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[*] SAS, MARTINAIR WITHOUT EGPWS

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[*] SAS 150-153 WITHOUT SB 34-82

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[*] SAS 150-154 WITH SB 34-82 AND ALL MTH AIRPLANES AND SAS 050-149, 155-999

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NAVIGATION - GENERAL - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The navigation systems are used to compute and display attitude, altitude, and position of the airplane with respect to the earth's surface. These systems acquire data from other airplane systems, ground stations, and/or environmental conditions about the airplane. The displayed data consists of movement, speed, and direction of travel in all three axis. Also, present position and future position are computed and displayed.
2. Introduction
   A. Navigation System
      (1) The navigation systems fall in the following general categories:
         (a) Those systems which sense and display flight environmental data.
         (b) Those systems which determine airplane attitude and direction.
         (c) Those systems which provide landing and taxiing aids.
         (d) Those systems which are self-contained and independent of ground based equipment.
         (e) Those systems which are dependent upon and operate in conjunction with ground based equipment.
3. System Description
   A. Component Locations
      (1) Most navigation units are located in three main centers. These centers include the forward equipment center, main equipment center, and mid equipment center. The units are remotely controlled from the flight compartment. Their data is also displayed in the flight compartment.
      (2) Receiving and/or transmitting antennas for the navigation systems are externally mounted as shown.
   B. Systems (Fig. 2)
      (1) Pitot-Static System (34-11-00)
         (a) The pitot-static system senses the dynamic (pitot) and ambient (static) air pressure external to the airplane. It supplies these pressures to systems which determine and/or indicate airspeed, mach number, or altitude. It also supplies data for determining true airspeed (TAS), static air temperature (SAT), and total air temperature (TAT).

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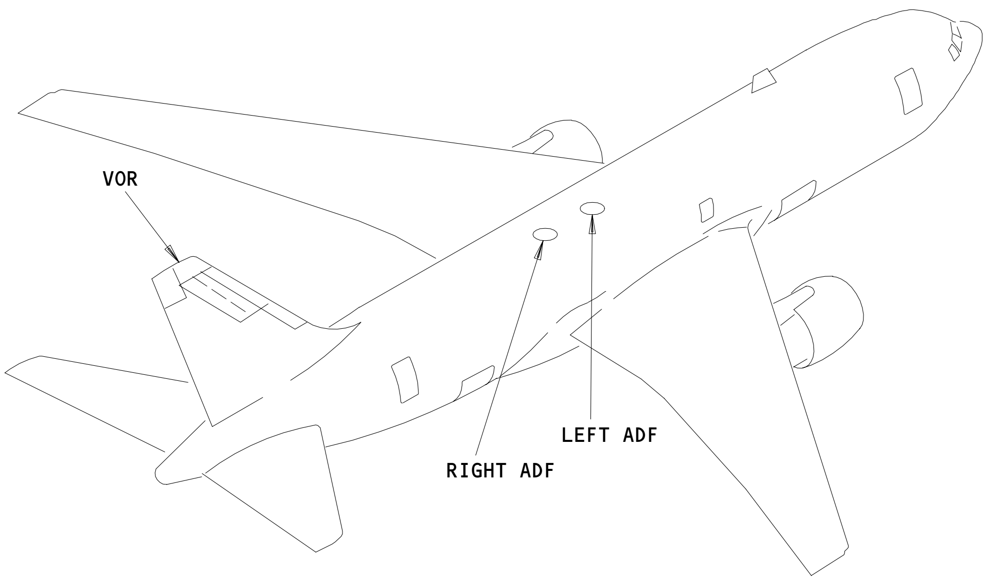

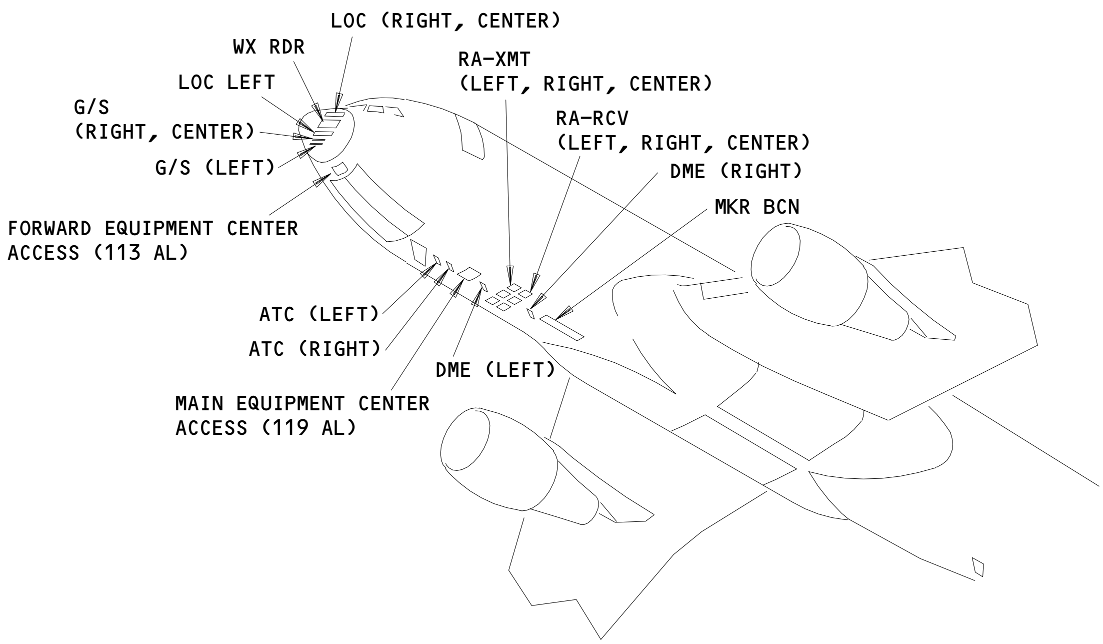

Navigational Systems Antenna Location
Figure 1 (Sheet 1)

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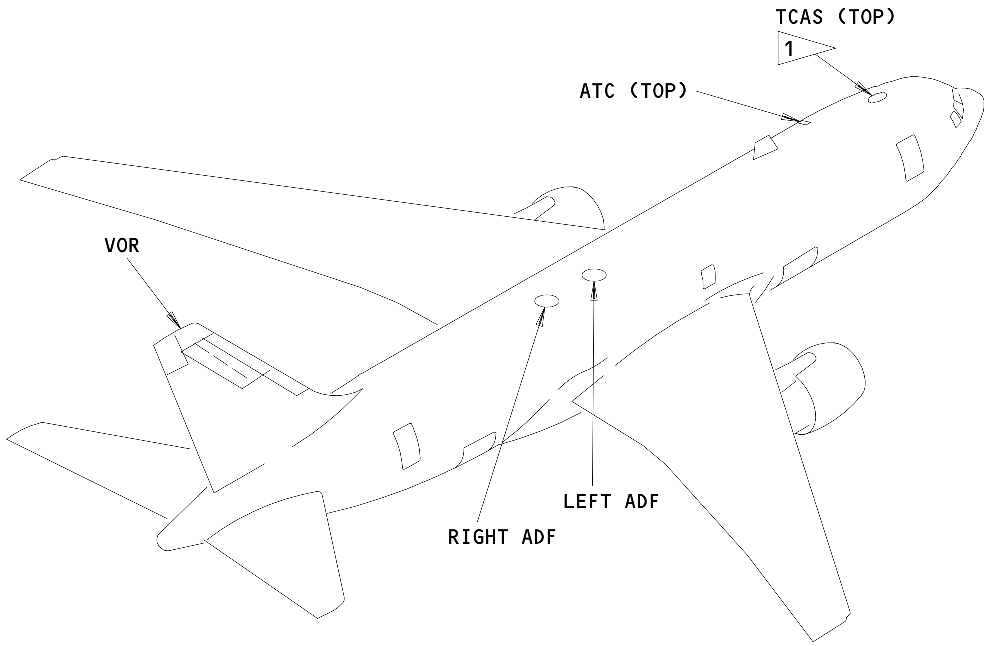

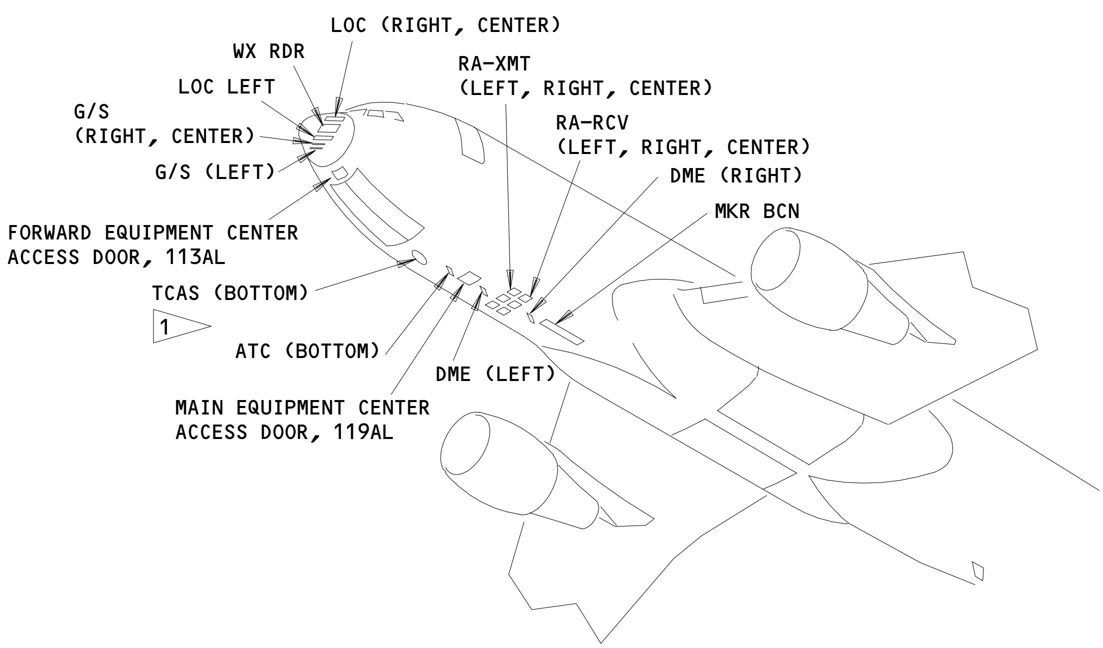

1 AIRPLANES WITH TCAS ANTENNAS

Navigational Systems Antenna Location
Figure 1 (Sheet 2)

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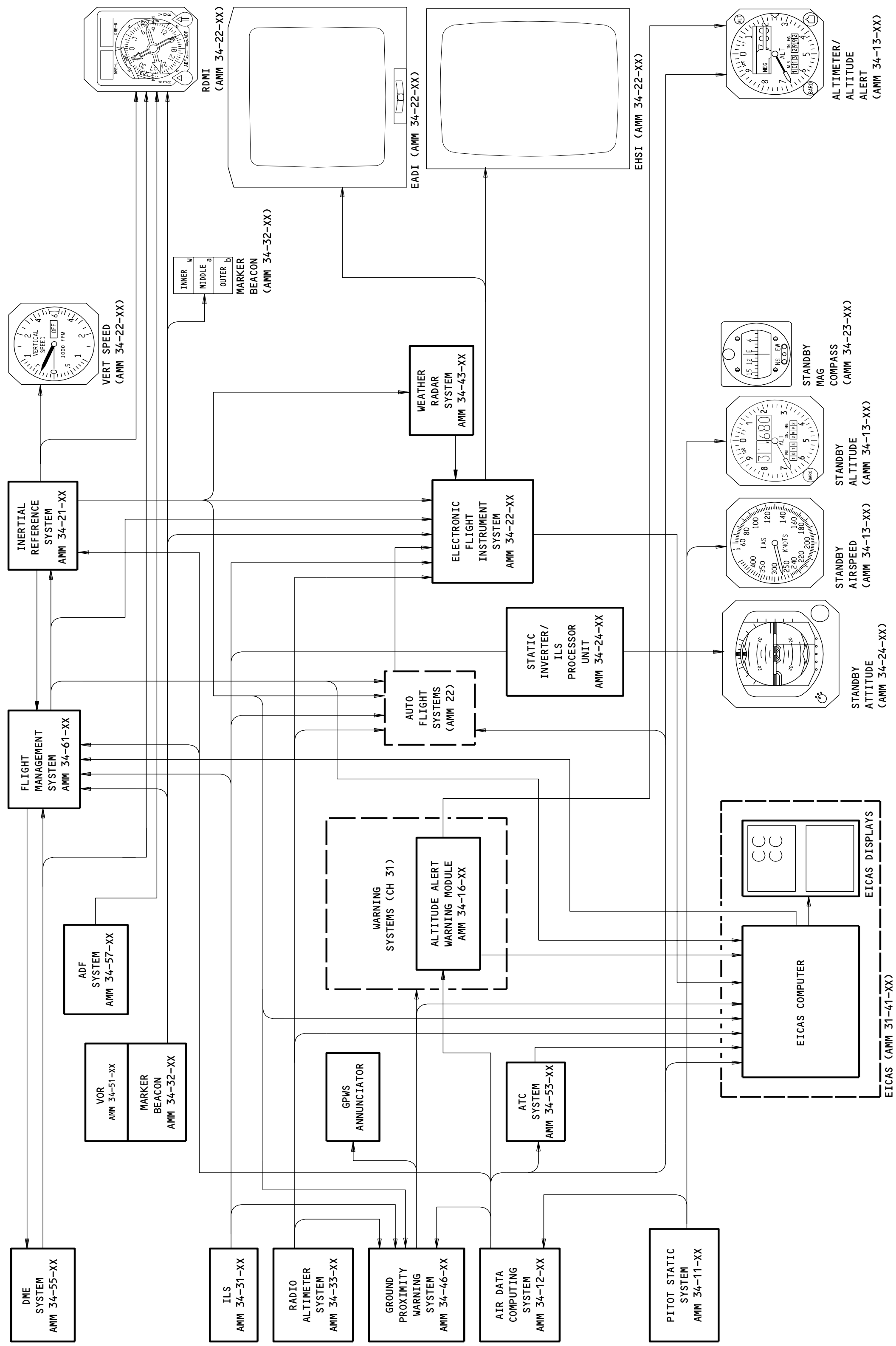

Navigational Systems Block Diagram
Figure 2

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(2) Air Data Computing System (34-12-00)
   (a) The air data computing system provides digital air data to interfacing systems. It computes altitude, airspeed, mach number, and air temperature from the pitot-static system input. This data is sent to the air data instruments, EICAS, and FMS for display. It is also sent to other airplane systems for computing flight parameters.
(3) Air Data Instruments (34-13-00)
   (a) The air data instruments display airplane speed and altitude based upon inputs from the atmosphere. These instruments receive inputs either from the pitot and static systems or from other units through ARINC 429 data buses.
(4) Altitude Alert System (34-16-00)
   (a) The altitude alert system provides aural and visual alert signals when the airplane approaches or departs from a selected altitude. Its prime source of data is the air data computing system.
(5) Inertial Reference System (34-21-00)
   (a) The inertial reference system (IRS) determines and provides angular rates and acceleration. It also computes attitude, true and magnetic headings, velocity, and present position. It is the primary reference source for the main navigation indicators. It is also the main reference for the autoflight systems (Chapter 22) and the other navigation systems which require this data.
(6) Flight Instrument System (34-22-00)
   (a) The flight instrument system is the primary navigation display system. It's main system is the electronic flight instrument system (EFIS). It also includes the radio distance magnetic indicators (RDMI) and the vertical speed indicators (VSI). The EFIS receives flight data from most of the navigation systems. The EFIS symbol generator converts this data into CRT symbology for the electronic horizontal situation (EHSI) and electronic attitude director (EADI) indicators. The symbol generator memory circuits contain all the standard symbology used for display.
(7) Standby Magnetic Compass (34-23-00)
   (a) The standby magnetic compass provides quick directional reference as an auxiliary compass. It receives no inputs and provides no outputs.
(8) Standby Attitude Reference System (34-24-00)
   (a) The standby attitude reference system provides a backup pitch and roll attitude display. The system also provides standby instrument landing system (ILS) data. The data is displayed on the standby attitude indicator.
(9) ILS Navigation System (34-31-00)
   (a) The instrument landing system (ILS) determines lateral (localizer) and vertical (glideslope) deviations of the airplane, relative to the runway during landing approaches. It provides this data to many of the airplane navigation systems. The main ILS display is provided by the EFIS.

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(10) Marker Beacon System (34-32-00)
 (a) The marker beacon system provides visual and aural indications when the airplane flies over marker beacon stations.
(11) Radio Altimeter System (34-33-00)
 (a) The radio altimeter system supplies vertical position data to the airplanes systems. It transmits a continuous radio signal to the ground. This signal is reflected back to the airplane. The radio altitude is then computed and sent to the EFIS for display on the EADI.
(12) Weather Radar System (34-43-00)
 (a) The weather radar system is used to determine weather conditions ahead of the airplane which includes the location and intensity of storm areas. A ground mapping mode is also included for presentation of terrain features.
(13) AIRPLANES WITH AN OPERATIONAL TCAS SYSTEM;
Traffic Alert and Collision Avoidance System (34-45-00)
 (a) The Traffic Alert and Collision Avoidance System (TCAS) supplies safe seperation between your airplane and other airplanes that have ATCRBS or Mode-S transponders. The TCAS computer displays information on the EFIS displays.
(14) Ground Proximity Warning System (34-46-00)
 (a) The ground proximity warning system provides the pilots with aural and visual warnings of airplane closeness to the terrain. Warnings are provided for various flight conditions. The warnings are determined by comparing the actual flight conditions and computed flight path relative to the ground.
 (b) The ground proximity warning system is also part of the wind shear system. It calculates the vertical and horizontal components of the wind and determines if a wind shear condition exists. Aural and visual warnings alert the pilot of the wind shear condition.
(15) VOR System (34-51-00)
 (a) The VHF omnirange navigation (VOR) system determines the airplane's position with respect to ground-based VOR transmitting stations. It determines lateral and horizontal deviation from the desired flight path. This data is displayed by the RDMIs and EHSIs.
(16) ATC System (34-53-00)
 (a) The air traffic control (ATC) system, when interrogated by a ground station, automatically transmits airplane data to a ground receiver. The data includes airplane altitude and identification data. This data is used by ground based personnel to monitor airplane traffic.
(17) DME System (34-55-00)
 (a) The distance measuring equipment (DME) system determines the distance from the airplane to selected ground stations. The distance is displayed on the RDMI.

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(18) ADF System (34-57-00)

(a) The automatic direction finder (ADF) system provides airplane bearing. Bearing is determined from conventional broadcast or low range radio stations. This is displayed as the bearing, relative to the airplane heading, on the RDMI and EHSI.

(19) Flight Management Computing System (34-61-00)

(a) The flight management computing system (FMCS) provides navigation, guidance, and performance management data to the autoflight systems (Ref Chapter 22) and the flight instrument system (AMM 34-22-00/001).

(b) The flight management computer (FMC) contains the main data base for all stored airplane performance and related navigation route data. The control display unit (CDU) provides a means for the crew to program flight plan data. This includes all lateral (L NAV) and vertical (V NAV) commands in a flight plan. The system also continuously calculates and executes optimum airplane performance paths.

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NAVIGATION - DDG MAINTENANCE PROCEDURES

1. General
   A. The procedure has the maintenance tasks that prepare the airplane for flight with certain systems or components inoperative.
   B. It also has the tasks that put the airplane back to its usual condition.
   C. These are the tasks for the components in the navigation system:
      (1) DDG 34-21-1 Preparation - L, or R, or C Inertial Reference Unit (IRU) Inoperative
      (2) DDG 34-21-1 Restoration - L, or R, or C Inertial Reference Unit (IRU) Inoperative
      (3) DDG 34-22-5 Preparation - L, or R, or C Electronic Flight Instrument System (EFIS) Symbol Generator Inoperative
      (4) DDG 34-22-5 Restoration - L, or R, or C Electronic Flight Instrument System (EFIS) Symbol Generator Inoperative
      (5) DDG 34-45-1 Preparation - Traffic Alert and Collision Avoidance System (TCAS) Inoperative
      (6) DDG 34-45-1 Restoration - Traffic Alert and Collision Avoidance System (TCAS) Inoperative

TASK 34-00-00-049-003

2. DDG 34-21-1 Preparation - L, or R, or C Inertial Reference Unit (IRU) Inoperative (Fig. 901)
   A. General
      (1) This task gives the maintenance steps which prepare the airplane for flight with the left (L), right (R), or center (C) inertial reference unit inoperative.
      (2) All IRUs are interchangeable.
      (3) For an inertial reference system (IRS) with a hydraulic motor-driven generator (HMG) installed:
         (a) Either the left or center IRU may be inoperative unless approach minimums require its use.
         (b) The right IRU may be inoperative for day VMC flight.
      (4) For an IRS without an HMG installed, one IRU may be inoperative if:
         (a) The approach minimums do not require its use.
         (b) For extended range (ER) operations:
            1) Left and center IRU operate normally.
            2) You verify isolation once each flight day by using the approved maintenance procedures in this task.
         (c) For non-ER operations:
            1) Either the left or right IRU operate normally.
            2) You verify isolation once each flight day by using the approved maintenance procedures in this task.
      (5) An inoperative left IRU will also cause the Windshear Guidance and Alerting System to be inoperative.

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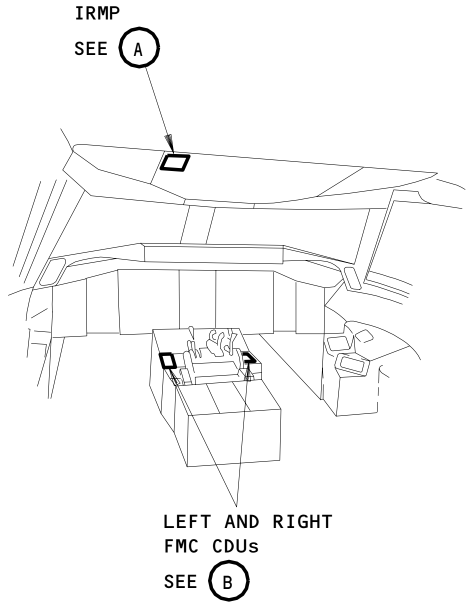
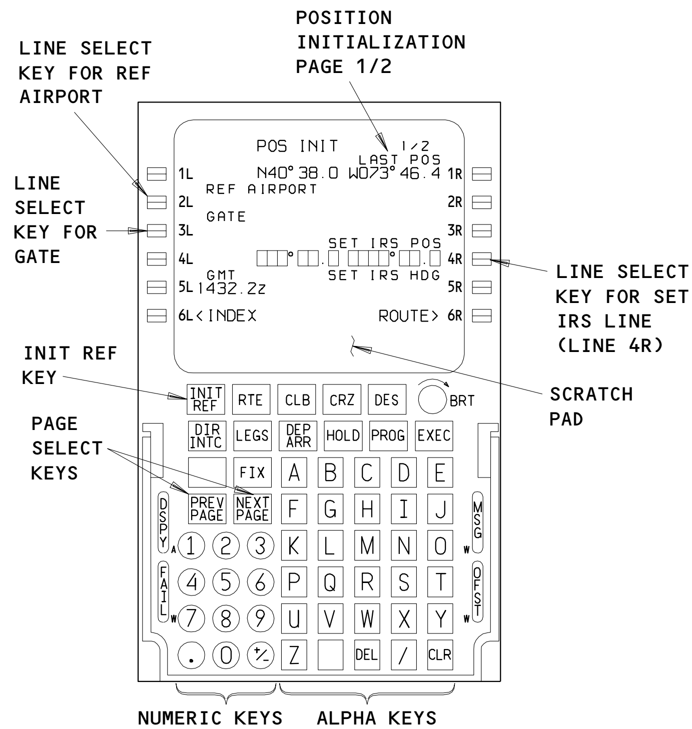
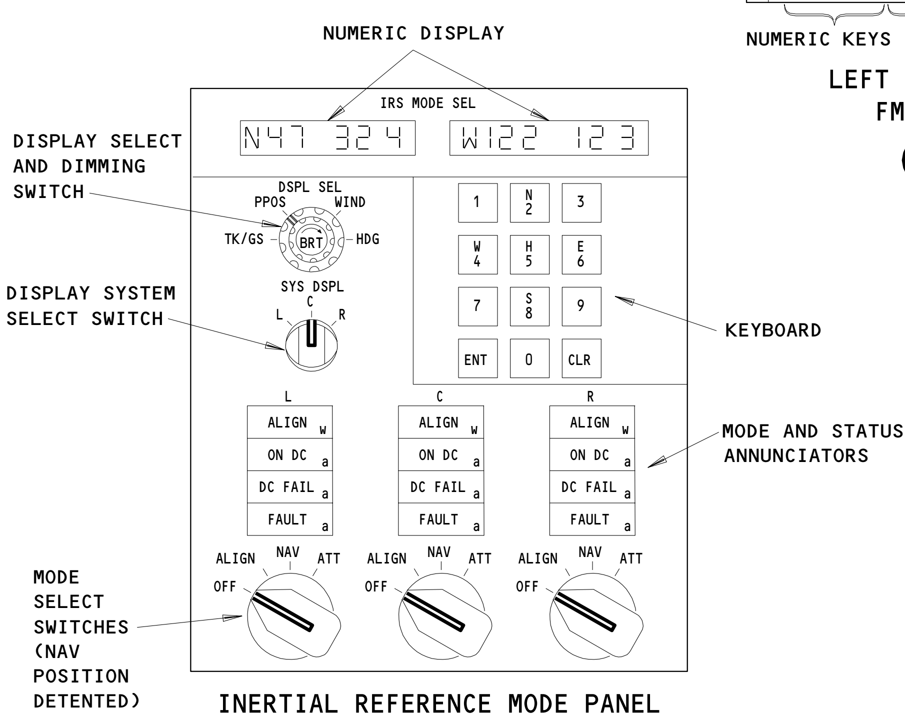


FLIGHT COMPARTMENT



LEFT OR RIGHT
FMC CDU
B



INERTIAL REFERENCE MODE PANEL
(IRMP)
A

IRS - Component Location
Figure 901 (Sheet 1)

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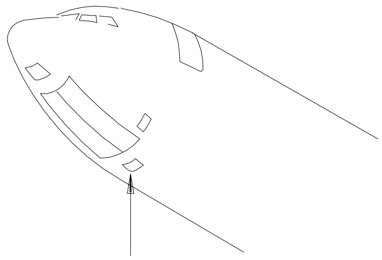
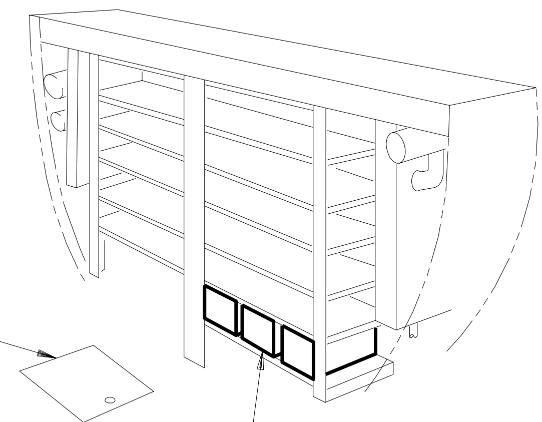
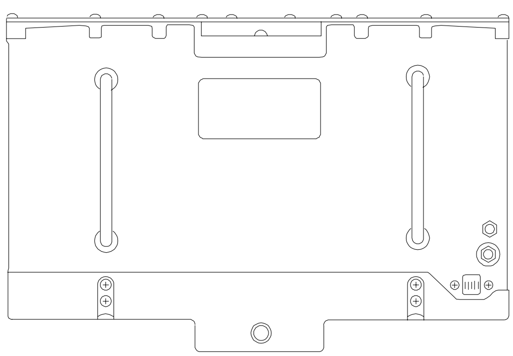




MAIN EQUIPMENT CENTER



INERTIAL REFERENCE UNIT
(IRU)
C

IRS - Component Location
Figure 901 (Sheet 2)

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(6) EICAS Status Messages (as applicable):
  (a) L IRS FAULT
  (b) L IRS ON DC
  (c) L IRS DC FAIL
  (d) GND PROX BITE (for inoperative left IRU)
  (e) R IRS FAULT
  (f) R IRS ON DC
  (g) R IRS DC FAIL
  (h) C IRS FAULT
  (i) C IRS ON DC
  (j) C IRS DC FAIL

B. Equipment
  (1) Lock-Circuit Breaker, Approved for Flight (commercially available)

C. References
  (1) AMM 20-10-01/401, E/E Rack Mounted Components
  (2) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
  (3) AMM 24-22-00/201, Electrical Power - Control

D. Access
  (1) Location Zones
    119/120 Main Equipment Center
    211/212 Flight Compartment
  (2) Access Panels
    119AL Main Equipment Center Access Door

E. Prepare to Deactivate the IRU

S 869-001
  (1) Set the two F/D switches on the autopilot mode control panel (MCP), P55, to the OFF position.

S 869-003
  (2) For the inoperative IRU, open the applicable circuit breaker and attach a circuit breaker lock (collar):
    (a) P6 Main Power Distribution Panel:
      1) 6D3, IRS L
      2) 6D4, IRS C
      3) 6D5, IRS R

S 869-005
  (3) For the inoperative IRU, open the applicable circuit breaker and attach a circuit breaker lock (collar):
    (a) P11 Overhead Circuit Breaker Panel:
      1) 11F1, IRS LEFT
      2) 11F21, IRS CENTER
      3) 11F22, IRS RIGHT

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S 869-006

CAUTION: DO NOT OPERATE THE MASTER DIM AND TEST SYSTEM FOR MORE THAN FIVE MINUTES WITH THE "IND LTS" SWITCH IN THE "DIM" POSITION WHEN ONE OR MORE OF THE THREE IRUS ARE NOT INSTALLED. THIS CAN CAUSE DAMAGE TO THE INERTIAL REFERENCE MODE SELECT PANEL (IRMP).

(4) Attach a tag adjacent to the TEST switch, P5, of the Master Dim and Test System which reads: Caution, one IRU is removed. Do not operate the TEST switch of the Master Dim and Test System for more than five minutes with the IND LTS switch in the DIM position. This can cause damage to the IRMP.

S 019-013
(5) Open the access door 119AL to the main equipment center.

S 919-014

CAUTION: DO NOT MOVE THE IRU BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE IRU.

(6) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

F. IRU Deactivation

S 049-008

WARNING: BE CAREFUL WHEN YOU MOVE THE IRU. BECAUSE THE IRU WEIGHS 47 POUNDS (21 KG), INJURY CAN OCCUR.

(1) Remove the inoperative IRU (AMM 20-10-01/401).

S 419-009
(2) Close the access door 119AL for the main equipment center.

S 869-011
(3) If you deactivated the left IRU, attach a tag adjacent to the left and right flight instrument source select panel which reads: Caution, the left IRU is deactivated. The Windshear Guidance and Alerting System is inoperative.

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G. Verification of IRU Isolation

S 869-036
(1) Supply electrical power (AMM 24-22-00/201).

S 869-022
(2) If you deactivated the left or right IRU, do these steps each flight day:

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(a) Set the IRS mode select switch on the Captain's or F/O's IRMP to the ALIGN position.
(b) Make sure that only one of the pilot's EFIS displays lose attitude and heading information.

H. Put the Airplane Back to Its Usual Condition

S 869-015
(1) For the inoperative IRU, set the applicable IRS mode select switch on the IRMP to the OFF position.

S 869-013
(2) Set the remaining IRS mode select switches on the IRMP back to their usual positions (NAV or OFF).

S 869-016
(3) Attach a tag adjacent to the IRMP which reads: Caution, one IRU is inoperative. Do not operate its mode select switch. Leave it in the OFF position.

S 869-014
(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-00-00-449-019
3. DDG 34-21-1 Restoration - L, or R, or C Inertial Reference Unit (IRU) Inoperative (Fig. 901)

A. General
(1) This task puts the airplane back to its usual condition after operation with the left, right, or center inertial reference unit inoperative.

B. References
(1) AMM 20-10-01/401, E/E Rack Mounted Components
(2) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
(3) AMM 34-21-01/401, Inertial Reference Unit

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C. Access
  (1) Location Zones
      119/120 Main Equipment Center
      211/212 Flight Compartment
  (2) Access Panels
      119AL Main Equipment Center Access Door

D. Prepare to Reactivate the IRU

S 869-020
  (1) Remove the circuit breaker lock and attach a DO-NOT-CLOSE tag to the applicable open circuit breaker:
    (a) P6 Main Power Distribution Panel:
      1) 6D3, IRS L
      2) 6D4, IRS C
      3) 6D5, IRS R

S 869-021
  (2) Remove the circuit breaker lock and attach a DO-NOT-CLOSE tag to the applicable open circuit breaker:
    (a) P11 Overhead Circuit Breaker Panel:
      1) 11F1, IRS LEFT
      2) 11F21, IRS CENTER
      3) 11F22, IRS RIGHT

S 919-017

CAUTION: DO NOT MOVE THE IRU BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE IRU.

  (3) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

E. IRU Reactivation

S 449-018

WARNING: BE CAREFUL WHEN YOU MOVE THE IRU. BECAUSE THE IRU WEIGHS 47 POUNDS (21 KG), INJURY CAN OCCUR.

  (1) Install the IRU (AMM 20-10-01/401).

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S 869-039

(2) If you installed the left IRU, remove the Windshear Guidance and Alerting System caution tags at the left and right instrument source select panels.

S 869-024

(3) If all three IRUs are now installed, remove the caution tag at the TEST switch, P5, of the Master Dim and Test System.

S 869-026

(4) Remove the DO-NOT-CLOSE tag and close the applicable circuit breaker:
   (a) P6 Main Power Distribution Panel:
      1) 6D3, IRS L
      2) 6D4, IRS C
      3) 6D5, IRS R

S 869-027

(5) Remove the DO-NOT-CLOSE tag and close the applicable circuit breaker:
   (a) P11 Overhead Circuit Breaker Panel:
      1) 11F1, IRS LEFT
      2) 11F21, IRS CENTER
      3) 11F22, IRS RIGHT

S 869-028

(6) Do the IRU Test (AMM 34-21-01/401).

TASK 34-00-00-049-004

4. <u>DDG 34-22-5 Preparation - L, or R, or C Electronic Flight Instrument System (EFIS) Symbol Generator Inoperative</u> (Fig. 902)

A. General
   (1) This task gives the maintenance steps which prepare the airplane for flight with the left (L), right (R), or center (C) EFIS symbol generator inoperative.
   (2) Except for extended range (ER) operations, one EFIS symbol generator may be inoperative if isolation is verified once each flight day.
   (3) For ER operations, the L or R EFIS symbol generator may be inoperative if isolation is verified once each flight day.
   (4) Isolation must be verified by the approved maintenance procedures in this task.

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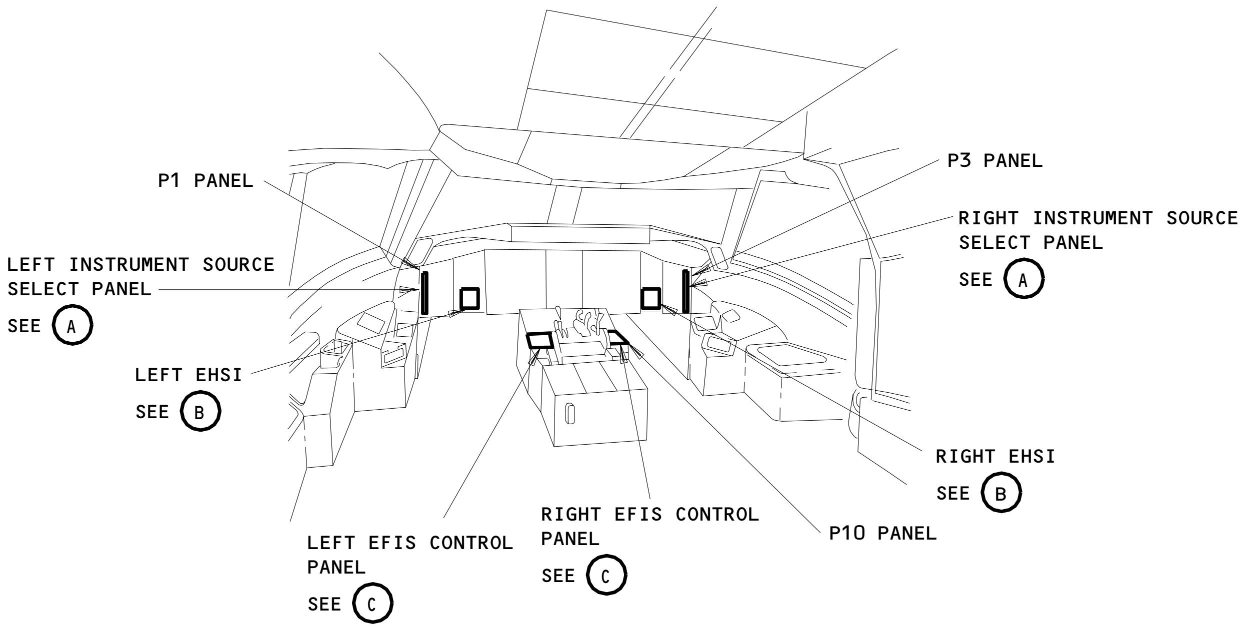
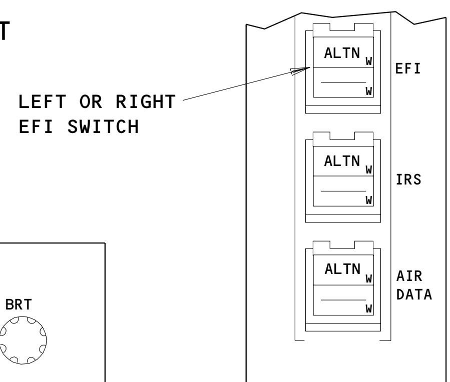
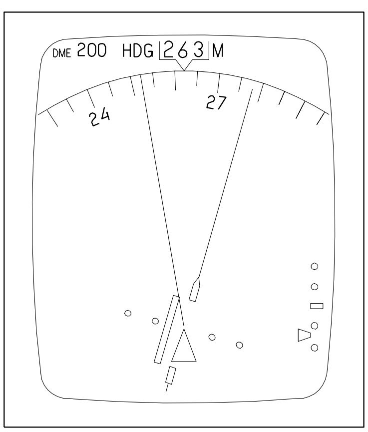


FLIGHT COMPARTMENT



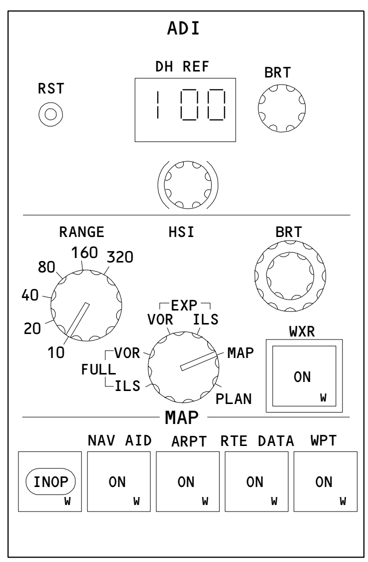
LEFT OR RIGHT INSTRUMENT SOURCE SELECT PANEL

A



LEFT OR RIGHT EHSI

B



LEFT OR RIGHT EFIS CONTROL PANEL

C

EFIS - Component Location
Figure 902 (Sheet 1)

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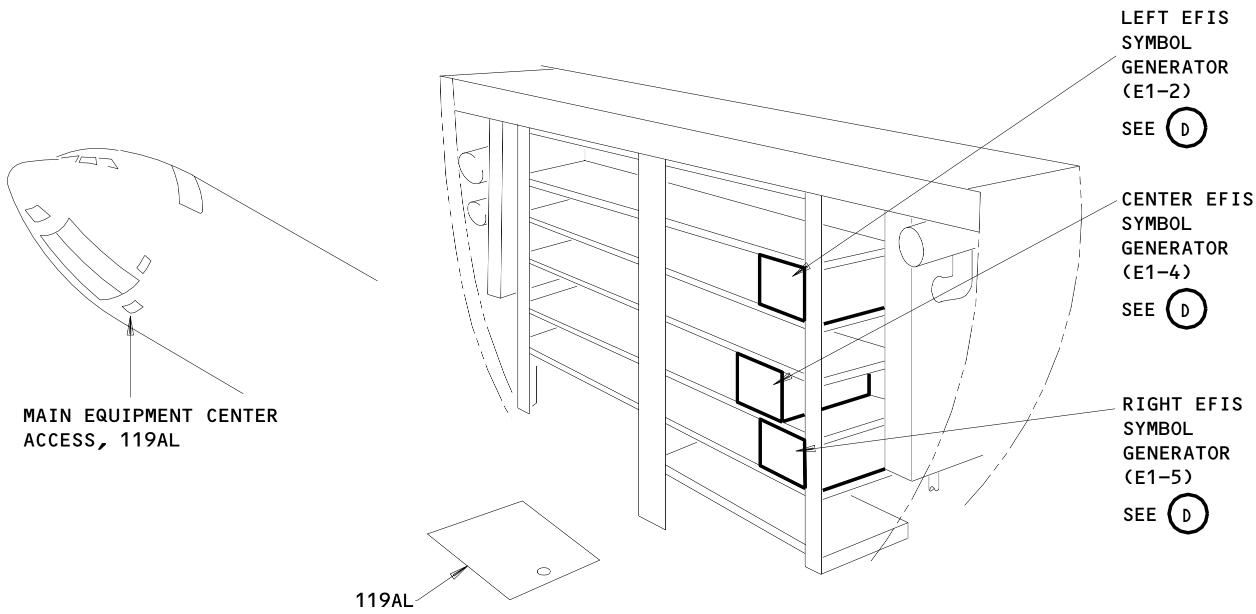
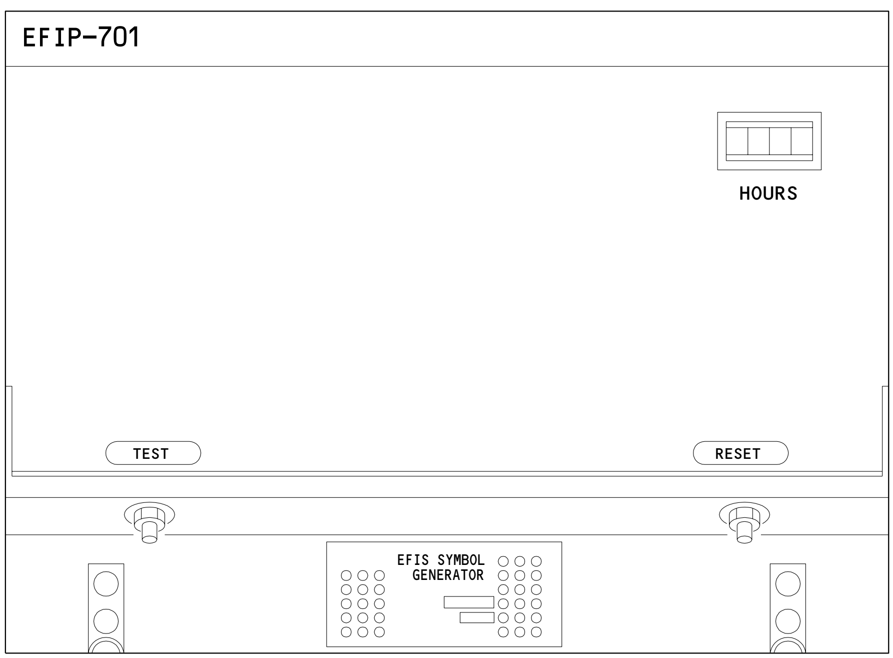


MAIN EQUIPMENT CENTER



EFIS SYMBOL GENERATOR

D

EFIS - Component Location
Figure 902 (Sheet 2)

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(5) EICAS Status Message (if applicable):
(a) INSTR SWITCH

NOTE: This EICAS message occurs if the EFI switches on the left and right instrument source select panels are in the ALTN position.

B. Equipment
(1) Lock-Circuit Breaker, Approved for Flight (commercially available)
C. References
(1) AMM 24-22-00/201, Electrical Power - Control
D. Access
(1) Location Zones
211/212 Flight Compartment
E. Prepare to Deactivate the EFIS Symbol Generator

S 869-030
(1) If you deactivate the left EFIS symbol generator, open these circuit breakers and attach circuit breaker locks (collars):
(a) P11 Overhead Circuit Breaker Panel:
1) 11F8, EFIS SYM GEN LEFT

S 869-031
(2) If you deactivate the right EFIS symbol generator, open these circuit breakers and attach circuit breaker locks (collars):
(a) P11 Overhead Circuit Breaker Panel:
1) 11F29, EFIS SYM GEN RIGHT

S 869-032
(3) If you deactivate the center EFIS symbol generator, open this circuit breaker and attach a circuit breaker lock (collar):
(a) P11 Overhead Circuit Breaker Panel:
1) 11F9, EFIS SYM GEN CENTER
F. Verification of EFIS Symbol Generator Isolation

S 869-023
(1) Supply electrical power (AMM 24-22-00/201).

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S 049-026

(2) If you deactivated the left EFIS symbol generator, do these steps:
   (a) Set the EFI switch on the left instrument source select panel, P1, to the ALTN (in) position.
   (b) Set the EFI switch on the right instrument source select panel, P3, to the NORM (out) position.
   (c) Set the mode switch on the right EFIS control panel to the VOR (-EXP if installed) position.
   (d) Set the mode switch on the left EFIS control panel to the ILS (-EXP if installed) position.
   (e) Make sure that VOR R shows on the right EHSI.
   (f) Apply an EFI NORM INOP placard to the EFI switch on the left instrument source select panel, P1.

S 049-027

(3) If you deactivated the right EFIS symbol generator, do these steps:
   (a) Set the EFI switch on the right instrument source select panel, P3, to the ALTN (in) position.
   (b) Set the EFI switch on the left instrument source select panel, P1, to the NORM (out) position.
   (c) Set the mode switch on the right EFIS control panel to the ILS (-EXP if installed) position.
   (d) Set the mode switch on the left EFIS control panel to the VOR (-EXP if installed) position.
   (e) Make sure that VOR L shows on the left EHSI.
   (f) Apply an EFI NORM INOP placard to the EFI switch on the right instrument source select panel, P3.

S 049-028

(4) If you deactivated the center EFIS symbol generator, do these steps:
   (a) Set the EFI switch on the left instrument source select panel, P1, to the NORM (out) position.
   (b) Set the EFI switch on the right instrument source select panel, P3, to the NORM (out) position.

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(c) Set the mode switch of the right EFIS control panel to the VOR (-EXP if installed) position.
(d) Set the mode switch of the left EFIS control panel to the ILS (-EXP if installed) position.
(e) Make sure that VOR R shows on the right EHSI.
(f) Set the mode switch on the left EFIS control panel to the VOR (-EXP if installed) position.
(g) Set the mode switch on the right EFIS control panel to the ILS (-EXP if installed) position.
(h) Make sure that VOR L shows on the left EHSI.
(i) Apply an EFI ALTN INOP placard to the EFI switches on the left and right instrument source select panels, P1 and P3.

G. Put the Airplane Back to Its Usual Condition

S 869-051
(1) Set the mode switches on the left and right EFIS control panels to their usual positions.

S 869-044
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-00-00-449-005
5. <u>DDG 34-22-5 Restoration - L, or R, or C Electronic Flight Instrument System (EFIS) Symbol Generator Inoperative</u> (Fig. 902)

A. General
(1) This task puts the airplane back to its usual condition after operation with the left (L), right (R), or center (C) EFIS symbol generator inoperative.

B. References
(1) AMM 20-10-01/401, E/E Rack Mounted Components
(2) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices

C. Access
(1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

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(2) Access Panels
119AL Main Equipment Center Access Door

D. EFIS Symbol Generator Reactivation

S 869-041
(1) Do the removal procedure to remove the inoperative EFIS Symbol Generator (AMM 34-22-01/401).

S 869-042
(2) Do the installation procedure to reactivate the EFIS Symbol Generator (AMM 34-22-01/401).

S 869-034
(3) Remove the EFI ALTN INOP or EFI NORM INOP placards from the EFI switches on the left, right, or center instrument source select panels, as applicable.

E. Put The Airplane Back to Its Usual Condition

S 869-092
(1) Set the EFI switches on the left and right instrument source select panels, P1 and P3, back to their usual positions.

S 869-091
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-00-00-049-006

6. DDG 34-45-1 Preparation - Traffic Alert and Collision Avoidance System (TCAS) Inoperative

A. General
(1) This task gives the maintenance steps which prepare the airplane for flight with the traffic alert and collision avoidance system computer inoperative.
(2) EICAS Status Message:
(a) TCAS SYSTEM

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B. Equipment
(1) Lock-Circuit Breaker, Approved for Flight (commercially available)

C. Access
(1) Location Zones
211/212 Flight Compartment

D. TCAS Deactivation

S 049-043
(1) Open this circuit breaker and attach a circuit breaker lock (collar):
(a) P11 Overhead Circuit Breaker Panel:
1) 11F12, TCAS

TASK 34-00-00-449-007

7. DDG 34-45-1 Restoration - Traffic Alert and Collision Avoidance System (TCAS) Inoperative

A. General
(1) This task puts the airplane back to its usual condition after operation with the traffic alert and collision avoidance system computer inoperative.

B. Access
(1) Location Zones
211/212 Flight Compartment

C. TCAS Reactivation

S 449-009
(1) Remove the circuit breaker lock (collar) and close this circuit breaker:
(a) P11 Overhead Circuit Breaker Panel:
1) 11F12, TCAS

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PITOT-STATIC SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The pitot-static system senses the dynamic (pitot) and ambient (static) air pressure external to the airplane. It supplies these two pressures to various systems for determining airplane altitude and motion through the air mass.
   B. The system consists of aerodynamic compensated pitot-static probes, static ports, drain fittings, and pneumatic tubes and hoses.
   C. The pitot and/or static pressures are supplied to the standby altimeter and standby airspeed indicator. They are also supplied to the differential pressure transducer, RAT ARM Q switch, air data and elevator feel computers.
   D. Electrical power is required only for the pitot-static probe anti-icing heaters (Ref 30-31-00).
2. Component Details (Fig. 1)
   A. Pitot-Static Probe
      (1) Two pitot-static probes are installed on the left lower nose section at station 200, and two pitot-static probes are installed on the opposite location.
      (2) Each pitot-static probe provides one dynamic and two ambient pressure inputs to various pitot-static subsystems. Pitot pressure is sensed through a single pitot opening at the tip of the probe. Static pressure is sensed through two sets of independent static ports located on the probe. Each pressure source is connected to its respective system.
      (3) Each probe is installed with mounting screws with the probe base having two index pins to ensure proper probe alignment. A gasket is installed between the probe base and the airplane structure to form a pressure seal. The probes are not interchangeable with the probes on the opposite side of the airplane.
      (4) Heaters are provided for pitot-static probe anti-icing (Ref 30-31-00).
   B. Alternate Static Port
      (1) The alternate static ports are flush mounted on each side of the lower forward fuselage at body station 465. Anti-icing heaters are not provided on the ports.
      (2) Each of the two ports is an independent sensor of external ambient pressure. The static port is cross connected with the port on the opposite side. It provides an alternate source of ambient pressure for the air data instruments. At the port, pressure is sensed through small holes open to the static line tubing.

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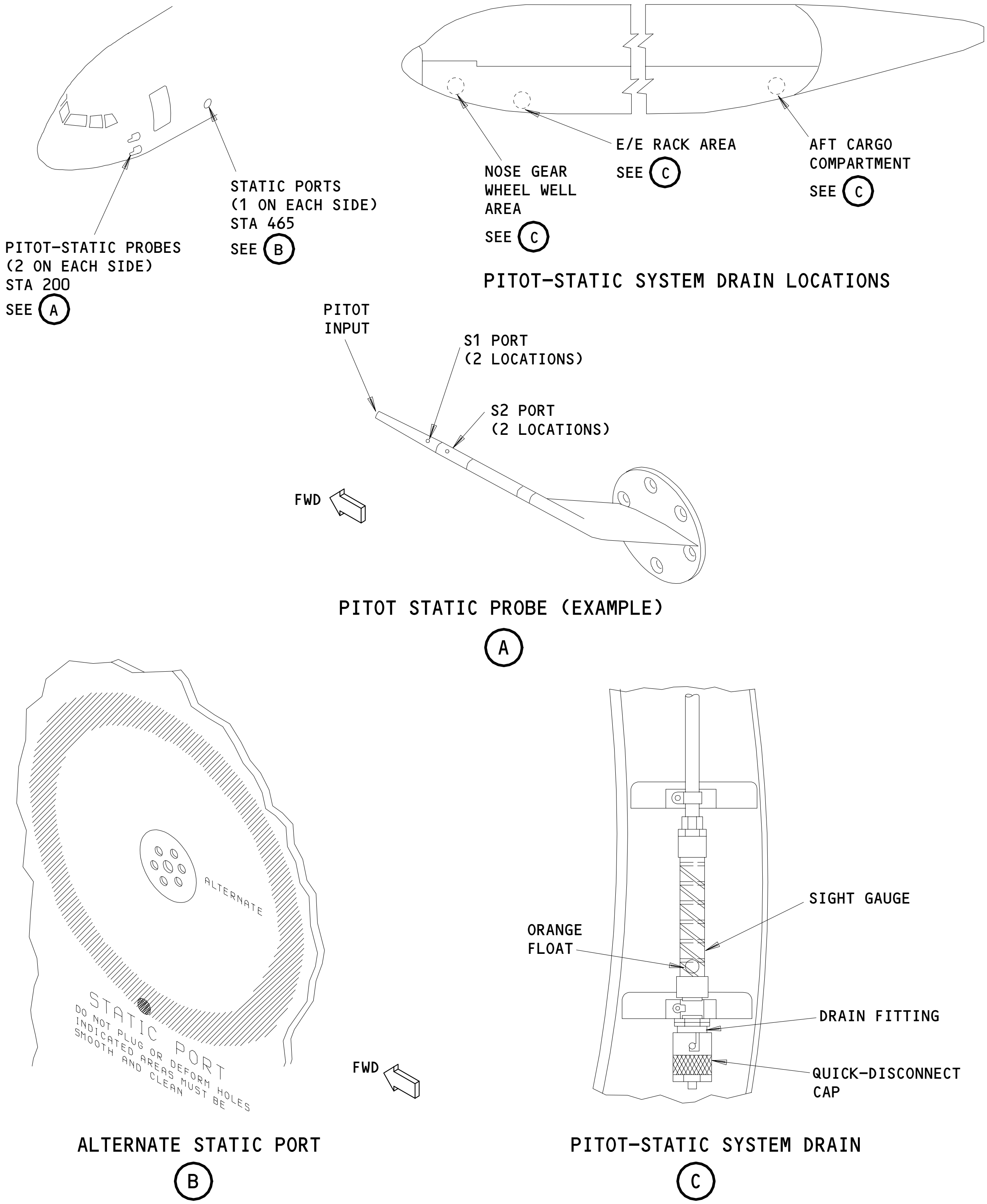

Pitot-Static System Component Locations
Figure 1 (Sheet 1)

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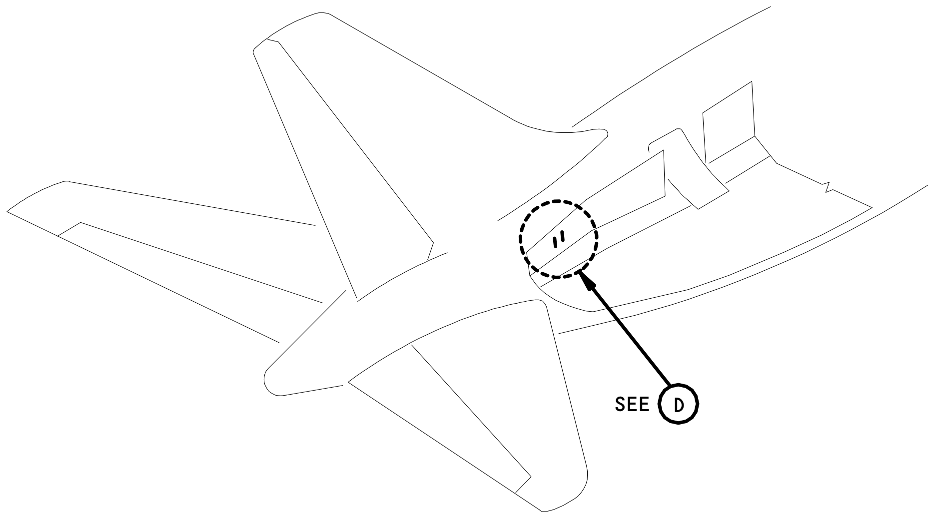
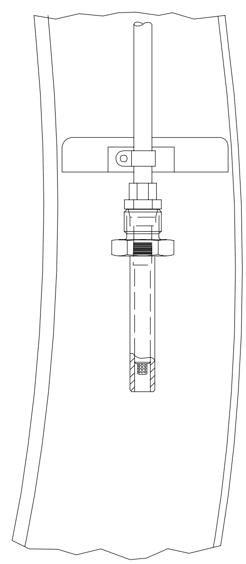


STATIC SYSTEM VISCO JET DRAIN LOCATIONS



STATIC SYSTEM VISCO JET DRAIN
D

Pitot-Static System Component Locations
Figure 1 (Sheet 2)

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(3) The altitude pressure switch is installed on the rack E8 in the main equipment center. This switch automatically enables the EICAS maintenance panel to be fully operational above 10,000 feet. During this operation, all usual maintenance pages can be shown.

C. Pitot-Static System Drains

(1) The pitot-static system drains are located in the nose wheel well and in the electronic equipment and aft cargo compartments.

(2) The system drain acts as a sump to remove condensation collected from the pitot-static lines. The sump has a reinforced transparent section of tubing with an orange float. This forms a sight gage to indicate the level of liquid accumulated in the sump.

(3) The lower portion of the drain contains a poppet valve covered by a bayonet cap. To drain the pitot static line, the cap is removed and the valve depressor on the cap is inserted into the poppet valve. Accumulated liquid in the sump is drained by gravity flow as the valve is depressed.

(4) Two Visco Jet drains are found in section 48 near STA 1629. The Visco Jets drain constantly so no liquid collects in them.

3. <u>Operation</u> (Fig. 2)

A. The pitot-static system consists of four independent pitot systems, four static systems, and one alternate static system. The function of each of the systems is similar.

B. Pitot Pressure Sensing

(1) A pitot-static probe is provided for each pitot system. The dynamic or ram pressure created by the forward motion of the airplane pressurizes the entire pitot portion of each subsystem.

(2) Each probe provides a single isolated source of dynamic pressure to interfacing equipment. The four pitot systems are referred to as captain's, first officer's, No. 1 and No. 2 auxiliary pitot systems.

C. Static Pressure Sensing

(1) Static ports are located on the top and bottom of the pitot-static probe. The surface at the port is designed to provide an accurate sensing of ambient air pressure as independent as possible of airspeed.

(2) The forward set of static ports opens into static line S1 and the aft set into static line S2. Static pressure inputs are equalized by cross connecting sets of static ports on opposite sides of the airplane. Connection is made through a common manifold. This tends to reduce any error caused by a localized pressure anomaly.

(3) There are four static systems. This results in four independent static systems which are referred to as captain's, first officer's and No. 1 auxiliary static and No. 2 auxiliary static system.

(4) The alternate static pressure input is sensed from a pair of alternate static ports. The static pressure inputs are equalized by cross connecting the ports on each side of the airplane.

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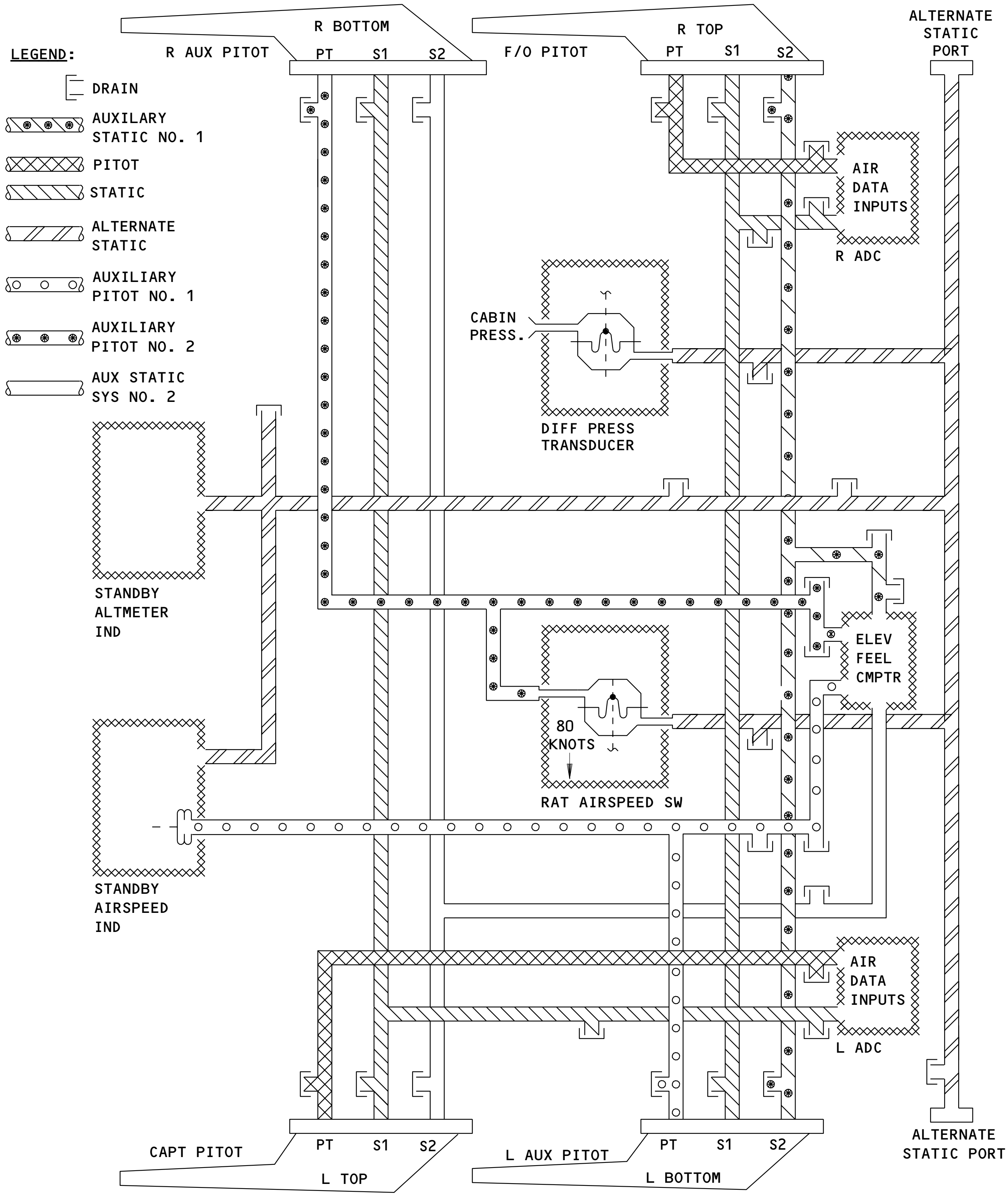

Pitot - Static System Schematic (Example)
Figure 2

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D. Pitot-Static Distribution

(1) Sensed pressures are distributed throughout the airplane in metal tubing. The tubing is mounted on walls and bulkheads with brackets. Unions and tee fittings are used for connection and branching of the tubing. Flexible hoses, quick-disconnects, or threaded fittings connect the pressure lines to interfacing components.

(2) The captain's pitot system provides pressure to the left air data computer. The first officer's pitot system provides pressure to the right air data computer. Auxiliary pitot system No. 1 provides pressure to the standby airspeed indicator and to the elevator feel computer. Auxiliary pitot system No. 2 provides pressure to the RAT ARM Q switch and to the elevator feel computer.

(3) The captain's static system provides pressure to the left ADC and the first officer's provides pressure to the right ADC. The No. 1 and No. 2 auxiliary static systems provide pressure to the elevator feel computer. The alternate static system provides pressure to the standby altimeter, standby airspeed indicator, the differential pressure transducer and to the RAT ARM Q switch.

E. The pitot-static system requires periodic draining, dependent upon the amount of liquid accumulated in each drain. Refer to Maintenance Planning Document for draining schedule.

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PITOT-STATIC SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
ALTIMETER - (FIM 34-13-00/101) STANDBY, N23				
INDICATOR - (FIM 34-13-00/101) STANDBY AIRSPEED, N22				
PORT - ALTERNATE STATIC	--	2	FORWARD FUSELAGE	34-11-03
PROBE - CAPTAIN'S PITOT STATIC, B26	--	1	NOSE SECT, LEFT UPPER PROBE	34-11-01
PROBE - FIRST OFFICER'S PITOT STATIC, B28	--	1	NOSE SECT, RIGHT UPPER PROBE	34-11-01
PROBE - LEFT AUXILIARY PITOT STATIC, B29	--	1	NOSE SECT, LEFT LOWER PROBE	34-11-01
PROBE - RIGHT AUXILIARY PITOT STATIC, B27	--	1	NOSE SECT, RIGHT LOWER PROBE	34-11-01
SENSOR - (FIM 21-30-00/101) DIFFERENTIAL PRESSURE, TS5072				
SWITCH - (FIM 29-21-00/101) RAT AIRSPEED, S614				

Pitot-Static System - Component Index
Figure 101

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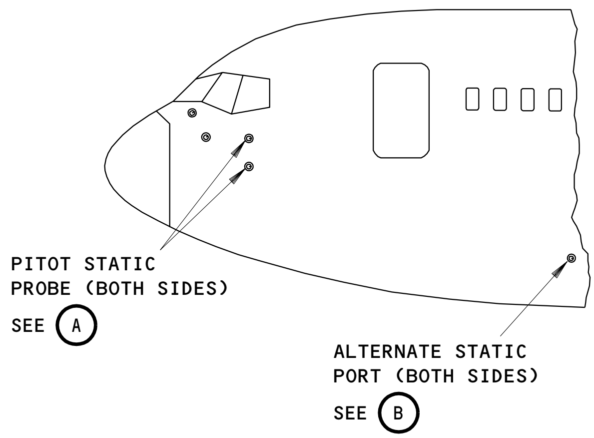
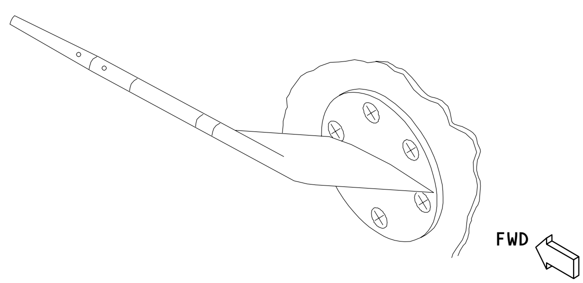
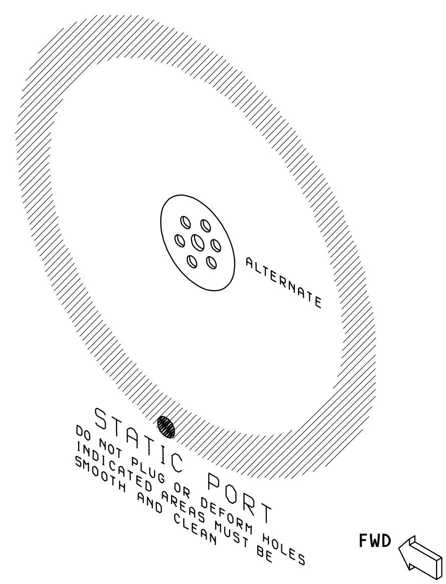




PITOT STATIC PROBE, B26, B27, B28, B29
(EXAMPLE)
A



ALTERNATE STATIC PORT
(EXAMPLE)
B

Pitot-Static System - Component Location
Figure 102

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PITOT-STATIC SYSTEM - MAINTENANCE PRACTICES (PRESSURIZATION)

1. General
   A. This procedure has one task. It shows how to pressurize each of the pitot-static systems independently. The procedure shows how to supply air pressure when it is necessary to do a test of other airplane systems.

TASK 34-11-00-862-045

2. Pressurize the Pitot-Static System
   A. Equipment
      (1) Adapters
         (a) Pitot-static probe test adapter -
             Rosemount Engineering, 884EH
             (2 Required)
             Rosemount Inc.
             14300 Judicial Rd.
             Burnsville, MN 55337
         (b) Static port adapter -
             NAVAIDS 33410LH-125-4
             NAV-AIDS LTD
             2955 Diab St.
             Montreal, Quebec, Canada H4S 1M1
      (2) Pneumatic Test Set
         (a) Dry air pressure source (1 required), 0 to 5 inches of mercury (absolute).
         (b) Vacuum sources (2 required), 0 to 20 inches of mercury (absolute).
      (3) Gages
         (a) Pitot system test gage - necessary to show a precision of ± 0.16 (you can read it to ± 0.03) inch of mercury or ± 5 (you can read it to ± 1) knots.
         (b) Static system test gage - necessary to show a precision of ± 0.1 (you can read it to ± 0.01) inch of mercury or ± 200 (you can read it to ± 20) feet.

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(c) Differential pressure gage - necessary to show 10 inches of mercury differential pressure (minimum) with a precision of ± 0.010 inch of mercury.

(4) Flow restrictors, control valves, cut-off valves, tape and port seals as necessary. (G02219 Tape, yellow vinyl adhesive - 3M Scotch brand No. 471, 3 inches wide, BAC 5034-4).

B. Consumables

(1) G02219 Tape, yellow vinyl adhesive - 3M Scotch brand No. 471, 3 inches wide, BAC 5034-4.

C. References

(1) AMM 34-11-01/601, Pitot-Static Probe

D. Access

(1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

(2) Access Panel

119AL	Main Equipment Center

E. Prepare to Pressurize the Pitot-Static System

S 862-002

(1) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:

(a) 6K14, PITOT HEAT CAPT ϕA
(b) 6K15, PITOT HEAT CAPT ϕB
(c) 6K16, PITOT HEAT R AUX ϕB
(d) 6K17, PITOT HEAT R AUX ϕC
(e) 6K20, PITOT HEAT L AUX ϕC
(f) 6K21, PITOT HEAT L AUX ϕB
(g) 6K22, PITOT HEAT F/O ϕB
(h) 6K23, PITOT HEAT F/O ϕA

F. Precautions

S 862-184

CAUTION: MAKE SURE THAT THE APPLIED PRESSURE IS NOT TOO HIGH. PRESSURE THAT IS TOO HIGH CAN CAUSE DAMAGE TO THE ELEVATOR FEEL COMPUTER.

(1) Make sure that the applied pressure is less than 5,000 (+/- 200) feet altitude.

S 862-168

(2) The rate that you apply or release the vacuum to a static system must be less than 5000 feet per minute.

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S 862-169

(3) The rate that you apply or release the pressure to a pitot system must be less than 300 knots per minute.

S 862-170

(4) The absolute pressure in the pitot system must be the same as or larger than the pressure in the static system.

S 862-171

(5) The difference between the pitot and the static pressures must not be larger than 10 inches of mercury or 420 knots.

S 862-172

(6) The absolute pressure applied to the static system must not be larger than the ambient pressure when an instrument is connected to that static system.

S 862-174

(7) Make sure the seals used on the static ports do not extend into the static ports.

S 862-175

(8) Make sure the seals do not damage or change the surface in the area when you remove the seals.

S 862-176

(9) Make sure the flow restrictors are installed between the cutoff valve and the pitot-static system.

S 862-177

(10) Make sure the autopilot is off.

S 862-178

(11) Make sure you flush the adapter on the pitot-static probe with water before you install it on the probe. Use a solution of half pure ethylene glycol and half water in temperatures between 32°F and -40°F.

G. Pressurize the Captain's Pitot and Static Systems

S 862-082

(1) Make the adapter on the pitot-static probe wet.

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S 862-193
(2) Install the pitot-static probe adapter on the pitot-static probe.

S 862-083
(3) Connect the inlet of the top left pitot-static probe to the pitot cutoff valve through the pitot system test gage and flow restrictor.

S 862-081
(4) Connect the S1 static connector on the probe adapter to the static system gages through the flow restrictors.

S 862-118

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(5) Put vinyl adhesive tape on the forward set of static ports (S1) on the pitot-static probe on the bottom right.

NOTE: You can pressurize the captain's pitot static system through drain connectors in the main electronic equipment center. You must have the applicable adapters to do this. If you do this, seal all the pitot and static ports in the above steps.

S 862-079

WARNING: KEEP PERSONS AND EQUIPMENT AWAY FROM THE TRAILING EDGE FLAPS AND THE RUDDER. THE TRAILING EDGE FLAPS AND RUDDER CAN MOVE DURING THE PRESSURIZATION AND DEPRESSURIZATION OF THE STATIC SYSTEM. THIS CAN CAUSE INJURY TO PERSONS AND CAN CAUSE DAMAGE TO THE EQUIPMENT.

(6) Make sure the equipment is installed for pressurization.

S 862-073
(7) For pressures below ambient pressure, do the steps that follow:
(a) Operate the pitot vacuum source and control valve.
(b) Make sure that the pressure in the pitot system does not start to decrease until after the static systems start to decrease in pressure.
(c) Monitor the pitot system vacuum continuously during the pump down.

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S 862-074

(8) For pressures above ambient pressure, do the steps that follow:
   (a) Operate the pitot pressure source and control valve.
   (b) Make sure that the pressure in the pitot system starts to increase before the static systems start to pressurize.
   (c) Monitor the instruments continuously.

S 862-075

CAUTION: ALWAYS KEEP THE PITOT PRESSURE THE SAME OR LARGER THAN THE STATIC LINE PRESSURE. THE DIFFERENCE MUST BE LESS THAN 10.00 INCHES OF MERCURY OR 420 KNOTS. THE DIFFERENCE MUST NOT GO BELOW ZERO. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(9) Apply the necessary pressure or vacuum to the pitot and static systems as shown on the test gages. Use the pneumatic test set and the control valves.

S 862-076

CAUTION: RELEASE THE PRESSURE OR VACUUM CONTINUOUSLY AND AT THE SAME TIME FOR THE PITOT AND STATIC SYSTEMS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(10) When you complete the test, release the pressure or vacuum on the pitot and static systems.

S 842-059

(11) As applicable, remove the seals and adapters from the pitot probe, the static ports, and the drains.

H. Pressurize the First Officer's Pitot and Static Systems

S 862-119

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PITOT PROBES. THIS CAN CAUSE THE PROBES TO NOT BE ALIGNED OR CAN CAUSE DAMAGE TO THEM.

(1) Make the adapter on the pitot-static probe wet.

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S 862-194

(2) Install the pitot-static probe adapter on the pitot-static probe.

S 862-093

(3) Connect the inlet of the top right pitot-static probe to the pitot cutoff valve through the pitot system test gage and flow restrictor.

S 862-092

(4) Connect the S1 static connector on the probe adapter to the static system gages through the flow restrictors.

S 862-146

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(5) Put vinyl adhesive tape on the forward set of static ports (S1) on the pitot-static probe on the bottom left.

NOTE: You can pressurize the first officer's pitot-static system through drain connectors in the main electronic equipment center. You must have the applicable adapters to do this. If you do this, seal all the pitot and static ports in the above steps.

S 862-090

WARNING: KEEP PERSONS AND EQUIPMENT AWAY FROM THE TRAILING EDGE FLAPS AND THE RUDDER. THE TRAILING EDGE FLAPS AND RUDDER CAN MOVE DURING THE PRESSURIZATION AND DEPRESSURIZATION OF THE STATIC SYSTEM. THIS CAN CAUSE INJURY TO PERSONS AND CAN CAUSE DAMAGE TO THE EQUIPMENT.

(6) Make sure the equipment is installed for pressurization.

S 862-089

(7) For pressures below ambient pressure, do the steps that follow:
    (a) Operate the pitot vacuum source and control valve.
    (b) Make sure that the pressure in the pitot system does not start to decrease until after the static systems start to decrease in pressure.

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(c) Monitor the pitot system vacuum continuously during the pump down.

S 862-088

(8) For pressures more than ambient pressure, do the steps that follow:
(a) Operate the pitot pressure source and control valve.
(b) Make sure that the pressure in the pitot system starts to increase before the static systems start to pressurize.
(c) Monitor the instruments continuously.

S 862-087

CAUTION: ALWAYS KEEP THE PITOT PRESSURE THE SAME AS OR LARGER THAN THE STATIC LINE PRESSURE. THE DIFFERENCE MUST BE LESS THAN 10.00 INCHES OF MERCURY OR 420 KNOTS. THE DIFFERENCE MUST NOT GO BELOW ZERO. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(9) Apply the necessary pressure or vacuum to the pitot and static systems as shown on the test gages. Use the pneumatic test set and the control valves.

S 862-086

CAUTION: RELEASE THE PRESSURE OR VACUUM CONTINUOUSLY AND AT THE SAME TIME FOR THE PITOT AND STATIC SYSTEMS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(10) When you complete the test, release the pressure or vacuum on the pitot and static systems.

S 862-148

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

(11) As applicable, remove the seals and adapters from the pitot probe, the static ports, and the drains.

I. Pressurize the Auxiliary Pitot System No. 1

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S 862-152

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(1) Put vinyl adhesive tape on the pitot chamber drain-hole in the top right probe.

NOTE: You can pressurize the auxiliary pitot system through the drain connectors in the left crawlway. You must have the applicable adapters to do this. If you do this, seal the pitot inlet on the probe.

S 862-006

CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PITOT PROBES. THIS CAN CAUSE THE PROBES TO NOT BE ALIGNED OR CAN CAUSE DAMAGE TO THEM.

(2) Make the adapter on the pitot-static probe wet.

S 862-195

(3) Install the pitot-static probe adapter on the pitot-static probe.

S 862-003

(4) Connect the inlet of the bottom left pitot-static probe to the pitot cutoff valve through the pitot system test gage and flow restrictor.

S 862-007

(5) Make sure the equipment is installed for pressurization.

S 862-005

(6) For pressures below ambient pressure, do the steps that follow:
   (a) Operate the pitot vacuum source and control valve.
   (b) Make sure that the pressure in the pitot system does not start to decrease until after the static systems start to decrease in pressure.

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(c) Monitor the pitot system vacuum continuously during the pump down.

S 862-008

(7) For pressures more than ambient pressure, do the steps that follow:
(a) Operate the pitot pressure source and control valve.
(b) Make sure that the pressure in the pitot system starts to increase before the static systems start to pressurize.
(c) Monitor the instruments continuously.

S 862-011

CAUTION: ALWAYS KEEP THE PITOT PRESSURE THE SAME AS OR LARGER THAN THE STATIC LINE PRESSURE. THE DIFFERENCE MUST BE LESS THAN 10.00 INCHES OF MERCURY OR 420 KNOTS. THE DIFFERENCE MUST NOT GO BELOW ZERO. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(8) Apply the necessary pressure or vacuum to the pitot and static systems as shown on the test gages. Use the pneumatic test set and the control valves.

S 862-009

CAUTION: RELEASE THE PRESSURE OR VACUUM CONTINUOUSLY AND AT THE SAME TIME FOR THE PITOT AND STATIC SYSTEMS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(9) When you complete the test, release the pressure or vacuum on the pitot and static systems.

S 862-132

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(10) Remove the vinyl adhesive tape and adapters from the pitot probe, the static ports, and the applicable drains.

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J. Pressurize the Auxiliary Static System No. 1

S 862-010

WARNING: MAKE SURE YOU OPEN THE RAM AIR TURBINE PWR CIRCUIT BREAKER. THIS PREVENTS UNWANTED OPERATION OF THE RAM AIR TURBINE. THIS CAN CAUSE INJURY TO PERSONS.

(1) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:

S 862-014

CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PITOT PROBES. THIS CAN CAUSE THE PROBES TO NOT BE ALIGNED OR CAN CAUSE DAMAGE TO THEM.

(2) Make the adapter on the pitot-static probe wet.

S 862-015

(3) Install the adapter on the bottom left probe.

S 862-016

(4) Connect the S2 static connector on the probe adapter to the static system gages through the flow restrictors.

S 862-133

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(5) Put vinyl adhesive tape on the aft set of static ports (S2) on the pitot-static probe on the top right.

NOTE: You can pressurize the auxiliary static system through drain connectors in the left crawlway. You must have the applicable adapters to do this. If you do this, seal all the static ports in the above steps.

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S 862-104

(6) Seal the visco jet drains with a pressure tape that will not cause a residue.

S 862-018

(7) Make sure the equipment is installed for pressurization.

S 862-019

(8) For pressures below ambient pressure, do the steps that follow:
   (a) Operate the pitot vacuum source and control valve.
   (b) Make sure that the pressure in the pitot system does not start to decrease until after the static systems start to decrease in pressure.
   (c) Monitor the pitot system vacuum continuously during the pump down.

S 862-020

(9) For pressures more than ambient pressure, do the steps that follow:
   (a) Operate the pitot pressure source and control valve.
   (b) Make sure that the pressure in the pitot system starts to increase before the static systems start to pressurize.
   (c) Monitor the instruments continuously.

S 862-021

CAUTION: ALWAYS KEEP THE PITOT PRESSURE THE SAME AS OR LARGER THAN THE STATIC LINE PRESSURE. THE DIFFERENCE MUST BE LESS THAN 10.00 INCHES OF MERCURY OR 420 KNOTS. THE DIFFERENCE MUST NOT GO BELOW ZERO. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(10) Apply the necessary pressure or vacuum to the pitot and static systems as shown on the test gages. Use the pneumatic test set and the control valves.

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S 862-022

CAUTION: RELEASE THE PRESSURE OR VACUUM CONTINUOUSLY AND AT THE SAME TIME FOR THE PITOT AND STATIC SYSTEMS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(11) When you complete the test, release the pressure or vacuum on the pitot and static systems.

S 862-135

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

(12) As applicable, remove the seals and adapters from the pitot probe, the static ports, and the drains.

K. Pressurize the Auxiliary Static System No. 2

S 862-136

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PITOT PROBES. THIS CAN CAUSE THE PROBES TO NOT BE ALIGNED OR CAN CAUSE DAMAGE TO THEM.

(1) Make the adapter on the pitot-static probe wet.

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S 862-101
(2) Install the adapter on the bottom right probe.

S 862-100
(3) Connect the S2 static connector on the probe adapter to the static system gages through the flow restrictors.

S 862-138

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(4) Put vinyl adhesive tape on the aft set of static ports (S2) on the pitot-static probe on the top left.

NOTE: You can pressurize the auxiliary static system through drain connectors in the left crawlway. You must have the applicable adapters to do this. If you do this, seal all the static ports in the above steps.

S 862-103
(5) Seal the visco jet drains with vinyl adhesive tape that will not cause a residue.

S 862-098
(6) Make sure the equipment is installed for pressurization.

S 862-097
(7) For pressures below ambient pressure, do the steps that follow:
(a) Operate the pitot vacuum source and control valve.

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(b) Make sure that the pressure in the pitot system does not start to decrease until after the static systems start to decrease in pressure.
(c) Monitor the pitot system vacuum continuously during the pump down.

S 862-096
(8) For pressures more than ambient pressure, do the steps that follow:
(a) Operate the pitot pressure source and control valve.
(b) Make sure that the pressure in the pitot system starts to increase before the static systems start to pressurize.
(c) Monitor the instruments continuously.

S 862-095

CAUTION: ALWAYS KEEP THE PITOT PRESSURE THE SAME AS OR LARGER THAN THE STATIC LINE PRESSURE. THE DIFFERENCE MUST BE LESS THAN 10.00 INCHES OF MERCURY OR 420 KNOTS. THE DIFFERENCE MUST NOT GO BELOW ZERO. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(9) Apply the necessary pressure or vacuum to the pitot and static systems as shown on the test gages. Use the pneumatic test set and the control valves.

S 862-094
(10) When you complete the test, release the pressure or vacuum on the pitot and static systems.

S 862-140

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(11) As applicable, remove the vinyl adhesive tape and adapters from the pitot probe, the static ports, and the drains.

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L. Pressurize the Auxiliary Pitot System No. 2

S 862-024

WARNING: MAKE SURE YOU OPEN THE RAM AIR TURBINE PWR CIRCUIT BREAKER. THIS PREVENTS UNWANTED OPERATION OF THE RAM AIR TURBINE. THIS CAN CAUSE INJURY TO PERSONS.

(1) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
(a) 6C2, RAM AIR TURBINE AUTO
(b) 6J8, RAM AIR TURBINE PWR

S 862-141

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(2) Put vinyl adhesive tape on the pitot chamber drain-hole in the top left probe.

NOTE: You can pressurize the auxiliary pitot system through drain connectors in the right crawlway. You must have the applicable adapters to do this. If you do this, seal all the pitot inlets on the probe.

S 862-026

CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PITOT PROBES. THIS CAN CAUSE THE PROBES TO NOT BE ALIGNED OR CAN CAUSE DAMAGE TO THEM.

(3) Make the adapter on the pitot-static probe wet.

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S 862-027

(4) Connect the inlet of the bottom right pitot-static probe to the pitot cutoff valve through the pitot system test gage and flow restrictor.

S 862-116

CAUTION: RELEASE THE PRESSURE OR VACUUM CONTINUOUSLY AND AT THE SAME TIME FOR THE PITOT AND STATIC SYSTEMS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(5) Make sure the equipment is installed for pressurization.

S 862-029

(6) For pressures below ambient pressure, do the steps that follow:
   (a) Operate the pitot vacuum source and control valve.
   (b) Make sure that the pressure in the pitot system does not start to decrease until after the static systems start to decrease in pressure.
   (c) Monitor the pitot system vacuum continuously during the pump down.

S 862-030

(7) For pressures above ambient pressure, do the steps that follow:
   (a) Operate the pitot pressure source and control valve.
   (b) Make sure that the pressure in the pitot system starts to increase before the static systems start to pressurize.
   (c) Monitor the instruments continuously.

S 862-031

CAUTION: THE PITOT PRESSURE MUST ALWAYS BE THE SAME AS OR LARGER THAN THE STATIC LINE PRESSURE. THE DIFFERENCE MUST BE LESS THAN 10.00 INCHES OF MERCURY OR 420 KNOTS. THE DIFFERENCE MUST NOT GO BELOW ZERO. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(8) Apply the necessary pressure or vacuum to the pitot and static systems as shown on the test gages. Use the pneumatic test set and the control valves.

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S 862-032

CAUTION: RELEASE THE PRESSURE OR VACUUM CONTINUOUSLY AND AT THE SAME TIME FOR THE PITOT AND STATIC SYSTEMS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(9) When you complete the test, release the pressure or vacuum on the pitot and static systems.

S 862-143

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(10) As applicable, remove the vinyl adhesive tape and adapters from the pitot probe, the static ports, and the drains.

M. Pressurize the Alternate Static System

S 862-034

WARNING: MAKE SURE YOU OPEN THE RAM AIR TURBINE PWR CIRCUIT BREAKER. THIS PREVENTS UNWANTED OPERATION OF THE RAM AIR TURBINE. THIS CAN CAUSE INJURY TO PERSONS.

(1) Make sure these circuit breakers on the P6 panel are open:
   (a) 6C2, RAM AIR TURBINE AUTO
   (b) 6J8, RAM AIR TURBINE PWR

S 862-035
(2) Install the static-port adapter to the right alternate static port.

S 862-036
(3) Install the adapter to the static system test gage through the flow restrictor.

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S 862-144

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(4) Put vinyl adhesive tape on the left alternate static port.

NOTE: You can pressurize the alternate static system through the drain connector in the right forward cargo compartment. You can also use the drain connector in the right crawlway. If you do this, seal all static ports in the above steps.

S 862-038

(5) Make sure the equipment is installed for pressurization.

S 862-039

(6) For pressures below ambient pressure, do the steps that follow:
(a) Operate the pitot vacuum source and control valve.
(b) Make sure that the pressure in the pitot system does not start to decrease until after the static systems start to decrease in pressure.
(c) Monitor the pitot system vacuum continuously during the pump down.

S 862-040

(7) For pressures more than ambient pressure, do the steps that follow:
(a) Operate the pitot pressure source and control valve.

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(b) Make sure that the pressure in the pitot system starts to increase before the static systems start to pressurize.

S 862-041

(8) Monitor the instruments continuously.

S 862-042

CAUTION: ALWAYS KEEP THE PITOT PRESSURE THE SAME OR LARGER THAN THE STATIC LINE PRESSURE. THE DIFFERENCE MUST BE LESS THAN 10.00 INCHES OF MERCURY OR 420 KNOTS. THE DIFFERENCE MUST NOT GO BELOW ZERO. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(9) Apply the necessary pressure or vacuum to the pitot and static systems as shown on the test gages. Use the pneumatic test set and the control valves.

S 862-043

CAUTION: RELEASE THE PRESSURE OR VACUUM CONTINUOUSLY AND AT THE SAME TIME FOR THE PITOT AND STATIC SYSTEMS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(10) When you complete the test, release the pressure or vacuum on the pitot and static systems.

S 862-196

(11) As applicable, remove the vinyl adhesive tape and adapters from the pitot probe, the static ports, and the drains.

N. Put the Airplane Back to Its Usual Condition

S 842-151

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

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(1) Make sure that all the vinyl adhesive tape and adapters are removed from the pitot-static probes and static ports.

S 842-197

(2) Make sure that all vinyl adhesive tape is removed from the visco jet drains.

S 212-190

(3) Examine the drain holes and static pressure ports for unwanted materials and rough locations on the inner and outer surfaces (AMM 34-11-01/601).

S 212-191

(4) Examine the pitot-static probes for signs of damage to the pitot tips and to the static ports (AMM 34-11-01/601).

S 842-043

(5) Remove the pneumatic test set.

S 842-044

(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 panel:
   (a) 6C2, RAM AIR TURBINE AUTO
   (b) 6J8, RAM AIR TURBINE PWR
   (c) 6K14, PITOT HEAT CAPT ϕA
   (d) 6K15, PITOT HEAT CAPT ϕB
   (e) 6K16, PITOT HEAT R AUX ϕB
   (f) 6K17, PITOT HEAT R AUX ϕC
   (g) 6K20, PITOT HEAT L AUX ϕC
   (h) 6K21, PITOT HEAT L AUX ϕB
   (i) 6K22, PITOT HEAT F/O ϕB
   (j) 6K23, PITOT HEAT F/O ϕA

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PITOT-STATIC SYSTEM-SERVICING

1. General
   A. To service the pitot-static system, the system must be drained and flushed. When you drain the system, it removes or makes sure there is no liquid collected in the pitot-static system sumps. When you flush the system, it removes or makes sure there is no unwanted material in the pitot-static lines.

TASK 34-11-00-683-001

2. Drain the Pitot-Static System
   A. General
      (1) The pitot-static drains are found in the forward and main equipment centers, and in the forward cargo and bulk cargo compartments.
   B. Equipment
      (1) Receptacle and/or absorbent cloth to collect the small amount of liquid from each drain.
   C. References
      (1) 34-11-00/501, Pitot-Static System
   D. Access
      (1) Location Zones

311/312	Area aft of pressure bulkhead to BS1725
121/122	Forward Cargo Compartment
113/114	Forward Equipment Center
119/120	Main Equipment Center
161/162	Bulk Cargo Compartment

      (2) Access Panels

113AL	Forward Equipment Center
119AL	Main Equipment Center

   E. Procedure

      S 613-002

      (1) Service the drain assembly as follows (Fig. 301):
         (a) Find each drain assembly.

            NOTE: If no liquid is seen in the drain sight gage, you do not have to drain the system.

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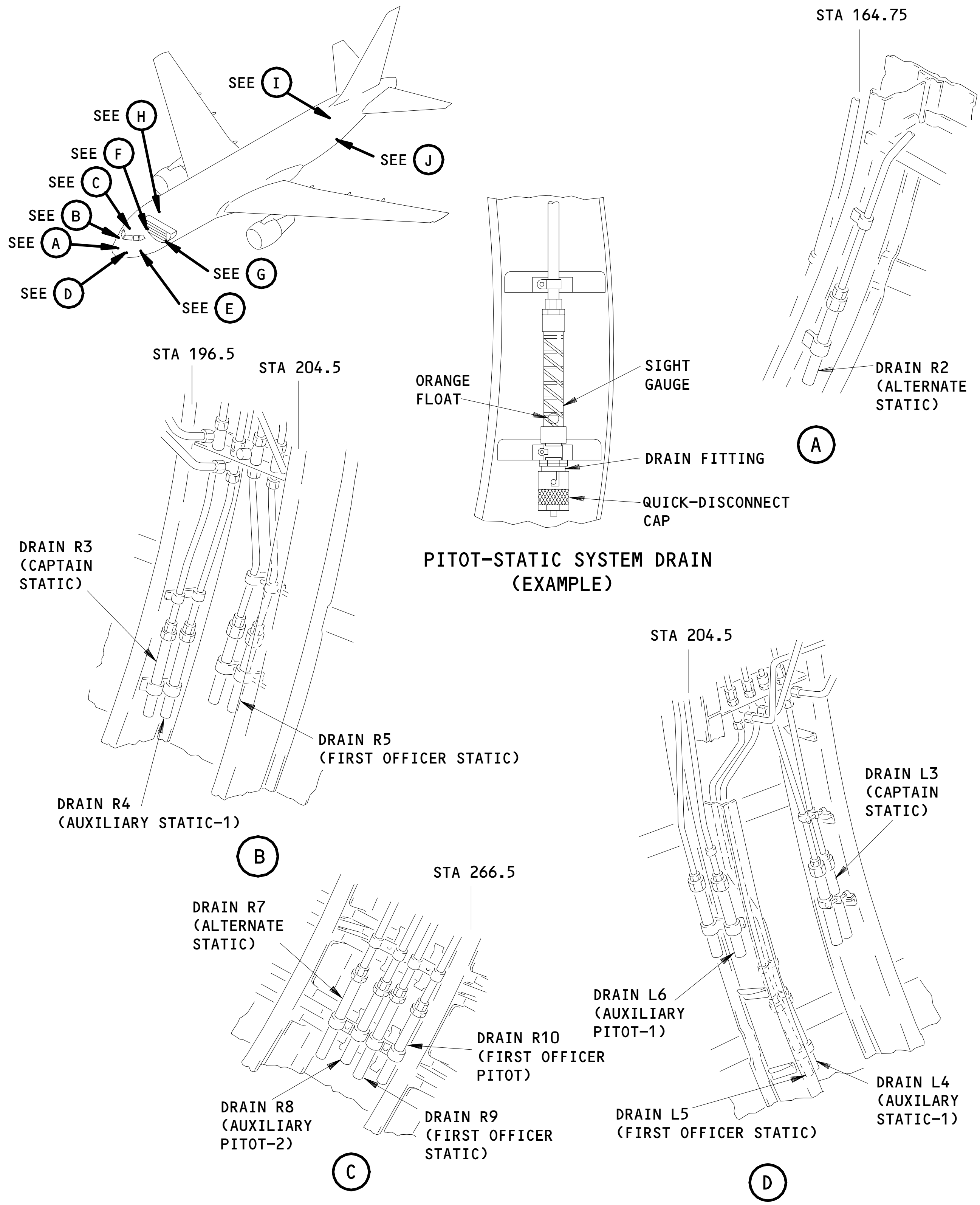

Pitot-Static System Drain Location
Figure 301 (Sheet 1)

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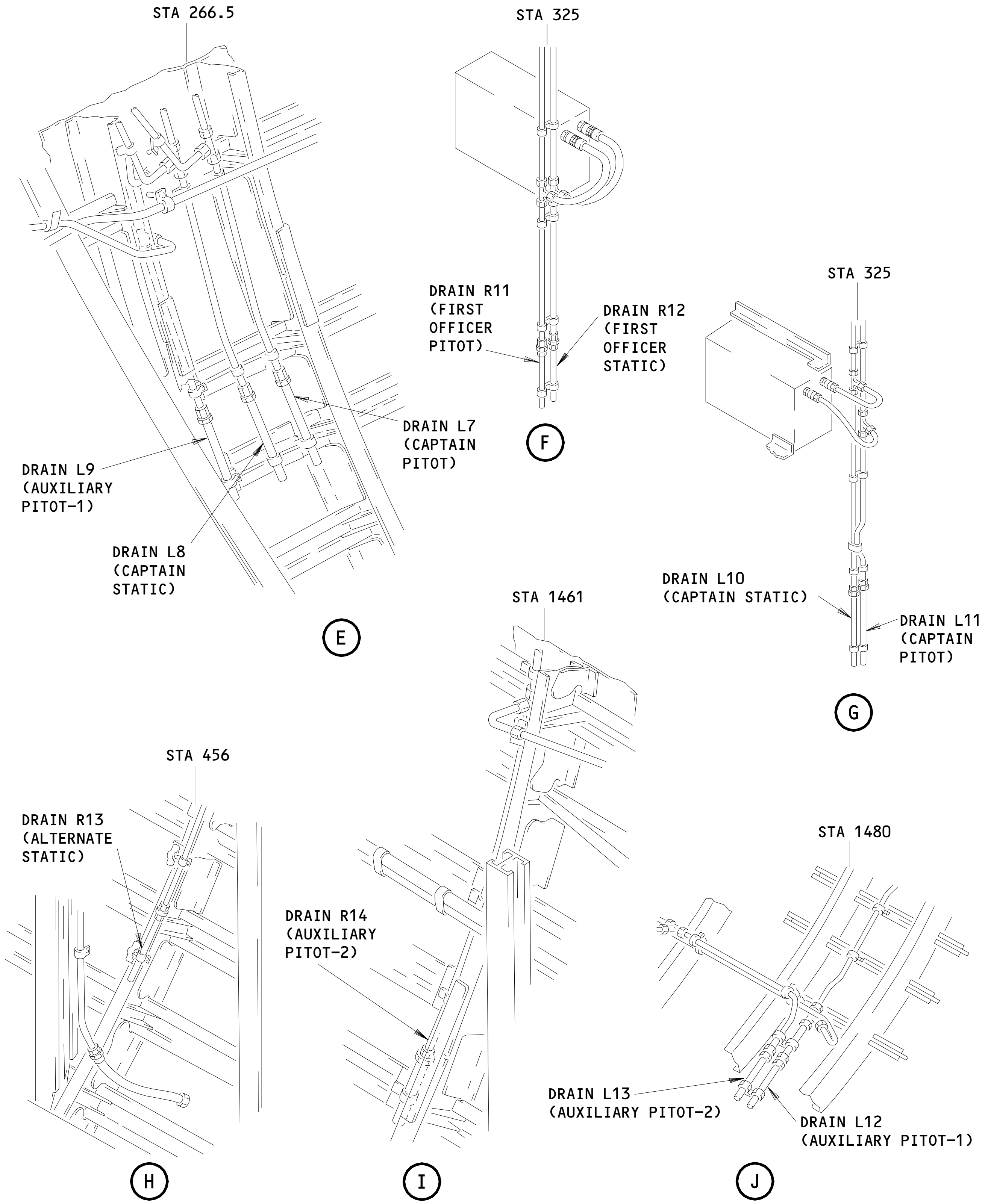

Pitot-Static System Drain Location
Figure 301 (Sheet 2)

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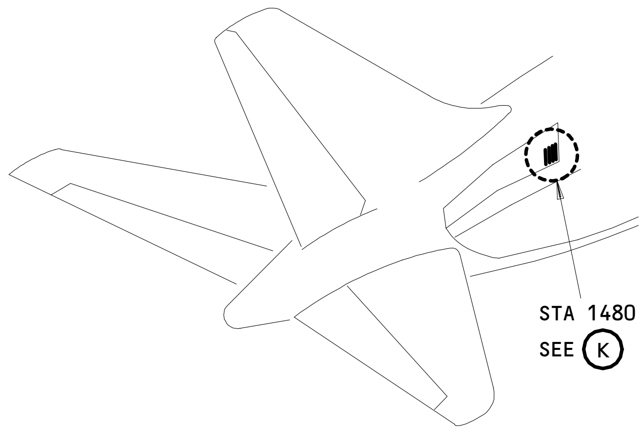
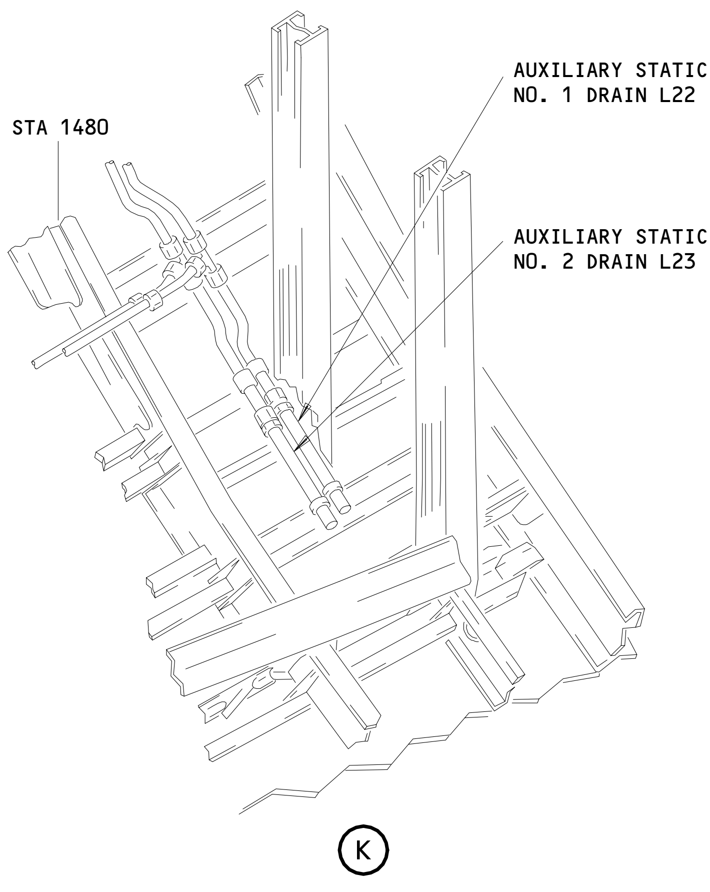


SECTION 46 AND 48



Pitot-Static System Drain Location
Figure 301 (Sheet 3)

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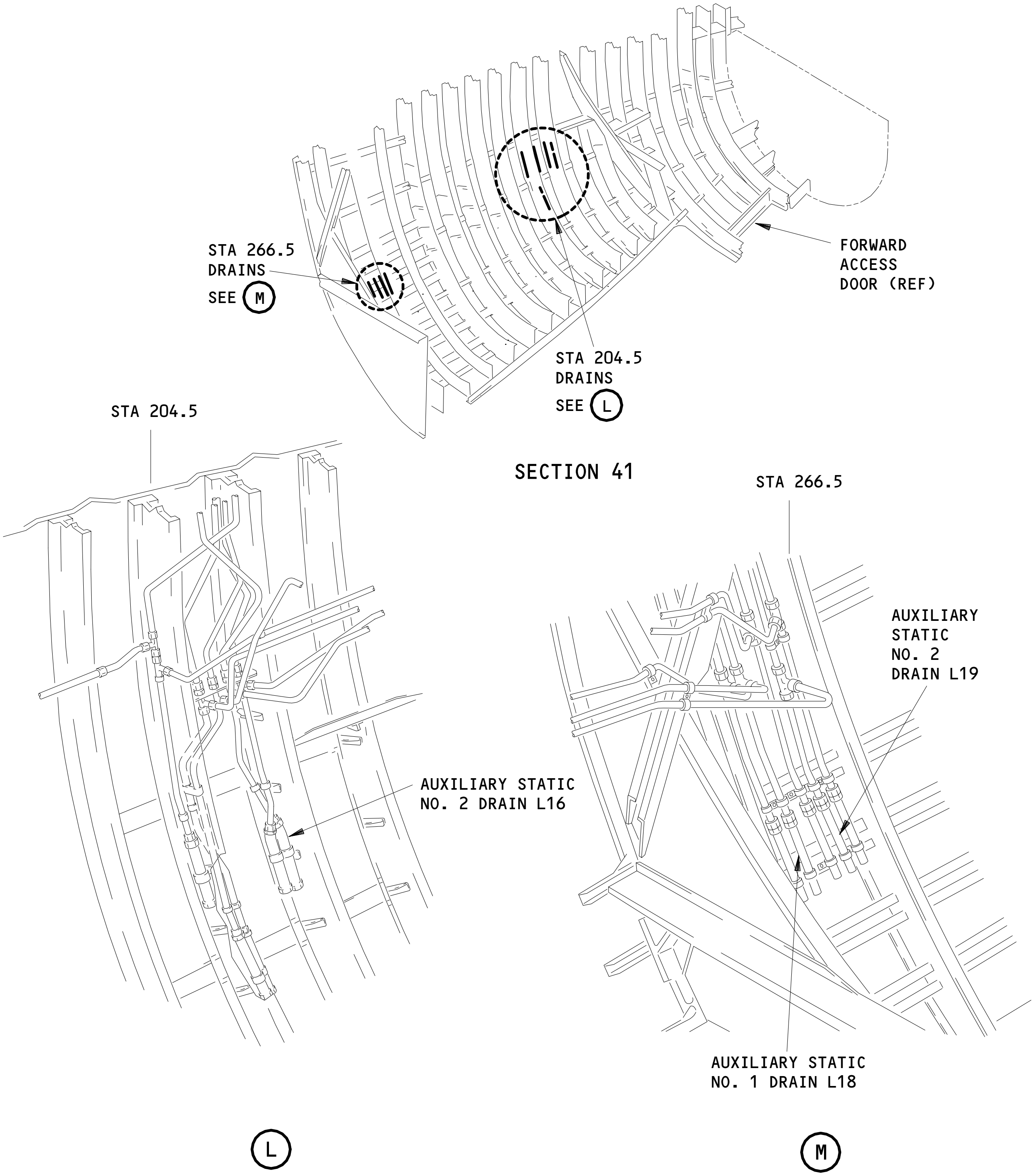

Pitot-Static System Drain Location
Figure 301 (Sheet 4)

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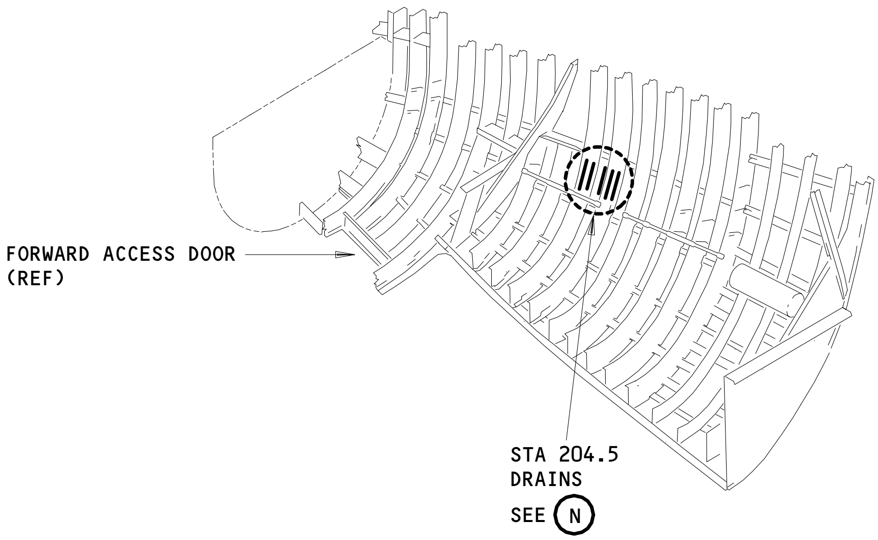
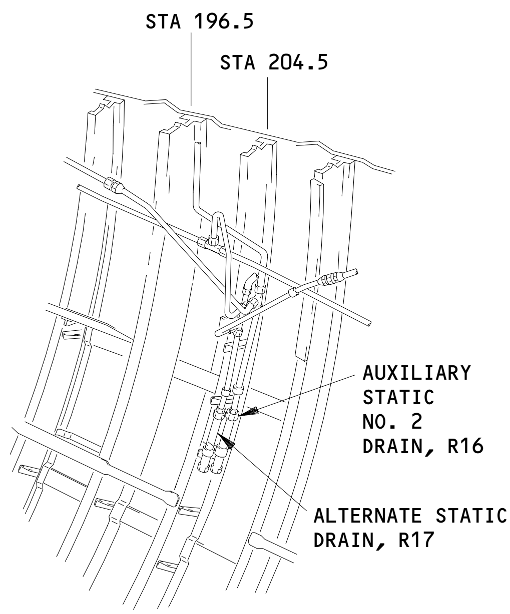


SECTION 41



N

Pitot-Static System Drain Location
Figure 301 (Sheet 5)

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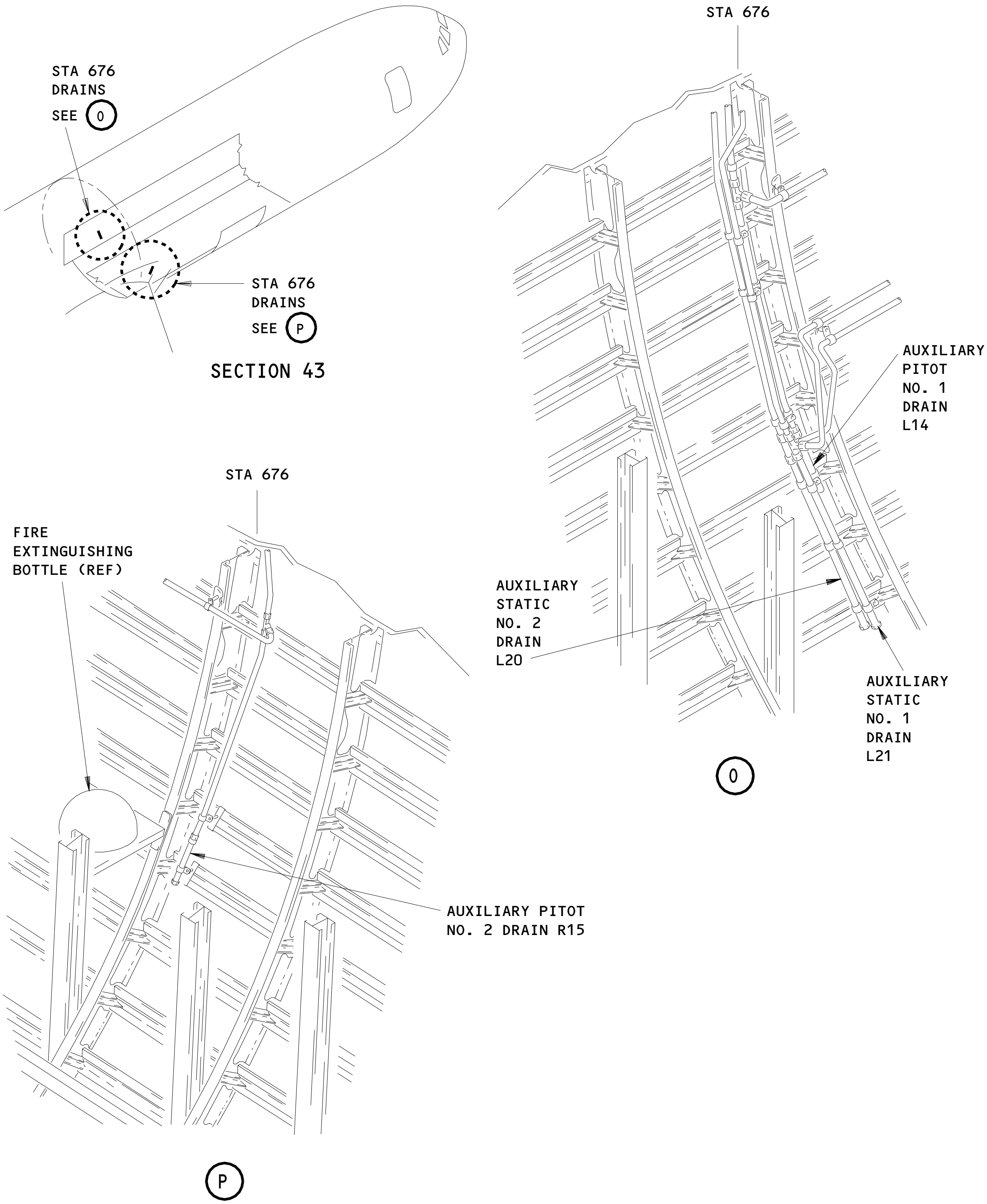

Pitot-Static System Drain Location
Figure 301 (Sheet 6)

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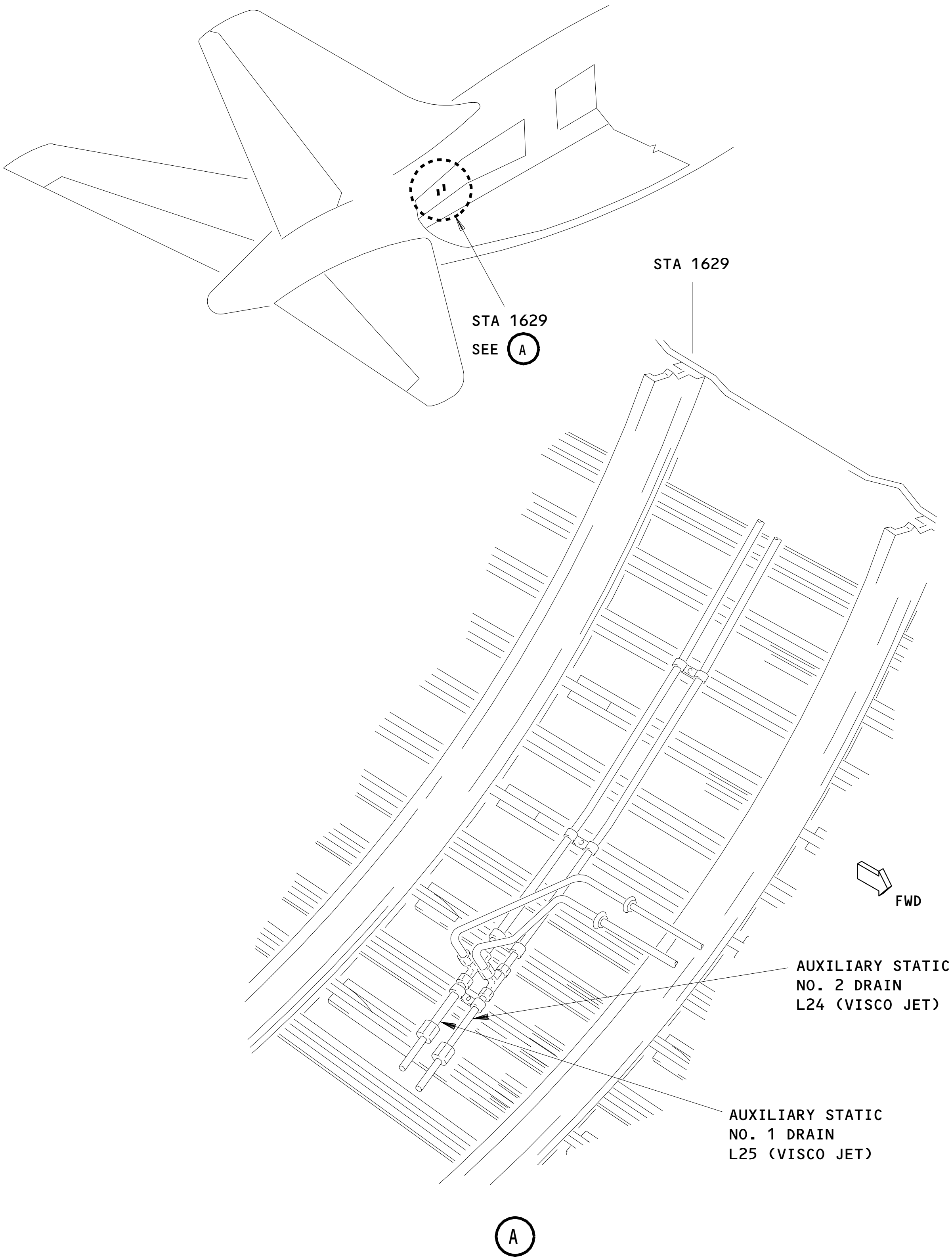

Static System Visco Jet Drain Location
Figure 302

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WARNING: THERE CAN BE HYDRAULIC FLUID WHEN YOU DRAIN THE STATIC SYSTEM. IF THE HYDRAULIC FLUID TOUCHES YOUR SKIN, FLUSH THE SKIN WITH WATER. IF THE HYDRAULIC FLUID TOUCHES YOUR EYES, FLUSH THE EYES WITH WATER AND GET MEDICAL AID.

(b) To remove the drain cap, push up and twist to release the cap from the bayonet pins.
(c) Turn the cap and put the pin in the bottom of the drain body.
(d) Push the cap into the drain body with hand pressure.
(e) Drain all of the liquid from the sump.
(f) Install the cap on the drain body in its initial position.

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TASK 34-11-00-173-004

3. Flush the Pitot-Static System

A. Equipment

(1) Dry air Pressure Source, 0-50 psig with filter and gage for measuring pressure.

B. References

(1) 21-33-04/401, Differential Pressure Transducer
(2) 27-31-19/401, Elevator Feel Computer
(3) 29-21-24/401, RAT Assembly
(4) 34-11-00/501, Pitot-Static System
(5) 34-11-01/401, Pitot-Static Probe
(6) 34-11-03/401, Alternate Static Port
(7) 34-12-01/401, Air Data Computer
(8) 34-13-05/401, Standby Airspeed Indicator
(9) 34-13-06/401, Standby Altimeter

C. Access

(1) Location Zones

161/162	Bulk Cargo Compartment
121/122	Forward Cargo Compartment
113/114	Forward Equipment Center
119/120	Main Equipment Center

(2) Access Panels

113AL	Forward Equipment Center
119AL	Main Equipment Center

D. Prepare to Flush the Pitot-Static System

S 033-006

(1) Disconnect the pitot-static system lines and cap each hose on the tube.

S 033-005

(2) As the steps that follow are done, remove the quick-disconnects installed on the hoses and hold all the hoses to prevent too much movement.

(a) On the flight deck, disconnect the instruments that follow from the pitot-static system:

1) The pilots' standby airspeed indicator (two inputs) (Ref 34-13-05).

2) The standby altimeter (one input) (Ref 34-13-06).

(b) Disconnect the differential pressure transducer from the static system in the right lower lobe area at approximately body station 212, WL 185 (Ref 21-33-04).

(c) Disconnect the instruments that follow from the pitot-static system in the main equipment center.

1) The left and right air data computers (two inputs each) (Ref 34-12-01).

2) The RAT pressure switch (two inputs) (AMM 29-21-24/401).

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(d) Disconnect the elevator feel computers from the pitot-static system (4 inputs) in section 48 of the airplanes (Ref 27-31-19).

S 033-108

WARNING: DO NOT LET HYDRAULIC FLUID GET ON YOUR BODY. HYDRAULIC FLUID CAN BE IN THE STATIC SYSTEM. FLUSH HYDRAULIC FLUID FROM YOUR SKIN WITH WATER. IF HYDRAULIC FLUID GETS IN YOUR EYES, FLUSH YOUR EYES WITH WATER. THEN GET MEDICAL AID.

(3) Remove all drain assemblies from pitot-static system.

S 393-007

(4) Seal each hose with a cap at the locations that follow (Fig. 301):
(a) In the forward equipment area
(b) In the left crawlway (section 41)
(c) In the right crawlway (section 41)
(d) In the main equipment center
(e) In the forward cargo compartment
(f) In the aft cargo compartment

S 033-026

CAUTION: PITOT-STATIC PROBES ARE INSTRUMENTS THAT ARE EASILY DAMAGED AND ARE CAREFULLY ALIGNED ON THE AIRPLANE. THE BEST CARE MUST BE USED WHEN YOU REMOVE, INSTALL OR TOUCH THE PROBES.

(5) Remove the pitot-static hoses from each pitot-static probe and seal each hose with a cap. You can do this from the inner side of the airplane in the left and right crawlways.

E. Flush the Pitot-Static System

S 173-010

(1) Flush the pitot-static lines with dry, filtered air, not more than 50 psi.

S 033-011

(2) Remove the caps one at a time from the location written below to flush to the outlet noted:
(a) Flush for three minutes.
(b) Make sure air comes out of each outlet flushed to make sure there are no lines cross-connected.
(c) After you flush, replace the cap before you do the next step.

S 173-012

(3) Flush the Captain's Pitot System
(a) Flush from the hose disconnected from the upper left pitot-static probe to the hoses that follow:
1) The pitot line disconnected from drain L7 at STA 266.5.

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2) The pitot hose disconnected from the left air data computer in the main equipment center at STA 325.
3) The pitot line disconnected from drain L10 in the main equipment center at STA 325.

S 173-013
(4) Flush the First Officer's Pitot System
(a) Flush from the hose disconnected from the upper right pitot-static probe to the hoses that follow:
1) The pitot hose disconnected from drain R10 at STA 266.5.
2) The pitot hose disconnected from the right air data computer in the main equipment center at STA 325.
3) The pitot hose disconnected from drain R11 in the main equipment center at STA 325.

S 173-014
(5) Flush the Auxiliary Pitot System No. 1
(a) Flush from the hose disconnected from the lower left pitot-static probe to the hoses that follow:
1) The pitot hose disconnected from the standby airspeed indicator (Ref 34-13-05).
2) The pitot line disconnected from drain L6 at STA 204.5.
3) The pitot line disconnected from drain L9 at STA 266.5.
4) The pitot line disconnected from drain L12 at STA 1480.
5) The pitot hose disconnected from the elevator feel computer (Ref 27-31-19).
6) SAS 150-274;
The pitot line disconnected from drain L14 at STA 676.

S 173-015
(6) Flush the Auxiliary Pitot System No. 2
(a) Flush from the hose disconnected from the lower right pitot-static probe to the hoses that follow:
1) The pitot line disconnected from drain R8 at STA 266.5.
2) The pitot hose disconnected from the RAT pressure switch (Ref 29-21-01).
3) The pitot line disconnected from drain R14 at STA 1461.
4) The pitot line disconnected from drain L13 at STA 1480.
5) The pitot hose disconnected from the elevator feel computer (Ref 27-31-19).
6) SAS 150-274;
the pitot line disconnected from drain R15 at STA 676.

S 173-016
(7) Flush the Captain's Static System
(a) Flush from the hose disconnected from the S1 port of the upper left pitot-static probe to the hoses that follow:
1) The static line disconnected from drain L3 at STA 204.5.
2) The static line disconnected from drain R3 at STA 196.3.
3) The static hose disconnected from the S1 port of the lower right static probe (Ref 34-11-01).

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(b) Flush from the static hose disconnected from the left air data computer to the hoses that follow:
   1) The static line disconnected from drain L8 in the main equipment center at STA 266.5.
   2) The static line disconnected from drain L11 in the main equipment center at STA 325.

S 173-017

(8) Flush the First Officer's Static System
   (a) Flush from the static hose disconnected from the S1 port of upper right pitot-static probe to the hoses that follow:
      1) The static line disconnected from drain R5 at STA 204.5.
      2) The static line disconnected from drain L5 at STA 204.5.
      3) The static hose disconnected from S1 port of the lower left static probe (Ref 34-11-01).
   (b) Flush from the static hose disconnected from the right air data computer to the hoses that follow:
      1) The static line disconnected from drain R12 in the main equipment center at STA 325.
      2) The static line disconnected from drain R9 at STA 266.5.

S 173-018

(9) Flush the Auxiliary Static System No. 1
   (a) Flush from the static hose disconnected from the S2 port of the upper right static probe to the hoses that follow:
      1) The static line disconnected from drain R4 at STA 196.5.
      2) The static line disconnected from drain L18 at STA 265.
      3) SAS 150-274;
         the static line disconnected from drain L21 at STA 676.
      4) The static line disconnected from drain L25 at STA 1629.
      5) The static line disconnected from drain L4 at STA 204.5.
      6) The static hose disconnected from the S2 port of the lower left pitot-static probe (Ref 34-11-01).
      7) SAS 050-149;
         the static hose disconnected from the differential pressure transducer (Ref 21-33-04).
      8) SAS 050-149;
         the static hose disconnected from the RAT pressure switch (Ref 29-21-01).
      9) SAS 150-999;
         the static hose disconnected from the elevator feel computer (Ref 27-31-19).
      10) The static line disconnected from drain L22 at STA 1476.

S 173-020

(10) Flush the Auxiliary Static System No. 2.
   (a) Flush from the static hose disconnected from the S2 port of the upper left static probe to the hoses that follow:
      1) The static line disconnected from drain L24 at STA 1629.
      2) The static line disconnected from drain L19 at STA 1480.
      3) The static line disconnected from drain L16 at STA 200.

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4) The static line disconnected from drain L23 at STA 1476.
5) The static line disconnected from drain R16 at STA 200.
6) The static line disconnected from drain L20 at STA 676.
7) The static line disconnected from the elevator feel computer (Ref 27-31-19).
8) The static hose disconnected from the pitot-static probe S2 on the lower right probes (Ref 34-11-01).

S 173-021

(11) Flush the Alternate Static System

(a) Flush from the static hose disconnected from the right alternate static port to the hoses that follow:

1) The static hose disconnected from the left alternate static port (Ref 34-11-03).
2) The static line disconnected from drain R13 at STA 456.
3) The static line disconnected from drain R7 at STA 266.5.
4) The static line disconnected from drain R17 at STA 200.
5) The static hose disconnected from the standby altimeter (Ref 34-13-06).
6) The static hose disconnected from the standby airspeed indicator (Ref 34-13-05).
7) The static line disconnected from drain R2 at STA 164.75.
8) SAS 150-999;
   the static hose disconnected from the differential pressure transducer (Ref 21-33-04).
9) SAS 150-999;
   the static hose disconnected from the RAT pressure switch (Ref 29-21-24).

F. Put the Airplane Back to Its Usual Condition

S 033-101

(1) Remove the caps on the pitot and static hoses and lines.

S 433-107

(2) Connect the drain assemblies to their related components.

NOTE: Make sure the acutation ring is fully engaged on the lock pins and make sure you see the colored locked ring indicator that shows a correct connection of the quick-disconnect fitting.

S 753-103

(3) Do the low-range leakage test on the pitot-static system (Ref 34-11-00/501).

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PITOT-STATIC SYSTEM - ADJUSTMENT/TEST

1. General
   A. The pitot-static system test has procedures for high range and low range leak tests. These leak tests cannot be done as pre-flight tests because they require a source of air as an input to the pitot-static system. A check of the indications on the air data instruments is the only test that can be done as a pre-flight check.
   B. The high range leak test is done for these conditions:
      - if a pitot-static system connection is disconnected to replace fittings, hoses or tubing.
      - if the pitot-static system is flushed.
      - if the indications on the air data instruments show that a leak is possible.
      - after a major airplane overhaul.
   C. The low range leakage test is done if a quick check of the pitot-static system is necessary. Do a high range leak test when the instruments behave as to suggest a leak, during the low range leak test.
   D. It is not necessary to do a leak test of a quick-disconnect self sealing fitting that has been disconnected and then connected again. It is only necessary to see that the fitting connection is locked and sealed (blue band indicates correct quick disconnect connection). If you are not sure the quick-disconnect is correct, do the low range leak test.
   E. Leak Test Pressure - Pitot
      (1) Low Range Pressure
         (a) 1.959 ± 0.16 inches of mercury (gage) or
             200 ± 5 knots (Airspeed Indicator)
      (2) High Range Pressure
         (a) 4.53 ± 0.16 inches of mercury (gage) or
             300 ± 5 knots (Airspeed Indicator)
   F. Leak Test Pressure - Static
      (1) Low Range Vacuum Pressure
         (a) Ambient pressure minus 5.25(± 0.25) inches of mercury or
             5000 ± 200 feet (Alitmeter Indicator).
      (2) High Range Pressure
         (a) Ambient pressure minus 18.82 ± 0.25 inches of mercury (gage) or
             25,000 ± 200 feet (Altimeter Indicator).

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TASK 34-11-00-735-001

2. System Test - Pitot-Static System

A. Equipment

(1) Adapters

(a) Pitot-static probe test adapter -
Rosemount Engineering, 884EH
(2 Required)
Rosemount Inc.
14300 Judicial Rd.
Burnsville, MN 55337

(b) Pitot-static probe adapter kit (For repair of test adapter) -
P/N RCF509 (2 Required).
RCF Seals & Couplings Inc.
320 Commerce Loop
Vidalia, GA 30474

(c) Static port adapter -
NAVAIDS, P/N 33410 LH-125-4
NAV-AIDS, LTD
2955 Diab St.
Montreal, Ouebec, Canada H45 1M1

(d) Equivalent Pitot Static Probe adapter set
P/N ADA 767 - 612
NAV-AIDS, LTD
2955 Diab St.
Montreal, Ouebec, Canada H45 1M1

(2) Pneumatic Test Set

(a) Dry air pressure source (1 necessary), 0 to 5 inches of mercury gage.

(b) Vacuum sources (2 necessary), 0 to 20 inches of mercury gage.

(c) Air Data test set - KOLLSMAN P/N 18910480000

(3) Gages

(a) Pitot system test gage:

1) Pressure of 30 to 35 inches of mercury (absolute) with accuracy of ± 0.16 (readable to ± 0.03) inch of mercury or ± 5 (readable to ± 1) knots.

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2) Vacuum of 10 to 30 inches of mercury (absolute) with accuracy of ± 1 inch of mercury minimum.

(b) Static system test gage - require to indicate vacuum of 10 to 30 inches of mercury (absolute) with accuracy of ± 0.1 (readable to ± 0.01) inch of mercury or ± 200 (readable to ± 20) feet.

(c) Differential pressure gage - must show 10 inches of mercury differential pressure (minimum) with a precision of ± 0.010 inch of mercury.

(4) Flow restrictors, control valves, cutoff valves, tape and port seals as necessary.

(5) Consumable Materials

(6) G02219 Tape, Yellow vinyl adhesive - 3M Scotch Brand No. 471, 3 inches wide, BAC 5034-4

B. References

(1) AMM 22-10-00/501, Autopilot (Flight Control) System
(2) AMM 27-31-19/401, Elevator Feel Computer
(3) AMM 29-21-24/401, Rat Airspeed Switch
(4) AMM 34-13-05/401, Standby Airspeed Indicator
(5) AMM 24-22-00/201, Electrical Power Control

C. Access

(1) Location Zones

119/120	Main Equipment Center
122	Forward Cargo Compartment (Right)
211/212	Flight Compartment
311/312	Area aft of pressure bulkhead

(2) Access Panels

119AL	Main Equipment Center Access
821	Forward Cargo Compartment

D. Prepare for the System Test

S 765-515

(1) Supply electrical power to the airplane (AMM 24-22-00/201).

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S 865-450

WARNING: MAKE SURE THE ATC TRANSPONDERS ARE NOT IN AN ALTITUDE REPORTING MODE WHEN YOU SIMULATE ALTITUDE. IF YOU DO NOT, YOU CAN ACCIDENTALLY CAUSE FALSE TCAS TARGETS.

(2) Make sure the ATC transponders are not in an altitude reporting mode.

S 495-021

(3) Seal the visco jet drains with vinyl adhesive tape that will not cause a residue.

S 215-022

(4) Make sure air cannot go into the system when you supply the vacuum.

S 865-023

(5) Remove all power from the autopilot (flight control) system (AMM 22-10-00/501).

S 865-024

(6) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
   (a) 6C2, RAM AIR TURBINE AUTO
   (b) 6J8, RAM AIR TURBINE PWR
   (c) 6K14, PITOT HEAT CAPT ϕA
   (d) 6K15, PITOT HEAT CAPT ϕB
   (e) 6K16, PITOT HEAT R AUX ϕB
   (f) 6K17, PITOT HEAT R AUX ϕC
   (g) 6K20, PITOT HEAT L AUX ϕC
   (h) 6K21, PITOT HEAT L AUX ϕB
   (i) 6K22, PITOT HEAT F/O ϕB
   (j) 6K23, PITOT HEAT F/O ϕA

S 865-236

WARNING: MAKE SURE THAT YOU DO NOT APPLY ELECTRICAL POWER TO THE FLIGHT CONTROLS. FLIGHT CONTROL SURFACES CAN MOVE AUTOMATICALLY WHEN YOU PRESSURIZE THE PITOT-STATIC SYSTEM. THIS CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(7) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
   (a) On the P11 panel open this circuit breaker:
      1) 11J13, T/E FLAP LOAD RELIEF

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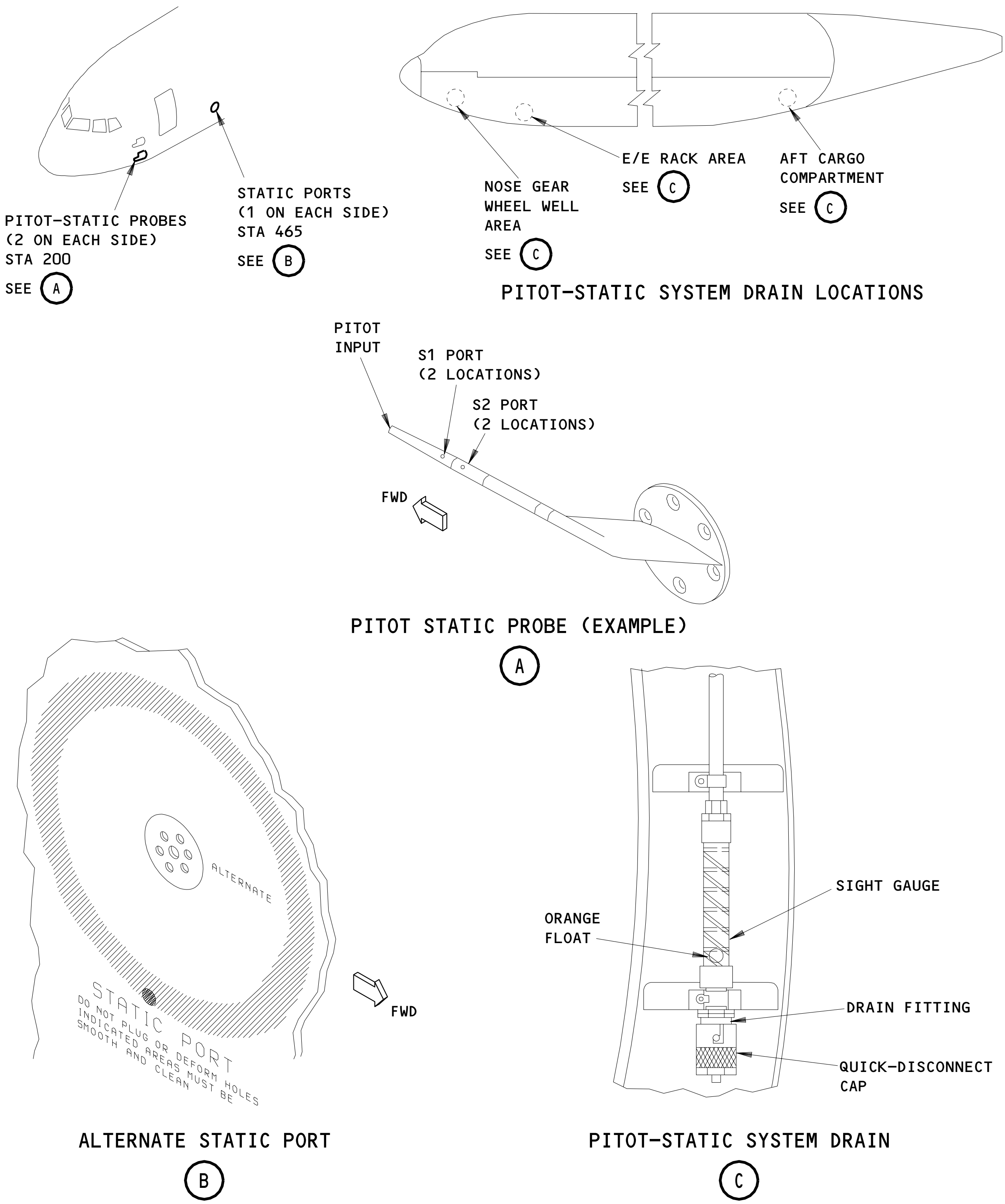

Pitot-Static System Component Locations
Figure 501 (Sheet 1)

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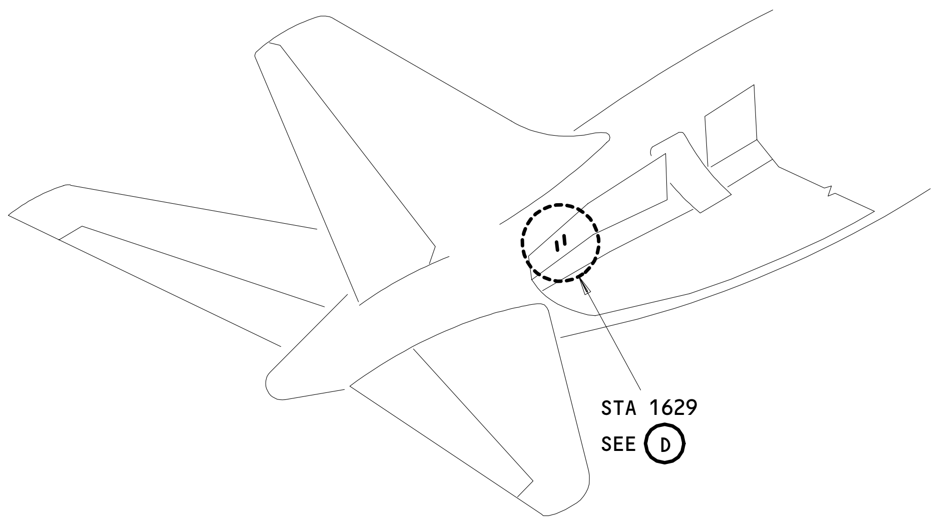
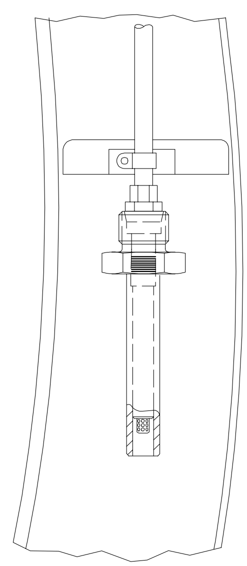


STATIC SYSTEM VISCO JET DRAIN LOCATIONS



STATIC SYSTEM VISCO JET DRAIN
D

Pitot-Static System Component Locations
Figure 501 (Sheet 2)

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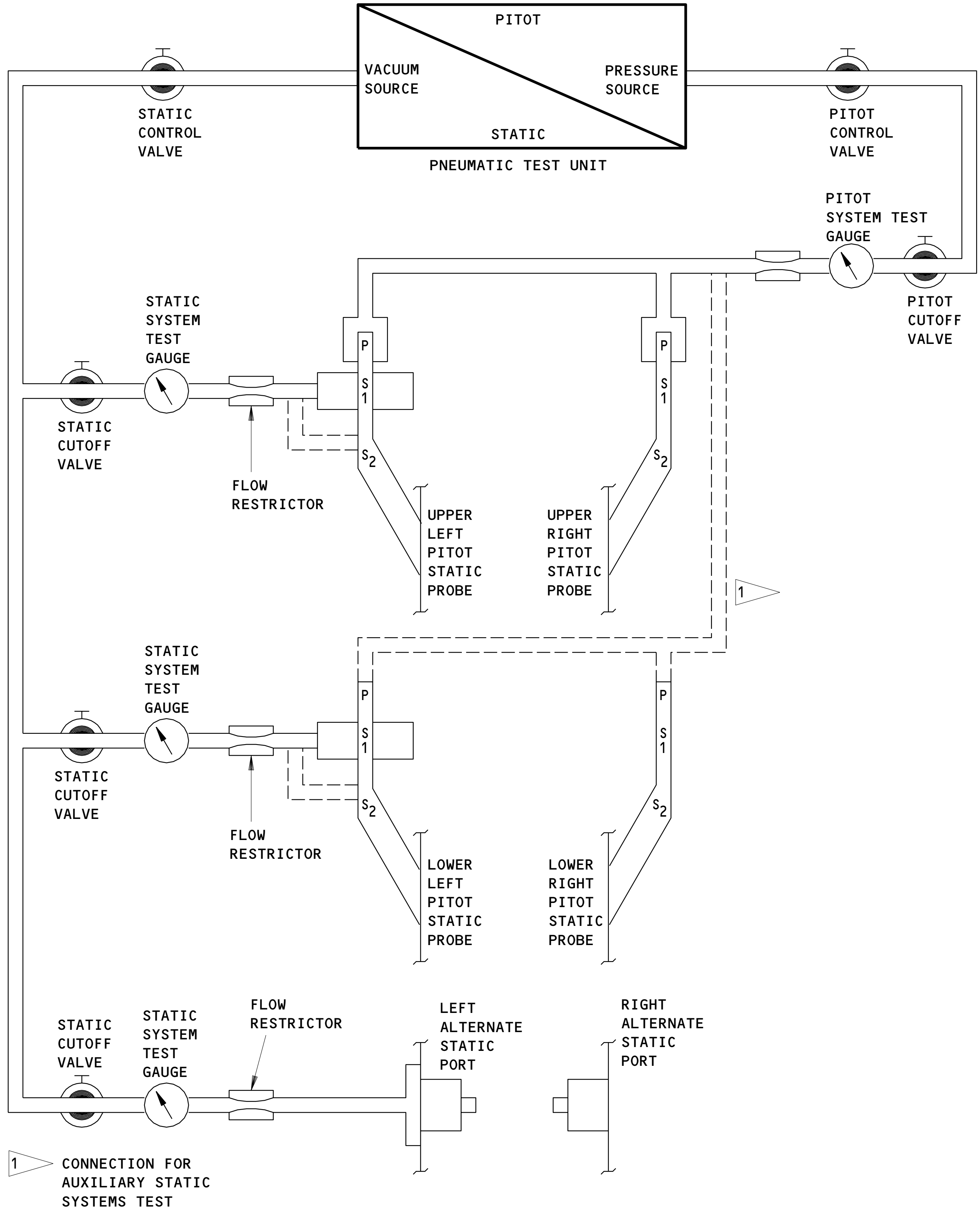

Pitot-Static Systems - Test Equipment Connection
Figure 502

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E. Leak Test of the Captain's Pitot System (Top left probe)

S 865-263

(1) Prepare for the leak test of the captain's pitot system.
   (a) Make sure this circuit breaker on the overhead circuit breaker panel, P11, is closed:
      1) 11A10, AIR DATA CMPTR L
      2) 11A11, AIR DATA AOA SENSOR L

   CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

   (b) Flush the adapter for the pitot-static probe with water before you install it on the probe.

      NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

   (c) Put vinyl adhesive tape on the drain hole for the pitot chamber on the top left probe.

   CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBES. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF THE ALIGNED POSITION.

   (d) Install the test adapter on the top left pitot-static probe.

   CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

   (e) Connect these items between the pitot pressure source on the pneumatic test set to the pitot inlet of the test adapter.
      1) A control valve.
      2) A cutoff valve.
      3) A flow restrictor.
      4) A pitot system test gage.

S 735-264

(2) Do the low range leakage test or the high range leakage test, as applicable, for the captain's pitot-static system:
   (a) Low range leakage test.
      1) Make sure the test equipment is installed correctly.
      2) Make sure that the left AOA vane is postion to approximately 0 degree when using the captain's airspeed indicator.

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CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO INSTRUMENTS OR EQUIPMENT.

3) Pressurize the captain's pitot system to 1.959 (±0.16) inches of mercury (gage) or 200 (±5) knots. Measure the pressure on the pitot system test gage or on the captain's airspeed indicator.
4) When the pressure is stable, close the pitot cutoff valve.
5) Read and record the value that shows on the test gage or the captain's airspeed indicator.
6) After 1 minute, make sure the pressure did not decrease by more than 0.03 inch of mercury or 1.5 knots.
7) Slowly release the pressure in the captain's pitot system.
8) Remove the test adapter from the pitot-static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

9) Remove the vinyl adhesive tape from the drain on the pitot-static probe.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS ON THE PROBE.

10) Make sure that all of the tape is removed.

(b) High range leakage test.
1) Make sure the test equipment is installed correctly.
2) Make sure that the left AOA vane is position to approximately 0 degree when using the captain's airspeed indicator.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

3) Pressurize the captain's pitot system to 4.53 (±0.16) inches of mercury (gage) or 300 (±5) knots. Measure the pressure on the pitot system test gage or on the captain's airspeed indicator.
4) When the pressure is stable, close the pitot cutoff valve.
5) Read and record the value that shows on the test gage or the captain's airspeed indicator.
6) After 1 minute, make sure the pressure has not decreased by more than 0.16 inch of mercury or 5 knots.

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7) Slowly release the pressure from the captain's pitot system.

8) Remove the test adapter from the pitot-static probe.

a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

9) Remove the vinyl adhesive tape from the drain on the pitot-static probe.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS ON THE PROBE.

10) Make sure that all of the tape is removed.

F. Leak Test of the Auxiliary Pitot System No. 1 (Standby Airspeed Instrument Line) (Bottom left probe)

S 865-265

(1) Prepare for the leak test of the auxiliary pitot system No. 1:

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

(a) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

(b) Put vinyl adhesive tape on the drain hole for the pitot chamber on the bottom left probe.

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBES. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PROBE OR PUT THE PROBES OUT OF THE ALIGNED POSITION.

(c) Install the test adapter on the bottom left pitot-static probe.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTORS BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(d) Connect these items between the pitot pressure source on the pneumatic test set to the pitot inlet of the test adapter.

(e) A control valve.

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(f) A cutoff valve.
(g) A flow restrictor.
(h) A test pitot system gage.

S 735-266

(2) Do the low range leakage test or the high range leakage test, as applicable, for the auxiliary pitot system No. 1:
(a) Low range leakage test.
1) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Pressurize the auxiliary pitot system No. 1 to 1.959 (± 0.16) inches of mercury (gage) or 200 (± 5) knots. Measure the pressure on the pitot system test gage or on the standby airspeed indicator.
3) When the pressure is stable, close the pitot cutoff valve.
4) Read and write the value that shows on the test gage or the standby airspeed indicator.
5) After 1 minute, make sure the pressure did not decrease by more than 0.03 inch of mercury or 1.5 knots.
6) Slowly release the pressure in the auxiliary pitot system No. 1.
7) Remove the test adapter from the pitot-static probe.
a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

8) Remove the vinyl adhesive tape from the pitot-static probe.
(b) High range leakage test.
1) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Pressurize the auxiliary pitot system No. 1 to 4.53 (±0.16) inches of mercury (gage) or 300 (±5) knots. Measure the pressure on the pitot system test gage or on the standby airspeed indicator.
3) When the pressure is stable, close the pitot cutoff valve.
4) Read and write the value that shows on the test gage or the standby airspeed indicator.
5) After 1 minute, make sure the pressure did not decrease by more than 0.16 inch of mercury or 5 knots.

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6) Slowly release the pressure in the auxiliary pitot system No. 1.
7) Remove the test adapter from the pitot static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

8) Remove the vinyl adhesive tape from the pitot-static probe.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS ON THE PROBE.

9) Make sure that all of the tape is removed.

G. Leak Test of the First Officer's Pitot System (Top right probe)

S 865-267

(1) Prepare for the leak test of the first officer's pitot system:
   (a) Remove the DO-NOT-CLOSE tag and close this circuit breaker on P11 panel:
      1) 11F30, AIR DATA CMPTR RIGHT
      2) 11F31, AIR DATA AOA SENSOR R
   (b) Put vinyl adhesive tape on the drain hole for the pitot chamber on the top right probe.

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF THE ALIGNED POSITION.

   (c) Install the test adapter on the top right pitot-static probe.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVES AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

   (d) Connect these items between pitot pressure source on the pneumatic test set to the pitot inlet of the test adapter.
      1) A control valve.
      2) A cutoff valve.
      3) A flow restrictor.
      4) A pitot system test gage.

S 735-268

(2) Do the low range leakage test or the high range leakage test, as applicable, of the first officer's pitot system:
   (a) Low range leakage test.
      1) Make sure the test equipment is installed correctly.

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CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Make sure that the right AOA vane is position to approximately 0 degree when using the First Officer's airspeed indicator.
3) Pressurize the first officer's pitot system to 1.959 (±0.16) inches of mercury (gage) or 200 (±5) knots. Measure the pressure on the pitot system test gage or on the first officer's airspeed indicator.
4) When the pressure is stable, close the pitot cutoff valve.
5) Read and record the value that shows on the test gage or the first officer's airspeed indicator.
6) After 1 minute, make sure the pressure did not decrease by more than 0.03 inch of mercury or 1.5 knots.
7) Slowly release the pressure in the first officer's pitot system.
8) Remove the test adapter from the pitot-static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

9) Remove the vinyl adhesive tape from the pitot-static probe.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS ON THE PROBE.

10) Make sure that all of the tape is removed.

(b) High range leakage test.
1) Make sure test equipment is installed correctly.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Make sure that the right AOA vane is position to approximately 0 degree when using the First Officer's airspeed indicator.
3) Pressurize the first officer's pitot system to 4.53 (±0.16) inches of mercury (gage) or 300 (±5) knots. Measure the pressure on the pitot system test gage or on the first officer's airspeed indicator.
4) When the pressure is stable, close the pitot cutoff valve.
5) Read and record the value that shows on the test gage or the first officer's airspeed indicator.

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6) After 1 minute, make sure the pressure did not decrease by more than 0.16 inch of mercury or 5 knots.
7) Slowly release the pressure in the first officer's pitot system.
8) Remove the test adapter from the pitot-static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

9) Remove the drain seal from the pitot-static probe.

H. Leak Test of the Auxiliary Pitot System No. 2 (Bottom right probe)

S 865-269

(1) Prepare for the leak test of the auxiliary pitot system No. 2:

WARNING: OPEN THESE CIRCUIT BREAKERS FOR THE RAM AIR TURBINE BEFORE YOU DO A TEST OF THE NO. 2 PITOT SYSTEM. IF YOU DO NOT OPEN THESE CIRCUIT BREAKERS, THE RAM AIR TURBINE CAN EXTEND AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(a) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
   1) 6C2, RAM AIR TURBINE AUTO
   2) 6J8, RAM AIR TURBINE PWR

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

(b) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

(c) Put vinyl adhesive tape on the drain hole for the pitot chamber on the bottom right probe.

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT THE PROBES. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF THE ALIGNED POSITION.

(d) Install the test adapter on the bottom right pitot-static probe.

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CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(e) Connect these items between the pitot pressure source on the pneumatic test set and the pitot inlet of the test adapter.
1) A control valve.
2) A cutoff valve.
3) A flow restrictor.
4) A pitot system test gage.

S 735-270
(2) Do the low range leakage test or the high range leakage test, as applicable, of the auxiliary pitot system No. 2:
(a) Low range leakage test.
1) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Pressurize the auxiliary pitot system No. 2 to 1.959 (±0.16) inches of mercury (gage) or 200 (±5) knots. Measure the pressure on the pitot system test gage.
3) When the pressure is stable, close the pitot cutoff valve.
4) Read and record the value that shows on the test gage.
5) After 1 minute, make sure the pressure did not decrease by more than 0.03 inch of mercury or 1.5 knots.
6) Slowly release the pressure in the auxiliary pitot system No. 2.
7) Remove the test adapter from the pitot-static probe.
a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

8) Remove the vinyl adhesive tape from the pitot-static probe.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS ON THE PROBE.

9) Make sure that all of the tape is removed.
(b) High range leakage test.
1) Make sure the test equipment is installed correctly.

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CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Pressurize the auxiliary pitot system No. 2 to 4.53 (±0.16) inches of mercury (gage) or 300 (±5) knots. Measure the pressure on the pitot system test gage.
3) When the pressure is stable, close the pitot cutoff valve.
4) Read and record the value that shows on the test gage.
5) After 1 minute, make sure the pressure did not decrease by more than 0.16 inch of mercury or 5 knots.
6) Slowly release the pressure in the auxiliary pitot system No. 2.
7) Remove the test adapter from the pitot-static probe.
   a) If the adapter was flushed with the ethylene glycol mixture, wipe off the probe head with a soft rag.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE THAT NO PIECES OF TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

8) Remove the vinyl adhesive tape from the pitot-static probe.

I. Leak Test of the Captain's Static System (Top left probe)

S 865-271

(1) Prepare for the leak test of the captain's static system:
(a) Make sure these circuit breakers on the overhead circuit breaker panel, P11 are closed.
   1) 11A10, AIR DATA CMTR L
   2) 11A11, AIR DATA AOA SENSOR L
(b) Make sure that the AOA vanes are positioned to approximately 0 degree.

NOTE: You may get altitude or mach airspeed errors if you do not align the AOA vanes.

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

(c) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

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CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBES. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF THE ALIGNED POSITION.

(d) Install the test adapter on the top left pitot-static probe.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(e) Connect these items between the static pressure source on the pneumatic test set and the S1 port on the adapter.
1) A control valve.
2) A cutoff valve.
3) A flow restrictor.
4) A static system test gage.

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(f) Put a vinyl adhesive tape on the S1 port on the bottom right probe.

S 735-272
(2) Do the low range leakage test or the high range leakage test, as applicable, of the captain's static system:
(a) Low range leakage test.
1) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Supply a vacuum equivalent to ambient pressure minus 5.25 (± 0.25) inches of mercury or use the test set to simulate an altitude of 5,000 (± 200) feet to the captain's static system.

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CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

3) When the vacuum is stable, close the cutoff valve.
4) Read and record the value that shows on the static system test gage.
5) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inch of mercury or 80 feet.
6) Slowly release the vacuum on the captain's static system.
7) Remove the test adapter from the pitot-static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

8) Remove the vinyl adhesive tape from the pitot-static probes.

(b) High range leakage test.
   1) Make sure the test equipment is installed correctly.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(c) Connect these items between the pitot pressure source on the pneumatic test set and the pitot inlet of the test adapter:
   1) A control valve.
   2) A cutoff valve.
   3) A flow restrictor.
   4) A pitot system test gage.

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CAUTION: KEEP THE ABSOLUTE PRESSURE OF THE CAPTAIN'S PITOT SYSTEM THE SAME AS OR MORE THAN THE PRESSURE IN THE CAPTAIN'S STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. KEEP THE PRESSURE DIFFERENCE BETWEEN THE CAPTAIN'S PITOT SYSTEM AND THE CAPTAIN'S STATIC SYSTEM LESS THAN 10 INCHES OF MERCURY OR 420 KNOTS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

5) Supply a vacuum equivalent to ambient pressure minus 18.82 (± 0.25) inches of mercury or use the test set to simulate an altitude of 25,000 ± 200 feet to the captain's static system.

CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

6) When the vacuum is stable, close the cutoff valve.
7) Read and record the value that shows on the static system test gage.
8) After 1 minute, make sure the vacuum did not decrease by more than 0.20 inch of mercury or 400 feet of altitude.
9) Slowly release the vacuum on the captain's static system.
10) Remove the test adapter from the pitot-static probe.
    a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

11) Remove the seals from the pitot-static probes.

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J. Leak Test of the First Officer's Static System (Top right probe)

S 865-273

(1) Prepare for the leak test of the first officer's static system:

(a) Make sure these circuit breakers on the overhead circuit breaker panel, P11 are closed.

1) 11F30, AIR DATA CMPTR RIGHT

2) 11F31, AIR DATA AOA SENSOR R

(b) Make sure that the AOA vanes are positioned to approximately 0 degree.

NOTE: You may get altitude or mach airspeed errors if you do not align the AOA vanes.

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

(c) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBES. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF THE ALIGNED POSITION.

(d) Install the test adapter on the top right pitot-static probe.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(e) Connect these items in-line from the static pressure source on the pneumatic test set to the S1 port on the adapter.

1) A control valve.

2) A cutoff valve.

3) A flow restrictor.

4) A static system test gage.

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(f) Put a vinyl adhesive tape on the S1 port on the bottom left aux pitot/static probe.

S 735-274

(2) Do the low range leakage test or the high range leakage test, as applicable, of the first officer's static system:

(a) Low range leakage test.

1) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Supply a vacuum equivalent to ambient pressure minus 5.25 (±0.25) inches of mercury or use the test set to simulate an altitude of 5,000 (± 200) feet to the first officer's static system.

CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

3) When the vacuum is stable, close the cutoff valve.

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4) Read and record the value that shows on the static system test gage.
5) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inch of mercury or 80 feet.
6) Slowly release the vacuum on the first officer's static system.
7) Remove the test adapter from the pitot-static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

8) Remove the vinyl adhesive tape from the pitot-static probes.

(b) High range leakage test.
   1) Make sure the test equipment is installed correctly.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVES AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(c) Connect these items between the pitot pressure source on the pneumatic test set and the pitot inlet of the test adapter:
   1) A control valve.
   2) A cutoff valve.
   3) A flow restrictor.
   4) A pitot system test gage.

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CAUTION: KEEP THE ABSOLUTE PRESSURE OF THE FIRST OFFICER'S PITOT SYSTEM THE SAME AS OR MORE THAN THE PRESSURE IN THE FIRST OFFICER'S STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. KEEP THE PRESSURE DIFFERENCE BETWEEN THE FIRST OFFICER'S PITOT SYSTEM AND THE FIRST OFFICER'S STATIC SYSTEM LESS THAN 10 INCHES OF MERCURY OR 420 KNOTS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

5) Supply a vacuum quivalent to ambient pressure minus 18.82 (± 0.25) inches of mercury or use the test set to simulate an altitude of 25,000 ± 200 feet to the first officer's static system.

CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

6) When the vacuum is stable, close the cutoff valve.
7) Read and record the value that shows on the static system test gage.
8) After 1 minute, make sure the vacuum did not decrease by more than 0.20 inch of mercury or 400 feet of altitude.
9) Slowly release the vacuum on the first officer's static system.
10) Remove the test adapter from the pitot-static probe.
    a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

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WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: EXAMINE THE PITOT-STATIC PROBE TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PROBE. FAILURE TO REMOVE THE TAPE CAN CAUSE DAMAGE TO THE PROBE.

11) Remove the adhesive tape from the pitot-static probes.

K. Leak Test of the Auxiliary Static System No. 1 (Top right probe)

S 865-275

(1) Prepare for the leak test of the auxiliary static system No. 1:

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

(a) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBES. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF THE ALIGNED POSITION.

(b) Install the test adapter on the top right pitot-static probe.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(c) Connect these between the static pressure source on the pneumatic test set and the S2 port on the adapter.
1) A control valve.
2) A cutoff valve.
3) A flow restrictor.
4) A static system test gage.

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(d) Put vinyl adhesive tape on the S2 port on the bottom left probe.

WARNING: OPEN THESE CIRCUIT BREAKERS FOR THE RAM AIR TURBINE BEFORE YOU DO THIS TEST. IF YOU DO NOT OPEN THESE CIRCUIT BREAKERS THE RAM AIR TURBINE COULD EXTEND AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(e) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
1) 6C2, RAM AIR TURBINE AUTO
2) 6J8, RAM AIR TURBINE PWR

S 735-064

(2) Do the low range leakage test or the high range leakage test, as applicable, of the auxiliary static system No. 1:
(a) Do a low range leakage test as follows:

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

1) Make sure the test equipment is installed correctly.

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CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

2) Supply a vacuum equivalent to ambient pressure minus 5.25 (±0.25) inches of mercury or use the test set to simulate an altitude of 5,000 (±200) feet to the auxiliary static system No. 1.
3) When the vacuum is stable, close the cutoff valve.
4) Read and record the value that shows on the static system test gage.
5) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inch of mercury or 80 feet.
6) Slowly release the vacuum on the auxiliary static system No. 1.
7) Remove the test adapter from the pitot-static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

8) Remove the vinyl adhesive tape from the pitot-static probes.

(b) Do a high range leakage test as follows:

WARNING: OPEN THESE CIRCUIT BREAKERS FOR THE RAM AIR TURBINE BEFORE YOU DO THIS TEST. IF YOU DO NOT OPEN THESE CIRCUIT BREAKERS THE RAM AIR TURBINE COULD EXTEND AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

1) Open thse circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
   a) 6C2, RAM AIR TURBINE AUTO

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b) 6J8, RAM AIR TURBINE PWR

CAUTION: DISCONNECT THE NO.2 AUXILIARY PITOT LINE FROM THE RAT AIRSPEED SWITCH BEFORE YOU DO THIS TEST. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE RAT AIRSPEED SWITCH.

2) Disconnect the auxiliary No. 2 pitot line quick disconnect from RAT airspeed switch (AMM 29-21-24/401).

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

3) Connect these items between the pitot pressure source on the pneumatic test set and the pitot inlet of the test adapter:
   a) A control valve.
   b) A cutoff valve.
   c) A flow restrictor.
   d) A pitot system test gage.

CAUTION: DISCONNECT THE NO. 1 AUXILIARY PITOT LINE FROM THE STANDBY AIRSPEED INDICATOR BEFORE YOU DO THIS TEST. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE STANDBY AIRSPEED INDICATOR.

4) Disconnect the No. 1 auxiliary pitot line from the standby airspeed indicator (AMM 34-13-05/401).

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

5) Flush the adapter for the pitot-static probe with water before you install it on the probe.

   NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

6) Install a test adapter on the bottom right pitot-static probe.
7) Connect these items between the pitot pressure source on the pneumatic test set and the pitot inlet of the test adapter:
   a) A control valve.
   b) A cutoff valve.

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c) A flow restrictor.
d) A pitot system test gage.

8) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. KEEP THE PRESSURE DIFFERENCE BETWEEN THE PITOT SYSTEM AND THE STATIC SYSTEM LESS THAN 10 INCHES OF MERCURY OR 420 KNOTS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

CAUTION: KEEP THE ABSOLUTE PRESSURE OF THE PITOT SYSTEM THE SAME AS OR MORE THAN THE PRESSURE IN THE STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

9) Supply a vacuum equivalent to ambient pressure minus 18.82 (± 0.25) inches of mercury or use the test set to simulate an altitude of 25,000 ± 200 feet to the auxiliary static system No. 1.
   a) Supply a vacuum to the auxiliary pitot No. 2 line to keep the pressure difference to less than 10 inches of mercury or 420 knots.

CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS MAY CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

10) When the vacuum is stable, close the cutoff valve.
11) Read and record the value that shows on the static system test gage.
12) After 1 minute, make sure the vacuum did not decrease by more than 0.20 inch of mercury or 400 feet of altitude.
13) Slowly release the vacuum on the auxiliary static system No. 1.
14) Remove the test adapters from the pitot-static probes.
15) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

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WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

16) Remove the vinyl adhesive tape from the pitot-static probes.
17) Connect the auxiliary No.2 pitot line quick disconnect to the RAT airspeed switch (AMM 29-21-24/401).
18) At the end of the full range leak test, connect the No. 1 auxiliary pitot line to the standby airspeed indicator.
19) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the main power distribution panel, P6:
    a) 6C2, RAM AIR TURBINE AUTO
    b) 6J8, RAM AIR TURBINE PWR

L. Leak Test of the Auxiliary Static System No. 2 (Top left probe)

S 865-276

(1) Prepare for the leak test of the auxiliary static system No. 2:

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

(a) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBES. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF THE ALIGNED POSITION.

(b) Install a test adapter on the bottom right pitot-static probe.

CAUTION: MAKE SURE THAT FLOW RESTRICTORS ARE INSTALLED BETWEEN THE CUTOFF VALVES AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(c) Connect these items in-line from the static pressure source on the pneumatic test set to the S2 port of the test adapter:
    1) A control valve.

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2) A cutoff valve.
3) A flow restrictor.
4) A static system test gage.

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(d) Put vinyl adhesive tape on the S2 ports on the top left pitot-static probe.

S 735-070

(2) Do the low range leakage test or the high range leakage test, as applicable, of the auxiliary static system No. 2:

(a) Low range leakage test:

1) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Supply a vacuum equivalent to ambient pressure minus 5.25 (±0.25) inches of mercury or use the test set to simulate an altitude of 5,000 (±200) feet to the auxiliary static system No. 2.

CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

3) When the vacuum is stable, close the cutoff valve.
4) Read and record the value that shows on the static system test gage.
5) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inch of mercury or 80 feet.
6) Slowly release the vacuum on the auxiliary static system No. 2.
7) Remove the test adapter from the pitot-static probe.
   a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

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WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

8) Remove the vinyl adhesive tape from the pitot-static probes.

(b) High range leakage test:

CAUTION: DISCONNECT THE AUXILIARY PITOT SYSTEM NO. 1 LINE FROM THE STANDBY AIRSPEED INDICATOR BEFORE YOU DO THIS TEST. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE STANDBY AIRSPEED INDICATOR.

1) Disconnect the quick disconnect of the auxiliary pitot system No. 1 line from the standby airspeed indicator.
2) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

3) Install the test adapter on the bottom left pitot-static probe.

CAUTION: DISCONNECT THE NO. 2 AUXILIARY PITOT LINE FROM THE RAT AIRSPEED SWITCH BEFORE YOU DO THIS TEST. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE RAT AIRSPEED SWITCH.

4) Disconnect the auxiliary pitot No. 2 line from the rat airspeed switch (AMM 29-21-24/401).

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

5) Connect these items between the pitot-static pressure source on the pneumatic test set and the pitot inlet of the test adapter:
   a) A control valve.
   b) A cutoff valve.
   c) A flow restrictor.

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d) A pitot system test gage.

6) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. KEEP THE PRESSURE DIFFERENCE BETWEEN THE PITOT AND STATIC SYSTEMS LESS THAN 10 INCHES OF MERCURY OR 420 KNOTS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

CAUTION: KEEP THE ABSOLUTE PRESSURE OF THE PITOT SYSTEM THE SAME AS OR MORE THAN THE PRESSURE IN THE STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

7) Supply a vacuum equivalent to ambient pressure minus 18.82 (± 0.25) inches of mercury or use the test set to stimulate an altitude of 25,000 (±200) feet to the auxiliary static system No. 2.
   a) Supply a vacuum to the Auxiliary Pitot No. 1 system to keep the pressure difference less than 10 inches of mercury.

CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS MAY CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

8) When the vacuum is stable, close the cutoff valve.
9) Read and record the value that shows on the static system test gage.
10) After 1 minute, make sure the vacuum did not decrease by more than 0.20 inch of mercury or 400 feet.
11) Slowly release the vacuum on the auxiliary static system No. 2.
12) Remove the test adapter from the pitot-static probe.
13) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

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14) Connect the quick disconnect of the auxiliary pitot system No. 1 line to standby airspeed indicator.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

15) Remove the vinyl adhesive tape from the pitot-static probes.

(c) At the end of the high range leak test, connect the No. 2 auxiliary pitot line to the rat airspeed switch (AMM 29-21-24/401).

M. Leak Test of the Alternate Static System

S 865-278

(1) Prepare for the leak test of the alternate static system:

WARNING: OPEN THESE CIRCUIT BREAKERS FOR THE RAM AIR TURBINE BEFORE YOU DO THIS TEST. IF YOU DO NOT OPEN THESE CIRCUIT BREAKERS THE RAM AIR TURBINE COULD EXTEND AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(a) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
1) 6C2, RAM AIR TURBINE AUTO
2) 6J8, RAM AIR TURBINE PWR

(b) Install a flush static port test adapter to the alternate static port on the right side.

CAUTION: MAKE SURE THE FLOW RESTRICTORS ARE INSTALLED BETWEEN THE CUTOFF VALVES AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(c) Connect these items between the static source on the pneumatic test set and the test adapter.
1) A control valve
2) A cutoff valve
3) A flow restrictor
4) A static system test gage

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(d) Put vinyl adhesive tape on the alternate static port on the left side.

S 735-279

(2) Do a low range leakage test or a high range leakage test, as applicable, of the alternate static system:

(a) Low range leakage test.

1) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

2) Supply a vacuum equivalent to ambient pressure minus 5.25 (±0.25) inches of mercury or use the test set to simulate an altitude of 5,000 (±200) feet to the alternate static system.

CAUTION: CONTINUE TO SUPPLY THE VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

3) When the vacuum is stable, close the cutoff valve.
4) Read and record the value that shows on the static system test gage.
5) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inch of mercury or 80 feet.
6) Slowly release the vacuum on the alternate static system.
7) Remove the test adapter.

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WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

8) Remove the vinyl adhesive tape from the left static port.

(b) High range leakage test.

1) Flush the adapter for the pitot-static probe with water before you install it on the probe.

NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE PITOT-STATIC PROBE TEST ADAPTER AND TEST HOSES SO NO WEIGHT IS ADDED TO THE PROBES. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE PROBE OR PUT THE PROBE OUT OF ALIGNMENT.

2) Install a test adapter on the bottom left pitot-static probe.

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTOR BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

3) Connect these items in-line from the pitot-static pressure source on the pneumatic test set to the pitot inlet of the test adapter:
   a) A control valve.
   b) A cutoff valve.
   c) A flow restrictor.
   d) A pitot system test gage.

CAUTION: DISCONNECT THE NO. 1 AUXILIARY PITOT LINE FROM THE ELEVATOR FEEL COMPUTER BEFORE YOU DO THIS TEST. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE ELEVATOR COMPUTER.

4) Disconnect the No. 1 auxiliary pitot line from the elevator feel computer (AMM 27-31-19/401).
5) Seal the No. 1 auxiliary pitot line with a cap.

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6) Disconnect the quick disconnect of the alternate static line from the rat airspeed switch (AMM 29-21-24/401) and the standby airspeed indicator (AMM 34-13-05/401).

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

7) Supply a vacuum equivalent to ambient pressure minus 18.82 (± 0.25) inches of mercury or use the test set to simulate an altitude of 25,000 (+/- 200) feet to the alternate static system.
   a) Supply a vacuum to the pitot system to keep the pressure difference less than 10 inches of mercury or 420 knots.

CAUTION: CONTINUE TO SUPPLY A VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

8) When the vacuum is stable, close the static cutoff valve.
9) Read and record the value that shows on the static system test gage.
10) After 1 minute, make sure the vacuum did not decrease by more than 0.20 inch of mercury or 400 feet.
11) Slowly release the vacuum on the alternate static systems.
12) Connect the alternate static line to the rat airspeed switch (AMM 29-21-24/401).
13) Connect the pitot line to the elevator feel computer (AMM 27-31-19/401), and do these steps:

    CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

   a) Supply a pressure of 4.53 (±0.16) inches of mercury (gage) or 300 (±5) knots to the auxiliary pitot system connected to the elevator feel computer.
   b) When the pressure is stable, close the pitot cutoff valve.
   c) Read and write the value that shows on the pitot system test gage.
   d) After 1 minute, make sure the pressure did not decrease by more than 0.16 inch of mercury or 5 knots.

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e) Slowly release the pressure on the auxiliary pitot system.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: EXAMINE THE ALTERNATE STATIC PORTS TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PORT. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PORT.

f) Remove the test adapter and seals from the alternate static ports.
g) Install the quick-disconnect caps back to the pitot-static drains.

14) Remove the test adapters from the pitot-static probes.
a) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

15) Remove the vinyl adhesive tape from the pitot-static probes.

N. Leak Test of the Static System Cross Manifold

NOTE: This procedure does not do a test of the system or instrument precision. This procedure does a test for continuity in the cross manifold.

S 865-280

(1) Prepare for the leak test of the static system cross manifold:
(a) Make sure the pitot-static probe heaters are off.
(b) Make sure the autopilot system is off.
(c) Make sure the pitot systems will stay at ambient pressure during this test.
(d) Adjust the captain's and first officer's altimeters, or test indicators to ambient pressure.
(e) Supply a vacuum to one static system at a time. All other static systems must stay at ambient pressure.

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(f) Make sure all pressure regulators in the vacuum source are off during this test (for Texas Instrument Gage Test Set, use SERVO CONTROL to supply the vacuum and use the SERVO GAGE control for the test).

S 735-084

(2) Do a test of the captain's static system cross manifold:

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(a) Put vinyl adhesive tape on the S1 ports of the top left and bottom right pitot-static probes.

(b) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the captain's static system. Supply the vacuum through the drain fitting in the main equipment center.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(c) Remove the vinyl adhesive tape from the S1 port on the top left probe.

(d) Make sure the test indicator shows the altitude of the airfield.

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(e) Put vinyl adhesive tape on the S1 port of the top left probe.
(f) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the captain's static system . Supply the vacuum through the drain fitting in the main equipment center.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(g) Remove the vinyl adhesive tape from the bottom right probe.
(h) Make sure the test indicator shows the altitude of the airfield.
(i) Remove the test hose from the drain fitting in the main equipment center.
(j) Put the quick-disconnect cap on the drain fitting.
(k) Remove the seal from the S1 port on the top left probe.

S 865-085

(3) Do a test of the first officer's static system cross-manifold:

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(a) Put vinyl adhesive tape on the S1 ports of the top right and bottom left pitot-static probes.
(b) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to first officer's static system thru the drain fitting in the main equipment center.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(c) Remove the vinyl adhesive tape from the S1 port on the top right probe.
(d) Make sure the test indicator shows the altitude of the airfield.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(e) Put vinyl adhesive tape on the S1 port of the top right probe.
(f) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the first officer's static system through the drain fitting in the main equipment center.

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WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(g) Remove the vinyl adhesive tape from the S1 port on the bottom left probe.
(h) Make sure the test indicator shows the altitude of the airfield.
(i) Remove the test hose from the drain fitting in the main equipment center.
(j) Put the quick-disconnect cap on the drain fitting.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(k) Remove the vinyl adhesive tape from the S1 port on the top right probe.

S 735-086
(4) Do a test of the auxiliary static system No. 1 cross manifold:

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(a) Put vinyl adhesive tape on the S2 port on the top right and bottom left pitot-static probes.
(b) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the auxiliary static system No. 1 through the drain fitting in the right crawlway.

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WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(c) Remove the vinyl adhesive tape from the S2 port on the top right probe.
(d) Make sure the test indicator shows the altitude of the airfield.

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(e) Put vinyl adhesive tape on the S2 port of the top right probe.
(f) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the auxiliary static system No. 1 through the drain fitting in the right crawlway.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(g) Remove the vinyl adhesive tape from the S2 port on the bottom left probe.
(h) Make sure the test indicator shows the altitude of the airfield.
(i) Remove the test hose from the drain fitting in the right crawlway.
(j) Put the quick-disconnect cap on the drain fitting.

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WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(k) Remove the vinyl adhesive tape from the S2 port on the top right probe.

S 735-092

(5) Do a test of the auxiliary static system No. 2 cross manifold:

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(a) Put vinyl adhesive tape on the S2 ports of the top left and bottom right pitot-static probes.
(b) Supply a vacuum equivalent to 100 feet above the the altitude of the airfield to the auxiliary static system No. 2. Supply the vacuum through the drain fitting in the right crawlway.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(c) Remove the vinyl adhesive tape from the top left probe.
(d) Make sure the test indicator shows the altitude of the airfield.

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(e) Put vinyl adhesive tape on the top left probe.
(f) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the auxiliary static system No. 2. Supply the vacuum through the drain fitting in the right crawlway.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(g) Remove the vinyl adhesive tape from the S2 port on the bottom right probe.
(h) Make sure the test indicator shows the altitude of the airfield.
(i) Remove the test hose from the drain fitting in the right crawlway.
(j) Put the quick-disconnect cap on the drain fitting.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(k) Remove the vinyl adhesive tape from the S2 port on the top left probe.

S 735-093
(6) Do a test of the alternate static system cross manifold:

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(a) Put a vinyl adhesive tape on the left and right alternate static ports.

WARNING: OPEN THESE CIRCUIT BREAKERS FOR THE RAM AIR TURBINE BEFORE YOU DO THIS TEST. IF YOU DO NOT OPEN THESE CIRCUIT BREAKERS THE RAM AIR TURBINE COULD EXTEND AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(b) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
   1) 6C2, RAM AIR TURBINE AUTO
   2) 6J8, RAM AIR TURBINE PWR

(c) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the alternate static system. Supply the vacuum through the drain fitting at the right side of the forward cargo compartment.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(d) Remove the vinyl adhesive tape from the left alternate static port.

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WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

(e) Make sure the test indicator shows the altitude of the airfield.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(f) Put a vinyl adhesive tape on the left alternate static port.
(g) Supply a vacuum equivalent to 100 feet above the altitude of the airfield to the alternate static system. Supply the vacuum through the drain fitting at the right side of the forward cargo compartment.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(h) Remove the vinyl adhesive tape from the right alternate static port.
(i) Make sure the test indicator shows the altitude of the airfield.
(j) Remove the test hose from the drain fitting in the forward cargo compartment.
(k) Put the quick-disconnect cap on the drain fitting.

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(l) Remove the vinyl adhesive tape from the left alternate static port.

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O. Put the Airplane Back to Its Usual Condition

S 085-315

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(1) Remove all vinyl adhesive tape and adapters from all pitot-static probes and alternate static ports.
   (a) Make sure no unwanted material stays on or adjacent to the alternate static ports or the holes on the pitot-static probes.
   (b) Make sure the area on or adjacent to the alternate static ports and the holes on the pitot-static probes is not rough.

S 085-095
(2) Remove all pitot-static test hoses and equipment.

S 865-096
(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the main power distribution panel, P6:
   (a) 6C2, RAM AIR TURBINE AUTO
   (b) 6J8, RAM AIR TURBINE PWR
   (c) 6K14, PITOT HEAT CAPT ϕA
   (d) 6K15, PITOT HEAT CAPT ϕB
   (e) 6K16, PITOT HEAT R AUX ϕB
   (f) 6K17, PITOT HEAT R AUX ϕC
   (g) 6K20, PITOT HEAT L AUX ϕC
   (h) 6K21, PITOT HEAT L AUX ϕB
   (i) 6K22, PITOT HEAT F/O ϕB
   (j) 6K23, PITOT HEAT F/O ϕA

S 865-237
(4) Remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:
   (a) 11J13, T/E FLAP LOAD RELIEF

S 865-097
(5) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-11-00-735-234

3. System Test - Alternate Static Line

NOTE: This is a scheduled maintenance task.

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A. Equipment
   (1) Adapters
      (a) Pitot-static probe test adapter -
          Rosemount Engineering, 884EH
          (2 Required)
          Rosemount Inc.
          14300 Judicial Rd.
          Burnsville, MN 55337
      (b) Static port adapter -
          NAVAIDS, P/N 33410 LH-125-4
          NAV-AIDS, LTD
          2955 Diab St.
          Montreal, Quebec, Canada H45 1M1
   (2) Pneumatic Test Set
      (a) Dry air pressure source (1 necessary), 0 to 5 inches of mercury gage.
      (b) Vacuum sources (2 necessary), 0 to 20 inches of mercury gage.
   (3) Gages
      (a) Pitot system test gage - must show a precision of ± 0.16 (readable to ± 0.03) inch of mercury or ± 5 (readable to ± 1) knots.
      (b) Static system test gage - must show a precision of ± 0.1 (readable to ± 0.01) inch of mercury or ± 200 (readable to ± 20) feet.
      (c) Differential pressure gage - must show 10 inches of mercury differential pressure (minimum) with a precision of ± 0.010 inch of mercury.
   (4) Flow restrictors, control valves, cutoff valves and port seals as necessary.

B. Consumable Materials
   (1) G02219 Tape, yellow vinyl adhesive - 3M Scotch brand No. 471, 3 inches wide, BAC 5034-4.

C. Reference
   (1) AMM 22-10-00/501, Autopilot (Flight Control) System

D. Prepare for the System Test

   S 865-451

   <u>WARNING</u>: MAKE SURE THE ATC TRANSPONDERS ARE NOT IN AN ALTITUDE REPORTING MODE WHEN YOU SIMULATE ALTITUDE. IF YOU DO NOT, YOU CAN ACCIDENTALLY CAUSE FALSE TCAS TARGETS.

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(1) Make sure the ATC transponders are not in an altitude reporting mode.

S 865-179

(2) Remove all power from the autopilot (flight control) system (AMM 22-10-00/501).

S 865-180

(3) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
(a) 6C2, RAM AIR TURBINE AUTO
(b) 6J8, RAM AIR TURBINE PWR
(c) 6K14, PITOT HEAT CAPT ϕA
(d) 6K15, PITOT HEAT CAPT ϕB
(e) 6K16, PITOT HEAT R AUX ϕB
(f) 6K17, PITOT HEAT R AUX ϕC
(g) 6K20, PITOT HEAT L AUX ϕC
(h) 6K21, PITOT HEAT L AUX ϕB
(i) 6K22, PITOT HEAT F/O ϕB
(j) 6K23, PITOT HEAT F/O ϕA

S 865-254

WARNING: MAKE SURE THAT YOU DO NOT APPLY ELECTRICAL POWER TO THE FLIGHT CONTROLS. FLIGHT CONTROL SURFACES CAN MOVE AUTOMATICALLY WHEN YOU PRESSURIZE THE PITOT-STATIC SYSTEM. THIS CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(4) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
(a) On the P11 panel open this circuit breaker:
1) 11J13, T/E FLAP LOAD RELIEF

E. Do a Test of the Alternate Static System

S 485-182

(1) Install a flush static port test adapter to the alternate static port on the left side.

S 485-183

CAUTION: MAKE SURE THE FLOW RESTRICTORS ARE INSTALLED BETWEEN THE CUTOFF VALVES AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(2) Connect these items between the static source on the pneumatic test set and the test adapter.
(a) A control valve

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(b) A cutoff valve
(c) A flow restrictor
(d) A static system test gage

S 485-317

WARNING: WHEN THE STATIC PORTS ARE COVERED, MAKE SURE THAT CONDITION IS VISIBLE FROM THE GROUND. FAILURE TO OBSERVE AND REMOVE COVERINGS OVER STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: DO NOT EXTEND THE SEALS INTO THE STATIC PORTS. YOU CAN CAUSE DAMAGE TO THE SURFACE IN THE AREA WHEN YOU REMOVE THE SEALS.

(3) Put vinyl adhesive tape on the alternate static port on the right side.

S 735-185

(4) Do a test of the alternate static system for leaks:

(a) Disconnect the alternate static line from the rat airspeed switch (AMM 29-21-24/401).

CAUTION: KEEP THE RATE OF STATIC CHANGE LESS THAN 5000 FEET PER MINUTE. KEEP THE PRESSURE DIFFERENCE BETWEEN THE AUXILIARY PITOT SYSTEM NO. 1 AND THE ALTERNATE STATIC SYSTEMS LESS THAN 10 INCHES OF MERCURY OR 420 KNOTS. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

(b) Supply a vacuum equivalent to ambient pressure (29.92) minus 5.25 (±0.25) inches of mercury or 5,000 (±200) feet altitude to the alternate static system.

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CAUTION: CONTINUE TO SUPPLY A VACUUM BEHIND THE CUTOFF VALVE AFTER YOU CLOSE THE CUTOFF VALVE. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE EQUIPMENT WHEN YOU OPEN THE CUTOFF VALVE.

(c) When the vacuum is stable, close the static cutoff valve.
(d) Read and record the value that shows on the static system test gage.
(e) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inch of mercury or 80 feet.
(f) Slowly release the vacuum on the alternate static systems.
(g) Connect the alternate static line to the rat airspeed switch (AMM 29-21-24/401).

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: EXAMINE THE ALTERNATE STATIC PORTS TO MAKE SURE NO PIECES OF THE TAPE STAY ON THE PORT. FAILURE TO DO THIS CAN CAUSE DAMAGE TO THE PORT.

1) Remove the test adapter and seals from the alternate static ports.

F. Put the Airplane Back To Its Usual Condition

S 085-318

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(1) Remove all the vinyl adhesive tape and adapters from all pitot-static probes and alternate static ports.
(a) Make sure no unwanted material stays on or adjacent to the alternate static ports or the holes on the pitot-static probes.

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(b) Make sure the area on or adjacent to the alternate static ports and the holes on the pitot-static probes is not rough.

S 085-187

(2) Remove all pitot-static test hoses and equipment.

S 865-188

(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the main power distribution panel, P6:
(a) 6C2, RAM AIR TURBINE AUTO
(b) 6J8, RAM AIR TURBINE PWR
(c) 6K14, PITOT HEAT CAPT ϕA
(d) 6K15, PITOT HEAT CAPT ϕB
(e) 6K16, PITOT HEAT R AUX ϕB
(f) 6K17, PITOT HEAT R AUX ϕC
(g) 6K20, PITOT HEAT L AUX ϕC
(h) 6K21, PITOT HEAT L AUX ϕB
(i) 6K22, PITOT HEAT F/O ϕB
(j) 6K23, PITOT HEAT F/O ϕA

S 865-238

(4) Remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:
(a) 11J13, T/E FLAP LOAD RELIEF

S 865-189

(5) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-11-00-735-191

4. System Test - Pitot-Static System

A. General
(1) This task contains the low range leak test for the Aux Pitot System No 1. It is for scheduled maintenance purposes.

B. Equipment
(1) Adapters
(a) Pitot-static probe test adapter -
Rosemount Engineering, 884EH or equivalent
(2 Required)
Rosemount Inc.
14300 Judicial Rd.
Burnsville, MN 55337

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(2) Pneumatic Test Set
   (a) Dry air pressure source (1 necessary), 0 to 5 inches of mercury gage.
   (b) Vacuum sources (2 necessary), 0 to 20 inches of mercury gage.
(3) Gages
   (a) Pitot system test gage - must show a precision of ± 0.16 (readable to ± 0.03) inch of mercury or ± 5 (readable to ± 1) knots.
   (b) Differential pressure gage - must show 10 inches of mercury differential pressure (minimum) with a precision of ± 0.010 inch of mercury.
(4) Flow restrictors, control valves, cutoff valves tape and port seals as necessary. (G02219 Tape, yellow vinyl adhesive - 3M Scotch brand No. 471, 3 inches wide, BAC 5034-4).

C. References
   (1) AMM 22-10-00/501, Autopilot (Flight Control) System
   (2) AMM 27-31-19/401, Elevator Feel Computer
   (3) AMM 29-21-24/401, Rat Airspeed Switch
   (4) AMM 34-13-05/401, Standby Airspeed Indicator

D. Consumables
   (1) G02219 Tape, yellow vinyl adhesive - 3M Scotch brand No. 471, 3 inches wide, BAC 5034-4.

E. Prepare for the System Test

S 865-452

WARNING: MAKE SURE THE ATC TRANSPONDERS ARE NOT IN AN ALTITUDE REPORTING MODE WHEN YOU SIMULATE ALTITUDE. IF YOU DO NOT, YOU CAN ACCIDENTALLY CAUSE FALSE TCAS TARGETS.

(1) Make sure the ATC transponders are not in an altitude reporting mode.

S 215-210

(2) Make sure air cannot go into the system when you supply the vacuum.

S 865-211

(3) Remove all power from the autopilot (flight control) system (AMM 22-10-00/501).

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S 865-212

(4) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
   (a) 6C2, RAM AIR TURBINE AUTO
   (b) 6J8, RAM AIR TURBINE PWR
   (c) 6K14, PITOT HEAT CAPT ϕA
   (d) 6K15, PITOT HEAT CAPT ϕB
   (e) 6K16, PITOT HEAT R AUX ϕB
   (f) 6K17, PITOT HEAT R AUX ϕC
   (g) 6K20, PITOT HEAT L AUX ϕC
   (h) 6K21, PITOT HEAT L AUX ϕB
   (i) 6K22, PITOT HEAT F/O ϕB
   (j) 6K23, PITOT HEAT F/O ϕA

S 865-239

WARNING: MAKE SURE THAT YOU DO NOT APPLY ELECTRICAL POWER TO THE FLIGHT CONTROLS. FLIGHT CONTROL SURFACES CAN MOVE AUTOMATICALLY WHEN YOU PRESSURIZE THE PITOT-STATIC SYSTEM. THIS CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(5) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
   (a) On the P11 panel open this circuit breaker:
      1) 11J13, T/E FLAP LOAD RELIEF

F. Do a Test of the Auxiliary Pitot System No. 1

S 845-252

CAUTION: MAKE SURE THAT YOU FLUSH THE PROBE ADAPTER WITH WATER BEFORE YOU ATTACH THE ADAPTER TO THE PROBE. YOU CAN CAUSE DAMAGE TO THE PROBE OR THE ADAPTER.

(1) Flush the adapter for the pitot-static probe with water before you install it on the probe.

   NOTE: Use a solution that has equal parts of ethylene glycol and water in temperatures between 32°F and -40°F.

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S 485-508

(2) Put vinyl adhesive tape on the drain hole for the pitot chamber on the bottom left probe.

S 485-507

CAUTION: BE CAREFUL WITH THE TEST HOSES. INSTALL THE TEST ADAPTER AND TEST HOSES SO THAT YOU DO NOT ADD WEIGHT TO THE PROBES. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE PROBE OR PUT THE PROBES OUT OF THE ALIGNED POSITION.

(3) Install the test adapter on the bottom left pitot-static probe.

S 495-225

CAUTION: MAKE SURE YOU INSTALL THE FLOW RESTRICTORS BETWEEN THE CUTOFF VALVE AND THE PITOT-STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(4) Connect these items between the pitot pressure source on the pneumatic test set to the pitot inlet of the test adapter.
- (a) A control valve.
- (b) A cutoff valve.
- (c) A flow restrictor.
- (d) A test pitot system gage.

S 735-228

(5) Do a test of the auxiliary pitot system No. 1 for leaks:

(a) Make sure the test equipment is installed correctly.

CAUTION: KEEP THE RATE OF PITOT PRESSURE CHANGE LESS THAN 300 KNOTS PER MINUTE. FAILURE TO DO THIS COULD CAUSE DAMAGE TO THE INSTRUMENTS OR EQUIPMENT.

(b) Pressurize the auxiliary pitot system No. 1 to 1.959 (±0.16) inches of mercury (gage) or 200 (±5) knots. Measure the pressure on the pitot system test gage or on the standby airspeed indicator.

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(c) When the pressure is stable, close the pitot cutoff valve.
(d) Read and write the value that shows on the test gage or the standby airspeed indicator.
(e) After 1 minute, make sure the pressure did not decrease by more than 0.03 inch of mercury or 1.5 knots.
(f) Slowly release the pressure in the auxiliary pitot system No. 1.
(g) Remove the test adapter from the pitot-static probe.
1) If you flushed the adapter with the ethylene glycol mixture, clean the probe head with a soft rag.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH PITOT-STATIC PROBE. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(h) Remove the vinyl adhesive tape from the drain on the pitot-static probe.

G. Put the Airplane Back To Its Usual Condition

S 085-319

WARNING: FAILURE TO REMOVE VINYL ADHESIVE TAPE FROM STATIC PORTS BEFORE FLIGHT MAY CAUSE LARGE ERRORS IN AIRSPEED-SENSING AND ALTITUDE-SENSING SIGNALS, WHICH MAY LEAD TO LOSS OF SAFE FLIGHT.

CAUTION: MAKE SURE THAT YOU REMOVE ALL OF THE PIECES OF TAPE FROM EACH STATIC PORT. THE SYSTEM WILL NOT OPERATE CORRECTLY WHEN THE TAPE IS IN ITS POSITION.

(1) Remove all the vinyl adhesive tape and adapters from all pitot-static probes and alternate static ports.
(a) Make sure no unwanted material stays on or adjacent to the alternate static ports or the holes on the pitot-static probes.

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(b) Make sure the area on or adjacent to the alternate static ports and the holes on the pitot-static probes is not rough.

S 085-230

(2) Remove all pitot-static test hoses and equipment.

S 865-231

(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the main power distribution panel, P6:
(a) 6C2, RAM AIR TURBINE AUTO
(b) 6J8, RAM AIR TURBINE PWR
(c) 6K14, PITOT HEAT CAPT ϕA
(d) 6K15, PITOT HEAT CAPT ϕB
(e) 6K16, PITOT HEAT R AUX ϕB
(f) 6K17, PITOT HEAT R AUX ϕC
(g) 6K20, PITOT HEAT L AUX ϕC
(h) 6K21, PITOT HEAT L AUX ϕB
(i) 6K22, PITOT HEAT F/O ϕB
(j) 6K23, PITOT HEAT F/O ϕA

S 865-240

(4) Remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:
(a) 11J13, T/E FLAP LOAD RELIEF

S 865-232

(5) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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PITOT-STATIC PROBE - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the pitot-static probes. The second task installs the pitot-static probes.

      NOTE: This is a scheduled maintenance task for airplanes with non-nickel plated pitot/static probes.

TASK 34-11-01-004-001

2. Pitot-Static Probe Removal (Fig. 401 or Fig. 401A)

   A. Reference
      (1) AMM 51-31-01/201, Seals and Sealing
   B. Access
      (1) Location Zones
          117/118 Area Outboard and Above NLG Wheel Well

   C. Procedure

      S 864-038

      WARNING: IF THE HEATER POWER HAS BEEN ON, DO NOT TOUCH THE PROBE UNTIL IT IS NOT HOT. THIS CAN CAUSE INJURY TO PERSONNEL.

      (1) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
          (a) 6K14, PITOT HEAT CAPT ϕA
          (b) 6K15, PITOT HEAT CAPT ϕB
          (c) 6K16, PITOT HEAT R AUX ϕB
          (d) 6K17, PITOT HEAT R AUX ϕC
          (e) 6K20, PITOT HEAT L AUX ϕC
          (f) 6K21, PITOT HEAT L AUX ϕB
          (g) 6K22, PITOT HEAT F/O ϕB
          (h) 6K23, PITOT HEAT F/O ϕA

      S 034-037

      CAUTION: BE CAREFUL WHEN YOU MOVE OR TOUCH THE PITOT-STATIC PROBES. THEY ARE EASILY DAMAGED. THE ALIGNMENT OF THE PROBES IS ALSO VERY IMPORTANT. DO NOT PUT EXTRA WEIGHT ON THE PROBES.

      CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

      (2) If there is sealant around the bottom of the probe, remove the sealant with sealant removal tool (AMM 51-31-01/201).

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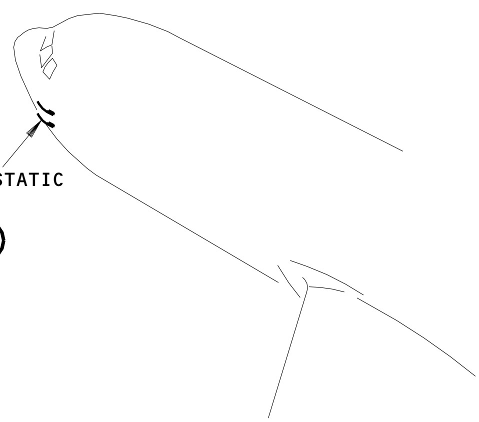

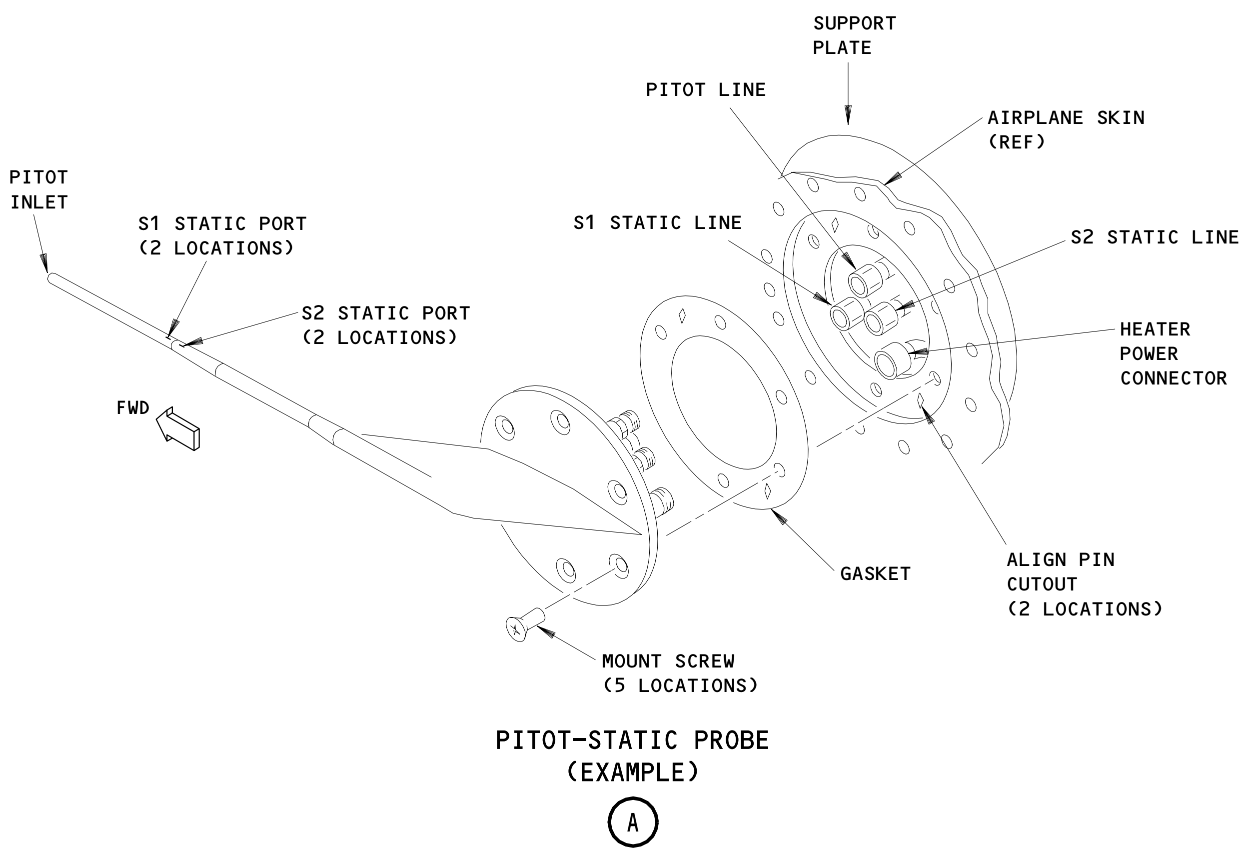

Pitot-Static Probe Installation
Figure 401 (Sheet 1)

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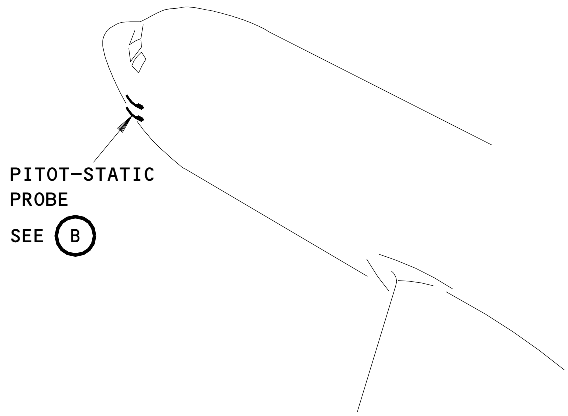

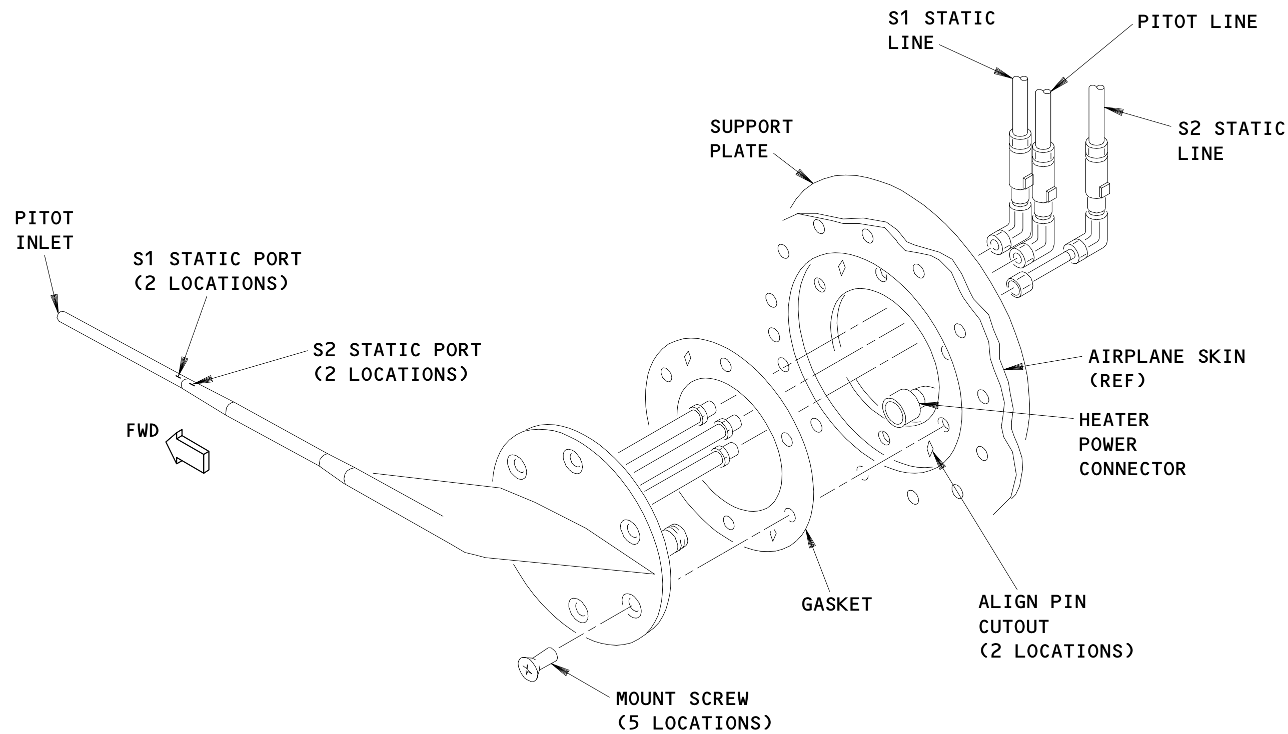

PITOT-STATIC PROBE
(EXAMPLE)
B

Pitot-Static Probe Installation
Figure 401 (Sheet 2)

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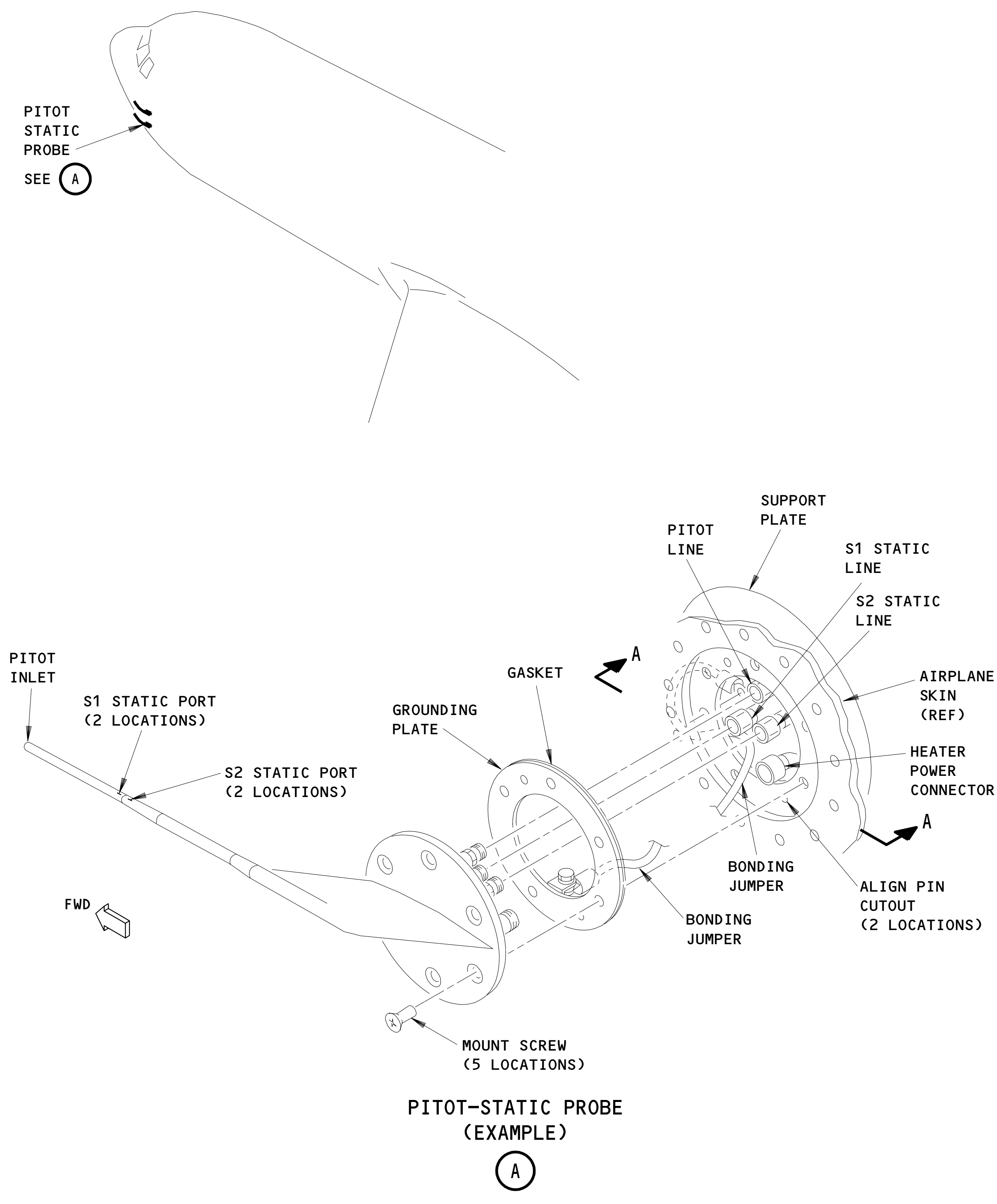

Pitot-Static Probe Installation
Figure 401A (Sheet 1)

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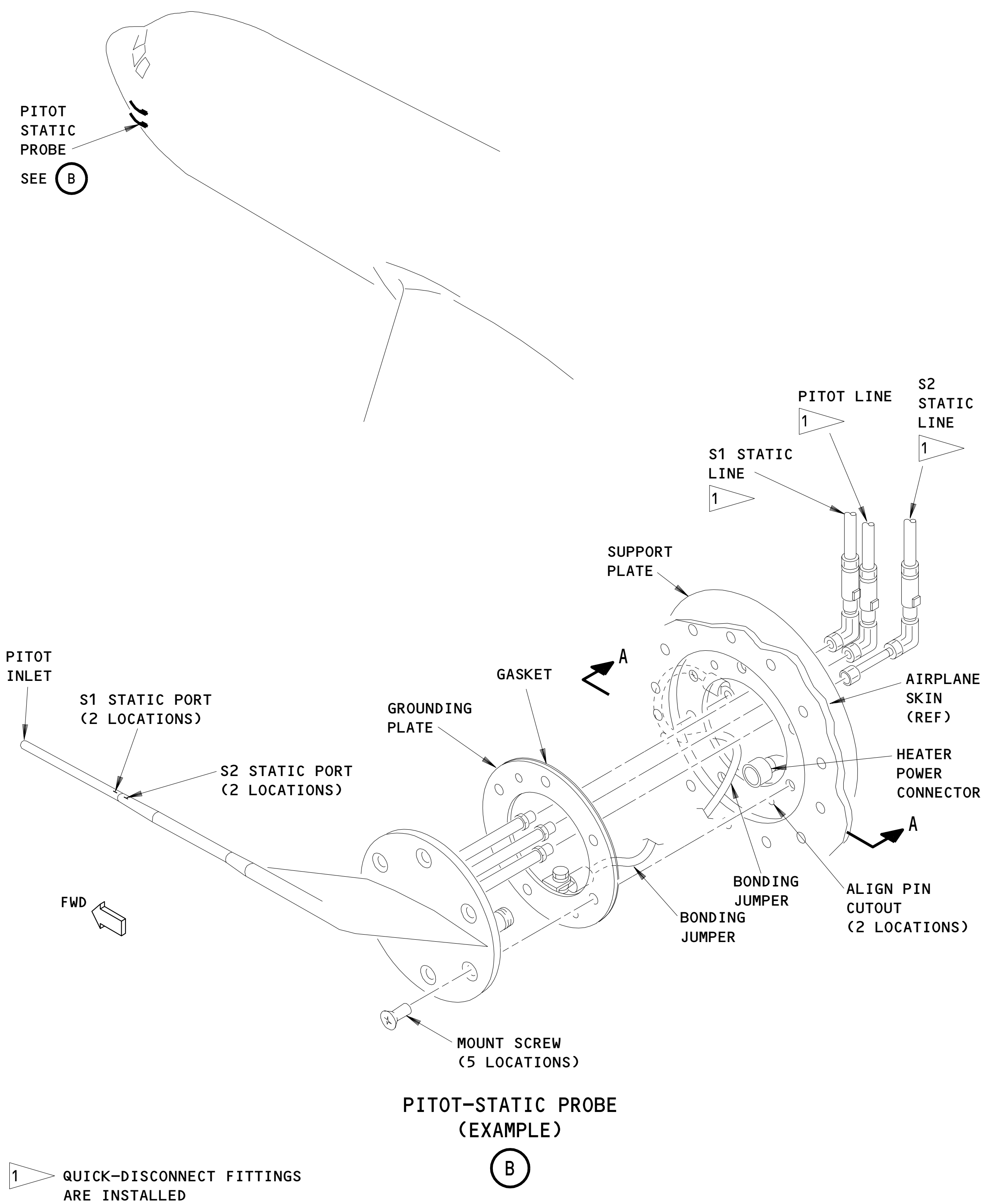

Pitot-Static Probe Installation
Figure 401A (Sheet 2)

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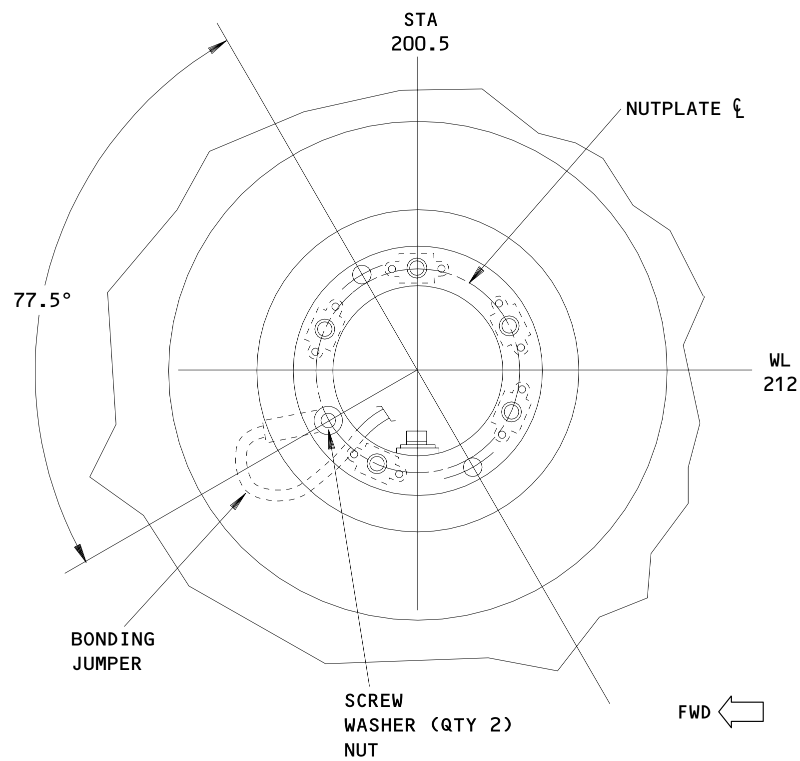

A-A

Pitot-Static Probe Installation
Figure 401A (Sheet 3)

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S 034-004
(3) Remove the probe mounting screws from the probe mounting flange.

S 034-005
(4) Hold the probe strut and loosen the gasket.

S 034-306
(5) AIRPLANES WITHOUT SB 34-0440;
Hold the probe strut and loosen the gasket.

S 034-305
(6) AIRPLANES WITH SB 34-0440
Hold the probe strut and loosen the ground plate and gasket.

S 024-008
(7) Carefully pull the probe out from the airplane skin until the electric connector and hose fittings on the bottom of the probe are in view.

S 034-307
(8) AIRPLANES WITH SB 34-0440;
Hold the probe and strut and remove the screw from the grounding plate and gasket from the nutplate.

S 034-009
(9) Move the probe as necessary to get access to the hose fittings and electrical connector.

S 434-143
(10) SAS 050, 051, 150-157, 162-167, 275-281 PRE-SB 34-234;
Disconnect the pitot-static hose fittings as follows:

CAUTION: USE WRENCHES ON EACH SIDE OF THE FITTING. APPLY COUNTER FORCE DURING THE DISASSEMBLY OF HOSE TO TUBE TO PREVENT TUBE DAMAGE.

(a) Unscrew the pitot-static hose fittings.

S 434-185
(11) SAS 050, 051, 150-157, 162-167, 275-281 POST-SB 34-234;
SAS 052-149, 158-161, 168-274, 282-999;
Disconnect the pitot-static hose at the quick-disconnects.

S 034-014
(12) Disconnect the electrical cable from the connector and remove the probe. (Restrain the cable and hoses so that they do not fall back inside the fuselage.)

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S 034-015
(13) Put protective caps on both probe and the disconnected hose fittings and electric connector to keep out unwanted material unless a probe is immediately replaced.

S 034-016
(14) Remove and discard the gasket.

TASK 34-11-01-404-017
3. Pitot-Static Probe Installation (Fig. 401 or Fig. 401A)
A. Equipment
(1) Resistance measuring bridge or milliohm/bonding meter which can measure 0.010 ohm with an accuracy of ±0.001 ohm
B. Consumable Materials
(1) A00247 Compound, Sealing - BMS 5-95 (Preferred)

A00091 Compound, Sealing - Dow Corning 93-006 (Alternate)
(2) B00184 Solvent - BMS 11-7
(3) G00009 Compound, Corrosion Inhibiting - BMS 3-23
C. References
(1) AMM 20-10-22/701, Metal Surfaces
(2) AMM 30-31-00/501, Pitot Static Probe Heat
(3) AMM 34-11-01/501, Pitot-Static Probe
(4) AMM 51-31-01/201, Seals and Sealing
(5) SRM 51-20-01
D. Access
(1) Location Zones
117/118 Area Outboard and Above NLG Wheel Well

E. Procedure

NOTE: To prevent contamination of the system, make sure there is no unwanted material in the pitot-static probe.

S 164-018
(1) Clean the surface and sides of the hole where the probe is installed (AMM 20-10-22/701).

S 164-019
(2) Clean the surface of the alignment pins on the bottom of the probe.

S 434-020
(3) Apply a thin layer of corrosion inhibiting compound to the surface of the alignment pins (SRM 51-20-01).

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S 034-308
(4) AIRPLANES WITH SB 34-0440
Put the bonding jumper through the new gasket.
Install the screw, washer, nut and the bounding jumper to the nutplate.

S 434-021
(5) Remove the protective caps from both probe and the disconnected hose fittings and electric connector.

S 434-022
(6) Set the new gasket in its correct position.

S 034-309
(7) AIRPLANES WITHOUT SB 34-0440
Set the new gasket in its correct position.

S 034-310
(8) AIRPLANES WITH SB 34-0440;
Set the new gasket and grounding plate in its correct position.

S 434-059
(9) SAS 050, 051, 150-157, 162-167, 275-281 PRE-SB 34-234;
Connect the probe hose fittings as follows:

CAUTION: USE WRENCHES ON EACH SIDE OF THE FITTING. APPLY COUNTER FORCE DURING THE ASSEMBLY OF HOSE TO TUBE TO PREVENT TUBE DAMAGE.

(a) Point the probe in the airplane's forward direction and attach the hose fittings to the bottom of the probe hose to tube fittings.

NOTE: Hose fittings are three different sizes so you cannot connect them incorrectly.

(b) Tighten the fittings to the values shown in the table that follows:

LINE	FITTING SIZE (INCHES)	TORQUE (POUND-INCHES)
PITOT LINE	1/4	110
S1 STATIC LINE	5/16	140
S2 STATIC LINE	3/8	170

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S 434-101

(10) SAS 050, 051, 150-157, 162-167, 275-281 POST-SB 34-234;
SAS 052-149, 158-161, 168-274, 282-999;
Connect the probe quick-disconnects as follows:

(a) Point the probe in the airplane's forward direction and attach the hose quick-disconnects to the probe quick-disconnects.

NOTE: Hose quick-disconnects are three different sizes so you cannot connect them incorrectly.

(b) Do a visual inspection of the quick-disconnect fittings that you connected.

1) Make sure that the actuation ring of the quick-disconnect fitting is fully engaged on the lock pins and make sure that you see the colored lock ring indicator that shows a correct connection of the quick-disconnect fitting.

(c) If you are not sure the quick-disconnect is correct, do the low-range leakage test of the pitot-static probe (AMM 34-11-01/501).

S 434-026

(11) Connect the electrical cable connector to the probe.

S 434-027

CAUTION: DO NOT BEND OR TWIST THE PROBE TO ENGAGE THE ALIGNMENT PINS. THIS CAN CAUSE DAMAGE TO THE PROBE.

(12) Coat probe alignment pins and alignment pin holes with BMS 5-95 sealant.

S 434-320

(13) Hold the probe at the bottom and carefully put the pneumatic hose and electrical cable into the hole in the support plate so that the probe bottom alignment pins align with the alignment pin holes and fits in the airplane skin cutout.

S 434-028

(14) Make sure that the probe bottom makes a continuous surface contact with the airplane skin.

S 424-029

(15) Install the probe mounting screws in the probe mounting flange and tighten them to 32-39 pound-inches.

S 764-282

(16) Measure the resistance between the strut of the pitot-static probe and the airplane skin with an ohmmeter.

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S 764-283

(17) If the resistance is more than 0.010 ohm, do these steps:
   (a) Remove the pitot-static probe.
   (b) Clean the bonding surfaces, including the countersunk holes in the pitot-static probe (SWPM 20-20-00).
   (c) Replace the existing screws with new screws.
   (d) Re-install the pitot-static probe.
   (e) Measure the resistance between the strut of the pitot-static probe and the airplane skin with an ohmmeter.
   (f) If the resistance is more than 0.010 ohm, do these steps:
      1) Remove the pitot-static probe.
      2) Replace the nutplates and rivets that attach the pitot-static probe (SRM 51-40-02).
      3) Re-install the pitot-static probe and make sure the bonding resistance is not more than 0.010 ohm.

F. Pitot-Static Probe Test

S 864-031

CAUTION: REMOVE THE PROTECTIVE COVER ON THE PITOT-STATIC PROBE, IF THERE IS ONE. THIS WILL PREVENT DAMAGE TO THE PROBE WHEN YOU APPLY PROBE HEATER POWER.

(1) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 panel:
   (a) 6K14, PITOT HEAT CAPT ϕA
   (b) 6K15, PITOT HEAT CAPT ϕB
   (c) 6K16, PITOT HEAT R AUX ϕB
   (d) 6K17, PITOT HEAT R AUX ϕC
   (e) 6K20, PITOT HEAT L AUX ϕC
   (f) 6K21, PITOT HEAT L AUX ϕB
   (g) 6K22, PITOT HEAT F/O ϕB
   (h) 6K23, PITOT HEAT F/O ϕA

S 724-032

(2) Do a test of the probe heater circuit (AMM 30-31-00/501).

S 724-033

(3) Do the low-range leak test for the pitot-static probe (AMM 34-11-01/501).

   NOTE: This test is requred on probes with none quick-disconnect fittings.

S 434-284

(4) AIRPLANES WITH 233T9121-5 GASKET;

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Fill the gap between the bottom of the probe and the airplane skin with (BMS 5-95) sealant.

NOTE: It is not neccessary to apply the sealant immediately, if the cure time will cause a flight delay. But, you must apply the sealant as soon as possible to keep moisture out of the area between the probe and airplane skin.

(a) Cure the sealant until the sealant is hard.

NOTE: You can apply heat to decrease the cure time (AMM 51-31-01/201).

S 434-292

(5) From inside the airplane, apply a layer of (BMS 5-95) sealant on the inboard surface of the airplane skin over the alignment pin locations.

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PITOT-STATIC PROBE - ADJUSTMENT/TEST

1. General
   A. This procedure has one task: the Pitot-Static Probe test. It makes sure there are no leaks in the system.
   B. You must do a leakage test on the applicable subsystems after each pitot-static probe installation. You usually do not have to flush the system. Flush the system only if you think that unwanted material got in the pitot-probe system hoses or tubing during disassembly/assembly.
   C. Keep the absolute pressure in the pitot system greater than or equal to the pressure in the static system. The difference between the pitot and static pressures must never be greater than 10 inches of mercury.
   D. The absolute pressure applied to any static system must never be greater than the ambient pressure when any instrument is connected to that static system.
   E. The pitot lines connected to the elevator feel computer must be disconnected and capped, or a separate line must be connected to the static port if the absolute pressure in the auxiliary pitot system No. 1 and/or No. 2 is decreased below ambient pressure. If the pitot lines are disconnected, a system leak check must be done after they are reconnected.
   F. You must flush the probe adapter with water before you install it on the pitot-static probe. If not, you can cause damage to the probe or the adapter. Use a solution of half pure ethylene glycol and half water if the temperature is between +32° and -40°F. If you use ethylene glycol, wipe off the probe head with a soft rag after the test is done.

TASK 34-11-01-725-001

2. Pitot-Static Probe Test
   A. Equipment
      (1) Adapter
         (a) Pitot-static probe test adapter -
             Rosemount Engineering, 884EH-3
             (2 necessary)
             Rosemount Inc.
             14300 Judicial Rd.
             Burnsville, MN 55337
      (2) Pneumatic Test Set
         (a) Dry air pressure source (1 necessary), 0
             to 5 inches of mercury (absolute)

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(b) Vacuum sources (2 necessary), 0 to 20 inches of mercury (absolute)

(3) Gages

(a) Pitot system test gage - one with an accuracy of ±0.16 (readable to ±0.03) inch of mercury or ±5 (readable to ±1) knots

(b) Static system test gage - one with an accuracy of ±0.1 (readable to ±0.01) inch of mercury or ±200 (readable to ±20) feet

(c) Differential pressure gage - one which can show 10 inches of mercury differential pressure (minimum) with an accuracy of ±0.010 inch of mercury

(4) Flow restrictors, control valves, cutoff valves, and port seals as necessary

B. References

(1) 24-22-00/201, Electrical Power - Control

C. Access

(1) Location Zones

117/118	Area Outboard and Above NLG Wheel Well
211/212	Flight Compartment

D. Prepare to Do the Pitot-Static Probe Test

S 865-085

(1) Seal the visco jet drains with a pressure tape that will not cause a residue.

S 865-089

WARNING: MAKE SURE THE RAM AIR TURBINE PWR (6J8) AND AUTO (6C2) CIRCUIT BREAKERS ON PANEL P6 ARE OPEN. THIS PREVENTS ACCIDENTAL OPERATION OF THE RAM AIR TURBINE WHICH CAN CAUSE INJURY TO PERSONS.

(2) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:

(a) 6C2, RAM AIR TURBINE AUTO
(b) 6J8, RAM AIR TURBINE PWR
(c) 6K14, PITOT HEAT CAPT ϕA
(d) 6K15, PITOT HEAT CAPT ϕB
(e) 6K16, PITOT HEAT R AUX ϕB
(f) 6K17, PITOT HEAT R AUX ϕC
(g) 6K20, PITOT HEAT L AUX ϕC
(h) 6K21, PITOT HEAT L AUX ϕB
(i) 6K22, PITOT HEAT F/O ϕB
(j) 6K23, PITOT HEAT F/O ϕA

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S 865-004
(3) Connect the pitot pressure source in the pneumatic test set through the pitot control valve to the pitot cutoff valve.

S 865-005
(4) Connect the static (vacuum) source in the pneumatic test set through the static control valve to the static cutoff valve.

S 725-006
(5) To do a leakage test of the captain's main pitot-static probe (top left), do the steps that follow:
   (a) Temporarily seal the S1 and S2 static ports on the captain's auxiliary pitot-static probe (bottom right).
   (b) Temporarily seal the pitot pressure chamber drain hole on the captain's main pitot-static probe (top left).

   CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PROBES. THIS CAN CAUSE THE PROBE TO GO OUT OF ALIGNMENT OR CAUSE DAMAGE TO IT.

   (c) Install the pitot-static probe test adapter on the top left pitot-static probe.
   (d) Connect the test adapter to the cutoff valves through the system test gage and flow restrictors.

S 725-007
(6) To do a leakage test of the first officer's main pitot-static probe (top right), do the steps that follow:
   (a) Temporarily seal the S1 and S2 static ports on the first officer's auxiliary pitot-static probe (bottom left).
   (b) Temporarily seal the pitot pressure chamber drain hole on the first officer's main pitot-static probe (top right).

   CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PROBES. THIS CAN CAUSE THE PROBE TO GO OUT OF ALIGNMENT OR CAUSE DAMAGE TO IT.

   (c) Install the pitot-static probe test adapter on the upper right pitot-static probe.
   (d) Connect the test adapter to the cutoff valves through the system test gage and flow restrictors.

S 725-008
(7) To do a leakage test of the captain's auxiliary pitot-static probe (bottom right), do the steps that follow:
   (a) Temporarily seal the S1 and S2 static ports on the captain's main pitot-static probe (top left).
   (b) Temporarily seal the pitot pressure chamber drain hole on the captain's auxiliary pitot-static probe (bottom right).

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CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PROBES. THIS CAN CAUSE THE PROBE TO GO OUT OF ALIGNMENT OR CAUSE DAMAGE TO IT.

(c) Install the pitot-static probe test adapter on the bottom right pitot-static probe.
(d) Connect the test adapter to the cutoff valves through the system test gage and flow restrictors.

S 725-009
(8) To do a leakage test of the first officer's auxiliary pitot-static probe (bottom left), do the steps that follow:
(a) Temporarily seal the S1 and S2 static ports on the first officer's main pitot-static probe (top right).
(b) Temporarily seal the pitot pressure chamber drain hole on the first officer's auxiliary pitot-static probe (bottom left).

CAUTION: MAKE SURE THE TEST HOSES AND ADAPTERS DO NOT PUT MORE WEIGHT ON THE PROBES. THIS CAN CAUSE THE PROBE TO GO OUT OF ALIGNMENT OR CAUSE DAMAGE TO IT.

(c) Install the pitot-static probe test adapter on the bottom left pitot-static probe.
(d) Connect the test adapter to the cutoff valves through the system test gage and flow restrictors.

E. Pitot-Static Probe Leakage Test

S 865-023

CAUTION: MAKE SURE THE RATE YOU APPLY OR RELEASE THE PRESSURE TO A PITOT SYSTEM IS LESS THAN 300 KNOTS PER MINUTE. THIS WILL PREVENT DAMAGE TO THE PITOT SYSTEM.

(1) Use the pneumatic test set and control valve to apply a pressure of 1.959 ±0.16 inches of mercury or 200 ±5 knots to the pitot system. (Read the value from the pitot system test gage).

S 865-010
(2) When the system has become stable, close the pitot cutoff valve.

S 975-011
(3) Read and make a record of the value on test gage.

S 755-013
(4) After 1 minute, make sure that the pressure did not decrease by more than 0.03 inches of mercury or 1.5 knots.

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S 865-025

CAUTION: MAKE SURE THE RATE YOU APPLY OR RELEASE THE PRESSURE TO A PITOT SYSTEM IS LESS THAN 300 KNOTS PER MINUTE. THIS WILL PREVENT DAMAGE TO THE PITOT SYSTEM.

(5) Slowly release the pressure in the pitot system until it goes back to ambient pressure.

S 865-026

CAUTION: MAKE SURE THE RATE YOU APPLY OR RELEASE THE VACUUM TO A STATIC SYSTEM IS LESS THAN 5000 FEET PER MINUTE. THIS WILL PREVENT DAMAGE TO THE STATIC SYSTEM.

(6) Operate the pneumatic test unit and static control valve to apply a vacuum pressure to the static systems equivalent to one of these:
   (a) Ambient pressure minus 5.25 ±0.25 inches of mercury as shown on the static system test gages.
   (b) 5,000 feet above the airport altitude as shown on the static system test gages.

S 725-024

CAUTION: YOU MUST KEEP A VACUUM AS A SAFETY MEASURE BEHIND THE CUTOFF VALVES DURING THE CUTOFF PERIOD. THIS WILL PREVENT INSTRUMENT OR EQUIPMENT DAMAGE. RELEASE THE VACUUM SLOWLY AND SIMULTANEOUSLY FOR ALL STATIC SYSTEMS.

(7) When you have the necessary vacuum and it is stable, close the cutoff valves.

S 975-016
(8) Read and make a record of the value on the test gage.

S 755-017
(9) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inches of mercury or an equivalent fall of 80 feet in altitude.

S 865-027

CAUTION: MAKE SURE THE RATE YOU APPLY OR RELEASE THE VACUUM TO A STATIC SYSTEM IS LESS THAN 5000 FEET PER MINUTE. THIS WILL PREVENT DAMAGE TO THE STATIC SYSTEM.

(10) Slowly release the vacuum in the static system until it goes back to ambient pressure.

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F. Put the Airplane Back to Its Usual Condition

S 845-019

(1) Remove the probe test adapters.

S 845-020

(2) Remove all seals on the pitot-static probe.

S 845-057

(3) Remove all seals from the visco jet drains.

S 845-021

(4) Remove the DO-NOT-CLOSE tags and close these P6 panel circuit breakers:
   (a) 6C2, RAM AIR TURBINE AUTO
   (b) 6J8, RAM AIR TURBINE PWR
   (c) 6K14, PITOT HEAT CAPT ϕA
   (d) 6K15, PITOT HEAT CAPT ϕB
   (e) 6K16, PITOT HEAT R AUX ϕB
   (f) 6K17, PITOT HEAT R AUX ϕC
   (g) 6K20, PITOT HEAT L AUX ϕC
   (h) 6K21, PITOT HEAT L AUX ϕB
   (i) 6K22, PITOT HEAT F/O ϕB
   (j) 6K23, PITOT HEAT F/O ϕA

S 865-022

(5) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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PITOT-STATIC PROBE - INSPECTION/CHECK

1. General
   A. This subject has one task. The task is to visually examine the pitot-static probe, static ports, pitot opening, and pitot drain hole for damage and unwanted materials. This procedure gives the limits for damage to the inlets of the pitot-static probes. If there is more damage than these limits you must replace the pitot-static probe (Ref 34-11-01/401).
   B. Fly Back Limits
      (1) Replace the pitot-static probe for one or more of the conditions that follow:
         (a) The flight crew finds a cross-panel airspeed or altitude difference
         (b) The pitot-static probe is out of tolerance
         (c) There is mechanical damage.
      (2) Do these steps when you see deterioration of the pitot-static probe:
         (a) You can dispatch the airplane from a base without maintenance facilities until one of the conditions that follow occur:
            1) 48 hours elapse
            2) The airplane gets to a maintenance base.

TASK 34-11-01-206-001

2. Examine the Pitot-Static Probe
   A. Equipment
      (1) Assorted gages or wires - 0.015 to 0.30 inch,
          OR
          Optical Micrometer - Model 966A1
          Monocle Industries, Inc.
          P.O. Box 2426
          Coppell, TX 75019, OR other suitable instrument

   B. References
      (1) AMM 34-11-00/301, Pitot-Static System
      (2) AMM 34-11-01/401, Pitot-Static Probe
   C. Access
      (1) Location Zones
          117/118 Area Outboard and Above NLG Wheel Well

   D. Procedure

      NOTE: All limits below include the tolerance caused by the techniques used to measure.

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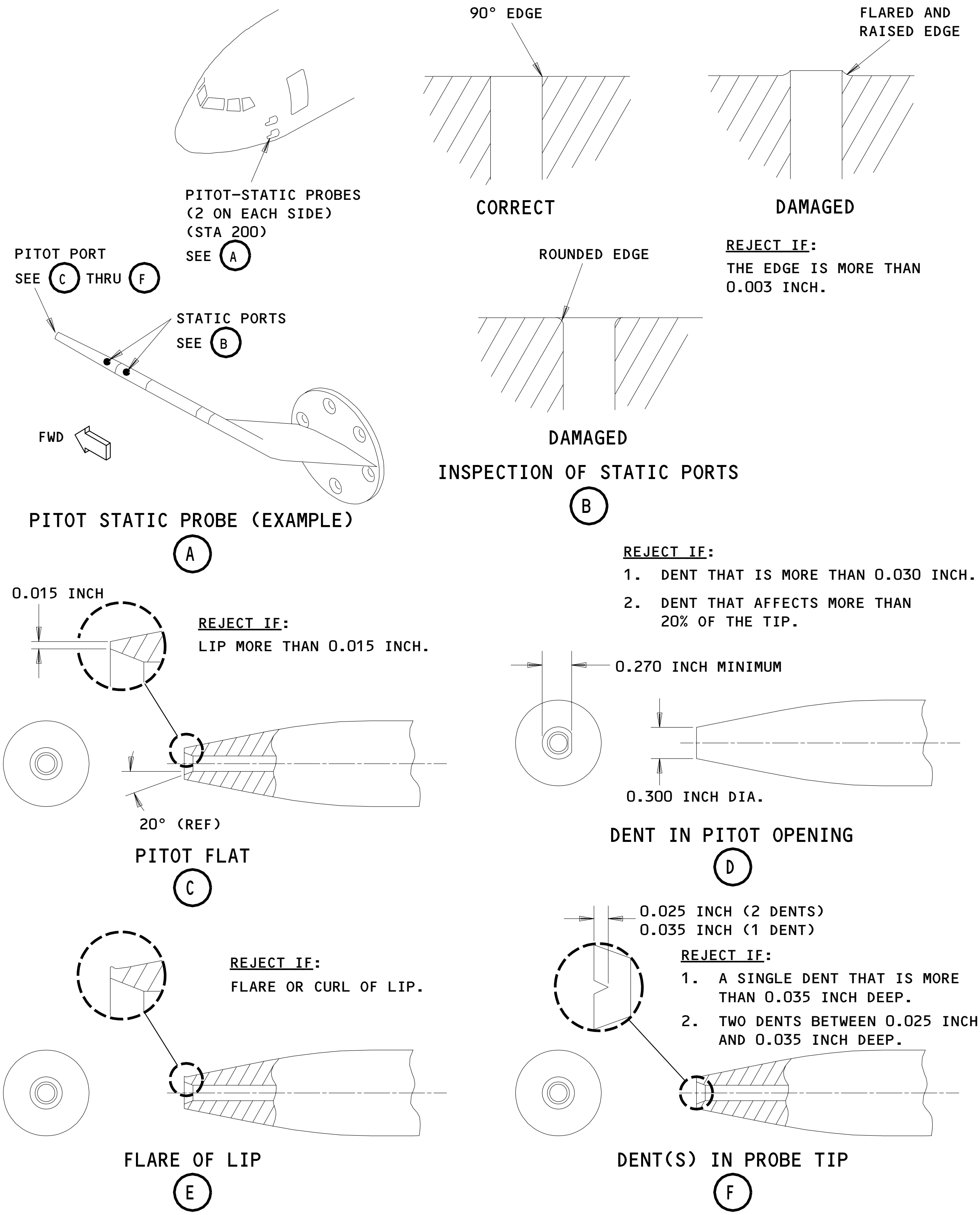

Pitot-Static Probe - Inspection/Check
Figure 601

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S 216-002
(1) Visually examine the pitot-static probes for damage.
  (a) If you see delamination or cracking on the leading edge of the probe strut, the probe should be replaced (AMM 34-11-01/401).

S 216-003
(2) Visually examine the pitot-static probes for unwanted material in the static ports, drain holes, pitot openings and the contour of the probe.

S 216-016
(3) If material is present in the static ports, drain holes, pitot openings or in the contour of the probe, drain and flush the pitot-static system (AMM 34-11-00/301).

S 226-004
(4) Make sure the static ports are square and sharp. The static ports must not be rounded or flared (Fig. 601).
  (a) Replace the probe if the edges are more than 0.003 inches (Ref 34-11-01/401).

S 226-005
(5) Make sure there is no damage more than 0.015 inches in depth in an area 0.5 inches around the static ports (Fig. 601).
  (a) Replace the probe if the damage is more than this limit (Ref 34-11-01/401).

S 226-006
(6) Make sure there is no damage more than 0.025 inches in depth on the remaining area on the head of the probes.
  (a) Replace the probe if the damage is more than this limit (Ref 34-11-01/401).

S 226-007
(7) Make sure there is no damage more than 0.125 inches in depth on the strut of the probes.
  (a) Replace the probe if the damage is more than this limit (Ref 34-11-01/401).

S 226-008
(8) Make sure the leading edge of the pitot openings is sharp. New tubes are 0.012 maximum flat.
  (a) Replace the probe if the lip is flat more than 0.015 inches (Fig. 601).

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S 226-009

(9) Make sure the inner surface of probe tips is smooth and circular (Fig. 601).
- (a) If there is a dent, it can not change the diameter more than 0.030 inches from the specufied tip diameter of 0.300 inches. Also a dent can not include more than 1/5 (20%) of the lip circumfrance.
- (b) Replace the probe if the damage is more than these limits (Ref 34-11-01/401).

S 216-011

(10) Make sure the outer surface of the probe tips is smooth and circular. The tip cannot be curled or flared out (Fig. 601).
- (a) You can find this condition if you move your fingernail along the outer surface at the tip.
- (b) Replace the probe if the tip is curled or flared out (Ref 34-11-01/401).

S 226-010

(11) Make sure the leading edge of the pitot-static probes do not have dents (Fig. 601).
- (a) If there are two dents that are between 0.025 and 0.035 inches in depth, replace the probe (Ref 34-11-01/401).
- (b) If there is a dent more than 0.035 inches in depth, replace the probe (Ref 34-11-01/401).

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PITOT-STATIC PROBE - CLEANING/PAINTING

1. General
   A. This procedure tells how to clean the inner and outer parts of the pitot-static probes.
   B. The pitot-static probe should not be painted. The data from the pitot-static probe can be affected if you paint the pitot-static probe.
   C. Two pitot-static probes are on each side of the airplane at Station 200.

TASK 34-11-01-107-001

2. Clean the Pitot-Static Probe
   A. Equipment
      (1) Drill rods of 0.029 inches and 0.035 inches.
      (2) Dry air pressure source.
   B. References
      (1) 34-11-01/401, Pitot-Static Probe
      (2) 34-11-01/601, Pitot-Static Probe
   C. Access
      (1) Location Zones
          117/118 Area Outboard and Above NLG Wheel Well

   D. Procedure

      S 227-003

      (1) Do the procedure, Pitot-Static Probe - Inspection/Check, before you clean the probes (Ref 34-11-01/601).

      S 167-005

      CAUTION: BE CAREFUL WHEN YOU TOUCH THE PITOT-STATIC PROBE. DO NOT PUT TOO MUCH WEIGHT ON THE PROBE. DAMAGE TO THE PROBE CAN OCCUR.

      (2) Do these steps to clean the inner side of the pitot-static probe:
          (a) Disconnect the pressure lines for the pitot-static probe.
          (b) Blow compressed dry air through the line end and out the ports on the probe. The maximum air pressure you can use is 60 psi.
          (c) If the compressed air does not remove the unwanted material from the probe, do these steps:
              1) Remove the pitot-static probe from the airplane (Ref 34-11-01/401).

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CAUTION: DO NOT USE FLUIDS THAT CONTAIN SODIUM CHLORIDE OR SULFUR COMPOUNDS TO CLEAN THE PROBE. SODIUM CHLORIDE AND SULFUR CAN CAUSE PREMATURE FAILURE OF THE PROBE.

2) Soak or flush the probe with clean water.
3) Drain the water from the probe.
4) Blow compressed dry air through the line end and out the ports on the probe. The maximum air pressure you can use is 60 psi.

CAUTION: MAKE SURE YOU DO NOT MAKE THE DRAIN HOLE LARGER WHEN YOU CLEAN IT (THE DIAMETER OF THE DRAIN HOLE IS 0.035 ±.001 INCHES). DAMAGE TO THE DRAIN HOLE CAN OCCUR.

(d) If the compressed air and the water do not remove the unwanted material from the drain hole, do these steps:
1) Put the 0.029 inch drill rod in the drain hole.
2) Put the 0.035 inch drill rod in the drain hole.

S 167-004
(3) Do these steps to clean the outer side of the pitot-static probe:

CAUTION: DO NOT PUT AN OBJECT INTO THE STATIC PORTS ON THE PROBE. DO NOT LET SOLVENTS, OIL, OR GREASE GET ON THE PROBE. DO NOT RUB THE SURFACE OF THE PROBE TO CLEAN IT. DAMAGE TO THE PROBE CAN OCCUR.

CAUTION: DO NOT USE FLUIDS THAT CONTAIN SODIUM CHLORIDE OR SULFUR COMPOUNDS TO CLEAN THE PROBE. SODIUM CHLORIDE AND SULFUR CAN CAUSE PREMATURE FAILURE OF THE PROBE.

(a) Clean the probe with clean water.
(b) Dry the probe with a soft cloth.

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ALTERNATE STATIC PORT - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the alternate static port. The second task installs the alternate static port.
   B. The alternate static ports are installed on the left and right sides of the fuselage at body station 465, WL 140. You must remove a heat exchange section to get access to the left static port.

TASK 34-11-03-004-035

2. Alternate Static Port Removal
   A. References
      (1) AMM 21-58-28/401, Heat Sink Transition Duct
      (2) AMM 25-52-01/401, Containerized Cargo Compartment Sidewall Lining
      (3) AMM 51-31-01/201, Seals and Sealing
      (4) AMM 20-10-23/401, Lockwires
   B. Access
      (1) Location Zones

117/118	Area Outboard and Above NLG Wheel Well
121/122	Forward Cargo Compartment

   C. Procedure

      S 034-001

      (1) Inside the forward cargo area, at approximately 6 feet in front of the cargo door, remove the appropriate sidewall panel, (Ref 25-52-01). (The alternate static port is about at floor level.)

      NOTE: Put a person outside the airplane by the static port.

      S 034-002

      CAUTION: DO NOT TWIST OR BEND THE STATIC HOSE DURING REMOVAL. A HOSE THAT HAS KINKS CAN CAUSE THE ALTERNATE STATIC SYSTEM NOT TO OPERATE.

      (2) Loosen and remove the connector that connects the hose to the static port.

      S 034-003

      (3) Put a protective cap on the hose to prevent the entry of unwanted materials.

      S 034-004

      (4) For the left static port removal, do the three steps that follow:
         (a) Remove the lockwire from the heat-sink retaining nut (AMM 20-10-23/401).
         (b) Remove the heat-sink retaining nut and washer.
         (c) Remove the heat-sink transition duct around the static port (Ref 21-58-21).

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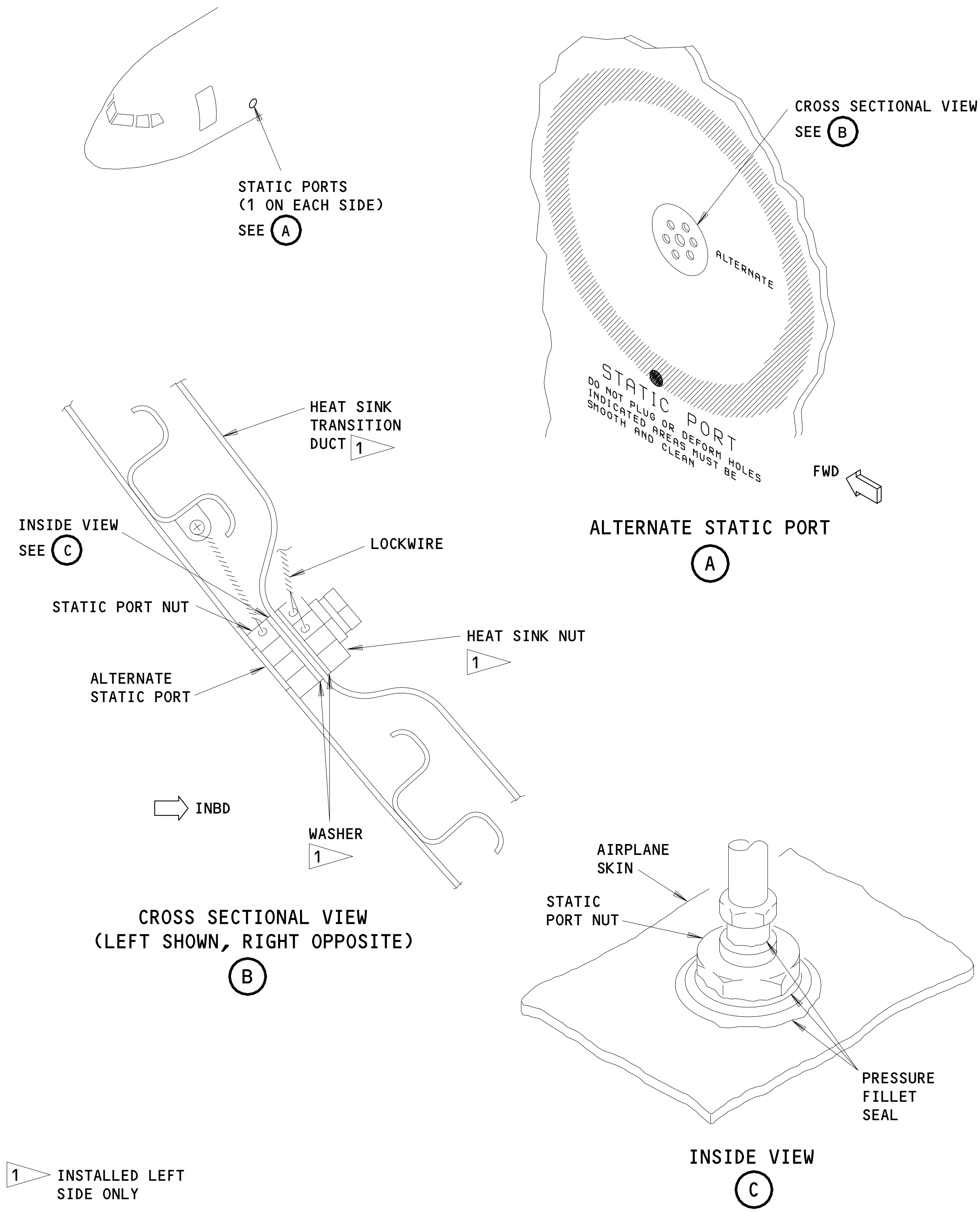

Alternate Static Port Installation
Figure 401

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S 024-041

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(5) Clean the sealant from around the static port and the static port retaining-nut (Ref 51-31-01).

S 034-006
(6) Remove the lockwire from the static port retaining-nut (20-10-23).

S 034-007

CAUTION: DO NOT CAUSE SCRATCHES OR DAMAGE TO THE SURFACE OF THE AIRPLANE SKIN NEAR THE AREA AROUND THE PAINTED CIRCLE. THIS CAN CAUSE THE SYSTEM TO OPERATE INCORRECTLY.

(7) Remove the static port retaining-nut.

S 024-009
(8) From outside the airplane, remove the static port.

TASK 34-11-03-404-010
3. Alternate Static Port Installation (Fig. 401)
A. Equipment
(1) Sealant Removal Tool - hardwood or plastic

B. Consumable Materials
(1) A02315 Compound, Pressure Sealant - BMS 5-142
(2) C00046 Coating - Alodine 1000, MIL-C-5541
(3) B00184 Solvent - BMS 11-7
C. References
(1) AMM 21-58-28/401, Heat Sink Transition Duct
(2) AMM 25-52-01/401, Containerized Cargo Compartment Sidewall Lining
(3) AMM 34-11-00/201, Pitot-Static System
(4) AMM 51-21-04/701, Alodine Coating
(5) AMM 51-31-01/201, Seals and Sealing
(6) AMM 20-10-23/401, Lockwires

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(7) SRM 51-10-01/101, Aerodynamic Smoothness

D. Access

(1) Location Zones

117/118	Area Outboard and Above NLG Wheel Well
121/122	Forward Cargo Compartment

E. Procedure

S 864-011

(1) Put a person with the static port to be installed at the mounting hole outside the airplane.

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S 164-042

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(2) Clean all sealant from the area (Ref 51-31-01).

S 164-037

(3) Prepare the area so you can apply the new sealant (Ref 51-31-01).

S 434-013

(4) From outside the airplane, install the static port in the mounting hole. (Adjust it until the face of the port makes a smooth surface with the airplane skin).

S 434-014

(5) Hold it in position.

S 424-015

(6) From inside the airplane, install the static port retaining-nut.

S 424-016

(7) Tighten the nut to 250-400 pound-inches.

S 434-017

(8) Install the lockwire to the static port nut (Ref 20-10-23). (Use the double twist procedure.)

S 434-018

(9) Make the external surface of the static port smooth with the airplane skin to less than +0.004/-0.001 inch. (SRM 51-10-01)

NOTE: After installation, the surface of the skin and port for a distance of 3 inches forward and aft of the port centerline shall be smooth within .010 inch. Measure between this surface and the edge of a 6 inch straight edge put horizontally against the surface. All rivets in less than 3 inches of the port center must be smooth within .003 inch.

S 434-019

(10) Make sure that there are no scratches, burrs, or deformations on the static port finish and around the sensing holes in the static port.

S 434-020

(11) Make sure that no unwanted material is in the static port.

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S 434-021
(12) Use a brush to apply the alodine on the external surface of the static port (Ref 51-21-04).

S 434-022
(13) Make sure that all inlet holes on the static port are free of blockage or damage.

S 424-043

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO APPLY THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(14) Apply the pressure fillet seal all around the static port and the static port retaining-nut (Ref 51-31-01).

S 434-024
(15) For the left static port installation, also do the steps that follow:
  (a) Install the washer on top of the static port retaining-nut.
  (b) Install the heat-sink transition duct (Ref 21-58-28).
  (c) Install the second washer and heat-sink retaining nut.
    1) Tighten the nut to 50-100 pound-inches.
  (d) Install the lockwire to the heat sink nut (Ref 20-10-23).
    1) Use the double twist procedure and attach it to the lug on the heat sink assembly.

S 434-025

CAUTION: DO NOT TWIST OR CAUSE KINKS IN THE STATIC HOSE. THIS CAN CAUSE DAMAGE TO THE HOSE OR CONNECTORS.

(16) Connect the hose and connectors to the static port.

S 214-039
(17) Do a visual inspection of the quick-disconnect fittings that you just connected.
  (a) Make sure that the actuation ring of the quick-disconnect fitting is fully engaged on the lock pins and make sure that you see the colored lock ring indicator that shows a correct connection of the quick-disconnect fitting.

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F. Alternate Static Port Test

NOTE: Flush the system only if you think unwanted material got in the alternate static system during disassembly/assembly (Ref 34-11-00). Test setup, pressurization, and pressure release are done per 34-11-00. Put the system back to usual per 34-11-00 also.

S 724-027

(1) Pressurize the alternate static system (Ref 34-11-00).

S 724-028

CAUTION: KEEP THE RATE OF STATIC CHANGE BELOW 5000 FEET PER MINUTE. KEEP THE DIFFERENTIAL PRESSURE BETWEEN 0 AND 10 INCHES OF MERCURY. IF YOU DO NOT, IT COULD CAUSE INSTRUMENT OR EQUIPMENT DAMAGE.

(2) Use the pneumatic test set and static control valve to apply a vacuum pressure equivalent to one of these:
   (a) Ambient pressure minus 5.25 ±0.25 inches of mercury (absolute pressure)
   (b) 5000 feet above the airport altitude that shows on the test gages.

S 724-036

CAUTION: YOU MUST KEEP A VACUUM AS A SAFETY MEASURE BEHIND THE CUTOFF VALVES DURING THE CUTOFF PERIOD. THIS WILL PREVENT INSTRUMENT OR EQUIPMENT DAMAGE. RELEASE THE VACUUM SLOWLY AND SIMULTANEOUSLY FOR ALL PITOT AND STATIC SYSTEMS.

(3) When you have the necessary vacuum and it is stable, close the cutoff valve.

S 864-029

(4) Immediately after you close the cutoff valve, read and make a record of the value on the static pressure gage.

S 754-030

(5) After 1 minute, make sure the vacuum did not decrease by more than 0.07 inches of mercury or an equivalent fall of 80 feet in altitude.

S 844-031

(6) Put the alternate static system back to ambient pressure (Ref 34-11-00).

S 864-032

(7) Remove all adapters and seals.

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S 864-033

(8) Install the sidewall panel (Ref 25-52-01).

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AIR DATA COMPUTING SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The air data computing system provides air data outputs to the air data instruments and other interfacing systems. The system consists of one total air temperature (TAT) probe, two air data computers (ADCs), and two angle of attack (AOA) sensors. The system also has two external test switches.
   B. The air data system uses pneumatic and electric signals as input data. Pitot and static air pressure from the pitot-static system (AMM 34-11-00) is applied to the ADC's. Total air temperature (TAT) is provided from a TAT probe. Angle of attack (AOA) and BARO correction are sent to the ADC by resolver voltages. The two ADC's are the central processing units of the system.
   C. Four identical ARINC 429 serial data buses from each ADC, transmit data to interfacing systems. The transmitted data includes altitude, airspeed, air temperature, air pressure, and angle of attack data. An overspeed discrete line is connected to the warning system (AMM 31-51-00) and EICAS (AMM 31-41-00).
2. Component Details (Fig. 1)
   A. Air Data Computer
      (1) The air data computers process all the air data inputs and provide computed air data outputs. Outputs are derived from three types of data sensed from the external ambient air. Pitot and static air pressures are provided from the pitot static system. Air temperature of the atmosphere is sensed by the total air temperature probe. Angle of attack information is provided by angle of attack sensors. Baro correction is supplied from the altimeters.
      (2) The ADC front panel provides pitot and static air pressure input connectors. It also provides an external sensor fault LED display, an ADC fail annunciator, and a functional test pushbutton switch.
      (3) The ADC fail annunciator indicates whether or not the ADC had a failure during the last flight. The annunciator shows black for no failures and yellow for a failure.
      (4) The external sensor fault LED display is only operational during the system self-test. The display identifies input sensor failures. It displays a 0-9 single digit number corresponding to specific failures on input sensors. When the test switch is pressed, a dash (-) appearing in the LED indicates no external sensor faults.

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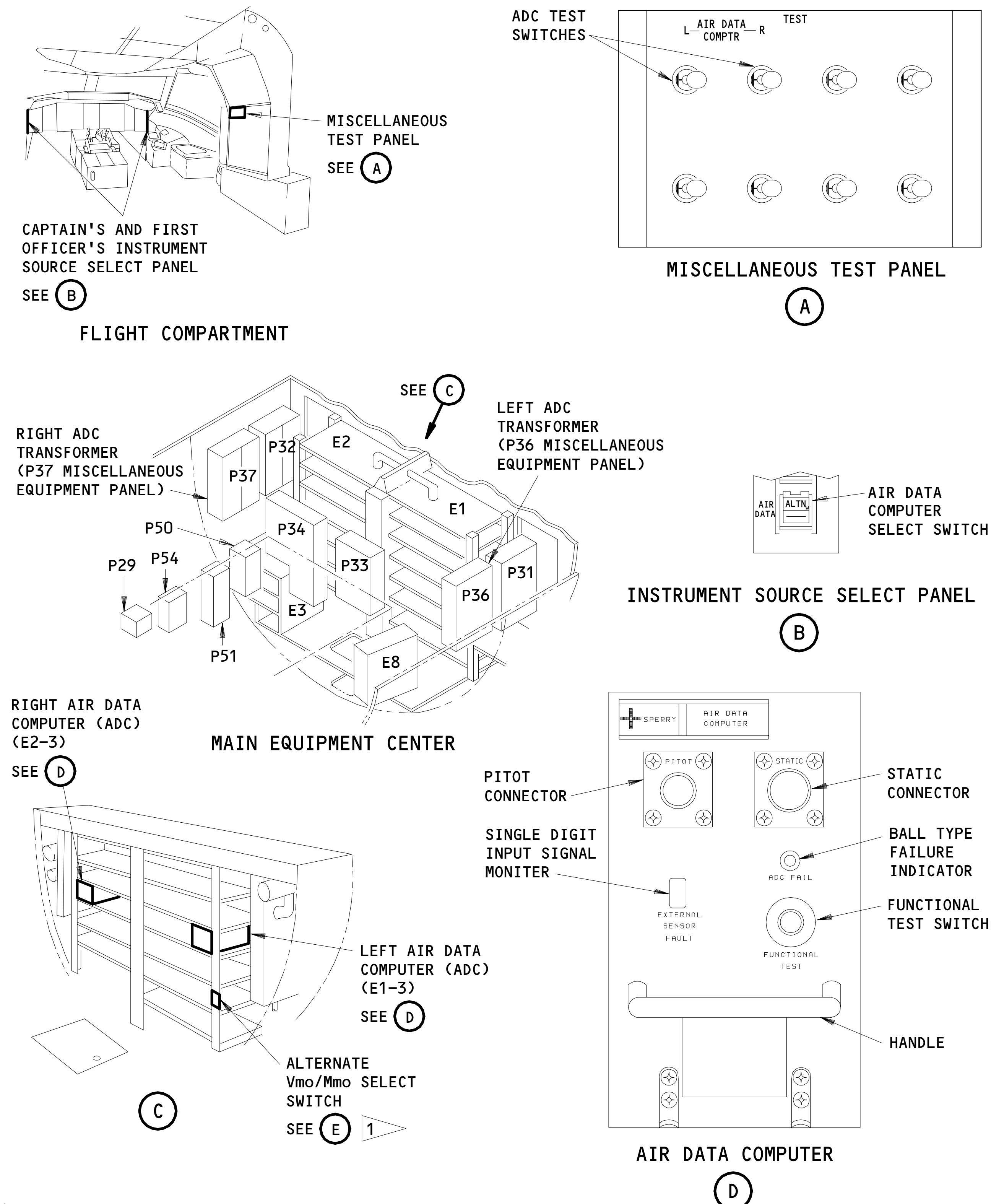

1 ALL MTH AIRPLANES

Air Data Computing System - Component Location
Figure 1 (Sheet 1)

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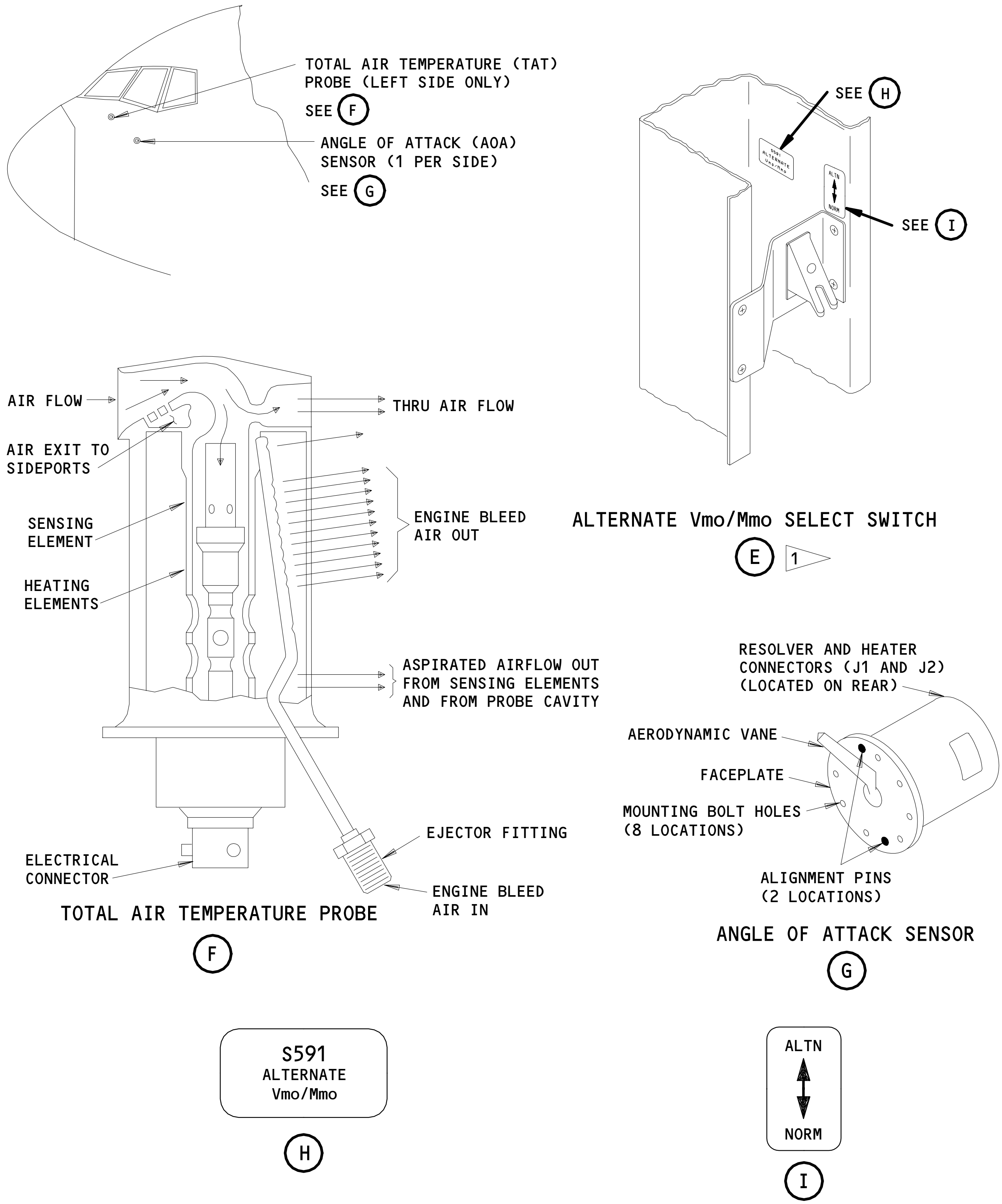

Air Data Computing - Component Location
Figure 1 (Sheet 2)

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(5) The functional test switch on the front panel initiates a self-test of the internal circuits of the respective ADC. Successful test results are the same as for the remote AIR DATA COMPTR test switch. The test switch is also used to reset the ADC faultball once the ADC fault has been corrected.

(6) The left and right ADC's are located in the main equipment center at racks E1-3 and E2-3, respectively.

B. ADC Test Switches

(1) The ADC (AIR DATA COMPTR) test switches are located on the P61 panel. The ADC test switches are wired in parallel with the functional test switch on the front of each ADC. However, these remote test switches are disabled in flight by the air/gnd relay. When the L or R AIR DATA COMPTR switch is held in the up position, the corresponding left or right ADC enters a self-test mode. Outputs are provided to the interfacing systems. However, the external sensor fault indicator on the front of each ADC is not activated by the corresponding L or R ADC test switch. The test is terminated when the switch is released and returns to the center (off) position.

C. Angle of Attack (AOA) Sensor

(1) The AOA sensor measures the direction of airflow relative to the fuselage. The sensor vane aligns itself with the prevailing airstream, rotating a central shaft. At the opposite end of the shaft, a gear drives position resolvers. The No. 1 and 2 synchro resolvers are powered by 26V, 400 Hz current and transform rotational position into an electrical output. This electrical output is proportional to the angle of attack. A viscous damper in the AOA vane stabilizes vane movements and reduces the effects of turbulence.

(2) The sensor has a solid-state vane heater which provides continuous de-icing/anti-icing. The AOA sensor also has a case heater which prevents condensation and reduces changes in damper fluid viscosity (AMM 30-31-00).

(3) The right and left sensors are physically and electrically interchangeable. They are located on both sides of the airplane.

D. Total Air Temperature Probe

(1) The total air temperature probe is a small metal strut mounted external to the airplane skin. It senses the temperature of airflow passing through cavities within the strut. Air enters an inlet port at the top and exits through several outlet ports on the side and aft surfaces. The TAT probe converts temperature to an analog output signal. It provides this output to the ADC. The TAT temperature is displayed on the EICAS display (AMM 31-41-00/001).

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(2) The probe contains two temperature sensitive wire elements. Airflow around these sensing elements causes the resistance of the wire to vary as a function of total air temperature.

(3) Bleed air provided by the engine bleed air distribution manifold (AMM 36-11-00) into the ejector fitting creates a negative pressure which draws outside air across the sensing elements at such a rate that the anti-ice heaters have a negligible effect. This feature permits accurate TAT readings to be displayed while the airplane is on the ground or in-flight at low airspeeds.

(4) The TAT probe is located on the left side of the airplane. Heating elements provide anti-icing for the probe (AMM 30-31-00/001).

E. ADC Transformers

(1) Each ADC transformer converts 115v ac to 26v ac. This stepdown voltage is used as a reference for barometric correction and AOA sensor resolver excitation.

(2) The left and right transformers are mounted on the left and right miscellaneous equipment panels P36 and P37, respectively.

F. AIR DATA Instrument Source Select Switch

(1) Both the captain and first officer have an AIR DATA instrument source select switch. This allows either pilot to switch over his instruments to operate off of the opposite ADC.

(2) The instrument source select switches are located on the captain's P1 panel and the first officer's P3 panel.

G. MTH 275-999;
Alternate Vmo/Mmo Select Switch

(1) The alternate Vmo/Mmo select switch is used to provide an input to the ADC to vary the Vmo/Mmo curve. This is done to compensate for a flight with the landing gear down. The switch is placed in the up (ALTERNATE Vmo/Mmo) position to compensate for landing gear down. The switch is located on the forward and outward stanchion of the E1 equipment rack.

3. Operation (Fig. 2)

A. Functional Description

(1) The left air data computing system is shown on the schematic and is covered in the following write-up. The right system is similar so the coverage for the left system applies.

(2) Power is supplied to the air data computing systems from the left and right 115v ac, 400 Hz buses. This power is rectified, filtered and regulated by the ADC power supplies to output dc voltages. The ADC transformer converts the 115v ac to 26v ac. This stepdown voltage is applied through the BARO correction circuit breakers to the ADC, AOA sensors, and air data instruments. It is used for reference and excitation voltage. P11 circuit breakers protect the 26v ac circuit breakers from overcurrents.

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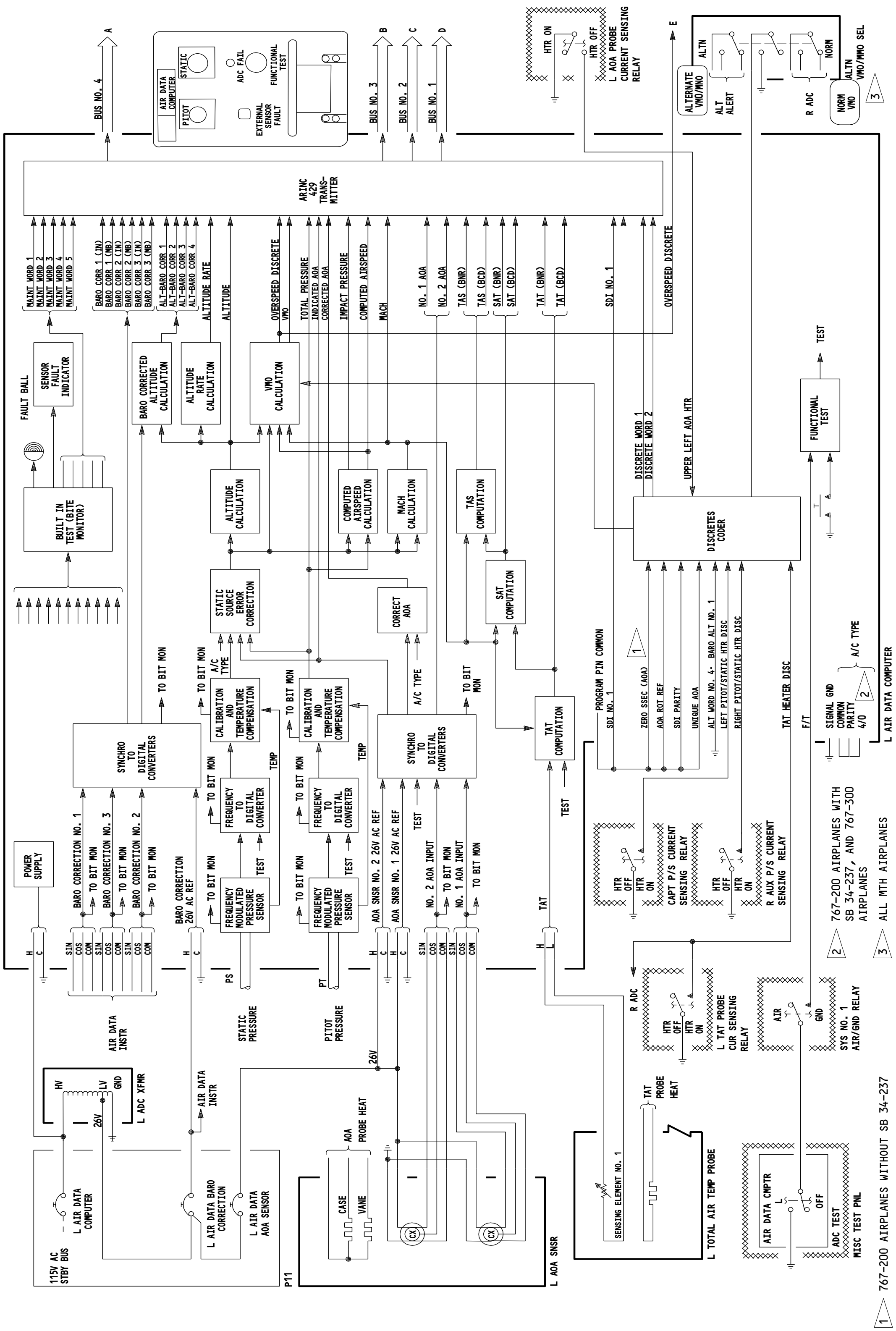

Air Data Computing System Schematic (Example)
Figure 2 (Sheet 1)

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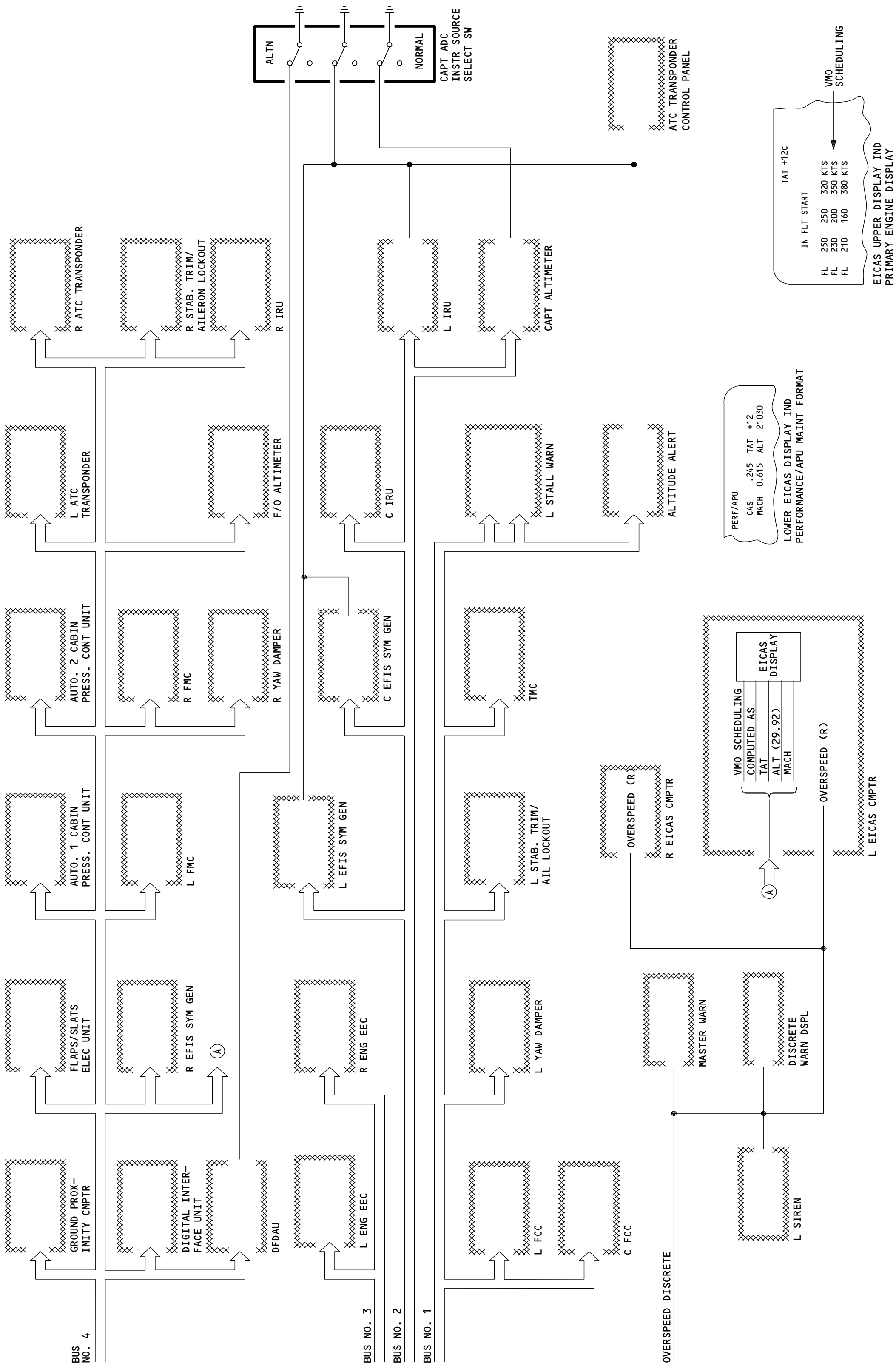

Air Data Computing System Schematic (Typical)
Figure 2 (Sheet 2)

642480

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(3) For a left bus failure (occurs when the bus voltage is less than 97 ±2v ac for greater than 180 mS), the left ADC, which is on the standby power bus, receives power from the hot battery bus, via the static inverter. When the left bus returns to greater than 106 ±2v ac for more than 1.2 seconds, the left ADC resumes its normal power flow from the left bus. The right ADC does not have alternate power capabilities.

(4) The ADCs use pneumatic and electric signals as input data. This data is converted to digital data for use by the central processing unit (CPU). The CPU controls all operations. It performs the required computations and outputs the proper data to the output transmitters. The CPU is represented by the compensation, computation, correction and calculation circuits.

(5) Pitot and static air pressures are applied directly to the ADC. The ADC uses two identical pressure sensors to convert the pressures to frequencies that are proportional to pressure. These frequencies are converted to digital data for use by the CPU. The data is calibrated and temperature compensated and then corrected for static source error. Static source error is the ratio of pressure error to static pressure. Static Source Error Correction (SSEC) factors are stored in the CPU memory and used to make the required compensation.

(6) 767-200 AIRPLANES;
Only mach inputs are used for the calculation of SSEC. Connection of pin K15 disables use of AOA for calculation of SSEC (WDM 34-12-12).

(7) 767-300 AIRPLANES;
Mach and AOA inputs are used for calculation of SSEC. Pin K15 is left open which enables use of AOA for calculation of SSEC (WDM 34-12-12).

(8) BARO correction 1 comes from the capt's altimeter and BARO correction 2 from the F/O's altimeter for both ADCs. BARO correction 3 comes from the capt's altimeter for the left ADC and from the F/O's altimeter for the right ADC. The analog signals are determined by BARO pressure correction setting. The sin and cos signals are sampled at the peak value of the 26v ac reference voltage. These signals are converted to digital data, which is then changed to develop the BARO correction factors.

(9) The resolver voltage signals from the AOA sensors are converted to digital angular information and computed with respect to AOA rotation angle. The indicated AOA data is then in digital binary form for ADC output and further ADC calculations.

(10) The variable resistance in the TAT probe provides an analog input to the TAT computation circuit. Here, the signals are converted to digital form and output to the CPU.

(11) Several discretes are coded to inform the ADC and interfacing systems of sensor heater status.

(12) The ADC is set for either a right or left system by shorting the SDI (source/destination identifier) pin to common.

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(13) The AIR DATA COMPTR remote test switch is paralleled with the FUNCTIONAL TEST switch on the front of the ADC. The air/ground relay prevents a system test from being initiated from the remote test switch during flight.

(14) Each ADC has four ARINC 429 digital data buses transmitting identical data. A fault on one bus does not affect data on other buses. The following data is output on each bus.

(a) Pressure altitude is derived from the static pressure input which is compensated for ambient temperature and corrected for static pressure source errors. The range is from -1000 to +50,000 feet.

(b) The BARO corrected altitudes are computed from pressure altitudes and the BARO correction inputs (range -1000 to +50,000 feet). BARO corrected altitude No. 4 is provided for the autopilot. It repeats BARO No. 1 for the left ADC or BARO No. 2 for the right ADC.

(c) The altitude rate is derived from pressure altitude. Its range is from -20,000 fpm to +20,000 fpm.

(d) Computed airspeed is computed from a combination of calibrated pitot and static pressure inputs. The static pressure has been corrected for static pressure source errors. Computed airspeed range is from 30 to 450 knots.

(e) MACH number is computed from the same inputs as computed airspeed. Range is from 0.1 to 1.0 MACH.

(f) True airspeed is computed from a combination of MACH and static air temperature (SAT). Range is from 100 to 599 knots.

(g) Static air temperature is computed from a combination of MACH and total air temperature. It ranges from -99°C to +60°C.

(h) Total air temperature is computed from the analog output of the TAT probe. TAT ranges from -60°C to +99°C.

(i) Impact pressure is derived from the difference between total pitot pressure and indicated static pressure. Its range is from 0 to 372.5 millibars.

(j) Total pressure is derived from the calibrated pitot pressure input that has been compensated for ambient temperature. The range is from 135.5 to 1354.5 millibars.

(k) BARO corrections No. 1, 2, and 3 are repeats of the BARO corrections received from the altimeters. Their range is from 745 to 1050 millibars or 22.00 to 31.00 in.

(l) The indicated angle of attack is either unique or averaged depending upon a program pin jumper. For unique AOA the #1 AOA sensor input is used primarily for computation. The #2 AOA sensor is used as a secondary input, in case of #1 sensor failure. For averaged AOA the inputs are averaged from both #1 and #2 AOA sensors. The range is ±60°.

(m) Corrected angle of attack is not used on the airplane.

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(n) Maximum allowable airspeed (Vmo) (display output) is computed from altitude, airspeed, MACH data and stored Vmo reference data. Reference data for 16 airplane types can be stored in memory. Selection of the correct reference data is made by the program jumper. Mmo is derived from Vmo reference data. The Vmo range is 150 to 450 knots.

(o) The ADC outputs digital discrete data words. These data words contain information such as probe or sensor heat on and test of ADC components and system. They also contain alternate ADC modes of functions in operation and other alternate modes of operation.

(p) ADC maintenance words include BITE test fail/OK data.

(q) The ADC provides input for the Passenger Flight Information Display System (PFIDS) through the Digital Interface Unit (DIU) (AMM 23-32-00/001).

(15) The ADC also provides an overspeed discrete when computed airspeed or MACH is greater than the maximum allowed. Detailed characteristics are covered later.

B. BITE

(1) BIT Fault Monitoring

(a) The ADC built-in-test (BIT) equipment uses software tests in combination with BIT hardware to detect ADC and input sensor failures. BIT tests are performed during the operational program.

(b) The BIT checks all input data, internal circuits, CPU operations and memory. It uses wrap-around tests to check the transmitter output. If the latter test fails for more than 2 seconds, ARINC transmissions are halted. After a failure and halt, one ARINC transmission is made every 5 seconds thereafter to do another wrap-around test. If any of these tests pass, ARINC transmissions are resumed.

(c) The results of the BIT tests are reported in maintenance words on the ADC output data bus. The results also set the sign status matrix in the binary outputs and inhibit the BCD output when a failure occurs. For detected ADC internal failures, the fault ball on the front of the ADC changes from black to yellow. In addition, the BIT logic will store in-flight failures into a fault memory. This information is used for bench maintenance.

(d) The BIT also checks that the operational program has executed all of the program that it should. If the program is not operating properly, the fault ball on the front of the ADC will turn to yellow. This fault will fail all outputs from the ADC.

(e) Once the fault ball is set, it cannot be reset until the fault causing the set condition has been corrected. Once that fault is cleared, the fault ball is reset by pressing the test button on the ADC front panel.

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(2) Self-Test

(a) The self-test provides a confidence check of the ADC. The test can be started by pressing the test switch on the ADC or the AIR DATA CMPTR test switch on the P61 panel. To prevent bad test results, the self-test function is prevented in flight by the air/ground logic.

(b) The self-test indicates faults and sends canned outputs to the flight deck displays. For the first two seconds of the test, both master warning lights, the respective red OVSPD discrete light on the P1-3 panel, an EICAS overspeed message, and aural warning come on. The ADC front panel indicates external sensor faults.

NOTE: The external sensor fault indicator on the ADC front panel is not activated by the ADC test switch on the P61 panel.

(c) The following indications occur on the air data instruments during the ADC self-test.

1) For the first four seconds, the altimeter indications on the altimeter and the airspeed and MACH indications on the EADI start to drive up scale. MACH is blank below .400.
2) After three seconds, if the IRS is on (NAV or ATT) the VSI OFF flag appears and remains in view until the TEST switch is released.
3) During the fourth to seventh seconds, the altimeter OFF flag appears and the altimeter indications (pointer and counter) are stationary. On the EADI, the SPD (airspeed) flag appears.
4) After seven seconds, all indicator flags, except for the VSI, are retracted from view and the altimeter drives to 10,000 feet (requires 15 to 30 seconds). On the EADI, the airspeed indication becomes 137 knots and MACH is blank. The indications will read these values as long as the ADC test switch is on.

(d) The TAT display on the EICAS appears as follows during the ADC self-test:

NOTE: The thrust management computer (TMC) must be off. Also the on-line EICAS computer must correspond (L or R) to the ADC being tested for the TAT display to appear during the ADC test.

1) During the first three seconds, the TAT display shows +35°C.
2) During the third to seventh seconds, the TAT display is blanked.
3) After seven seconds, the TAT display again reads +35°C.

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(e) During the ADC self test, a numeric display on the ADC front panel indicates external sensor failures, which do not set the ADC fault ball. It is activated when the functional test button on the ADC front panel is pushed and remains on as long as the test button is pressed in. The readout indicates a BIT detected failure of external sensor data. Each digit represents a failure as shown.

0 - Spare	5 - TAT probe sensor resistance
1 - No. 1-AOA synchro input	6 - No. 1 Baro-correction synchro
2 - No. 2-AOA synchro input	7 - No. 2 Baro-correction synchro
3 - SDI parity	8 - No. 3 Baro-correction synchro
4 - Spare	9 - Aircraft type program
	"-" - No fault detected

(f) If multiple faults should occur, the LED display will indicate the faults in numerical order. When the first fault is corrected, the next fault in numerical order will be displayed.

(g) Caution must be exercised while using the ADC self test. If the pitot-static system is pressurized when the self test is activated, the ADC will enter an erroneous failure mode. The fault ball will show yellow and components receiving ADC data will display ADC failure. This failure mode can only be corrected by returning the pitot-static system to ambient pressure and then clearing the fault by pressing the ADC functional test button.

(3) MACH/Airspeed Warning Curve Characteristics (Fig. 3)

(a) The graph shows maximum allowed operating velocity and MACH. Unsafe operations are to the right of the curve.

(b) Vmo/Mmo is a function of altitude and MACH number. The curve values are stored in computer memory and compared with computed airspeed and MACH.

(c) The airplane is MACH limited to .86M above 25,723 ft. For constant Mach, airspeed must decrease as altitude increases.

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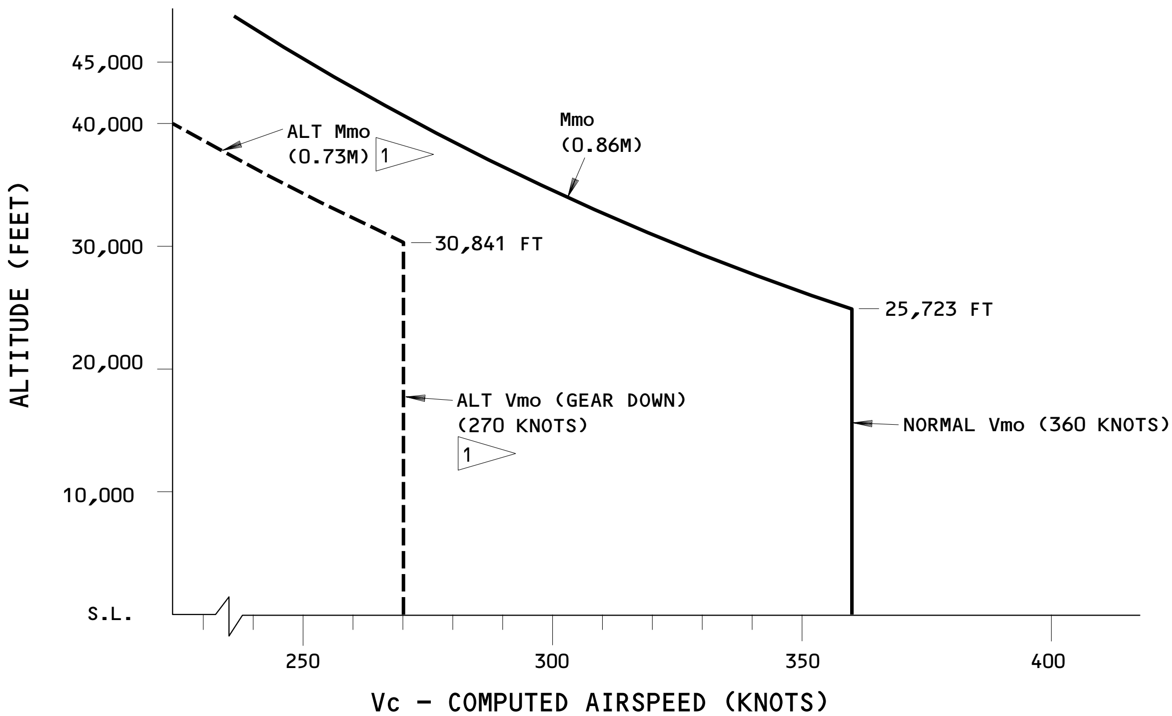

767 MAXIMUM OPERATING SPEED SCHEDULE

NORMAL Vmo/Mmo OVERSPEED SWITCH ACTUATION POINTS
Vc ≥362.0 ±0.25 KNOTS
Mc ≥0.8630 ±0.0005 MACH

ALTERNATE Vmo/Mmo OVERSPEED SWITCH ACTUATION POINTS
Vc ≥272.0 ±0.25 KNOTS [1]
Mc ≥0.7330 ±0.0005 MACH [1]

Vc = COMPUTED AIRSPEED OUTPUT OF ACTIVATION POINT, KNOTS
Vmo = MAX OPERATING AIRSPEED
Mc = MACH NUMBER OUTPUT OF ACTIVATION POINT
Mmo = MAX OPERATING MACH

[1] ALL MTH AIRPLANES

Vmo/Mmo Operation Curve and Select Switch
Figure 3

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(d) ALL MTH AIRPLANES;
an ALT Vmo/Mmo switch input is provided to the ADC. When the switch is pushed up to the ALTERNATE position, the ADC adjusts the Vmo/Mmo curve to compensate for a flight with the landing gear down.

(e) The ADC outputs an overspeed discrete when the computed airspeed reaches Vc +/-0.25 knots or Mach reaches Mc +/-0.0005 mach which ever is applicable. The overspeed discrete causes the aural warning to come on. The red WARNING lights on the glareshield and the red OVSPD discrete warning indicator on the captain's panel come on. An overspeed message will also appear on the upper EICAS display.

(f) Once the ADC outputs an overspeed discrete, it will continue until the speed is reduced to Vmo ±0.25 kts, or Mmo ±0.0005 M, whichever is applicable.

C. Control

(1) There is no on-off switch for the ADCs. They are always on, provided their circuit breakers are closed.

(2) To check the ADC's do the following:

(a) Provide electrical power (AMM 24-22-00/201).

(b) Close the following overhead panel P11 circuit breakers:

1) 11A10, AIR DATA CMPTR L
2) 11A11, AIR DATA AOA SENSOR L
3) 11A12, AIR DATA BARO CORRECT L
4) 11F30, AIR DATA CMPTR RIGHT
5) 11F31, AIR DATA AOA SENSOR RIGHT
6) 11F32, AIR DATA BARO CORRECT RIGHT

(c) Make sure that pitot-static system is at ambient pressure (AMM 34-11-00/501).

(d) Press FUNCTIONAL TEST button on front of each ADC.

1) Check that a "-" appears in the EXTERNAL SENSOR FAULT display.
2) Check that ADC FAIL indicator shows black.

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AIR DATA COMPUTING (ADC) SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
ALTIMETER - (REF 34-13-00, FIG. 101)				
CAPT, N8				
F/O, N48				
CIRCUIT BREAKERS	1		FLIGHT COMPARTMENT, P11	
AIR DATA AOA SENSOR LEFT, C1		1	11A11	*
AIR DATA AOA SENSOR RIGHT, C3		1	11F31	*
AIR DATA BARO CORRECT LEFT, C2		1	11A12	*
AIR DATA BARO CORRECT RIGHT, C4		1	11F32	*
AIR DATA COMPTR LEFT, C625		1	11A10	*
AIR DATA COMPTR RIGHT, C626		1	11F30	*
COMPUTER - AIR DATA LEFT, M100	2	1	119AL, MAIN EQUIP CENTER, E1-3	34-12-01
COMPUTER - AIR DATA RIGHT, M101	2	1	119AL, MAIN EQUIP CENTER, E2-3	34-12-01
COMPUTER - (REF 31-41-00, FIG. 101)				
EICAS LEFT, M10181				
EICAS RIGHT, M10182				
INDICATOR - (REF 34-22-00, FIG. 101)				
ELEX ATTITUDE DIRECTION LEFT, N4				
ELEX ATTITUDE DIRECTION RIGHT, N44				
MODULE - DISCRETE WARNING DISPLAY, M779	1	1	FLIGHT COMPARTMENT, P1-3	*
PANEL - (REF 28-43-00, FIG. 101)				
MISC TEST, M10398				
PROBE - TOTAL AIR TEMPERATURE, TS161	2	1	LEFT SIDE FORWARD FUSELAGE	34-12-02
RELAY - (REF 31-01-33, FIG. 101)				
AOA PROBE CURRENT SENSING LEFT, K400				
AOA PROBE CURRENT SENSING RIGHT, K401				
AUX PITOT STATIC CURRENT SENSING LEFT, K312				
AUX PITOT STATIC CURRENT SENSING RIGHT, K243				
PITOT STATIC CURRENT SENSING CAPT, K241				
PITOT STATIC CURRENT SENSING F/O, K310				
TAT PROBE CURRENT SENSING LEFT, K411				
RELAY - (REF 31-01-36, FIG. 101)				
SYS 1 AIR/GND, K149				
RELAY - (REF 31-01-37, FIG. 101)				
SYS 2 AIR/GND, K207				
SENSOR - ANGLE OF ATTACK LEFT, TS12	2	1	LEFT SIDE FUSELAGE NOSE	34-12-03
SENSOR - ANGLE OF ATTACK RIGHT, TS13	2	1	RIGHT SIDE FUSELAGE NOSE	34-12-03
SWITCH - ALTERNATE VMO/MMO SELECT, S591 [1]	2	1	119AL, MAIN EQUIP CENTER	*
SWITCH - CAPT ADC INSTR SOURCE SELECT, S482	1	1	FLIGHT COMPARTMENT, P1-1	*
SWITCH - F/O ADC INSTR SOURCE SELECT, S483	1	1	FLIGHT COMPARTMENT, P3-3	*
TRANSFORMER - (REF 31-01-36, FIG. 101)				
AIR DATA COMPUTER LEFT, T139				
TRANSFORMER - (REF 31-01-37, FIG. 101)				
AIR DATA COMPUTER RIGHT, T140				

* SEE THE WDM EQUIPMENT LIST

[1] ALL MTH AIRPLANES

Air Data Computing (ADC) System - Component Index
Figure 101

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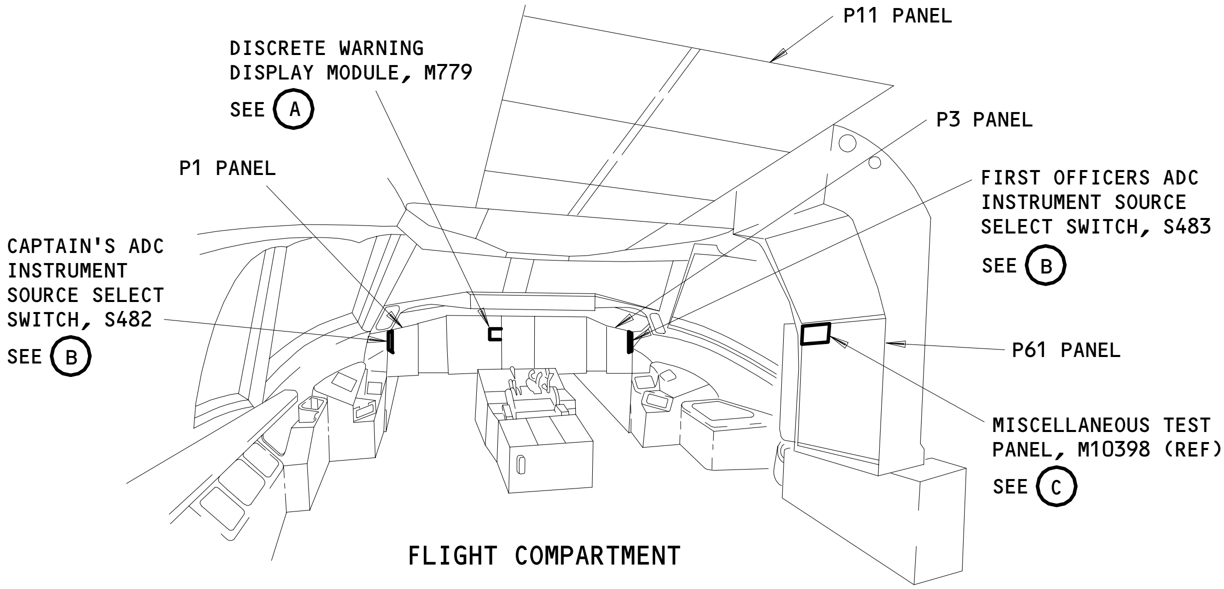
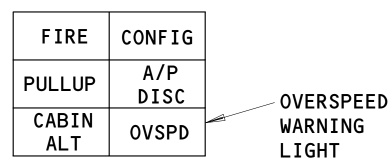
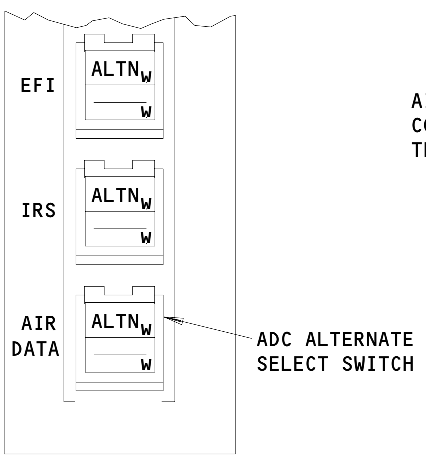


FLIGHT COMPARTMENT



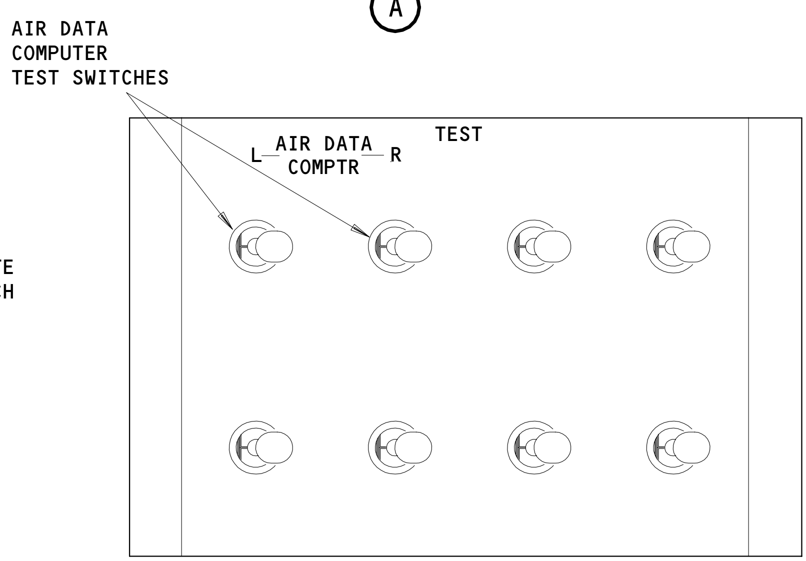
DISCRETE WARNING
DISPLAY MODULE, M779

A



CAPTAIN'S OR FIRST OFFICERS
INSTRUMENT SOURCE SELECT
SWITCH, S482 OR S483

B



MISCELLANEOUS TEST PANEL, M10398 (REF)

C

Air Data Computing (ADC) System - Component Location
Figure 102 (Sheet 1)

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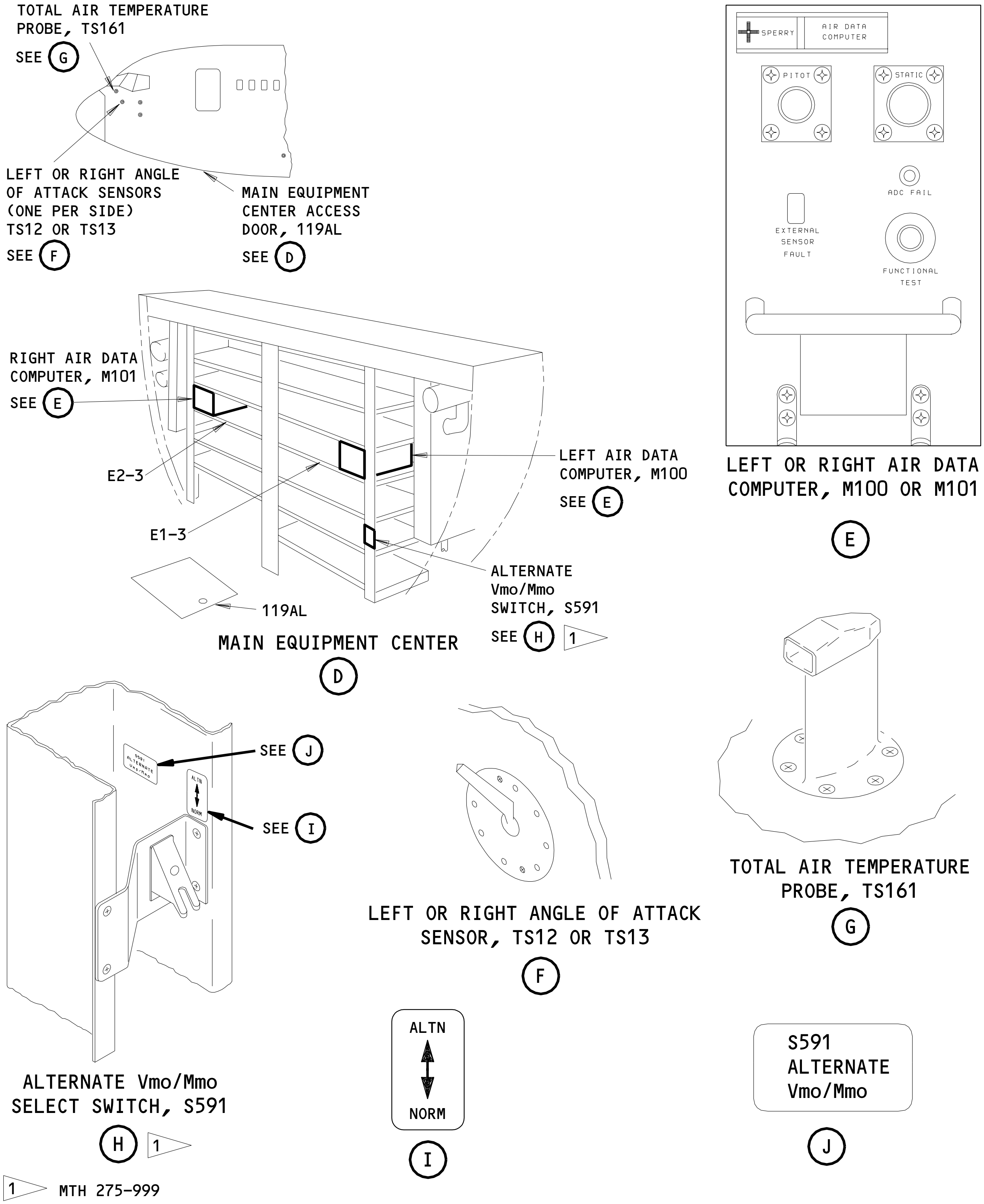

Air Data Computing (ADC) System - Component Location
Figure 102 (Sheet 2)

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AIR DATA COMPUTING SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure contains two tasks. The first procedure is an operational test and the second procedure is a system test. The operational test uses the air data computer (ADC) bite test to make sure the basic air data system operates. The system test includes the operational test and uses external equipment.
   B. The operational and system tests also make sure the electric air data instruments (34-13-00) operate. During the test, these devices show the output. The total function and precision of the system from input to output is tested at one time.

TASK 34-12-00-715-001

2. Operational Test - Air Data Computing System
   A. General
      (1) The operational test is the self-test mode of air data computer system. This test will make sure of the conditions that follow:
         - the air data computer modules function correctly.
         - the interface and failure warning system between computers and air data instruments operates correctly.
         - the air data instruments operate from input signals without internal failures.
   B. References
      (1) 24-22-00/201, Electrical Power - Control
   C. Access
      (1) Location Zones
         211/212 Flight Compartment

   D. Prepare for Test

      S 865-002
      (1) Supply electrical power (Ref 24-22-00).

      S 865-003
      (2) Set both of the F/D switches on the MCP to OFF.

      S 865-005
      (3) Make sure these circuit breakers on the overhead panel, P11, are closed:
         (a) 11A7, EFIS DSPL SW L
         (b) 11A10, AIR DATA CMPTR L
         (c) 11A11, AIR DATA AOA SENSOR L
         (d) 11A12, AIR DATA BARO CORRECT L
         (e) 11A33, IND LIGHTS 1
         (f) 11A34, IND LIGHTS 2
         (g) 11A35, IND LIGHTS 3
         (h) 11B16, AURAL WARN SPKR L
         (i) 11B18, WARN ELEX B
         (j) 11E2, ALTM LEFT
         (k) 11E3, ADI LEFT

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(l) 11E4, EFIS CONTROL PANEL LEFT
(m) 11E8, FMCS CDU LEFT
(n) 11E9, FMCS CMPTR LEFT
(o) 11E23, ALTM RIGHT
(p) 11E24, ADI RIGHT
(q) 11E25, EFIS CONT PNL RIGHT
(r) 11E29, FMCS CDU RIGHT
(s) 11E30, FMCS CMPTR RIGHT
(t) 11F8, EFIS SYM GEN L
(u) 11F9, EFIS SYM GEN C
(v) 11F24, EFIS DSPL SW RIGHT
(w) 11F29, EFIS SYM GEN RIGHT
(x) 11F30, AIR DATA CMPTR RIGHT
(y) 11F31, AIR DATA AOA SENSOR RIGHT
(z) 11F32, AIR DATA BARO CORRECT RIGHT
(aa) 11H35, AURAL WARN SPKR RIGHT
(ab) 11J2, EICAS CMPTR L
(ac) 11J3, EICAS UPPER DSPL
(ad) 11J29, EICAS CMPTR R
(ae) 11J30, EICAS LOWER DSPL
(af) 11J31, EICAS DSPL SW
(ag) 11J32, EICAS DSPL SELECT
(ah) 11J34, WARN ELEX A
(ai) 11R30, RIGHT IND LTS 3

S 865-006

(4) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
(a) 11F14, TMC AC
(b) 11F15, TMC DC

S 865-004

(5) On the select panel of the EICAS display, (P9), set the COMPUTER switch to the L position.

E. Left ADC Test

S 865-009

(1) Make sure that the fault ball and ADC FAIL indicator on the front panel of each ADC shows black.

S 865-010

(2) Make sure that the AIR DATA switches on the captain's and first officer's instrument source select panels are not set to ALTN.

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S 715-011

(3) Push the FUNCTIONAL TEST switch on the front panel of the left ADC.

<u>NOTE</u>: Do not push the ADC test switch while the pitot-static system is pressurized. The ADC will go into a fault condition in error and report this incorrect fault condition to its interface systems. To erase this fault, do the steps that follow:
- Put the pitot-static system to ambient pressure.
- Push the ADC test switch to reset the ADC.

(a) Make sure the display on each ADC front panel shows a dash (-) when you push the switch.

S 705-010

(4) On the miscellaneous test panel, P61, set and hold the AIR DATA CMPTR - L test switch in the up position.

(a) Make sure the conditions in the table that follows occur: (Use the left half of the OVERSPEED light and use the capt's instruments.)

<table>
<tr><th colspan="3">ADC TEST INDICATIONS</th></tr>
<tr><th>TIME</th><th colspan="2">OVERSPEED WARNINGS</th></tr>
<tr><td rowspan="4">0-2 Sec</td><td colspan="2">Half of the red OVERSPEED light comes on. The aural warnings sound and both master WARNING lights on the glareshield come on. A level A red OVERSPEED message is shown on the upper EICAS display.</td></tr>
<tr><th colspan="2">AIRSPEED AND ALTITUDE INDICATIONS</th></tr>
<tr><th>ALTIMETER</th><th>EADI</th></tr>
<tr><td rowspan="2">Drives up scale to 10,000 feet.</td><td>CAS drives to 419 knots. MACH drives to 0.75.</td></tr>
<tr><td>2-7 Sec</td><td>SPD and MACH flags are shown.</td></tr>
<tr><td>After 7 Sec</td><td>ALT shows 10,000 feet. (May take more than 7 seconds.)</td><td>SPD and MACH flags are removed. MACH display drives below 0.38.</td></tr>
</table>

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S 755-012

(5) Make sure the conditions that follow occur:

(a) The TAT display on the EICAS shows as follows during the ADC self test:

NOTE: The thrust management computer (TMC) must be off. The EICAS computer used (L or R) must be the same as the ADC used (L or R). Open the TMC circuit breakers to turn off the TMC.

1) From 0-3 seconds, the TAT display shows +35°C.
2) From 3-7 seconds, the TAT display shows no data.
3) After 7 seconds, the TAT display shows +35°C.

(b) Release the switch.

(c) Wait 15 seconds for the ADC to reset.

F. Right ADC Test

S 865-016

(1) On the EICAS display select panel, P9, set the COMPUTER select switch to the R position.

S 865-017

(2) Open this circuit breaker on the overhead circuit breaker panel, P11, and attach a DO-NOT-CLOSE tag:

(a) 11A10, AIR DATA CMPTR L

S 705-018

(3) On the miscellaneous test panel, P61, set and hold the AIR DATA CMPTR-R test switch in the up position.

S 715-013

(4) Do the Right ADC Test the same as the Left ADC Test except as follows:

(a) Use the right ADC
(b) Use the AIR DATA CMPTR - R switch
(c) Use the right half of the OVERSPEED light
(d) Use the F/O's instruments

S 755-014

(5) Make sure the same conditions occur.

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S 865-080

(6) Wait 15 seconds for the ADC to reset.

G. Put the Airplane Back to Its Usual Condition

S 865-021

(1) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11A10, AIR DATA CMPTR L
   (b) 11F14, TMC AC
   (c) 11F15, TMC DC

S 845-022

(2) On the EICAS display select panel, set the COMPUTER select switch to AUTO.

S 845-023

(3) Remove electrical power if it is not necessary (Ref 24-22-00/201).

TASK 34-12-00-725-076

3. System Test - Air Data Computing System

A. General
(1) The system test makes sure of the conditions that follow:
   (a) The two temperature sensing systems are accurate for at least one temperature.
   (b) AIRPLANE WITH POST-SB 34-0332;
   The IAS DISAGREE and ALT DISAGREE EICAS caution messages are correctly switched and displayed.
   (c) The air data instruments give accurate values of computed and raw air data over a range of data points.
   (d) The pressure transducers in the computers and air data instruments function accurately.
(2) The main equipment center and the flight compartment must have an air temperature of 25 +/-5 DEC C and relative humidity of less than 85%. Use equipment cooling air (Ref 21-58-00) and flight deck temperature control (Ref 21-61-00) to get these conditions.

B. Equipment
(1) Air Data Test Set, Sperry ADT222A
(2) Pitot-Static Probe Test Adapter - Rosemount 884EH
(3) Data Bus Analyzer - 429EB, 429EBP; JcAIR Instrumention (preferred) 400 Industrial Parkway, Industrial Airport, KS 66031
   - 429-2; Interface Technology (optional) 150 E. Arrow Highway, San Dimas, CA 91773
(4) Thermometer - 10° to +40°C ±0.5°C, or Wekslar

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(5) Angular displacement measuring tool - A34012-24 (Prefered)
(6) Angular displacement measuring tool - J34002-1 (Alternative)

C. References

(1) 24-22-00/201, Electrical Power - Control
(2) 34-11-00/201, Pitot Static System
(3) 36-00-00/201, Pneumatic Power System

D. Access

(1) Location Zones
211/212 Flight Compartment

E. Procedure

S 865-024
(1) Supply electrical power (Ref 24-22-00).

S 865-025
(2) Make sure that these circuit breakers on the overhead circuit breaker panel are closed:
(a) 11A7, EFIS DSPL SW L
(b) 11A10, AIR DATA CMPTR L
(c) 11A11, AIR DATA AOA SENSOR L
(d) 11A12, AIR DATA BARO CORRECT L
(e) 11A33, IND LIGHTS 1
(f) 11A34, IND LIGHTS 2
(g) 11A35, IND LIGHTS 3
(h) 11B16, AURAL WARN SPKR L
(i) 11B18, WARN ELEX B
(j) 11E2, ALTM LEFT
(k) 11E3, ADI LEFT
(l) 11E4, EFIS CONTROL PANEL LEFT
(m) 11E8, FMCS CDU LEFT
(n) 11E9, FMCS CMPTR LEFT
(o) 11E23, ALTM RIGHT
(p) 11E24, ADI RIGHT
(q) 11E25, EFIS CONT PNL RIGHT
(r) 11E29, FMCS CDU RIGHT
(s) 11E30, FMCS CMPTR RIGHT
(t) 11F8, EFIS SYM GEN L
(u) 11F9, EFIS SYM GEN C
(v) 11F14, TMC AC
(w) 11F15, TMC DC
(x) 11F24, EFIS DISP SW RIGHT
(y) 11F29, EFIS SYM GEN RIGHT
(z) 11F30, AIR DATA CMPTR RIGHT
(aa) 11F31, AIR DATA AOA SENSOR RIGHT
(ab) 11F32, AIR DATA BARO CORRECT RIGHT
(ac) 11H35, AURAL WARN SPKR RIGHT
(ad) 11J2, EICAS CMPTR L
(ae) 11J3, EICAS UPPER DSPL

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(af) 11J29, EICAS CMPTR R
(ag) 11J30, EICAS LOWER DSPL
(ah) 11J31, EICAS DSPL SW
(ai) 11J32, EICAS DSPL SELECT
(aj) 11J34, WARN ELEX A
(ak) 11R30, RIGHT IND LTS 3

S 865-124
(3) AIRPLANE WITH POST-SB 34-0332;
Make sure these circuit breakers on the P6-5 panel are closed:
(a) C1190, AIR DATA SOURCE SEL RELAY LEFT
(b) C1191, AIR DATA SOURCE SEL RELAY RIGHT

S 865-026

WARNING: OPEN THE RAM AIR TURBINE (RAT) POWER (6J8) CIRCUIT BREAKER ON THE P6 PANEL BEFORE YOU DO THE PITOT-STATIC TEST. IF YOU APPLY A PITOT-STATIC DIFFERENTIAL PRESSURE OF 80 KNOTS OR MORE AND THE TWO ENGINES ARE OFF, THE RAT WILL COME OUT. THIS CAN CAUSE INJURY TO PERSONS.

WARNING: MAKE SURE THAT ALL THE PITOT, TAT, AND AOA PROBE HEAT IS OFF. FAILURE TO DO THIS CAN CAUSE INJURY TO PERSONS.

(4) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
(a) 6J8, RAM AIR TURBINE PWR HOT BATTERY BUS
(b) 6K14, PITOT HEAT CAPT ϕA
(c) 6K15, PITOT HEAT CAPT ϕB
(d) 6K16, PITOT HEAT R AUX ϕB
(e) 6K17, PITOT HEAT R AUX ϕC
(f) 6K20, PITOT HEAT L AUX ϕC
(g) 6K21, PITOT HEAT L AUX ϕB
(h) 6K22, PITOT HEAT F/O ϕB
(i) 6K23, PITOT HEAT F/O ϕA
(j) 6K24, PROBE HEAT AOA R
(k) 6L17, PROBE HEAT AOA L
(l) 6L18, PROBE HEAT TAT L

S 715-028
(5) Do the Operational Test for the ADC system.

NOTE: Do not do the steps in this paragraph: " Put the Airplane Back to Its Usual Condition".

S 865-029
(6) Make sure that the captain's and first officer's AIR DATA switches on the instrument source select instrument panels are set to the usual positions.

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S 715-030

(7) To do a test of the capt's ADC system do the steps that follow:
  (a) Open this circuit breaker on the P11 panel:
    1) 11A10, AIR DATA CMPTR L
  (b) Make sure the capt's altimeter has the failure flag in view.
  (c) Make sure the capt's EADI has the failure flag in view.
  (d) Push the captain's AIR DATA switch on the instrument source select panel to ALTN.
    1) Make sure that the failure flags go out of view.
  (e) Close this circuit breaker on the P11 panel:
    1) 11A10, AIR DATA CMPTR L
  (f) Set the captain's AIR DATA switch to the usual position.
    1) Make sure there are no failure flags in view.

S 715-031

(8) To do a test of the F/O's ADC system do the steps that follow:
  (a) Open this circuit breaker on the P11 panel:
    1) 11F30, AIR DATA CMPTR RIGHT
  (b) Make sure that the F/O's altimeter has the failure flag in view.
  (c) Make sure that the F/O's EADI has the failure flag in view.
  (d) Push the first officer's AIR DATA switch to ALTN.
    1) Make sure that the failure flags go out of view.
  (e) Close this circuit breaker on the P11 panel:
    1) 11F30, AIR DATA CMPTR RIGHT
  (f) Set the first officer's AIR DATA switch to the usual position.
  (g) Make sure there are no failure flags in view.

S 865-075

WARNING: MAKE SURE YOU OPEN THE FLAP LOAD RELIEF CIRCUIT BREAKER BEFORE YOU DO THE ADC TEST WITH THE PITOT-STATIC SYSTEM PRESSURIZED. THE TRAILING EDGE FLAPS CAN MOVE DURING THE ADC TEST OF THE COMPUTED AIRSPEED. THIS CAN CAUSE INJURY TO PERSONS.

(9) Open this circuit breaker on the P11 panel and attach a DO-NOT-CLOSE tag:
  (a) 11J13, FLAP LOAD RELIEF

NOTE: For the 767-300, and the 767-200 WITH SB 34-237, the ADC indicated MACH valve and the indicated Angle of Attack (AOA). When you do a check of the ADC outputs (at 0.55 MACH or more) you must set the AOA vanes to 10° indicated AOA. (This is ADC octal label 221). For the 767-200, set the AOA vanes to 0 degree, the ADC SSEC does not use the AOA. It uses only the MACH number.

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S 865-032

(10) 767-200 AIRPLANES WITH SB 34-237, AND 767-300 AIRPLANES;
do the steps that follow:

(a) Set the left AOA Vane to 10°+ OFFSET+/-0.5.

(b) Set the right AOA Vane to 10° - OFFSET+/-0.5.

S 865-035

WARNING: MAKE SURE PERSONS AND EQUIPMENT ARE NOT NEAR THE RUDDER WHILE YOU DO THE ADC TEST WITH THE PITOT-STATIC SYSTEM PRESSURIZED. THE RUDDER CAN MOVE DURING THE ADC TEST OF THE COMPUTED AIRSPEED. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

CAUTION: MAKE SURE THE STATIC PRESSURE DOES NOT BECOME MORE THAN 31.1 IN. HG. THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(11) Pressurize the capt's pitot and static systems. Use a pressure of 20.565 in. HG for the static system and 23.067 in. Hg. for the pitot system (Ref 34-11-00).

S 865-077

(12) Pressurize the F/O's pitot and static systems. Use a pressure of 20.565 in. HG for the static system and 23.067 in. Hg. for the pitot system (Ref 34-11-00).

F. ADC System Test (Fig. 501)

S 865-038

(1) Set the BARO set switch on the capt's and F/O's altimeters to the values in the table that follows:

(a) Make sure the values in the table for the altitude, airspeed, and MACH show on the applicable altimeter or EADI.

BARO SETTING (in Hg)	ALTITUDE (ft)	MACH	COMPUTED AIRSPEED (Kts)
30.71	10722 +/- 30	.407+/-.01	225+/-5
29.92	10000 +/- 30	.407+/-.01	225+/-5
29.12	9251 +/- 30	.407+/-.01	225+/-5

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S 865-041

WARNING: MAKE SURE THERE IS NO PNEUMATIC POWER TO THE TAT PROBE. THIS PREVENTS INJURY TO PERSONS.

(2) Make sure there is no pneumatic power to the TAT probe (Ref 36-00-00).

S 725-065

(3) To do a test of the capt's ADC system, do the steps that follow:
- (a) Keep the capt's baro set control at 29.12.
- (b) Set the F/O's baro set control to 29.92.
- (c) Attach probe A of the ARINC 429 data bus reader to the Burndy block H11, TB0105 on the E1-3 shelf.
- (d) Attach probe B to the Burndy block H13, TB0105 on the E1-3 shelf.
- (e) Make sure the data bus reader shows the values in decimal format in the table that follows for the capt's system.
- (f) For the Total Air Temperature data, do the steps that follow:
  - 1) Put the thermometer adjacent to the TAT probe. (Keep wind and sunlight away from it.)
  - 2) After the thermometer has become stable measure the temperature.
  - 3) Use this value as the ambient air temperature.

S 725-066

(4) To do a test of the F/O's ADC system, do the steps that follow:
- (a) Set the capt's baro set control to 29.92.
- (b) Set the F/O's baro set control to 29.12.
- (c) Attach probe A of the ARINC 429 receiver/bus reader to the Burndy block H65, TB0119 on the E1-5 shelf.
- (d) Attach probe B to the Burndy block H67, TB0119 on the E1-5 shelf.
- (e) Make sure the data bus reader shows the values in decimal format in the table that follows for the F/O's system.
- (f) For the Total Air Temperature data, do the steps that follow:
  - 1) Put a thermometer adjacent to the TAT probe. (Keep wind and sunlight away from it.)
  - 2) After the thermometer has become stable measure the temperature.
  - 3) Use this value as the ambient air temperature.

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NOTE: If the DATA/BUS READER used can only read octal label 251 as "distance to go", and octal label 252 as "time to go", you must read these labels in binary. Then binary to decimal conversion is necessary to get the equivalent decimal value in feet. Refer to Fig. 501.

PARAMETER	OCTAL LABEL CAPTAIN ADC OUTPUT	OCTAL LABEL FIRST OFFICER ADC OUTPUT	DATA
VMO	207	207	357 ±2
Baro Altitude No. 1	N.A.	204	10000 ±30
Baro Altitude No. 2	220	N.A.	10000 ±30
Baro Altitude No. 3	251	251	9251 ±30
Baro Altitude No. 4	252	252	9251 ±30
Total Air Temp	211	211	*[1]

*[1] Data must be equal to the measured ambient air temperature ±3.0°C.

S 725-125

(5) AIRPLANES WITH POST-SB 34-0332;
Do these steps to test the IAS DISAGREE and the ALT DISAGREE EICAS messages:
(a) Set the BARO correction knobs to 29.92 inches Hg on the captain's and first officer's altimeters.
(b) Make sure the ADC select switches on the captain's and first officer's instrument panels are not set to ALTN.
(c) Set the static and pitot pressures equivalent to these altitudes and airspeeds (AMM 34-11-00/201):
1) 5000 feet and 250 knots for the captain's air data computer.

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2) 5210 feet and 256 knots for the first officer's air data computer.

(d) Make sure the EICAS messages IAS DISAGREE and ALT DISAGREE are shown.

(e) Set the captain's ADC select switch to ALTN.
1) Make sure ALTN is shown on the switch.
2) Make sure the EICAS messages IAS DISAGREE and ALT DISAGREE are not shown.

(f) Set the captain's ADC select switch to normal.
1) Make sure ALTN is not shown on the switch.

(g) Set the first officer's ADC select switch to ALTN.
1) Make sure ALTN is shown on the switch.
2) Make sure the EICAS messages IAS DISAGREE and ALT DISGREE are not shown.

(h) Set the captain's air data source select switch to ALTN.
1) Make sure ALTN is shown on the switch.
2) Make sure the EICAS messages IAS DISAGREE and ALT DISAGREE are shown.

(i) Set the static and pitot pressures equivalent to 5150 feet and 252 knots to the first officer's air data computer.

(j) Set the captain's air data source select switch to normal.
1) Make sure ALTN is not shown on the switch.

(k) Set the first officer's air data source select switch to normal.
1) Make sure ALTN is not shown on the switch.
2) Make sure the EICAS messages IAS DISAGREE and ALT DISAGREE are not shown.

S 865-044

(6) Read and make a record of the offset value found on the trailing edge of the left and right AOA vanes.

S 865-067

(7) Connect the data bus reader to the left or right ADC data buses as follows:

(a) For the left data bus reader, do these steps:
1) Attach probe A of the ARINC 429 data bus reader to the Burndy block H11, TB0105 on the E1-3 shelf.

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BINARY TO DECIMAL CONVERSION TABLE

DECIMAL VALUE (Ft)	SSM 31	SSM 30	SIGN 29	BINARY FORMAT DATA FIELD 28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	SDI 10	SDI 9 BIT NO.
11,005	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	D	D
11,004	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	1	0	0	0	D	D
11,003	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	1	1	D	D	D
11,002	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	1	0	D	D	D
11,001	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	0	1	D	D	D
11,000	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	1	0	0	0	D	D	D
10,999	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	1	1	1	D	D	D
10,998	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	1	1	0	D	D	D
10,997	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	1	0	1	D	D	D
10,996	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	1	0	0	D	D	D
10,995	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	0	1	1	D	D	D
10,994	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	0	1	0	D	D	D
10,993	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	0	0	1	D	D	D
10,992	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	0	0	0	D	D	D
10,991	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	1	1	1	D	D	D
10,990	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	1	1	0	D	D	D
10,989	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	1	0	1	D	D	D
10,988	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	1	0	0	D	D	D
10,987	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	0	1	1	D	D	D
10,986	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	0	1	0	D	D	D
10,985	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	0	0	1	D	D	D
10,984	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	1	0	0	0	D	D	D
10,983	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	1	1	1	D	D	D
10,982	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	1	1	0	D	D	D
10,981	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	1	0	1	D	D	D
10,980	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	1	0	0	D	D	D
10,979	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0	1	1	D	D	D
10,978	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0	1	0	D	D	D
10,977	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0	0	1	D	D	D
10,976	D	D	0	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0	0	0	D	D	D
10,975	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	1	1	1	D	D	D
10,974	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	1	1	0	D	D	D
10,973	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	1	0	1	D	D	D
10,972	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	1	0	0	D	D	D
10,971	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	0	1	1	D	D	D
10,970	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	0	1	0	D	D	D
10,969	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	0	0	1	D	D	D
10,968	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	1	0	0	0	D	D	D
10,967	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	1	1	1	D	D	D
10,966	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	1	1	0	D	D	D
10,965	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	1	0	1	D	D	D
10,964	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	1	0	0	D	D	D
10,963	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	1	1	D	D	D
10,962	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	1	0	D	D	D
10,961	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	0	1	D	D	D
10,960	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	0	0	D	D	D
10,959	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	1	1	1	D	D	D
10,958	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	1	1	0	D	D	D
10,957	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	1	0	1	D	D	D
10,956	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	1	0	0	D	D	D
10,955	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	0	1	1	D	D	D
10,954	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	0	1	0	D	D	D
10,953	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	0	0	1	D	D	D

ADC Adjustment Test - Binary To Decimal Conversion Table
Figure 501 (Sheet 1)

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BINARY TO DECIMAL CONVERSION TABLE

DECIMAL VALUE (Ft)	SSM 31	SSM 30	SIGN 29	BINARY FORMAT DATA FIELD 28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	SDI 10	SDI 9 BIT NO.
10,952	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	1	0	0	0	D	D	D
10,951	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	1	1	1	D	D	D
10,950	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	1	1	0	D	D	D
10,949	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	1	0	1	D	D	D
10,948	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	1	0	0	D	D	D
10,947	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	0	1	1	D	D	D
10,946	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	0	1	0	D	D	D
10,945	D	D	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	0	0	1	0	D	D
10,030	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	1	0	0	0	D	D	D
10,039	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	1	1	1	D	D	D
10,038	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	1	1	0	D	D	D
10,037	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	1	0	1	D	D	D
10,036	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	1	0	0	D	D	D
10,035	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	0	1	1	D	D	D
10,034	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	0	1	0	D	D	D
10,033	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	0	0	1	D	D	D
10,032	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	0	0	0	D	D	D
10,031	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	1	1	1	D	D	D
10,030	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	1	1	0	D	D	D
10,029	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	1	0	1	D	D	D
10,028	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	1	0	0	D	D	D
10,027	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	0	1	1	D	D	D
10,026	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	0	1	0	D	D	D
10,025	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	0	0	1	D	D	D
10,024	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	0	0	0	D	D	D
10,023	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	1	1	1	D	D	D
10,022	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	1	1	0	D	D	D
10,021	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	1	0	1	D	D	D
10,020	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	1	0	0	D	D	D
10,019	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1	1	D	D	D
10,018	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1	0	D	D	D
10,017	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	0	1	D	D	D
10,016	D	D	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	0	0	D	D	D
10,015	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	1	1	1	D	D	D
10,014	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	1	1	0	D	D	D
10,013	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	1	0	1	D	D	D
10,012	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	1	0	0	D	D	D
10,011	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	0	1	1	D	D	D
10,010	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	0	1	0	D	D	D
10,009	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	0	0	1	D	D	D
10,008	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	1	0	0	0	D	D	D
10,007	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	1	1	1	D	D	D
10,006	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	1	1	0	D	D	D
10,005	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	1	0	1	D	D	D
10,004	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	1	0	0	D	D	D
10,003	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	1	D	D	D
10,002	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	1	0	D	D	D
10,001	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	1	D	D	D
10,000	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	0	D	D	D
9,999	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	1	1	D	D	D
9,998	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	1	0	D	D	D
9,997	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	0	1	D	D	D
9,996	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	1	0	0	D	D	D

ADC Adjustment Test - Binary To Decimal Conversion Table
Figure 501 (Sheet 2)

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BINARY TO DECIMAL CONVERSION TABLE

DECIMAL VALUE (Ft)	SSM 31	SSM 30	SIGN 29	BINARY FORMAT DATA FIELD 28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	SDI 10	SDI 9	BIT NO.
9,995	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	1	1	D	D	D	
9,994	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	1	0	D	D	D	
9,993	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	0	1	D	D	D	
9,992	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	0	0	D	D	D	
9,991	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	1	1	1	D	D	D	
9,990	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	1	1	0	D	D	D	
9,989	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	1	0	1	D	D	D	
9,988	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	1	0	0	0	D	D	
9,987	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	1	D	D	D	
9,986	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	D	D	D	
9,985	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	1	D	D	D	
9,984	D	D	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	D	D	D	
9,983	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	1	1	1	D	D	D	
9,982	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	1	1	0	D	D	D	
9,981	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	1	0	1	D	D	D	
9,980	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	1	0	0	D	D	D	
9,979	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	0	1	1	D	D	D	
9,978	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	0	1	0	D	D	D	
9,977	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	0	0	1	D	D	D	
9,976	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	1	0	0	0	D	D	D	
9,975	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	D	D	D	
9,974	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	1	1	0	D	D	D	
9,973	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	1	0	1	D	D	D	
9,972	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	1	0	0	D	D	D	
9,971	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	0	1	1	D	D	D	
9,970	D	D	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	0	1	0	D	D	D	
9,281	D	D	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	D	D	D	
9,280	D	D	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	D	D	D	
9,279	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	1	1	1	D	D	D	
9,278	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	1	1	0	D	D	D	
9,277	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	1	0	1	D	D	D	
9,276	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	1	0	0	D	D	D	
9,275	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0	1	1	D	D	D	
9,274	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0	1	0	D	D	D	
9,273	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0	0	1	D	D	D	
9,272	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	1	0	0	0	D	D	D	
9,271	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	1	1	D	D	D	
9,270	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	1	0	D	D	D	
9,269	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	0	1	D	D	D	
9,268	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	1	0	0	D	D	D	
9,267	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	1	1	D	D	D	
9,266	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	1	0	D	D	D	
9,265	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1	D	D	D	
9,264	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	D	D	D	
9,263	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	1	1	D	D	D	
9,262	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	1	0	D	D	D	
9,261	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	0	1	D	D	D	
9,260	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	0	0	D	D	D	
9,259	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	1	1	D	D	D	
9,258	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	1	0	D	D	D	
9,257	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	1	D	D	D	
9,256	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0	0	D	D	D	
9,255	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	1	1	D	D	D	
9,254	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	1	0	D	D	D	
9,253	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	1	D	D	D	
9,252	D	D	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	D	D	D	

ADC Adjustment Test - Binary To Decimal Conversion Table
Figure 501 (Sheet 3)

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BINARY TO DECIMAL CONVERSION TABLE

DECIMAL VALUE (Ft)	SSM 31	SSM 30	SIGN 29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	SDI 10	SDI 9
				BINARY FORMAT DATA FIELD																			BIT NO.
9,251	D	D	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	1	1	D	D	D
9,250	D	D	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	1	0	D	D	D
9,249	D	D	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	1	D	D	D
9,248	D	D	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	D	D	D
9,247	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1	1	1	D	D	D
9,246	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1	1	0	D	D	D
9,245	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1	0	1	D	D	D
9,244	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1	0	0	0	D	D
9,243	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	1	1	D	D	D
9,242	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	1	0	D	D	D
9,241	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	0	1	D	D	D
9,240	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	0	0	D	D	D
9,239	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	1	1	D	D	D
9,238	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	1	0	D	D	D
9,237	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	0	1	D	D	D
9,236	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	1	0	0	D	D	D
9,235	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	1	D	D	D
9,234	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	1	0	D	D	D
9,233	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	1	D	D	D
9,232	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	D	D	D
9,231	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	1	1	D	D	D
9,230	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	1	0	D	D	D
9,229	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0	1	D	D	D
9,228	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0	0	D	D	D
9,227	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	1	1	D	D	D
9,226	D	D	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	1	0	D	D	D
9,225	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	D	D	D
9,224	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	D	D	D
9,223	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	D	D	D
9,222	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	D	D	D
9,221	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	D	D	D
9,220	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	D	D	D
9,219	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	D	D	D
9,218	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	D	D	D
9,217	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	D	D	D
9,216	D	D	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	D	D	D
9,215	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	D	D	D
9,214	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	0	D	D	D
9,213	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	0	1	D	D	D
9,212	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	0	0	D	D	D
9,211	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	D	D	D
9,210	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	1	0	D	D	D
9,209	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	0	1	D	D	D
9,208	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	0	0	0	D	D	D
9,207	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	0	1	1	1	D	D	D
9,206	D	D	0	0	0	0	1	0	0	0	1	1	1	1	1	1	0	1	1	0	D	D	D

D = DO NOT CARE

INSTRUCTIONS: FIND THE BINARY VALUE IN THE "BINARY FORMAT" SECTION THAT IS DISPLAYED ON TEST SET. READ ACROSS TO OBTAIN ITS DECIMAL EQUIVALENCE.

ADC Adjustment Test - Binary To Decimal Conversion Table
Figure 501 (Sheet 4)

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2) Attach probe B to the Burndy block H13, TB0105 on the E1-3 shelf.

(b) For the right data bus reader, do these steps:

1) Attach probe A of the ARINC 429 receiver/bus reader to the Burndy block H65, TB0119 on the E1-5 shelf.

2) Attach probe B to the Burndy block H67, TB0119 on the E1-5 shelf.

S 865-068

(8) Use an angular displacement measuring tool to set the angle of attack (AOA) vanes to the values in the table that follows.

S 755-069

(9) Use the data bus reader to make sure the right or left ADC output values agree with the values in the table that follows.

RIGHT ADC TEST	
RIGHT VANE POSITION	OCTAL LABEL 221, 222, and 223 OUTPUT
0° - Offset +10° - Offset -10° - Offset -20° - Offset	0° ± .75° 10° ± .75° -10° ± .75° -20° ± .75°

LEFT ADC TEST	
LEFT VANE POSITION	OCTAL LABEL 221, 222, and 223 OUTPUT
0° + Offset -5° + Offset +10° + Offset +20° + Offset	0° ± .75° -5° ± .75° 10° ± .75° 20° ± .75°

S 865-045

(10) Connect the data bus reader to the left ADC data bus as follows:

(a) Attach probe A of the ARINC 429 data bus reader to the Burndy block H11, TB0105 on the E1-3 shelf.

(b) Attach probe B to the Burndy block H13, TB0105 on the E1-3 shelf.

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S 865-046

CAUTION: MAKE SURE THE COVER IS NOT ON THE PITOT-STATIC PROBE. THIS PREVENTS DAMAGE WHEN YOU APPLY PROBE HEATER POWER.

(11) Make sure no test equipment or covers are on the pitot-static probes.

S 865-047

(12) Make sure that these circuit breakers on the P11 panel are closed.
   (a) 11A15, PROBE HEAT IND L
   (b) 11A28, PROBE HEAT IND R
   (c) 11C30, LANDING GEAR POSITION AIR/GND SYS 1
   (d) 767-300 AIRPLANES;
       11U23, POSITION AIR/GND SYS 2
   (e) 767-200 AIRPLANES;
       11U24, POSITION AIR/GND SYS 2

S 865-078

(13) Open these circuit breakers on the left miscellaneous electrical equipment panel, P36, and attach DO-NOT-CLOSE tags:
   (a) 36H6, ICE/RAIN WINDOW HEAT 2R
   (b) 36H7, ICE/RAIN WINDOW HEAT 3R
   (c) 36L5, ICE/RAIN WINDOW HEAT 1L

S 865-079

(14) Open these circuit breakers on the right miscellaneous electrical equipment panel, P37, and attach DO-NOT-CLOSE tags:
   (a) 37D2, ICE & RAIN WINDOW HEAT 1R
   (b) 37E1, ICE & RAIN WINDOW HEAT 2L
   (c) 37E2, ICE & RAIN WINDOW HEAT 3L

S 865-048

CAUTION: REMOVE ALL THE CAPS, TEST HOSES, AND ADAPTORS FROM ALL THE PROBES. THIS PREVENTS DAMAGE WHEN YOU APPLY PROBE HEAT POWER. MAKE SURE PROBE HEAT POWER IS NOT ON MORE THAN 2 MINUTES.

(15) Make sure there are no caps, hoses, or adaptors from the probes.

S 865-049

(16) Set the ARINC 429 data bus reader to read label 270 and to show it in binary format.
   (a) Make sure that bits 14, 15, 16, 17, and 18 are in the "zero" state.

S 725-050

(17) For the capt's ADC system, do the steps that follow:
   (a) Close these circuit breakers on the P6 panel:
       1) 6K14, PITOT HEAT CAPT ϕA

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2) 6K15, PITOT HEAT CAPT ϕB
(b) On the miscellaneous test panel, P61, push down and hold the WINDOW/PROBE HEAT test switch.
1) Make sure that bit 14 goes to the "one" state.
(c) Release the WINDOW/PROBE HEAT switch.
(d) Open these circuit breakers on the P6 panel:
1) 6K14, PITOT HEAT CAPT ϕA
2) 6K15, PITOT HEAT CAPT ϕB
(e) Close these circuit breakers on the P6 panel:
1) 6K16, PITOT HEAT R AUX ϕB
2) 6K17, PITOT HEAT R AUX ϕC
(f) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 15 goes to the "one" state.
(g) Release the WINDOW/PROBE HEAT switch.
(h) Open these circuit breakers on the P6 panel:
1) 6K16, PITOT HEAT R AUX ϕB
2) 6K17, PITOT HEAT R AUX ϕC
(i) Close this circuit breaker on the P6 panel:
1) 6L17, PROBE HEAT AOA L
(j) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 17 goes to the "one" state.
(k) Release the WINDOW/PROBE HEAT switch.
(l) Open this circuit breaker on the P6 panel:
1) 6L17, PROBE HEAT AOA L
(m) Close this circuit breaker on the P6 panel:
1) 6K24, PROBE HEAT AOA R
(n) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 18 is in the "zero" state.
(o) Release the WINDOW/PROBE HEAT switch.
(p) Open this circuit breaker on the P6 panel:
1) 6K24, PROBE HEAT AOA R
(q) Close this circuit breaker on the P6 panel:
1) 6L18, PROBE HEAT TAT L
(r) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 16 is in the "one" state.
(s) Release the WINDOW/PROBE HEAT switch.
(t) Open this circuit breaker on the P6 panel:
1) 6L18, PROBE HEAT TAT L

S 865-051

(18) For the F/O's ADC system, connect the data bus reader to the right ADC data bus as follows:
(a) Attach probe A of the Arinc 429 data bus reader to the Burndy block H65, TB0119 on the E1-5 shelf.
(b) Attach probe B to the Burndy block H67, TB0119 on the E1-5 shelf.
(c) Make sure the ARINC 429 data bus reader is set to read label 270 and to show it binary format.
(d) Make sure that bits 14, 15, 16, 17, and 18 are in the "zero" state.

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(e) Close these circuit breakers on the P6 panel:
1) 6K22, PITOT HEAT F/O ϕB
2) 6K23, PITOT HEAT F/O ϕA
(f) On the miscellaneous test panel, P61, push down and hold the WINDOW/PROBE HEAT test switch.
1) Make sure that bit 15 goes to the "one" state.
(g) Release the WINDOW/PROBE HEAT switch.
(h) Open these circuit breakers on the P6 panel:
1) 6K22, PITOT HEAT F/O ϕB
2) 6K23, PITOT HEAT F/O ϕA
(i) Close these circuit breakers on the P6 panel:
1) 6K20, PITOT HEAT L AUX ϕC
2) 6K21, PITOT HEAT L AUX ϕB
(j) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 14 goes to the "one" state.
(k) Release the WINDOW/PROBE HEAT switch.
(l) Open these circuit breakers on the P6 panel:
1) 6K20, PITOT HEAT L AUX ϕC
2) 6K21, PITOT HEAT L AUX ϕB
(m) Close this circuit breaker on the P6 panel:
1) 6L17, PROBE HEAT AOA L
(n) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 17 goes to the "zero" state.
(o) Release the WINDOW/PROBE HEAT switch.
(p) Open this circuit breaker on the P6 panel:
1) 6L17, PROBE HEAT AOA L
(q) Close this circuit breaker on the P6 panel:
1) 6K24, PROBE HEAT AOA R
(r) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 18 goes to the "one" state.
(s) Release the WINDOW/PROBE HEAT switch.
(t) Open this circuit breaker on the P6 panel:
1) 6K24, PROBE HEAT AOA R
(u) Close this circuit breaker on the P6 panel:
1) 6L18, PROBE HEAT TAT L
(v) Push down and hold the WINDOW/PROBE HEAT switch.
1) Make sure that bit 16 goes to the "one" state.
(w) Release the WINDOW/PROBE HEAT switch.
(x) Open this circuit breaker on the P6 panel:
1) 6L18, PROBE HEAT TAT L

S 865-052

(19) Set BARO set switch knob on the capt's and F/O's altimeters to 29.92 in. Hg.

S 485-095

(20) Connect the data bus reader to the left and right ADC data buses as done before.

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S 865-055

(21) 767-200 AIRPLANES WITH SB 34-237, AND 767-300 AIRPLANES;
set the left AOA Vane to 10°+OFFSET +/-0.5 and the right AOA Vane to 10°-OFFSET +/-0.5.

S 865-057

CAUTION: MAKE SURE THE STATIC PRESSURE DOES NOT BECOME MORE THAN 31.1 IN. HG. THIS CAN CAUSE DAMAGE TO THE PITOT-STATIC SYSTEM.

(22) Set the pressures in the capt's and F/O's pitot (Pt) and static (Ps) lines to the values shown in Figure 504 (Ref 34-11-00):
  (a) Make sure the capt's and F/O's instruments read the values given for altitude, MACH, airspeed, TAS, SAT and Vmo.
  (b) Read the Vmo value with the data bus reader. Use label 207.
  (c) Read the TAS and SAT values on the progress page 1 and 2 of the FMC-CDU (AMM 34-61-00/201).

S 865-072

(23) ALL MTH AIRPLANES;
do the steps that follow:
  (a) Make sure the pressure in the capt's and F/O's static lines are at 8.885 in. Hg (AMM 34-11-00/501).
  (b) Make sure the pressure in the capt's and F/O's pitot lines are at 12.439 in. Hg (AMM 34-11-00/501).
  (c) Turn the alternate Vmo/Mmo switch to the ALTN position. The select switch is found on the E1-3 stanchion in the Main Equipment Center.

    NOTE: When you set the alternate Vmo/Mmo switch to ALTN it causes an overspeed condition to occur.

    1) Make sure that label 207 on the data bus reader shows 267 ±2 kts on the left and right ADC bus.

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TRUE AIRSPEED (KTS)						
Measured Temp (deg C)	CAS=150	CAS=200	CAS=300	M=0.75	M=0.80	M=0.85
-10	142.6	226.4	395.3	449.5	476.1	502.2
-9	142.9	226.8	396.0	450.3	477.0	503.2
-8	143.1	227.3	396.8	451.2	477.9	504.1
-7	143.4	227.7	397.5	452.0	478.8	505.1
-6	143.7	228.1	398.3	452.9	479.7	506.0
-5	143.9	228.5	399.0	453.7	480.6	507.0
-4	144.2	229.0	399.8	454.6	481.5	507.9
-3	144.5	229.4	400.5	455.4	482.4	508.9
-2	144.7	229.8	401.2	456.3	483.3	509.8
-1	145.0	230.2	402.0	457.1	484.2	510.8
0	145.3	230.7	402.7	457.9	485.1	511.7
1	145.5	231.1	403.4	458.8	486.0	512.6
2	145.8	231.5	404.2	459.6	486.9	513.6
3	146.1	231.9	404.9	460.4	487.8	514.5
4	146.3	232.3	405.7	461.3	488.6	515.4
5	146.6	232.8	406.4	462.1	489.5	516.4
6	146.9	233.2	407.1	462.9	490.4	517.3
7	147.1	233.6	407.8	463.8	491.3	518.2
8	147.4	234.0	408.6	464.6	492.2	519.1
9	147.6	234.4	409.3	465.4	493.0	520.1
10	147.9	234.8	410.0	466.2	493.9	521.0
11	148.2	235.3	410.7	467.1	494.8	521.9
12	148.4	235.7	411.5	467.9	495.6	522.8
13	148.7	236.1	412.2	468.7	496.5	523.7
14	148.9	236.5	412.9	469.5	497.4	524.6
15	149.2	236.9	413.6	470.3	498.2	525.6
16	149.5	237.3	414.3	471.2	499.1	526.5
17	149.7	237.7	415.1	472.0	500.0	527.4
18	150.0	238.1	415.8	472.8	500.8	528.3
19	150.2	238.5	416.5	473.6	501.7	529.2
20	150.5	239.0	417.2	474.4	502.5	530.1
21	150.8	239.4	417.9	475.2	503.4	531.0
22	151.0	239.8	418.6	476.0	504.3	531.9
23	151.3	240.2	419.3	476.8	505.1	532.8
24	151.5	240.6	420.0	477.6	506.0	533.7
25	151.8	241.0	420.7	478.4	506.8	534.6
26	152.0	241.4	421.4	479.2	507.7	535.5
27	152.3	241.8	422.1	480.0	508.5	536.4
28	152.5	242.2	422.8	480.8	509.4	537.3
29	152.8	242.6	423.6	481.6	510.2	538.2
30	153.0	243.0	424.3	482.4	511.0	539.1
31	153.3	243.4	425.0	483.2	511.9	539.9
32	153.5	243.8	425.6	484.0	512.7	540.8
33	153.8	244.2	426.3	484.8	513.6	541.7
34	154.0	244.6	427.0	485.6	514.4	542.6
35	154.3	245.0	427.7	486.4	515.2	543.5
36	154.5	245.4	428.4	487.2	516.1	544.4
37	154.8	245.8	429.1	488.0	516.9	545.2
38	155.0	246.2	429.8	488.8	517.7	546.1
39	155.3	246.6	430.5	489.5	518.6	547.0
40	155.5	247.0	431.2	490.3	519.4	547.9

ADC Adjustment Test - TAS Values
Figure 502

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STATIC AIR TEMPERATURE (DEG C)

Measured Temp (deg C)	CAS=150	CAS=200	CAS=300	M=0.75	M=0.80	M=0.85
-10	-12.7	-16.8	-30.6	-36.6	-39.9	-43.2
-9	-11.7	-15.8	-29.6	-35.7	-39.0	-42.4
-8	-10.7	-14.8	-28.7	-34.8	-38.1	-41.5
-7	-9.7	-13.8	-27.8	-33.9	-37.2	-40.6
-6	-8.7	-12.9	-26.9	-33.0	-36.2	-39.7
-5	-7.7	-11.8	-26.0	-32.1	-35.4	-38.9
-4	-6.7	-10.8	-25.0	-31.2	-34.5	-38.0
-3	-5.8	-9.9	-24.1	-30.3	-33.7	-37.1
-2	-4.8	-9.0	-23.2	-29.4	-32.8	-36.2
-1	-3.8	-8.0	-22.3	-28.5	-31.9	-35.4
0	-2.8	-7.0	-21.3	-27.6	-31.0	-34.5
1	-1.8	-6.0	-20.4	-26.7	-30.1	-33.6
2	-.8	-5.1	-19.5	-25.8	-29.2	-32.7
3	.2	-4.1	-18.6	-24.9	-28.3	-31.9
4	1.2	-3.1	-17.7	-24.0	-27.4	-31.0
5	2.2	-2.1	-16.7	-23.1	-26.6	-30.1
6	3.2	-1.2	-15.8	-22.2	-25.7	-29.2
7	4.1	-0.2	-14.9	-21.3	-24.8	-28.4
8	5.1	0.8	-14.0	-20.4	-23.9	-27.5
9	6.1	1.8	-13.0	-19.5	-23.0	-26.6
10	7.1	2.7	-12.1	-18.6	-22.1	-25.7
11	8.1	3.7	-11.2	-17.7	-21.2	-24.9
12	9.1	4.7	-10.3	-16.8	-20.4	-24.0
13	10.1	5.7	-9.4	-15.9	-19.5	-23.1
14	11.1	6.6	-8.4	-15.0	-18.6	-22.3
15	12.1	7.6	-7.5	-14.1	-17.7	-21.4
16	13.1	8.6	-6.6	-13.2	-16.8	-20.5
17	14.0	9.5	-5.7	-12.3	-15.9	-19.6
18	15.0	10.5	-4.7	-11.4	-15.0	-18.8
19	16.0	11.5	-3.8	-10.5	-14.2	-17.9
20	17.0	12.5	-2.9	-9.6	-13.3	-17.0
21	18.0	13.4	-2.0	-8.7	-12.4	-16.1
22	19.0	14.4	-1.1	-7.8	-11.5	-15.3
23	20.0	15.4	-0.1	-6.9	-10.6	-14.4
24	21.0	16.4	0.8	-6.0	-9.7	-13.5
25	22.0	17.3	1.7	-5.2	-8.8	-12.6
26	22.9	18.3	2.6	-4.3	-7.9	-11.8
27	23.9	19.3	3.5	-3.4	-7.1	-10.9
28	24.9	20.3	4.5	-2.5	-6.2	-10.0
29	25.9	21.2	5.4	-1.6	-5.3	-9.1
30	26.9	22.2	6.3	-0.7	-4.4	-8.3
31	27.9	23.2	7.2	0.2	-3.5	-7.4
32	28.9	24.2	8.2	1.1	-2.6	-6.5
33	29.9	25.1	9.1	2.0	-1.7	-5.7
34	30.9	26.1	10.0	2.9	-0.9	-4.8
35	31.9	27.1	10.9	3.8	0.0	-3.9
36	32.8	28.1	11.8	4.7	.9	-3.0
37	33.8	29.0	12.8	5.6	1.8	-2.2
38	34.8	30.0	13.7	6.5	2.7	-1.3
39	35.8	31.0	14.6	7.4	3.6	-0.4
40	36.8	32.0	15.5	8.3	4.5	.5

ADC Adjustment Test - SAT Values
Figure 503

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	Ps	Pt	Altitude	Mach	Airspeed	TAS	SAT	Vmo Barber-pole
1	29.916	31.012	0 ±25		150 ±2.0	2	3	357 ±2
	1		DELTA = 38		DELTA = 3.0			
2	8.914	12.904	30,000 ±60	0.75 ±0.006		2	3	326 ±2
	1		DELTA = 90	DELTA = 0.009				
3	5.610	8.8820	40,000 ±80	0.85 ±0.005		2	3	260 ±2
	1		DELTA = 120	DELTA = 0.008				

1 "DELTA" SHOWS THE MAXIMUM PERMITTED DIFFERENCE BETWEEN THE CAPTAIN'S AND FIRST OFFICER'S INSTRUMENTS.

2 THE TRUE AIRSPEED ON THE TAS INDICATOR MUST AGREE WITH THE VALUES IN FIG. 502 ±6 KTS. USE THE TEST THERMOMETER TO FIND THE AMBIENT TEMPERATURE.

3 THE STATIC AIR TEMPERATURE ON THE SAT INDICATOR MUST AGREE WITH THE VALUES IN FIG. 503 ±3°. USE THE TEST THERMOMETER TO FIND THE AMBIENT TEMPERATURE.

Altitude, Mach, Airspeed, TAS, SAT, Vmo Values
Figure 504 (Sheet 1)

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	Ps	Pt	Altitude	Mach	Airspeed	TAS	SAT	Vmo Barber-pole
1	29.916	31.012	0 ±25		150 ±2.0	[2]	[3]	357 ±2
	[1]		DELTA = 38		DELTA = 3.0			
2	20.567	22.536	10,000 ±30		200 ±2.0	[2]	[3]	357 ±2
	[1]		DELTA = 45		DELTA = 3.0			
3	13.930	18.284	20,000 ±40		300 ±2.0	[2]	[3]	357 ±2
	[1]		DELTA = 60		DELTA = 3.0			
4	9.092	12.904	30,000 ±60	0.75 ±0.006		[2]	[3]	326 ±2
	[1]		DELTA = 90	DELTA = 0.009				
5	7.267	10.732	35,000 ±70	0.80 ±0.005		[2]	[3]	292 ±2
	[1]		DELTA = 105	DELTA = 0.008				
6	5.791	8.8820	40,000 ±80	0.85 ±0.005		[2]	[3]	260 ±2
	[1]		DELTA = 120	DELTA = 0.008				

[1] "DELTA" SHOWS THE MAXIMUM PERMITTED DIFFERENCE BETWEEN THE CAPTAIN'S AND FIRST OFFICER'S INSTRUMENTS.

[2] THE TRUE AIRSPEED ON THE TAS INDICATOR MUST AGREE WITH THE VALUES IN FIG. 502 ±6 KTS. USE THE TEST THERMOMETER TO FIND THE AMBIENT TEMPERATURE.

[3] THE STATIC AIR TEMPERATURE ON THE SAT INDICATOR MUST AGREE WITH THE VALUES IN FIG. 503 ±3°. USE THE TEST THERMOMETER TO FIND THE AMBIENT TEMPERATURE.

Altitude, Mach, Airspeed, TAS, SAT, Vmo Values
Figure 504 (Sheet 2)

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(d) Turn the alternate Vmo/Mmo switch to the NORMAL position.

NOTE: You must lock the alternate Vmo/Mmo switch with wire in the NORMAL position after the test.

G. Put the Airplane Back to Its Usual Condition

S 845-074
(1) Put the pitot-static system back to its usual condition (Ref 34-11-00).

S 865-059
(2) Remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:
(a) 11J13, FLAP LOAD RELIEF

S 865-060
(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 panel:
(a) 6J8, RAM AIR TURBINE PWR HOT BATTERY BUS
(b) 6K14, PITOT HEAT CAPT ϕA
(c) 6K15, PITOT HEAT CAPT ϕB
(d) 6K16, PITOT HEAT R AUX ϕB
(e) 6K17, PITOT HEAT R AUX ϕC
(f) 6K20, PITOT HEAT L AUX ϕC
(g) 6K21, PITOT HEAT L AUX ϕB
(h) 6K22, PITOT HEAT F/O ϕB
(i) 6K23, PITOT HEAT F/O ϕA
(j) 6K24, PROBE HEAT AOA R
(k) 6L17, PROBE HEAT AOA L
(l) 6L18, PROBE HEAT TAT L

S 865-061
(4) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P36 panel:
(a) 36H6, ICE/RAIN WINDOW HEAT 2R
(b) 36H7, ICE/RAIN WINDOW HEAT 3R
(c) 36L5, ICE/RAIN WINDOW HEAT 1L

S 865-062
(5) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P37 panel:
(a) 37D2, ICE & RAIN WINDOW HEAT 1R
(b) 37E1, ICE & RAIN WINDOW HEAT 2L
(c) 37E2, ICE & RAIN WINDOW HEAT 3L

S 845-063
(6) Remove the test equipment.

S 865-064
(7) Remove electrical power if it is not necessary (Ref 24-22-00).

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AIR DATA COMPUTING SYSTEM - INSPECTION/CHECK

1. General
   A. The Air Data Computing System Inspection/Check procedure has several tasks, these tasks are checks for the:
      (1) air data computer (ADC) operation and isolation
      (2) overspeed annunciation
      (3) altimeter
      (4) EADI

TASK 34-12-00-716-010

2. Air Data Computer Check (Fig. 601)
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center
          211/212 Flight Compartment

   C. Prepare for the Check

      S 866-003
      (1) Supply electrical power (AMM 24-22-00/201).

      S 866-004
      (2) Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:
          (a) 11A7, EFIS DSPL SW L
          (b) 11A10, AIR DATA CMPTR L
          (c) 11A11, AIR DATA AOA SENSOR L
          (d) 11A12, AIR DATA BARO CORRECT L
          (e) 11A35, IND LIGHTS 3
          (f) 11B16, AURAL WARN SPKR L
          (g) 11B18, WARN ELEX B
          (h) 11E2, ALTM LEFT
          (i) 11E3, ADI LEFT
          (j) 11E4, EFIS CONT PNL LEFT
          (k) 11E23, ALTM RIGHT
          (l) 11E24, ADI RIGHT
          (m) 11E25, EFIS CONT PNL RIGHT
          (n) 11F8, EFIS SYM GEN L
          (o) 11F9, EFIS SYM GEN C
          (p) 11F24, EFIS DSPL SW RIGHT
          (q) 11F29, EFIS SYM GEN RIGHT
          (r) 11F30, AIR DATA CMPTR RIGHT
          (s) 11F31, AIR DATA AOA SENSOR RIGHT
          (t) 11F32, AIR DATA BARO CORRECT RIGHT
          (u) 11H35, AURAL WARN SPKR R
          (v) 11J34, WARN ELEX A
          (w) 11R30, RIGHT IND LTS 3

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D. Procedure

S 866-006

(1) On the miscellaneous test panel, P61, set the AIR DATA COMPTR test switch to the L position and hold it there.
   (a) Make sure an aural warning sounds and the left half of the OVSP (overspeed) light comes on for approximately 2 seconds.
   (b) Make sure the capt's altimeter start to slew up-scale.
   (c) Make sure the airspeed indication on the capt's EADI start to slew up-scale.

S 866-007

(2) On the miscellaneous test panel, release the AIR DATA COMPTR test switch.

S 866-011

(3) On the miscellaneous test panel, P61, set the AIR DATA COMPTR test switch to the R position and hold it there.
   (a) Make sure an aural warning sounds and the right half of the OVSP (overspeed) light comes on for approximately 2 seconds.
   (b) Make sure the F/O's altimeter start to slew up-scale.
   (c) Make sure the airspeed indication on the F/O's EADI start to slew up-scale.

E. Put the Airplane Back to Its Usual Condition

S 866-009

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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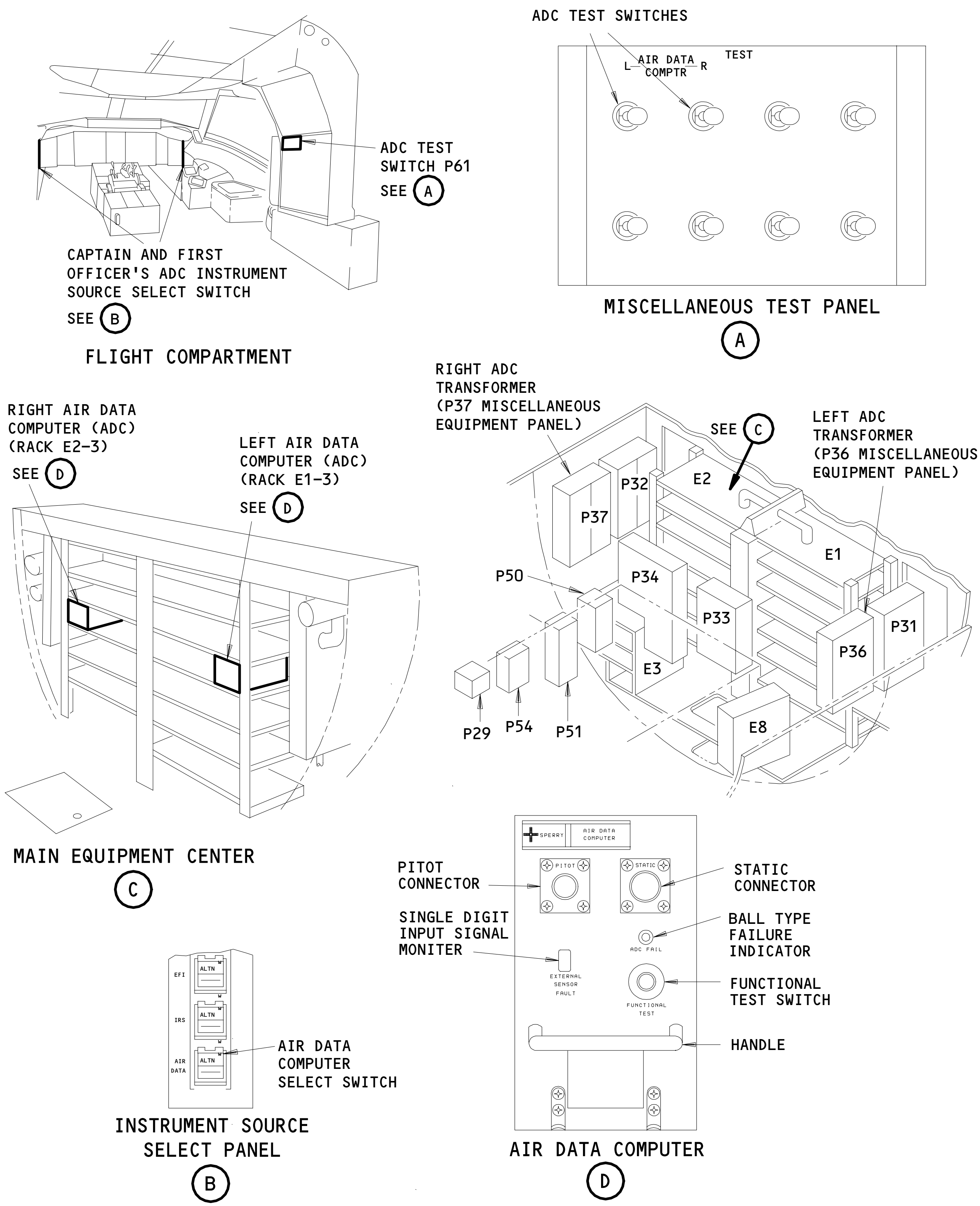

Air Data Computing System Component
Figure 601

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AIR DATA COMPUTER (ADC) - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the ADC. The second task installs the ADC. After the ADC is installed, a functional test is done.

   B. The left, M100, and right, M101, ADCs are found on the E1-3 and E2-3 racks in the main equipment center. All electrical connections are made through connectors at the rear of the unit.

TASK 34-12-01-004-001

2. ADC Removal
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center

      (2) Access Panel
          119AL Main Equipment Center

   C. Procedure

      S 864-002
      (1) Set the two Flight Director (F/D) switches on the Mode Control Panel (MCP) to the OFF position.

      S 864-003
      (2) Open these circuit breakers (as applicable) on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11A10, AIR DATA CMPTR L
          (b) 11A11, AIR DATA AOA SENSOR L
          (c) 11A12, AIR DATA BARO CORRECT L
          (d) 11F30, AIR DATA CMPTR RIGHT
          (e) 11F31, AIR DATA AOA SENSOR RIGHT
          (f) 11F32, AIR DATA BARO CORRECT RIGHT

      S 034-004
      (3) Disconnect the pitot-static system hoses from the front panel of the ADC.

      S 024-005
      (4) Remove the ADC (AMM 20-10-01/401).

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TASK 34-12-01-404-006

3. ADC Installation

A. General

(1) You do not have to do a leak test when you connect a quick-disconnect fitting. A visual examination of the quick-disconnect for a complete seal is necessary. You must do a leak test when you cannot make sure that the quick-disconnect has a complete seal.

(2) You must do a leak test of the pitot and static systems if you installed quick-disconnects on the air data computer.

B. References

(1) 20-10-01/401, E/E Rack Mounted Components

(2) 22-00-02/201, Autoflight BITE

(3) 24-22-00/201, Electrical Power - Control

(4) 34-12-00/501, Air Data Computer

C. Access

(1) Location Zones

119/120 Main Equipment Center

(2) Access Panel

119AL Main Equipment Center

D. Procedure

S 864-007

(1) Make sure that these circuit breakers (as applicable) on the overhead circuit breaker panel, P11, are open:

(a) 11A10, AIR DATA CMPTR L

(b) 11A11, AIR DATA AOA SENSOR L

(c) 11A12, AIR DATA BARO CORRECT L

(d) 11F30, AIR DATA CMPTR RIGHT

(e) 11F31, AIR DATA AOA SENSOR RIGHT

(f) 11F32, AIR DATA BARO CORRECT RIGHT

S 424-008

(2) Install the ADC (AMM 20-10-01/401).

S 424-021

(3) AIRPLANES WITH THE -206 ADC AND PREVIOUS;
Install quick-disconnects on the ADC.

(a) Make sure the quick-disconnects are connected and locked in a sealed position.

S 424-022

(4) AIRPLANES WITH THE -211 ADC AND SUBSEQUENT;
Connect the pitot-static system hoses to the front panel of the ADC.

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NOTE: The Air Data Computers have quick-disconnect connectors. You do not have to do a leak test when you replace/reconnect a component. Visually make sure the quick-disconnects are fully connected and locked in a sealed position. If you are not sure the quick-disconnect is correct, do the system leak test (AMM 34-11-01/501).

(a) Do a visual inspection of the quick-disconnect fittings that you disconnected.
1) Make sure that the actuation ring of the quick-disconnect fitting is fully engaged on the lock pins and make sure that you see the colored lock ring indicator that shows a correct connection of the quick-disconnect fitting.

S 864-011
(5) Remove the DO-NOT-CLOSE tags and close these circuit breakers (as applicable) on the overhead circuit breaker panel, P11:
(a) 11A10, AIR DATA CMPTR L
(b) 11A11, AIR DATA AOA SENSOR L
(c) 11A12, AIR DATA BARO CORRECT L
(d) 11F30, AIR DATA CMPTR RIGHT
(e) 11F31, AIR DATA AOA SENSOR RIGHT
(f) 11F32, AIR DATA BARO CORRECT RIGHT

E. ADC Test

S 864-012
(1) Supply electrical power (Ref 24-22-00).

S 744-016
(2) Push and hold the FUNCTIONAL TEST switch on the front panel of the left ADC (Rack E1) and right ADC (Rack E2).

NOTE: Do not push the ADC test switch while there is pressure on the pitot-static system. The ADC will go into an incorrect failure condition. It will send this incorrect condition to its interface systems. To erase this condition, do the steps that follow:
- Put the pitot-static system to ambient pressure.
- Push the ADC test switch to set the ADC to its usual condition.

(a) Make sure a dash (-) shows in the EXTERNAL SENSOR FAULT display on the front panel of the ADC.
(b) Make sure the ADC FAIL indicator shows black.

S 744-014
(3) Do the MCDP Test - 30 CURRENT FAULT REPORT (Ref 22-00-02).

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F. Put the Airplane Back to Its Usual Condition

S 864-015

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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TOTAL AIR TEMPERATURE (TAT) PROBE - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the TAT probes. The second task installs the TAT probes.
   B. The TAT probe is installed on the left front of the airplane.

TASK 34-12-02-004-001

2. TAT Probe Removal (Fig. 401)

   A. Consumable Materials
      (1) B00184, Solvent - BMS 11-7
   B. References
      (1) AMM 36-00-00/201, Pneumatic General
      (2) AMM 51-31-01/201, Seals and Sealing
   C. Access
      (1) Location Zone
         117 Area Outboard and Above NLG Wheel Well

   D. Procedure

      S 864-048
      (1) Make sure the two F/D switches on the MCP are in the OFF position.

      S 864-002

      WARNING: MAKE SURE THE PROBE HEAT IS NOT ON. THIS CAN CAUSE INJURY TO PERSONS.

      (2) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
         (a) 6L18, PROBE HEAT TAT L

      S 864-003
      (3) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11A10, AIR DATA CMPTR L
         (b) 11F30, AIR DATA CMPTR RIGHT

      S 864-004

      WARNING: MAKE SURE THE PNEUMATIC POWER IS NOT ON. THIS CAN CAUSE INJURY TO PERSONS.

      (4) Make sure that there is not pneumatic power to the TAT probe (AMM 36-00-00/201).

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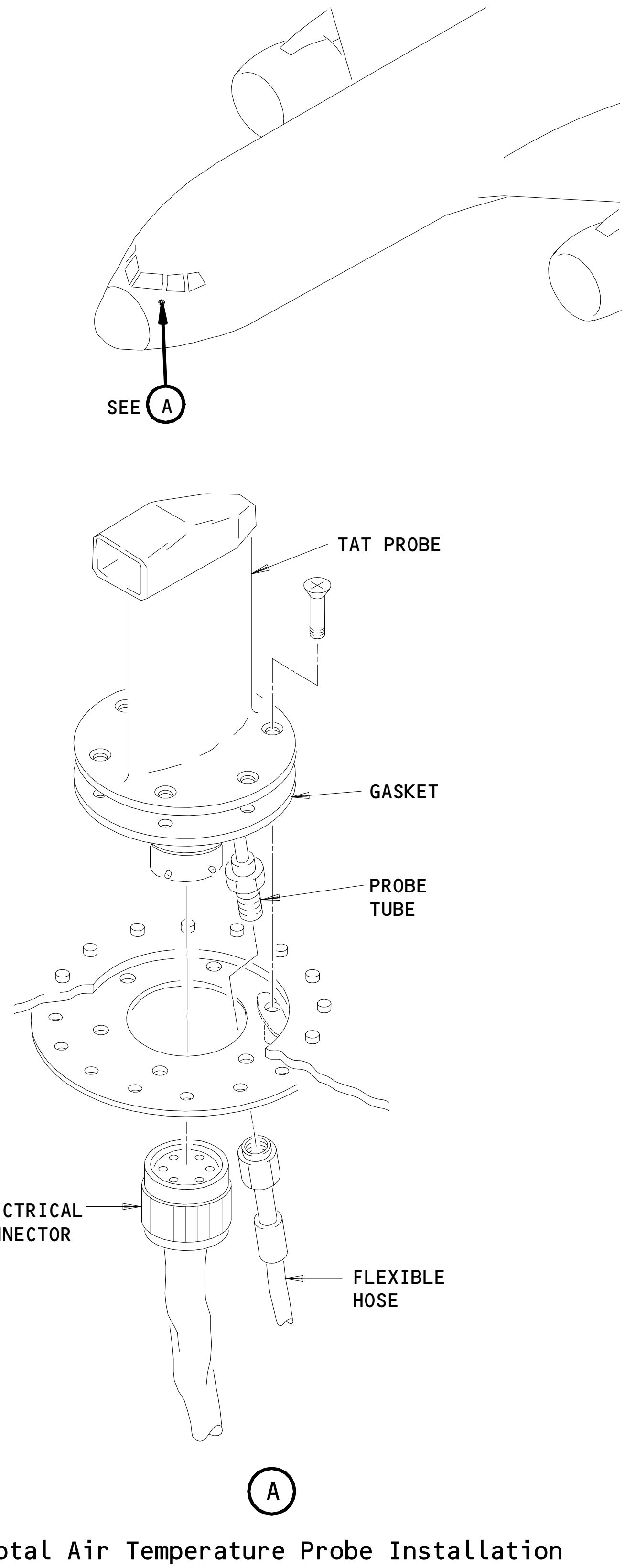

Total Air Temperature Probe Installation
Figure 401

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S 024-056

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(5) Remove the sealant from around the bottom of the probe (AMM 51-31-01/201).

S 034-006

(6) Remove the screws that hold the probe to the airplane.

S 024-057

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(7) Remove the sealant around the antenna until the seal is fully broken (AMM 51-31-01/201).

S 034-045

CAUTION: DO NOT PULL THE PROBE CABLE. THIS CAN CAUSE DAMAGE TO IT.

(8) Pull the probe away from the airplane skin until you see the electrical cable.

NOTE: DO NOT USE FLUIDS THAT CONTAIN SODIUM CHLORIDE OR SULFUR COMPONDS TO CLEAN THE PROBE. SODIUM CHLORIDE AND SULFUR CAN CAUSE PREMATURE FAILURE OF THE PROBE.

S 024-007

(9) Disconnect the electrical cable and flexible hose from the probe.

S 034-042

(10) Put caps on the hose connectors and electrical connectors for protection.

S 034-043

(11) Make sure the electrical cable and hose do not fall into the airplane.

TASK 34-12-02-404-008

3. Install the TAT Probe (Fig. 401)

A. Equipment

(1) Resistance measuring bridge or milliiohm/bonding meter which can measure 0.010 ohm with a precision of ±0.001 ohm.

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(2) Sealant Removal Tool - hardwood or plastic

B. Consumable Materials
   (1) A00247 Sealant - Pressure and environmental, chromate type - BMS 5-95.
   (2) B00184 Solvent - BMS 11-7

C. References
   (1) AMM 24-22-00/201, Electrical Power - Control
   (2) AMM 31-41-00/501, Engine Indication and Crew Alerting System
   (3) AMM 33-16-00/501, Master Dim and Test
   (4) AMM 36-00-00/201, Pneumatic General
   (5) AMM 51-31-01/201, Seals and Sealing

D. Access
   (1) Location Zone
       117 Area Outboard and Above NLG Wheel Well

E. Procedure

S 864-049
(1) Make sure the two F/D switches on the MCP are in the OFF position.

S 864-009
(2) Make sure that these circuit breakers on the overhead circuit breaker panel, P11, are open:
   (a) 11A10, AIR DATA CMPTR L
   (b) 11F30, AIR DATA CMPTR RIGHT

S 864-010

WARNING: MAKE SURE THE PNEUMATIC POWER IS NOT ON. THIS CAN CAUSE INJURY TO PERSONS.

(3) Make sure that there is not pneumatic power to the TAT probe (AMM 36-00-00/201).

S 864-011

WARNING: MAKE SURE THE PROBE HEAT IS NOT ON. THIS CAN CAUSE INJURY TO PERSONS.

(4) Make sure that this circuit breaker on panel P6 is open:
   (a) 6L18, PROBE HEAT TAT L

S 434-012
(5) Remove and discard the used gasket.

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S 424-058

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(6) Remove the used sealant from the TAT hole on the airplane (AMM 51-31-01/201).

S 164-044

(7) Clean and prepare the surface of the airplane around the hole (AMM 51-31-01/201).

S 434-014

(8) Install the new gasket.

S 434-015

(9) Remove the caps on the electrical connectors.

S 434-047

(10) Remove the caps on the hose connectors.

S 434-016

(11) Connect the electrical cable and flexible hose to the bottom of the probe.

S 434-017

(12) Put the cable and hose into the airplane while you put the bottom of the probe into the hole.

S 434-018

(13) Move the probe and gasket until the probe points forward. (The wide intake points forward and the exit holes on the back of the strut point aft.)

S 434-019

(14) Make sure that the probe bottom makes a continuous surface with the airplane skin.

S 424-020

(15) Install the screws and tighten them to 18-22 pound-inches.

S 824-021

(16) Measure the resistance between the TAT probe body and the airplane skin.

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S 864-054

(17) If the resistance is more than 0.010 Ohms, do these steps:
   (a) Remove the TAT Probe.
   (b) Clean the bonding surfaces, including the countersunk holes in the TAT Probe (SWPM 20-20-00).
   (c) Replace the existing screws with new screws.
   (d) Re-install the TAT Probe.
   (e) Measure the resistance between the strut of the TAT Probe and the airplane skin.
   (f) If the resistance is more than 0.010 Ohms, do these steps:
      1) Remove the TAT Probe.
      2) Replace the nutplates and rivets that attach the TAT Probe (SRM 51-40-02).
      3) Re-install the TAT Probe and make sure that the bonding resistance is not more than 0.010 Ohms.

S 434-052

CAUTION: It is not necessary to apply the sealant immediately if the cure time will cause a flight delay. Up to a ten day interval is allowed before sealant must be applied. Sometime during this ten day interval, the probe must be removed again and the base of the probe plus the aircraft skin underneath the probe must be dried with a soft cloth. If corrosion is present, it must be removed. The probe is then installed and the sealant is applied and cured.

(18) Fill the hole around the probe bottom with sealant (AMM 51-31-01/201).

S 864-023

(19) Dry the sealant until it becomes hard (AMM 51-31-01/201).

NOTE: The sealant will dry in less time if you apply heat.

S 864-025

(20) Remove the DO-NOT-CLOSE tag and close this circuit breaker on the P6 panel:
   (a) 6L18, PROBE HEAT TAT L

S 864-026

(21) Remove DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11A10, AIR DATA COMPTR L
   (b) 11F30, AIR DATA COMPTR RIGHT

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F. TAT Probe Test

S 864-027
(1) Make sure there is no test equipment or covers installed on the probes. (This includes the pitot static and angle of attack probes.)

S 864-028
(2) Supply electrical power to the main AC buses (AMM 24-22-00/201).

S 864-029
(3) Make sure the master dim and test system operates correctly (AMM 33-16-00/501).

S 864-030
(4) Make sure the Engine Indication and Crew Alerting System (EICAS) operates correctly (AMM 31-41-00/501).

S 864-031
(5) Make sure that these circuit breakers on the P11 panel are closed:
(a) 11A11, AIR DATA AOA SENSOR L
(b) 11A12, AIR DATA BARO CORRECT L
(c) 11F31, AIR DATA AOA SENSOR RIGHT
(d) 11F32, AIR DATA BARO CORRECT RIGHT

S 714-032
(6) Push and hold the FUNCTIONAL TEST switch on the front panel of the left ADC (Rack E1) and right ADC (Rack E2).

NOTE: Do not push the ADC test switch while there is pressure on the pitot-static system. The ADC will go into an incorrect failure condition. It will send this incorrect condition to its interface systems. To erase this condition, do the steps that follow:
- Put the pitot-static system to ambient pressure.
- Push the ADC test switch to set the ADC to its usual condition.

(a) Make sure the EXTERNAL SENSOR FAULT on the ADC front panel shows a dash (-).
(b) Make sure the TAT light on the M10394 miscellaneous annunciator panel, P5, is on.

S 864-033
(7) On the P9 panel, set the computer select switch for the EICAS to the AUTO position.
(a) Make sure the PROBE HEAT message shows on the top EICAS display on the P2 panel.

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S 864-034

WARNING: DO NOT TOUCH THE PROBES WHILE YOU DO THE TEST. THIS CAN CAUSE INJURY TO PERSONS.

CAUTION: DO NOT OPERATE THE PROBE HEATERS FOR MORE THAN 30 SECONDS. WAIT AT LEAST 5 MINUTES BETWEEN EACH OPERATION. IF YOU DO NOT, YOU CAN CAUSE DAMAGE TO THE PROBE.

(8) Hold the WING ANTI-ICE WINDOW/PROBE HEAT switch on the P61 panel in the WINDOW/PROBE HEAT position.

S 754-036

(9) Make sure the conditions that follow occur:
- (a) The TAT light is off.
- (b) None of the EICAS messages that follow show:
  - 1) PROBE HEAT
  - 2) TAT PROBE
- (c) The TAT probe is warm.

S 864-037

(10) Open the PROBE HEAT TAT (6L18) circuit breaker.
- (a) Make sure the TAT PROBE message shows on the EICAS display.
- (b) Make sure the TAT light is on.

S 864-038

(11) Close the PROBE HEAT TAT (6L18) circuit breaker.

S 864-039

(12) Release the WING ANTI-ICE WINDOW/PROBE HEAT switch.

S 864-040

(13) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ANGLE OF ATTACK (AOA) SENSOR - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the AOA sensor. The second task installs the AOA sensor.
   B. The left, TS12, and right, TS13, Angle of Attack (AOA) sensors are found on the side of the airplane. There is an electrical connector at the rear of each sensor.

TASK 34-12-03-004-001

2. Remove the AOA Sensor

   A. Consumable Materials
      (1) B00184 Solvent - BMS 11-7
   B. References
      (1) AMM 20-10-22/701, Metal Surfaces
      (2) AMM 51-31-01/201, Seals and Sealing
   C. Access
      (1) Location Zones
         117/118 Area Outboard and Above NLG Wheel Well

   D. Procedure

      S 864-034
      (1) Make sure the two F/D switches on the MCP are in the OFF position.

      S 864-002
      (2) Open these circuit breakers, as applicable, on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11A10, AIR DATA CMPTR L
         (b) 11A11, AIR DATA AOA SENSOR L
         (c) 11A12, AIR DATA BARO CORRECT L
         (d) 11F30, AIR DATA CMPTR RIGHT
         (e) 11F31, AIR DATA AOA SENSOR RIGHT
         (f) 11F32, AIR DATA BARO CORRECT RIGHT

      S 864-003
      (3) Open the applicable circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
         (a) 6K24, PROBE HEAT AOA R
         (b) 6L17, PROBE HEAT AOA L

      S 034-004
      (4) Remove the eight screws that hold the AOA sensor.

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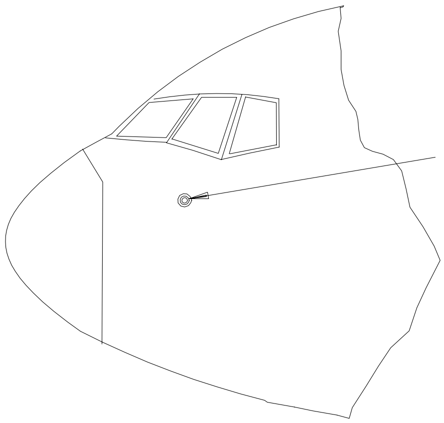

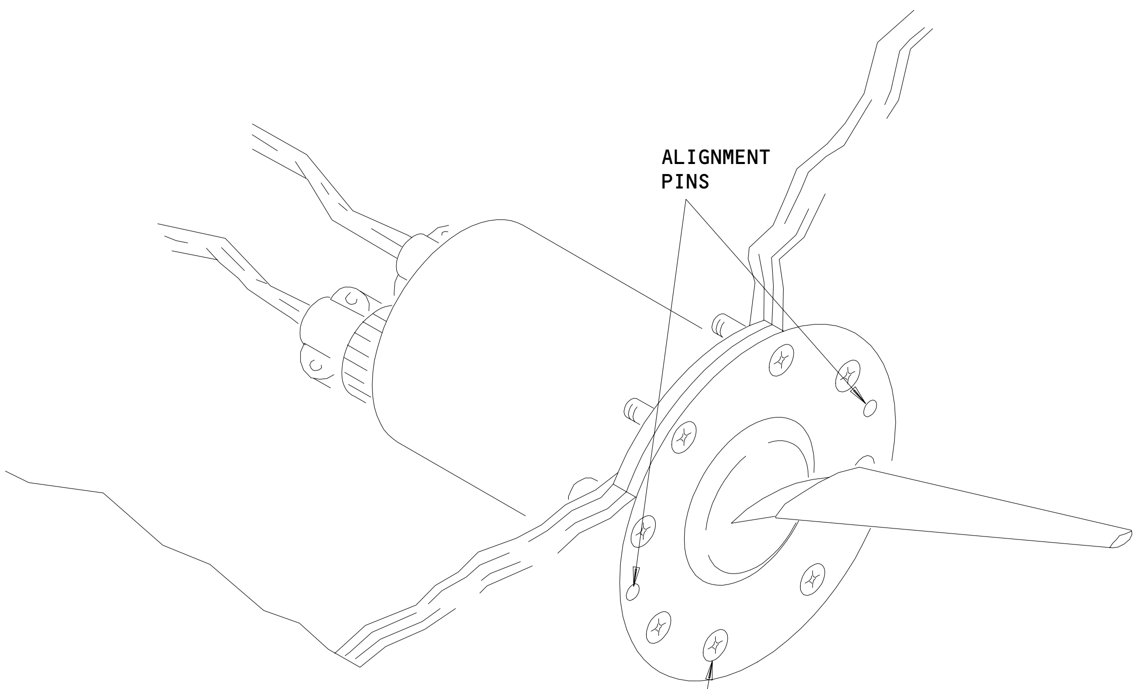

Angle of Attack Sensor Installation
Figure 401

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S 024-068

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(5) Use the sealant removal tool to remove the sealant around the AOA sensor (AMM 51-31-01/201).

S 034-006

CAUTION: DO NOT USE FORCE ON THE SENSOR VANE. THIS CAN CAUSE DAMAGE TO THE VANE.

(6) Lightly move the sensor to break the seal.

S 024-008
(7) Remove the sensor.

S 034-009
(8) Remove the gaskets.

S 024-010
(9) Disconnect the electrical connector from the AOA sensor.

NOTE: Make sure the connector and wires do not fall back into the airplane.

S 024-069

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(10) Remove the used sealant from the sensor hole and airplane skin (AMM 51-31-01/201).

S 164-012
(11) Clean the area around the hole (AMM 20-10-22/701).

TASK 34-12-03-404-013
3. Angle of Attack Sensor Installation
A. Equipment
(1) Data Bus Analyzer
(a) 429EB, JcAIR Test Systems (recommended)
Goodrich Corporation
400 New Century Parkway,
New Century, KS 66031-0009

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(b) 429-2, Interface Technology (optional)
150 E. Arrow Highway,
San Dimas, CA 91773

(2) Angular displacement measuring tool, A34012-24
(3) Angular displacement measuring tool, J34002-1 (alternate)
(4) Resistance Measuring Bridge or Milliohm/Bonding meter that can measure 0.010 ohm.

B. Consumable Materials
(1) Gasket
(2) A00247 Sealant, Pressure and environmental, chromate type - BMS 5-95
(3) D00633 Grease - BMS 3-33 (Preferred)
(4) G00009 Grease - BMS 3-24 (Alternate)

C. References
(1) AMM 20-10-22/701, Metal Surfaces
(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 51-31-01/201, Seals and Sealing

D. Access
(1) Location Zones
117/118 Area Outboard and Above NLG Wheel Well

E. Procedure

S 864-035
(1) Make sure the two F/D switches on the MCP are in the OFF position.

S 864-014
(2) Make sure the applicable circuit breakers on the P11 panel are open:
(a) 11A10, AIR DATA CMPTR L
(b) 11A11, AIR DATA AOA SENSOR L
(c) 11A12, AIR DATA BARO CORRECT L
(d) 11F30, AIR DATA CMPTR RIGHT
(e) 11F31, AIR DATA AOA SENSOR RIGHT
(f) 11F32, AIR DATA BARO CORRECT RIGHT

S 864-015
(3) Make sure that this circuit breaker, if it is applicable, on the P6 panel is open:
(a) 6K24, PROBE HEAT AOA R
(b) 6L17, PROBE HEAT AOA L

S 864-016
(4) Make sure the area around the AOA hole is clean (AMM 20-10-22/701).

S 164-017
(5) Clean the surface of the alignment pins on the bottom of the sensor (AMM 20-10-22/701).

S 644-018
(6) Apply a thin layer of grease on the alignment pins.

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S 434-019

(7) Install the new gasket.

S 434-020

(8) Connect the electrical connector to the sensor.

S 424-021

(9) Carefully put the sensor into the airplane skin.

S 424-022

(10) Install the eight screws and tighten them to 32-39 pound-inches.

S 224-023

(11) Make sure the face of the sensor makes a continuous surface +/- 0.01 inch with the airplane skin.

S 224-024

(12) Measure the resistance between the sensor bottom and the airplane skin.

S 864-066

(13) If the resistance is more than 0.010 Ohms, do these steps:
   (a) Remove the AOA Sensor.
   (b) Clean the bonding surfaces, including the countersunk holes in the AOA Sensor (SWPM 20-20-00).
   (c) Replace the existing screws with new screws.
   (d) Re-install the AOA Sensor.
   (e) Measure the resistance between the strut of the AOA Sensor and the airplane skin.
   (f) If the resistance is more than 0.010 Ohms, do these steps:
      1) Remove the AOA Sensor.
      2) Replace the nutplates and rivets that attach the AOA Sensor (SRM 51-40-02).
      3) Re-install the AOA Sensor and make sure that the bonding resistance is not more than 0.010 Ohms.

S 394-025

(14) Put sealant in the space between the sensor and the airplane skin (AMM 51-31-01/201).

NOTE: It is not necessary to apply the sealant immediately, if the cure time will cause a flight delay. But, you must apply the sealant as soon as possible to keep moisture out of the area between the probe and airplane skin.

S 224-026

(15) Make sure the sealant makes a continuous surface +/- 0.01 inch with the airplane skin.

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S 144-071

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(16) Remove unwanted sealant from the airplane (AMM 51-31-01/201).

S 864-027

(17) Supply electrical power (AMM 24-22-00/201).

S 864-028

(18) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11A10, AIR DATA CMPTR L
   (b) 11A11, AIR DATA AOA SENSOR L
   (c) 11A12, AIR DATA BARO CORRECT L
   (d) 11F30, AIR DATA CMPTR RIGHT
   (e) 11F31, AIR DATA AOA SENSOR RIGHT
   (f) 11F32, AIR DATA BARO CORRECT RIGHT

F. Angle of Attack Sensor Test (Recommended)

S 864-037

WARNING: MAKE SURE THE AOA PROBE HEAT IS OFF BEFORE YOU TOUCH THE AOA PROBE. THIS WILL PREVENT BAD BURNS.

(1) Set the AOA sensor to 0 degrees plus or minus .5 degrees.

S 714-043

(2) Push the FUNCTIONAL TEST switch on the front panel of the associated ADC (left if the left AOA sensor was replaced or right if the right AOA sensor was replaced).

NOTE: Do not push the ADC test while the pitot-static system is pressurized. The ADC will go into an incorrect fault condition and report this to its interface systems. Special procedures will have to be done to remove this type of fault (AMM 34-12-00/501).

S 214-040

(3) Make sure the numeric display on the front panel of the ADC shows a (-).

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S 714-075

(4) Do the ground test for the heater circuit of the installed AOA sensor (AMM 30-32-00/501).

S 484-047

(5) Do the following test when you replace the left (Captains) AOA sensor:

(a) Set up the ARINC 429 Databus Analyzer:

1) RX speed to LO

2) Display to ENG

3) Set the ON switch to ON

(b) Attach probe A of the ARINC 429 Databus Analyzer to Burndy block H4 on TB105, E1-3 shelf (WDM 34-12-12).

(c) Attach probe B of ARINC 429 Databus Analyzer to Burndy block H6 on TB105, E1-3 shelf.

S 484-046

(6) Do the following test when you replace the right (First Officers) AOA sensor:

(a) Set up the ARINC 429 Databus Analyzer:

1) RX speed to LO

2) Display to ENG

3) Set the ON switch to ON

(b) Attach probe A of the ARINC 429 Databus Analyzer to Burndy block H69 on TB145, Shelf E2-3 (WDM 34-12-22).

(c) Attach probe B of the ARINC 429 Databus Analyzer to Burndy block H71 on TB145, Shelf E2-3.

S 724-049

(7) Use an angular displacement measuring tool to move the angle of attack (AOA) vanes to the values that follow.

S 724-050

(8) Use the ARINC 429 Databus Analyzer to make sure the right and left ADC output values agree with the values listed below.

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NOTE: A plus (+) sign indicates trailing edge up and a minus (-) sign indicates trailing edge down.

S 724-076

(9) Apply the aerodynamic offset printed on the trailing edge of the vane to the ADC output values when comparing to the table below. For the right vane, algebraically subtract the aerodynamic offset from the ADC output value. For the left vane, algebraically add aerodynamic offset to the ADC output value.

Example #1
Vane Position = +10°
ADC Output = +10.30
Aero Offset = -0.25 (printed on trailing edge)

Right Vane
+10 = +10.30 - (-0.25) = 10.55 ---> compare to the table

Left Vane
+10 = +10.30 + (-0.25) = 10.05 ---> compare to table

Example #2
Vane Position = +10°
ADC Output = +10.30
Aero Offset = +0.25 (printed on trailing edge)

Right Vane
+10 = +10.30 - (+0.25) = 10.05 ---> compare to table

Left Vane +10 = +10.30 + (+0.25) = 10.55 ---> compare to table

RIGHT ADC TEST	
RIGHT VANE POSITION	OCTAL LABEL 221, 222, and 223 OUTPUT
0° +10° -10°	0° ± 0.75° 10° ± 0.75° 350° or -10° ± 0.75°

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LEFT ADC TEST	
LEFT VANE POSITION	OCTAL LABEL 221, 222, and 223 OUTPUT
0°	0° ± 0.75°
+10°	10° ± 0.75°
-10°	350° or -10° ± 0.75°

S 964-077

(10) If the left or right sensor angles are not satisfactory, replace the AOA sensor.

S 084-063

(11) Remove the test equipment.

G. Angle of Attack Sensor Test (Alternative)

NOTE: Use the alternative test only when the recommended calibrator tool is not available.

S 864-055

WARNING: MAKE SURE THE AOA PROBE HEAT IS OFF BEFORE YOU TOUCH THE AOA PROBE. THIS WILL PREVENT BAD BURNS.

(1) Set the AOA sensor to 0 degrees plus or minus 6 degrees.

S 714-057

(2) Push the FUNCTIONAL TEST switch on the front panel of the associated ADC (left if the left AOA sensor was replaced or right if the right AOA sensor was replaced).

NOTE: Do not push the ADC test switches while the pitot-static system is pressurized. The ADC will go into an incorrect fault condition and report this to its interface systems. Special procedures will have to be done to remove this type of fault (AMM 34-12-00/501).

S 214-058

(3) Make sure the numeric display on the front panel of the ADC shows a (-).

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S 714-059

(4) Do the following test when you replace the left (Captains) AOA sensor:

(a) Set up the ARINC 429 Databus Analyzer:
1) RX speed to LO
2) Display to ENG
3) Set the ON switch to ON

(b) Attach probe A of the ARINC 429 Databus Analyzer to Burndy block Z5 on TB105, E1-3 shelf (WDM 34-12-12).

(c) Attach probe B of the ARINC 429 Databus Analyzer to Burndy block Z6 on TB105, E1-3 shelf.

(d) Monitor the octal labels 221, 222 and 223 on the ARINC 429 data bus analyzer for test results.

(e) Move the left AOA sensor vane to 0 degrees +/-5, with respect to the AOA sensor alignment pins.
1) Make sure the ARINC 429 Databus Analyzer shows 0 degrees +/-5.

(f) Move the left AOA sensor, trailing edge up, to the maximum upper stop.
1) Make sure that the ARINC 429 Databus Analyzer shows 90 degrees +/-5.

(g) Move the left AOA sensor, trailing edge down, to a maximum lower stop.
1) Make sure that the ARINC 429 Databus Analyzer shows 270° ±5.

(h) Make a record of the left AOA sensor values.

(i) If the left sensor angles are not satisfactory, replace the left AOA sensor.

S 714-065

(5) Do the following test when you replace the right (First Officers) AOA sensor:

(a) Set up the ARINC 429 Bus Analyzer:
1) RX speed to LO
2) Display to ENG
3) Set the ON switch to ON

(b) Attach probe A of the ARINC 429 Bus Analyzer to Burndy block Z51 on TB145, Shelf E2-3 (WDM 34-12-22).

(c) Attach probe B of the ARINC 429 Data Bus Analyzer to Burndy block Z52 on TB145, Shelf E2-3.

(d) Monitor the octal labels 221, 222 and 223 on the ARINC 429 data bus analyzer for test results.

(e) Move the right AOA sensor vane to 0 degrees +/-5, with respect to the AOA sensor alignment pins.
1) Make sure the data bus reader shows 0 degrees +/-5.

(f) Move the right AOA sensor, trailing edge up, to the maximum upper stop.
1) Make sure that the ARINC 429 Databus Analyzer shows 90 degrees +/-5.

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(g) Move the right AOA sensor, trailing edge down, to the maximum lower stop.
1) Make sure that the ARINC 429 Databus Analyzer shows 270° ±5.
(h) Make a record of the right AOA sensor values.
(i) If the right sensor angles are not satisfactory, replace the right AOA sensor.

S 084-064
(6) Remove the test equipment.

H. Return the Airplane to the Normal Condition

S 844-060
(1) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 panel:
(a) 6L17, PROBE HEAT AOA-L
(b) 6K24, PROBE HEAT AOA-R

S 844-061
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AIR DATA INSTRUMENTS - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The air data instruments display airplane speed and altitude based upon inputs from the atmosphere. These instruments receive inputs either from the pitot and static systems or from other units through ARINC 429 data buses.
   B. Those instruments that receive inputs from the pitot and static systems include the standby airspeed indicator and standby altimeter. The airspeed indicator receives input pressure from the alternate static system and input pressure from the No. 1 auxiliary pitot system. The standby altimeter receives static inputs from the alternate static system.
   C. Those instruments that receive inputs through ARINC 429 data buses include the captain's and F/O's altimeters. They receive inputs from the air data computer (ADC).
   D. The Electronic Attitude Direction Indicators (EADIs) also display airspeed data and are part of the Electronic Flight Instrument System (EFIS) (Ref 34-22-00). The EADI's display computed airspeed and MACH. The airspeed data is provided by the ADC's which feed the EFIS Symbol Generators via ARINC 429 data buses. The EFIS Symbol Generators convert this data into video signals and transmit them for display on the EADI's.
   E. True airspeed/static air temperature (TAS/SAT) and total air temperature (TAT), usually part of air data instruments, are displayed elsewhere. TAS/SAT is displayed on the FMC control display unit (Ref 34-61-00). TAT is displayed on the EICAS indicator (Ref 31-41-00).
2. Component Details (Fig. 1)
   A. Altimeter
      (1) The altimeter displays corrected pressure altitude. It also displays barometric correction. It also contains a set altitude marker and an altitude alert light.
      (2) Altitude is displayed by a pointer and a drum counter. The pointer is read against a dial which indicates altitude between thousand-foot levels in 20-foot increments. The counter is a 5-digit, 4-drum mechanical counter. It has a range of -1000 to +50,000 feet displayed in 20-foot increments. The left digit drum is colored green to alert the pilots that the altitude is less than 10,000 feet. A NEG shutter covers the counter digits when negative altitude is displayed.

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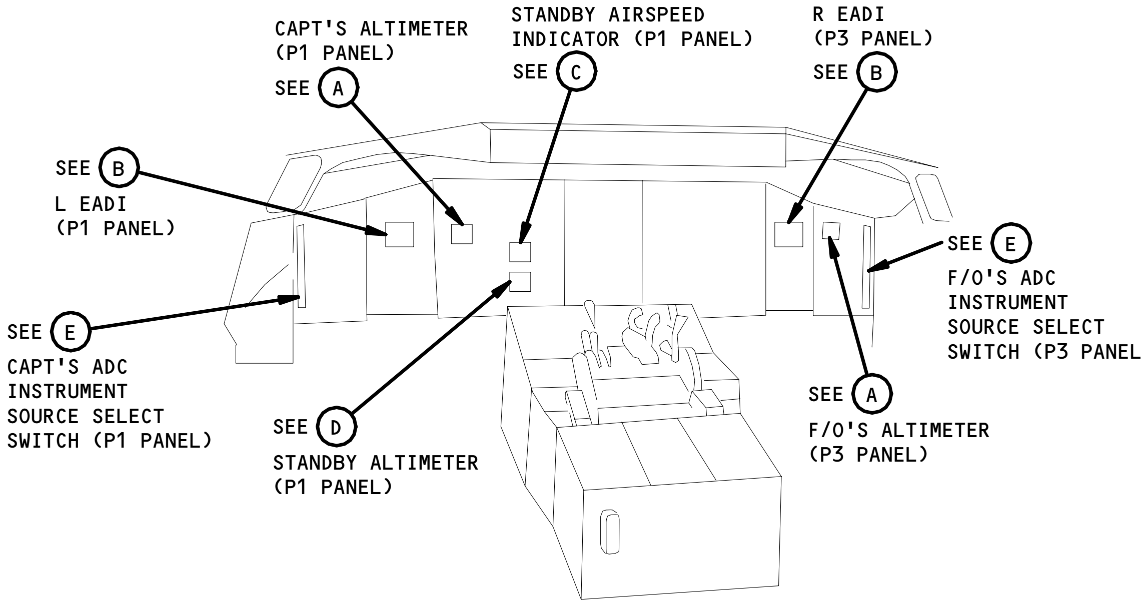
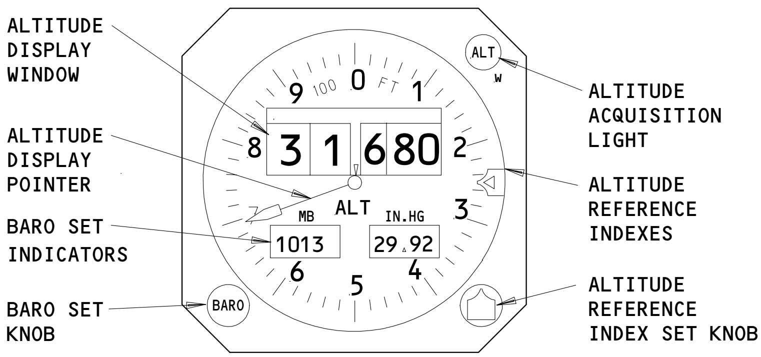
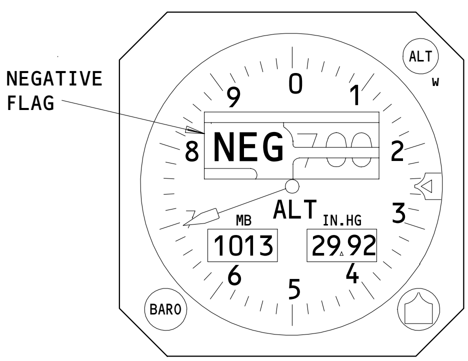




STANDARD BARO CORRECTION

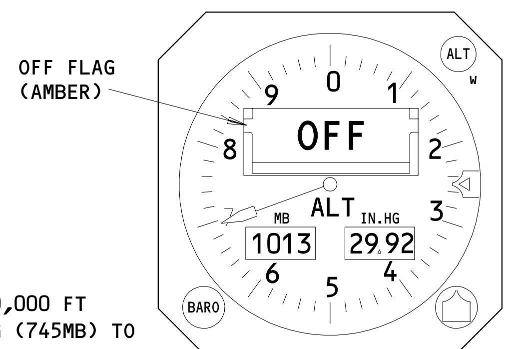


NEGATIVE ALTITUDE -
SHUTTER IN VIEW

NOTE:

DISPLAY RANGE

ALTITUDE: -1000 TO 50,000 FT
BARO SET: 22.00 IN HG (745MB) TO
31.00 IN HG (1049MB)



FLAG IN VIEW

ALTIMETER
A

Air Data Instruments Components
Figure 1 (Sheet 1)

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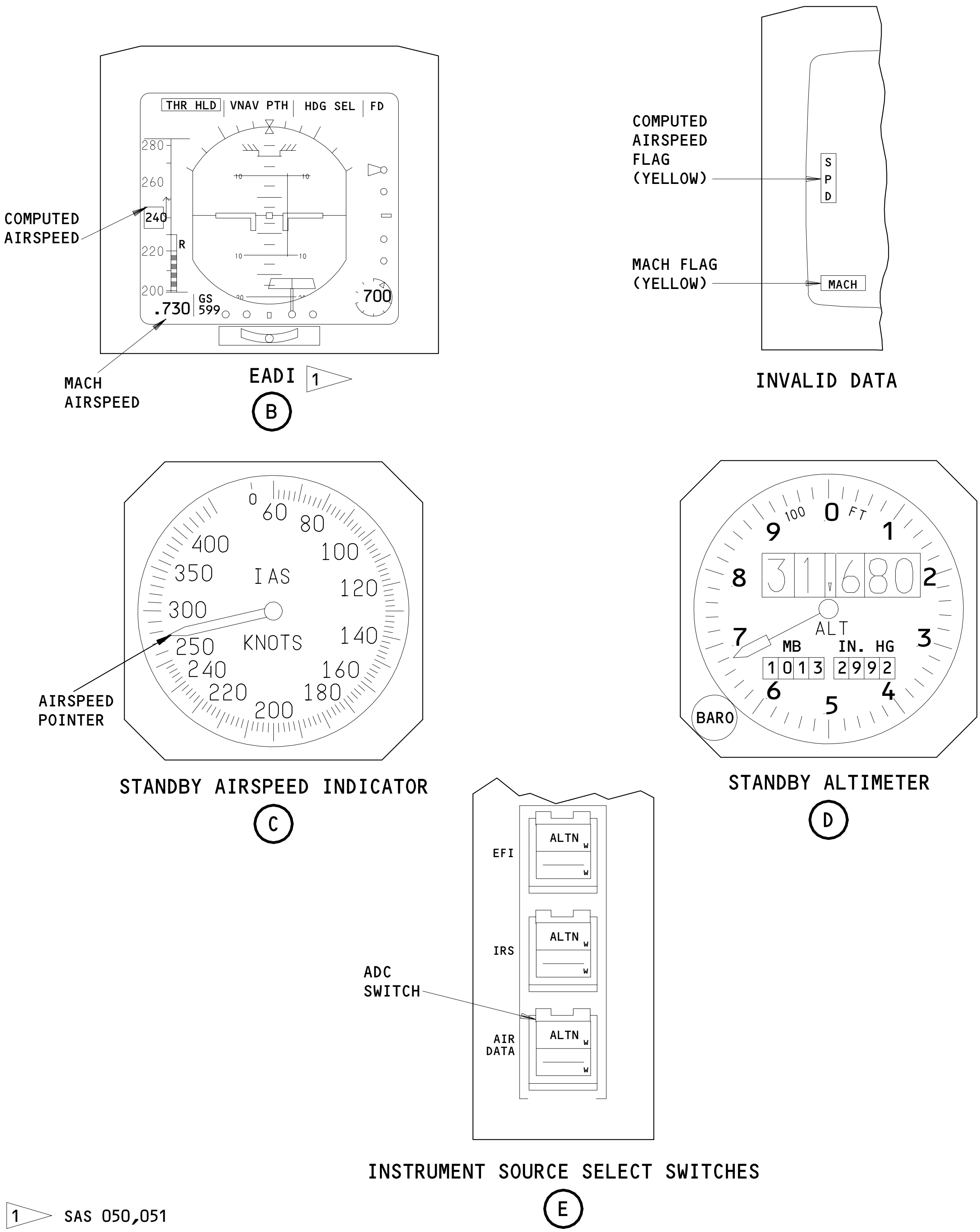

Air Data Instruments - Component Location
Figure 1 (Sheet 2)

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(3) The indicator may be adjusted to local barometric pressure by means of the BARO set knob on the indicator. Two counters indicate the barometric setting. One reads in inches of mercury from 22.00 to 30.99 in. Hg. The other reads in millibars from 745 to 1049 mbs.

(4) The altitude reference index is located on the outer edge of the indicator. The marker is manually set by the altitude reference set knob located on the lower right corner.

(5) An altitude acquisition (ALT) light is located on the upper right corner. The light comes on when the altitude alert system is activated.

(6) If the altimeter is defective, if the input signal to the altimeter is bad, or if electrical power is removed, the OFF flag will show in front of the counter, and the counter and the pointer will stop. If there is a large difference between the altitude on the display and the altitude of the airplane, the OFF flag will show until the altimeter's pointer and counter agree with the altitude of the airplane.

(7) One altimeter is installed in the pilot's center instrument panel. Another is installed on the F/O's main instrument panel.

B. Standby Altimeter

(1) The standby altimeter serves as a backup to the pilots' electric altimeters. The standby altimeter displays altitude from -1000 to 50,000 feet by means of a drum counter and a pointer. The altitude readout displays are identical to the electric altimeter. Baro settings and readout are also the same.

(2) The indicator can be adjusted to local barometric pressure by means of the BARO set knob. Two counters indicate the barometric setting. One reads in inches of mercury from 22.00 to 31 in Hg. and the other reads in millibars from 745 to 1050 mbs.

(3) The Standby Altimeter is located on the pilot's center instrument panel.

C. Standby Airspeed Indicator

(1) The standby airspeed indicator provides a visual display of the indicated airspeed in the range of 60 to 450 knots. Airspeed is indicated by a pointer read against a graduated scale which is divided into 2-knot increments.

(2) The standby airspeed indicator is installed in the pilot's center instrument panel.

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D. EADI

(1) The EADI's display computed airspeed and MACH. Computed airspeed is displayed on the left side of the EADI's. MACH data is displayed in the lower left corner.

(2) Computed airspeed is indicated by a white airspeed tape that moves against a fixed green pointer. Speed scale numbers are also in white. When the speed is equal to or less than 30 knots or NCD, the tape indicates 30 knots. Speed scale below 30 knots is blank. Invalid data is annunciated by replacing the normal display with the letters SPD in a yellow box (Ref 34-22-00).

(3) MACH is indicated by white numerics and is displayed for MACH values greater than or equal to .400. Invalid data is annunciated by replacing the normal display with the letters MACH in yellow outlined by a yellow box (Ref 34-22-00). For MACH NCD, three dashes are displayed.

(4) Airspeed trend, a green symbol placed alongside the airspeed tape, indicates the airspeed acceleration or deceleration. For acceleration, the arrow points upward and for deceleration, the arrow points downward. The symbol is displayed when the trend is greater than 4.5 knots and is removed when the trend is less than 3.5 knots.

3. <u>Operation</u> (Fig. 2)

A. AIR DATA Instrument Source Select Switch

(1) The EFIS Symbol Generators and the altimeter both receive data from both air data computers. The captain's instruments normally run off the left ADC and the first officer's instruments off the right ADC. When either the captain's or first officer's AIR DATA switch is set to ALTN, a discrete is sent to the respective EFIS Symbol Generator and altimeter. This causes these instruments to switch over to the alternate ADC.

B. Altimeter

(1) Power

(a) The altimeter receives 115v ac from the altimeter circuit breaker for its power supply. It receives 26v ac from the ADC for resolver excitation. It also receives 28v dc from the lighting circuits for the ALT acquisition light.

(b) In case of a left power bus failure, the capt's altimeter is switched over to the right bus. This occurs when the left bus drops below 97 ±2v ac for more than 180mS. The capt's altimeter switches back to the left bus, when the left bus returns to greater than 106 ±2v ac for more than 1.2 seconds (Ref 24-51-00).

(c) For a right bus failure the F/O's altimeter is switched to the left bus as described for the Capt's altimeter.

(2) The following description is common to both the captain's and F/O's altimeters.

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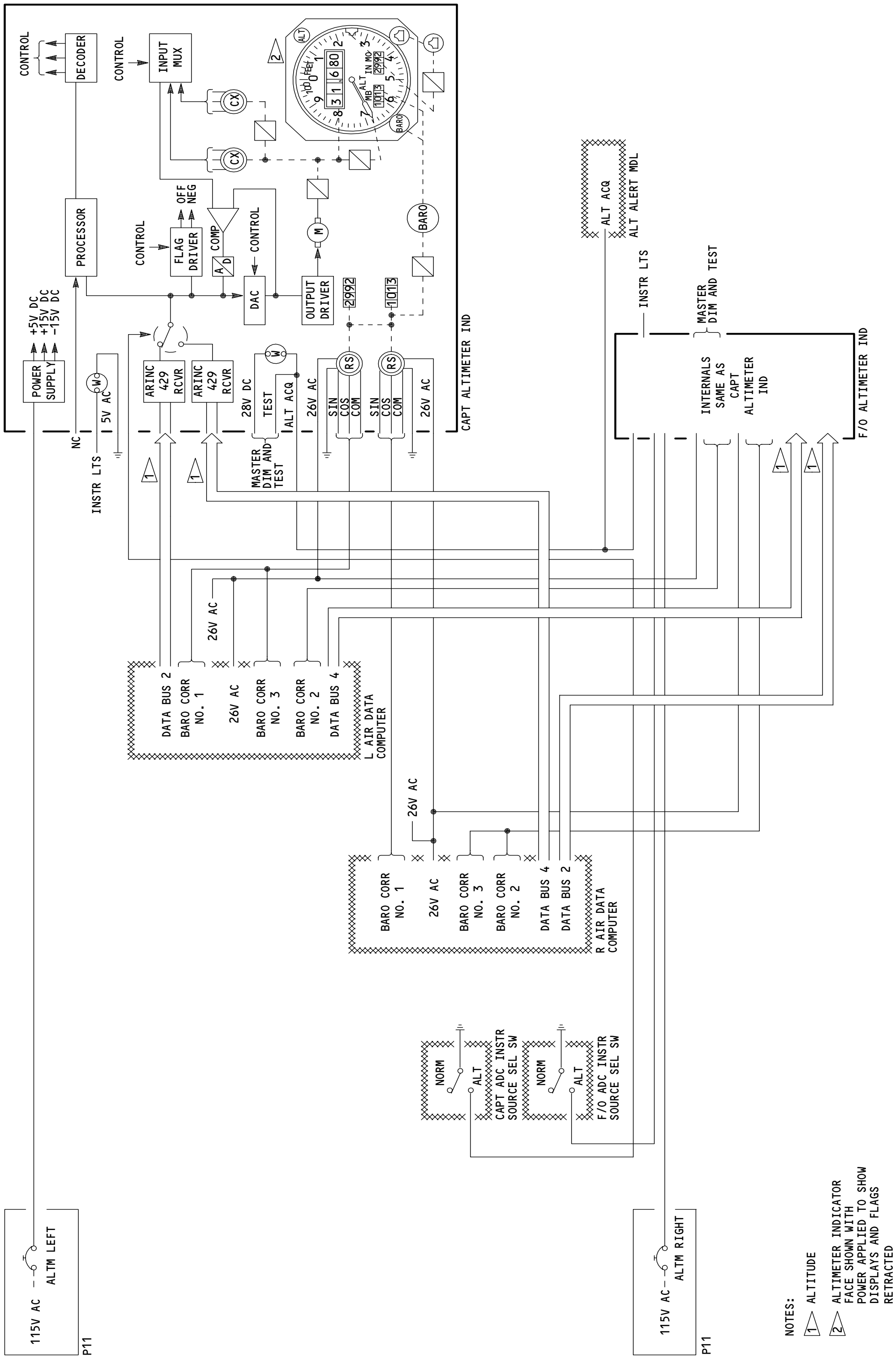

Left and Right Air Data Instruments Schematic
Figure 2 (Sheet 1)

244048

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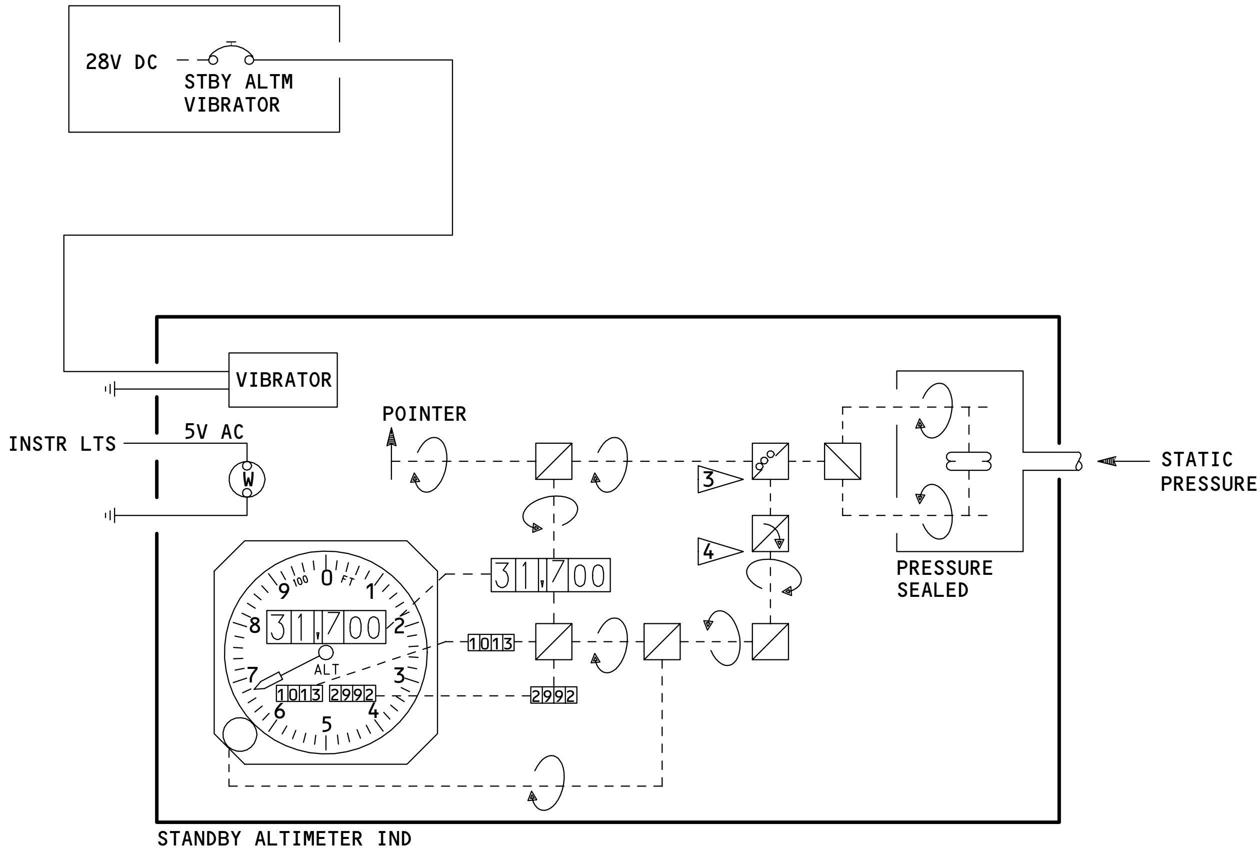

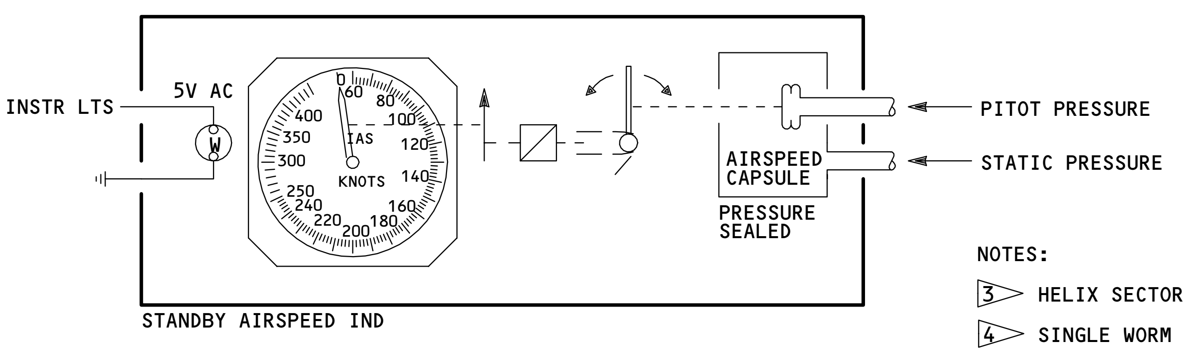

Left And Right Air Data Instruments Schematic
Figure 2 (Sheet 2)

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(3) Altitude Display

(a) The altimeter receives altitude data on an ARINC 429 digital data bus from both ADC's. The AIR DATA instrument source select switch controls ADC input switching and therefore which ADC feeds the altimeter. The altitude data is buffered and then transferred to the processor. The processor controls all operations by execution of its stored program. It also performs data calculations, storage, and failure monitoring.

(b) After the data is processed, it is routed to the digital-to-analog converter (DAC). The analog signal is output to both the comparator (COMP) and to the output driver. The analog signal drives the pointer and drum display through the servo motor and driver. They are driven to the position determined by the ADC input.

(c) The motor also drives the two-speed resolver. The resolver pick-off sends position feedback signals to the input MUX. The MUX output or display position is compared with the desired position. Any error signal is processed and routed to the servo loop. The servo error is reduced to a null when the displayed altitude equals the ADC input.

(4) BARO Correction

(a) The BARO set knob on the front panel is used to correct for variations in local barometric pressure. It is mechanically linked to the front panel BARO counters. Two resolvers, linked to the counters, transmit the BARO correction to the ADC.

(5) Altitude Acquisition Light

(a) The altitude acquisition light comes on when within 900 feet of the selected altitude (Ref 34-16-00). It will go off when within 300 feet of this altitude.

(6) Altitude Reference Index

(a) The altitude reference index is manually driven by the reference index knob. The index moves around the outer edge of the display and can be set anywhere on the dial. This system is independent of any other system in the indicator.

C. Standby Altimeter

(1) The standby altimeter receives static pressure from the alternate static system. The altimeter mechanism is housed in an airtight case, into which static air enters. Two aneroid diaphragms expand or contract in response to the static pressure change.

(2) The aneroid diaphragms drive the altitude gear train. The gear train links mechanically to the altitude counter and pointer.

(3) Rotation of the BARO set knob on the front panel provides correction for local changes in barometric pressure. The knob drives the spiral gear and linkage. This changes the operation of the mechanical drive system to correct for pressure variations. It also drives the two BARO counters.

(4) A vibrator is used on the standby altimeter to reduce friction errors in the mechanical linkage and to improve indicator response. The vibrator receives 28v dc power from the 28v dc standby bus. Power is controlled by the STBY ALTM VIBRATOR circuit breaker on the P11 panel.

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D. Standby Airspeed Indicator

(1) The indicator mechanism is contained in a hermetically sealed case with two pressure ports. One port is for static pressure which is supplied to the case interior. The other port is connected to the aneroid diaphragm and supplies pitot pressure. The diaphragm expands and contracts in response to changes in the pitot-static pressure. This deflection is transmitted by the rocking shaft sector gear to the pinion drive gear. This gear converts the linear motion to rotary movement of the pointer shaft and airspeed pointer. The hairspring removes backlash from the mechanism.

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AIR DATA INSTRUMENTS

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
ALTIMETER - CAPTAIN, N8	--	1	FLT COMPT, P1	34-13-01
ALTIMETER - FIRST OFFICER, N48	--	1	FLT COMPT, P3	34-13-01
ALTIMETER - STANDBY, N23	--	1	FLT COMPT, P1	34-13-06
CIRCUIT BREAKERS -	--		FLT COMPT, P11	*
ALTM LEFT, C584		1	11E2	*
ALTM RIGHT, C585		1	11E23	*
STBY ALTM VIB, C591		1	11A8	*
COMPUTERS - (34-12-00/101)				
AIR DATA LEFT, M100				
AIR DATA RIGHT, M101				
INDICATOR - STANDBY AIRSPEED, N22	--	1		34-13-05
MODULE - (34-16-00/101)				
ALTITUDE ALERT, M617			FLT COMPT, P1	
PANEL - (22-11-00/101)				
AFCS MODE CONTROL, M90				
SWITCHES - (34-12-00/101)				
CAPTAIN ADC INSTRUMENT SOURCE SELECT, S482				
FIRST OFFICER ADC INSTRUMENT SOURCE SELECT, S483				

* SEE THE WDM EQUIPMENT LIST

Air Data Instruments - Component Index
Figure 101

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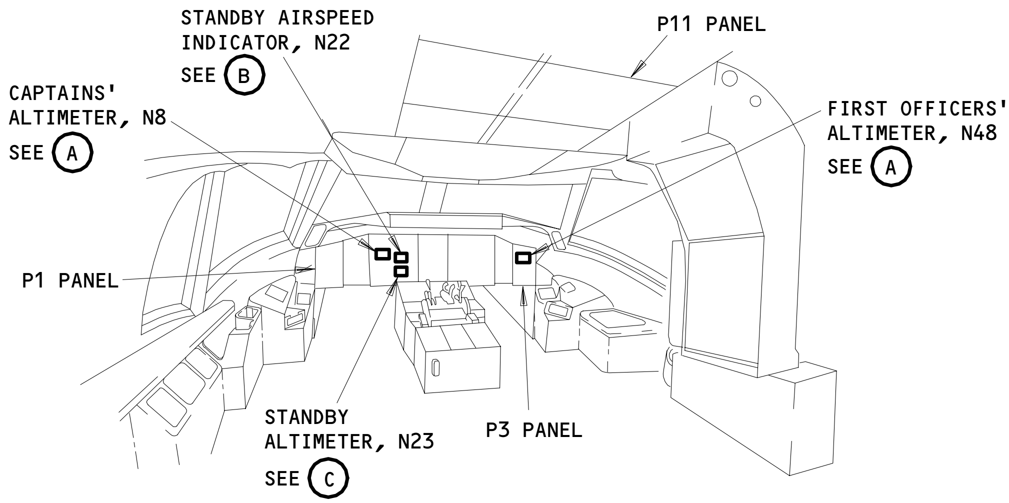
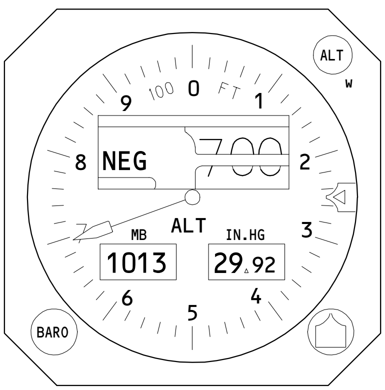
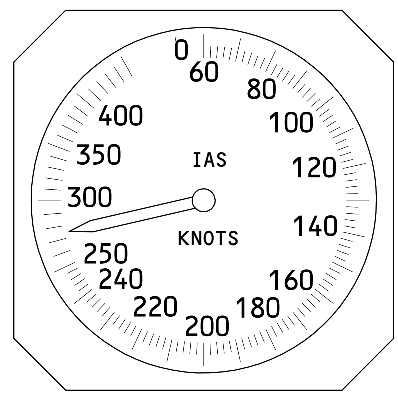


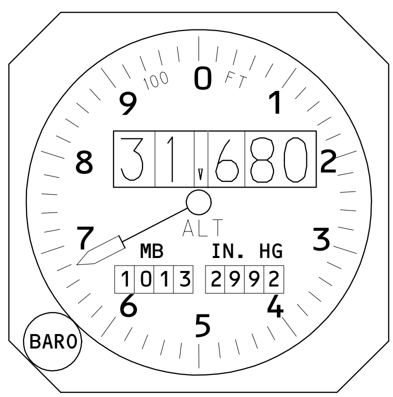
FLIGHT COMPARTMENT



ALTIMETER (WITH OFF FLAG)
A



STANDBY AIRSPEED INDICATOR
B



STANDBY ALTIMETER
C

Air Data Instruments - Component Location
Figure 102

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AIR DATA INSTRUMENTS - ADJUSTMENT/TEST

1. General
   A. This procedure contains two tasks. The first task is the system test for the Standby Airspeed Indicator. The second task is the system test for the Standby Altimeter.
   B. The operational and system tests for the electric air data instruments are done in the air data computer system adjustment/test (34-12-00/501). This procedure does the test for air data instruments that get inputs directly from the pitot and/or static system. These instruments are the Standby Airspeed Indicator and the Standby Altimeter. This test uses the pitot-static system to give indication of airspeed and altitude for these two instruments. Equipment used, operation, and setup are included in the Pitot-Static System Pressurization (AMM 34-11-00/201).

TASK 34-13-00-735-001

2. System Test - Standby Airspeed Indicator
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
      (2) AMM 34-11-00/201, Pitot-Static System
      (3) AMM 34-11-00/501, Pitot-Static System
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 865-003
      (1) Make sure this circuit breaker on the P11 panel is closed:
          (a) 11B7, LIGHTS STBY INSTR

      S 865-059
      (2) Prepare to pressurize the alternate static system and the auxiliary pitot system No. 1 (AMM 34-11-00/201).

      S 865-060

      CAUTION: KEEP DIFFERENTIAL PRESSURE BETWEEN THE PITOT AND STATIC SYSTEM LESS THAN 10 INCHES OF MERCURY. FAILURE TO DO THIS COULD CAUSE INSTRUMENT OR EQUIPMENT DAMAGE.

      CAUTION: KEEP THE ABSOLUTE PRESSURE OF THE PITOT SYSTEM THE SAME AS OR GREATER THAN THE PRESSURE IN THE STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO INSTRUMENTS OR EQUIPMENT.

      CAUTION: KEEP THE PITOT SYSTEM AT A POSITIVE PRESSURE. DO NOT APPLY A VACUUM TO THE SYSTEM OR IT CAN CAUSE DAMAGE TO THE ELEVATOR FEEL COMPUTER.

      (3) Make sure that you only apply positive pressure to the pitot system.

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S 865-057
(4) Apply pressures equivalent to airspeeds specified in the table that follows. Make sure the values on the standby airspeed indicator are less than the tolerances shown for each airspeed value.

AIRSPEED (KNOTS)	PRESSURE (PITOT MINUS STATIC) (INCHES MERCURY)	TOLERANCES (KNOTS)
120	.695	± 3
180	1.580	± 4
250	3.100	± 4
280	3.924	± 5
300	4.534	± 5

D. Put the Airplane Back to Its Usual Condition

S 865-058
(1) Set pitot-static system to ambient (AMM 34-11-00/201).

S 865-011
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

S 865-061
(3) Remove the pitot-static test equipment and seals (AMM 34-11-00).

TASK 34-13-00-735-005
3. System Test - Standby Altimeter
A. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 34-11-00/201, Pitot-Static System

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(3) AMM 34-11-00/501, Pitot-Static System

B. Access

(1) Location Zones

211/212 Flight Compartment

C. Procedure

S 865-009

(1) Supply electrical power (AMM 24-22-00/201).

S 865-010

(2) Make sure these circuit breakers on the P11 panel are closed:

(a) 11A8, STBY ALTM VIB

(b) 11B7, LIGHTS STBY INSTR

S 865-069

(3) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags.

(a) 6C2, RAM AIR TURBINE AUTO

(b) 6J8, RAM AIR TURBINE PWR

S 845-024

(4) Make sure the vibrator in the standby altimeter operates.

NOTE: Feel the standby altimeter casing.

S 825-025

(5) Set BARO scale to 29.92 inches of mercury (1013 millibars).

S 035-026

CAUTION: IF THE ABSOLUTE PRESSURE IN THE AUXILIARY PITOT SYSTEM NO. 1 DECREASES BELOW AMBIENT PRESSURE, DISCONNECT THE PITOT LINES CONNECTED TO THE ELEVATOR FEEL COMPUTER AND SEAL THEM WITH CAPS. IF YOU DO NOT, IT CAN CAUSE DAMAGE TO THE ELEVATOR FEEL COMPUTER.

(6) Disconnect the lower left pitot line from the Elevator Feel Computer (AMM 34-11-00/501).

S 435-027

(7) Seal the pitot line with a cap.

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S 435-070

(8) Disconnect the alternate static line from the RAT airspeed switch (AMM 29-21-24) and seal the end of the disconnected pipe with a suitable plug.

S 865-028

CAUTION: KEEP DIFFERENTIAL PRESSURE BETWEEN THE PITOT AND STATIC SYSTEM LESS THAN 10 INCHES OF MERCURY. FAILURE TO DO THIS COULD CAUSE INSTRUMENT OR EQUIPMENT DAMAGE.

CAUTION: KEEP THE ABSOLUTE PRESSURE OF THE PITOT SYSTEM THE SAME AS OR GREATER THAN THE PRESSURE IN THE STATIC SYSTEM. FAILURE TO DO THIS COULD CAUSE DAMAGE TO INSTRUMENTS OR EQUIPMENT.

(9) Pressurize alternate static system (AMM 34-11-00/201).

S 865-030

(10) Apply pressures to the alternate static system equivalent to altitudes shown in the table that follows. Make sure values on the standby altimeter are less than tolerances shown for each test point. At each test point, decrease pressure slowly to the correct level without overshoot.

ALTITUDE (FEET)	PRESSURE (STATIC) INCHES MERCURY	ACCURACY FEET
0	29.921	± 25
5,000	24.896	± 45
10,000	20.577	± 60
20,000	13.750	± 100
25,000	11.104	± 120
40,000	5.538	± 200

S 825-033

(11) Set pitot-static system to ambient (AMM 34-11-00/201).

S 435-035

(12) Connect lower-left pitot line at Elevator Feel Computer and do the system leak check (AMM 34-11-00/501).

S 435-071

(13) Remove the plug from and reconnect the alternate static line to the RAT airspeed switch (AMM 29-21-24).

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S 435-072

(14) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the main power distribution panel, P6.
  (a) 6C2, RAM AIR TURBINE AUTO
  (b) 6J8, RAM AIR TURBINE PWR

S 865-006

(15) Remove electrical power if it is not necessary (AMM 24-22-00/201).

S 085-007

(16) Remove the pitot-static test equipment and seals (AMM 34-11-00).

TASK 34-13-00-735-017

4. System Test - Air Data Standby Instruments

A. References
  (1) AMM 24-22-00/201, Electrical Power - Control
  (2) AMM 34-11-00/201, Pitot-Static System
  (3) AMM 34-11-00/501, Pitot-Static System

B. Access
  (1) Location Zones
      211/212 Flight Compartment

C. Procedure

S 865-018

(1) Supply electrical power (AMM 24-22-00/201).

S 865-019

(2) Make sure these circuit breakers on the P11 panel are closed:
  (a) 11A8, STBY ALTM VIB
  (b) 11B7, LIGHTS STBY INSTR

S 865-036

(3) Make sure the vibrator in the standby altimeter operates.

NOTE: Feel the standby altimeter casing.

S 865-037

(4) Set BARO scale to 29.92 inches of mercury (1013 millibars).

S 035-038

CAUTION: YOU MUST DISCONNECT THE ELEVATOR FEEL COMPUTER FROM THE PITOT STATIC SYSTEM. YOU CAN CAUSE DAMAGE TO THE ELEVATOR FEEL COMPUTER.

(5) Disconnect the lower left pitot line from the Elevator Feel Computer (AMM 34-11-00/501).

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S 865-062
(6) Apply pressures to the pitot-static system for each test point shown in Table 501 (AMM 34-11-00/201).

S 865-039
(7) Add the head correction from Fig. 501, to the standby altimeter indication.

S 865-040
(8) Make sure the value on the standby indicator is less than the tolerance shown in Table 501.

Table 501

TEST POINT	STATIC PRESSURE (In. Hg)	DIFF PRESSURE (In. Hg)	PITOT PRESSURE (In. Hg)	STANDBY ALTIMETER (Feet)	STANDBY ALTIMETER (Meters)	STANDBY AIRSPEED (Knots)
1	29.921	0.695	30.616	0 ±25	0 ±6	120 ±3
2	24.896	1.580	26.476	5000 ±45	1524 ±12	180 ±4
3	20.577	3.100	23.677	10,000 ±60	3048 ±24	250 ±4
4	13.750	3.924	17.674	20,000 ±100	6096 ±40	280 ±5
5	5.538	4.534	10.072	40,000 ±200	12,000 ±70	300 ±5

D. Instrument Leak Test

S 865-063
(1) Close the pitot and static system cutoff valves.

S 175-041
(2) Stop for 5 to 6 minutes to let the systems become stable.
(a) Read and write the values of the altitude and airspeed on the standby altimeter and standby airspeed indicator.

S 865-064
(3) Stop for one more minute and read the altitude and airspeed again.
(a) Make sure that the altitude did not decrease by more than 400 feet or 120 meters.

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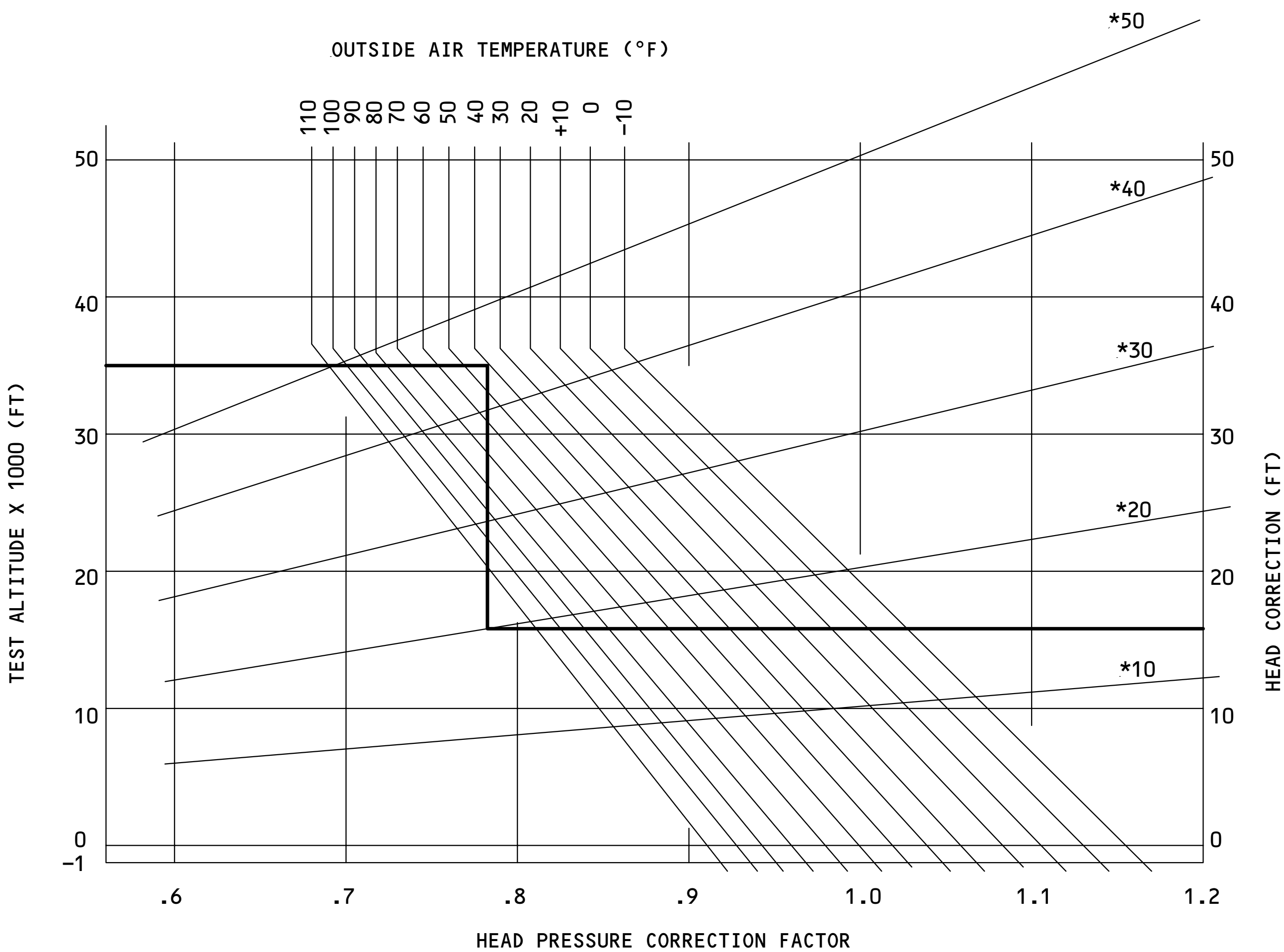

*VERTICAL SEPARATION
BETWEEN PRESSURE
SOURCE AND SENSOR

EXAMPLE: TEST ALTITUDE = 35,000 FEET
OUTSIDE AIR TEMPERATURE = 40°F
VERTICAL SEPARATION = 20 FEET
HEAD PRESSURE CORRECTION = +16 FEET

NOTE: IF THE PRESSURE SOURCE IS ABOVE THE SENSOR, THE CORRECTION FACTOR MUST BE SUBTRACTED FROM THE ALTITUDE.

Head Correction
Figure 501

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(b) Make sure that the airspeed did not decrease by more than 5.0 knots (0.16 in. Hg).

S 865-065

CAUTION: THE PITOT LINE PRESSURE MUST BE EQUAL OR MORE THAN THE STATIC LINE PRESSURE. KEEP THE RATE OF THE PITOT PRESSURE CHANGE LESS THAN 300 KNOTS FOR EACH MINUTE. KEEP THE RATE OF THE STATIC PRESSURE CHANGE LESS THAN 5,000 FEET FOR EACH MINUTE. KEEP THE DIFFERENTIAL PRESSURE BETWEEN 0 AND 9.33 INCHES OF MERCURY. IF YOU DO NOT FOLLOW THE INSTRUCTIONS ABOVE, YOU CAN CAUSE DAMAGE TO THE EQUIPMENT.

(4) Open the pitot and static system cutoff valves.

S 865-066

(5) Put the pitot-static system to the ambient condition (AMM 34-11-00/201).

S 435-046

(6) Connect the lower left pitot line at the Elevator Feel Computer and do the system leak check (AMM 34-11-00/501).

S 865-020

(7) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ALTIMETER - REMOVAL/INSTALLATION

1. General
   A. There are two altimeters (N8-Left and N48-Right). The procedures that follow are for the removal, installation and check out of the unit.

TASK 34-13-01-004-001

2. Altimeter Removal
   A. References
      (1) 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 864-023
      (1) Make sure the two F/D switches on the MCP are in the OFF position.

      S 864-008
      (2) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) For the captain's altimeter:
              1) 11A10, AIR DATA CMPTR L
              2) 11A11, AIR DATA AOA SENSOR L
              3) 11A12, AIR DATA BARO CORRECT L
              4) 11E2, ALTM LEFT
              5) 11P2, LIGHTING INSTRUMENT & PANEL CAPT
          (b) For the first officer's altimeter:
              1) 11E23, ALTM RIGHT
              2) 11F30, AIR DATA CMPTR RIGHT
              3) 11F31, AIR DATA AOA SENSOR RIGHT
              4) 11F32, AIR DATA BARO CORRECT RIGHT
              5) 11P28, LIGHTING INSTRUMENT & PANEL F/O

      S 034-009
      (3) Loosen the clamp screws on the front panel adjacent to the indicator.

      S 014-010
      (4) Move the altimeter out of the instrument panel.

      S 034-011
      (5) Disconnect the electrical cable.

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S 024-012
(6) Remove the altimeter.

TASK 34-13-01-404-004
3. Altimeter Installation
A. References
(1) 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 864-018
(1) Make sure the two F/D switches on the MCP are in the OFF position.

S 864-013
(2) Make sure these circuit breakers on the P11 panel are open:
(a) For the captain's altimeter:
1) 11A10, AIR DATA CMPTR L
2) 11A11, AIR DATA AOA SENSOR L
3) 11A12, AIR DATA BARO CORRECT L
4) 11E2, ALTM LEFT
5) 11P2, LIGHTING INSTRUMENT & PANEL CAPT
(b) For the first officer's altimeter:
1) 11E23, ALTM RIGHT
2) 11F30, AIR DATA CMPTR RIGHT
3) 11F31, AIR DATA AOA SENSOR RIGHT
4) 11F32, AIR DATA BARO CORRECT RIGHT
5) 11P28, LIGHTING INSTRUMENT & PANEL F/O

S 434-014
(3) Connect the electrical cable.

S 424-016
(4) Install the altimeter.

S 434-015
(5) Tighten the clamp screws.
D. Altimeter Test

S 864-020
(1) Supply electrical power (Ref 24-22-00).

S 864-022
(2) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) For the captain's altimeter:
1) 11A10, AIR DATA CMPTR L
2) 11A11, AIR DATA AOA SENSOR L

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3) 11A12, AIR DATA BARO CORRECT L
4) 11E2, ALTM LEFT
5) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

(b) For the first officer's altimeter:
1) 11E23, ALTM RIGHT
2) 11F30, AIR DATA CMPTR RIGHT
3) 11F31, AIR DATA AOA SENSOR RIGHT
4) 11F32, AIR DATA BARO CORRECT RIGHT
5) 11P28, LIGHTING INSTRUMENT & PANEL F/O

S 864-019

(3) Set the BARO position on the altimeter to the BARO-correction value for the day of installation.

S 754-021

(4) Make sure the altimeter OFF flag does not show.

E. Put the Airplane Back to Its Usual Condition

S 864-021

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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STANDBY AIRSPEED INDICATOR - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task is to remove the standby airspeed indicator. The second task is to install the standby airspeed indicator. The installation task also includes a test of the standby airspeed indicator.

TASK 34-13-05-004-001

2. Standby Airspeed Indicator Removal
   A. References
      (1) 24-22-00/201, Electrical Power - Control
      (2) 34-11-00/501, Pitot-Static System
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 864-016
      (1) Open these circuit breakers on the overhead panel P11 and attach DO-NOT-CLOSE tags:
          (a) 11B7, LIGHTS STBY INSTR
          (b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

      S 034-002

      CAUTION: CAREFULLY MOVE THE INDICATOR OUT OF THE INSTRUMENT PANEL. THIS CAN CAUSE DAMAGE TO THE CABLE AND PNEUMATIC HOSE AT THE REAR OF THE INDICATOR.

      (2) Loosen the two larger clamp screws adjacent to the indicator.

      S 014-018
      (3) Move the indicator out of the instrument panel.

      S 034-019
      (4) Disconnect the electrical cable.

      S 034-003

      WARNING: MAKE SURE THE PITOT-STATIC SYSTEM IS AT AMBIENT PRESSURE BEFORE YOU DISCONNECT THE HOSES. INJURY TO PERSONNEL CAN OCCUR.

      (5) Operate the quick disconnects to disconnect the pitot and static hoses.

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S 024-020
(6) Remove the standby airspeed indicator.

TASK 34-13-05-404-004

3. Standby Airspeed Indicator Installation

A. General
   (1) You do not have to do a leak test when you connect a quick-disconnect fitting. A visual examination of the quick-disconnect for a complete seal is necessary. You must do a leak test when you cannot make sure that the quick-disconnect has a complete seal.

B. References
   (1) 24-22-00/201, Electrical Power - Control
   (2) 34-11-00/501, Pitot-Static System

C. Access
   (1) Location Zones
       211/212 Flight Compartment

D. Procedure

S 864-021
(1) Make sure these circuit breakers on the P11 panel are open:
   (a) 11B7, LIGHTS STBY INSTR
   (b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

S 434-022
(2) If the replacement indicator does not have quick-disconnects, do the steps that follow:
   (a) Remove the quick-disconnects from the used indicator.
   (b) Examine the O-rings for deterioration.
   (c) Replace the O-rings if necessary.
   (d) Install the quick-disconnects on the replacement indicator.
   (e) Tighten the quick disconnect fitting with a torque wrench to 65 in-lb (7.34 N-m).

S 434-029
(3) Connect the electrical cable.

S 434-013

WARNING: PITOT-STATIC SYSTEM MUST BE AT AMBIENT PRESSURE BEFORE PNEUMATIC HOSES ARE CONNECTED. INJURY TO PERSONNEL CAN OCCUR.

(4) Connect the pitot and static hoses.

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S 754-031

(5) Make sure the quick-disconnect fittings are fully mated and connections are locked in position.

(a) Do a visual inspection of the quick disconnect fittings that you disconnected.

1) Make sure the actuation ring of the quick-disconnect fitting is fully engaged on the lock pins and make sure that you see the colored lock ring indicator that shows a correct connection of the quick-disconnect fitting.

S 954-032

(6) If you installed the non-quick disconnect fittings on the replacement indicator, do the step that follows:

(a) Do a low-range leakage test on the alternate static and auxiliary No. 1 pitot systems (Ref 34-11-00).

S 424-015

CAUTION: CAREFULLY PUT THE INDICATOR INTO THE PANEL. THIS CAN CAUSE DAMAGE TO THE CABLE AND PNEUMATIC HOSES AT REAR OF THE INDICATOR.

(7) Install the standby airspeed indicator.

S 434-026

(8) Tighten the clamp screws.

E. Standby Airspeed Test

S 864-025

(1) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:

(a) 11B7, LIGHTS STBY INSTR

(b) 11P2, LIGHTING INSTRUMENT PANEL CAPT

S 864-024

(2) Supply electrical power (Ref 24-22-00).

S 754-023

(3) Make sure the indicator light is on.

F. Put the Airplane Back to Its Usual Condition

S 864-028

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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STANDBY ALTIMETER - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task is to remove the standby altimeter, the second task is to install the standby altimeter.

TASK 34-13-06-004-001

2. Standby Altimeter Removal
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
      (2) AMM 34-11-00/501, Pitot-Static System
   B. Access
      (1) Location Zone
          211/212 Flight Compartment

   C. Procedure

      S 864-018
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11B7, LIGHT STBY INSTR
          (b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT
          (c) 11A8, VIBRATOR, STBY ALTIMETER

      S 024-002

      CAUTION: CAREFULLY MOVE THE INDICATOR OUT OF THE INSTRUMENT PANEL TO PREVENT DAMAGE TO THE CABLE AND PNEUMATIC HOSE AT THE REAR OF THE INDICATOR.

      (2) Loosen the two larger clamp screws adjacent to the indicator.

      S 014-018
      (3) Move the indicator out of the instrument panel.

      S 034-020
      (4) Disconnect the electrical cable.

      S 864-003

      WARNING: THE PITOT-STATIC SYSTEM MUST BE AT AMBIENT PRESSURE BEFORE YOU DISCONNECT THE HOSES. INJURY TO PERSONS CAN OCCUR.

      (5) Operate the quick-disconnect to disconnect the static hose.

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S 024-019
(6) Remove the standby altimeter.

TASK 34-13-06-404-004

3. Standby Altimeter Installation

A. General
(1) You do not have to do a leak test when you connect a quick-disconnect fitting. A visual examination of the quick-disconnect for a complete seal is necessary. You must do a leak test when you cannot make sure that the quick-disconnect has a complete seal.

B. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 34-11-00/501, Pitot-Static System

C. Access
(1) Location Zones
211/212 Flight Compartment

D. Procedure

S 864-020
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11B7, LIGHTS STBY INSTR
(b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT
(c) 11A8, VIBRATOR, STBY ALTIMETER

S 434-015
(2) If the replacement indicator does not have a quick-disconnect, do the steps that follow:
(a) Remove the quick-disconnect from the used indicator.
(b) Inspect the O-ring for deterioration.
(c) Replace the O-ring if necessary.
(d) Install the quick-disconnect on the replacement indicator.
(e) Tighten the quick disconnect fitting with a torque wrench to 65 in-lb (7.34 N-m).

S 434-014
(3) Connect the electrical cable to the indicator.

S 434-013

WARNING: THE PITOT-STATIC SYSTEM MUST BE AT AMBIENT PRESSURE BEFORE YOU CONNECT THE PNEUMATIC HOSES. INJURY TO PERSONNEL CAN OCCUR.

(4) Connect the static hose to the indicator.

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S 754-028
(5) Make sure quick-disconnect fittings are fully mated and that connection is locked in position.
(a) Do a visual inspection of the quick disconnect fittings that you disconnected.
1) Make sure the actuation ring of the quick-disconnect fitting is fully engaged on the lock pins and make sure that you see the colored lock ring indicator that shows a correct connection of the quick-disconnect fitting.

S 954-027
(6) If you installed the non-quick disconnect fitting on the replacement indicator, do the step that follows:
(a) Do a low-range leakage test on the alternate static system (AMM 34-11-00/501).

S 424-016

CAUTION: MAKE SURE YOU CAREFULLY INSERT THE INDICATOR INTO THE PANEL. DAMAGE TO THE CABLE AND PNEUMATIC HOSES CAN OCCUR.

(7) Install the standby altimeter.

S 434-026
(8) Tighten the clamp screws.

E. Standby Altimeter Test

S 864-024
(1) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11B7, LIGHTS STBY INSTR
(b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT
(c) 11A8, Vibrator, STBY ALTIMETER

S 864-023
(2) Supply electrical power (AMM 24-22-00/201).

S 864-019
(3) Make sure the instrument vibrator operates.

S 754-022
(4) Make sure the indicator light is on.

F. Put the Airplane Back to Its Usual Condition

S 864-021
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ALTITUDE ALERT SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The altitude alert system provides the pilots with aural and visual alert signals, when the airplane approaches or deviates from a selected altitude. The selected altitude is set on the autopilot mode select panel. It is compared with the airplane altitude as displayed on the altimeter.
   B. The altitude alert system consists of an altitude alert module and display lights. The selected altitude is set by the pilots on the autopilot mode select panel. Input signals are supplied by other airplane sensors and systems. These signals are processed by the altitude alert module under microprocessor control to provide an output alert signal.
   C. SAS 050-274;
      the altitude alert system is inhibited when the landing gears are down and locked.
   D. SAS 275-999;
      the altitude alert system is inhibited when the landing gears are down and locked unless the ALTERNATE VMO/MMO select switch in the main E/E bay is in the ALTERNATE position.
2. Component Details (Fig. 1)
   A. Altitude Alert Module
      (1) The altitude alert module is located in the warning electronics unit on the P51 panel.
      (2) The altitude alert module is a microprocessor controlled circuit board. It receives and processes the input signals to the system. It also provides alert signals when the airplane approaches or deviates from the selected altitude.
   B. Altitude Advisory Light
      (1) An ALT advisory light is located on the upper right corner of the captain's and first officer's altimeter.
      (2) SAS 154, 156 PRE-SB 34-493;
          SAS 050, 051, 150-153, 155, 157, 162-167, 275-999;
          The white altitude advisory (ALT) light is turned on by the altitude alert module. This occurs when the airplane approaches the selected altitude at less than 900 feet but greater than 300 feet.

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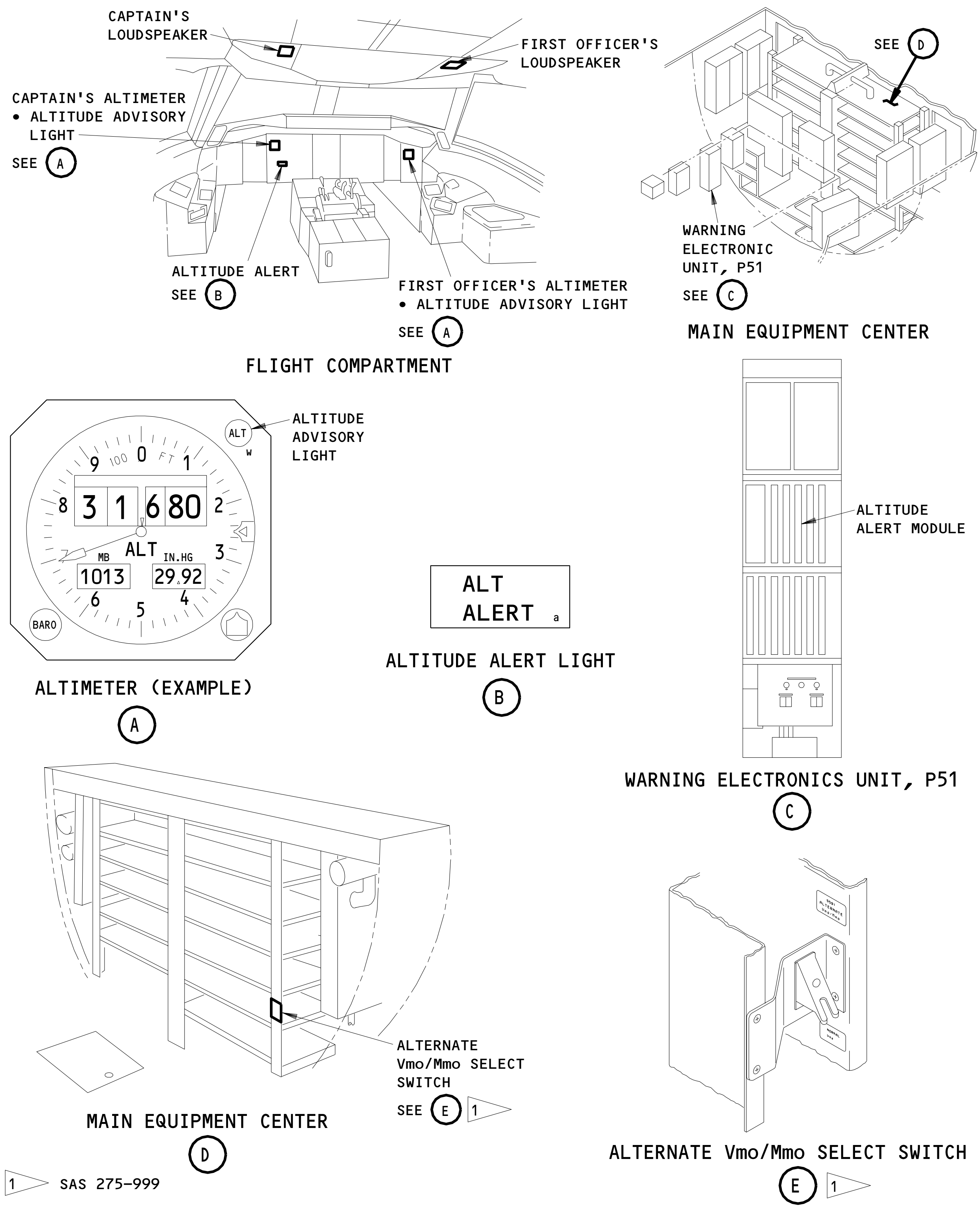

Altitude Alert System Components
Figure 1

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(3) SAS 154, 156, POST-SB 34-493;
The white altitude advisory (ALT) light is turned on by the altitude alert module. This occurs when the airplane approaches the selected altitude at less than 500 feet but greater than 200 feet.

C. Altitude Alert Light

(1) The altitude alert (ALT ALERT) light is located on the center instrument panel.

(2) SAS 154, 156 PRE-SB 34-493;
SAS 050-153, 155, 157-274;
the altitude alert light displays the amber message ALT ALERT. The light is turned on by the altitude alert module when the airplane deviates more than 300 feet but less than 900 feet from the selected altitude.

(3) SAS 275-999;
the altitude alert light shows the amber message ALT ALERT. The light is turned on by the altitude alert module when the airplane approaches the selected altitude at less then 900 feet but greater than 300 feet, and when the airplane deviates from the selected altitude greater than 300 feet. The ALT light remains on until a new altitude is selected on the MCP.

(4) SAS 154, 156 POST-SB 34-493;
The altitude alert light displays the amber message ALT ALERT. The light is turned on by the altitude alert module when the airplane deviates more than 200 feet but less than 500 feet from the selected altitude.

3. Operation (Fig. 2)

A. The altitude alert module receives ±12 volts dc and +5 volts dc power from the power supply modules A and B. The power supplies receive their power through the WARN ELEX A and B circuit breakers on the P11 panel.

B. The following input signals are required by the altitude alert module to check altitude alert conditions:

(1) The airplane altitude input is supplied from the left and right ADC.

(2) Altitude information to the Altitude Alert System is taken from either the left or right ADC dependent upon the operation of the Flight Control Computers (FCC's).

(a) When no FCC is in command or when more than one FCC is in command, the setting of the Captain's ADC instrument source select switch determines which ADC will be used by the Altitude Alert System. When the switch is in NORM, the left ADC is used by the system and when in ALTN, the right ADC is used by the system.

(b) When only one FCC is in command, the Altitude Alert System will use the same ADC that is driving the FCC in command. The left and center FCCs use the left ADC and the right FCC uses the right ADC.

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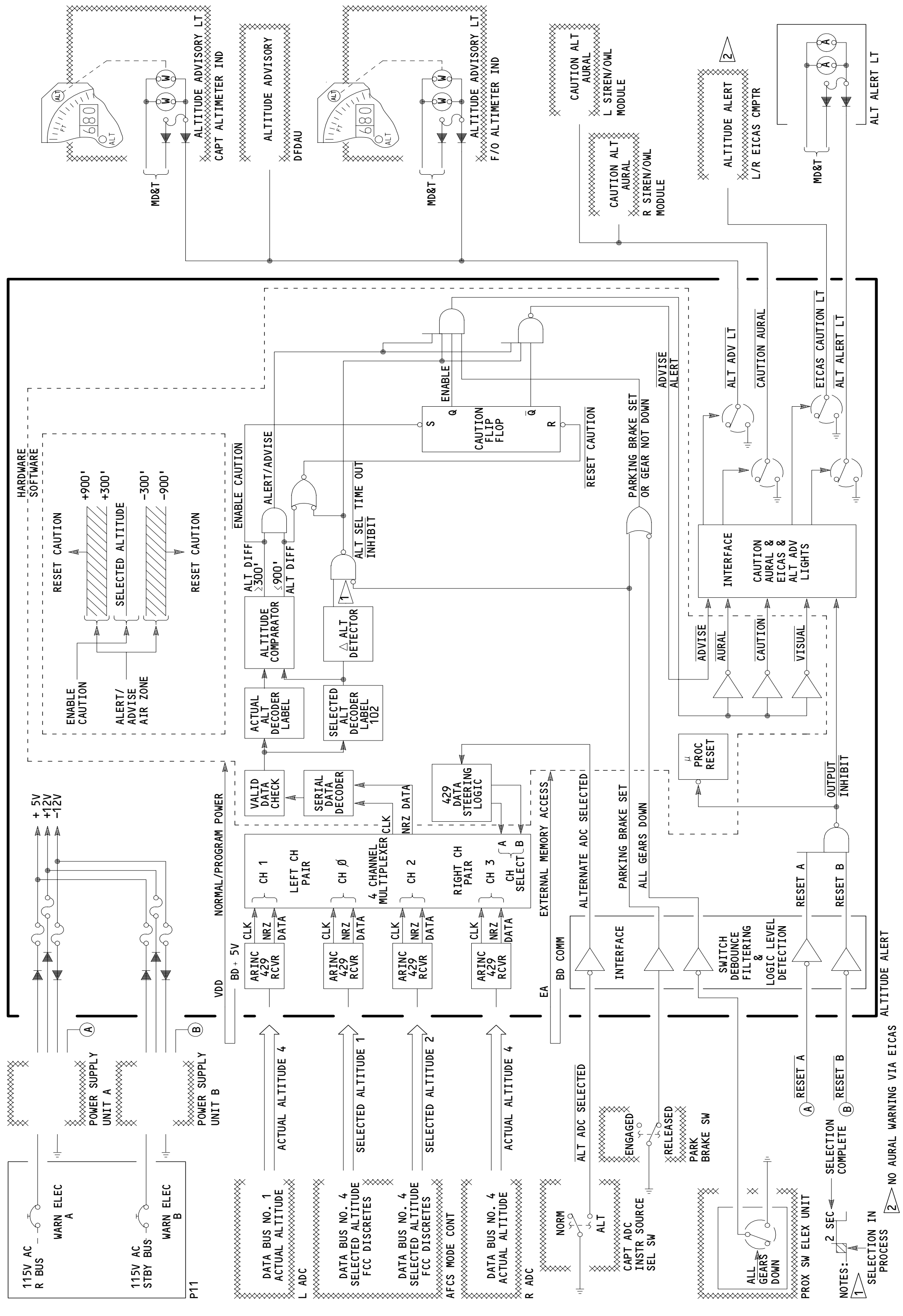

Altitude Alert System Schematic
Figure 2 (Sheet 1)

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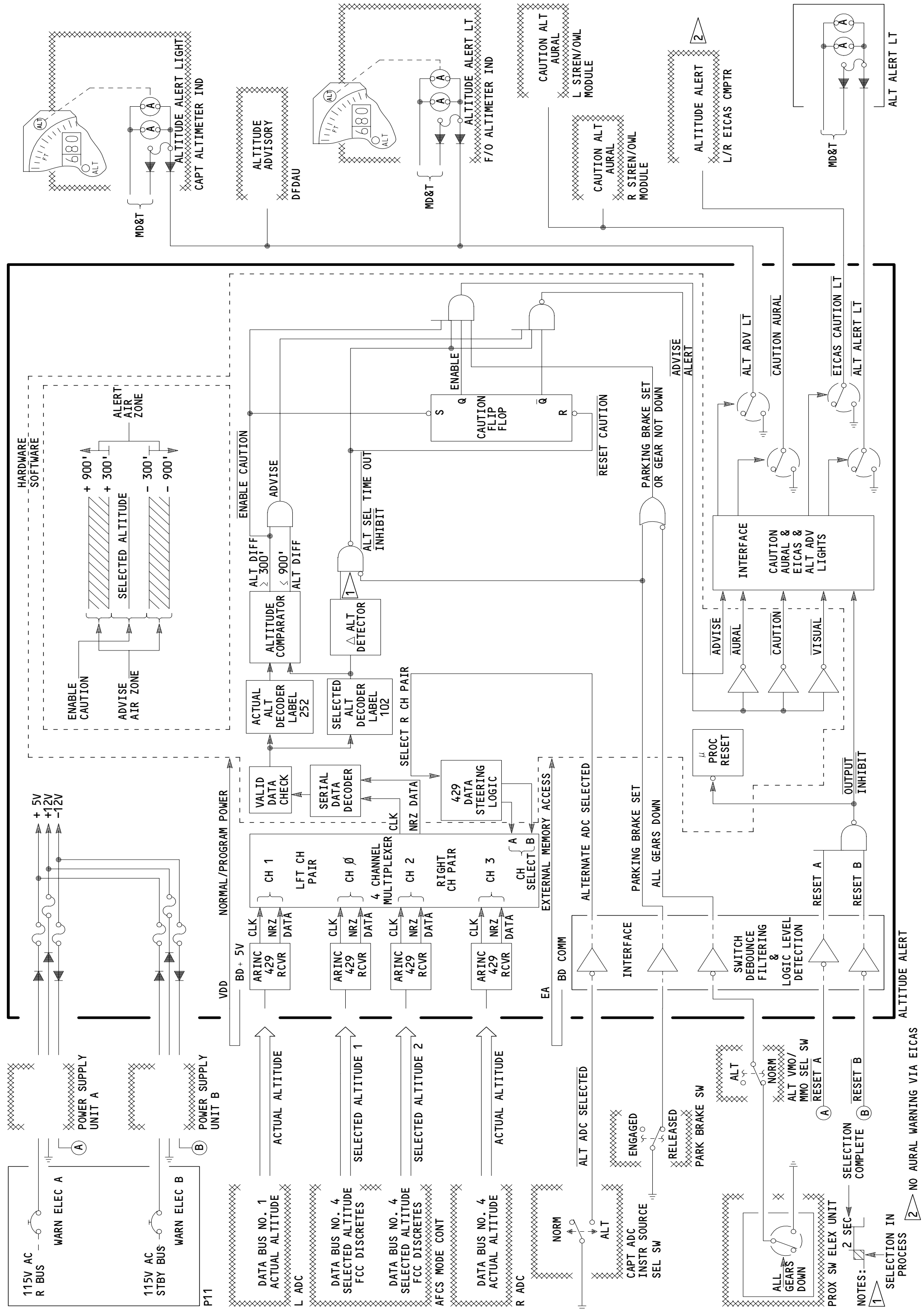

Altitude Alert System Schematic
Figure 2 (Sheet 2)

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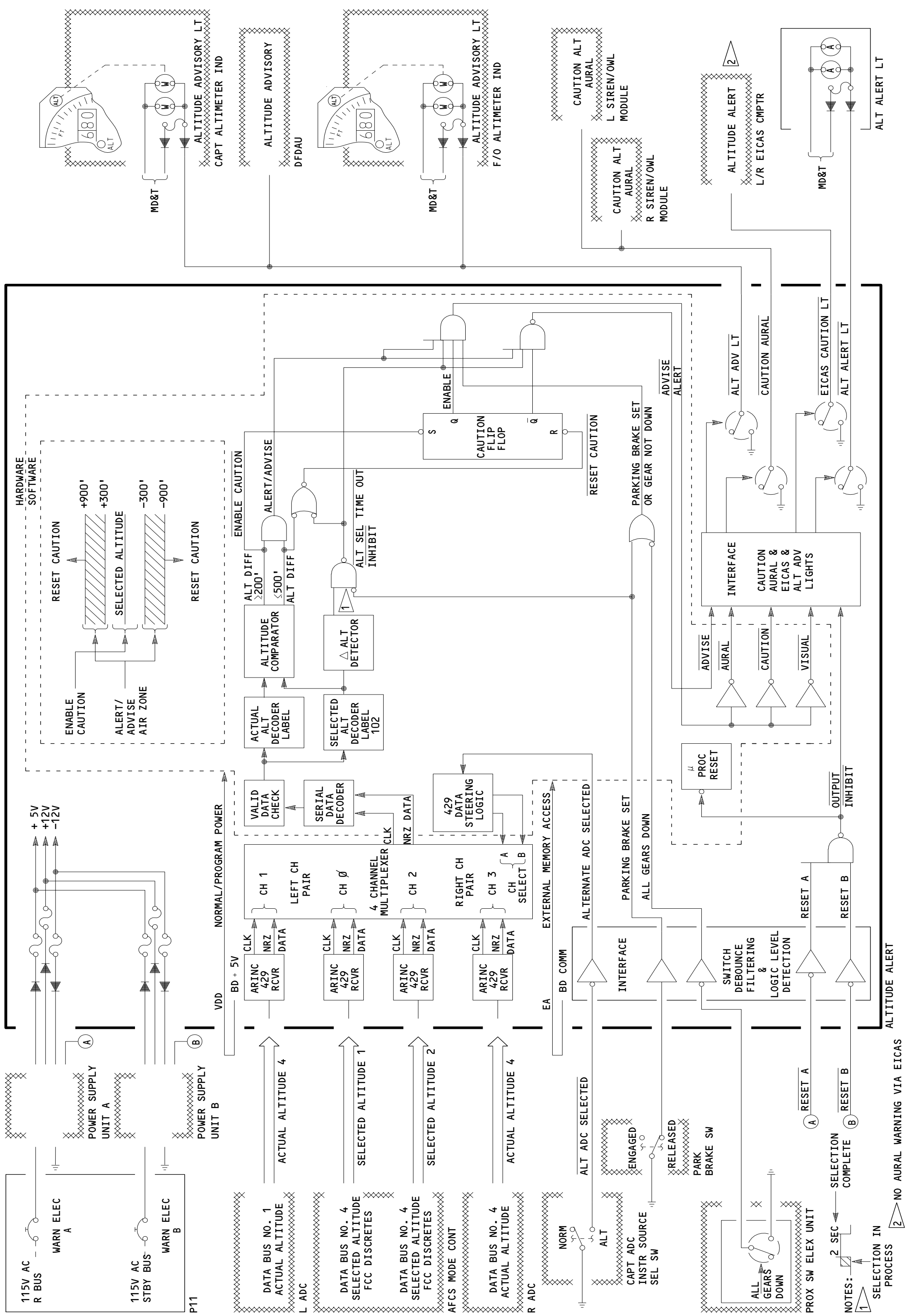

Altitude Alert System Schematic
Figure 2 (Sheet 3)

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(3) A parking brake discrete is provided from the parking brake switch. A landing gear not down and locked discrete is provided by the proximity switch electronic unit. The landing gear not down and locked discrete enables the altitude alert system when the airplane is in the air and the landing gear is retracted. The parking brake discrete is used to prevent the altitude alert system from entering test mode unless the parking brake is set.

C. SAS 154, 156 POST-SB 34-493;
The selected altitude input is first decoded and then compared with the ADC altitude. The difference is used to set up the output logic and to provide the output signals. Output signals are provided for three difference categories. These are differences of less than 500 but greater than 200 feet, less than 200 feet, and greater than 500 feet.

D. SAS 154, 156 PRE-SB 34-493;
SAS 050, 051, 150-153, 155, 157, 162-167, 275-999;
The selected altitude input is first decoded and then compared with the ADC altitude. The difference is used to set up the output logic and to provide the output signals. Output signals are provided for three difference categories. These are differences of less than 900 but greater than 300 feet, less than 300 feet, and greater than 900 feet.

E. SAS 154, 156, POST-SB 34-493;
When the airplane first approaches within 500 feet of the selected altitude, the ALT light on each of the altimeters comes on. When the airplane is within 200 feet of the selected altitude, the ALT light is turned off. The altitude alert caution logic is also armed. When the airplane deviates more than 200 feet from the selected altitude, it turns on the amber ALT ALERT light. It also provides a ground discrete to the EICAS computer to turn on the master CAUTION lights and the ALTITUDE ALERT caution message. A ground is also sent to the aural warning module to generate the caution aural (electronic owl).

F. SAS 154, 156, PRE-SB 34-493;
SAS 050, 051, 150-153, 155, 157, 162-167, 275-999;
When the airplane first approaches within 900 feet of the selected altitude, the ALT light on each of the altimeters comes on. A discrete signal is also provided to the DFDAU from the altitude alert module. When the airplane is within 300 feet of the selected altitude, the ALT light is turned off. The altitude alert caution logic is also armed. When the airplane deviates more than 300 feet from the selected altitude, it turns on the amber ALT ALERT light. It also provides a ground discrete to the EICAS computer to turn on the master CAUTION lights and the ALTITUDE ALERT caution message. A ground is also sent to the aural warning module to generate the caution aural (electronic owl).

G. The caution signals are reset, the alert caution is cancelled, and the microprocessor is reset to the approach mode during any reset condition as follows:
(1) SAS 154, 156, POST-SB 34-493;
The airplane deviates more than 500 feet from the selected altitude.
(2) SAS 154, 156 PRE-SB 34-493;
SAS 050, 051, 150-153, 155, 157, 162-167;
The airplane deviates more than 900 feet from the selected altitude.
(3) A new altitude is selected on the AFCS mode control panel.

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(4) The airplane recaptures the selected altitude.

H. The altitude alert cautions are inhibited when the landing gear is down and locked. This prevents nuisance cautions from occurring during airplane landings.

I. SAS 275-999;
for flights that must be dispatched with the gear down and locked, the altitude alert system can be enabled by positioning the ALTERNATE VMO/MMO select switch in the main E/E bay to the ALTERNATE position. This simulates a landing gear not down and locked condition by opening the ALL GEARS DOWN & LOCKED discrete.

J. When the parking brake is set, the alert cautions are not inhibited by the landing gear down and locked. This allows for ground testing of the altitude alert module.

K. SAS 275-999;
when the parking brake is set during a ground test, an additional reset condition occurs when the airplane deviates more than 900 feet from the selected altitude.

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ALTITUDE ALERT SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
ALTIMETER - (FIM 34-13-00/101)				
CAPTAIN, N8				
FIRST OFFICER, N48				
CIRCUIT BREAKER -			FLT COMPT, P11	
AURAL WARN SPKR LEFT, C567	--	1	11B16	*
AURAL WARN SPKR RIGHT, C568	--	1	11H35	*
WARN ELEX A, C565	--	1	11J34	*
WARN ELEX B, C566	--	1	11B18	*
LIGHT - ALTITUDE ADVISORY	--	2	FLT COMPT, P1, P3, ALTIMETER N8, N48	*
LIGHT - ALTITUDE ALERT, L136	--	1	FLT COMPT, P1	*
MODULE - ALTITUDE ALERT, M617	--	1	119AL, MAIN EQUIP CTR, P51	34-16-01
MODULE - (FIM 32-09-03/101)				
PSEU, M162				
SWITCH - (FIM 34-12-00/101)				
ALTERNATE VMO/MMO SELECT, S591 [1]				
CAPTAIN ADC SOURCE SELECT, S482				
SWITCH - (FIM 32-44-00/101)				
PARKING BRAKE, S459				
UNIT (FIM 31-31-00/101)				
DIGITAL FLIGHT DATA ACQUISITION, M138				

* SEE THE WDM EQUIPMENT LIST

[1] SAS 275-999

Altitude Alert System - Component Index
Figure 101

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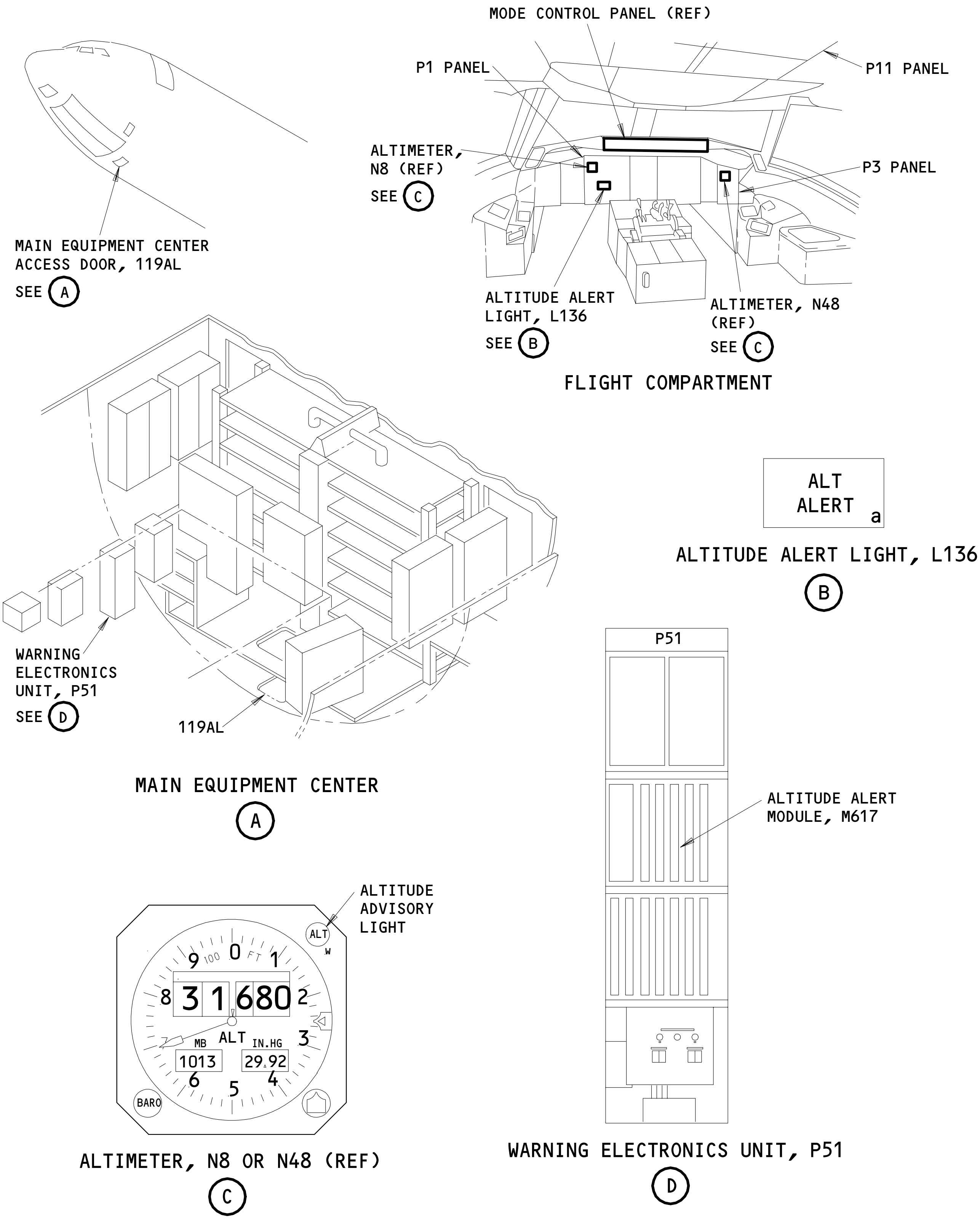

Altitude Alert System - Component Location
Figure 102

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ALTITUDE ALERT SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure is a system test of the altitude alert system.
   B. The altitude alert system test uses installed equipment to make sure the system operates correctly. Test equipment is not necessary.

TASK 34-16-00-735-001

2. Altitude Alert System Test
   A. Equipment
      (1) Proximity Sensor Actuator/Deactuator Set - A27092-84 (2 rectangular sensor deactuators are necessary)
   B. References
      (1) 22-10-00/501, Autopilot (Flight Control) System
      (2) 24-22-00/201, Electrical Power - Control
      (3) 31-41-00/201, Engine Indication and Crew Alerting System (EICAS)
      (4) 32-09-02/201, Air/Ground Relays
      (5) 34-12-00/501, Air Data Computing System
   C. Access
      (1) Location Zones

211/212	Flight Compartment
711	Nose Landing Gear (NLG)
731	Left Main Landing Gear (MLG)
741	Right Main Landing Gear (MLG)

   D. Prepare for the System Test

      S 865-002
      (1) Supply electrical power (Ref 24-22-00).

      S 865-003
      (2) Make sure the autopilot flight director system operates correctly (Ref 22-10-00).

      S 865-004
      (3) Make sure the air/ground relay system operates correctly (Ref 32-09-02).

      S 865-005
      (4) Make sure the air data computing system operates correctly (Ref 34-12-00).

      S 865-006
      (5) Make sure the AIR DATA switches on the instrument source select panels are in the NORM position.

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S 865-008
(6) SAS 275-999;
make sure the VMO/MMO switch in the main E/E compartment is set to the NORM position.

S 865-009
(7) Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:
(a) 11B16, AURAL WARN SPKR L
(b) 11H35, AURAL WARN SPKR R
(c) 11J34, WARN ELEX A
(d) EICAS circuit breakers (6 locations)

S 865-010
(8) Open this circuit breaker on the P11 panel and attach a DO-NOT-CLOSE tag:
(a) 11B18, WARN ELEX B

S 865-011
(9) Do the EICAS procedure for engine shutdown input removal (Ref 31-41-00).

S 865-012
(10) Set the parking brake to the on position.

S 865-191
(11) Set the FUEL CONTROL switch for the LEFT engine to RUN.

E. Procedure

S 745-013
(1) Push the IND LIGHTS TEST switch on the pilots' overhead panel, P5.

S 755-014
(2) Make sure the lights come on as follows:
(a) The ALT light on the captain's and first officer's altimeters
(b) The ALT ALERT light on the instrument panel
(c) The master CAUTION lights on the glareshield.

S 745-015
(3) Push the IND LIGHTS TEST switch again to stop the test.

S 865-016
(4) Adjust the BARO switch on the captain's and first officer's altimeters to the nearest thousand ±40 feet.

S 865-018
(5) Set the mode control panel (MCP) ALT display on the glareshield to 10,000 feet.

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S 755-019
(6) Make sure these indicators are off as follows:
   (a) The ALT ALERT light
   (b) The two altimeter ALT lights
   (c) The master CAUTION lights
   (d) The EICAS message, ALTITUDE ALERT, on the top display.

S 865-020
(7) Set the MCP ALT display to 600 ±200 feet above the altimeter altitude.

S 755-024
(8) Make sure the altimeter ALT lights come on.

S 865-234
(9) SAS 154, 156 POST-SB 34-493;
Set the MCP ALT display to less than 200 feet above the altimeter altitude.

S 865-235
(10) SAS 154, 156 PRE-SB 34-493;
SAS 050, 051, 150-153, 155, 157, 162-167, 275-999;
Set the MCP ALT display to less than 300 feet above the altimeter altitude.

S 755-029
(11) Make sure the altimeter ALT lights go off.

S 865-030
(12) Set the MCP ALT display to 600 ±200 feet above the altimeter altitude.

S 755-034
(13) Make sure these indicators are on:
   (a) The ALT ALERT light
   (b) The master CAUTION lights
   (c) The EICAS message, ALTITUDE ALERT, on the top display
   (d) An owl aural tone for 1 second.

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S 865-236
(14) SAS 154, 156 POST-SB 34-493;
Set the MCP ALT display to greater than 500 feet above the altimeter altitude.

S 865-237
(15) SAS 154, 156 PRE-SB 34-493;
SAS 050, 051, 150-153, 155, 157, 162-167, 275-999;

S 865-035
(16) Set the MCP ALT display to greater than 900 feet above the altimeter altitude.

S 755-039
(17) Make sure these indicators are off:
(a) The ALT ALERT LIGHT
(b) The master CAUTION lights
(c) The owl aural tone
(d) The EICAS message, ALTITUDE ALERT, on the top display.

S 865-040
(18) Remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:
(a) 11B18, WARN ELEX B

S 865-041
(19) Open this circuit breaker on the P11 panel and attach a DO-NOT-CLOSE tag:
(a) 11J34, WARN ELEX A

S 715-042
(20) Do the steps for the Altitude Alert System Test again for the power supply B.

S 865-043
(21) Set the MCP ALT display to less than 250 feet, then to 600 ±200 feet above the altimeter altitude.

S 755-047
(22) Make sure the EICAS message, ALTITUDE ALERT, is shown on the top display unit.

S 865-048
(23) Release the parking brake.

S 755-050
(24) Make sure these indicators are off:
(a) The ALT ALERT light

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(b) The two altimeter ALT lights
(c) The master CAUTION lights
(d) The EICAS message, ALTITUDE ALERT, on the top display

S 865-052
(25) SAS 275-999;
do these steps for the VMO/MMO switch as follows:
(a) Set the VMO/MMO switch on the E1 rack to the ALTERNATE position.
(b) Make sure the EICAS message, ALTITUDE ALERT, is shown on the top display.
(c) Set the VMO/MMO switch back to the NORM position.
(d) Make sure the EICAS message, ALTITUDE ALERT, is not shown on the top display.

S 865-054
(26) Use an aluminum deactuator to deactivate one of the six gear down and locked switches:
(a) S232 - Nose Gear Down
(b) S233 - Nose Gear Locked
(c) S236 - Left Side Brace Down
(d) S237 - Left Drag Brace Down
(e) S240 - Right Side Brace Down
(f) S241 - Right Drag Brace Down

S 865-055
(27) Deactivate one of these gear down and locked switches:
(a) S254 - Nose Gear Down
(b) S255 - Nose Gear Locked
(c) S258 - Left Side Brace Down
(d) S259 - Left Drag Brace Down
(e) S262 - Right Side Brace Down
(f) S263 - Right Drag Brace Down

S 755-056
(28) Make sure the EICAS message, ALTITUDE ALERT, is shown on the top display.

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S 865-057
(29) Open the WARN ELEX B (11B18) circuit breaker for 5 seconds and then close it.

S 865-058
(30) Open these circuit breakers on the P11 panel:
(a) 11E34, MODE CONT PNL R
(b) 11F30, AIR DATA CMPTR R

S 755-059
(31) Make sure the altimeter ALT lights are on.

S 865-060
(32) Close these circuit breakers on the P11 panel:
(a) 11E34, MODE CONT PNL R
(b) 11F30, AIR DATA CMPTR R

S 865-061
(33) Open these circuit breakers on the P11 panel:
(a) 11A10, AIR DATA CMPTR L
(b) 11E16, MODE CONT PNL L

S 755-062
(34) Make sure the altimeter ALT lights are off.

S 865-063
(35) Set the AIR DATA switch on the left instrument source select panel to the ALTN position.

S 865-064
(36) Make sure the MCP ALT display is 600 ±200 feet above the altimeter altitude.

S 755-068
(37) Make sure the altimeter ALT lights are on.

S 865-069
(38) Remove all the actuators and deactuators from the gear down and locked switches.

S 865-070
(39) Close these circuit breakers on the P11 panel:
(a) 11A10, AIR DATA CMPTR L
(b) 11E16, MODE CONT PNL L
(c) 11J34, WARN ELEX A

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F. Put the Airplane Back to Its Usual Condition

S 865-071

(1) Set the parking brake to the on position.

S 865-192

(2) Set the FUEL CONTROL switch for the LEFT engine to CUTOFF.

S 865-077

(3) Set the AIR DATA switch on the left instrument source select panel back to the NORM position.

S 865-106

(4) Adjust the BARO switch on the captain's and first officer's altimeters back to the correct position.

S 865-072

(5) Return the EICAS system to its usual condition (Ref 31-41-00).

S 865-073

(6) Remove electrical power if it is not necessary (Ref 24-22-00).

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ALTITUDE ALERT MODULE - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the altitude alert module; the other is the installation of the altitude alert module.
   B. The altitude alert module is installed in the warning electronics unit (WEU). The WEU is installed to the right and forward of the main electronic equipment compartment.

TASK 34-16-01-004-001

2. Altitude Alert Module Removal (Fig. 401)
   A. References
      (1) AMM 20-10-01/401, E/E Rack-Mounted Components
      (2) AMM 20-41-01/201, Electrostatic Sensitive Devices
   B. Access
      (1) Location Zone
         120 Main Equipment Center (Right)

   C. Procedure

      S 864-003

      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11B18, WARN ELEX B
         (b) 11J34, WARN ELEX A

      S 014-004

      (2) Open the access door to the WEU.

      S 914-002

      CAUTION: DO NOT TOUCH THE ALTITUDE ALERT MODULE BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE ALTITUDE ALERT MODULE.

      (3) Do the procedure for electrostatic discharge sensitive devices (AMM 20-41-01/201).

      S 024-005

      (4) Remove the altitude alert module (AMM 20-10-01/401).

TASK 34-16-01-404-006

3. Altitude Alert Module Installation (Fig. 401)
   A. References
      (1) AMM 20-10-01/401, E/E Rack-Mounted Components

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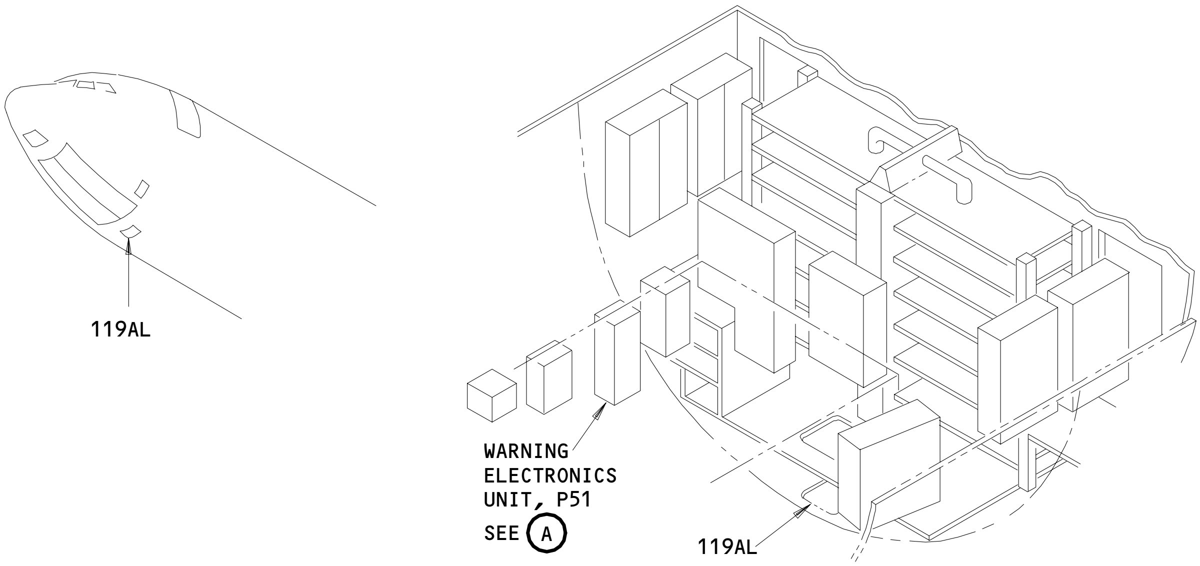
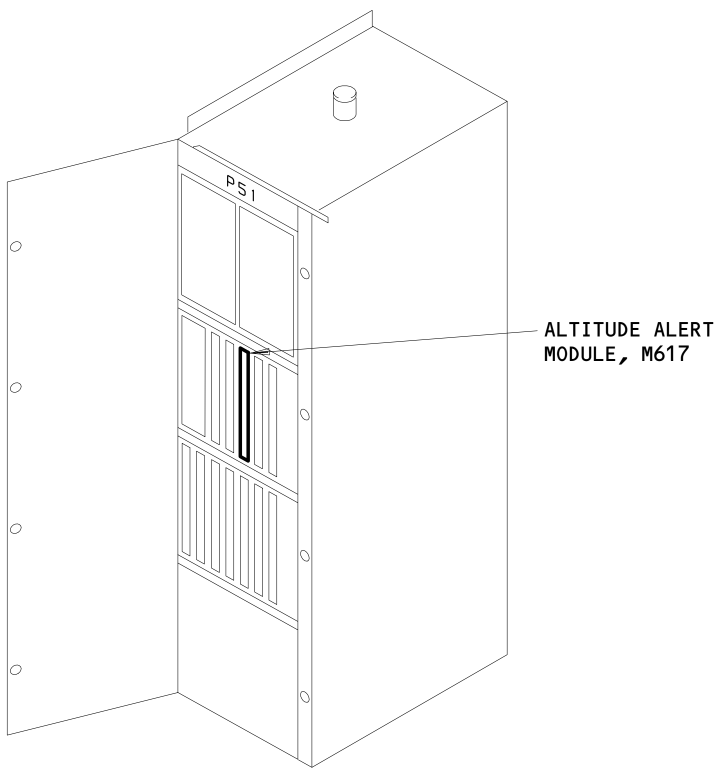


MAIN EQUIPMENT CENTER



WARNING ELECTRONICS UNIT, P51

A

Altitude Alert Module
Figure 401

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(2) AMM 20-41-01/201, Electrostatic Sensitive Devices
(3) AMM 22-10-00/501, Autopilot Flight Director System
(4) AMM 24-22-00/201, Electrical Power - Control
(5) AMM 32-09-02/201, Air/Ground Relays
(6) AMM 34-12-00/501, Air Data Computing System

B. Access

(1) Location Zones

120	Main Equipment Center (Right)
211/212	Flight Compartment

C. Procedure

S 864-007

(1) Make sure these circuit breakers on the P11 panel are open:
   (a) 11B18, WARN ELEX B
   (b) 11J34, WARN ELEX A

S 914-008

CAUTION: DO NOT TOUCH THE ALTITUDE ALERT MODULE BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE ALTITUDE ALERT MODULE.

(2) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 424-009

(3) Install the altitude alert module (AMM 20-10-01/401).

S 414-010

(4) Close the access door to the WEU.

D. Altitude Alert Module Test

S 864-011

(1) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11B18, WARN ELEX B

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(b) 11J34, WARN ELEX A

S 864-053

(2) Supply electrical power (AMM 24-22-00/201).

S 714-012

(3) Make sure the autopilot flight director system operates correctly (AMM 22-10-00).

S 714-013

(4) Make sure the air data computing system operates correctly (AMM 34-12-00).

S 714-014

(5) Make sure the air/ground relay system operates correctly (AMM 32-09-02).

S 864-015

(6) Make sure the AIR DATA switches on the instrument source select panels are in the NORM position.

S 864-016

(7) Set the parking brake to the on position.

S 864-018

(8) SAS 275-999;
Make sure the VMO/MMO switch in the E/E compartment is in the NORM position.

S 864-019

(9) Adjust the BARO switch on the captain's and first officer's altimeters to the nearest thousand ±40 feet.

S 864-021

(10) Set the mode control panel ALT display for the Auto-Flight Control System to 600 ±200 feet above the altimeter altitude.

S 754-025

(11) Make sure the ALT light on the captain's and first officer's altimeters comes on.

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E. Put the Airplane Back to Its Usual Condition

S 864-028

(1) Adjust the BARO switch on the captain's and first officer's altimeters back to the correct position.

S 864-030

(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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INERTIAL REFERENCE SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The inertial reference system (IRS) provides inertial navigation data to user systems. It uses a ring laser gyro instead of the conventional rate gyro to sense angular rate about the roll, pitch, and yaw axes. The system is termed strapdown since its sensors are, in effect, directly mounted to the airframe.
   B. The inertial reference system (IRS) includes three inertial reference units (IRU). One common mode control panel (IRS MODE SELECT) is used to control the three IRUs. The system provides inertial navigation and flight control data to other systems.
   C. Each IRU contains three laser gyros and three accelerometers. These sense angular rates and linear accelerations, respectively. The sensed data is resolved to local vertical coordinates and combined with air data inputs to compute the following:
      (1) position (latitude, longitude)
      (2) attitude (pitch, roll, yaw)
      (3) true and magnetic heading
      (4) windspeed and direction
      (5) velocity
      (6) accelerations
      (7) angular rate data
      (8) altitude
   D. The IRS outputs are displayed on the flight instrument system displays (Ref 34-22-00). They are also displayed on the flight management computer control display unit (FMC-CDU) (Ref 34-61-00).
2. Component Details (Fig. 1)
   A. IRS MODE SELECT Panel
      (1) The IRS mode select panel (IRMP) is used to control the three IRUs. It provides individual mode selection, displays align status, displays fault annunciation for each IRU, and provides a display and keyboard for IRU initialization and data display. The IRMP is located on the pilot's overhead panel.
      (2) The IRMP has three rotary switches for selecting the following modes of each IRU.
         (a) OFF - IRS is off.

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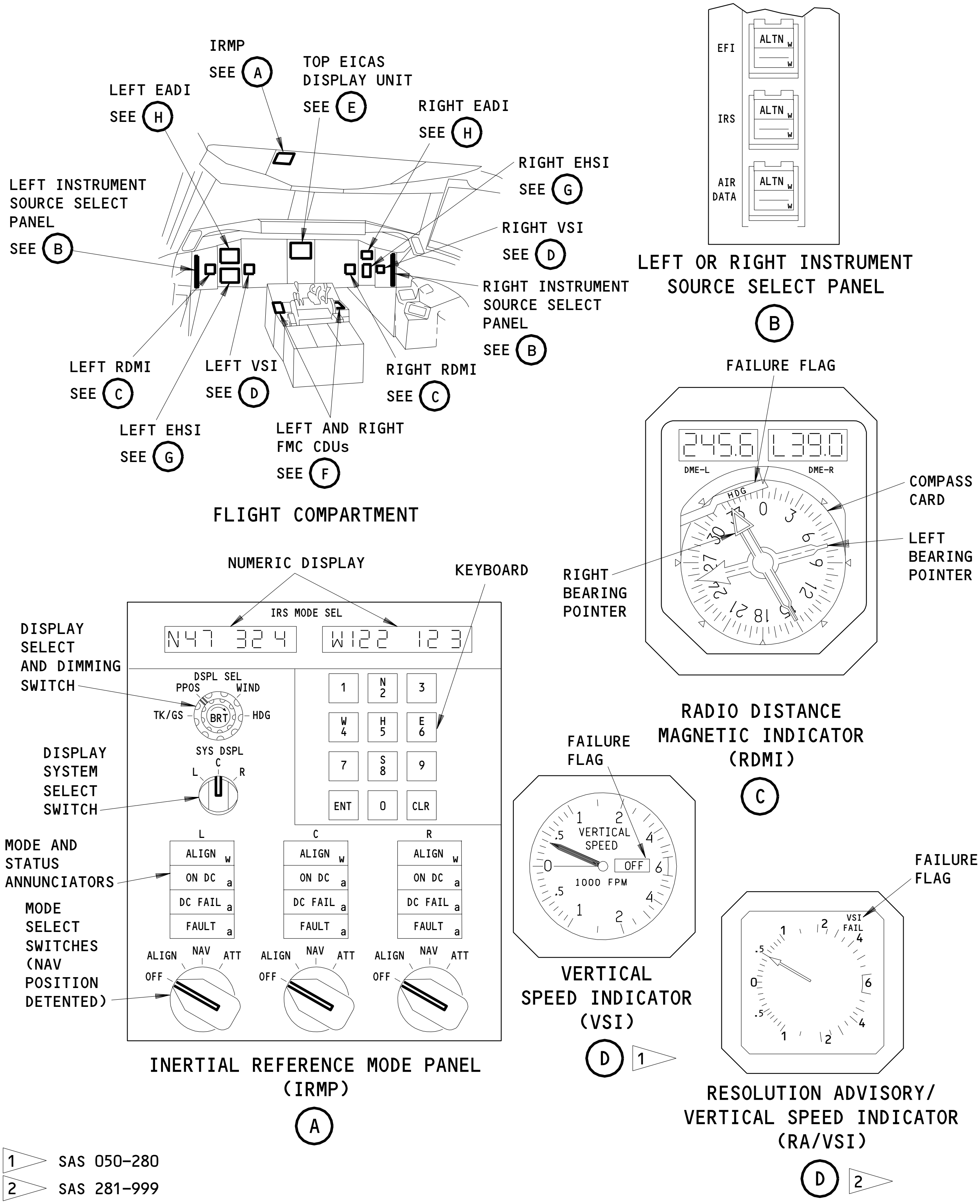

Inertial Reference System - Component Location
Figure 1 (Sheet 1)

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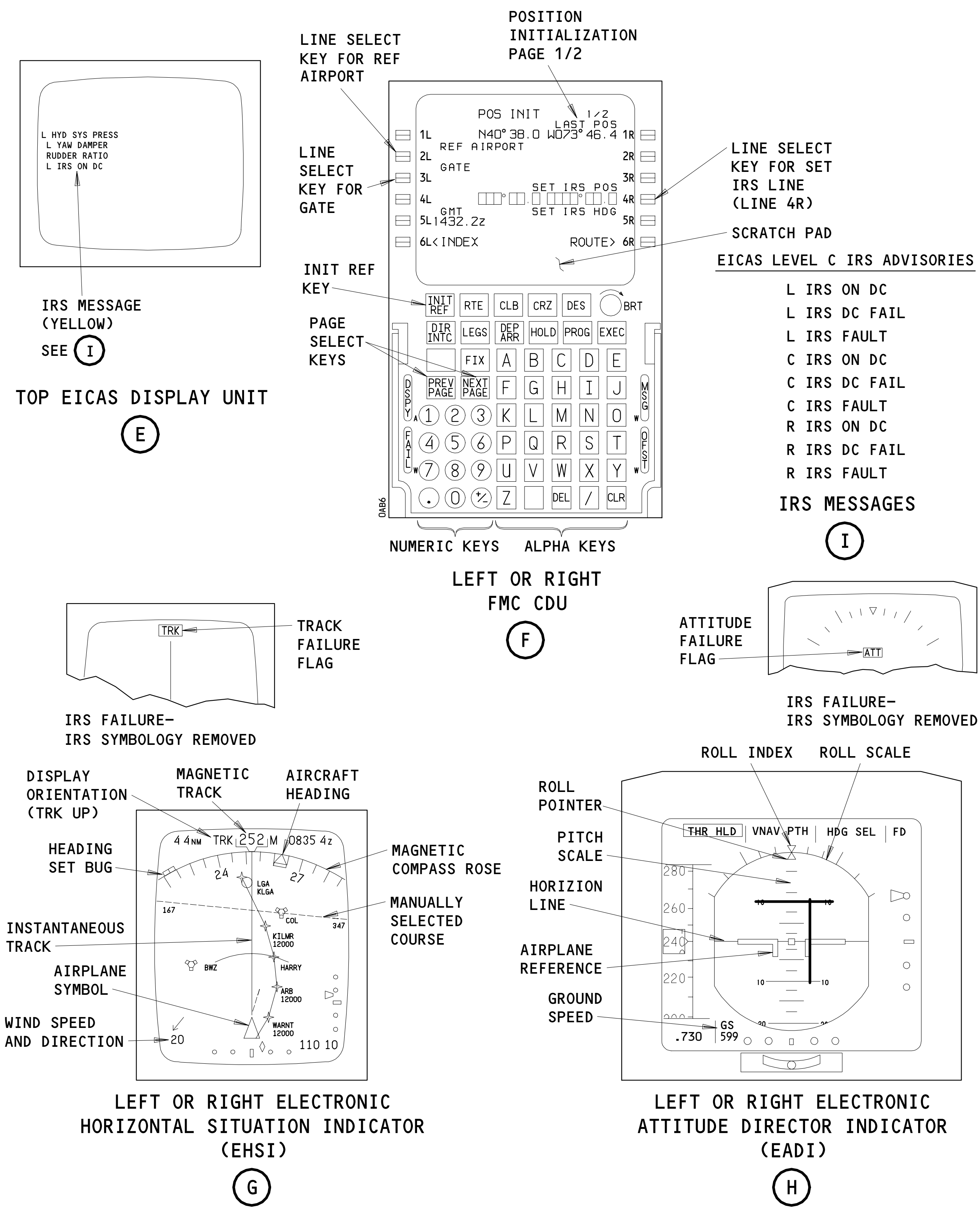

Inertial Reference System - Components
Figure 1 (Sheet 2)

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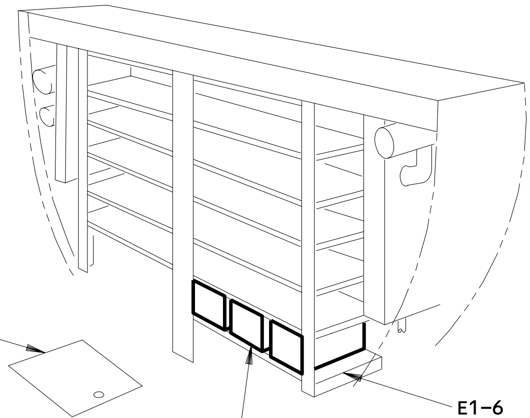
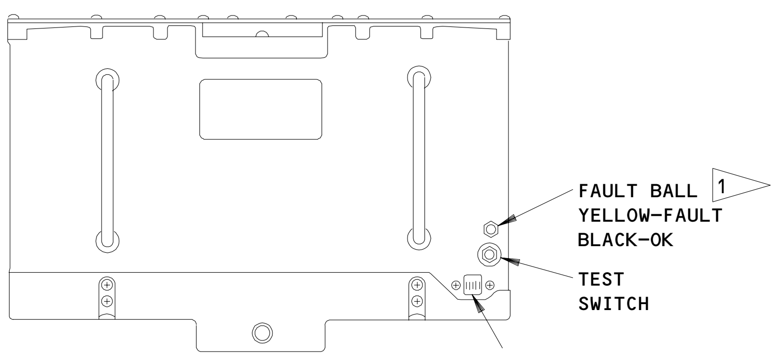


MAIN EQUIPMENT CENTER



INERTIAL REFERENCE UNIT
(IRU)
J

1 AIRPLANES WITH -110 IRUs AND SUBSEQUENT;
NO FAULT BALL INDICATOR IS INSTALLED.
THE CHASSIS INDICATOR HOLE CONTAINS A PLUG.

Inertial Reference System - Components
Figure 1 (Sheet 3)

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(b) ALIGN (alignment) - During the ALIGN mode, the IRU is initialized. The position information given to the IRS is checked for accuracy in the IRU. This process, when properly completed, allows the IRU to advance to the NAV mode.

(c) NAV (navigation) - The NAV mode is the normal operating mode for the IRS. In this mode, the IRS performs inertial navigation functions and outputs normal IRS data to be displayed or used by other systems.

(d) ATT (attitude) - The ATT mode is used when failure or total power loss (AC and DC power) is detected in the NAV mode. In this mode, only attitude data is output to the user systems.

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(3) The ALIGN, NAV, ATT, and OFF modes are entered using the following mode sequences. The corresponding IRU operation and ALIGN annunciator status are as follows:

MODE SEQUENCE	IRU OPERATION	ALIGN LIGHT
OFF TO ALIGN *[1]	REMAINS IN ALIGN MODE AND CONTINUES FINE LEVELING AND EARTH RATE ESTIMATION.	REMAINS ON
OFF TO ALIGN TO NAV *[1] *[2]	PERFORMS 10-MINUTE ALIGNMENT AND AUTOMATICALLY SEQUENCES TO NAV MODE.	ON DURING ALIGNMENT
OFF OR NAV TO ATT	FULL SUPPORT OF ATTITUDE - RELATED AND BODY ACCELERATION OUTPUTS IN 30 SECONDS.	ON FOR 30 SECONDS
NAV TO ALIGN *[1] *[3]	SETS VELOCITIES TO ZERO AND CONTINUES TO REFINE LEVELING AND HEADING DETERMINATION (NAV MAY BE RE-ENTERED IN APPROXIMATELY 30 SECONDS).	REMAINS ON, FLASHES IF MOVEMENT
NAV TO ALIGN TO NAV *[1] *[3]	SETS VELOCITIES TO ZERO.	ON FOR 30 SEC, FLASHES IF MOV-EMENT WHILE ON
ATT TO NAV OR ALIGN	REMAINS IN ATT MODE UNTIL SWITCHED OFF.	OFF
ALIGN TO NAV	IF ALIGN TIME GREATER THAN 10 MINUTES, IRU SEQUENCES TO NAV, HOWEVER, AN ALIGN TIME OF 17 MINUTES IS REQUIRED ABOVE 70 DEGREES NORTH LATITUDE.	ON DURING ALIGNMENT
ATT OR NAV OR ALIGN TO OFF	30 SECOND POWER-OFF COUNTDOWN, BITE INFORMATION, PPOS, AND AUTOCAL TRANSFER TO NVM.	ON FOR 30 SECONDS

*[1] Details of mode sequences to ALIGN mode are described in Functional Description of IRS Alignment.
*[2] The mode sequence "OFF TO ALIGN TO NAV" should not be used above 70 degrees north latitude. A full 17 minute alignment is required.
*[3] The IRU should not be sequenced out of NAV mode above 70 degrees north latitude. Accuracy updates require a full 17 minute alignment.

(4) Each mode select switch has a detented NAV position which prevents accidental movement of the switch out of the NAV mode. When the switch is in the NAV position, it must first be pulled out of detent before selecting a new position to prevent damage to the switch.

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(5) Three sets of four lights provide system status and fault indication. ALIGN (white when lit), ON DC, DC FAIL, and FAULT (amber when lit) lights are provided for each IRU. These lights work as follows:
   (a) The ALIGN light denotes that the IRU is in the align mode and is running an initial position determination, is in initial attitude mode, or is powering down.
   (b) The ON DC annunciator lights when the IRU has switched to backup battery power.
   (c) If battery power fails, the DC FAIL light will come on.
   (d) A lit FAULT annunciator indicates that a BITE detected failure has occurred. The FAULT light also comes on if certain alignment tests fail. These tests are covered in detail in the operation section.

(6) IRMP Keyboard and Display
   (a) The SYS DSPL switch selects the IRU, for on-line interface with the IRMP. The IRMP can only display data from the IRU which has been selected by the SYS DSPL switch.
   (b) The DSPL SEL switch selects the type of data to be displayed on the IRMP numeric displays. The IRU, as selected by the SYS DSPL switch, supplies the data. The four switch positions and the data displayed for each position is as follows:
      1) TK/GS - Track angle (TK) is displayed in the left display and the ground speed (GS) in the right display.
      2) PPOS - Latitude is displayed in the left display and the longitude in the right display.
      3) WIND - Wind angle is displayed in the left display and the wind velocity in the right display. Wind displays present true wind when in flight.
      4) HDG - True heading is displayed in the left display and the right display remains blank.
   (c) There are two numeric displays on the IRMP. When the IRMP is receiving IRU data, the DSPL SEL switch determines the data on the display. When the IRMP keyboard is used to initialize an IRU, the data punched in at the keyboard is shown on the two displays. For invalid data from an IRU, both displays are blanked. A brightness control for the displays is located concentric within the DSPL SEL switch.
   (d) The keyboard consists of twelve lighted keys. To change the numeric display from the IRU receive mode to a keyboard display mode, one of the following keys must first be pressed: N(2), S(8), H(5), E(6), or W(4). Any other initial key is ignored.
      1) Pressing N(2) or S(8) once will cause a N or S to appear in the left display. These represent north and south and are used to initialize latitude in the IRU.
      2) Pressing W(4) or E(6) once will cause a W or E to appear in the right display. These represent west and east and are used to initialize longitude in the IRU.
      3) Pressing H(5) once will also switch the IRMP from an IRU receive mode to the keyboard display mode. This is used to enter magnetic heading in the ATT mode.

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4) Numeric data can be entered after one of the five letter keys is pressed. It will be appropriately displayed in the numeric display as it is entered.
5) Keys with letters on them, as well as numbers, provide the letter value when they are the first punched key in a program sequence.
6) The ENT key, when pressed, transfers the data in the IRMP to the IRU. Also, when the ENT key is pressed, the display is first blanked and then returned to the IRU receive mode.
7) The CLR key clears the display, then returns the IRMP to the IRU receive mode.

(7) The IRMP also has a Time to NAV (TTN) display and a maintenance fault code display.

(a) The Time to NAV (TTN) feature counts down the minutes to completion of a 10 minute alignment. The IRU must be in the ALIGN mode, the IRMP mode select switch must be set to ALIGN or NAV, and the DSPL SEL switch must be set to HDG. A single digit will appear on the right side of the IRMP display to indicate minutes remaining as follows:

MINUTES REMAINING	NUMBER DISPLAYED
10	7
9	7
8	7
7	7
6	6
5	5
4	4
3	3
2	2
1	1
0	0

1) The TTN zero will not be visible with the mode select switch set to NAV. The display will blank as the IRS sequences to NAV and the ALIGN annunciator goes off.
2) When realign mode is selected, the TTN will display 7 and count toward 0 in 30 seconds.
3) A 17 minute alignment procedure is required at positions above 70 degrees north latitude. The TTN display will remain at zero for the last seven minutes of the procedure.

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(b) The maintenance fault code display mode provides access to some IRU faults without external test equipment. Faults are classified as either critical, noncritical, or BITE memory only. The maintenance fault code display mode will display critical and noncritical faults, but external test equipment is required to read faults stored in BITE memory. Regardless of fault classification, all faults are stored in BITE memory when the IRU is turned off.

1) To enter the maintenance code display mode, first select the desired IRU using the SYS DSPL Select Switch. Next, set the DSPL SEL switch to the HDG position. Enter a 0 on the keyboard, followed within five seconds by a 1. The highest priority code will be displayed in the two right digits of the IRMP display. Record the code, press CLR to display the next priority code, and repeat to cycle through the remaining codes.
2) If the IRS was navigating, the last displayed value of true heading will be frozen on the display.
3) If TTN display was present, the display will be frozen when the maintenance code is entered. The internal clock will continue to run and a new TTN value will appear after all maintenance codes are displayed.
4) The following table indicates the corresponding fault for each IRMP code:

IRMP CODE AND PRIORITY	IRU FAULT
01	POWER SUPPLY CRITICAL
02	DIGITAL I/O WRAP-AROUND
03	RAM/NVM/PROM MEMORY
04	LSIC
05	DISCRETE INPUT
06	PROCESSOR
07	GYRO
08	ALIGN/SYSTEM
09	A/D MUX DATA TRANSFER
11	POWER SUPPLY
12	ADC DISCRETE OUT
13	NOT USED
14	CALIBRATION PROM
15	INA/OTA
16	ANALOG PITCH RATE
17	GYRO
18	GYRO CONFIGURATION
19	TEMPERATURE SENSOR
20	NOT USED

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5) AIRPLANES WITH -109 IRU's AND PREVIOUS;
Code 01 thru 09 are critical faults. A critical fault turns on the IRMP fault annunciator and sets the IRU faultball immediately upon detection of the fault.

6) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
Codes 01 thru 09 are critical faults. A critical fault turns on the IRMP FAULT light.

7) Codes 11 thru 20 are noncritical faults and are indicated as follows:

a) AIRPLANES WITH -109 IRU's AND PREVIOUS;
During initialization, align, align downmode, or navigate mode, a non-critical fault sets the IRU faultball immediately upon detection of the fault. If a non-critical fault is detected on the ground, the IRMP fault annunciator turns on. If a non-critical fault is detected in the air, the IRMP fault annunciator turns on below a set ground speed after touchdown.

b) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
During initialization, align, align downmode, or navigate mode, if a non-critical fault is detected on the ground, the IRMP fault annunciator turns on. If a non-critical fault is detected in the air, the IRMP fault annunciator turns on below a set ground speed after touchdown.

c) AIRPLANES WITH -109 IRU's AND PREVIOUS;
During attitude mode, no failure indication is given by the IRMP fault annunciator. A fault detected prior to entering attitude mode is indicated as previously described. Entering attitude mode causes the IRMP fault annunciator to go out, but the IRU faultball remains set.

d) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
During attitude mode, no failure indication is given by the IRMP fault annunciator. A fault detected prior to entering attitude mode is indicated as previously described. Entering attitude mode causes the IRMP fault annunciator to go out.

B. Inertial Reference Unit (IRU)

(1) Each IRU provides the guidance reference for the airplane by sensing airplane angular rate and linear acceleration. Position, velocity, attitude, heading, acceleration and body angular rates are compiled from the sensor data. A digital computer in each IRU performs all the calculations for IRS.

(2) The IRU weighs 47 lbs. It consists of 3 laser gyros, 3 accelerometers, circuit cards, a sensor assembly, a power supply and a chassis assembly. The three IRU's are located in the main equipment center, E1-6.

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(3) AIRPLANES WITH -109 IRU's AND PREVIOUS;
The front panel of the IRU has a faultball indicator, an interface test switch, and a total time display.

(a) The BITE fault ball indicator shows black for an operational IRU and yellow for a failed IRU. The fault ball indicates a failure that could cause erroneous outputs. Other failures detected by BITE, which do not affect the outputs are stored in BITE memory.

(4) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
The front panel of the IRU has a plug, an interface test switch, and a total time display.

(a) Pushing the test switch activates the IRMP annunciator discretes for 2 seconds, then IRU digital failure words for 8 seconds. After 10 seconds and until the switch is released, the IRU outputs canned test data for observation in the flight deck. The test may be performed in the NAV or ALIGN mode. The test is inhibited in the NAV mode whenever the ground speed is greater than 20 knots and in the ATT mode. Some displayed test outputs are:

1)	Inertial Vertical Speed	-600 ft/min
2)	Magnetic heading	15°
3)	Pitch Angle	5° UP
4)	Present Position (Lat, Long)	N22 30.0', E22 30.0'
5)	Roll Angle	45° RIGHT
6)	True Heading	10°
7)	Wind Direction as follows:	
	a) 30° on the IRMP	
	b) 30° on the EHSI if "TRU" is shown above the compass card	
	c) 35° on the EHSI if "M" is shown above the compass card	
8)	Wind Speed	100 Kts

(b) The total time display provides accumulated ON-time.

C. FMC-CDU IRS Functions

(1) CDU - IRS Initialization Functions

(a) The IRS is initialized (present position entered) by selecting IRS pages on the FMC-CDU keyboard. For detailed operation of the FMC-CDU, refer to 34-61-00. The FMC-CDUs are located in the forward electronics panel, P9.

(2) IRS Related CDU Displays (Fig. 2)

(a) The INIT/REF INDEX page provides access to pages of data required for initializing and monitoring the IRS.

(b) The POS INIT page is selected to enter the initial reference position for IRS alignment.

(c) The POS REF 2/2 page displays current position and ground speed, as computed by the FMC and each IRU.

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(d) The MAINTENANCE INDEX provides access to two pages of data from which maintenance personnel can check IRU status and performance.

1) The SENSOR STATUS page displays the current status of each IRU (OK, TEST, or FAIL).

2) The IRS MONITR page displays the FMC computed position error rate for each IRS. This is calculated by subtracting the final position deviation from the initial position deviation and dividing by the total time of the previous flight segment. All error rates are displayed in nautical miles per hour and are available at the completion of each flight segment.

(3) The FMC CDU RTE 1 LEGS page may be used to perform an actual position error check. This is done by entering the actual and IRS positions as waypoints and comparing their difference in nautical miles to a deviation criterion.

D. Instrument Source Select Panel

(1) The IRS switches on the instrument source select panels permit the captain and first officer to switch between the normal and alternate (ALTN) IRUs. The switch is lit (white) in the ALTN position (Ref 34-22-00). The switches are located on the captain's and F/O's instrument panels.

E. Radio Distance Magnetic Indicator (RDMI)

(1) The RDMIs display magnetic heading supplied by the IRS. The HEADING failure flag appears on the instrument face if the IRS is off, the data displayed is invalid (Ref 34-22-00), or the IRU is in the self-test mode. The RDMIs are located on the captain's and F/O's instrument panels.

F. Vertical Speed Indicator (VSI)

(1) AIRPLANES WITH VSI;
the VSIs display vertical speed supplied by the IRS. The OFF failure flag appears on the instrument face if the IRS is off, the IRS data is invalid (Ref 34-22-00), or the IRU is in the self-test mode. The VSIs are located on the captain's and F/O's instrument panels.

(2) AIRPLANES WITH RA/VSI;
the RA/VSIs display vertical speed supplied by the IRS, and advisory and alert information from TCAS. The VSI failure flap appears on the instrument face if the IRS is off or the IRS data is invalid (AMM 34-22-00). TCAS failures appear if TCAS is off or if TCAS data is invalid (AMM 34-45-00). The RA/VSIs are located on the captain's and F/O's instrument panels.

G. Electronic Horizontal Situation Indicator (EHSI)

(1) The EHSIs display IRS generated track and heading. IRS failures and IRU self-test operation remove IRS related symbology and display the TRK failure flag (Ref 34-22-00). The EHSIs are located on the captain's and F/O's instrument panels.

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H. Electronic Attitude Director Indicator (EADI)
   (1) The EADIs display pitch, roll, and ground speed supplied by the IRS. IRS failures and IRU self-test operation remove IRS related symbology and display the ATT failure flag (Ref 34-22-00). The EADIs are located on the captain's and F/O's instrument panels.

I. EICAS Display Units
   (1) The upper EICAS display unit provides nine IRS level C advisory messages, which include IRS on DC, DC FAIL, and FAULT for each IRU (Ref 31-41-00). These same messages are also displayed on the IRMP. The EICAS display units are located on the center instrument panel, P2.

J. Yaw Damper Test Switch
   (1) The yaw damper test causes all three IRUs to go into self-test (Ref 22-21-00). The test mode is inhibited in the NAV mode when ground speed is greater than 20 knots, and it is also inhibited in the ATT mode. The yaw damper test switch is located on the P61 test panel.

3. Operation

A. Functional Description (Fig. 2)
   (1) IRS Alignment
      (a) The IRS can be initialized by the FMC-CDU or the IRMP, whenever the IRU is in the alignment (ALIGN) mode. When a mode select switch, on the IRMP, is switched to ALIGN or NAV, the respective IRU enters the alignment mode.
      (b) In the alignment mode, the IRU reference axis is aligned to the local vertical. The IRU calculates latitude by estimating the horizontal earth rate components. While in the alignment mode, the IRU outputs a discrete signal to light the ALIGN annunciator on the IRMP. When the mode select switch is switched to ALIGN from OFF, initial latitude and longitude (lat/long) must be entered to complete the alignment process. Initial latitude and longitude are not required when switching from NAV to ALIGN.
      (c) Position initialization by the FMC-CDU is done by accessing the POS INIT 1/2 page on the FMC-CDU by one of four methods:
         1) Pressing the INIT/REF mode select key (when on the ground and when the IRS position has not been initialized).
         2) Pressing the POS line select key when the INDEX page is displayed.
         3) Pressing the POS INIT line select key when the IDENT page is displayed.

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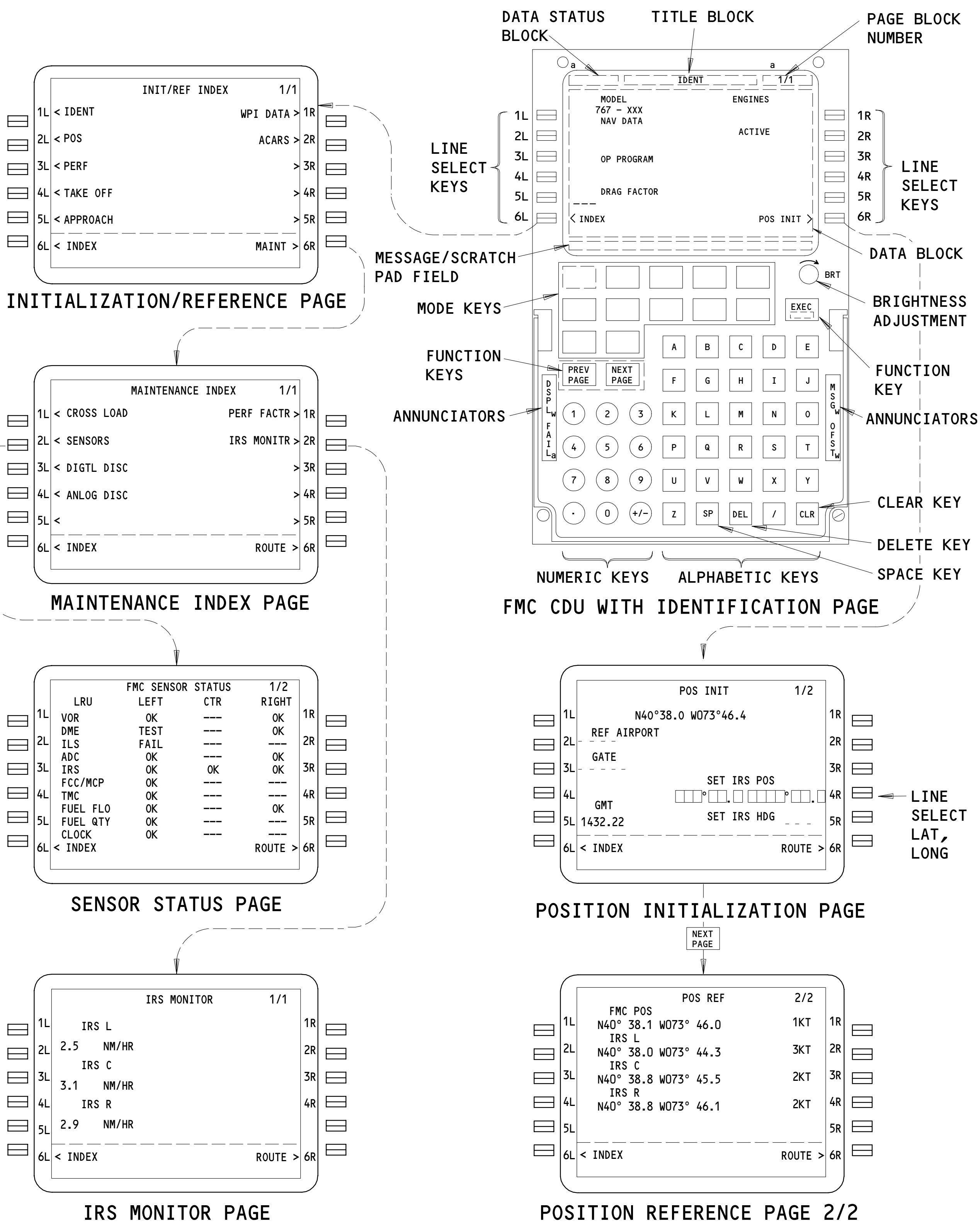

IRS Related FMC CDU Pages
Figure 2 (Sheet 1)

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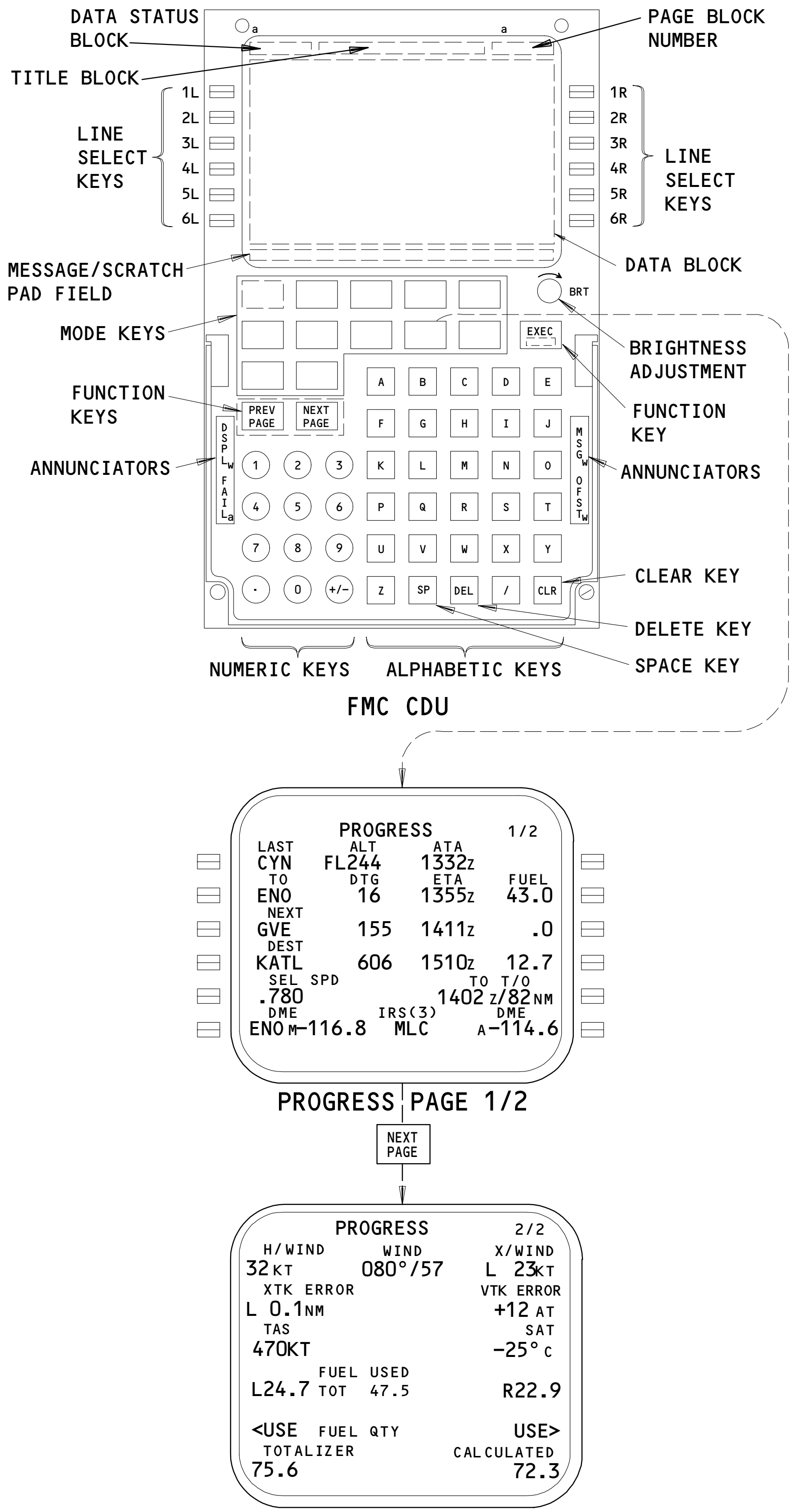

IRS Related FMC CDU Pages
Figure 2 (Sheet 2)

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4) Pressing the PREV PAGE or NEXT PAGE key when the POS REF 2/2 page is displayed.

(d) The POS REF page 2/2 displays ground speed (GS) and current position as computed by the FMC and each IRU. The GS displays are frozen at flight completion and retained until power down, any IRU in ALIGN mode, or engine start.

(e) Prompt Boxes (FMC CDU)

1) Prior to the entry of present position LAT/LONG into the FMC-CDU, box prompts may appear in the SET IRS POS line. Box prompts are necessary for the original entry of data into this line. Re-entry or overwriting of data does not require box prompts. Box prompts appear when the IRMP mode select switch is turned from OFF to ALIGN or NAV. They will also appear if the IRMP mode select switch is turned from NAV to ALIGN after the IRU's have completed an alignment.

2) In certain situations, box prompts will appear in the SET IRS POS line even though the insertion of data is not required. This is a normal feature of the system. It does not require operator action, and does not indicate system malfunction. Box prompts will disappear after an alignment is completed, or if the IRUs are OFF and power is temporarily removed from the FMC.

(f) One of the following three methods is used to enter present position lat/long into the SET IRS POS line of the POS INIT page on the CDU.

1) LAT/LONG is entered into the scratch pad using the keyboard, then line selected into the SET IRS POS line.

2) LAT/LONG is transferred from the LAST POS line to the SET IRS POS line via the scratch pad.

3) REF AIRPORT or REF AIRPORT and GATE is entered, the resultant lat/long is line selected to the SET IRS POS line.

(g) Initialization at the IRMP is done as follows:

1) Set DSPL SEL in the PPOS position.

2) Enter the present position (latitude and longitude) by pressing in proper sequence, two of the following keys: N(2), W(4), E(6), or S(8) and the input position.

3) Press ENT key to transmit the data displayed to the IRUs.

4) The display data is sent to all three IRUs simultaneously. Correct data reception by an IRU can be verified by setting SYS DSPL to the appropriate IRU (L, C, R) and reading the IRMP display.

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(h) The alignment mode can be entered by turning the mode select switch in any of four sequences. These are OFF to ALIGN, OFF to ALIGN to NAV, NAV to ALIGN, or NAV to ALIGN to NAV.

NOTE: The mode sequence OFF TO ALIGN should be used for initialization above 70 degrees north latitude. A full 17 minute alignment procedure is required.

1) OFF to ALIGN. Switching from OFF to ALIGN requires that the initial position (latitude and longitude) be entered in order to complete the alignment satisfactorily. This requires that initialization of the IRU be performed and that the airplane is not moving. If left in the ALIGN position, the system will continue to perform the alignment process.
2) OFF to ALIGN to NAV. Switching from OFF to ALIGN to NAV requires that the initial position be entered during the alignment period, and that the airplane is not moving. Once the alignment process is complete, the align annunciator will go out and the IRU will enter the navigate mode.
3) NAV to ALIGN. Switching from NAV to ALIGN will zero the system residual velocity errors and level the system. If the ground speed is greater than 20 knots, the IRU will remain in the NAV mode of operation. A maximum of 30 seconds is required to complete the process. It is permissible to enter a second, more accurate latitude and longitude to improve the system alignment. Updates to latitude and longitude are allowed only during the ALIGN mode. The system will enter the navigation mode when selected manually.
4) NAV to ALIGN to NAV. This sequence, when completed in less than 30 seconds, will zero the system residual velocity errors and level the system. The system will automatically revert to the NAV mode after the 30 second releveling process is complete. The above sequence can only be performed when the airplane is not moving.

(2) Alignment Conditions and Indications (Fig. 3)
(a) The table lists annunciation for good alignment. It also lists alignment problems.

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ALIGNMENT CONDITIONS TABLE

ACTION	RESULTS		
	ALIGN ANNUNCIATOR	FAULT ANNUNCIATOR	OPERATIONAL MODE
MODE SELECT SWITCH MOVED TO ALIGN OR NAV FROM OFF.	ON	OFF	ALIGN
ELAPSED TIME = 0:			
LATITUDE DATA ENTERED.	ON	OFF	ALIGN (DATA STORED)
LONGITUDE DATA ENTERED IS NOT WITHIN 1 DEGREE OF PREVIOUS ENTRY OR MISCOMPARES WITH STORED VALUE.	FLASHING	OFF	ALIGN (DATA STORED)
SAME LONGITUDE DATA ENTERED SECOND CONSECUTIVE TIME (IDENTICAL DATA).	ON	OFF	ALIGN (DATA ACCEPTED)
ACCEPTABLE LONGITUDE DATA ENTERED.	ON	OFF	ALIGN (DATA ACCEPTED)
ELAPSED TIME = 10 MINUTES:			
NO LATITUDE AND/OR LONGITUDE DATA HAS BEEN ACCEPTED.	FLASHING	OFF	ALIGN (AWAITING DATA)
INVALID LATITUDE DATA ENTERED.	FLASHING	OFF	ALIGN (DATA IGNORED)
MARGINALLY BAD LATITUDE DATA ENTERED FOR FIRST TIME, MISCOMPARES WITH COMPUTED LATTITUDE.	FLASHING	OFF	ALIGN (DATA STORED)
DIFFERENT LAT ENTERED MISCOMPARES WITH COMPUTED LATITUDE.	FLASHING	OFF	ALIGN
SAME LATITUDE DATA ENTERED SECOND CONSECUTIVE TIME (IDENTICAL DATA).	ON	ON	ALIGN
LONGITUDE DATA INVALID, NOT WITHIN 1 DEG OF PREVIOUS ENTRY OR MISCOMPARES WITH STORED VALUE.	FLASHING	OFF	ALIGN (DATA STORED)
AIRPLANE WAS MOVED DURING 10-MINUTE INTERVAL. ALIGNMENT AUTOMATICALLY RESTARTS AFTER 30 SECONDS USING PREVIOUS ENTRY.	ON	OFF	ALIGN (DATA ACCEPTED)
SAME BAD LONGITUDE DATA ENTERED SECOND CONSECUTIVE TIME (IDENTICAL DATA).	ON	OFF	ALIGN (DATA ACCEPTED)
SOME OTHER DIFFICULTY IS PREVENTING PROPER ALIGNMENT (IRS FAULT).	ON/FLASH	ON/OFF	ALIGN
LATITUDE AND LONGITUDE DATA HAVE BEEN ACCEPTED, AIRPLANE WAS NOT MOVED, NO OTHER PROBLEMS ARE PREVENTING ALIGNMENT, AND MODE SELECT SWITCH IS IN NAV POSITION.	OFF	OFF	NAV
MODE SELECT NAV-ALIGN-NAV CONDITION. ZEROES RESIDUAL VELOCITY ERRORS.	OFF	OFF	ALIGN

IRS Alignment Conditions
Figure 3

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(b) The IRU compares entered longitude with the last known longitude stored in BITE memory. If the difference is greater than one degree, the ALIGN annunciator flashes. This could legitimately occur (i.e. the entry is correct) if the IRU was newly installed. In this case, a re-entry of the same (correct) position will be accepted.

NOTE: Latitude and longitude are not compared to the present position stored in memory after the IRU is powered down from the attitude mode or due to a power loss or after the IRU is returned from a repair center.

(c) Entered latitude is compared with an IRU computed latitude during alignment. A difference in latitude Sine/Cosine of greater than .15/.01234 causes a flashing ALIGN light.

NOTE: The latitude sin/cos test will be performed only once per latitude entry and once prior to entering NAV mode.

(3) Laser Gyro Operation (Fig. 4)

(a) The ring laser gyro uses laser light to measure angular rotation. It is contained in a triangular cavity filled with helium-neon gas. Mirrors are mounted at each corner, and high voltage electrodes are mounted in each leg. The cavity and mirrors form a positive feedback, resonant system required for laser action.

(b) When a high voltage is applied between the cathode and anodes, the helium-neon gas ionizes, producing a clockwise and counterclockwise beam of laser light. The two light beams are reflected around the cavity by the mirrors.

(c) The path length around the cavity is carefully monitored. It is then adjusted so that it is an integral multiple of the peak power laser wavelength.

(d) When the laser gyro is at rest, the frequencies of the two opposite travelling laser beams are equal. When the laser gyro is rotated about an axis perpendicular to the laser beams' plane, a frequency difference between the two laser beams results. The frequency difference is created because the speed of light is constant. One laser beam will thus have a greater apparent distance to travel than the other laser beam in completing one pass around the cavity.

(e) A small amount of light from the two laser beams passes through one of the mirrors (less than .2%). The beams are combined by optical means. If there is an input angular rate, the two different light frequencies produce a beat frequency. This takes the form of a fringe (interference) pattern. This beat frequency of light compares to two different audio frequencies combining to produce a third difference frequency.

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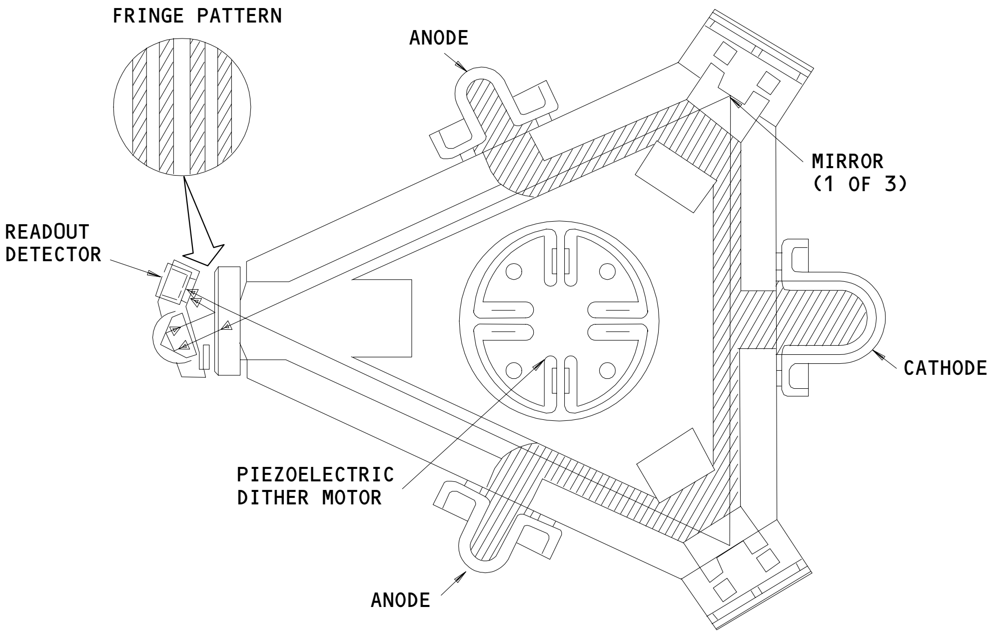

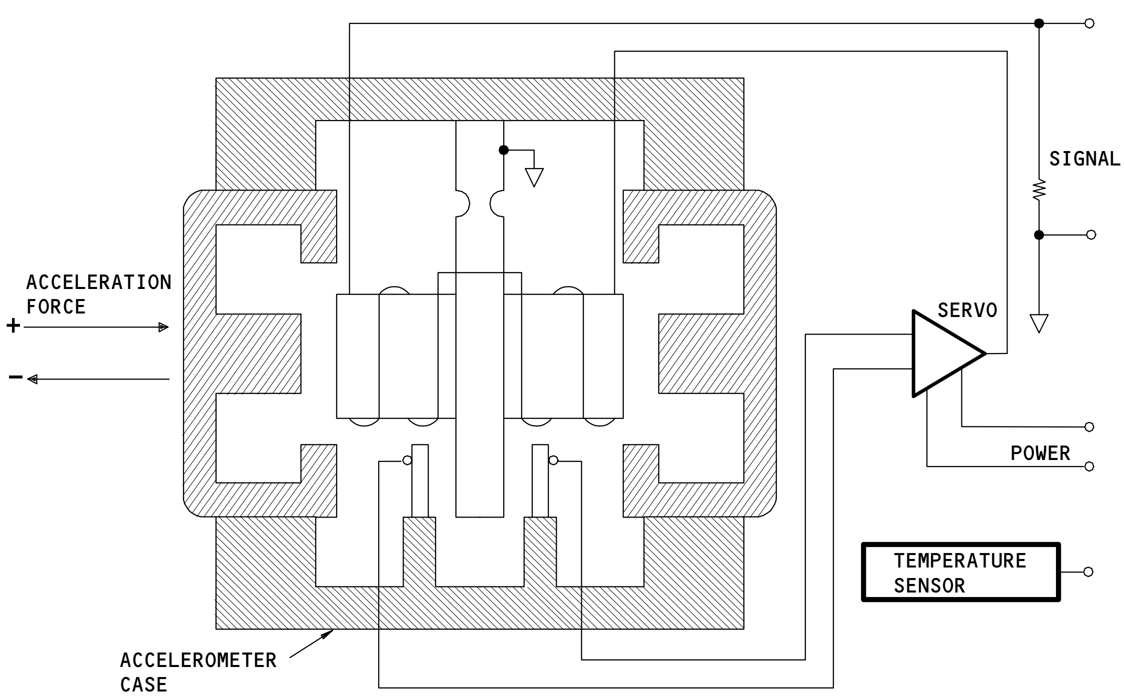

Laser Gyro and Accelerometer Operation
Figure 4

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(f) When the laser beam frequencies differ, a fringe pattern of alternate dark and light stripes is created. Photodiodes sense the fringe pattern rate and direction of movement. The frequency and relative phase of the two diode outputs indicate magnitude and the direction of the gyro's rotation.

(g) At low rotation rates, the small frequency difference between the laser beams leads to beam coupling. This locks the frequencies together at a single false value. To compensate for this effect, a piezoelectric dither motor is used to vibrate the laser block through the lock-in region. Dither vibration has a net zero average. It produces no net inertial rotation. The dither motor vibration can be felt on the IRU case and produces an audible hum.

(4) Accelerometer Operation

(a) The accelerometer senses acceleration (changes in velocity). A proof mass is mounted on a pivot between two capacitor plates. The proof mass suspends a common capacitor plate forming two capacitances, C1 and C2. During an acceleration, the proof mass begins to pivot causing the capacitances to become unequal.

(b) A servo loop senses the unequal capacitances. As a result, it forces current through an electromagnetic torque coil which drives the proof mass to null (C1=C2). The changing servo current is proportional to acceleration. It provides a continuous measure of static and dynamic acceleration.

(c) A temperature sensor is provided for each axis (X, Y, Z) to improve accelerometer accuracy. Each sensor provides a signal proportional to temperature. This signal is used by the IRU for compensation and correction of sensor data.

(5) IRS Block Diagram (Fig. 5)

(a) Normal system power is 115v ac from circuit breakers in P11 with 28v dc from the hot battery bus providing a backup power source.

(b) Switching to 28v dc is accomplished automatically by each IRU when loss of 115v ac is sensed. If 115v ac power to all three IRUs is not available, a time delay relay conserves battery power by disconnecting power the right IRU. Five minutes after 28v dc is supplied from the main battery relay, the backup hot battery bus 28v dc is removed from the right IRU by the IRS DC power disconnect relay. The center and left IRUs remain powered from the airplane battery. During autoland, the center bus isolation relay, K123, inhibits the IRS DC power disconnect relay.

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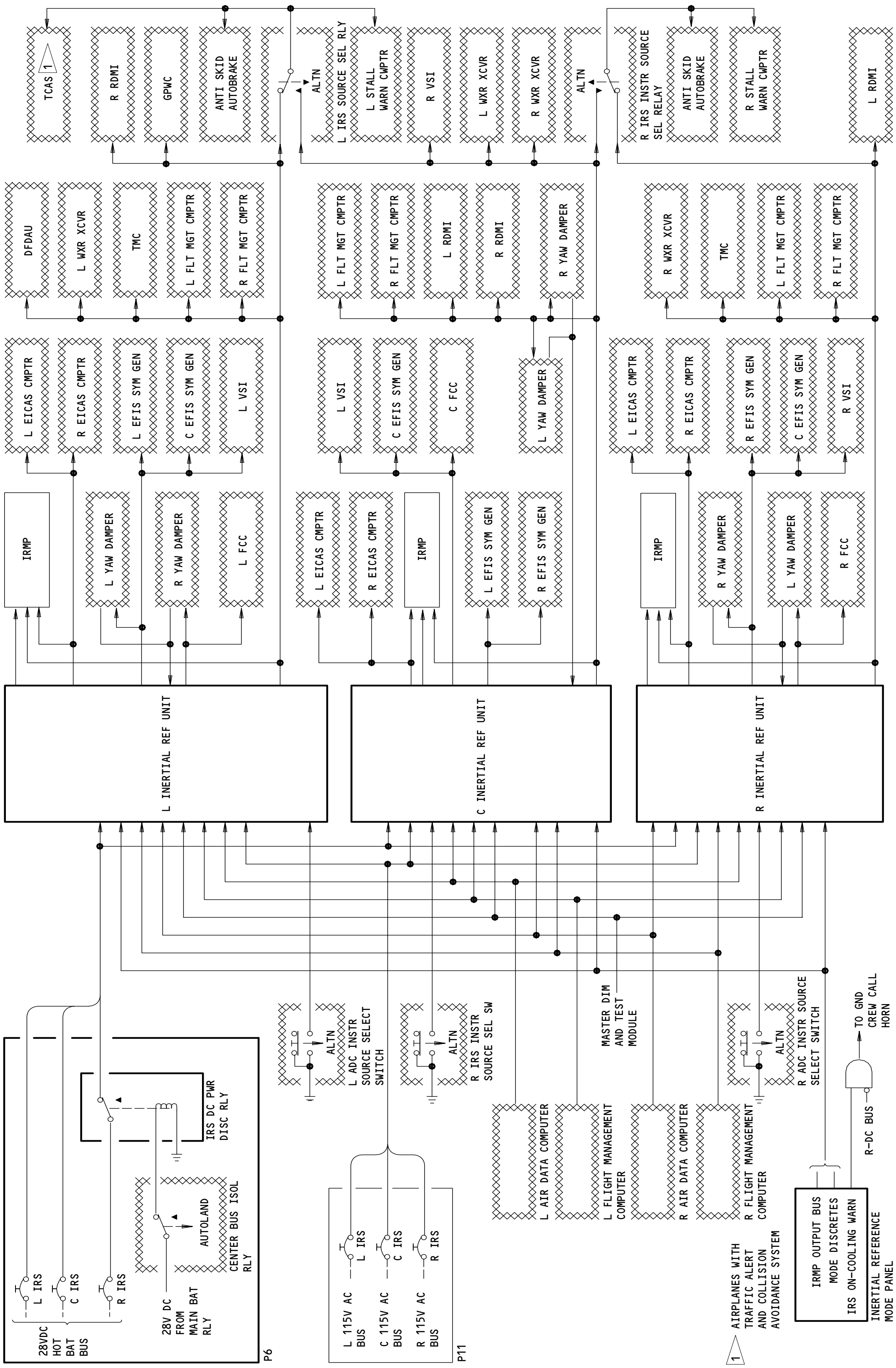

Inertial Reference System Block Diagram
Figure 5

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(c) The inertial reference mode panel provides mode select discretes to the IRUs.

(d) The left and right air data computers provide altitude, altitude rate, and true airspeed to the IRU's. For the left and right IRUs, the ADC is selected by the onside ADC instrument source select switch. The center IRU receives a switching discrete from the first officer's IRS source select switch to control which (left or right) ADC input it utilizes. In normal position, the left ADC supplies the center IRU. In ALTN (alternate) position, the right ADC supplies the center IRU.

(e) Data also comes from both left and right flight management computers as initialization inputs.

(f) The ground-crew call horn will sound during either of the conditions that follow:

1) An IRU is on and there is no power to the over-temperature protection circuits (AC and HMG DC power has failed or pilot selected equipment cooling override).

2) AC and HMG DC power are lost and an IRU is on (powered from the main battery).

(g) Each IRU transmits data related to airplane heading, attitude, inertial velocities, position, acceleration, angular rates, and wind velocity and direction to the various airplane systems. Status discretes are routed to the IRMP and to the EICAS computers for display on the upper EICAS display unit.

(h) The data transmitted to the IRS instrument source select relays is routed to the stall warning computers and the antiskid/autobrake system. The antiskid/autobrake system monitors IRU calculated ground speeds to maintain the optimum deceleration rate while the autobrake system is in use.

(i) If either yaw damper is placed in self-test, all three IRUs will be given a self test discrete input.

(6) System Operation (Fig. 6, 7)

(a) The left and right IRS are shown on the schematics. Only the internals of the right system are shown. However, all systems are similar, so the write up applies to the other systems.

(b) The IRMP and the FMC's supply initialization data and the ADC's furnish required air data inputs to the system. The IRMP also supplies mode selection discretes to the IRU. A yaw damper remote test discrete directs IRS to output canned data for checks of the yaw damper system and inter-system wiring.

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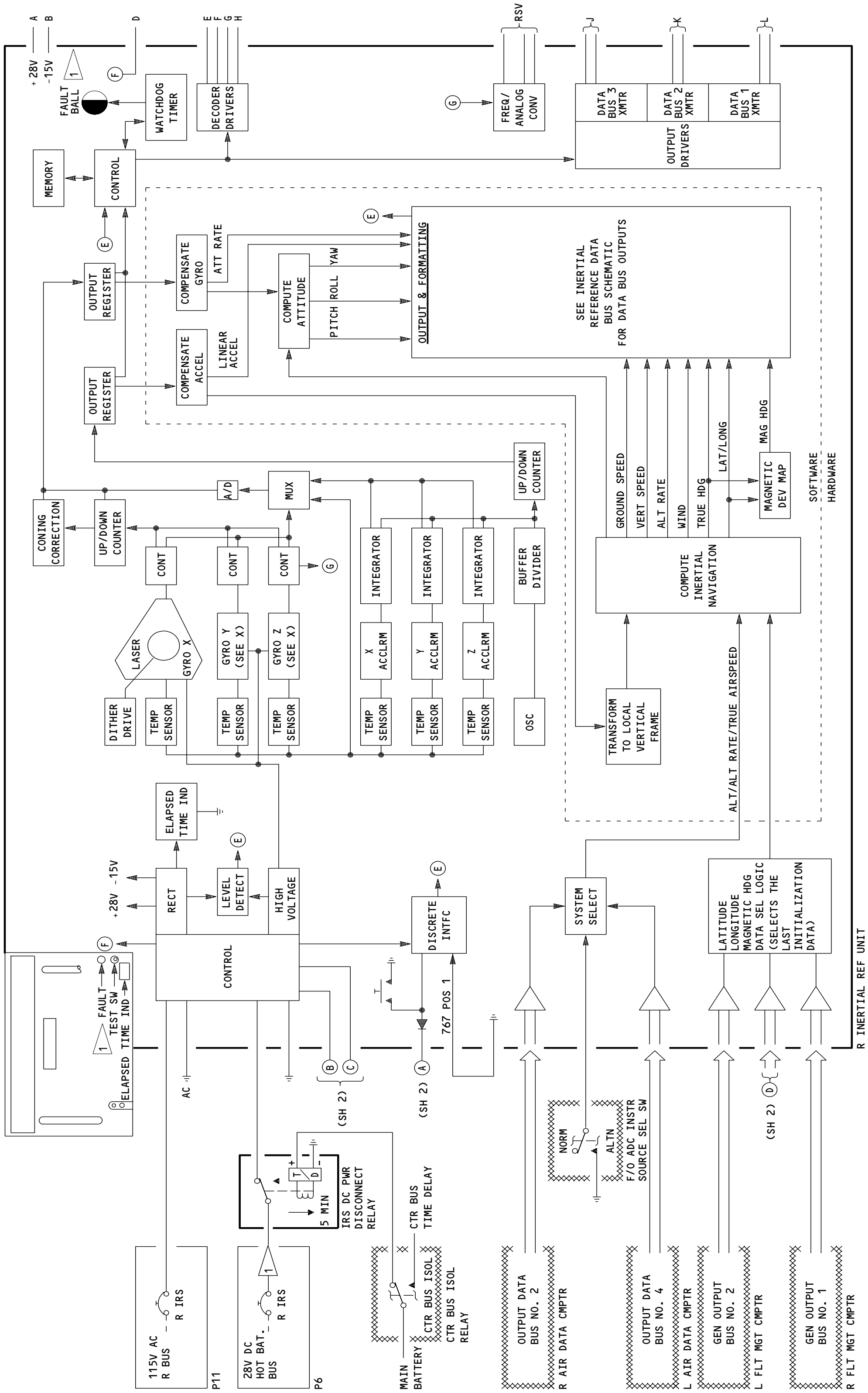

1 AIRPLANES WITH -110 IRUs AND SUBSEQUENT; NO FAULT BALL INDICATOR IS INSTALLED. THE CHASSIS INDICATOR HOLE CONTAINS A PLUG.

Inertial Reference System Schematic (Typical)
Figure 6 (Sheet 1)

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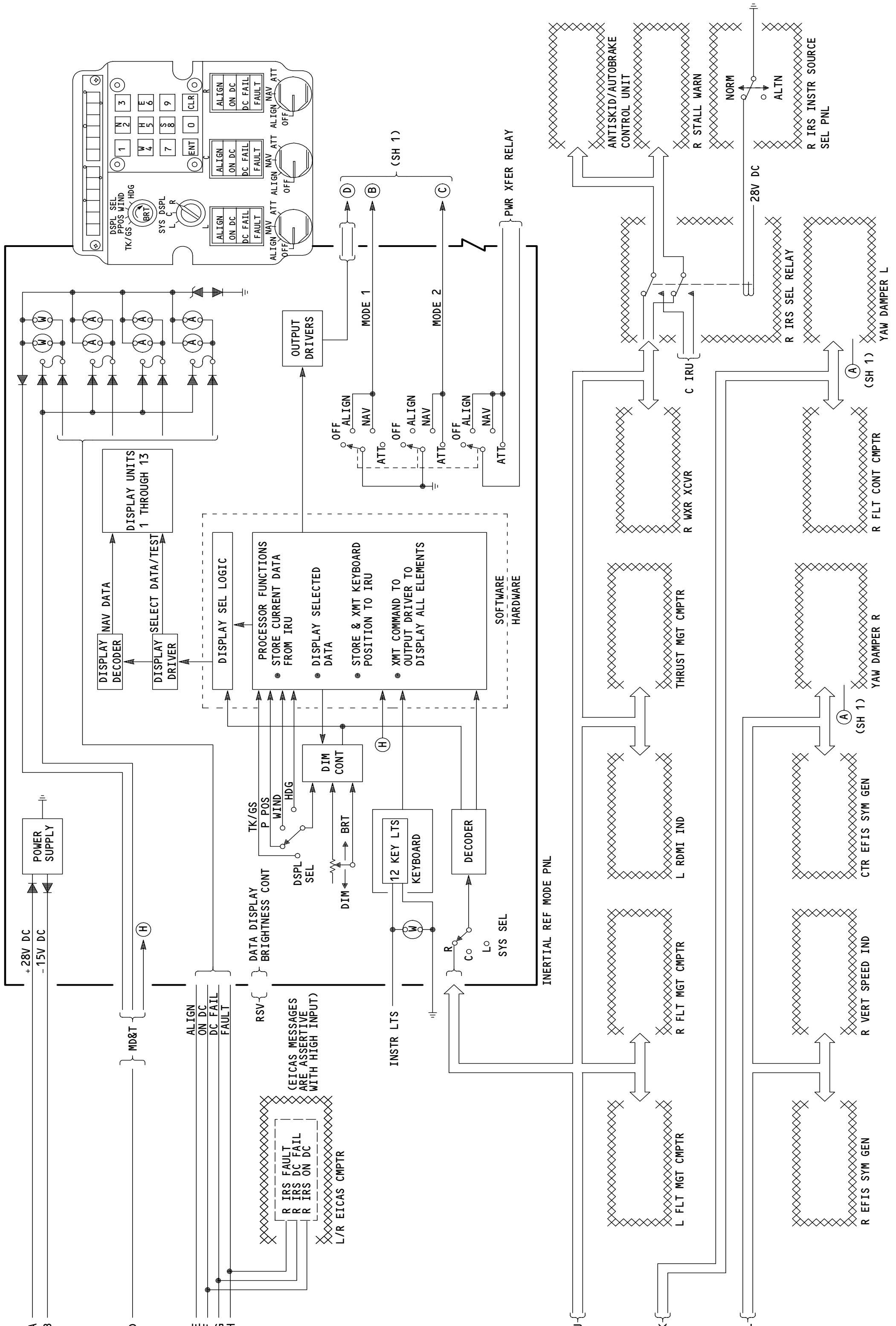

Inertial Reference System Schematic (Example)
Figure 6 (Sheet 2)

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IRU DATA BUS OUTPUTS •

IRU DATA BUS INPUTS +

OUTPUT SIGNALS \ IRU OUTPUT TO	R IRS SEL	L IRS SEL	IRMP	L,R FMC	DFDAU	L FLT CONT CMPTR	C FLT CONT CMPTR	R FLT CONT CMPTR	GND PROX CMPTR	L EFIS SYM GEN	C EFIS SYM GEN	R EFIS SYM GEN	THRUST MGMT CMPTR	L WXR RCVR	R WXR RCVR	L,R YAW DAMPER	L SWC	R SWC	L RMI /RDMI	L VSI	R RMI /RDMI	R VSI	L AIR DATA CMPTR	R AIR DATA CMPTR	IRU INPUT FROM \ INPUT DATA
L IRU		•	• +	• +	•	•			•	•	•		•	•		•	•			•	•		+		L IRU
R IRU	•		• +	• +				•			•	•	•		•	•		•	•		•	•	+	+	R IRU
C IRU	•	•	• +	• +			•			•	•	•		•	•	•	•	•	•	•		•		+	C IRU
ALONG TK HRZ ACCEL			+	• +		•	•	•																	SET LATITUDE
BODY LATERAL ACCEL			+	• +		•	•	•								•									SET LONGITUDE
BODY LONGIT ACCEL	•	•	+	• +		•	•	•									•	•							SET MAGNETIC HDG
BODY NORMAL ACCEL						•	•	•					•				•	•					+	+	ALTITUDE (29.92)
BODY PITCH RATE						•	•	•					•				•	•					+	+	ALTITUDE RATE
BODY ROLL RATE						•	•	•								•							+	+	TRUE AIRSPEED
BODY YAW RATE						•	•	•					•			•									
CROSS TK HRZ ACCEL				•		•	•	•		•	•	•													
DRIFT ANGLE					•					•	•	•													
E-W VELOCITY				•																					
FLIGHT PATH ACCEL				•		•	•	•		•	•	•	•												
FLIGHT PATH ANGLE					•					•	•	•													
GROUND SPEED	•	•		•		•	•	•		•	•	•	•			•									
GROUND SPEED-D			•							•	•	•													
INERTIAL ALTITUDE				•		•	•	•					•												
INERTIAL VERT SPD				•	•	•	•	•					•							•		•			
MAGNETIC HEADING				•		•	•	•		•	•	•							•		•				
MAGNETIC HEADING-D									•																
N-S VELOCITY				•																					
PITCH ANGLE				•		•	•	•		•	•	•	•	•	•		•	•							
PITCH ATT RATE						•	•	•																	
PRESENT POS LAT-D			•																						
PRESENT POS LONG-D			•																						
PRESENT POS-LAT				•	•																				
PRESENT POS-LONG				•	•																				
ROLL ANGLE				•		•	•	•		•	•	•	•	•	•	•									
TRACK ANGLE TRUE						•	•	•		•	•	•													
TRACK ANGLE TRUE-D			•																						
TRACK ANGLE-MAG						•	•	•		•	•	•													
TRUE HEADING				•		•	•	•		•	•	•							•		•				
TRUE HEADING-D			•																						
VERTICAL ACCEL				•		•	•	•																	
WIND DIRECT TRUE					•					•	•	•													
WIND DIRECT TRUE-D			•																						
WIND SPEED					•					•	•	•													
WIND SPEED-D			•																						
DISCRETES: ALIGN MODE/NR				•																					
DISCRETES: REV ATTITUDE MODE				•																					
DISCRETES: NAV MODE				•																					
DISCRETES: SET HEADING				•																					
DISCRETES: ATTITUDE INVALID				•																					
DISCRETES: DC FAIL				•																					
DISCRETES: ON DC				•																					
DISCRETES: ADC FAULT				•																					
DISCRETES: IRU FAULT				•																					
DISCRETES: DC FAIL ON DC				•																					
DISCRETES: ALIGN FAULT				•		•	•	•					•												
DISCRETES: NO IRS INITIAL				•		•	•	•					•												
DISCRETES: EXCESS MOTION ERR				•		•	•	•					•												
DISCRETES: ADC/IRU FAULT				•		•	•	•					•												

Inertial Reference Data Bus Schematic
Figure 7

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(c) When airplane power fails, the IRU automatically switches to battery power. The right system stays on battery power for a maximum of 5 minutes. The left and center systems stay on battery power indefinitely. All three systems stay on battery power during autoland.
    1) The right system stays on battery power for a maximum of 5 minutes. The left and center systems stay on battery power indefinitely. All three systems stay on battery power during autoland.

(d) Power Supply - The power supply furnishes the control currents and voltages for the IRU and IRS mode select panel. The main supply provides two drive signals for the HV power supply. It also provides two status indication signals for the IRS mode select panel. It provides two mode selection signals to the input electronics, and a power-up initialization signal for the entire IRS.

(e) The power supply receives 115 V, 400 Hz power and 28 V dc back-up power from the airplane. MODE 1 and MODE 2 mode select discretes from the IRMP, control the on/off condition of the main power supply.

(f) If 115 V ac is not available from the airplane, the IRU automatically switches to 28 V dc battery power. It also provides a signal to light the ON DC annunciator on the IRMP. If the battery voltage drops below 18 V, the IRU will generate a DC FAIL discrete which is displayed at the IRS MODE SELECT panel.

(g) After 5 minutes on battery power or termination of autoland, the DC power disconnect relay (K137) opens to remove battery power from the right IRU. The left and center IRU's stay on battery power until the voltage drops below 18 V. The center bus isolation relay (K123) maintains triple system operation during autoland (Ref 24-00-00).

(h) When the IRMP's mode select switch is moved from OFF to ALIGN or NAV, a self-test BITE signal disables the 115v ac input and inserts the 28v dc battery as the power source for 5 seconds. This tests the battery and associated power switching circuits. The ON DC annunciator lights momentarily during this test.

(i) Gyro electronics - Each laser sensor assembly contains a laser gyro fringe pattern detector, and control circuits. The main function of each laser gyro assembly is to produce pulsers indicating CW/CCW rotation.

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(j) The laser gyro detects pitch, roll, and yaw rates and provides this data to the IRU/ADIRU computer for computation and navigation. A temperature sensor provides a signal that is used for correction of thermal drifts. Each gyro has correction values stored in a PROM which details the gyro's unique bias, thermal, and alignment characteristics. The PROM data is routed to the CPU at turn-on. It is used to provide error correction of laser gyro outputs.

(k) The laser gyro is started by -950 V dc and +3500 V dc levels from the HV power supply. Once laser action starts, the +3500 V dc is turned off and operation is sustained on the -950 V dc supply. Control signals standardize the path length for each gyro such that gyro operation effeciency is maximized. A dither drive circuit controls the operation of the dither motor. The dither motor develops a vibration to keep the gyro out of the lock-in region during low rotation rates.

(l) Accelerometer electronics - These circuits consist of three accelerometers, temperature sensors and wave-shaping circuits. This portion of the IRU outputs analog and digitized acceleration. The output of each accelerometer is an analog current proportioned to acceleration. The current is integrated and digitized and the digital counts are stored. They are then used to produce a component of velocity and change in velocity (acceleration) for each axis.

(m) The accelerometer electronics also contains a 7.68 MHz precision system clock. The clock outputs are divided down to 3.84 MHz and 640 kHz. The clock signals control the timing of data transfer and computer program execution.

(n) Sensor electronics and A/D multiplexer - The A/D multiplexer converts analog input signals from the sensors into digital words. The input signals are accelerometer analog currents and sample and hold signals, pitch rate, temperature sensor signals, and BITE monitor signals.

(o) Acceleration and gyro data are received under timing control of a clock signal. The accelerometer pulses are accumulated as velocity and change in velocity. The gyro pulses are summed as changes in angular rate and direction. Coning circuits correct the gyro data for errors developed by the cone-shaped motion of the gyros. Sensor data is then routed to the common CPU bus.

(p) IRU sensor data is supplied by the laser gyros, accelerometers, and their temperature sensors. Signal outputs of these devices are formatted into data words for manipulation by the IRU computer. A microprocessor is used in the IRU computer of the central processing unit (CPU). A common data bus links the following blocks of the IRU.
    1) Input electronics.
    2) Sensor electronics and A/D multiplexor.
    3) CPU
    4) Output electronics.
    5) BITE electronics.

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(q) Input Electronics - The IRU receives altitude, altitude rate, and true airspeed (TAS) from the air data computer (ADC). The flight management computers (FMCs) and the IRMP send initial latitude/longitude and heading (in the ATT mode only) to the IRU. This data is transferred to the IRU memory. It is then placed on the CPU input bus for use by the CPU computer program. Mode 1 and Mode 2 discretes, switched from the IRS mode select panel, select the operating mode using open/ground logic as shown on the schematic. IRU on/off discretes alert the equipment cooling system that the IRU is on/off.

(r) CPU - The IRU computer is controlled by a stored program. The computer uses the sensor data to perform calculations.

(s) A 16-bit microprocessor is used as the central processing unit (CPU) for each IRU. Input control signals direct the CPU to perform specific tasks with the aid of software. The program is run at the system clock frequency of 3.84 MHz. The sensor inputs are compensated for inherent drifts, bias, and misalignments. The program uses stored coefficients to perform this function. The inputs are used to compute airplane attitude. This attitude is referenced to the local level navigational coordinates. The angular rate of the airplane over the surface of the earth is also included in the computation. This rate accounts for the airplanes velocity and the earth's rotation. This provides for rotation of the local vertical. Attitude data is also used to resolve acceleration data into the local level coordinate frame. Acceleration is used to compute the airplane's horizontal and vertical velocity. It is also used to compute the airplanes present position.

(t) A magnetic deviation look-up table is used to compute magnetic heading. The look-up table contains values of global deviation stored in memory. As the result, heading is computed as a function of present position latitude and longitude. This computed data is added to true heading and true track to produce magnetic referenced data. In the areas beyond 82 degrees south and 82 degrees north, and the magnetic polar regions, the IRS transmits NO COMPUTED DATA (NCD) for magnetic heading.

(u) The IRS uses inputs from the ADC to compute windspeed and direction. It also uses these inputs to smooth out the vertical velocity and altitude computations.

(v) When the mode select switch on the IRMP is placed in the ALIGN position, the respective IRU enters the alignment mode. The IRU reference axis is aligned to the local vertical. It computes latitude by estimating the horizontal earth rate components. True north is computed from the vector sum of these earth rate components. While in the alignment mode, the IRU will output a signal to light the ALIGN display on the IRMP.

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(w) Ten minutes are required to complete the alignment for any latitude between ± 70 degrees. For latitudes greater than ± 70 degrees, a 17-minute alignment procedure is required. The system can engage the NAV mode at any time after a proper alignment. This is determined by the following:
   1) The total time in the ALIGN mode is 10 minutes or greater. For latitudes above 70 degrees, a 17 minute alignment will provide the necessary accuracy to engage the NAV mode.
   2) The quality-of-alignment index is less than 1. (This is a measurement of how fast the computed earth rate is reaching a steady state value).
   3) For latitude, the cosine of the entered amount equals the cosine of the computed amount within 0.01234.
   4) For latitude, the sine of the entered amount equals the sine of the computed amount within 0.15.
   5) The longitude in memory equals the input longitude within one degree.
   6) Latitude and longitude are not compared to the present position stored in memory after any of the following conditions:
      a) The IRU is powered down from the attitude mode.
      b) The IRU is powered down due to a power loss.
      c) The IRU is returned from a repair center.

(x) AIRPLANES WITH -109 IRU's AND PREVIOUS;
If during the alignment process the criteria outlined is not met, several indications occur. If the quality-of-align index is greater than one when the IRU attempts to sequence from the ALIGN to the NAV mode, the IRU transmits a signal to the IRS MODE SELECT panel. The signal lights the FAULT annunciator and sets the fault ball on the IRU. This fault is also stored in BITE memory.

(y) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
If during the alignment process the criteria outlined is not met, several indications occur. If the quality-of-align index is greater than one when the IRU attempts to sequence from the ALIGN to the NAV mode, the IRU transmits a signal to the IRS MODE SELECT panel. The signal lights the FAULT annunciator. This fault is also stored in BITE memory.

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(z) If the entered latitude fails the sin/cos test, the ALIGN annunciator will flash. If the same latitude is entered a second time, the flashing ALIGN annunciator will go steady and the FAULT annunciator will light. If the second latitude entry does not agree with the first entry, the ALIGN annunciator will continue to flash. A FAULT is annunciated only after the same latitude is entered twice and fails the sin/cos test after the second entry. However, a latitude may be entered at anytime during the alignment process. If it passes the tests, the system will enter the NAV mode, providing that the IRMP switch is in the NAV position.

NOTE: The latitude sin/cos test will be performed only once per latitude entry and once prior to entering NAV mode.

(aa) The entered longitude is compared to the last computed longitude stored in the IRU memory. If the difference is greater than one degree, the ALIGN annunciator will flash and the test failure is stored in memory. If the second longitude entry is identical to the first, the longitude is then taken as correct, the ALIGN annunciator goes out, and the IRU enters the NAV mode. If the remaining tests pass, conditions are satisfied. Once in the NAV mode, no further updates of latitude or longitude are accepted by the IRU.

(ab) When the mode select switch is in NAV or ALIGN position (ALIGN mode only), updating of the present position latitude and longitude is allowed from the FMC. This, however, cannot occur once the IRS has entered the NAV mode. In the NAV mode, the IRS performs inertial navigation. It provides data on airplane attitude. It outputs body rates and accelerations. It also provides true and magnetic heading along with velocity vectors. Latitude and longitude are also output. The IRS accepts the latitude and longitude entered during the alignment mode as the starting point for dead-reckoning computations.

(ac) The attitude mode provides a rapid attitude/heading restart capability. The ATT mode is used if the IRS has had a total power shutdown for more than .010 seconds. ATT mode outputs are attitude/heading, rate, acceleration and vertical velocity.

(ad) The attitude mode is selected by switching the mode select switch to the ATT position. Magnetic heading inputs from the IRMP and FMC are only accepted by the IRU while the mode select switch is in the ATT position.

(ae) If the attitude mode is selected, the magnetic heading changes will track the platform heading changes after heading is entered.

(af) The bus transmitters format and transfer CPU data to the ARINC 429 busses. The ARINC 429 busses supply identical information to the interface system and the IRMP.

(ag) Status discretes are sent to the IRS MODE SELECT panel status annunciators and to EICAS.

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B. BITE

(1) Fault Monitoring

(a) AIRPLANES WITH -109 IRU's AND PREVIOUS;
IRU BITE automatically monitors unit performance. It also initiates self-tests. It detects failures that could cause erroneous outputs of heading, attitude, angular rates, or accelerations. If BITE detects any of these failures, it will cause the IRS valid output discrete to be set invalid. It will also light the FAULT indicator on the IRMP and set the IRU faultball. All inputs are transmitted with a failure warning sign/status matrix if a critical fault is detected. BCD data is removed from the data bus upon detection of a critical failure.

(b) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
IRU BITE automatically monitors unit performance. It also initiates self-tests. It detects failures that could cause erroneous outputs of heading, attitude, angular rates, or accelerations. If BITE detects any of these failures, it will cause the IRS valid output discrete to be set invalid. It will also light the FAULT indicator on the IRMP. All inputs are transmitted with a failure warning sign/status matrix if a critical fault is detected. BCD data is removed from the data bus upon detection of a critical failure.

(c) BITE monitors and tests the following:

1) Power supply
2) Laser gyros and accelerometers
3) Pitch rate output
4) Discrete Input/Output
5) Sensor/electronics
6) Computer clock/interfaces
7) Input receiver and output transmitters
8) Alignment, air data input, and computed data reasonableness
9) Derived latitude compared to entered latitude
10) Keyed in longitude compared to stored longitude
11) Memory operation
12) Instruction execution
13) Internal temperature

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(d) AIRPLANES WITH -109 IRU's AND PREVIOUS;
The watch dog timer (WDT) monitors and detects failures that prevent the CPU from executing its program. The CPU is programmed to reset the WDT every 20 ms (50 Hz rate). If the CPU is unable to reset the WDT because of a computer failure, hangup, or memory failure, the WDT will time out. This will set the faultball and light the FAULT annunciator. In addition, the analog pitch rate will be invalidated and a fault word will be written into BITE memory.

(e) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
The watch dog timer (WDT) monitors and detects failures that prevent the CPU from executing its program. The CPU is programmed to reset the WDT every 20 ms (50 Hz rate). If the CPU is unable to reset the WDT because of a computer failure, hangup, or memory failure, the WDT will time out. This will light the FAULT annunciator. In addition, the analog pitch rate will be invalidated and a fault word will be written into BITE memory.

(f) Non-volatile BITE memory states the latest calculated longitude and accumulated BITE status record of the last two power-on periods. It also stores a summary of IRS discrete message words for the last six power on periods.

(g) AIRPLANES WITH -109 IRU's AND PREVIOUS;
When BITE detects a failure, the analog pitch rate invalid discrete is set. The fault annunciator on the IRS MODE SELECT panel is also lit and the faultball is set.

(h) AIRPLANES WITH -110 IRU's AND SUBSEQUENT;
When BITE detects a failure, the analog pitch rate invalid discrete is set. The fault annunciator on the IRS MODE SELECT panel is also lit.

(2) Interface Test

(a) Pushing the interface test switch provides the following outputs:

1) For 0 - 2 seconds - BCD output data with SSM set to functional test and all display segments illuminated. BNR output data with SSM set to functional test and data set at the pre-determined values. IRMP annunciator discretes illuminated.

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2) For 2 - 10 seconds - No BCD output data. BNR output data with SSM set to failure warning and data set to the pre-determined values. IRMP annunciator discretes indicates proper status. Pitch Rate Validity discrete set invalid.
3) Over 10 seconds - BCD output data with SSM set to functional test and data set to pre-determined values. BNR output data with SSM set to functional test and data set to pre-determined values. IRMP annunciator discretes indicate proper status. Pitch rate validity discrete indicates proper status.
4) The analog pitch rate output remains at the test value for the entire duration of the test.

(b) The interface test mode cannot be run whenever the displayed ground speed exceeds 20 knots. It also cannot be run when the IRU is in the attitude mode. Some of the test outputs are:

1)	Ground Speed	200 Kts
2)	Vertical Speed	-600 ft/min
3)	Magnetic Heading	15°
4)	Pitch Angle	5° up
5)	Present Position (Lat, Long)	N22°30.0', E22°30.0'
6)	Roll Angle	45° (R)
7)	Magnetic Heading	15°
8)	True Heading	10°
9)	Wind Speed	100 Kts

10) Wind Direction as follows:
a) 30° on the IRMP
b) 30° on the EHSI if "TRU" is shown above the compass card
c) 35° on the EHSI if "M" is shown above the compass card

(c) Pressing the test switch on the IRU, or the yaw damper test switch (Ref 22-21-00) on the P61 panel, activates the manual interface test mode. This test mode is inhibited in the NAV mode when the ground speed exceeds 20 kts and in the ATT mode. The manual interface test causes the following to occur:
1) Activation of all IRMP annunciator discretes for two seconds, causing all four IRMP annunciator to come on. Also, all IRMP display segments come on for two seconds.
2) Activation of IRS test words occurs for 8 seconds. Two of the more visible results are that the VSI and RDMI fault flags come into view.
3) After 10 seconds, each output of IRS is set to a test value until the IRU test switch is released.

C. Control
(1) To activate the IRS, do the following:
(a) Provide electrical power (MM 24-22-00).
(b) Close circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
1) 6D3, IRS L
2) 6D4, IRS C

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3) 6D5, IRS R

(c) Close these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
   1) 11F1, IRS LEFT
   2) 11F21, IRS CENTER
   3) 11F22, IRS RIGHT

(d) Turn the mode select switch on the IRMP as follows:
   1) For positions below 70 degrees north latitude, select the NAV position.
   2) For positions above 70 degrees north latitude, select the ALIGN position.

(e) Enter the present longitude and latitude at the FMC-CDU (Ref 34-61-00) or the IRMP.

(f) For positions below 70 degrees north latitude, check that the ALIGN light on the IRMP goes out at 10 minutes.

   NOTE: Re-entry of present position is necessary if the ALIGN light flashes.

(g) For positions above 70 degrees north latitude, perform the following after the 17 minute alignment procedure is complete.
   1) Turn the mode select switch on the IRMP to the NAV position.
   2) Check that the ALIGN light on the IRMP goes out.

      NOTE: Re-entry of present position is necessary if the ALIGN light flashes.

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INERTIAL REFERENCE SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
CIRCUIT BREAKERS	--		FLIGHT COMPARTMENT, P11	*
IRS CENTER, C613			11F21	*
IRS LEFT, C611			11F1	*
IRS RIGHT, C612			11F22	*
CIRCUIT BREAKERS	--		FLIGHT COMPARTMENT, P6	*
IRS C, C621			6D4	*
IRS L, C614			6D3	*
IRS R, C620			6D5	*
COMPUTER - (REF 34-12-00, FIG. 101)				
AIR DATA L, M100				
AIR DATA R, M101				
PANEL - INERTIAL REFERENCE MODE, M59	--	1	FLIGHT COMPARTMENT, P5	34-21-02
RELAY - (REF 31-01-06, FIG. 101)				
CENTER BUS ISOLATION, K123				
IRS DC POWER DISCONNECT, K137				
SWITCH - (REF 34-12-00, FIG. 101)				
CAPT ADC INSTR SOURCE SELECT, S482				
F/O ADC INSTR SOURCE SELECT, S483				
SWITCH - (REF 34-22-00, FIG. 101)				
R IRS INSTR SOURCE SELECT, S12				
UNIT - CENTER INERTIAL REFERENCE, M160	--	1	119AL, MAIN EQUIP CTR, E1-6	34-21-01
UNIT - LEFT INERTIAL REFERENCE, M159	--	1	119AL, MAIN EQUIP CTR, E1-6	34-21-01
UNIT - RIGHT INERTIAL REFERENCE, M161	--	1	119AL, MAIN EQUIP CTR, E1-6	34-21-01

* SEE THE WDM EQUIPMENT LIST

Inertial Reference System - Component Index
Figure 101

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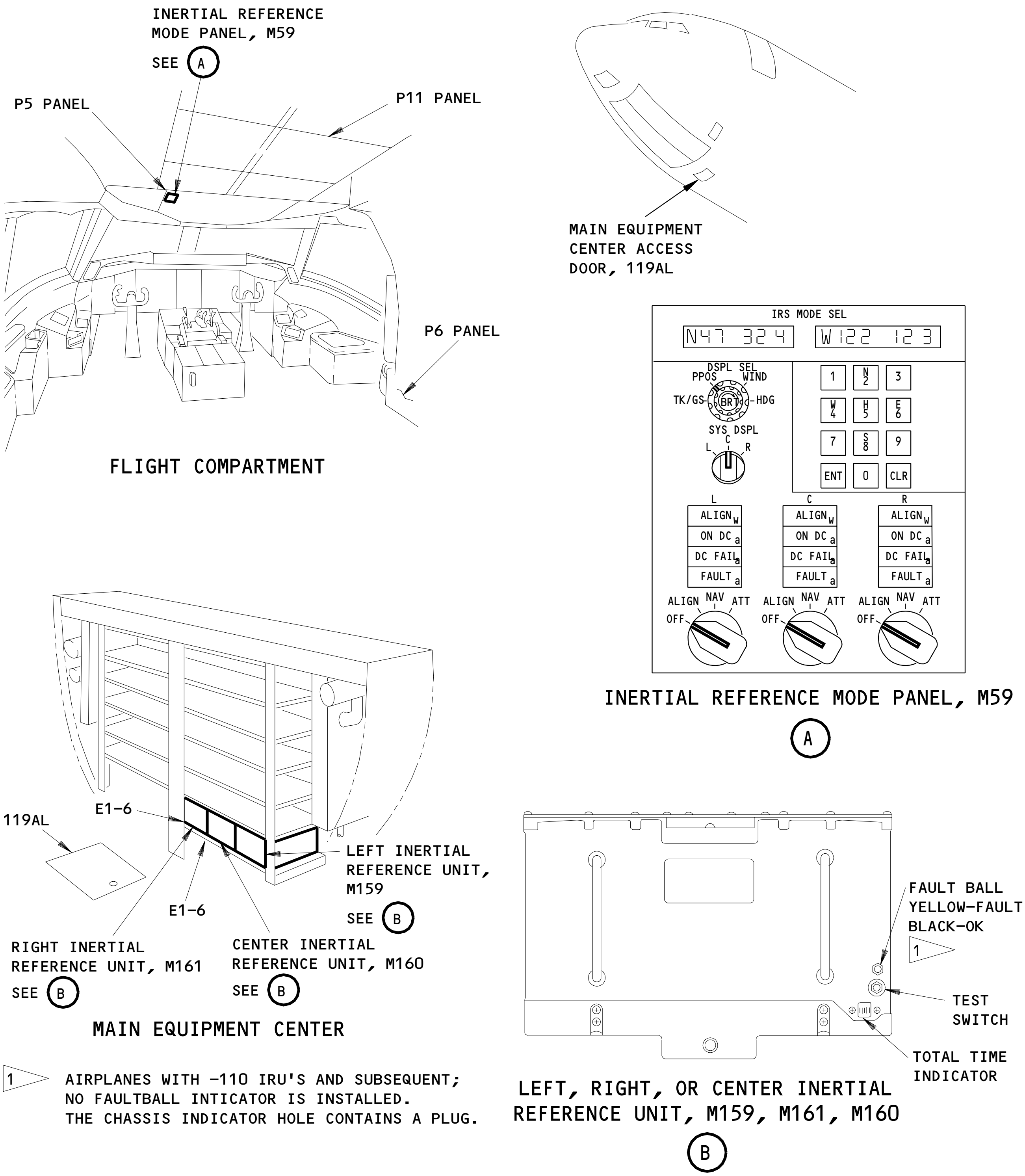

Inertial Reference System - Component Location
Figure 102

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INERTIAL REFERENCE SYSTEM - MAINTENANCE PRACTICES

1. General
   A. This procedure contains one task. That task is the alignment of the inertial reference system (IRS).
   B. There are two types of alignments: regular and high latitude.
   C. A regular alignment is used between latitudes 70.2 degrees south and 70.2 degrees north. A regular alignment takes 10 minutes.
   D. A high latitude alignment is used between latitudes 70.2 degrees north and 78.2 degrees north and from 70.2 degrees south to 78.2 degrees south. A high latitude alignment takes 17 minutes.
   E. Above 78.2 degrees north latitude and below 78.2 degrees south latitude you can not align the IRS.
   F. You can align the IRS from any flight management computer (FMC) control display unit (CDU) or the inertial reference mode panel (IRMP). You do not have to align the IRS from the IRMP and a CDU. You only have to align the IRS from a single source.
   G. There are three IRS alignment messages displayed on the FMC CDU. Push the clear key to remove the message from the CDU.
      (1) IRS MOTION (the airplane moved during alignment)
      (2) CYCLE IRS OFF-NAV (on IRS alignment problem makes it necessary to turn the mode switch to OFF and then to NAV)
      (3) ENTER IRS POSITION (the FMC finds a problem that makes it necessary to put the position in again).
   H. You can not move the airplane while you align the IRS.
   I. You must know the local latitude and longitude to align the IRS.

   TASK 34-21-00-822-006
2. Alignment of the IRS
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zone
            211 Flight Compartment - Left
            212 Flight Compartment - Right

   C. Prepare to Align the IRS

      S 862-007
      (1) Make sure that these circuit breakers are closed:
         (a) P11 Overhead Circuit Breaker Panel
            1) 11E4, EFIS CONT PNL LEFT
            2) 11E8, FMCS CDU LEFT
            3) 11E9, FMCS CMPTR LEFT
            4) 11E25, EFIS CONT PNL RIGHT
            5) 11E29, FMCS CDU RIGHT
            6) 11E30, FMCS CMPTR RIGHT
            7) 11F1, IRS LEFT
            8) 11F8, EFIS SYM GEN L
            9) 11F9, EFIS SYM GEN C
            10) 11F21, IRS CENTER

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11) 11F22, IRS RIGHT
12) 11F29, EFIS SYM GEN RIGHT

(b) P6 Main Power Distribution Panel
1) 6D3, IRS L
2) 6D4, IRS C
3) 6D5, IRS R

S 862-017
(2) Make sure that the EQUIP COOLING switch on the P5 panel is set to the AUTO position.

S 862-037
(3) Make sure that the captain's and first officer's F/D switches on the mode control panel are set to the OFF position.

S 862-027
(4) Set the NAV switch on the captain's instrument source select panel to the FMC-L or FMC-R position.

S 862-028
(5) Set the NAV switch on the first officer's instrument source select panel to the FMC-L or FMC-R position.

S 862-018
(6) Supply electrical power (AMM 24-22-00/201).

S 822-009
(7) Do these steps to align the IRS from a CDU.

<u>NOTE</u>: You can align the IRS from a CDU or the IRMP. You do not have to align the IRS from the IRMP and a CDU. You only have to align the IRS from a single source.

<u>CAUTION</u>: THE SWITCHES ON THE IRMP MUST FIRST BE PULLED AND THEN TURNED TO LEAVE THE NAV POSITION. IN THE NAV POSITION, IF YOU TRY TO TURN THESE SWITCHES BEFORE YOU PULL THEM, YOU CAN DAMAGE THE IRMP.

(a) To do a high latitude alignment,
set the switches on the IRMP to the ALIGN position from the OFF position.

<u>NOTE</u>: You can find the IRMP on the P5 overhead panel.
A high latitude alignment takes 17 minutes.
Note the present time for later use in this procedure.

1) Make sure that the ON DC lights on the IRMP come on for a short time.

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2) Make sure that the ALIGN lights on the IRMP come on.

(b) To do a regular alignment,
set the switches on the IRMP to the NAV position from the OFF position.

NOTE: You can find the IRMP on the P5 overhead panel. A regular alignment takes 10 minutes.

1) Make sure that the ON DC lights on the IRMP come on for a short time.
2) Make sure that the ALIGN lights on the IRMP come on.

(c) Push the INIT REF key on the CDU.

(d) Push the line select key adjacent to the <INDEX prompt.
1) Make sure that the CDU shows the INIT/REF INDEX page.

(e) Push the line select key adjacent to the <POS prompt.
1) Make sure that the CDU shows the first POS INIT page.

(f) Push the CLR key to erase the scratch pad.

(g) Put the latitude and the longitude into the scratch pad line of the CDU.

NOTE: Do not put a space between the latitude and the longitude. Example N1234.5W01234.5

(h) Push the line select key adjacent to SET IRS POS.

NOTE: The ALIGN lights on the IRMP may flash. If they flash, make sure the position on the SET IRS POS line is correct. If correct, then enter again the same position.

1) Make sure that the CDU shows the latitude and the longitude below SET IRS POS.

(i) Push the PREV PAGE key to show the POS REF page.
1) Make sure that you can see the position you just entered on the IRS L, C, and R lines.

(j) If you did a regular alignment,
after 10 minutes, make sure that the ALIGN lights on the IRMP go off.

NOTE: The IRS is now aligned and in the navigation mode.

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(k) If you did a high latitude alignment,
after 17 minutes, set the switches on the IRMP to the NAV position from the ALIGN position.

1) Make sure that the ALIGN lights on the IRMP go off.

NOTE: The IRS is now aligned and in the navigation mode.

S 822-031

(8) Do these steps to align the IRS from the IRMP.

NOTE: You can align the IRS from the IRMP or a CDU. You do not have to align the IRS from the IRMP and a CDU. You only have to align the IRS from a single source.

CAUTION: THE SWITCHES ON THE IRMP MUST FIRST BE PULLED AND THEN TURNED TO LEAVE THE NAV POSITION. IN THE NAV POSITION, IF YOU TRY TO TURN THESE SWITCHES BEFORE YOU PULL THEM, YOU CAN DAMAGE THE IRMP.

(a) To do a high latitude alignment,
set the switches on the IRMP to the ALIGN position from the OFF position.

NOTE: You can find the IRMP on the P5 overhead panel.
A high latitude alignment takes 17 minutes.
Note the present time for later use in this procedure.

1) Make sure that the ON DC lights on the IRMP come on for a short time.
2) Make sure that the ALIGN lights on the IRMP come on.

(b) To do a regular alignment,
set the switches on the IRMP to the NAV position from the OFF position.

NOTE: You can find the IRMP on the P5 overhead panel.

A regular alignment takes 10 minutes.

1) Make sure that the ON DC lights on the IRMP come on for a short time.
2) Make sure that the ALIGN lights on the IRMP come on.

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(c) Set the DSPL SEL switch on the IRMP to the PPOS position.

NOTE: You can find the IRMP on the P5 overhead panel.

(d) Push the N or S key on the IRMP.
(e) Put in the degrees and minutes of the local latitude on the IRMP.
1) Make sure that the local latitude shows on the left side of the IRMP.
(f) Push the ENT key to transmit the local latitude to the inertial reference units (IRU).
(g) Push W or E on the IRMP.
(h) Put in the degrees and minutes of the local longitude on the IRMP.
1) Make sure that the local longitude shows on the right side of the IRMP.
(i) Push the ENT key to transmit the local longitude to the IRUs.

NOTE: The ALIGN lights on the IRMP may flash. If they flash, check the position on the IRMP to be sure it is correct. If correct, then enter the exact same position.

(j) Set the SYS DSPL switch on the IRMP to the L position.
1) Make sure that the position shown on the IRMP is correct.
(k) Set the SYS DSPL switch on the IRMP to the C position.
1) Make sure that the position shown on the IRMP is correct.
(l) Set the SYS DSPL switch on the IRMP to the R position.
1) Make sure that the position shown on the IRMP is correct.
(m) If you did a regular alignment, after 10 minutes, make sure that the ALIGN lights on the IRMP turn off.

NOTE: The IRS is now aligned and in the navigation mode.

(n) If you did a high latitude alignment, after 17 minutes, set the switches on the IRMP to the NAV position from the ALIGN position.
1) Make sure that the ALIGN lights on the IRMP go off.

NOTE: The IRS is now aligned and in the navigation mode.

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INERTIAL REFERENCE SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure has three tasks. The first task aligns the IRS. The second task does an operational test of the IRS. The operational test uses the built-in-test equipment (BITE) of the IRS. The third task does a full test of the IRS. It also tests the interface between the IRS and other systems.

TASK 34-21-00-825-003

2. Align the IRS
   A. General
      (1) You can align the IRUs from the Flight Management Computer Control Display Unit (FMC-CDU).
      (2) You can also align the IRUs from the IRMP.
   B. References
      (1) 24-22-00/201, Electrical Power - Control
      (2) 29-11-00/201, Main Hydraulic Systems
   C. Access
      (1) Location Zones
          211/212 Flight Compartment

      (2) Access Panel
          119AL Main Equipment Center

   D. Prepare to Align the IRUs

      S 865-004
      (1) Supply electrical power (Ref 24-22-00).

      S 865-005
      (2) Set the two Flight Director (F/D) switches on the Mode Control Panel (MCP) to OFF.

      S 865-006
      (3) Make sure that these circuit breakers on the overhead circuit breaker panel, P11, are closed:
          (a) 11A6, RDMI L
          (b) 11A7, EFIS DSPL SW L
          (c) 11E3, ADI LEFT
          (d) 11E4, EFIS CONT PNL LEFT
          (e) 11E5, VSI LEFT
          (f) 11E6, HSI LEFT

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(g) 11E8, FMCS CDU LEFT
(h) 11E9, FMCS CMPTR LEFT
(i) 11E24, ADI RIGHT
(j) 11E25, EFIS CONT PNL RIGHT
(k) 11E26, VSI RIGHT
(l) 11E27, HSI RIGHT
(m) 11E29, FMCS CDU RIGHT
(n) 11E30, FMCS CMPTR RIGHT
(o) 11F1, IRS LEFT
(p) 11F8, EFIS SYM GEN L
(q) 11F9, EFIS SYM GEN C
(r) 11F21, IRS CENTER
(s) 11F22, IRS RIGHT
(t) 11F24, EFIS DSPL SW RIGHT
(u) 11F25, RDMI RIGHT
(v) 11F29, EFIS SYM GEN RIGHT

S 865-169

(4) Make sure that these circuit breakers on the main power distribution panel, P6, are closed:
(a) 6D3, IRS L
(b) 6D4, IRS C
(c) 6D5, IRS R
(d) EICAS (6 places)

S 755-001

(5) IRUs WITH FAULTBALL INDICATOR;
Make sure that the faultball on each IRU is black.

E. Align the IRUs with the FMC-CDU

S 865-002

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(1) Set each IRMP mode select switch to OFF.
(a) After 1 minute, do the steps that follow:
1) Make sure the IRS annunciator lights on the IRMP stay off.

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2) Make sure that the IRS Engine Indication and Crew Alerting System (EICAS) messages do not show on the EICAS displays.

NOTE: Do not move the airplane during the align procedure. The align procedure will automatically start again 30 seconds after the airplane movement. It will use position data put in before.

S 755-008

(2) Set each IRMP mode select switch to the NAV position.

(a) Make sure that all ON DC lights on the IRMP come on and then go off.

(b) Make sure that the ALIGN lights on the IRMP come on and stay on.

S 865-009

(3) Do the steps that follow on the left FMC-CDU:

(a) Push the INIT REF switch found on the left FMC-CDU.

NOTE: You can align the IRUs from the left or the right FMC-CDU. The steps are the same. You must put in the local latitude and longitude data less than 10 minutes after the IRMP mode select switches goes to NAV or to ALIGN.

1) Make sure that the CDU shows the INIT/REF INDEX page.

(b) Push the line select key adjacent to the <POS prompt.

1) Make sure that the CDU shows the first post INIT page.

(c) Push the CLR key to erase the scratch pad.

(d) Put the latitude and the longitude into the scratch pad line of the CDU.

NOTE: Do not put a space between the latitude and the longitude. Example N1234.5W01234.5

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(e) Push the line select key that is adjacent to SET IRS POS.

NOTE: The ALIGN lights on the IRMP may flash. If they flash, make sure that the position on the SET IRS POS line is correct. If it is not correct, then enter again the same position.

1) Make sure that the CDU shows the latitude and the longitude below SET IRS POS.

NOTE: For positions below 70 degrees north latitude, the IRUs can go into the NAV mode after 10 minutes if NAV is selected on the IRMP. For all latitudes, the IRUs will remain in the ALIGN mode if ALIGN is selected on the IRMP.

(f) Push the PREV PAGE key to show the POS REF page.
1) Make sure that you can see the position you just entered on the IRS L, C, and R lines.

S 865-091
(4) If the ALIGN lights continue to flash, you must do the full align procedure again.

NOTE: You must do a full 10 minute (positions below 70 degrees north latitude) or 17 minute (positions above 70 degrees north latitude) align procedure if one or more of these conditions occur:
- airplane movement occurs during preflight alignment
- ALIGN lights flash during an align downmode (30-second realignment below 70 degrees north latitude) after two identical position entries.
- the mode selector switch is accidentally moved from the NAV to ATT position, or the NAV to OFF position

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S 865-094

(5) You can use the IRS codes that show in the maintenance code display mode to show the cause of the flash of the IRS ALIGN lights.

(a) To go into the maintenance code display mode, do the steps that follow:

1) Set the IRU SYS DSPL switch to the applicable IRU.
2) Set the DSPL SEL switch to the HDG position.
3) Put in a 0 on the keyboard, and in less than 5 seconds, a 1. (The highest priority code will show in the two right digits of the IRMP display.)
4) Make a record of the code.
5) Push the CLR switch to show the next priority code.
6) Do the steps again to see the other codes.

(b) If code 08 shows, there was airplane movement.

(c) If code 08 does not show, only a position entry is necessary.

NOTE: If code 08 does not show while in align downmode (30-second realignment) and the ALIGN light continues to flash after you put in two of the same positions, a full alignment is necessary.

S 755-095

(6) After the IRU goes into the NAV mode, make sure that the ALIGN light goes off as follows:

NOTE: If the alignment data is not accepted by an IRU, a caution signal, RE-ENTER IRS POSITION, will show on line six of the left FMC-CDU.

(a) For positions below 70 degrees north latitude with NAV selected on the IRMP mode select switch: at 10 minutes ±20 seconds.

(b) For positions below 70 degrees north latitude with ALIGN selected: as the IRMP mode select switch is moved from ALIGN to NAV after a 10 minute alignment is done.

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(c) For positions above 70 degrees north latitude: as the IRMP mode select switch is moved from ALIGN to NAV after a 17 minute alignment is done.

S 755-014

(7) Push the NEXT PAGE switch on the left FMC-CDU.

(a) Make sure that the latitude and longitude show on lines 2, 3, and 4 of the left FMC-CDU display.

NOTE: If the position data is not accepted by an IRU, the left FMC-CDU display will show no data for that IRU.

F. Alignment Procedure with the FMC-CDU and a Constant Flash of the ALIGN Light

S 865-096

(1) Set the mode select switch to OFF.

S 755-097

(2) After 30 seconds, make sure the ALIGN light goes off.

S 755-099

(3) Make sure that the airplane does not move during the align procedure. If the ALIGN lights flash because of movement, stop for 30 seconds.

NOTE: The alignment will automatically start again 30 seconds after the movement. It will use position data put in before.

S 865-100

(4) Set the IRMP mode select switch to the position that follows:

(a) For positions below 70 degrees north latitude: NAV position.

(b) For positions above 70 degrees north latitude: ALIGN position.

(c) For positions below 70 degrees north latitude, stop until the ALIGN light flashes (approximately 10 minutes).

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(d) For positions above 70 degrees north latitude, do the steps that follow:
1) Stop for 17 minutes until the alignment is done.
2) Move the IRMP mode select switch to the NAV position.
a) Make sure that the ALIGN light flashes.

S 865-102
(5) Put in the correct latitude and longitude data in the scratch pad area of the POS INIT page of the FMC-CDU.

S 865-103
(6) Push the line 4R switch to move the data to line 4.
(a) After 5 seconds, make sure that the message, RE-ENTER IRS POSITION, does not show.
(b) Make sure the latitude and longitude data was received correctly as follows:
1) Push the next page POS REF switch.
2) Compare the display data for the applicable IRU to the data put in.
3) If the data is not the same put the data in again as done before.
(c) If the ALIGN light flashes, put in the same position data put in before.
(d) Make sure the position data is received correctly as done before.
(e) If the IRU does not go into NAV mode at this time, it is defective.

G. Align the IRUs with the IRMP

S 755-104
(1) Set all three IRMP mode select switches to the positions as follows:
(a) For positions below 70 degrees north latitude, the NAV position.
(b) For positions above 70 degrees north latitude, the ALIGN position.

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S 755-105
(2) Do the steps that follow:
(a) Make sure that the L-ALIGN light on the IRMP comes on and stays on.
(b) Make sure that the ON DC light on the IRMP comes on momentarily.
(c) Make sure that the ON DC message shows on the EICAS momentarily.

S 865-016
(3) Set the SYS DSPL switch to the L position.

S 865-017
(4) Put in the local latitude.

S 865-018
(5) Set the DSPL SEL switch to PPOS.
(a) Make sure that the position data shows on the IRMP display.

S 865-019
(6) Push the IRMP ENT switch to put the latitude data into all three IRUs.

NOTE: You must put in the local latitude and longitude data in less than 10 minutes after the IRMP mode select switches move to NAV or ALIGN. You must put in the latitude and longitude data separately.

S 865-020
(7) Put in the local longitude data.
(a) Make sure the data shows on the IRMP display.

S 865-021
(8) Push the IRMP ENT switch to put the data into all three IRUs.

NOTE: If the longitude data that was put in during alignment does not agree with the longitude kept in the IRU memory, the ALIGN light will flash immediately. To stop the flash of the light, put in the same longitude data again. (DO NOT move the IRMP mode select switch to the OFF position.)

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NOTE: For positions below 70 degrees north latitude, stop for 10 minutes for the alignment to complete. For positions above 70 degrees north latitude, stop for 17 minutes and then turn the IRMP mode select switches to the NAV positions.

(a) Make sure that all ALIGN lights go off.

NOTE: If the latitude data put in during alignment does not agree with the latitude calculated during alignment by an IRU, the ALIGN light for that IRU will flash after the alignment cycle for that IRU is complete. To stop the flash of the light, put in the correct current latitude data. If the ALIGN light is on but does not flash and the fault light is on, the IRU is possibly defective.

H. Alignment Procedure with the IRMP and a Constant Flash of the ALIGN Light

S 865-022

(1) Put the latitude and longitude data in again.

S 865-023

(2) After 30 seconds, if the ALIGN light continues to flash, set the mode select switch to OFF.

(a) Make sure that the airplane does not move during the align procedure. If the ALIGN lights flash because of movement, stop for 30 seconds.

NOTE: The alignment automatically starts again after 30 seconds if there was airplane movement. If it starts again, the ALIGN light will be on and not flash.

S 865-109

(3) For positions below 70 degrees north latitude, do the steps that follow:

(a) Set all three IRMP mode select switches in the NAV position.

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(b) Stop until the ALIGN light flashes (approximately 10 minutes).

S 865-110

(4) For positions above 70 degrees north latitude, do the steps that follow:
(a) Set all three IRMP mode select switches to the ALIGN position.
(b) Stop for 17 minutes for the alignment to complete.
(c) Set all three IRMP mode select switches to the NAV position.
1) Make sure that the ALIGN light flashes.

S 865-024

(5) Put in the correct latitude and longitude data.

S 865-025

(6) Do the steps that follow to make sure that the data was received correctly:
(a) Set the DSPL SEL switch in the PPOS position.
(b) Set the SYS DSPL switch to the applicable system.
(c) Make sure the data that shows in the display is the same as the data you put in.

S 865-138

(7) If the data is not the same, put in the data again.

S 865-026

(8) Do the steps that follow to make sure that the data was received correctly:
(a) Set the DSPL SEL switch in the PPOS position.
(b) Set the SYS DSPL switch to the applicable system.
(c) Make sure the data that shows in the display is the same as the data you put in.

S 865-027

(9) If the ALIGN light flashes, put in the correct data again.

S 865-028

(10) Do the steps that follow to make sure that the data was received correctly:
(a) Set the DSPL SEL switch in the PPOS position.

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(b) Make sure the data that shows in the display is the same as the data you put in.

I. IRS Alignment and Heading Update with the IRMP

S 865-111

(1) On the EFIS control panel, set the EHSI mode switch to MAP.

S 865-112

(2) Set the IRS switch on the captain's and F/O's INSTR SOURCE SEL panels to the usual position.

(a) Make sure that all IRS annunciators stay off.

S 865-029

(3) Set the mode select switch to the ATT (attitude) position.

S 865-030

(4) Set the display selector switch to the HDG (heading) position.

S 865-031

(5) Put in the magnetic heading. (Start the magnetic heading with the H. (5) switch).

S 865-032

(6) Push the ENT key.

S 755-033

(7) Make sure that the correct heading shows on the EHSI and the RDMI.

J. IRS Alignment and Heading Update with the FMC-CDU

S 865-034

(1) Set the IRMP mode select switch to the ATT (attitude) position.

S 865-035

(2) Put in the correct magnetic heading in the scratch pad area of the POS INIT page of the FMC-CDU.

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S 865-036
(3) Push the line 5R switch on the FMC-CDU to move the data into the SET IRS HDG line.

S 755-037
(4) Make sure that the correct heading shows on the RDMI and the EHSI.

S 865-120
(5) Set the IRMP display selector switch to HDG.
(a) Make sure the correct heading shows on the IRMP.

TASK 34-21-00-715-038
3. <u>Operational Test</u>
A. References
(1) 24-22-00/201, Electrical Power - Control
(2) 29-11-00/201, Main Hydraulic Systems
B. Access
(1) Location Zones
119/120 Main Equipment Center
211/212 Flight Compartment

(2) Access Panel
119AL Main Equipment Center

C. Procedure

S 865-039
(1) Supply electrical power (Ref 24-22-00).

S 865-040
(2) Make sure that these circuit breakers on the overhead circuit breaker panel, P11, are closed:
(a) 11A6, RDMI L
(b) 11A7, EFIS DSPL SW L

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(c) 11E3, ADI LEFT
(d) 11E4, EFIS CONT PNL LEFT
(e) 11E5, VSI LEFT
(f) 11E6, HSI LEFT
(g) 11E8, FMCS CDU LEFT
(h) 11E9, FMCS CMPTR LEFT
(i) 11E24, ADI RIGHT
(j) 11E25, EFIS CONT PNL RIGHT
(k) 11E26, VSI RIGHT
(l) 11E27, HSI RIGHT
(m) 11E29, FMCS CDU RIGHT
(n) 11E30, FMCS CMPTR RIGHT
(o) 11F1, IRS LEFT
(p) 11F8, EFIS SYM GEN L
(q) 11F9, EFIS SYM GEN C
(r) 11F21, IRS CENTER
(s) 11F22, IRS RIGHT
(t) 11F24, EFIS DSPL SW RIGHT
(u) 11F25, RDMI RIGHT
(v) 11F29, EFIS SYM GEN RIGHT

S 865-171

(3) Make sure that these circuit breakers on the main power distribution panel, P6, are closed:
(a) 6D3, IRS L
(b) 6D4, IRS C
(c) 6D5, IRS R
(d) EICAS (6 places)

S 865-042

(4) Make sure that all IRMP mode select switches are in the ALIGN or NAV position.

<u>NOTE</u>: For the IRS self-test, ground speed must be less than 20 knots.

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S 865-043
(5) Set the left and right FMC-CDUs to the POS REF 2/2 page.

S 865-044
(6) Set the IRMP SYS DSPL select switch to L.

S 715-045
(7) To do a self-test for the left IRU, push and hold the test switch on the left IRU.

NOTE: You can also do the IRU self-test from the flight compartment with the YAW DAMPER test switch on the miscellaneous test panel. If you use this procedure, make sure that hydraulic power is off, or obey the applicable safety precautions (Ref 29-11-00). The L or R YAW DAMPER test switch starts the test for all three IRUs at the same time. You must do the test again for each selection (L, C, R) of the IRMP SYS DSPL select switch. For the center IRU, you must make the ALTN IRS selection. With the YAW DAMPER test switch, the instrument indications stay on the displays only a short time. With the IRU test switch, some indications stay on the displays as long as you hold the test switch in.

S 865-148
(8) Make sure the sequence of indications that follows occurs:
(a) Seconds 0-2:
1) IRMP four left annunciator lights come on.
2) All segments come on in both IRMP display windows for all selections of the DSPL SEL switch.
3) UPPER EICAS display flashes the level C messages that follow for approximately 1/2 second:
a) L IRS ON DC
b) L IRS DC FAIL
c) L IRS FAULT
(b) Seconds 3-10:
1) Left IRMP annunciator lights show the correct indication.
2) IRMP display shows no data for all selections of the DSPL SEL switch.

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3) Captain's VSI and F/O's RDMI HDG fault flags show.
4) Left FMC-CDU shows no data for the IRS L PPOS on line 2L of the POS REF 2/2 page.

(c) <u>After 10 seconds</u>:
For the left IRU, make sure that the indications that follow show on the Captain's and F/O's instruments:

<u>NOTE</u>: The outputs with the *[1] flash for only 1/2 second at approximately the tenth second. You must do the test again as many times as necessary to view all the outputs. The YAW DAMPER test switch is the easiest to use to do this. Make sure that the hydraulic power is OFF, or obey the applicable safety precautions (AMM 29-11-00).

IRMP *[1]	TRACK	0.0°
	PPOS (LAT)	N22° 30.0'
	PPOS (LONG)	E 22° 30.0'
	WIND DIRECTION	30°
	WIND SPEED	100 Kts
	HDG	10.0°

CAPT VSI	VERTICAL SPEED	-600 ft/min

CAPT EHSI *[1]	DRIFT ANGLE	-10° LEFT *[2]
	MAGNETIC HEADING	15°
	WIND DIRECTION	*[3]
	WIND SPEED	100 Kts

*[2] FULL VOR OR FULL ILS MODES ONLY
*[3] IF "TRU" SHOWS ABOVE THE EHSI COMPASS CARD, WIND DIRECTION IS 30° (NOT CORRECTED FOR MAGNETIC DECLINATION).
IF "M" SHOWS ABOVE THE EHSI COMPASS CARD, WIND DIRECTION IS 35° (CORRECTED FOR MAGNETIC DECLINATION OF 5°).

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CAPT EADI	PITCH ANGLE	5° UP
	ROLL ANGLE	45° RIGHT

F/O RDMI	MAGNETIC HEADING	15°

S 865-046

(9) Release the test switch on the left IRU.
   (a) Make sure that all IRMP annunciator lights go off.
   (b) Make sure that the L and R FMC-CDUs show the latitude and longitude data put in during the alignment.
   (c) Make sure that the IRMP shows the latitude and longitude data put in during the alignment.

S 865-047

(10) Set the SYS DSPL switch on the IRMP to R.

S 715-048

(11) Do the same test for the right IRU as done for the left IRU except as follows:
   (a) Use the test switch on the right IRU.
   (b) Use the right annunciator lights on the IRMP.
   (c) Use the R IRS message on the EICAS.
   (d) Use the F/O's EADI, EHSI, VSI.
   (e) Use the left RDMI.
   (f) Use line 4L of the POS REF 2/2 page on the FMC-CDU.

S 865-049

(12) Set the captain's and F/O's IRS INSTR SOURCE SEL switches to ALTN IRS.

S 865-050

(13) Set the SYS DSPL switch on the IRMP to C.

S 715-051

(14) Do the same test for the center IRU as done for the left IRU except as follows:
   (a) Use the test switch on the center IRU.
   (b) Use the center annunciator lights on the IRMP.
   (c) Use the C IRS messages on the EICAS.
   (d) Use the captain's and F/O's instruments.
   (e) Use line 3L of the POS REF 2/2 page on the FMC-CDU.

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D. Put the Airplane Back to Its Usual Condition

S 865-052

(1) Set the captain's and F/O's INSTR SOURCE SEL switches for the IRS to the usual positions.

S 845-140

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(2) Turn the IRS mode select switches on the IRMP to OFF.

S 865-054

(3) Remove electrical power if it is not necessary (Ref 24-22-00).

TASK 34-21-00-735-055

4. System Test - Inertial Reference System

A. General

(1) The IRS system test makes sure the VSI, the IRU alignment, the IRS system, and the IRS system interfaces are correct. It gives information to the IRS through the FMC-CDU, the ADC test switch, the IRMP, and the INSTR SOURCE SEL panel.

B. References

(1) 24-22-00/201, Electrical Power - Control

C. Access

(1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

(2) Access Panel

119AL	Main Equipment Center

D. Procedure

S 865-056

(1) Supply electrical power (Ref 24-22-00).

S 865-057

(2) Make sure that these circuit breakers on the P11 panel are closed:

(a) 11A6, RDMI L

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(b) 11A7, EFIS DSPL SW L
(c) 11E3, ADI LEFT
(d) 11E4, EFIS CONT PNL LEFT
(e) 11E5, VSI LEFT
(f) 11E6, HSI LEFT
(g) 11E8, FMCS CDU LEFT
(h) 11E9, FMCS CMPTR LEFT
(i) 11E24, ADI RIGHT
(j) 11E25, EFIS CONT PNL RIGHT
(k) 11E26, VSI RIGHT
(l) 11E27, HSI RIGHT
(m) 11E29, FMCS CDU RIGHT
(n) 11E30, FMCS CMPTR RIGHT
(o) 11F1, IRS LEFT
(p) 11F8, EFIS SYM GEN L
(q) 11F9, EFIS SYM GEN C
(r) 11F21, IRS CENTER
(s) 11F22, IRS RIGHT
(t) 11F24, EFIS DSPL SW RIGHT
(u) 11F25, RDMI RIGHT
(v) 11F29, EFIS SYM GEN RIGHT

S 865-170

(3) Make sure that these circuit breakers on the main power distribution panel, P6, are closed:
(a) 6D3, IRS L
(b) 6D4, IRS C
(c) 6D5, IRS R
(d) EICAS (6 places)

S 865-122

(4) Set the IRS switch on the captain's and F/O's INSTR SOURCE SEL panels to the usual position.
(a) Make sure that all the IRMP lights stay off.

S 715-123

(5) Do the IRS Operational Test but do not remove electrical power after the test.

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S 865-124

(6) Open these circuit breakers on the P6 panel and attach DO-NOT-CLOSE tags:
   (a) 6D3, IRS L
   (b) 6D4, IRS C
   (c) 6D5, IRS R

S 865-141

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(7) Set all three IRS mode select switches on the IRMP to ALIGN.
   (a) Make sure that all three ALIGN lights are on for the L, C, and R IRUs.
   (b) Make sure that all three DC FAIL lights are on for the L, C, and R IRUs.
   (c) Make sure that the IRS DC FAIL messages show on the EICAS display for the L, C, and R IRUs.

S 755-058

(8) Set all three IRMP mode select switches to OFF.
   (a) Make sure that all IRMP lights and EICAS IRS messages are off.

S 865-059

(9) Remove the DO-NOT-CLOSE tags and close these P6 panel circuit breakers:
   (a) 6D3, IRS L
   (b) 6D4, IRS C
   (c) 6D5, IRS R

S 865-060

(10) Make sure that the IRMP lights stay off.

S 865-061

(11) Set all three IRMP mode select switches to NAV.

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S 755-062
(12) Make sure the conditions that follow occur:
(a) All three ON DC lights come on momentarily on the IRMP.
(b) The message IRS ON DC shows momentarily on the EICAS display unit for the L, R, and C IRUs.
(c) All three ALIGN lights come on on the IRMP.
(d) All other lights are off on the IRMP.

S 865-142

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(13) Turn the R and C IRMP mode select switches to the OFF position.

S 865-064
(14) Set the DSPL SEL switch to the PPOS position.

S 865-065
(15) Set the SYS DSPL switch to the L position.

S 735-066
(16) Do the left IRS-IRMP test as follows:
(a) Put in the local longitude with the IRMP keyboard. (You must do this less than ten minutes after you turn the L mode select switch to NAV.)
(b) Make sure that the IRMP display shows the longitude data.
(c) Make sure that only the L ALIGN light is on.
(d) If the L ALIGN light flashes, put in the longitude again.
1) Make sure the L ALIGN light does not flash and stays on.
(e) Approximately 10 minutes after the IRU was energized, make sure that the L ALIGN light starts to flash.

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(f) Make sure that all other annunciator lights are off on the IRMP.
(g) Put in the incorrect latitude (local latitude + 3 degrees) with the IRMP.
(h) Make sure that the L ALIGN light continues to flash.
(i) Make sure that all other annunciator lights stay off.
(j) Put in the same incorrect latitude data again.
(k) Make sure that the L ALIGN light does not flash and stays on.
(l) Make sure that the L FAULT light comes on.
(m) Make sure the FAULT message shows on the EICAS display.

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(n) Set the L IRMP mode select switch to OFF.
(o) After 30 seconds, make sure the conditions that follow occur:
1) All annunciator lights on the IRMP are off.
2) There are no IRS fault messages on the EICAS display.
(p) Set the L IRMP mode select switch to NAV.
(q) Make sure the ON DC light comes on momentarily on the IRMP.
(r) Make sure the ON DC message comes on momentarily on the EICAS display.
(s) Make sure the L ALIGN light comes on on the IRMP.
(t) Make sure all other lights on the IRMP stay off.
(u) With the IRMP keyboard, put in the local latitude and longitude less than 10 minutes after the IRU is energized.
(v) Make sure that only the L ALIGN light on the IRMP is on.
(w) In approximately 10 minutes after the IRU is energized, make sure the conditions that follow occur:
1) The L ALIGN light goes off.
2) The IRMP display shows the latitude and longitude data that was put in.

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(x) Turn the L IRMP mode select switch to OFF.

S 865-143
(17) Set the SYS DSPL switch to R.

S 865-144
(18) Set the R mode select switch to NAV.
(a) Make sure that ON DC shows momentarily on the EICAS display.

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(b) Make sure that the R ON DC light on the IRMP comes on momentarily.
(c) Make sure the R IRMP ALIGN light comes on and stays on.

S 735-161
(19) Do the right IRS-IRMP test the same as the LEFT IRS-IRMP test except as follows:
(a) Use the R IRMP mode select switch.
(b) Use the R IRMP lights.
(c) Use the right EICAS messages.

S 865-145
(20) Set the SYS DSPL switch to C.

S 865-067

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(21) Set the C mode select switch to NAV.
(a) Make sure that ON DC shows momentarily on the EICAS display.
(b) Make sure that the C ON DC light on the IRMP comes on momentarily.
(c) Make sure that the C IRMP ALIGN light comes on and stays on.

S 735-162
(22) Do the center IRS-IRMP test the same as the left IRS-IRMP test except as follows:
(a) Use the C IRMP mode select switch.
(b) Use the C IRMP lights.
(c) Use the center EICAS messages.

S 715-075
(23) Do the L FMC-CDU IRS test as follows:

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(a) Set all three IRMP mode selector switches to OFF.
(b) After 30 seconds, make sure that all IRMP lights and EICAS IRS messages are off.
(c) Set all three IRMP mode select switches to NAV.
(d) Make sure the conditions that follow occur:
1) All three IRMP ON DC lights come on momentarily.
2) The message IRS ON DC appears momentarily on the EICAS display unit for L, R, and C IRUs.
3) All three IRMP ALIGN lights come on and all other IRMP lights are off.
(e) Push the INIT REF switch found on the L FMC-CDU.

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(f) Put in the local longitude and latitude.
(g) Make sure the data shows correctly on line six of the L FMC-CDU.
(h) Push the line 4R switch to move the data to line four.
(i) Make sure the conditions that follow occur:
1) The latitude and longitude show on line four of the L FMC-CDU.
2) On the IRMP, all three ALIGN lights stay on and all other lights stay off.
3) All three IRMP ALIGN lights go off at 10 minutes ± 20 seconds after the IRMP mode select switches were set to the NAV position. (This shows the alignment is complete.)

NOTE: If one of the IRUs does not accept the data, a caution signal, RE-ENTER IRS POSITION, will show on line six of the L FMC-CDU.

(j) Push the NEXT PAGE switch on the L FMC-CDU.
(k) Make sure that the latitude and longitude appear on lines 2, 3 and 4 of the L FMC-CDU.

NOTE: If one of the IRUs does not accept the data, the L FMC-CDU display will show no data for that IRU.

S 715-076
(24) Do the R FMC-CDU IRS test the same as the L FMC-CDU IRS test except use the R FMC-CDU.

E. Orientation Program Pin Test

S 865-164
(1) Make sure the HDG REF switch on the P3-1 panel is in the NORM position.

S 865-165
(2) Make sure the IRS switch on the left INSTR SOURCE SEL panel is in the NORM position.
(a) Make sure the magnetic heading on the left EHSI shows ± 30 degrees of heading on the standby compass.

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S 865-166
(3) Set the IRS switch on the left INSTR SOURCE SEL panel to the ALTN position.
  (a) Make sure the magnetic heading on the left EHSI shows ± 30 degrees of heading on the standby compass.

S 865-167
(4) Set the IRS switch on the left INSTR SOURCE SEL panel to the NORM position.

S 865-181
(5) Make sure the IRS switch on the right INSTR SOURCE SEL panel is in the NORM position.
  (a) Make sure the magnetic heading on the right EHSI shows ± 30 degrees of heading on the standby compass.

S 865-077
(6) Make sure all three mode select switches on the IRMP are in the NAV position and all three IRUs are aligned.
  (a) Make sure all lights on the IRMP are off.

S 865-078
(7) Make sure the IRS switches on the left and right INSTR SOURCE SEL panels are in the NORM position.

S 865-079
(8) Make sure the AIR DATA switches on the left and right INSTR SOURCE SEL panels are in the NORM position.

S 715-080
(9) Do the L-ADC/L-IRU/L-VSI interface test as follows:
  (a) On the P61 miscellaneous test panel, push up and hold the L-ADC test switch for approximately 10 seconds.
    1) Make sure the L vertical speed indicator (VSI) flag comes into view.
  (b) Release the L-ADC test switch.
    1) Make sure the L-VSI flag goes out of view.
    2) Make sure the L-VSI shows zero vertical speed.

S 715-126
(10) Do the L-ADC/R-IRU/R-VSI interface test as follows:
  (a) Set the AIR DATA switch on the right INSTR SOURCE SEL panel to the ALTN position.
  (b) Make sure all lights on the IRMP are off.
  (c) On the P61 miscellaneous test panel, push up and hold the L-ADC test switch for approximately 10 seconds.
    1) Make sure the R-VSI flag comes into view.

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(d) Release the L-ADC test switch.
    1) Make sure the R-VSI flag goes out of view.
    2) Make sure the R-VSI shows zero vertical speed.
(e) Set the AIR DATA switch on the right INSTR SOURCE SEL panel to the NORM position.

S 715-127

(11) Do the R-ADC/C-IRU/R-VSI interface test as follows:
(a) Set the IRS switch on the right INSTR SOURCE SEL panel to the ALTN position.
(b) Make sure all lights on the IRMP are off.
(c) On the P61 miscellaneous test panel, push up and hold the R-ADC test switch for approximately 10 seconds.
    1) Make sure the R-VSI flag comes into view.
(d) Release the R-ADC test switch.
    1) Make sure the R-VSI flag goes out of view.
    2) Make sure the R-VSI shows zero vertical speed.
(e) Set the IRS switch on the right INSTR SOURCE SEL panel to the NORM position.

S 715-128

(12) Do the R-ADC/R-IRU/R-VSI interface test as follows:
(a) On the P61 miscellaneous test panel, push up and hold the R-ADC test switch for approximately 10 seconds.
    1) Make sure the R-VSI flag comes into view.
(b) Release the R-ADC test switch.
    1) Make sure the R-VSI flag goes out of view.
    2) Make sure the R-VSI shows zero vertical speed.

S 715-129

(13) Do the R-ADC/L-IRU/L-VSI interface test as follows:
(a) Set the AIR DATA switch on the left INSTR SOURCE SEL panel to the ALTN position.
(b) Make sure all lights on the IRMP are off.
(c) On the P61 miscellaneous test panel, push up and hold the R-ADC test switch for approximately 10 seconds.
    1) Make sure the L-VSI flag comes into view.
(d) Release the R-ADC test switch.
    1) Make sure the L-VSI flag goes out of view.
    2) Make sure the L-VSI shows zero vertical speed.
(e) Set the AIR DATA switch on the left INSTR SOURCE SEL panel to the NORM position.

S 715-131

(14) Do the L-ADC/C-IRU/L-VSI interface test as follows:
(a) Set the IRS switch on the left INSTR SOURCE SEL panel to the ALTN position.
(b) Make sure all lights on the IRMP are off.
(c) On the P61 miscellanenous test panel, push up and hold the L-ADC test switch for approximately 10 seconds.
    1) Make sure the L-VSI flag comes into view.

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(d) Release the L-ADC test switch.
1) Make sure the L-VSI flag goes out of view.
2) Make sure the L-VSI shows zero vertical speed.
(e) Set the IRS switch on the left INSTR SOURCE SEL panel to the NORM position.
1) Make sure all lights on the IRMP are off.

S 865-081
(15) Set the DSPL SEL switch on the IRMP to the HDG position.

S 865-082
(16) Set the SYS DSPL switch on the IRMP to the L, C, and R position, one position at a time.
(a) Examine the headings and make sure they show the same value ±1°.

S 865-135
(17) Set the HDG REF switch on the P3-1 panel to the TRUE position.
(a) Make sure the true heading shows on the left and right EHSIs.
(b) Make sure the true heading on the RDMIs agrees with the heading on the EHSIs ± 1 degree.

F. Equipment Cooling Ground-Warning Test

S 155-139
(1) Do the Equipment Cooling Ground-Warning Test through the IRS as follows:

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(a) Set the IRMP mode select switches to OFF.
(b) Make sure that the P6 panel circuit breaker that follows is closed:
1) 6D6, EQUIP COOL GND WARN
(c) Open the P11 panel circuit breakers that follow:
1) 11C19, EQUIP COOL OVRD
2) 11P21, EQUIP COOL OVHT/SMOKE VLV IND

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(d) Set the left IRMP mode select switch to ALIGN.
(e) After approximately 2 seconds, make sure you hear the ground warning horn.
(f) Set the left mode select switch to OFF.

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S 715-084

(2) Do the "Equipment Cooling Ground-Warning Test" again except use the C IRMP mode select switch.

S 715-085

(3) Do the "Equipment Cooling Ground-Warning Test" again except use the R IRMP mode select switch.

S 865-158

(4) Make sure that these circuit breakers on the P11 panel are closed:
   (a) 11C19, EQUIP COOL OVRD
   (b) 11P21, EQUIP COOL OVHT/SMOKE VLV IND

G. Five Minute Time Delay Test

S 715-086

(1) Do the Five Minute Time-Delay Test as follows:
   (a) Set all the IRMP mode select switches to the ALIGN position.
      1) Make sure that all three ON DC lights come on momentarily.
      2) Make sure that all three ALIGN lights come on and stay on.
   (b) Open the P11 panel circuit breakers that follow and attach DO-NOT-CLOSE tags:
      1) 11F1, IRS LEFT
      2) 11F21, IRS CENTER
      3) 11F22, IRS RIGHT
   (c) Make sure that all three ALIGN lights are on.
   (d) Make sure that all three ON DC lights are on.
   (e) On the P5 Overhead Panel, set the BAT switch to ON.
   (f) On the P5 Overhead Panel, set the STBY PWR switch to BAT.
   (g) After approximately 5 minutes, make sure the conditions that follow occur:
      1) The R ALIGN and ON DC lights go off.
      2) The L and C ALIGN ond ON DC lights stay on.
   (h) Set the BAT switch and the STBY PWR switch on the P5 Overhead Panel to their initial positions.
   (i) Remove the DO-NOT-CLOSE tags and close the P11 panel circuit breakers that follow:
      1) 11F1, IRS LEFT
      2) 11F21, IRS CENTER
      3) 11F22, IRS RIGHT

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H. IRU Nuisance Non-critical Fault Test.

S 865-188

(1) If a "FAULT" light is illuminated on the IRMP, do nuisance non-critical fault test.
   (a) Condition: The IRU may latch a nuisance non-critical fault that can be cleared by cycling power to the IRU via the mode select switch (reference 757 Maintenance Tip 34-042, 767 Maintenance Tip 34-046).
   (b) If the IRU "FAULT" on the IRMP illuminates during rollout and ground speed deceleration below 40 knots, then perform the following applicable action before the IRUs are selected off (reference 757 Maintenance Tip 34-042, 767 Maintenance Tip 34-046).

S 865-189

(2) AIRPLANES WITH P/N S242T101-201 AND -202 IRMPS;
On the IRMP, turn the applicable IRU mode select switch to the OFF position. Wait approximately 30 seconds, then turn the mode select switch to the NAV position.
   (a) Enter present position to initialize the IRU.
   (b) Verify that electrical power is applied to the ADC system and the FMC system.
   (c) Wait approximately 10 minutes until the IRMP "ALIGN" annunciator extinguishes and the IRU is operating in the nav mode.
   (d) If the IRMP "FAULT" annunciator extingushes after transaction to the NAV mode, then the IRU does not require replacement. If the annunciator remains illuminated, then the IRU should be replaced.

S 865-190

(3) AIRPLANES WITH P/N S242T101-203, -204 OR -206 IRMPS;
On the IRMP, turn the "SYS DSPL" knob to the "L" or "C" or "R" position corresponding to the IRU that has the fault.
   (a) On the IRMP, place the "DSPL SEL" knob to the "HDG" position. Enable display of IRU fault codes by pressing "0" and then "1" within five seconds.
   (b) If fault code 15 is displayed, then perform step 4. Otherwise, turn the applicable IRU off via the mode select switch and replace the unit.
   (c) On the IRMP, turn the applicable IRU off by the mode select switch. Wait approximately 30 seconds until the IRMP "ALIGN" annunciator extingushes, then select the mode select switch to the "NAV" position.
   (d) Enter present position to initialize the IRU.
   (e) Verify that electrical power is applied to the ADC system and the FMC System.
   (f) Wait approximately 10 minutes until the IRMP "ALIGN" annunciator extinguishes and the IRU is operating in the nav mode.

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(g) If the IRMP "FAULT" annunciator extingushes after transaction to the NAV mode, then the IRU does not require replacement. If the annunciator remains illuminated, then the IRU should be replaced.

I. Put the Airplane Back to Its Usual Condition

S 845-087

(1) Set all IRS INSTR SOURCE SEL switches to their usual positions.

S 845-163

CAUTION: WHEN THE IRU MODE SELECT SWITCH IS IN THE "NAV" POSITION, YOU MUST PULL AND TURN IT TO SET IT TO A NEW POSITION. THIS PREVENTS DAMAGE TO THE SWITCH.

(2) Turn all three IRMP mode select switches to OFF.

S 865-090

(3) Remove electrical power if it is not necessary (Ref 24-22-00).

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INERTIAL REFERENCE UNIT - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes an IRU. The second task installs an IRU.
   B. The left (M159), center (M160), and right (M161) IRUs are found in the main equipment center rack, E2. All electrical connections are made through connectors at the rear of the units.

TASK 34-21-01-004-001

2. IRU Removal
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
      (2) AMM 20-41-01/201, Electrostatic Sensitive Devices
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center

   C. Procedure

      S 864-002

      (1) Set the two F/D switches on the Mode Control Panel (MCP) to OFF.

      S 864-003

      (2) Open these circuit breakers (as applicable) on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
          (a) 6D3, IRS L
          (b) 6D4, IRS C
          (c) 6D5, IRS R

      S 864-004

      (3) Open these circuit breakers (as applicable) on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11F1, IRS LEFT
          (b) 11F21, IRS CENTER
          (c) 11F22, IRS RIGHT

      S 864-024

CAUTION: DO NOT OPERATE THE "MASTER DIM AND TEST" SWITCH FOR MORE THAN FIVE MINUTES WITH THE "IND LTS" SWITCH IN THE DIM POSITION WHEN ONE OR MORE OF THE THREE IRUS ARE NOT INSTALLED. THIS CAN CAUSE DAMAGE TO THE IRMP.

      (4) Attach a tag by the Master Dim and Test switch which reads: Caution, one IRU is removed. Do not operate the Master Dim and Test switch for more than five minutes with the IND LTS switch in the Dim position. This can cause damage to the IRMP.

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S 864-010

CAUTION: DO NOT MOVE THE IRU BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE IRU.

(5) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 024-005

WARNING: BE CAREFUL WHEN YOU MOVE THE IRU. BECAUSE THE IRU WEIGHS 47 POUNDS (21 KG), INJURY CAN OCCUR.

(6) Remove the IRU (AMM 20-10-01/401).

TASK 34-21-01-404-006

3. IRU Installation

A. References
   (1) AMM 20-10-01/401, E/E Rack Mounted Components
   (2) AMM 20-41-01/201, Electrostatic Sensitive Devices
   (3) AMM 22-00-02/201, Autoflight BITE
   (4) AMM 24-22-00/201, Electrical Power - Control
   (5) AMM 34-21-00/501, Inertial Reference System

B. Access
   (1) Location Zones
       119/120   Main Equipment Center

C. Procedure

S 864-007

(1) Make sure these circuit breakers (as applicable) on the P6 panel are open:
   (a) 6D3, IRS L
   (b) 6D4, IRS C
   (c) 6D5, IRS R

S 864-008

(2) Make sure that these circuit breakers (as applicable) on the P11 panel are open:
   (a) 11F1, IRS LEFT
   (b) 11F21, IRS CENTER
   (c) 11F22, IRS RIGHT

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S 864-009

CAUTION: DO NOT MOVE THE IRU BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE IRU.

(3) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 424-011

WARNING: BE CAREFUL WHEN YOU MOVE THE IRU. BECAUSE THE IRU WEIGHS 47 POUNDS (21 KG), INJURY CAN OCCUR.

(4) Install the IRU (AMM 20-10-01/401).

S 434-012

(5) If all three IRUs are installed, remove the caution tag at the Master Dim and Test switch.

S 864-013

(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers (as applicable) on the P6 panel:
- (a) 6D3, IRS L
- (b) 6D4, IRS C
- (c) 6D5, IRS R

S 864-014

(7) Remove the DO-NOT-CLOSE tags and close these circuit breakers (as applicable) on the P11 panel:
- (a) 11F1, IRS LEFT
- (b) 11F21, IRS CENTER
- (c) 11F22, IRS RIGHT

D. IRU Test

S 864-015

(1) Supply electrical power (AMM 24-22-00/201).

S 864-016

(2) Set the IRMP mode select switch to NAV for the applicable IRU.

S 754-017

(3) Make sure that only the ALIGN annunciator on the IRMP stays on.

S 864-018

(4) Put in the present position longitude and latitude (AMM 34-21-00/501). (If the ALIGN light flashes, put the same position in again).

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S 754-019
(5) Make sure that ten minutes after you set the IRMP mode select switch to NAV, the ALIGN light goes off.

S 754-020
(6) If the IRU is the type with a fault ball, make sure that the IRU fault ball shows black.

S 714-021
(7) Do the Maintenance Control Display Panel (MCDP) Test - 30 CURRENT FAULT REPORT (AMM 22-00-02/201).

S 864-022
(8) Set the IRMP mode select switch to OFF.

S 864-023
(9) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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IRS MODE SELECT PANEL - MAINTENANCE PRACTICES

1. General
   A. This procedure has four tasks. The first task replaces the lights in the IRMP annunciators. The second task replaces the incandescent display lights. The third task removes the IRMP. The fourth task installs the IRMP.
   B. The lights in the annunciator are replaced from the front of the panel. The lights are at the rear of the annunciator.
   C. The IRMP is installed on the overhead panel. There are electrical connectors at the rear of the panel.

TASK 34-21-02-962-001

2. Annunciator Light Replacement (Fig. 201)
   A. Access
      (1) Location Zones
          211/212 Flight Compartment

   B. Procedure

      S 862-034
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11F1, IRS LEFT
          (b) 11F21, IRS CENTER
          (c) 11F22, IRS RIGHT

      S 962-003
      (2) Push the annunciator in until you feel a detent position, then release it. (The annunciator will extend out from the assembly.)

      S 962-004
      (3) Carefully pull the annunciator out more from the assembly until it does not move freely.

      S 962-005
      (4) Continue to pull the annunciator out lightly and turn the annunciator down as shown in C. (A retaining clip holds the annunciator to the assembly.)

      S 962-006
      (5) At the base of the annunciator, lift the light out of the annunciator by the lip of the light base as shown in D.

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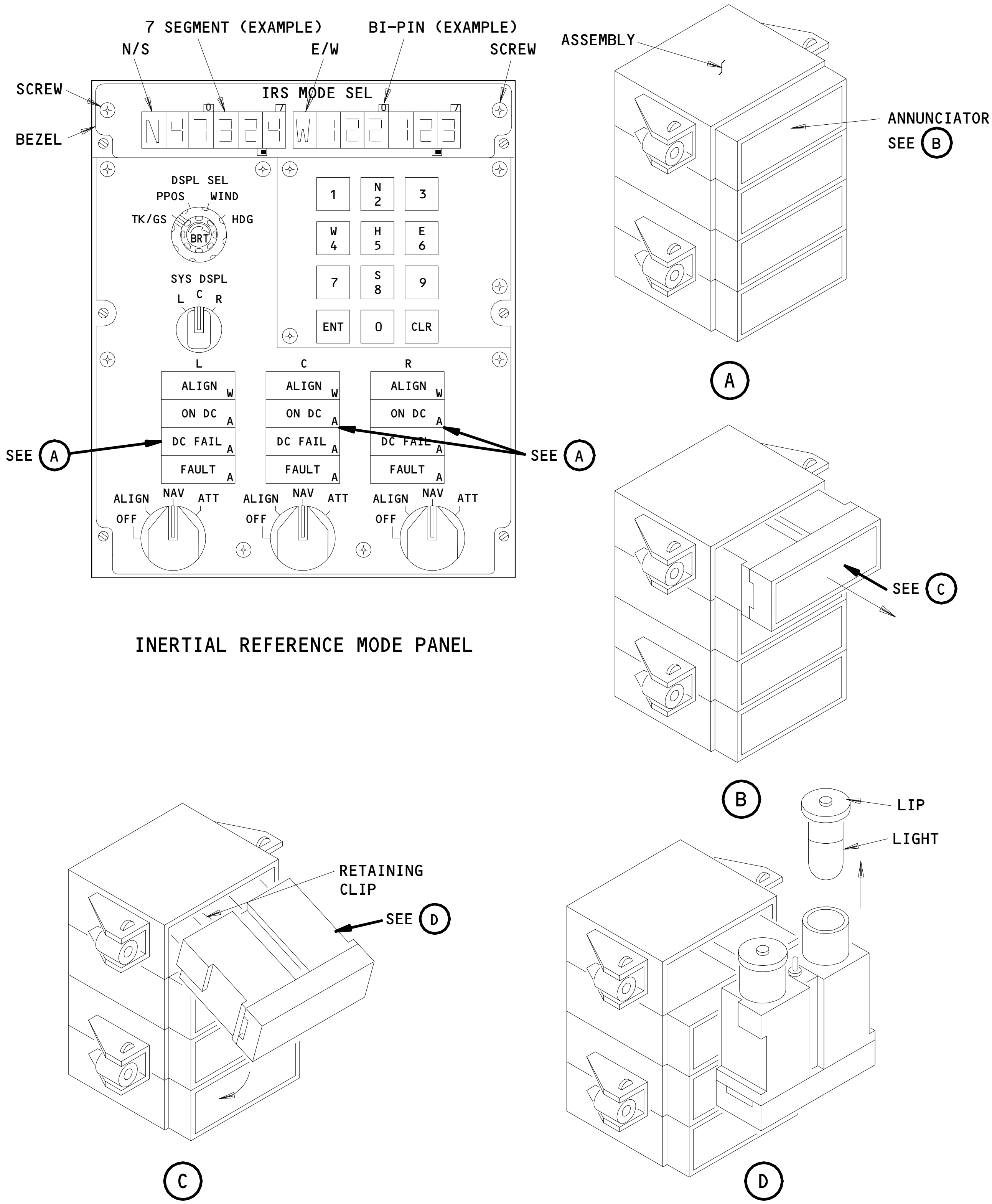

IRMP Light Replacement
Figure 201

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S 962-007
(6) Replace the light.

S 962-008

CAUTION: WHEN YOU MOVE THE ANNUNCIATOR, DO NOT CAUSE DAMAGE TO THE RETAINING CLIP.

(7) Turn the annunciator up until it is in the position shown in B.

S 962-009
(8) Push the annunciator in until you feel a detent position, then release it. (Make sure the annunciator is smooth with the other annunciators as shown in A.)

S 862-041
(9) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11F1, IRS LEFT
(b) 11F21, IRS CENTER
(c) 11F22, IRS RIGHT

TASK 34-21-02-962-010
3. Incandescent Light Replacement (Fig. 201)
A. Access
(1) Location Zones
211/212 Flight Compartment

B. Procedure

S 862-036
(1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
(a) 11F1, IRS LEFT

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(b) 11F21, IRS CENTER
(c) 11F22, IRS RIGHT

S 962-011
(2) Loosen the two screws located on the bezel and remove it.

S 962-012
(3) Remove the light that does not work. Use needle-nose pliers to remove a display light and tweezers to remove a bi-pin light if necessary.

S 962-013
(4) Replace the light. (Align the seven segment, N/S, and E/W display light so the small mark on the face of the bulb is toward the bottom of the IRMP. Put a white plastic spacer on replacement bi-pin lights.)

S 962-014
(5) Attach the bezel and tighten the two screws.

S 862-042
(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11F1, IRS LEFT
(b) 11F21, IRS CENTER
(c) 11F22, IRS RIGHT

TASK 34-21-02-002-015
4. IRMP Removal
A. References
(1) AMM 20-41-01/201, Electrostatic Sensitive Devices
(2) AMM 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

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S 862-037

CAUTION: DO NOT MOVE THE IRMP BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE IRMP.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 862-040
(2) Set all three mode select switches on IRMP to OFF.

S 862-016
(3) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
(a) 6D3, IRS L
(b) 6D4, IRS C
(c) 6D5, IRS R

S 862-017
(4) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
(a) 11F1, IRS LEFT
(b) 11F21, IRS CENTER
(c) 11F22, IRS RIGHT

S 032-018
(5) Loosen the mounting screws on the control panel.

S 032-019
(6) Lower the control panel and disconnect the electrical cables.

S 022-020
(7) Remove the IRMP.

TASK 34-21-02-402-021
5. Install the IRMP
A. References
(1) AMM 20-41-01/201, Electrostatic Sensitive Devices
(2) AMM 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

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S 862-038

CAUTION: DO NOT MOVE THE IRMP BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE IRMP.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 862-039
(2) Make sure that these circuit breakers on the P6 panel are open:
(a) 6D3, IRS L
(b) 6D4, IRS C
(c) 6D5, IRS R

S 862-022
(3) Make sure that these circuit breakers on the P11 panel are open:
(a) 11F1, IRS LEFT
(b) 11F21, IRS CENTER
(c) 11F22, IRS RIGHT

S 432-023
(4) Connect the electrical cables to the rear of the IRMP.

S 422-024
(5) Install the control panel and tighten the mounting screws.

S 862-025
(6) Remove the DO-NOT-CLOSE tags and close these P6 panel circuit breakers:
(a) 6D3, IRS L
(b) 6D4, IRS C
(c) 6D5, IRS R

S 862-026
(7) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11F1, IRS LEFT
(b) 11F21, IRS CENTER
(c) 11F22, IRS RIGHT

D. IRMP Test

S 862-027
(1) Supply electrical power (AMM 24-22-00/201).

S 712-028
(2) Set the three mode select switches to ALIGN.
(a) Make sure that the three ALIGN annunciators come on after approximately 10 seconds.

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S 712-029

(3) Keep the IRU mode select switches in ALIGN and put in the present position on the IRMP.

S 712-030

(4) Push the ENT key.

S 712-031

(5) Set the DSPL SEL switch to PPOS.

(a) Make sure that the IRMP shows the present position.

E. Put the Airplane Back to Its Usual Condition

S 712-032

(1) Set the IRMP mode select switches to OFF

S 862-033

(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ELECTRONIC FLIGHT INSTRUMENT SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The flight instrument system provides the main displays for most of the airplane's navigation systems. It includes the electronic flight instrument system (EFIS), the radio distance magnetic indicators (RDMI), and the vertical speed indicators (VSI). It also includes the switches on the instrument source select panels.
   B. The EFIS uses CRT indicators. It provides multicolor navigation displays. The system displays the following:
      (1) Pitch, roll, and directional data; map displays and flight path data; weather radar data; altitude and decision height; autopilot mode data; airspeed data; and input system fault annunciations.
   C. The two displays associated with the EFIS are the Electronic Horizontal Situation Indicator (EHSI) and the Electronic Attitude Director Indicator (EADI). Two units of each display are installed. Each set operates independently under normal conditions. Each display set has a dedicated control panel, remote light sensor, and a symbol generator. A third symbol generator is installed, as a backup, for either display set.
   D. The switches on the instrument source select panels provide selection for backup data sources in the event of a main data source failure.
   E. Normally, the left and right symbol generators supply the corresponding display set. If a fault is detected by the operating symbol generator, either display set can be switched to the center symbol generator. The RDMIs and VSIs can be switched to the center IRU if a source fault is detected.
   F. If the captain and F/O select the center EFIS system, a level B caution message - INSTR SWITCH - will appear on the EICAS display.
   G. The RDMIs are the secondary heading, bearing, and distance displays. A portion of the indicators display the airplane's present heading. They also display the directional bearing and navigational distance to selected reference points.
   H. The RDMIs receive this data from the IRS, VOR, DME, and ADF systems.
   I. The VSIs are the main vertical rate-of-climb and descent display. They receive this data from the inertial reference system.

   NOTE: The component detail and operation of the RDMI and VSI will be covered after the EFIS operation section.

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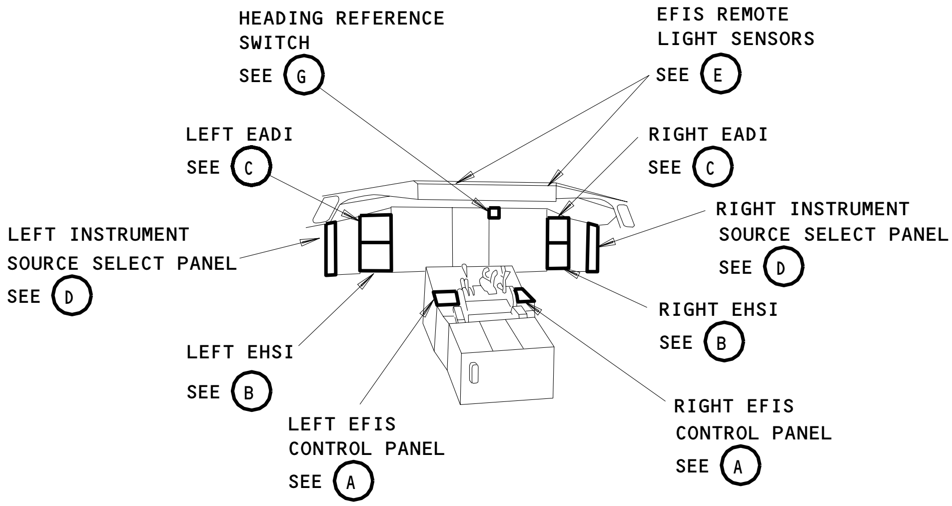
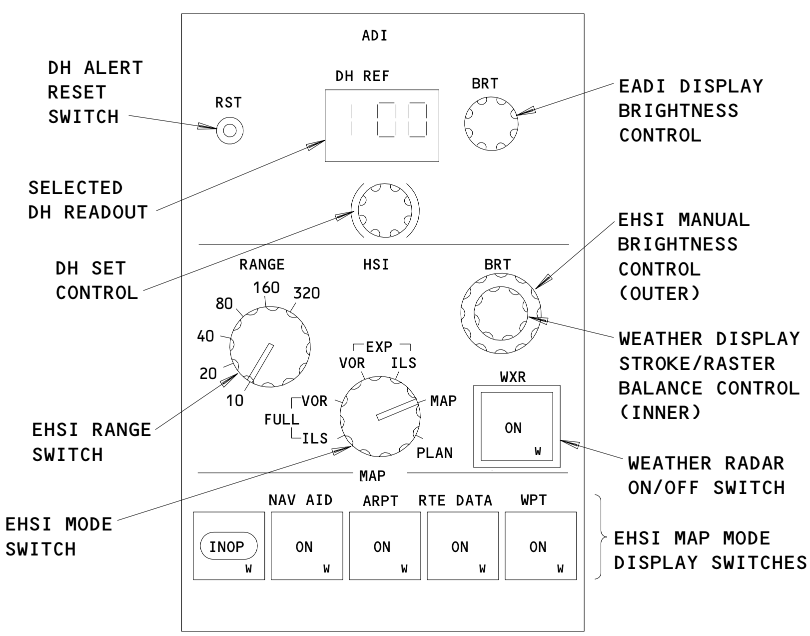
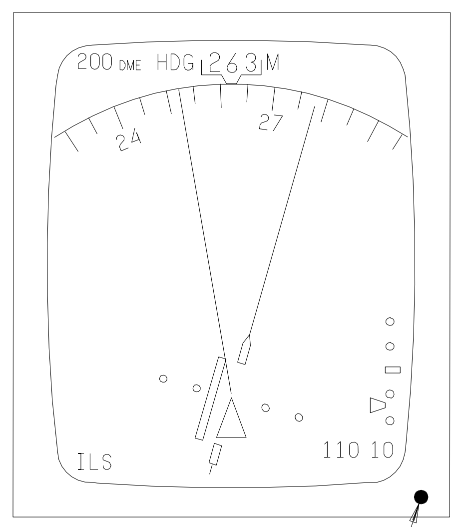


FLIGHT COMPARTMENT



EFIS CONTROL PANEL

A



EHSI (EXAMPLE)

B

EFIS - Component Location
Figure 1 (Sheet 1)

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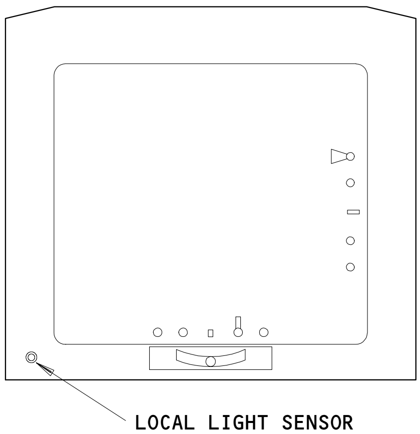
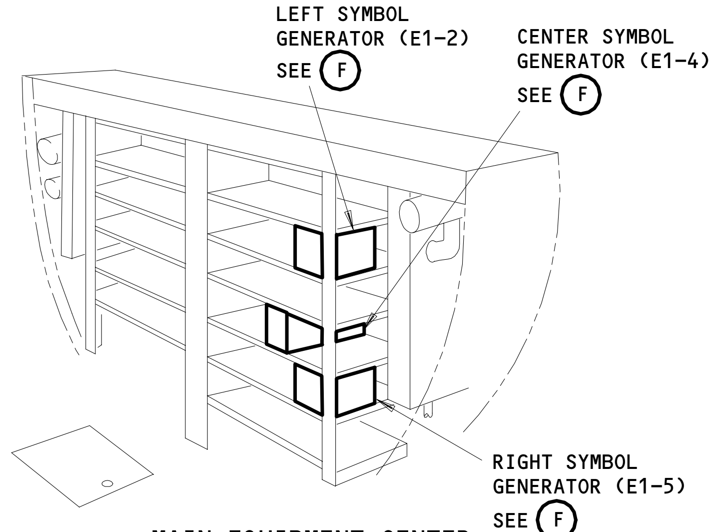
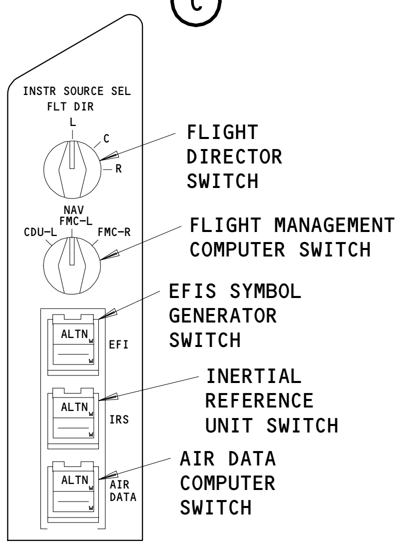


EADI (EXAMPLE)

C

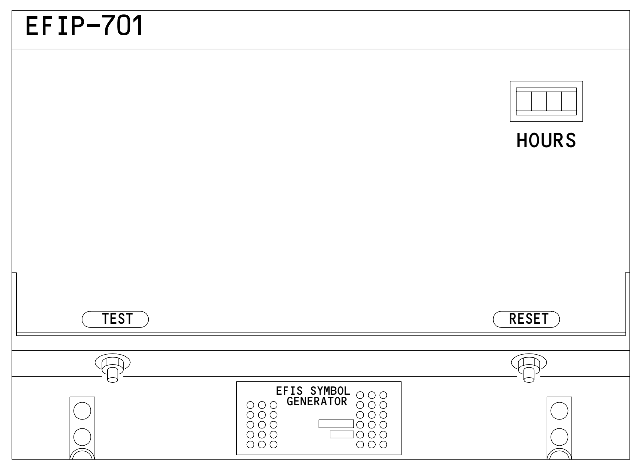


MAIN EQUIPMENT CENTER



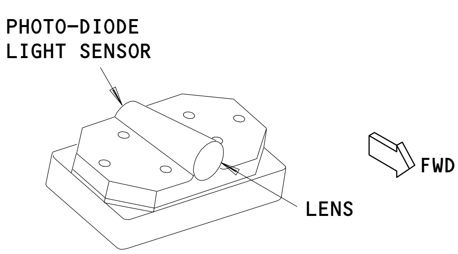
INSTRUMENT SOURCE
SELECT PANEL

D



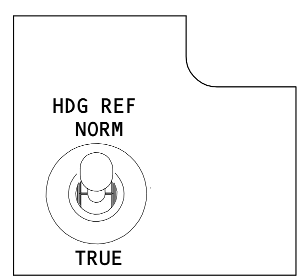
EFIS SYMBOL GENERATOR

F



EFIS REMOTE LIGHT SENSOR

E



HEADING REFERENCE SWITCH

G

EFIS - Component Locations
Figure 1 (Sheet 2)

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J. Configuration
(1) EFIS Symbol Generator

	-414	-420	-421
SAS 050-156, 162-166, 275-276	BASIC		
SAS 157, 166, 167, 277-280		BASIC	
SAS 158-161, 168-274, 281-999			BASIC

2. <u>Component Details - EFIS</u> (Fig. 1)
A. EFIS Symbol Generator
(1) The left, right, and center EFIS symbol generators are located in the main equipment center on rack E1.
(2) The front panel of the symbol generator has two push switches. One is a self-test switch which, when pressed, causes the symbol generator's BITE circuits to run a system self-test. The symbol generator will check the operation of the control panel, the display units, and itself. Any detected faults are stored in a 2-flight non-volatile memory. The other switch is a BITE memory reset switch. When this is pressed, all stored faults in the BITE memory are erased.
B. EFIS Control Panel
(1) The left and right EFIS control panels are located on the aisle control stand (P10).
(2) The EADI controls and their functions are as follows:
(a) The EADI display brightness control is a rotary potentiometer control for manual EADI brightness adjust.
(b) The selected DH readout is a three-digit, LCD display, representing selected DH in feet.
(c) The DH set control is a two-speed, ten-turn, rotary switch used to select DH. If the control is turned slowly, the display will advance 1 foot per click at 24 feet per revolution. If the control is turned quickly, the display will advance 4 feet per click at 96 feet per revolution.
(d) The DH reset switch is a push switch, used to manually reset the DH alert.
(3) The EHSI controls and their functions are as follows:
(a) The range switch is a six position rotary switch used to select display range. It also controls the range processing in the WXR XCVR (AMM 34-43-00/001). The switch selects 10, 20, 40, 80, 160, or 320 nmi display range.
(b) The EHSI brightness control and WXR display brightness control are two concentric rotary controls. The outer control is for the overall EHSI brightness. The inner control is for the WXR raster brightness.

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(c) The EHSI map mode display switches are a set of five (far left inoperative) push-on/push-off switches. They illuminate in the ON position and call up useful display data in the map mode. When in the ON position, the following data will be included in the map display:

1) The NAVAID - displays all VOR, VORTAC, and NAVAIDS, with identifiers, in the displayed range.
2) The ARPT - displays all airports and identifiers in the displayed range.
3) The RTE DATA - displays altitude and ETA next to all flight path waypoints.
4) The WPT - displays all waypoints, with identifiers, not on flight path and within display range.

(d) The weather radar ON/OFF switch is used to turn on WXR system (AMM 34-43-00/001) and WXR display on the EHSI.

(e) The EHSI mode switch is a six position rotary switch. It is used to select either the MAP, PLAN, Expanded (EXP) VOR, EXP ILS, FULL VOR, or FULL ILS display modes for the EHSI.

C. HDG REF Switch

(1) The HDG REF switch is used to manually switch the heading displays on the RDMIs and EHSIs between a magnetic (NORM position) or true (TRUE position) north reference.

(2) The HDG REF switch is located on the P3 panel.

D. Instrument Source Select Panel

(1) Both instrument source select panels contain one flight director, one flight management computer (FMC) navigation, and three normal/alternate source select switches. These are used to switch from a normal data source to an alternate, in the event of a failure. All switching is done within the displaying system components (ex. EFIS symbol generator, RDMI, VSI). The left and right instrument source select panels are located on the captain's instrument panel (P1) and first officer's instrument panel (P3), respectively.

(2) The flight director source select, a three position rotary switch, is used to select either the left, right, or center flight control computer (FCC).

(3) The FMC navigation source select, also a three position rotary switch, is used to select either the left or right FMC, or the on-side CDU.

(4) The three normal/alternate source select switches are pushed once for alternate and again for normal. They are lighted when in the the alternate mode.

(5) The electronic flight instrument (EFI) switch selects which symbol generator supplies the display units. The switching is done by relays in the left and right symbol generators. The captain's and F/O's EFI switches are electronically interlocked.

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(6) The inertial reference system (IRS) switch selects which IRU supplies pitch, roll, heading, and track data. This is supplied to and switched within the EFIS symbol generators, the RDMIs, the VSIs, and the digital flight data acquisition units (DFDAU).

(7) The air data computer (AIR DATA) switch selects which ADC supplies true airspeed data. This is supplied to and switched within the EFIS symbol generators.

E. EFIS Remote Light Sensor

(1) The remote light sensors detect the amount of ambient light coming through the windshield and are used for automatic intensity control of the display units. The left and right remote light sensors are located on the glareshield (P7).

(2) The light passes through a lens and is sensed by the photo diode light sensor. The diode allows current to pass through it, which corresponds to the amount of detected light. The voltage is sent to the display units to automatically adjust their brightness.

F. Normal Displays

(1) The purpose of the EADIs and EHSIs is to display basic attitude and navigation data. The displays are color CRTs which receive symbol data from the symbol generator. Navigational format and content are mainly supplied by the FMC. Attitude data comes from the IRS. Both indicators are also capable of displaying text information such as flight parameters and system status.

(2) The colors used on the displays generally have the following meanings:

(a) GREEN - indicates engaged flight mode annunciations, dynamic conditions

(b) WHITE - indicates present status situation, scales, flight mode annunciations

(c) MAGENTA - Indicates command information, pointers, symbols, fly-to condition

(d) CYAN (Light Blue) - Indicates non active background information (i.e. EADI sky)

(e) RED - indicates warning.

(f) YELLOW - indicates cautionary information, faults flags (i.e. EADI ground)

(g) BLACK - indicates blank areas

(3) The following figures and tables describe the display symbols and their parameters on the EADIs and EHSIs under normal conditions.

G. Electronic Attitude Director Indicator (EADI) (Fig. 2)

(1) The EADIs display basic attitude information, ILS data, radio altitude, airspeed data, and autopilot mode data. They also display fault data for the input systems in the event of a failure. The display consists of a standard attitude display centered on the screen. Text, which represents various flight parameters, is located in each corner of the screen. The left and right EADIs are located in the captain's (P1) and first officer's (P3) instrument panels, respectively.

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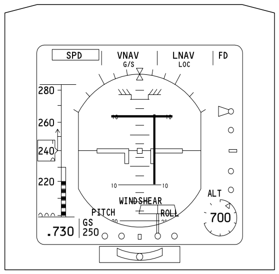
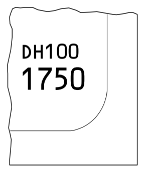


EADI DISPLAY (EXAMPLE)



SYMBOL	NAME	REMARKS
	AIRPLANE	WHITE AIRPLANE ATTITUDE REFERENCE PRODUCED BY EFIS SYMBOL GENERATOR
	SKY/GROUND/HORIZON LINE	CYAN SKY AND YELLOW GROUND PRODUCED BY EFIS SYMBOL GENERATOR. SKY/GROUND MOVEMENT AND WHITE HORIZON LINE PRODUCED BY IRS DATA
	SPLIT AXIS FLIGHT DIRECTOR	MAGENTA SYMBOL PRODUCED BY FCC DATA. DISPLAYED WITH FD SWITCH ON AND VALID STEERING COMMANDS AVAILABLE. ALSO DISPLAYED WHEN T/O GO AROUND SW ACTIVATED IN WINDSHEAR CONDITION, EVEN WITH FD SWITCH OFF.
	PITCH SCALE	WHITE (±90°) PRODUCED BY IRS DATA. 0° INDICATED BY HORIZON LINE
	ROLL SCALE, POINTER AND INDEX	WHITE SCALE (±60°), POINTER AND INDEX POINTER MOVEMENT PRODUCED FROM IRS DATA. SCALE AND INDEX PRODUCED BY EFIS SYMBOL GENERATOR
	EXPANDED LOC SCALE AND POINTER AND RISING RUNWAY	WHITE SCALE, MAGENTA POINTER AND STEM, AND GREEN RISING RUNWAY. FOR VALID ILS DATA, THE STANDARD LOC DISPLAY WILL APPEAR UNTIL THE FOLLOWING CONDITIONS ARE MET: 1. LOC DEVIATION <5/8 DOT; 2. AFDS LOC OR ROLLOUT MODE IS ENGAGED/OPERATIVE. THESE CONDITIONS CAUSE THE EXPANDED LOC SCALE TO APPEAR. THE SYMBOL WILL REVERT BACK TO THE STANDARD DISPLAY IF BOTH AFDS MODES ARE DISENGAGED AND THE GROUND SPEED <30 KNOTS OR RA >200 FT. THE RISING RUNWAY DISPLAYS A REPRESENTATIVE RA OF 0 TO 200 FT VERTICAL MOVEMENT IS CONTROLLED BY THE RA SYSTEM. LATERAL MOVEMENT IS CONTROLLED BY THE ILS. ZERO FT RA IS INDICATED WHEN THE RUNWAY TOUCHES THE AIRPLANE SYMBOL
	STANDARD LOC SCALE AND POINTER	

SYMBOL	NAME	REMARKS
	GLIDESLOPE SCALE AND POINTER	WHITE SCALE AND MAGENTA POINTER. SCALE PRODUCED BY EFIS SYMBOL GENERATOR. POINTER DISPLAYED WHEN VALID ILS DATA IS RECEIVED. POINTER REMOVED FOR NCD AND FOR BACK COURSE OR WHEN THE DIFFERENCE BETWEEN AIRPLANE TRACK ANGLE AND SELECTED RUNWAY HEADING IS >90°. (ILS)
DH100 1750	NUMERICAL DECISION HEIGHT AND RA DISPLAY	GREEN DECISION HEIGHT SELECTED ON EFIS CONTROL PANEL. WHITE RA (+1000 TO +2500 FT) FROM RADIO ALTIMETER SYSTEM (EFIS CP/RA)
750	ANALOG DECISION HEIGHT AND RA DISPLAY	BELOW 1000 FT THE DIGITAL RA DISPLAY CHANGES TO A WHITE ANALOG RING, RANGE MARKS, AND DIGITAL RA. THE DH IS REPRESENTED BY A MAGENTA TRIANGULAR BUG. SEGMENTS WILL DISAPPEAR/APPEAR TO REPRESENT THE DIGITAL RA (-20 TO +1000 FT)
	DH ALERT	YELLOW ALERT WHEN RA ≤DH. DISPLAY FLASHES FOR INITIAL 3 SECONDS OF ALERT. ALERT CAN BE CANCELLED MANUALLY FROM EFIS CP OR CANCELS AUTOMATICALLY WHEN RA = 0 OR RA = DH+75 (EFIS CP/RA)
GS 250	GROUND SPEED	WHITE DISPLAY OF CALCULATED GROUND SPEED (KNOTS) (FMC, IRS)
FD	AFDS STATUS MODE	GREEN DISPLAY FOR ENGAGED MODE (AFDS)
LOC	ROLL MODE ARMED	WHITE DISPLAY FOR ARMED ROLL MODE (AFDS)
G/S	PITCH MODE ARMED	WHITE DISPLAY FOR ARMED PITCH MODE (AFDS)
LNAV	ROLL MODE ENGAGED	GREEN DISPLAY FOR ENGAGED ROLL MODE (AFDS)
VNAV	PITCH MODE ENGAGED	GREEN DISPLAY FOR ENGAGED PITCH MODE (AFDS)
SPD	A/T MODE	GREEN DISPLAY FOR A/T MODE (TMS)
	MODE CHANGE HIGHLIGHT	GREEN BOX AROUND MODE ANNUNCIATION FOR TEN SEC AFTER CHANGE TO VALID MODE
ALT	H ALERT	WHITE DISPLAY AT 500 FT <RA ≤2500 FT
	PITCH LIMIT	YELLOW SYMBOL. READOUT AGAINST PITCH SCALE. BOTTOM EDGE OF SYMBOL INDICATES PITCH MARGIN TO STICK-SHAKER. (SWC)
WINDSHEAR	WINDSHEAR WARN	RED DISPLAY FOR DETECTED WINDSHEAR CONDITION (GPWS)
	WINDSHEAR ALERT	YELLOW DISPLAY FOR POSSIBLE WINDSHEAR CONDITION (GPWS)
ROLL	ROLL COMPARATOR	YELLOW ANNUNCIATION DISPLAYED WHEN ONSIDE ROLL DISPLAY DRIVE VALUE DIFFERS FROM OFFSIDE ROLL DISPLAY DRIVE VALUVE BY ≥3° FOR 2 SEC. DISPLAYED BY BOTH EFIS SG SIMULTANEOUSLY. (EFIS)
PITCH	PITCH COMPARATOR	YELLOW ANNUNCIATION DISPLAYED WHEN ONSIDE PITCH DISPLAY DRIVE VALE DIFFERS FROM OFFSIDE PITCH DISPLAY DRIVE VALUE BY ≥3° FOR 2 SEC. DISPLAYED BY BOTH EFIS SG SIMULTANEOUSLY. (EFIS)

EFIS EADI Display - Component Detail
Figure 2 (Sheet 1)

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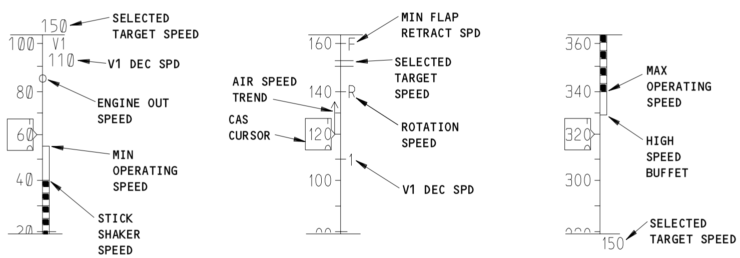
SYMBOL	NAME	REMARKS
180 160 140	AIRSPEED TAPE AND ROLLING DIGIT CAS CURSOR	WHITE AIRSPEED TAPE MOVES AGAINST FIXED WHITE CAS CURSOR WITH ROLLING DIGITS. SPEED SCALE NUMBERS ALSO ARE IN WHITE. SPEED SCALE BELOW 30 KTS IS BLANK. WHEN THE SPEED IS EQUAL TO OR LESS THAN 30 KTS (OR NCD), THE TAPE INDICATES 30 KTS. (ADC)
.730	MACH DISPLAY	CURRENT MACH NUMBER COMPUTED BY ADC, DISPLAYED BY WHITE NUMERICS. DISPLAYED FOR MACH ≥ .400.
= 250	SELECTED TARGET SPEED	MAGENTA INDEX PLACED AGAINST RESPECTIVE READING ON AIR-SPEED TAPE. REPLACED BY MAGENTA THREE-DIGIT DISPLAY WHEN SELECTED TARGET SPEED IS OFF-SCALE. DIGITAL DIS-PLAY IS PLACED IMMEDIATELY BELOW AIRSPEED TAPE FOR A VALUE LESS THAN THE CURRENT SPEED AND ABOVE AIR-SPEED TAPE FOR A VALUE GREATER THAN THE CURRENT SPEED. MOTION CONTROL IS FROM AFDS-MCP.
	MAXIMUM OPERATING SPEED	RED/BLACK BAND PLACED ALONGSIDE UPPER PORTION OF AIR-SPEED TAPE. BOTTOM EDGE INDICATES MAX OPERATING SPEED. (SWC)
	HIGH SPEED BUFFET	YELLOW SYMBOL PLACED ALONGSIDE UPPER PORTION OF AIR-SPEED TAPE. BOTTOM EDGE INDICATES THE SPEED WHERE THE AIRPLANE WOULD ENCOUNTER BUFFETING OR THE FLAPS SHOULD BE EXTENDED. (SWC)
-1 V1 140	DECISION SPEED (V1)	GREEN SYMBOL "-1" IS PLACED AGAINST AIRSPEED TAPE. IF OFF SCALE, THIS INDICATION IS REPLACED BY DISPLAY "V1" AND V1 SPEED VALUE ON THE LINE BELOW, INSIDE THE TOP OF THE AIRSPEED TAPE. (FMC)
-F	MINIMUM FLAP RETRACTION SPEED	GREEN SYMBOL PLACED AGAINST AIRSPEED TAPE. (SWC)
-R	ROTATION SPEED (VR)	GREEN SYMBOL PLACED AGAINST AIRSPEED TAPE DURING TAKEOFF. (FMC)
-R	APPROACH REFERENCE SPEED (V REF)	GREEN SYMBOL PLACED AGAINST AIRSPEED TAPE DURING LANDING. (FMC)
	MINIMUM OPERATING SPEED	YELLOW BAND PLACED ALONGSIDE LOWER PORTION OF AIRSPEED TAPE. UPPER EDGE INDICATES MIN OPERATING SPEED. (SWC)
	STICK SHAKER SPEED	RED/BLACK SYMBOL PLACED ALONGSIDE LOWER PORTION OF AIR-SPEED TAPE. TOP EDGE INDICATES STICK SHAKER SPEED. (SWC)
○	ENGINE OUT OPERATING SPEED	CYAN SYMBOL PLACED ACROSS AIRSPEED TAPE. (SWC)
↑	AIRSPEED TREND VECTOR	GREEN SYMBOL PLACED LEFT AND ALONGSIDE OF AIRSPEED TAPE. LENGTH OF SYMBOL IS PROPORTIONAL TO TREND VALUE. ARROWHEAD TIP INDICATES PROJECTED AIRSPEED AFTER 10 SEC. ARROW POINTS UPWARD FOR ACCELERATION, DOWNWARD FOR DECELERATION. IF TREND IS < 3.5 KTS, SYMBOL IS REMOVED. IF TREND IS > 4.5 KTS, SYMBOL IS DISPLAYED. IF TREND IS ≥ 42 KTS, 42 KT TREND IS INDICATED.



AIRSPEED DISPLAY SYMBOLS

EFIS EADI Display - Component Detail
Figure 2 (Sheet 2)

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(2) The display is a shadow masked vertical raster CRT with three color guns (red, blue, green). It utilizes magnetic deflection and electrostatic focus control. Failure of one of the color guns will result in a monochromatic display. The three colors are used to generate other color combinations such as magenta, cyan, yellow, and white.

(3) The circuit operation and unit temperature are checked by the symbol generator BITE circuits. Any detected faults are displayed on the screen.

(4) The front panel includes the screen, an inclinometer, and a light sensor. The light sensor detects cabin lighting intensity and varies the display brightness accordingly. The inclinometer is a standard ball-type and is used as an attitude backup. The display area is approximately 5 inches square.

H. Electronic Horizontal Situation Indicator (EHSI)

(1) The EHSI displays flight information in a horizontal format. It displays standard type HSI information and many other flight parameters in modified formats. It also is used for the WXR display in the MAP, VOR-EXP, and ILS-EXP modes. The left and right EHSIs are located on the captain's (P1) and first officer's (P3) instrument panels, respectively. The EHSI has a display area of approximately 5 x 6 inches.

(2) MAP and PLAN Modes (Fig. 3)

(a) Plan mode - used in conjunction with FMC CDU for flight path planning. This mode is displayed in a north up presentation. It can be utilized for inflight changes in a planned route. Generally though, it is used in pre-flight route planning.

(b) Map mode - used to display present position of airplane during flight. It displays in a map format active flight plan, ground stations (waypoints, VOR stations, airports, navigation aids, etc.), and other flight parameters. It also displays heading, track, windspeed and direction, and other selectable data. This mode is displayed in a track-up presentation.

(3) VOR and ILS Modes (Fig. 4)

(a) VOR mode - used when flying by VOR ground stations. This mode displays heading-up oriented deviation from desired flight path. It also displays heading data, track data, and flight data text.

(b) ILS mode - used during ILS landing approaches. The display is similar to the VOR mode. It displays heading-up oriented ILS deviations, heading information, track information and flight parameters in text.

3. <u>Operation</u>

A. Functional Description

(1) Flight Instrument System - Block Diagram (Fig. 5)

(a) The EFIS symbol generator receives digital navigation and sensor data from many of the airplane's navigation systems. This is converted into digital video data and sent to the displays. The display content and format is controlled by the data and the EFIS control panel.

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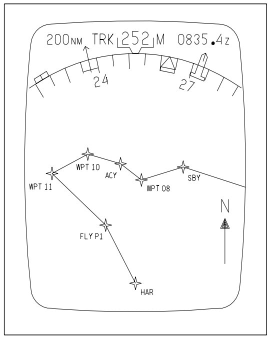
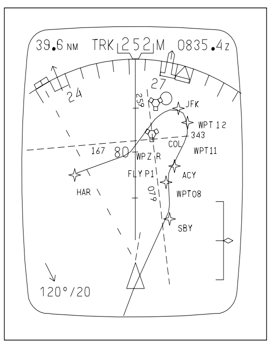


EHSI DISPLAY (PLAN MODE)



EHSI DISPLAY (MAP MODE)

SYMBOL	NAME	COLOR	APPLICABLE MODE	REMARKS [SYMBOL DATA SOURCE]
	AIRPLANE SYMBOL	WHITE	MAP	AIRPLANE POSITION IS INDICATED BY THE APEX OF THE TRIANGLE. THE APEX OF THE AIRPLANE SYMBOL IS THE CENTER OF ROTATION AND TRANSLATION FOR ALL THE BACKGROUND AND DYNAMIC SYMBOLS. [EFIS]
	CURVED TREND VECTOR	WHITE	MAP	THE THREE SEGMENT CURVE PREDICTS DIRECTIONAL TREND. IT IS BASED ON PRESENT POSITION, GROUND SPEED AND CROSS TRACK ACCELERATION AT THE END OF 30, 60 AND 90 SECOND INTERVALS. [IRS/EFIS/FMC]
80	PRESENT TRACK, STRAIGHT TREND, AND RANGE SCALE	WHITE	MAP	MAGNETIC TRACK WHICH WILL RESULT WITH PRESENT HEADING AND WINDS. DISPLAYED RANGE IS ONE-HALF THE ACTUAL SELECTED RANGE. [EFIS/FMC]
TRK 252 M	TRACK - ORIENTATION INDICATOR AND REFERENCE (MAG HEADING)	GREEN - (TRK, TRU AND M) WHITE - (TRK BOX, TRU BOX, AND NUM.) AMBER - (TRU BOX)	MAP, PLAN	NUMBER UNDER POINTER IS A TRACK. BOX DISPLAYS ACTUAL TRACK. COMPASS HEADING IS AUTOMATICALLY SWITCHED TO MAG BETWEEN 70 DEGREES N AND 60 DEGREES S, AND TRUE AT GREATER LATITUDE. THE HEADING CAN BE MANUALLY SWITCHED TO TRUE WITH THE HDG REF SWITCH. THE M/TRU STATUS CHANGE SHOWS FOR TEN SECONDS AFTER THE CHANGE. [IRS/FMC/EFIS]
TRK 252 TRU	TRACK - ORIENTATION INDICATOR AND REFERENCE (TRUE HEADING)			
39.6 NM	DISTANCE DISPLAY	WHITE	MAP, PLAN	DISTANCE TO NEXT FMC WAYPOINT (NM). [FMC]
0835.4Z	ETA DISPLAY	WHITE	MAP, PLAN	INDICATES TIME TO NEXT ACTIVE WAYPOINT. [FMC]
80	RANGE-TO-ALTITUDE ARC (NOT SHOWN)	GREEN	MAP	CURVED ARC REPRESENTS THE POINT WHERE THE REFERENCE ALTITUDE WILL BE REACHED IF CURRENT VERTICAL & LATERAL FLIGHT PATH ANGLES ARE MAINTAINED. [FMC]
24 27	EXPANDED COMPASS ROSE	WHITE	MAP, PLAN	COMPASS DATA IS PROVIDED BY THE SELECTED FMC. 360° ARE AVAILABLE BUT APPROXIMATELY 70° ARE DISPLAYED. [FMC/IRS]
	SELECTED HEADING MARKER AND LINE	MAGENTA	MAP, PLAN	MANUALLY POSITIONED BY HEADING SELECTOR ON MCP. [FCC]
	PRESENT HEADING MARKER	WHITE	MAP, PLAN	DISPLAYED WHEN SELECTED MODE HAS TRK UP ORIENTATION. [IRS]
120°/20	WINDSPEED AND DIRECTION	WHITE	MAP	INDICATES WIND SPEED IN KNOTS AND WIND DIRECTION WITH RESPECT TO THE MAP DISPLAY REFERENCE (MAGNETIC OR TRUE NORTH REFERENCE).
ACY WPT08 SBY	ROUTE	ACTIVE - MAGENTA INACTIVE - WHITE CHANGES - CYAN	MAP, PLAN	THE ACTIVE ROUTE IS DISPLAYED WITH CONTINUOUS LINES BETWEEN WAYPOINTS. INACTIVE ROUTES ARE DISPLAYED WITH LONG DASHES BETWEEN WAYPOINTS. CHANGES TO THE ACTIVE ROUTE ARE DISPLAYED WITH SHORT DASHES BETWEEN WAYPOINTS. WHEN A CHANGE IS ACCEPTED IN THE FMC, THE SHORT DASHES ARE REPLACED WITH A CONTINUOUS LINE. [FMC]
HAR	WAYPOINT	—	MAP, PLAN	CONDITIONAL WAYPOINTS - WHITE. ACTIVE WAYPOINTS - MAGENTA. IDENTIFIER LISTED BELOW - RIGHT [FMC]
	ADF BEARING POINTERS L,R,L(RECIP),R(RECIP)	GREEN OR CYAN	MAP, PLAN	DIRECTION TO/FROM SELECTED L(R) ADF STATION (ADF)
	VERTICAL DEVIATION SCALE AND POINTER	WHITE - SCALE MAGENTA - POINTER	MAP	DISPLAYS VERTICAL DEVIATION FROM SELECTED VERTICAL PROFILE IN MAP MODE. FULL SCALE EQUALS 400 FEET DEVIATION. [FMC]

EFIS EHSI (Map and Plan Modes) - Component Detail
Figure 3 (Sheet 1)

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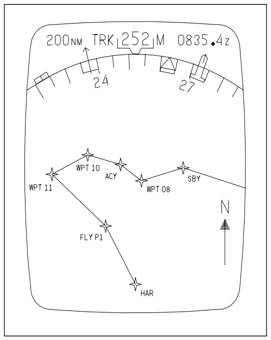
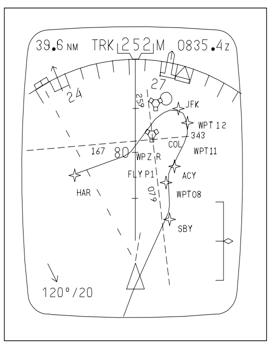


EHSI DISPLAY (PLAN MODE)



EHSI DISPLAY (MAP MODE)

SYMBOL	NAME	COLOR	APPLICABLE MODE	REMARKS [SYMBOL DATA SOURCE]
	OFFSET PATH (NOT SHOWN)	MAGENTA	MAP, PLAN	WHEN AN OFFSET PATH AND AFFECT DISTANCE IS SELECTED ON THE FMC CDU, A DOT-DASH LINE IS DISPLAYED PARALLEL TO AND OFFSET BY THE DESIRED DISTANCE FROM THE ACTIVE FLIGHT PLAN. [FMC]
	MARKER BEACON (NOT SHOWN)	GREEN	MAP, PLAN	NAVIGATION [FMC]
	NONDIRECTIONAL BEACON (NDB) (NOT SHOWN)	GREEN	MAP, PLAN	NAVIGATION [FMC]
	HOLDING PATTERN (NOT SHOWN)	2	MAP, PLAN	DISPLAYED WHEN FMC IS ACTIVELY ENGAGED TO FOLLOW A HOLDING PATTERN. [FMC]
	PROCEDURE TURN (NOT SHOWN)	2	MAP, PLAN	DISPLAYED WHEN FMC IS ACTIVELY ENGAGED TO FOLLOW A PROCEDURE FORM. [FMC]
KABC 22L	AIRPORT AND RUNWAY (NOT SHOWN)	WHITE	MAP, PLAN	SELECTED ON FMC CDU; WHEN EHSI RANGE IS 80,160, OR 320 NM. [FMC]
22L		WHITE		SELECTED ON FMC CDU; WHEN EHSI RANGE IS 10,20, OR 40 NM. [FMC]
	WEATHER RADAR RETURNS (NOT SHOWN)	GREEN YELLOW RED	MAP	MULTICOLORED RETURNS ARE PRESENTED WHEN EITHER WXR ON SWITCH IS PUSHED. MOST INTENSE AREAS ARE DISPLAYED IN RED. [WXR] 1
VAR/WX +12	WEATHER RADAR MODE, GAIN, AND TILT (NOT SHOWN)	GREEN	MAP	DISPLAYS WXR MODE, GAIN, AND ANTENNA TILT ANGLE WHEN WXR ON SWITCH IS PUSHED. [WXR] 1
T/D S/D T/C B/D	ALTITUDE PROFILE POINTS (NOT SHOWN)	GREEN	MAP	CALCULATED BY FMC T/D (TOP-OF-DESCENT), T/C (TOP-OF-CLIMB) S/C (STEP CLIMB), B/D (BOTTOM-OF-DESCENT. [FMC]
N	NORTH-UP POINTER	GREEN	PLAN	NOTES PLAN MODE IS NORTH UP PRESENTATION. [EFIS]
KTEB	AIRPORT	WHITE	MAP	SUITABLE AIRPORTS DISPLAYED WHEN APRT SWITCH IS ON. [FMC] 1
KILMR 12000 08352	ROUTE DATA (NOT SHOWN)	WHITE	MAP	ALT AND ETA FOR ACTIVE WAYPOINTS DISPLAYED WHEN RTE DATA SWITCH ON [FMC] 1
	NAVAIDS, VOR, DME/TACAN, VOR TAC	WHITE	MAP	NONFLIGHT PLAN NAVAIDS DISPLAYED WHEN NAV AID SWITCH ON. [FMC] 1
MLF	WAYPOINT (NOT SHOWN)	WHITE	MAP	NONFLIGHT PLAN WAYPOINTS DISPLAYED WHEN WPT SWITCH ON. [FMC] 1
ABC	SELECTED REFERENCE POINT (NOT SHOWN)	GREEN	MAP	DISPLAYED AS A SELECTED REFERENCE POINT (FIX) VIA THE FMC CDU FIX KEY. CAN BE WITH ANY NUMBER OF SPECIAL MAP SYMBOLS (i.e. VOR,VORTAC, AIRPOINT OR WAYPOINT, ETC.). [FMC]

1 WXR ON, APRT, RTE DATA, NAVAID, AND WPT SELECT SWITCHES LOCATED ON EFIS CONTROL PANEL

2 COLORS MATCH ROUTE COLORS (SEE SHEET 1)

EFIS EHSI (Map and Plan Modes) - Component Detail
Figure 3 (Sheet 2)

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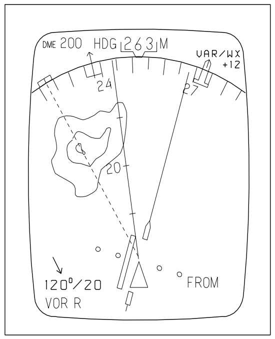
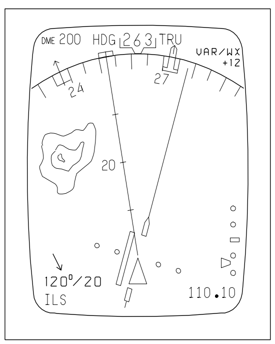


EHSI VOR-EXP MODE
(EXAMPLE)



EHSI ILS-EXP MODE
(EXAMPLE)

SYMBOL	NAME	COLOR	APPLICABLE MODE	REMARKS [SYMBOL DATA SOURCE]
△	AIRPLANE SYMBOL	WHITE	VOR (EXP) ILS (EXP)	AIRPLANE POSITION IS INDICATED BY THE APEX OF THE TRIANGLE. THE APEX OF THE AIRPLANE SYMBOL IS THE CENTER OF ROTATION AND TRANSLATION FOR ALL THE BACKGROUND AND DYNAMIC SYMBOLS. [EFIS]
20	PRESENT TRACK LINE AND RANGE SCALE	WHITE	VOR (EXP) ILS (EXP)	MAGNETIC COURSELINE WHICH WILL RESULT WITH PRESENT HEADING AND WINDS. [FMC,IRS]
				RANGE SCALE DISPLAYED WHEN WXR ON SWITCH IS PUSHED. DISPLAYED RANGE IS ONE-HALF SELECTED RANGE. [FMC,WXR,EFIS]
HDG 263 M	HEADING - ORIENTATION INDICATOR AND REFERENCE (MAG HEADING)	GREEN - (HDG,TRU, AND M) WHITE - (HDG BOX,TRU BOX AND NUM.) AMBER- (TRU BOX)	VOR, ILS	NUMBER UNDER POINTER IS A HEADING. BOX DISPLAYS ACTUAL HEADING. COMPASS HEADING IS AUTOMATICALLY SWITCHED TO MAG BETWEEN 70 DEGREES N AND 60 DEGREES S, AND TRUE AT GREATER LATITUDE. THE HEADING CAN BE MANUALLY SWITCHED TO TRUE WITH THE HDG REF SWITCH. THE M/TRU STATUS CHANGE SHOWS FOR TEN SECONDS AFTER THE CHANGE. [IRS/FMC/EFIS]
HDG 263 TRU	HEADING ORIENTATION INDICATOR AND REFERENCE (TRUE HEADING)			
DME 200	DISTANCE DISPLAY	WHITE	VOR, ILS	DISPLAYS DISTANCE TO NEXT TUNED NAVAID. [DME]
24 27	EXPANDED COMPASS ROSE	WHITE	VOR (EXP) ILS (EXP)	COMPASS DATA IS PROVIDED BY THE SELECTED IRS. 360° ARE AVAILABLE BUT APPROXIMATELY 70° ARE DISPLAYED [IRS]
	SELECTED HEADING MARKER	MAGENTA	VOR (EXP) ILS (EXP)	MANUALLY POSITIONED BY HEADING SELECTOR ON MCP. AUTOMATICALLY REPOSITIONED TO SELECTED LOCALIZER COURSE UPON LOCALIZER CAPTURE (ILS MODE). [FCC]
	COURSE DEVIATION	WHITE - (SCALE)	VOR	WHEN THE VOR MODE IS SELECTED, VOR COURSE DEVIATION IS DISPLAYED. ONE DOT EQUALS 5° DEVIATION. [VOR]
	LOCALIZER DEVIATION	MAGENTA - (BAR)	ILS	WHEN THE ILS MODE IS SELECTED, ILS COURSE DEVIATION IS DISPLAYED. ONE DOT EQUALS 1-1/4° DEVIATION. [ILS]
	GLIDESLOPE DEVIATION	WHITE - (SCALE) MAGENTA - (POINTER)	ILS	DISPLAYS GLIDESLOPE DEVIATION IN ILS MODE. ONE DOT EQUALS APPROXIMATELY 0.35 DEGREES. GS POINTER REMOVED FOR BACK COURSE OPERATION
	WEATHER RADAR DISPLAY	GREEN YELLOW RED	VOR (EXP) ILS (EXP)	MULTICOLORED RETURNS ARE PRESENTED WHEN EITHER WXR ON SWITCH IS PUSHED. MOST INTENSE AREAS ARE DISPLAYED IN RED. [WXR]
VAR/WX +12	WEATHER RADAR MODE, GAIN, AND TILT	GREEN	VOR (EXP) ILS (EXP)	DISPLAYS WXR MODE, GAIN, AND ANTENNA TILT ANGLE WHEN WXR ON SWITCH IS PUSHED. [WXR]
	COURSE SELECT POINTER	MAGENTA - (LINE) WHITE - (POINTER)	VOR (EXP)	INDICATES SELECTED VOR COURSE. [VOR]
	RUNWAY HEADING POINTER		ILS (EXP)	INDICATES SELECTED RUNWAY HEADING FOR FRONT COURSE APPROACH. [ILS]
VOR R(L)	SELECTED NAV RADIO	GREEN	VOR	DISPLAYS SELECTED NAV RADIO BASED ON EFIS CP SELECTION. [EFIS]
ILS		GREEN	ILS	
110.10	ILS FREQUENCY DISPLAY	GREEN	ILS	DISPLAYED WHEN VALID ILS FREQUENCY DATA IS BEING RECEIVED AND THE ILS PARK SIGNAL IS NOT BEING RECEIVED. [ILS]
FROM (TO)	TO/FROM ANNUNCIATOR	WHITE	VOR (EXP)	INDICATES AIRPLANE FLYING TO OR FROM THE SELECTED VOR STATION. [VOR]

EFIS EHSI (VOR and ILS Modes) - Component Detail
Figure 4 (Sheet 1)

586236

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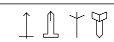
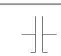
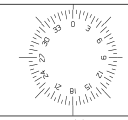
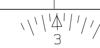
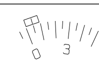
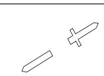
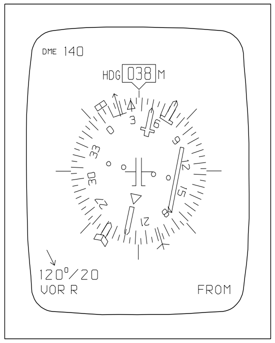
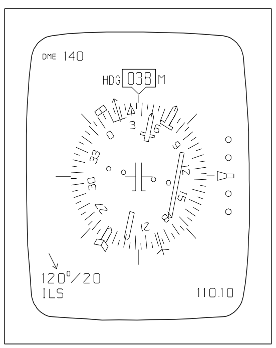
SYMBOL	NAME	COLOR	APPLICABLE MODE	REMARKS [SYMBOL DATA SOURCE]
120°/20	WINDSPEED AND DIRECTION	WHITE	VOR, ILS	INDICATES WIND SPEED IN KNOTS AND WIND DIRECTION WITH RESPECT TO THE DISPLAY REFERENCE (MAGNETIC OR TRUE NORTH REFERENCE). [FMC OR IRS]
	ADF BEARING POINTERS L,R,L(RECIP),R(RECIP)	GREEN OR CYAN	VOR, ILS	DIRECTION TO/FROM SELECTED L(R) ADF STATION. [ADF]
	AIRPLANE SYMBOL	WHITE	VOR (FULL) ILS (FULL)	AIRPLANE POSITION IS INDICATED BY THE SYMBOL. THE AIRPLANE SYMBOL IS THE CENTER OF ROTATION AND TRANSLATION FOR ALL THE DYNAMIC SYMBOLS. [EFIS]
	FULL COMPASS ROSE DISPLAY	WHITE	VOR (FULL) ILS (FULL)	DISPLAYS 360° OF IRS COMPASS DATA. [IRS]
	DRIFT ANGLE POINTER	WHITE	VOR (FULL) ILS (FULL)	INDICATES FMC/IRS COMPUTED DRIFT ANGLE. [FMC/IRS]
	SELECTED HEADING MARKER	MAGENTA	VOR (FULL) ILS (FULL)	MANUALLY POSITIONED BY HEADING SELECTOR ON MCP. AUTOMATICALLY REPOSITIONED TO SELECTED LOCALIZER COURSE UPON LOCALIZER CAPTURE (ILS MODE). [FCC]
	COURSE SELECT POINTER	WHITE	VOR (FULL)	INDICATES SELECTED VOR COURSE. [VOR]
	RUNWAY HEADING POINTER		ILS (FULL)	INDICATES SELECTED RUNWAY HEADING FOR FRONT COURSE APPROACH. [ILS]
▽ (△) FROM (TO)	TO/FROM ANNUNCIATOR	WHITE	VOR (FULL)	INDICATES AIRPLANE FLYING TO OR FROM THE SELECTED VOR STATION. [VOR]



EHSI VOR-FULL MODE
(EXAMPLE)



EHSI ILS-FULL MODE
(EXAMPLE)

EFIS EHSI (VOR and ILS Modes) - Component Detail
Figure 4 (Sheet 2)

245563

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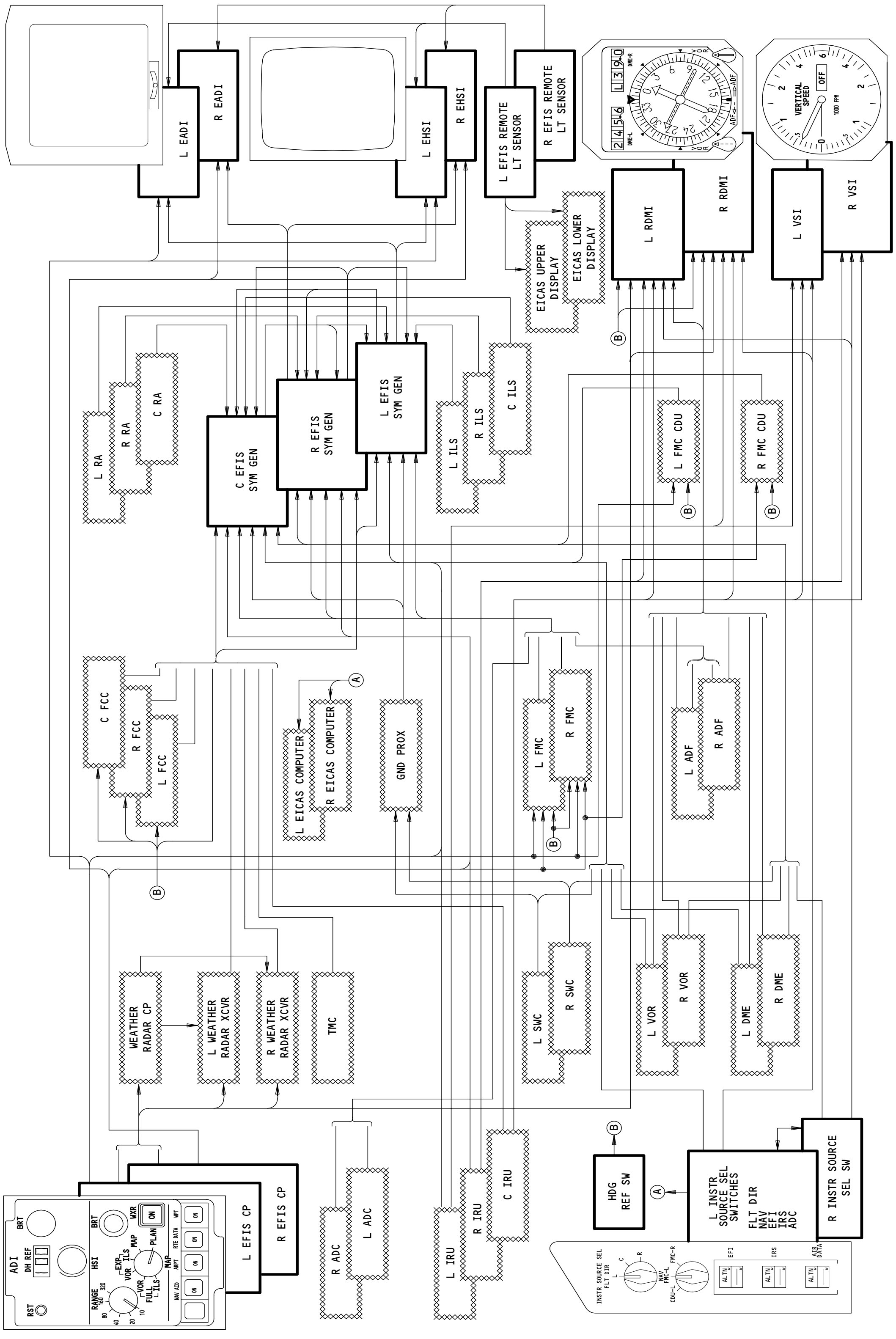

Flight Instrument System Block Diagram
Figure 5 (Sheet 1)

585917

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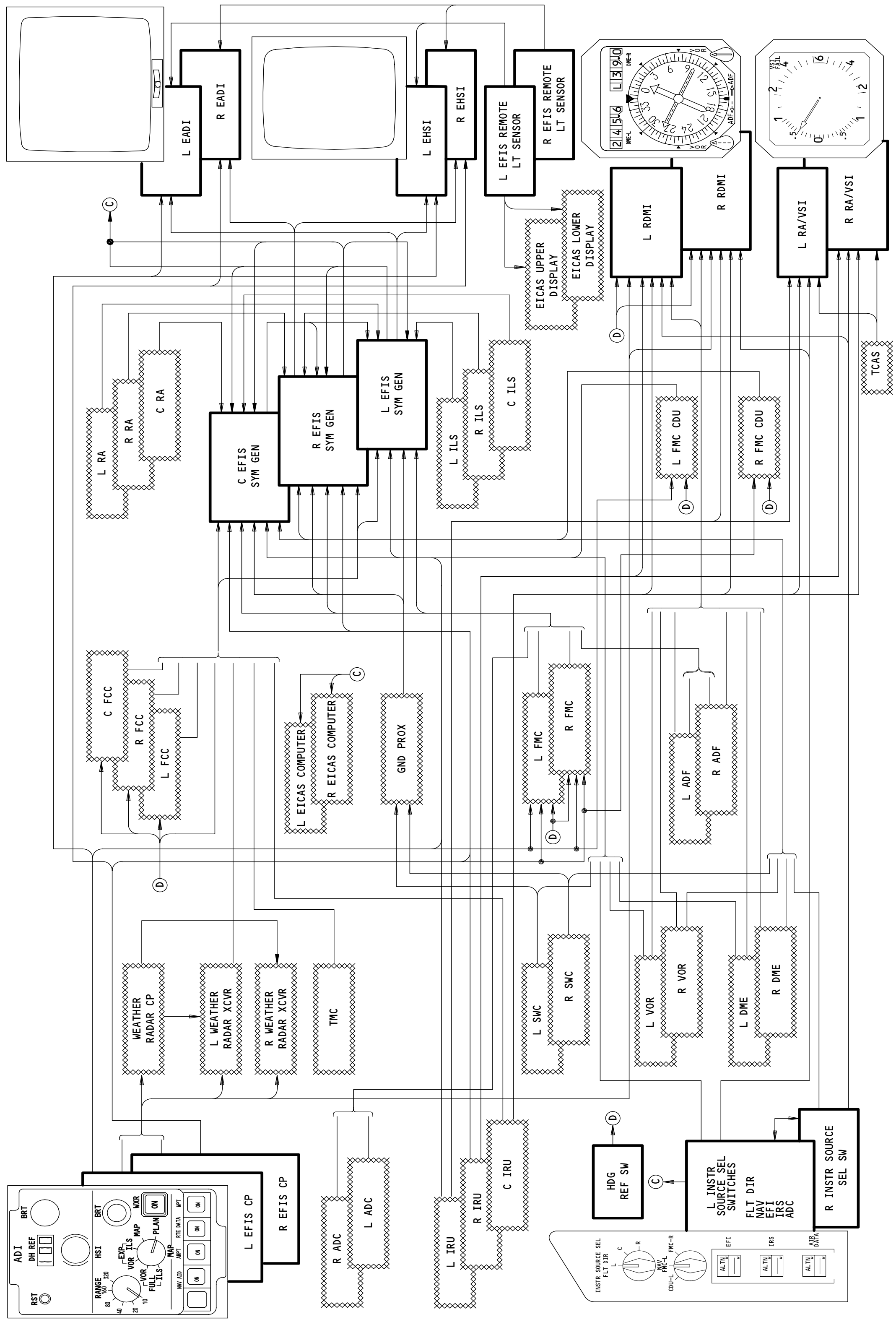

Flight Instrument System Block Diagram
Figure 5 (Sheet 2)

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(b) The EFIS control panels provide display control and selection of mode, range, symbology, DH, brightness, and WXR data.

(c) The symbol generators provide all character input data to the displays. They also provide all system monitoring for the EFIS. The symbol generators receive multiple digital inputs from the ADCs, FCCs, FMCs, and IRUs. Also, single inputs are received by all the symbol generators from the ILS receivers, RA receiver/transmitters, and thrust management computer (TMC). A single input for the left and right, and a dual input to the center symbol generator are received from the stall warning computers (SWC), VOR receivers, and DME interrogators. Where more than one source feeds a symbol generator, the switches on the instrument source select panels provide selection.

(d) SAS 281-999;
The EFIS symbol generators do an attitude comparison through an ARINC 429 crosstie connection between all 3 SGs.

1) If there is a ≥3 degree difference between the pitch or roll attitude indications of the two operational SGs, a signal is sent to the EICAS computers through an EFIS/EICAS attitude comparison relay.
2) This condition will cause a level B caution message, "ATT DISAGREE", to show on the top EICAS display.
3) When the symbol generators are not able to do the pitch and roll comparisons, a status message, "COMPARATOR BITE", will show on the bottom EICAS display.
4) The EICAS message, "COMPARATOR BITE", will also show on the bottom display as follows:
    a) For 2-3 seconds when the EFI switch on one of the instrument source select panels is changed to the ALTN position.
    b) Continuously when the two EFI switches are in the ALTN position.
    c) Continuously when the IRUs are not aligned.

(e) The EADIs and EHSIs display different types of information. Electronically though, the two types of indicators are essentially the same. Display contrast and brightness is controlled by two means. The intensity can be varied manually by the ADI and HSI brightness knobs on the EFIS control panel. The intensity is also automatically controlled. As the cabin lighting changes, the EFIS light sensors cause the display brightness to change accordingly. Under normal conditions, the left display set is driven by the left symbol generator; and the right display set is driven by the right symbol generator. Either can be driven by the center symbol generator. In the event of a main symbol generator fault, the EFI switch on the instrument source select panels are used to switch the displays to the center unit.

(2) Flight Instrument System - Input Data (Fig. 5A)

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TABLE I - FLIGHT INSTRUMENT SYSTEM - INPUT DATA

INPUT SOURCE	INPUT DATA	TYPE	DISPLAY
EFIS CONTROL PANEL	SELECTED DH	D	EADI
	DH RESET	Dd	EADI
	BRIGHTNESS CONTROL	D	EADI/EHSI
	RANGE SELECT	D	EHSI
	MODE SELECT	D	EHSI
		Dd	RDMI
	MAP AID SELECTIONS	D	EHSI
	WXR ON	D	EHSI
AIR DATA COMPUTER	COMPUTED AIRSPEED	D	EADI
	MACH	D	EADI
	TRUE AIRSPEED	D	NOT USED
DISTANCE MEASURING EQUIPMENT	DME DISTANCE	D	EHSI
		D	RDMI
FLIGHT CONTROL COMPUTER	AFDS MODE STATUS	D	EADI
	FLT DIR-PITCH	D	EADI
	FLT DIR-ROLL	D	EADI
	SELECTED HEADING	D	EHSI
	AFDS STATUS MODES	Dd	EADI
	AFDS ROLL MODES ARMED	Dd	EADI
	AFDS ROLL MODES ENGAGED	Dd	EADI
	AFDS PITCH MODES ENGAGED	D	EADI
	AFDS PITCH MODES ARMED/LIMIT	Dd	EADI
FLIGHT MANAGEMENT COMPUTER	CROSS TRACK DISTANCE	D	EHSI
	DESIRED TRACK	D	EHSI
	DISTANCE-TO-GO	D	EHSI
	DRIFT ANGLE (I)	D	EADI/EHSI
	MAP BACKGROUND DATA	D	EHSI
	ETA	D	EHSI
	FLIGHT PATH ANGLE (I)	D	EADI
	GROUND SPEED (I)	D	EADI
	PRESENT POS - LAT	D	EHSI
	PRESENT POS - LONG	D	EHSI
	RANGE TO ALTITUDE	D	EHSI
	TRACK ANGLE (I)	D	EHSI
	VERTICAL DEVIATION (= NCD)	D	EHSI
	WIND DIRECTION (I)	D	EHSI
	WIND SPEED (I)	D	EHSI
FLIGHT MANAGEMENT COMPUTER CONTROL DISPLAY UNIT (BACKUP MODE)	CROSS TRACK DISTANCE	D	EHSI
	DESIRED TRACK	D	EHSI
	DISTANCE-TO-GO	D	EHSI
	MAP BACKGROUND DATA	D	EHSI
	ETA	D	EHSI
	PRESENT POS - LAT	D	EHSI
	PRESENT POS - LONG	D	EHSI

Flight Instrument System - Input Data
Figure 5A (Sheet 1)

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INPUT SOURCE	INPUT DATA	TYPE	DISPLAY
GROUND PROXIMITY WARNING COMPUTER	WINDSHEAR WARN WINDSHEAR ALERT	Ad Ad	EADI EADI
INSTRUMENT LANDING SYSTEM	ILS PARK GLIDESLOPE DEV ILS FREQUENCY LOCALIZER DEV SELECTED RNWY HDG	Ad D D D D	EADI/EHSI EADI/EHSI EHSI EADI/EHSI EHSI
INERTIAL REF SYSTEM	CROSS TRK HRZ ACCEL DRIFT ANGLE (II) FLT PATH ACCEL FLT PATH ANGLE (II) GROUND SPEED (II) MAG HEADING PITCH ANGLE ROLL ANGLE TRACK ANGLE (II) TRUE HEADING WIND DIRECTION (II) WIND SPEED (II) TRUE HEADING VERT SPEED	D D D D D D D D D D D D D D	EHSI EADI/EHSI EADI EADI EADI EHSI EADI EADI EHSI EHSI EHSI EHSI RDMI VSI
RADIO ALTIMETER	RADIO HEIGHT	D	EADI
STALL WARNING COMPUTER	PITCH LIMIT (PLI) ENGINE OUT SPEED HIGH SPEED BUFFET MAX OP SPEED MIN OP SPEED STICK SHAKER SPEED MIN A/S - FLAP RETRACTION	D D D D D D D	EADI EADI EADI EADI EADI EADI EADI
THRUST MGMT SYSTEM	SPEED DEVIATION TMS FMA STATUS	D D	EADI EADI
TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM [1]	TCAS DATA	D	RA/VSI
VOR SYSTEM	SELECTED COURSE VOR FREQUENCY VOR OMNIBEARING L/R SYS VOR OMNIBEARING	D D D Ad D	EHSI EHSI EHSI EHSI RDMI
WEATHER RADAR	WXR DATA	D	EHSI
INSTRUMENT SOURCE SELECT PANEL	FLT DIR SELECT FMC SELECT IRS SELECT EFI SELECT ADC SELECT	Ad Ad Ad Ad Ad	EADI EADI/EHSI/RDMI EADI/EHSI/RDMI/VSI EADI/EHSI EADI
AUTOMATIC DIRECTION FINDER SYSTEM	ADF BEARING	D	RDMI/EHSI

[1] SAS 281-999

Flight Instrument System - Input Data
Figure 5A (Sheet 2)

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(a) The flight instrument systems receive flight data which they process for display. The following table describes the data which each input system provides and how it is used for display (under normal conditions). For fault data displays, see EFIS-, RDMI-, or VSI-BITE in the operation areas of this section.

NOTE: In Table I, the type of data transmission will be noted in the column under TYPE as follows: D - digital data, Dd - digital discrete, or Ad - analog discrete.

(b) Under normal conditions, the EFIS will display FMC generated data (noted by I). With the exception of track angle, if the FMC data is determined to be invalid, the EFIS will automatically switch to the IRS generated data (noted by II).
(c) When the airplane is stationary, the EFIS will display IRS heading data as a direct substitute for FMC/IRS track data.
(d) If the FMC/IRS ground speed is greater than or equal to 50 knots and subsequently not less than or equal to 40 knots, EFIS will select FMC/IRS track data. If the above condition is not satisfied, EFIS will then select IRS heading information in place of track information.
(e) When FMC/IRS track data is selected, EFIS will select FMC data if FMC is valid (noted by I). If FMC data is determined to be invalid, EFIS will automatically switch to IRS generated track data (noted by II).
(f) When the FMC data is determined to be invalid, the EFIS will also automatically switch to FMC CDU (backup mode) generated data as shown in Fig. 5A.

(3) EFIS - Power Distribution and Instrument Lighting (Fig. 6)
(a) The EFIS power distribution is as follows:
1) The left (right) EFIS control panel receives 115v ac, 400 Hz, single phase power from the capt (F/O) instrument transfer bus. They also receive 5v ac for panel lighting from the lighting control circuits (AMM 33-16-00/001). The control panel power supply converts the input power into ± 12v dc and ± 5v dc for internal operation.

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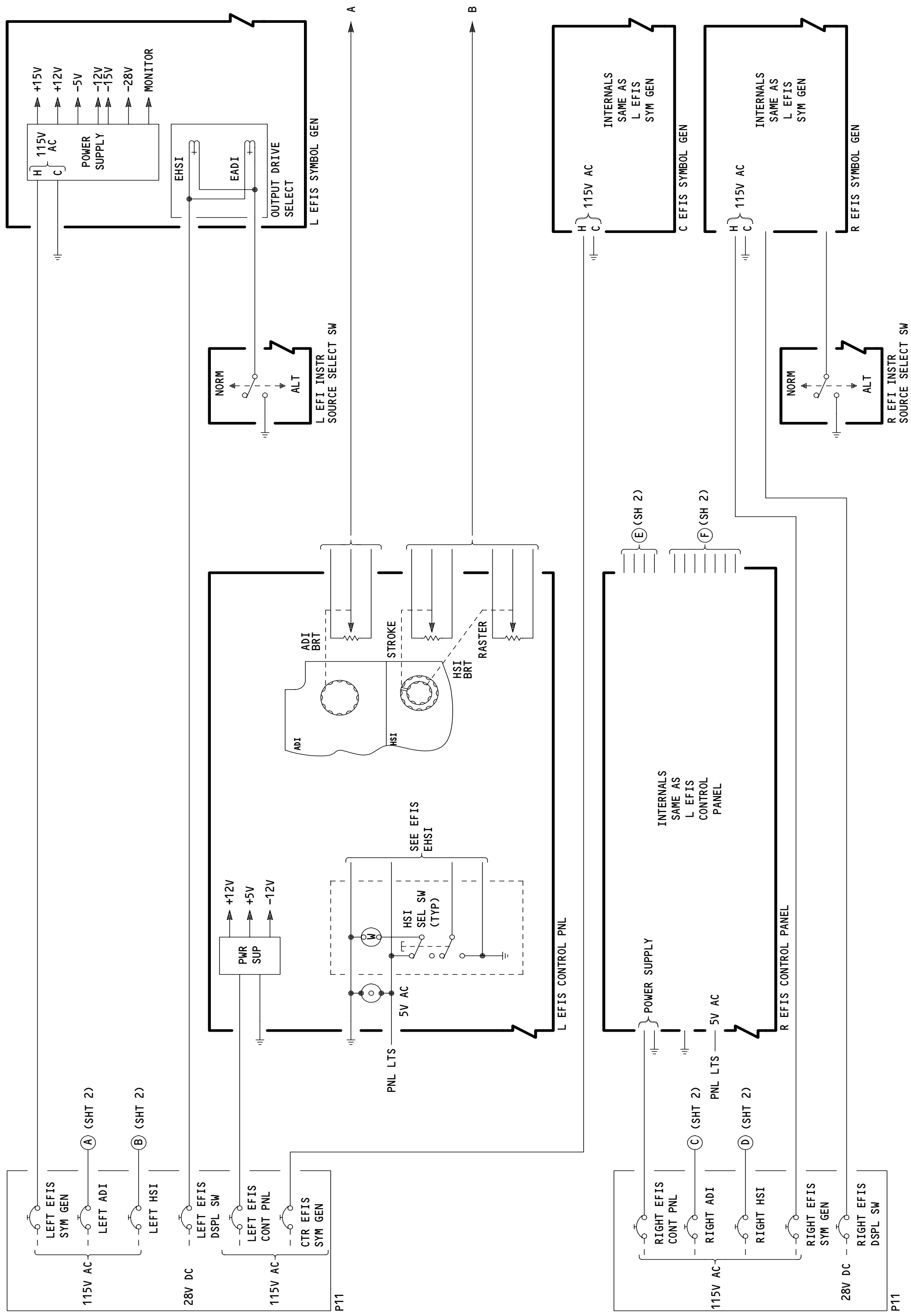

EFIS Power Distribution and Instrument Lighting Schematic
Figure 6 (Sheet 1)

170567

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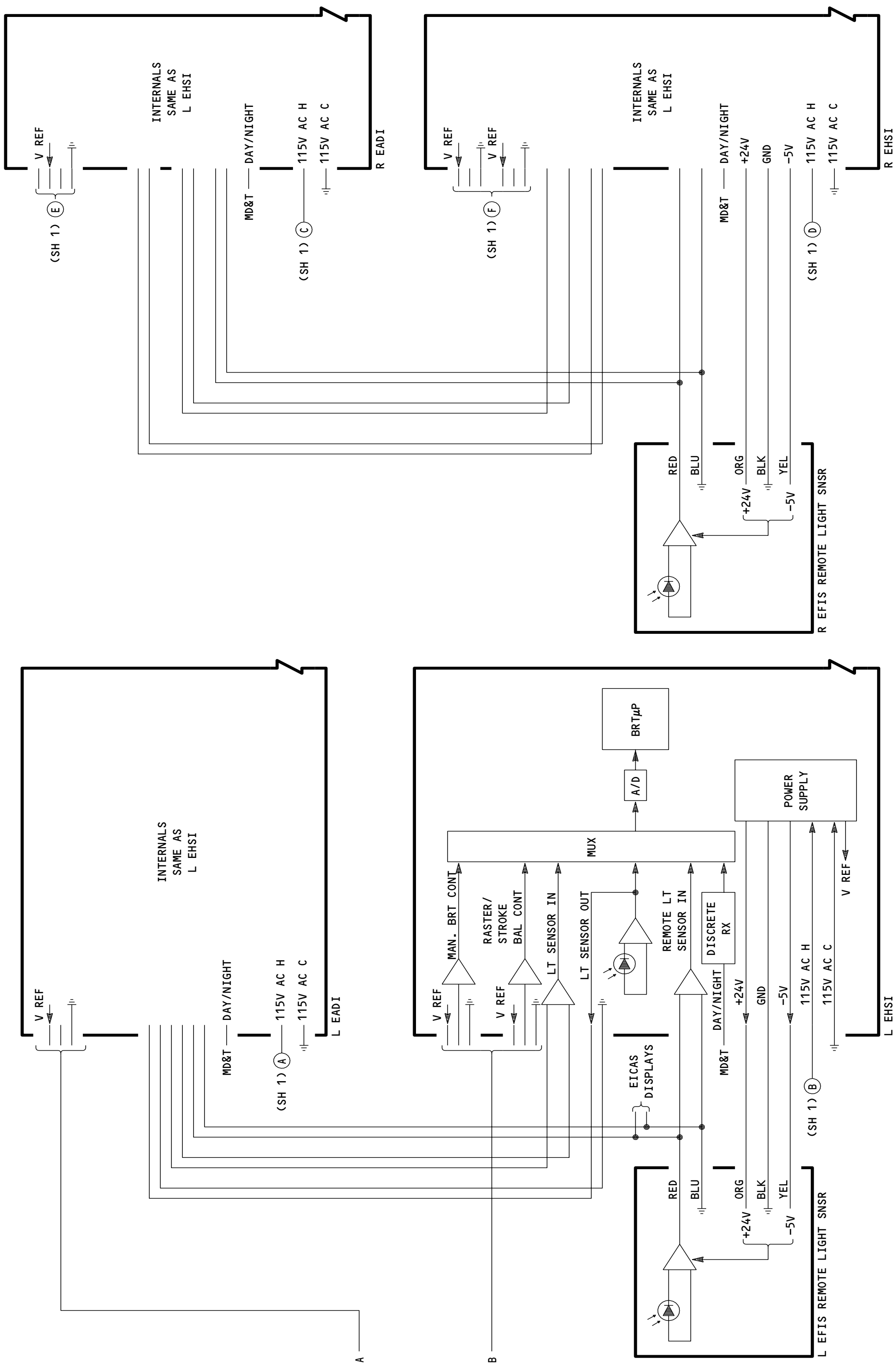

EFIS Power Distribution and Instrument Lighting Schematic
Figure 6 (Sheet 2)

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2) The right EFIS symbol generator receives 115v ac, 400 Hz, single phase power from the F/O instrument transfer bus. The left and center symbol generators receive 115v ac, 400 Hz, single phase power from the Captain's instrument transfer bus. They also receive +28v dc for the output drive select relay. This relay is energized when the EFI switch on the instrument source select panel is in the ALTN position. (The center symbol generator does not require this switching voltage.) The symbol generator converts the 115v ac into ± 15v dc, ± 12v dc, -5v dc, and -28v dc for internal circuit operation.
3) The right EHSI and EADI each receive 115v ac, 400 Hz, single phase power from the F/O instrument transfer bus. The left EADI and EHSI receive 115v ac, 400 Hz, single phase power from the capt instrument transfer bus. They convert this into dc power for internal operation.
4) Normally, the capt (F/O) instrument transfer bus is powered by the left (right) main power bus. In the event of a left (right) power bus failure, the applicable instruments will automatically switch to the right (left) power bus. This will occur when the bus drops below 97 ±2v ac for more than 180 ms. They will automatically switch back to the original bus when its power increases to greater than 106 ±2v ac for more than 1.2 seconds (AMM 24-51-00/001).

(b) Each HSI map mode display switch illuminates an internal switch light in the ON position. The ADI BRT potentiometer controls the EADI display intensity by a variable dc voltage. The HSI BRT potentiometer controls the stroke/raster balance of the EHSI by a variable dc voltage.
(c) The HSI BRT potentiometer also controls the overall EHSI brightness by a variable dc voltage.
(d) The remote light sensors each receive -24Vdc and -5Vdc from the EHSIs for internal operation.
(e) The EADI receives the variable dc voltage from the control panel for manual brightness control. The EHSI receives two variable dc voltages from the control panel for manual brightness control and raster/stroke balance control.

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(f) Both the EADI and EHSI receive automatic brightness control from the remote and local light sensors. In addition, they receive a day/night discrete from the master dim and test circuits.

(g) A display set consists of one EADI, one EHSI and one remote light sensor. Each display set combines and processes all of the automatic brightness control inputs for that set. This is done within the individual CRTs. The combined automatic brightness control inputs maintain the intensity ratio of the sets' displays. As cabin light conditions change, the displays' intensities will change in equal amounts.

(h) The display brightness control signals, both manual and automatic, are converted into digital data by the analog mux. This data is then processed by the BRT CPU for a single display intensity control signal.

(4) EFIS Symbol Generator Schematic (Fig. 6A)

(5) EFIS - Program Pin Options (Fig. 6B)

(a) The EFIS symbol generators contain selectable program pins. These pins can be grounded or left open to set the applicable EFIS options. Each option is assigned a binary number, 0 (open) or 1 (grounded), that represents its state. These options are arranged to form a specified sequence of binary numbers. A binary to hexadecimal conversion of this sequence makes a hex code.

1) The hex code is shown on the EADI during self-test.

(6) EFIS EHSI (Fig. 7)

(a) The lower portion of the control panel is used to control the EHSI and the symbol generator's EHSI circuits. All of the controls utilize ground discrete circuits which send their information to the input select level shifter. The unit is microprocessor controlled and provides both digital and discrete data to other systems.

(b) Each of the range switch settings (10, 20, 40, 80, 160, and 320 nmi) and the VOR/ILS orient program pin provides a ground discrete, when selected. These are sent to the input select level shifter. The VOR/ILS orient program pin causes the EHSI display to be a heading-up orientation in the VOR and ILS modes. The display is track-up in the MAP and PLAN modes when the map orient program pin is open.

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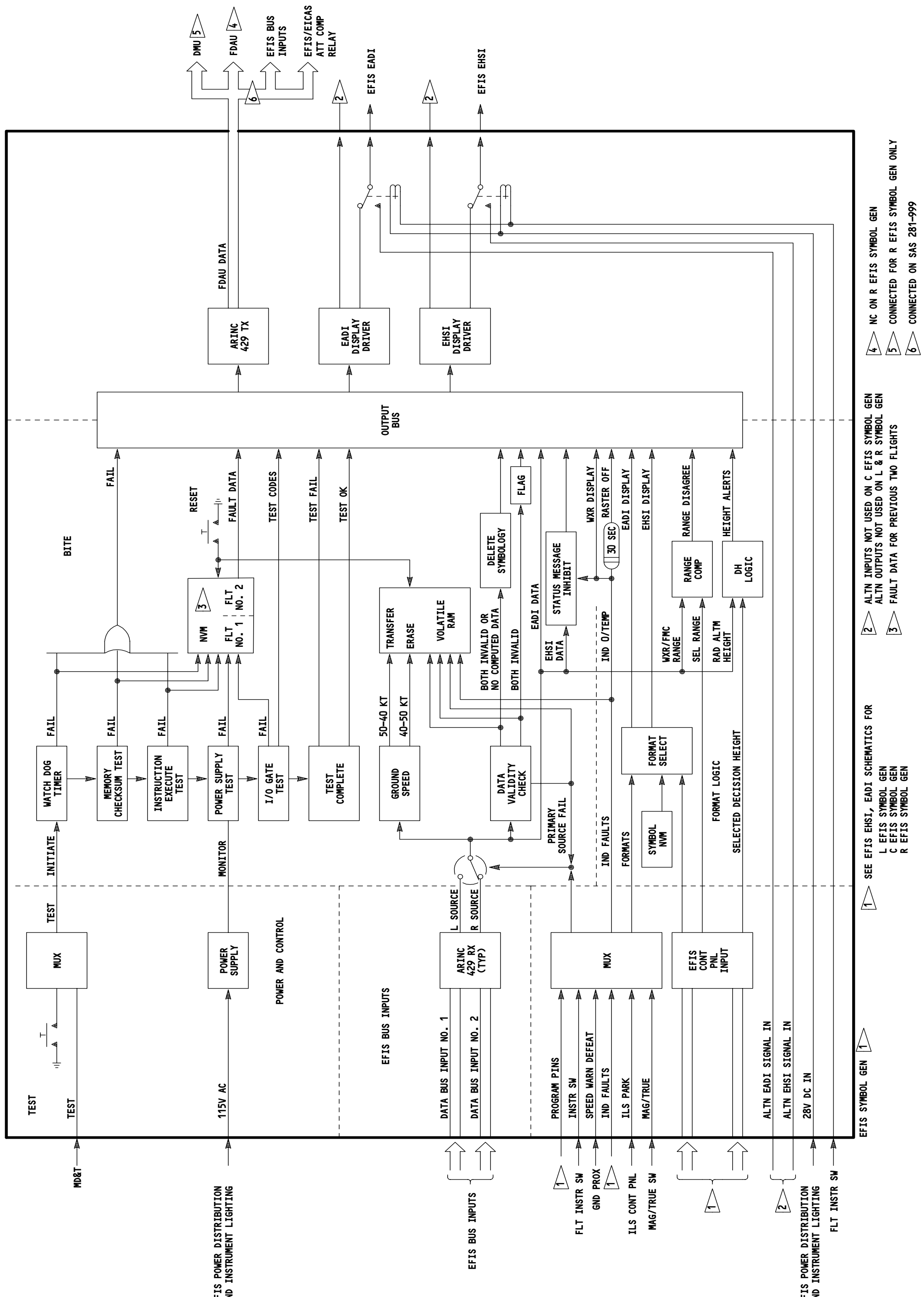

EFIS Symbol Generator Schematic
Figure 6A

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EFIS HEX CODE BIT ASSIGNMENT

FIRST LINE

LEFTMOST DIGIT

Function	CONN	PIN
DME SOURCE	B	A03
G/S SOURCE	B	B03
RA SOURCE	B	C03
ADF SOURCE	B	D03
A/P SEL1	B	E03
A/P SEL2	B	F03
ADF INSTALL1	B	D12
ADF INSTALL2	B	E12
SPD TREND VECTOR - DISABLE	B	J03
MIN OP SPEED - DISABLE	B	K03
SINGLE CH ANN	B	A04
PRODUCT IMPROVEMENTS	B	B04
FMC INSTALL (1/2)	B	E04
ANCDU INSTALL1	B	F04
ANCDU INSTALL2	B	C02
IRU INSTALL (2/3)	B	D02
NA	B	D09
FD DSPLY SEL1	B	E11
FD DSPLY SEL2	B	F11
H ALERT SEL1	B	F09
H ALERT SEL2	B	G09
RA DSPLY SEL1	B	D10
RA DSPLY SEL2	B	E10
FPM DSPLY	B	D11
PROGRAM PIN PARITY	B	J06
ILS DEV WARN	B	E08
LOC DEV SCALE - CAA	B	E09
BK CRS LOC REV - DISABLE	B	C05

RIGHTMOST DIGIT

HEX	BINARY
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

SECOND LINE

LEFTMOST DIGIT

Function	CONN	PIN
SPD TAPE	B	D05
TAS DSPLY ON EADI	B	E05
NA	B	F05
F/S - G/S REVERSAL	B	G05
WXR MODE DSPLY SEL2	A	G14
COMPARATOR DSPLY	B	J05
CENTER MAP - FULL ROSE	B	K05
ANALOG ILS FLAGS	B	D07
CAA COMPARATOR	B	G10
POS DIFF DSPLY SEL1	B	G02
POS DIFF DSPLY SEL2	B	H02
WXR TURB COLOR - MAGENTA	B	E06
EADI FORMAT - EUROPEAN	B	F06
WXR MODE DSPLY SEL1	B	G06
RANGE ARCS	B	H06
ADF POINTERS (MAP) - DISABLE	A	D12
EHSI SYMBOLOGY - ALTERNATE	A	A13
GS AND TAS DISPLAY	A	B13
F/S DURING G/A - DISABLE	D	D12
NA	D	A13
DO NOT GROUND THIS PIN	D	B13
SPD TAPE REVERSAL	D	K13
ROLLING DIGIT CURSOR - DISABLE	D	C14
NU		
ALT PLACEMENT	B	B02
NA	B	G12
RANGE RING - DISABLE	B	H03
MAP SOURCE ANNUN	B	J02

RIGHTMOST DIGIT

NOTES: PIN GROUNDED = 1
PIN OPEN = 0
NU = 0

EFIS - Program Pin Options
Figure 6B (Sheet 1)

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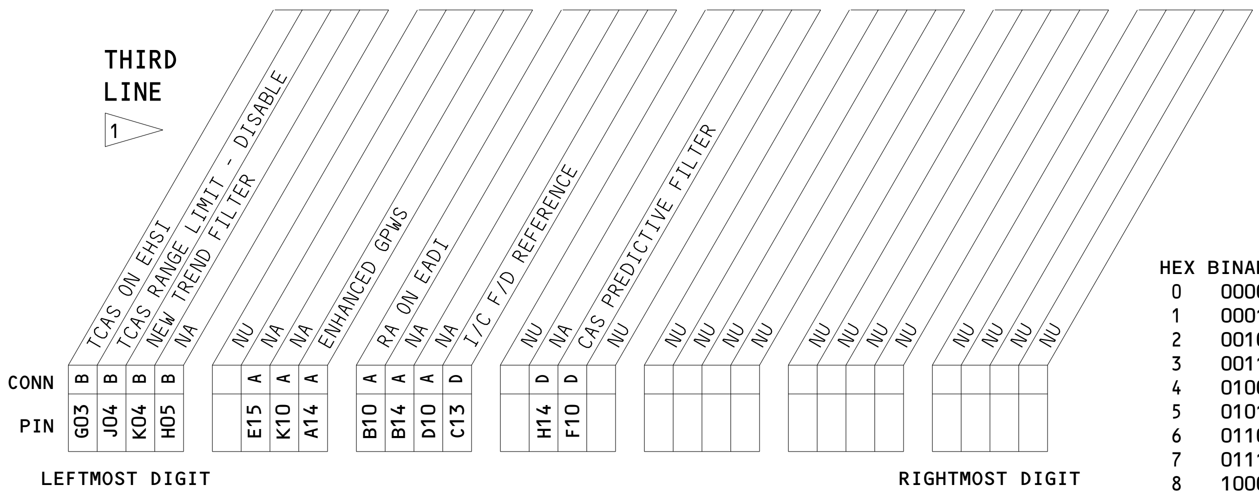
EFIS HEX CODE BIT ASSIGNMENT



HEX	BINARY
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

NOTES: PIN GROUNDED = 1
PIN OPEN = 0
NU = 0

1 ON AIRPLANES WITH -420 EFIS SGs AND ON, THE THIRD HEX LINE SHOWS

Program Pin Options
Figure 6B (Sheet 2)

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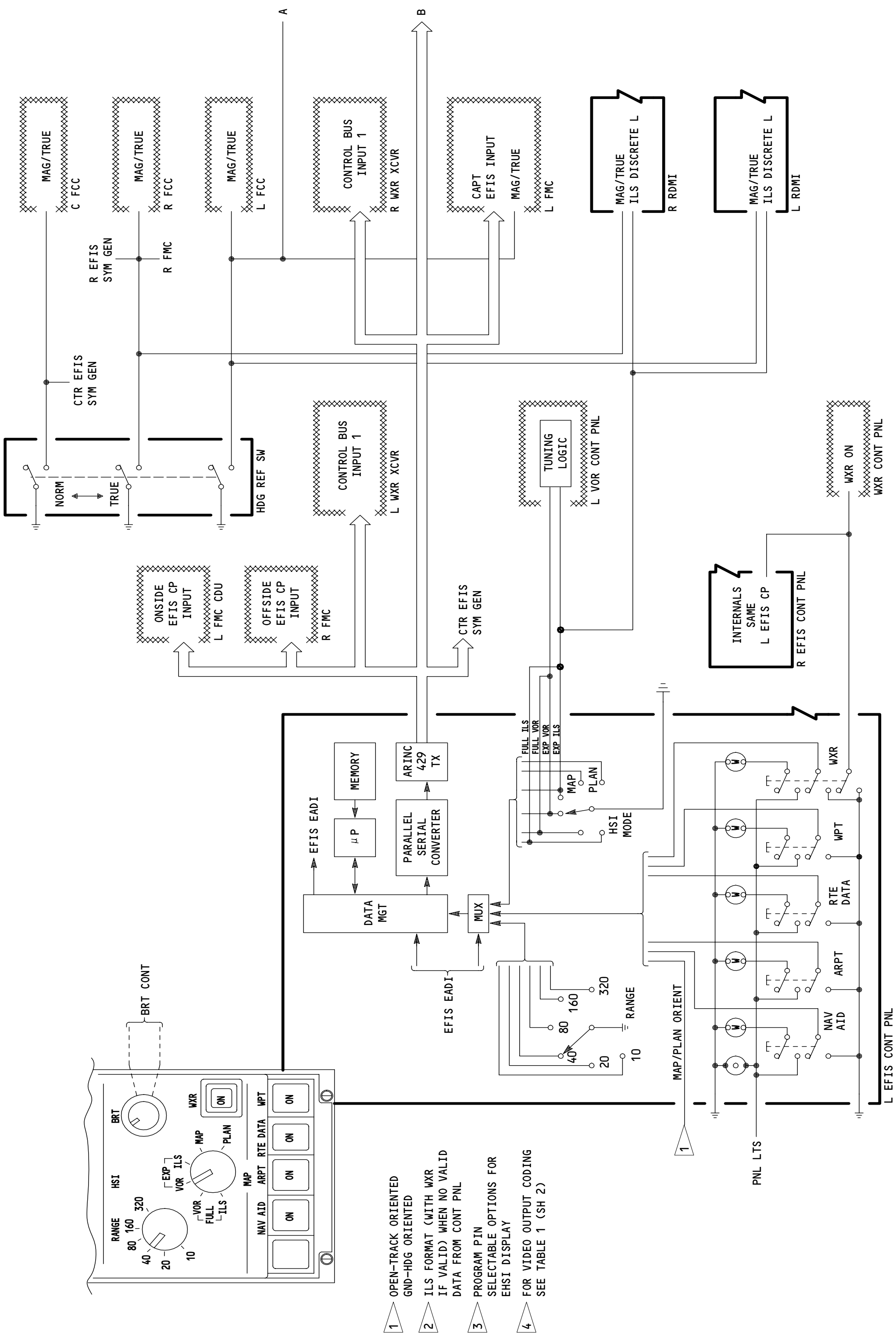

EFIS EHSI - Schematic
Figure 7 (Sheet 1)

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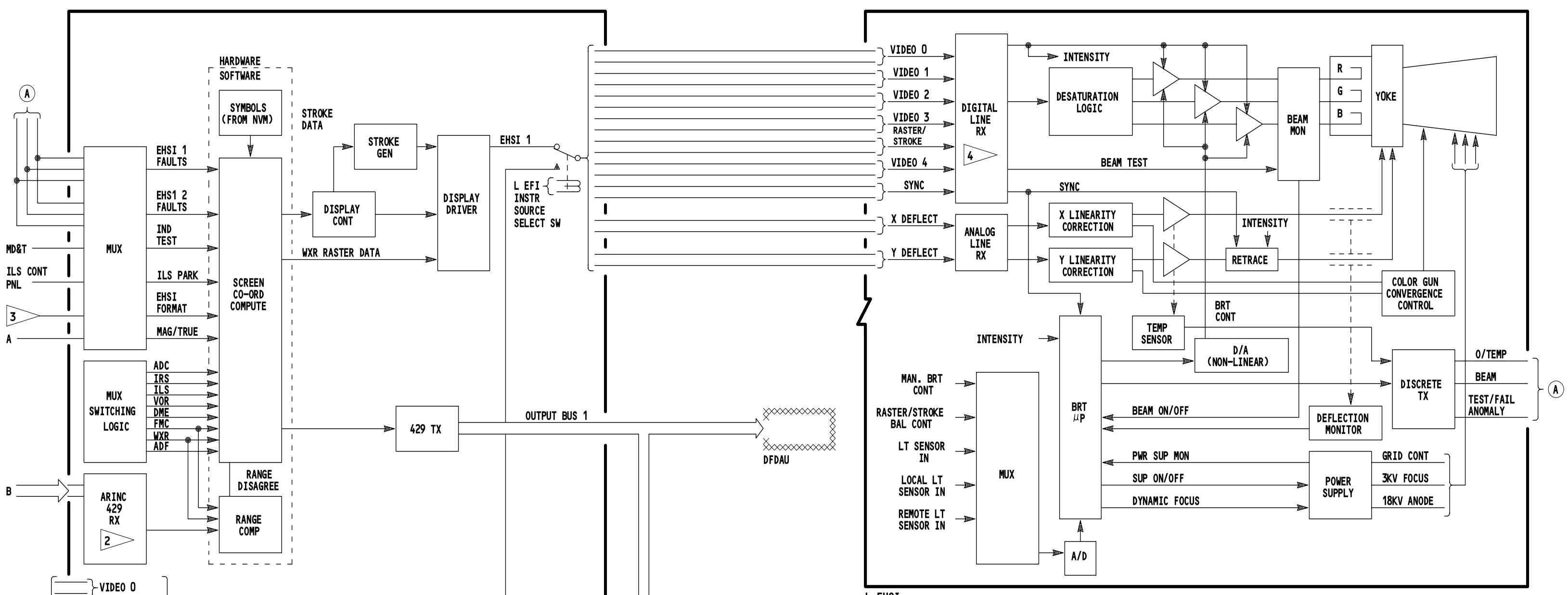

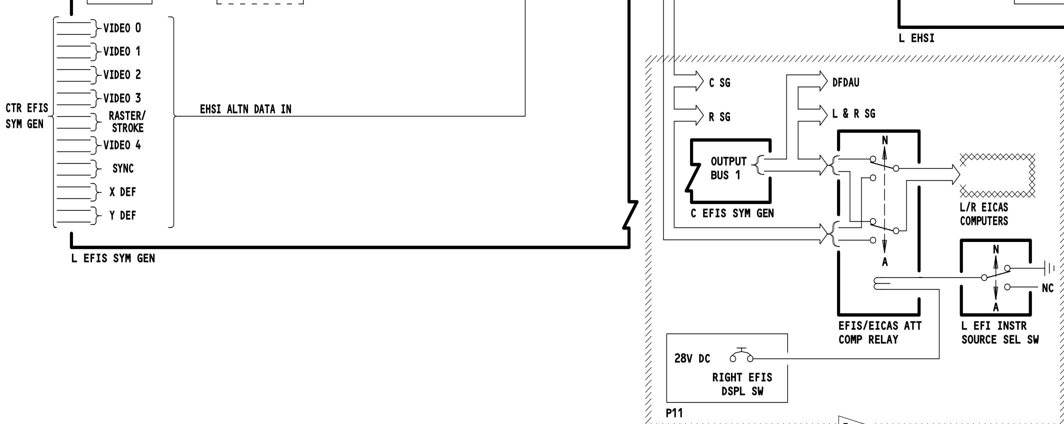

TABLE 1 VIDEO OUTPUT CODES

VIDEO SELECT NO.					CRT OUTPUT		VIDEO SELECT NO.					CRT OUTPUT	
V4	V3	V2	V1	V0	STROKE	RASTER	V4	V3	V2	V1	V0	STROKE	RASTER
0	0	0	0	0	BLACK	BLACK	1	0	0	0	0	BEAM TEST	BLACK
0	0	0	0	1	BLACK	BLACK	1	0	0	0	1	BEAM TEST	BLACK
0	0	0	1	0	RED	RED	1	0	0	1	0	TEST RED	RED
0	0	0	1	1	RED/2	RED	1	0	0	1	1	BLACK	RED/2
0	0	1	0	0	GREEN	GREEN	1	0	1	0	0	TEST GREEN	GREEN
0	0	1	0	1	GREEN/2	GREEN	1	0	1	0	1	BLACK	GREEN/2
0	0	1	1	0	PURPLE	YELLOW	1	0	1	1	0	TEST BLUE	YELLOW
0	0	1	1	1	PURPLE/2	YELLOW	1	0	1	1	1	BLACK	YELLOW/2
0	1	0	0	0	BLUE	BLACK	1	1	0	0	0	YELLOW	BLUE
0	1	0	0	1	BLUE/2	BLACK	1	1	0	0	1	YELLOW/2	BLUE/2
0	1	0	1	0	MAGENTA	BLACK	1	1	0	1	0	BLACK	MAGENTA
0	1	0	1	1	MAGENTA/2	BLACK	1	1	0	1	1	BLACK	MAGENTA/2
0	1	1	0	0	CYAN	CYAN	1	1	1	0	0	BLACK	CYAN
0	1	1	0	1	CYAN/2	CYAN	1	1	1	0	1	BLACK	CYAN/2
0	1	1	1	0	WHITE	YELLOW/2	1	1	1	1	0	BLACK	WHITE
0	1	1	1	1	WHITE/2	BLACK	1	1	1	1	1	BLACK	WHITE/2

X/2 = HALF INTENSITY

5 SAS 281-999

EFIS EHSI Schematic
Figure 7 (Sheet 2)

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(c) Each of the map mode display switches and the WXR on/off switch sends a ground discrete to the input select level shifter, in the ON position. Each of these switches also turns on an indicator lamp beneath the switch when selected. The lamps all receive parallel inputs from the panel lighting control circuits (AMM 33-13-00/001). The WXR ON/OFF discrete output is also sent to the right EFIS control panel and the WXR control panel. This provides for WXR system initiation by either EFIS control panel (AMM 34-43-00/001).

(d) Each EHSI mode switch position sends a ground discrete to the input select level shifter. It also sends ground discretes to the VOR control panels, and the RDMIs. In the VOR and ILS mode position(s) a ground discrete is sent to the left VOR control panel for manual VOR tuning (AMM 34-51-00/001). It also sends the ILS mode discrete to the RDMIs which will display the letter L, ahead of the left DME displays, and display the VOR bearing to the selected VOR station (see RDMI section, this chapter).

(e) The control data is converted from parallel to serial and sent to the data management circuits. Here, the data is arranged and labeled by information from the controller and memory circuits. The final control data is sent to the 429 transmitter. It is then routed, by an ARINC 429 digital data bus, to the left symbol generator. This data is also sent to the WXR XCVR(s) (AMM 34-43-00/001), the left FMC (AMM 34-61-00/001), and the center EFIS symbol generator.

(f) The left symbol generator receives digital control data from the left EFIS control panel. It receives digital display source data from many other navigation systems.

(g) All control and display source data (except WXR) is routed to the symbol generator by ARINC 429 digital data busses. The WXR data is sent by very high speed, ARINC 453, digital data busses. The digital data is accepted by corresponding 429 and 453 RCVRS. It is then sent to the input select circuits. The selected data is routed to the data management circuits. The information is decoded and converted into parallel data. All digital inputs are monitored by the symbol generator for validity and presence. Any detected errors are flagged on the display units and stored in the BITE memory circuits for later reference.

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(h) The symbol generator receives discrete inputs from the program pins on the unit. It also receives discrete inputs from the master annunciator light test circuits. The program pins ground setup determines the display format for the airplane. This is routed through an I/O controller to the input select switching circuits. The program pins provide the formatting of the following displayed data:

1) Drift angle pointer on the full compass rose of the EHSI.
2) European EADI format.
3) Numeric RA and DH on EADI (above 1000 feet).
4) Rising Runway on EADI.
5) Analog RA on EADI.
6) Altitude alert at 2500 feet on EADI
7) Attitude Comparator annunciation on EADI
8) Pitch Limit Indication on EADI.
9) Windshear Warn on EADI.
10) Windshear Alert on EADI.
11) Speed Tape display on EADI.
12) Split Axis flight director command display on EADI.
13) Weather Radar Mode, Gain and Tilt display on EHSI
14) Digital display of Wind Bearing on EHSI.
15) ADF Bearing Pointers on EHSI.

(i) The input select switching circuits receive the data previously stated and they receive fault data from the display units. This data includes display unit anomalies, beam fail, and over temperature discretes. Any detected display faults are stored in the symbol generators BITE memory circuits. The DFDAU acquires the pitch, roll, and heading maintenance status data from the symbol generator.

(j) The input select circuits are used to switch from normal to alternate inputs. (See digital and discrete switching section, this chapter). The input select circuits then send the selected input data to the display control circuits. This provides the main interface for all I/O functions between the control memory and caps processor. The control memory and caps processor provides the main control, data processing and memory for the system.

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(k) WXR data is sent from the display control to the weather memory and control circuits. This provides all control of the raster, refresh, input, rotate/translate, and standby functions of the WXR input data. The memory controls the WXR output data to the raster generator.

(l) The display controller sends all other display data to the display sequencer. Here the raster and stroke data are separated and sent to the respective generators.

(m) The raster generator provides master timing signals for raster, stroke, EADI and EHSI functions. It also generates X-raster data for raster rotation. It provides this to the stroke/raster deflect select circuits in three forms of data. These are raster/stroke select, raster X-deflection, and raster Y-deflection. It also sends video data to the dual video driver. This is processed and sent in the form of digital data. This data includes red, green, blue, beam test, sync, intensity, and raster/stroke signals. The dual video driver outputs are applied to the output drive select relay.

(n) The stroke generator produces all single characters. Special symbols, and character strings. It also generates all arcs, and straight and curved lines. The character and stroke memory provides the stroke generator with the standard symbol data. This data is sent to the stroke/raster deflect select circuits in the form of X and Y stroke deflection signals.

(o) The stroke/raster deflect circuits receive X and Y, raster and stroke deflection data from the raster and stroke generators. It receives the raster/stroke select signal from the raster generator. The circuit alternates the stroke and raster deflection signals. This produces a single set of analog X and Y deflection signals. The WXR raster display field is built from two combined frames of vertical scale lines. Each frame is updated at an 80 Hz rate. This results in the complete raster display field being updated at a 40 Hz rate. The X and Y deflection signals are then amplified and applied to the output drive select relay.

(p) The relay receives the data from the dual video driver and stroke/raster select circuits. It receives an identical set of signals from the center symbol generator. The relay is controlled by the EFI switch on the left instrument source select panel. This allows the left EHSI to receive video data from either the left or center symbol generator. (See digital and discrete switching section, this chapter.)

(q) The deflection and video drive signals, R1, and R2, are provided for future expansion.

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(r) The EHSI display is generated by control and drive signals from the left or center symbol generator. Two analog deflection input signals (X-horizontal, Y-vertical) drive the CRT. Four digital video inputs (red, green, blue, and beam test) provide amplitude control of the electron guns. Three digital mode inputs (raster/stroke, sync, and intensity) provide the following:
  1) The raster/stroke signal is provided at the beginning of each raster frame. This ensures the EHSI is in the raster mode.
  2) The sync signal maintains the power supply stability with respect to the display.
  3) The intensity signal controls the high/low intensity of the raster and stroke signals.
  4) The EHSI also receives five brightness/contrast inputs from the control panel, and the remote and local light sensors.

(s) The deflection circuits receive the analog X/Y deflect data. The data is corrected for liniarity, amplified, and sent to the yoke. The input raster/stroke and sync signals are used to synchronize the scanning patterns between the stroke and raster scans. The corrected data is also sent to the CRT for color gun convergence control. In the circuit, the deflection amps are monitored for overtemperature conditions. If the temperature exceeds 88°C, a DU overtemp. discrete is sent to the symbol generator. This first causes the raster display to shut down. If the temperature continues to rise to 128°C, the entire display will shut down. However, if the temperature cools to less than 82°C (usually 4 to 6 minutes) the raster display will return.

(t) The color control circuits provide the various colors needed for the display symbols. The three main colors' (red, blue, and green) intensities can be varied and combined to produce cyan (light blue), yellow, white, and magenta (pink). The input signals are received, amplified, monitored, and then sent to the electron guns in the CRT. The video amplifiers receive control from two sources. They receive the digital intensity signal from the symbol generator. This controls the high or low intensity display of certain symbols (ex. the range scale is displayed in low intensity). The other control signal is the brightness control. This data comes from the combined light sensor inputs and the manual BRT (stroke) and raster/stroke balance controls. The beam monitor circuit provides for continuous beam test and monitoring.

(u) A test is periodically initiated by the beam test discrete. This causes all three guns to come on, resulting in a white beam which is deflected off of the screen. The three guns' cathode currents are monitored and checked for the correct values. If incorrect values are detected, the beam test failure discrete is sent to the symbol generator. This causes the display to become monochromatic. The failing gun will turn off and the remaining guns will stay on.

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(v) The CRT control circuits provide convergence control, purity adjust, and the high voltage power supply signals to the CRT. The color gun convergence control assures that the three main color beams are properly aligned. It ensures that when the three guns are on, at the same intensity, the display is pure white. This portion of the circuit receives its input data from the X and Y linearity correction circuits. The X and Y purity adjust circuit provides for even color contrast over the entire area of the display.

(w) The automatic and manual analog brightness/contrast signals enter the symbol generator to an analog mux. They are converted to digital and accepted by the brightness VCU.

(x) The VCU provides control signals to the high voltage power supply and the filament control circuits. It monitors the power supply, the beam, the deflecton amp temperature, and other display unit anomolies. The high voltage power supply receives dynamic focus and an ON/OFF signal from the VCU. The ON/OFF signal originates in the filament control circuit. This circuit ensures that the filament is up to temperature before turn-on of the high voltage power supply. The high voltage power supply also receives the digital sync signal to ensure correct internal switching. The power supply provides 18KV anode beam acceleration, 3KV focus, and grid control voltages to the CRT. In the event of a fault the filament control circuit turns the filaments off for at least 30 seconds.

(y) The VCU monitors the power supplies, the filament current monitor, and the filament cool-down timer. If a fault is detected in any of these, the display will shut down. Also, a DU anomolies discrete is sent to the symbol generator.

(7) Right EFIS EHSI Control

(a) The right EFIS control panel operates in the same manner as the left. The analog mode outputs are output to the right VOR and the RDMIs. The digital control signals are routed to the right and center EFIS symbol generators. They are also routed to the right FMC and WXR XCVR(s).

(b) The right and center symbol generators operate in the same manner as the left.

(c) The center symbol generator provides back-up video and deflection data to the left and right symbol generators. (This is controlled by the EFI switches on the instrument source select panels). Both left and right EHSIs provide the anomalies discretes to the center symbol generator.

(d) The right EHSI operates in the same manner as the left.

(8) EFIS EADI (Fig. 8)

(a) The EADI utilizes the same control panel as the EHSI. The following circuits are the EADI control portion of the EFIS control panel.

1) The EADI brightness control potentiometer is used to manually select the brightness of the respective EADI.

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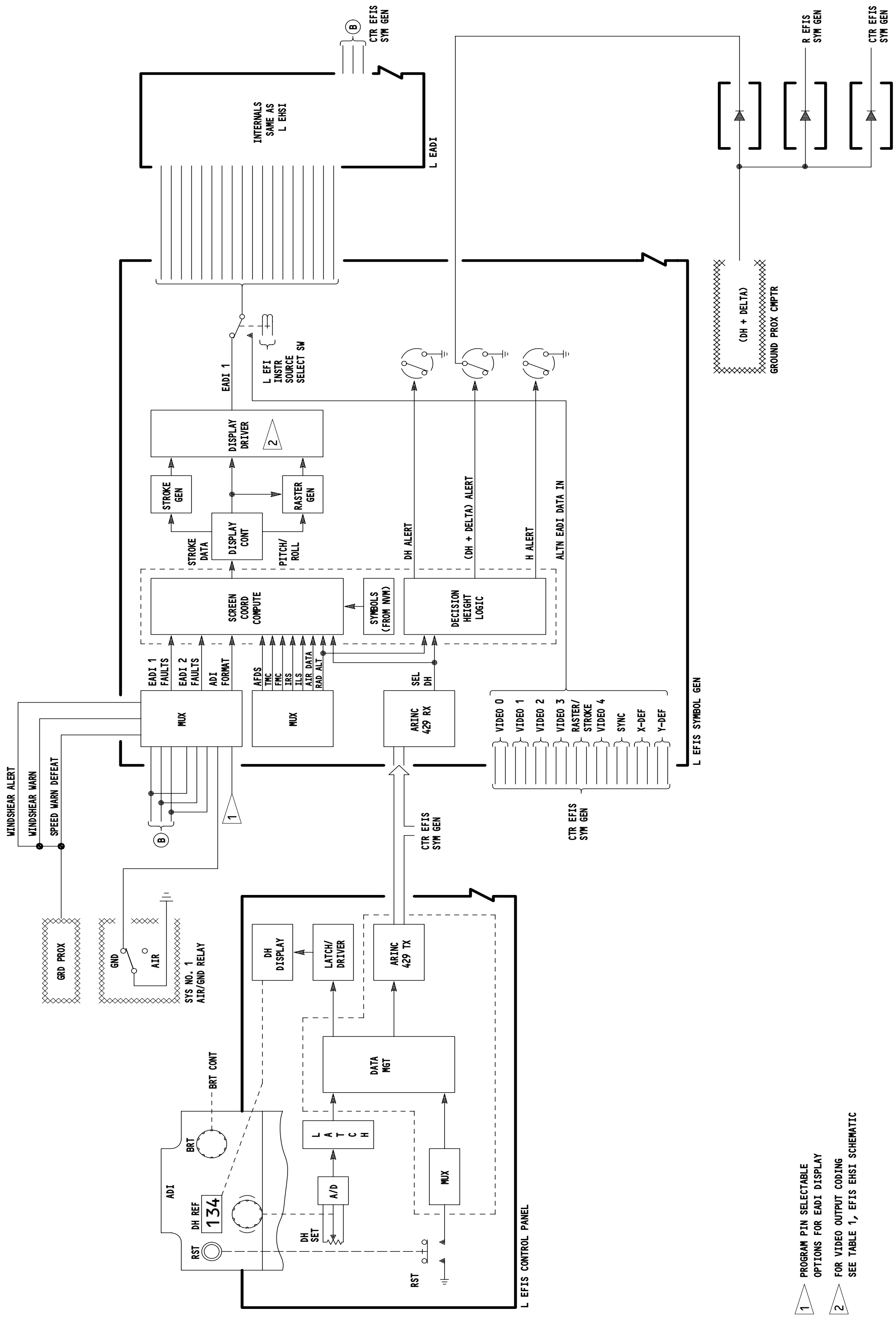

EFIS EADI - Schematic
Figure 8

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2) The DH set potentiometer develops a variable voltage when turned. This is coverted into digital data and used to drive the DH REF display on the control panel. The selected DH is also sent to the symbol generator. It is transmitted on an ARINC 429 digital data bus, for processing and display on the EADI.
3) The DH reset switch sends a digital discrete to the symbol generator on the same ARINC 429 bus. This signal causes the symbol generator to reset the DH alert aural supplied by the siren owl module (AMM 31-51-00/001).

(b) The EADI uses the same symbol generator as the EHSI. Many of the circuits are used by both displays. The EADI utilizes some independent circuits. Whether common or independent, the basic theory of symbol generation is the same. The main differences are the types of input, the symbol/character memory, and the output data. Symbol generator circuits which are shared by the EADI and EHSI are as follows:
1) Raster generator (used on EADI for sky/ground display; on EHSI for WXR display)
2) Display sequencer
3) Output switching relay

(c) The circuits which are duplicated for EADI use, are as follows:
1) Character and symbol memory
2) Stroke generator
3) Stroke/raster deflection select circuits
4) X/Y deflection amplifiers

(d) The EADI is electrically identical to the EHSI. The theory of operation is also the same. The EADI does have raster circuits but, it does not display WXR data.

(9) Right EFIS EADI Control
(a) The EADI portion of the right control panel operates in the same manner as the left.
(b) The right symbol generator operates in the same manner as the left.
(c) Normally, the right symbol generator supplies data to the right EADI. The EFI switch on the right instrument source select panel, in the ALTN position, switches the right EADI to the center symbol generator. The left EADI provides DU anomalies discretes to the center symbol generator.
(d) The right EADI operates in the same manner as the left.

(10) EFIS - Digital Data Bus Inputs (Fig. 9)

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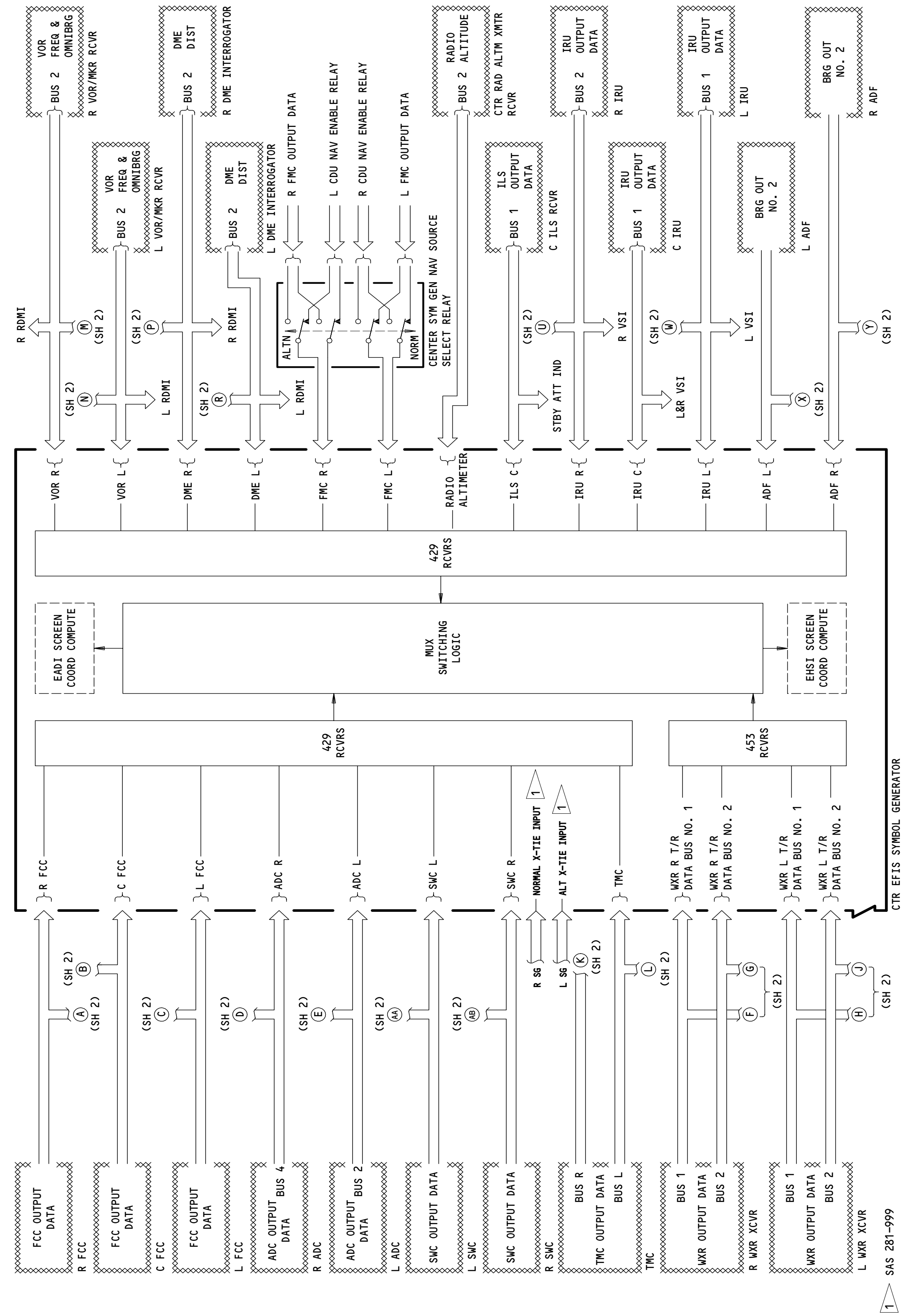

EFIS Bus Inputs - Schematic
Figure 9 (Sheet 1)

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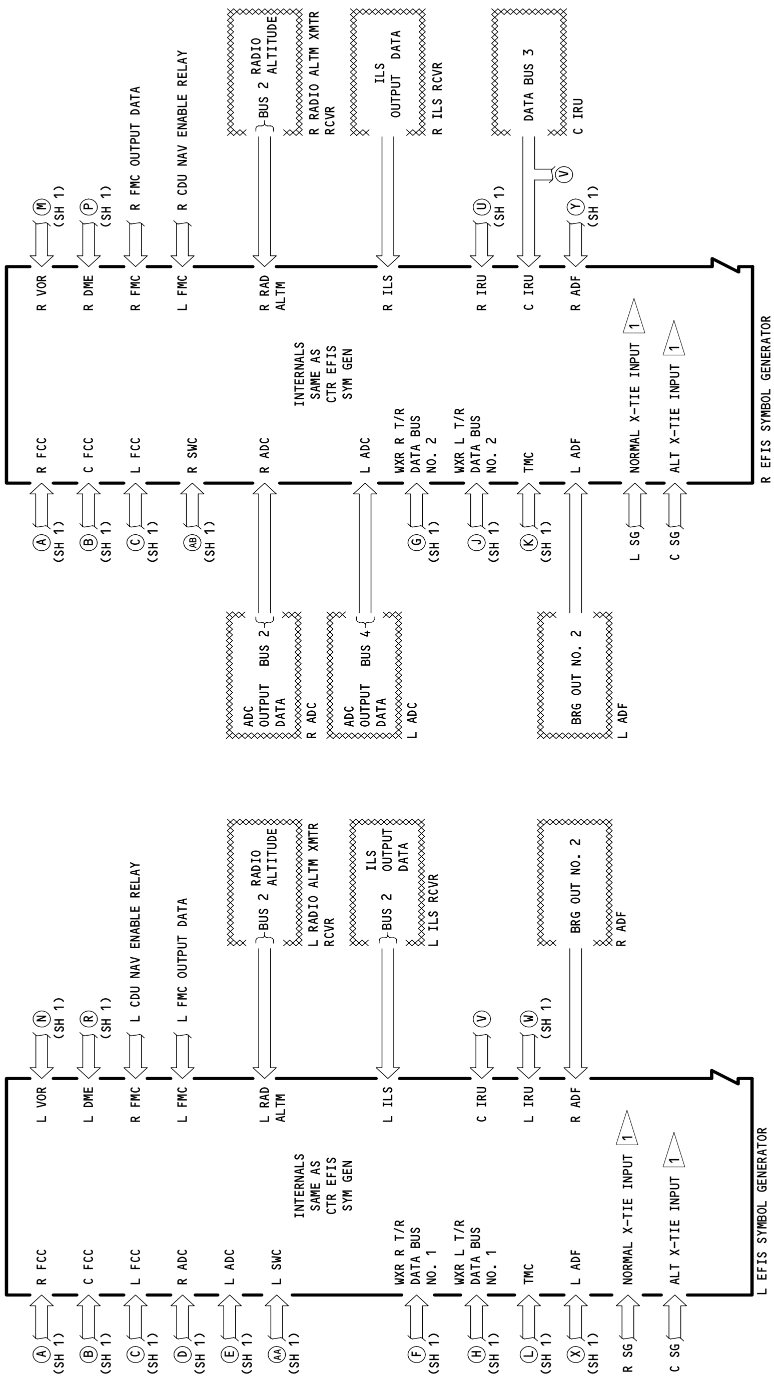

EFIS Bus Inputs - Schematic
Figure 9 (Sheet 2)

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(a) The EFIS symbol generators receive input data from the airplane's navigation systems on digital data busses. All the data except WXR, is transmitted on ARINC 429 digital data busses. The WXR data is transmitted on ARINC 453, very high speed, digital data busses. In most cases due to system redundancy, each symbol generator receives a system's input data from more than one system component. Selection of a normal or alternate system component is controlled by the switches on the instrument source select panels. The actual switching however, is executed by relays within the symbol generators. The two general categories of input data are non-switched and switched. The non-switched data is defined as, data that the symbol generator receives from only one system component, (ex. the left symbol generator receives radio altitude from only the left RA R/T unit). The switched data occurs when one of two system components can be selected (ex. the left symbol generator receives position data from either the left or center IRU).

(11) L&R EFIS SG Data Busses - Non-Switched

(a) The left EFIS symbol generator receives non-switched data from the following system components:

1) The left radio altimeter (RA) provides radio altitude and RA status.
2) The left ILS receiver provides LOC and G/S deviation data and ILS status.
3) The left VOR provides selected VOR course and frequency, VOR bearing, and VOR status.
4) The left DME provides computed distance and DME status.
5) The left and right ADF provide ADF bearing and ADF status.
6) The left stall warning computer provides pitch limit data and SWC status.
7) The TMC provides auto throttle fast/slow command data and TMC status discretes.
8) The WXR XCVRs provide weather and ground return data, antenna azimuth, and WXR status (AMM 34-43-00/001).

(b) The right EFIS symbol generator receives the same system data. It however, receives them from the right system components (except the TMC, which is the same for both).

(12) L & R EFIS S.G. Data Busses - Switched (Fig. 9A)

(a) Under normal conditions the left symbol generator receives input data from left system components. Some systems, however, transmit more than one independent output to the symbol generator. Selection of an alternate source input, from these systems, is controlled by the switches on the instrument source select panels. Each switchable system has a dedicated switch. The following table lists switched inputs to the left symbol generator. It lists the input systems, their input data, the sources, and their controlling switch and its location.

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TABLE II - LEFT SYMBOL GENERATOR - SWITCHED INPUT DATA BUSSES

System (Ref)	Input Data	Source	Controlling Switch (Normal Component)	Switch Location
Flight Director (F/D) (22-11-00)	ADFD Mode status, F/D pitch and roll, selected heading, and TMS Mode Status	Left, right, and center FCC	Captain's F/D instrument source select switch (L)	Left instrument source select panel
Flight Management Computer (FMC) (34-61-00)	Nav. data such as: Position, speed, drift angle, track data, windspeed and direction, display symbology	Left and right FMCs, Left FMC CDU	Captain's NAV instrument source select switch (FMC-L)	Left instrument source select panel
Inertial Reference System (IRS) (34-21-00)	Position data such as pitch and roll, mag heading, ground speed track angle, flight path angle and accel, and wind speed and angle	Left, right and center IRUs	Captain's IRS instrument source select switch (L)	Left instrument source select panel
Air Data Computer (ADC) (34-12-00)	Computed Airspeed, MACH, True Airspeed, and ADC status	Left and right ADCs	Capt's ADC instrument source select switch (L)	Left instrument source select panel
Weather Radar System (34-43-00)	Weather and ground return data, antenna azimuth, and weather radar status	Left and right WXR XCVRs	SYS L/SYS R WXR select switch (L)	WXR control panel

EFIS - Left Symbol Generator Input
Figure 9A

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(b) The symbol generator processes both WXR inputs at the same time. However, only one WXR XCVR is operating at a time. Effectively therefore, only one input is processed. The actual WXR switching is done within the WXR system (AMM 34-43-00/001).

(c) The right EFIS symbol generator normally receives information from the right components of the above systems. The systems, input data, and components are the same. The controlling switches are on the right instrument source select panel.

(13) EFIS Center Symbol Generator Input (Fig. 9B)

(a) The center symbol generator provides back-up capability in the event the left or right symbol generator fails. It is selected as a back-up by either EFI switch on the instrument source select panels. If the captain selects the alternate (center) symbol generator, the left navigation systems will still provide input. The right systems will feed the center symbol generator if it is selected by the F/O. If both select the alternate symbol generator, the left systems will provide input and the captain's instruments will provide control. The following table relates system input to instrument source select switch position, for the center symbol generator.

(14) Digital Data Bus - Signal Processing

(a) Within the three symbol generators, the digital data busses are all accepted by ARINC 429 receivers. The received data is routed to the internal switching circuits. These receive one bus for each of the input system components. The switching circuits are controlled by program pins (not shown) and/or they are controlled by the IRS, FMC, and F/D instrument source switches. The program pin arrangements determine whether the symbol generator operates as a left, right, or center component. This programs the symbol generator to use the correct input data.

(b) Some of the switching circuits are also controlled by the switches on the instrument source select panels. This is for normal/alternate selection of input data, as previously discussed. The switched data then passes to the input select circuits. In the left and right symbol generators, this circuit is permanently programmed. The program pins determine the normal and alternate inputs for that symbol generator. The center symbol generator input select circuit is controlled by the EFI switches on the instrument source select panels. This enables the center symbol generator to operate as a left or right symbol generator. The EFI switches are connected in series. This causes the center symbol generator to operate as a left symbol generator when selected by both the Captain and F/O. The selected input data is then processed, for display, as previously discussed.

(15) EFIS - Flight Instrument System Switching (Fig. 10)

(a) The switches on the instrument source select panels also provide switching capability for critical NAV systems. In the event of a failure the crew can switch from a primary (normal) to a back-up (alternate) system.

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TABLE III - EFIS CENTER SYMBOL GENERATOR INPUT

INPUTS TO CENTER SYMBOL GENERATOR		LEFT EFI SWITCHED TO ALTERNATE								RIGHT EFI SWITCHED TO ALTERNATE							
		OTHER LEFT SWITCHES IN NORMAL				OTHER LEFT SWITCHES IN ALTERNATE				OTHER RIGHT SWITCHES IN NORMAL				OTHER RIGHT SWITCHES IN ALTERNATE			
		F/D	NAV	IRS	ADC	F/D	NAV	IRS	ADC	F/D	NAV	IRS	ADC	F/D	NAV	IRS	ADC
FCC	SWITCHED	L	N/C	N/C	N/C	R OR C	N/C	N/C	N/C	R	N/C	N/C	N/C	L OR C	N/C	N/C	N/C
FMC		N/C	L	N/C	N/C	N/C	L CDU OR R	N/C	N/C	N/C	R	N/C	N/C	N/C	R CDU OR L	N/C	N/C
IRU		N/C	N/C	L	N/C	N/C	N/C	C	N/C	N/C	N/C	R	N/C	N/C	N/C	C	N/C
ADC		N/C	N/C	N/C	L	N/C	N/C	N/C	R	N/C	N/C	N/C	R	N/C	N/C	N/C	L
VOR RCVR	NON SWITCHED	LEFT VOR RECEIVER								RIGHT VOR RECEIVER							
DME INTER-ROGATOR		LEFT DME INTERROGATOR								RIGHT DME INTERROGATOR							
SWC		LEFT STALL WARNING COMPUTER								RIGHT STALL WARNING COMPUTER							
WXR		LEFT OR RIGHT WEATHER RADAR TRANSCEIVER															
TMC		THRUST MANAGEMENT COMPUTER															
RA RCVR-XMTR		CENTER RADIO ALTIMETER RECEIVER/TRANSMITTER															
ILS RCVR		CENTER ILS RECEIVER															
ADF RCVR		LEFT AND RIGHT ADF RECEIVERS															

L - LEFT UNIT
C - CENTER UNIT
R - RIGHT UNIT
N/C - NO CHANGE WHEN SWITCHED

EFIS - Center Symbol Generator Input
Figure 9B

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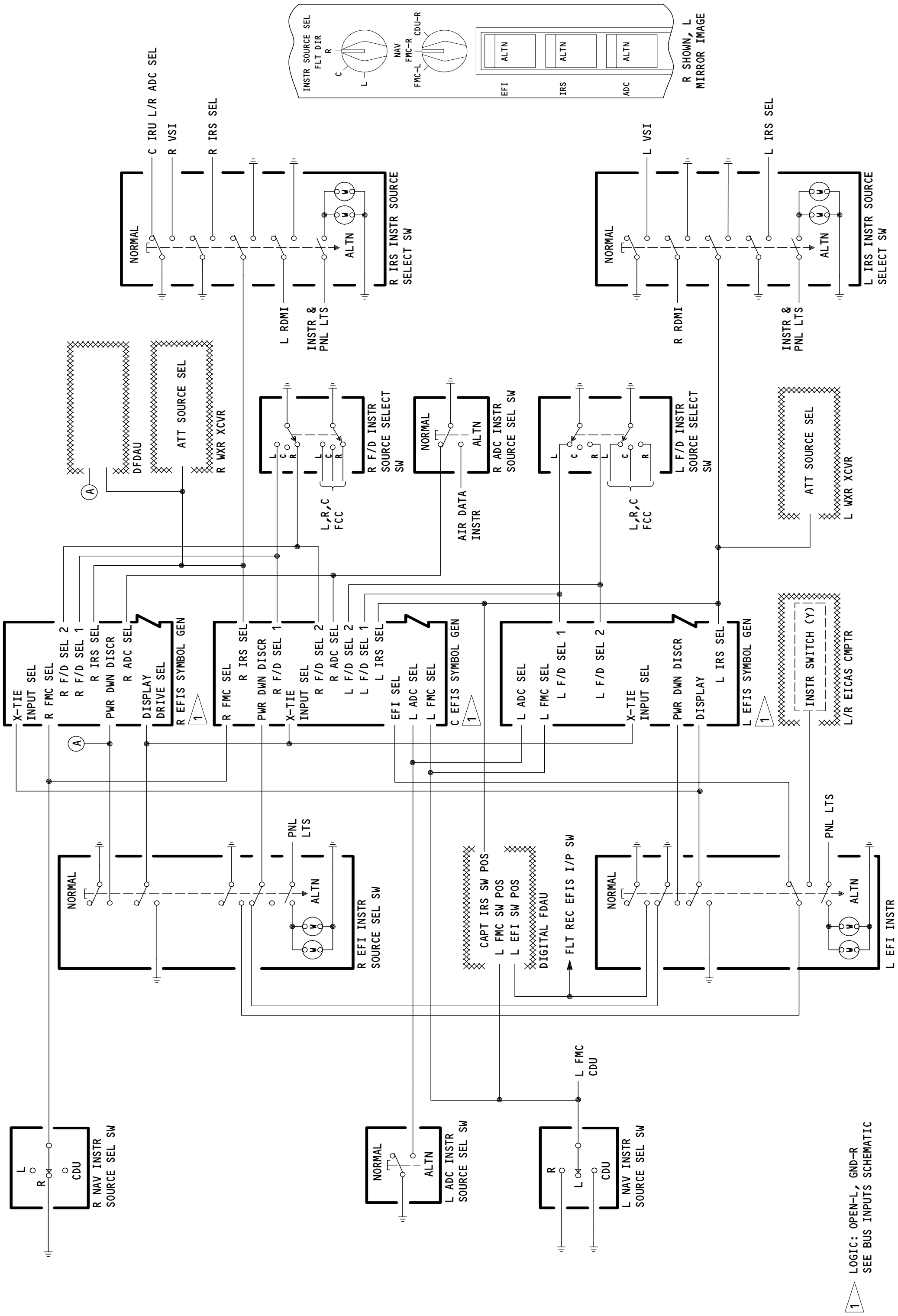

Flight Instrument Switching Schematic
Figure 10

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(b) If the captain and F/O both select the center EFIS symbol generator, a Level B caution condition will exist and be annunciated.
(c) If both EFI switches are in the ALTN position, the captain and F/O both on relay will energize. This provides the captain with complete control of the EFIS.
(d) Table IV describes the conditions which exist for the EFI and NAV switches in the normal and alternate positions (Fig. 10A).
(e) Table V describes the conditions which exist for the IRS and F/D switches in normal and alternate positions (Fig. 10B).

B. BITE (Fig. 11)
(1) If a fault is detected in the data from an interfacing system, the EADIs and EHSIs will display a fault annunciation. They will also annunciate any detected faults within the EFIS system. Faults from interfacing systems are detected in the respective system. A message is then transmitted to the symbol generator as a digital fault word. EFIS faults may be detected in the symbol generators, control panels, or the display units.
(2) The two major categories of faults are invalid data and no computed data (NCD). Invalid data occurs when a system BITE detects a fault and determines a hardware cause. This usually causes the corresponding symbol(s) to blank and a yellow flag to appear. NCD occurs when a system BITE detects a lack of input data, but finds no hardware cause (ex. a transmitting ground station is out of range). This usually causes the corresponding symbol(s) to simply blank or be replaced by dashes.
(3) The figure relates the symbols and the corresponding displays for these conditions.

NOTE: WXR and FMC disagree conditions are described in WXR (AMM 34-43-00/001) and FMC (AMM 34-61-00/001).

C. EFIS Test Patterns (Fig. 12)
(1) When an EFIS self-test is run, the symbol generator injects a test signal into the major system components. A test pattern and the test results are displayed on the corresponding EHSIs and EADIs. The components tested and their failure indications are control panel (CP), display unit (DU), and symbol generator (SG). Each symbol generator will test itself and the corresponding DU and CP as selected by the EFI switches on the instrument source select panels.

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TABLE IV - NAV AND EFI INSTRUMENT SOURCE SELECT SWITCHES

Instrument Source Select Switch	Normal Position Conditions	Alternate Position Conditions
Left NAV	Left FMC bus 1 supplied to left VOR and left DME and bus 2 supplied to right VOR and right DME. (Hi discrete sent to left and center EFIS S.G.s, left FMC CDU and L FMC TUNING RELAY)	Right FMC bus 1 supplied to left VOR and left DME and bus 2 supplied to right VOR and right DME. (lo discrete sent to same components).
Right NAV	Lo discrete sent to right and center EFIS S.G.s. Hi discrete sent to right FMC CDU.	Hi discrete sent to right and center EFIS S.G.s. Lo discrete sent to right FMC CDU.
Left EFI	Hi discrete sent to left EFIS S.G. display drive select (left EFIS S.G. drives left displays) Hi discrete sent to center EFIS S.G. EFI select (switch to left inputs and left S.G. output). Hi discrete sent to DFDAU and Flt Rec EFIS I/P relay (left EFIS S.G. output to DFDAU). Lo discrete to center EFIS S.G. power down (C-S.G. off).	Lo discrete sent to left EFIS S.G. display drive select (center EFIS S.G. drives displays). Hi discrete sent to center EFIS S.G. EFI select (switch to left inputs and left S.G. outputs). Lo discrete sent to DFDAU and Flt Rec EFIS I/P relay (center EFIS S.G. output to DFDAU). Lo discrete to left EFIS S.G. power down (L-S.G. off).
Right EFI	Hi discrete sent to center EFIS S.G. EFI select (switch to left inputs and left S.G. output). Lo discrete sent to center EFIS S.G. power down (C-S.G. off). Hi discrete sent to right EFIS S.G. display drive sel. (right EFIS S.G. drives right displays)	Lo discrete sent to center EFIS S.G. EFI select (switch to right inputs and right S.G. output. Hi discrete sent to center EFIS S.G. power down (C-S.G. on). Lo discrete sent to right EFIS S.G. display drive sel. (center EFIS S.G. drives right displays).

NOTE: The information in the table assumes that both switches are not in the same position. If they are, the conditions for the left switch alternate position will occur.

EFIS - Instrument Source Select Switches
Figure 10A

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TABLE V - IRS AND F/D INSTRUMENT SOURCE SELECT SWITCHES

Instrument Source Select Switch	Normal Position Conditions	Alternate Position Conditions
Left IRS	Lo discrete sent to right RDMI - IRS select. Hi discret sent to left VSI - IRS select. Hi discrete sent to left and center EFIS S.G., and WXR XCVR - IRS select. Hi discrete sent to Antiskid/Autobrake system - IRS select. (All use L-IRS Data).	Hi discrete sent to right RDMI - IRS select. Lo discrete sent to left VSI - IRS select. Lo discrete sent to left and center EFIS S.G., and WXR XCVR - IRS select. Lo discrete sent to Antiskid/Autobrake system - IRS select. (All use C-IRS Data).
Right IRS	Hi discrete sent to Antiskid/ Autobrake system - IRS select. Lo discrete sent to center IRU for left or right ADC select. Hi discrete sent to right VSI - IRS select. Hi discrete sent to right and center EFIS S.G., and WXR XCVR - IRS select. Lo discrete sent to left RDMI IRS select. (All use R-IRS Data).	Lo discrete sent to Antiskid/ Autobrake system - IRS selct. Hi discrete sent to center IRU for left or right ADC select. Lo discrete sent to right VSI - IRS select. Lo discrete sent right and center EFIS S.G., and WXR XCVR - IRS select. Hi discrete sent to left RDMI - IRS select. (All use C-IRS Data).
Left F/D	Lo discrete to selected (L,R or C) FCC. Lo discrete to left and center EFIS S.G. - F/D select.	Same as Normal
Right F/D	Lo discrete to selected (L,R, or C) FCC. Lo discrete to right and center EFIS S.G. - F/D select.	Same as Normal

NOTE: The information in the table assumes that both switches are not in the same position. If they are, the conditions for the left switch alternate position will occur.

EFIS - Instrument Source Select Switches
Figure 10B

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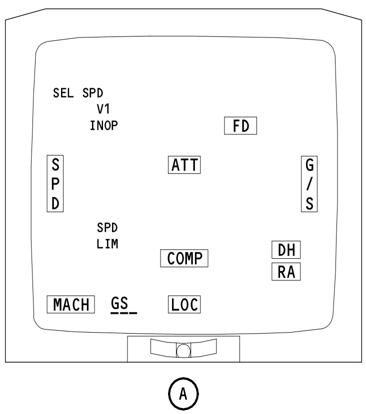
EADI - FAULT DISPLAYS

SEE (A)

REMOVED DATA	FLAG	COLOR	CONDITION
HORIZON LINE, PITCH LINES, ROLL POINTER, SKY/GROUND, AND PITCH LIMIT	ATT	YELLOW	INVALID PITCH AND/OR ROLL DATA FROM IRS.
	NONE	---	NCD PITCH AND/OR ROLL DATA FROM IRS.
FLIGHT DIRECTOR COMMAND BARS	FD	YELLOW	INVALID PITCH AND ROLL FLIGHT DIRECTOR COMMANDS FROM FCC. 2
	NONE	---	NCD PITCH AND ROLL FLIGHT DIRECTOR COMMANDS FROM FCC.
SINGLE FLIGHT DIRECTOR COMMAND BAR	NONE	---	INVALID OR NCD PITCH OR ROLL FLIGHT DIRECTOR COMMANDS FROM FCC.



REMOVED DATA	FLAG	COLOR	CONDITION
GLIDE SLOPE POINTER AND SCALE	G / S	YELLOW	INVALID GLIDE SLOPE DATA FROM ILS.
GLIDE SLOPE POINTER	NONE	---	NCD GLIDE SLOPE DATA FROM ILS.
LOCALIZER POINTER AND SCALE	LOC	YELLOW	INVALID LOCALIZER DATA FROM ILS.
LOCALIZER POINTER	NONE	---	NCD LOCALIZER DATA FROM ILS. ALSO FOR LOSS OF PRESENT TRACK FROM IRS OR SELECTED RUNWAY HEADING FROM ILS.
RA DISPLAY	RA	YELLOW	INVALID RADIO ALTITUDE FROM RA.
	NONE	---	NCD RADIO ALTITUDE FROM RA
RA AND DH DISPLAY	DH RA	YELLOW	INVALID RADIO ALTITUDE FROM RA AND SELECTED DH FROM EFIS CONTROL PANEL.
	DH	YELLOW	NCD RADIO ALTITUDE FROM RA AND SELECTED DH FROM EFIS CONTROL PANEL.
DH BUG	DH	YELLOW	INVALID OR NCD SELECTED DH FROM EFIS CONTROL PANEL. FLAG NOT DISPLAYED IF RA >999.
RISING RUNWAY AND STEM	LOC	YELLOW	INVALID LOCALIZER FROM ILS.
	NONE	---	NCD LOCALIZER FROM ILS.
RISING RUNWAY REMOVED, STEM USED FOR LOCALIZER	NONE	---	INVALID OR NCD RADIO ALTITUDE FROM RA.
GROUND SPEED NUMERICS CHARACTERS	NONE	---	INVALID GROUND SPEED FROM FMS AND IRS.
GROUND SPEED NUMERICS	GS---	WHITE	NCD GROUND SPEED FROM FMS AND IRS.
PITCH ANNUNCIATION	COMP	YELLOW	OFFSIDE PITCH DATA INVALID OR NCD
ROLL ANNUNCIATION	COMP	YELLOW	OFFSIDE ROLL DATA INVALID OR NCD
AFDS OR TMS CHARACTERS	NONE	---	INVALID OR NCD FLIGHT MODE ANN FROM AFDS OR TMS.
LINE THROUGH AFDS OR TMS CHARACTERS	~~LNAV~~	YELLOW	FMA FAULT BIT SET IN DISCRETE WORD FROM AFDS OR TMS.
PITCH LIMIT SYMBOL	NONE	N/A	PITCH LIMIT INVALID OR NCD
ALL DATA (BOTH EHSI AND EADI BLANK)	SG FAIL (NOT SHOWN)	WHITE	SYMBOL GENERATOR FAILURE 1

1 FAULT CODES THAT MAY APPEAR WITH SG FAIL DISPLAY ARE INTERNAL SYMBOL GENERATOR FAULTS AND ARE FOR SHOP USE ONLY.

2 AIRPLANES WITH SYMBOL GENERATORS -414 AND PREVIOUS; INVALID OR NCD PITCH AND ROLL FLIGHT DIRECTOR COMMANDS FROM FCC.

EFIS - Fault Displays
Figure 11 (Sheet 1)

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REMOVED DATA	FLAG	COLOR	CONDITION
MIN FLAP RETRACTION SPEED SYMBOL (-F)	NONE	N/A	MIN FLAP RETRACTION SPD INVALID OR NCD
ALL AIRSPEED TAPE SYMBOLOGY	S P D	YELLOW	COMPUTED AIRSPEED INVALID. WHEN "SPD" FLAG DISPLAYED, "MACH" "SPD LIM", "SEL SPD", AND "V1 INOP" FLAGS ARE NOT DISPLAYED (AS LISTED BELOW)
NORMAL AIRSPEED DISPLAY WITH INDICATION OF 30 KTS	N/A	N/A	COMPUTED AIRSPEED NCD
MACH NUMBER	MACH	YELLOW	INVALID MACH
	----	WHITE	MACH NCD
DECISION SPEED V1 SYMBOL (-1)	V1 INOP	YELLOW	V1 INVALID OR NCD
MIN OPERATING SPEED SYMBOL (BAR)	NONE	N/A	MINIMUM OPER SPD INVALID
ROTATION SPEED VR SYMBOL (-R)	NONE	N/A	ROTATION SPD INVALID OR NCD
STICK SHAKER SPEED SYMBOL (BARBER POLE)	SPD LIMIT	YELLOW	STICK SHAKER SPEED INVALID
	NONE	N/A	STICK SHAKER SPEED NCD
MAX OPERATING SPEED SYMBOL (BARBER POLE)	SPD LIMIT	YELLOW	MAX OPER SPD INVALID OR NCD
ENGINE-OUT SPEED SYMBOL (CIRCLE)	NONE	N/A	ENG-OUT SPD INVALID OR NCD
SELECTED TARGET SPEED POINTER	SEL SPD	YELLOW	SEL TARGET SPD INVALID
	NONE	N/A	SEL TARGET SPD NCD
HIGH-SPEED BUFFET SYMBOL (BAR)	NONE	N/A	HIGH SPEED BUFFET INVALID OR NCD
AIRSPEED TREND	NONE	N/A	INVALID OR NCD AIRSPEED TREND

EFIS - Fault Displays
Figure 11 (Sheet 2)

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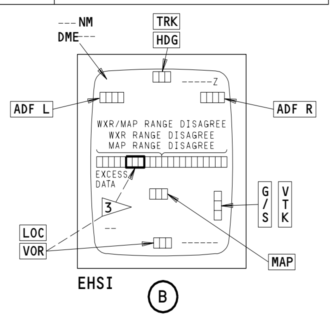
EHSI - FAULT DISPLAYS

SEE (B)

REMOVED DATA	FLAG	COLOR	CONDITION
LOC DEVIATION BAR AND SCALE	LOC	YELLOW	INVALID LOC FROM ILS
LOC DEVIATION BAR	NONE	---	NCD LOC FROM ILS
LATERAL DEVIATION BAR AND SCALE	VOR	YELLOW	INVALID LATERAL DEV DATA FROM VOR
LATERAL DEVIATION BAR	NONE	---	NCD LATERAL DEV FROM VOR
GLIDE SLOPE DEVIATION BAR AND SCALE	G/S	YELLOW	INVALID G/S FROM ILS
GLIDE SLOPE DEVIATION POINTER	NONE	---	NCD G/S FROM ILS
RNWY HDG POINTER AND LINE, G/S DEVIATION POINTER (LOC DEVIATION BAR ORIENTED VERTICALLY)	NONE	---	INVALID OR NCD SELECTED RUNWAY HEADING FROM ILS
COURSE POINTER AND LINE, LATERAL DEVIATION POINTER	NONE	---	INVALID OR NCD SELECTED COURSE HEADING FROM VOR
DISTANCE NUMERICS AND DME CHARACTERS	NONE	---	INVALID DISTANCE FROM DME OR TUNED DME FREQUENCY DOES NOT CORRESPOND TO SELECTED ILS OR VOR STATION
DISTANCE NUMERICS	DME---	WHITE	NCD DISTANCE FROM DME
ILS FREQUENCY NUMERICS	NONE	---	INVALID ILS FREQUENCY
	------	GREEN	NCD ILS FREQUENCY
HEADING TAPE AND NUMERICS, SELECTED HDG MARKER, TRACK LINE (ORIENT COURSE POINTER AND DEV BAR VERTICALLY), HEADING READOUT NUMERICS, HDG AND MAG/TRUE, WINDSPEED AND ARROW, ADF POINTERS	HDG	YELLOW	INVALID HDG FROM IRS (TRK FROM FMC OR FMC CDU (BACKUP MODE) - VALID, NCD, OR INVALID)
HEADING TAPE NUMERICS, SELECTED HDG MARKER, TRACK LINE (ORIENT COURSE POINTER AND DEV BAR VERTICALLY), HEADING READOUT NUMERICS REPLACE W/3 DASHES, WINDSPEED REPLACE W/3 DASHES, WINDSPEED ARROW, ADF POINTERS	---	WHITE	NCD HDG FROM IRS (TRK FROM FMC OR FMC CDU (BACKUP MODE) - VALID, NCD, OR INVALID)



1 FAULT CODES THAT MAY APPEAR WITH SG FAIL DISPLAY ARE INTERNAL SYMBOL GENERATOR FAULTS AND ARE FOR SHOP USE ONLY.

3 LOCATION OF LOC/VOR FLAG WHEN EFIS IS IN FULL ILS OR FULL VOR MODES.

REMOVED DATA	FLAG	COLOR	CONDITION
TRACK LINE	NONE	---	INVALID OR NCD TRACK FROM FMC (HDG FROM FMC VALID)
ALL MAP DATA	MAP	YELLOW	INVALID OR NCD MAP DATA FROM FMC OR FMC CDU (BACKUP MODE)
ALL NON-ACTIVE FLIGHT PLAN DATA	EXCESS DATA	YELLOW	MORE INPUT (SELECTED) DATA THAN CAN BE DISPLAYED
NONE (REF 34-43-00 AND 34-61-00)	WXR/MAP RANGE DISAGREE	YELLOW	DISPLAYED (SELECTED) RANGE DISAGREES W/ BOTH WXR AND FMC COMPUTED RANGE
NONE (REF 34-43-00 AND 34-61-00)	WXR RANGE DISAGREE	YELLOW	DISPLAYED (SELECTED) AND FMC RANGE DISAGREE W/ WXR COMPUTED RANGE
NONE (REF 34-43-00 AND 34-61-00)	MAP RANGE DISAGREE	YELLOW	DISPLAYED (SELECTED) AND WXR RANGE DISAGREE W/ FMC COMPUTED RANGE
TRACK TAPE AND NUMERICS, SELECTED HEADING MARKER AND LINE, PRESENT HEADING MARKER AND LINE, TRK READOUT NUMERICS, TRK, MAG/TRUE, WINDSPEED ARROW AND NUMERICS ADF POINTERS (WXR DISPLAY REMAINS, HDG UP)	TRK	YELLOW	INVALID TRACK DATA FROM FMC OR FMC CDU (BACKUP MODE) (IRS HDG DATA - VALID, NCD, OR INVALID) AND IRS TRK NCD OR INVALID
TRACK TAPE NUMERICS, SELECTED HEADING MARKER AND LINE, PRESENT HEADING MARKER, TRACK READOUT NUMERICS REPLACE W/3 DASHES, WINDSPEED REPLACE W/3 DASHES, WINDSPEED ARROW, ADF POINTERS (WXR DISPLAYS REMAINS, HDG UP)	---	WHITE	NCD TRACK DATA FROM FMC OR FMC CDU (BACKUP MODE) (IRS HDG DATA - VALID, NCD, OR INVALID) AND IRS TRK NCD OR INVALID
PRESENT HEADING MARKER	NONE	---	INVALID OR NCD HEADING FROM IRS (FMC TRACK VALID)
RANGE SCALE MARKS	NONE	---	INVALID OR NCD RANGE FROM EFIS CONTROL PANEL
Z CHARACTER AND ETA NUMERICS	NONE	---	INVALID ETA FROM FMC OR FMC CDU (BACKUP MODE)
ETA NUMERICS	------Z	WHITE	NCD ETA FROM FMC OR FMC CDU (BACKUP MODE)
NM CHARACTERS AND DISTANCE NUMERICS	NONE	---	INVALID DISTANCE FROM FMC OR FMC CDU (BACKUP MODE)
DISTANCE NUMERICS	---NM	WHITE	NCD DISTANCE FROM FMC OR FMC CDU (BACKUP MODE)
VERTICAL DEVIATION POINTER AND SCALE	VTK		INVALID VERTICAL DEVIATION FROM FMC OR FMC CDU (BACKUP MODE)
	NONE	---	NCD VERTICAL DEVIATION FROM FMC OR FMC CDU (BACKUP MODE)
ADF BEARING POINTER(S)	ADF L ADF R	YELLOW	INVALID BEARING FROM ADF
	NONE	---	NCD BEARING FROM ADF
ALL DATA (BOTH EHSI AND EADI BLANK)	SG FAIL (NOT SHOWN)	WHITE	SYMBOL GENERATOR FAILURE 1

EFIS - Fault Displays
Figure 11 (Sheet 3)

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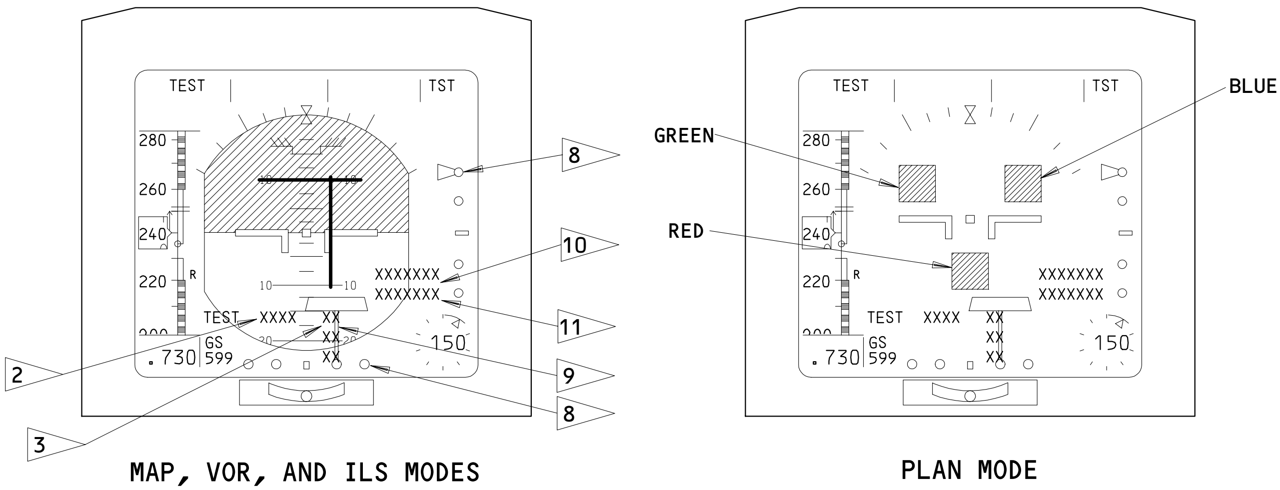

EADI

THIS UNIT IS ELECTROSTATIC SENSITIVE

NOTE: SYMBOLOGY COLORS SAME AS FOR NORMAL OPERATION.

1 PRESENTATION IS SET BY THE STATE OF THE PROGRAM PIN AND/OR DIGITAL DISCRETE INPUT

2 TEST MESSAGE "OK" OR "FAIL"

3 FAILURE MESSAGE-CP (CONTROL PANEL); DU (DISPLAY UNIT); AND SG (SYMBOL GENERATOR)

4 NUMERIC VALUE SHOWS THE EFIS CONTROL PANEL RANGE SELECTION

5 SOFTWARE VERSION

6 SHOWS THE HSI MAP DATA SELECTED ON THE EFIS CONTROL PANEL

7 RED-YELLOW-GREEN WXR TEST PATTERN

8 THE G/S AND LOC SCALES AND POINTERS WILL NOT SHOW IF THE FREQUENCY ON THE ILS CONTROL PANEL IS IN THE "PK" POSITION

9 BAR FLASHES FOR ILS DEVIATION WARNING

10 PROGRAM PIN HEX CODES

11 ON AIRPLANES WITH -420 EFIS SYMBOL GENERATORS AND SUBSEQUENT, THERE ARE THREE HEX CODE LINES

12 AIRPLANES WITH -420 EFIS SYMBOL GENERATORS AND SUBSEQUENT; THE HARDWARE PART NUMBER IS ALSO SHOWN

EFIS Test Patterns
Figure 12 (Sheet 1)

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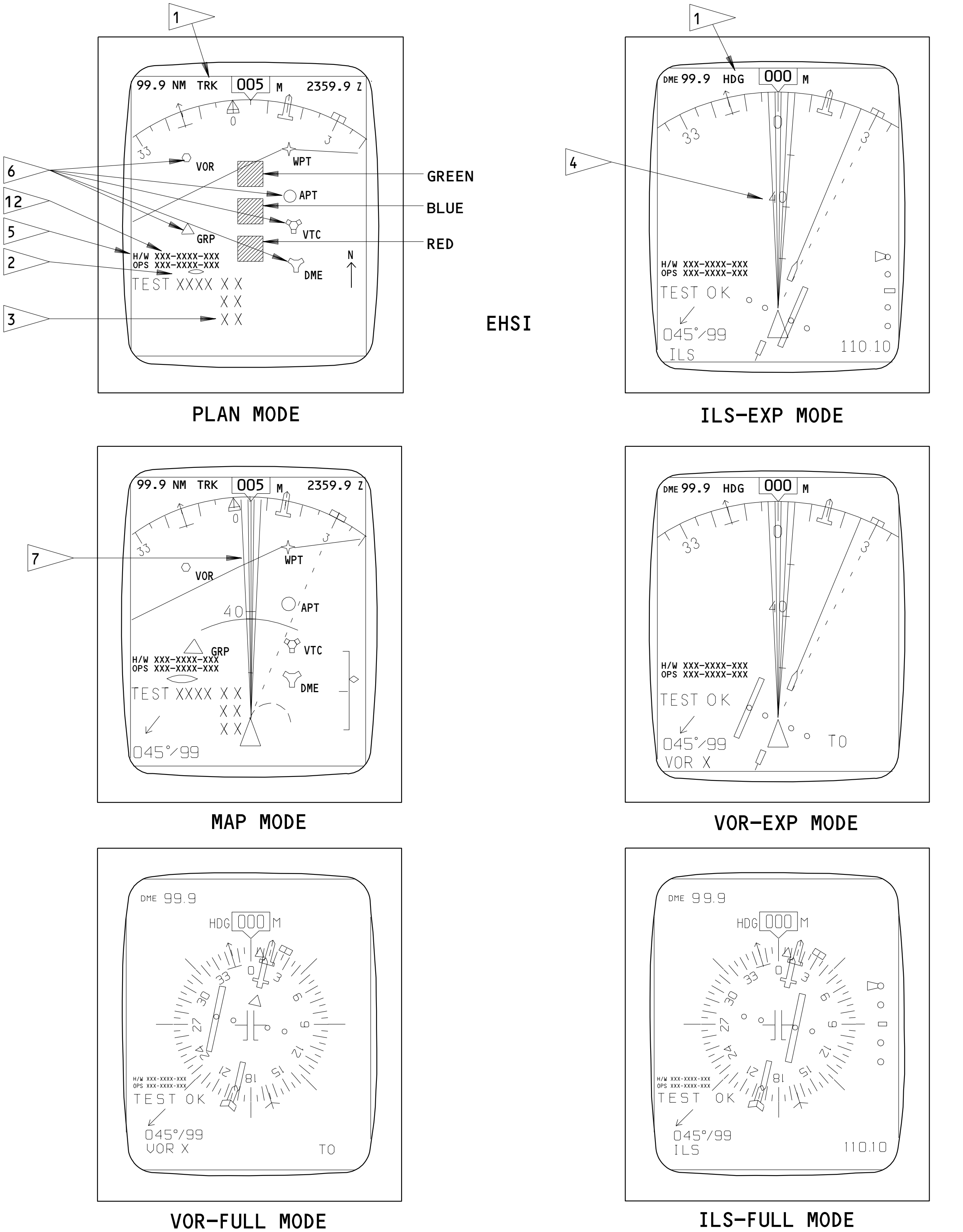

THIS UNIT IS ELECTROSTATIC SENSITIVE

EFIS Test Patterns
Figure 12 (Sheet 2)

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(2) The EADI displays the test pattern shown in the figure during a self-test. The word TEST appears in three places, on the bottom left, the upper left, and the upper right corners. At the end of the test, if all parameters pass, the word OK appears beside TEST in the bottom left corner. If the test fails the word FAIL appears and listed in the bottom right corner, will be any faulty LRU(s) (CP, DU, or SG).

(3) ON AIRPLANES WITH -413 OR -414 EFIS SYMBOL GENERATORS;
The EADI also displays the program pin configuration. The readout will consist of two lines of hexadecimal digits and will be shown at the lower right side of the attitude ball.

(4) ON AIRPLANES WITH -420 EFIS SYMBOL GENERATORS AND SUBSEQUENT;
The EADI also displays the program pin configuration. The readout will consist of three lines of hexadecimal digits and will be shown at the lower right side of the attitude ball.

(5) The EHSI displays the test patterns shown in the figure. Each EHSI mode has a separate test pattern. The test annunciation, however, are located in the same position for each mode. The word TEST is located in the bottom left corner of the display. The same test result annunciations (OK, FAIL, CP, DU, SG) will appear as on the EADI. The relative position and conditions for test messages display are also the same as on the EADI.

(6) The symbols, colors, and data displayed in the test modes, are the same as for those discussed previously in the normal operation. A weather radar test pattern--not the same as a weather radar self test (AMM 34-43-00/001) will appear in the MAP, EXP VOR, and EXP ILS modes.

(7) The test pattern will be a three color (red, yellow, and green) radial arc segment.

(8) The arc segment extends from the airplane reference symbol to the track line.

D. Control

(1) To place EFIS in operation close the following overhead panel P11 circuit breakers:

(a) 11A7, EFIS DSPL SW L

(b) 11E3, ADI LEFT

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(c) 11E4, EFIS CONT PNL LEFT
(d) 11E6, HSI LEFT
(e) 11E24, ADI RIGHT
(f) 11E25, EFIS CONT PNL RIGHT
(g) 11E27, HSI RIGHT
(h) 11F8, EFIS SYM GEN L
(i) 11F9, EFIS SYM GEN C
(j) 11F24, EFIS DSPL SW RIGHT
(k) 11F29, EFIS SYM GEN RIGHT

(2) Set the left and right EFIS control panel switches and the switches on the instrument source select panels as desired.

4. <u>Component Detail - RDMI</u> (Fig. 13)

A. The two RDMIs are located on the main instrument panel. The Captain's is located on the P-1 panel and the F/O's is located on the P-3 panel.

B. The RDMIs display magnetic or true heading, VOR and/or ADF bearing, and DME/VOR, or DME/ILS distance information.

C. The display includes the heading dial, the bearing pointers, and the DME displays. The heading dial is a 360° mechanical compass card display. It rotates within the display and the heading is marked by a fixed lumbar line. There are also six fixed index marks and a heading reciprocal marker, for reference. Two bearing pointers rotate independently on the face of the heading dial. The pointers mark the relative VOR and/or ADF bearing to the selected station. The two ADF/VOR bearing source switches are used to select the data source for the respective pointer.

(1) The heading card reads magnetic heading at typical operational latitudes. At higher latitudes, true heading can displayed by switching the heading reference switch (if installed) to the TRUE position. The DME is displayed (for left and right systems) by two three-digit LCD displays. The displays represent the distance, in nautical miles, to the selected station (VOR or ILS). Each display is independently driven by the left or right DME interrogator. The mode of each interrogator is controlled by the respective (left or right) EFIS control panel. The space before the three digits is reserved for the tuning system, DME annunciation. These may be blank for VOR tuning or L for ILS tuning.

5. <u>Operation - RDMI</u>

A. Functional Description (Fig. 14)

(1) The left RDMI receives 115 Vac, 400 Hz power from the standby power bus. The right RDMI receives 115 Vac, 400 Hz power from the right main power bus.

(2) The left and right RDMI operation is electrically identical. Only the left RDMI operation will be discussed.

(3) The RDMI receives all heading, bearing, and distance data on ARINC 429 digital data buses. Switching control data is received as discrete signals from the instrument source select switches.

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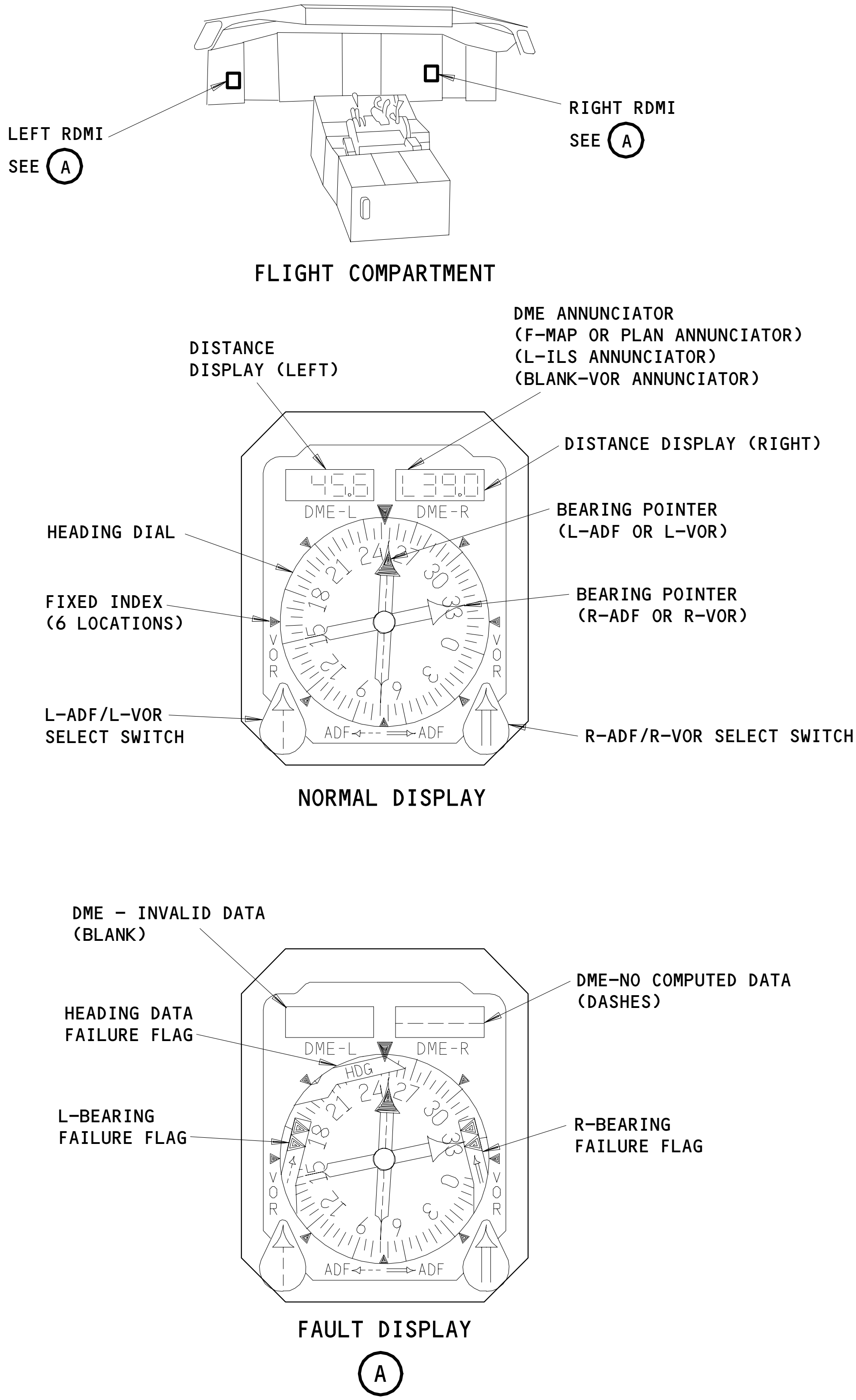

Radio Distance Magnetic Indicator - Component Location
Figure 13

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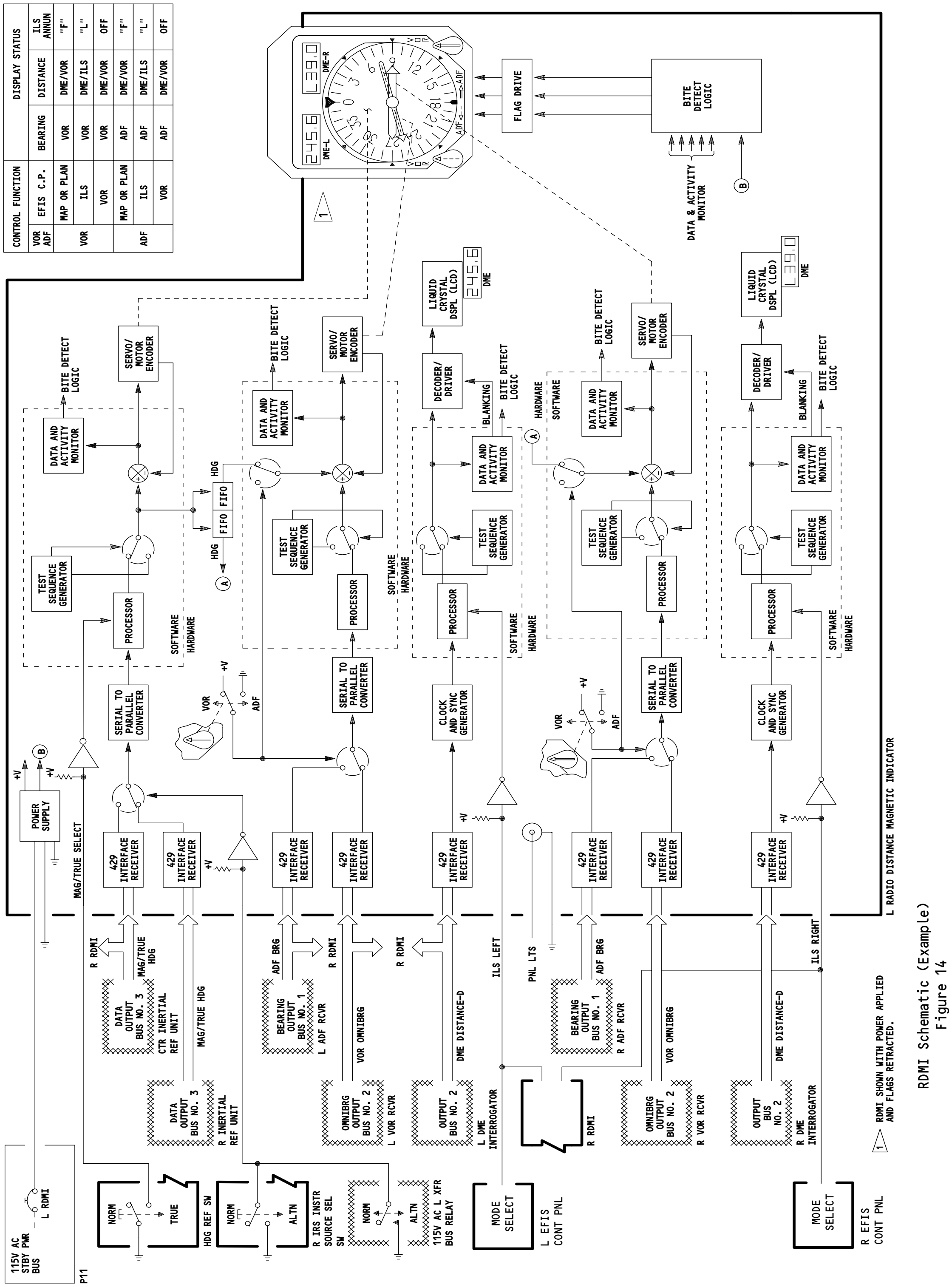

CONTROL FUNCTION		DISPLAY STATUS		
VOR ADF	EFIS C.P.	BEARING	DISTANCE	ILS ANNUN
VOR	MAP OR PLAN	VOR	DME/VOR	"F"
	ILS	VOR	DME/ILS	"L"
	VOR	VOR	DME/VOR	OFF
ADF	MAP OR PLAN	ADF	DME/VOR	"F"
	ILS	ADF	DME/ILS	"L"
	VOR	ADF	DME/VOR	OFF

RDMI Schematic (Example)
Figure 14

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(4) The left RDMI receives heading data from the right and center IRUs. The desired data source is routed to the processing circuits by the source select relay which is controlled by the IRS switch on the right instrument source select panel. This source/display crossfeeding allows both the Captain and F/O to compare left and right IRU operation. The data is then processed, monitored, and sent to the heading servo/motor circuits for display drive.

(5) The left RDMI receives bearing data from the left and right - VOR and ADF receivers. The desired data source is routed to the processing circuits by the source select relays. The right needle can be driven by the right VOR or ADF system. The left needle can be driven by the left VOR or ADF system.

(6) The ADF/VOR switches select between the navigation inputs (VOR and/or ADF).

(7) The distance display's data source selection is controlled by the EHSI mode switch. In the VOR mode(s), the DME display represents paired DME/VOR distance. This is the distance to the tuned VOR station. In the ILS mode(s), the DME display represents paired DME/ILS distance. This is the distance to the tuned ILS station. In the ILS mode the letter L appears before the distance readout. In the map or plan mode, the FMC drives the display and the letter F appears.

(8) The EFIS symbol generator monitors the DME to verify that the tuned DME frequency corresponds with the ILS or VOR station selected. If the tuned DME frequency does not correspond with the selected ILS or VOR station, the DME display will go blank on both the RDMI and EHSI.

B. BITE

(1) For system self-test displays, refer to the corresponding system (IRS, VOR, ADF or DME) chapters.

(2) The RDMI's internal failure monitor circuits continuously check the five display circuits. A failure in any circuit will cause the applicable fault display to appear, as previously discussed.

(3) The left and right bearing failure flags indicate either invalid input data, or a fault within the RDMI's respective bearing circuits. The heading data failure flag indicates either invalid input data or a fault in the RDMI heading circuits. For NCD the heading card remains at the last valid position.

(4) The DME displays warning (invalid) data by going blank. NCD is displayed by four dashes in place of the numerics.

(5) The DME display will also go blank if the tuned DME frequency does not correspond with the ILS or VOR station selected.

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C. Control
   (1) To place RDMIs in operation, close the following P11 panel circuit breakers:
      (a) 11A6, RDMI L
      (b) 11F25, RDMI RIGHT

6. Component Details - VSI (Fig. 15)
   A. Normal Displays
      (1) The two VSIs are located on the main instrument panel. The captain's is located on the P1 panel and the F/O's is located on the P3 panel.
      (2) SAS 050-280;
          The VSI displays the inertial rate of climb and descent in (feet per minute) X 1000. This is shown on a mechanical display as sensed by the IRS.
      (3) SAS 281-999;
          The VSI displays the inertial rate of climb and descent in (feet per minute) X 1000. This is shown on an LCD display as sensed by the IRS.
      (4) SAS 050-280;
          In the case of invalid or NCD from the IRS, the OFF flag will appear.
      (5) SAS 281-999;
          In the case of invalid or NCD from the IRS, the VSI FAIL flag will appear.

7. Operation - VSI
   A. Functional Description (Fig. 16)
      (1) The operation of the left and right VSIs is electrically identical. Only the left system will be discussed in this manual.
      (2) The left VSI is powered by 115 Vac, 400 Hz, single phase voltage, from the instrument transfer bus.
      (3) Normally, the instrument transfer bus receives power from the left main power bus. In the event of a left power bus failure, the captain's VSI will automatically switch to the right power bus. This will occur when the left bus drops below 97 ±2 Vac for more than 180 ms. It will automatically switch back to the left bus when the left bus power increases to greater than 106 ±2 Vac for more than 1.2 seconds (AMM 24-51-00/001).
      (4) The left VSI receives vertical speed data from the left and center IRUs on ARINC 429 digital data busses. The data is received and passes through the internal switching circuits. A ground discrete, from the IRS switch on the left instrument source select panel, will cause the relay to switch from the left to the center IRU. A high discrete causes the relay to switch to the left IRU. The selected digital input data is processed, monitored, and converted to analog data. This data drives the pointers servo.

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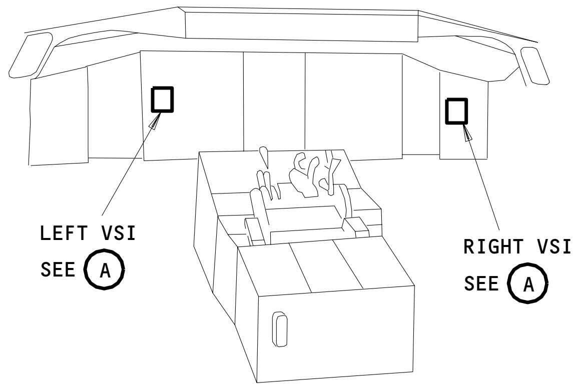
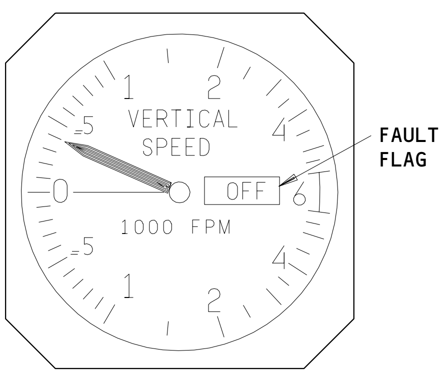
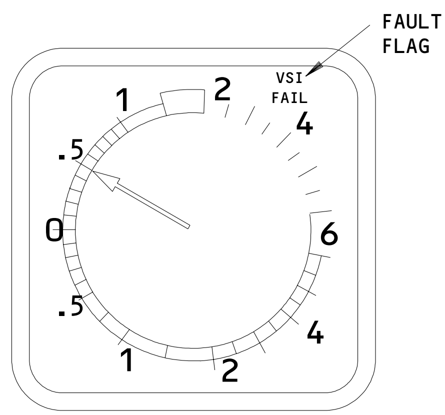


FLIGHT COMPARTMENT



VSI

A 1



VSI

A 2

1 SAS 050-280

2 SAS 281-999

Vertical Speed Indicator - Component Location
Figure 15

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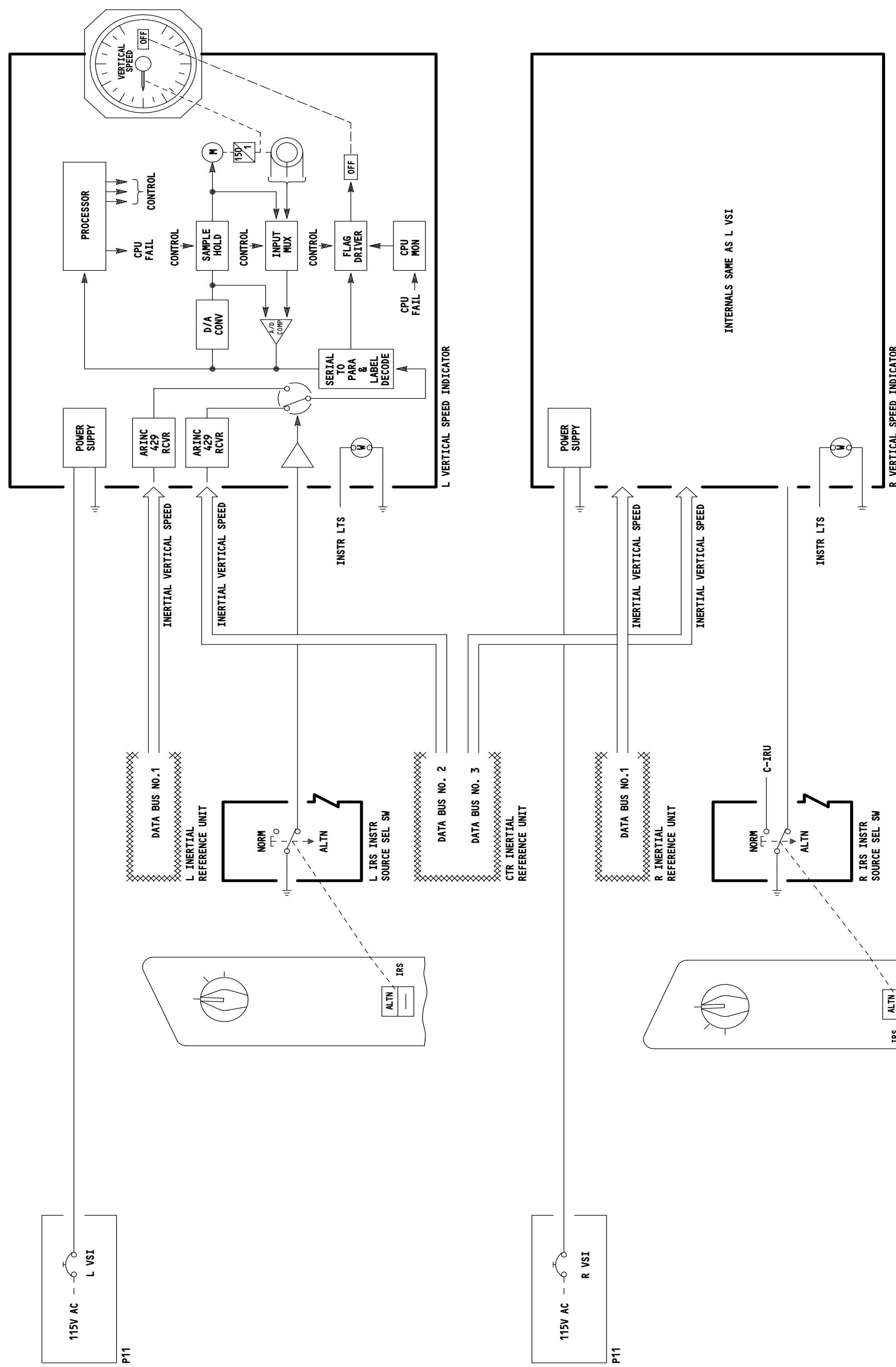

VSI Schematic
Figure 16 (Sheet 1)

E18404

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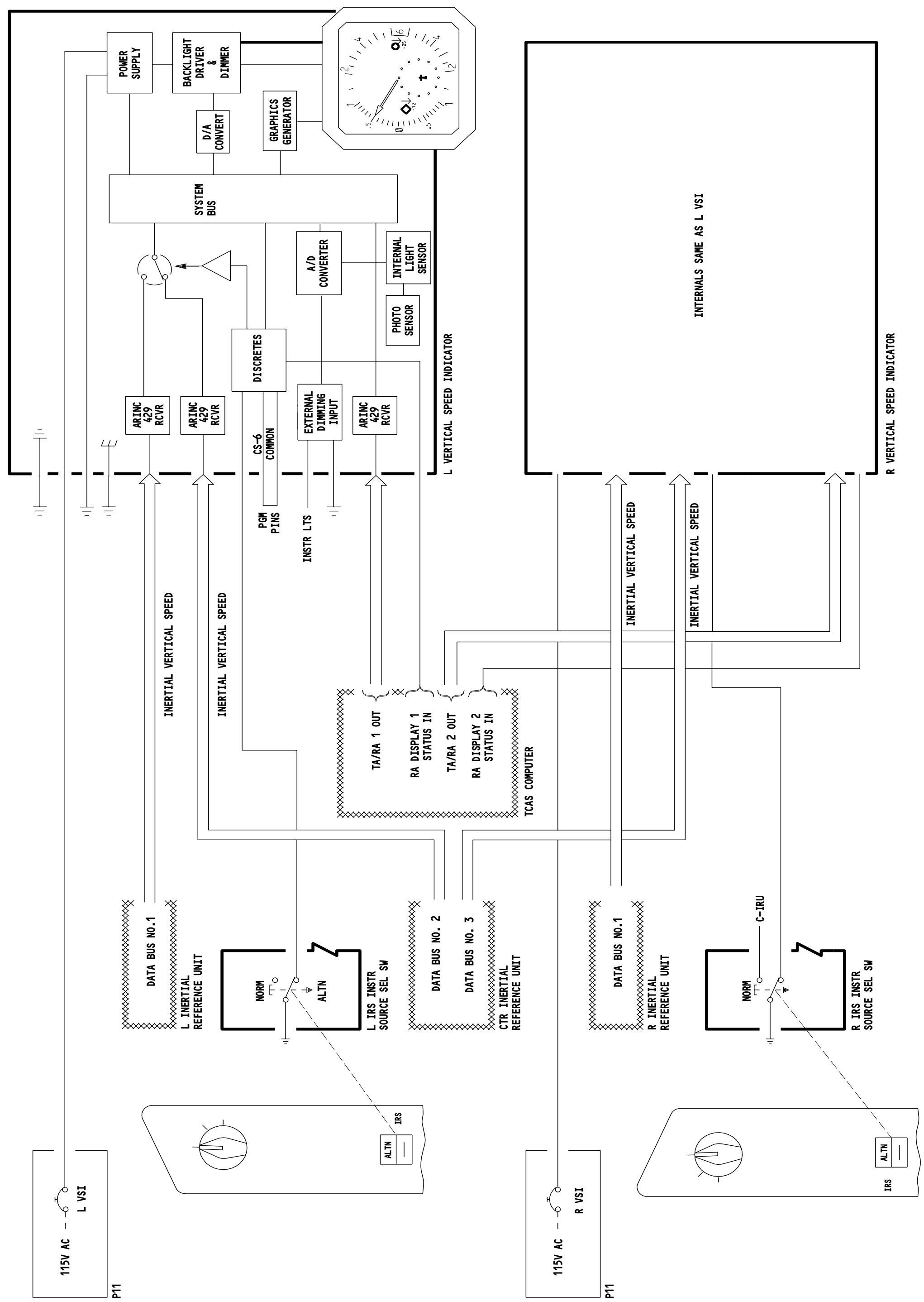

VSI Schematic
Figure 16 (Sheet 2)

E22572

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B. BITE

(1) SAS 050-280;
The monitor circuits continuously check the input data for presence and validity. In the event of a failure, the OFF flag will appear.

(2) SAS 281-999;
The monitor circuits continuously check the input data for presence and validity. In the event of a failure, the VSI FAIL flag will appear.

(3) SAS 050-280;
A display test is initiated by an IRS system self-test (AMM 34-21-00/001). This causes the OFF flag to appear for 10 seconds, followed by a 600 fpm rate of descent display for the duration of the test.

(4) SAS 281-999;
A display test is initiated by an IRS system self-test (AMM 34-21-00/001). This causes the VSI FAIL flag to appear for 10 seconds, followed by a 600 fpm rate of descent display for the duration of the test.

C. Control

(1) To place the VSIs in operation, close the following P11 panel circuit breakers:
(a) 11E5, VSI LEFT
(b) 11E26, VSI RIGHT

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ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
CIRCUIT BREAKER -	1		FLT COMPT, P11	
ADI LEFT, C593		1	11E3	*
ADI RIGHT, C594		1	11E24	*
EFIS CONT PNL LEFT, C633		1	11E4	*
EFIS CONT PNL RIGHT, C634		1	11E25	*
EFIS DSPL SW L, C622		1	11A7	
EFIS DSPL SW RIGHT, C623		1	11F24	*
EFIS SYM GEN L, C637		1	11F8	*
EFIS SYM GEN RIGHT, C638		1	11F29	*
EFIS SYM GEN C, C639		1	11F9	*
HSI LEFT, C588		1	11E6	*
HSI RIGHT, C589		1	11E27	*
RDMI L, C635		1	11A6	*
RDMI RIGHT, C636		1	11F25	*
VSI LEFT, C586		1	11E5	*
VSI RIGHT, C587		1	11E26	*
GENERATOR - CENTER EFIS SYMBOL, M149	1	1	119AL, MAIN EQUIP CTR, E1-4	34-22-01
GENERATOR - LEFT EFIS SYMBOL, M148	1	1	119AL, MAIN EQUIP CTR, E1-2	34-22-01
GENERATOR - RIGHT EFIS SYMBOL, M150	1	1	119AL, MAIN EQUIP CTR, E1-5	34-22-01
INDICATOR - LEFT ELECTRONIC ATTITUDE DIRECTOR, N4	2	1	FLT COMPT, P1-1	34-22-03
INDICATOR - LEFT ELECTRONIC HORIZONTAL SITUATION, N5	2	1	FLT COMPT, P1-1	34-22-04
INDICATOR - LEFT RADIO DISTANCE MAGNETIC, N3	2	1	FLT COMPT, P1-1	34-22-05
INDICATOR - LEFT RESOLUTION ADVISORY/ VERTICAL SPEED, N9 [2]	2	1	FLT COMPT, P1-3	34-22-09
INDICATOR - LEFT VERTICAL SPEED, N9 [1]	2	1	FLT COMPT, P1-3	34-22-06
INDICATOR - RIGHT ELECTRONIC ATTITUDE DIRECTOR, N44	2	1	FLT COMPT, P3-3	34-22-03
INDICATOR - RIGHT ELECTRONIC HORIZONTAL SITUATION, N45	2	1	FLT COMPT, P3-3	34-22-04
INDICATOR - RIGHT RADIO DISTANCE MAGNETIC, N43	2	1	FLT COMPT, P3-3	34-22-05
INDICATOR - RIGHT RESOLUTION ADVISORY/ VERTICAL SPEED, N49 [2]	2	1	FLT COMPT, P3-3	34-22-09
INDICATOR - RIGHT VERTICAL SPEED, N49 [1]	2	1	FLT COMPT, P3-3	34-22-06
PANEL - (FIM 34-51-00/101)				
LEFT VOR/DME CONTROL, M91				
RIGHT VOR/DME CONTROL, M92				
PANEL - LEFT EFIS CONTROL, M94	2	1	FLT COMPT, P10	34-22-02
PANEL - RIGHT EFIS CONTROL, M93	2	1	FLT COMPT, P10	34-22-02
RELAY - (FIM 31-01-37/101)				
EFIS/EICAS ATT COMP, K1297 [2]				
FLIGHT RECORDER I/P SWITCHING, K15				

* SEE THE WDM EQUIPMENT LIST

[1] SAS 050-280
[2] SAS 281-999

Electronic Flight Instrument System (EFIS) - Component Index
Figure 101 (Sheet 1)

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ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
SENSOR - LEFT EFIS REMOTE LIGHT, TS187	--	1	FLT COMPT, P7	34-22-07
SENSOR - RIGHT EFIS REMOTE LIGHT, TS188	--	1	FLT COMPT, P7	34-22-07
SWITCH - HEADING REFERENCE, S616	2	1	FLT COMPT, P3-1	*
SWITCH - LEFT EFI, S3	1	1	FLT COMPT, P1-1	33-13-00
SWITCH - LEFT F/D, S1	1	1	FLT COMPT, P1-1	33-13-00
SWITCH - LEFT IRS, S4	1	1	FLT COMPT, P1-1	33-13-00
SWITCH - LEFT NAV, S2	1	1	FLT COMPT, P1-1	33-13-00
SWITCH - RIGHT EFI, S11	1	1	FLT COMPT, P3-3	33-13-00
SWITCH - RIGHT F/D, S9	1	1	FLT COMPT, P3-3	33-13-00
SWITCH - RIGHT IRS, S12	1	1	FLT COMPT, P3-3	33-13-00
SWITCH - RIGHT NAV, S10	1	1	FLT COMPT, P3-3	33-13-00

* SEE THE WDM EQUIPMENT LIST

Electronic Flight Instrument System (EFIS) - Component Index
Figure 101 (Sheet 2)

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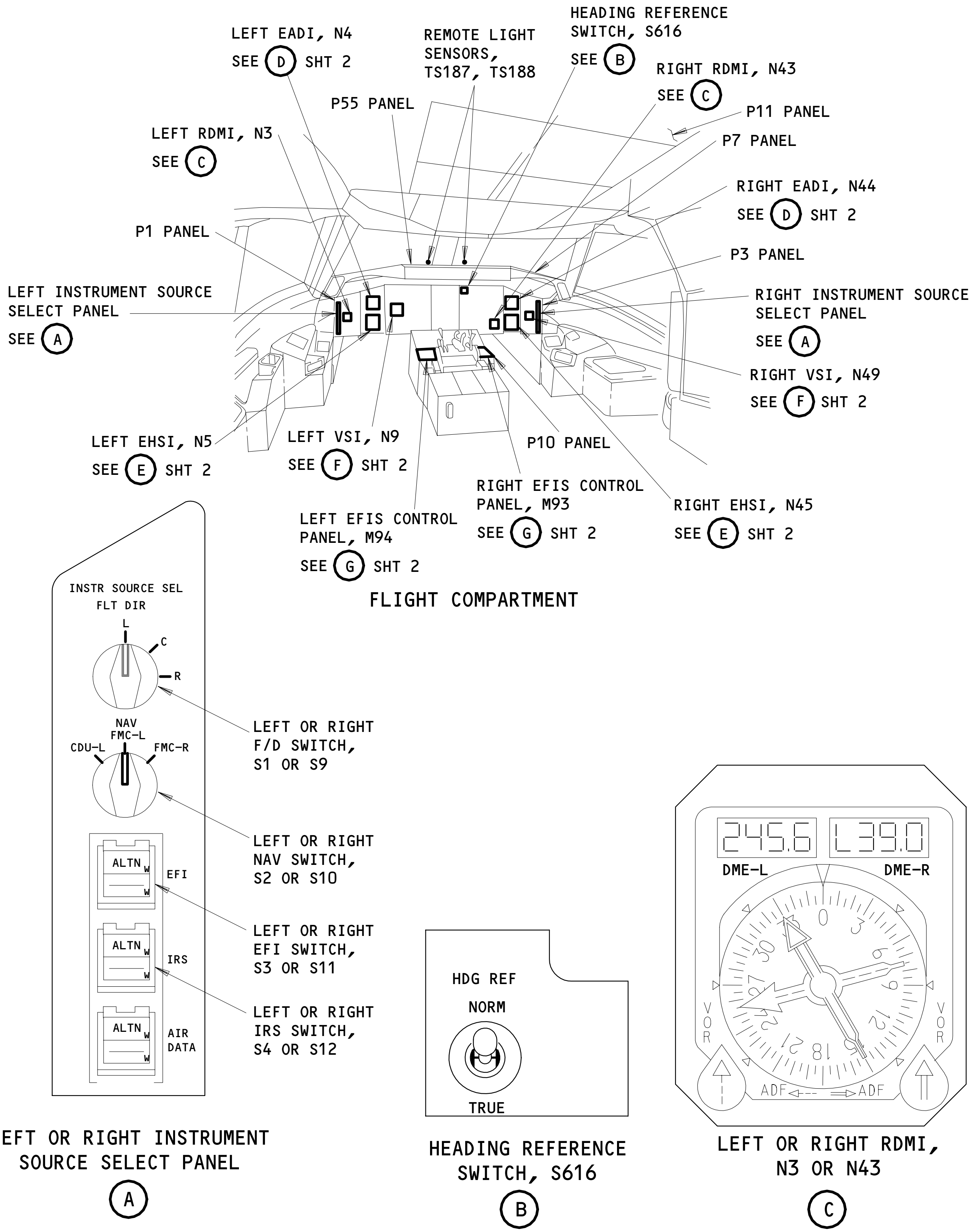

EFIS - Component Location
Figure 102 (Sheet 1)

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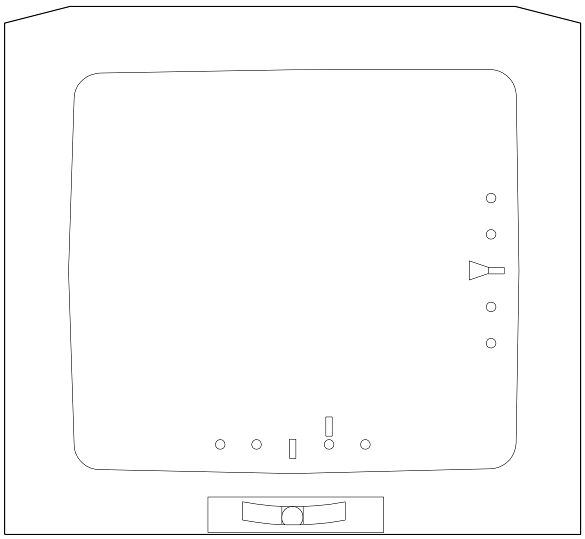
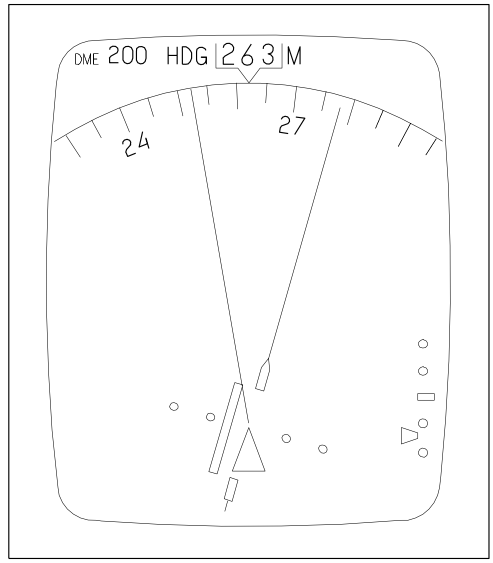


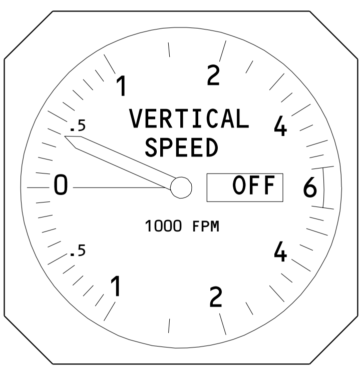
LEFT OR RIGHT EADI, N4 OR N44

D



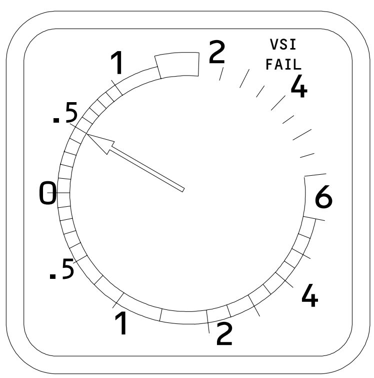
LEFT OR RIGHT EHSI, N5 OR N45

E



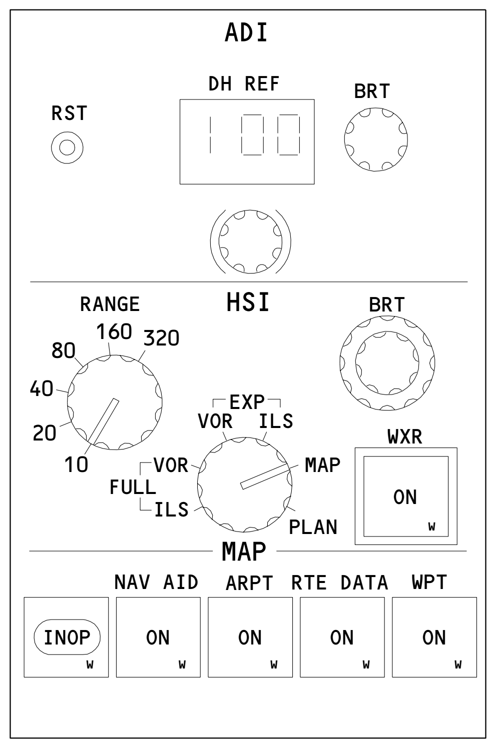
LEFT OR RIGHT
VERTICAL SPEED
INDICATOR,
N9 OR N49

F 1



LEFT OR RIGHT
RESOLUTION ADVISORY/
VERTICAL SPEED
INDICATOR,
N9 OR N49

F 2



LEFT OR RIGHT EFIS
CONTROL PANEL, M94 OR M93

G

1 SAS 050-280
2 SAS 281-999

EFIS - Component Location (Details from Sht 1)
Figure 102 (Sheet 2)

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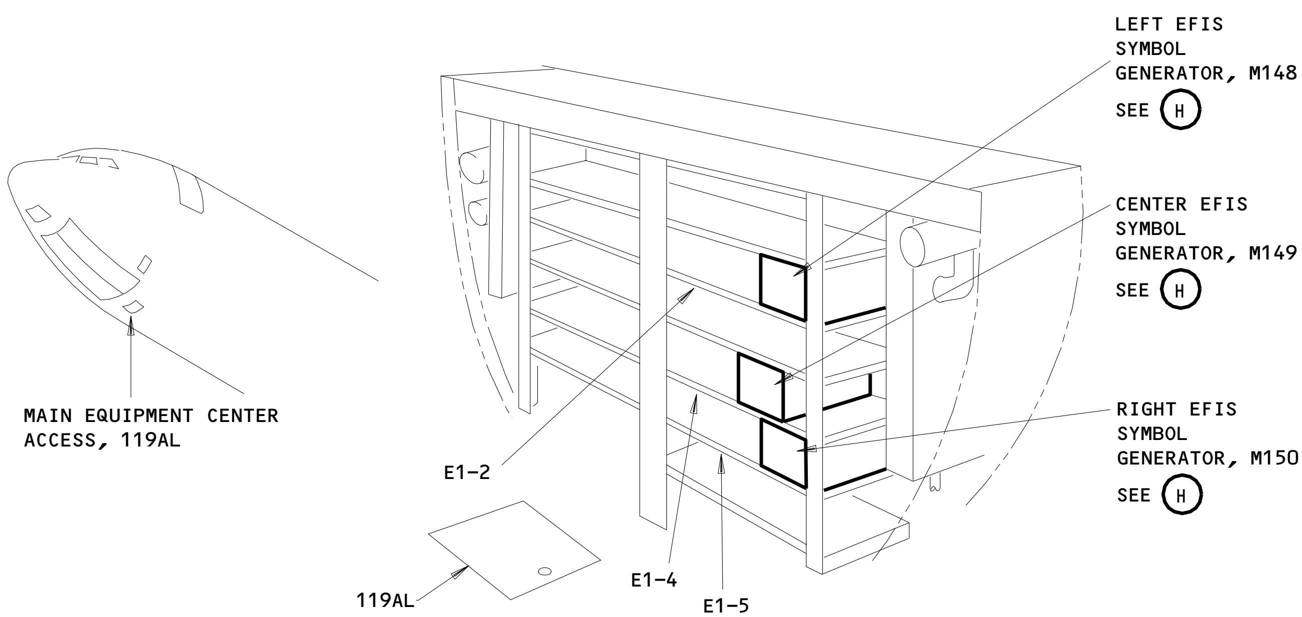
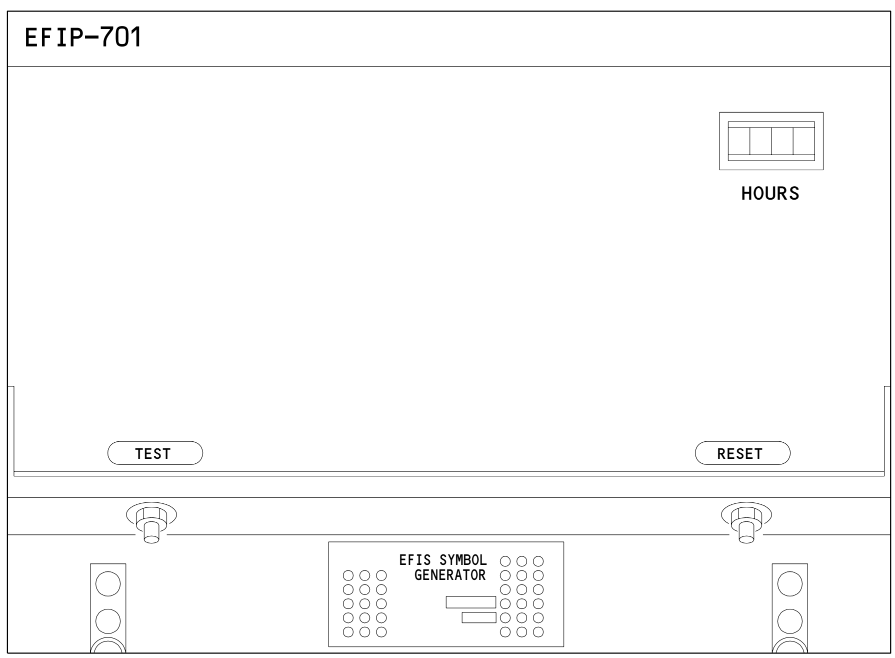
F19547



MAIN EQUIPMENT CENTER



EFIS SYMBOL GENERATOR

H

EFIS - Component Location
Figure 102 (Sheet 3)

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ELECTRONIC FLIGHT INSTRUMENT SYSTEM - MAINTENANCE PRACTICES

1. General
   A. The procedures that follow are the maintenance practices for the electronic flight instrument system (EFIS):
      (1) CRT Display Surface Cleaning
      (2) CRT Brightness - Adjustment/Test
      (3) EADI Inclinometer - Adjustment/Seal
      (4) EFIS Symbol Generator Software Installation
   B. Software Installation
      (1) This procedure has these tasks for software installation:
         (a) An installation of the EFIS software with an airborne data loader (ADL) on the flight deck.
         (b) An installation of the EFIS software with a portable data loader (PDL) on the flight deck.
         (c) An installation of the EFIS software using a portable data loader (PDL) and data loader adapter. This is done in the electronic bay, directly into the EFIS symbol generator.
      (2) To install software in the EFIS symbol generator on the flight deck, these requirements must be met:
         (a) There is a data loader control panel on the P61 panel.
         (b) There are EFIS switch positions on the data loader control panel.
         (c) There is an airborne data loader or a connector panel for a portable data loader on the P61 panel.
      (3) If you cannot install the software from the flight deck, then you can install the software directly into the EFIS symbol generator with the use of a portable data loader and an adapter tray.

TASK 34-22-00-162-032

2. CRT Display Surface Cleaning
   A. Equipment
      (1) Brush - Soft bristle (commercially available)
   B. Consumable Materials
      (1) B50012 Cleaner, Optical Cleaning, Calotherm Solution - Supaspray (use with Supacloth)

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(2) B50013 Cloth, Calocoat Hi-Tech Lenscloth - Supacloth (use with Supaspray)
(3) G02457 Cleaner, Wet/Dry Anti-static Sachet - ALGLAS Visial ALG/CR 215

C. Access
(1) Location Zones
211/212 Flight Compartment

D. Procedure

S 102-134

CAUTION: DO NOT USE ABRASIVE MATERIALS OR SOLVENTS WHEN YOU CLEAN THE DISPLAY SURFACE. ABRASIVE MATERIALS AND SOLVENTS WILL CAUSE DAMAGE TO THE DISPLAY SURFACE.

(1) Remove all particles from the display surface with a clean, soft, natural-bristle brush.

S 102-137
(2) Carefully clean the display surface with the Supaspray and Supacloth or the wet/dry sachets:
(a) Apply 2 or 3 sprays of the Supaspray to the Supacloth, or open the wet sachet.
(b) Use the moist cloth or wet sachet to carefully clean the display surface in a straight line from top to bottom.
(c) Gradually move from one side of the display surface to the other side while you clean from top to bottom.
(d) When the display surface is clean, use a clean, dry area of the cloth or the dry sachet in a straight line from top to bottom to carefully dry the display surface.

TASK 34-22-00-702-003
3. <u>CRT Brightness - Adjustment/Test</u> (Fig. 201)
A. General
(1) In the Prepare for Test and Return Airplane to Its Usual Condition sections, procedures are provided for an EICAS CRT and an EFIS CRT.
B. Equipment
(1) Hand-held Photometer, Photo Research PR504
(2) Microreader Probe, Photo Research MR500
C. References
(1) AMM 24-22-00/201, Electrical Power - Control
D. Access
(1) Location Zones
211/212 Flight Compartment

E. Prepare for Test

S 862-004
(1) Supply electrical power (AMM 24-22-00/201).

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S 112-031
(2) Remove unwanted materials from the CRT face.

S 712-005
(3) EFIS DISPLAY UNITS;
Do these steps:
(a) Make sure that these circuit breakers on the overhead panel, P11, are closed:
1) ADI (2 places)
2) HSI (2 places)
3) EFIS (7 places)
(b) Permit 10 minutes for the CRT to become warm.
(c) On the left and right EFIS control panels, put the MODE switches in the PLAN position.
(d) On the left and right EFIS control panels, put the four BRT controls in the fully clockwise position.
(e) On the overhead light control panel, push the TEST switch.
(f) Make sure that the correct PLAN mode test pattern shows on the EADI and EHSI displays.

S 712-006
(4) EICAS DISPLAY UNITS;
Do these steps:
(a) Make sure that these P11 panel circuit breakers are closed:
1) EICAS (6 places)
(b) Permit 10 minutes for the CRT to become warm.
(c) On the EICAS MAINT panel, push the TEST switch.
(d) On the EICAS control panel, adjust the BRT control so that the EICAS displays are at maximum intensity.
(e) Make sure that the EICAS test pattern shows on the two displays.

F. CRT Brightness Test

S 862-033

CAUTION: DO NOT ALLOW THE PHOTOMETER TEMPERATURE TO BECOME MORE THAN 150 DEGREES FAHRENHEIT. DO NOT PUT THE PHOTOMETER DIRECTLY IN THE SUNLIGHT. THE PHOTOMETER IS SENSITIVE TO HEAT AND LIGHT. EQUIPMENT DAMAGE CAN OCCUR.

(1) Energize the hand-held photometer.
(a) Make sure that the battery operates correctly.
(b) Make sure that the meter is adjusted for a correct meter-zero value.

S 862-008
(2) Attach the micro-reader probe to the photometer.

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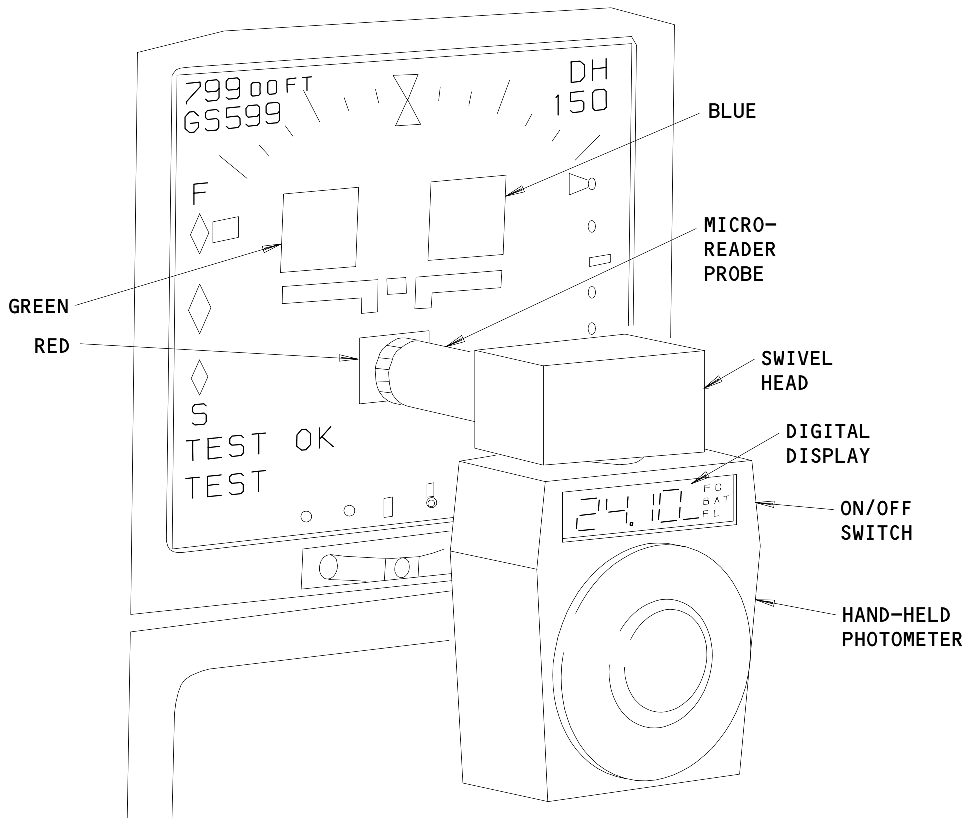

EADI (EXAMPLE)

CRT Brightness Test
Figure 201

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S 862-009
(3) Turn the swivel head so that the probe and digital display point in opposite directions.

S 862-010
(4) Hold the probe against the CRT face so that it is in the center of the area to be measured.

S 862-011
(5) Push the ON button for 15 seconds or until the digital display value becomes stable.

S 862-012
(6) With the ON button pushed in, move the probe around the area to be tested until there is a maximum stable value.

NOTE: Make sure that the CRT face is not in the direct sunlight.

S 972-013
(7) Write the value on Table I.

S 862-014
(8) Repeat this procedure until there are three values for each area to be tested.

S 972-015
(9) Write the micro-reader probe multiplexer value on Table I.

S 972-016
(10) Do the calculations.

S 862-017
(11) Make sure that the calculated values are not less than these values for each color:

BLUE	5.0 FOOT-LAMBERTS
GREEN	30.0 FOOT-LAMBERTS
RED	14.0 FOOT-LAMBERTS

G. Put the Airplane Back to Its Usual Condition

S 112-018
(1) Remove unwanted materials from the CRT face.

S 862-019
(2) EFIS;
On the overhead light control panel, push the TEST switch to remove the electrical power from the test circuits.

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S 862-020

(3) EICAS;
On the EICAS MAINT, push the TEST switch to remove the electrical power from the test circuits.

S 862-021

(4) Remove the electrical power if it is not necessary (AMM 24-22-00/201).

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TABLE I
CRT BRIGHTNESS TEST

Record the following:

DATE ______________________________

PHOTOMETER NO. ____________________

CRT _______________________________

AIRPLANE NO. ______________________

GREEN VALUES ________________________

____

____

AVERAGE (AVG) ________________________
GREEN

_______AVG GREEN X____________________________METER COEF = ____________FL
(> 30 FL)

RED VALUES ________________________

____

____

AVG RED ________________________

_________AVG RED X______________________________METER COEF = ____________FL
(> 14 FL)

BLUE VALUES ________________________

____

____

AVG BLUE ______________________________

AVG BLUE X____________________________METER COEF = ____________FL
(> 5.0 FL)

COMMENTS:

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TASK 34-22-00-712-022

4. EADI Inclinometer - Adjustment/Seal

A. General

(1) This procedure is to be done each time that a new EADI is installed or each time that there is a difference between the inclinometers. Where there is a difference and it is not known which inclinometer is correct, the airplane must be made level. The incorrect inclinometer should then be adjusted by this procedure.

B. Equipment

(1) Scraper - wood or plastic

C. Consumable Materials

(1) A00247 Sealant - BMS 5-95 Class B-1/2

(2) B00184 Solvent - BMS 11-7

D. References

(1) AMM 08-21-00/201, Leveling

(2) AMM 20-30-01/201, Adhesives, Cements, and Sealers

(3) AMM 20-30-02/201, Cleaners and Polishes

(4) AMM 20-30-05/201, Strippers

(5) AMM 51-31-01/201, Seals and Sealing

E. Access

(1) Location Zones

211/212 Flight Compartment

F. Adjust the Inclinometer (Fig. 202)

S 862-023

(1) If necessary, make the airplane level to find the incorrect inclinometer.

S 912-024

(2) Remove the sealant from the zero-adjustment screws on the applicable inclinometer (AMM 51-31-01/201).

S 032-025

(3) Loosen the zero-adjustment screws.

S 862-026

(4) If the plane was made level, adjust the incorrect inclinometer so that the slip ball is between the two vertical lines.

S 862-027

(5) If the plane was not made level, adjust the incorrect inclinometer until the slip ball is within 0.03 inch of the indication on the correct inclinometer.

S 432-028

(6) Tighten the zero-adjustment screws.

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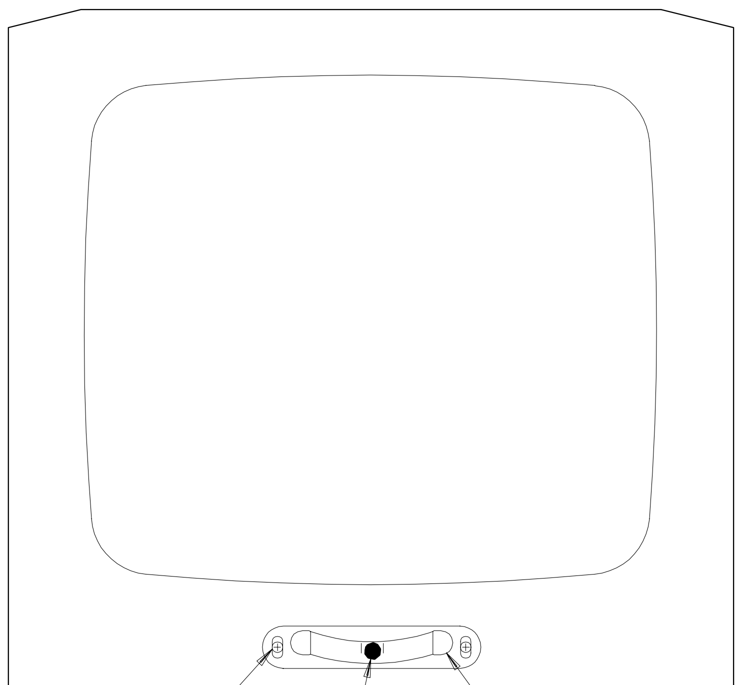

EADI Inclinometer Adjustment and Sealing
Figure 202

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S 912-029
(7) Apply the sealant, BMS 5-95, over the zero-adjustment screw heads (AMM 51-31-01/201).

S 912-030
(8) Remove any unwanted sealant (AMM 51-31-01/201).

TASK 34-22-00-472-076

5. EFIS Symbol Generator Software Installation with an Airborne Data Loader

A. General
   (1) This procedure shows you how to install the operational program software (OPS) in the EFIS symbol generator.
   (2) An airborne data loader (ADL) and a data loader control panel are necessary for this procedure (P61).
   (3) The airplane must be on the ground with the engines shut down before you can install the software.
   (4) There must be an EFIS position on the data loader control panel. If there is not an EFIS position on the data loader control panel, then do the procedure to load the software directly into the EFIS signal generator using the PDL in the EE bay.
   (5) To read about software installation times and data loaders, do this task: On-Airplane Software Installation - Maintenance Practices (AMM 20-15-11/201).

B. References
   (1) AMM 20-15-11/201, On-Airplane Software Installation
   (2) AMM 24-22-00/201, Electrical Power - Control
   (3) AMM 34-21-00/201, Inertial Reference System

C. Access
   (1) Location Zones
      211 Flight Compartment, Left
      212 Flight Compartment, Right

D. Procedure

S 862-077
(1) Do this task: Supply electrical power (AMM 24-22-00/201).

S 862-127
(2) Do this task: Alignment of the IRS (AMM 34-21-00/201).

S 862-129
(3) Make sure the left and right EFI instrument source select switches are in the normal position.

S 862-130
(4) Make sure the system select switch on the data loader control panel is set to NORMAL (P61).

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S 862-107
(5) Make sure this circuit breaker is closed:
(a) P11 Circuit Breaker Panel:
1) 11G24, DATA LOADER

S 472-080
(6) Use an airborne data loader (ADL) to install software in the EFIS symbol generator.

NOTE: You must know the correct software part numbers for the EFIS symbol generator. For the EFIS symbol generator to be an approved installation, software with the correct part numbers must be installed.

(a) If you will install the software in the center EFIS symbol generator, then set the EFI instrument source select switch on the P1-1 panel to ALTN.
(b) AIRPLANES WITH ONE SWITCH ON THE DATA LOADER CONTROL PANEL (P61);
Set the system select switch to EFIS-L, EFIS-C, or EFIS-R.
(c) AIRPLANES WITH TWO SWITCHES ON THE DATA LOADER CONTROL PANEL (P61);
Do these steps:
1) Set the upper switch to L, C, or R.
2) Set the system select switch to EFIS.
(d) Put the correct disk in the disk drive.

NOTE: When software is installed in the left or center EFIS SG, then the left EADI and EHSI will go blank.

When software is installed in the right EFIS SG, then the right EADI and EHSI will go blank.

This can take 30 to 40 seconds.

(e) Follow the prompts on the data loader to complete the installation.

NOTE: When the data transfer starts, OPS TRANSFER IN PROGRESS will show on the EHSI that is not blank.

(f) When the installation is complete, make sure that OPS TRANSFER COMPLETE shows on the EHSI that is not blank.
(g) Make sure the OPS part number after the letter (L, C, or R) for the EFIS signal generator being loaded is on the EHSI.
(h) Remove the disk from the disk drive.

S 862-108
(7) Set the switch on the data loader control panel to NORMAL.

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E. Put the Airplane Back to Its Usual Condition

S 862-097

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-22-00-472-083

6. EFIS Symbol Generator - Software Installation with a PDL on the Flight Deck

A. General

(1) This procedure shows you how to install the operational program software (OPS) in the EFIS symbol generator.

(2) A portable data loader (PDL) is necessary for this procedure. A data loader control panel and a PDL interface connector are also necessary for this procedure (P61).

(3) There must be an EFIS position on the data loader control panel. If there is not an EFIS position on the data loader control panel, then do the procedure to load the software directly into the EFIS signal generator using the PDL in the EE bay.

(4) A PDL is not a Boeing supplied part. Refer to the PDL supplier for instructions for operation. PDLs have a disk drive for software installation from disks. Some PDLs have an internal mass storage device. If the software is stored in the PDL, then disks are not necessary.

(5) The airplane must be on the ground with the engines shut down before you can install software.

(6) To read about software installation times and data loaders, do this task: On-Airplane Software Installation - Maintenance Practices (AMM 20-15-11/201).

B. References

(1) AMM 20-15-11/201, On-Airplane Software Installation

(2) AMM 24-22-00/201, Electrical Power - Control

(3) AMM 34-21-00/201, Inertial Reference System

C. Equipment

(1) Data Loader (or alternative tool)

(a) 11615-02 Loader - Data, Portable, ARINC 615-3 (alternative)
Qualtair Equipment and Engineering (Vendor Code 1HEC2)
15720 Mill Creek Boulevard, Suite 200, Mill Creek, WA 98012

(b) 11615-20 Loader - Data, Portable, ARINC 615-3, Includes Mass Storage Device (alternative)
Qualtair Equipment and Engineering (Vendor Code 1HEC2)
15720 Mill Creek Boulevard, Suite 200, Mill Creek, WA 98012

(c) 964-0400-025 Loader - Data, Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Honeywell, Inc. (Vendor Code 97896)
15001 N.E. 36th St., P.O. Box 97001, Redmond WA 98073-9701

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(d) 964-0400-055 Loader - Data, Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Honeywell, Inc. (Vendor Code 97896)
15001 N.E. 36th St., P.O. Box 97001, Redmond WA 98073-9701

(e) 465130-01-01 Loader - Data Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Litton Systems Inc.,
6101 Condor Drive, Moorpark, CA 93021-2602

(f) 964-0400-024 Loader - Data, Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Honeywell, Inc. (Vendor Code 97896)
15001 N.E. 36th St., P.O. Box 97001, Redmond WA 98073-9701

(g) 30100 Loader - DATA, Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Demo Systems Inc. (Vendor Code OBAWO)
379 Science Dr.,
MoorPark, CA 93021

(h) 2231560-1B Loader - Data Portable, ARINC 615, with two 3.5 inch diskette (alternative)
Teledyne Controls
12333 W. Olympic Blvd.
Los Angeles, CA 90064-1021

(i) YV68A110 Loader - Data, Portable, ARINC 615 (alternative)
SFIM (Vendor Code F6158)
SA 13 AV Marcel Ramofo Garmier, Massy, 91301 France

(j) 18000-02 Loader - Data, Portable, ARINC 615/A with Mass Storage Device (alternative)
Qualtair Equipment and Engineering (Vendor Code 1HEC2)
15720 Mill creek Boulevard, Suite 200, Mill creek, WA 98012

(k) 80000-03-01010203 Loader - Data, Portable, ARINC 615/A with Mass Storage Device (alternative)
Demo Systems, Inc. (Vendor Code OBAWO)
379 Science Dr., MoorPark, CA 93021

D. Access

(1) Location Zones

211	Flight Compartment, Left
212	Flight Compartment, Right

E. Procedure

S 862-092

(1) Do this task: Supply electrical power (AMM 24-22-00/201).

S 862-128

(2) Do this task: Alignment of the IRS (AMM 34-21-00/201).

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S 862-087

(3) Use a Portable Data Loader (PDL) to install software in the applicable EFIS Symbol Generator.

NOTE: You must know the correct software part numbers for the EFIS signal generators. For the EFIS symbol generators to be an approved installation, software with the correct part numbers must be installed.

S 862-119

(4) Do these steps to prepare for the software installation:

(a) Make sure the left and right EFI instrument source select switches are in the normal position.

(b) Make sure the system select switch on the data loader control panel is set to NORMAL (P61).

CAUTION: MAKE SURE THE CIRCUIT BREAKER FOR THE DATA LOADER IS OPEN BEFORE YOU CONNECT OR REMOVE THE INTERFACE CABLE FOR THE PORTABLE DATA LOADER. IF THE CIRCUIT BREAKER IS NOT OPEN, DAMAGE TO EQUIPMENT CAN OCCUR.

(c) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
1) P11 Circuit Breaker Panel:
a) 11G24, DATA LOADER

CAUTION: MAKE SURE THE POWER SWITCH FOR THE PORTABLE DATA LOADER IS SET TO OFF BEFORE YOU CONNECT OR REMOVE THE INTERFACE CABLE. IF THE POWER SWITCH IS NOT OFF, DAMAGE TO THE PORTABLE DATA LOADER CAN OCCUR.

(d) Set the power switch on the PDL to the off position.

(e) Connect the interface cable from the PDL to the DATA TRANSFER UNIT RECEPTACLE on the P61 panel.

(f) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
1) P11 Circuit Breaker Panel:
a) 11G24, DATA LOADER

(g) If you will install the software in the center EFIS symbol generator, then set the EFI instrument source select switch on the P1-1 panel to ALTN.

(h) AIRPLANES WITH ONE SWITCH ON THE DATA LOADER CONTROL PANEL (P61);
Set the system select switch to EFIS-L, EFIS-C, or EFIS-R.

(i) AIRPLANES WITH TWO SWITCHES ON THE DATA LOADER CONTROL PANEL (P61);
Do these steps at the data loader control panel:
1) Set the upper switch to L, C, or R.
2) Set the system select switch to EFIS.

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S 472-089

(5) SOFTWARE INSTALLATION WITH A PDL DISK DRIVE;
Do these steps to install the software:

NOTE: For more information on how to use the PDL, refer to the supplier's instructions for the PDL.

(a) Set the power switch on the PDL to the on position.
(b) Put the correct disk in the disk drive.

NOTE: When software is installed in the left or center EFIS SG, then the left EADI and EHSI will go blank.

When software is installed in the right EFIS SG, then the right EADI and EHSI will go blank.

This can take 30 to 40 seconds.

(c) Follow the prompts on the data loader to complete the installation.

NOTE: When the data transfer starts, OPS TRANSFER IN PROGRESS will show on the EHSI that is not blank.

(d) When the installation is complete, make sure that OPS TRANSFER COMPLETE shows on the EHSI that is not blank.
(e) Make sure the OPS part number after the letter (L, C, or R) for the EFIS signal generator being loaded is on the EHSI.
(f) Remove the disk from the disk drive.

S 862-131

(6) SOFTWARE INSTALLATION WITH A PDL MASS STORAGE DEVICE;
Follow the PDL supplier instructions to install the software.

NOTE: When software is installed in the left or center EFIS SG, then the left EADI and EHSI will go blank.

When software is installed in the right EFIS SG, then the right EADI and EHSI will go blank.

This can take 30 to 40 seconds.

When the data transfer starts, OPS TRANSFER IN PROGRESS will show on the EHSI that is not blank.

(a) When the installation is complete, make sure that OPS TRANSFER COMPLETE shows on the EHSI that is not blank.
(b) Make sure the OPS part number after the letter (L, C, or R) for the EFIS signal generator being loaded is on the EHSI.

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S 862-132
(7) Set the system select switch on the data loader control panel to NORMAL.

S 862-133
(8) Set the power switch on the PDL to the off position.

F. Put the Airplane Back to Its Usual Condition

S 862-122
(1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
(a) P11 Circuit Breaker Panel:
1) 11G24, DATA LOADER

S 862-099
(2) Remove the PDL interface cable from the DATA TRANSFER UNIT RECEPTACLE.

S 862-123
(3) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
(a) P11 Circuit Breaker Panel:
1) 11G24, DATA LOADER

S 862-103
(4) Remove the electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-22-00-472-109

7. EFIS Symbol Generator - Software Installation with a PDL in the EE Bay

A. General
(1) This procedure tells you how to install the operational program software (OPS) directly into an EFIS signal generator.
(2) A portable data loader (PDL) is necessary for this procedure.
(3) A tray adapter is used to provide the connections between the EFIS Symbol Generator and the Portable Data Loader.
(4) A PDL is not a Boeing supplied part. Refer to the PDL supplier for instructions for operation. PDLs have a disk drive for software installation from disks. Some PDLs have an internal mass storage device. If the software is stored in the PDL, then disks are not necessary.
(5) To read about software installation times and data loaders, do this task: On-Airplane Software Installation - Maintenance Practices (AMM 20-15-11/201).

B. References
(1) AMM 24-22-00/201, Supply Electrical Power
(2) AMM 20-15-11/201, On-Airplane Software Installation
(3) AMM 34-22-01/401, EFIS Symbol Generator

C. Equipment
(1) Tray Adapter (or alternative tool)
(a) C34006-58 Adapter, Tray - EFIS SYMBOL GENERATOR software loading (alternative)

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(b) C34006-57 Adapter, Tray - EFIS SYMBOL GENERATOR software loading (alternative)
(c) C34006-54 Adapter, Tray - EFIS SYMBOL GENERATOR software loading (alternative)
(d) C34006-2 Adapter, Tray - EFIS SYMBOL GENERATOR software loading (alternative)

(2) Data Loader (or alternative tool)
(a) 11615-02 Loader - Data, Portable, ARINC 615-3 (alternative)
Qualtair Equipment and Engineering (Vendor Code 1HEC2)
15720 Mill Creek Boulevard, Suite 200, Mill Creek, WA 98012
(b) 11615-20 Loader - Data, Portable, ARINC 615-3, Includes Mass Storage Device (alternative)
Qualtair Equipment and Engineering (Vendor Code 1HEC2)
15720 Mill Creek Boulevard, Suite 200, Mill Creek, WA 98012
(c) 964-0400-025 Loader - Data, Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Honeywell, Inc. (Vendor Code 97896)
15001 N.E. 36th St., P.O. Box 97001, Redmond WA 98073-9701
(d) 465130-01-01 Loader - Data Portable, ARINC 615, 3.5 Inch Diskette (alternative) Litton Systems Inc.
6101 Condor Drive, Moorpark, CA 93021-2602
(e) 964-0400-024 Loader - Data, Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Honeywell, Inc. (Vendor Code 97896)
15001 N.E. 36th St., P.O. Box 97001, Redmond WA 98073-9701
(f) 30100 Loader - Data, Portable, ARINC 615, 3.5 Inch Diskette (alternative)
Demo Systems Inc. (Vendor Code 0BAW0)
379 Science Dr., MoorPark, CA 93021
(g) 2231560-1-B Loader - Data Portable, ARINC 615, With two 3.5 Inch Diskette (alternative)
Teledyne Controls, 12333 W. Olympic Blvd., Los Angeles, CA 90064-1021
(h) YV68A110 Loader - Data, Portable, ARINC 615 (alternative)
SFIM (Vendor Code F6158)
SA 13 AV Marcel Ramofo Garmier, Massy, 91301 France
(i) 18000-02 Loader - Data, Portable, ARINC 615/A with Mass Storage Device (alternative)
Qualtair Equipment and Engineering (Vendor Code 1HEC2)
15720 Mill creek Boulevard, Suite 200, Mill creek, WA 98012
(j) 80000-03-01010203 Loader - Data, Portable, ARINC 615/A with Mass Storage Device (alternative)
Demo Systems, Inc. (Vendor Code 0BAW0)
379 Science Dr., MoorPark, CA 93021

D. Access
(1) Location Zones

211	Flight Compartment, Left
212	Flight Compartment, Right

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E. Procedure

S 862-110

(1) Do this task: Supply Electrical Power (AMM 24-22-00/201).

S 862-111

(2) Make sure these circuit breakers are open:
   (a) P11 Circuit Breaker Panel:
      1) 11F8, EFIS SYM GEN LEFT
      2) 11F9, EFIS SYM GEN CENTER
      3) 11F29, EFIS SYM GEN RIGHT

S 902-112

(3) Remove the EFIS symbol generator from its tray in the electronics bay (AMM 34-22-01/401).

S 902-113

(4) Put the tray adapter into the empty EFIS symbol generator tray.
   (a) Make sure the tray adapter is fully seated in the tray.

S 902-114

(5) Put the EFIS symbol generator into the tray adapter.
   (a) Make sure the EFIS symbol generator is fully seated in the tray adapter.

S 862-125

CAUTION: MAKE SURE THE POWER SWITCH FOR THE PORTABLE DATA LOADER (PDL) IS OFF. MAKE SURE THE CIRCUIT BREAKER FOR THE EFIS SIGNAL GENERATOR IS OPEN. THE POWER MUST BE OFF BEFORE YOU CONNECT OR REMOVE THE INTERFACE CABLE FOR THE PDL. DAMAGE TO EQUIPMENT CAN OCCUR.

(6) Set the power switch on the PDL to the off position.

S 472-126

(7) Connect the interface cable from the PDL to the tray adapter.

S 862-117

(8) Set the EFI instrument source select switch as follows:
   (a) To select the left EFIS symbol generator:
      1) Set the left EFI source select switch (located left of the left EFIS display) to the normal (out) position.

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(b) To select the right EFIS symbol generator:
1) Set the right EFI source select switch (located right of the right EFIS display) to the normal (out) position.
(c) To select the center EFIS symbol generator:
1) Set the left EFI source select switch (located left of the EFIS displays) to the alternate (in) position.

S 862-138
(9) Close the applicable EFIS symbol generator circuit breaker:
(a) P11 Circuit Breaker Panel:
1) 11F8, EFIS SYM GEN LEFT
2) 11F9, EFIS SYM GEN CENTER
3) 11F29, EFIS SYM GEN RIGHT

S 472-139
(10) SOFTWARE INSTALLATION WITH A PDL DISK DRIVE;
Do these steps to install the software:

NOTE: For more information on how to use the PDL, refer to the supplier's instructions for the PDL.

(a) Set the power switch on the PDL to the on position.
(b) Put the correct disk in the disk drive.
(c) Follow the prompts on the PDL to complete the installation.
(d) When the installation is complete, make sure the software part number that shows on the EHSI is the same part number that is on the disk.

NOTE: COMP, LOAD COMPLETE, and TRANSF COMPLETE are examples of data loader prompts for a completed installation.

(e) Remove the disk from the disk drive.

S 472-142
(11) SOFTWARE INSTALLATION WITH A PDL MASS STORAGE DEVICE;
Follow the PDL supplier instructions to install the software.
(a) When the installation is complete, make sure the software part number that shows on the EHSI is the same part number that you installed.

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S 862-140
(12) Set the power switch on the PDL to the off position.

S 862-141
(13) Do these steps to remove the PDL and re-install the EFIS symbol generator:
(a) Open the applicable circuit breaker and attach DO-NOT-CLOSE tags:
1) P11 Circuit Breaker Panel:
a) 11F8, EFIS SYM GEN LEFT
b) 11F9, EFIS SYM GEN CENTER
c) 11F29, EFIS SYM GEN RIGHT

CAUTION: MAKE SURE THE POWER SWITCH FOR THE PORTABLE DATA LOADER (PDL) IS OFF. MAKE SURE THE CIRCUIT BREAKER FOR THE EFIS SIGNAL GENERATOR IS OPEN. THE POWER MUST BE OFF BEFORE YOU CONNECT OR REMOVE THE INTERFACE CABLE FOR THE PDL. DAMAGE TO EQUIPMENT CAN OCCUR.

(b) Disconnect the PDL interface cable from the tray adapter.
(c) Remove the EFIS symbol generator from the tray adapter.
(d) Remove the tray adapter from the EFIS symbol generator tray.
(e) Install the EFIS symbol generator into the tray (AMM 34-22-01/401).

F. Put the airplane back to its usual condition.

S 862-118
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ELECTRONIC FLIGHT INSTRUMENT SYSTEM - ADJUSTMENT/TEST

1. General
   A. There are two tasks in this procedure. They are the operational and system tests for the electronic flight instrument system (EFIS).

      NOTE: In the operational and system tests, the EADI and EHSI displays will momentarily go out of view. This is not a failure condition.

   B. The acronyms that are used in the Electronic Flight Instrument System are as follows:

      ADC - Air Data Computer
      AFDS - Autopilot Flight Director System
      CDU - Control Display Unit
      DME - Distance Measuring Equipment
      EADI - Electronic Attitude Director Indicator
      EFIS - Electronic Flight Instrument System
      EHSI - Electronic Horizontal Situation Indicator
      EICAS - Engine Indication and Crew Alerting System
      FMC - Flight Management Computer
      ILS - Instrument Landing System
      IRMP - Inertial Reference Mode Panel
      MCDP - Maintenance Control Display Panel
      RA - Radio Altimeter
      VOR - Very High Frequency (VHF) Omnidirectional Range
      WXR - Weather Radar

TASK 34-22-00-705-001

2. Operational Test - Electronic Flight Instrument System (Fig. 501)
   A. General
      (1) The Electronic Flight Instrument System operational test is done to make sure that all of the components in the system operate correctly.
   B. References
      (1) AMM 24-22-00/201, Electrical Power - Control
      (2) AMM 34-21-00/201, Inertial Reference System

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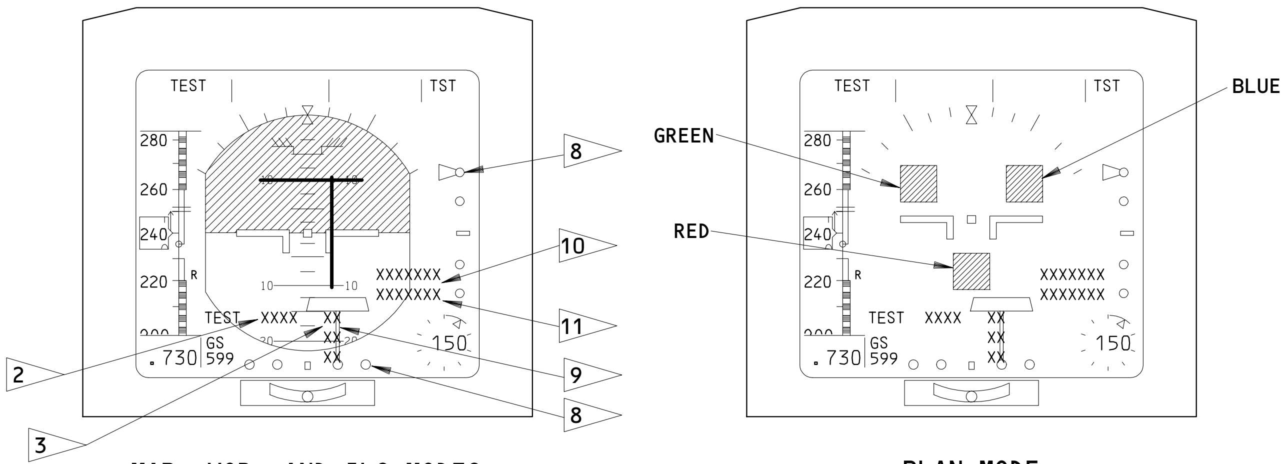

MAP, VOR, AND ILS MODES

PLAN MODE

EADI

THIS UNIT IS ELECTROSTATIC SENSITIVE

<u>NOTE</u>: SYMBOLOGY COLORS SAME AS FOR NORMAL OPERATION.

1 PRESENTATION IS SET BY THE STATE OF THE PROGRAM PIN AND/OR DIGITAL DISCRETE INPUT

2 TEST MESSAGE "OK" OR "FAIL"

3 FAILURE MESSAGE-CP (CONTROL PANEL); DU (DISPLAY UNIT); AND SG (SYMBOL GENERATOR)

4 NUMERIC VALUE SHOWS THE EFIS CONTROL PANEL RANGE SELECTION

5 SOFTWARE VERSION

6 SHOWS THE HSI MAP DATA SELECTED ON THE EFIS CONTROL PANEL

7 RED-YELLOW-GREEN WXR TEST PATTERN

8 THE G/S AND LOC SCALES AND POINTERS WILL NOT SHOW IF THE FREQUENCY ON THE ILS CONTROL PANEL IS IN THE "PK" POSITION

9 BAR FLASHES FOR ILS DEVIATION WARNING

10 PROGRAM PIN HEX CODES

11 ON AIRPLANES WITH -420 EFIS SYMBOL GENERATORS AND SUBSEQUENT, THERE ARE THREE HEX CODE LINES

12 AIRPLANES WITH -420 EFIS SYMBOL GENERATORS AND SUBSEQUENT; THE HARDWARE PART NUMBER IS ALSO SHOWN

EFIS Test Patterns
Figure 501 (Sheet 1)

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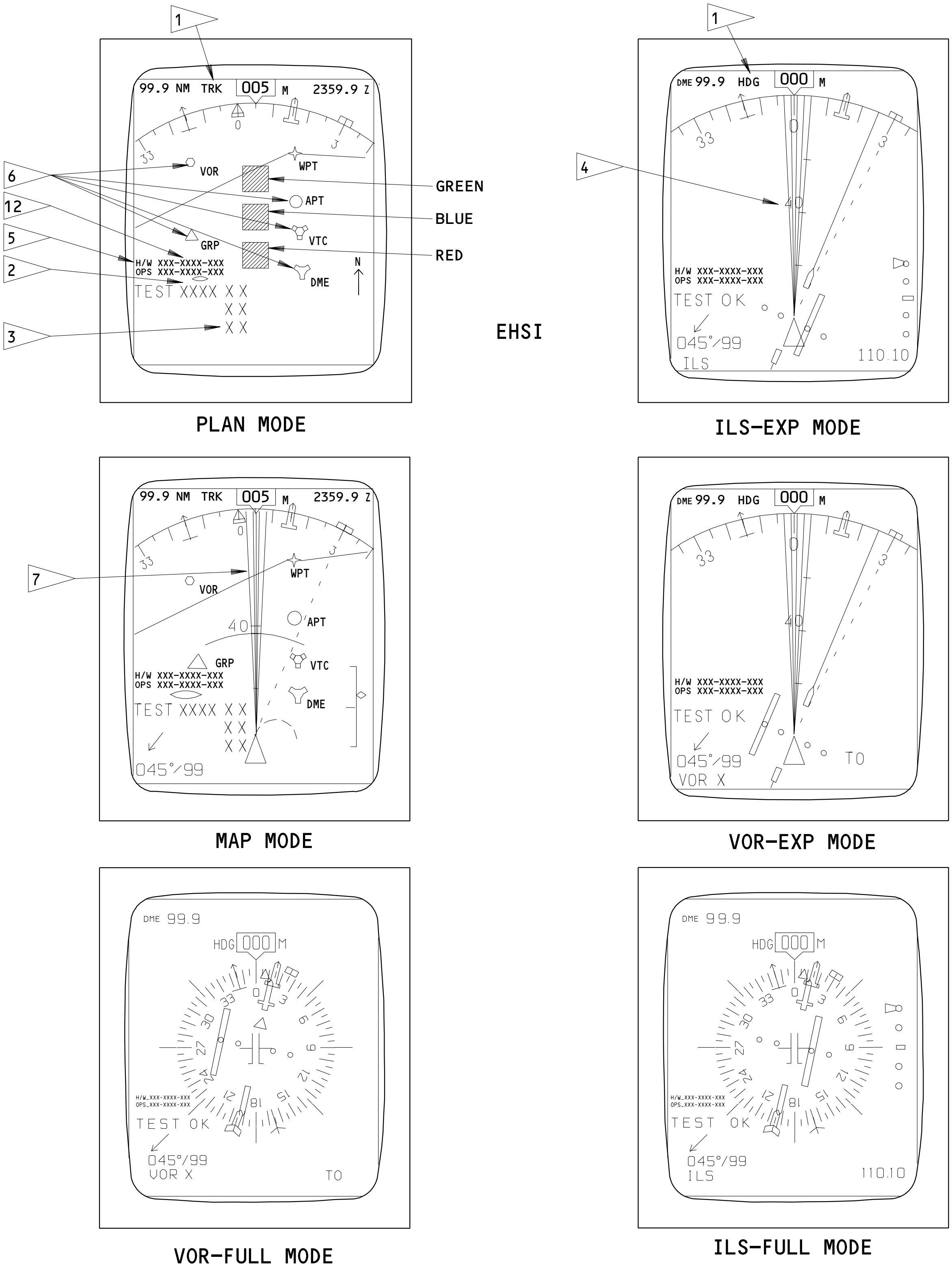

THIS UNIT IS ELECTROSTATIC SENSITIVE

EFIS Test Patterns
Figure 501 (Sheet 2)

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C. Access
   (1) Location Zones
       211/212 Flight Compartment

D. Prepare for Test

   S 865-002
   (1) Supply electrical power (AMM 24-22-00/201).

   S 865-003
   (2) On the left and right EFIS control panels, put the switches and controls in the positions indicated:
       (a) Range Select - 80 NM
       (b) HSI Mode Select - EXP VOR
       (c) WXR Select - Off position
       (d) MAP NAVAID - ON (in)
       (e) MAP APRT - ON (in)
       (f) MAP RTE DATA - ON (in)
       (g) MAP WPT - ON (in)
       (h) ADI BRT - Equal distance between fully clockwise and fully counterclockwise
       (i) HSI BRT - Equal distance between fully clockwise and fully counterclockwise

   S 865-403
   (3) On the left and right instrument source select panels, put the switches in the positions indicated:
       (a) FLT DIR - L position (left panel)/R position (right panel)
       (b) NAV - FMC-L position (left panel)/FMC-R position (right panel)
       (c) EFI - NORM (out)
       (d) IRS - NORM (out)
       (e) AIR DATA - NORM (out)

   S 865-004
   (4) On the instrument panel P3, put the HDG REF switch in the NORM position.

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S 865-418
(5) On the AFDS mode control panel, set the two F/D switches to the OFF position.

S 865-008
(6) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
(a) 11A1, VOR/MKR L
(b) 11A2, ILS CENTER or C MMR
(c) 11A3, ADF R
(d) 11A7, EFIS DSPL SW L
(e) 11E3, ADI LEFT
(f) 11E4, EFIS CONT PNL LEFT
(g) 11E6, HSI LEFT
(h) 11E9, FMCS CMPTR LEFT
(i) 11E10, ILS LEFT or L MMR
(j) 11E11, DME LEFT
(k) 11E16, MODE CONT PNL L
(l) 11E17, FLT CONT CMPTR PWR L
(m) 11E20, FLT CONT CMPTR PWR C
(n) 11E21, FLT CONT CMPTR SERVO C
(o) 11E24, ADI RIGHT
(p) 11E25, EFIS CONT PNL RIGHT
(q) 11E27, HSI RIGHT
(r) 11E30, FMCS CMPTR RIGHT
(s) 11E31, ILS RIGHT or R MMR
(t) 11E32, DME RIGHT
(u) 11E33, VOR RIGHT
(v) 11E34, MODE CONT PNL R
(w) 11E35, FLT CONT CMPTR PWR R
(x) 11F1, IRS LEFT
(y) 11F2, WX RADAR LEFT
(z) 11F5, RAD ALTM LEFT
(aa) 11F6, ADF LEFT
(ab) 11F8, EFIS SYM GEN L
(ac) 11F9, EFIS SYM GEN C
(ad) 11F15, TMC DC
(ae) 11F20, RAD ALTM CENTER
(af) 11F21, IRS CENTER
(ag) 11F22, IRS RIGHT
(ah) 11F23, WX RADAR RIGHT
(ai) 11F24, EFIS DSPL SW RIGHT
(aj) 11F26, RAD ALTM RIGHT
(ak) 11F29, EFIS SYM GEN RIGHT

S 865-009
(7) On the IRMP, put the left, center and right mode switches in the OFF position.

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S 865-010
(8) Make sure that these P11 panel circuit breakers are closed:
(a) 11F14, TMC AC
(b) 11F16, TMC SERVO
(c) 11U15, AIR/GND SYS 1

S 865-011
(9) Open these circuit breakers on the main power distribution panel, P6, and attach DO-NOT-CLOSE tags:
(a) 6D3, IRS L
(b) 6D4, IRS C
(c) 6D5, IRS R

E. Left and Right EFIS Test

S 865-014
(1) On the left and right EFIS control panels, make sure that the NAVAID, APRT, RTE DATA, and WPT switch-lights are on.

S 865-013
(2) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11A2, ILS CENTER or C MMR
(b) 11E4, EFIS CONT PNL LEFT
(c) 11E10, ILS LEFT or L MMR
(d) 11E25, EFIS CONT PNL RIGHT
(e) 11E31, ILS RIGHT or R MMR

S 865-016
(3) On the left and right EFIS control panels, make sure that the NAVAID, APRT, RTE DATA, and WPT switch-lights stay on.

S 865-015
(4) On the ILS control panel, set the frequency to 110.10.

S 865-594
(5) On the left and right EFIS control panels, set the DH REF control to 50.

S 865-017
(6) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11A7, EFIS DSPL SW L
(b) 11E3, ADI LEFT
(c) 11E6, HSI LEFT
(d) 11E24, ADI RIGHT
(e) 11E27, HSI RIGHT

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(f) 11F8, EFIS SYM GEN L
(g) 11F9, EFIS SYM GEN C
(h) 11F24, EFIS DSPL SW RIGHT
(i) 11F29, EFIS SYM GEN RIGHT

S 865-018
(7) On the left, center, and right EFIS symbol generators, momentarily push the RESET switch.

S 865-019
(8) Permit 30 seconds for the EFIS to become warm.

S 745-485
(9) Push and hold the TEST switch on the overhead light control panel, P5, to start an EFIS self-test.

S 755-023
(10) On the two EADIs, make sure that the displays are equivalent to the EADI VOR mode in Fig. 501.
(a) Make sure that the TEST OK indication shows in the lower left position of the display.
(b) Make sure that the EFIS program pin hex codes that follow show in the lower right position of the EADI display:

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Airplanes	Upper Code	Middle Code	Lower Code
SAS WITH -413 OR -414 SG			
SAS SAS (ALL)	02101F0	N/A	840C200
SAS MTH (ALL)	02101F0	N/A	840C200
SAS WITH -420 SG AND ON			
SAS 050-156, 162-166	02101F0	840C200	0000000
SAS 157-161, 167-274	02101F0	840C200	2000000
MTH 275-278	02101F0	840C200	0000000
MTH 279-999	02101F0	840C200	2000000
SAS WITH -420 SG AND ON AND WITH MTO-340934			
SAS SAS 050-156, 162-166	02101F0	840C200	2000000
SAS MTH 275-278	02101F0	840C200	2000000

S 865-021

(11) On the left and right EFIS control panels, put the WXR switch in the on position.

S 755-679

(12) On the two EHSIs, make sure that the displays are equivalent to the EHSI EXP-VOR mode in Fig. 501.
- (a) Make sure that the TEST OK message shows in the lower left position of the displays.
- (b) Make sure that the VOR L (left EHSI) and VOR R (right EHSI) messages show in the lower left position.
- (c) Make sure that the weather radar line segments show in the center position.
- (d) Make sure that the wind bearing and wind speed information shows in the lower left position.

S 745-033

(13) Release the TEST switch to stop the EFIS self-test.

F. Center EFIS Symbol Generator Test

S 865-025

(1) Make sure that these P11 panel circuit breakers are closed:
- (a) 11A7, EFIS DSPL SW L
- (b) 11E3, ADI LEFT
- (c) 11E4, EFIS CONT PNL LEFT
- (d) 11E6, HSI LEFT

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(e) 11E24, ADI RIGHT
(f) 11E25, EFIS CONT PNL RIGHT
(g) 11E27, HSI RIGHT
(h) 11F8, EFIS SYM GEN L
(i) 11F9, EFIS SYM GEN C
(j) 11F24, EFIS DSPL SW RIGHT
(k) 11F29, EFIS SYM GEN RIGHT

S 865-026

(2) On the right EFIS control panel, put the switches and controls in the positions indicated:
(a) Range Select - 80 NM
(b) HSI Mode Select - MAP
(c) WXR Select - ON (in)
(d) Map Mode Select Switches (4) - ON (in)
(e) ADI BRT and HSI BRT - Fully clockwise.

S 745-036

(3) Push and hold the TEST switch on the overhead light control panel, P5, to start an EFIS self-test.
(a) Make sure that the test pattern shows on the right EADI and EHSI (Fig. 501-MAP mode).
(b) Make sure that the EHSI test pattern has an indicated range of 40 NM on the 2nd concentric ring band.

S 745-037

(4) Release the TEST switch to stop the EFIS self-test.

S 865-029

(5) Open this P11 panel circuit breaker:
(a) 11F29, EFIS SYM GEN RIGHT

S 755-039

(6) Make sure that the right EADI and EHSI displays do not show data.

S 865-486

(7) Put the right EFI instrument source select switch in the ALTN position.

S 745-041

(8) Push and hold the TEST switch on the overhead light control panel, P5, to start an EFIS self-test.
(a) Make sure that the test pattern shows on the right EADI and EHSI (Fig. 501).
(b) Make sure that the EHSI is in the MAP mode and has an indicated range of 80 NM.

S 745-042

(9) Release the TEST switch to stop the EFIS self-test.

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S 865-034
(10) Close this P11 panel circuit breaker:
(a) 11F29, EFIS SYM GEN RIGHT

S 865-A19
(11) Put the right EFI instrument source select switch in the NORM position.

S 755-045
(12) Make sure that the right EADI and EHSI displays show data.

S 865-036
(13) On the right EFIS control panel, put the switches and controls in the positions indicated:
(a) HSI Mode Select - EXP VOR
(b) WXR Select - Off position
(c) ADI BRT - Equal distance between fully clockwise and fully counterclockwise
(d) HSI BRT - Equal distance between fully clockwise and fully counterclockwise

S 865-037
(14) On the left and right instrument source select panels, put the switches in the positions indicated:
(a) FLT DIR - L position (left panel)/R position (right panel)
(b) NAV - FMC-L position (left panel)/FMC-R position (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)

S 865-038
(15) Momentarily push the RESET switch on the center EFIS symbol generator.

S 865-039
(16) On the right instrument source select panel, put the EFI switch in the ALTN position.

S 745-050
(17) On the center EFIS symbol generator, push and hold the TEST button.

S 755-051
(18) On the right EADI, make sure that the display is equivalent to the EADI VOR mode in Fig. 501.
(a) Make sure that the TEST OK indication shows in the lower left position of the display.

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(b) Make sure that the EFIS program pin hex codes that follow show in the lower right position of the EADI display:

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	Airplanes	Upper Code	Middle Code	Lower Code
SAS SAS	WITH -413 OR -414 SG			
SAS	SAS (ALL)	02101F0	N/A	840C200
SAS	MTH (ALL)	02101F0	N/A	840C200
SAS SAS	WITH -420 SG AND ON			
	SAS 050-156, 162-166	02101F0	840C200	0000000
	SAS 157-161, 167-274	02101F0	840C200	2000000
	MTH 275-278	02101F0	840C200	0000000
	MTH 279-999	02101F0	840C200	2000000
SAS SAS SAS	WITH -420 SG AND ON AND WITH MTO-340934			
SAS SAS	SAS 050-156, 162-166	02101F0	840C200	2000000
SAS	MTH 275-278	02101F0	840C200	2000000

S 865-042

(19) On the right EFIS control panel, set the DH REF to 40.
- (a) Make sure that DH 40 shows on the right side of the display.

S 865-043

(20) On the right EFIS control panel, put the WXR select switch in the on (illuminated) position.

S 755-589

(21) On the right EHSI, make sure that the display is equivalent to the EHSI EXP-VOR mode in Fig. 501.
- (a) Make sure that the TEST OK message shows in the lower left position of the display.
- (b) Make sure that the VOR R message shows in the lower left position.
- (c) Make sure that the weather radar line segments show in the center of the display.
- (d) Make sure that the wind bearing and wind speed information shows in the lower left position.

S 745-063

(22) Release the TEST switch on the center EFIS symbol generator.

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S 865-047

(23) On the right EFIS control panel, put the mode select switch in the MAP position.
   (a) Make sure that yellow VTK flag shows on the right EHSI display.

S 865-048

(24) On the left instrument source select panel, put the EFI switch in the ALTN position.
   (a) Make sure that a yellow VOR flag shows on the right EHSI display.

S 865-049

(25) Open this P11 panel circuit breaker:
   (a) 11A7, EFIS DSPL SW L

S 755-067

(26) Make sure that the left EHSI and EADI displays do not show data.

S 865-051

(27) Open this P11 panel circuit breaker:
   (a) 11F24, EFIS DSPL SW RIGHT

S 755-069

(28) Make sure that the right EADI and EHSI displays do not show data.

G. EFIS Manual Brightness Control Test

S 865-054

(1) On the left and right EFIS control panels, make sure that the switches and controls are in the positions indicated:
   (a) Range Select - 80 NM
   (b) HSI Mode Select - EXP VOR
   (c) WXR Select - Off position
   (d) MAP NAVAID - ON (in)
   (e) MAP APRT - ON (in)
   (f) MAP RTE DATA - ON (in)
   (g) MAP WPT - ON (in)
   (h) ADI BRT - Equal distance between fully clockwise and fully counterclockwise
   (i) HSI BRT - Equal distance between fully clockwise and fully counterclockwise

S 865-055

(2) On the left and right instrument source select panels, make sure that the switches are in the positions indicated:
   (a) FLT DIR - L position (left panel)/R position (right panel)

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(b) NAV - FMC-L position (left panel)/FMC-R position (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)
(e) AIR DATA - NORM (out)

S 865-056
(3) Close these P11 panel circuit breakers:
(a) 11A7, EFIS DSPL SW L
(b) 11F24, EFIS DSPL SW RIGHT

S 745-074
(4) Push and hold the test switch on the overhead light control panel, P5, to start an EFIS self-test.

S 755-591
(5) On the two EADIs, make sure that the displays are equivalent to the EADI VOR mode in Fig. 501.

S 755-593
(6) On the two EHSIs, make sure that the displays are equivalent to the EHSI VOR-EXP mode in Fig. 501.

NOTE: The weather radar test lines will not show.

S 865-060
(7) On the left and right EFIS control panels, do the steps that follow:
(a) Turn the ADI BRT controls fully clockwise.
1) Make sure that the two EADI displays become brighter.
(b) Turn the ADI BRT controls fully counterclockwise.
1) Make sure that the two EADI displays become dimmer.
(c) Put the ADI BRT controls an equal distance between fully clockwise and fully counterclockwise.
(d) Turn the HSI BRT controls fully clockwise.
1) Make sure that the two EHSI displays become brighter.
(e) Turn the HSI BRT controls fully counterclockwise.
1) Make sure that the two EHSI displays become dimmer.
(f) Put the HSI BRT controls an equal distance between fully clockwise and fully counterclockwise.
(g) Put the two WXR switches in the on position.
1) Make sure that the two EHSI displays show the weather radar test lines.
(h) Turn the inner HSI BRT controls fully clockwise.
1) Make sure that the weather radar test lines become brighter.
(i) Turn the inner HSI BRT controls fully counterclockwise.
1) Make sure that the weather radar test lines become dimmer.

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(j) Put the HSI BRT controls an equal distance between fully clockwise and fully counterclockwise.
(k) Put the two WXR switches in the off position.

S 745-085
(8) Release the TEST switch to stop the EFIS self-test.

H. EFIS Automatic Brightness Control Test

S 745-086
(1) Push and hold the test switch on the overhead light control panel, P5, to start an EFIS self-test.

S 955-062
(2) On the glareshield, put tape on the left EFIS remote light sensor.
(a) Make sure that the left EADI and EHSI displays become dimmer.

S 955-063
(3) On the left EHSI, put tape on the local light sensor.

NOTE: The EHSI light sensor is on the lower right position of the metal bezel.

S 865-836
(4) Point a light source at the left EADI light sensor.

NOTE: The EADI light sensor is on the lower left position of the metal bezel.

(a) Make sure that the left EADI and EHSI displays become brighter.

S 955-407
(5) Remove the tape from the left EHSI light sensor.

S 955-064
(6) Put tape on the left EADI light sensor.

S 865-065
(7) Point a light source at the left EHSI light sensor.
(a) Make sure that the left EADI and EHSI displays become brighter.

S 955-066
(8) Remove the tape from the left EADI light sensor.

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S 955-067
(9) Remove the tape from the remote light sensor.

S 745-095
(10) Release the TEST switch to stop the EFIS self-test.

S 735-069
(11) Use the right light sensors to do a test of the right system.

S 865-070
(12) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11A1, VOR/MKR L
(b) 11A3, ADF R
(c) 11E11, DME LEFT
(d) 11E16, MODE CONT PNL L
(e) 11E17, FLT CONT CMPTR PWR L
(f) 11E30, FMCS CMPTR RIGHT
(g) 11E32, DME RIGHT
(h) 11E33, VOR RIGHT
(i) 11E34, MODE CONT PNL R
(j) 11E35, FLT CONT CMPTR PWR R
(k) 11F1, IRS LEFT
(l) 11F2, WX RADAR LEFT
(m) 11F5, RAD ALTM LEFT
(n) 11F6, ADF LEFT
(o) 11F15, TMC DC
(p) 11F20, RAD ALTM CENTER
(q) 11F21, IRS CENTER
(r) 11F22, IRS RIGHT
(s) 11F23, WX RADAR RIGHT
(t) 11F26, RAD ALTM RIGHT

S 865-071
(13) Remove the DO-NOT-CLOSE tags and close these P6 panel circuit breakers:
(a) 6D3, IRS L
(b) 6D4, IRS C

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(c) 6D5, IRS R

I. Instrument Source Select Switching Test

S 865-072

(1) Make sure that these P11 panel circuit breakers are open:
  (a) 11E9, FMCS CMPTR LEFT
  (b) 11E20, FLT CONT CMPTR PWR C
  (c) 11E21, FLT CONT CMPTR SERVO C

S 865-073

(2) Make sure that these P11 panel circuit breakers are closed:
  (a) EICAS (6 places)

S 865-074

CAUTION: DO NOT OPEN THE AIR DATA CMPTR RIGHT CIRCUIT BREAKER WITH THE PITOT-STATIC SYSTEM PRESSURIZED. THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(3) Open this P11 panel circuit breaker:
  (a) 11F30, AIR DATA CMPTR RIGHT

S 865-076

(4) On the left and right EFIS control panels, put the HSI MODE switch in the MAP position.

S 865-077

(5) On the AFDS mode control panel, set the two F/D switches to the ON position.

S 865-078

(6) On the IRMP, set the left and right mode switches to the NAV position (AMM 34-21-00/201).

NOTE: Make sure you permit time for the IRUs to align.

S 865-079

(7) On the IRMP, set the center mode switch to the OFF position.

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S 865-408
(8) Put the left and right instrument source select switches and controls in the positions that follow:

NOTE: Make sure that the non-rotary switches are illuminated when they are in the ALTN position.

(a) FLT DIR - L position (left panel)/R position (right panel)
(b) NAV - FMC-L (left panel)/FMC-R (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)
(e) AIR DATA - NORM (out)

S 755-107
(9) Make sure that these displays have the indications that follow while in the MAP mode.
(a) Look at the left and right EADIs.
1) Make sure that the flight director mode annunciation, FD, shows on the right side.
(b) Look at the left EHSI:
1) Make sure that the top left and right positions are blank.
(c) Look at the right EHSI:
1) Make sure that three horizontal lines and the letters NM show in the top left position.
2) Make sure that six horizontal lines and the letter Z show in the top right position.
(d) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH does not show.
(e) Look at the left altimeter and EADI airspeed tape.
1) Make sure that the failure flags do not show.
(f) Look at the right altimeter and EADI airspeed tape.
1) Make sure that the failure flags show.

S 865-081
(10) Put the left FLT DIR switch in the C position.

NOTE: In the steps that follow, only the display changes that are necessary to make sure of correct switch operation are given.

(a) Look at the left EADI.
1) Make sure that the FD annunciation goes out of view.

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2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag shows.

S 865-082

(11) Put the right FLT DIR switch in the C position.
(a) Look at the right EADI.
1) Make sure that the FD annunciation goes out of view.
2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag shows.

S 865-083

(12) Put the left FLT DIR switch in the R position.
(a) Look at the left EADI.
1) Make sure that the FD annunciation shows.
2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag does not show.

S 865-084

(13) Put the right FLT DIR switch in the L position.
(a) Look at the right EADI.
1) Make sure that the FD annunciation shows.
2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag does not show.

S 865-085

(14) Put the left FLT DIR switch in the L position.

S 865-086

(15) Put the right FLT DIR switch in the R position.

S 865-090

(16) Put the left NAV switch in the FMC-R position.

S 865-096

(17) Put the right NAV switch in the FMC-L position.

S 755-659

(18) Look at the left EHSI.
(a) Make sure the MAP failure flag does not show.

S 755-660

(19) Look at the right EHSI.
(a) Make sure that the MAP failure flag shows.

S 865-099

(20) Remove the DO-NOT-CLOSE tag and close this P11 panel circuit breaker:
(a) 11E9, FMCS CMPTR LEFT

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S 865-103
(21) Put the left NAV switch to FMC-L and the right NAV switch to FMC-R.

S 755-664
(22) Look at the left and right EHSIs.
(a) Make sure that the MAP failure flags do not show.

S 865-106
(23) On the left EFIS control panel, put the HSI MODE control in the PLAN position.
(a) Look at the left EHSI.
1) Make sure that the PLAN mode shows.

S 865-107
(24) Put the left and right EFI switches in the ALTN position.
(a) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH shows.
(b) Look at the left and right EHSIs.
1) Make sure that the PLAN mode shows.

S 865-832
(25) Put the right EFI switch in the NORM position.
(a) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH does not show.
(b) Look at the right EHSI.
1) Make sure that the MAP mode shows.

S 865-833
(26) Put the right EFI switch in the ALTN position.
(a) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH shows.
(b) Look at the right EHSI.
1) Make sure that the PLAN mode shows.

S 865-834
(27) Put the left EFI switch in the NORM position.
(a) Look at the EICAS.
1) Make sure that the message INSTR SWITCH does not show.
(b) Look at the right EHSI.
1) Make sure that the MAP mode shows.

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S 865-111
(28) Put the right EFI switch in the NORM position.
(a) Make sure that there are no display changes.

S 865-112
(29) On the left EFIS control panel, put the HSI MODE control in the MAP position.
(a) Look at the left EHSI.
1) Make sure that the MAP mode shows.

S 865-547
(30) Put the left and right IRS switches in the ALTN position.
(a) Look at the left and right EADIs.
1) Make sure that the ATT flags show.

S 865-113
(31) Put the left IRS switch in the NORM position.
(a) Look at the left EADI.
1) Make sure that the ATT flag goes out of view.

S 865-114
(32) Put the right IRS switch in the NORM position.
(a) Look at the right EADI.
1) Make sure that the ATT flag goes out of view.

S 865-848
(33) On the IRMP, set the left and right mode switches to the OFF position.

S 865-116
(34) On the IRMP, set the center mode switch to the ATT position.
(a) Look at the left and right EADIs.
1) Make sure that the ATT flag shows.

S 865-117
(35) Put the left IRS switch in the ALTN position.
(a) Look at the left EADI.
1) Make sure that the ATT flag goes out of view.

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S 865-118
(36) Put the left IRS switch in the NORM position.

S 865-119
(37) Put the right IRS switch in the ALTN position.
(a) Look at the right EADI.
1) Make sure that the ATT flag goes out of view.

S 865-120
(38) Put the right IRS switch in the NORM position.

S 865-121
(39) Set the left AIR DATA switch to the ALTN position.
(a) Look at the left altimeter.
1) Make sure that the failure flag shows.
(b) Look at the left EADI.
1) Make sure that the SPD flag shows.

S 865-122
(40) Set the right AIR DATA switch to the ALTN position.
(a) Look at the right altimeter.
1) Make sure that the failure flag does not show.
(b) Look at the right EADI.
1) Make sure that the SPD flag does not show.

S 865-123
(41) Set the left and right AIR DATA switches to the NORM position.
(a) Look at the left altimeter.
1) Make sure that the failure flag does not show.
(b) Look at the left EADI.
1) Make sure that the SPD flag does not show.
(c) Look at the right altimeter.
1) Make sure that the failure flag shows.
(d) Look at the right EADI.
1) Make sure that the SPD flag shows.

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J. Put the Airplane Back to Its Usual Condition

S 865-124

(1) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
  (a) 11E20, FLT CONT CMPTR PWR C
  (b) 11E21, FLT CONT CMPTR SERVO C
  (c) 11F30, AIR DATA CMPTR RIGHT

S 865-125

(2) On the IRMP, set the center mode switch to the OFF position.

S 865-425

(3) On the AFDS mode control panel, set the two F/D switches to the OFF position.

S 865-126

(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-22-00-735-127

3. <u>System Test - Electronic Flight Instrument System</u> (Fig. 501)

A. General
  (1) The Electronic Flight Instrument System system test is done to make sure that all of the system components and the interface systems operate correctly.

  <u>NOTE</u>: The Electronic Flight Instrument System operational test must be done before the system test to make sure of the correct operation of the components.

B. Equipment
  (1) Radio Altimeter Ramp Test Set - TRT 9599-607-15902

C. References
  (1) AMM 22-00-02/201, Autoflight Bite
  (2) AMM 24-22-00/201, Electrical Power - Control
  (3) AMM 32-09-02/201, Air/Ground Relays

D. Access
  (1) Location Zones
    211/212 Flight Compartment

E. Prepare for Test

S 865-128

(1) Supply electrical power (AMM 24-22-00/201).

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S 715-129
(2) Do the Electronic Flight Instrument System - Operational Test.

S 865-130
(3) On the left and right EFIS control panels, put the switches and controls in the positions indicated:
(a) Range Select 80 - NM
(b) HSI Mode Select - EXP VOR
(c) WXR Select - Off position
(d) MAP NAVAID - ON (in)
(e) MAP APRT - ON (in)
(f) MAP RTE DATA - ON (in)
(g) MAP WPT - ON (in)
(h) ADI BRT - Equal distance between fully clockwise and fully counterclockwise.
(i) HSI BRT - Equal distance between fully clockwise and fully counterclockwise.

S 865-131
(4) On the left and right instrument source select panels, put the switches and controls in the positions indicated:
(a) FLT DIR - L position (left panel)/R position (right panel)
(b) NAV - FMC-L position (left panel)/FMC-R position (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)
(e) AIR DATA - NORM (out)

F. Right EFIS System Test

S 865-132
(1) Open these P11 panel circuit breakers:
(a) 11A3, ADF R
(b) 11A11, NAVIGATION AIR DATA AOA SENSOR LEFT
(c) 11A12, NAVIGATION AIR DATA BARO CORRECT LEFT
(d) 11B18, WARN ELEX B
(e) 11E10, ILS LEFT or L MMR
(f) 11E16, MODE CONT PNL L
(g) 11E17, FLT CONT CMPTR PWR L
(h) 11E20, FLT CONT CMPTR PWR C
(i) 11E29, FMCS CDU RIGHT
(j) 11E30, FMCS CMPTR RIGHT

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(k) 11E31, ILS RIGHT or R MMR
(l) 11E32, DME RIGHT
(m) 11E33, VOR RIGHT
(n) 11E34, MODE CONT PNL R
(o) 11E35, FLT CONT CMPTR PWR R
(p) 11F2, WXR RADAR LEFT
(q) 11F6, ADF LEFT
(r) 11F22, IRS RIGHT
(s) 11F23, WXR RADAR RIGHT
(t) 11F24, EFIS DSPL SW RIGHT
(u) 11F26, RAD ALTM RIGHT
(v) 11F31, NAVIGATION AIR DATA AOA SENSOR RIGHT
(w) 11F32, NAVIGATION AIR DATA BARO CORRECT RIGHT
(x) 11J34, WARN ELEX A

S 865-133
(2) Open this P6 panel circuit breaker:
(a) 6D5, IRS R

S 865-134
(3) Permit 30 seconds for the system to become warm.

S 755-190
(4) Look at the right EADI.
(a) Make sure that a yellow RA flag shows.

S 755-191
(5) Look at the right EHSI.
(a) Make sure that a yellow VOR flag shows.
(b) Make sure that a green VOR R message shows on the lower left side.
(c) Make sure that yellow ADF L and ADF R flags show.

S 865-137
(6) Close this P11 panel circuit breaker:
(a) 11F26, RAD ALTM RIGHT

S 755-193
(7) Look at the right EADI.
(a) Make sure that the yellow RA flag is replaced with an RA value.

S 865-139
(8) Close this P11 panel circuit breaker:
(a) 11E33, VOR RIGHT

S 755-195
(9) Look at the right EHSI.
(a) Make sure that the yellow VOR flag is replaced with a white, four-point scale.

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S 865-141
(10) Close this P11 panel circuit breaker:
(a) 11E32, DME RIGHT

S 755-198
(11) Look at the right EHSI.
(a) Make sure that three white lines and the letters DME show in the top left position.

S 865-144
(12) On the ILS control panel, set the frequency to 110.10.

S 865-145
(13) Close this P11 panel circuit breaker:
(a) 11E31, ILS RIGHT or R MMR

S 755-201
(14) Look at the right EADI.
(a) Make sure that the white, four-point localizer and glideslope scales show.

S 865-147
(15) On the ILS control panel, set the frequency to the PARK position (-----).

S 755-203
(16) Look at the right EADI.
(a) Make sure that the scales go out of view.

S 865-149
(17) On the ILS control panel, set the frequency to 110.10.

S 755-205
(18) Look at the right EADI.
(a) Make sure that the scales come into view.

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S 865-151
(19) Open this P11 panel circuit breaker and attach a DO-NOT-CLOSE tag:
(a) 11F26, RAD ALTM RIGHT

S 485-152
(20) Connect the RA test set to the test connector on the front of the right RA transceiver.

S 865-153
(21) Remove the DO-NOT-CLOSE tag and close this P11 panel circuit breaker:
(a) 11F26, RAD ALTM RIGHT

S 865-154
(22) On the RA test set, set the controls as indicated:
(a) RA data value - 3000 ft.
(b) RA data sign status matrix bits - normal operation

S 865-155
(23) Slowly decrease the RA data value to 2000 ft.

S 755-217
(24) Look at the right EADI.
(a) Make sure that the letters ALT come into view at the test set altitude of 2500 feet.

S 865-414
(25) Open this P11 panel circuit breaker and attach a DO-NOT-CLOSE tag:
(a) 11F26, RAD ALTM RIGHT

S 085-158
(26) Disconnect the RA test set.

S 865-159
(27) Remove the DO-NOT-CLOSE tag and close this P11 panel circuit breaker:
(a) 11F26, RAD ALTM RIGHT

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S 865-A92
(28) Close these P11 panel circuit breakers:
(a) 11F30, NAVIGATION AIR DATA CMPTR RIGHT
(b) 11A11, NAVIGATION AIR DATA AOA SENSOR LEFT
(c) 11F31, NAVIGATION AIR DATA AOA SENSOR RIGHT
(d) 11A12, NAVIGATION AIR DATA BARO CORRECT LEFT
(e) 11F32, NAVIGATION AIR DATA BARO CORRECT RIGHT

S 755-673
(29) Look at the right EADI.
(a) Make sure that airspeed tape replaces the yellow SPD flag.

S 865-162
(30) Close this P11 panel circuit breaker:
(a) 11F22, IRS RIGHT

S 865-163
(31) Close this P6 panel circuit breaker:
(a) 6D5, IRS R

S 865-164
(32) On the IRMP, set the right mode control to the ALIGN position.

S 755-231
(33) Look at the right EADI.
(a) Make sure that the yellow ATT flag does not show.

S 865-166
(34) Close these P11 panel circuit breakers:
(a) 11E29, FMCS CDU RIGHT
(b) 11E30, FMCS CMPTR RIGHT

S 865-167
(35) On the right EFIS control panel, set the HSI MODE control to the MAP position.

S 755-234
(36) Look at the right EHSI.
(a) Make sure that the letters DME are replaced with the letters NM.

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S 865-169
(37) On the AFDS mode control panel, make sure the two F/D switches are in the OFF position.

S 865-487
(38) Open this P11 panel circuit breaker:
(a) 11F15, TMC DC

S 865-488
(39) Close these P11 panel circuit breakers:
(a) 11E34, MODE CONT PNL R
(b) 11E35, FLT CONT CMPTR PWR R

S 865-170
(40) On the AFDS mode control panel, set the right F/D switch to the ON position.

S 865-171
(41) On the right instrument source select panel, turn the FLT DIR switch to the C, L, and back to the R position.

NOTE: Stop for approximately five seconds at the C and L positions.

S 755-240
(42) Look at the right EADI.
(a) Make sure that the letters FD show in the R position only.

S 865-415
(43) Close the P11 panel circuit breaker that follows:
(a) 11A3, ADF R

S 755-242
(44) Look at the right EHSI.
(a) Make sure that the ADF R flag goes out of view.

S 865-174
(45) Close this P11 panel circuit breaker:
(a) 11F6, ADF LEFT

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S 755-244
(46) Look at the right EHSI.
(a) Make sure that the ADF L flag goes out of view.

S 865-593
(47) Close these P11 panel circuit breakers:
(a) 11B18, WARN ELEX B
(b) 11F24, EFIS DSPL SW RIGHT
(c) 11J34, WARN ELEX A

S 865-183
(48) On the IRMP, set the right and center controls to the ATT position.

S 865-184
(49) On the P61 miscellaneous test panel, momentarily set the Stall Warning Computer test switch to the STALL-R position.

S 755-265
(50) Look at the right EADI.
(a) Make sure that the pitch limit indicator shows at the ten degree line while the switch is held.

S 865-186
(51) On the right instrument source select panel, set the EFI switch to the ALTN position.

S 865-187
(52) On the P61 miscellaneous test panel, momentarily set the Stall Warning Computer test switch to the STALL-R position.

S 755-268
(53) Look at the right EADI.
(a) Make sure that the pitch limit indicator shows at the ten degree line while the switch is held.

S 865-189
(54) On the right instrument source select panel, set the EFI switch to the NORM position.

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S 865-190
(55) On the IRMP, set the right and center controls to the OFF position.

S 865-835
(56) On the AFDS mode control panel, set the right F/D switch to the OFF position.

G. Left EFIS System Test

S 865-191
(1) Open these P11 panel circuit breakers:
(a) 11E29, FMCS CDU RIGHT
(b) 11E30, FMCS CMPTR RIGHT
(c) 11E31, ILS RIGHT or R MMR
(d) 11E32, DME RIGHT
(e) 11E33, VOR RIGHT
(f) 11E34, MODE CONT PNL R
(g) 11E35, FLT CONT CMPTR PWR R
(h) 11F22, IRS RIGHT
(i) 11F26, RAD ALTM RIGHT

S 865-192
(2) Open this P6 panel circuit breaker:
(a) 6D5, IRS R

S 865-193
(3) On the left and right EFIS control panels, put the switches and controls in the positions indicated:
(a) Range Select - 80 NM
(b) HSI Mode Select - EXP VOR
(c) WXR Select - Off position
(d) MAP NAVAID - ON (in)
(e) MAP APRT - ON (in)
(f) MAP RTE DATA - ON (in)
(g) MAP WPT - ON (in)
(h) ADI BRT - Equal distance between fully clockwise and fully counterclockwise.

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(i) HSI BRT - Equal distance between fully clockwise and fully counterclockwise.

S 865-194

(4) On the left and right instrument source select panels, put the switches and controls in the positions indicated:
(a) FLT DIR - L position (left panel)/R position (right panel)
(b) NAV - FMC-L (left panel)/FMC-R (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)
(e) AIR DATA - NORM (out)

S 865-489

(5) Open these P11 panel circuit breakers:
(a) 11A1, VOR/MKR L
(b) 11A7, EFIS DSPL SW L
(c) 11B18, WARN ELEX B
(d) 11E8, FMCS CDU LEFT
(e) 11E9, FMCS CMPTR LEFT
(f) 11E11, DME LEFT
(g) 11F1, IRS LEFT
(h) 11F5, RAD ALTM LEFT
(i) 11J34, WARN ELEX A

S 865-490

(6) Open this P6 panel circuit breaker:
(a) 6D3, IRS L

S 735-195

(7) Do again the Right EFIS System Test with the left (L) system displays, controls, circuit breakers, and switch positions in place of the right (R). Display areas are the same.

H. Center EFIS System Test

S 865-196

(1) On the left and right EFIS control panels, put the switches and controls in the positions indicated:
(a) Range Select - 80 NM
(b) HSI Mode Select - EXP VOR
(c) WXR Select - Off position
(d) MAP NAVAID - ON (in)
(e) MAP APRT - ON (in)

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(f) MAP RTE DATA - ON (in)
(g) MAP WPT - ON (in)
(h) ADI BRT - Equal distance between fully clockwise and fully counterclockwise.
(i) HSI BRT - Equal distance between fully clockwise and fully counterclockwise.

S 865-197
(2) On the left and right instrument source select panels, put the switches and controls in the positions indicated:
(a) FLT DIR - L position (left panel)/R position (right panel)
(b) NAV - FMC-L (left panel/FMC-R (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)
(e) AIR DATA - NORM (out)

S 865-202
(3) Close these P11 panel circuit breakers:
(a) 11E29, FMCS CDU RIGHT
(b) 11E31, ILS RIGHT or R MMR
(c) 11F24, EFIS DSPL SW RIGHT

S 865-203
(4) Permit 30 seconds for the system to become warm.

S 865-198
(5) On the IRMP, set the right mode control to the ALIGN position.

S 755-283
(6) Look at the right EHSI.
(a) Make sure that three white lines in a white rectangle replaces the yellow HDG flag.

S 865-200
(7) On the right instrument source select panel, set the EFI switch to the ALTN position.

S 755-285
(8) Look at the right EADI and EHSI.
(a) Make sure that the three white lines remain in the rectangle.

NOTE: The displays will momentarily go out of view when the switch is turned to ALTN.

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S 865-436
(9) On the AFDS mode control panel, make sure the two F/D switches are in the OFF position.

S 865-204
(10) Open these P11 panel circuit breakers:
 (a) 11E9, FMCS CMPTR LEFT
 (b) 11E17, FLT CONT CMPTR PWR L
 (c) 11F29, EFIS SYM GEN RIGHT

S 865-205
(11) Close these P11 panel circuit breakers:
 (a) 11A7, EFIS DSPL SW L
 (b) 11E30, FMCS CMPTR RIGHT
 (c) 11E32, DME RIGHT
 (d) 11E33, VOR RIGHT
 (e) 11E35, FLT CONT CMPTR PWR R

S 755-289
(12) Look at the right EADI.
 (a) Make sure that an RA value replaces the yellow RA flag.
 (b) Make sure that a four-point scale shows on the right side.
 (c) Make sure that speed tape shows on the left side.
 (d) Make sure that the letters FD do not show.

S 755-290
(13) Look at the right EHSI.
 (a) Make sure that the letters DME show.
 (b) Make sure that a four-point scale shows by the triangular airplane symbol.
 (c) Make sure that line segments show in the top center position.

S 865-208
(14) On the right EFIS control panel, set the HSI MODE control to the MAP position.

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S 755-292

(15) Look at the right EHSI.

(a) Make sure that six white lines and the letter Z show in the top right position.

S 865-212

(16) On the ILS control panel, set the frequency to PARK (-----).

S 755-294

(17) Look at the right EADI.

(a) Make sure that the glideslope and localizer scales go out of view.

S 865-214

(18) On the ILS control panel, set the frequency to 110.10.

(a) Look at the right EADI.

(b) Make sure that the glideslope and localizer scales come back in to view.

S 865-215

(19) On the EICAS control panel, set the COMPUTER control to the R position.

S 865-216

(20) On the left instrument source select panel, set the EFI switch to the ALTN position.

S 755-298

(21) Look at the EICAS.

(a) Make sure that the INSTR SWITCH message shows.

S 755-299

(22) Look at the right EADI and EHSI.

(a) Make sure that the displays are equivalent to the left EADI and EHSI displays.

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S 865-219
(23) On the EICAS control panel, set the COMPUTER control to the L position.

S 865-210
(24) Open these P11 panel circuit breakers:
(a) 11E33, VOR RIGHT
(b) 11F8, EFIS SYM GEN L

S 865-211
(25) Close this P11 panel circuit breaker:
(a) 11F26, RAD ALTM RIGHT

S 755-303
(26) Look at the left EHSI.
(a) Make sure that three white lines and the letters DME show in the top left position.
(b) Make sure that the white, four-point scale shows in the lower center position.

S 755-304
(27) Look at the EICAS.
(a) Make sure that the INSTR SWITCH message shows.

S 865-437
(28) Open this P11 panel circuit breaker and attach a DO-NOT-CLOSE tag:
(a) 11F20, RAD ALTM CENTER

S 485-222
(29) Connect the RA test set to the test connector on the front of the center RA transceiver.

S 865-223
(30) Remove the DO-NOT-CLOSE tag and close this P11 panel circuit breaker:
(a) 11F20, RAD ALTM CENTER

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S 865-224
(31) On the RA test set, set the controls as indicated:
(a) RA data value - 3000 ft
(b) RA sign status matrix bits - normal operation

S 865-225
(32) Slowly decrease the RA test set altitude to 2000 ft.

S 755-316
(33) Look at the left and right EADIs.
(a) Make sure that the ALT message shows when the RA test set is at 2500 feet.

S 865-228
(34) Open this P11 panel circuit breaker and a attach DO-NOT-CLOSE tag:
(a) 11F20, RAD ALTM CENTER

S 085-229
(35) Disconnect the RA test set.

S 865-416
(36) Remove the DO-NOT-CLOSE tag and close this P11 panel circuit breaker:
(a) 11F20, RAD ALTM CENTER

S 865-317
(37) Close this P11 panel circuit breaker:
(a) 11A3, ADF R

S 755-325
(38) Look at the left and right EHSIs.
(a) Make sure that the ADF R flag goes out of view.

S 865-409
(39) Close this P11 panel circuit breaker:
(a) 11F6, ADF LEFT

S 755-327
(40) Look at the left and right EHSIs:
(a) Make sure that the ADF L flag goes out of view.

S 865-234
(41) On the left and right EFIS control panels, put the switches and controls in the positions indicated:
(a) HSI Mode Select - MAP
(b) WXR Select - Off position
(c) MAP NAVAID - ON (in)

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(d) MAP APRT - ON (in)
(e) MAP RTE DATA - ON (in)
(f) MAP WPT - ON (in)
(g) ADI BRT - Equal distance between fully clockwise and fully counterclockwise.
(h) HSI BRT - Equal distance between fully clockwise and fully counterclockwise.

S 865-235
(42) On the left and right instrument source select panels, put the switches and controls in the positions indicated:
(a) FLT DIR - L position (left panel)/R position (right panel)
(b) NAV - FMC-L (left panel)/FMC-R (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)
(e) AIR DATA - NORM (out)

I. Instrument Switching System Test

NOTE: In the test, the EFIS displays will momentarily go out of view. This is not a failure condition.

S 865-239
(1) On the ILS control panel, make sure that the frequency is set to 110.10.

S 865-240
(2) On the IRMP, make sure that the three mode switches are in the OFF position.

S 865-237
(3) Open these P11 panel circuit breakers:
(a) 11E30, FMCS CMPTR RIGHT
(b) 11E35, FLT CONT CMPTR PWR R
(c) 11F9, EFIS SYM GEN C

S 865-238
(4) Close these P11 panel circuit breakers:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E20, FLT CONT CMPTR PWR C
(c) 11F29, EFIS SYM GEN RIGHT

S 865-241
(5) Make sure that this P6 panel circuit breaker is closed:
(a) 6D4, IRS C

S 865-242
(6) Make sure that this P11 panel circuit breaker is closed:
(a) 11F21, IRS CENTER

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S 865-243
(7) On the IRMP, set the center mode control to the ALIGN position.

S 865-236
(8) On the AFDS mode control panel, set the two F/D switches to the ON position.

S 755-343
(9) Look at the right EADI.
(a) Make sure that a yellow ATT flag shows.

S 755-344
(10) Look at the right EHSI.
(a) Make sure that the top left position is blank.

S 865-246
(11) On the right instrument source select panel, set the IRS switch to the ALTN position.

S 755-346
(12) Look at the right EADI.
(a) Make sure that the yellow ATT flag goes out of view.

S 865-248
(13) On the right instrument source select panel, set the IRS switch to the NORM position.

S 755-348
(14) Look at the right EADI.
(a) Make sure that the yellow ATT flag comes in to view.

S 865-410
(15) On the right instrument source select panel, set the NAV switch to the FMC-L position.

S 755-361
(16) Look at the right EHSI.
(a) Make sure that three white lines and the letters NM show in the top left position.
(b) Make sure that the letter Z shows in the top right position.

S 865-838
(17) On the right instrument source select panel, set the NAV switch to the FMC-R position.

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S 755-373
(18) Look at the right EHSI.
 (a) Make sure that the top left corner is blank.

S 865-839
(19) On the right instrument source select panel, put the FLT DIR switch in the C position.

S 755-375
(20) Look at the right EADI.
 (a) Make sure that the letters FD show in the top right position.

S 865-840
(21) Close this P11 panel circuit breaker:
 (a) 11E17, FLT CONT COMPUTER POWER LEFT

S 865-841
(22) Open this P11 panel circuit breaker:
 (a) 11E20, FLIGHT CONT CMPTR PWR CENTER

S 755-378
(23) Look at the right EADI.
 (a) Make sure that the letters FD go out of view.

S 865-411
(24) On the right instrument source select panel, put the FLT DIR switch in the L position.

S 755-380
(25) Look at the right EADI.
 (a) Make sure that the green letters FD come back in to view.

S 865-595
(26) Close this P11 panel circuit breaker:
 (a) 11E20, FLIGHT CONT CMPTR PWR CENTER

S 865-842
(27) Open this P11 panel circuit breaker:
 (a) 11E17, FLT CONT COMPUTER POWER LEFT

S 755-383
(28) Look at the right EADI.
 (a) Make sure that the green letters FD go out of view.

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S 865-843
(29) Close this P11 panel circuit breaker:
  (a) 11F9, EFIS SYM GEN CENTER

S 865-689
(30) Open this P11 panel circuit breaker:
  (a) 11F29, EFIS SYM GEN RIGHT

S 865-690
(31) On the left instrument source select panel, put the FLT DIR switch in the R position.

S 865-691
(32) On the right instrument source select panel, put the EFI switch in the ALTN position.

S 755-388
(33) Look at the right EADI.
  (a) Make sure that the green letters FD do not show.

S 865-692
(34) On the right instrument source select panel, put the IRS switch in the ALTN position.

S 755-390
(35) Look at the right EADI.
  (a) Make sure that the yellow ATT flag does not show.

S 865-693
(36) On the right instrument source select panel, put the IRS switch in the NORM position.

S 755-392
(37) Look at the right EADI.
  (a) Make sure that the yellow ATT flag comes in to view.

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S 865-286
(38) On the right instrument source select panel, set the NAV switch to the FMC-L position.

S 755-405
(39) Look at the right EHSI.
(a) Make sure that three white lines and the letters NM show in the top left position.
(b) Make sure that the letter Z shows in the top right position.

S 865-292
(40) On the right instrument source select panel, set the NAV switch to the FMC-R position.

S 755-418
(41) Look at the right EHSI.
(a) Make sure that the top right position goes blank.

S 865-294
(42) On the right instrument source select panel, put the FLT DIR switch in the C position.

S 755-420
(43) Look at the right EADI.
(a) Make sure that the green letters FD show.

S 865-296
(44) On the left instrument source select panel, put the FLT DIR switch in the L position.

S 865-297
(45) Open these P11 panel circuit breakers:
(a) 11E9, FMCS CMPTR LEFT
(b) 11F24, EFIS DSPL SW RIGHT

S 865-298
(46) Close these P11 panel circuit breakers:
(a) 11E30, FMCS CMPTR RIGHT

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(b) 11F8, EFIS SYM GEN L

S 865-299
(47) Permit 30 seconds for the system to become warm.

S 865-300
(48) On the left instrument source select panel, set the IRS switch to the ALTN position.

S 755-426
(49) Look at the left EADI.
(a) Make sure that the yellow ATT flag goes out of view.

S 865-302
(50) On the left instrument source select panel, set the IRS switch to the NORM position.

S 755-428
(51) Look at the left EADI.
(a) Make sure that the yellow ATT flag comes in to view.

S 865-304
(52) On the left instrument source select panel, set the NAV switch to the FMC-R position.

S 755-441
(53) Look at the left EHSI.
(a) Make sure that three white lines and the letters NM show in the top left position.
(b) Make sure that the letter Z shows in the top right position.

S 865-311
(54) On the left instrument source select panel, set the NAV switch to the FMC-L position.

S 755-454
(55) Look at the left EHSI.
(a) Make sure that the top corners are blank.

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S 865-596
(56) On the left instrument source select panel, put the FLT DIR switch in the C position.

S 755-456
(57) Look at the left EADI.
(a) Make sure that the green letters FD show.

S 865-319
(58) Close this P11 panel circuit breaker:
(a) 11E35, FLT CONT CMPTR POWER RIGHT

S 865-320
(59) Open this P11 panel circuit breaker:
(a) 11E20, FLIGHT CONT CMPTR PWR CENTER

S 755-459
(60) Look at the left EADI.
(a) Make sure that the letters FD go out of view.

S 865-322
(61) On the left instrument source select panel, put the FLT DIR switch in the R position.

S 755-461
(62) Look at the left EADI.
(a) Make sure that the green letters FD come back in to view.

S 865-324
(63) Open this P11 panel circuit breaker:
(a) 11F8, EFIS SYM GEN LEFT

S 865-325
(64) On the left instrument source select panel, put the EFI switch in the ALTN position.

S 755-464
(65) Look at the left EADI.
(a) Make sure that the green letters FD show.

S 865-327
(66) On the left instrument source select panel, put the IRS switch in the ALTN position.

S 755-466
(67) Look at the left EADI.
(a) Make sure that the yellow ATT flag does not show.

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S 865-329
(68) On the left instrument source select panel, put the IRS switch in the NORM position.

S 755-468
(69) Look at the left EADI.
(a) Make sure that the yellow ATT flag comes in to view.

S 865-332
(70) On the left instrument source select panel, set the NAV switch to the FMC-R position.

S 755-481
(71) Look at the left EHSI.
(a) Make sure that the three white lines and the letters NM show in the top left position.
(b) Make sure that the letter Z shows in the top right position.

S 865-339
(72) On the left instrument source select panel, set the NAV switch to the FMC-L position.

S 865-344
(73) Close these P11 panel circuit breakers:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E17, FLT CONT CMPTR PWR L

S 865-345
(74) Open these P11 panel circuit breakers:
(a) 11E30, FMCS CMPTR RIGHT
(b) 11E35, FLT CONT CMPTR PWR R

S 755-496
(75) Look at the left EADI.
(a) Make sure that the letters FD do not show.

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S 865-347
(76) On the left instrument source select panel, put the FLT DIR switch in the L position.

S 755-498
(77) Look at the left EADI.
(a) Make sure that the letters FD show.

S 865-695
(78) On the IRMP, turn the center mode control from the ALIGN position to the OFF position.

S 865-350
(79) On the IRMP, turn the left mode control from the OFF position to the ALIGN position.

S 755-844
(80) Look at the left EADI.
(a) Make sure that the yellow ATT flag goes out of view.

S 865-454
(81) On the AFDS mode control panel, set the two F/D switches to the OFF position.

J. Heading Reference Switch Test

S 865-352
(1) Make sure that the switches and controls on the left and right EFIS control panels are as indicated in the Prepare for Test section.

S 865-353
(2) Close these P11 panel circuit breakers:
(a) 11F8, EFIS SYM GEN LEFT
(b) 11F24, EFIS DSPL SW RIGHT
(c) 11F29, EFIS SYM GEN RIGHT

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S 865-357
(3) On the left, center, and right EFIS symbol generators, momentarily push the RST buttons.

S 745-509
(4) Push the TEST switch on the right overhead light control panel.

S 755-510
(5) Look at the left and right EHSIs.
(a) Make sure that the correct test display shows.

S 865-360
(6) On the P3 panel, put the HDG REF switch in the TRUE position.

S 755-514
(7) Look at the left and right EHSIs.
(a) Make sure that a yellow rectangle shows around the green letters TRU.

S 865-364
(8) On the left instrument source select panel, put the EFI switch in the ALTN position.

S 755-516
(9) Look at the left EHSI.
(a) Make sure that the TRU display does not change.

S 865-366
(10) On the left instrument source select panel, put the EFI switch in the NORM position.

S 755-518
(11) Look at the left EHSI.
(a) Make sure that the TRU display does not change.

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S 865-368
(12) Put the HDG REF switch in the NORM position.

S 755-522
(13) Look at the left and right EHSIs.
(a) Make sure that the letter M replaces the letters TRU.
(b) Make sure that a green rectangle replaces the yellow rectangle for approximately 10 seconds and then goes out of view.

S 745-523
(14) On the right overhead light control panel, push the TEST switch to remove the electrical power from the test circuits.

K. Wind Shear System Interface Test

S 865-373
(1) Make sure that these P11 panel circuit breakers are closed:
(a) 11A7, EFIS DSPL SW L
(b) 11B18, WARN ELEX B
(c) 11E3, ADI LEFT
(d) 11E24, ADI RIGHT
(e) 11F4, GND PROX
(f) 11F8, EFIS SYM GEN L
(g) 11F9, EFIS SYM GEN C
(h) 11F24, EFIS DSPL SW RIGHT
(i) 11F29, EFIS SYM GEN R
(j) 11J34, WARN ELEX A

S 865-374
(2) On the IRMP, make sure that the left, center, and right mode controls are in the ALIGN position.

S 865-375
(3) On the left and right instrument source select panels, set the EFI switches to the NORM position.

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S 745-527
(4) Push the TEST switch on the right overhead light control panel.

S 745-528
(5) On the P61 miscellaneous test panel, momentarily push the GND PROX test switch.

S 755-529
(6) Look at the left and right EADIs.
(a) Make sure that the red WINDSHEAR message shows.

S 755-530
(7) Look at the instrument panel.
(a) Make sure that the WINDSHEAR light is on.

S 865-380
(8) On the right instrument source select panel, set the EFI switch to the ALTN position.

S 745-532
(9) On the P61 miscellaneous test panel, momentarily push the GND PROX test switch.

S 755-533
(10) Look at the right EADI.
(a) Make sure that the red WINDSHEAR message shows.

S 755-534
(11) Look at the instrument panel.
(a) Make sure that the WINDSHEAR light is on.

S 745-535
(12) On the right overhead light control panel, push the TEST switch to remove the electrical power from the test circuits.

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S 865-385
(13) On the right instrument source select panel, set the EFI switch to the NORM position.

L. Airplanes Air/Ground Logic Test

S 915-413

WARNING: DO THE DEACTIVATION PROCEDURE FOR FLIGHT MODE SIMULATION BEFORE YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS. WHEN YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS THE AIRPLANE IS IN FLIGHT MODE. IN FLIGHT MODE, MANY OF THE AIRPLANE SYSTEMS CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(1) Do the deactivation procedure for flight mode simulation (AMM 32-09-02/201).

S 865-386
(2) Make sure that these P11 panel circuit breakers are closed:
(a) 11A10, AIR DATA CMPTR L
(b) 11F30, AIR DATA COMPTR RIGHT

S 865-387
(3) Open these P11 panel circuit breakers:
(a) 11U15, AIR/GND SYS 1
(b) 11U24, POSITION AIR/GND SYS 2

S 755-540
(4) Look at the left and right EADIs.
(a) Make sure that the SPD flag replaces the speed tape display.

S 865-389
(5) Close these P11 panel circuit breakers:
(a) 11U15, AIR/GND SYS 1
(b) 11U24, POSITION AIR/GND SYS 2

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S 755-542

(6) Look at the left and right EADIs.
  (a) Make sure that the computed airspeed display is 30 knots.

S 865-391

(7) On the left instrument source select panel, set the EFI switch to the ALTN position.

S 865-392

(8) Open this P11 panel circuit breaker:
  (a) 11U15, AIR/GND SYS 1

S 755-545

(9) Look at the left EADI.
  (a) Make sure that the SPD flag replaces the speed tape display.

S 865-394

(10) Close this P11 panel circuit breaker:
  (a) 11U15, AIR/GND SYS 1

S 755-547

(11) Look at the left EADI.
  (a) Make sure that the computed airspeed display is 30 knots.

S 865-396

(12) On the left instrument source select panel, set the EFI switch to the NORM position.

M. SAS 281-999;
EFIS/EICAS Attitude Comparator Test

S 865-709

(1) Set the COMPUTER switch on the EICAS display select panel to the L position.

S 865-849

(2) Push the ECS/MSG switch on the EICAS MAINT panel.

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S 865-711
(3) Open this circuit breaker on the overhead circuit breaker panel, P11:
  (a) 11F8, EFIS SYM GEN LEFT

S 755-616
(4) Make sure the EICAS message, COMPARATOR BITE, shows on the bottom display.

S 865-850
(5) Close this circuit breaker on the overhead circuit breaker panel, P11:
  (a) 11F8, EFIS SYM GEN LEFT

S 755-618
(6) Make sure the EICAS message, COMPARATOR BITE, does not show on the bottom display.

S 865-713
(7) Set the COMPUTER switch on the EICAS display select panel to the R position.

S 755-620
(8) Make sure the EICAS message, COMPARATOR BITE, does not show on the bottom display.

S 865-851
(9) Set the EFI switch on the left instrument source select panel to the ALTN position.

S 755-622
(10) Make sure the EICAS message, COMPARATOR BITE, does not show on the bottom display.

S 865-715
(11) Set the EFI switch on the left instrument source select panel to the NORM position.

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S 865-852
(12) Set the EFI switch on the right instrument source select panel to the ALTN position.

S 865-853
(13) Make sure the EICAS message, COMPARATOR BITE, does not show on the bottom display.

S 865-718
(14) Set the EFI switch on the right instrument source select panel to the NORM position.

S 865-719
(15) Set the COMPUTER switch on the EICAS display select panel to the AUTO position.

N. Put the Airplane Back to Its Usual Condition

S 865-397
(1) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11E20, FLT CONT CMPTR PWR C
(b) 11E30, FMCS CMPTR RIGHT
(c) 11E33, VOR RIGHT
(d) 11E34, MODE CONT PNL R
(e) 11E35, FLT CONT CMPTR PWR R
(f) 11F2, WXR RADAR LEFT
(g) 11F15, TMC DC
(h) 11F22, IRS RIGHT
(i) 11F23, WXR RADAR RIGHT

S 865-398
(2) Remove the DO-NOT-CLOSE tag and close this P6 panel circuit breaker:
(a) 6D5, IRS R

S 865-399
(3) On the left and right instrument source select panels, put the EFI switches in the NORM position.

S 865-400
(4) On the IRMP, put the left, right, and center mode switches to the OFF position.

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S 865-401
(5) On the AFDS mode control panel, set the two F/D switches to the OFF position.

S 865-402
(6) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-22-00-715-581
4. Instrument Source Select Switching Test

NOTE: This is a scheduled maintenance task.

A. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 34-21-00/201, Inertial Reference System

B. Access
(1) Location Zones
211/212   Flight Compartment

C. Prepare for the Test

S 865-492
(1) Supply electrical power (AMM 24-22-00/201).

D. Procedure

S 865-493
(1) Make sure that these P11 panel circuit breakers are open:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E20, FLT CONT CMPTR PWR C
(c) 11E21, FLT CONT CMPTR SERVO C

S 865-494
(2) Make sure that these P11 panel circuit breakers are closed:
(a) EICAS (6 locations)

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S 865-495

CAUTION: DO NOT OPEN THE AIR DATA CMPTR RIGHT CIRCUIT BREAKER WITH THE PITOT-STATIC SYSTEM PRESSURIZED. THIS CAN CAUSE DAMAGE TO THE EQUIPMENT.

(3) Open this P11 panel circuit breaker:
(a) 11F30, AIR DATA CMPTR RIGHT

S 865-496
(4) On the left and right EFIS control panels, put the HSI MODE switch in the MAP position.

S 865-497
(5) On the AFDS mode control panel, set the two F/D switches to the ON position.

S 865-498
(6) On the IRMP, set the left and right mode switches to the NAV position (AMM 34-21-00/201).

NOTE: Make sure you permit time for the IRUs to align.

S 865-499
(7) On the IRMP, set the center mode switch to the OFF position.

S 865-500
(8) Put the left and right instrument source select switches and controls in the positions that follow:

NOTE: Make sure that the non-rotary switches are illuminated when they are in the ALTN position.

(a) FLT DIR - L position (left panel)/R position (right panel)

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(b) NAV - FMC-L (left panel)/FMC-R (right panel)
(c) EFI - NORM (out)
(d) IRS - NORM (out)
(e) AIR DATA - NORM (out)

S 755-845
(9) Make sure that these displays have the indications that follow while in the MAP mode.
(a) Look at the left and right EADIs.
1) Make sure that the flight director mode annunciation, FD, shows on the right side.
(b) Look at the left EHSI:
1) Make sure that the top left and right positions are blank.
(c) Look at the right EHSI:
1) Make sure that three horizontal lines and the letters NM show in the top left position.
2) Make sure that six horizontal lines and the letter Z show in the top right position.
(d) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH does not show.
(e) Look at the left altimeter and EADI airspeed tape.
1) Make sure that the failure flags do not show.
(f) Look at the right altimeter and EADI airspeed tape.
1) Make sure that the failure flags show.

S 865-502
(10) Put the left FLT DIR switch in the C position.

NOTE: In the steps that follow, only the display changes that are necessary to make sure of correct switch operation are given.

(a) Look at the left EADI.
1) Make sure that the FD annunciation goes out of view.
2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag shows.

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S 865-503
(11) Put the right FLT DIR switch in the C position.
(a) Look at the right EADI.
1) Make sure that the FD annunciation goes out of view.
2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag shows.

S 865-504
(12) Put the left FLT DIR switch in the R position.
(a) Look at the left EADI.
1) Make sure that the FD annunciation shows.
2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag does not show.

S 865-505
(13) Put the right FLT DIR switch in the L position.
(a) Look at the right EADI.
1) Make sure that the FD annunciation shows.
2) AIRPLANES WITH -414 EFIS SG AND PREVIOUS;
Make sure that the FD failure flag does not show.

S 865-506
(14) Put the left FLT DIR switch in the L position.

S 865-507
(15) Put the right FLT DIR switch in the R position.

S 865-513
(16) Put the left NAV switch in the FMC-R position.

S 865-523
(17) Put the right NAV switch in the FMC-L position.

S 755-666
(18) Look at the left EHSI.
(a) Make sure the MAP failure flag does not show.

S 755-667
(19) Look at the right EHSI.
(a) Make sure that the MAP failure flag shows.

S 865-528
(20) Remove the DO-NOT-CLOSE tag and close this P11 panel circuit breaker:
(a) 11E9, FMCS CMPTR LEFT

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S 865-534
(21) Put the left NAV switch to FMC-L and the right NAV switch to FMC-R.

S 755-671
(22) Look at the left and right EHSIs.
(a) Make sure that the MAP failure flags do not show.

S 865-539
(23) On the left EFIS control panel, put the HSI MODE control in the PLAN position.
(a) Look at the left EHSI.
1) Make sure that the PLAN mode shows.

S 865-540
(24) Put the left and right EFI switches in the ALTN position.
(a) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH shows.
(b) Look at the left and right EHSIs.
1) Make sure that the PLAN mode shows.

S 865-541
(25) Put the right EFI switch in the NORM position.
(a) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH does not show.
(b) Look at the right EHSI.
1) Make sure that the MAP mode shows.

S 865-542
(26) Put the right EFI switch in the ALTN position.
(a) Look at the EICAS.
1) Make sure that the EICAS message INSTR SWITCH shows.
(b) Look at the right EHSI.
1) Make sure that the PLAN mode shows.

S 865-543
(27) Put the left EFI switch in the NORM position.
(a) Look at the EICAS.
1) Make sure that the message INSTR SWITCH does not show.
(b) Look at the right EHSI.
1) Make sure that the MAP mode shows.

S 865-544
(28) Put the right EFI switch in the NORM position.
(a) Make sure that there are no display changes.

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S 865-545
(29) On the left EFIS control panel, put the HSI MODE control in the MAP position.
(a) Look at the left EHSI.
1) Make sure that the MAP mode shows.

S 865-546
(30) Put the left and right IRS switches in the ALTN position.
(a) Look at the left and right EADIs.
1) Make sure that the ATT flags show.

S 865-548
(31) Put the left IRS switch in the NORM position.
(a) Look at the left EADI.
1) Make sure that the ATT flag goes out of view.

S 865-549
(32) Put the right IRS switch in the NORM position.
(a) Look at the right EADI.
1) Make sure that the ATT flag goes out of view.

S 865-968
(33) On the IRMP, set the left and right mode switches to the OFF position.

S 865-969
(34) On the IRMP, set the center mode switch to the ATT position.
(a) Look at the left and right EADIs.
1) Make sure that the ATT flag shows.

S 865-970
(35) Put the left IRS switch in the ALTN position.
(a) Look at the left EADI.
1) Make sure that the ATT flag goes out of view.

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S 865-971
(36) Put the left IRS switch in the NORM position.

S 865-972
(37) Put the right IRS switch in the ALTN position.
(a) Look at the right EADI.
1) Make sure that the ATT flag goes out of view.

S 865-973
(38) Put the right IRS switch in the NORM position.

S 865-550
(39) Set the left AIR DATA switch to the ALTN position.
(a) Look at the left altimeter.
1) Make sure that the failure flag shows.
(b) Look at the left EADI.
1) Make sure that the SPD flag shows.

S 865-551
(40) Set the right AIR DATA switch to the ALTN position.
(a) Look at the right altimeter.
1) Make sure that the failure flag does not show.
(b) Look at the right EADI.
1) Make sure that the SPD flag does not show.

S 865-552
(41) Set the left and right AIR DATA switches to the NORM position.
(a) Look at the left altimeter.
1) Make sure that the failure flag does not show.
(b) Look at the left EADI.
1) Make sure that the SPD flag does not show.
(c) Look at the right altimeter.
1) Make sure that the failure flag shows.
(d) Look at the right EADI.
1) Make sure that the SPD flag shows.

E. Put the Airplane Back to Its Usual Condition

S 865-553
(1) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11E20, FLT CONT CMPTR PWR C
(b) 11E21, FLT CONT CMPTR SERVO C
(c) 11F30, AIR DATA CMPTR RIGHT

S 865-554
(2) On the IRMP, set the center mode switch to the OFF position.

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S 865-555
(3) On the AFDS mode control panel, set the two F/D switches to the OFF position.

S 865-556
(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-22-00-715-582
5. Center EFIS Symbol Generator Test

NOTE: This is a scheduled maintenance task.

A. References
(1) AMM 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Prepare for Test

S 865-557
(1) Supply electrical power (AMM 24-22-00/201).

S 865-558
(2) On the left and right instrument source select panels, put the switches in the positions indicated:
(a) EFI - NORM (out)

S 865-559
(3) On the instrument panel P3, put the HDG REF switch in the NORM position.

S 865-563
(4) On the AFDS mode control panel, set the two F/D switches to the OFF position.

S 865-564
(5) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
(a) 11F2, WX RADAR LEFT
(b) 11F23, WX RADAR RIGHT

S 865-565
(6) Make sure that these P11 panel circuit breakers are closed:
(a) 11U15, AIR/GND SYS 1
D. Procedure

S 865-566
(1) Make sure that these P11 panel circuit breakers are closed:
(a) 11A7, EFIS DSPL SW L

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(b) 11E3, ADI LEFT
(c) 11E4, EFIS CONT PNL LEFT
(d) 11E6, HSI LEFT
(e) 11E24, ADI RIGHT
(f) 11E25, EFIS CONT PNL RIGHT
(g) 11E27, HSI RIGHT
(h) 11F8, EFIS SYM GEN L
(i) 11F9, EFIS SYM GEN C
(j) 11F24, EFIS DSPL SW RIGHT
(k) 11F29, EFIS SYM GEN RIGHT

S 865-567
(2) On the right EFIS control panel, put the switches and controls in the positions indicated:
(a) Range Select - 80 NM
(b) HSI Mode Select - MAP
(c) WXR Select - ON
(d) Map Mode Select Switches (4) - ON (in)
(e) ADI BRT and HSI BRT - Fully clockwise.

S 865-568
(3) Push and hold the test switch on the overhead light control panel, P5, to start an EFIS self-test.
(a) Make sure that the test pattern shows on the right EADI and EHSI (Fig. 501-MAP mode).
(b) Make sure that the EHSI test pattern has an indicated range of 80 NM.

S 745-569
(4) Release the TEST switch to stop the EFIS self-test.

S 865-570
(5) Open this P11 panel circuit breaker:
(a) 11F29, EFIS SYM GEN RIGHT

S 755-571
(6) Make sure that the right EADI and EHSI displays do not show data.

S 865-572
(7) Put the right EFI instrument source select switch in the ALTN position.

S 745-573
(8) Push and hold the test switch on the overhead light control panel, P5, to start an EFIS self-test.
(a) Make sure that the test pattern shows on the right EADI and EHSI (Fig. 501).
(b) Make sure that the EHSI is in the MAP mode and has an indicated range of 80 NM.

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S 745-574
(9) Release the TEST switch to stop the EFIS self-test.

S 865-701
(10) Close this P11 panel circuit breaker:
(a) 11F29, EFIS SYM GEN RIGHT

S 865-A54
(11) Put the right EFI instrument source select switch in the NORM position.

S 755-577
(12) Make sure that the right EADI and EHSI displays show data.

S 865-846
(13) On the right EFIS control panel, put the switches and controls in the positions indicated:
(a) WXR Select - Off position
(b) Map Mode Select Switches (4) - OFF (out)
(c) ADI BRT and HSI BRT - Fully counterclockwise.

S 865-703
(14) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11F2, WX RADAR LEFT
(b) 11F23, WX RADAR RIGHT

E. Put the Airplane Back to Its Usual Condition

S 865-847
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS) COOLING AIR INLET SCREEN - INSPECTION/CHECK

1. General
   A. There are two electronic attitude director indicators (EADIs) and two electronic horizontal situation indicators (EHSIs) installed on the airplane. The procedures that follow supply instructions for an inspection of the cooling air inlet screens for these display units.

      NOTE: Remove and install only one of the EADIs at a time. If this is not done, then the airplane will have to be made level in order to adjust the inclinometers.

TASK 34-22-00-006-001

2. EADI Cooling Air Inlet Screen Inspection
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
      (2) AMM 29-11-00/201, Main Hydraulic Systems
      (3) AMM 33-16-00/501, Master Dim and Test
      (4) AMM 34-22-00/201, Cathode Ray Tube (CRT)
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 866-002
      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
          (a) P11 Circuit Breaker Panel
              1) 11E3, ADI LEFT
              2) 11E24, ADI RIGHT

      S 866-003
      (2) Make sure that hydraulic power is removed from the flight controls (AMM 29-11-00/201).

      S 026-055

      CAUTION: DO NOT PULL THE CRT HANDLE. THE HANDLE TURNS OUT AUTOMATICALLY WHEN THE SPRING IS RELEASED. HOLD THE HANDLE UNTIL IT IS COMPLETELY RELEASED FROM THE SCREWS. YOU CAN CAUSE DAMAGE TO THE HANDLE IF YOU TURN IT OUT BEFORE IT IS RELEASED FROM THE SCREWS.

      (3) Hold the CRT handle against the left EADI.

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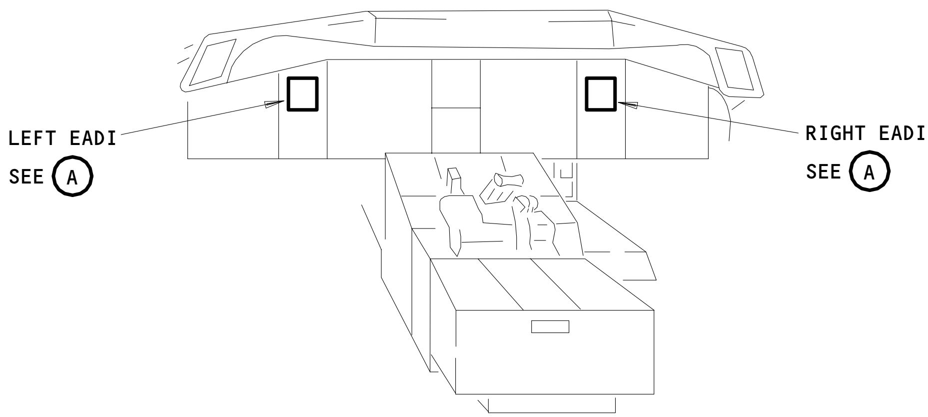
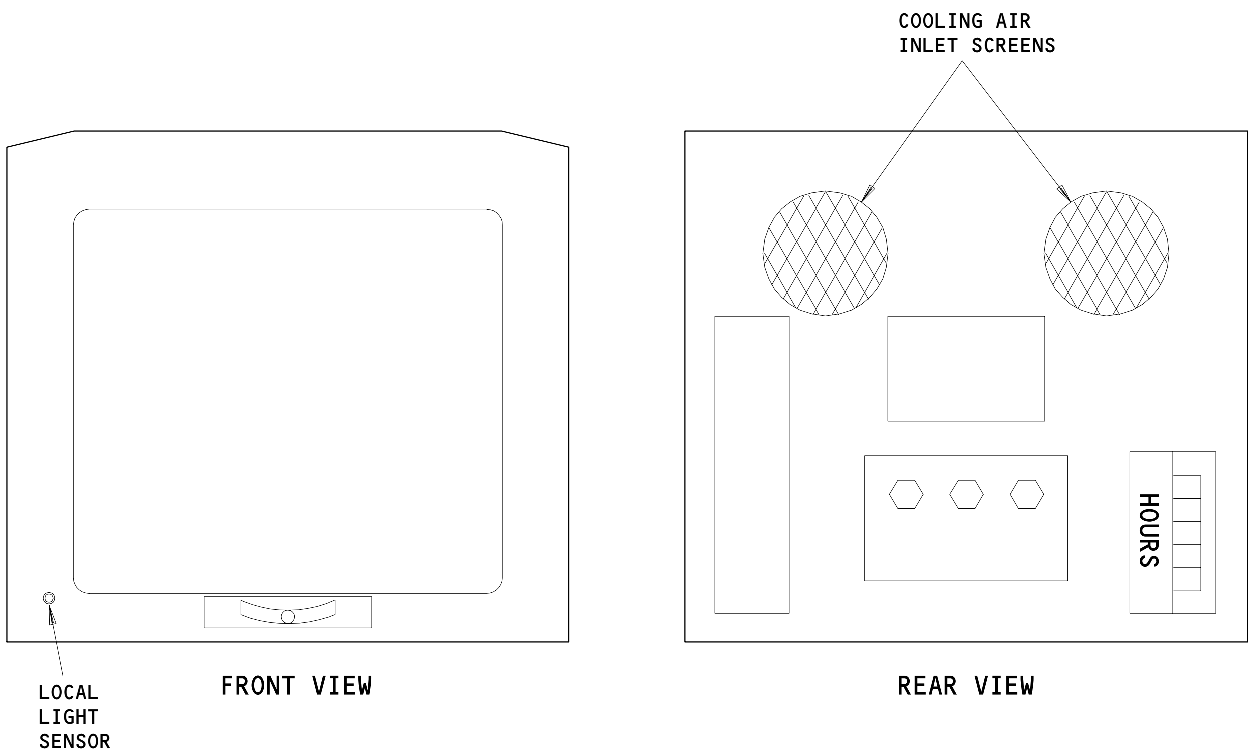


FLIGHT COMPARTMENT



EADI (EXAMPLE)
A

EFIS EADI
Figure 601

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S 026-056

(4) Loosen the two screws at the top of the left EADI.

NOTE: Do not completely remove the handle screws.

S 026-057

(5) Pull the the handle out and down.

NOTE: If the handle is not fully extended when you remove the CRT, springs installed in the instrument panel can come out.

S 016-058

(6) Pull the control column rearwards and hold it there.

S 026-008

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EADI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EADI.

(7) Slowly pull the left EADI out from the instrument panel.

S 036-009

(8) Install a dust cap on the electrical connector of the EADI.

S 166-010

(9) Make sure that the inlet screen at the rear of the EADI is clean (Fig. 601).

S 866-011

(10) Make sure these circuit breakers are open:
   (a) P11 Circuit Breaker Panel
      1) 11E3, ADI LEFT
      2) 11E24, ADI RIGHT

S 436-012

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EADI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EADI.

(11) Remove the dust cap from the electrical connector of the EADI.

S 426-013

(12) Slowly push the left EADI into the instrument panel.

NOTE: Make sure that the handle is fully extended out.

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S 866-014
(13) Slowly release the control column.

S 866-015
(14) Put the handle in the up and locked position.

S 436-016
(15) While the handle is held, tighten the screws.

S 866-017
(16) Adjust the inclinometer if necessary (AMM 34-22-00/201).

S 216-018
(17) Do this procedure again for the right EADI.

D. EADI Test

S 866-019
(1) Supply electrical power (AMM 24-22-00/201).

S 866-020
(2) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
(a) P11 Circuit Breaker Panel
1) 11E3, ADI LEFT
2) 11E24, ADI RIGHT

S 866-021
(3) Make sure these circuit breakers are closed:
(a) P11 Circuit Breaker Panel
1) 11A7, EFIS DSPL SW LEFT
2) 11E4, EFIS CONT PNL LEFT
3) 11E25, EFIS CONT PNL RIGHT
4) 11F8, EFIS SYM GEN LEFT
5) 11F24, EFIS DSPL SW RIGHT
6) 11F29, EFIS SYM GEN RIGHT

S 866-022
(4) Set the EFI switches on the two instrument source select panels to the NORM position.

S 746-064
(5) Use the TEST switch on the overhead light control panel, P5, to start an EFIS self-test (AMM 33-16-00/501).
(a) Make sure the test pattern shows on the EADI.

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S 746-050
(6) Use the TEST switch to stop the EFIS self-test.

S 116-026
(7) Clean the face of the EADI (AMM 34-22-00/201).

E. Put the Airplane Back to Its Usual Condition

S 866-027
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-22-00-006-028

3. EHSI Cooling Air Inlet Screen Inspection

A. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 29-11-00/201, Main Hydraulic Systems
(3) AMM 33-16-00/501, Master Dim and Test
(4) AMM 34-22-00/201, Cathode Ray Tube (CRT)

B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 866-029
(1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
(a) P11 Circuit Breaker Panel
1) 11E6, HSI LEFT
2) 11E27, HSI RIGHT

S 866-030
(2) Make sure that hydraulic power is removed from the flight controls (AMM 29-11-00/201).

S 026-059

CAUTION: DO NOT PULL THE CRT HANDLE. THE HANDLE TURNS OUT AUTOMATICALLY WHEN THE SPRING IS RELEASED. HOLD THE HANDLE UNTIL IT IS COMPLETELY RELEASED FROM THE SCREWS. YOU CAN CAUSE DAMAGE TO THE HANDLE IF YOU TURN IT OUT BEFORE IT IS RELEASED FROM THE SCREWS.

(3) Hold the CRT handle against the left EHSI.

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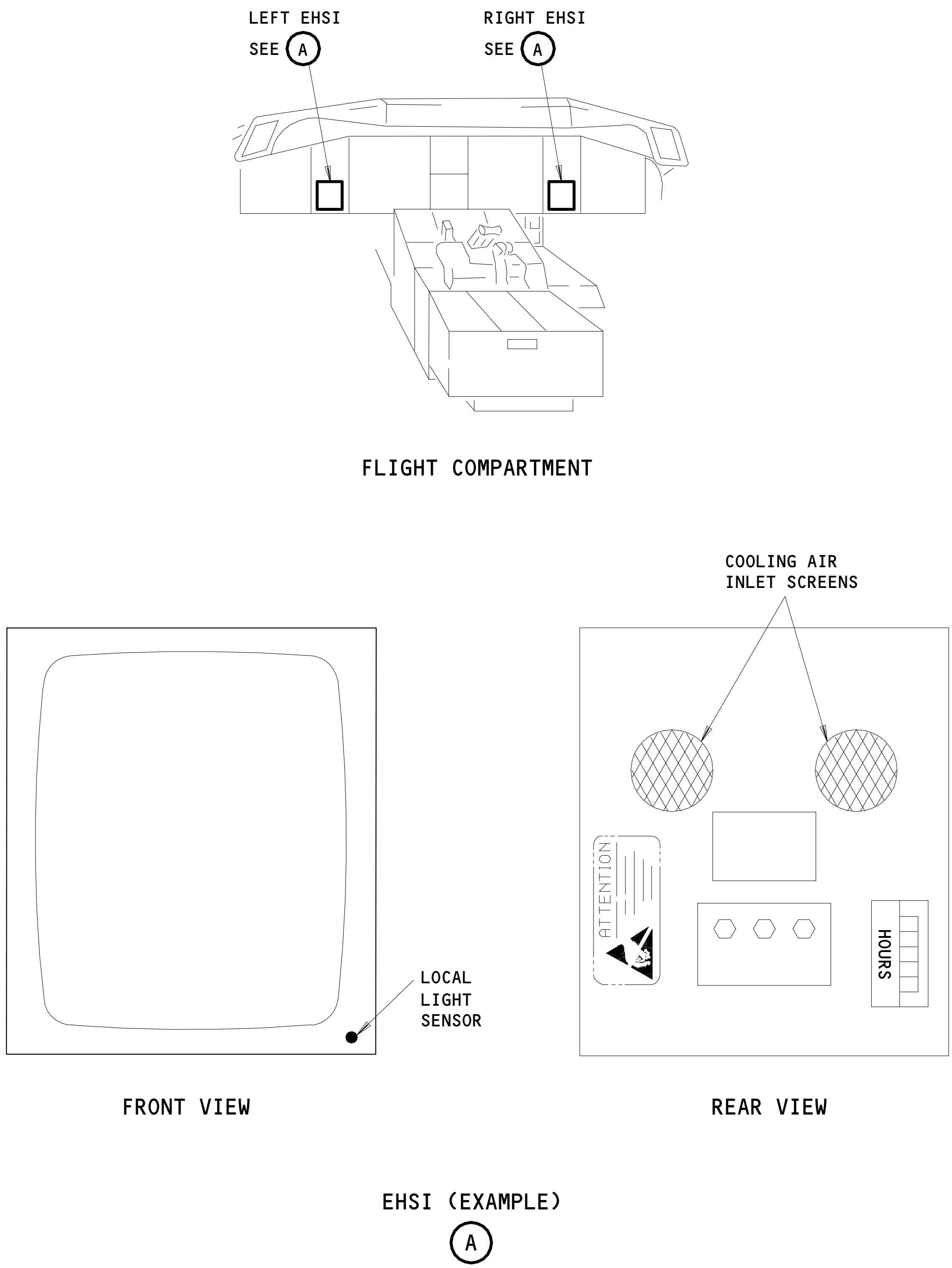

EFIS EHSI
Figure 602

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S 026-060
(4) Loosen the two screws at the top of the left EHSI.

NOTE: Do not completely remove the handle screws.

S 026-061
(5) Pull the handle out and down.

NOTE: If the handle is not fully extended when you remove the CRT, springs installed in the instrument panel can come out.

S 016-062
(6) Pull the control column rearward and hold it there.

S 026-035

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EHSI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EHSI.

(7) Slowly pull the left EHSI out from the instrument panel.

S 036-036
(8) Install a dust cap on the electrical connector of the EHSI.

S 166-037
(9) Make sure that the inlet screen at the rear of the EHSI is clean (Fig. 602).

S 866-038
(10) Make sure these circuit breakers are open:
(a) P11 Circuit Breaker Panel
1) 11E6, HSI LEFT
2) 11E27, HSI RIGHT

S 436-039

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EHSI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EHSI.

(11) Remove the dust cap from the electrical connector of the EHSI.

S 426-040
(12) Slowly push the left EHSI into the instrument panel.

NOTE: Make sure that the handle is fully extended out.

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S 866-041
(13) Slowly release the control column.

S 416-042
(14) Put the handle in the up and locked position.

S 436-043
(15) While the handle is held, tighten the mounting screws.

S 216-044
(16) Do this procedure again for the right EHSI.

D. EHSI Test

S 866-045
(1) Supply electrical power (AMM 24-22-00/201).

S 866-046
(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
(a) 11E6, HSI LEFT
(b) 11E27, HSI RIGHT

S 866-047
(3) Make sure these circuit breakers are closed:
(a) P11 Circuit Breaker Panel
1) 11A7, EFIS DSPL SW LEFT
2) 11E4, EFIS CONT PNL LEFT
3) 11E25, EFIS CONT PNL RIGHT
4) 11F8, EFIS SYM GEN LEFT
5) 11F24, EFIS DSPL SW RIGHT
6) 11F29, EFIS SYM GEN RIGHT

S 866-048
(4) Set the EFI switches on the two instrument source select panels to the NORM position.

S 746-049
(5) Use the TEST switch on the overhead light control panel, P5, to start an EFIS self-test (AMM 33-16-00/501).
(a) Make sure the test pattern shows on the EHSI.

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S 746-051

(6) Use the TEST switch to stop the EFIS self-test.

S 116-052

(7) Clean the face of the EHSI (AMM 34-22-00/201).

E. Put the Airplane Back to Its Usual Condition

S 866-053

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)
SYMBOL GENERATOR - REMOVAL/INSTALLATION

1. General
    A. There are three EFIS symbol generators installed. They are located in the main equipment center on the E-1 rack.
    B. The procedures that follow supply instructions for the removal, installation, and test of the symbol generators.

TASK 34-22-01-004-001

2. Remove the EFIS Symbol Generator
    A. References
        (1) AMM 20-10-01/401, E/E Rack Mounted Components
        (2) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
    B. Access
        (1) Location Zones
            119/120   Main Equipment Center
    C. Procedure

        S 914-002

CAUTION: DO NOT TOUCH THE EFIS SYMBOL GENERATOR BEFORE YOU READ THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE SYMBOL GENERATOR.

        (1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

        S 864-003
        (2) For the left EFIS symbol generator, open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
            (a) 11A7, EFIS DSPL SW L
            (b) 11F8, EFIS SYM GEN L

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S 864-004
(3) For the right EFIS symbol generator, open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
(a) 11F24, EFIS DSPL SW RIGHT
(b) 11F29, EFIS SYM GEN RIGHT

S 864-005
(4) For the center EFIS symbol generator, open this circuit breaker on the overhead circuit breaker panel, P11, and attach a DO-NOT-CLOSE tag:
(a) 11F9, EFIS SYM GEN C

S 024-026
(5) Remove the EFIS symbol generator (AMM 20-10-01/401).

TASK 34-22-01-404-006
3. Install the EFIS Symbol Generator
A. References
(1) AMM 20-10-01/401, E/E Rack Mounted Components
(2) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
(3) AMM 24-22-00/201, Electrical Power - Control
(4) AMM 34-22-00/201, EFIS Symbol Generator
B. Access
(1) Location Zones
119/120 Main Equipment Center

C. Procedure

S 914-007

CAUTION: DO NOT TOUCH THE EFIS SYMBOL GENERATOR BEFORE YOU READ THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE SYMBOL GENERATOR.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

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S 864-008

(2) For the left EFIS symbol generator, make sure these circuit breakers on the P11 panel are open:
(a) 11A7, EFIS DSPL SW L
(b) 11F8, EFIS SYM GEN L

S 864-009

(3) For the right EFIS symbol generator, make sure these circuit breakers on the P11 panel are open:
(a) 11F24, EFIS DSPL SW RIGHT
(b) 11F29, EFIS SYM GEN RIGHT

S 864-027

(4) For the center EFIS symbol generator, make sure this circuit breaker on the P11 panel is open:
(a) 11F9, EFIS SYM GEN C

S 214-010

(5) Examine the unit and rack connectors for unwanted materials and loose or damaged pins.
(a) Use the vacuum cleaner to clean the rear connectors, ventilation holes, installation tray connector(s), cooling air supply and return plenums, mounting fasteners, and mounting surfaces.

S 424-035

(6) Install the EFIS symbol generator (AMM 20-10-01/401).

NOTE: AIRPLANES WITH -420 EFIS SYMBOL GENERATORS AND ON; make sure the correct software version has been installed on the new EFIS symbol generator.

S 864-012

(7) For the left EFIS symbol generator, close these circuit breakers on the P11 panel and remove the DO-NOT-CLOSE tags:
(a) 11A7, EFIS DSPL SW L
(b) 11F8, EFIS SYM GEN L

S 864-013

(8) For the right EFIS symbol generator, close these circuit breakers on the P11 panel and remove the DO-NOT-CLOSE tags:
(a) 11F24, EFIS DSPL SW RIGHT
(b) 11F29, EFIS SYM GEN RIGHT

S 864-014

(9) For the center EFIS symbol generator, close this circuit breaker on the P11 panel and remove the DO-NOT-CLOSE tag:
(a) 11F9, EFIS SYM GEN C

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D. EFIS Symbol Generator Test

S 864-015
(1) Supply electrical power (AMM 24-22-00/201).

S 864-016
(2) Make sure these circuit breakers on the P11 panel are closed:
(a) 11E3, ADI LEFT
(b) 11E4, EFIS CONT PNL LEFT
(c) 11E6, HSI LEFT
(d) 11E24, ADI RIGHT
(e) 11E25, EFIS CONT PNL RIGHT
(f) 11E27, HSI RIGHT

S 864-028
(3) Set the EFI switch on the two instrument source select panels to the NORM position.

S 864-017
(4) On the left and right EFIS control panels, set the switches and controls to these positions:
(a) RANGE - 10
(b) MODE - MAP
(c) MAP MODE SELECT SWITCHES (4) - ON
(d) BRIGHTNESS - Fully clockwise

S 864-018
(5) Push the RESET switch on the applicable symbol generator.

S 864-019
(6) On the overhead light control panel, push the TEST switch.

S 754-029
(7) Make sure that the test pattern shows on the EADIs and EHSIs.
(a) Make sure that the two EHSI test patterns are in the MAP mode and have an indicated range of 10 nautical miles.

S 754-037
(8) AIRPLANES WITH -420 EFIS SYMBOL GENERATORS AND ON;
do these steps to do a software configuration check of the EFIS symbol generator.

NOTE: You must know the correct software part numbers for the EFIS symbol generator. For the generator to be an approved installation, software with the correct part numbers must be installed.

(a) Make sure that the letters OPS, followed by a 12 character number are on the left side of the left and right EHSI.

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(b) Make sure that the OPS software part numbers are correct.
1) If the software part numbers are not correct, then do the software installation task (AMM 34-22-00/201) or replace the EFIS symbol generator with one that has the correct software.

S 864-021
(9) Set the EFI switch on the two instrument source select panels to the ALTN position.

S 864-022
(10) On the overhead light control panel, push the TEST switch.

S 754-030
(11) Make sure that the test pattern shows on the EADIs and EHSIs.
(a) Make sure that the two EHSI test patterns are in the MAP mode and have an indicated range of 10 nautical miles.

E. Put the Airplane Back to Its Usual Condition

S 864-024
(1) Set the EFI switch on the two instrument source select panels to the NORM position.

S 864-025
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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EFIS CONTROL PANEL - MAINTENANCE PRACTICES

1. General
   A. There are two EFIS control panels installed. The procedures that follow include instructions to relamp, remove, and install the control panels.

TASK 34-22-02-002-001

2. EFIS Control Panel Lamp Replacement
   A. General
      (1) The switch-lights on the EFIS control panel are relamped from the front of the panel. The lights are found on the back of the switch lens assembly. The switches must be in the off position to relamp them.
   B. Equipment
      (1) Needle-nose pliers
   C. References
      (1) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
   D. Access
      (1) Location Zones
          211/212 Flight Compartment

   E. Lamp Removal

      S 912-002

      CAUTION: DO NOT MOVE THE SWITCH-LIGHT ASSEMBLIES BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE CONTROL PANEL.

      (1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

      S 862-035

      CAUTION: DO NOT TRY TO RELAMP THE SWITCHES WITH THE POWER ON. FAILURE TO REMOVE THE POWER COULD RESULT IN DAMAGE TO THE SWITCH.

      (2) Open these circuit breakers on the overhead panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11P1, INSTRUMENT AND PANEL AISLE STAND

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S 012-004

CAUTION: MAKE SURE THAT THE BAIL WIRE RETAINER IS NOT DAMAGED WHEN THE LENS ASSEMBLY IS REMOVED FROM THE SWITCH HOUSING. MAKE SURE THAT THE LENS ASSEMBLY IS CONNECTED TO THE RETAINER. DAMAGE TO THE SWITCH CAN OCCUR IF A DAMAGED OR DISCONNECTED RETAINER IS PUT IN TO THE SWITCH HOUSING.

(3) To remove the assembly, pull the assembly straight out from the housing.

NOTE: The assembly will be held by a bail wire retainer to keep it connected to the housing.

S 022-005

(4) Remove the lamp from the lens assembly.

NOTE: If necessary, use a needle-nose pliers to remove the lamp.

F. Lamp Installation

S 422-006

(1) Put the new lamp in the lens assembly.

S 412-007

CAUTION: MAKE SURE THAT THE LENS ASSEMBLY IS CONNECTED TO THE BAIL WIRE RETAINER. IF THE RETAINER IS NOT CONNECTED, INSTALLATION OF LAMP CAN CAUSE THE LAMP POWER TO SHORT-CIRCUIT.

(2) Carefully put the lens assembly in the switch housing.

S 432-008

(3) Slowly push the lens assembly in until the switch engages.

S 862-009

(4) Release the switch.

S 862-030

(5) Remove the DO-NOT-CLOSE tag close this P11 panel circuit breaker:
   (a) 11P1, INSTRUMENT AND PANEL AISLE STAND

TASK 34-22-02-002-010

3. EFIS Control Panel Removal

A. References

(1) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices

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B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 912-011

CAUTION: DO NOT MOVE THE EFIS CONTROL PANEL BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EFIS CONTROL PANEL.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 862-012
(2) Open this P11 circuit breaker, as applicable, and attach a DO-NOT-CLOSE tag:
(a) 11E4, EFIS CONT PNL LEFT
(b) 11E25, EFIS CONT PNL RIGHT

S 862-031

WARNING: REMOVE ELECTRICAL POWER FROM THE FLIGHT COMPARTMENT SEAT. ACCIDENTAL ELECTRICAL OPERATION OF THE FLIGHT COMPARTMENT SEAT CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(3) Open these circuit breakers on the main power distribution panel, P6, as applicable, and attach DO-NOT-CLOSE tags:
(a) 6H15, CAPT SEAT
(b) 6J21, F/O SEAT

S 012-016
(4) Remove the left or right access panel, as applicable, on the aisle control stand (Fig. 201).

S 012-017
(5) Disconnect the electrical cable on the rear of the control panel.

S 032-018
(6) Loosen the mounting screws on the control panel.

S 022-019
(7) Remove the control panel.

TASK 34-22-02-402-020
4. EFIS Control Panel Installation (Fig. 201)
A. References
(1) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices

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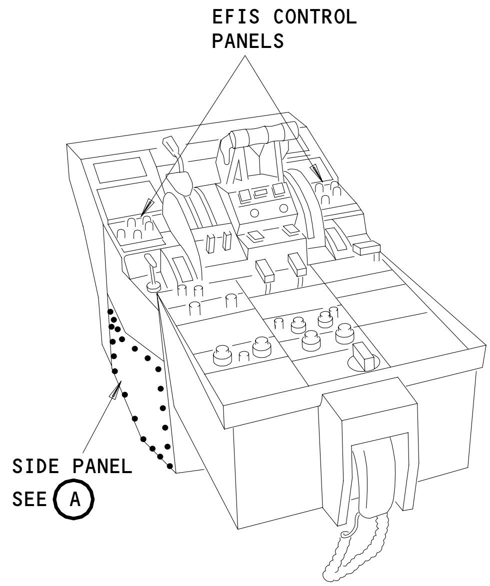
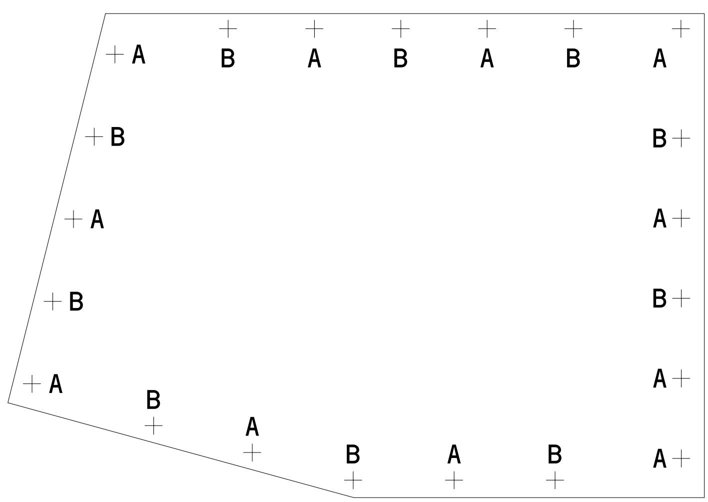


AISLE CONTROL STAND



SIDE PANEL
A

Side Panel on the Aisle Control Stand - Installation
Figure 201

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(2) AMM 24-22-00/201, Electrical Power - Control

B. Access

(1) Location Zones

211/212 Flight Compartment

C. Procedure

S 912-021

CAUTION: DO NOT MOVE THE EFIS CONTROL PANEL BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EFIS CONTROL PANEL.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 862-022

(2) Make sure that this P11 panel circuit breaker, as applicable, is open:

(a) 11E4, EFIS CONT PNL LEFT

(b) 11E25, EFIS CONT PNL RIGHT

S 412-027

(3) Move the control panel into the aisle control stand.

S 432-026

(4) Tighten the mounting screws.

NOTE: If there was a blank placard on the range switch of the old EFIS control panel, make sure you put it on the new EFIS control panel.

S 412-025

(5) Connect the electrical cable to the rear of the control panel.

S 862-024

(6) Supply electrical power (AMM 24-22-00/201).

S 862-023

(7) Remove the DO NOT CLOSE tag and close this P11 panel circuit breaker, as applicable:

(a) 11E4, EFIS CONT PNL LEFT

(b) 11E25, EFIS CONT PNL RIGHT

S 212-028

(8) Make sure that the control panel lights come on.

S 422-029

(9) Replace the applicable aisle control stand access panel.

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S 862-014

(10) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P6 panel as applicable:

(a) 6H15, CAPT SEAT

(b) 6J21, F/O SEAT

S 862-049

(11) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ELECTRONIC ATTITUDE DIRECTOR INDICATOR (EADI) - REMOVAL/INSTALLATION

1. General
   A. There are two electronic attitude director indicators (refer to as EADIs) installed. The procedures that follow supply instructions for the removal, installation, and test of the EADIs.

      NOTE: If the left and the right EADIs are to be removed, then remove and install only one of the EADIs at a time. If this is not done, then the airplane will have to be made level in order to adjust the inclinometers.

TASK 34-22-03-004-001

2. EADI Removal
   A. References
      (1) AMM 29-11-00/201, Main Hydraulic Systems
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 864-003
      (1) Open the applicable circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) P11 Circuit Breaker Panel
              1) 11E3, ADI LEFT
              2) 11E24, ADI RIGHT

      S 864-004
      (2) Make sure that hydraulic power is removed from the flight controls (AMM 29-11-00/201).

      S 024-034

      CAUTION: DO NOT PULL THE CRT HANDLE. THE HANDLE TURNS OUT AUTOMATICALLY WHEN THE SPRING IS RELEASED. HOLD THE HANDLE UNTIL IT IS COMPLETELY RELEASED FROM THE SCREWS. YOU CAN CAUSE DAMAGE TO THE HANDLE IF YOU TURN IT OUT BEFORE IT IS RELEASED FROM THE SCREWS.

      (3) Hold the CRT handle against the EADI.

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S 024-035
(4) Loosen the two screws at the top of the EADI display.

NOTE: Do not completely remove the handle screws.

S 024-036
(5) Pull the handle out and down.

NOTE: If the handle is not fully extended when you remove the CRT, springs installed in the instrument panel can come out.

S 014-037
(6) Pull the control column rearwards and hold it there.

S 024-028

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EADI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EADI.

(7) Slowly pull the EADI out from the instrument panel.

S 034-029
(8) Install a dust cap on the electrical connector of the EADI.

TASK 34-22-03-404-026
3. EADI Installation
A. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 33-16-00/501, Master Dim and Test
(3) AMM 34-22-00/201, Cathode Ray Tube (CRT)
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 864-011
(1) Make sure the applicable circuit breaker is open:
(a) P11 Circuit Breaker Panel
1) 11E3, ADI LEFT

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2) 11E24, ADI RIGHT

S 164-032

(2) Make sure that the inlet screen at the rear of the EADI is clean (Fig. 401).

S 434-030

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EADI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EADI.

(3) Remove the dust cap from the electrical connector of the EADI.

S 424-014

(4) Slowly push the EADI into the instrument panel.

NOTE: Make sure that the handle is fully extended out.

S 864-013

(5) Slowly release the control column.

S 414-014

(6) Put the handle in the up and locked position.

S 434-015

(7) While the handle is held, tighten the mounting screws.

S 864-016

(8) Supply electrical power (AMM 24-22-00/201).

S 864-017

(9) Remove the DO-NOT-CLOSE tag and close the applicable circuit breaker:

(a) P11 Circuit Breaker Panel

1) 11E3, ADI LEFT

2) 11E24, ADI RIGHT

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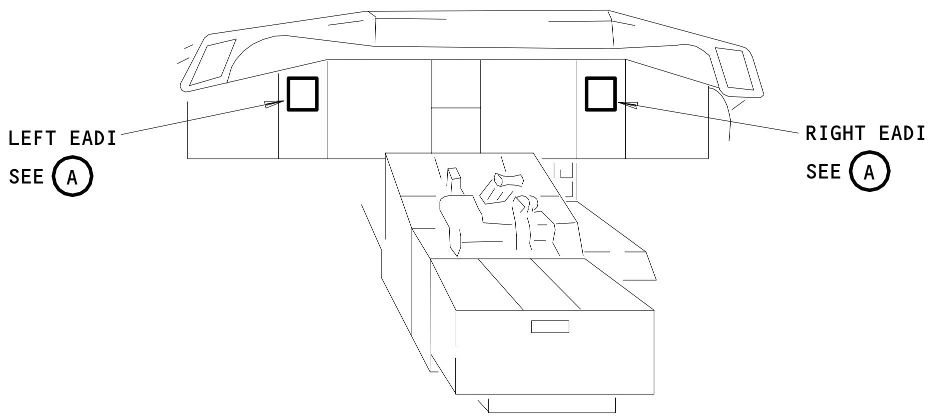
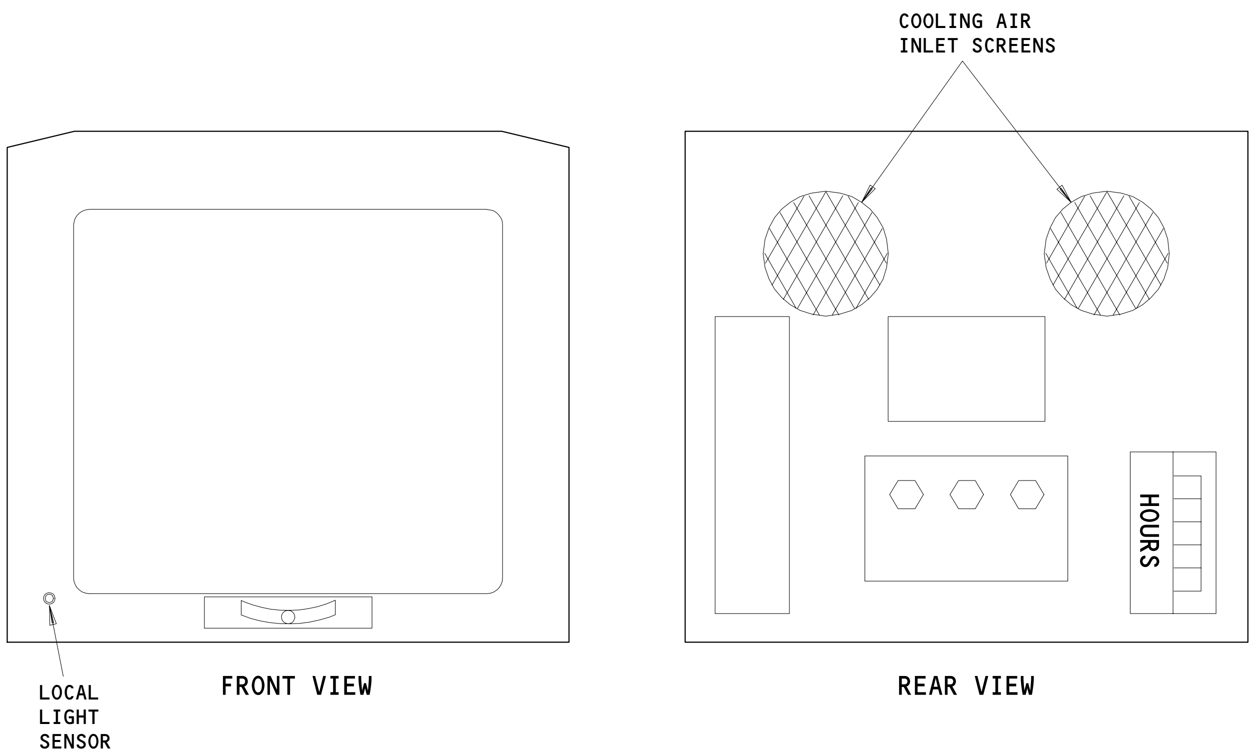


FLIGHT COMPARTMENT



EADI (EXAMPLE)
A

EFIS EADI
Figure 401

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D. EADI Test

S 864-031

(1) Supply electrical power (AMM 24-22-00/201).

S 864-018

(2) Make sure these circuit breakers are closed:
    (a) P11 Circuit Breaker Panel
        1) 11A7, EFIS DSPL SW L
        2) 11E4, EFIS CONT PNL LEFT
        3) 11E25, EFIS CONT PNL RIGHT
        4) 11F8, EFIS SYM GEN L
        5) 11F24, EFIS DSPL SW RIGHT
        6) 11F29, EFIS SYM GEN RIGHT

S 864-019

(3) Set the EFI switches on the two instrument source select panels to the NORM position.

S 864-020

(4) On the overhead light control panel, push the TEST switch to start the test (AMM 33-16-00/501).

S 754-033

(5) Make sure the test pattern shows on the EADI.

S 864-022

(6) On the overhead light control panel, push the TEST switch to stop the test (AMM 33-16-00/501).

S 864-023

(7) Adjust the inclinometer if necessary (AMM 34-22-00/201).

S 114-024

(8) Clean the face of the EADI (AMM 34-22-00/201).

E. Put the Airplane Back to Its Usual Condition

S 864-025

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ELECTRONIC HORIZONTAL SITUATION INDICATOR (EHSI) - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the EHSI; the other is the installation of the EHSI.
   B. Two EHSIs (N5 - left, N45 - right) are installed.

TASK 34-22-04-004-010

2. EHSI Removal
   A. References
      (1) AMM 29-11-00/201, Main Hydraulic Systems
   B. Access
      (1) Location Zones
          211/212   Flight Compartment

   C. Procedure

      S 864-012
      (1) Open the applicable circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) P11 Circuit Breaker Panel
              1) 11E6, HSI LEFT
              2) 11E27, HSI RIGHT

      S 864-013
      (2) Make sure that hydraulic power is removed from the flight controls (AMM 29-11-00/201).

      S 024-037

CAUTION: DO NOT PULL THE CRT HANDLE. THE HANDLE TURNS OUT AUTOMATICALLY WHEN THE SPRING IS RELEASED. HOLD THE HANDLE UNTIL IT IS COMPLETELY RELEASED FROM THE SCREWS. YOU CAN CAUSE DAMAGE TO THE HANDLE IF YOU TURN IT OUT BEFORE IT IS RELEASED FROM THE SCREWS.

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(3) Hold the CRT handle against the EHSI.

S 024-038
(4) Loosen the two screws at the top of the EHSI display.

NOTE: Do not completely remove the handle screws.

S 024-039
(5) Pull the handle out and down.

NOTE: If the handle is not fully extended when you remove the CRT, springs installed in the instrument panel can come out.

S 014-028
(6) Pull the control column rearwards and hold it there.

S 024-031

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EHSI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EHSI.

(7) Slowly pull the EHSI out from the instrument panel.

S 034-032
(8) Install a dust cap on the electrical connector of the EHSI.

TASK 34-22-04-404-019
3. EHSI Installation
A. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 33-16-00/501, Master Dim and Test
(3) AMM 34-22-00/201, Cathode Ray Tube (CRT)
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 864-021
(1) Make sure the applicable circuit breaker is open:
(a) P11 Circuit Breaker Panel
1) 11E6, HSI LEFT

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2) 11E27, HSI RIGHT

S 164-035

(2) Make sure that the inlet screen at the rear of the EHSI is clean (Fig. 401).

S 434-033

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE EHSI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE EHSI.

(3) Remove the dust cap from the electrical connector of the EHSI.

S 424-023

(4) Slowly push the EHSI into the instrument panel.

NOTE: Make sure that the handle is fully extended out.

S 414-029

(5) Slowly release the control column.

S 414-024

(6) Put the handle in the up and locked position.

S 434-026

(7) While the handle is held, tighten the mounting screws.

S 864-002

(8) Remove the DO-NOT-CLOSE tag and close the applicable circuit breaker:

(a) P11 Circuit Breaker Panel

1) 11E6, HSI LEFT

2) 11E27, HSI RIGHT

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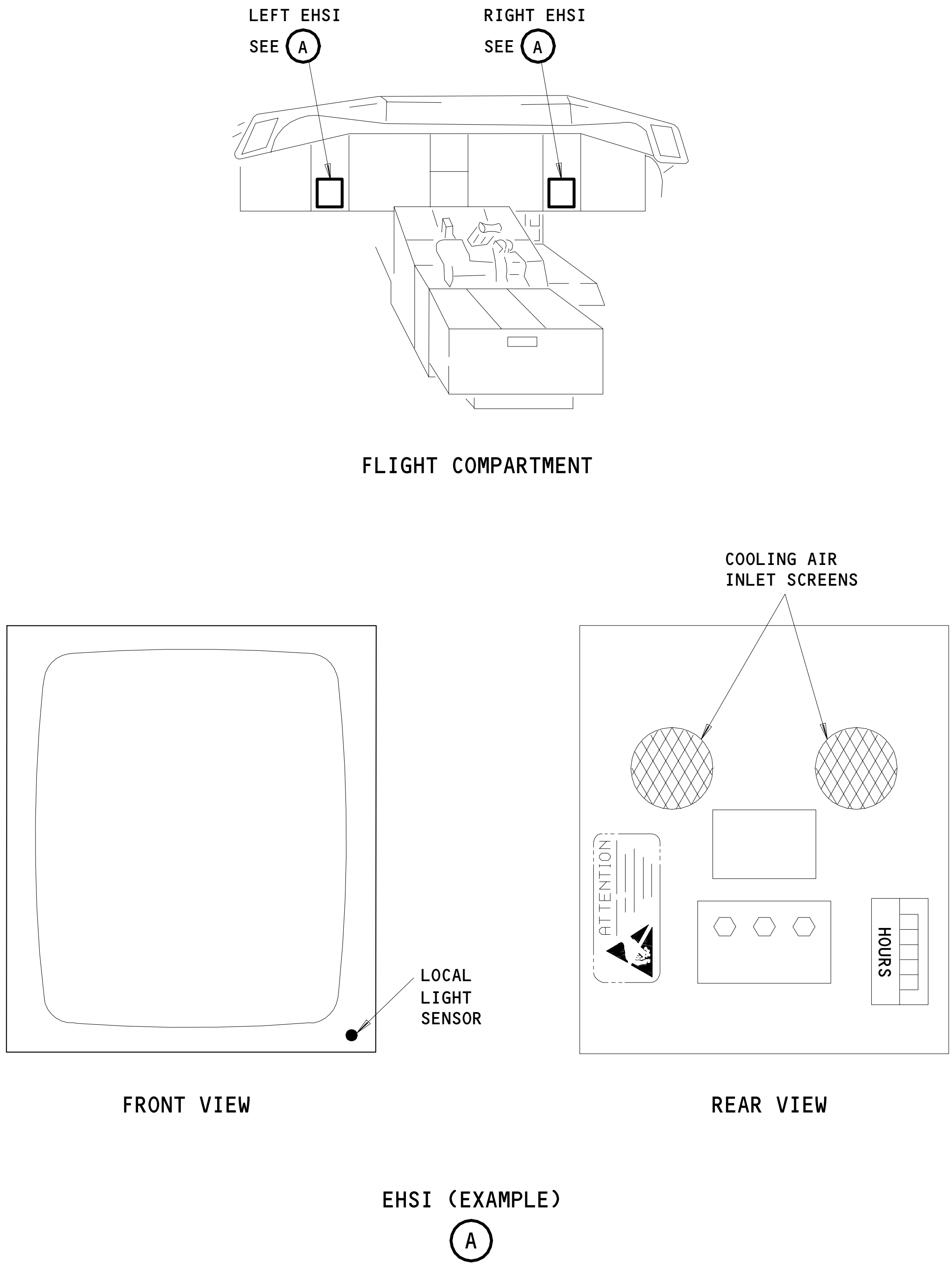

EFIS EHSI
Figure 401

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D. EHSI Test

S 864-034
(1) Supply electrical power (AMM 24-22-00/201).

S 864-003
(2) Make sure these circuit breakers are closed:
(a) P11 Circuit Breaker Panel
1) 11A7, EFIS DSPL SW L
2) 11E4, EFIS CONT PNL LEFT
3) 11E25, EFIS CONT PNL RIGHT
4) 11F8, EFIS SYM GEN L
5) 11F24, EFIS DSPL SW RIGHT
6) 11F29, EFIS SYM GEN RIGHT

S 864-004
(3) Set the EFI switches on the two instrument source select panels to the NORM position.

S 864-005
(4) On the overhead light control panel, push the TEST switch to start the test (AMM 33-16-00/501).

S 754-036
(5) Make sure the test pattern shows on the EHSI.

S 864-007
(6) On the overhead light control panel, push the TEST switch to stop the test (AMM 33-16-00/501).

S 114-008
(7) Clean the face of the EHSI (AMM 34-22-00/201).

E. Put the Airplane Back to Its Usual Condition

S 864-009
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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RDMI - REMOVAL/INSTALLATION

1. General
   A. Two RDMIs are installed. The procedure that follows gives instruction for the removal, installation and test of the replaced unit.

TASK 34-22-05-004-001

2. RDMI Removal
   A. References
      (1) AMM 20-41-01/201, Electrostatic Sensitive Devices
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Prepare for Removal

      S 914-004

      CAUTION: DO NOT TOUCH THE RDMIS BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE RDMIS.

      (1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

      S 864-007
      (2) Open the overhead panel, P11, circuit breakers that follow, as applicable, and attach DO-NOT-CLOSE tags:
          (a) For the captain's RDMI:
              1) 11A6, RDMI L
          (b) For the first officer's RDMI:
              1) 11F25, RDMI RIGHT
   D. Procedure

      S 034-008
      (1) Loosen the instrument clamp screws on the front panel adjacent to the indicator.

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S 024-009
(2) Pull the indicator out of the instrument panel.

S 014-010
(3) Disconnect the electrical connector at the rear of the indicator.

TASK 34-22-05-404-011
3. RDMI Installation
A. References
(1) AMM 20-41-01/201, Electrostatic Sensitive Devices
(2) AMM 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Prepare for Installation

S 914-014

CAUTION: DO NOT TOUCH THE RDMIS BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE RDMIS.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 864-025
(2) Make sure the P11 panel circuit breakers that follow, as applicable, are open:
(a) For the captain's RDMI:
1) 11A6, RDMI L
(b) For the first officer's RDMI:
1) 11F25, RDMI RIGHT

S 414-018
(3) Connect the electrical cable to the rear of the indicator.

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S 424-019
(4) Push the indicator into the instrument panel.

S 434-027
(5) Tighten the instrument clamp screws on the front panel adjacent to the indicator.

S 864-020
(6) Supply electrical power (AMM 24-22-00/201).

D. Indicator Test

S 864-021
(1) Remove the DO-NOT-CLOSE tags and close the P11 panel circuit breakers that follow:
(a) 11A6, RDMI L
(b) 11F25, RDMI RIGHT

S 214-022
(2) Make sure that the RDMI panel lights come on.

S 864-026
(3) Remove the electrical power if it is not necessary (AMM 24-22-00/201).

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VERTICAL SPEED INDICATOR (VSI) - REMOVAL/INSTALLATION

1. General
   A. The two vertical speed indicators are installed on the captain's and first officer's instrument panels. Power is supplied by an electrical connector at the rear of the instrument. The indicator is held in place by an instrument panel clamp.

TASK 34-22-06-004-001

2. Remove the VSI
   A. Access
      (1) Location Zones
          211/212 Flight Compartment

   B. Procedure

      S 864-002
      (1) Open this overhead panel, P11, circuit breaker, as applicable, and attach a DO-NOT-CLOSE tag:
          (a) 11E5, VSI LEFT
          (b) 11E26, VSI RIGHT

      S 034-003
      (2) Loosen the instrument mounting screws on the front panel adjacent to the indicator.

      S 014-024

      CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE VSI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE VSI.

      (3) Pull the VSI out from the instrument panel.

      S 034-005
      (4) Disconnect the electrical cable.

      S 024-006
      (5) Remove the VSI.

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S 034-025
(6) Install dust caps on the electrical connectors.

TASK 34-22-06-404-017
3. Install the VSI
A. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 34-21-00/501, Inertial Reference System
B. Access
(1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

C. Procedure

S 864-007
(1) Make sure that this P11 panel circuit breaker, as applicable, is open:
(a) 11E5, VSI LEFT
(b) 11E26, VSI RIGHT

S 434-026

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE VSI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE VSI.

(2) Remove the dust caps from the electrical connectors.

S 434-016
(3) Connect the electrical cable.

S 424-009
(4) Push the VSI into the instrument panel.

S 434-011
(5) Tighten the instrument mounting screws.

S 864-015
(6) Supply electrical power (AMM 24-22-00/201).

S 864-012
(7) Remove the DO-NOT-CLOSE tag and close this P11 panel circuit breaker, as applicable:
(a) 11E5, VSI LEFT
(b) 11E26, VSI RIGHT

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D. VSI Test

S 864-019

(1) Make sure the applicable IRU is energized and aligned (AMM 34-21-00/201).

S 714-018

(2) Do this VSI test with the applicable left or right IRS controls and indicators:
  (a) Make sure the IRS switch on the applicable instrument source select panel is in the NORM position.
  (b) Make sure the VSI off flag does not show.
  (c) Set the applicable mode switch on the IRMP to the ALIGN position.
    1) Make sure the ALIGN light comes on.
    2) Make sure the VSI off flag shows.
  (d) Push and hold the test switch on the applicable IRU.
  (e) Make sure this sequence of indications occurs for the applicable Inertial Reference System:
    1) <u>Seconds 0-2</u>:
      a) The IRMP annunciator lights ALIGN, ON DC, DC FAIL, and FAULT come on.
      b) The IRMP shows the number "8" in all the display areas.
    2) <u>Seconds 2-10</u>:
      a) The annunciator lights ON DC, DC FAIL, and FAULT go off, and ALIGN stays on, on the IRMP.
      b) The VSI off flag shows.
    3) <u>After 10 seconds</u>:
      a) The VSI shows -600 ft/min.
  (f) Release the test switch on the IRU.
  (g) Set the mode switch on the IRMP to the OFF position.
  (h) Make sure the annunciator lights on the IRMP are off.
  (i) Make sure the VSI off flag shows.

S 864-021

(3) Set the IRS switch on the applicable instrument source select panel to the ALTN position.

S 714-022

(4) Do the VSI test again on the applicable left or right VSI with the center IRS controls and the center IRU.

E. Put the Airplane Back to Its Usual Condition

S 864-023

(1) Set the IRS switch on the applicable instrument source select panel to the NORM position.

S 864-020

(2) Remove power from the applicable IRU (AMM 34-21-00/501).

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S 864-014

(3) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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EFIS REMOTE LIGHT SENSOR - REMOVAL/INSTALLATION

1. General
   A. Two equivalent EFIS remote light sensors are installed on the glareshield (P7) panel.

   TASK 34-22-07-004-001
2. EFIS Remote Light Sensor Removal
   A. Equipment
      (1) Insert/Extract Tool - NAS1664-20
   B. References
      (1) AMM 20-41-01/201, Electrostatic Sensitive Devices
      (2) AMM 51-31-01/201, Seals and Sealing
   C. Access
      (1) Location Zones
          211/212 Flight Compartment

   D. Prepare for Removal

      S 864-002
      (1) Open these overhead panel, P11, circuit breakers, as applicable, and attach DO-NOT-CLOSE tags:
         (a) For the left remote light sensor:
            1) 11A1, VOR MKR LEFT
            2) 11E3, ADI LEFT
            3) 11E6, HSI LEFT
            4) 11J3, EICAS UPPER DSPL
            5) 11J30, EICAS LOWER DSPL
         (b) For the right remote light sensor:
            1) 11E24, ADI RIGHT
            2) 11E27, HSI RIGHT
            3) 11E33, VOR RIGHT

      S 864-003

      WARNING: REMOVE ELECTRICAL POWER FROM THE FLIGHT COMPARTMENT SEAT. ACCIDENTAL ELECTRICAL OPERATION OF THE FLIGHT COMPARTMENT SEAT CAN CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

      (2) Open these circuit breakers on the main power distribution panel, P6, as applicable, and attach DO-NOT-CLOSE tags:
         (a) 6H15, CAPT SEAT
         (b) 6J21, F/O SEAT

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E. Procedure

S 014-004

(1) Remove the connectors and cooling ducts from the rear of the applicable VOR control panel, as necessary, to get access to the remote light sensor.

S 914-005

CAUTION: DO NOT TOUCH THE LIGHT SENSOR BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE LIGHT SENSOR.

(2) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 034-006

(3) Disconnect the five wires from the terminal block with the extract tool.

S 034-007

(4) Loosen the screws on the glareshield adjacent to the sensor.

S 024-027

(5) Remove the light sensor from below the glareshield.

S 914-008

(6) Remove the used sealant from below the glareshield (AMM 51-31-01/201).

TASK 34-22-07-404-036

3. EFIS Remote Light Sensor Installation (Fig. 401)

A. Equipment
   (1) Insert/Extract Tool - NAS1664-20
   (2) Handheld light source

B. Consumable Materials
   (1) A00247 Sealant - BMS 5-95 Chromate type
   (2) Black tape

C. References
   (1) AMM 20-41-01/201, Electrostatic Sensitive Devices
   (2) AMM 24-22-00/201, Electrical Power - Control
   (3) AMM 51-31-01/201, Seals and Sealing

D. Access
   (1) Location Zones
       211/212   Flight Compartment

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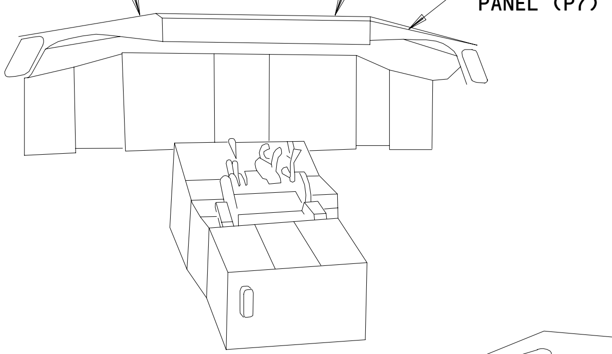
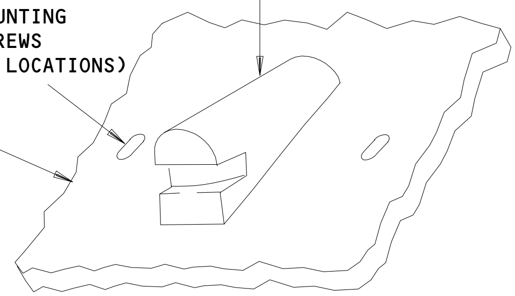
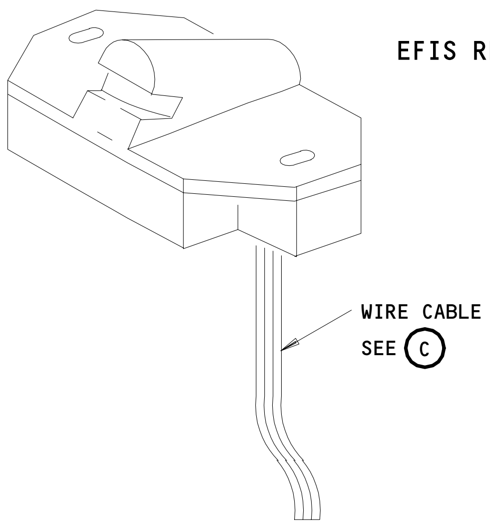


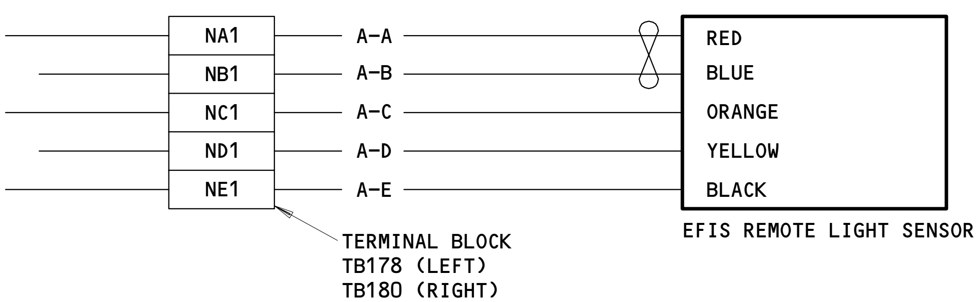
FLIGHT COMPARTMENT



EFIS REMOTE LIGHT SENSOR
A



EFIS REMOTE LIGHT SENSOR
B



WIRING
C

EFIS Remote Light Sensor
Figure 401

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E. Prepare for Installation

S 864-009

(1) Make sure that these P11 panel circuit breakers, as applicable, are open:
  (a) For the left remote light sensor:
    1) 11A1, VOR MKR LEFT
    2) 11E3, ADI LEFT
    3) 11E6, HSI LEFT
    4) 11J3, EICAS UPPER DSPL
    5) 11J30, EICAS LOWER DSPL
  (b) For the right remote light sensor:
    1) 11E24, ADI RIGHT
    2) 11E27, HSI RIGHT
    3) 11E33, VOR RIGHT

S 864-010

(2) Make sure that these P6 panel circuit breakers, as applicable, are open:
  (a) 6H15, CAPT SEAT
  (b) 6J21, F/O SEAT

F. Procedure

S 914-011

CAUTION: DO NOT TOUCH THE LIGHT SENSOR BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE LIGHT SENSOR.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 424-012

(2) Put the remote light sensor into the hole in the glareshield with the sensor lens face to the front of the airplane.

S 434-013

(3) Install the screws on the glareshield adjacent to the light sensor.

S 914-014

(4) Apply the sealant, BMS 5-95, around the light sensor below the glareshield to prevent light leakage (AMM 51-31-01/201).

  NOTE: Make sure that the sealant does not have leakage on to the glareshield surface.

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S 864-015
(5) Cut the wires on the new light sensor to a length equivalent to the wire length on the removed light sensor.

S 864-016
(6) Install the contacts on the ends of the wires.

S 434-017
(7) Put the wire contacts into the correct terminal block sockets with the insert tool.

S 434-018
(8) Attach the connectors and cooling ducts to the VOR control panel.

S 864-019
(9) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers, as applicable:
   (a) For the left remote light sensor:
      1) 11A1, VOR MKR LEFT
      2) 11E3, ADI LEFT
      3) 11E6, HSI LEFT
      4) 11J3, EICAS UPPER DSPL
      5) 11J30, EICAS LOWER DSPL
   (b) For the right remote light sensor:
      1) 11E24, ADI RIGHT
      2) 11E27, HSI RIGHT
      3) 11E33, VOR RIGHT

S 864-020
(10) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers, as applicable:
   (a) 6H15, CAPT SEAT
   (b) 6J21, F/O SEAT

G. Remote Light Sensor Test

S 864-021
(1) Supply electrical power (AMM 24-22-00/201).

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S 864-022
(2) Make sure that these P11 panel circuit breakers, as applicable, are closed:
(a) 11A7, EFIS DSPL SW L
(b) 11E3, ADI LEFT
(c) 11E4, EFIS CONT PNL LEFT
(d) 11E6, HSI LEFT
(e) 11E24, ADI RIGHT
(f) 11E25, EFIS CONT PNL RIGHT
(g) 11E27, HSI RIGHT
(h) 11F8, EFIS SYM GEN L
(i) 11F24, EFIS DSPL SW RIGHT
(j) 11F29, EFIS SYM GEN RIGHT

S 864-023
(3) On the applicable EFIS control panel, put the ADI BRT and HSI BRT controls an equal distance between fully clockwise and fully counterclockwise.

S 864-024
(4) For light conditions:
(a) Put black tape on the applicable remote light sensor.
(b) On the applicable EHSI and EADI, make sure that the display brightness decreases.
(c) Remove the tape from the remote light sensor.
(d) Make sure that the display brightness goes back to the control value.

S 864-025
(5) For no light conditions:
(a) Apply a light source to the applicable remote light sensor.
(b) On the applicable EHSI and EADI, make sure that the display brightness increases.
(c) Remove the light source from the remote light sensor.
(d) Make sure that the display brightness goes back to the control value.

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H. Put the Airplane Back to Its Usual Condition

S 864-026

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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RESOLUTION ADVISORY/VERTICAL SPEED INDICATOR (RA/VSI) - REMOVAL/INSTALLATION

1. General
   A. The RA/VSIs are installed on the captain's, P1, and first officer's, P3, instrument panels. The electrical connection is at the rear of the unit.

TASK 34-22-09-004-001

2. RA/VSI Removal
   A. Access
      (1) Location Zones
          211/212 Flight Compartment

   B. Procedure

      S 864-002
      (1) Open the applicable circuit breaker and attach a DO-NOT-CLOSE tag:
          (a) P11 Overhead Circuit Breaker Panel
              1) 11E5, VSI LEFT
              2) 11E26, VSI RIGHT

      S 014-003
      (2) Loosen the instrument mounting screws on the front panel adjacent to the RA/VSI.

      S 014-024

      CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE RA/VSI IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE RA/VSI.

      (3) Pull the RA/VSI out from the instrument panel to get to the electrical cable.

      S 014-005
      (4) Disconnect the electrical cable.

      S 024-006
      (5) Remove the RA/VSI.

      S 014-025
      (6) Install dust caps on the electrical connectors.

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TASK 34-22-09-404-008

3. RA/VSI Installation

A. References
   (1) AMM 24-22-00/201, Electrical Power - Control
   (2) AMM 34-21-00/201, Inertial Reference System
   (3) AMM 34-45-00/501, Traffic Alert and Collision Avoidance System

B. Access
   (1) Location Zones
       211/212 Flight Compartment

C. Procedure

S 864-009

(1) Make sure the applicable circuit breaker is open:
    (a) P11 Overhead Circuit Breaker Panel
        1) 11E5, VSI LEFT
        2) 11E26, VSI RIGHT

S 414-026

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE RA/VSI. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE RA/VSI.

(2) Remove the dust caps from the electrical connectors.

S 414-016

(3) Connect the electrical cable.

S 424-012

(4) Push the RA/VSI into position in the instrument panel.

S 414-011

(5) Tighten the instrument mounting screws.

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D. RA/VSI Test

S 864-014

(1) Supply electrical power (AMM 24-22-00/201).

S 864-015

(2) Remove the DO-NOT-CLOSE tag and close the applicable circuit breaker:
   (a) P11 Overhead Circuit Breaker Panel
      1) 11E5, VSI LEFT
      2) 11E26, VSI RIGHT

S 864-016

(3) Make sure the applicable IRU is energized and aligned (AMM 34-21-00/201).

S 714-017

(4) Do this RA/VSI test with the applicable left or right IRS controls and indicators:
   (a) Make sure the IRS switch on the applicable instrument source select panel is in the NORM position.
   (b) Make sure the VSI FAIL fault flag does not show.
   (c) Set the applicable mode switch on the IRMP to the ALIGN position.
      1) Make sure the ALIGN light comes on.
      2) Make sure the VSI FAIL fault flag shows.
   (d) Push and hold the test switch on the applicable IRU.
   (e) Make sure this sequence of indications occurs for the applicable Inertial Reference System:
      1) <u>Seconds 0-2</u>:
         a) The IRMP annunciator lights come on.
         b) The IRMP shows the number "8" in all the display areas.
      2) <u>Seconds 2-10</u>:
         a) The annunciator light, ALIGN, shows on the IRMP.
         b) The VSI FAIL fault flag shows.
      3) <u>After 10 seconds</u>:
         a) The RA/VSI shows -600 ft/min.
   (f) Release the test switch on the IRU.
   (g) Set the mode switch on the IRMP to the OFF position.
   (h) Make sure the annunciator lights on the IRMP are off.

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(i) Make sure the VSI FAIL fault flag shows.

S 864-018

(5) Set the IRS switch on the applicable instrument source select panel to the ALTN position.

S 714-019

(6) Do the RA/VSI test again on the applicable left or right RA/VSI with the center IRS controls and the center IRU.

S 714-013

(7) Do the TCAS - Operational Test (AMM 34-45-00/501).

E. Put the Airplane Back to Its Usual Condition

S 864-020

(1) Set the IRS switch on the applicable instrument source select panel to the NORM position.

S 864-021

(2) Remove power from the applicable IRU (AMM 34-21-00/201).

S 864-022

(3) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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STANDBY MAGNETIC COMPASS - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The standby compass is used by the pilots as a quick directional reference and as an auxiliary compass. It is a highly sensitive instrument that is installed in a liquid filled case. The liquid serves to dampen rapid movement and oscillations of the compass.
2. Component Detail (Fig. 1)
   A. Standby Magnetic Compass
      (1) The standby magnetic compass is a single instrument mounted in the control cabin above the center of the left and right windshields. The unit is mounted to the airframe with a nonferrous bracket.
      (2) The compass employs a circular card having two parallel and horizontal magnets attached to indicate magnetic direction. The card is free to rotate and tilt within the liquid filled case. The front panel has E-W and N-S compensator adjusters for alignment of the compass card.
      (3) AIRPLANES WITH STANDBY MAGNETIC COMPASS P/N C-5H;

          Rotate the cover screw counter-clockwise and remove the cover to gain acess to the compensator adjustors.
      (4) AIRPLANES WITH STANDBY MAGNETIC COMPASS P/N C-5M;

          Rotate the cover screw clockwise to expose the compensator adjustors.
      (5) 767-200,300 AIRPLANES WITH
          STANDBY MAGNETIC COMPASS
          P/N C-5H;

          The indicating card is illuminated by means of a single 5V ac bulb located at the top of the compass. The bulb brightness is controlled by the PANEL lighting intensity control on the captain's lighting control panel (P7). A lamp access cover permits easy replacement of the light bulb.
      (6) 767-200,300 AIRPLANES WITH
          STANDBY MAGNETIC COMPASS
          P/N C-5M;

          The indicating card is illuminated by means of a single 5V ac bulb located at the botttom of the compass. The bulb brightness is controlled by the PANEL lighting intensity control on the captain's lighting control panel (P7). A lamp access cover permits easy replacement of the light bulb.

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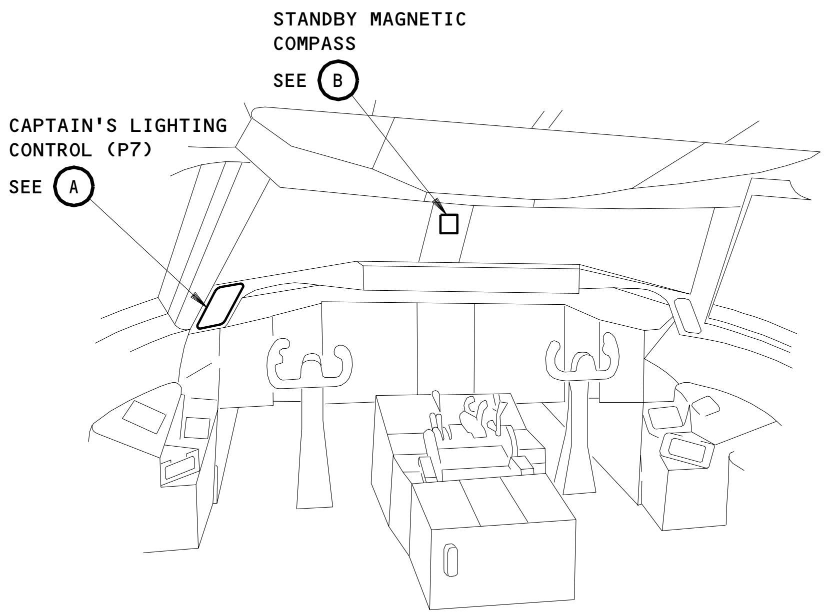
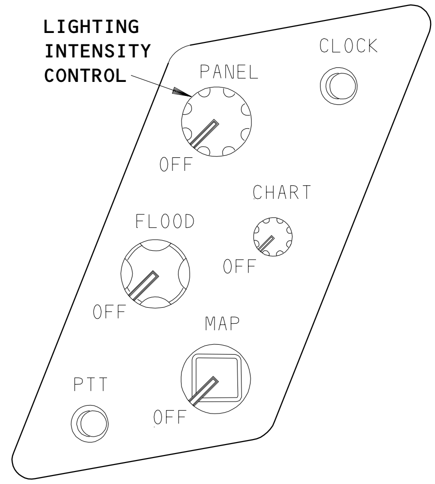
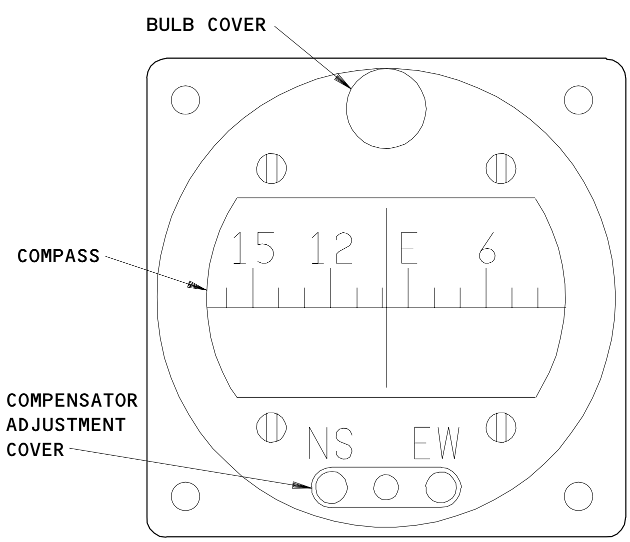


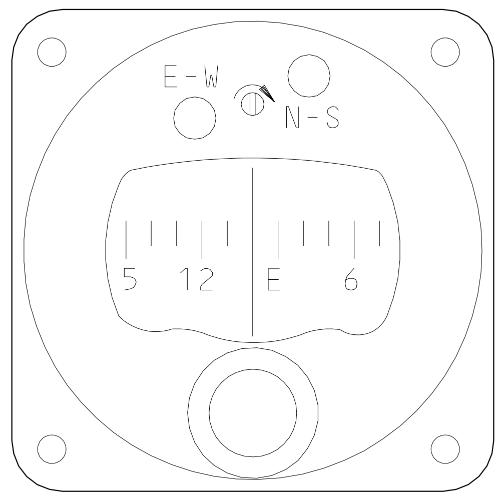
FLIGHT COMPARTMENT



CAPTAIN'S LIGHTING CONTROL
A



STANDBY MAGNETIC COMPASS
B 1



STANDBY MAGNETIC COMPASS
B 2

1 AIRPLANES WITH STANDBY MAGNETIC COMPASS P/N C-5H
2 AIRPLANES WITH STANDBY MAGNETIC COMPASS P/N C-5M

Standby Magnetic Compass - Component Detail
Figure 1

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3. Operation (Fig. 1)
   A. Functional Description
      (1) The magnets attached to the compass card align themselves with the earth's magnetic lines of flux. This rotates the compass card which is calibrated to indicate the airplane heading relative to the earth's field.
      (2) The compensators adjust the local magnetic field to correct for deviations produced by airplane components and currents in the airplane wiring. When small errors cannot be removed by the compensators, they are noted on a card mounted near the compass for the pilots' use.
   B. Control
      (1) To provide power to compass lighting, perform the following steps:
         (a) Provide electrical power (AMM 24-22-00).
      (2) Close the following overhead panel P11 circuit breaker:
         (a) 11P2, LIGHTING INSTRUMENT & PANEL CAPT
         (b) Adjust compass lighting by rotating the PANEL lighting control knob, located on captain's lighting control panel (P7).

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STANDBY MAGNETIC COMPASS

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
COMPASS - STANDBY MAGNETIC, N99		1	FLT COMPT, P5	34-23-01

Standby Magnetic Compass - Component Index
Figure 101

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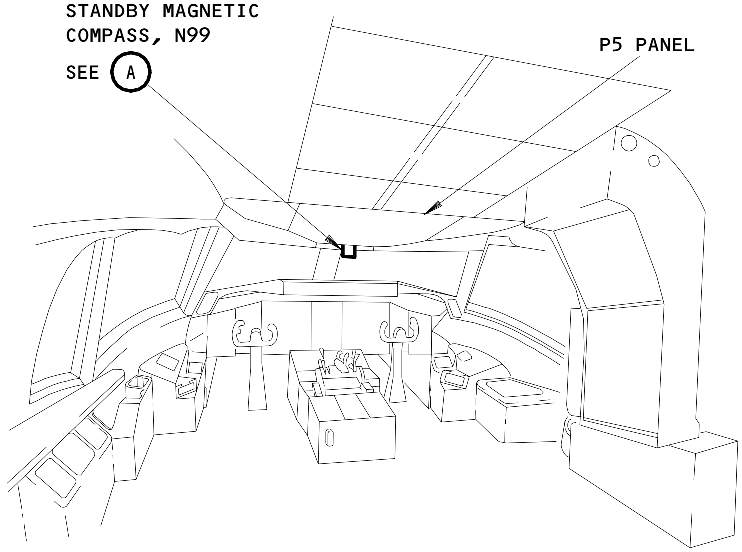

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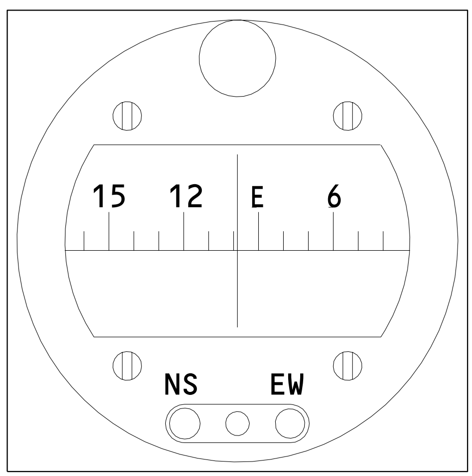

STANDBY MAGNETIC COMPASS, N99

A

Standby Magnetic Compass - Component Location
Figure 102 (Sheet 1)

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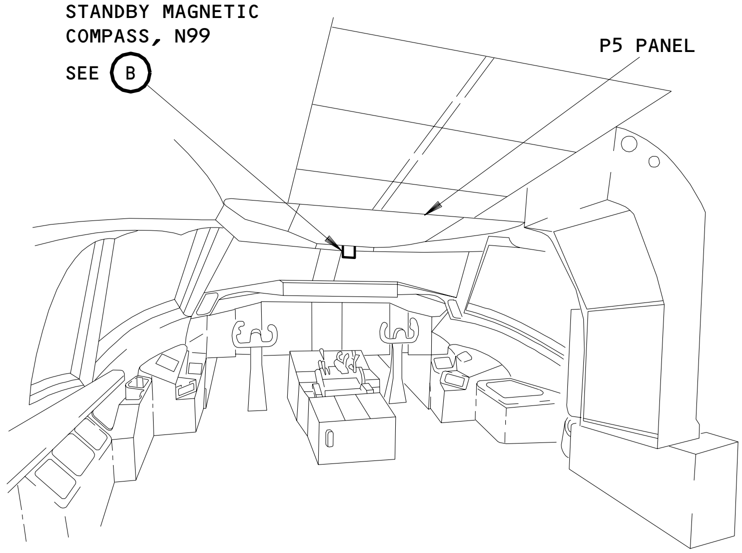

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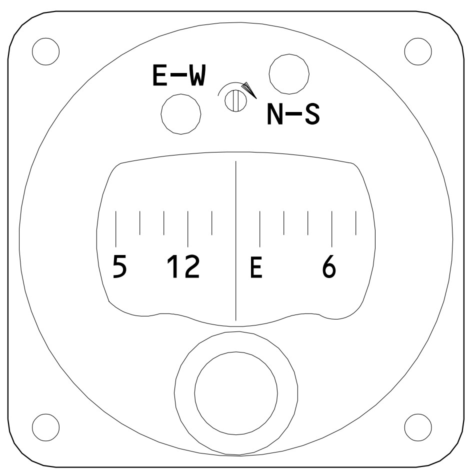

STANDBY MAGNETIC COMPASS, N99

B

Standby Magnetic Compass - Component Location
Figure 102 (Sheet 2)

W36759
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STANDBY MAGNETIC COMPASS - MAINTENANCE PRACTICES

1. General
   A. This procedure has these tasks:
      (1) Standby Magnetic Compass - Calibration
      (2) Standby Magnetic Compass light - Removal
      (3) Standby Magnetic Compass Light - Installation
   B. The Standby Magnetic Compass calibration procedure contains two tasks. Each task is a different procedure that you can use to do a swing of the standby compass. One procedure is to tow the airplane around a compass rose (Tow Around Procedure). The other procedure is to use a standby compass calibrator (Calibrator Procedure). Use only one of these procedures to do a swing of the standby compass. In the event that the compass is removed and no modifications are made to the area and the same compass is re-installed, there is no need nor requirement to swing the compass.
   C. Air bubbles can occur in the standby magnetic compass because of temperature change and/or decrease of liquid. Maintenance limits made for liquid quantity make sure of satisfactory compass operation. When an air bubble is larger than 3/8-inch wide and 1/8-inch high, with the glass approximately vertical, replace the standby compass.

   D. Each compass calibration task has two parts. The first part is to do a swing of the standby compass through four compass points (N, E, S, W). Use this procedure for compass calibration. The second part is to do a swing of the standby compass through 12 compass points that are approximately 30 degrees apart. Use this procedure to measure the remaining errors and to make sure the standby compass heading is accurate. Use this data to make the compass correction card. This card must stay with the standby compass.
   E. It is not necessary to keep a constant radius or tangency during airplane tow around the compass rose or swing area. Tow direction is optional. These make no difference when you calculate the solutions.
   F. Do not park vehicles less than 250 feet from the airplane during the compass swing.
   G. Make sure the radio receivers are on during the compass swing.
   H. You can use the APU during the compass swing.

   TASK 34-23-00-822-001
2. Standby Magnetic Tow-Around Procedure
   A. Equipment
      (1) Tow Tractor
      (2) Non-magnetic tools to adjust the standby magnetic compass.
      (3) One compass correction card - AN5823-1
   B. References
      (1) AMM 9-11-00/201 - Towing
      (2) AMM 24-22-00/201 - Electrical Power - Control
      (3) AMM 34-21-00/201 - Inertial Reference System (IRS)
      (4) AMM 34-22-00/501 - Electronic Flight Instrument System (EFIS)

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C. Access

(1) Location Zones

211/212 Flight Compartment

D. Procedure

NOTE: Ferromagnetic parts installed near the standby compass can cause compass heading errors. Make sure no ferromagnetic parts are near the captain's and the first officer's window frames. If found, replace the parts with non-magnetic, corrosion-resistant steel (CRES) parts.

S 582-043

(1) Tow the airplane to the compass swing area (AMM 9-11-00/201).

NOTE: The Compass Swing Area must be a level area with a smooth surface. It must be sufficiently strong to hold the weight of the airplane. The area must be large enough to tow or taxi the airplane. Make sure all vehicles other than the tow vehicle are at least 250 feet from the airplane.

The horizontal component of the earth's magnetic field must be constant (±1 degree) in the test area. Measure the horizontal component if magnetic material (such as a building) is installed less than 600 feet from the compass rose. Do not use the compass rose if the horizontal component is not constant (± 1 degree).

S 862-067

(2) Supply the electrical power (AMM 24-22-00/201).

S 862-003

(3) Initialize and align the IRS (AMM 34-21-00/201).

S 862-004

(4) On the P5 panel, set the three IRS mode select switches to the NAV position.

S 862-068

(5) Energize all of the electronic equipment, radios, and control cabin lighting for the usual conditions that occur in flight.

S 862-006

(6) On the P10 panel, set the captain's and first officer's EFIS mode switches to the VOR or ILS position (AMM 34-22-00/501).

S 862-007

(7) Make sure that the two EHSIs show the same magnetic heading.

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E. Standby Compass Adjustment

NOTE: The steps that follow are for the four-point calibration swing:

S 582-044

(1) Turn the airplane so that the captain's Electronic Horizontal Situation Indicator (EHSI) shows the north magnetic heading (MH)N ±2 degrees.

S 862-009

(2) Set the left and right IRS instrument source select switches on panels P1 and P3 to the NORM position.

S 722-102

CAUTION: USE TOOLS THAT ARE NOT MAGNETIC. MAGNETIC TOOLS CAN CAUSE COMPASS DIFFERENCES.

(3) Make sure that the N-S and E-W compensations on the standby compass are at neutral.

S 972-011

(4) Make a record of the EHSI magnetic heading (MH)N and the standby compass heading (CH)N.

S 862-012

(5) Calculate the north heading deviation (DN) and its sign as follows:

DN = (MH)N - (CH)N

S 972-013

(6) Make a record of DN.

S 862-014

(7) Tow the airplane to less than 2° from an east magnetic heading (MH)E as shown on the captain's EHSI.

S 972-015

(8) Make a record of the EHSI magnetic heading (MH)E and the standby compass heading (CH)E.

S 862-016

(9) Calculate the east heading deviation (DE) and its sign as follows:

DE = (MH)E - (CH)E

S 972-017

(10) Make a record of DE.

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S 862-018
(11) Tow the airplane to less than 2° from a south magnetic heading (MH)S as shown on the captain's EHSI.

S 972-019
(12) Make a record of the EHSI magnetic heading (MH)S and the standby compass heading (CH)S.

S 862-020
(13) Calculate the south heading deviation (DS) and its sign as follows:

$$DS = (MH)S - (CH)S$$

S 972-021
(14) Make a record of DS.

S 862-022
(15) Calculate the north-south single cycle error coefficient (C) as follows:

$$C = \frac{DN - DS}{2}$$

S 972-023
(16) Make a record of C.

S 862-024
(17) Adjust the N-S compensation screw on the standby magnetic compass (while at the south magnetic heading) to give a compass heading indication of (CH)S - C on the indicator.

S 862-025
(18) Tow the airplane to less than 2° from the west magnetic heading (MH)W as shown on the captain's EHSI.

S 972-026
(19) Make a record of the EHSI magnetic heading (MH)W and the standby compass heading (CH)W.

S 862-027
(20) Calculate the west heading deviation (DW) and its sign as follows:

$$DW = (MH)W - (CH)W$$

S 972-028
(21) Make a record of DW.

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S 862-029
(22) Calculate the east-west single cycle error coefficient (B) as follows:

$$B = \frac{DE - DW}{2}$$

S 972-042
(23) Make a record of B.

S 862-030
(24) Adjust the E-W compensation screw on the standby magnetic compass (while at the west magnetic heading) to give a compass heading indication of (CH)W - B on the indicator. Make sure the difference between the maximum positive and maximum negative value is 10 degrees or less.

NOTE: For FAA airplane certification, the remaining deviation for the standby magnetic compass must not be more than ±8 degrees. For CAA certification, the remaining deviation must not be more than ±5 degrees.

F. Standby Compass Accuracy Check

NOTE: The steps that follow are for the 12-point accuracy swing:

S 862-031
(1) Move the airplane near the center of the compass swing area. Use the magnetic heading of 0° as shown by the EHSI.

S 972-032
(2) Make a record of the magnetic heading (MH) and standby compass heading (CH).

S 862-033
(3) Calculate the deviation as follows:

$$D = MH - CH$$

S 972-034
(4) Make a record of D.

S 862-035
(5) Move the airplane to the magnetic headings as shown on the EHSI for these target headings: 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, and 330 degrees.

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S 862-037
(6) Calculate the deviation for each heading as follows:

D = MH - CH

S 972-038
(7) Make a record of D.

NOTE: The difference between the maximum positive and maximum negative remaining errors measured over the compass swing must not be more than 10 degrees.

S 862-039
(8) Do the steps that follow to complete the compass correction card:
  (a) Add the deviation values to the nominal aircraft magnetic headings.
  (b) Add a note that the calibration was done with the radio equipment on.

G. Put the Airplane Back to Its Usual Condition.

S 842-040
(1) Set the three IRS mode select switches to the OFF position.

S 862-041
(2) Remove electrical power if it is not necessary (Ref 24-22-00).

TASK 34-23-00-822-101

3. Standby Compass Calibrator Procedure

A. Equipment
  (1) Tow Tractor
  (2) Non-magnetic tools to adjust the standby magnetic compass.
  (3) One compass correction card - AN5823-1.
  (4) Standby Compass Calibrator Kit, Honeywell 2591553-901
  (5) Non-Magnetic Tripod

B. References
  (1) AMM 9-11-00/201 - Towing
  (2) AMM 24-22-00/201 - Electrical Power - Control
  (3) AMM 34-21-00/201 - Inertial Reference System (IRS)
  (4) AMM 34-22-00/501 - Electronic Flight Instrument System (EFIS)

C. Access
  (1) Location Zones
      211/212 Flight Compartment

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D. Calibrator Adjustment (Fig. 201)

S 822-071

(1) Do this procedure to calibrate the standby compass calibrator (SCC) to the magnetic field at the location of the compass rose.

(a) Make sure that there are no vehicles or airplanes less than 250 feet away.

(b) Make sure that there are no buildings less than 250 feet away.

(c) Put a nonmagnetic tripod at the center of the compass swing area.

(d) Remove the magnet assembly by removing the thumbscrew securing it.

(e) Remove the knob assembly by loosing the thumbscrew securing it.

(f) Attach a master magnetic compass to the SCC with two mounting screws.

<u>NOTE</u>: You can use an accurate standby magnetic compass for a master magnetic compass. Make sure that the N-S and E-W adjustment screws are at neutral.

(g) Put the SCC/master compass assembly on the tripod.

<u>NOTE</u>: Make sure the assembly is level.

(h) Turn the assembly until the master magnetic compass displays an indication of magnetic north (N).

(i) Reinstall the magnet assembly on the SCC.

(j) Reinstall the knob assembly on the SCC.

(k) Turn the top and bottom SCC dials to show an indication of E at the index line.

(l) Make a record of the heading shown on the standby magnetic compass.

(m) Turn the top and bottom SCC dials to show an indication of W at the index line.

(n) Make a record of the heading shown on the standby magnetic compass.

(o) Turn the magnetic field cancellation adjustment screw on the SCC to decrease the heading errors in each direction (E and W) to a minimum.

(p) Continue to adjust the SCC dials for each direction (E and W). Then use the field cancellation adjustment screw until the errors are at a minimum.

<u>NOTE</u>: Continue to do this procedure until the error in each direction is at a minimum.

Do not move the field cancellation adjustment screw before the compass swing is completed.

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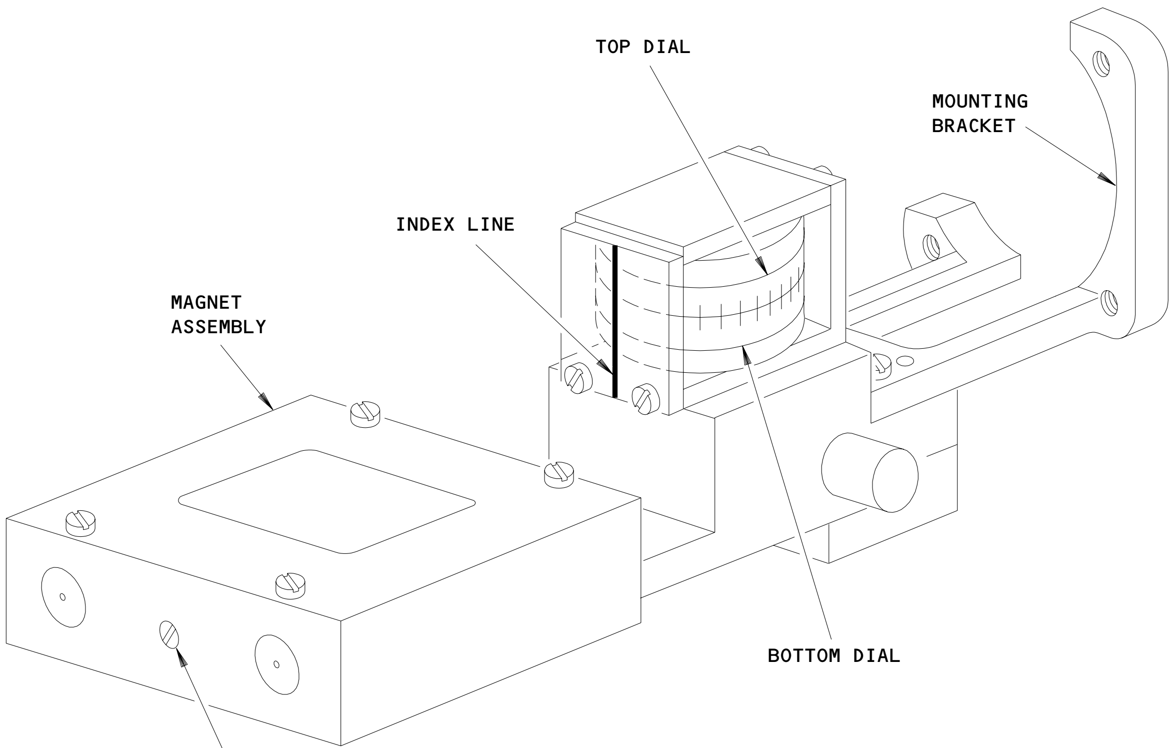

Standby Compass Calibrator
Figure 201

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E. Prepare for a Compass Swing of the Standby Compass

S 582-072

(1) Tow the airplane to the compass swing area (AMM 9-11-00/201).

NOTE: The compass swing area must be a level area with a smooth surface. It must be sufficiently strong to hold the weight of the airplane. The area must be large enough to tow or taxi the airplane. Make sure all vehicles other than the tow vehicle are not less than 250 feet from the airplane.

The horizontal component of the earth's magnetic field must be constant (±1 degree) in the test area. Measure the horizontal component if magnetic material (such as a new building) is less than 600 feet from the compass rose. Do not use the compass rose if the horizontal component is not constant (±1 degree).

S 862-073

(2) Supply the electrical power (AMM 24-22-00/201).

S 862-074

(3) Energize all of the electronic equipment, radios, and control cabin lighting for the usual conditions that occur in flight.

S 862-075

(4) On the P10 panel, set the captain's and first officer's EFIS mode switches to the VOR or ILS position (AMM 34-22-00/201).

S 862-076

(5) Align the IRS to the NAV mode (AMM 34-21-00/201).

S 862-077

CAUTION: USE TOOLS THAT ARE NOT MAGNETIC. MAGNETIC TOOLS CAN CAUSE COMPASS DIFFERENCES.

(6) Make sure that the N-S and E-W adjustment screws on the standby compass are at neutral.

S 862-078

(7) Make sure that one EHSI shows a magnetic heading that is less than one degree from the other EHSI.

S 752-079

(8) Make sure all vehicles but the tow truck are not less than 250 feet from the airplane.

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F. Standby Compass Adjustment

NOTE: The steps that follow are for the four-point calibration swing:

S 582-080
(1) Turn the airplane to a direction where the captain's EHSI shows a magnetic heading of 0 degrees.

S 032-081
(2) Remove and keep the lower left and upper right mounting screws on the standby magnetic compass.

S 482-082
(3) Use the two mounting screws to install the SCC on the face of the standby magnetic compass.

S 822-083
(4) Turn the top and bottom SCC dials to show an indication of E at the index line.

S 972-084
(5) Make a record of the heading shown on the standby magnetic compass.

S 822-085
(6) Turn the top and bottom SCC dials to show an indication of W at the index line.

S 972-086
(7) Make a record of the heading shown on the standby magnetic compass.

S 822-087
(8) Turn the E-W adjustment screw on the standby magnetic compass until the error in the last two recorded values is at a minimum.

NOTE: Divide the error in each of the two directions as equally as possible.

S 822-088
(9) Turn the top and bottom SCC dials to show an indication of N at the index line.

S 972-089
(10) Make a record of the heading shown on the standby magnetic compass.

S 822-090
(11) Turn the top and bottom SCC dials to show an indication of S at the index line.

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S 972-091
(12) Make a record of the heading shown on the standby magnetic compass.

S 822-092
(13) Turn the N-S adjustment screw on the standby magnetic compass until the error in the last two recorded values is at a minimum.

NOTE: Divide the error in each of the two directions as equally as possible.

S 822-093
(14) Continue to adjust the SCC dials for each pair of directions (E-W, N-S). Then turn the E-W and N-S adjustment screws until the errors are at a minimum.

NOTE: Continue to do this procedure until the error in each pair of directions is at a minimum. Start with E-W and turn the E-W adjustment screw. Then do N-S and turn the N-S adjustment screw.

When the errors are at a minimum, do the steps that follow for the 12-point accuracy swing:

S 582-094
(15) Adjust the SCC dials to indicate these magnetic headings: 0, 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, and 330 degrees.

S 972-095
(16) Make a record of the magnetic heading (MH) and standby compass heading (CH).

S 972-096
(17) Calculate and make a record of the difference for each 30-degree heading in the steer column on the compass correction card as follows:

$$D = MH - CH$$

NOTE: During these steps, make sure that each difference is less than ± 8 degrees. For CAA certification, each difference must be less than ± 5 degrees.

S 972-100
(18) Make sure the difference between the maximum positive and maximum negative value is 10 degrees or less.

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G. Put the airplane back to its usual condition.

S 862-098

(1) Set the mode selector switch for each IRS to OFF.

S 862-099

(2) Remove the electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-23-00-002-175

4. Standby Magnetic Compass Light - Removal

A. General

(1) The Standby Magnetic Compass Light is located on the face of the Standby Magnetic Compass, which is located above the center of the left and right windshields.

B. Access

(1) Location Zones

(a) 211 Flight Compartment - Left

(b) 212 Flight Compartment - Right

C. Procedure

S 862-176

(1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:

(a) Circuit Breaker Panel, P11-3:

1) 11P2, INSTR & PNL LTS - CAPT

S 002-177

(2) Do these steps to remove the standby magnetic compass light:

(a) Remove the lightholder assembly or lamp cap.

(b) Remove the light.

TASK 34-23-00-402-178

5. Standby Magnetic Compass Light - Installation

A. References

(1) AMM 24-22-00/201, Electrical Power - Control

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B. Procedure

S 862-179
(1) Make sure that this circuit breaker is open:
(a) Circuit Breaker Panel, P11-3:
1) 11P2, INSTR & PNL LTS - CAPT

S 402-180
(2) Do these steps to install the standby magnetic compass light:
(a) Insert the light.
(b) Install the lightholder assembly or lamp cap on the compass.

S 862-181
(3) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
(a) Circuit Breaker Panel, P11-3:
1) 11P2, INSTR & PNL LTS - CAPT

S 862-182
(4) Supply Electrical Power (AMM 24-22-00/201).

S 862-183
(5) Make sure the panel light switch is in the ON position.

S 212-184
(6) Make sure the standby magnetic compass internal lights are on.

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STANDBY MAGNETIC COMPASS - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the standby magnetic compass. The second task installs it.
   B. The standby magnetic compass is found in the control cabin in the center of the windshield.

TASK 34-23-01-004-001

2. Compass Removal (Fig. 401)
   A. References
      (1) 34-23-00/201, Standby Magnetic Compass
   B. Access
      (1) Location Zones
          211/212 Flight Compartment
   C. Procedure

      S 034-002
      (1) Disconnect the electrical cable at the rear of the compass.

      S 034-003

      CAUTION: USE ONLY NON-MAGNETIC TOOLS FOR THE REMOVAL AND INSTALLATION OF THE COMPASS. MAGNETIC TOOLS CAN CAUSE IMPROPER OPERATION OF THE COMPASS.

      (2) Keep the compass in position and remove the screws that hold it to the mounting bracket.

      S 024-004
      (3) Remove the compass.

TASK 34-23-01-404-005

3. Compass Installation (Fig. 401)
   A. References
      (1) 34-23-00/201, Standby Magnetic Compass

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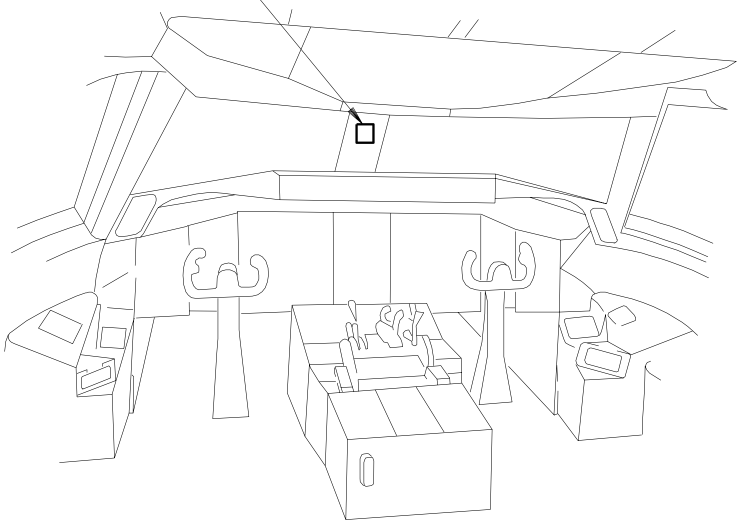
STANDBY MAGNETIC
COMPASS
SEE A



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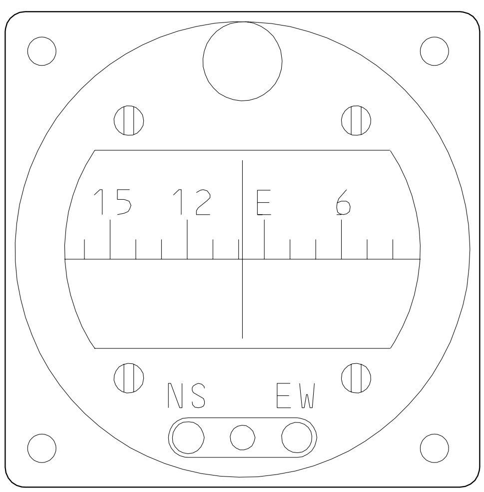
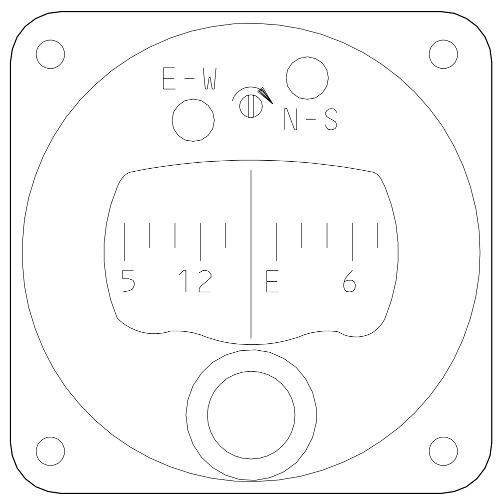


STANDBY MAGNETIC COMPASS

A 1



STANDBY MAGNETIC COMPASS

A 2

1 AIRPLANES WITH STANDBY MAGNETIC COMPASS P/N C-5H

2 AIRPLANES WITH STANDBY MAGNETIC COMPASS P/N C-5M

Standby Magnetic Compass Installation
Figure 401

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B. Access

(1) Location Zones

211/212 Flight Compartment

C. Procedure

S 424-006

CAUTION: USE ONLY NON-MAGNETIC SCREWS TO ATTACH THE COMPASS TO THE PANEL. MAGNETIC SCREWS CAN CAUSE IMPROPER OPERATION OF THE COMPASS.

(1) Install the compass on the mounting bracket with brass screws.

S 424-007

(2) Connect the electrical cable to the rear of the compass.

(a) Connect the electrical connector to the rear of the standby magnetic compass. Push the electrical connector until it locks into its position with a click.

(b) Wind 1 inch wide Scotch No. 24 wire mesh tape around the junction of the electrical connector and standby magnetic compass a minimum of three times. Temporarily secure the end of the tape.

NOTE: The tape must touch against the rear of the standby magnetic compass case. Keep sufficient tension on the tape while you wind the junction to make it the shape of the connector. You can use thinner tape, if you wind the connector with a minimum overlap of 50 percent. Wind all parts of the connector within 1 inch of the compass with a minimum of three wrappings.

(c) Wind the mesh tape a minimum of two times with 1 inch wide Scotch No. 70 or A-A-59163 Type I self-fusing silicone rubber tape.

NOTE: Keep sufficient tension on the tape while you wind the junction to make it the shape of the connector. You can use thinner tape, if you wind the connector with a minimum overlap of 50 percent. Wind all of the wire of mesh tape with a minimum of two wrappings of the silicone rubber tape.ape.

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NOTE: If the connector is removed for any reason, discard all tape and repeat the steps above using new tape.

S 824-010

(3) Do the compass swing procedure (Ref 34-23-00).

NOTE: In the event the compass is removed and there are no modifications to the area and the same equipment is installed, there is no need nor requirement to swing the compass.

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STANDBY ATTITUDE REFERENCE SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The standby attitude reference system is a standby navigational aid. It provides a backup display for pitch and roll attitude. The system also displays ILS LOC and G/S deviation. It functions as a backup in event of a main system failure.
   B. The system receives its power from the standby power bus. It receives instrument landing system data from the center ILS/MMR receiver. Attitude display data is generated within the system.
   C. The system includes a standby attitude indicator which contains the attitude and ILS displays. The system also includes a static inverter/ILS processor (PRCS) which provides gyro power and ILS pointer and flag drive voltage to the indicator.
2. Component Detail (Fig. 1)
   A. Standby Attitude Indicator
      (1) The indicator provides the ILS and attitude displays. It is of the conventional mechanical type. The indicator is located on the captain's instrument panel (P1-3).
      (2) Attitude is provided by a 3-phase vertical gyro suspended in a two degree-of-freedom gimbal system. This system is connected to a drum type roll and pitch attitude display. The system displays approximately 90 degrees of freedom in climb, 80 degrees of freedom in dive, and 360 degrees of freedom in roll.
      (3) The gyro system utilizes a spinning ball type device to automatically erect the gyro at turn-on. The caging knob on the front panel is used to mechanically accelerate the erection process. The erection process stabilizes the display drum near the vertical.
      (4) The GYRO fault flag appears when gyro power is lost.
      (5) The ILS display consists of the localizer (LOC) and glide slope (G/S) deviation pointers and scales. The pointers indicate deviation from their respective centerline and are driven by the center ILS/MMR receiver (Ref 34-31-00).
      (6) The ILS display is controlled by the rotary mode control switch on its front panel. The switch has three positions which operate as follows:
         (a) OFF - ILS pointers and failure flags (LOC and G/S) retract out of view.

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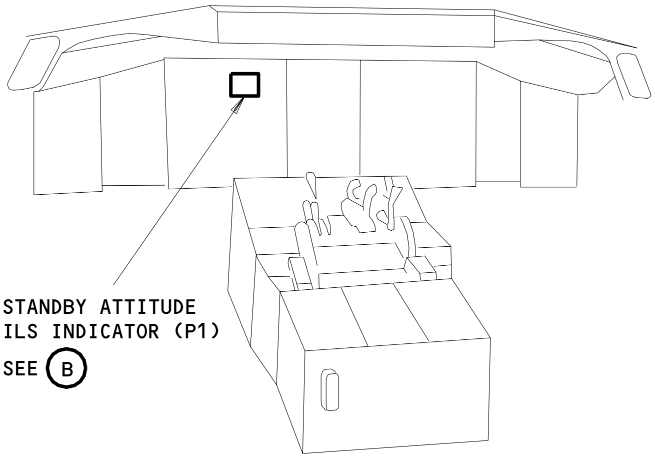
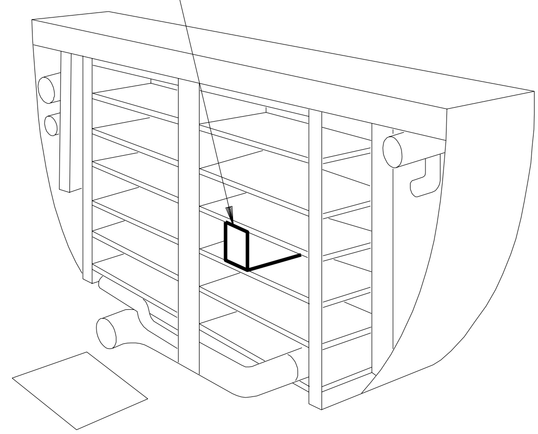
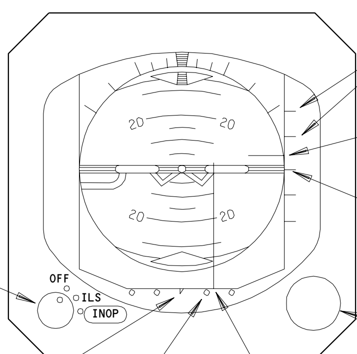


FLIGHT COMPARTMENT

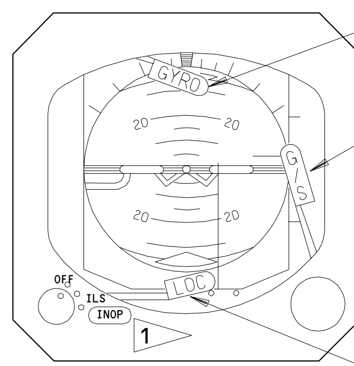


MAIN EQUIPMENT CENTER



SAS

NORMAL DISPLAY



FAILURE DISPLAY

STANDBY ATTITUDE ILS INDICATOR

B

SAS 1 MTH 275-299: B/CRS (INSTEAD OF INOP)

Standby Attitude Reference System - Component Location
Figure 1

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(b) ILS or APP - ILS operation normal for front course approach.

SAS (c) SAS 050-167;
INOP - Indicates B/CRS mode is not used. Operates same as OFF.

SAS (d) MTH 275-299;
SAS B/CRS - Indicates B/CRS mode. Provides for back course
SAS approach a reversed LOC indication, but no G/S indication.

(7) The LOC and G/S failure flags come into view for invalid ILS data and/or failures in the standby attitude/ILS system. For no computed data (NCD) conditions, the LOC or G/S deviation pointers and flags are retracted from view.

B. Static Inverter/ILS Processor

(1) The static inverter/ILS PRCS provides two functions. The static inverter circuit provides input power to the indicator gyro and control to the gyro fault flag motor. The ILS PRCS circuit uses ILS input data to provide drive for the localizer (LOC) and glideslope (G/S) pointers. The ILS PRCS also provides control for the G/S and LOC fault flag motors. The unit is located in the main elex. equipment center, rack E1.

(2) The static inverter/ILS PRCS has no external adjustments, indicators, or controls.

3. <u>Operation</u> (Fig. 2)

A. Functional Description

(1) Power

(a) The static inverter/ILS processor receives 28V dc power from the standby power bus. Power to the standby bus is normally supplied by the main dc power. When this power is lost, the standby bus is automatically switched to receive battery power for operation of the system. This same power switching occurs during CAT III Autoland Mode (Ref 24-33-00).

(b) The static inverter converts the 28V dc into 3 phase, 115V ac, 400 Hz power in the power follower network. The static inverter also routes the 28V dc power to the gyro fault flag torque motor for flag operation.

(c) The ILS PRCS power supply produces +28V dc for the LOC and G/S and flag motor operation. It supplies ±15V dc to retract the LOC and G/S pointers. It also supplies voltage for the ILS PRCS internal operation.

(2) Standby Attitude Functions

(a) Both coils of the inverter transformer supply three phase power to the gyro motor in the indicator. The inverter current sensing circuit monitors flow in the two transformer coils. Equal coil current flow causes the GYRO flag to be torqued out of view. Power loss or an open circuit, in any portion of the gyro power circuit, causes unbalanced coil currents. This unbalance will cause the flag motor to deenergize, allowing a spring to pull the GYRO flag into view.

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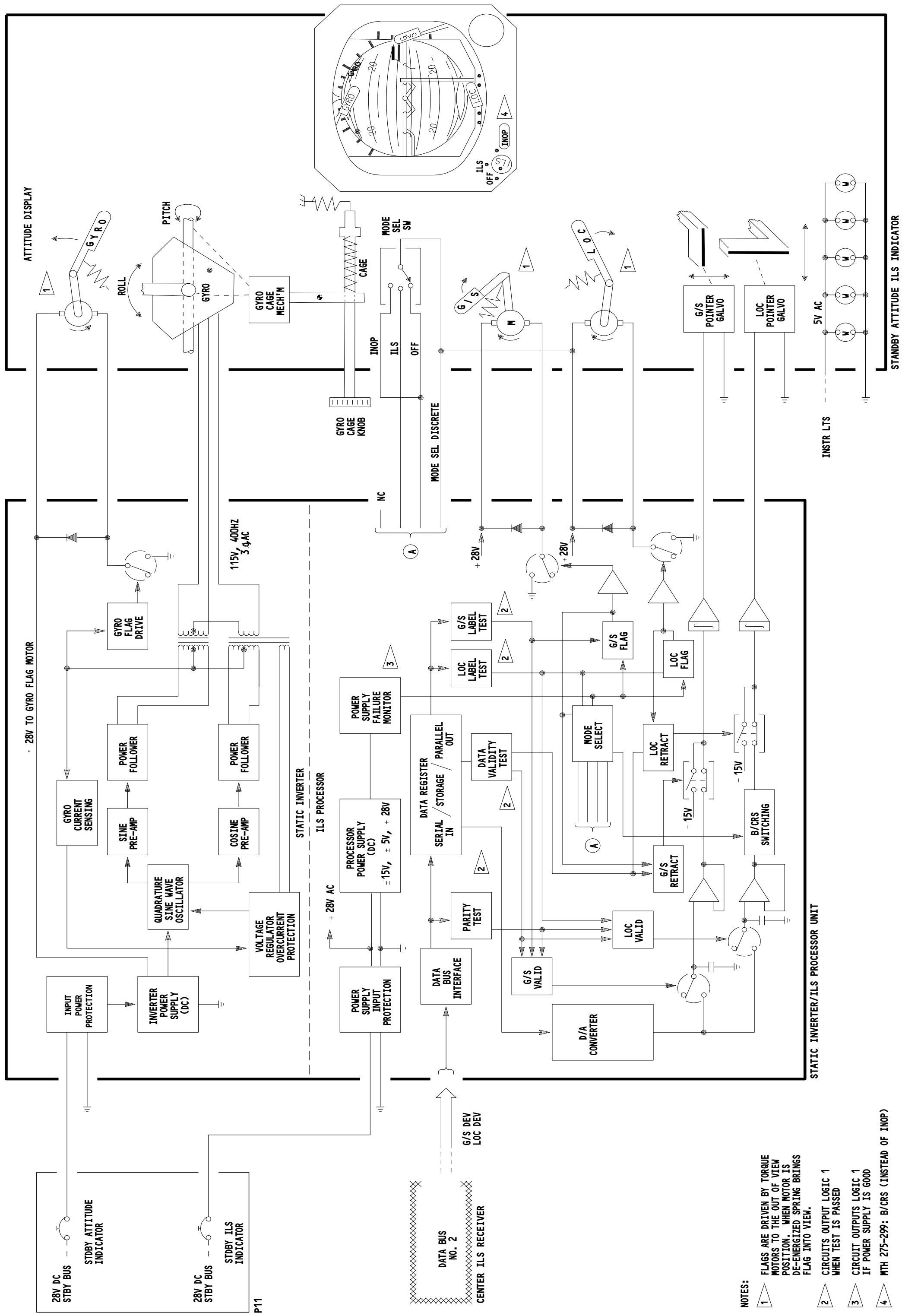

NOTES:

1. FLAGS ARE DRIVEN BY TORQUE MOTORS TO THE OUT OF VIEW POSITION. WHEN MOTOR IS DE-ENERGIZED SPRING BRINGS FLAG INTO VIEW.
2. CIRCUITS OUTPUT LOGIC 1 WHEN TEST IS PASSED
3. CIRCUIT OUTPUTS LOGIC 1 IF POWER SUPPLY IS GOOD
4. MTH 275-299: B/CRS (INSTEAD OF INOP)

Standby Attitude Reference System Schematic
Figure 2

BOEING PROPRIETARY - Copyright (C) - Unpublished Work - See title page for details.

(b) When the gyro is turned off, it will assume any position in the gyro mechanism. The display reference marks will not line up with the airplane reference, and the GYRO flag will be in view.

(c) When power is first applied to the gyro, the gyro mechanism precesses causing the drum display to oscillate. The CAGE knob is used to speed up erection and to stabilize the display.

(3) ILS Functions

(a) The ILS PROCS circuits receive ARINC 429 digital LOC and G/S data from the center ILS receiver (Ref 34-31-00). They convert this data into an analog output voltage to drive the LOC and G/S pointers in the indicator. The ILS system also supplies test and fault data (along with the normal data) on the same bus.

(b) In the ILS PROCS the data is first checked for parity. The signal is then converted from serial to parallel data and checked for validity and correct labeling (G/S and LOC). Next, the data is converted to analog data in the D/A converter. If parity, validity and labeling are correct, the analog signals are gated to the G/S and LOC pointer galvos in the indicator.

(c) If any of the checks fail on the incoming data, the corresponding G/S or LOC flag will appear. For invalid data, the corresponding pointer will be retracted and flags will be in view. For no computed data (NCD), both the flags and pointers will be retracted out-of-view.

(d) ILS flag operation is controlled by a transistor switch. When there are no faults, the switch is closed completing the circuit for the motor to retract the flags. When a fault occurs, the switch will open, de-energizing the motor, which allows a spring to pull the flag in view.

(e) When the indicator mode select switch is in the ILS position, the ILS PRCS drives the G/S and LOC pointer for front course approaches.

SAS (f) SAS 050-167;
In the INOP mode, the OFF mode is simulated.

SAS (g) MTH 275-299;
In the B/CRS mode the LOC pointer polarity is reversed to display a backcourse approach.

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(h) The OFF mode is selected by placing the indicator switch in the OFF position. In this mode, the mode select circuitry provides gating signals to retract the LOC and G/S pointers and flags. This is the same indication as for no computed data.

B. Self Test

(1) The self-test for the standby attitude reference system is initiated by pressing the self test button on the center ILS/MMR receiver (Ref 34-31-00). The center ILS/MMR receiver provides test data. This causes the following test sequence to appear on the indicator.

(a) LOC and G/S flags visible for 3 seconds (approximately).

(b) LOC and G/S pointers disappear for 2 seconds (approximately).

(c) Pointers appear at 1 dot UP/LEFT for 3 seconds (approximately).

(d) Pointers move to 1 dot DN/RIGHT position (This takes approximately 2 seconds).

(e) One dot DN/RIGHT continues until test switch released.

(2) No test is performed on the attitude portion of the display.

C. Control

(1) To place the standby attitude reference system in operation, the following steps are required:

(a) Provide electrical power (Ref 24-22-00).

(b) Close the following overhead panel P11 circuit breakers:

1) 11A2, MMR CENTER

2) 11A5 or 11H33, STBY ATT IND

3) 11A9, STBY ILS IND

(c) On standby attitude indicator, place mode switch in APP.

(d) Wait 30 seconds, then pull CAGE knob until horizon line is stabilized.

(e) Gently release CAGE knob.

(f) Wait six minutes and check that pitch and roll indications are within ± 2 degrees of 0.

(g) Check that LOC and G/S flags and pointers are out of view.

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STANDBY ATTITUDE REFERENCE SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
CHARGER - ISFD DEDICATED BATTERY, M11331 [1]	--	1	MAIN EQUIPMENT CTR, E1-4	34-24-01
CIRCUIT BREAKER -			FLT COMPT, P11	
ISFD, C2023 [2]	--	1	FLT COMPT, P1-3	*
STBY ATT IND, C619 [1]		1	11A5	*
STBY ILS IND, C604 [1]		1	11A9	*
DISPLAY - INTEGRATD STANDBY FLIGHT DISPLAY, N177 [1]	--	1	FLT COMPT, P1-3	34-24-01
INDICATOR - STANDBY ATTITUDE ILS, N20	--	1	FLT COMPT, P1	34-24-01
UNIT - STATIC INV/ILS PRCS, M917	--	1	119AL, MAIN EQUIP CTR, E1-4	34-24-02

* SEE THE WDM EQUIPMENT LIST

[1] AIRPLANES WITHOUT INTEGRATED STANDBY FLIGHT DISPLAY
[2] AIRPLANES WITH INTEGRATED STANDBY FLIGHT DISPLAY

Standby Attitude Reference System - Component Index
Figure 101

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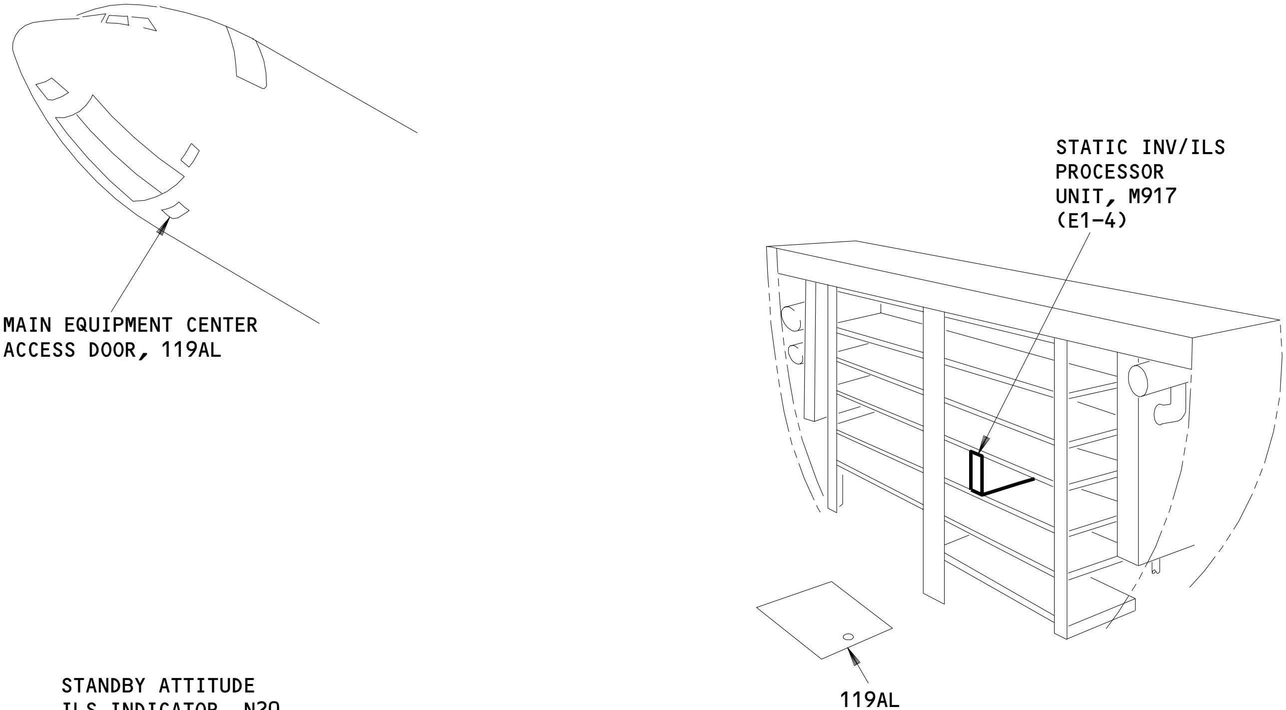
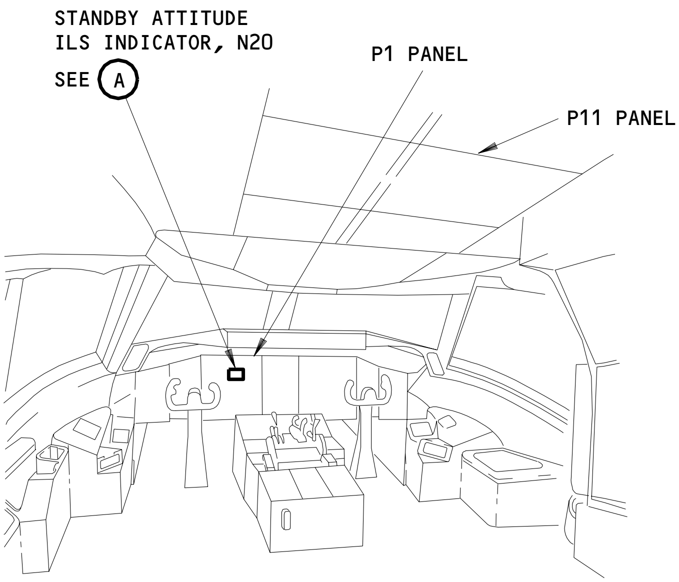
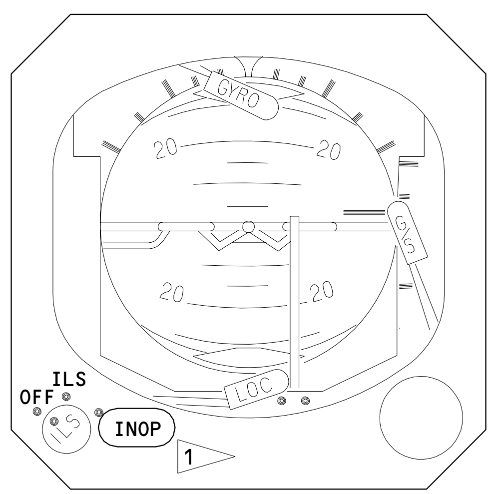


MAIN EQUIPMENT CENTER



FLIGHT COMPARTMENT



STANDBY ATTITUDE ILS INDICATOR, N20

A

SAS

SAS 1 MTH 275-299: B/CRS (INSTEAD OF INOP)

Standby Attitude Reference System - Component Location
Figure 102

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STANDBY ATTITUDE REFERENCE SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure does the operational test for the standby attitude reference system.
   B. The standby attitude reference system gives standby attitude and standby Instrument Landing System (ILS) displays. The standby attitude part is self-contained. It uses only airplane power for operation. The ILS part receives ILS data from the center ILS receiver. You can do the ILS system adjustment/test at the same time as this test (Ref 34-31-00).

TASK 34-24-00-715-001

2. Operational Test
   A. Equipment
      (1) Stopwatch
   B. References
      (1) 24-22-00/201, Electrical Power - Control
      (2) 34-31-00/501, ILS Navigation System
   C. Access
      (1) Location Zones
          211/212 Flight Compartment

   D. Procedure

      S 865-002
      (1) Supply electrical power (Ref 24-22-00).

      S 865-004
      (2) On the standby attitude indicator, set the mode control knob to the ILS position.

      S 755-005
      (3) After 30 seconds, make sure that the conditions that follow occur if there is no computed data (NCD):
          (a) The GYRO fault flag goes out of view.

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(b) The G/S fault flag goes out of view.
(c) The LOC fault flag goes out of view.
(d) The glide slope deviation pointer goes out of view.
(e) The localizer deviation pointer goes out of view.

NOTE: If the GYRO flag does not retract when power is applied, momentarily pull the caging knob.

S 865-006
(4) On the indicator, pull the caging knob until the horizon line becomes stable, then release it.

S 755-007
(5) After 6 minutes, make sure that the pitch and roll indications are equal to the airplane attitude ±2 degrees.

S 865-008
(6) Tune the ILS control panel to a frequency that can be used other than PARK.

S 745-017
(7) Push and release the TEST switch on the ILS control panel.

S 745-009
(8) Make sure the conditions that follow occur on the standby attitude indicator in this order:
(a) Invalid data shows (G/S and LOC flags are in view, G/S and LOC pointers are out of view).
(b) NCD (G/S and LOC pointers and G/S and LOC flags are out of view).
(c) Localizer deviation pointer moves to one dot left and stays there.
(d) Glide slope deviation pointer moves one dot up and stays there.
(e) Localizer deviation pointer moves one dot right and stays.
(f) Glide slope deviation pointer moves one dot down and stays there.

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SAS
SAS S 745-032
SAS (9) MTH 275-299;
Do these steps to do a test of the BCRS mode:
(a) Set the mode select switch in the BCRS position.
(b) Push and release the TEST switch on ILS control panel.
(c) Make sure the conditions that follow occur on the standby attitude indicator:
1) Invalid data shows for 3 seconds (G/S and LOC flags are in view, G/S and LOC pointers are out of view).
2) NCD for 2 seconds (G/S and LOC, pointers, and G/S and LOC flags are out of view).
3) Localizer deviation pointer moves to one dot right and stays there for 3 seconds.
4) Glide slope deviation pointer moves one dot up and stays there for 3 seconds.
5) Localizer deviation pointer moves one dot left and stays there for 5 seconds.
6) Glide slope deviation pointer moves one dot down and stays there for 5 seconds.

E. Put the Airplane Back to Its Usual Condition

S 865-021
(1) Set the mode select switch to the OFF position.

S 865-017
(2) Make sure that the GYRO, G/S, and LOC flags do not show.

S 865-022
(3) Remove electrical power if it is not necessary (Ref 24-22-00).

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STANDBY ATTITUDE INDICATOR - MAINTENANCE PRACTICES

1. General
   A. This procedure has three tasks. The first task replaces the light in the standby attitude indicator. The second task removes the standby attitude indicator. The third task installs it.
   B. The lights are found on the light block assembly.

TASK 34-24-01-962-002

2. Standby Attitude Indicator Light Replacement
   A. References
      (1) 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 862-001
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11B7, LIGHTS STBY INSTR
          (b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

      S 032-003
      (2) Loosen the screws that hold the mask to the front of the standby attitude indicator.

      S 032-004
      (3) Remove the mask.

      S 022-005
      (4) Remove the light block assembly.

      S 962-006
      (5) Install the replacement light block assembly on the front of the standby attitude indicator.

      S 432-007
      (6) Put the mask back in its correct position and tighten the screws.

      S 862-009
      (7) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
          (a) 11B7, LIGHTS STBY INSTR
          (b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

TASK 34-24-01-002-010

3. Standby Attitude Indicator Removal
   A. References
      (1) 24-22-00/201, Electrical Power - Control

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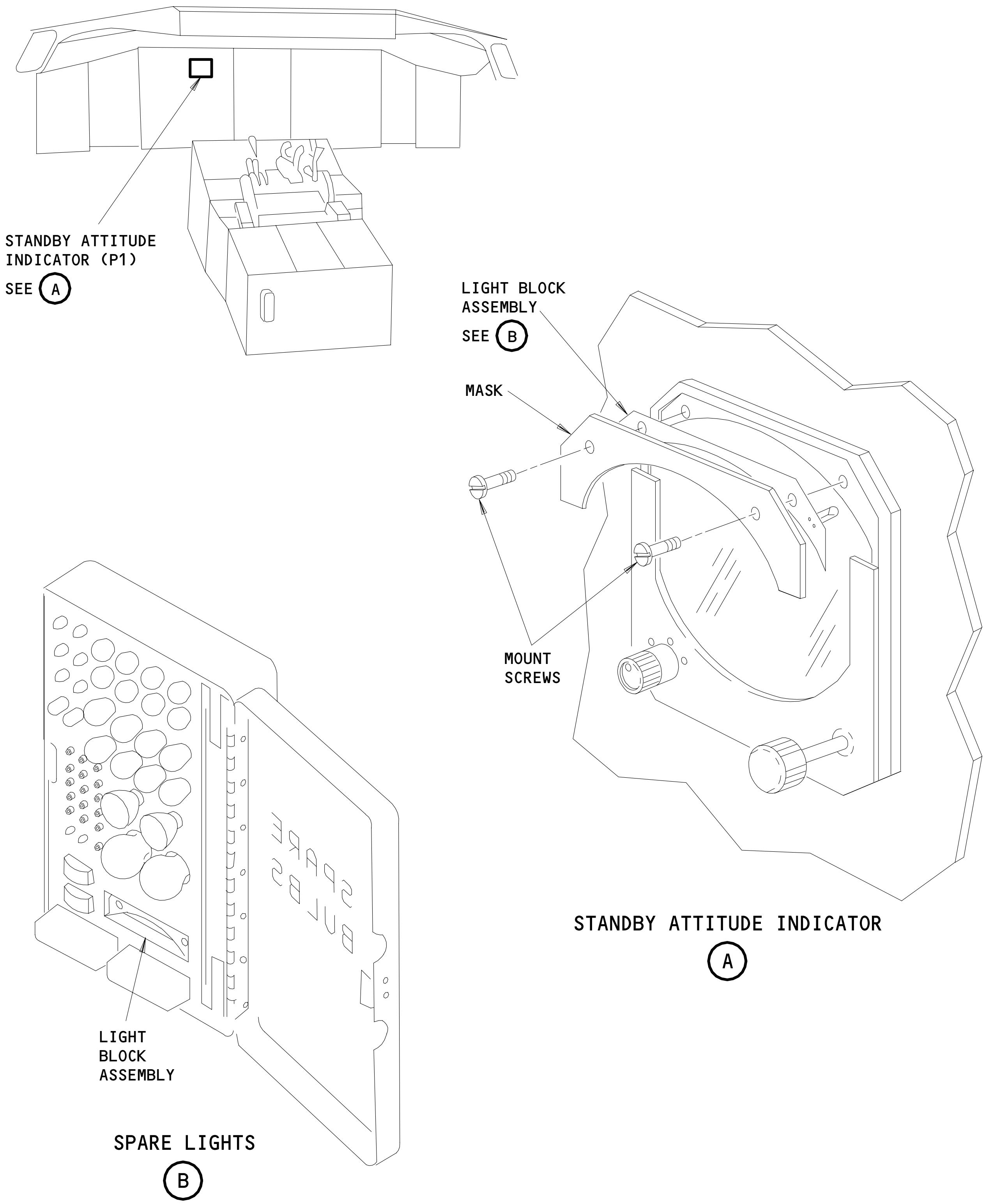

Standby Attitude Indicator Light Block Installation
Figure 201

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B. Access

(1) Location Zones

211/212 Flight Compartment

C. Procedure

S 862-008

(1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:

(a) 11A5, STBY ATT IND

(b) 11A9, STBY ILS IND

(c) 11B7, LIGHTS STBY INSTR

(d) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

S 022-049

CAUTION: LET THE GYRO RUN DOWN FOR APPROXIMATELY THREE MINUTES AFTER YOU OPEN THE CIRCUIT BREAKERS. DAMAGE TO THE GIMBALS CAN OCCUR IF YOU REMOVE THE INDICATOR BEFORE THE GYRO STOPS.

(2) Stop for three minutes to let the gyro run down.

S 032-012

CAUTION: MAKE SURE THERE IS A DEVICE INSTALLED TO LOCK THE KNOB IN THE CAGE POSITION. THIS WILL PREVENT DAMAGE TO THE GYRO WHEN YOU MOVE THE INDICATOR.

(3) Pull the CAGE knob out and install a device to lock it in the caged position.

S 032-013

(4) Loosen the instrument clamp screws on the front panel adjacent to the indicator.

S 022-014

(5) Carefully pull the indicator out of the instrument panel.

S 032-015

(6) Disconnect the electrical cable.

S 862-016

(7) Put the indicator on a level, soft surface.

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SAS
SAS S 032-037
SAS (8) SAS 050-167;
remove the INOP tag from the indicator. (Keep it to use on the new indicator.)

TASK 34-24-01-402-017

4. Standby Attitude Indicator Installation

A. References
(1) 24-22-00/201, Electrical Power - Control

B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 862-018
(1) Make sure that these circuit breakers on the P11 panel are open:
(a) 11A5, STBY ATT IND
(b) 11A9, STBY ILS IND
(c) 11B7, LIGHTS STBY INSTR
(d) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

S 432-019
(2) Connect the electrical cable to the indicator.

S 422-020
(3) Carefully move the indicator into the instrument panel.

S 432-021
(4) Tighten the clamp screws.

S 432-022
(5) Remove the device that locks the CAGE knob in position.

SAS
SAS S 432-042
SAS (6) SAS 050-167;
attach the INOP tag from the old indicator over the B/CRS name.

S 862-024
(7) Supply electrical power (Ref 24-22-00).

S 862-025
(8) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11A5, STBY ATT IND
(b) 11A9, STBY ILS IND

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(c) 11B7, LIGHTS STBY INSTR
(d) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

S 752-026
(9) Make sure that the indicator panel lights come on.

D. Put the Airplane Back to Its Usual Condition.

S 862-027
(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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STATIC INVERTER/INSTRUMENT LANDING SYSTEM (ILS) PROCESSOR - REMOVAL/INSTALLATION

TASK 34-24-02-004-001

1. Static Inverter/ILS Processor Removal

   A. References

      (1) AMM 20-10-01/401, E/E Rack-Mounted Components

      (2) AMM 24-22-00/201, Electrical Power - Control

      (3) AMM 20-41-01/201, Electrostatic Sensitive Devices

   B. Access

      (1) Location Zones

119/120	Main Equipment Center

   C. Procedure

      S 864-002

      CAUTION: DO NOT MOVE THE STATIC INVERTER/ILS PROCESSOR BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE STATIC INVERTER/ILS PROCESSOR.

      (1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

      S 864-004

      (2) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:

         (a) 11A5, STBY ATT IND

         (b) 11A9, STBY ILS IND

      S 024-005

      (3) Remove the static inverter/ILS processor (AMM 20-10-01/401).

TASK 34-24-02-404-006

2. Static Inverter/ILS Processor Installation

   A. References

      (1) AMM 20-10-01/401, E/E Rack-Mounted Components

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(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 20-41-01/201, Electrostatic Sensitive Devices

B. Access
(1) Location Zones
119/120 Main Equipment Center

C. Procedure

S 864-003

CAUTION: DO NOT MOVE THE STATIC INVERTER/ILS PROCESSOR BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE STATIC INVERTER/ILS PROCESSOR.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 864-007
(2) Make sure that these circuit breakers on the P11 panel are open:
(a) 11A5, STBY ATT IND
(b) 11A9, STBY ILS IND

S 424-008
(3) Install the static inverter/ILS processor.

S 864-009
(4) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11A5, STBY ATT IND
(b) 11A9, STBY ILS IND

D. Static Inverter/ILS Processor Test

S 864-010
(1) Supply electrical power (AMM 24-22-00/201).

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S 864-011

(2) Make sure that this P11 panel circuit breaker is closed:
   (a) 11A2, ILS CENTER

S 714-012

(3) On the aft electronics panel, P8, push and release the TEST button on the ILS control panel.

S 754-013

(4) Monitor the standby attitude indicator on the pilot's main panel and make sure that the sequence that follows occurs:
   (a) The LOC and G/S flags are in view for approximately three seconds.
   (b) The LOC and G/S pointers go out of view for approximately two seconds.
   (c) The LOC pointer moves to one dot left and stays there for approximately three seconds.
   (d) The G/S pointer moves to one dot up and stays there for approximately three seconds.
   (e) The LOC pointer moves to one dot right and stays there for approximately three seconds.
   (f) The G/S pointer moves one dot down and stays there for approximately three seconds.

E. Put the Airplane Back to Its Usual Condition

S 864-014

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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INSTRUMENT LANDING SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The instrument landing system (ILS) is a navigational aid. The ILS provides position data of the airplane for landing approaches. It is designed to receive and process localizer and glideslope information. The system outputs this data to interfacing systems for display and navigational use.
   B. Three instrument landing systems are installed and are designated as left, right and center systems. Each system consists of a receiver, a glideslope antenna, and a localizer antenna. One control panel serves all three systems. The left system normally provides information to the captain's EFIS instruments. The right system provides input to the first officer's EFIS instruments. The center system provides inputs to the standby attitude reference system for display on the standby attitude indicator. It also provides input to the center EFIS system for left or right ILS system backup. The EFI instrument source select switch (AMM 34-22-00) is used to select the center EFIS SG as a backup. This is done in the event of a malfunction.
   C. ILS output deviation is displayed on the captain's and first officer's EHSIs and EADIs as well as on the standby attitude display. The system also provides an aural ground station identification output to the flight interphone system. ILS outputs are supplied to the flight control computer (FCC) for control of the airplane during automatic landing (AUTOLAND) (Ref Chapter 22). Outputs are also provided to the ground proximity (GND PROX) warning computer. Provisions for interface with the flight management computer (FMC) are installed.
2. Component Details (Fig. 1)
   A. ILS Antenna
      (1) The system uses two dual channel G/S antennas and two dual channel LOC antennas. Both the top G/S and LOC dual antennas receive signals for the right and center ILS receivers. The bottom G/S and LOC dual antennas receive signals for the left system. One channel of these antennas is not used.
      (2) The antennas are located on the forward pressure bulkhead within the radome. One dual loop LOC antenna is located above and one below the weather radar antenna. The two dual loop G/S antennas are located beneath the lower LOC antenna.
   B. G/S Director Element
      (1) The G/S director element is used to alter the glide slope radiation antenna patterns such that the ILS receivers have maximum glide slope sensitivity.
      (2) One G/S director element is installed in the nose radome assembly. It is a 12 inch continuous strip of aluminum foil, pressure sensitive tape, positioned horizontally across the center butt line on the inside surface of the radome, about 18 inches from the radome lower edge.

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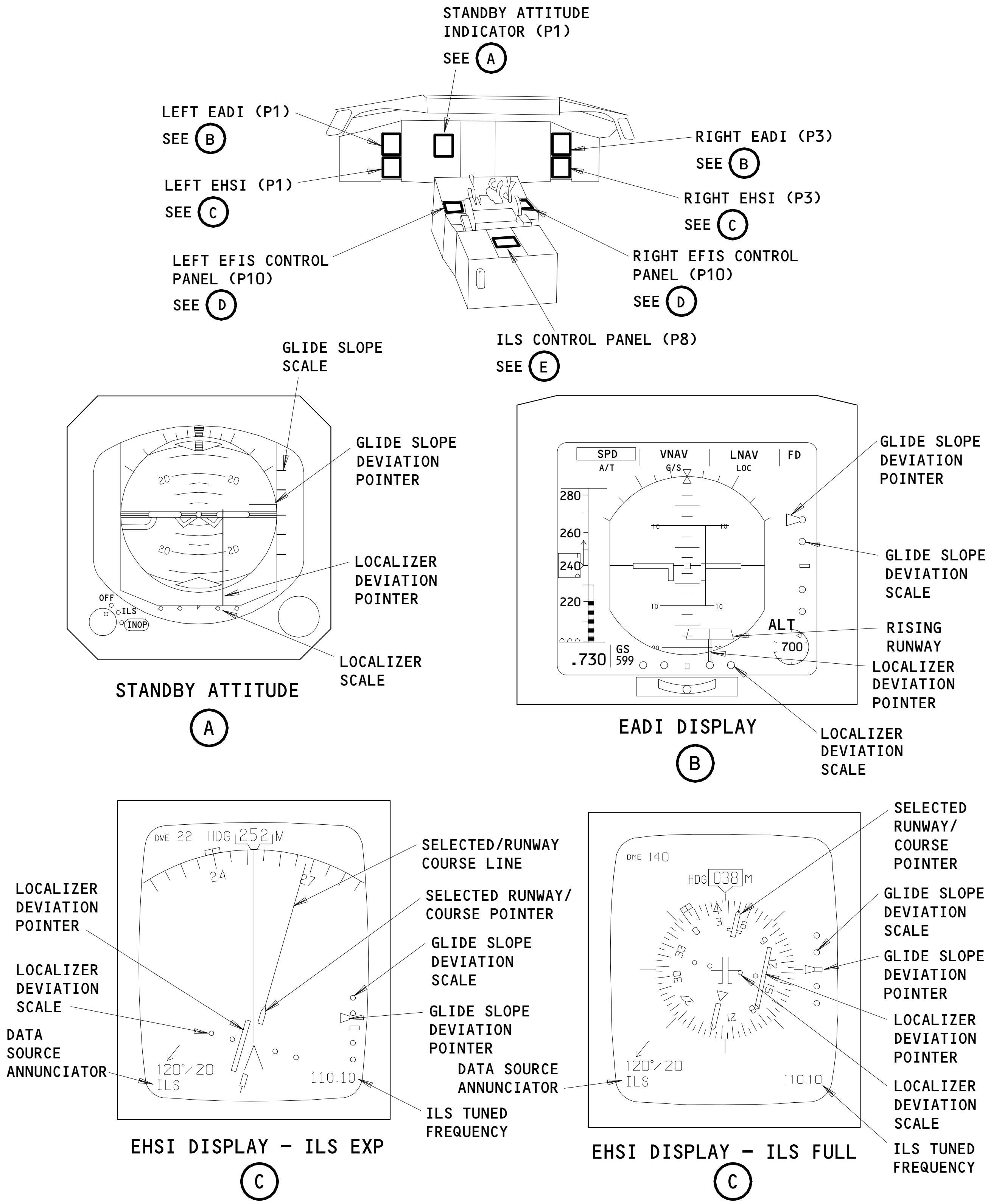

ILS Components
Figure 1 (Sheet 1)

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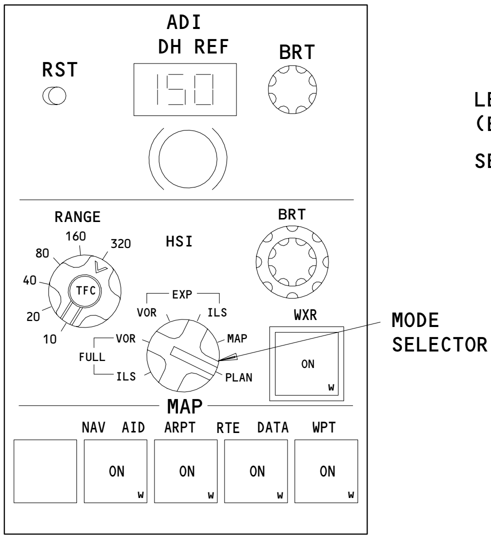
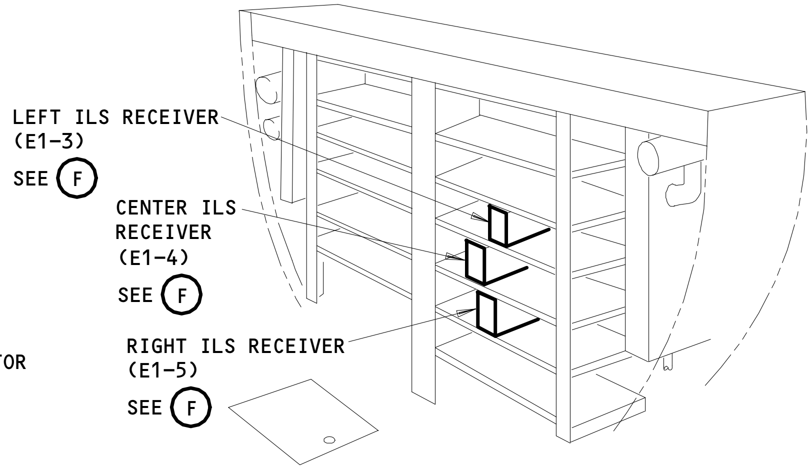
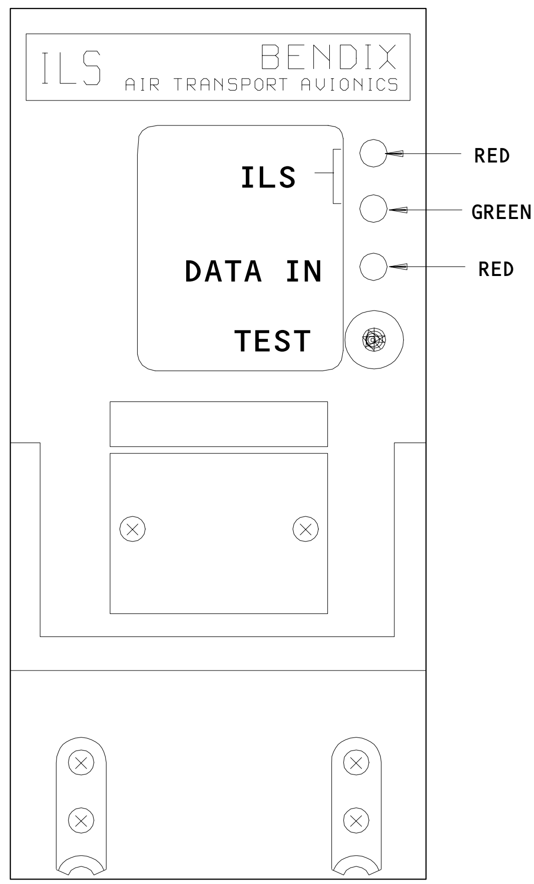


EFIS CONTROL PANEL

D

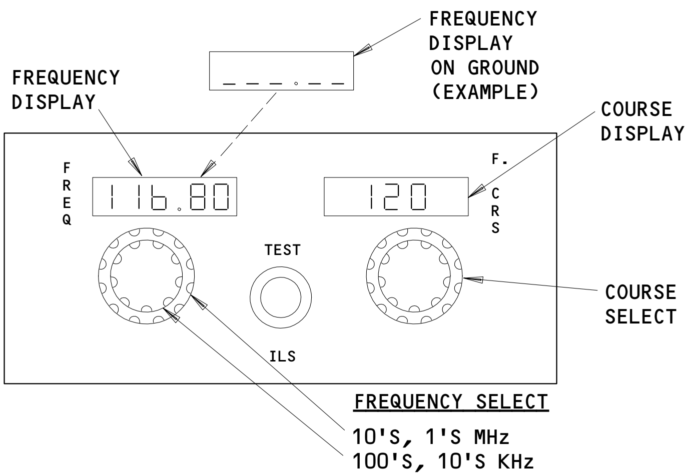


MAIN EQUIPMENT CENTER



ILS RECEIVER

F



ILS CONTROL PANEL

E

ILS Components
Figure 1 (Sheet 2)

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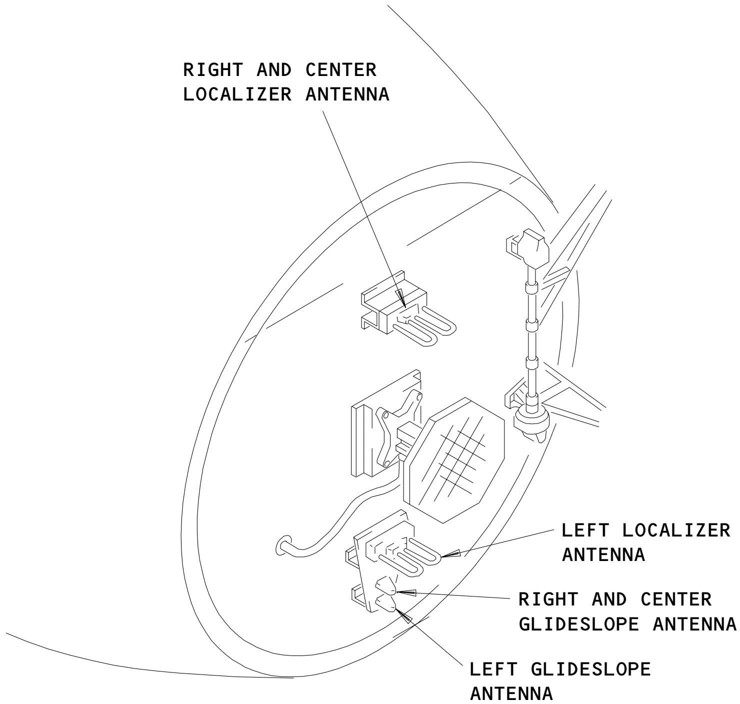
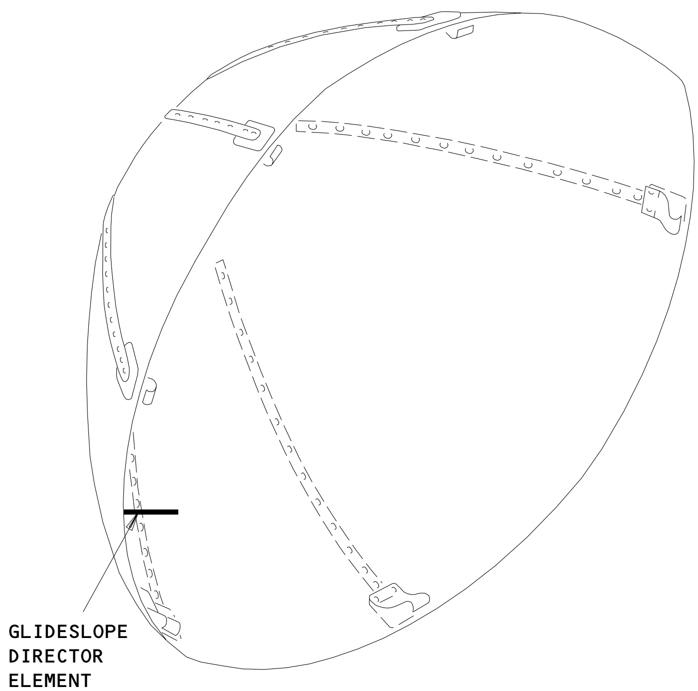


FORWARD BULKHEAD



NOSE RADOME

ILS Components
Figure 1 (Sheet 3)

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C. ILS Receiver
   (1) The ILS receiver accepts ILS localizer and glideslope signals from the ground station. It processes these signals to provide digital localizer and glideslope output data to interfacing systems. It also provides station identification audio to the flight interphone system.
   (2) The unit provides reception on 40 localizer channels from 108.10 to 111.95 MHz with 50 kHz channel spacing. Glideslope channels are paired with localizer channels and are received from 329.15 to 335.00 MHz with 150 kHz channel spacing.
   (3) The receiver has built in test equipment (BITE) which automatically performs self test procedures as part of an internal program. In addition, a self-test may be manually initiated by the front panel TEST button. The front panel lights show status of the receiver self-test. A Green light comes on for a PASS condition and red lights come on for FAIL conditions.
   (4) The three ILS receivers are located in rack E1 in the Main E/E Equipment Center.

D. ILS Control Panel
   (1) The ILS control panel provides frequency and course selection and a system self-test button.
   (2) G/S and LOC frequencies are selected in pairs by the left two concentric knobs. The outer knob selects tens and units of MHz in 1 MHz increments. The inner knob selects tenths and hundredths of MHz in .05 MHz increments. Three ganged wafers provide identical, yet independent, tuning for each ILS system. The left frequency is displayed on the left EHSI, the right on the right EHSI, and the center on the control panel FREQ display.
   (3) The ILS FREQ display is a five digit readout that shows the selected localizer frequency with the 100 MHz space fixed at 1. The selected frequency limits are from 108.10 to 111.95 MHz. For the next step past 111.95, the display indicate five dashes or 1 PK.00. In this position, the ILS control panel sends a NCD ILS frequency word to the receivers, which places them in standby mode. The next selections are 108.10, 108.15, 108.30, 108.35, etc. (odd tenths) back to 111.95.
   (4) The control panel TEST switch is pressed for a system self-test and is inhibited during landing approaches by the FCC.

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(5) The course selection knob provides selection of the runway heading in degrees from 0° to 359°.

(6) The course selection display indicates the runway heading (in degrees) selected on the course selection knob.

(7) The ILS control panel is located on the aft electronics panel (P8).

E. EFIS Control Panel

(1) The EFIS control panel mode selector is used to select the EHSI display mode. When the mode selector is in the ILS-FULL position, the EHSI displays the ILS full-compass rose display. When the mode selector is in the ILS-EXP position, the EHSI displays the ILS expanded display.

(2) When the mode selector is in either ILS position, the DME frequency is paired with the ILS rather than the VOR frequency (AMM 34-55-00).

F. EHSI

(1) The EHSI is a multifunction indicator which provides displays for several electronic systems. The following paragraphs describe the ILS displays for the EHSI ILS modes. For a more detailed description of the EHSI, refer to 34-22-00, EFIS System.

(a) The localizer and glideslope deviation pointers and scale display deviation from the respective beam. They indicate the direction that the airplane must go in order to reduce the deviation to zero. When the airplane is in a park condition, the pointers are removed.

(b) Localizer deviation for back-course approaches is automatically displayed on the EHSI. The glideslope deviation pointer is removed from the EHSI during back-course approaches. This occurs when the difference between airplane track angle and selected runway heading is greater than 90 degrees. The EFIS determines this from airplane/runway heading data sent by the IRS and FMC.

(c) The EHSI displays the runway (course) direction and the ILS tuned frequency selected on the ILS control panel. The ILS frequency is displayed in the lower right corner. When ILS frequency on the control panel is set to PARK (-----), the last valid frequency will be displayed on the EHSI.

(d) The data source annunciator (ILS) is shown in the lower left corner of the EHSI when ILS is selected on the EFIS control panel.

(e) Localizer and glideslope deviation failures on the EHSI, are displayed as follows:

1) For no-computed data (NCD) in the receiver G/S channel, the G/S deviation pointer is removed. For NCD in the localizer channel, the runway direction line is removed. Also, the course pointer is oriented vertically. In either case, 6 green dashes replace the displayed ILS frequency.

2) For invalid data in either channel, the corresponding pointer and scale are removed, the G/S or LOC flag is displayed. Also, the ILS frequency display is removed.

(f) For NCD or invalid data failure associated with the runway heading line, the runway direction line is removed, and the deviation pointer is oriented vertically.

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(g) The data source annunciator shows 5 green dashes for NCD and is blank for invalid data.

G. EADI

(1) The EADI is a multifunction display (AMM 34-22-00). It displays glideslope and localizer deviation which operate the same as the EHSI deviation pointers. For the park condition, the pointers and scales are removed. For back-course approaches, glideslope deviation pointer is removed.

(2) For valid ILS data, the standard (four dot) LOC scale will be displayed until the following conditions are met. For these conditions, the display changes to the expanded (two dot) LOC scale.

(a) LOC deviation is less than 5/8 of one dot.

(b) AFDS LOC or ROLLOUT mode is armed

(c) L, R, and/or C - A/P is engaged.

(3) The display will revert back to the standard LOC scale if:

(a) Ground speed is less than 30 knots or radio altitude is greater than 200 ft.

(b) Neither AFDS mode is engaged

(4) For ILS NCD failures on the EADI, the pointer for the failing channel is removed. For ILS invalid data failures, the pointer and scale for the invalid channel (G/S or LOC) are removed. The corresponding flag (G/S or LOC) also comes into view.

H. Standby Attitude Indicator

(1) The standby attitude indicator displays G/S and localizer deviation from the center ILS system (AMM 34-24-00). These deviation displays operate in the same manner as the EHSI.

(2) For ILS invalid data failures on the standby attitude indicator, the pointer for the invalid channel is removed. The corresponding flag (LOC or G/S) is driven into view.

3. <u>Operation</u> (Fig. 2 and 3)

A. ILS System Block Diagram (Fig. 2)

(1) Three ILS systems are installed, and are designated as left, right and center. Each system consists of a receiver, G/S antenna, and LOC antenna. One control panel serves all three systems.

(2) Each receiver receives power from the 115 volt ac bus through the P11 CB panel, which it then routes to the control panel.

(3) The ILS control panel encodes and outputs the ILS frequency and the front course runway heading, as selected by the pilot, to the left and right VOR control panels and each ILS receiver.

(4) The ILS receiver accepts localizer and glide slope ground station transmission signals, as well as ILS digital frequency data. The receiver processes these signals, and provides digital data to the pilot and automatic flight control system (AFCS) through the interface systems.

(5) The EFIS symbol generators accept ILS digital data and generate video signals for ILS displays on the EHSI and EADI.

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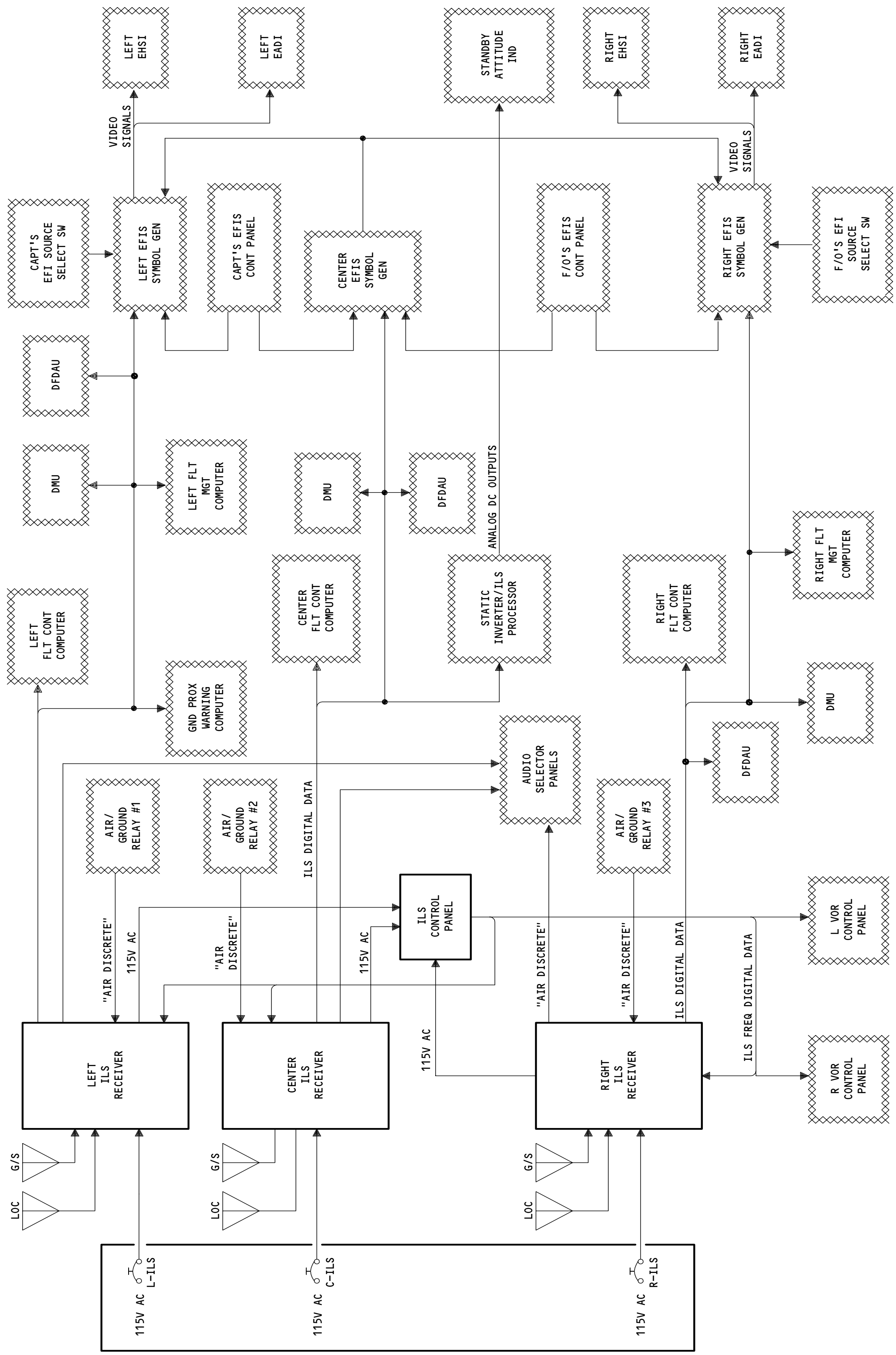

ILS Block Diagram
Figure 2

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(6) The static inverter/ILS processor accepts center ILS digital data and converts it to analog dc outputs to drive G/S and LOC meter movements on the standby attitude indicator.
(7) The flight management computers accept ILS localizer digital data for position update.
(8) The ground proximity warning computer (GPWC) accepts left ILS digital data to compare actual G/S deviation with calculated admissable G/S deviation. If excessive deviation is detected, the GPWC generates GLIDE SLOPE aural advisory annunciations.
(9) The audio select panels accept ILS audio output which contains ILS station identification in Morse Code, for controlled routing to cockpit speakers, flight crew headsets, and voice recorder.
(10) The air/ground relays provide air discrete signals which enable the identification of faults which develop while airborne, to be stored for maintenance purposes.

B. Functional Description (Fig. 3)
(1) Three ILS receivers and one control panel are installed. All receiver operations are identical, so only the left system is described.
(2) Each ILS receiver is powered by 115V ac at 400 Hz. Power is received from the corresponding circuit breakers on the P11 panel. The receiver power supply generates dc voltages for internal circuit operation. Each receiver supplies 115V ac, 400 Hz to separate power supplies in the ILS control panel. The control panel indicator lights are supplied by 0-5V ac from the master power and dim circuit.
(3) ILS frequency and course are selected manually on the control panel. The frequency and course signals are processed and routed to the respective output driver. The control signals are sent via an ARINC 429 digital data bus to the receiver for tuning purposes. The frequency data is also routed to the VOR control panel on the same digital data bus for DME tuning.
(4) Discrete control signals are received from the air/ground relay and the flight control computer (FCC). The air/ground relay discrete enables the ILS BITE memory to identify flight segments. The BITE memory stores faults by flight segment. A flight segment starts each time the airplane takes off. The FCC provides a discrete to inhibit self-test and manual tuning during autoland approaches and landing.

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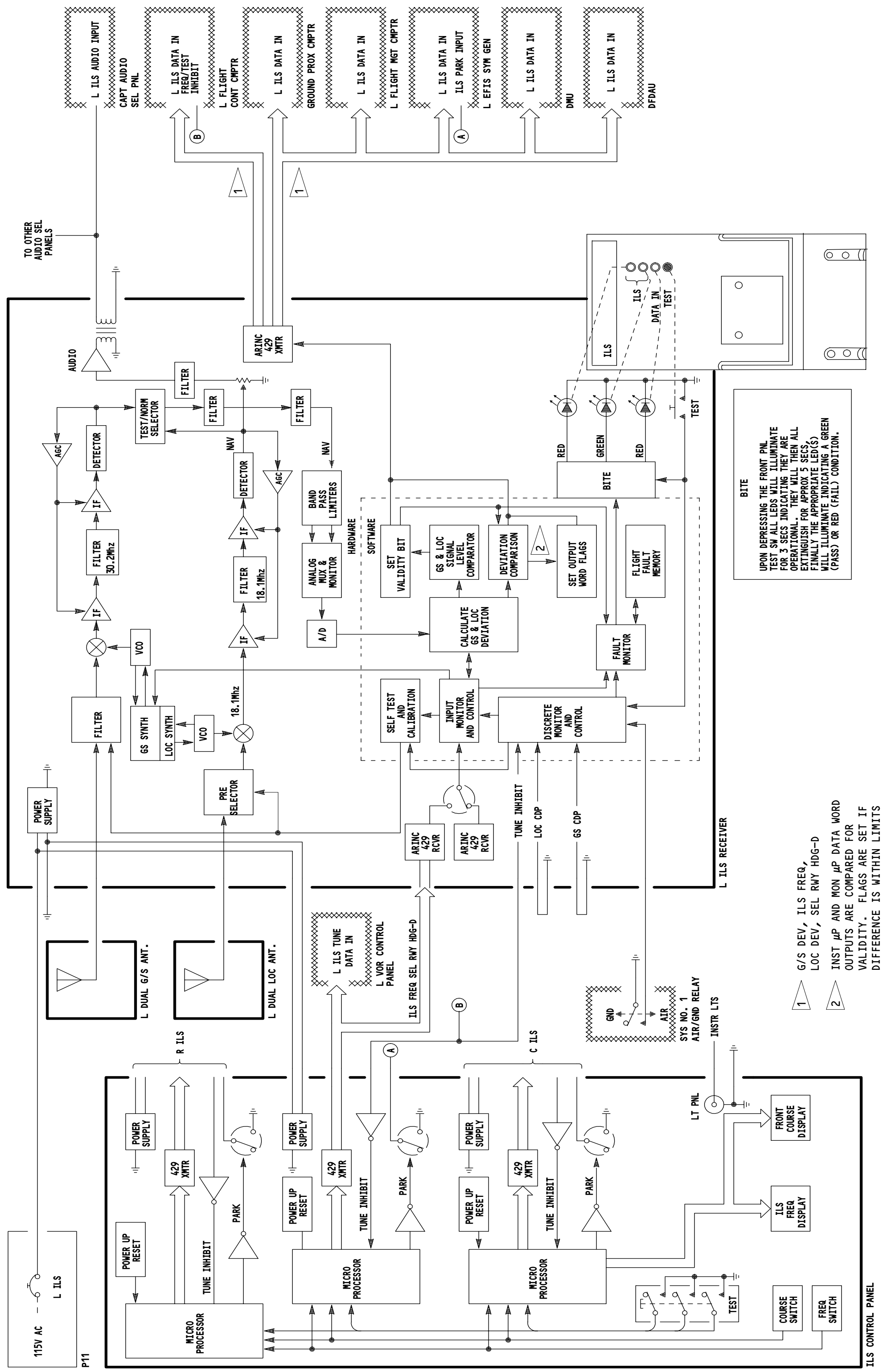

ILS Schematic (Example)
Figure 3

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(5) The central processor unit (CPU) performs all control, timing, logic, and computations required for system operation. The CPU controls operations of the receiver by means of a stored program in memory (ROM).

(6) Tuning is controlled by the frequency selection on the control panel. This control data is received by the interface module in the receiver and processed by the CPU. The CPU uses this data to provide tuning voltage to the glideslope and localizer synthesizers. It also transmits tuning voltage to the localizer receiver channel.

(7) Each ILS receiver contains separate channels for processing of the LOC and glideslope signals. Operation of the two channels is the same except for the frequency ranges. Frequency range for the localizer channels (40 total) is from 108.10 to 111.95 MHz. The 40 paired glideslope channels range from 329.15 to 335.00 MHz.

(8) The LOC signal received at the antenna is modulated with 90 Hz, 150 Hz, and 1020 Hz tones. The 90 Hz and 150 Hz tones contain localizer course information while the 1020 Hz has station code identification. The localizer input signal is applied to the NAV receiver preselector. The preselector is tuned to the selected localizer channel by a tuning voltage provided by the CPU module. A local oscillator signal generated by the NAV VCO module and the digital synthesizer module is injected into a balanced mixer. The mixer subtracts the local oscillator frequency from the preselector localizer signal to produce an 18.1 MHz IF signal.

(9) The 18.1 MHz IF signal from the mixer is amplified by the first IF amplifier. The IF signal is then filtered by an 18.1 MHz crystal filter prior to additional amplification by a second IF amplifier. The 90-, 150-, and 1020-Hz audio signals are recovered by a diode detector. This detected audio signal is the NAV composite signal.

(10) Primary and secondary AGC feedback signals are developed by dual AGC circuits to ensure a constant receiver output level with carrier input level variations. The AGC circuits filter the NAV composite signal to remove the audio components. The primary AGC signal is fed back to the input of the second IF amplifier. The secondary AGC signal is fed back to the input of the first IF amplifier.

(11) The NAV signal is applied to the filter and limiter circuits which pass the 1020 Hz signal. This signal is amplified and coupled through a transformer to the audio select panels. A preset output adjustment in the amplifier controls the audio output level. The audio output level is reduced by 10 db when a no computed data (NCD) fault occurs.

(12) The NAV signal is also applied to the test/normal selector in the BITE module. During normal operation, the NAV signal is connected through the test/normal selector to a group of 90/150 Hz low pass filters. These low pass filters pass the 90 and 150 Hz signals and remove the 1020 Hz signal. The filter network also separates each tone from the NAV signal and generates a voltage proportional to the modulation level of each tone. The CPU computes course deviation from this voltage based upon the difference in modulation of the two tones. The course deviation is output to the interface module.

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(13) The glideslope signal received at the antenna is also modulated with 90 and 150 Hz tones. These 90 and 150 Hz signals contain glideslope course information. Processing of the glideslope 90 and 150 Hz signals is the same as for the LOC signal. The CPU calculates and outputs the glideslope deviation to the interface module.

(14) The outputs of the GS and LOC 90/150 Hz filters are also connected to the monitor CPU. The monitor CPU computes localizer and glideslope deviations. It also reads the deviation data output from the data ports. The output data is compared to the computed data. The result is transmitted to the primary CPU. Both the primary CPU and monitor CPU perform comparison of the output data for each transmission.

(15) Output data is converted from parallel to serial format by the ARINC 429 interface module. The left ILS system sends ILS data over an ARINC 429 bus to the left EFIS symbol generator, and the GPWS. The right system sends data to the right EFIS symbol generator. The center ILS system sends data to the static inverter/ILS processor and to the center EFIS symbol generator. In addition, the left, right, and center ILS receivers send data to the left, right, and center FCCs respectively over a separate dedicated data bus.

C. BITE and Self Test

(1) The ILS built in test equipment (BITE) performs self test procedures on the receiver as part of the CPU stored program. During normal operations, the CPU monitors static signals such as supply voltage and VCO drive signals. It tests G/S and LOC input data at the receiver input and throughout the processing stages to determine low signal level faults. It checks the input tuning data from the control panel for integrity. The BITE also monitors the output data for comparison with the calculated data output from the CPU.

(2) For detected faults, the receiver will output failure warning codes on the ARINC 429 data bus. For receiver failures, an invalid data code is output. For absent or improper ILS input signals from the antenna and/or tuning data input a no computed data code (NCD) is output.

(3) All receiver faults detected during the BITE program are stored in a non-volatile fault memory. The faults are stored by flight segments for subsequent evaluation in the shop. Each flight segment starts when the airplane takes off as detected by the air/ground relay. The fault memory can store faults for up to 63 flights. The maximum number of faults that can be stored for any flight segment is 13. If a fault exists continuously, it is only stored once. If it exists intermittently, it is stored each time it occurs and remains for 1 second or more. The test data history is available on the ATE connector for shop personnel. In addition, a number corresponding to the failed module is displayed by an internal fault display for shop purposes. This internal display does not show location of intermittent faults. Failure warning codes will be output on the data bus if two or more identical faults are stored in memory from at least two of the last four flight segments, even though the unit currently tests good.

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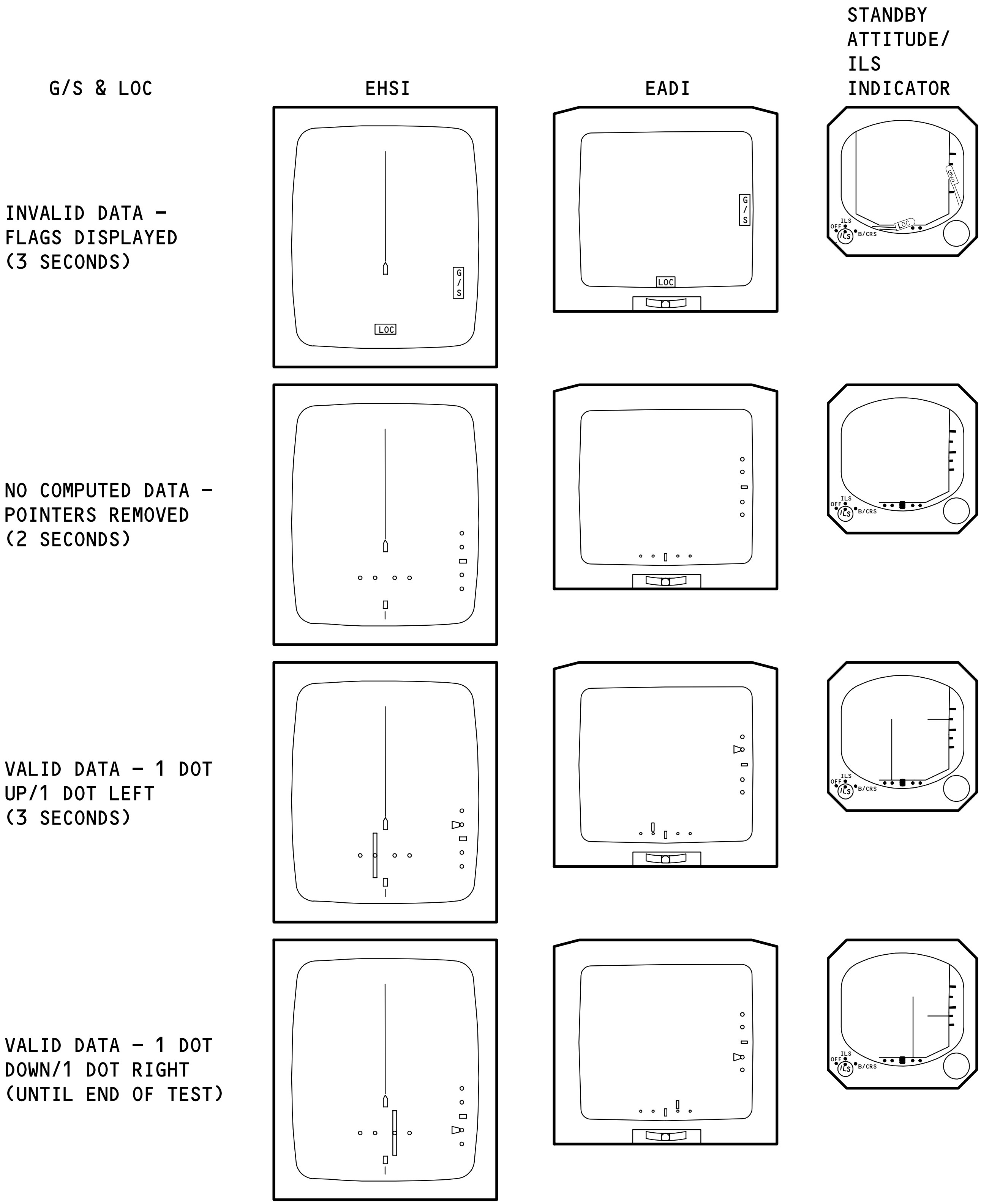

ILS Displays - Self Test Sequence
Figure 4

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(4) A system self-test is manually initiated by pressing the TEST button on either the receiver front panel or the ILS control panel. When a self-test is run, a G/S and LOC test signal are injected into parts of the receiver. Test signals are injected into either the front end of the receiver or at the NORMAL/TEST circuit in the BITE module as determined by the CPU program. These signals are processed and checked in the same manner as for normal operation. Fault codes are also output and displayed in the same manner. In addition, the lights on the receiver front panel will come on to show pass or fail conditions for the test.

(5) The following test sequence will occur on the ILS receiver during the test.

NOTE: Test button on the receiver front panel must be held in for the entirety of the test (16 seconds).

(a) All front panel lights come on for about 3 seconds to show that they work.
(b) All lights then go off for about 1 second.
(c) The green ILS light comes on to indicate the test was successful.
(d) The red ILS light comes on for two conditions. It comes on if an internal ILS receiver fault has been detected. It will also come on if two or more identical faults from at least two of the last four flight segments are stored in the flight fault memory.
(e) The red DATA IN light comes on if a fault in the ARINC 429 receiver is detected. It will also come on if the digital data word from the ILS control panel was not properly received.

(6) At the same time, the receiver outputs ILS test information. This data is used to produce the following patterns on the applicable flight instruments:

NOTE: Glideslope deviation pointer is removed from view on EADI and EHSI (ILS mode) when difference between airplane track angle and selected runway heading is greater than 90 degrees (back-course approaches).

(a) An invalid data display occurs for 3 seconds.
(b) A NCD condition occurs for the next 2 seconds.
(c) G/S and localizer pointers move to one dot up and one dot left respectively, for 3 seconds.
(d) G/S and localizer pointers move to one dot down and one dot right for remainder of the test.

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INSTRUMENT LANDING SYSTEM (ILS)

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
ANTENNA - L DUAL G/S, M250	1	1	111A1, NOSE RADOME	34-31-03
ANTENNA - L DUAL LOC, M248	1	1	111A1, NOSE RADOME	34-31-04
ANTENNA - R/C DUAL G/S, M251	1	1	111A1, NOSE RADOME	34-31-03
ANTENNA - R/C DUAL LOC, M249		1	111A1, NOSE RADOME	34-31-04
CIRCUIT BREAKER -			FLT COMPT, P11	
ILS CENTER, C606		1	11A2	*
ILS LEFT, C603		1	11E10	*
ILS RIGHT, C605		1	11E31	*
INDICATOR - (FIM 34-22-00/101)				
LEFT ELECTRONIC ATTITUDE DIRECTOR, N4				
LEFT ELECTRONIC HORIZ SITUATION, N5				
RIGHT ELECTRONIC ATTITUDE DIRECTOR, N44				
RIGHT ELECTRONIC HORIZ SITUATION, N45				
INDICATOR - (FIM 34-24-00/101)				
STBY ATTITUDE ILS, N20				
PANEL - (FIM 23-51-00/101)				
CAPTAIN AUDIO SELECTOR, M70				
F/O AUDIO SELECTOR, M71				
FIRST OBSERVER AUDIO SELECTOR, M98				
PANEL - (FIM 34-22-00/101)				
LEFT EFIS CONTROL, M94				
RIGHT EFIS CONTROL, M93				
PANEL - ILS CONTROL, M87	2	1	FLT COMPT, P8	34-31-02
SYMBOL GENERATOR - (FIM 34-22-00/101)				
CENTER ELECTRONIC FLT INST SYS, M149				
LEFT ELECTRONIC FLT INST SYS, M148				
RIGHT ELECTRONIC FLT INST SYS, M150				
RECEIVER - CENTER ILS, M157	1	1	119AL, MAIN EQUIP CTR, E1-4	34-31-01
RECEIVER - LEFT ILS, M156	1	1	119AL, MAIN EQUIP CTR, E1-3	34-31-01
RECEIVER - RIGHT ILS, M158	1	1	119AL, MAIN EQUIP CTR, E1-5	34-31-01
RELAY - (FIM 31-01-36/101)				
SYS NO. 1 AIR/GND, K124				
RELAY - (FIM 31-01-37/101)				
SYS NO. 2 AIR/GND, K214				
SYS NO. 2 AIR/GND, K293				
UNIT - (FIM 34-24-00/101)				
STATIC INV/ILS PROCESS, M917				

* SEE THE WDM EQUIPMENT LIST

Instrument Landing System (ILS) - Component Index
Figure 101

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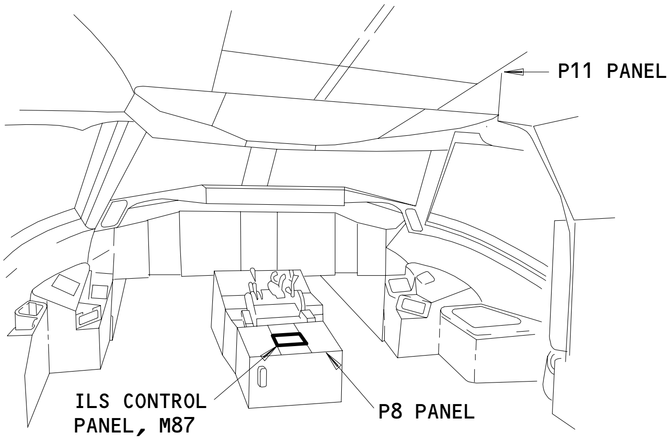
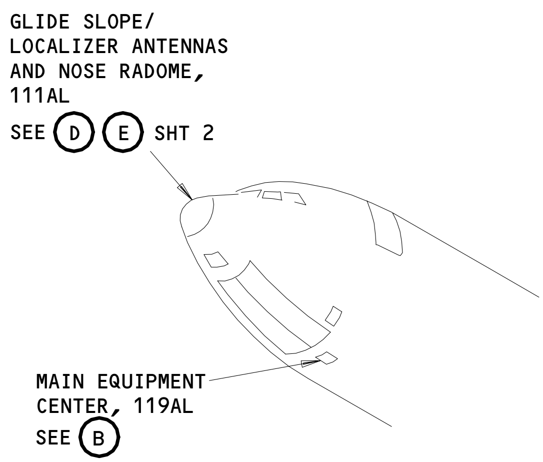
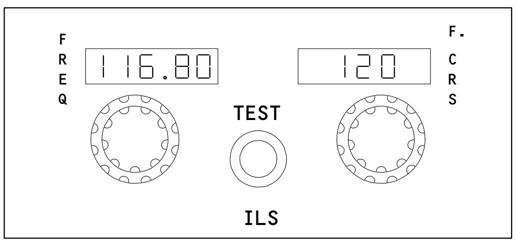


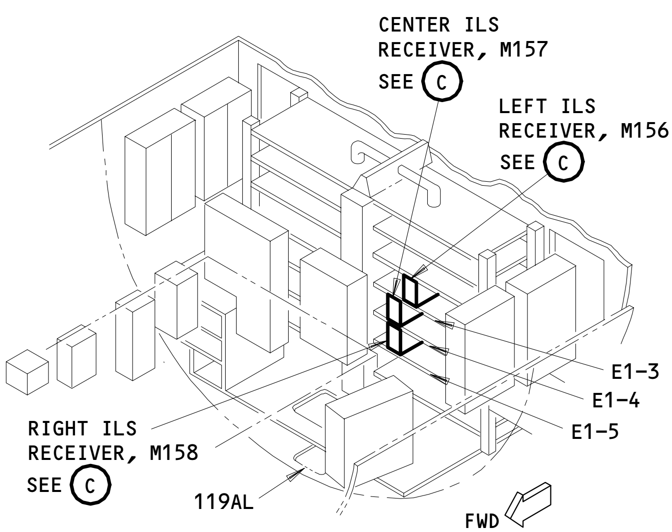
FLIGHT COMPARTMENT





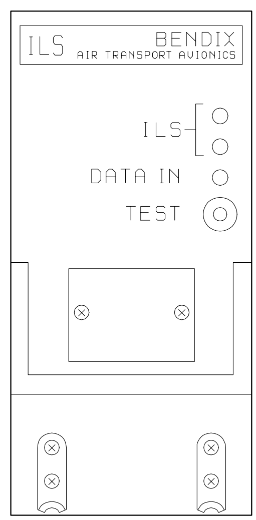
ILS CONTROL PANEL, M87

A



MAIN EQUIPMENT CENTER

B



LEFT, CENTER OR RIGHT ILS RECEIVER,
M156, M157, OR M158

C

ILS - Component Location
Figure 102 (Sheet 1)

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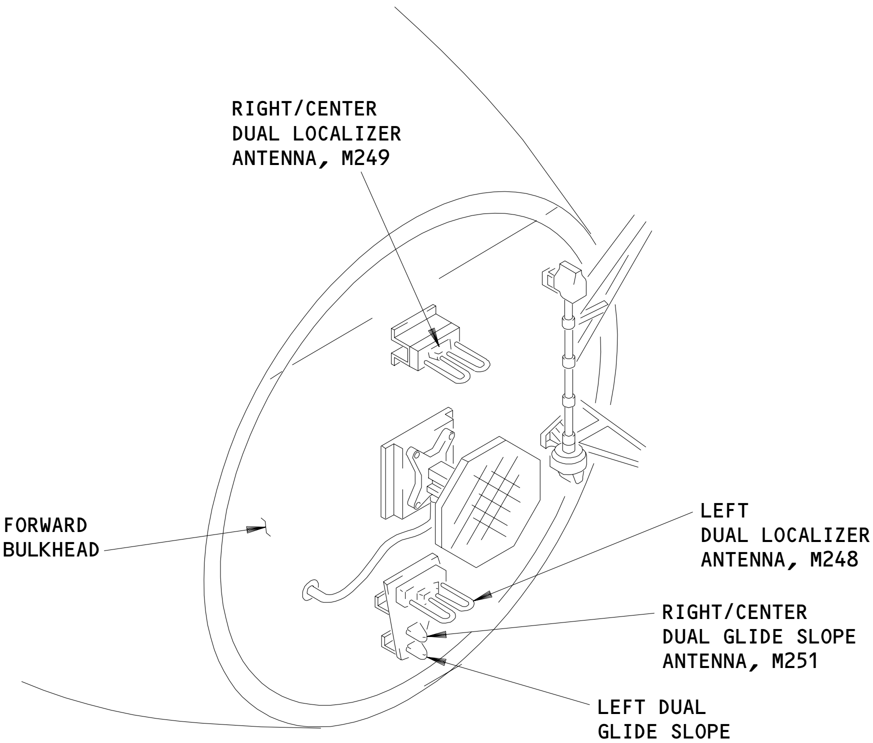
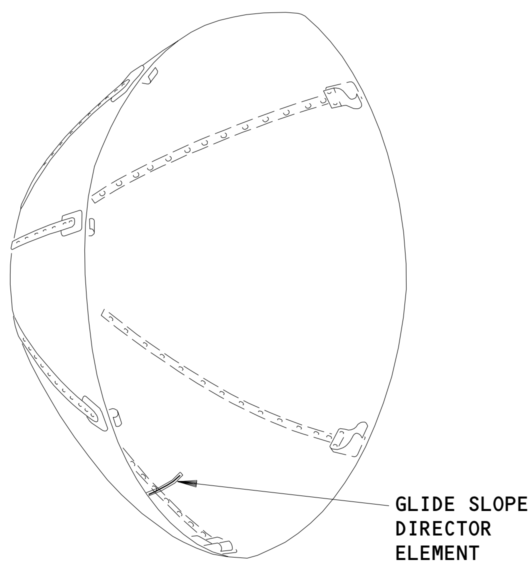


NOSE RADOME - OPEN

D



NOSE RADOME

E

ILS - Component Location (Detatils from Sht 1)
Figure 102 (Sheet 2)

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INSTRUMENT LANDING SYSTEM (ILS) - ADJUSTMENT/TEST

1. General
   A. This procedure has two tasks. The Operational Test uses the BITE functions of the system, and no test equipment is necessary. The System Test is a more complete test of the system with a ramp test set.

TASK 34-31-00-715-001

2. ILS - Operational Test
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
      (2) AMM 34-21-00/501, Inertial Reference System - Initialization
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Prepare for the Operational Test

      S 865-002
      (1) Supply electrical power (AMM 24-22-00).

      S 865-003
      (2) On the EFIS control panels, set the mode select switch to the ILS, ILS-EXP, or APP position.

      S 865-008
      (3) On the standby attitude indicator, set the switch to the ILS or APP position.

      S 865-009
      (4) Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:
          (a) 11P1 LIGHTING INSTRUMENT & PANEL AISLE STAND
          (b) 11P2, LIGHTING INSTRUMENT & PANEL CAPT

      S 755-010
      (5) Make sure the displays are on and the standby attitude indicator is on.

      S 865-011
      (6) Make sure these circuit breakers on the P11 panel are closed:
          (a) 11A2, ILS CENTER or C MMR
          (b) 11A9, STBY ILS IND
          (c) 11E4, EFIS CONT PNL LEFT
          (d) 11E6, HSI LEFT

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(e) 11E10, ILS LEFT or L MMR
(f) 11F8, EFIS SYM GEN L

S 755-012
(7) Make sure the glide slope (G/S) flags, localizer (LOC) flags, and deviation pointers are not in view on the captain's EHSI and standby attitude indicator.

NOTE: If the ILS control panel is set to the local approved ILS frequency, the deviation pointers will be in view.

S 865-013
(8) Make sure these circuit breakers on the P11 panel are closed:
(a) 11E25, EFIS CONT PNL RIGHT
(b) 11E27, HSI RIGHT
(c) 11E31, ILS RIGHT or R MMR
(d) 11F29, EFIS SYM GEN RIGHT

S 755-073
(9) Make sure the G/S and LOC flags and the deviation pointers are not in view on the first officer's EHSI.

NOTE: If the ILS control panel is set to the local approved ILS frequency, the deviation pointers will be in view.

S 865-079
(10) Do these steps to permit the G/S and LOC flags to come into view:
(a) Open these circuit breakers on the P11 panel:
1) 11E10, ILS LEFT or L MMR
2) 11E31, ILS RIGHT or R MMR
(b) On the instrument source select panels, make sure the EFI switch is in the NORM position.
(c) Set the FREQ control on the ILS control panel to a position other than PK.
(d) On the EADIs, make sure the G/S and LOC flags are in view.
(e) Close these circuit breakers on the P11 panel:
1) 11E10, ILS LEFT or L MMR
2) 11E31, ILS RIGHT or R MMR
(f) On the EADIs, make sure the G/S and LOC flags are out of view.

S 865-027
(11) Energize and align the Inertial Reference System (AMM 34-21-00).

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S 865-028

(12) Set the CRS heading display on the ILS control panel to the same airplane heading as shown on the EHSIs.

NOTE: The glide slope pointer is not shown when the difference between the airplane track angle and the runway heading is greater than 90 degrees (backcourse operation).

(a) Make sure the captain's and the first officer's course pointers agree with the CRS heading on the ILS control panel.

(b) Make sure the position of the captain's and the first officer's course pointers are the same.

D. Procedure

S 865-080

(1) Make sure the ILS frequency is set to a position other than PK.

S 745-176

(2) Push and hold the TEST switch on the left ILS receiver.

(a) Make sure the following sequence occurs:

1) All the lights come on.

2) All the lights go off.

3) The green ILS light comes on and stays on.

(b) Release the TEST switch on the ILS receiver.

S 745-032

(3) Do the procedure again for the center and right receivers.

S 745-033

(4) On the ILS control panel, momentarily push and release the TEST switch.

S 755-081

(5) Make sure these indications occur for approximately 3 seconds:

(a) On each EHSI, the G/S and LOC deviation scales go out of view. Also, the G/S and LOC deviation pointers stay out of view, and the G/S and LOC flags come into view.

(b) On the standby attitude indicator, the G/S and LOC deviation pointers stay out of view. Also, the G/S and LOC flags come into view.

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S 755-082
(6) Make sure these No Computed Data (NCD) indications occur for approximately 2 seconds:
(a) On each EHSI, the G/S and LOC deviation scales come into view. Also, the G/S and LOC deviation pointers stay out of view, and the G/S and LOC flags go out of view.
(b) On the standby attitude indicator, the G/S and LOC deviation pointers stay out of view. Also, the G/S and LOC flags go out of view.

S 755-083
(7) Make sure these indications occur on each EHSI and on the standby attitude indicator:
(a) For approximately 3 seconds, the G/S and LOC deviation pointers move to one dot up and left.
(b) For approximately 5 seconds, the pointers move to one dot down and right.

S 755-084
(8) Make sure the G/S and LOC deviation pointers go out of view.

E. Put the Airplane Back to Its Usual Condition

S 865-034
(1) Remove electrical power if it is not necessary (AMM 24-22-00).

TASK 34-31-00-735-078

3. ILS - System Test

A. General
(1) The first part of the system test is the operational test. Then, you do a test of the localizer and glide slope functions and the audio signal of the localizer.

B. Equipment
(1) VOR/ILS Ramp Test Set, NAV402AP (preferred), NAV401L (optional)
Instrument & Flight Research Inc.
10200 West York Street,
Wichita, KS, 67215

C. References
(1) AMM 24-22-00/201, Electrical Power - Control

D. Access
(1) Location Zones
211/212 Flight Compartment

E. Prepare for the System Test

S 865-035
(1) Follow the test set instructions to prepare the test set.

S 865-036
(2) Set the output of the test set as follows:
(a) The RF FREQ to the approved test frequency

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(b) The RF LEVEL to the middle of the scale
(c) The MODULATION to 30 percent at 1020 Hz (audio tone)
(d) The DDM to zero for the G/S and the LOC

NOTE: Turn the control for the master modulation lever fully counterclockwise to get 30% modulation for the IDENT tone. It will supply 20% modulation for the localizer 90 and 150 Hz tones. It will also supply 40% modulation for the glideslope 90 and 150 Hz tones.

(e) The MODE switch to the LOC XTL position.

F. Procedure

S 715-037
(1) Do the ILS - Operational Test. Do not remove electrical power.

S 865-095
(2) Make sure that the cabin interphone system is serviceable (AMM 23-42-00/501).

S 865-039
(3) Set the ILS control panel to the same frequency as the test set.

S 865-040
(4) Set the CRS heading display on the ILS control panel to the same airplane heading as shown on the EHSIs.

S 755-041
(5) On the captain's EHSI, first officer's EHSI, and standby attitude indicator, make sure these indications occur:
(a) The G/S and LOC deviation pointers come into view and are in the middle of their scales.
(b) The frequency shown on the ILS control panel is also shown in the lower right corner of the EHSIs.
(c) The airplane heading and runway heading are the same on the EHSIs.

NOTE: The glide slope pointer is not shown when the difference between the airplane track angle and the runway heading is greater than 90 degrees (backcourse operation).

S 865-042
(6) On the test set, turn the localizer DDM control clockwise to +0.155 DDM.

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S 755-043
(7) On the captain's EHSI, first officer's EHSI, and standby attitude indicator, make sure the LOC pointers move right two dots.

S 865-046
(8) On the standby attitude indicator, set the ILS switch to the INOP position.
(a) Make sure the LOC and G/S deviation pointers are out of view.

S 865-048
(9) On the standby attitude indicator, set the switch to the OFF position.

S 755-049
(10) Make sure the LOC and G/S deviation pointers are out of view.

S 865-050
(11) On the standby attitude indicator, set the ILS switch back to the ILS position.

S 755-051
(12) Make sure the G/S pointer returns to the center and the LOC pointer returns to two dots right.

S 865-052
(13) On the test set, turn the localizer DDM control counterclockwise to -0.155 DDM.

S 755-053
(14) On the captain's EHSI, first officer's EHSI, and standby attitude indicator, make sure the LOC pointers move left two dots.

S 865-054
(15) On the test set, turn the localizer DDM control clockwise to zero.

S 755-055
(16) On the captain's EHSI, first officer's EHSI, and standby attitude indicator, make sure the localizer pointers are in the center.

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S 865-056
(17) On the captain's audio selector panel, set the switch, in sequence, to the L, C, and R ILS positions.

S 755-057
(18) Make sure you hear the ILS ident tone for the test frequency on the flight compartment speakers for each position. If necessary, adjust the volume on the speakers.

S 715-058
(19) Do the same procedure again for the ident tone at the remaining audio select panels.

S 865-059
(20) Set the MODE switch on the test set to the G/S XTL position.

S 865-060
(21) On the test set, turn the glideslope DDM control counterclockwise to +0.175 DDM.

S 755-062
(22) On the captain's EHSI, first officer's EHSI, and standby attitude indicator, make sure the G/S deviation pointers move down two dots.

S 865-061
(23) On the test set, turn the glideslope DDM control clockwise to -0.175 DDM.

S 755-063
(24) On the captain's EHSI, first officer's EHSI, and standby attitude indicator, make sure the G/S deviation pointers move up two dots.

S 865-064
(25) On the test set, turn the glideslope DDM control counterclockwise to zero.

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S 755-065
(26) On the captain's, EHSI, first officer's EHSI, and standby attitude indicator, make sure the glide slope pointers are in the center.

S 865-066
(27) Turn the course select control on the ILS control panel clockwise until the selected runway course line moves 5 degrees right on the EHSIs.

S 755-067
(28) Make sure the course display shows 5 degrees more than the airplane heading on the EHSIs.

S 865-068
(29) Turn the course select switch on the ILS control panel counterclockwise until the selected runway course line moves 5 degrees left on the EHSIs.

S 755-069
(30) Make sure the course display shows 5 degrees less than the airplane heading on the EHSIs.

S 865-070
(31) Remove the test equipment.

G. Put the Airplane Back to Its Usual Condition

S 865-072
(1) Remove the electrical power from the Inertial Reference System if it is not necessary (AMM 34-21-00).

S 865-071
(2) Remove electrical power if it is not necessary (AMM 24-22-00).

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INSTRUMENT LANDING SYSTEM OR MULTI-MODE RECEIVER - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the ILS or multi-mode receiver; the other is the installation of the ILS or multi-mode receiver.
   B. The three ILS or multi-mode receivers are installed on the E1 rack in the main equipment center.

TASK 34-31-01-004-044

2. Remove the Receiver
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
   B. Access
      (1) Location Zones
         119/120 Main Equipment Center

   C. Prepare for Removal

      S 864-002

      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11A2, ILS CENTER or C MMR
         (b) 11E10, ILS LEFT or L MMR
         (c) 11E31, ILS RIGHTor R MMR
   D. Procedure

      S 024-047

      (1) Remove the ILS or multi-mode receiver (AMM 20-10-01/401).

TASK 34-31-01-404-045

3. Install the Receiver
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
      (2) AMM 22-00-02/201, Autoflight BITE
      (3) AMM 24-22-00/201, Electrical Power - Control

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B. Access
(1) Location Zones
119/120 Main Equipment Center
211/212 Flight Compartment

C. Prepare for Installation

S 864-005
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11A2, ILS CENTER or C MMR
(b) 11E10, ILS LEFT or L MMR
(c) 11E31, ILS RIGHT or R MMR

D. Procedure

S 424-046
(1) Install the ILS or multi-mode receiver (AMM 20-10-01/401).

S 864-007
(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11A2, ILS CENTER or C MMR
(b) 11E10, ILS LEFT or L MMR
(c) 11E31, ILS RIGHT or R MMR

E. Installation Test

S 864-008
(1) Supply electrical power (AMM 24-22-00/201).

S 864-009
(2) Set the frequency on the ILS control panel to a position other than PK.

S 744-053
(3) Push and hold the TEST switch on the applicable ILS receiver.
(a) Make sure the following sequence occurs:
1) All the lights come on.
2) All the lights go off.
3) The green ILS light comes on and stays on.
(b) Release the TEST switch on the receiver.

S 734-012
(4) Do the Maintenance Control Display Panel Test - 30 Current Fault Report (AMM 22-00-02/201).

S 754-013
(5) Make sure there are no ILS fault messages.

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NOTE: No GPS Operation Test - AMM 34-58-00/501 is required for center MMR.

F. Put the Airplane Back to Its Usual Condition

S 864-014

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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INSTRUMENT LANDING SYSTEM (ILS) CONTROL PANEL - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the ILS control panel; the other is the installation of the ILS control panel.
   B. The ILS control panel, M87, is installed on the pilots' aft electronic control panel, P8. Electrical connections are at the rear of the control panel.

TASK 34-31-02-004-001

2. Remove the ILS Control Panel
   A. Access
      (1) Location Zones
          211/212 Flight Compartment

   B. Prepare for Removal

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11A2, ILS CENTER or C MMR
          (b) 11E10, ILS LEFT or L MMR
          (c) 11E31, ILS RIGHT or R MMR
   C. Procedure

      S 034-003
      (1) Loosen the screws on the control panel.

      S 014-004
      (2) Move the panel out to get access to the electrical connections.

      S 034-005
      (3) Disconnect the electrical cables.

      S 024-006
      (4) Remove the ILS control panel.

TASK 34-31-02-404-007

3. Install the ILS Control Panel
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control

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B. Access
(1) Location Zones
211/212 Flight Compartment

C. Prepare for Installation

S 864-008
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11A2, ILS CENTER or C MMR
(b) 11E10, ILS LEFT or L MMR
(c) 11E31, ILS RIGHT or R MMR

D. Procedure

S 434-009
(1) Connect the electrical cables to the control panel.

S 424-010
(2) Install the ILS control panel.

S 434-011
(3) Tighten the screws on the control panel.

S 864-012
(4) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11A2, ILS CENTER or C MMR
(b) 11E10, ILS LEFT or L MMR
(c) 11E31, ILS RIGHT or R MMR

E. ILS Control Panel Test

S 864-013
(1) Supply electrical power (AMM 24-22-00).

S 754-014
(2) Make sure all the control panel lights come on.

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S 864-015
(3) Set the mode select switch on the EFIS control panels to the ILS position.

S 864-016
(4) On the ILS control panel, set the frequency control to a position other than the PK position.

S 754-017
(5) Make sure the same ILS frequency display value shows on the captains's EHSI, first officer's EHSI, and the ILS control panel.

F. Put the Airplane Back to Its Usual Condition

S 864-018
(1) Remove electrical power if it is not necessary (AMM 24-22-00).

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ILS GLIDE SLOPE (G/S) ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the G/S antenna; the other is the installation of the G/S antenna.
   B. Two glide slope antennas (M250 - left G/S antenna, M251 - right and center G/S antenna) are installed in the nose radome.

TASK 34-31-03-004-001

2. Remove the G/S Antenna
   A. References
      (1) AMM 53-12-01/201, Nose Radome
      (2) AMM 53-12-05/401, G/S Director Element
   B. Access
      (1) Location Zone
          111 Radome

   C. Prepare for Removal

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) For the left antenna:
              1) 11E10, ILS LEFT or L MMR
          (b) For the right/center antenna:
              1) 11A2, ILS CENTER or C MMR
              2) 11E31, ILS RIGHT or R MMR
   D. Procedure

      S 014-003
      (1) Open and lock the nose radome (AMM 53-12-01/201).

      NOTE: Inspect the G/S director element before you remove the G/S antenna. It is a 12-inch continuous strip of aluminum foil tape. The strip is located horizontally across the center butt line on the inside surface of the radome. It is approximately 18 inches from the lower edge of the radome.

      If the director element is undamaged, go on with the G/S antenna removal. Replace the strip if it is damaged (AMM 53-12-05/401).

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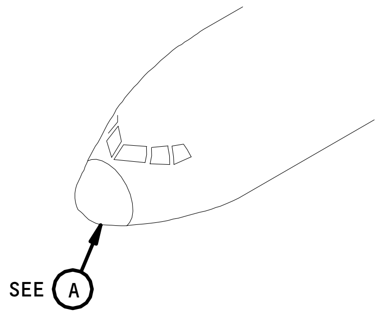
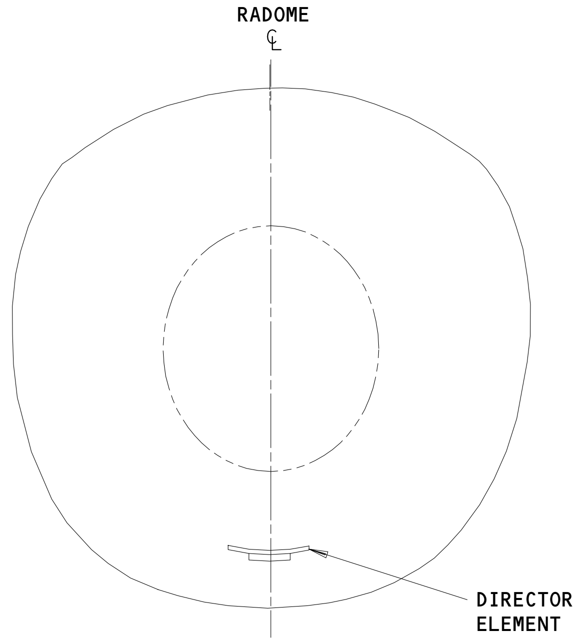
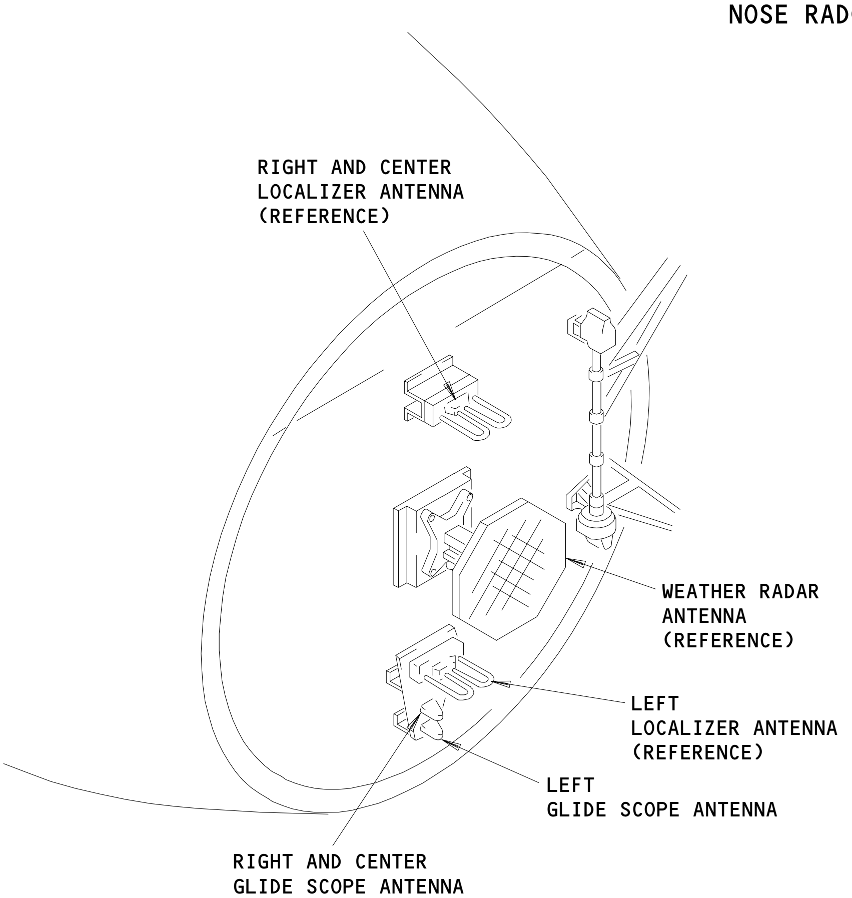




NOSE RADOME INNER SURFACE
A



ILS Dual G/S Antenna Installation
Figure 401

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S 034-004
(2) Loosen the antenna screws.

S 034-005
(3) Disconnect the coaxial antenna cable.

S 024-006
(4) Remove the G/S antenna.

TASK 34-31-03-404-007
3. Install the G/S Antenna
A. Equipment
(1) VOR/ILS Ramp Test Set, NAV402AP (preferred), NAV401L (optional), Instrument & Flight Research Inc, 10200 West York Street, Wichita, KS, 67215
(2) VOR/ILS Ramp Test Set, T-30-C, T-30-D or equivalent.
(3) Resistance measuring bridge or ohmmeter which can measure to .0025 ohm
B. Consumable Materials
(1) B00083 Solvent, TT-N-95, Aliphatic naphtha, Type I
(2) G00009 Compound - Corrosion Inhibiting - BMS 3-23
C. References
(1) AMM 20-10-22/701, Metal Surfaces
(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 53-12-01/201, Nose Radome
(4) SRM 51-20-01
D. Access
(1) Location Zones

111	Radome
211/212	Flight Compartment

E. Prepare for Installation

S 864-008
(1) Make sure these circuit breakers on the P11 panel are open:
(a) For the left antenna:
1) 11E10, ILS LEFT or L MMR

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(b) For the right/center antenna:
1) 11A2, ILS CENTER or C MMR
2) 11E31, ILS RIGHT or R MMR

S 214-009
(2) Make sure there is no corrosion on the coaxial connections or the antenna cable.

S 214-010
(3) Make sure the mating surfaces of the antenna and the airplane do not have corrosion.

S 114-011
(4) Clean the mating surfaces with the solvent, TT-N-95 (AMM 20-10-22).

S 624-012
(5) Apply the corrosion inhibiting compound, BMS 3-23, to the mating surfaces of the antenna and the airplane (SRM 51-20-01).

F. Procedure

S 434-013
(1) Connect the coaxial cable to the antenna.

S 424-014
(2) Install the G/S antenna.

S 434-015
(3) Tighten the antenna screws.

S 764-016
(4) Make sure the resistance between the antenna and the airplane is less than .0025 ohm.

S 414-017
(5) Unlock and close the nose radome (AMM 53-12-01/201).

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S 864-018
(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) For the left antenna:
1) 11E10, ILS LEFT or L MMR
(b) For the right/center antenna:
1) 11A2, ILS CENTER or C MMR
2) 11E31, ILS RIGHT or R MMR

G. G/S Antenna Test

S 864-027
(1) Make sure these circuit breakers on the P11 panel are closed:
(a) 11E10, ILS LEFT or L MMR
(b) 11A2, ILS CENTER or C MMR
(c) 11E31, ILS RIGHT or R MMR

S 864-019
(2) Supply electrical power (AMM 24-22-00/201).

S 864-020
(3) Follow the test set instructions to prepare the test set.

S 864-021
(4) Set the local approved frequency for the test on the ILS control panel.

S 864-022
(5) Set the output of the test set as follows:
(a) The RF FREQ to the same frequency as the local approved frequency for the test.
(b) The RF LEVEL to the middle of the scale
(c) The MODULATION to 30 percent at 1020 hz (audio tone).
(d) The DDM to zero for the G/S and the localizer.

S 724-023
(6) Do the left antenna test as follows:
(a) Set the mode select switch on the left EFIS control panel to the ILS, APP or ILS-EXP position.
(b) Adjust the G/S DDM on the test set to + 0.175 DDM.
(c) Make sure the G/S deviation pointer on the captain's EHSI moves down two dots from the center.

S 724-024
(7) Do the right/center antenna test as follows:
(a) Set the mode select switch on the right EFIS control panel to the ILS, APP or ILS-EXP position.
(b) Adjust the G/S DDM on the test set to + 0.175 DDM.
(c) Make sure the G/S deviation pointer on the first officer's EHSI moves down two dots from the center.

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(d) Set the EFI switch on the first officer's instrument source select panel to the ALTN position.
(e) Make sure the G/S deviation pointer on the first officer's EHSI stays down two dots from the center.
(f) Set the EFI switch on the first officer's instrument source select panel to the NORM position.

S 864-025
(8) Remove the test set.

H. Put the Airplane Back to Its Usual Condition

S 864-026
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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ILS LOCALIZER (LOC) ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the LOC antenna; the other is the installation of the LOC antenna.
   B. Two localizer antennas (M248 - left LOC antenna, M249 - right and center LOC antenna) are installed in the nose radome.

TASK 34-31-04-004-001

2. Remove the Localizer Antenna
   A. References
      (1) AMM 53-12-01/201, Nose Radome
   B. Access
      (1) Location Zone
          111 Radome

   C. Prepare for Removal

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) For the left antenna:
              1) 11E10, ILS LEFT or L MMR
          (b) For the right/center antenna:
              1) 11A2, ILS CENTER or C MMR
              2) 11E31, ILS RIGHT or R MMR
   D. Procedure

      S 014-003
      (1) Open and lock the nose radome (AMM 53-12-01/201).

      S 034-004
      (2) Loosen the antenna screws.

      S 034-005
      (3) Disconnect the coaxial antenna cable.

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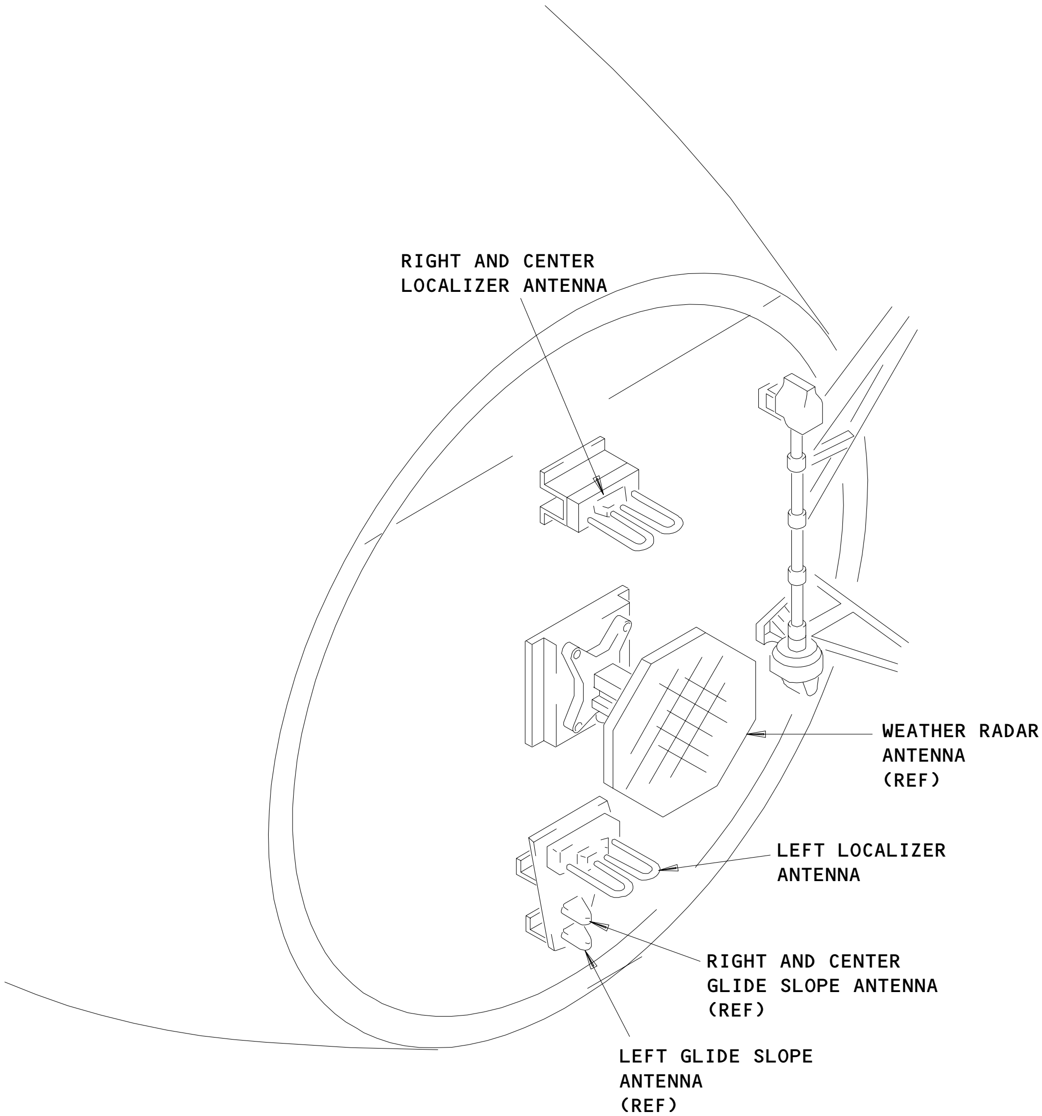

ILS Dual Loc Antenna Installation
Figure 401

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S 024-006
(4) Remove the LOC antenna.

TASK 34-31-04-404-007

3. Install the Localizer Antenna

A. Equipment
   (1) VOR/ILS Ramp Test Set, NAV402AP Preferred
       IFR NAV401L Optional
   (2) VOR/ILS Ramp Test Set, T-30-C, T-30-D or equivalent.
   (3) Resistance measuring bridge or ohmmeter which
       can measure 0.0025 ohm

B. Consumable Materials
   (1) B00083 Solvent, TT-N-95, Aliphatic naphtha,
       Type I
   (2) G00009 Compound - Corrosion Inhibiting -
       BMS 3-23

C. References
   (1) AMM 20-10-22/701, Metal Surfaces
   (2) AMM 24-22-00/201, Electrical Power - Control
   (3) AMM 53-12-01/201, Nose Radome
   (4) SRM 51-20-01

D. Access
   (1) Location Zones

111	Radome
211/212	Flight Compartment

E. Prepare for Installation

S 864-008
(1) Make sure these circuit breakers on the P11 panel are open:
   (a) For the left antenna:
      1) 11E10, ILS LEFT or L MMR
   (b) For the right/center antenna:
      1) 11A2, ILS CENTER or C MMR
      2) 11E31, ILS RIGHT or R MMR

S 214-009
(2) Make sure there is no corrosion on the coaxial connections or the antenna cable.

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S 214-010
(3) Make sure the mating surfaces of the antenna and the airplane do not have corrosion.

S 114-011
(4) Clean the mating surfaces with the solvent, TT-N-95 (AMM 20-10-22).

S 624-012
(5) Apply the corrosion inhibiting compound, BMS 3-23, to the mating surfaces of the antenna and the airplane (SRM 51-20-01).

F. Procedure

S 434-013
(1) Connect the coaxial cable to the antenna.

S 424-014
(2) Install the LOC antenna.

S 434-015
(3) Tighten the antenna screws.

S 764-016
(4) Make sure the resistance between the antenna and the airplane is less than 0.0025 ohm.

S 414-017
(5) Unlock and close the nose radome (AMM 53-12-01/201).

S 864-018
(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
    (a) For the left antenna:
        1) 11E10, ILS LEFT or L MMR
    (b) For the right/center antenna:
        1) 11A2, ILS CENTER or C MMR

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2) 11E31, ILS RIGHT or R MMR

G. LOC Antenna Test

S 864-019

(1) Make sure these circuit breakers on the P11 panel are closed:
   (a) 11A2, ILS CENTER or C MMR
   (b) 11E10, ILS LEFT or L MMR
   (c) 11E31, ILS RIGHT or R MMR

S 864-020

(2) Supply electrical power (AMM 24-22-00/201).

S 864-021

(3) Follow the test set instructions to prepare the test set.

S 864-023

(4) Set the local approved frequency for the test on the ILS control panel.

S 864-022

(5) Set the output of the test set as follows:
   (a) The RF FREQ to the same frequency as on the ILS control panel
   (b) The RF LEVEL to the middle of the scale
   (c) The MODULATION to 30 percent at 1020 Hz (audio tone)
   (d) The DDM to zero for the LOC and the glide slope.

S 864-024

(6) On the captain's audio select panel, set the controls as follows:
   (a) The FILTER switch to the BOTH position
   (b) The VOR/ILS switch to the ILS position
   (c) The applicable ILS switch to the on position.

S 724-025

(7) Do the left antenna test as follows:
   (a) Adjust the left ILS volume control.
   (b) Adjust the gain control on the captain's flight compartment speaker to get the correct audio signal.

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S 724-027

(8) Do the right/center antenna test as follows:
   (a) Adjust, in sequence, the right and center ILS volume controls.
   (b) Adjust the gain control on the captain's flight compartment speaker to get the correct audio signal for each volume control.

H. Put the Airplane Back to Its Usual Condition

S 864-028

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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MARKER BEACON SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The marker beacon system provides visual and aural indications when the airplane flies over ground based marker beacon tramsmitters. The ground stations transmit narrow beams of RF signals modulated with either 400, 1300, or 3000 Hz audio. The signals turn on appropriate lights or indicators as the airplane passes over the transmitters. This confirms specific positions during point to point navigation. It also gives positive indication of distance from the runway during a landing approach.
   B. The system consists of a marker beacon receiver module, an antenna, and flight deck marker beacon indications.
2. Component Detail
   A. Marker Beacon Receiver Module
      (1) The active marker beacon module is located in the left VOR/MKR receiver (AMM 34-51-00). The VOR receiver is located in the main equipment center on rack E2-2. The module in the right VOR receiver is inhibited.
      (2) The marker beacon module receives signals at the standard beacon transmitting frequency of 75 MHz. It detects the audio modulation frequencies of 400 Hz, 1300 Hz, and 3000 Hz. These frequencies indicate passage over the outer, middle and inner markers, respectively. The receiver provides an output signal to drive the appropriate marker beacon indications. It also sends the audio signal to the flight interphone system.
      (3) The marker beacon system also outputs signals to the flight data recorder system (If installed), (AMM 31-31-00) as the airplane passes over the ground stations.
   B. The marker beacon system uses dc power provided by the VOR/MKR receiver power supply. The VOR receiver is powered by 115 volts ac, 400 Hz from the left VOR circuit breaker on the P11 panel.
   C. Audio Selector Panel (Interface Component)
      (1) Marker beacon audio tones are routed to all the audio selector panels. The tones are monitored by flight crew headphones or the captain's and F/O's flight deck speakers. Marker beacon audio is turned on/off by the MKR switch on the panel.
   D. Antenna
      (1) The marker beacon antenna is shaped like a canoe hull and is flush mounted on the bottom centerline of the fuselage. It receives the 75 MHz marker beacon signal and provides it to the receiver on a 52 ohm coaxial cable.
   E. Marker Beacon Lights
      (1) The marker beacon lights are color coded blue, amber, and white and are labeled OUTER, MIDDLE, and INNER/AIRWAYS, respectively. They come on with detection of the marker audio tones. The blue light comes on with the 400 Hz tone, amber with 1300 Hz, and white with 3000 Hz. Two bulbs light each indicator.

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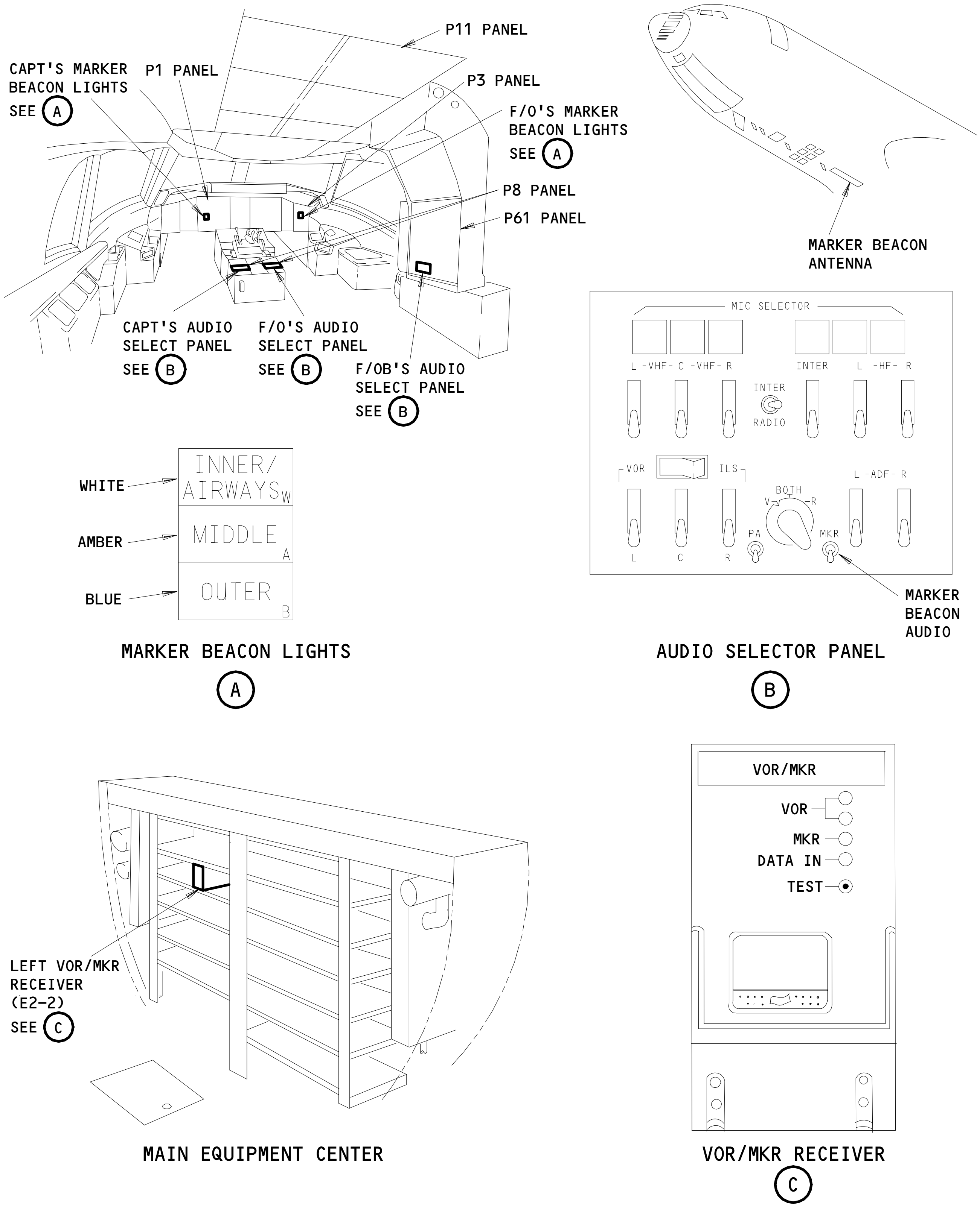

Marker Beacon - Component Locations
Figure 1

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(2) The two sets of marker beacon lights are located on the captain's panel, P1 and on the first officer's panel, P3.

3. Operation (Fig. 2)

A. Functional Description

(1) The 75 MHz incoming signal from the antenna is applied to the marker beacon RF receiver. The signal is applied to a 75 MHz crystal filter at the input to the receiver. The filter provides receiver tuning and rejection of undesired frequencies. The receiver detects the audio modulation present at marker beacon stations.

(2) The RF receiver provides an audio output of 400 Hz, 1300 Hz, or 3000 Hz depending upon whether the outer, middle, inner, or airway marker is being crossed. This output is applied to the threshold sensor. The sensor determines when the amplitude of the output signal is sufficient to light the marker lamps. The threshold sensitivity is adjustable on the bench by the LO SENS ADJ control. The HI SENS ADJ is inoperative.

(3) The tone decoders count the audio frequency to find which of the modulation frequencies is present. This is done so that the appropriate light can be illuminated. The outputs of the threshold sensor and tone decoders are applied to the lamp drivers which consists of three transistor switches. Based upon the levels of the threshold sensor and the tone decoder inputs, the appropriate lamp circuit is completed through the associated switch. The lamp power is supplied by the master dim and test circuit. The lamp drivers can be held off by an output inhibit from the OR gate. The OR gate is controlled by the VOR/MKR receiver CPU.

(4) The status monitor checks the outputs of the threshold sensor, tone decoders, and OR gate. From these inputs, the monitor develops a digital status signal which is routed to the CPU. This signal informs the CPU of the marker receiver status.

(5) The aural outputs from the RF receiver are filtered by 400, 1300, and 3000 Hz filters prior to further amplification in the final audio amplifier. The audio amplifier provides the gain needed to supply the three audio selector panels. Audio output is adjustable on the bench by the AUDIO LEVEL ADJ control on the module.

(6) For the 400 Hz outer marker, the tone output is continuous dashes (----). For the 1300 Hz middle marker signal, the tone output is alternating dots and dashes (-.-.-.). For the 3000 Hz inner marker, the tone output is continuous dots (....). The airways markers are also 3000 Hz. They are coded with the station identification letters.

B. BITE

(1) The VOR/MKR built-in test equipment (BITE) continuously monitors marker beacon module performance. The lights on the receiver front panel will indicate system status.

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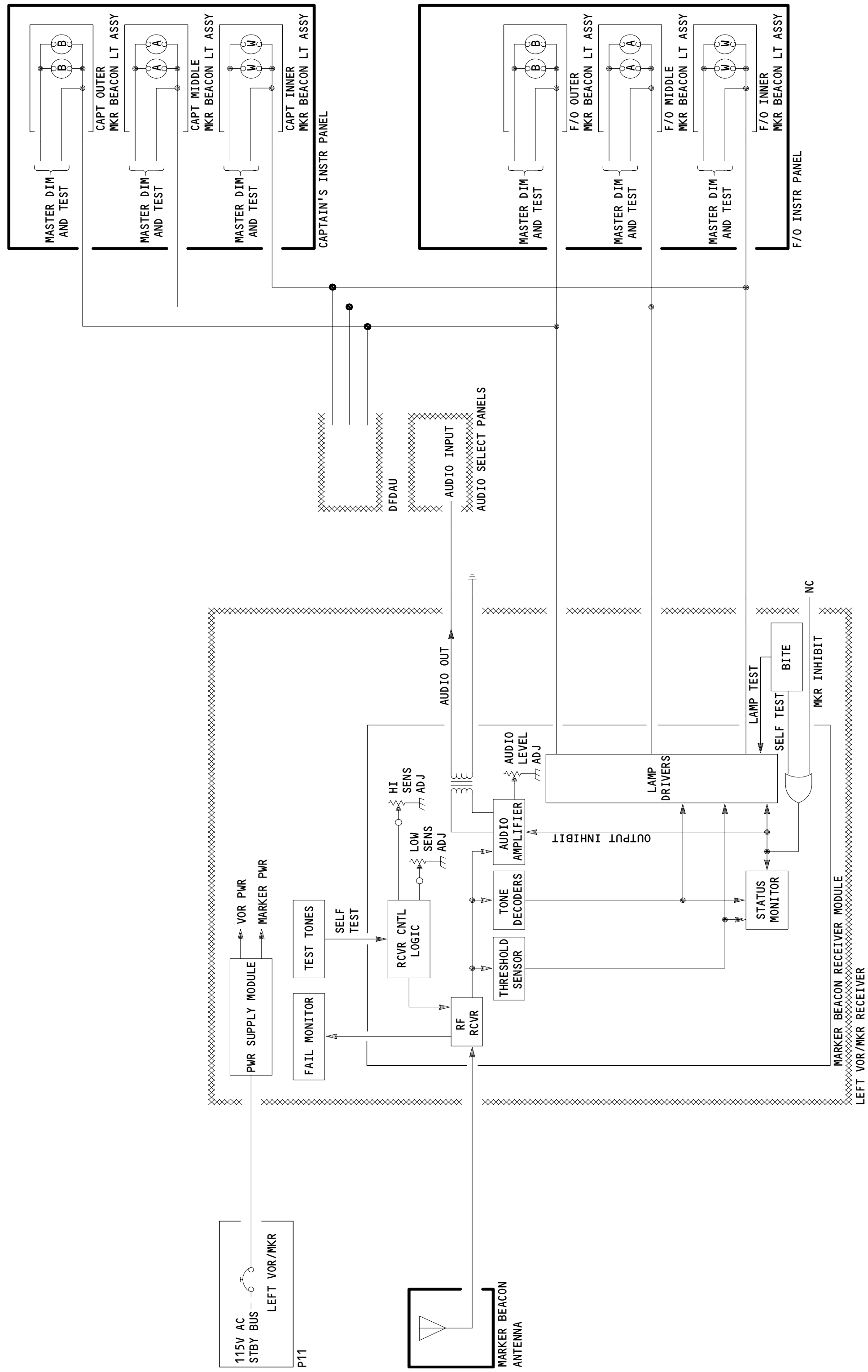

Marker Beacon System Schematic
Figure 2

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(2) When the front panel TEST switch is pressed, three marker tones are generated sequentially by BITE. They are used to modulate a test carrier in the marker receiver. A feedback path is inserted from the last rf amplifier to the receiver input. This causes the receiver to oscillate at 75 MHz. This wrap around test simulates receiver operation, turning on the marker beacon indication when the receiver is good.

(3) When the TEST switch on the left VOR/MKR receiver front panel is pushed and held the test sequence is initiated. The illumination sequence of the LEDS is as follows:

(a) All LEDs will come on.

(b) After 2 to 3 seconds all LEDs will go out.

(c) Then After another 2 to 3 seconds, either one of the LEDs will come on to indicate a pass or fail condition as follows:

1) A green VOR LED indicates no faults with the VOR/MKR receivers.

2) A red MKR LED indicates the marker beacon receiver fault.

3) A red VOR LED indicates a VOR/MKR receiver failure.

4) A red DATA IN LED indicates input tuning data is either faulty or not present.

(4) All faults detected during flight are stored in a flight fault memory (AMM 34-51-00). If a fault exists intermittently, it will not affect status of the receiver lights during the BITE test unless the fault exists during the test.

(5) If two or more identical faults are stored in the flight fault memory from at least two of the last four flight segments, the front panel lights will show a failed condition.

(6) The marker beacon indication in the cockpit also come on continuously while the test button is pushed.

C. Control

(1) There are no operating controls for the marker beacon. To turn power on to the receiver, perform the following:

(a) Provide electrical power (AMM 24-22-00).

(b) Check that the following overhead panel P11 circuit breaker is closed:

1) 11A1, VOR/MKR L

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MARKER BEACON SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
ANTENNA - MARKER BEACON, M243	--	1	BOTTOM FWD FUSELAGE	34-32-01
CIRCUIT BREAKER	--		FLT COMPT, P11	*
VOR/MKR L, C595		1	11A1	*
LIGHT - CAPT INNER MARKER BEACON LIGHT, L585	--	1	FLT COMPT, P1	*
LIGHT - CAPT MIDDLE MARKER BEACON LIGHT, L586	--	1	FLT COMPT, P1	*
LIGHT - CAPT OUTER MARKER BEACON LIGHT, L587	--	1	FLT COMPT, P1	*
LIGHT - F/O INNER MARKER BEACON LIGHT, L588	--	1	FLT COMPT, P3	*
LIGHT - F/O MIDDLE MARKER BEACON LIGHT, L589	--	1	FLT COMPT, P3	*
LIGHT - F/O OUTER MARKER BEACON LIGHT, L590	--	1	FLT COMPT, P3	*
PANEL - (REF 23-51-00, FIG. 101)				
CAPTAIN AUDIO SELECTOR, M70				
F/O AUDIO SELECTOR, M71				
FIRST OBSERVER AUDIO SELECTOR, M98				
RECEIVER - LEFT VOR/MKR, M186	--	1	119AL, MAIN EQUIP CTR, E2-2	34-51-01

* SEE THE WDM EQUIPMENT LIST

Marker Beacon System - Component Index
Figure 101

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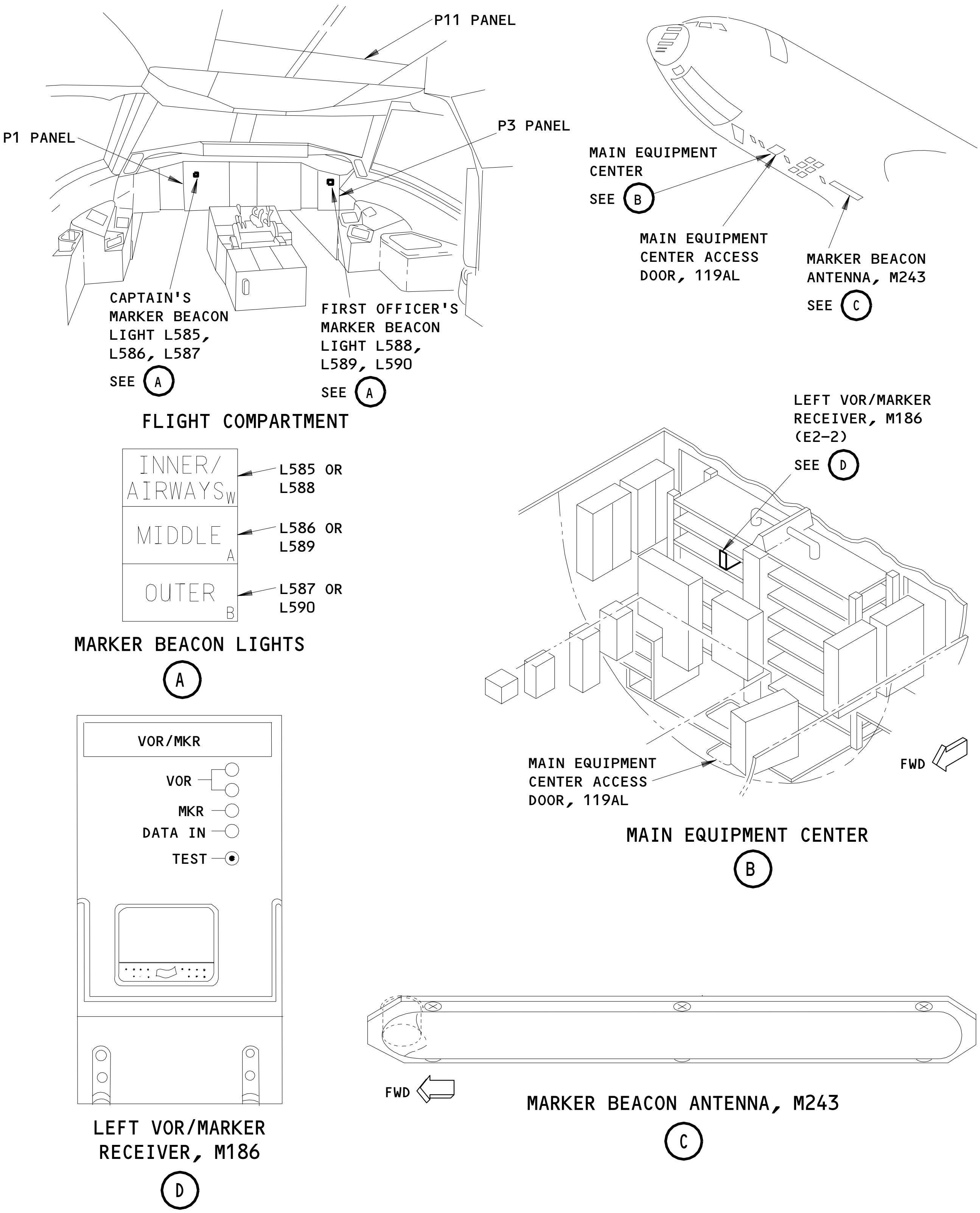

Component Location
Figure 102

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MARKER BEACON (MKR/BCN) SYSTEM - ADJUSTMENT/TEST

1. General
   A. The marker beacon adjustment/test procedure has two tasks. One is an operational test; the other is a system test. The operational test is a fast check for proper operation of the system. It uses only the VOR test switch to do the test. The system test uses test equipment and is a full check of the marker beacon system.

TASK 34-32-00-715-028

2. Marker Beacon System - Operational Test
   A. General
      (1) The operational test makes sure the proper indicators come on when the test switch on the VOR receiver is pushed. These indications include the panel lights, the VOR receiver lights, and the self-test audio tone.
   B. References
      (1) 23-51-00/501, Flight Interphone System
      (2) 24-22-00/201, Electrical Power - Control
   C. Access
      (1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

   D. Prepare for the Operational Test

      S 865-002
      (1) Supply electrical power (AMM 24-22-00).

      S 865-029
      (2) Make sure the flight interphone system is serviceable (AMM 23-51-00/501).

      S 865-003
      (3) Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:
         (a) 11A1, VOR/MKR L
         (b) 11C25, INTERPHONE FLT AMPL DUAL PWR CAPT OBS
         (c) 11C26, INTERPHONE F/O DUAL PWR
         (d) 11G29, INTERPHONE CAPT OBS FLT AMPL DUAL PWR
         (e) 11G30, INTERPHONE F/O DUAL PWR
         (f) 11R3, LEFT IND LIGHTS 3

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S 865-004
(4) On the captain's and first officer's audio selector panel, set the controls as follows:
(a) The MKR control to the ON position
(b) The other switches to the off position
(c) The volume control to a minimum
(d) The filter switch to the BOTH position.

E. Procedure

S 745-079
(1) Push and hold the TEST switch on the left VOR/MKR receiver.

S 745-099
(2) Make sure this sequence of visual indications occurs:

TIME(SEC)	VOR RCVR LIGHTS	SIX MKR BEACON LIGHTS
0	OFF	OFF
1-3	ALL ON	ON
4-5	OFF	ON
6-9	GREEN ON	ON
10	OFF	OFF

F. Put the Airplane Back to Its Usual Condition

S 865-008
(1) Remove electrical power if it is not necessary (AMM 24-22-00).

TASK 34-32-00-735-009
3. Marker Beacon System - System Test
A. General
(1) The system test uses a signal generator as a marker beacon ground transmitter during the test.

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B. Equipment
(1) VOR/ILS Ramp Test Set, NAV402AP (preferred). NAV401L (optional). Instrument & Flight Research Inc, 10200 West York Street, Wichita, KS, 67215
(2) VOR/ILS Ramp Test Set (Optional) - TIC T30B, T30C, T30D. Tel-Instrument - Electronics Corp, 728 Garden Street, Carlstadt, NJ 07072
(3) Flight Interphone Headset

C. References
(1) 24-22-00/201, Electrical Power - Control

D. Access
(1) Location Zones

123/124	Area Below Forward Cargo Compartment (Exterior)
211/212	Flight Compartment

E. Prepare for the System Test

S 865-010
(1) Put the signal generator directly beneath the marker beacon antenna.

NOTE: You can put the test antenna as close to the aircraft's antenna as necessary to get the best power transfer.

S 865-011
(2) Activate the signal generator, and permit time for it to become warm.

F. Procedure

S 715-012
(1) Do the Marker Beacon System - Operational Test.

S 865-100
(2) Connect the headphones if needed (AMM 23-51-00)

S 745-013
(3) Push and hold the IND LIGHTS test switch on the overhead panel, P5.

S 755-014
(4) Make sure that the OUTER (blue), MIDDLE (yellow), and INNER/AIRWAYS (white) marker beacon lights on the captain's and first officer's instrument panels come on.

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S 745-016
(5) Release the IND LIGHTS test switch.

S 865-017
(6) Apply a 75 MHz signal with 400 Hz modulation from the signal generator.
    (a) Make sure the two OUTER marker lights come on.
    (b) Make sure a 400 Hz tone is heard on the audio selector panels.

S 865-020
(7) Change the modulation to 1300 Hz.
    (a) Make sure the two MIDDLE marker lights come on.
    (b) Make sure a 1300 Hz tone is heard on the audio selector panels.

S 865-023
(8) Change the modulation to 3000 Hz.
    (a) Make sure the two INNER/AIRWAYS marker lights come on.
    (b) Make sure a 3000 Hz tone is heard on the audio selector panels.

G. Put the Airplane Back to Its Usual Condition

S 865-027
(1) Remove electrical power if it is not necessary (AMM 24-22-00).

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MARKER BEACON ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One task is the removal of the marker beacon antenna. The other task is the installation of the marker beacon antenna.
   B. The marker beacon antenna is installed on the bottom of the fuselage at station 680.

TASK 34-32-01-004-001

2. Remove the Marker Beacon Antenna

   A. References
      (1) AMM 51-31-01/201, Seals and Sealing
   B. Access
      (1) Location Zones
          123/124   Area Below Forward Cargo Compartment (Exterior)

   C. Prepare for Removal

      S 864-002
      (1) Open this circuit breaker on the overhead circuit breaker panel, P11, and attach a DO-NOT-CLOSE tag:
          (a) 11A1, VOR/MKR L
   D. Procedure

      S 034-030
      (1) If it is necessary, remove the aerodynamic sealant found on the head of each screw (AMM 51-31-01/201).

      S 034-003
      (2) Remove the screws from the antenna base.

      S 034-004

   CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

      (3) Remove the sealant around the antenna until the seal is fully broken (AMM 51-31-01/201).

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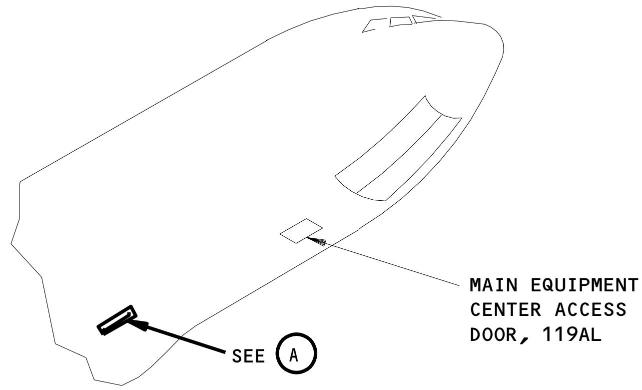
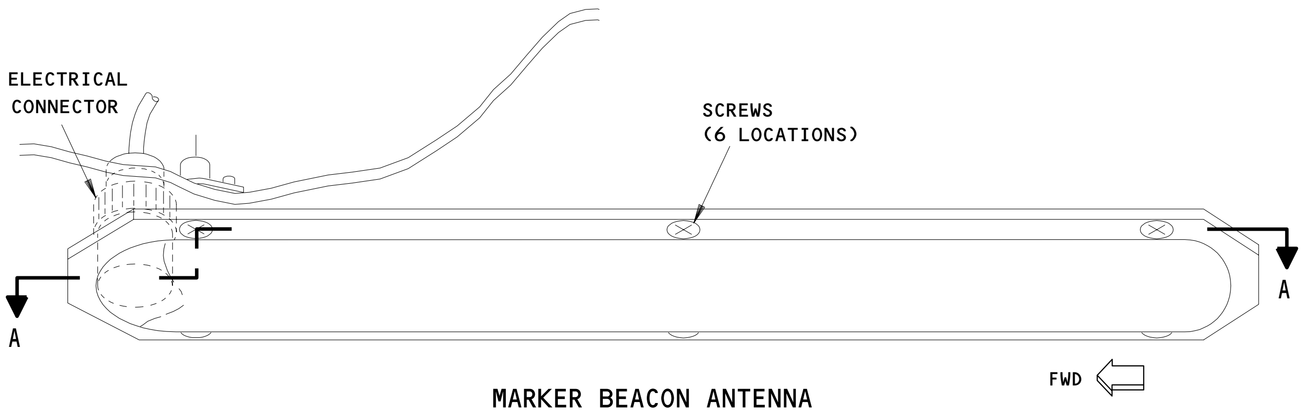
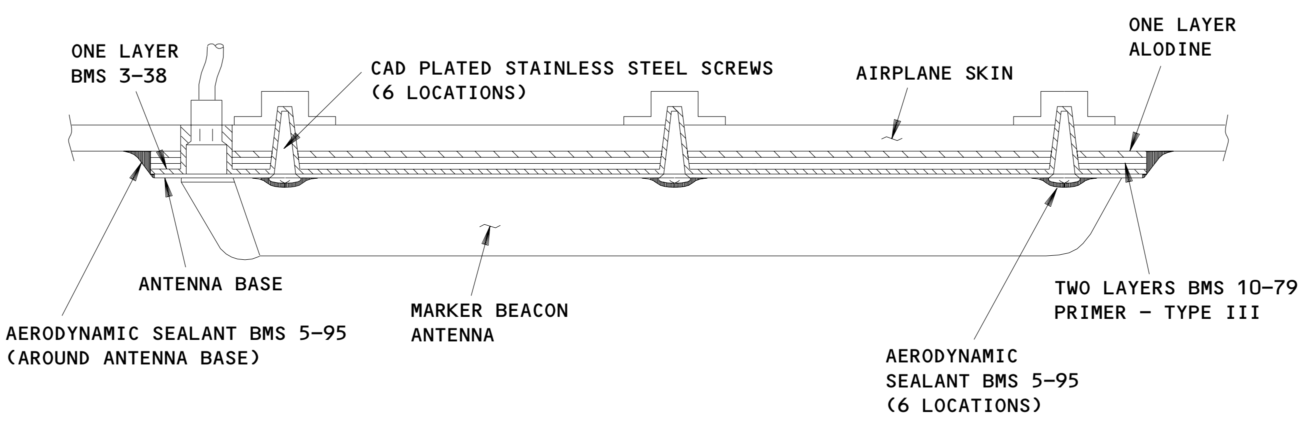




MARKER BEACON ANTENNA
A



INSTALLATION BUILDUP
A-A

Marker Beacon Antenna Installation
Figure 401

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S 014-005

CAUTION: LOWER THE ANTENNA ONLY AS FAR AS NECESSARY TO DISCONNECT THE CABLE. DAMAGE TO THE ANTENNA CABLE CAN OCCUR IF YOU PULL THE CABLE.

(4) Lower the antenna until you can get access to the antenna cable connector.

S 034-006
(5) Disconnect the antenna.

S 024-007
(6) Remove the marker beacon antenna.

TASK 34-32-01-404-008
3. Install the Marker Beacon Antenna
A. Equipment
(1) VOR/ILS Ramp Test Set, NAV402AP (preferred), NAV401L (optional), Instrument & Flight Research Inc, 10200 West York Street, Wichita, KS, 67215
(2) Bonding Meter
B. Consumable Materials
(1) B00316 Solvent - Aliphatic Naptha TT-N-95
(2) C00855 Alodine 1000
(3) G50136 Compound - Corrosion-Inhibiting, BMS 3-38
(4) C00175 Primer - BMS 10-79 type III
(5) A00145 Sealant - Aerodynamic, BMS 5-95, class B-2
(6) B00148 Solvent - Methyl Ethyl Ketone (MEK), TT-N-261
(7) G00034 Cheese Cloth - lint free
C. References
(1) AMM 24-22-00/201, Manual Control
(2) AMM 51-21-04/701, Alodine Coating
(3) AMM 51-31-01/201, Seals and Sealing

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(4) SWPM 20-20-00, Electrical Bonding and Grounding

D. Access

(1) Location Zones

123/124 Area Below Forward Cargo Compartment (Exterior)

E. Prepare for Installation

S 864-161

(1) Make sure this circuit breaker on the P11 panel is open:

(a) 11A1, VOR/MKR L

F. Procedure

S 114-162

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(1) Clean the airplane mating surface with solvent, Series 88 (AMM 20-30-88/201):

(a) Make a clean cheesecloth moist (not soaked) with solvent, Series 88 (AMM 20-30-88/201).

(b) Rub the airplane mating surface with the cheesecloth until the surface is clean.

S 374-069

(2) SAS 050, 051, 150-157, 162-167, 275-280 PRE-SL 51-23;
Do these steps to prepare the airplane surface (Fig. 401):

(a) Do this task to apply a layer of alodine 1000 to the airplane mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

(b) Apply two layers of BMS 10-79 type III primer to the airplane mating surface.

1) Let each layer dry for the correct cure time.

S 374-112

(3) SAS 050, 051, 150-157, 162-167, 275-280 POST-SL 51-23;
SAS 052-149, 158-161, 168-274, 281-999;
If the airplane surface has corrosion or other damage, do these steps to prepare the airplane surface (Fig. 401):

(a) Do this task to apply a layer of alodine 1000 to the airplane mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

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(b) Apply two layers of BMS 10-79 type III primer to the airplane mating surface.
1) Let each layer dry for the correct cure time.

S 624-129

(4) Apply a layer of BMS 3-38 (corrosion-inhibiting compound) to these surfaces:
(a) The opening for the coaxial cable
(b) The nutplate
(c) The threads of the bolts.

S 624-130

(5) Apply a very thin layer of BMS 3-38 on the mating surface of the marker beacon antenna.

S 424-033

(6) Install the marker beacon antenna:
(a) Connect the coaxial cable to the antenna.
(b) Put the new antenna into position on the airplane surface.
(c) Lightly tighten the cad plated stainless steel screws to hold the antenna in the correct position.

CAUTION: TIGHTEN THE SCREWS MANUALLY TO THE CORRECT TORQUE VALUE. USE OF POWER OR AIR TOOLS TO TIGHTEN THE SCREWS CAN CAUSE DAMAGE TO THE ANTENNA SURFACE.

(d) Manually tighten the screws to 12-15 pound-inches of torque.
(e) Clean the BMS 3-38 with aliphatic naptha TT-N-95 or equivalent.

NOTE: This is important because the aerodynamic sealant, BMS 5-95, will not stick to the BMS 3-38.

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO APPLY AND REMOVE THE SEALANT . IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(f) Apply the weather aerodynamic sealant, BMS 5-95, to the outer edge of the antenna (AMM 51-31-01/201).

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(g) Remove the unwanted sealant from around the antenna base (AMM 51-31-01/201).

G. Resistance Measurement

S 764-034

(1) Do a check of the continuity between the antenna and the airplane skin (SWPM 20-20-00):

(a) Connect the bonding meter between the head of each screw and the airplane skin.

1) Make sure each measurement of continuity is less than 25 milliohms.

S 624-035

(2) Apply the weather aerodynamic sealant, BMS 5-95, to the head of each screw (AMM 51-31-01/201).

S 864-020

(3) Remove the DO-NOT-CLOSE tag and close this circuit breaker on the P11 panel:

(a) 11A1, VOR/MKR L

H. Marker Beacon Antenna Test

S 864-021

(1) Supply electrical power (AMM 24-22-00/201).

S 864-022

(2) Make sure this circuit breaker on the P11 panel is closed:

(a) 11R3, LEFT IND LIGHTS 3

S 864-023

(3) Put the signal generator directly beneath the marker beacon antenna.

S 864-024

(4) Activate the signal generator, and permit time for it to become warm.

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S 864-025
(5) Set the signal generator to a 75 MHz signal with 400 Hz modulation.

S 754-147
(6) Make sure that the marker beacon light, OUTER, on the captains instrument panel comes on.

I. Put the Airplane Back to Its Usual Condition

S 864-027
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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RADIO ALTIMETER SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The radio altimeter (RA) system supplies vertical position data for use by the pilots for runway approach, landing, and takeoff. The RA system provides accurate measurement of absolute altitude (height above terrain) from 2500 ft. to touchdown. Altitude data is routed to user systems on 429 digital data buses.
   B. Three complete systems are installed. Each system consists of a receiver/transmitter (R/T), and one transmit and one receive antenna. Altitude data is displayed on the electronic attitude director indicators (EADIs).
2. Component Detail (Fig. 1)
   A. Receiver/Transmitter
      (1) The left, center and right R/T units are installed in the mid electronic equipment center on rack E5, shelf 1.
      (2) A test connector on the front panel provides connection for a test set.
      (3) The R/T front panel lights and test switch operate as follows:
         (a) The TEST switch initiates a self-test which checks all R/T circuits and status lights.
         (b) The status lights indicate system status during the self-test only. A green light indicates a go condition. Red light(s) indicate a no-go condition.
         (c) When the front panel test switch is pressed, the indicators come on momentarily to show that they all work. At the end of the test, if the green SYSTEM OK indicator stays on and the other indicators go out, the R/T has passed the self-test. If the red UNIT indicator comes on, the R/T is faulty.
      (4) The red ANT light comes on when an antenna failure has been detected. The red IND (indicator) light is not used. A radio altimeter indicator unit usually is not provided when radio altitude is displayed on the EADIs.
      (5) A line maintenance test connector on the front panel is used to connect a test set for system checks.
   B. Antennas
      (1) Each R/T has a transmit and receive antenna. They are identical microstrip units, with a characteristic impedance of 50 ohms.
      (2) The receiver and transmit antennas are installed on the bottom of the fuselage. The three transmit antennas are located side-by-side at body station 577. The three receive antennas are located side-by-side at station 621.

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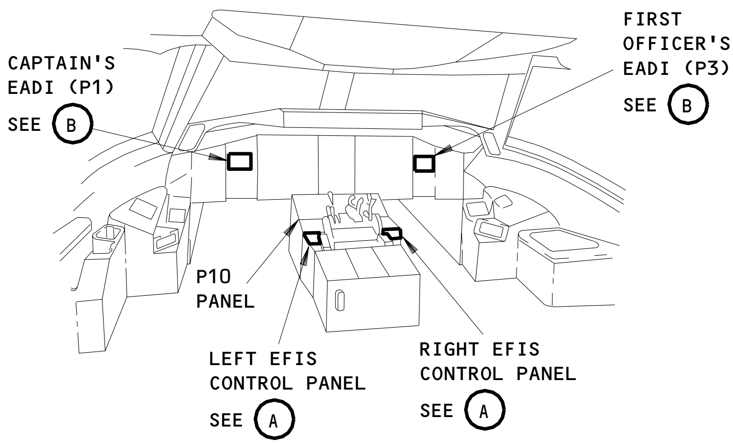
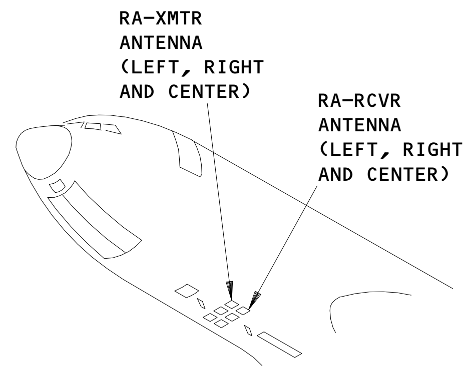
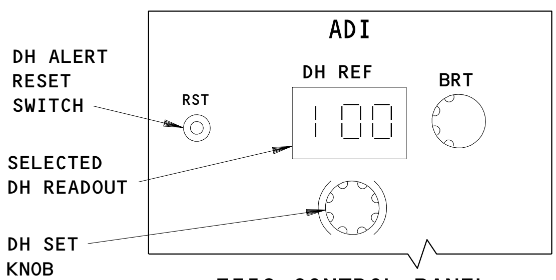


FLIGHT COMPARTMENT

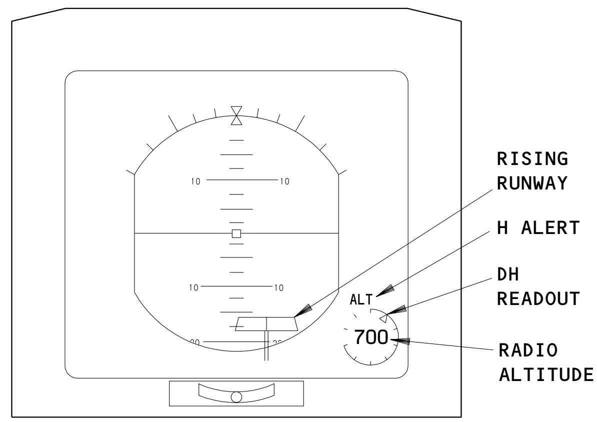


RADIO ALTIMETER ANTENNAS



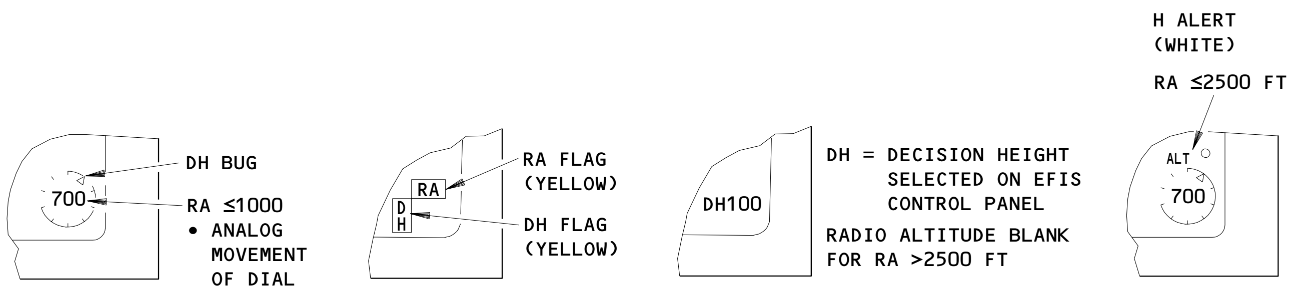
EFIS CONTROL PANEL

A



EADI
(EXAMPLE)

B



NORMAL DH ALERT
RA ≤ DH SELECTED

INVALID DATA

NO COMPUTED DATA

H ALERT

RADIO ALTIMETER ANNUNCIATIONS ON EADI

Radio Altimeter System - Component Location
Figure 1 (Sheet 1)

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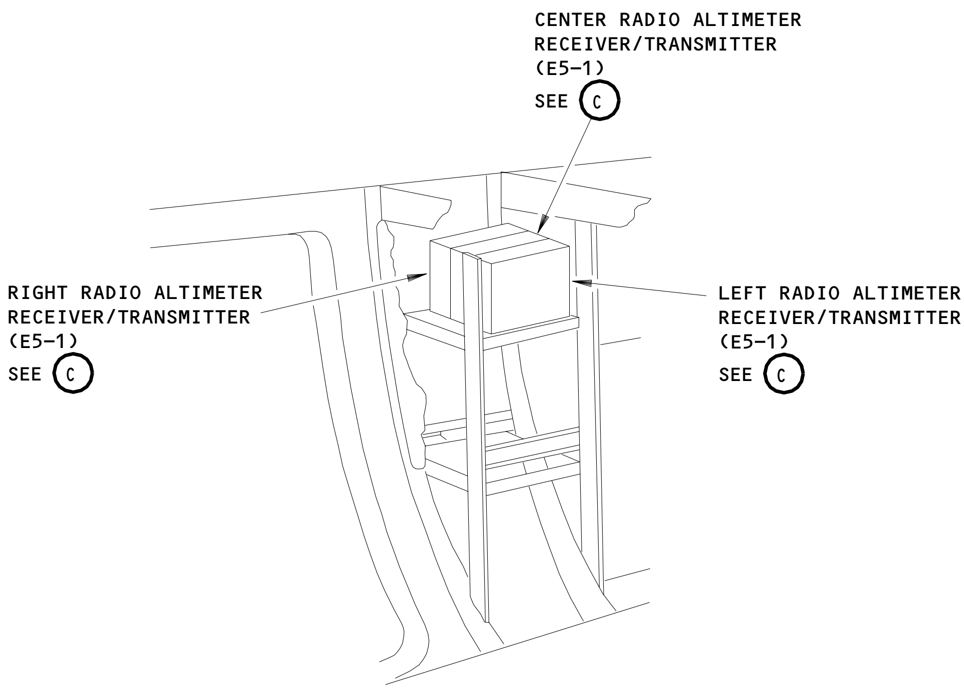
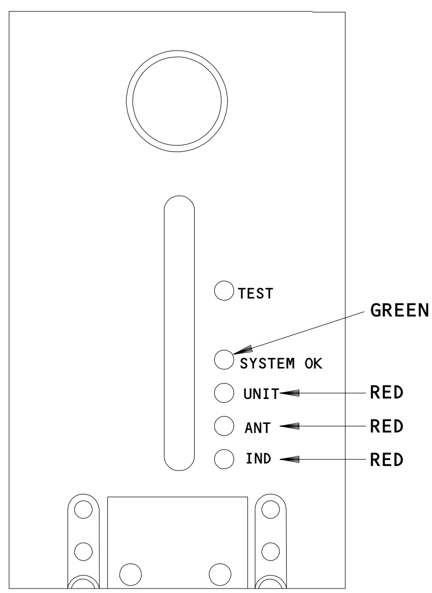


MID EQUIPMENT CENTER



RADIO ALTIMETER
RECEIVER/TRANSMITTER
C

Radio Altimeter System - Component Location
Figure 1 (Sheet 2)

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C. EFIS Control Panel (RA Related Functions)
  (1) The EFIS control panel provides selection of the decision height (DH). DH can be selected from -20 to +999 ft. by turning the DH SELECT knob. DH is read from the 3-digit DH REF LCD display. The RST switch terminates DH alert when it is pressed, and a new DH value may be selected.
  (2) The EFIS control panels are located on the pilots' control stand, P10.

D. EADI
  (1) The EADIs are located on the captain's and F/O's instrument panels, P1 and P3, respectively.
  (2) Radio altitude and DH data is displayed in the lower right corner of the EADI's.
  (3) For the radio altitude, from 2500' down to -20' the radio altitude (RA) numerical value (numerics) is white. For RA above 2500', or for no-computed-data (NCD) conditions, the RA numerics are replaced by a blank space. For invalid data from a faulty radio altimeter R/T, the numerics are replaced by yellow letters RA outlined by a yellow box. (AMM 34-22-00).
  (4) At 1000 feet a circular white scale (dial), divided into 100 feet increments, is displayed around the radio altitude display. In addition the selected digital decision height (DH) display is replaced by a magenta cursor that indicates DH on the dial.
  (5) Between 1000 feet and DH the arc of the dial decreases to match the radio altitude.
  (6) At and below DH the entire round dial display including the radio altitude readout turns amber, flashes for three seconds, and then remains steady amber until one of the following takes place:
    (a) DH is reset on the EFIS control panel
    (b) Radio altitude exceeds DH + 75 feet
    (c) Radio altitude reaches zero
  (7) The white letters ALT are displayed in the lower right corner of the EADI. This occurs when the EFIS detects a descending RA ≤2500 ft. This is a function of grounding the two EFIS H ALERT program pins (AMM 34-22-00).

3. Operation

A. Functional Description
  (1) Radio Altimeter Block Diagram (Fig. 2)

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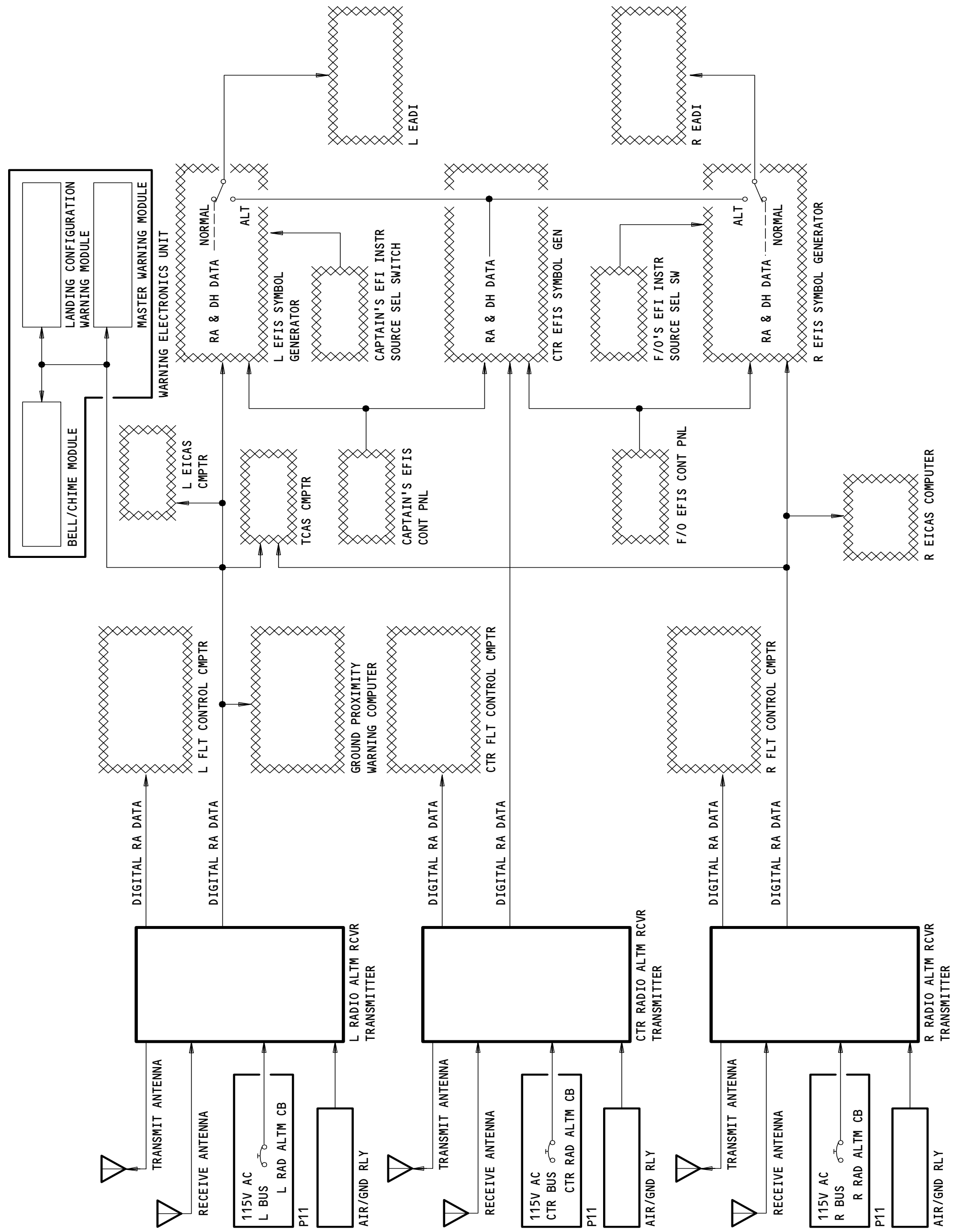

Radio Altimeter System Block Diagram
Figure 2

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(a) The R/T supplies a FM/CW signal to the transmit antenna. The signal is transmitted, reflected from the terrain, and picked up by the receive antenna. The R/T sets the difference frequency of the transmit and received signals to 25 kHz. The rate of frequency modulation for the transmit signal is adjusted so the difference frequency is a constant 25 kHz. The period of the rate of frequency modulation corresponds to the altitude of the airplane. This period is then converted to the proper digital altitude format and output on the 429 data buses.

(b) Each R/T provides altitude data in a 32 bit word format via two ARINC 429 digital data buses. These buses supply data to the symbol generators, flight control computers, EICAS, ground proximity warning computers, and to the warning electronics units. DH data from the EFIS control panels is supplied to the symbol generators. Setting of the EFIS instrument source select switches selects which symbol generator feeds DH and altitude data to the EADI's.

(2) Signal Processing

(a) The R/T units receive 115 V, 400 Hz power from the L, R, and C AC buses via the L, R, and C RAD ALTM circuit breakers on the P11 panel. R/T power supply provides various regulated DC voltages to all circuits in the R/T. The system is turned on as long as the circuit breakers are closed.

(b) The R/T transmits a carrier wave via the transmitter antenna. The signal is centered at 4.3 GHz and frequency modulated by a sawtooth generator.

(c) The transmit signal is applied through the transmit isolator to the transmit antenna. The signal from the antenna is transmitted to the earth and reflected back to the receive isolator to the mixer. The isolators provide protection for the R/T circuits.

(d) There are two modes of R/T operation, the search mode and the track mode. During the search mode the frequency deviation is varied over a 123 MHz range. When the difference between the transmitted signal and received signal is equal to 25 kHz, the monitor discriminator causes the altitude processor to switch the track discriminator to the track mode. Small changes in the difference frequency from 25 kHz cause the track discriminator to change the slope of the sawtooth wave producing a constant difference frequency of 25 kHz.

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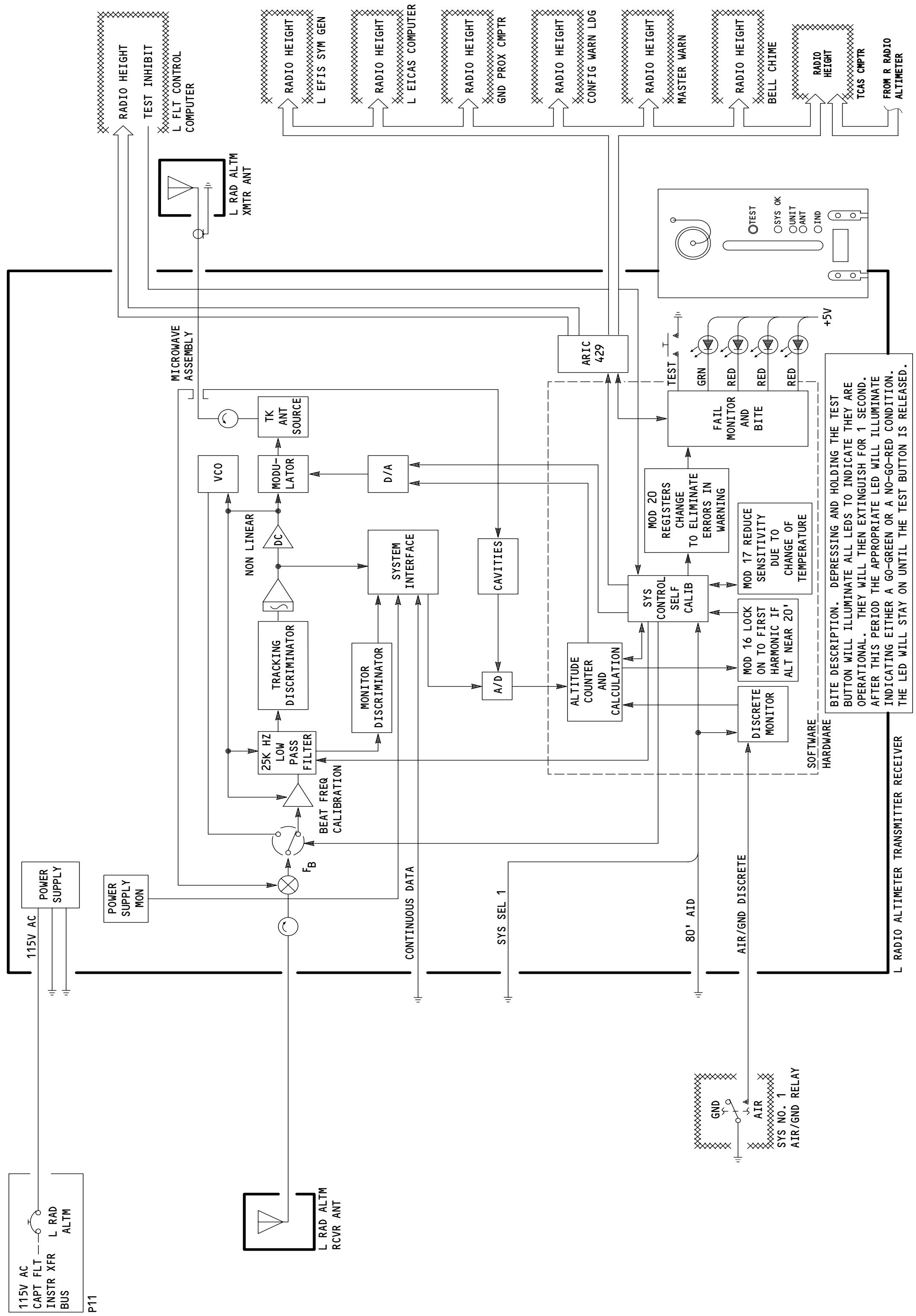

Radio Altimeter Schematic (Example)
Figure 3

212088

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(e) The altitude is calculated by measuring the period of the sawtooth wave, which is proportional to the radio altitude. The altitude processor computes the altitude and sends this data in digital format via the ARINC 429 data buses to the interfacing systems. It also outputs status (valid, invalid, test, and no-computed data) on the same buses to the systems.

1) The aircraft installation delay (AID) program pins are jumpered for 80 feet. This calibrates the system so that the altitude readout is zero at touchdown. It compensates for the length of the antenna cables plus fuselage to ground distance.

2) The indicator status pins are used for an external display. They are grounded because the system does not use an indicator other than the EADI.

3) The continuous data program pins are jumpered to assure non-interrupted altitude data, regardless of validity, to the flight control computer (FCC).

(f) The test inhibit line from the FCC to the R/T supplies a functional test inhibit signal. This prevents the R/T from being manually tested below 1500 feet, during an automatic landing.

B. BITE (Fig. 3)

(1) Monitoring

(a) The altitude processor contains self-test and monitoring features that check for proper operation of the system. This BITE program is conducted as part of the stored software program. During normal transmit/receive operations, the program provides a continuous check of the signal flow through each module of the unit. It also provides a continuous verification of the calibration constants. Complete monitoring is performed at cruise altitude even when there are no ground return signals present.

(b) For detected faults, the altitude processor will output failure warning codes on the ARINC 429 data buses. When computed data is not available for reasons other than equipment failure, a no computed data (NCD) code is output. The type of fault will be indicated on the EADI as described in component details.

(c) The self monitoring system is divided into two parts. One which monitors the R/T components all the time and the other monitors the R/T system during the calibration cycle.

1) Some components are monitored continuously by the test discriminator. These include the power supply and the mixer for the transmit and receive signals.

2) Most of the components and R/T system are monitored during the calibration cycle. These include the following:

a) Software execution, loops, subroutines, accuracy, etc.
b) Transmit power
c) Receiver sensitivity and gain
d) Search generator
e) Calibration of component system and tolerance

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f) Tracking-loop accuracy and ability to switch to search mode and back again.

(d) For loss of the receive signal, other than a detected failure the R/T will go into the search mode until the proper signal is received. This is normal for above 5,000 ft (upper limit of operating range).

(e) For detected faults the R/T outputs on invalid fail warning on the ARINC 429 data bus. For circumstances, such as out of range, where no data is available, a no computed data (NCD) message is output on the 429 data bus. The EADI, as described earlier in component details, indicates RA R/T failure NCD or invalid conditions.

(2) Manual Self Test

(a) When the test switch is pressed and held in, the front panel lights (LEDs) will come on for 1 second to indicate that they are operative. The lights then extinguish for 1 second. After this period, the appropriate light will come on to indicate either a go-green or no-go-red condition. The light will remain on until the test button is released.

(b) Pressing the test button will also cause an altitude of 40 ±2 feet to be indicated on the EADI. This altitude will remain until the test button is released.

(c) The self-test function is inhibited below 1500 feet by a test inhibit discrete received from the flight control computer during a normal automatic landing.

C. Control

(1) Provide electrical power (AMM 24-22-00).

(2) Close the following overhead panel P11 circuit breakers:

(a) 11F5, RAD ALTM LEFT
(b) 11F20, RAD ALTM CENTER
(c) 11F26, RAD ALTM RIGHT
(d) ADI (2 places)
(e) EFIS (7 places)

(3) Make sure that the captain's EADI and the F/O's EADI display a radio altitude of -6+/-2 feet.

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RADIO ALTIMETER SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
ANTENNA - RADIO ALTIMETER RECEIVER, M253, M255,M257	--	3	BOTTOM FORWARD FUSELAGE	34-33-02
ANTENNA - RADIO ALTIMETER TRANSMITTER, M252,M254,M256	--	3	BOTTOM FORWARD FUSELAGE	34-33-02
CIRCUIT BREAKERS -	--		FLIGHT COMPARTMENT, P11	
RAD ALTM CENTER, C602		1	11F20	*
RAD ALTM LEFT, C600		1	11F5	*
RAD ALTM RIGHT, C601		1	11F26	*
COMPUTER - (REF 34-41-00, FIG. 101)				
LEFT EICAS, M10181				
RIGHT EICAS, M10182				
INDICATOR - (REF 34-22-00, FIG. 101)				
LEFT ELECTRONIC ATTITUDE DIRECTOR, N4				
RIGHT ELECTRONIC ATTITUDE DIRECTOR, N44				
RELAY - (REF 31-01-36, FIG. 101)				
SYS NO. 1 AIR/GND, K124				
SYS NO. 2 AIR/GND, K214				
SYS NO. 2 AIR/GND, K293				
SYMBOL GENERATOR - (REF 34-22-00, FIG. 101)				
CENTER EFIS, M149				
LEFT EFIS, M148				
RIGHT EFIS, M150				
TRANSMITTER/RECEIVER - CENTER RAD ALTM, M204	--	1	821, FWD CARGO COMPT, E5-1	34-33-02
TRANSMITTER/RECEIVER - LEFT RAD ALTM, M202	--	1	821, FWD CARGO COMPT, E5-1	34-33-02
TRANSMITTER/RECEIVER - RIGHT RAD ALTM, M203	--	1	821, FWD CARGO COMPT, E5-1	34-33-02

* SEE THE WDM EQUIPMENT LIST

Radio Altimeter System - Component Index
Figure 101

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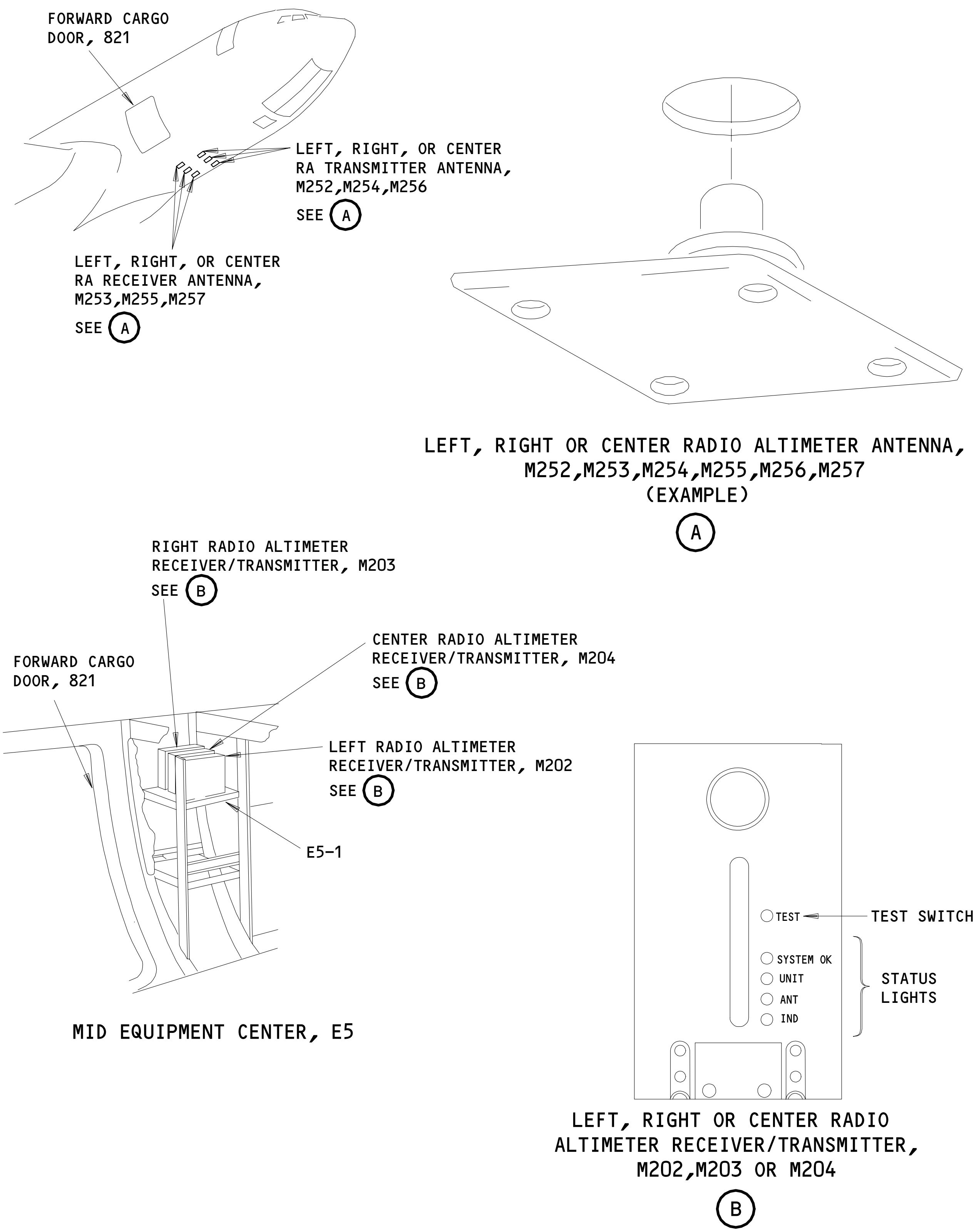

Radio Altimeter System - Component Location
Figure 102

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RADIO ALTIMETER SYSTEM - MAINTENANCE PRACTICES

1. General
   A. The procedure contains:
      (1) A task to do a radio altitude simulation test using the Atlantis ramp test set.
      (2) A task to do a radio altitude simulation test using the TRT ramp test set.

TASK 34-33-00-722-307

2. Radio Altimeter System Altitude Simulation Test (Using Atlantis Ramp Test Set DRA-707(B))
   A. General
      (1) The DRA-707(B) Ramp Test Set is used for radio altitude simulation with Collins or Honeywell or TRT radio altimeters that have 429 bus digital altitude output.
      (2) To make sure the system interfaces needed for radio altitude simulation are operational, do these procedures in sequence until completion of the Altitude Ramp-Down (Example) later in this section.
      (3) Refer to AMM 34-46-00/501 for the altitudes and the altitude rates (ramps) necessary to do a test of the GPWS.
   B. Special Tools and Equipment
      (1) Ramp Test Set - Atlantis Model DRA-707B1,
          Atlantis P/N 110-0430-100.
   C. References
      (1) AMM 06-46-00/201, Entry/Service, Emergency Exits, and Cargo Doors (Major Zone 800) Access Doors and Panels
      (2) AMM 24-22-00/201, Electrical Power - Control
      (3) AMM 34-22-00/501, Electronic Flight Instrument System
      (4) AMM 34-33-00/501, Radio Altimeter System
      (5) AMM 34-46-00/501, Ground Proximity Warning System
      (6) Technical Manual - Atlantis Ramp Test Set DRA-707, P/N 110-0400-100.
   D. Access
      (1) Location Zones

211/212	Flight Compartment
122	Forward Cargo Compartment, Right (E5 Rack)

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(2) Access Door

821 Forward Cargo Compartment Door

E. Prepare for the Tests

S 862-281

(1) Supply electrical power (AMM 24-22-00/201).

S 712-282

(2) Make sure the electronic flight instrument system (EFIS) operates (AMM 34-22-00/501).

S 712-283

(3) Make sure the radio altimeter system operates (AMM 34-33-00/501).

S 862-371

(4) Open these circuit breakers and attach DO-NOT-CLOSE tags:

(a) On the overhead equipment panel P11:

1) 11F5, RAD ALTM LEFT

2) 11F20, RAD ALTM CENTER

3) 11F26, RAD ALTM RIGHT

S 012-321

(5) Open the forward cargo compartment door, 821, to get access to the radio altimeter R/Ts (AMM 06-46-00/201).

S 862-324

(6) Set the POWER switch on the Ramp Test Set to OFF.

S 482-322

(7) Connect the correct test cable(s) between the TEST connector on the Ramp Test Set and the TEST connector on the R/T(s).

NOTE: You can do a test of each radio altimeter (L, C,or R) seperately, or all together, with these test cables in the Ramp Test Unit:

Test cable ATLANTIS P/N 110-0440-101 or AY969-00298-001 is used only with Collins LRA-700 digital output radio altimeters.

Test cable ATLANTIS P/N AY969-00666-001 or P/N AY969-00666-002 is used with Collins LRA-900 digital output radio altimeter.

Test cable ATLANTIS P/N 110-0440-106 is used only with TRT ERT-530 digital output radio altimeters.

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S 482-285

(8) Connect the power cable to the correct primary power source shown on the front panel of the Ramp Test Set.

NOTE: If the batteries in the Ramp Test Set have the correct charge, connection to a primary power source is not necessary.

S 862-367

(9) Remove the DO-NOT-CLOSE tag and close the applicable circuit breaker for the R/T(s) to be used for tests:

(a) On the P11 panel:

1) 11F5, RAD ALTM LEFT

2) 11F20, RAD ALTM CENTER

3) 11F26, RAD ALTM RIGHT

F. Procedure

S 752-318

(1) Prepare the Ramp Test Set for the simulation tests:

(a) Set the power ON/OFF switch to the ON position.

1) Make sure the 5 VDC and HOLDING lights come on.

(b) Set the NO COMPUTED DATA switches to the NORMAL position.

(c) Push and release the START ALT key.

1) Make sure START ALT shows on the LEDs.

(d) Use the keypadd to put in a value of +4000 (ft).

(e) Push and release the ENTER key.

1) Make sure the radio altitude value shown on the EADIs is blank.

NOTE: The altitude on the radio altimeter 429 busses is limited by a program in the radio altimeter R/Ts to a range of +2500 to -20 feet. The R/Ts compute altitudes higher than +2500 feet but inhibit this data on the busses.

S 862-319

(2) Prepare the captain's and the first officer's EFIS control panels for the simulation tests:

(a) Push and release the RST (reset) button.

(b) Turn the DH controls to show DH 450 at the captain's display and DH 400 at the first officer's display.

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S 752-189
(3) Set these controls on the Ramp Test Set:
(a) Push and release the STOP ALT key.
1) Make sure the LEDs show STOP ALT.
(b) On the keypad, put in a value of -20 (ft).
(c) Push and release the ENTER key.
1) Make sure the LEDs show STOP ALT -20.
(d) Push and release the VERT SPD key.
1) Make sure the LEDs show VERT SPD.
(e) On the keypad, put in a value of -4000 (fpm).
(f) Push and release the ENTER key.
1) Make sure the LEDs show VERT SPD -4000.

S 722-360
(4) Altitude Ramp-Down Procedure (Example)
(a) Push the RAMP/HOLD key on the Ramp Test Set.
1) Make sure the RAMPING light comes on.
(b) Look for these indications on the captain's and the first officer's displays.
1) The radio altitude goes out of view for approximately 22.5 seconds while the altitude on the Ramp Test Set decreases from 4000 to 2500 feet.
(c) After the timeout of 22.5 seconds (previous step), a radio altitude of 2500 feet comes into view on the displays and decreases toward zero.

NOTE: The displays indicate the radio altitudes set on the Ramp Test Set within the limit of 2500 feet to -20 feet.

(d) These indications change on the captain's display when the radio altitude decreases to 450 feet:
1) The DH value changes to a yellow color and flashes for 3 seconds.
2) The radio altitude continues to decrease toward zero.
(e) These indications change on the first officer's display when the radio altitude decreases to 400 feet:
1) The DH value changes to a yellow color and flashes for 3 seconds.
2) The radio altitude continues to decrease toward zero.
(f) These indications change on the displays as the radio altitude decreases to zero feet:
1) The radio altitude value changes to a white color.
2) The DH value changes to the numbers set at the captain's and first officer's EFIS control panels.
(g) At this place in the procedures, the simulated altitude from the radio altimeter R/T(s) is proved operational with the EFIS system and the Ramp Test Set.

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(h) Set the controls on the Ramp Test Set as necessaey for radio altitude tests of the GPWS, autoflight system, and other systems on the airplane.
(i) Go to the next test step when you complete the tests for the other systems.

G. Put the Airplane in its Usual Condition.

S 862-332

(1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
   (a) On the P11 panel:
      1) 11F5, RAD ALTM LEFT
      2) 11F20, RAD ALTM CENTER
      3) 11F26, RAD ALTM RIGHT

S 752-287

(2) Set the POWER ON/OFF switch on the Ramp Test Set to the OFF position.

S 082-333

(3) Disconnect the Ramp Test Set power cable from the primary power source (if the power cable was used).

S 082-334

(4) Disconnect the test cable(s) from the Ramp Test Set and the applicable R/Ts.

S 842-335

(5) Put the test cable(s) in the the Ramp Test Set box.

S 412-336

(6) Install the TEST connector protective cover on the R/T(s).

S 862-337

(7) Remove the DO-NOT-ClOSE tags and close these circuit breakers:
   (a) On the P11 panel:
      1) 11F5, RAD ALTM LEFT
      2) 11F20, RAD ALTM CENTER
      3) 11F26, RAD ALTM RIGHT

S 862-338

(8) Make sure that the displays show a radio altitude of -6±2 feet.

S 412-323

(9) Close the forward cargo compartment door, 821, if access is not necessary (AMM 06-46-00/201).

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S 862-288
(10) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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TASK 34-33-00-722-339

3. Radio Altimeter System Altitude Simulation Test (Using TRT Ramp Test Unit SIM-530)

A. General
   (1) The SIM-530 Ramp Test Set is used for radio altitude simulation with TRT radio altimeters that have 429 bus digital altitude output.
   (2) The altitude simulation test has three procedures:
      (a) Radio Altitude Ramp-down Program Test.
      (b) Manually Simulated Radio Altitude Mode Test.
      (c) Fault Codes Test.
   (3) Use the SIM-530 Ramp Test Unit to simulate radio altitudes for test of other systems on the airplane. Do the test procedures in sequence until you get the test altitude you need.
   (4) Refer to AMM 34-46-00/501 for the altitudes and altitude rates (ramps) used to do a test of the GPWS.

B. Special Tools and Equipment
   (1) TRT Ramp Test Unit SIM-530
       TRT P/N 9599-607-15902

C. References
   (1) AMM 06-46-00/201, Entry/Service, Emergency Exits, and Cargo Doors (Major Zone 800) Access Doors and Panels
   (2) AMM 24-22-00/201, Manual Control
   (3) AMM 34-22-00/501, Electronic Flight Instrument System
   (4) AMM 34-33-00/501, Radio Altimeter System
   (5) AMM 34-46-00/501, Ground Proximity Warning System
   (6) Telecommunications Radioelelectriques et Telephoniques (TRT) Ramp Test Unit SIM-530 Ground Equipment Manual with Illustrated Parts List, TRT Document P/N 3511-271-13891.

D. Access
   (1) Location Zones

211/212	Flight Compartment
122	Forward Cargo Compartment, Right (E5 Rack)

   (2) Access Panel

821	Forward Cargo Compartment Door

E. Prepare for the Tests

   S 862-340
   (1) Supply electrical power (AMM 24-22-00/201).

   S 712-341
   (2) Make sure the electronic flight instrument system (EFIS) operates (AMM 34-22-00/501).

   S 712-365
   (3) Make sure the radio altimeter system operates (AMM 34-33-00/501).

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S 862-342
(4) Open these circuit breakers and attach DO-NOT-CLOSE tags:
(a) On the P11 panel:
1) 11F5 RAD ALTM LEFT
2) 11F20 RAD ALTM CENTER
3) 11F26 RAD ALTM RIGHT

S 862-343
(5) Set these controls on the Ramp Test Unit:
(a) Set the power ON/OFF switch to the OFF position.
(b) Set the MANUAL SIMULATION/OFF switch to the OFF position.

S 012-344
(6) Open the forward cargo compartment door, 821, to get access to the the radio altimeter R/Ts (AMM 06-46-00/201).

S 482-345
(7) Connect the test cable(s) between the TEST connector on the Ramp Test Unit and the TEST connector on the R/T(s).

NOTE: Use the test cables provided with the Ramp Test Unit to do a test of each radio altimeter (L, C, R) separately, or all together.

Test cable W87 (TRT P/N 3511-180-87431) connects the Ramp Test Unit to one of the three TRT ERT-530 digital R/Ts.

Test cable W88 (TRT P/N 3511-180-87441) is a four connector assembly that connects the Ramp Test Unit to all three R/Ts.

S 862-346
(8) Remove the DO-NOT-CLOSE tag and close the applicable circuit breaker for the R/T(s) to be used for the tests:
(a) On the P11 panel:
1) 11F5 RAD ALTM LEFT
2) 11F20 RAD ALTM CENTER
3) 11F26 RAD ALTM RIGHT

S 862-347
(9) Prepare the Ramp Test Unit for the simulation tests:
(a) Set the power ON/OFF switch to ON.
1) Make sure the ON light comes on.

NOTE: The Ramp Test Unit receives primary power from the applicable R/T through the test cable. When the four-connector test cable assembly is used, primary power comes from the R/T connected to the cable end marked RA1.

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(b) Push the LAMP TEST button.
  1) Make sure all the lights and LEDs on the Ramp Test Unit come on.
(c) If the lights and LEDs do not come on, set the power ON/OFF switch to OFF.
  1) Make sure the power OFF light comes on.
(d) Push and hold the LAMP TEST button.
(e) Set the power ON/OFF switch to ON.
(f) Release the LAMP TEST button.
(g) Push and release the LAMP TEST button.
  1) Make sure all the lights and LEDs come on.

NOTE: Permit the R/T and the Ramp Test Unit to become warm for five minutes from a cold start.

(h) Set the RA DISPLAY SELECT switch to the 1 position.
(i) Set the middle switch on the left side of the unit to the MANUAL SIMULATION position.
  1) Make sure the MANUAL SIMULATION light is on.
(j) Set the - + variable control for the MANUAL SIMULATION (lower left switch) to the middle position between the - and + symbols.
(k) Set the VOLTS/FAULT CODE/FEET switch to the SIM position.
(l) Look for a radio altitude at the D/A OUTPUT LEDs.
  1) Make sure the number changes only when you turn the - + control.
(m) If the D/A OUTPUT LEDs continuously change, do as follows:
  1) Permit more time for the Ramp Test Unit to becomwe warm.
  2) Do the Ramp Test Unit preliminary control settings again.

S 862-362
(10) Prepare the captain's and the first officer's EFIS control panels for the simulation tests:
(a) Push and release the RST (reset) button.
(b) Turn the DH controls to show DH 450 at the captain's EADI and DH 400 at the first officer's EADI.

S 722-348
(11) Do the radio altitude ramp-down program test:
(a) Set these controls on the Ramp Test Unit:
  1) Push and release the REMOTE TEST-RA1 HOLD button.
  2) Make sure the middle switch on the left side of the unit is set to the OFF position.
  3) Set the VOLTS/FAULT CODE/FEET switch to the BUS 1 position.
  4) Set the RA DISPLAY to the 1 position.

NOTE: This sets the ramp test unit to do a test of the left R/T.

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5) Set the thumbwheels for the REMOTE TEST ALTITUDE to give a ramp-down from +4000 feet to -20 feet.
   a) Set the UPPER (FEET) wheels to 4000.
   b) Set the SLOPE (FEET/SECOND) wheels to 20.
   c) Set the LOWER (FEET) wheels to -0020.
6) Make sure the D/A OUTPUT LEDs show +4000.

(b) Push and release the REMOTE TEST-START button to start the ramp-down program.

NOTE: The ramp-down can be stopped or continued at altitudes between +4000 feet and -20 feet. To do this, push the REMOTE TEST-RA1 HOLD button again.

(c) Look for these displays on the captain's and the first officer's EADIs:
1) The display is blank for approximately 75 seconds after you push the REMOTE TEST-START button.
2) The display then shows 2500 (white numerals) and decreases at 20 fps (feet per second).
3) After approximately 98 seconds, at 550 feet, the letters DH will flash (amber) for three seconds on the captain's EADI only.
4) After approximately 103 seconds, at 440 feet, the letters DH will flash (amber) for three seconds on the first officer's EADI only.
5) The radio altitude continues to decrease to the stop altitude of -20 feet.

(d) If it is necessary to do the previous +4000 to -20 foot cycle again, push and release the REMOTE TEST-START button.

S 722-349

(12) Do the manually simulated radio altitude mode test:

(a) Set these controls on the Ramp Test Unit:
1) Set the middle switch on the left side of the unit to the MANUAL SIMULATION position.
2) Set the VOLTS/FAULT CODE/FEET switch to the SIM position.
3) Make sure that simulated altitudes from +3000 to -4 feet feet can be displayed on the D/A OUTPUT LEDs by turning the - + control.
4) Make sure that radio altitudes from +2500 to -4 feet can be set on the - + control and shown on the PFDs.

NOTE: The flight management computer (FMC) limits the upper limit of radio altitude on the PFDs to +2500 feet.

S 722-350

(13) Do the fault codes test:

(a) Make sure the applicable R/T is connected to the Ramp Test Unit with the correct test cable (W87).

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(b) Set these the controls and observe these indicators on the Ramp Test Unit:
1) Set the VOLTS/FAULT CODE/FEET switch to the FAULT CODE RA1 position.
2) Look at the D/A OUTPUT LEDs for a fault code number from 1 to 21.
a) Fault codes 1 through 20 show there is a module failure in the R/T.
b) Fault code 21 shows there is a failure in the transmit or receive antenna related with the R/T.

(c) If you do not see fault codes, push and hold the TEST button (S10) on the Ramp Test Unit.
1) Make sure a radio altitude of 40 feet is shown on the EADIs.
2) Make sure the AP WARNING light (RA1, RA2, or RA3 as applicable) comes on at the Ramp Test Unit.

(d) Release the TEST button.
1) Make sure the applicable AP WARNING light (RA1, RA2, or RA3) on the Ramp Test Unit goes off.

F. Put the Airplane in its Usual Condition

S 862-351
(1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
(a) On the P11 panel:
1) 11F5 RAD ALTM LEFT
2) 11F20 RAD ALTM CENTER
3) 11F26 RAD ALTM RIGHT

S 862-352
(2) On the Ramp Test Unit, set the power ON/OFF switch to the OFF position.

S 082-353
(3) Disconnect the test cable(s) from the Ramp Test Unit and the applicable R/T(s).

S 842-354
(4) Put the test cable(s) in with the Ramp Test Unit.

S 412-355
(5) Install the TEST connector protective cover on the R/T(s).

S 862-356
(6) Remove the DO-NOT-ClOSE tags and close these circuit breakers:
(a) On the P11 panel:
1) 11F5 RAD ALTM LEFT
2) 11F20 RAD ALTM CENTER
3) 11F26 RAD ALTM RIGHT

S 862-357
(7) Make sure that the EADIs show a radio altitude of -6 ±2 feet.

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S 412-358
(8) Close the forward cargo compartment door, 821, if access is not necessary (AMM 06-46-00/201).

S 862-359
(9) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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RADIO ALTIMETER (RA) SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure has one task: the operational test. The test uses the Built-In-Test Equipment (BITE) and the RA displays to make sure the system operates correctly.

TASK 34-33-00-715-001

2. RA Operational Test
   A. References
      (1) 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 865-002
      (1) Supply electrical power (Ref 24-22-00).

      S 865-086
      (2) Do these steps:
         (a) Set the captain's and F/O's Electronic Attitude Director Indicator (EADI) DH and the RA indicator DH (if installed) to 200 ft.
         (b) Set the captain's and F/O's Electronic Flight Instrument (EFI) source-select switches to the usual positions.
         (c) Make sure that the captain's and F/O's EADI RA displays and RA indicator (if installed) show -6 ±2.0 feet.
         (d) Make sure that the captain's and F/O's DH displays on the RA indicators (if installed) are on.
         (e) Set the captain's EFI instrument source-select switch to ALTN.
         (f) Make sure that the captain's EADI RA display and the RA indicator (if installed) show -6 ±2.0 feet.
         (g) Set the F/O's EFI instrument source-select switch to ALTN.
         (h) Make sure that the F/O's EADI RA display and the RA indicator (if installed) show -6 ±2.0 feet.

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(i) Set the captain's and F/O's EFI instrument source-select switches to the usual positions.

D. BITE Test

S 745-058

(1) Push and hold the TEST switch on the applicable R/T and make sure the conditions that follow occur:
   (a) All monitor lights come on for one second.
   (b) All monitor lights go off for one second.
   (c) The green panel light comes on until the TEST switch is released.
   (d) The radio altitude display on the EADI shows 40 ±2.0 feet.

S 745-017

(2) Do the BITE test for the right RA R/T the same as the left RA R/T except as follows:
   (a) Use the right RA R/T test switch.
   (b) Use the F/O's displays.
   (c) Make sure the same conditions occur.

S 865-018

(3) Set the captain's and F/O's EFI instrument source select switch to ALTN.

S 745-019

(4) Do the BITE test for the center RA R/T the same as the left RA R/T except as follows:
   (a) Use the center RA R/T test switch.
   (b) Use the captain's and F/O's displays.
   (c) Make sure the same conditions occur.

E. Put the Airplane Back to Its Usual Condition

S 845-020

(1) Set the captain's and F/O's EFI instrument source-select switches to normal.

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S 845-021
(2) Remove electrical power if it is not necessary (Ref 24-22-00).

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RADIO ALTIMETER (RA) RECEIVER/TRANSMITTER (R/T) - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the RA R/T. The second task installs the RA R/T.
   B. The left (M202), right (M203), and center (M204) RA R/Ts are found in the mid equipment center rack, E5. All electrical connections are made through connectors at the rear of the units.

TASK 34-33-01-004-001

2. RA R/T Removal
   A. References
      (1) AMM 20-10-01/401, E/E Rack-Mounted Components
      (2) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zone
          122 Forward Cargo Compartment (Right)

   C. Procedure

      S 864-002
      (1) Open these circuit breakers (as applicable) on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11F5, RAD ALTM LEFT
          (b) 11F20, RAD ALTM CENTER
          (c) 11F26, RAD ALTM RIGHT

      S 014-003
      (2) Loosen the E-5 rack door connectors.

      S 014-004
      (3) Open the door.

      S 024-005
      (4) Remove the RA R/T (AMM 20-10-01/401).

TASK 34-33-01-404-006

3. RA R/T Installation
   A. References
      (1) AMM 20-10-01/401, E/E Rack-Mounted Components

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(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 34-22-00/501, Electronic Flight Instrument System (EFIS)

B. Access
(1) Location Zone
122 Forward Cargo Compartment (Right)

C. Procedure

S 864-007
(1) Make sure that these circuit breakers (as applicable) are open:
(a) 11F5, RAD ALTM LEFT
(b) 11F20, RAD ALTM CENTER
(c) 11F26, RAD ALTM RIGHT

S 434-008
(2) Install the RA R/T.

S 864-009
(3) Remove the applicable DO-NOT-CLOSE tags and close these circuit breakers (as applicable) on the P11 panel:
(a) 11F5, RAD ALTM LEFT
(b) 11F20, RAD ALTM CENTER
(c) 11F26, RAD ALTM RIGHT

D. RA R/T Test

S 864-055

WARNING: DO THESE STEPS BEFORE YOU SUPPLY EXTERNAL POWER. IF YOU DO NOT OBEY THESE STEPS, THE PITOT PROBE CAN BECOME VERY HOT. IT CAN BURN YOU.

(1) Do these steps:
(a) Push the BAT switch on the P5 panel to the ON position.
(b) Turn the STBY POWER switch on the P5 panel to the AUTO position.

S 864-037
(2) Supply electrical power (AMM 24-22-00/201).

S 864-044
(3) Make sure the flight instrument system (EFIS) is serviceable (AMM 34-22-00/501).

S 754-038
(4) For the left (right) R/T, make sure that the RA display on the Capt's (F/O'S) Electronic Attitude Director Indicator (EADI) shows -6 ±2 feet.

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S 864-039

(5) For the center R/T, set the Capt's Electronic Flight Instrument (EFI) source select switch to ALTN.

(a) Make sure that the RA display on the Capt's EADI shows -6 ±2 feet.

S 754-014

(6) Push and hold the TEST switch on the R/T and make sure the conditions that follow occur:

(a) All front panel lights come on for 1 second.

(b) All front panel lights go off for 1 second.

(c) The green panel light comes on until the TEST switch is released.

(d) The RA display on the EADI shows 40 ±2 feet.

(e) The green panel light comes on until the TEST switch is released.

E. Put the Airplane Back to Its Usual Condition

S 414-041

(1) Close the E-5 rack door.

S 414-042

(2) Tighten the connectors.

S 864-043

(3) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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RADIO ALTIMETER (RA) ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the radio altimeter antenna. The second task installs the radio altimeter antenna.
   B. There are six radio altimeter antennas found on the bottom of the airplane. They are all the same. The left and right radio altimeter antennas have a fairing spacer between the antenna base and the surface of the airplane.

TASK 34-33-02-004-001

2. Radio Altimeter Antenna Removal (Fig 401)
   A. General
      (1) It is not necessary to remove the fairing spacer to remove the left or right antenna. The aerodynamic sealant will hold the fairing spacer to the airplane skin.
   B. Equipment

   C. References
      (1) AMM 51-31-01/201, Seals and Sealing
   D. Access
      (1) Location Zones
         123/124   Area Below Forward Cargo Compartment

   E. Procedure

      S 864-002

      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
         (a) P11 Overhead Circuit Breaker Panel
            1) 11F5, RADIO ALTM LEFT
            2) 11F20, RADIO ALTM CENTER
            3) 11F26, RADIO ALTM RIGHT

      S 024-248

      CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

      (2) Remove the aerodynamic sealant from around the antenna and on the head of each screw (AMM 51-31-01/201).

      S 034-003

      (3) Remove the four screws from the antenna base.

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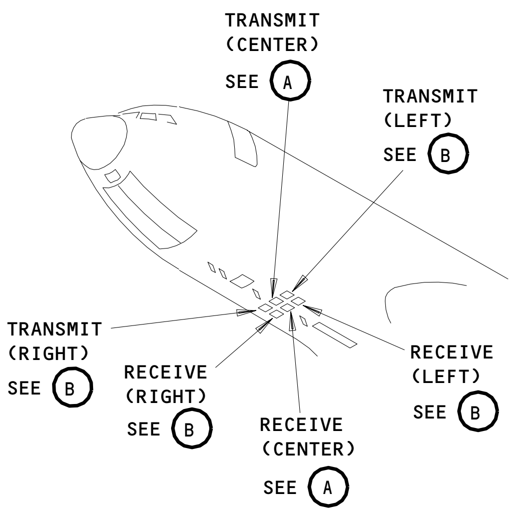
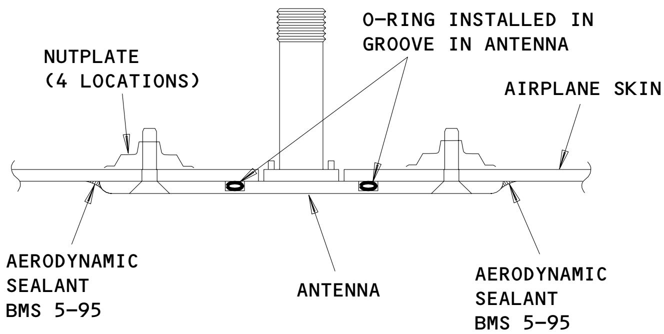
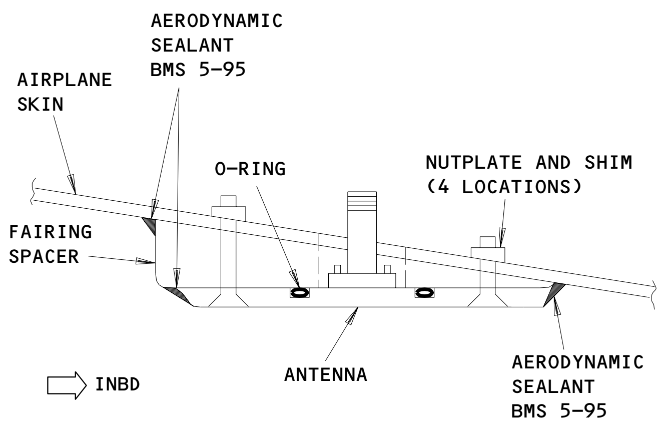


RADIO ALTIMETER ANTENNAS



CENTER RADIO ALTIMETER ANTENNA
(SIDE VIEW)
A



LEFT OR RIGHT RADIO ALTIMETER ANTENNA
(AFT VIEW FOR LEFT AND FORWARD VIEW FOR RIGHT)
B

Radio Altimeter Antenna Installation
Figure 401 (Sheet 1)

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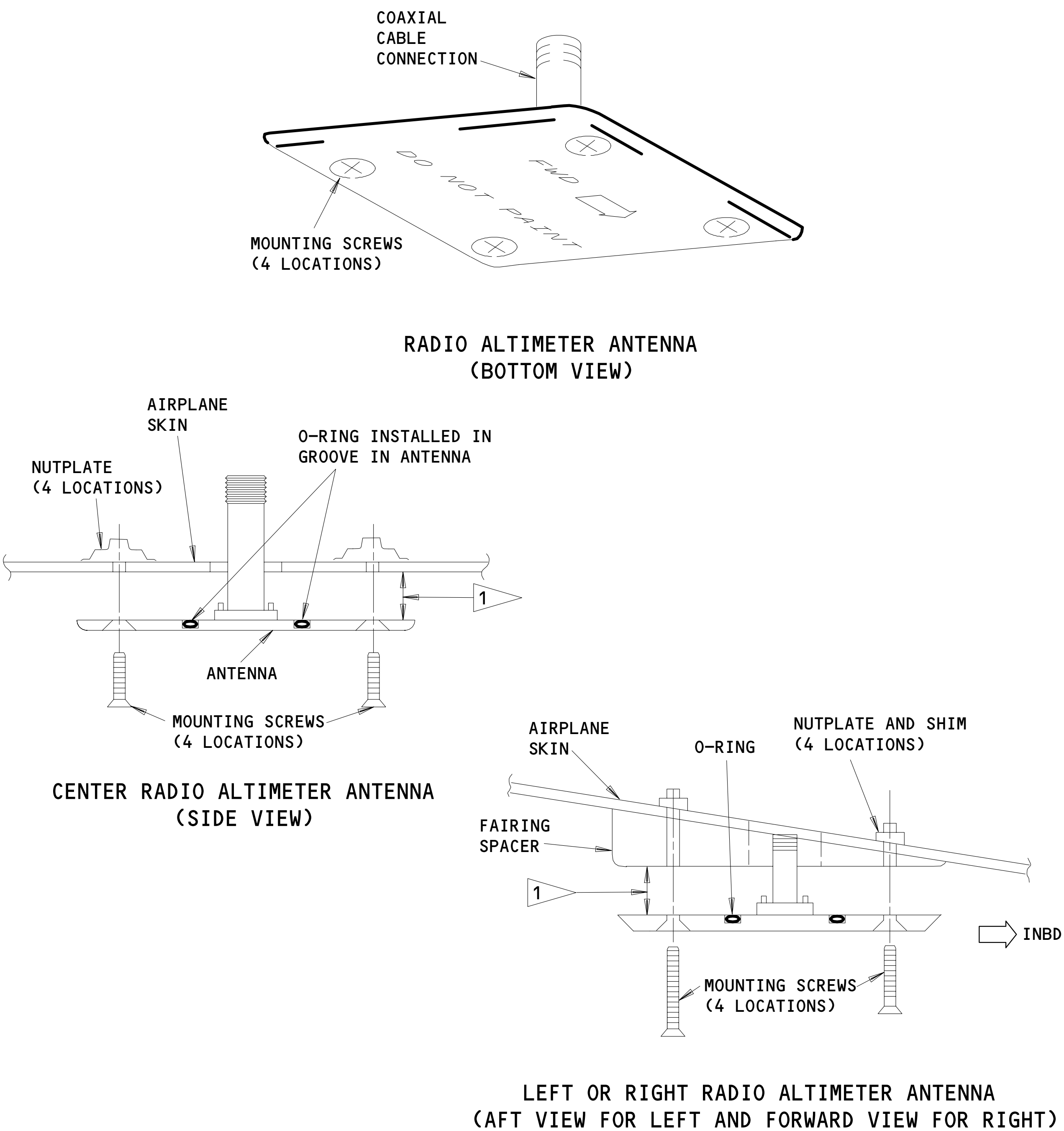

1 SEE SHEET 3 FOR CORROSION PROTECTION.

Radio Altimeter Antenna Installation
Figure 401 (Sheet 2)

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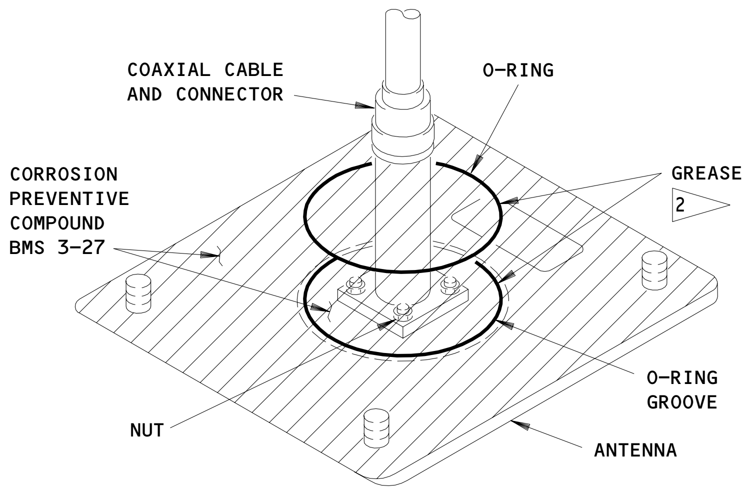
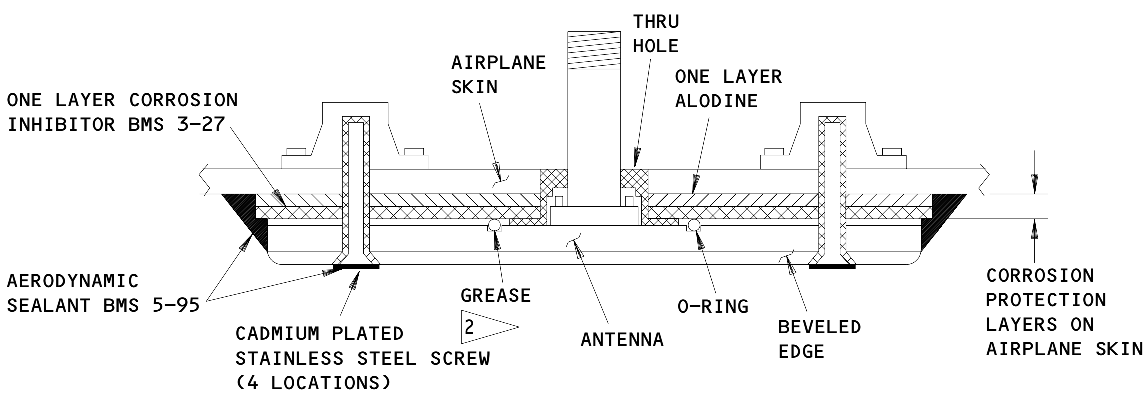
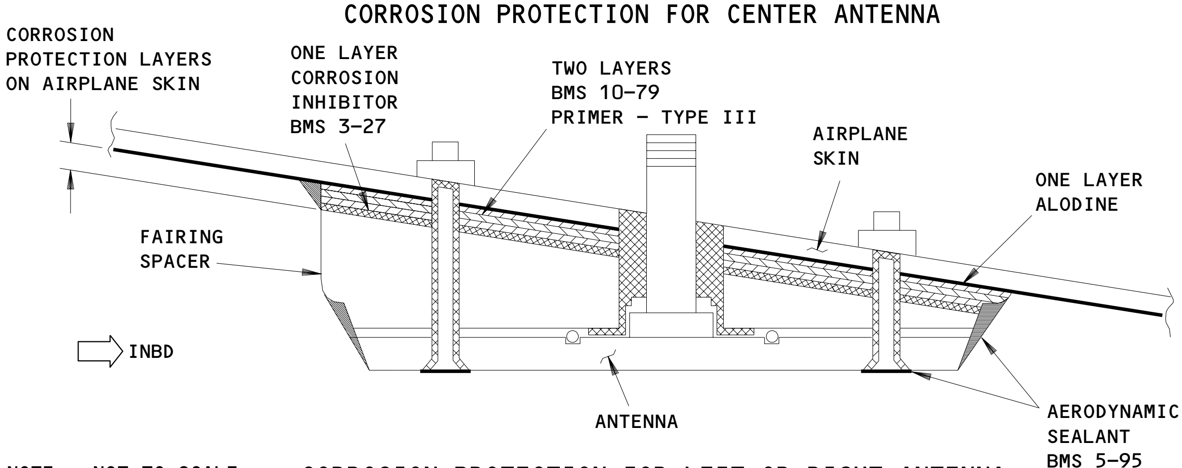


RADIO ALTIMETER ANTENNA
(TOP VIEW)



CORROSION PROTECTION FOR CENTER ANTENNA



NOTE: NOT TO SCALE.

CORROSION PROTECTION FOR LEFT OR RIGHT ANTENNA

2 BMS 3-33 (PREFERRED), BMS 3-24 (ALTERNATE).

Radio Altimeter Antenna Installation
Figure 401 (Sheet 3)

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S 034-004

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(4) Remove the sealant around the radio altimeter antenna (AMM 51-31-01/201).

S 034-005

CAUTION: DO NOT PULL THE ANTENNA CABLE. THIS CAN CAUSE DAMAGE TO IT. LOWER THE ANTENNA ONLY AS FAR AS NECESSARY TO DISCONNECT THE CABLE FROM THE ANTENNA. DAMAGE TO THE ANTENNA CABLE CAN OCCUR IF YOU PULL THE CABLE.

(5) Lower the antenna to get access to the coaxial cable connector.

S 034-006
(6) Disconnect the coaxial cable from the antenna.

S 024-007
(7) Remove the radio altimeter antenna.

TASK 34-33-02-404-009
3. Radio Altimeter Antenna Installation (Fig 401)
A. Equipment
(1) Ohmmeter - accurate to 0.025 ohm
(2) Sealant removal tool - hardwood or plastic
B. Consumable Materials
(1) A00490 Sealant - Aerodynamic, BMS 5-95
(2) B00316 Solvent Aliphatic Naptha TT-N-95
(3) B00148 Solvent - Methyl Ethyl Ketone (MEK), TT-N-261
(4) C00175 Primer - BMS 10-79 type III
(5) C00855 Alodine 1000 or 1200
(6) D00254 Dow Corning No. 4

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(7) D00633 Grease - BMS 3-33 (preferred)
(8) D00294 Grease - BMS 3-24 (alternate)
(9) G00033 Cheesecloth - BMS 15-5 B, Class A (woven)

C. References
(1) AMM 24-22-00/201, Manual Control
(2) AMM 51-21-04/701, Alodine Coating
(3) AMM 51-31-01/201, Seals and Sealing
(4) SWPM 20-20-00, Electrical Bonding and Grounding

D. Procedure

S 864-010
(1) Make sure these circuit breakers are open with DO-NOT-CLOSE tags attached:
(a) P11 Overhead Circuit Breaker Panel
1) 11F5, RADIO ALTM LEFT
2) 11F20, RADIO ALTM CENTER
3) 11F26, RADIO ALTM RIGHT

S 114-103

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCDURES.

(2) Clean the airplane mating surface with solvent, Series 88 (AMM 20-30-88/201):
(a) Make a clean cheesecloth moist (not soaked) with solvent, Series 88 (AMM 20-30-88/201).
(b) Rub the airplane mating surface with the cheesecloth until the surface is clean.

S 374-131
(3) SAS 050, 051, 150-157, 162-167, 275-280 WITHOUT SL 51-23;
Do these steps to prepare the mating surface:
(a) Do this task to apply a layer of alodine 1000 to the mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

(b) Apply two layers of BMS 10-79 type III primer to the mating surface.
1) Let each layer dry for the correct cure time.

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S 374-174

(4) SAS 050, 051, 150-157, 162-167, 275-280 WITH SL 51-23, AND SAS 052-149, 158-161, 168-274, 281-999;
If the mating surface has corrosion or other damage, do these steps to prepare the surface:
   (a) Do this task to apply a layer of alodine 1000 to the mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

   NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

   (b) Apply two layers of BMS 10-79 type III primer to the mating surface.
      1) Let each layer dry for the correct cure time.
   (c) Apply alodine to the contact surfaces of the antenna and the airplane and let the alodine dry.
   (d) Install the O-ring.

S 424-064

(5) Install the radio altimeter antenna:
   (a) Connect the coaxial cable to the antenna.
   (b) Apply a layer of Dow Corning No. 4 to the coaxial cable connector.
   (c) Put the antenna in the correct position on the fuselage.
   (d) Lightly tighten three of the four cad plated stainless steel screws to hold the antenna in the correct position.

CAUTION: TIGHTEN THE SCREWS MANUALLY TO THE CORRECT TORQUE VALUE. IF YOU USE POWER OR AIR TOOLS TO TIGHTEN THE SCREWS, YOU CAN CAUSE DAMAGE TO THE ANTENNA SURFACE.

   (e) Manually tighten the three screws to 20-25 pound-inches.

S 764-065

(6) Measure the resistance (SWPM 20-20-00):
   (a) Measure the resistance between the empty screw hole in the antenna (antenna baseplate) and the airplane skin.

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(b) Make sure that the resistance is less than 0.025 ohm.

S 424-068

(7) Install the last screw for the radio altimeter antenna:
    (a) Lightly tighten the cad plated stainless steel screw.

CAUTION: TIGHTEN THE SCREWS MANUALLY TO THE CORRECT TORQUE VALUE. IF YOU USE POWER OR AIR TOOLS TO TIGHTEN THE SCREWS, YOU CAN CAUSE DAMAGE TO THE ANTENNA SURFACE.

    (b) Manually tighten the screw to 20-25 pound-inches.
    (c) Remove the BMS 3-27 (preferred) or BMS 3-38 (alternate) pushed out around the antenna.

S 394-066

(8) Apply the areodynamic sealant:

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO APPLY THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

    (a) Apply the aerodynamic sealant, BMS 5-95, to the outer edge of the antenna (AMM 51-31-01/201).

    NOTE: Make sure there is no air in the sealant. Use more sealant than necessary to make sure the bead is smooth and level.

    (b) Apply the aerodynamic sealant, BMS 5-95, to the outer edge of the fairing spacer (AMM 51-31-01/201).
    (c) In addition, apply aerodynamic sealant, BMS 5-95, to the head of each screw.
    (d) Use a spatula to make sure the sealant is a smooth symmetrical 45-degree bead.

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO APPLY THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

    (e) Remove the unwanted sealant from around the antenna base (AMM 51-31-01/201).
    (f) Let the sealant dry until it cannot be dented.

S 864-067

(9) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
    (a) P11 Overhead Circuit Breaker Panel
        1) 11F5, RADIO ALTM LEFT

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2) 11F20, RADIO ALTM CENTER
3) 11F26, RADIO ALTM RIGHT

E. Antenna Test

S 864-043
(1) Supply electrical power (AMM 24-22-00/201).

S 864-031
(2) Set the captain's INSTR SOURCE SEL EFI switch to the out position.
(a) Make sure that the captain's ADI radio altitude display shows -6 ±2 feet.

S 864-032
(3) Set the captain's INSTR SOURCE SEL EFI switch to ALTN (in position).
(a) Make sure that the captain's ADI radio altitude display shows -6 ±2 feet.

S 864-033
(4) Set the first officer's INSTR SOURCE SEL EFI switch to the out position.
(a) Make sure that the first officer's ADI radio altitude display shows -6 ±2 feet.

F. Put the Airplane in its Usual Condition

S 864-034
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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WEATHER RADAR SYSTEM - DESCRIPTION AND OPERATION

1. Description
   A. General
      (1) The weather radar system uses the reflective effect of microwave pulses on material substances to obtain a picture of conditions ahead of the airplane. The weather radar system presents the pilots with a topographic map type of display of moisture laden weather formations (WX) or major terrain features such as rivers, coastlines, major mountain peaks, and cities for position fixing (MAP). The weather displays permit the pilot to avoid storm penetration and the associated turbulence.
      (2) The weather radar operates in the X-band and has a penetration range through relatively light intervening rainfall to detect distant rainfall storm areas at ranges of up to 320 miles. The weather displays permit the pilot to avoid weather storms and the associated turbulence. Strong echoes may also return from other objects (such as mountains). All returns are displayed on the captains and first officers displays and the dedicated Weather Radar Indicator (if installed).
      (3) The receiver/transmitter generates and transmits high energy radio frequency (RF) pulses which are radiated by the antenna. A small portion of the radiated energy is reflected back to the airplane by moisture laden clouds or by major terrain features. The reflected signals are received by the same antenna, processed by the R/T unit and sent to the displays. The transfer of the RF energy between the R/T unit and the antenna takes place via the waveguide and waveguide switch. Stabilization of the antenna in pitch and roll is provided by the inertial reference system.
      (4) While in the MAP Mode of operation the weather radar system presents the pilots with a topographic map type display of moisture laden weather formations or major terrain features such as rivers, coastlines, major mountain peaks, and cities for position fixing. The weather displays permit the pilot to avoid weather storms and the associated turbulence.
   B. Component Details
      (1) WXR Control Panel
         (a) The Weather Radar Control Panel has these controls:
            1) SYS L or SYS R - Selects the LEFT or RIGHT receiver transmitter for weather radar operations.
            2) The MODE controls are as follows:
               a) TEST - Turns the radar system on and provides a normal test pattern on the display. Starts a sequential fault isolation check of the line replaceable units (LRU's) of the radar system.

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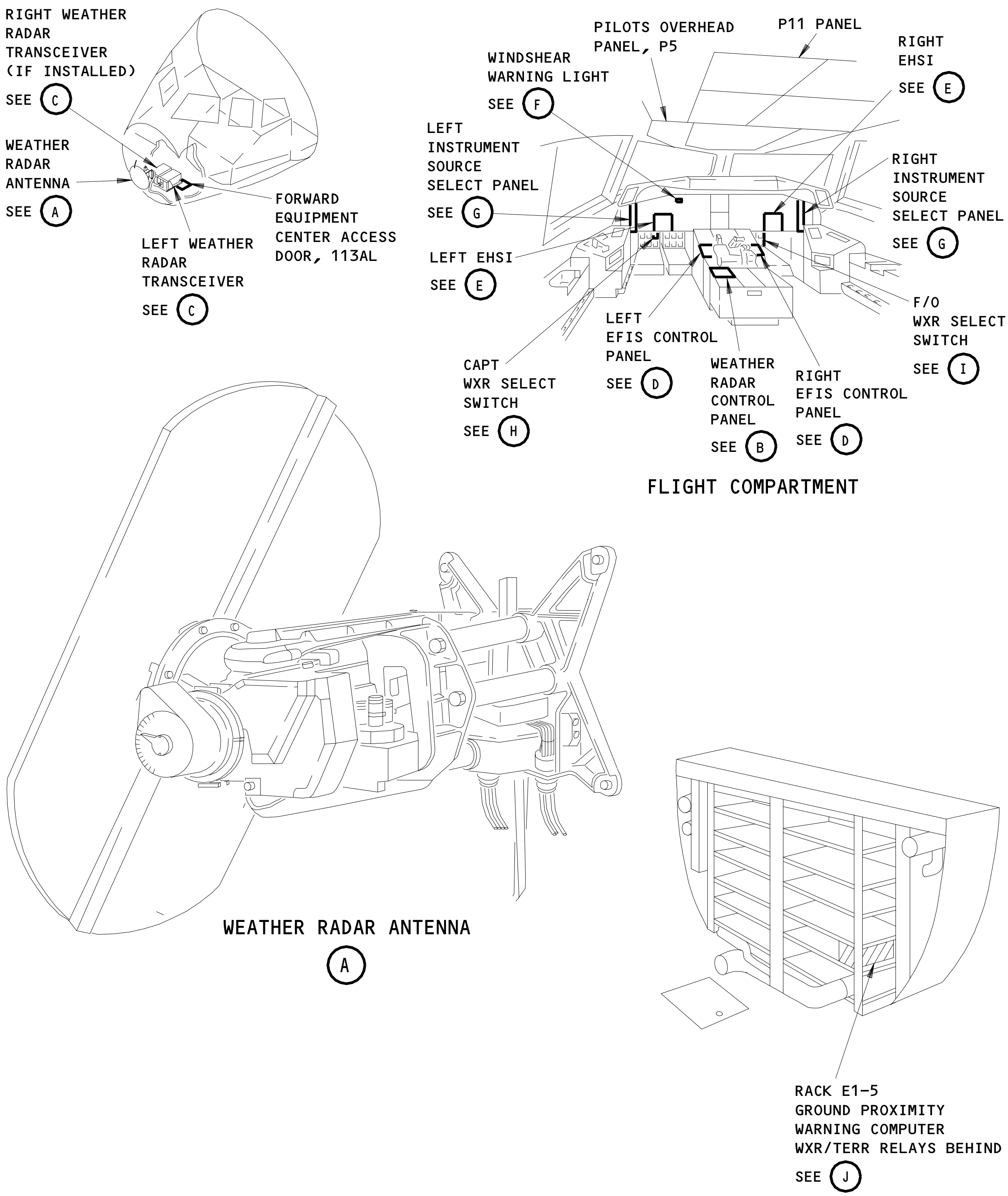

Weather Radar System - Component Location
Figure 1A (Sheet 1)

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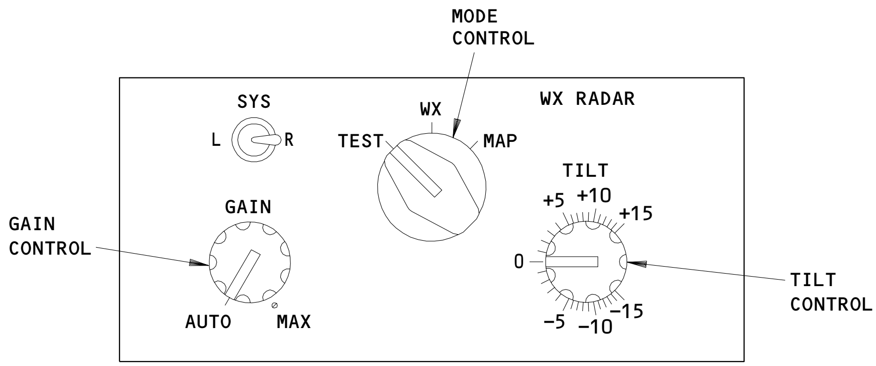
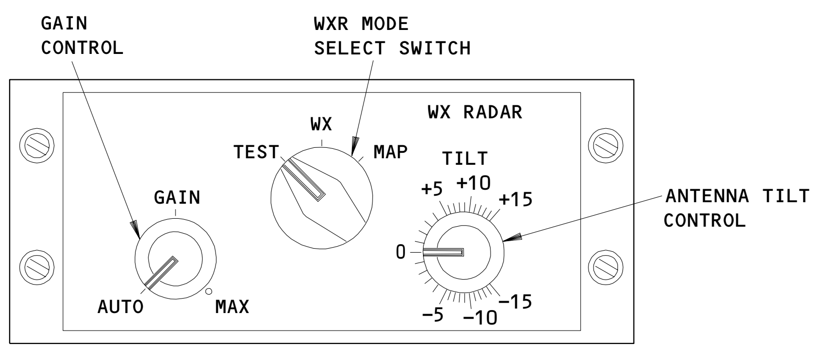


WEATHER RADAR CONTROL PANEL
(2041220-0402)

B



WEATHER RADAR CONTROL PANEL
(2041223-0402)

B

Weather Radar System - Component Location
Figure 1A (Sheet 2)

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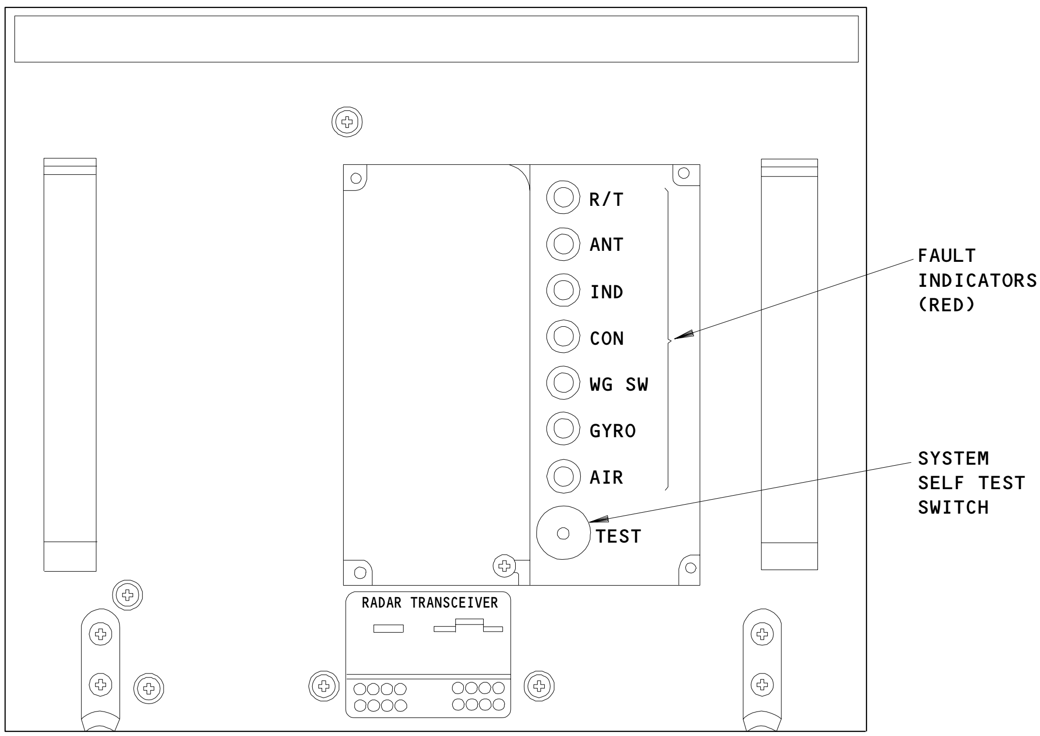

WEATHER RADAR TRANSCEIVER
(ALLIEDSIGNAL RDR-4A)
(EXAMPLE)

C

Weather Radar System - Component Location
Figure 1A (Sheet 3)

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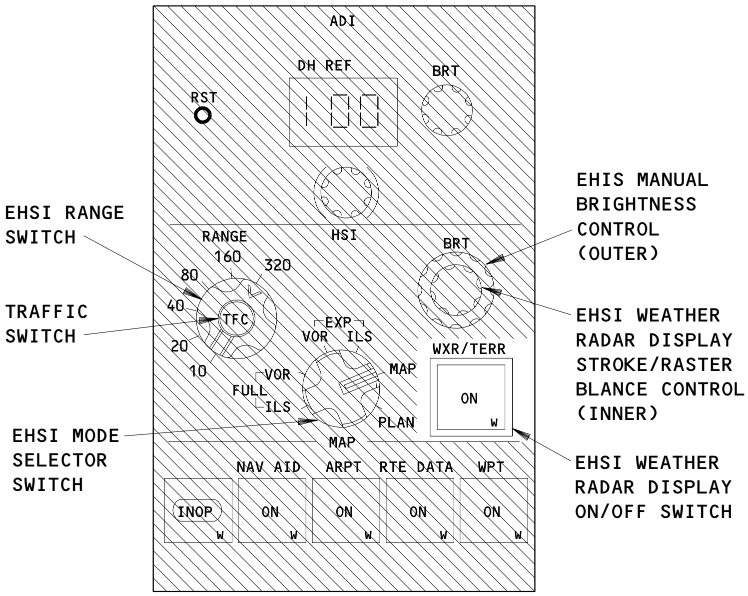
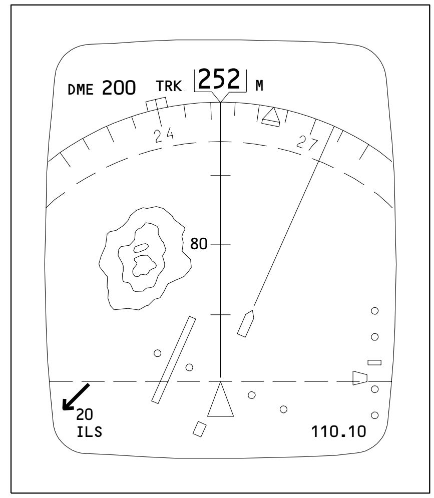


EFIS CONTROL PANEL

D

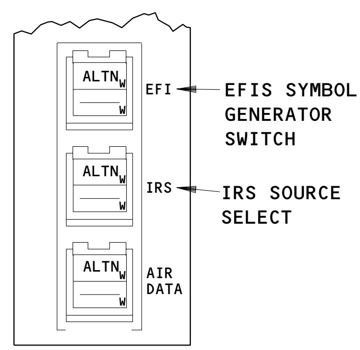


ELECTRONIC HORIZONTAL SITUATION INDICATOR

E

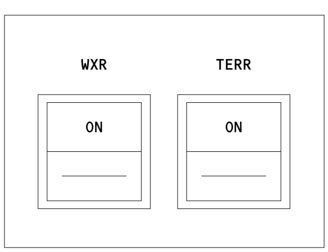
WINDSHEAR WARNING LIGHT

F



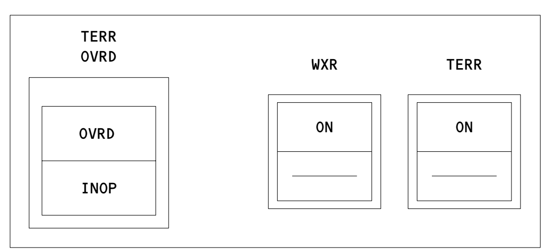
INSTRUMENT SOURCE SELECT PANEL

G



CAPT'S WXR SELECT SWITCH

H



F/O'S WXR SELECT SWITCH

I

Weather Radar System - Component Location
Figure 1A (Sheet 4)

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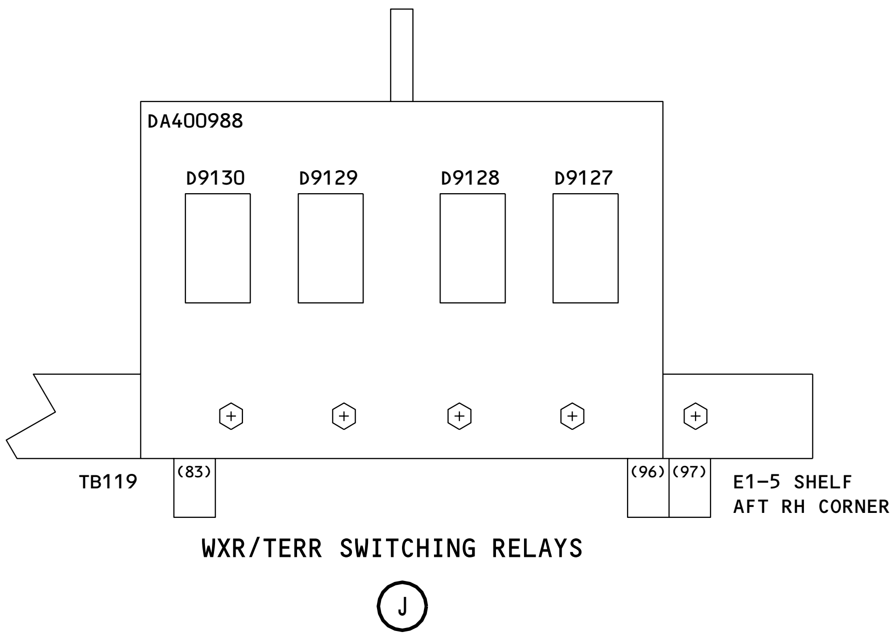

Weather Radar System - Component Location
Figure 1A (Sheet 5)

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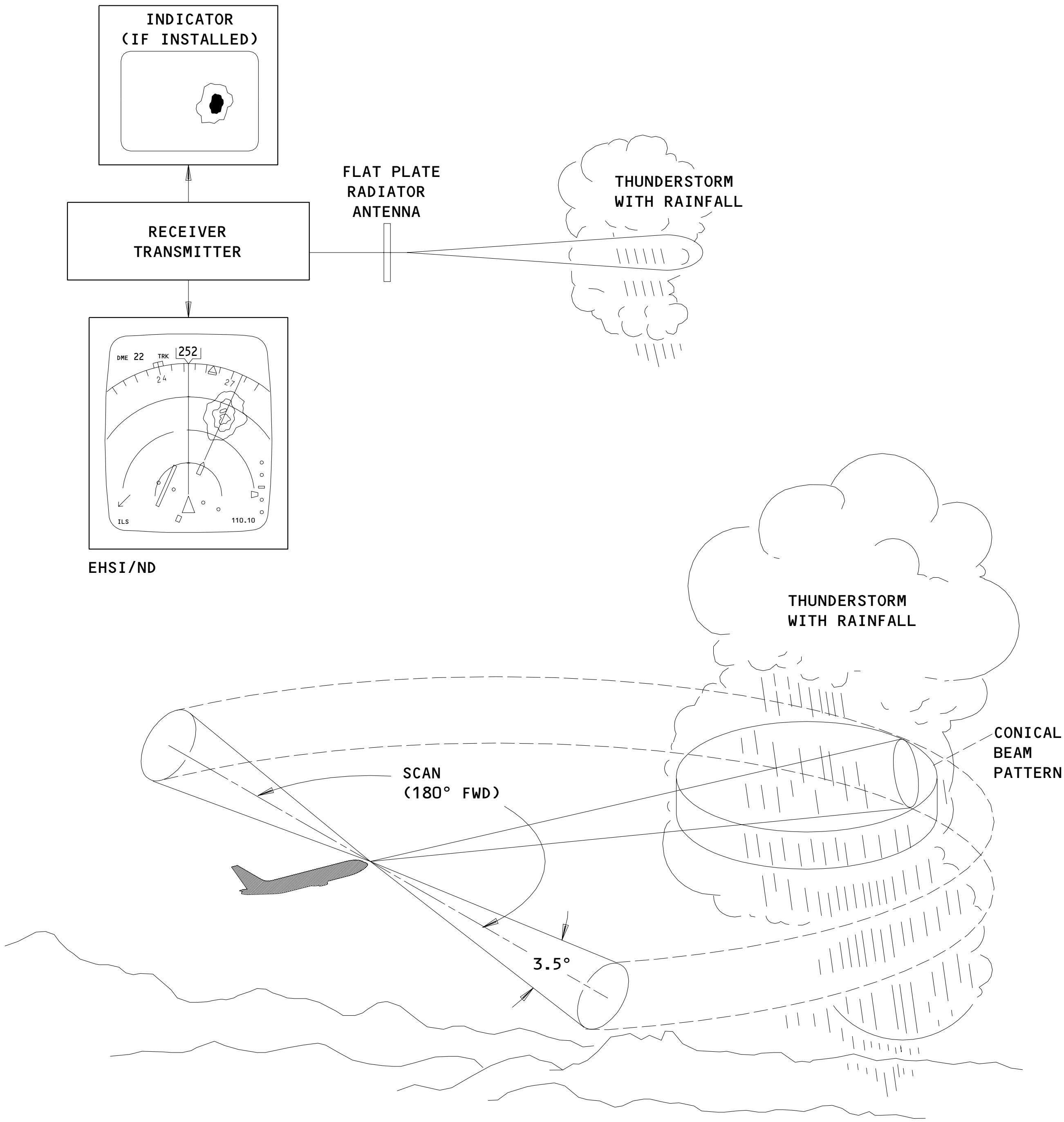

Weather Radar Scan Display and Antenna RF Beam Pattern
Figure 2

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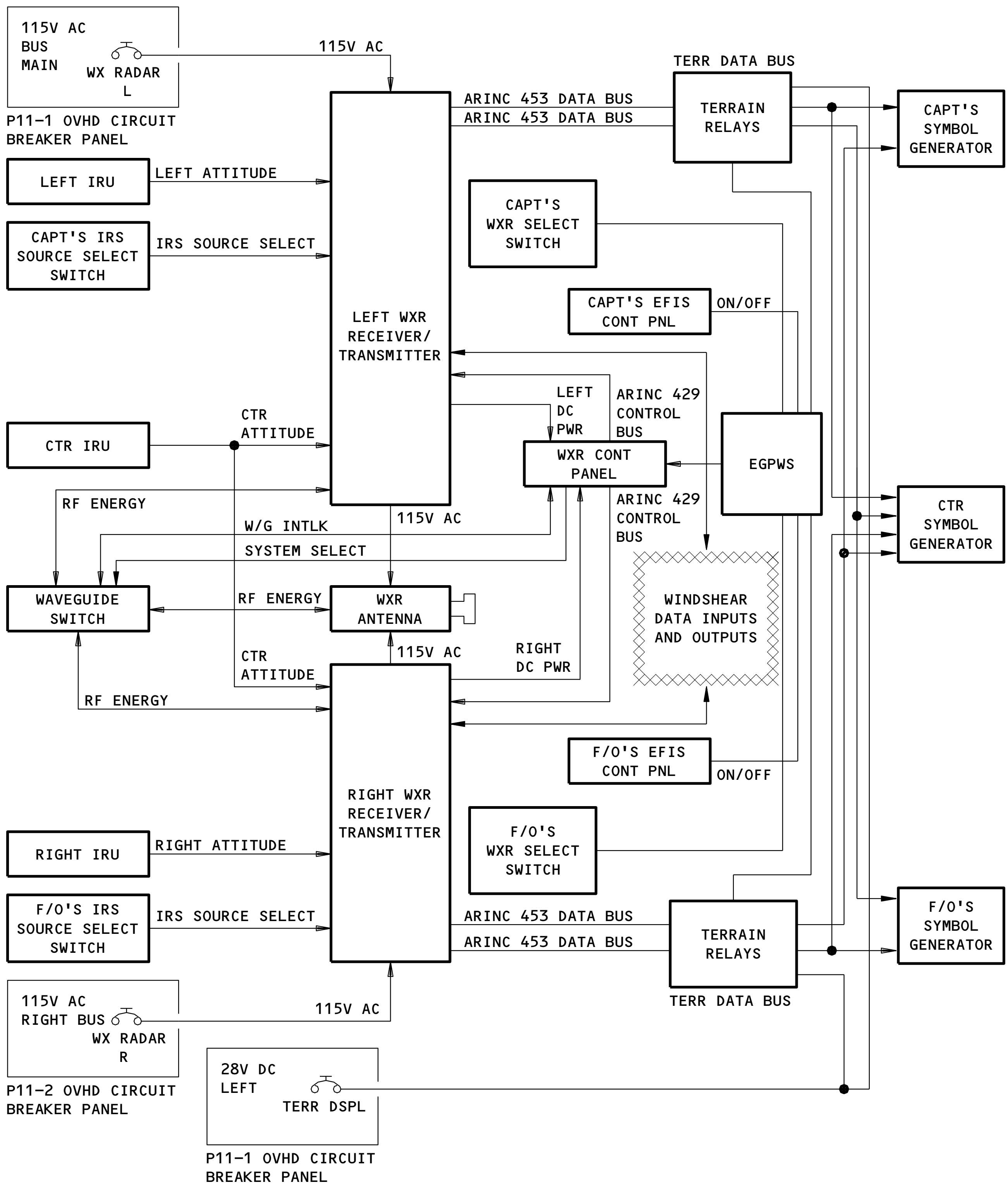

Weather Radar System Block Diagram
Figure 3

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EFFECTIVITY
AIRPLANES WITH DUAL WEATHER RADAR
RECEIVERS/TRANSMITTERS

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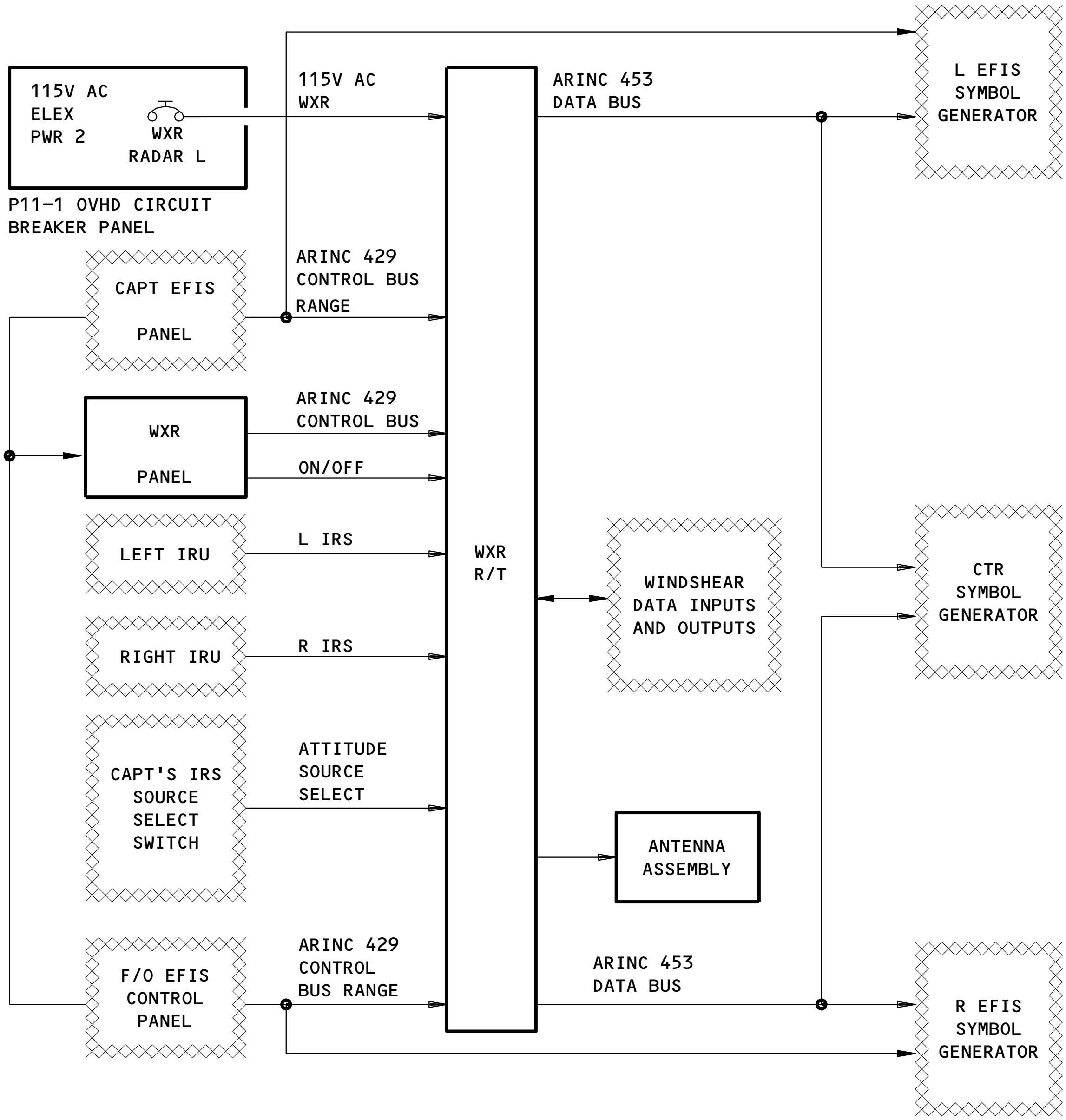

Weather Radar System Block Diagram
Figure 3A

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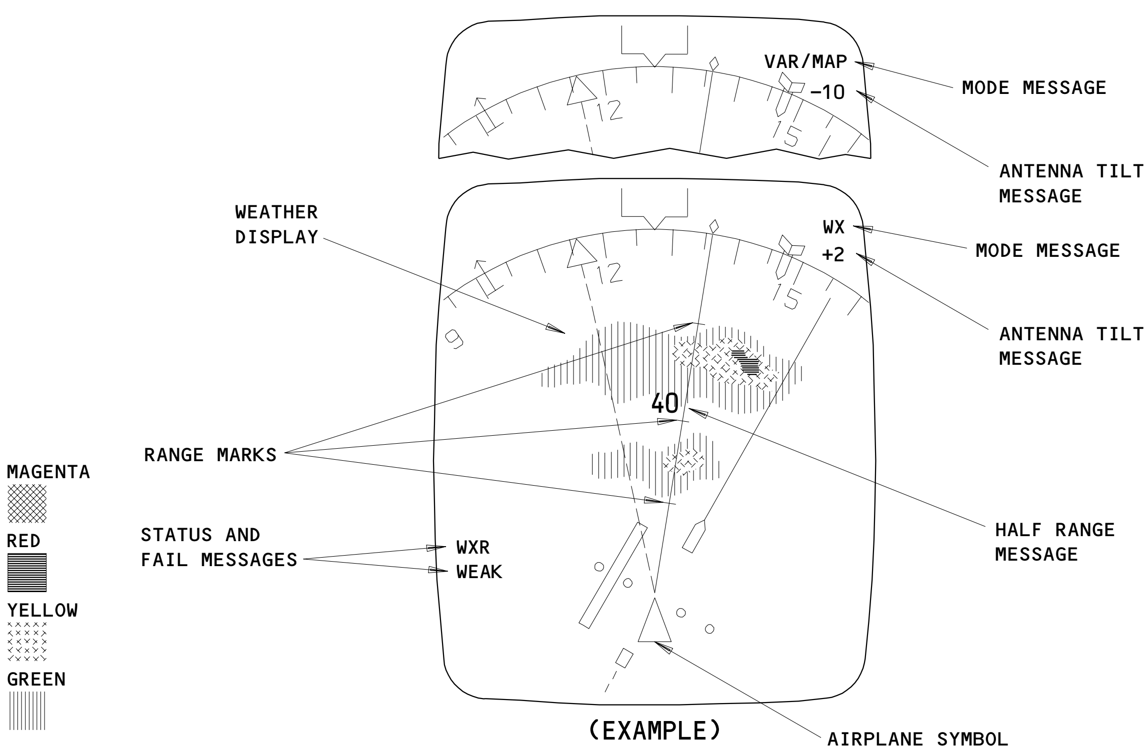

EHSI Weather Radar Display
Figure 4

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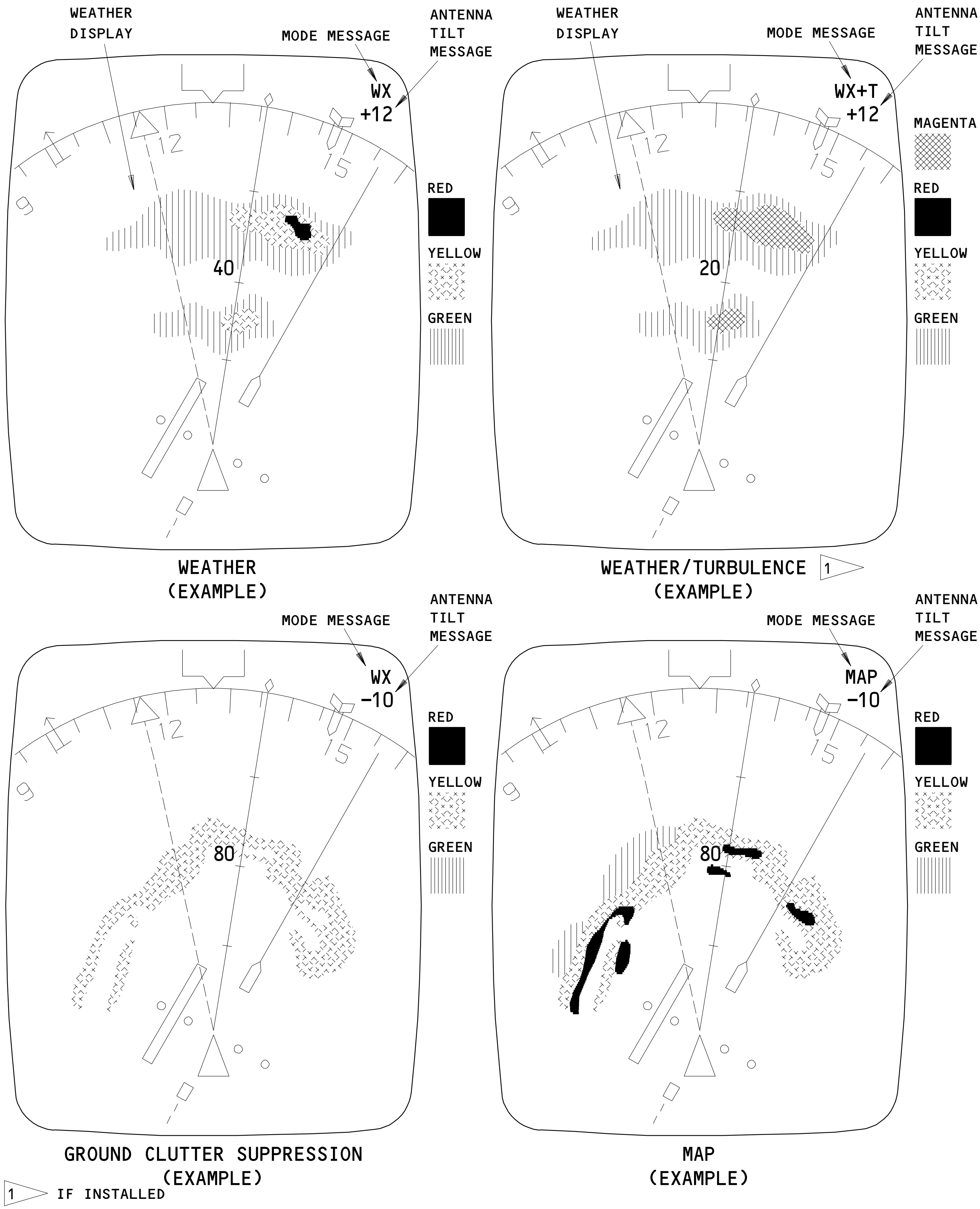

Weather Radar Display and Indicator Mode Displays
Figure 5

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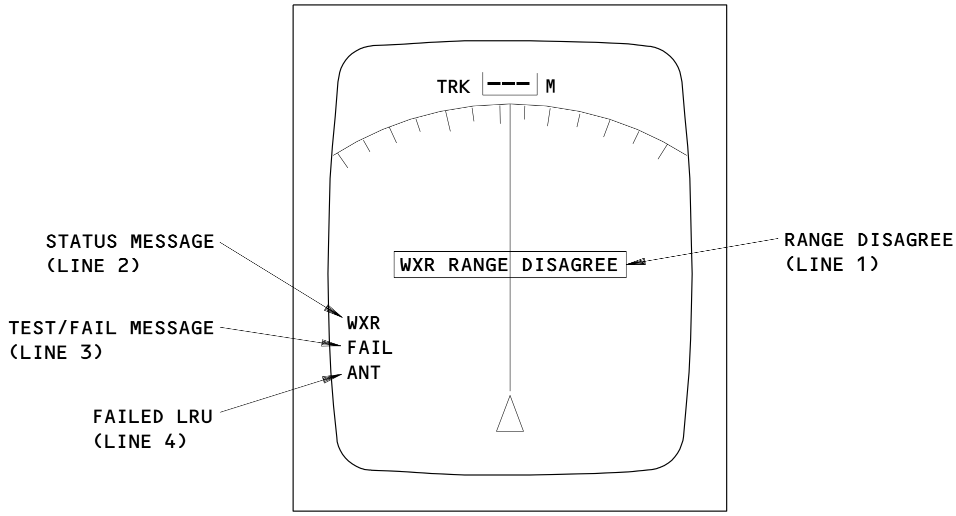

EHSI/ND - STATUS AND FAULT DISPLAY

ANNUNCIATION			MEANING OF THE ANNUNCIATION	WXR DATA DISPLAY	ORDER OF PRIORITY OF MESSAGE
LINE 2 (YELLOW)	LINE 3 (YELLOW)	LINE 4 (YELLOW)			
WXR	FAIL	WEAK	CALIBRATION FAULT	DISPLAYED	FIRST PRIORTY
WXR	FAIL	ATT	ATTITUDE INPUT FAULT	DISPLAYED	SECOND PRIORTY
WXR	FAIL	RT	FAULT RECEIVER/TRANSMITTER	REMOVED	WXR WEAK, ATT AND STAB MESSAGE INHIBITED
WXR	FAIL	CONT	CONTROL FAULT	REMOVED	
WXR	FAIL	ANT	ANTENNA FAULT	REMOVED	
WXR	DSPY		EHSI TEMP ABOVE 1ST (75°C) THRESHOLD	REMOVED AFTER 30 SEC	ALL OTHER WXR MESSAGES INHIBITED
BLANK	BLANK		EHSI TEMP ABOVE 2ND (100°C) THRESHOLD	ENTIRE EHSI DISPLAY OFF	

STATUS AND FAULT MESSAGES

MESSAGE (LINE 1)	COLOR	WXR DATA DISPLAY	CONDITION	EFIS MODE
WXR RANGE DISAGREE	YELLOW	REMOVED	WXR XCVR RANGE PROCESSED DISAGREES WITH EFIS CP SELECTED RANGE	VOR, ILS, MAP AND CTR MAP
WXR/MAP RANGE DISAGREE	YELLOW	REMOVED	WXR XCVR RANGE PROCESSED AND FMC SELECTED RANGE BOTH DISAGREE WITH EFIS CP SELECTED RANGE	MAP

RANGE DISAGREEMENT MESSAGES

Weather Radar EHSI/ND Status and Fault Messages
Figure 6

H32891

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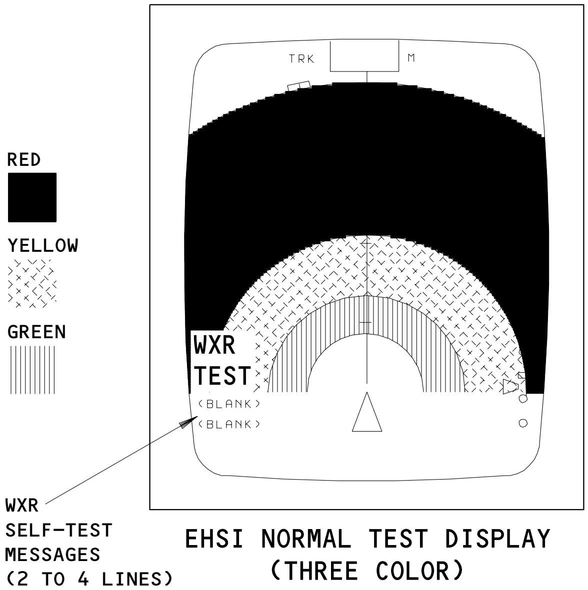
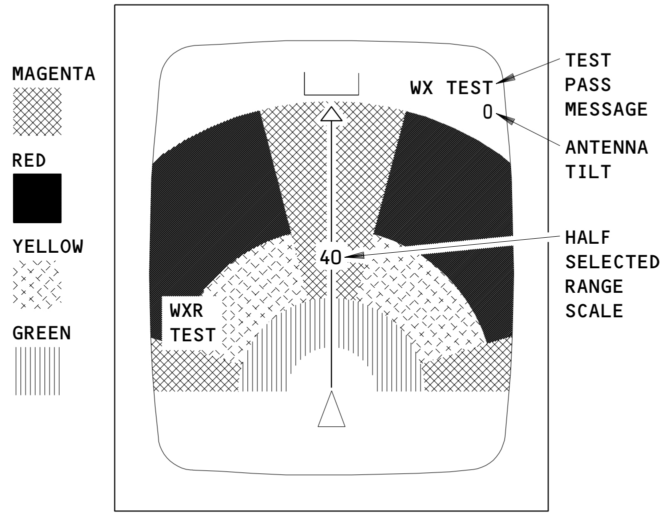
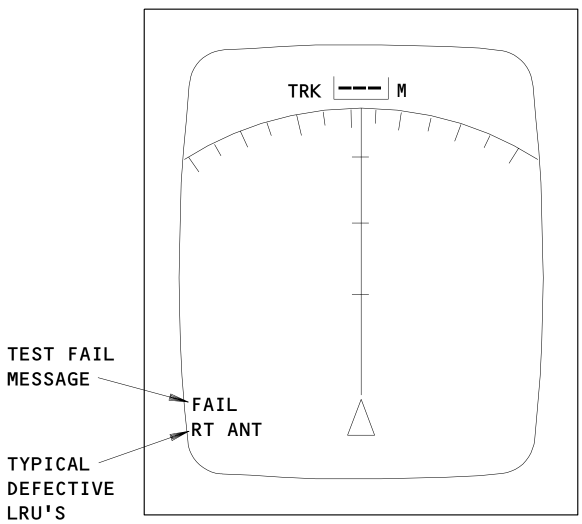


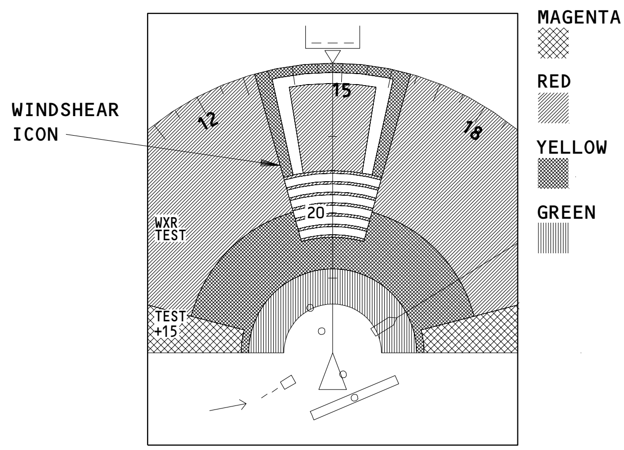
EHSI NORMAL TEST DISPLAY
(THREE COLOR)



EHSI NORMAL TEST DISPLAY
(FOUR COLOR)



EHSI FAILURE DISPLAY



ND TEST PASS DISPLAY
(WITH PWS)

WXR TEST PASS/FAIL (YELLOW)	DEFECTIVE LRU(S) (CYAN)	CONDITION	WXR TEST PATTERN
WXR TEST	BLANK	TEST PASS	ON
WXR FAIL	RT	RECEIVER/TRANSMITTER FAULT	OFF
WXR FAIL	ANT	ANTENNA FAULT	OFF
WXR FAIL	CONT	CONTROL FAULT	OFF
WXR FAIL	ATT	ATTITUDE INPUT FAULT	OFF
WXR FAIL	WEAK	CALIBRATION FAULT	OFF
WXR FAIL	STAB	STABILIZATION SWITCH OFF	ON

EHSI/ND PASS/FAIL MESSAGES

Weather Radar Test Displays
Figure 7

H31106

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b) WX - activates the weather detection mode within the receiver transmitter.
c) MAP - Depending on the setting of the TILT control, a terrain mapping effect is displayed for identifying terrain features. The colors green, yellow, and red represent increasing levels of return for the radar in the MAP mode. The system gain is selectable in the MAP mode by the use of the GAIN control on the weather radar control panel.

3) GAIN control - XCVR gain is controlled in the weather radar WX and MAP modes by rotating the GAIN control through its ten detented positions. Counterclockwise rotation of the GAIN control decreases the gain. A VAR message is displayed on the display anytime the GAIN control is in any detent position other than AUTO. The VAR message appears to the left of the mode message in the upper right hand corner.
4) TILT control - Tilts the antenna radiator up or down a maximum of 15 degrees from the zero reference position. Antenna tilt in + or - degrees is displayed on the display. The tilt control can be adjusted up or down to provide a more accurate display of the weather conditions in front of the airplane.

(2) WXR Transceiver
(a) The WXR XCVR generates and processes all the rf pulses. It also monitors all system components and input control data for detected faults. The XCVR also monitors and provides all scan, position, and stabilization data to the antenna. The XCVR provides "raw" WXR, test, and fault display data.
(b) The WXR XCVR is located just aft of the forward bulkhead in the forward equipment center.
(c) The inertial reference sytem (IRS) provides attitude data to the XCVR (AMM 34-21-00). This is used to stabilize the antenna's scan, level with the horizon.
(d) The XCVR front panel contains a system TEST button and various system status lights. These lights illuminate if a system fault is detected during a XCVR initiated self test. These status lights indicate faults of the XCVR, antenna, indicator (when installed), control panel, waveguide switch (for dual WXR systems), IRS input, and XCVR air supply.

(3) Antenna
(a) The purpose of the antenna is to radiate a narrow conical beam of rf energy and to receive the reflected pulses. The beam width is approximately 5.4°. The WXR antenna is located inside of the radome assembly and is mounted to the forward pressure bulkhead (Section 41).
(b) The antenna base provides drive for the antenna. It provides normal scan, test, stabilization, and manual tilt movement. It also provides feedback operations.

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(c) The antenna scans ±90° parallel to the horizon. It scans ahead of the airplane at 15 looks-per-minute. The flat antenna is driven by brushless stepper motors at 1/4° increments for all axis.

(d) The antenna scan is automatically stabilized as the airplane changes attitude. It has a stabilization range of ±40° in the pitch axis. It also has manual tilt capability of ±15° within the ±40° of pitch. The manual tilt angle is selected on the WXR control panel.

(e) It can be stabilized over a combined tilt, pitch and roll input; up to ±45°. If the airplane's attitude exceeds these limits, the antenna drive will return the antenna to zero degrees pitch and roll position. It will remain there until the airplanes' attitude returns to within these limits.

(4) Waveguide Assembly

(a) The WXR waveguide provides a path for the rf pulses between the antenna and the XCVR. It runs from the XCVR to the antenna, through the forward bulkhead.

(5) EFIS Control Panel

SAS (a) The EFIS control panel provides WXR/TERR display turn-on and range selection for the EHSIs. Both the captain's and F/O's EFIS control panels provide independent WXR control for the respective display. The left and right EFIS control panels are located on the quadrant stand (P-10).

(b) The range selector rotary knob has six range settings which include 10, 20, 40, 80, 160, and 320 nmi. The selected range is sent to the XCVR, the EFIS symbol generator, and the flight management computer (FMC), via a common ARINC 429 data bus. The XCVR is capable of processing WXR data for three separate selected ranges.

SAS (6) WXR Select Switch

SAS (a) The Capt's and F/O's WXR switch is located on the P1-1 and P3-1 respectively.

SAS (b) When the WXR select switch is pushed, and the respective WXR/TERR switch on the EFiS control panel is on, the weather radar picture is displayed on the EHSI and the WXR light will come on.

SAS If TERR (EGPWS Terrain display) was already selected, the TERR display will be replaced by the WXR display and the TERR light will go off.

SAS If the WXR switch is pushed, when WXR is already selected, the weather radar picture display will disappear and the WXR light go off.

SAS (c) The switching between WXR and TERR display is accomplished by four switching relays located AFT Right on the E1-5 shelf.

(7) Electronic Horizontal Situation Indicator (EHSI)

(a) The Capt's and F/O's EHSIs/NDs are located on panels P1 and P3, respectively.

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(b) The WXR data is displayed on the EHSI's in a low intensity, raster format. The weather and turbulence data is displayed in a three color format. Each color (green, yellow, red) represents a range of moisture gradients. Position on the EHSI of the displayed WXR data corresponds to the actual storm position in relation to the airplane. Display position is also dependent on the selected range.

(c) AIRPLANES WITH FOUR COLOR WEATHER RADAR;
a fourth color, magenta, also indicates detected turbulence as well as heavy precipitation.

(d) For normal WXR operation, the EHSI/ND provides the following displays during the EFIS operating modes of VOR, ILS, and MAP. A four color coded WXR data display is provided at the following intensity ranges:
1) Black - Low or no precipitation.
2) Green - Light precipitation.
3) Yellow - Medium precipitation.
4) Red - Heavy precipitation.
5) Magenta - Very heavy precipitation. Also used for turbulence detection.

2. Operation

A. Functional Description

(1) Electrical Power and Power Control Circuits

(a) The XCVR receives electrical power of 115V ac, 400 Hz, single phase from the left main power bus. Within the XCVR, the power supply is controlled by a +28V dc enable signal from the WXR control panel. Internal XCVR dc power is on only when it is enabled by the WXR control panel and the WXR switch on the EFIS control panel is ON. The control panel internal power is provided by +28V dc signal from the transceiver keep alive power supply. The control panel lights are operated by a 5V ac signal from the airplane lighting bus. The antenna is powered by 115V ac routed through the transceiver.

(2) Weather Radar System Control Functions

(a) The range selector, on the EFIS control panel, sends a digital discrete to the XCVR on an ARINC 429 data bus. This is routed through the I/O circuits to the CPU for processing within the XCVR.

(b) The control information is processed by the WXR control panel microprocessor. The microprocessor output is routed to a 3 to 8 line decoder. The information is then converted to serial data. From there, the information is prepared for transmission by the digital control bus line driver. The digital control information is sent to the XCVR by an ARINC 429 data bus.

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(c) The XCVR main power supply is energized when it receives a +28V dc discrete from the WXR control panel system selector switch (if installed). The +28V dc discrete is applied to this switch when the WXR ON/OFF button, on the EFIS control panel, is pressed to the ON position. The selected XCVR routes a discrete to the relay. This causes the relay contacts to switch the antenna to the energized XCVR.

(d) Within the XCVR, the input control data is fed to the Timing, Control, and Monitoring circuits and the Antenna Stabilization circuits. The Timing, Control, and Monitoring circuits provide timing, control, and monitoring of all functions of the XCVR.

(e) The XCVRs main power supply is energized when either WXR/TERR ON/OFF switch on the EFIS control panels are energized and respective WXR select switch pushed. The WXR control panel has master/slave control capability which provides control/display override for the controls not in the TFR mode.

(3) AIRPLANES WITH RDR-4A TRANSCEIVER;
Receiver/Transmitter Functions

(a) The R-T unit is a lightweight airborne unit consisting of a transmitter, receiver, video processing circuitry, digital interfaces, stabilization servo-loop circuitry, system monitoring circuitry, and power supply.

(b) The transmitter consists of a driver stage, which receives its input from crystal-controlled reference oscillator, and a power amplifier output stage. Output of the transmitter is at 9345 MHz and is a nominal 125 watts peak; pulse width alternates between 6 and 18 microseconds. The 6-microsecond pulse echoes are processed to produce the zero to 40 nautical mile targets on the indicator; and the 18-microsecond pulses echoes are processed to produce the targets greater then 100 nautical miles. Echoes from both the 6- and 18-microsecond pulses are processed to produce the targets between 40 and 100 nautical miles.

(c) Because the receiver and transmitter both receive their reference from a crystal-controlled oscillator, an automatic fine-tune control (afc) circuit is not necessary. The receiver circuit is a triple-conversion superheterodyne. The two front end stages are Gallium-Arsenide FET (Ga-As FET) low-noise amplifiers. The third stage is an intermediate frequency logarithmic amplifier that has a 60-dB dynamic range. This provides the capability to detect and process weather targets having intensity levels from 0 dBZ to 60 dBZ. The receiver design provides an overall MDS (minimum discernible signal) of -121.9 dB (typical) for the system.

(d) The video circuits first convert the analog video signals into a digital format. The video processor adjusts the signal level with sensitivity timing control (STC). This allows nearby echo signals to be displayed with the same intensity as distant ones. STC is effective to about 70 nm. In the MAP mode, STC is modified to optimize analysis of terrain features.

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(e) The video processor also adjusts the overall threshold attenuation and penetration compensation. This compensates for weakened radar returns to intervening targets. Also, the video processor determines the intensity of the weather target and stores this in the video memory. The timing and control circuits sends antenna tilt and scan angle data, selected range data, and any detected fault data to the video memory.

(f) Receiver/Transmitter Antenna Stabilization Functions

1) The antenna stabilization system is a microprocessor-controlled servo loop. The microprocessor receives inputs from: roll and pitch attitude, selected tilt angle, and elevation and azimuth scan angles of the antenna. The microprocessor solves the line-of-sight equation from these inputs and predicts the new position of the antenna elevation. The difference between the predicted position and the desired position is used to derive the elevation motor drive signal. The azimuth drive is an open-loop operation. For this, the microprocessor monitors the position of the antenna and generates signals to reverse the direction of scan when the antenna reaches 90 degrees either side of dead ahead.

2) The R/T's receive continuous No. 1 and No. 2 IRS pitch and roll attitude stabilization inputs. When The ATTITUDE select switch is in the NORMAL position the R/T's receive IRS pitch and roll attitude inputs from the No. 1 IRS. When the ATTITUDE select switch is set to the BOTH ON R position a discrete ground, ATT SOURCE SELECT, is sent to both R/T's. These discrete ground transfers the IRS pitch and roll inputs from the No. 1 to the No. 2 IRS in the R/T's.

(g) System Monitoring

1) The timing control and monitoring module in the R/T performs the system monitoring functions. The module has a timing and control (T&C) microprocessor, power supply monitor, discrete monitor, antenna stabilization, fault memory, data bus, receivers and decoders and various other circuits.

2) Initially after power turn on the power supply monitor checks various dc voltage levels. The monitor also receives a temperature sensor input to detect an overheat condition in the receiver/transmitter mount cooling system. The timing and control microprocessor codes the fault condition and stores it in the fault memory.

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3) During each R/T transmit/receive period of operation, the timing and control module checks the operation of the receiver/transmitter and antenna. The antenna stabilization and drive circuits stabilization processor performs software tests on its own circuits, antenna drive circuits, the antenna unit and inertial reference unit (IRU) inputs. Any fault conditions are sent from the antenna stabilization processor to the T&C microprocessor. The timing and control microprocessor codes the fault condition and stores it in the fault memory.
4) Normal power supply voltages and temperature causes the timing microprocessor to enable the BITE circuit antenna stabilization microprocessor. When a fault is detected the microprocessor goes through a fault routine to locate the fault condition. Faults are sent by a data bus to the timing microprocessor which codes the fault condition and stores it in the fault memory.
5) The BITE monitoring circuits in the timing control checks each of the weather radar unit functions to determine which replaceable unit or units are faulty. The BITE circuits generate fault messages which are sent through the ARINC 453 data buses No. 1 and 2 to the EHSI's/ND's.
6) When a fault is detected the receiver/transmitter T&C microprocessor also stores the fault in the fault memory for display when the R/T front panel TEST switch is pressed. When the TEST pushbutton is pressed (and held), all fault annunciators come on for 1 second to perform a lamp test; then they all go off if no fault is detected. If any of the fault annunciator LEDs stay illuminated, a failure in that unit is indicated. Releasing the pushbutton causes all annunciators to go off and remain off.

(h) The transmitted rf pulse is used to detect the targets. The pulse begins in the Frequency Source/Multiplying circuits. The crystal oscillators in the Frequency Source provide the frequency reference for both transmitter and receiver. By mixing and multiplying, the frequency of 9.345 MHz is delivered to the transmitter circuits.
(i) For transmission, the Timing and Control microprocessor sends trigger pulses to the modulator to develop 6-microsecond and 12-microsecond pulses at 125 watts. The output of the transmitter is coupled to the waveguide through the rf front end. This contains a three-port circulator which provides coaxial-to-waveguide matching. It also provides transmit-receive isolation.
(j) The rf pulses are routed through the waveguide, through the scan and elevation rotary joints, and through the antenna. The energy is radiated into the atmosphere until a target causes the energy to be reflected back.

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(4) Antenna Functions

(a) The antenna scan and elevation drive motors are controlled by the XCVR antenna stabilization microprocessor. Antenna scan is controlled by switching in the C.W. or the C.C.W. winding of the scan drive motor at the end of each scan. The scan synchro feeds back the antenna azimuth position. The microprocessor sends elevation commands to the elevation servo motor and receives elevation position from the elevation synchro. The elevation motor maintains the scan of the antenna parallel to the horizon at the angle selected by the TILT knob.

(b) Weather Radar Receive Functions

1) Rf pulses, returning to the antenna as target echoes, are routed through the waveguide to the rf front end and the rf preamplifier. Within the rf front end is a limiter. The limiter protects the rf preamp and receiver section from the effects of transmission of nearby radar systems. The rf preamplifiers provide amplification of the received radar signals. The received signal is mixed at the first mixer and sent to the receiver circuits.

2) The receiver circuits operate with automatic AGC. It converts the first IF signal to a third IF signal. It does this by mixing the first IF signal with second and third local oscillator (lo) frequencies. The third IF signal from the log amp is an analog video signal which is sent to the video circuits.

3) The video circuits first convert the analog video signals into a digital format. The digital video data is sent to the video processor. It adjusts the signal level with sensitivity timing control (STC). This allows nearby echo signals to be displayed with the same intensity as distant ones. STC is effective to about 70 nm. In the MAP (WXR) mode, STC is modified to optimize analysis of terrain features.

4) The video processor also adjusts the overall threshold attenuation and penetration compensation. This compensates for weakened radar returns due to intervening targets. Also, the video processor determines the intensity of the weather target and stores this in the video memory. The timing and control circuit sends antenna tilt and scan angle data, selected range data, and any detected fault data to the video memory. The contents of the video memory are formatted and sent to the EFIS symbol generators (Ref 34-22-00) for display. This video memory data is transmitted about every four seconds via ARINC 453 very high speed data busses.

(5) EFIS Function

(a) The WXR XCVR transmits data to all 3 EFIS symbol generators. The EFIS is programmed in such a way that data is accepted based on selected XCVR.

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(b) The XCVR supplies all three EFIS symbol generators with digital WXR data. In the symbol generator, the digital data is converted to video data in a X-Y raster format. The signals are separated into analog deflection signals and digital video signals. The information is then routed to the EHSI's/ND's.

(c) AIRPLANES WITH FOUR COLOR DISPLAYS;
The EHSI separates the WXR raster display from the EHSI stroke display symbol generator inputs. The two formats are processed separately. The EHSI then displays the WXR data in a four color format in a low intensity raster format.
The EHSI/ND separates the WXR raster display from the EHSI/ND stroke display symbol generator inputs. The two formats are processed separately. The EHSI/ND then displays the WXR data in a multi color format in a low intensity raster format.

(d) The EHSI/ND also displays all WXR fault messages. It also displays a WXR test pattern in the TEST mode.

(e) AIRPLANES WITH OPTIONAL TILT, MODE AND GAIN;
the EHSI/ND also shows WXR control panel settings, such as WXR GAIN, MODE and ANTENNA TILT position.

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WEATHER RADAR SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
ANTENNA - WEATHER RADAR, M269	2	1	111AL, NOSE RADOME	34-43-05
ASSEMBLY - WAVEGUIDE	2	1	113AL, FORWARD BULKHEAD	34-43-04
CIRCUIT BREAKERS	1		FLIGHT COMPARTMENT, P11	
WX RADAR L, C615		1	11F2	*
WX RADAR R, C599		1	11F23	*
PANEL - (REF 34-22-00, FIG. 101)				
LEFT EFIS CONTROL, M94				
RIGHT EFIS CONTROL, M93				
PANEL - WEATHER RADAR CONTROL, M75	1	1	FLIGHT COMPARTMENT, P8	34-43-02
SWITCH - WAVEGUIDE, S36	2	1	113AL, FORWARD BULKHEAD	34-43-04
SWITCH - (REF 34-22-00, FIG. 101)				
LEFT IRS, S4				
RIGHT IRS, S12				
TRANSCEIVER - WEATHER RADAR, M213,M214	2	2	113AL, FWD EQUIP CTR	34-43-01

* SEE THE WDM EQUIPMENT LIST

Weather Radar System - Component Index
Figure 101

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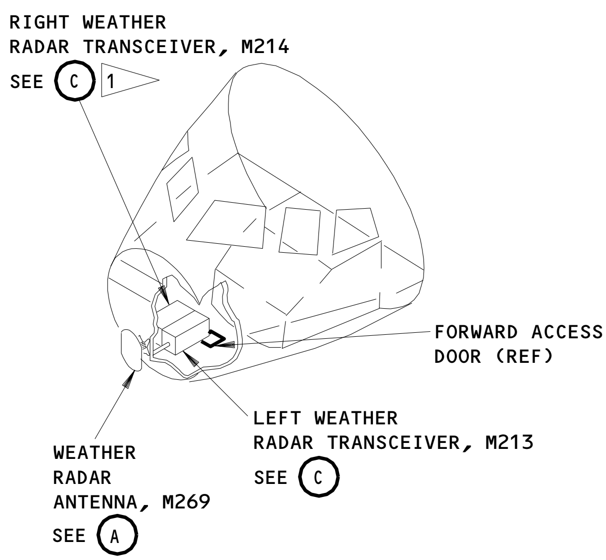
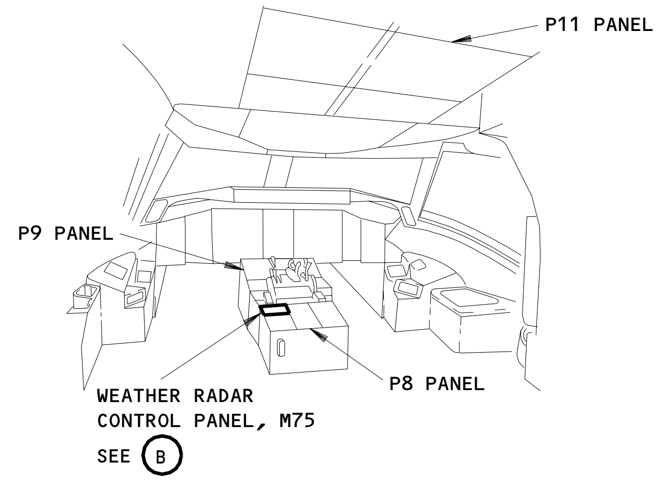
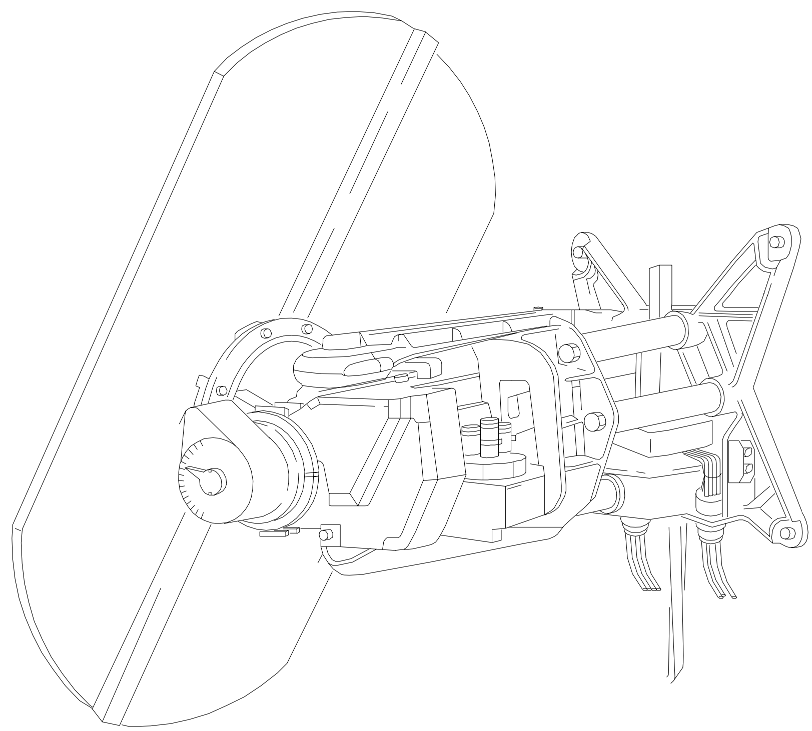




FLIGHT COMPARTMENT



WEATHER RADAR ANTENNA AND WAVEGUIDE, M269

A

1 IF INSTALLED

Weather Radar System - Component Location
Figure 102A (Sheet 1)

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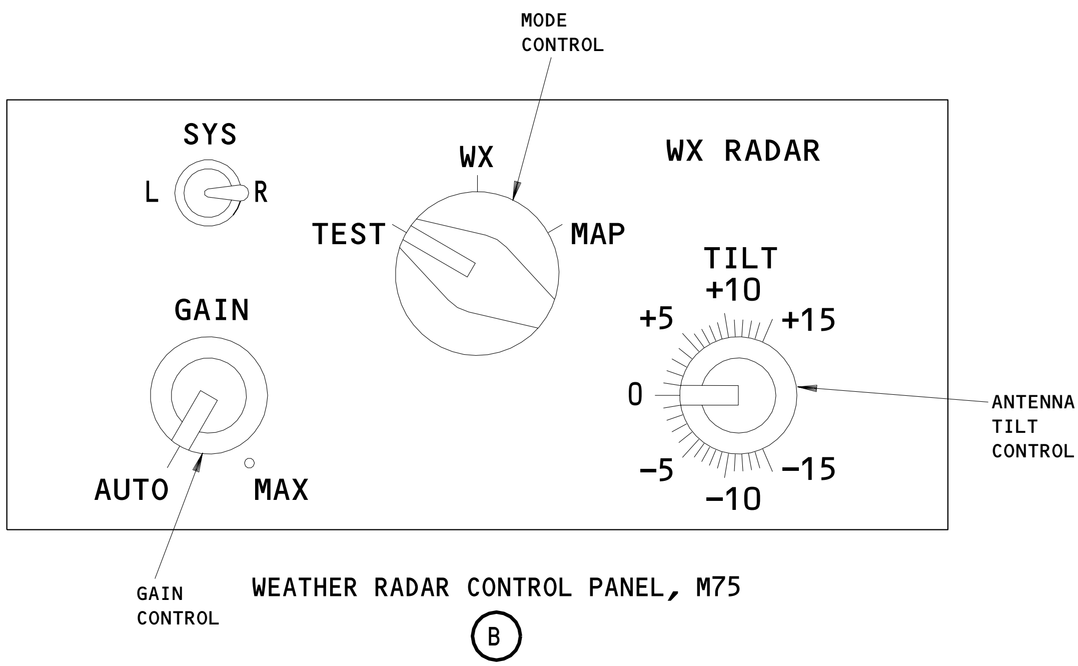

Weather Radar System - Component Location
Figure 102A (Sheet 2)

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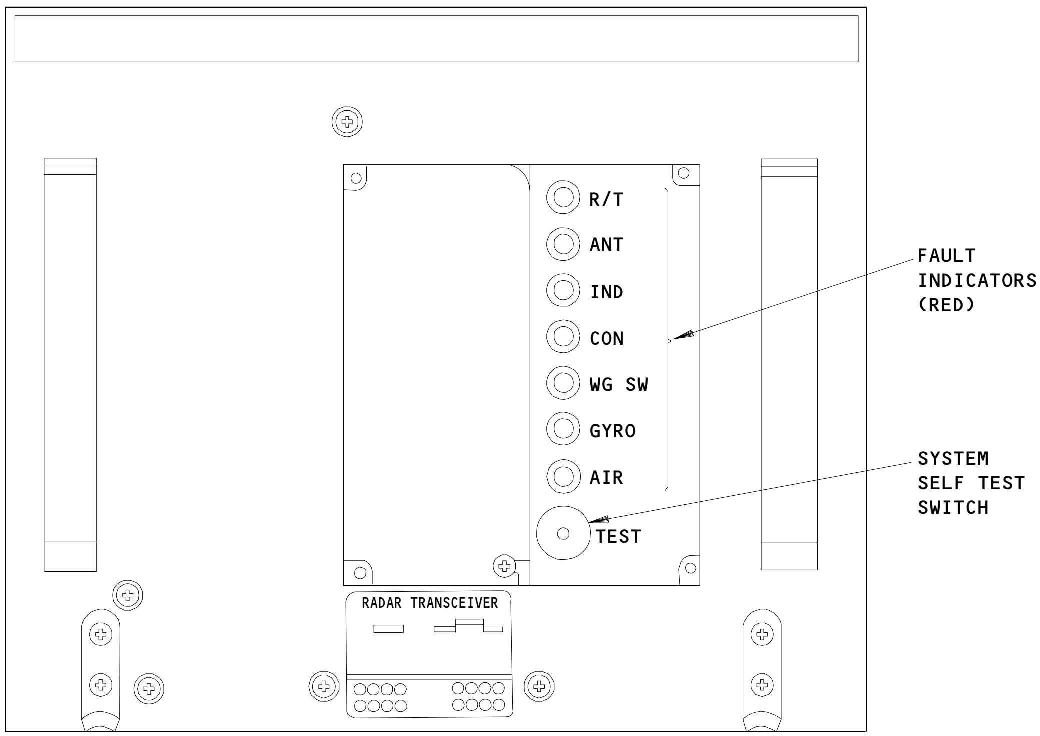

WEATHER RADAR TRANSCEIVER, M213, M214
(ALLIEDSIGNAL RDR-4A)
C

Weather Radar System - Component Location
Figure 102A (Sheet 3)

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WEATHER RADAR SYSTEM - ADJUSTMENT/TEST

1. General
   A. This subject contains these tasks:
      (1) Operational Test
         (a) The operational test uses the self-test circuits to make sure all functions of the weather radar system are serviceable.
      (2) System Test
         (a) The system test makes sure all functions of the weather radar operate correctly.

TASK 34-43-00-715-001

2. Operational Test (Fig. 501)
   A. General
      (1) The operational test uses the mode selector switch on the WXR control panel in the TEST position. In the TEST mode, the self test circuits monitor the performance of the left (right) weather radar systems.
      (2) During the self-test the weather radar system operates as follows:
         (a) The transceiver operates for 1 second.
         (b) A weather radar test pattern is sent to the display while the system searches for failures.
   B. References
      (1) AMM 24-22-00/201, Electrical Power - Control
      (2) AMM 21-58-00/501, Equipment Cooling
      (3) AMM 34-21-00/501, Inertial Reference System (IRS)
      (4) AMM 34-22-00/501 Flight Instrument System (EFIS)
   C. Access
      (1) Location Zones
         101 Control Cabin Left
         102 Control Cabin Right
         202 Lower Nose Compartment

   D. Prepare for Test

      NOTE: A test pattern, which appears distorted along a radial line (segmented test pattern) during the first sweep of the weather radar, is normal. An abnormal condition occurs if the above test pattern continues after the second full sweep.

      S 865-286
      (1) Supply electrical power (AMM 24-22-00/201).

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S 865-317

CAUTION: MAKE SURE THE EQUIPMENT COOLING SYSTEM OPERATES BEFORE THE ELECTRONIC SYSTEMS ARE OPERATED. THE EQUIPMENT COOLING SYSTEM MUST BE SET FOR CORRECT COOLING. IF THESE CAUTIONS ARE NOT OBEYED, DAMAGE TO THE ELECTRONIC SYSTEMS CAN OCCUR.

(2) Supply equipment cooling (AMM 21-58-00/501).

S 865-379

(3) Make sure the flight instrument system (EFIS) is serviceable (AMM 34-22-00/501).

S 865-380

(4) Make sure the Inertial Reference System is serviceable (AMM 34-21-00/501).

S 865-288

(5) Make sure these circuit breakers on the overhead panel, P11, are closed:
   (a) 11F2, WX RADAR L
SAS (b) 11F3, TERR DSPL
   (c) AIRPLANES WITH DUAL WEATHER RADAR R/T'S; 11F27, WX RADAR RIGHT

S 865-444

WARNING: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

WARNING: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

(6) On the EFIS control panel, do the steps that follow:
   (a) Mode selector - Expanded Scale
SAS (b) WXR/TERR ON pushbutton - ON

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SAS

SAS S 865-396

SAS (7) On P1-1 or P3-1, do the steps that follow:

SAS (a) Push the respective WXR select switch.

S 865-367

(8) Select TEST on the Weather Radar Control Panel.

(a) Make sure the test pattern shows on the display.

(b) Verify that no fault codes are present.

S 865-368

(9) On the EFIS control panel, do the steps that follow:

SAS (a) WXR/TERR ON - OFF

S 865-369

(10) Weather Radar Control Panel mode switch - AS NECESSARY.

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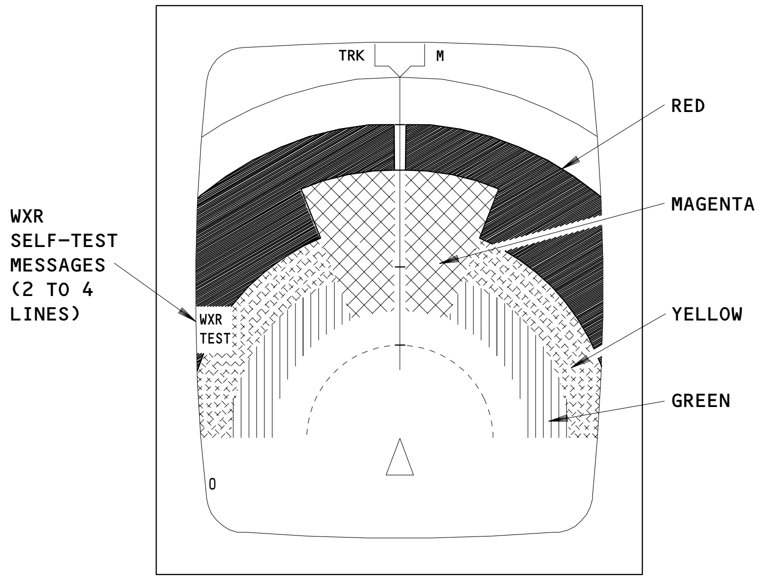
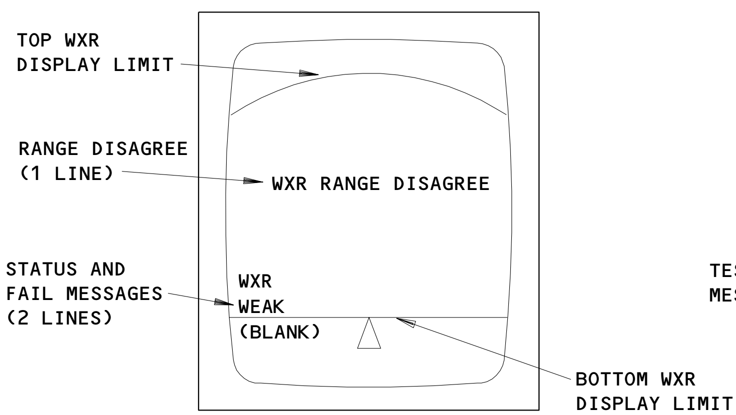
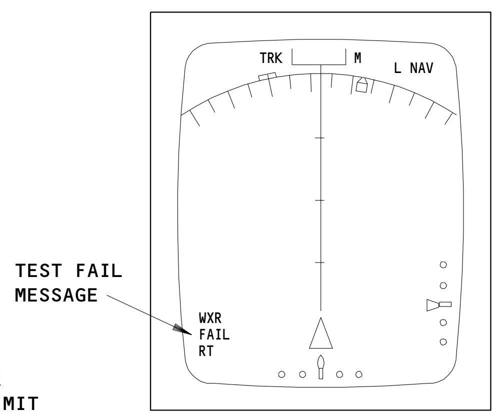


WXR TEST PASS DISPLAY
(EXAMPLE)



WXR DISPLAY LIMITS
AND STATUS AND FAIL MESSAGES
(EXAMPLE)



WXR TEST FAIL DISPLAY
(EXAMPLE)

Weather Radar System-Displays and Self-Test
Figure 501

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TASK 34-43-00-725-319

3. System Test - Weather Radar System

A. General

(1) The system tests are as follows:

(a) The Prepare to do a Weather Radar System Test

(b) Weather Radar Display Test

(c) The Mode test

(d) The Gain Test

(e) The Antenna Tilt Test

B. References

(1) AMM 21-58-00/501, Equipment Cooling

(2) AMM 24-22-00/201, Electrical Power - Control

(3) AMM 34-21-00/501, Inertial Reference System (IRS)

(4) AMM 34-22-00/501 Flight Instrument System (EFIS)

C. Access

(1) Location Zones

101 Control Cabin Left
102 Control Cabin Right
202 Lower Nose Compartment

D. Prepare to do a Weather Radar System test:

NOTE: A test pattern, which appears distorted along a radial line (segmented test pattern) during the first sweep of the weather radar, is normal. An abnormal condition occurs if the above test pattern continues after the second full sweep.

S 585-293

(1) Point the airplane away from all large metal objects and to an open area. The antenna scan can include hills or mountains at different heights in the distance.

S 585-294

(2) Set the warning lights around the front of the airplane in an arc 15 feet from the radome.

S 585-295

(3) Supply electrical power (AMM 24-22-00/201).

S 585-296

(4) Make sure these circuit breakers on the overhead panel, P11, are closed:

(a) 11F2, WX RADAR L

SAS (b) 11F3, TERR DSPL

(c) AIRPLANES WITH DUAL WEATHER RADAR R/T'S;
11F23, WX RADAR RIGHT

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S 585-318

CAUTION: MAKE SURE THE EQUIPMENT COOLING SYSTEM OPERATES BEFORE THE ELECTRONIC SYSTEMS ARE OPERATED. THE EQUIPMENT COOLING SYSTEM MUST BE SET FOR CORRECT COOLING. IF THESE CAUTIONS ARE NOT OBEYED, DAMAGE TO THE ELETRONIC SYSTEMS MAY OCCUR.

(5) Supply equipment cooling (AMM 21-58-00/501).

S 585-298

(6) Make sure the inertial reference system is serviceable (AMM 34-21-00/501).

S 865-387

(7) Make sure the flight instrument system (EFIS) is serviceable (AMM 34-22-00/501).

S 865-361

(8) On the Captains and First Officers Instrument Source Select Panel make sure that these switches are set:
   (a) Set the AIR DATA to "NORM".
   (b) Set the IRS to "NORM".

S 585-300

(9) Prepare the WXR control panel for the test:
   (a) Do the steps that follow:
      1) Set the MODE Control - TEST
      2) Set the SYS L(R) - AS NECESSARY
      3) Set the GAIN Control - AUTO
      4) Set the TILT Control - 0 degrees

S 865-304

(10) Set the controls on the captain's and the first officer's EFIS control panel as follows:
   (a) BRT control - Mid-scale

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(b) RANGE switch - 80
(c) Mode selector switch - EXP VOR
(d) WXR power switch - off

E. Weather Radar Display Test

NOTE: A test pattern, which appears distorted along a radial line (segmented test pattern) during the first sweep of the weather radar, is normal. An abnormal condition occurs if the above test pattern continues after the second full sweep.
Weather Radar Display Test

S 715-305
(1) To complete the display test do the following:

S 865-446

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WARNING: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

SAS (2) Push the WXR/TERR power switch on the captain's and the first
SAS officer's EFIS control panels to the ON position and push the WXR
SAS select switch on P1-1 respective P3-1.

S 865-405
(3) Make sure these indications occur:
(a) Make sure the weather radar test shows on the display as shown:
1) The tilt angle shows on the display and reads 0°.
2) A WXR TEST message shows.
3) The range marks (arcs) have equal space between them.
4) The half range message shows in the center.
(b) If failures occur, these messages will show on the display:

NOTE: For some failures you will not see a test pattern.
1) A WXR FAIL message.

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2) An LRU failure message of RT, ANT, CONT, ATT, OR WEAK.
3) A FAIL or WEAK message.
4) An LRU failure message of T/R, ANT, CTL, or DSP.

(c) Push the WXR switch on the captain's EFIS control panel to the off position.

NOTE: These steps make sure the correct operation of the WXR power switch on the first officer's EFIS control panel.

1) Make sure the weather radar data on the captain's display is removed.
2) Make sure the test pattern stays on the first officer's display.

SAS (d) Push the WXR switch on the captain's EFIS control panel to the
SAS ON position and push respective WXR select switch.

1) Make sure the weather radar data on the captain's display comes back on.

F. Mode Test

NOTE: A test pattern, which appears distorted along a radial line (segmented test pattern) during the first sweep of the weather radar, is normal. An abnormal condition occurs if the above test pattern continues after the second full sweep.

S 845-373

(1) Do the weather radar mode test.

WARNING: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

WARNING: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

(a) Select these modes on the weather radar control panel for the left and right system:

1) Set the MODE Select switch to WX.
   a) Make sure that WX shows on the display.

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2) Set the MODE select switch to MAP
a) Make sure that MAP shows on the display.

G. Gain Test

S 735-309

(1) Do the gain test

NOTE: The full gain test will not be possible when there are no radar targets from weather, mountains or large buildings. When there are no targets only the gain message part of this test will be done.

WARNING: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

WARNING: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

(a) Set the MODE on the WXR control panel to MAP.
(b) Turn the GAIN control mid scale to get a middle level of radar targets.
1) Make sure that VAR shows on the display.
(c) Turn the GAIN control counter-clockwise.
1) Make sure the radar returns display decreases in intensity.
(d) Turn the GAIN control to clockwise.
1) Make sure the radar returns on the display increase in intensity.
(e) Set the GAIN control to CAL (AUTO) position.
1) Make sure the gain mode message shows MAP only on the displays.

H. Antenna Tilt Test

S 735-310

(1) Do the antenna tilt test.

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<u>WARNING</u>: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

<u>WARNING</u>: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

(a) SET the MODE selector switch on the WXR control panel to the WX position.
(b) Set the range switch on each EFIS control panel to move the radar targets to the center of each display.
(c) Turn the TILT control on the WXR control panel to 0 degrees.
  1) Make sure the tilt message on the display show the correct tilt angle ± 0.5 degree.
(d) Turn the antenna TILT control on the WXR control panel in steps from 0 to plus 4.75 degrees.
  1) Make sure the tilt messages on the display shows the correct tilt angle ± 1 degree.
  2) Make sure the close in targets on the display decrease in intensity.
(e) Turn the antenna TILT control on the WXR control panel in steps from plus 5 to 15.00 degrees.
  1) Make sure the tilt messages on the display shows the correct tilt angle ± 2 degree.
(f) Turn the antenna TILT control on the WXR control panel in steps from 0 to minus 4.75 degrees.
  1) Make sure the tilt messages on the displays, show the correct tilt angle ± 1 degree.
  2) Make sure the close in targets on the display increase in intensity.
(g) Turn the antenna TILT control on the WXR control panel in steps from minus 5 to 15.00 degrees.
  1) Make sure the tilt messages on the display show the correct tilt angle ± 2 degree.
(h) Turn the antenna TILT control on the WXR control panel to 0 degrees.

<u>WARNING</u>: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

<u>WARNING</u>: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

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I. Put the Airplane Back to Its Usual Condition

S 865-312

(1) Remove the electrical power if it is not necessary (AMM 24-22-00/201).

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WEATHER RADAR (WXR) TRANSCEIVER - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the WXR transceiver. The second task installs the WXR transceiver.
   B. The left and right WXR transceivers are found immediately aft of the forward bulkhead. You can gain access to them through the forward access door, 113AL (AMM 06-41-00/201).

TASK 34-43-01-004-001

2. Weather Radar Transceiver Removal
   A. References
      (1) AMM 06-41-00/201, Fuselage Access Doors and Panels
      (2) AMM 20-10-01/401, E/E Rack Mounted Components
      (3) AMM 20-41-01/201, Electrostatic Sensitive Devices
      (4) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          113/114 Area Forward of NLG Wheel Well

      (2) Access Panel
          113AL Forward Equipment Center

   C. Procedure

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11F2, WX RADAR LEFT
          (b) 11F23, WX RADAR RIGHT

      S 864-028

      CAUTION: DO NOT MOVE THE WXR TRANSCEIVER BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE WXR TRANSCEIVER.

      (2) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

      S 024-004
      (3) Remove the WXR transceiver (AMM 20-10-01/401).

TASK 34-43-01-404-005

3. Weather Radar Transceiver Installation
   A. References
      (1) AMM 06-41-00/201, Fuselage Access Doors and Panels

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(2) AMM 20-10-01/401, E/E Rack Mounted Components
(3) AMM 20-41-01/201, Electrostatic Sensitive Devices
(4) AMM 24-22-00/201, Electrical Power - Control

B. Access
(1) Location Zones
113/114 Area Forward of NLG Wheel Well

(2) Access Panel
113AL Forward Equipment Center

C. Procedure

S 864-006
(1) Make sure that these circuit breakers on the P11 panel are open:
(a) 11F2, WX RADAR LEFT
(b) 11F23, WX RADAR RIGHT

S 864-029

CAUTION: DO NOT MOVE THE WXR TRANSCEIVER BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE WXR TRANSCEIVER.

(2) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 424-008
(3) Install the WXR transceiver.

S 864-009
(4) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
(a) 11F2, WX RADAR LEFT
(b) 11F23, WX RADAR RIGHT

TASK 34-43-01-584-046

4. WXR Transceiver Test

A. Procedure

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S 864-102

WARNING: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

WARNING: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

(1) Supply electrical power (AMM 24-22-00/201).

S 864-011

(2) Make sure that these circuit breakers on the main power distribution panel, P6, are closed:
   (a) 6D3, IRS L
   (b) 6D4, IRS C
   (c) 6D5, IRS R

S 864-012

(3) Make sure that these circuit breakers on the overhead circuit breaker panel, P11, are closed:
   (a) 11A7, EFIS DSPL SW L
   (b) 11E4, EFIS CONT PNL LEFT
   (c) 11E6, HSI LEFT
   (d) 11F1, IRS LEFT
   (e) 11F8, EFIS SYM GEN L
   (f) 11F21, IRS CENTER
   (g) 11F22, IRS RIGHT
SAS (h) 11F3, TERR DSPL

S 864-013

(4) Set the left, right and center IRS mode selectors in ATT.

   NOTE: Attitude data will not be available for 30 seconds.

S 864-014

(5) On the WXR control panel, set the switches in the positions that follow:
   (a) Do the steps that follow:
      1) If the left transceiver was replaced, set the SYS L/SYS R switch to the SYS L position.
      2) If the right transceiver was replaced, set the SYS L/SYS R switch to the SYS R position.
   (b) MODE in WX position.

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(c) TILT to 0 degrees
(d) Set all other controls as necessary.

S 864-017
(6) On the captain's instrument source select panel, set the EFI switch to NORM.

S 864-018
(7) On the L-EFIS control panel, set the switches in the positions that follow:
(a) RANGE to 160
(b) MODE to MAP
(c) All MAP DATA switches to OFF (out)
SAS (d) WXR/TERR to ON
SAS
SAS S 754-075
SAS (8) On P1-1, do the steps that follow:
SAS (a) Push the WXR select switch.

S 754-021
(9) On the captain's Electronic Horizontal Situation Indicator (EHSI), make sure weather or ground returns show.

S 754-022
(10) On the captain's EHSI, make sure no WXR FAIL message shows.
(a) Adjust the tilt and range as necessary.

B. Put the Airplane Back to Its Usual Condition
SAS
SAS S 844-076
SAS (1) On the EFIS control panel, set the WXR/TERR switch to OFF.

S 864-027
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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WEATHER RADAR (WXR) CONTROL PANEL - REMOVAL/INSTALLATION

1. General
   A. One WXR control panel, M75 is found on panel P8, the pilot's aft electronic control stand. This procedure has two tasks. The first task removes the control panel. The second task installs the control panel.

TASK 34-43-02-004-001

2. Remove the WXR Control Panel
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zone
          211/212 Flight Compartment
   C. Procedure

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11F2, WX RADAR LEFT
          (b) 11F23, WX RADAR RIGHT

      S 034-004
      (2) Loosen the screws which hold the control panel in position.

      S 034-005
      (3) Pull the control panel out.

      S 024-006
      (4) Disconnect the electrical cable and remove the panel.

TASK 34-43-02-404-015

3. Install the WXR Control Panel
   A. References
      (1) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zone
          211/212 Flight Compartment

   C. Procedure

      S 864-007
      (1) Make sure these P11 panel circuit breakers are open:
          (a) 11F2, WX RADAR LEFT
          (b) 11F23, WX RADAR RIGHT

      S 434-008
      (2) Attach the electrical cable to the control panel.

      S 424-009
      (3) Install the control panel and tighten the mounting screws.

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D. WXR Control Panel Test

S 864-010

(1) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
   (a) 11F2, WX RADAR LEFT
   (b) 11F23, WX RADAR RIGHT

S 864-012

(2) Supply electrical power (AMM 24-22-00/201).

S 724-013

(3) Make sure that the weather radar control panel lights come on.

S 864-014

(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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WEATHER RADAR WAVEGUIDE - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. The first task removes the waveguide assembly. The last task installs it. The steps to remove or install the switch (relay) assembly and related equipment are also in this procedure.
   B. It is not necessary to have a dummy load to do a test or to remove the assembly components.

TASK 34-43-04-004-002

2. Remove the Waveguide Assembly (Fig. 401)
   A. Equipment

   B. Consumable Materials
      (1) B00184 Presealing, Cleaning Solvent BMS 11-7
   C. References
      (1) AMM 6-41-00/201, Fuselage Access Door and Panels
      (2) AMM 51-31-01/201, Seals and Sealing
      (3) AMM 53-12-01/201, Nose Radome
      (4) AMM 53-12-02/401, Nose Radome Latch
   D. Access
      (1) Location Zones
         111 Radome
         113/114 Area forward of NLG wheel well
      (2) Access Panel
         113AL Forward Equipment Center
   E. Prepare for Removal

      S 864-192
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11F2, WX RADAR LEFT
         (b) 11F23, WX RADAR RIGHT

      S 864-004
      (2) Go into the forward equipment center through the forward access door, 113AL (AMM 06-41-00/201).

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F. Procedure

S 034-005
(1) In the forward equipment center, disconnect the control lead connector from the switch (relay) assembly.

S 034-009
(2) Remove the screws from the three waveguide connectors at the switch (relay) assembly.

S 034-010
(3) Remove the screws from the switch (relay) assembly and remove the switch.

S 034-011
(4) Remove the screws from the connectors of waveguide sections 1 and 2 at the right and left weather radar transceivers.

S 034-017
(5) Remove the support clamps connected to sections 1 and 2.

S 024-020
(6) Remove sections 1 and 2.

S 034-021
(7) Put protective caps on both of the transceivers' connectors.

S 034-028
(8) Remove the screws from the section 3 waveguide connector behind the bulkhead.

S 024-029
(9) Do the steps that follow to remove section 3.
 (a) Lower and then turn section 3 so that the elbow joint is parallel to the bulkhead.
 (b) Lift section 3 over the switch (relay) mount.

S 864-030
(10) Open the nose radome and lock it in the open position (AMM 53-12-01/201).

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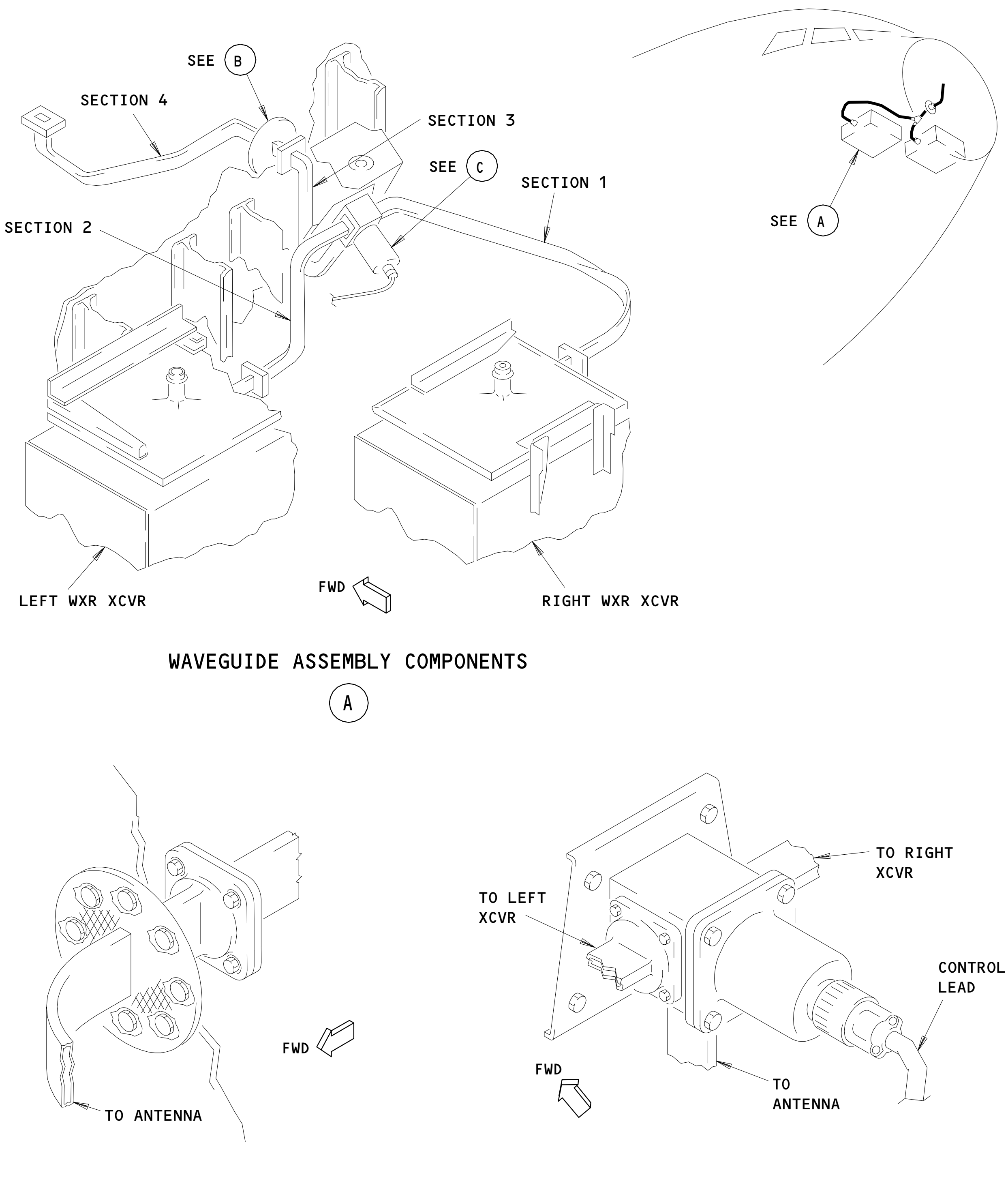

WAVEGUIDE ASSEMBLY COMPONENTS
A

WAVEGUIDE FLANGE
B

WAVEGUIDE SWITCH ASSEMBLY
C

Waveguide Assembly Components Installation
Figure 401

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NOTE: If the water such as raindrop remains on the flat plate, transmitting or receiving radio wave become weak, and the radar performance gets worse. Do not open the radome in rainy condition if possible. If the water remains on the flat plate, wipe off the water completely before the radome is closed.

S 034-032

(11) Remove the screws from the waveguide connector at the base of the weather radar antenna.

S 024-264

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR

(12) Remove the sealant from the waveguide flange bolts and around the flange (AMM 51-31-01/201).

S 034-036

(13) Remove the bolts securing the waveguid flange to the bulkhead.

S 034-037

(14) Use an approved sealant removal tool to pry the flange until the seal is broken.

S 024-038

(15) Remove the waveguide support clamp and the final section of the waveguide from the forward bulkhead.

S 034-039

(16) Put a protective cap on the weather radar antenna connector.

S 024-265

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR

(17) Remove the old sealant from the bulkhead (AMM 51-31-01/201).

S 164-041

(18) Clean the area with solvent and a clean rag so there is no dirt, grease, corrosion, or other unwanted material (AMM 51-31-01/201).

S 034-044

(19) Put a protective cap on the weather radar antenna connector.

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TASK 34-43-04-404-047

3. Install the Waveguide Assembly (Fig. 401)

A. Consumable Materials

(1) A00247 Compound - Sealing - BMS 5-95

B. References

(1) AMM 06-41-00/201, Fuselage Access Door and Panels
(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 51-31-01/201, Seals and Sealing
(4) AMM 53-12-01/201, Nose Radome

C. Access

(1) Location Zones

111 Radome
113/114 Area forward of NLG wheel well

(2) Access Panel

113AL Forward Equipment Center

D. Procedure

S 214-261

(1) The clear plastic window in the antenna waveguide is to keep dirt, moisture, or other contaminents from entering the waveguide. It is not mandatory to replace the clear plastic window if it has been removed, however it is recommended.

S 864-128

(2) Make sure these P11 panel circuit breakers are open:
(a) 11F2, WX RADAR LEFT
(b) 11F23, WX RADAR RIGHT

S 434-048

(3) Remove the protective cap from the weather radar antenna connector.

S 434-052

(4) Replace the "O" rings in the waveguide connectors on section 4.

S 434-055

(5) Apply sealant to the new waveguide flange. (Be careful not to let sealant get in the waveguide cavity (AMM 51-31-01)).

S 424-056

(6) Put the waveguide flange on the bulkhead.

S 424-057

(7) Replace the flange support bolts and tighten them.

S 434-058

(8) Apply the sealant over the flange bolts and around the edge of the flange on the inside and outside of the bulkhead.

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S 424-267

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR

(9) Remove any unwanted sealant from the bulkhead (AMM 51-31-01/201).

S 434-060

(10) Replace the "O" ring in the waveguide connector on the weather radar antenna.

S 424-063

(11) Set the section 4 waveguide connector over the weather radar antenna waveguide connector and replace the screws.

S 424-065

(12) Attach the waveguide to the weather radar antenna.

S 434-068

(13) Replace the "O" ring in the waveguide connectors on section 3.

S 424-069

(14) Move section 3 over the switch (relay) bracket and down along the bulkhead.

S 424-070

(15) When section 3 is as low as possible, turn it so the short side points away from the bulkhead.

S 424-071

(16) Lift section 3 into the correct position.

S 424-072

(17) Attach section 3 to section 4 on the rear of the bulkhead and install the waveguide connector screws.

S 434-073

(18) Put the switch (relay) assembly on the mounting bracket and install the screws.

S 434-074

(19) Replace the "O" rings in the waveguide connectors on the switch (relay) assembly.

S 424-163

(20) Attach the section 3 waveguide connector to the switch (relay) assembly waveguide connector (port 1) with the screws.
    (a) Attach the control leads.

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S 434-077

(21) In the forward equipment center, remove the protective caps from the weather radar transceivers.

S 434-078

(22) Replace the "O" rings in the waveguide connectors on the left and right transceivers.

S 434-079

(23) Replace the "O" rings in the waveguide connectors on section 1.

S 424-080

(24) Attach the section 1 waveguide connector to the right transceiver waveguide connector with the screws.

S 424-162

(25) Attach the second section 1 waveguide connector to the switch (relay) waveguide connector (port 2) with the screws.

S 434-082

(26) Replace the "O" rings in the waveguide connectors on section 2.

S 424-083

(27) Attach the section 2 waveguide connector to the left transceiver waveguide connector with the screws.

S 424-161

(28) Attach the second section 2 waveguide connector to the switch (relay) waveguide connector (port 3) with the screws.

S 424-160

(29) Make sure a cover plate is installed over port 4 of the switch (relay) waveguide connector.

S 434-094

(30) Replace all support clamps in the original positions.

E. Assembly Components Function Test

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S 864-285

WARNING: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

WARNING: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

(1) Supply electrical power (AMM 24-22-00/201).

S 864-097

(2) Remove the DO-NOT-CLOSE tags and close these P11 panel circuit breakers:
- (a) 11F2, WX RADAR LEFT
- (b) 11F23, WX RADAR RIGHT
- SAS (c) 11F3, TERR DSPL

S 754-100

(3) Make sure these main power distribution panel P6 circuit breakers are closed:
- (a) 6D3, IRS L
- (b) 6D4, IRS C
- (c) 6D5, IRS R

S 754-101

(4) Make sure these P11 panel circuit breakers are closed:
- (a) 11A7, EFIS DSPL SW L
- (b) 11E4, EFIS CONT PNL LEFT
- (c) 11E6, HSI LEFT
- (d) 11E25, EFIS CONT PNL RIGHT
- (e) 11E27, HSI RIGHT
- (f) 11F1, IRS LEFT
- (g) 11F8, EFIS SYM GEN L
- (h) 11F9, EFIS SYM GEN C
- (i) 11F21, IRS CENTER
- (j) 11F22, IRS RIGHT
- (k) 11F24, EFIS DSPL SW RIGHT
- (l) 11F29, EFIS SYM GEN RIGHT

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S 864-191

CAUTION: DO NOT OPERATE THE WEATHER RADAR UNLESS THE INERTIAL REFERENCE SYSTEM OPERATES CORRECTLY. THIS IS TO PREVENT DAMAGE TO THE ANTENNA.

(5) Set the left, right, and center IRS MODE SELECTORS to ATT.

NOTE: The attitude data will not be available for 30 seconds.

S 864-103

(6) On the WXR control panel, set the switches in the positions that follow:
- (a) The MODE in the WX position.
- (b) The SYS L/SYS R in the R position
- (c) The TILT to 0 degrees
- (d) Set all other controls as necessary

S 864-105

(7) On the captain's and first officer's instrument source select panel, set the EFI switch to NORM.

S 864-106

(8) On the EFIS control panels, set the switches in the positions that follow:
- (a) The RANGE to 80
- (b) The MODE to MAP
- SAS (c) The WXR/TERR to ON

SAS

SAS S 864-245

SAS (9) On P1-1 and P3-1, do the steps that follow:
- SAS (a) Push the respective WXR select switch.

S 754-109

(10) On the captain's and first officer's EHSI, make sure weather or ground returns show. (Adjust the TILT and RANGE controls as necessary.)

S 864-111

(11) On the WXR control panel, set the SYS L/SYS R switch to the L position.

S 754-118

(12) On the captain's and first officer's EHSI, make sure weather or ground returns show.

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SAS
SAS S 864-246
SAS (13) On the EFIS control panel, set the WXR/TERR switch to off.

S 864-125
(14) Remove power from the IRUs.

F. Put the Airplane Back to Its Usual Condition

S 844-126
(1) Close and lock the nose radome (AMM 53-12-02/401).

S 864-190
(2) Remove electrical power if it is not necessary (AMM 24-22-00).

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WEATHER RADAR ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has five tasks, two removal tasks, two installation tasks, and a test task.
   B. The third task installs the planar array on the antenna drive assembly and the fourth task installs the full antenna on the base assembly (either the drive assembly and planar array together, or the drive assembly seperately).
   C. The fifth task is a test of the antenna after it is installed on the base assembly.
   D. The antenna is found in the nose radome.
   E. It is necessary to remove power from the antenna when the antenna is removed or installed. You do this to prevent movement of the planar array.

TASK 34-43-05-024-001

2. Weather Radar Antenna Removal
   A. References
      (1) AMM 53-12-01/201, Nose Radome
   B. Access
      (1) Location Zone
          111   Radome

   C. Procedure

      S 864-002

      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
          (a) P11 Overhead Circuit Breaker Panel
              1) 11F2, WXR RADAR LEFT
              2) 11F23, WXR RADAR RIGHT

      S 014-054

      CAUTION: DO NOT LET THE WORKSTANDS OR EQUIPMENT HIT OR TOUCH THE ANTENNA. THIS CAN CAUSE DAMAGE TO THE ANTENNA.

      (2) Open the nose radome and lock it in the open position (AMM 53-12-01/201).

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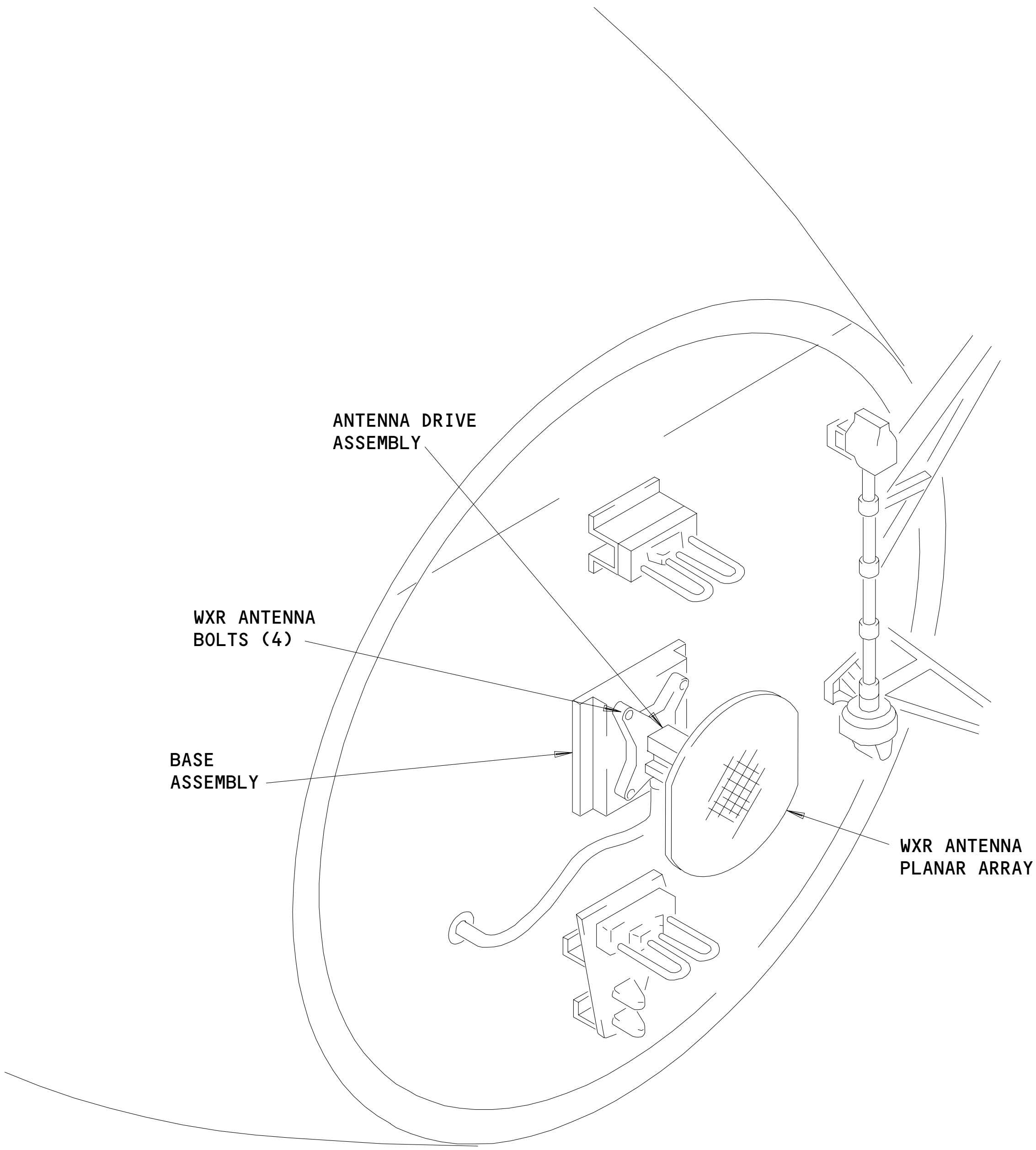

Weather Radar Antenna Installation
Figure 401

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S 024-005

(3) Remove the weather radar antenna:

(a) Remove the electrical cables from the antenna.

(b) Remove the screws and washers from the flanges between waveguide section 1 and the antenna drive assembly.

CAUTION: DO NOT LOOSEN THE BOLTS ON THE CASTING OR THE BASE ASSEMBLY. THESE ARE ALIGNED AT THE FACTORY. IF THE BOLTS ARE ACCIDENTALLY LOOSENED, OR IF THE BASE IS LOOSE OR NOT ALIGNED, SPECIAL ALIGNMENT PROCEDURES MUST BE DONE BY A BOEING SPECIALTY TEAM. CONTACT BOEING SEATTLE A.O.G. OFFICE, TECHNICAL ASSISTANCE TEAM.

(c) Remove the bottom two bolts that hold the antenna to the base assembly.

(d) Loosen the top two bolts that hold the antenna to the base assembly.

WARNING: USE TWO PERSONS AND A SAFELY INSTALLED WORKSTAND TO REMOVE THE ANTENNA. THIS WILL PREVENT INJURY TO YOU OR DAMAGE TO THE ANTENNA.

CAUTION: OBEY THE NO-HANDHOLD PLACARD ON THE DRIVE ASSEMBLY WAVEGUIDE. DAMAGE TO THE ANTENNA WILL OCCUR WHEN THE DRIVE ASSEMBLY WAVEGUIDE IS USED TO HOLD THE ANTENNA.

(e) Lift the antenna up and above the top two bolts that hold the antenna to the base assembly.

S 214-006

(4) Make sure the base assembly is not cracked or damaged (fig. 401).

S 034-007

(5) Put protective dust caps on the electrical connectors and the waveguide flanges.

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TASK 34-43-05-024-009

3. Weather Radar Antenna Planar Array Removal

A. References

(1) AMM 53-12-01/201, Nose Radome

B. Access

(1) Location Zone

111 Radome

C. Procedure

S 014-012

(1) If the antenna drive assembly is installed on the airplane, do the steps that follow:

(a) Open these circuit breakers and attach DO-NOT-CLOSE tags:

1) P11 Overhead Circuit Breaker Panel

a) 11F2, WXR RADAR LEFT

b) 11F23, WXR RADAR RIGHT

CAUTION: DO NOT LET WORKSTANDS OR EQUIPMENT HIT OR TOUCH THE ANTENNA. THIS CAN CAUSE DAMAGE TO THE ANTENNA.

(b) Open the nose radome and lock it in the open position (AMM 53-12-01/201).

NOTE: If the water such as raindrop remains on the flat plate, transmitting and receiving radio wave become weak, and the radar performance gets worse. Do not open the radome in the rainy condition if possible. If the water remains on the flat plate, wipe off the water completely before the radome is closed.

S 024-014

(2) Remove the planar array from the antenna drive assembly (fig. 402):

(a) Remove the four screws and lockwashers that attach the waveguide flanges of the planar array and the drive assembly.

(b) Remove the eight screws and lockwashers that attach the planar array to the ring mount.

WARNING: USE TWO PERSONS AND A SAFELY INSTALLED WORKSTAND. THIS WILL PREVENT INJURY TO YOU OR DAMAGE TO THE PLANAR ARRAY.

(c) Carefully lift the planar array away from the antenna drive assembly.

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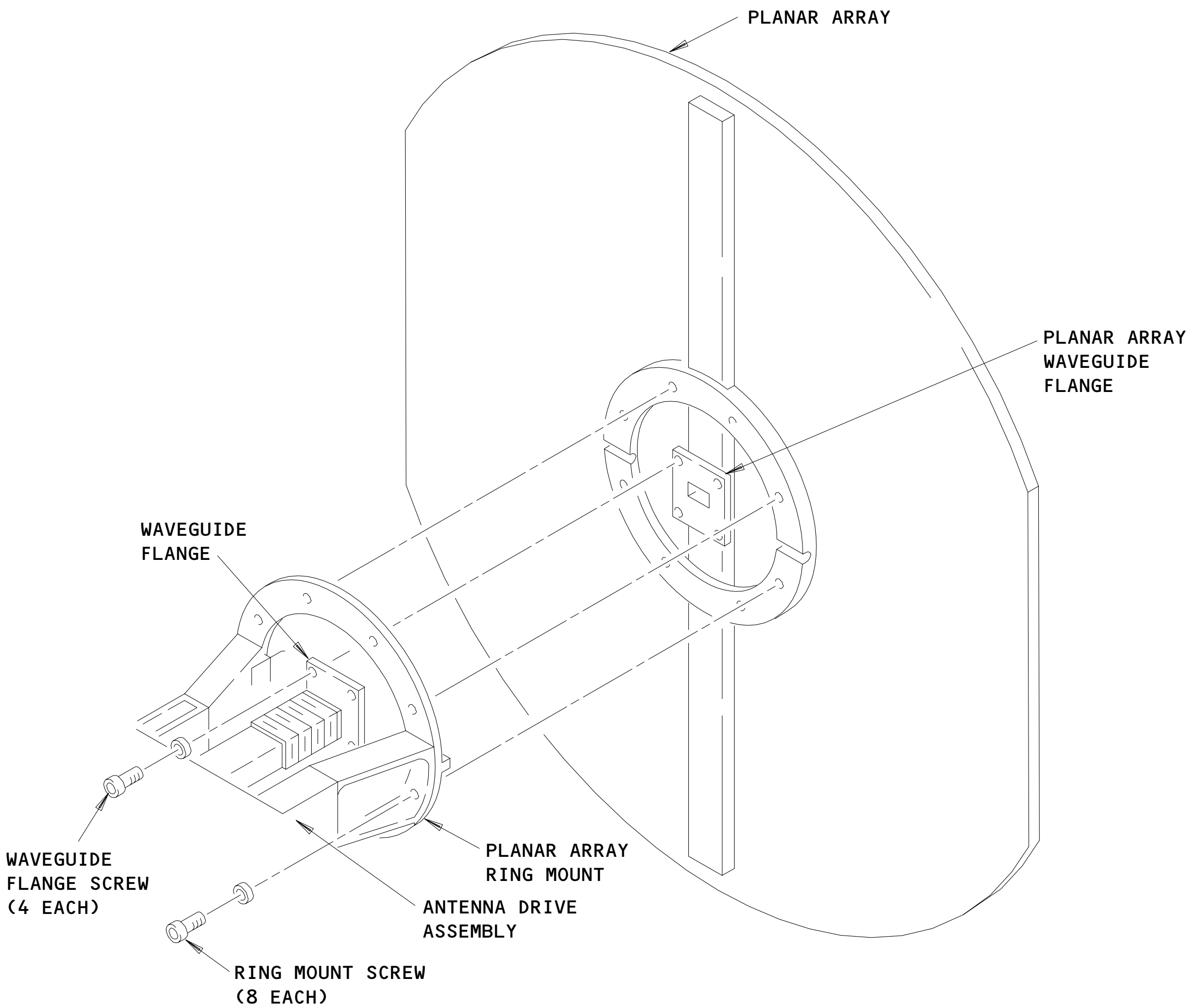
CAUTION: PLANAR ARRAY IS COUNTERBALANCED BY A TORQUE SPRING. RESTRICT ROTOR ASSEMBLY MOVEMENT WHEN REMOVING PLANAR ARRAY FROM ROTOR ASSEMBLY.



NOTE: TIGHTEN SCREWS TO 20-23 INCH-POUNDS.

Weather Radar Antenna Array Installation
Figure 402

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S 034-015
(3) Put dust caps on the waveguide flanges between the antenna drive assembly and the antenna planar array.

S 034-016
(4) If it is necessary to remove the antenna drive assembly after you removed the planar array, do the antenna removal task.

TASK 34-43-05-424-017
4. Weather Radar Planar Array Installation
A. References
(1) AMM 34-43-04/401, Weather Radar Waveguide R/I
AMM 53-12-01/201, Nose Radome
B. Access
(1) Location Zone
111 Radome

C. Procedure

S 414-018
(1) If the antenna drive assembly is installed on the airplane, do the steps that follow:
(a) Make sure these circuit breakers are open:
1) P11 Overhead Circuit Breaker Panel
a) 11F2, WXR RADAR LEFT
b) 11F23, WXR RADAR RIGHT
(b) Open the nose radome and lock it in the open position (AMM 53-12-01/201).

S 434-019
(2) Remove the dust caps from the waveguide flanges on the antenna drive assembly and the antenna planar array.

S 424-020
(3) Install the weather radar planar array (fig. 402):

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WARNING: USE TWO PERSONS AND A SAFELY INSTALLED WORKSTAND. THIS WILL PREVENT INJURY TO YOU OR DAMAGE TO THE PLANAR ARRAY.

CAUTION: MAKE SURE A GOOD GASKET IS INSTALLED BETWEEN THE WAVEGUIDE FLANGES. A DAMAGED GASKET OR NO GASKET WILL POSSIBLY CAUSE ANTENNA DAMAGE.

(a) Carefully set the mounting flange of the planar array on the mounting flange of the antenna drive assembly.

NOTE: Make sure the guide pins on the drive assembly mounting flange engage the holes on the planar array mounting flange. Also, make sure the ring clamp on the elevation zero monitor A5 does not block or touch the planar array.

(b) Install eight screws and lockwashers on the ring mount.
(c) Tighten the screws to between 20 to 23 inch-pounds.
(d) Align the waveguide flange on the drive assembly with the waveguide flange on the planar array.
(e) Carefully install the four screws and lockwashers on the waveguide flange.
(f) Tighten the screws to between 20 to 23 inch-pounds.

S 214-055
(4) Make sure the elevation zero monitor continues to show 0 degrees.

TASK 34-43-05-424-021
5. Weather Radar Antenna Installation
A. Access
(1) Location Zone
111 Radome

B. Procedure

S 864-022
(1) Make sure these circuit breakers are open:
(a) P11 Overhead Circuit Breaker Panel
1) 11F2, WXR RADAR LEFT
2) 11F23, WXR RADAR RIGHT

S 434-023
(2) Remove the dust caps from the electrical connectors and waveguide flanges.

S 424-025
(3) Install the weather radar antenna:

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WARNING: USE TWO PERSONS AND A SAFELY INSTALLED WORKSTAND. THIS WILL PREVENT INJURY TO YOU OR DAMAGE TO THE ANTENNA.

CAUTION: OBEY THE NO-HANDHOLD PLACARD ON THE DRIVE ASSEMBLY WAVEGUIDE. DAMAGE TO THE ANTENNA WILL RESULT WHEN THE DRIVE ASSEMBLY WAVEGUIDE IS USED TO HOLD THE ANTENNA.

(a) Put the antenna on the two top boltheads that hold the antenna to the base assembly.
(b) Lower the antenna until it is on the top bolts.
(c) Put the two bottom bolts through the antenna and the base assembly.
(d) Tighten all four bolts that hold the antenna to the base assembly.
(e) Connect waveguide section 1 to the antenna waveguide flanges with the screws and washers.
(f) Connect the electrical connectors to the antenna.

TASK 34-43-05-714-031

6. Weather Radar Antenna Test

A. References
   (1) AMM 24-22-00/201, Manual Control
   (2) AMM 53-12-01/201, Nose Radome

B. Access
   (1) Location Zone
       211/212 Control Cabin

C. Procedure

S 864-032

(1) Supply electrical power (Ref 24-22-00/201).

S 864-084

WARNING: DO NOT OPERATE THE WEATHER RADAR IN A HANGAR OR WITHIN 50 FEET OF ANY PERSONNEL. THESE CONDITIONS CAN CAUSE INJURY TO PERSONNEL.

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WARNING: DO NOT OPERATE THE WEATHER RADAR WITHIN 50 FEET OF A FUEL SPILL OR OPEN FUEL CELLS. OPERATION OF THE WEATHER RADAR WITHIN THE 50 FT LIMIT CAN CAUSE A FIRE OR EXPLOSION. A FIRE OR EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH TO PERSONS AND CAUSE DAMAGE TO EQUIPMENT.

(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
   (a) P11 Overhead Circuit Breaker Panel
      1) 11F2, WXR RADAR LEFT
      2) 11F23, WXR RADAR RIGHT

SAS 3) 11F3, TERR DSPL

S 864-034
(3) Make sure these circuit breakers are closed:
   (a) P11 Overhead Circuit Breaker Panel
      1) 11A7, EFIS DSPL SW L
      2) 11E4, EFIS CONT PNL LEFT
      3) 11E6, HSI LEFT
      4) 11F8, EFIS SYS GEN L

S 864-035
(4) On the WXR control panel, set the switches in the positions that follow:
   (a) Put the MODE switch in the WX position.
   (b) Put the SYS L/SYS R in the SYS L position.
   (c) Put the TILT switch to the 0 degree position.
   (d) Set all other controls as necessary.

S 864-038
(5) On the captain's instrument source select panel, set the EFI switch to the NORM position.

S 864-039
(6) On the L-EFIS control panel, set the switches in the positions that follow:
   (a) Set the RANGE to 160.
   (b) Put the MODE switch in the MAP position.
   (c) Put all of the MAP DATA switches to the OFF (out) position.
   (d) Push the WXR button to ON.

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S 714-045
(7) On the captain's EHSI, make sure weather or ground targets show.

NOTE: Adjust the TILT and the RANGE controls as necessary.

S 714-046
(8) On the captain's EHSI, make sure the WXR FAIL message does not show.

D. Put the Airplane Back to Its Usual Condition

S 864-047
(1) On the EFIS control panel, set the WXR switch to the OFF position.

S 414-052
(2) Close the nose radome (AMM 53-12-01/201).

S 864-053
(3) Remove the electrical power if it is not necessary (AMM 24-22-00/201).

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WEATHER RADAR ANTENNA MOUNT - MAINTENANCE PRACTICES

1. General
   A. This subject has three tasks:
      (1) Weather Radar Antenna Mount Removal
      (2) Weather Radar Antenna Mount Installation
      (3) Weather Radar Antenna Mount Adjustment.

TASK 34-43-07-002-024

2. Weather Radar Antenna Mount Removal (Fig. 201)
   A. General
      (1) Do not remove the weather radar (WXR) antenna mount unless the approved tools are available to do the antenna mount alignment.
   B. References
      (1) AMM 34-43-05/401, Weather Radar Antenna
      (2) AMM 53-12-01/201, Nose Radome
      (3) AIPC 34-43-03 Fig. 1
   C. Access
      (1) Location Zone
          111 Radome

   D. Procedure

      S 012-034

      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
          (a) On the overhead circuit breaker panel P11:
              1) 11F2, WX RADAR L
              2) 11F23, WX RADAR R

      S 012-003

      (2) Open the nose radome (AMM 53-12-01/201) if it is necessary.

      NOTE: If the water such as rain drop remains on the flat plate, transmitting or receiving radio wave become weak, and the radar performance gets worse. Do not open the radome in the rainy condition if possible. If the water remains on the flat plate, wipe off the water completely before the radome is closed.

      S 012-004

      (3) Remove the WXR antenna (AMM 34-43-05/401).

      S 022-005

      (4) Remove the WXR antenna mount:
          (a) Remove the four pitch adjustment bolts, nuts and washers that hold the WXR antenna mount to the airplane support structure.
          (b) Remove the two pivot bolts, nuts and washers that hold the WXR antenna mount to the airplane support structure.
          (c) Remove the WXR antenna mount from the airplane support structure.

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(d) Keep the bolts, nuts and washers for installation of the WXR antenna mount.

TASK 34-43-07-002-025

3. Weather Radar Antenna Mount Installation (Fig. 201)

A. Reference
   (1) AMM 34-43-05/401, Weather Radar Antenna
   (2) AMM 53-12-01/201, Nose Radome
   (3) AIPC 34-43-03

B. Access
   (1) Location Zone
       111 Radome

C. Procedure

S 012-035

(1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
   (a) On the overhead panel circuit breaker panel P11:
      1) 11F2, WX RADAR L
      2) 11F23, WX RADAR R

S 012-008

(2) Open the nose radome (AMM 53-12-01/201) if it is necessary.

NOTE: If the water such as rain drop remains on the flat plate, transmitting or receiving radio wave become weak, and the radar performance gets worse. Do not open the radome in the rainy condition if possible. If the water remains on the flat plate, wipe off the water completely before the radome is closed.

S 212-013

(3) Examine the mount and support assemblies of the WXR antenna mount for cracks or damage.

S 022-009

(4) Install the WXR antenna mount:
   (a) Make sure that six sets of pitch adjustment and pitch pivot bolts, nuts and washers are available.

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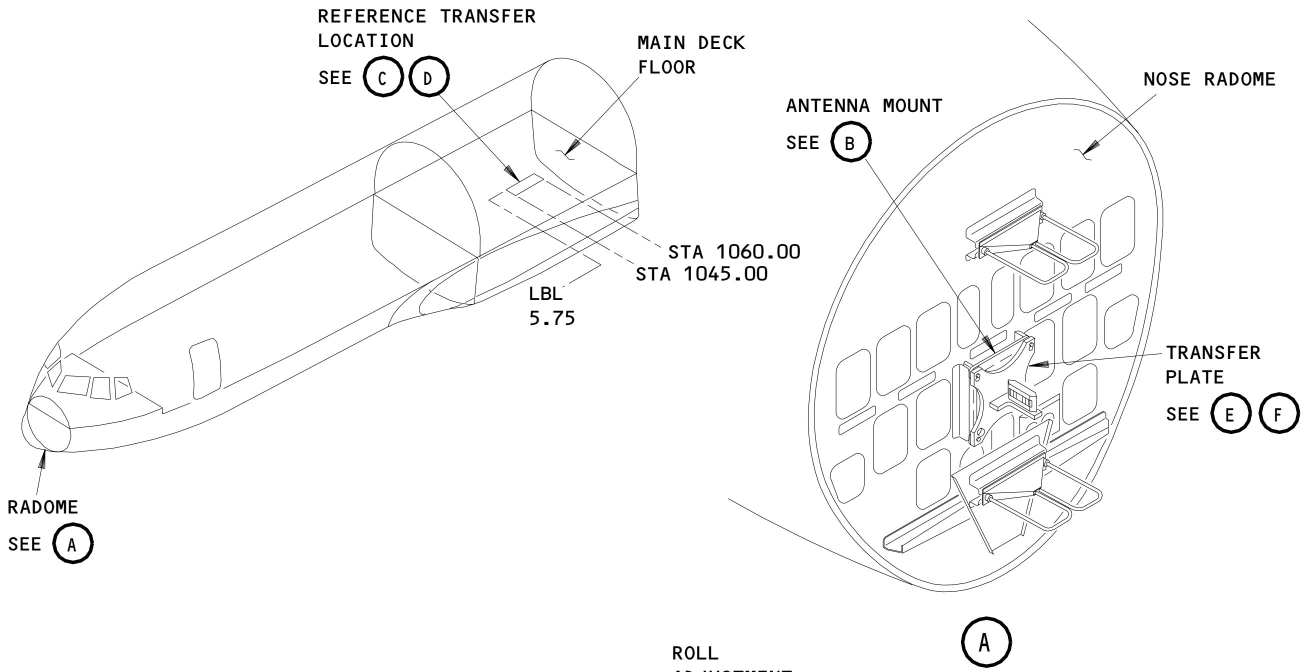

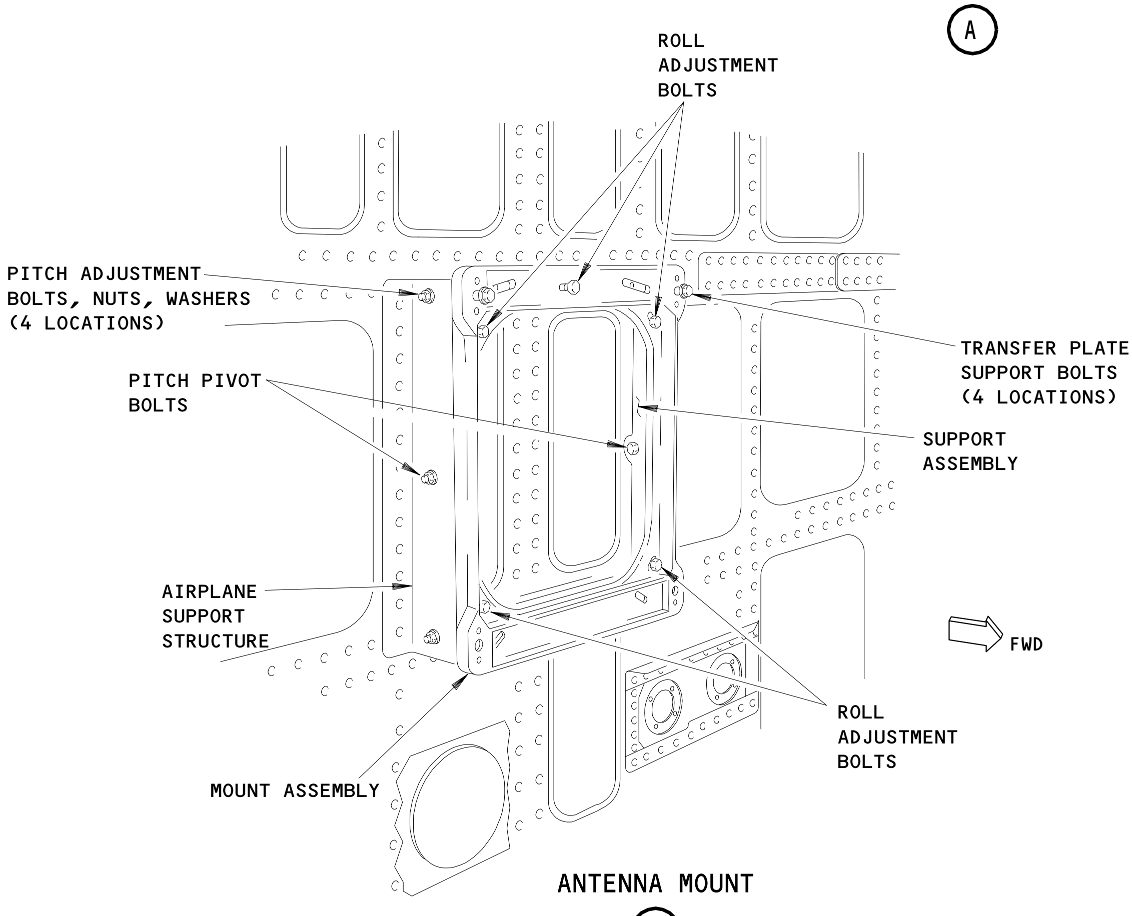

ANTENNA MOUNT
B

Weather Radar Antenna Mount Maintenance Practice
Figure 201 (Sheet 1)

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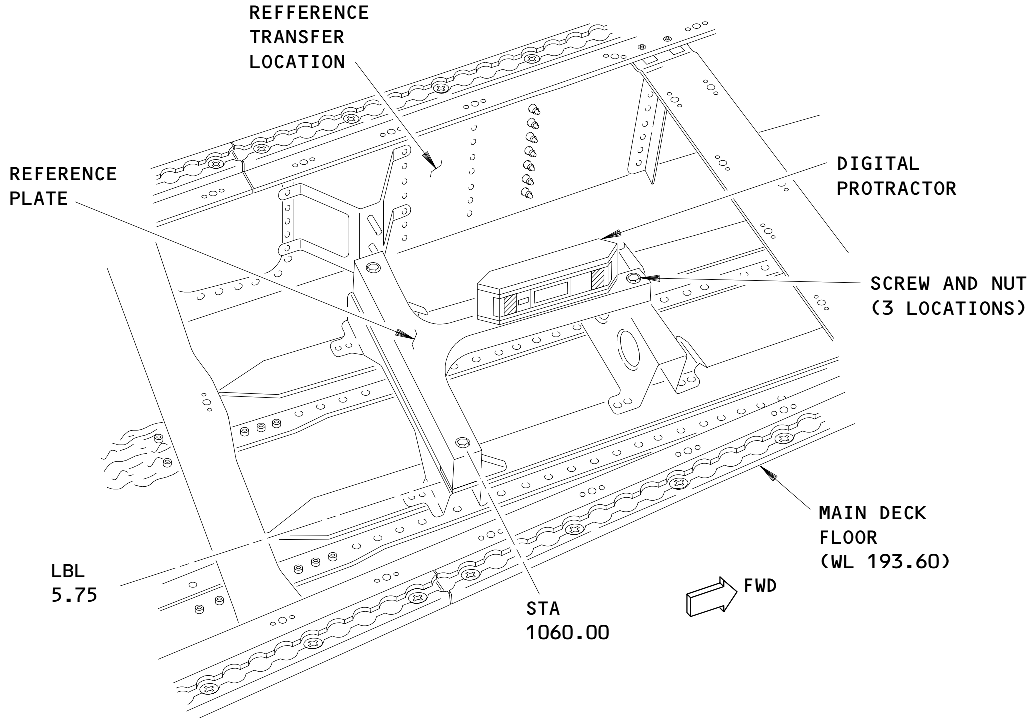
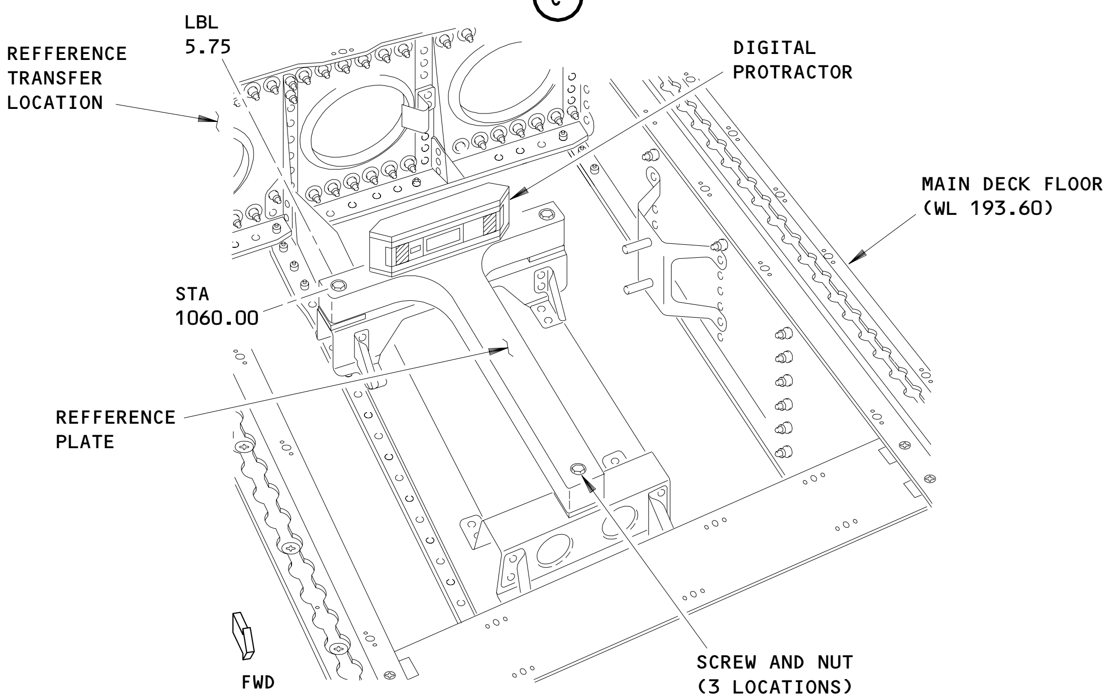


PITCH MEASUREMENT

C



ROLL MEASUREMENT

D

Weather Radar Antenna Mount Maintenance Practice
Figure 201 (Sheet 2)

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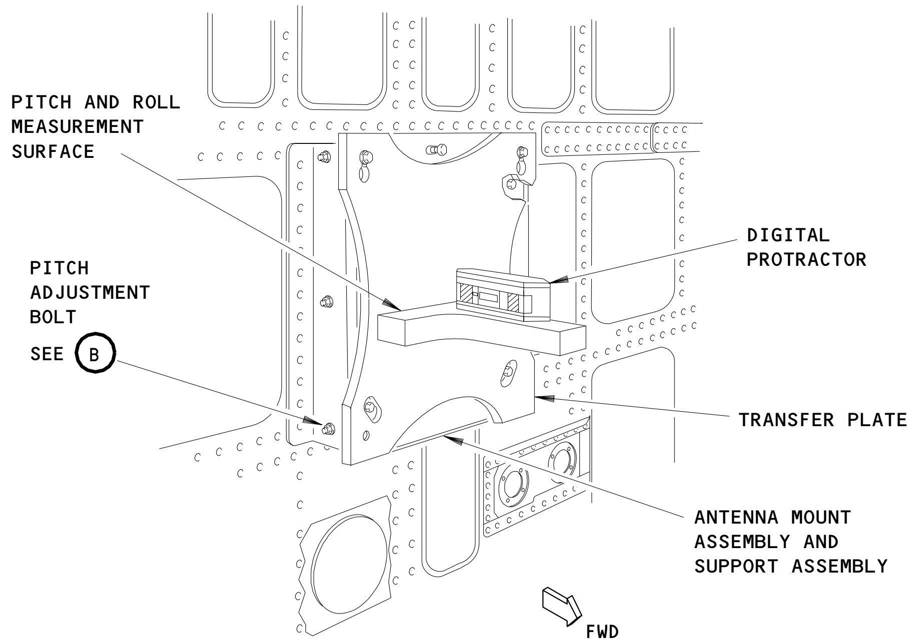
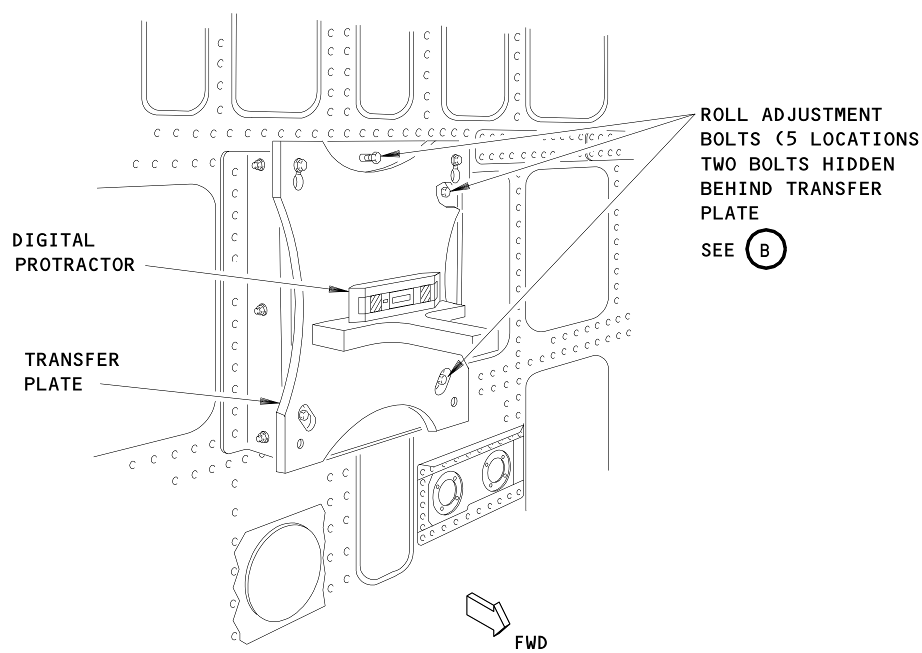


PITCH TRANSFER
E



ROLL TRANSFER
F

Weather Radar Antenna Mount Maintenance Practice
Figure 201 (Sheet 3)

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(b) Make sure the five roll adjustment bolts and washers are correctly installed on the WXR antenna mount.
(c) Install the WXR antenna mount on the airplane support structure.
(d) Install the four pitch adjustment bolts with washers and nuts through the support assembly and the airplane support structure.
(e) Install the two pivot bolts with washers and nuts through the support assembly and airplane support structure.
(f) Lightly tighten the six-pitch bolts.

S 722-010
(5) Do the weather radar antenna mount adjustment task (AMM 34-43-07/201).

S 722-011
(6) Install the WXR antenna (AMM 34-43-05/401).

S 412-012
(7) Close the nose radome (AMM 53-12-01/201).

TASK 34-43-07-002-026
4. Weather Radar Antenna Mount Adjustment (Fig. 201)
A. General
(1) When this adjustment is done, the airplane must be in a position that is as level as possible.
(2) During moderate or high wind conditions the airplane must be put in a hanger so wind gusts do not affect the adjustment.
(3) Keep a minimum number of maintenance persons on the airplane when this adjustment is done.
(4) The digital protractor is used as part of the G34004 adjustment equipment. If a replacement digital protractor is used make sure the resolution, repeatibility and accuracy is the same or better than the specifications listed below.
(a) Resolution: 0.01 degree (0 to 10 degrees)
(b) Accuracy: ± 0.05 degree (0 to 10 degrees)
(c) Repeatability: ± 0.05 degree
B. Equipment
(1) Weather Radar Antenna Mount Adjustment Equipment - G34004-17
(a) KS6005 Digital Protractor (recommended) Kell Strom Pro 3600
(b) DP-60 Digital Protractor (alternative) Lucus Angle Star
(2) Lint-free dry cloth
C. References
(1) AMM 25-25-01/201, Passenger Seat
(2) AMM 53-01-01/401, Floor Panels
(3) AMM 53-12-01/201, Nose Radome

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D. Access

(1) Location Zones

111 Radome

251 Passenger Cabin

E. Procedure

S 012-036

(1) Open these circuit breakers and attach DO-NOT-CLOSE tags:

(a) On the overhead circuit breaker panel P11:

1) 11F2, WX RADAR L

2) 11F23, WX RADAR R

S 012-015

(2) Open the nose radome (AMM 53-12-01/201) if it is necessary.

S 012-016

(3) Remove the passenger seats necessary to get to the reference transfer location as shown in Fig. 201 (AMM 25-25-01/201).

S 012-012

(4) Remove the floor panels necessary to get to the reference transfer location (AMM 53-01-01/401).

S 482-017

(5) Install the reference plate:

NOTE: For the Kell Strom Pro 3600 digital protractor, use in one mode, either the normal or alternate reference (ALT -O-) mode, through the entire adjustment.

The procedure that follows is written in the normal reference mode of operation.

NOTE: For the Lucus Angle Start DP-60 digital protractor, use in one mode, either the normal or alternate reference (ALT REF) mode, through the entire adjustment.

Use the same measure scale through the full adjustment. The procedure that follows is written in the normal mode of operation.

(a) Find the reference transfer location between STA 1045 to 1060 at LBL 5.75.

(b) Make clean the top and bottom surfaces of the reference plate with a lint-free dry cloth.

(c) Make clean the reference transfer points on the pressure deck stiffeners with a lint-free dry cloth.

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(d) Install the G34004 reference plate to the reference transfer points on the pressure deck stiffeners.
(e) Attach the G34004 reference plate to the reference transfer points with three screws and nuts.
(f) Torque the screws from 60 to 80 pound-inches.

S 482-019
(6) Install the G34004 transfer plate on the WXR antenna mount at the nose radome:
(a) Loosen the top left and right roll adjustment bolts on the WXR antenna mount.
(b) Do not loosen the top center or the two bottom roll adjustment bolts.
(c) Install the two top support bolts from the G34004 transfer plate into the two top threaded holes of WXR antenna mount.

NOTE: The support bolts used with the WXR antenna can be used.

(d) Install the G34004 transfer plate on the two top transfer plate support bolts.
(e) Install the two bottom support bolts through the transfer plate into the WXR antenna mount.
(f) Torque the four support bolts for the transfer plate to 160-180 pound-inches.

S 972-018
(7) Measure the airplane pitch and roll at the reference transfer location:

NOTE: Make sure the digital protractor on the reference plate and the transfer plate is turned in the same direction.

Look to see if the digital protractor reads a minus or plus angle or if it reads an up or down directional arrow.

(a) LUCAS ANGLE STAR DP-60;
Push the ALT REF switch on the digital protractor to operate in the normal (gravity reference) mode.

NOTE: Use the digital protractor in one mode, either the normal or alternate reference (ALT REF) mode, through the entire adjustment.

Use the same measure scale through the full adjustment. The procedure that follows is writted in the normal mode of operation.

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(b) Set the ON/OFF switch on the digital protractor to ON.
(c) Set the digital protractor on the reference plate to read pitch (Fig. 201).
(d) KELL STROM PRO 3600;
Make sure the digital protractor has been in position for 5 seconds before reading the display.
(e) Push the ALT REF switch on the digital protractor to operate in the normal (gravity reference) mode.

NOTE: Use the digital protractor in one mode, either the normal or alternate reference (ALT REF) mode through the entire document.

Use the same measure scale through the full adjustment. The procedure that follows is written in the normal mode of operation.

(f) Read and record the plus or minus pitch value on the digital protractor.
(g) Set the digital protractor on the reference plate to read roll (Fig. 201).
(h) KELL STROM PRO 3600;
Make sure the digital protractor has been in position for 5 seconds before reading the display.
(i) Read and record the plus or minus roll value on the digital protractor.
(j) KELL STROM PRO 3600;
Keep the ON/OFF switch on the digital protractor in the ON position.

S 822-020
(8) Adjust the WXR antenna mount to the airplane pitch value:

NOTE: Make sure the digital protractor on the transfer plate is in the same direction as on the reference plate.

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(a) Loosen the six pitch bolts that hold the WXR antenna mount to the radome structure.
(b) Make clean the measure surfaces on the transfer plate with a lint-free dry cloth.
(c) Put the digital protractor on the pitch measure surface of the transfer plate.
(d) KELL STROM PRO 3600;
Make sure the digital protractor has been in position for 5 seconds before reading the display.
(e) Move the WXR antenna mount slowly in pitch until the value is within ± 0.10 degree of the reference plate pitch value.

NOTE: With the Kell Strom Pro 3600, each time the antenna is moved, do not read the protractor diisplay until the protractor has been in position for 5 seconds.

(f) Carefully tighten the two top and two bottom pitch adjustment bolts to a value of 50 to 80 pound-inches.
(g) Do a check of the digital protractor pitch value.
1) The pitch value must be within the reference plate pitch value ± 0.10 degree.
(h) Tighten the two pitch pivot bolts to a value of 50 to 80 pound-inches.

S 822-021
(9) Adjust the WXR antenna mount to the airplane roll value:

NOTE: Make sure the digital protractor on the transfer plate is in the same direction as on the reference plate.

(a) Loosen the two bottom and the top center roll adjustment bolts on the WXR antenna mount.
(b) Make clean the measurement surfaces on the transfer plate with a lint-free dry cloth.
(c) Put the digital protractor on the roll measure surface of the transfer plate.

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(d) KELL STROM PRO 3600;
Make sure the digital protractor has been in position for 5 seconds before reading the display.

(e) Move the WXR antenna mount slowly in roll until the value is within ± 0.10 degree of the reference plate roll value.

NOTE: With the Kell Strom Pro 3600, each time the antenna is moved, do not read the protractor display until the protractor has been in position for 5 seconds.

(f) Carefully tighten the two bottom and top center roll adjustment bolts to a value of 50 to 80 pound-inches.

(g) Do a check of the digital roll value.
1) The roll value must be within the reference plate roll value ± 0.10 degree.

(h) Set the ON/OFF switch on the digital protractor to OFF.

(i) Remove the digital protractor from the transfer plate.

(j) Remove the transfer plate from the WXR antenna mount.
1) Remove the two bottom transfer plate bolts from the WXR antenna mount.
2) Remove the transfer plate from the WXR antenna mount.

(k) Tighten the top left and top right roll adjustment bolts to a value of 50 to 80 pound-inches.

S 082-022

(10) Remove the two top support bolts, which are part of the G34004 transfer plate, from the WXR antenna mount.

S 412-023

(11) If necessary,
Install the two top antenna support bolts into the WXR antenna mount.

S 082-018

(12) Remove test equipment from the airplane:
(a) Remove the two top transfer plate bolts from the antenna mount.

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(b) Put the transfer plate bolts into the holes supplied in the transfer plate.
(c) Remove the reference plate from the reference transfer points at STA 1045 and LBL 5.75.

S 412-019
(13) Install the floor panels removed at STA 1045 and LBL 5.75 (AMM 53-01-01/401).

S 412-020
(14) Install the passenger seats removed at STA 1045 and LBL 5.75 (AMM 25-25-01/201).

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SAS TCAS SYSTEM - DESCRIPTION AND OPERATION

SAS 1. General
SAS A. The basic Traffic Alert nd Collision Avoidance System (TCAS) supplies safe separation between your airplane and other airplanes that have ATCBRS or Mode S Transponders.
SAS B. The TCAS uses this equipment (Fig. 1):
SAS (1) TCAS Computer
SAS (2) Two Directional Antennas
SAS (3) Two Vertical Speed Indicator/Traffic and Resolution Advisory (VSI/TRA) displays.
SAS (4) A Mode S Transponder System that has this equipment:
SAS (a) Two Mode S Transponders
SAS (b) A TCAS/ATC Control Panel
SAS (c) Two Omnidirectional Antennas.
SAS C. The TCAS Computer, Directional Antenna and TCAS display on the VSI/TRA are included in this section. See Chapter 34-53-00 for the Mode S Transponder and control panel description.
SAS 2. Component Details (Fig. 2)
SAS A. TCAS Computer
SAS (1) The TCAS Computer Unit is located in the main equipment center on the E1-3 rack. The TCAS Computer receives its primary power from the 115V ac Left Bus.
SAS (2) The TCAS computer reads and keeps this information about your airplane:
SAS (a) Radio altitude from left or right Radio Altimeter Transceiver
SAS (b) Barometric altitude input from the selected Mode S Transponder
SAS (c) Mode control request and traffic display control inputs from the Mode S transponder
SAS (d) Mode S identification code
SAS (e) Maximum airspeed data from the Mode S Transponder
SAS (f) Input from weight-on-gear (Air-Ground) strut switch
SAS (g) Landing gear lever position
SAS (h) Advisory Delay discrete inputs from the Ground Prox and wind shear system.
SAS (3) The radio altimeter input used with the barometric altitude data sets the TCAS sensitivity. The barometric altitude is used to calculate relative altitude to other aircraft. The mode control data comes from the transponder control panel through the Mode S Transponder.
SAS (4) The Mode S identification code comes from the ATC transponder. The identification code is permanently connected in the airplane with wire straps in the 24 discrete bit strapped inputs to the transponder. The Mode S identification code is used by TCAS computer during collision avoidance routines with intruders.

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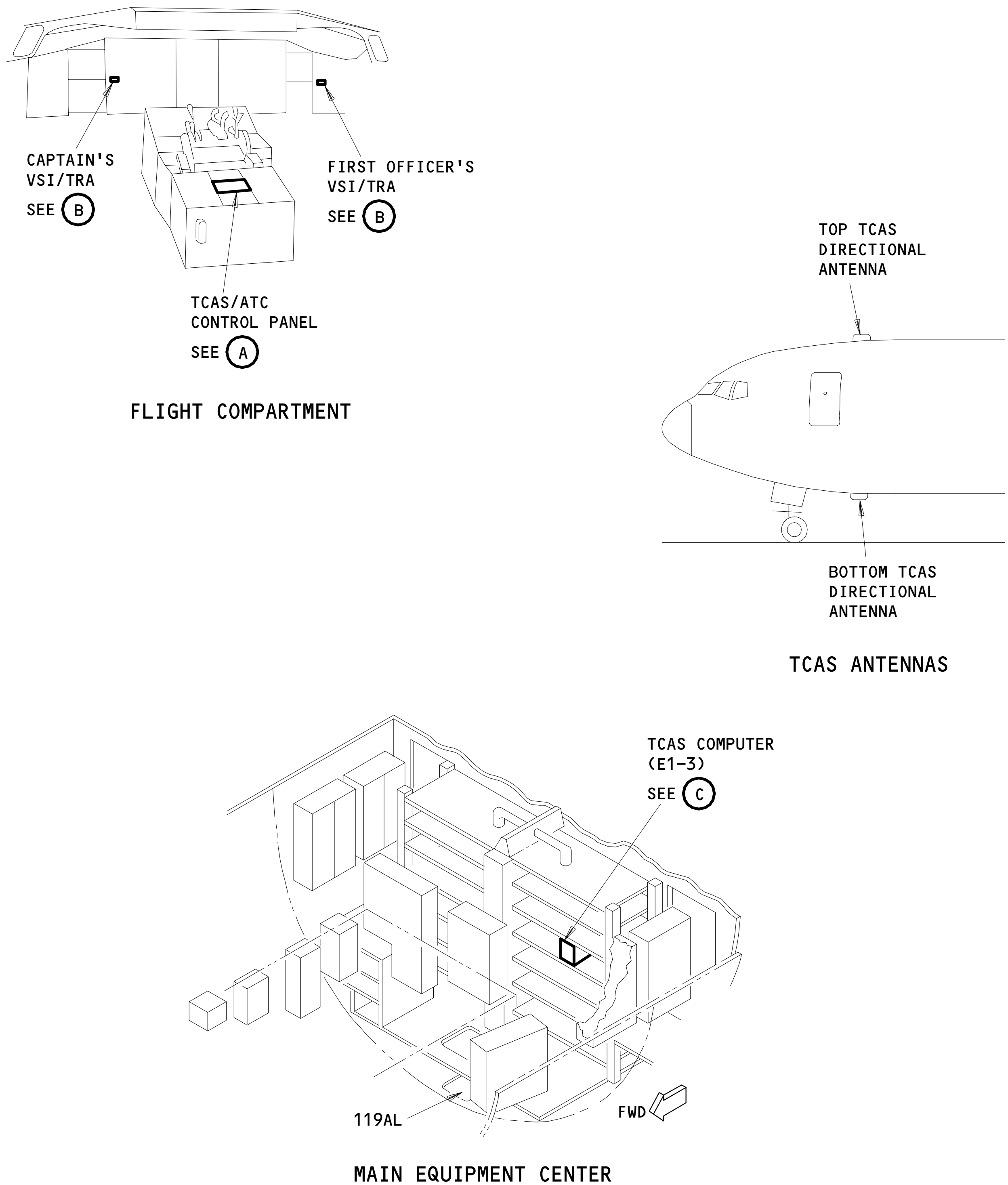

TCAS - Component Location
Figure 1 (Sheet 1)

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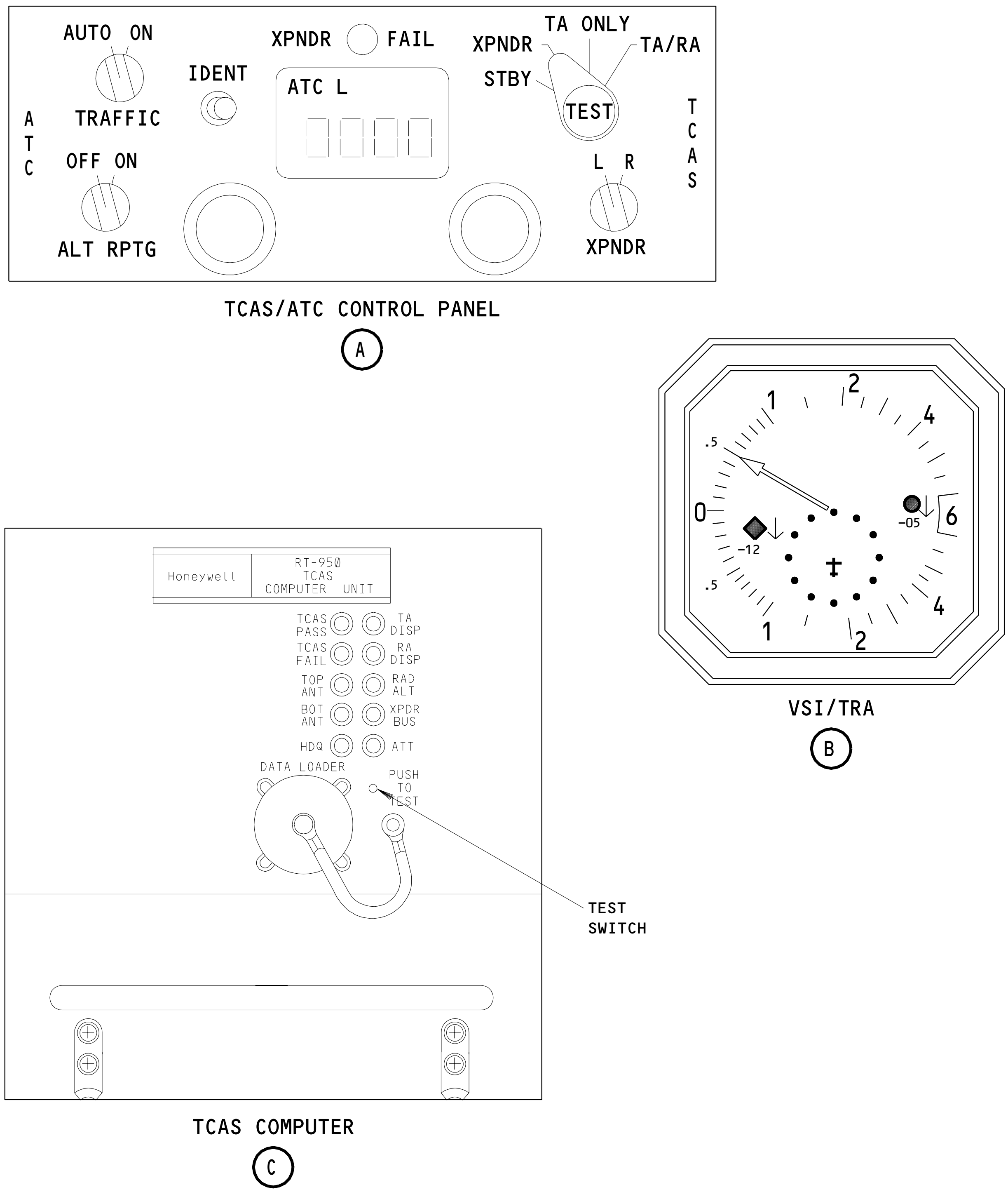

TCAS - Component Location
Figure 1 (Sheet 2)

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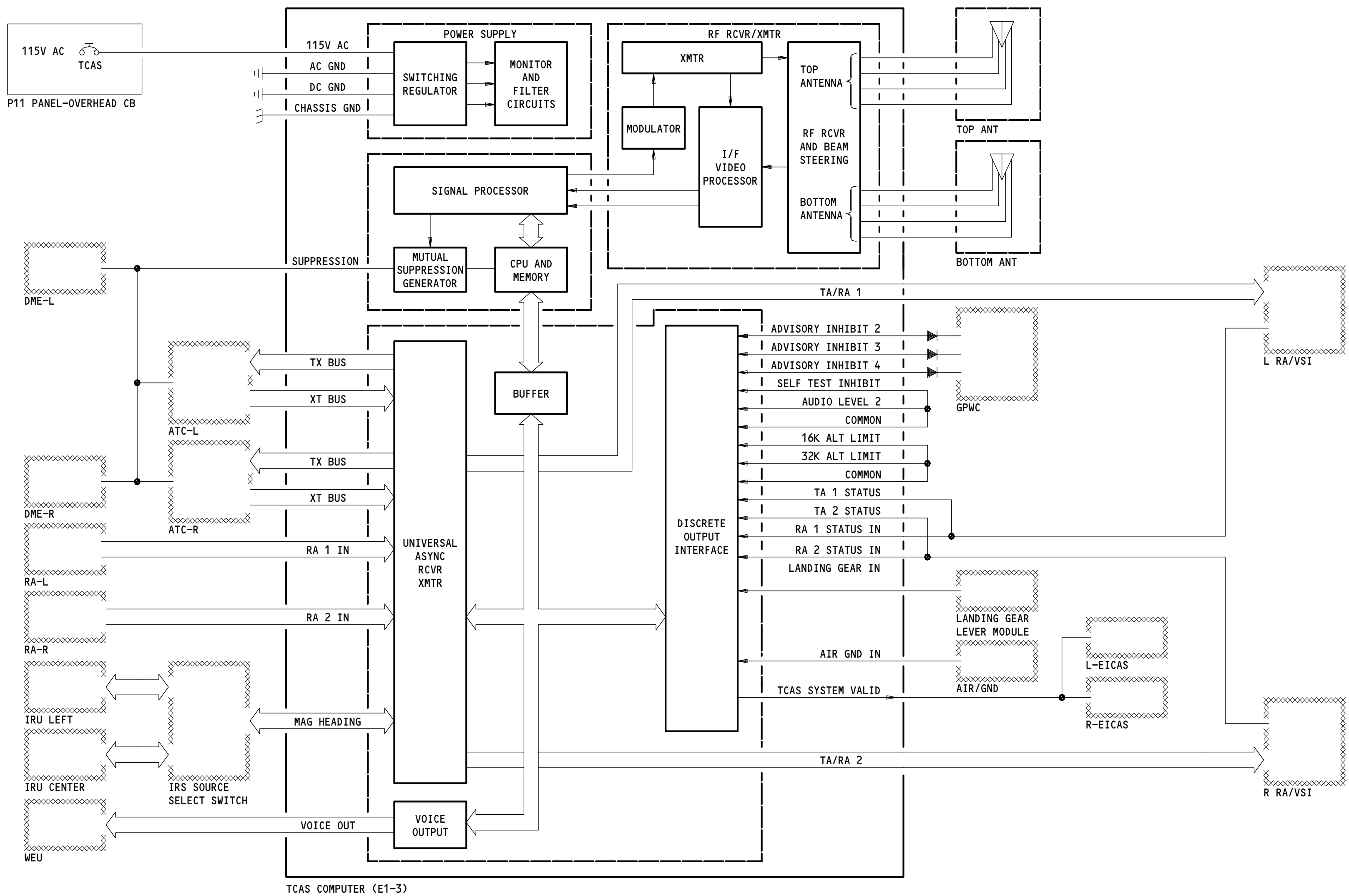

TCAS Schematic
Figure 2

A62289

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SAS (5) The maximum airspeed data is used in RA calculations and to make a
SAS projection of the maximum rate that two airplanes can come together.
SAS The Air/Ground inputs tells the TCAS whether your airplane is
SAS in-flight or on-the-ground.
SAS (6) The landing gear lever input is used to change operation of the
SAS bottom directional antenna to an omnidirectional antenna at gear
SAS down. Lever input is also used for TCAS computer system fault
SAS memory flight count.
SAS (7) The Advisory Delay signals supress RA and TA indications if wind
SAS shear or ground proximity conditions occur.
SAS (8) If a failure is found on any of these system failure inputs, the
SAS TCAS sends failure data to the VSI/TRA and EICAS displays:
SAS (a) Failure inputs from radio altimeters and VSI/TRA displays.
SAS (b) Continuity failure in the TCAS antennas or antenna cables.
SAS (c) Failure data or data leakage on the ARINC 429 data bus from the
SAS Mode S Transponder.
SAS (d) Internal TCAS computer failures and failure of internal power
SAS supplies.
SAS (e) Incorrect data from the radio altimeter.
SAS (f) Failures that occur in the TCAS computer/transponder rf
SAS loop-around test.
SAS (g) If a failure makes the TCAS operate unsatisfactory, the TCAS
SAS computer stops all TCAS operations and shows the applicable
SAS indication on the displays.
SAS (9) The TEST switch on the TCAS Computer front panel initiates a system
SAS self-test and display of system status. The self-test checks top
SAS antenna, bottom antenna, TCAS computer, TA/RA displays, radio
SAS altimeter inputs and transponder interface busses.
SAS (10) System status after test switch activation is displayed by eleven
SAS LED indicators on the TCAS computer front panel.
SAS (11) Recorded fault data from the previous 10 flight legs are stored in
SAS the computer memory.
SAS (12) Software updates can be incorporated into the computer via an ARINC
SAS 603 or 615 data loader port through the connector on the front
SAS panel.
SAS B. VSI/TRA displays
SAS (1) The Vertical Speed Indicator/Traffic and Resolution Advisory
SAS Displays are located on the P1 and P3 panels. The display consists
SAS of a full color active matrix liquid crystal display panel. It is
SAS controlled by a microprocessor receiving 429 high speed data from
SAS the IRU and TCAS computer.
SAS (2) The VSI/TRA can display a maximum of 12 intruder airplanes within
SAS the display range.

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SAS (3) Graphics shown on the VSI/TRA tell the pilot about own aircraft
SAS vertical speed, Proximate Traffic (PT), Traffic Advisory (TA) and
SAS Resolution Advisory (RA) conditions and show TCAS operation modes
SAS and failure conditions.
SAS (4) Display dimming is controlled by a combination of light sensed by an
SAS internal light sensor mounted on the bezel and the instrument panel
SAS lightning control. The display is dimmed by varying the brightness
SAS of the LCD panel backlightning.
SAS C. Control panel
SAS (1) The ATC/TCAS control panel is located on the P8 panel. The TCAS
SAS modes are controlled through the ATC Mode S transponder. See
SAS Chapter 34-53-00 for Mode S transponder control.
SAS D. Antenna
SAS (1) The TCAS uses two directional antennas. One is installed on top and
SAS the other one is installed on the bottom of the airplane. These
SAS antennas transmit to and receive signals from intruder airplanes.
SAS Each antenna is connected to the TCAS computer with four coaxial
SAS cables that have TNC plugs on the antenna end.
SAS (2) The antenna is a four-element, vertically polarized, monopole array
SAS transmitting in four selectable directions. It is capable of
SAS receiving replies from all directions simultaneously with bearing
SAS information.
SAS (3) Each of the four elements of the directional antenna has a resistor
SAS that goes from the antenna element to ground. Each of the four
SAS resistors has a different value. The TCAS computer regulary does a
SAS continuity test on the antenna ports and will see the correct
SAS resistance value if the port is not shorted and not open.
SAS 3. Operation (Fig. 3, 4 and 5)
SAS A. Functional Description
SAS (1) The TCAS is an airborne Traffic Alert and Collision Avoidance System
SAS that does not use ATC ground stations. The system finds intruder
SAS airplanes that have transponders that reply to ATCBRS or Mode S
SAS interrogations. TCAS monitors and make an analysis of possible
SAS threat of other airplanes to your airplane. During threat
SAS situations, the system provides Traffic Advisories (TAs) and
SAS vertical movement Resolution Advisories (RAs) to help the pilot
SAS avoid mid-air collisions.
SAS
SAS NOTE: Only intruder airplanes with altitude data (Mode C or Mode S)
SAS in their transponder replies can cause RAs to occur in the
SAS TCAS. Intruders that do not have Mode C or Mode S
SAS transponders can only cause TAs to occur in the TCAS.
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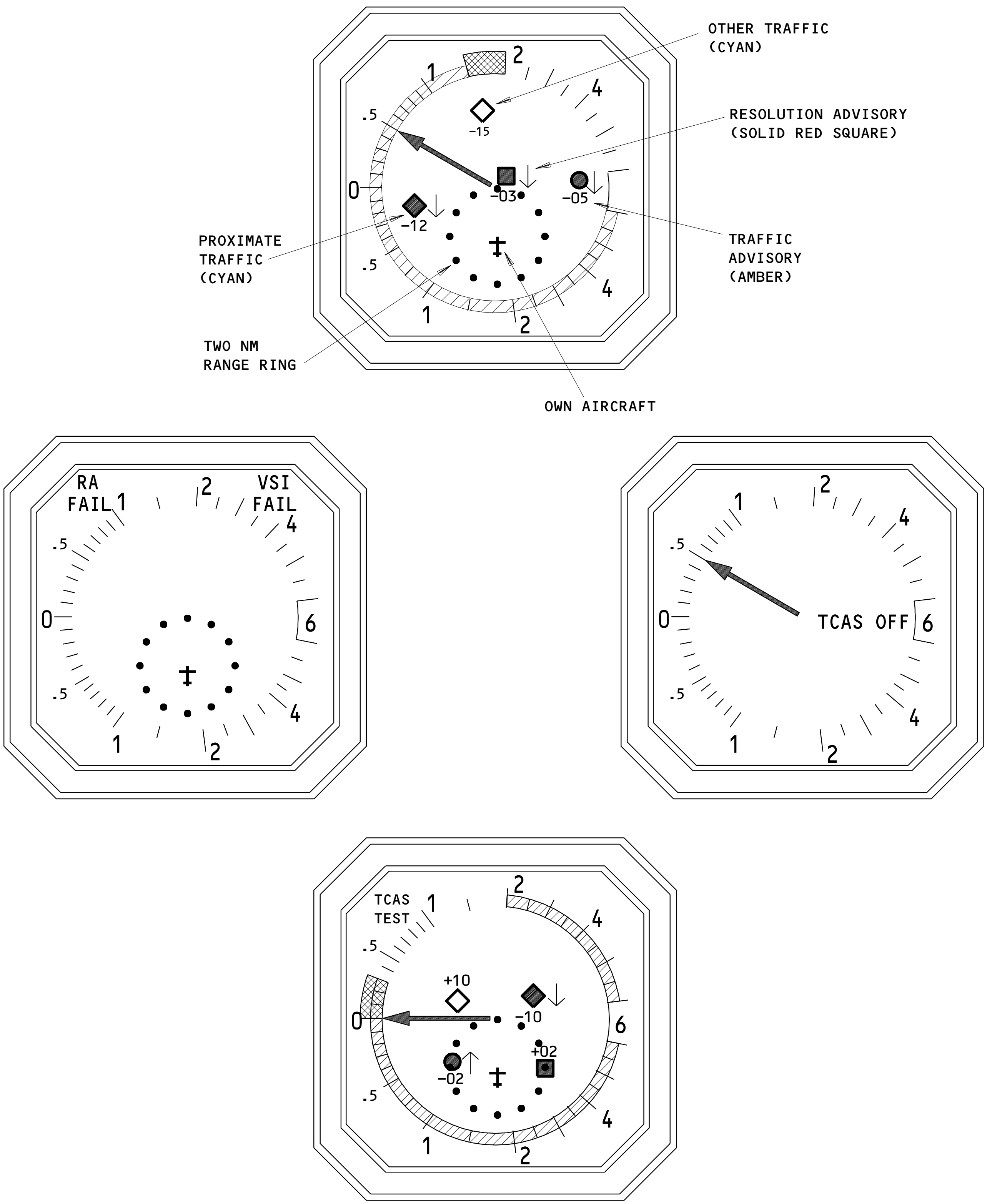

TCAS - VSI/TRA Display (Example)
Figure 3

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CONDITION	AURAL	VSI/TRA ANNUNCIATION				NOTES
		UPPER LEFT	UPPER RIGHT	CENTER	COLOR	
TRAFFIC DISPLAY CONTROL ON MODE	NORMAL					RANGE RING AND OWN AIRCRAFT IN VIEW AT ALL TIMES, ALONG WITH QUALIFYING TRAFFIC.
TRAFFIC DISPLAY CONTROL AUTO MODE	NORMAL					RANGE RING AND OWN AIRCRAFT COME UP WITH TRAFFIC WHEN A TA OR RA EXISTS.
TRANSPONDER ONLY MODE	NONE			TCAS OFF	WHITE	TCAS IS NOT OPERATIONAL.
STANDBY MODE	NONE			TCAS OFF	WHITE	TCAS IS NOT OPERATIONAL, TRANSPONDER IS IN STANDBY.
VERTICAL SPEED INPUT FAILURE TO SINGLE VSI	NORMAL	RA FAIL ON FAILED SIDE	VSI FAIL ON FAILED SIDE		YELLOW	VERTICAL SPEED NEEDLE REMOVED FROM DISPLAY WITH FAILED DATA, NO RAs POSTED ON FAILED SIDE TCAS IS OPERATIONAL ON REMAINING SIDE.
VSI INPUT FAILURE TO BOTH VSI	NONE		VSI FAIL BOTH SIDES	TCAS FAIL BOTH SIDES	YELLOW	VERTICAL SPEED NEEDLE REMOVED FROM BOTH VSIs. NO RA INFORMATION POSTED. TCAS IS NOT OPERATIONAL.
TA ONLY MODE	TRAFFIC-TRAFFIC ONLY	TA ONLY			WHITE (ON GRD) YELLOW (IN AIR)	TRAFFIC ALERTS ARE THE ONLY INFORMATION DISPLAYED. NO RAs.
TRANSPONDER OR ALTITUDE SOURCE FAIL	NONE			TCAS FAIL	YELLOW	TCAS IS NOT OPERATIONAL.
ALTITUDE REPORTING OFF				TCAS OFF	WHITE	TCAS IS NOT OPERATIONAL.
RA FAIL		RA FAIL	VSI FAIL		YELLOW	NO RESOLUTION ADVISORIES DISPLAYED.
TRAFFIC DISPLAY FAILURE				TD FAIL	YELLOW	NO TRAFFIC ADVISORIES DISPLAYED.
SINGLE VSI/TRA FAILURE	NORMAL			X ACROSS FAILED DISPLAY	RED	ON FAILED SIDE - ALL SYMBOLOGY REMOVED AND REPLACED WITH A LARGE RED X, AND HEX-CODED FAILURE NUMBER. TCAS OPERATIONAL ON GOOD SIDE.
DUAL VSI/TRA FAILURE	NONE			X ACROSS BOTH DISPLAYS	RED	ALL SYMBOLOGY REMOVED FROM BOTH DISPLAYS AND REPLACED WITH LARGE RED X, AND FAILURE CODE TCAS IS NOT OPERATIONAL.

TCAS Mode and Failure Annunciations
Figure 4

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CONDITION	AURAL	VSI/TRA ANNUNCIATION				NOTES
		Upper Left	Upper Right	Center	Color	
TCAS SELF-TEST SELF-TEST SHOULD ONLY BE RUN IN STANDBY MODE OR ON THE GROUND.						
TCAS TEST MODE FIRST SECOND	"TCAS TEST"	TCAS TEST			WHITE	TCAS SYSTEM SELF-TEST.
TCAS TEST MODE 2 TO 8 SECONDS		TCAS TEST			WHITE	TCAS TEST PATTERN SHOWN.
TCAS TEST MODE AT 8 SECONDS	"TCAS TEST PASS/ FAIL"	TCAS TEST				TCAS TEST PATTERN REMOVED AND TCAS RETURNS TO NORMAL OPERATION UNLESS TEST SWITCH IS HELD AND AIRCRAFT IS ON THE GROUND AND TCAS IN "STBY".
TCAS EXTENDED SELF-TEST (MAINTENANCE ONLY) "EXTENDED" SELF-TEST PROVIDES MAINTENANCE INFORMATION ON SEVEN "SCREENS" SELECTED VIA 4096 CODE. THIS MODE IS AVAILABLE <u>ONLY</u> ON THE GROUND AND IN STANDBY. EXTENDED SELF-TEST ENDS AUTOMATICALLY WITH TCAS/TRANSPONDER MODE CHANGE OR IF THE AIRCRAFT BECOMES AIRBORNE.						
TCAS EXTENDED TEST MODE (TEST SWITCH HELD AT 7 SECONDS FOR 2 SECONDS AND AIRCRAFT ON THE GROUND ONLY)				SYSTEM INFORMA- TION PAGES	WHITE	CURRENT STATUS OF THE TCAS SYSTEM, TRANSPONDER, ANTENNAS, RADIO ALTIMETERS, BARO ALTITUDE, ECT. IS PRESENTED IN A SERIES OF PAGES CALLED BY SELECTION OF 4096 CODE.

VERTICAL SPEED SCALE		
VSI NEEDLE	RED AREA	GREEN AREA
0 FPM	+2000 TO +6000 fpm AND 0 to -6000	0 TO +300 fpm

TRAFFIC				
TYPE TRAFFIC	BEARING	DISTANCE	RELATIVE ALTITUDE	ALTITUDE RATE
RA	+90 deg	2.0 nmi	+200 ft	NO VERTICAL RATE
TA	-90 deg	2.0 nmi	-300 ft	CLIMBING
PROX	+33.75 deg	3.625 nmi	-1100 ft	DESCENDING
OTHER	-33.75 deg	3.625 nmi	+2000 ft	NO VERTICAL RATE

SELF-TEST INDICATIONS DURING EIGHT-SECOND DISPLAY

TCAS Self-Test
Figure 5

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SAS (2) The VSI/TRA display shows the position of near airplanes that are, or could become, collision threats. This makes it easier for the flight crew to see intruder airplanes before they respond to an RA. The TCAS provides color-coded visual advisory areas behind the Vertical Speed Indicators's scale. These color-coded indications instruct the pilot what vertical speed region is to be avoided (RED). If a change in vertical speed is necessary, the specific region of vertical speed the pilot is to "fly to" is illuminated in green.

SAS (3) The directional antenna lets the TCAS computer transmit interrogations and recieve replies on one of four antenna beams. The TCAS computer electronically points the antenna beam in one of four different directions to find the bearing of intruder airplanes. The antenna does not have to move. The TCAS adjusts the drive level and phase of each of the four antenna elements in the directional antenna to point the beam.

SAS (4) The TCAS finds airplanes that have a Mode S transponder by listening for Mode S squitter transmissions. Mode S transponders transmit squitter data once every second. The TCAS also finds airplanes that have transponders that do not reply to Mode S interrogations but do reply to ATCRBS interrogations. The TCAS must interrogate intruder airplanes that have Mode A and C transponders because they do not transmit squitter data. When an intruder is found, the TCAS monitors the intruder. The TCAS can monitor up to 30 intruders.

SAS (5) The TCAS interrogates intruders continuously to monitor the intruders. When an intruder is interrogated, transponders reply after a fixed delay. The TCAS measures the time between an interrogation and reply to find the range of the intruder. The TCAS can find the relative altitude of the intruder if the intruder has a Mode C or Mode S transponder. The TCAS uses the directional antennas to find the bearing of the intruder.

SAS (6) The TCAS puts intruders into groups as nonthreat, proximity, TA, or RA threats group airplanes. It uses the relative speed and position calculated from the reply data to put the intruder in the correct group. TCAS provides one or more of these data and instructions to the pilot:

SAS (a) TCAS shows an intruder airplane as a symbol on the VSI/TRA display. The symbol position on the display shows the range and bearing of the intruder. The symbol's shape and color tells if the airplane has been grouped as a nonthreat, proximity, TA or RA threat. The intruder's relative altitude is shown adjacent to the symbol if the intruder makes its reply in Mode C or Mode S.

SAS

SAS <u>NOTE</u>: TCAS can only group and show an intruder airplane as a RA threat if the intruder is reporting altitude (Mode C or Mode S).

SAS

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(b) The TCAS supplies a TA voice alert "TRAFFIC TRAFFIC" on the cockpit audio system if the intruder is grouped as a TA.

(c) The TCAS supplies an RA voice alert on the cockpit audio system and a vertical movement RA on the VSI/TRA if the intruder is grouped as an RA.

(d) An airplane with TCAS has a Mode S Air Traffic Control (ATC) transponder and an ATC/TCAS control panel. The Mode S transponder does the Mode S Transponder functions necessary for TCAS and the non-TCAS functions of ATCBRS (Mode A and C) transponders.

(e) When two airplanes with TCAS are threats to each other, the TCAS in each airplane supplies data to the other and they automatically make a decision which resolution advisory occurs in each airplane. The TCAS will not allow the same vertical movement RA to occur in both airplanes. Coordination of mutal intentions with the other aircraft is through the Mode S transponder.

(f) The TCAS operates at the same transmit and recieve frequencies as ground stations (1030 MHz transmit and 1090 MHz receive). The TCAS and ground stations operate at transmit and receive frequencies that are opposite to the transponder transmit and receive frequencies as shown below.

SYSTEM	TRANSMIT FREQ	RECEIVE FREQ
TCAS	1030 MHz	1090 MHz
Ground Station	1030 MHz	1090 MHz
ATC Transponder	1090 MHz	1030 MHz

TCAS transmits 1030 MHz messages from the top and bottom TCAS antennas to interrogate ATC transponders in other airplanes. The TCAS receives 1090 MHz messages from ATC transponders through the same antennas.

(7) The TCAS modes are selected on the ATC/TCAS control panel and sent through the Mode S transponder to the TCAS computer. TCAS will normally receive control data from the left transponder. If left transponder fails, TCAS automatically switches to receive control data from right transponder. The TCAS control operate in the following manner:

(a) STBY, XPNDR, and ATL RPTG OFF modes disables TCAS operation, including interrogations. These ATC system operating modes may be required while operating in airspace where TCAS RF interrogations are not allowed.

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SAS (b) TA ONLY mode provide TA against aircraft which are considered a threat. RA (aural and visual) are inhibited in this mode.
SAS (c) TA/RA provides full TCAS operation.
SAS (d) TRAFFIC ON mode provide display of all traffic within range of display, and ±2700 feet vertically of own aircraft.
SAS (e) TRAFFIC AUTO mode provide "pop up" display of RAs or TAs along with Proximate traffic when an "intruder" is predicted to enter the TCAS aircraft's collision area.
SAS (f) Test mode verifies proper operation of aural advisory, resolution advisory and traffic advisory display.

B. BITE

SAS (1) The TCAS computer continuously runs self-tests and monitors system functions when the microprocessor is not busy with system operations. The TCAS computer can detect any failure that would degrade the normal system operations. The TCAS also monitors the ATC system status. If a failure occurs in the ATC or TCAS systems these indications and system actions will occur in the TCAS:
SAS (a) TCAS FAIL will show on both VSI/TRA displays.
SAS (b) TCAS FAIL level C message will show on EICAS.
SAS (c) Normal TCAS display indications on VSI/TRAs are stopped.
SAS (d) Stops interrogations by your airplane TCAS.
SAS (e) Sends TCAS fail status in the Mode S transmission when interrogations are received from other airplanes.
SAS (f) Fault data is stored in the TCAS computer memory.
SAS (2) There are two ways to start the BITE test manually:
SAS (a) Push the TEST switch on the front panel of the TCAS computer.
SAS (b) Select STBY Mode and Push the test switch on the ATC/TCAS control panel.
SAS (3) If there is a failure detected during manual BITE test it will be shown as follows:
SAS (a) A failure LED indicator will come on on the front panel of the TCAS computer.
SAS (b) The voice TCAS TEST PASS will NOT be heard in flight deck.
SAS (4) The TCAS computer can store fault data up to ten flight legs for later display. Each leg can be called by pressing the "TEST" switch on the TCAS computer front. Repeated presses of this switch will cause display of a flight leg status. Each status display is separated by a lamp test where all lamps are on for a few seconds.
SAS (a) Procedure for Current Status display on TCAS computer.
SAS 1) Push the TEST switch.

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SAS 2) Lamp test is on for four seconds.
SAS 3) Current status is on for 10 seconds.
SAS 4) All lamps go off.
SAS (b) Procedure for Current Status and Past Flight Legs on TCAS computer.
SAS 1) Push the TEST switch.
SAS 2) Lamp test is on for four seconds.
SAS 3) Current status is on for 10 seconds.
SAS 4) Push the TEST switch (before lights go out).
SAS 5) Lamp test is on for two seconds.
SAS 6) Past (just completed) flight's status is on for 10 seconds.
SAS 7) Push the TEST switch (before lamps go out).
SAS 8) Lamp test is on for two seconds.
SAS 9) Past flight 1 status is on for 10 seconds.
SAS 10) Repeat for up to 10 past flight legs.
SAS 11) All lamps flash after last leg is displayed.
SAS (5) The LED indicator on the TCAS computer front indicate status (current or past flight legs) as follows:
SAS (a) TCAS PASS - Minimum required equipment (1 VST/TRA, 1 RAD ALT, 1 baro altitude source, 1 Mode-S transponder, all antennas and the TCAS computer) are operational.
SAS (b) TCAS FAIL - TCAS SYSTEM failure in the flight displayed. When this light is on alone, the TCAS computer was at fault. This light also may come on with failures of other TCAS system units.
SAS (c) TOP ANT FAIL - The Top Antenna DC resistance test indicates failure.
SAS (d) BOT ANT FAIL - The Bottom Antenna DC resistance test indicates failure.
SAS (e) TA DISP - Traffic Advisory display left and right validity discretes indicate fail (Both VSI/TRA failed).
SAS (f) RA DISP - Resolution Advisory display left and right validity discretes indicate fail (Both VSI/TRA failed).
SAS (g) RAD ALT - Radio Altitude Sources left and right indicate invalid or lost.
SAS (h) XPNDR BUS - ARINC 429 digital data from left and right Mode S transponder has been lost or indicate failure warning.

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(i) RA LOG - Not used.
(j) ATT - Not used.
(k) HDG - Not used.

(6) Extended test mode provides maintenance information on the VSI/TRA. This mode is accessed by pushing and holding the test switch on the ATC/TCAS Control Panel for more than 8 seconds. Pages of information can be selected by setting transponder code 0000 to 0007 on the ATC/TCAS Control Panel. Any other (unused) code will display the TCAS TEST MENU on the VSI/TRAs.

NOTE: Extended test mode will only operate with the aircraft on the ground and STBY mode selected.

TCAS TEST MENU	
FUNCTION	CODE
SYSTEM STATUS	0000
DISPLAY STATUS	0001
RAD/ALT STATUS	0002
XPNDR STATUS	0003
PROGRAM PINS	0004
PROGRAM PINS	0005
PROGRAM PINS	0006
HELP REFERENCE	0007

C. Control
(1) Provide electrical power (Ref 24-22-00).
(2) System control is provided by the mode select switch on the TCAS/ATC control panel.
(3) Set the mode select switch to TA/RA for normal TCAS operation (TA ONLY will be announced if Radio Altitude is below 500 feet).
(4) Set the mode select switch to TA ONLY for TA only mode. This mode keeps the TCAS from giving RAs.
(5) Turn the mode select switch to STBY and push TEST switch for one second to start self-test.
(6) Turn the mode select switch to STBY and push TEST switch for more than 8 seconds to start extended test.
(7) Set the mode control switch out of STBY to exit extended test.

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TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
ANTENNA - BOTTOM TCAS, M1707	1	1	BOTTOM OF FUSELAGE	34-45-02
ANTENNA - TOP TCAS, M1706	1	1	TOP OF FUSELAGE	34-45-02
CIRCUIT BREAKER -			FLIGHT COMPARTMENT, P11	
TCAS, C628		1	11F12	*
COMPUTER - (FIM 31-41-00/101)				
EICAS LEFT, M10181				
EICAS RIGHT, M10182				
COMPUTER - (FIM 34-46-00/101)				
GROUND PROXIMITY, M147				
COMPUTER - TCAS, M1705	2	1	119BL, MAIN EQUIP CENTER, E1-3	34-45-01
INDICATOR - (FIM 34-22-00/101)				
LEFT ELECTRONIC HORIZONTAL SITUATION, N5				
LEFT VERTICAL SPEED, N9				
RIGHT ELECTRONIC HORIZONTAL SITUATION, N44				
RIGHT VERTICAL SPEED, N49				
INTERROGATOR - (FIM 34-55-00/101)				
LEFT DME, M123				
RIGHT DME, M124				
MODULE - (FIM 31-51-00/101)				
LEFT SIREN/OWL (AURAL WARNING), M999				
RIGHT SIREN/OWL (AURAL WARNING), M619				
MODULE - (FIM 32-30-00/101)				
LANDING GEAR LEVER, M937				
PANEL - ATC CONTROL, M81	2	1	FLIGHT COMPARTMENT, P8	34-53-02
RELAY (FIM 31-01-36/101)				
SYS NO. 1 AIR/GND, K143				
RELAY (FIM 31-01-37/101)				
SYS NO. 2 AIR/GND, K201				
SWITCH - (FIM 34-12-00/101)				
LEFT ADC, S482				
RIGHT ADC, S483				
SWITCH - (FIM 34-21-00/101)				
IRS SOURCE SELECT, S12				
SYMBOL GENERATOR - (FIM 34-22-00/101)				
CENTER EFIS, M149				
LEFT EFIS, M148				
RIGHT EFIS, M150				
TRANSPONDER - (FIM 34-53-00/101)				
LEFT ATC, M112				
RIGHT ATC, M113				
UNIT - (FIM 31-31-00/101)				
FLT DATA ACQUISITION, M138				

* SEE THE WDM EQUIPMENT LIST

Traffic Alert and Collision Avoidance System (TCAS) - Component Index
Figure 101

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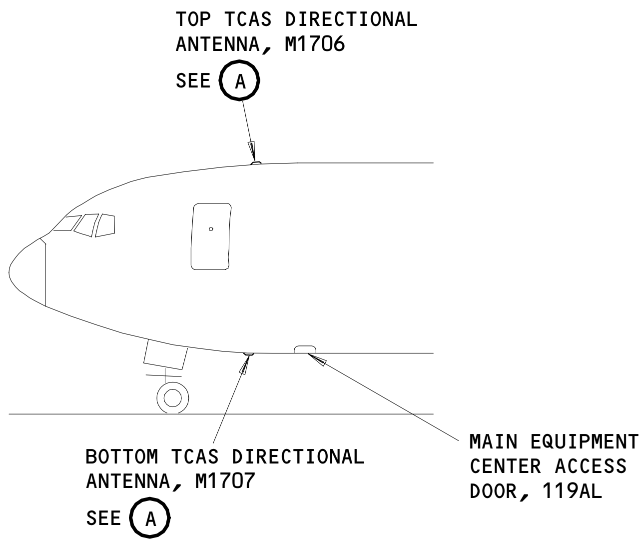

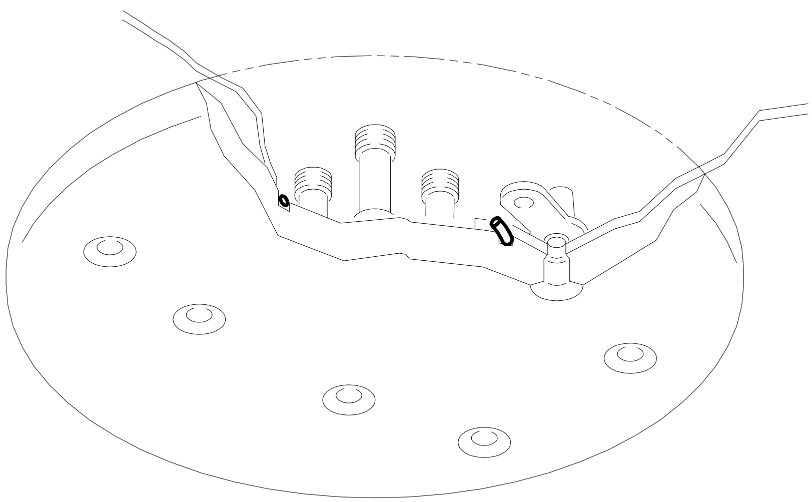

BOTTOM OR TOP TCAS DIRECTIONAL ANTENNA, M1707 OR M1706

A

Traffic Alert and Collision Avoidance System (TCAS) - Component Location
Figure 102 (Sheet 1)

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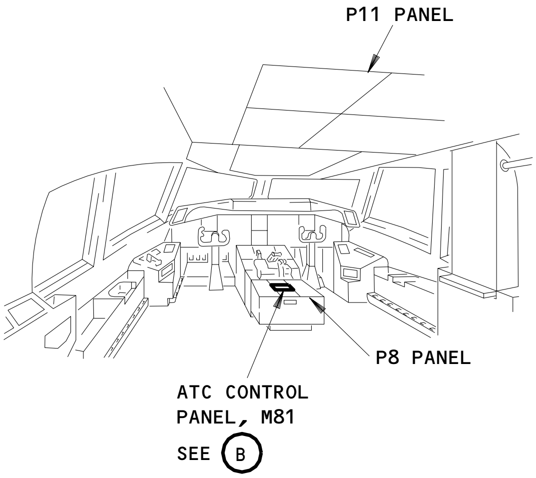
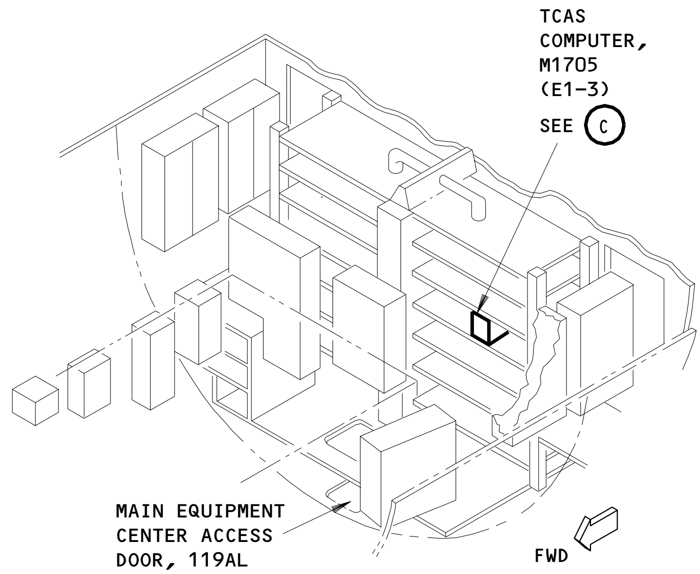
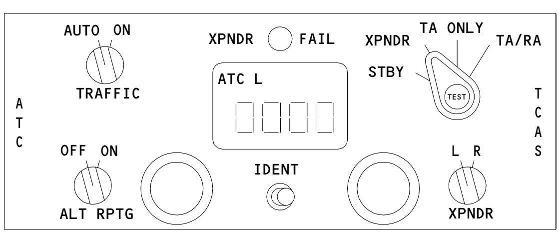


FLIGHT COMPARTMENT

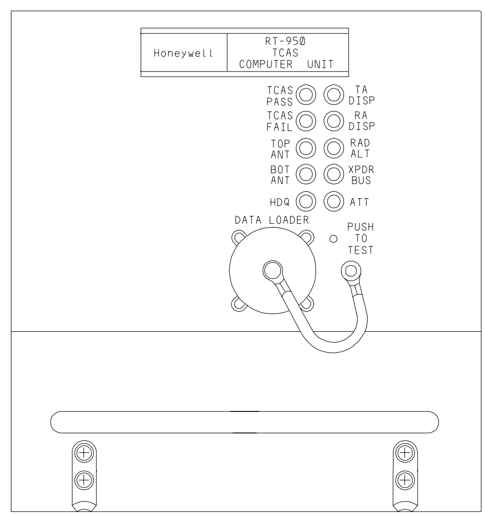


MAIN EQUIPMENT CENTER



TCAS/ATC CONTROL PANEL, M81

B



TCAS COMPUTER, M1705

C

Traffic Alert and Collision Avoidance System (TCAS) - Component Location
Figure 102 (Sheet 2)

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TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) - ADJUSTMENT/TEST

1. General
   A. This procedure has two tasks. One is an operational test and the other is a system test. The operational test is a fast test of the TCAS system. The system test uses the operational test, then does a test of the system functions with additional test equipment.

TASK 34-45-00-715-035

2. Operational Test - TCAS
   A. General
      (1) This test is to make sure the TCAS operates properly. It uses only the system's Built In Test Equipment (BITE) functions and special test or ground equipment is not necessary.
   B. References
      (1) 24-22-00/201, Electrical Power - Control
   C. Procedure

      S 865-003
      (1) Supply electrical power (Ref 24-22-00/201).

      S 865-002
      (2) Make sure these circuit breakers are closed:
         (a) P11, Overhead Circuit Breaker Panel:
            1) 11F12 TCAS
            2) 11F7 L ATC
            3) 11F28 R ATC
            4) 11F11 ATC ANT SW
            5) 11E5 L VSI
            6) 11E26 R VSI

      S 865-001
      (3) Set L XPNDR, ALT RPTG ON and STBY MODE on the ATC/TCAS control panel.
         (a) Make sure the XPNDR FAIL on the control panel is off.
         (b) Make sure TCAS OFF shows on the VSI/TRA.

      S 745-004
      (4) Do the self-test as follows:
         (a) Press and hold the TEST switch on the ATC/TCAS control panel for 1 second.
         (b) Make sure these results occur:
            1) A "TCAS TEST" voice announcement comes on.

      S 215-038
      (5) The VSI/TRA shows the test pattern below (Fig. 501):
         (a) TCAS TEST shows on the upper left of VSI/TRA displays.
         (b) The vertical speed scale shows red area +2000 to +6000 fpm and 0 to -6000.

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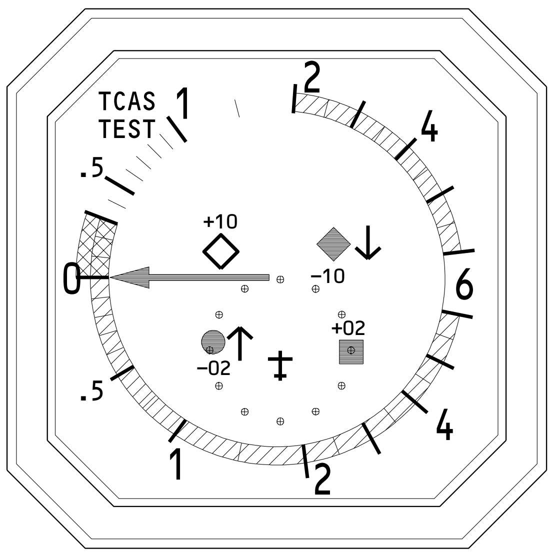

TCAS VSI/TRA Test Display
Figure 501

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(c) The vertical speed scale shows green area from 0 to +300 feet.
(d) An RA (red square) at 3 o'clock, range 2 miles, 200 feet above and flying level.
(e) A TA (yellow circle) at 9 o'clock, range of 2 miles, 200 feet below and climbing.
(f) Proximate Traffic (solid cyan diamond) at 1 o'clock, range 3.6 miles, 1000 feet below and descending.
(g) Non-Threat Traffic (open cyan diamond) at 11 o'clock, range of 3.6 miles, 1000 feet above and flying level.

S 865-039

(6) A "TCAS TEST PASS" voice announcement comes on at the end of the test if the test passes.

S 745-032

(7) Do the self test again with the XPNDR switch in the R position on the control panel.

S 865-033

(8) Remove the electrical power if it is not necessary. (AMM 24-22-00)

TASK 34-45-00-735-036

3. System Test - TCAS

A. General
(1) This test is a complete system test of the TCAS. The system test first runs the TCAS/ATC Operational Test, and then does a test of the TCAS with ground test equipment.

B. References
(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 32-09-02/201, Air/Ground Relays

C. Equipment
(1) TCAS Ramp Test Set - IFR Model TCAS-201 or equivalent
(2) Radio Altimeter Test Set - 9599-607-15902
(3) Pitot/Static Test Set

D. Prepare for the System Test

S 485-005

CAUTION: DO NOT OPERATE THE TEST SET WHEN TEST SET ANTENNA IS WITHIN 15 INCHES OF AIRPLANE ANTENNA. DAMAGE TO THE TEST SET MAY OCCUR.

(1) Use the manufacturers instructions to set up the TCAS-201 tester antenna forward of the airplane at 45 degrees off of the centerline. The tester will send signals to the TCAS top directional antenna.

E. Test the TCAS system

S 865-008

(1) Supply electrical power (AMM 24-22-00/201).

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SAS

S 715-007

(2) Do the TCAS Operational Test. Do not remove electrical power.

S 485-006

(3) Connect the radio altimeter test set to the left and right radio altimeter transceivers.

S 865-037

(4) Set the radio altitude to 2000 feet.

S 485-009

(5) Connect the pitot/static test set to the airplane so that you can pressurize the two Air Data Computers.

S 485-010

(6) Use the pitot/static test to apply an altitude of 10,000 feet.

S 865-042

WARNING: YOU MUST CAREFULLY FOLLOW THE STEPS IN THE REFERENCED TASK TO PREPARE THE SAFETY SENSITIVE SYSTEMS FOR THE AIR MODE. FAILURE TO FOLLOW THE STEPS CORRECTLY CAN CAUSE THE AUTOMATIC OPERATION OF THE AIRPLANE SYSTEMS. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

(7) Do the Prepare Safety-Sensitive Systems for Air Mode Simulation task (Ref 32-09-02/201).

S 915-040

CAUTION: THE ATC TRANSPONDER WILL DURING THE FOLLOWING PROCEDURE REPORT AN ALTITUDE OF 10,000 FEET. THIS MIGHT BE PICKED UP BY OTHER TCAS EQUIPPED AIRCRAFT. DO NOT CHANGE THE PITOT/STATIC ALTITUDE DURING TEST.

(8) Tell the Control Tower that your transponder will reply 10,000 during test.

S 865-011

(9) Set aircraft to "Air mode" by pulling circuit breaker U15 AIR/GND SYSTEM 1 and U24 AIR/GND SYSTEM 2.

S 865-012

(10) Set L XPNDR, ALT RPTG ON and STBY MODE on the ATC/TCAS control panel.

S 865-013

(11) Push the TEST switch on the control panel, and hold it for at least three seconds then release it. A TCAS self-test should not occur.

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SAS
SAS S 865-014
SAS (12) Set TA/RA on the control panel.
SAS
SAS S 865-015
SAS (13) Push the POWER switch to supply power to the TCAS-201 tester.
SAS
SAS S 865-016
SAS (14) Push the SCEN key to display scenario menu.
SAS
SAS S 865-017
SAS (15) Set up this scenario:
SAS (a) INTRUDER TYPE: Mode C
SAS (b) RANGE: 14.0 nm RATE: +280 kt
SAS (c) ALTITUDE: 10,000 FT RATE: 0 fpm
SAS
SAS S 865-018
SAS (16) Push the RUN/STOP key to start the scenario, and watch for this
SAS sequence on the VSI/TRA:
SAS (a) The intruder moves down at a 45-degree bearing to the airplane
SAS symbol.
SAS (b) The intruder has the correct relative altitude.
SAS (c) The intruder begins as a Proximate Traffic (solid cyan
SAS diamond).
SAS (d) The intruder changes to a Traffic Advisory (solid amber
SAS circle).
SAS (e) The intruder changes to a Resolution Advisory (solid red
SAS square), and gives a "climb climb climb" voice announcement on
SAS the flight compartment speakers.
SAS (f) Shortly before the intruder reaches the closest point of
SAS approach, the TCAS gives an increase climb voice announcement.
SAS
SAS S 865-019
SAS (17) Set XPNDR R on the ATC/TCAS control panel.
SAS
SAS S 285-020
SAS (18) Make sure the flap setting is at a non take-off position.
SAS
SAS S 285-021
SAS (19) Make sure the airplane altitude is 10,000 ft.
SAS
SAS S 865-022
SAS (20) On the TCAS-201 tester, push the SCEN key to display the scenario
SAS menu.

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S 865-023
(21) Set up this scenario:
(a) INTRUDER TYPE Mode C
(b) RANGE: 8.0 nm RATE: +280 KT
(c) ALTITUDE: 10,000 FT RATE: 0 fpm

S 865-024
(22) Push the RUN/STOP key to start the scenario, and watch for this sequence on the VSI/TRA:
(a) The intruder moves down at a 45-degree bearing to the airplane symbol.
(b) The intruder has the correct relative altitude.
(c) The intruder begins as a Proximate Traffic (solid cyan diamond).
(d) The intruder changes to a Traffic Advisory (solid amber circle).
(e) The intruder changes to a Resolution Advisory (solid red square), and gives a "climb climb climb" voice announcement on the flight compartment speaker.

S 865-025
(23) During the Resolution Advisory, rapidly decrease the radio altimeter input to induce a GPWS warning.
(a) The GPWS voice announcement warning should override the TCAS voice announcement.

S 865-026
(24) Set the radio altitude to 1200 feet.

S 865-027
(25) Set the pitot static air speed to 200 knots.

S 865-028
(26) Push the SCEN key on the TCAS-201 tester and set up this scenario:
(a) RANGE: 8.0 nm RATE +280 knots
(b) ALTITUDE 9900 ft RATE 0 fpm

S 865-034
(27) Push the RUN/STOP key to start the scenario, and watch for this sequence on the VSI/TRA:

S 215-041
(28) The intruder moves down at a 45-degree bearing to the airplane symbol.
(a) The intruder has the correct relative altitude.
(b) The intruder begins as a Proximate Traffic (solid cyan diamond).

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SAS (c) The intruder changes to a Traffic Advisory (solid amber
SAS circle).
SAS (d) The intruder changes to a Resolution Advisory (solid red
SAS square), and gives a "climb climb climb" voice announcement on
SAS the flight compartment speaker.
SAS
SAS S 865-029
SAS (29) Quickly lower the pitot static input from 200 knots to 150 knots
SAS airspeed to induce a WINDSHEAR warning.
SAS (a) The WINDSHEAR warning should override the TCAS aural warning.
SAS
SAS S 085-030
SAS (30) Remove the test equipment.
SAS
SAS S 865-031
SAS (31) Remove the electrical power if it is not necessary
SAS (AMM 24-22-00/201).

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SAS TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)
SAS COMPUTER - REMOVAL/INSTALLATION
SAS
SAS 1. General
SAS A. This procedure has two tasks. One is the removal of the TCAS computer,
SAS the other is the installation of the TCAS computer.
SAS B. The M1705, TCAS computer is installed on the E1 rack in the main
SAS equipment center (Fig. 401).
SAS
SAS TASK 34-45-01-004-006
SAS 2. TCAS Computer Removal
SAS A. References
SAS (1) 20-10-01/401, E/E Rack-Mounted Components
SAS B. Access
SAS (1) Location Zone
SAS 119/120 Main Equipment Center
SAS
SAS (2) Access Panel
SAS 119AL Main Equipment Center Access Door
SAS
SAS C. Procedure
SAS
SAS S 864-001
SAS (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
SAS (a) P11, Overhead Circuit Breaker Panel:
SAS 1) 11F12, TCAS
SAS
SAS S 024-007
SAS (2) Remove the TCAS computer (Ref 20-10-01/401).
SAS
SAS TASK 34-45-01-404-008
SAS 3. TCAS Computer Installation
SAS A. References
SAS (1) 20-10-01/401, E/E Rack-Mounted Components
SAS (2) 24-22-00/201, Electrical Power - Control
SAS (3) 34-45-00/501, TCAS
SAS B. Access
SAS (1) Location Zone
SAS 119/120 Main Equipment Center

SAS (2) Access Panel
SAS 119AL Main Equipment Center Access Door
SAS

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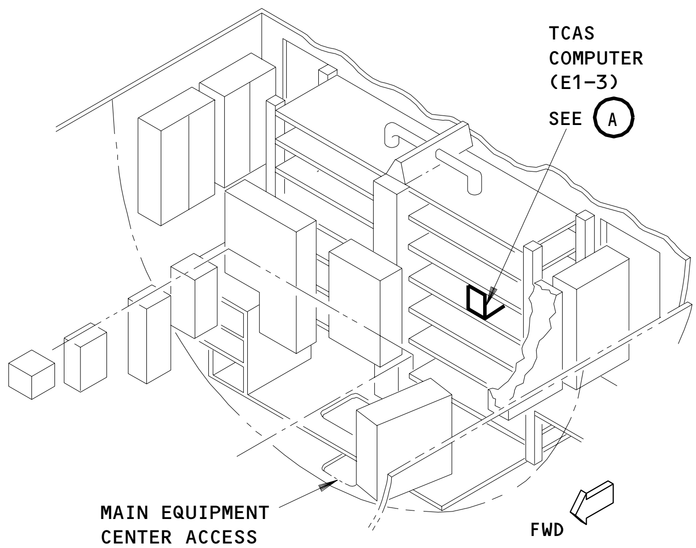
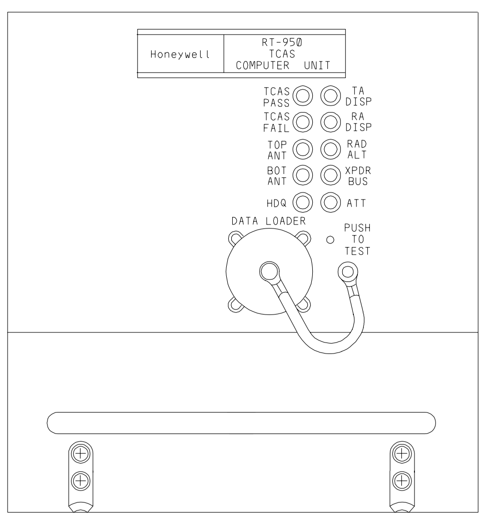


MAIN EQUIPMENT CENTER



TCAS COMPUTER

A

TCAS - Component Location
Figure 401

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SAS C. Procedure

SAS S 864-002

SAS (1) Make sure these circuit breaker are open:

SAS (a) P11, Overhead Circuit Breaker Panel:

SAS 1) 11F12, TCAS

SAS S 424-003

SAS (2) Install the TCAS Computer (Ref 20-10-01/401).

SAS D. TCAS Computer Test

SAS S 864-004

SAS (1) Remove the DO-NOT-CLOSE tags and close these circuit breakers:

SAS (a) P11, Overhead Circuit Breaker Panel:

SAS 1) 11F12, TCAS

SAS S 864-007

SAS (2) Supply electrical power (Ref 24-22-00/201).

SAS S 714-005

SAS (3) Do the TCAS Operational test.

SAS (a) Select ALT RPTG ON and STBY mode on the ATC/TCAS control panel.

SAS (b) Push the TEST switch on the ATC/TCAS control panel and hold it for one second.

SAS (c) Make sure you hear "TCAS TEST PASS" on the flight compartment speaker.

SAS E. Put the Airplane Back to Its Usual Condition

SAS S 864-006

SAS (1) Remove the electrical power if it is not necessary (Ref 24-22-00/201).

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TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)
DIRECTIONAL ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the TCAS directional antenna; the other is the installation of the TCAS directional antenna.
   B. One TCAS directional antenna is installed on top of the airplane. Another TCAS directional antenna is installed on the bottom of the airplane (Fig. 401).

TASK 34-45-02-004-025

2. TCAS Directional Antenna Removal
   A. Equipment
      (1) Sealant removal tool - hardwood or plastic
   B. Consumable Materials
      (1) B00184 Solvent - BMS 11-7
   C. References
      (1) AMM 20-10-22/701, Metal Surfaces
   D. Access
      (1) Location Zones

119/120	Main Equipment Center (Exterior)
223/224	Area Above Passenger Cabin Ceiling (Exterior)

   E. Procedure

S 864-018

      (1) Open this circuit breaker and attach a DO-NOT-CLOSE tag:
         (a) P11, Overhead Circuit Breaker Panel:
            1) 11F12, TCAS

S 034-019

      (2) Remove the screws from the antenna base.

S 034-031

CAUTION: BE CAREFUL WHEN YOU USE FORCE WITH THE SEALANT REMOVAL TOOL TO BREAK THE ANTENNA SEAL. TOO MUCH FORCE CAN DAMAGE THE AIRPLANE SKIN OR THE ELECTRICAL CABLE AT THE ANTENNA BASE.

      (3) Use force around the antenna with the sealant removal tool until the seal is fully broken.

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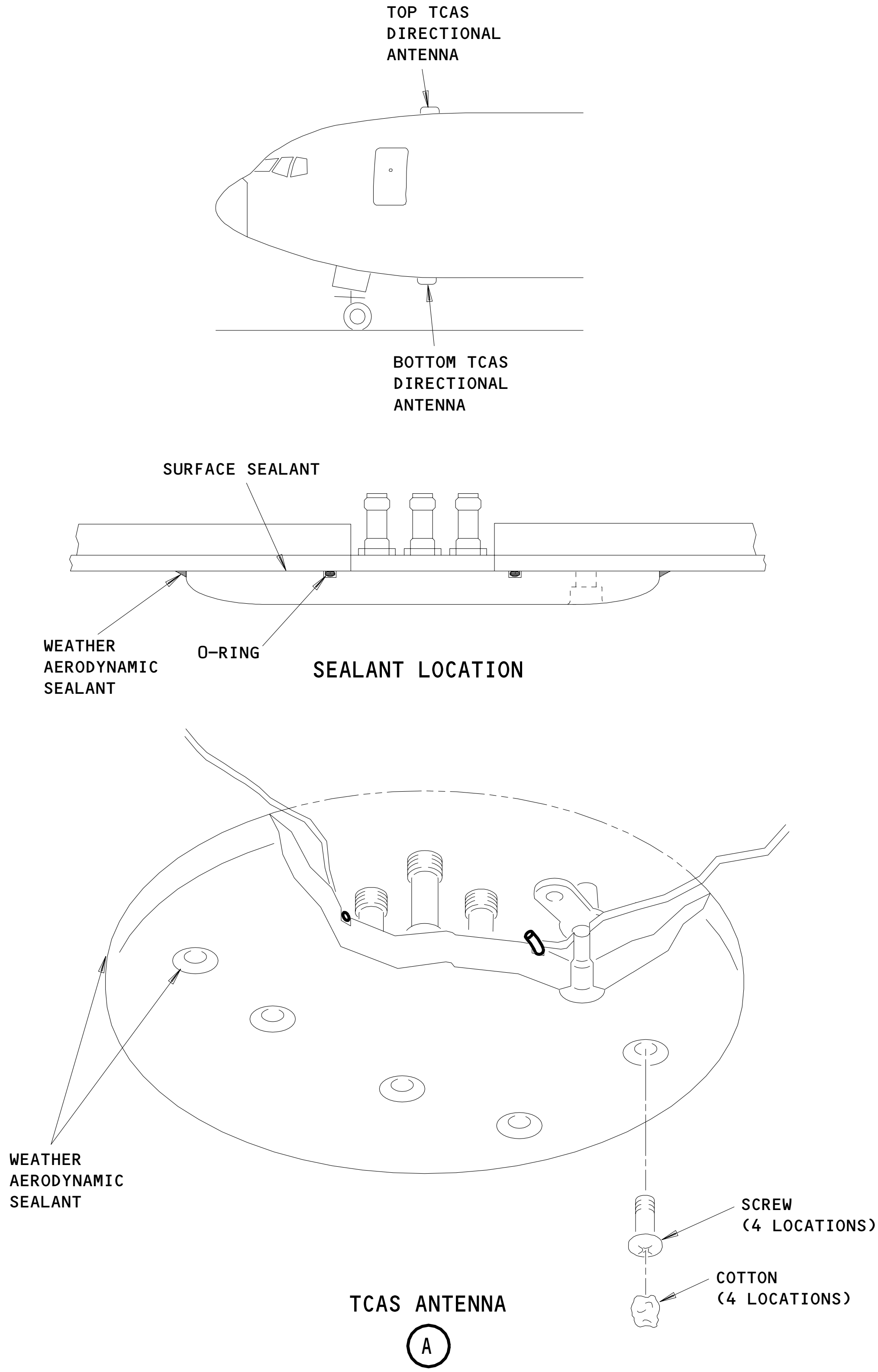

TCAS Antenna Installation
Figure 401

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SAS
SAS S 024-029
SAS
SAS CAUTION: MOVE THE ANTENNA ONLY AS FAR AS NECESSARY TO DISCONNECT THE CABLES. DAMAGE TO THE ANTENNA CABLES CAN OCCUR IF YOU PULL THE CABLES.
SAS
SAS (4) Move the antenna until you can get access to the antenna cable connectors.
SAS
SAS S 034-022
SAS (5) Disconnect the antenna cables.
SAS
SAS NOTE: Do not let the antenna cables fall into the fuselage.

SAS
SAS S 024-023
SAS (6) Remove the TCAS antenna.
SAS
SAS S 114-024
SAS (7) Remove the sealant from the airplane skin in the antenna area (AMM 20-10-22/701).
SAS
SAS S 114-025
SAS (8) Clean the airplane surface in the antenna area with the solvent, BMS 11-7, and a cleaning rag (AMM 20-10-22/701).
SAS
SAS TASK 34-45-02-404-026
SAS 3. TCAS Antenna Installation
SAS A. Equipment
SAS (1) Resistance measuring bridge or ohmmeter than can measure .1 ohm.
SAS B. Consumable Materials
SAS (1) Solvent - BMS 3-2, Type 1
SAS (2) Sealant - BMS 5-95, Class B 1/2
SAS (3) Sealant - BMS 5-37
SAS (4) Coating - Conversion - Alodine 1200
SAS C. References
SAS (1) 20-10-22/701, Metal Surfaces
SAS (2) 24-22-00/201, Electrical Power - Control
SAS (3) 51-21-04/701, Alodine Coating
SAS (4) 51-31-01/201, Seals and Sealing

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SAS D. Access
SAS (1) Location Zones
SAS 119/120 Main Equipment Center (Exterior)
SAS 119/120 Main Equipment Center
SAS 211/212 Flight Compartment
SAS
SAS E. Procedure
SAS
SAS S 864-001
SAS (1) Make sure this circuit breaker is open:
SAS (a) P11, Overhead Circuit Breaker Panel:
SAS 1) 11F12, TCAS
SAS
SAS S 214-002
SAS (2) Visually examine the contact surfaces of the antenna and the
SAS airplane for corrosion and unwanted material.
SAS
SAS <u>NOTE</u>: If the surfaces are not clean, the ground will not be
SAS sufficient, and incorrect system operation will occur.
SAS
SAS
SAS S 114-003
SAS (3) Clean the contact surfaces with solvent, BMS 3-2,
SAS (AMM 20-10-22/701).
SAS
SAS S 614-004
SAS (4) Apply Alodine 1200 to the contact surfaces of the antenna and the
SAS airplane (AMM 51-21-04/701).
SAS
SAS S 614-005
SAS (5) Apply a thin layer corrosion inhibiting compound BMS 3-23 on the
SAS airplane contact surface.
SAS
SAS S 284-006
SAS (6) Make sure that an O-ring is installed on the new antenna.
SAS
SAS S 614-007
SAS (7) Apply a removable surface seal, BMS 5-37 on the antenna base
SAS (AMM 51-31-01/201).

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S 864-027

(8) Connect the coaxial cables to the antenna as follows:

CABLE SLEEVE COLOR	TCAS ANTENNA CONNECTOR
Yellow	J1
Black	J2
Blue	J3
Red	J4

S 424-008

(9) Put the antenna into position and install all except one of the screws.

<u>NOTE</u>: Leave one screw out to do the electrical bond check.

S 434-009

(10) Tighten the screws to 18 pound-inches of torque.

S 284-010

(11) Make sure the resistance from the antenna base to the airplane skin is not greater than .1 ohms.

S 424-011

(12) Install the last screw in the antenna.

S 434-012

(13) Tighten the screw to 18 pound-inches of torque.

S 164-030

(14) Remove the unwanted sealant from around the antenna base (AMM 51-31-01/201).

S 614-013

(15) Apply a fillet seal around the outer edge of the antenna using sealant BMS 5-95 (AMM 51-31-01/201).

S 614-014

(16) Fill the screw holes with cotton and apply sealant to cover the holes (AMM 51-31-01/201).

S 164-031

(17) Remove the unwanted sealant from around the antenna base (AMM 51-31-01/201).

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SAS
SAS S 864-015
SAS (18) Remove the DO-NOT-CLOSE tag and close this circuit breaker:
SAS (a) P11, Overhead Circuit Breaker Panel:
1) 11F12, TCAS
SAS F. TCAS Antenna Test
SAS
SAS S 864-016
SAS (1) Supply electrical power (AMM 24-22-00/201).
SAS
SAS S 714-017
SAS (2) Do the TCAS operational test.
SAS (a) Select ALT RPTG ON and STBY mode on the ATC/TCAS control panel.
SAS (b) Push the TEST switch on the ATC/TCAS control panel and hold it
SAS for one second.
SAS (c) Make sure you hear "TCAS TEST PASS" on the flight compartment
SAS speaker.
SAS G. Put the Airplane Back to Its Usual Condition
SAS
SAS S 864-028
SAS (1) Remove the electrical power if it is not necessary
SAS (AMM 24-22-00/201).

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GROUND PROXIMITY WARNING SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. For various flight conditions, the ground proximity warning system (GPWS) provides aural and visual warnings of airplane closeness to the terrain. The potentially dangerous flight modes are:
      (1) Mode 1 - Large Descent Rate
      (2) Mode 2 - Large Terrain Closure Rate
      (3) Mode 3 - Too Much Altitude Loss During Climbout (at Takeoff or in Go-Around) When Not In Landing Configuration
      (4) Mode 4 - Not Enough Terrain Clearance
      (5) Mode 5 - Too Much Deviation Below The Glide Slope Centerline
      (6) Mode 6 - Aural Callouts When Descending Through Selected Radio Altitudes
      (7) Mode 7 - Windshear Detection
   B. The system consists of:
      (1) 1 - Ground Proximity Warning Computer (GPWC)
      (2) 1 - GND PROX Light - G/S INHB Switch/Light
      (3) 1 - WINDSHEAR Light
      (4) 1 - PULL UP Light
      (5) 1 - Ground Proximity Test Switch
      (6) 1 - Gear Override Switch
      (7) 1 - Flap Override Switch
2. Component Details (Fig. 1)
   A. Ground Proximity Warning Computer
      (1) The ground proximity warning computer (GPWC) is located on the E1-5 rack in the main equipment center. The GPWC LRU is the main element of the Ground Proximity Warning System (GPWS). The GPWC LRU front panel contains a toggle switch and an 8-character LED BITE display. Present status or flight history data shows on the BITE display when the toggle switch is selected.
      (2) The computer receives and processes input signals to determine the alert and warning mode conditions. It also generates the aural and visual alert and warning messages.
      (3) The computer continuously monitors the validity of input signals and internal functions. System failures detected are stored in a non-volatile memory.
      (4) A three-position STATUS/HISTORY switch and a BITE window are located on the front panel. The switch may be set to either display the system present status or flight history on the BITE window. Up to five failures during each of the last ten flights may be called out on the display.

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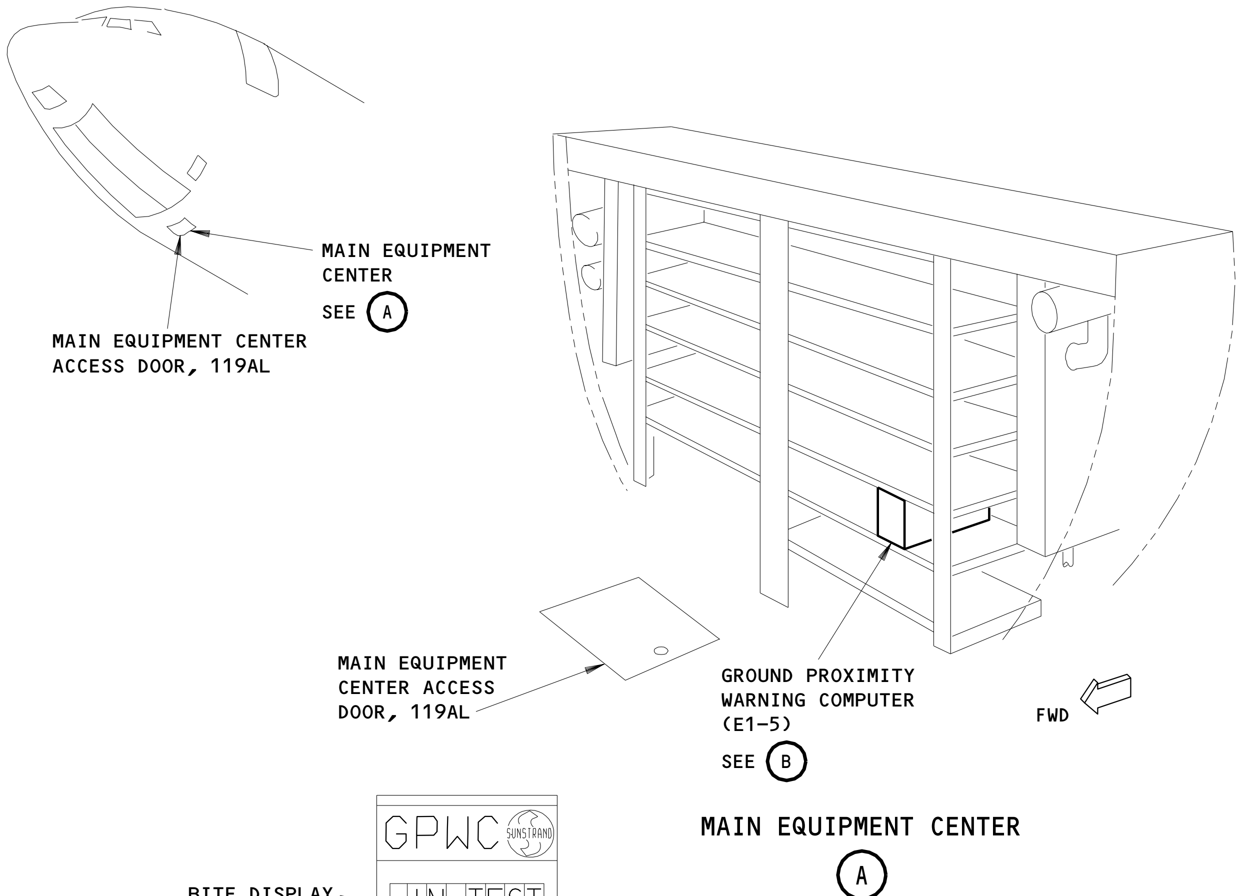

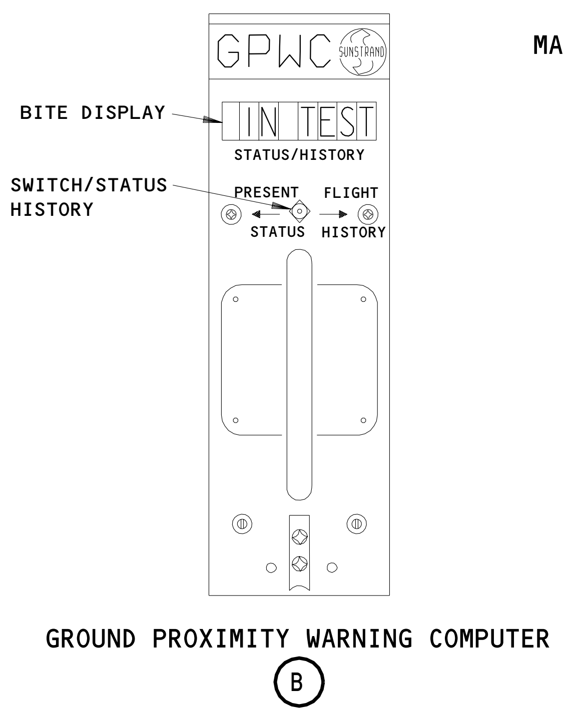

Ground Proximity Warning System - Component Location
Figure 1 (Sheet 1)

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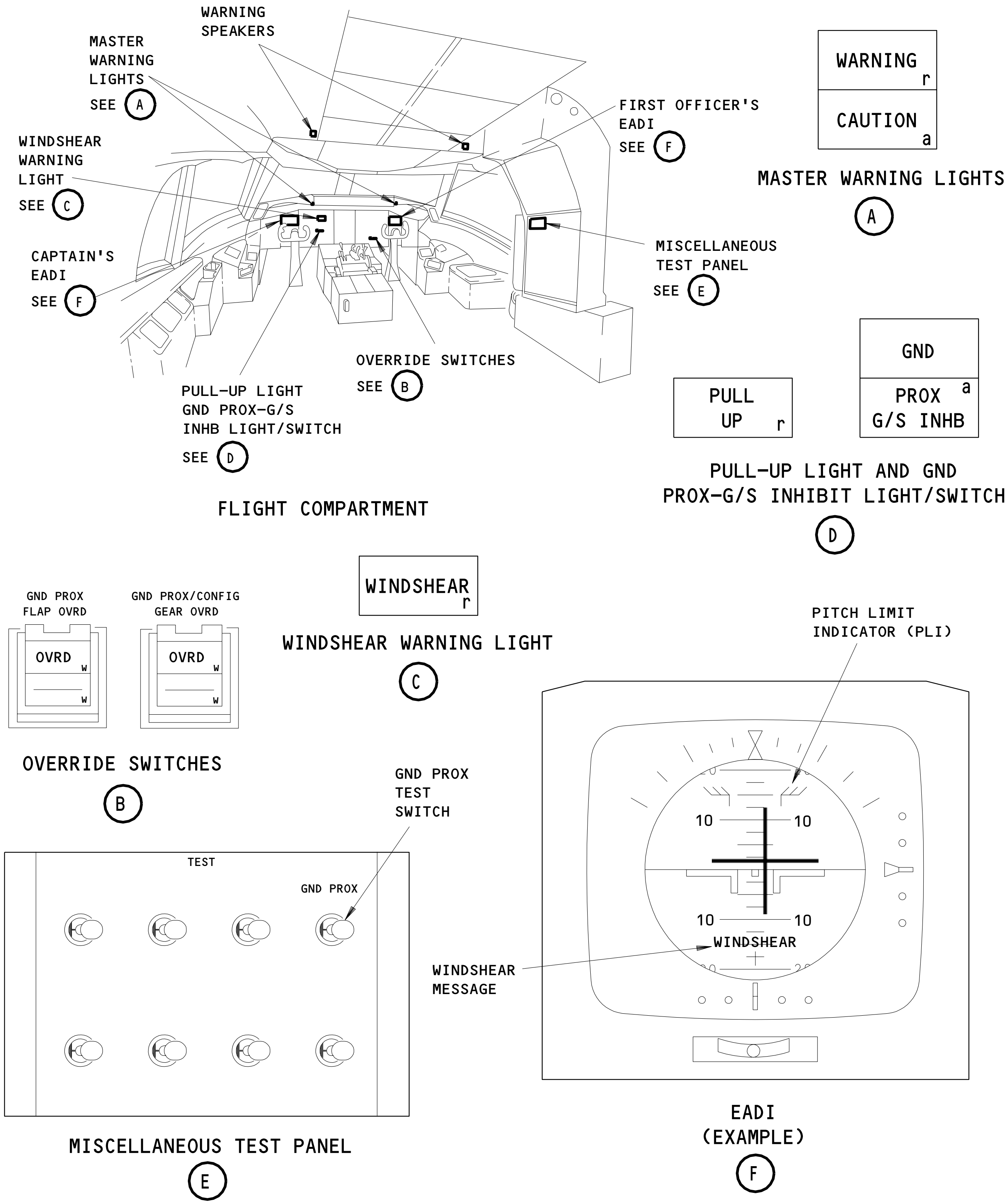

Ground Proximity Warning System Components
Figure 1 (Sheet 2)

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B. GND PROX TEST Switch

(1) The TEST switch is located on the miscellaneous test panel at the right side panel P61. It provides a momentary ground discrete to the GPWC to start the self test. The self test can be performed while airborne, or on the ground, as follows:

(a) The airborne self test is enabled when the landing gear is up and the radio altitude is above 1000 feet. Setting the TEST switch for less than 5 seconds starts the test sequence.

(b) The ground self test is enabled when the radio altitude is below 30 feet. Setting the TEST switch for less than 5 seconds starts the test sequence. A total vocabulary test is started if the TEST switch is set for more than 5 seconds.

C. Override Switches

(1) The GND PROX FLAP OVRD switch is used to inhibit the Mode 4 caution message. The switch provides an open or ground discrete to the GPWC. Open indicates normal flap operation; ground indicates a flap inhibit to the GPWC. The inhibit signal is generated by pressing the switch.

(2) The GND PROX GEAR OVRD switch is used to inhibit the Mode 4 caution message. The switch provides an open or ground discrete to the GPWC. Open indicates normal gear operation; ground indicates a gear inhibit to the GPWC. The inhibit signal is generated by pressing the switch.

D. PULL UP Warning Indication

(1) The red ground proximity warning PULL UP light is located on the Captain's instrument panel. The light comes on when a PULL UP warning occurs.

E. WINDSHEAR Warning Indication

(1) The red ground proximity warning WINDSHEAR light is located on the Captain's instrument panel. The light comes on when a Mode 7 WINDSHEAR warning occurs.

F. GND PROX Light-G/S INHB Switch/Light

(1) The amber GND PROX Light-G/S INHB Switch/Light provides a momentary contact to ground and an amber light. The momentary contact to ground provides the Mode 5 glideslope inhibit discrete to the GPWC. The GND PROX light illuminates when there is a GPWS alert condition. The mode 5 caution may be inhibited by pressing the switch/light provided the advisory condition has not already occurred.

G. Warning Speakers

(1) The aural warning speakers are located on each side adjacent to the pilots' overhead panel P5. The speakers come on to annunciate the GPWS warning and advisory aural messages. The Warning Electronics Unit (WEU) controls the speakers.

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H. Siren/Owl and Master Warning Modules
   (1) The siren/owl modules and the master warning module are located in the warning electronics unit, P51. The siren/owl modules turn on the warning speakers when activated by the GPWC. The master warning module turns on the red warning lights when activated by the GPWC.
I. EICAS Display Units
   (1) The EICAS display units are located on the center instrument panel. They display the GPWS failure message if there is a GPWS system fault (AMM 31-41-00/001).

3. Operation
   A. Functional Description
      (1) Mode 1 Function (Fig. 2)
         (a) Mode 1 provides warnings and advisories when the airplane has a large descent rate with respect to the altitude above ground level (AGL) during descent and approach. If the airplane barometric descent rate becomes excessive, the aural SINKRATE message is heard and the amber GND PROX light comes on. If the descent rate becomes severe, the aural changes to PULL UP, and the red PULL UP indication shows and the master warning lights come on.
      (2) Mode 2 Function (Fig. 2)
         (a) Mode 2 provides warning and advisories for excessive closure rates to the terrain with respect to altitude AGL, phase of flight, and speed. Mode 2 has two sub-modes, Mode 2A and 2B.
            1) Mode 2A advisories and warnings are given when the airplane is not in landing configuration. If the terrain closure rate is excessive, the aural TERRAIN TERRAIN message is heard and the amber GND PROX light comes on. If the condition is not corrected, the aural message changes to the PULL UP warning, and the red PULL UP indication shows and the master warning lights come on.
            2) Mode 2B advisories and warnings are given when the flaps are in landing configuration or during an ILS approach with glideslope deviation less than plus or minus 2 dots. If the terrain closure rate is excessive, the aural TERRAIN message is heard repeatedly and the amber GND PROX light comes on. If the condition is not corrected after 1.6 seconds, the aural message changes to the PULL UP warning (repeated continuously), and the red PULL UP indication shows and the master warning lights come on. If the terrain closure rate is excessive, with the landing gear extended and the flaps in the landing configuration, the PULL UP aural warning is replaced by the TERRAIN aural caution.

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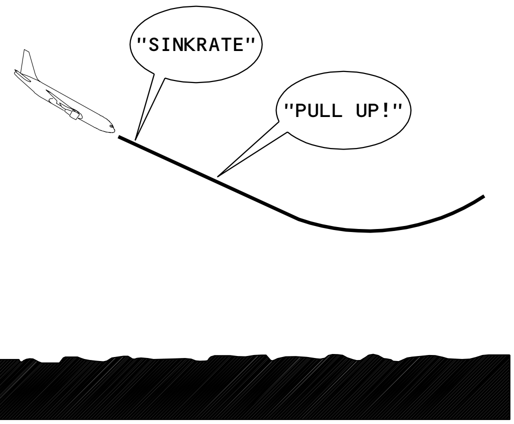
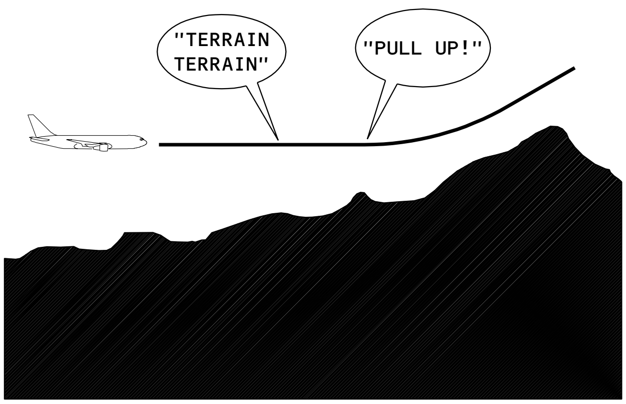
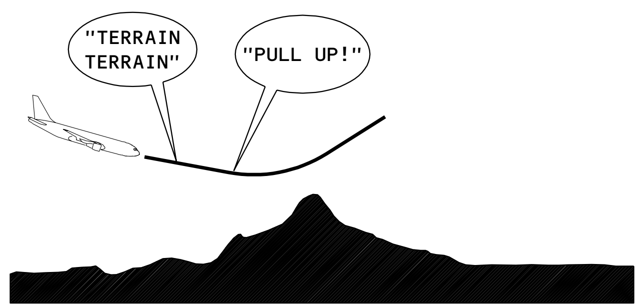


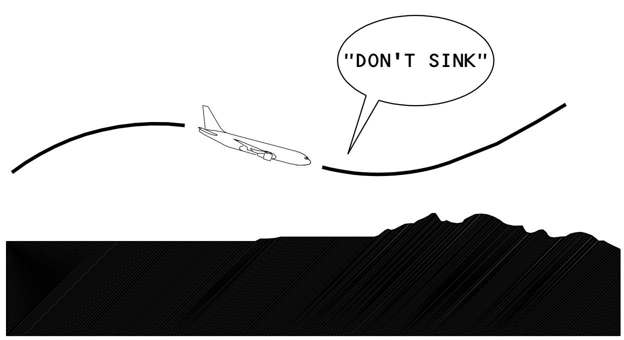
MODE 1
EXCESSIVE DESCENT RATE



MODE 2A
EXCESSIVE TERRAIN CLOSURE RATE



MODE 2B
EXCESSIVE TERRAIN CLOSURE RATE
(FLAPS AND GEAR DOWN)



MODE 3
ALTITUDE LOSS AFTER TAKEOFF OR GO-AROUND

Ground Proximity Warning System Modes
Figure 2 (Sheet 1)

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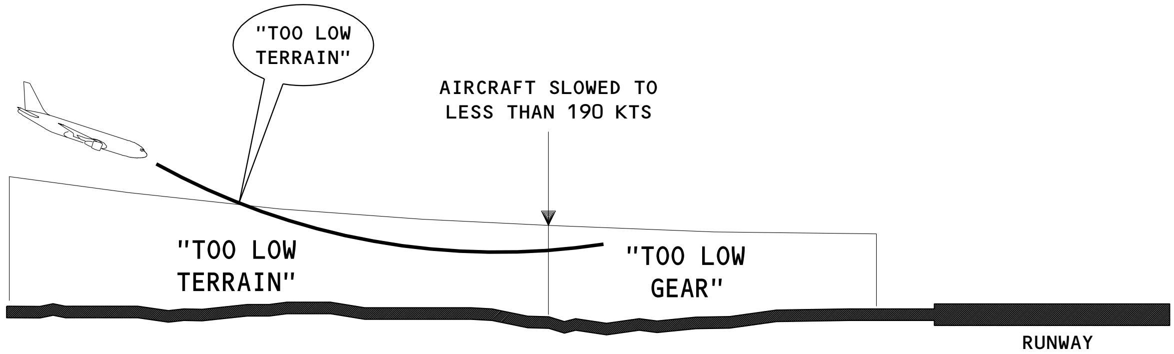
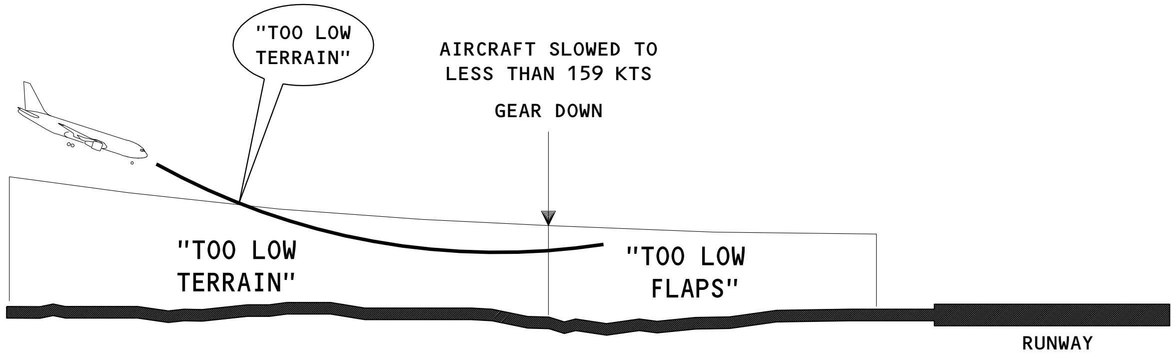
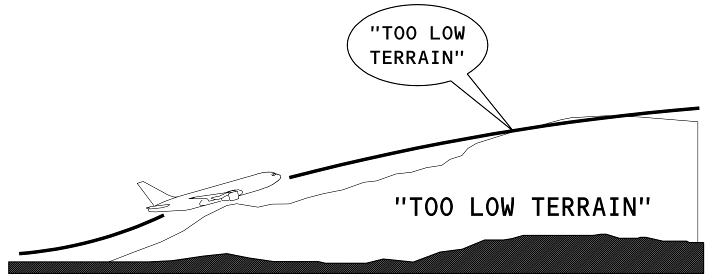


MODE 4A
UNSAFE TERRAIN CLEARANCE
(GEAR UP)



MODE 4B
UNSAFE TERRAIN CLEARANCE
(GEAR DOWN)



MODE 4C
UNSAFE TERRAIN CLEARANCE
(TAKEOFF OR GO-AROUND)

Ground Proximity Warning System Modes
Figure 2 (Sheet 2)

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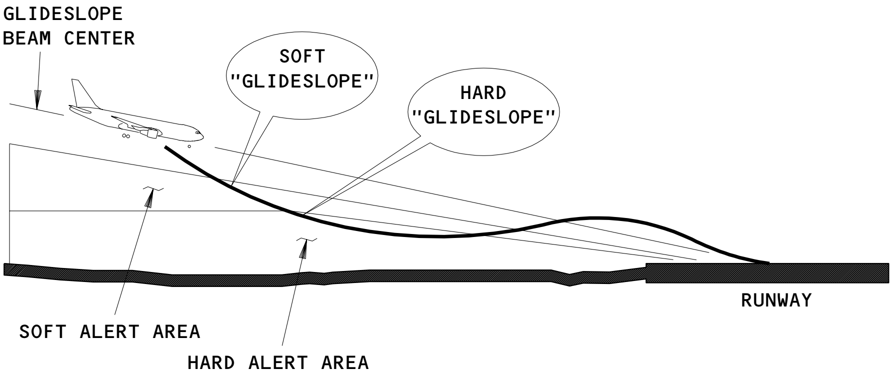
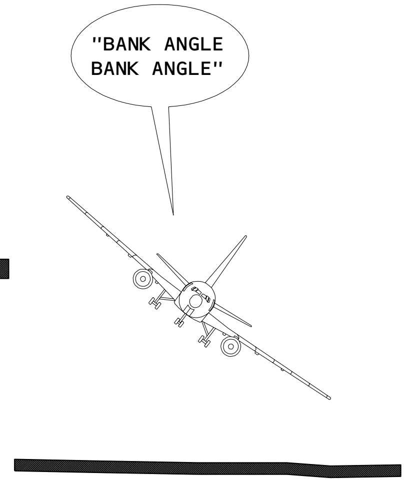
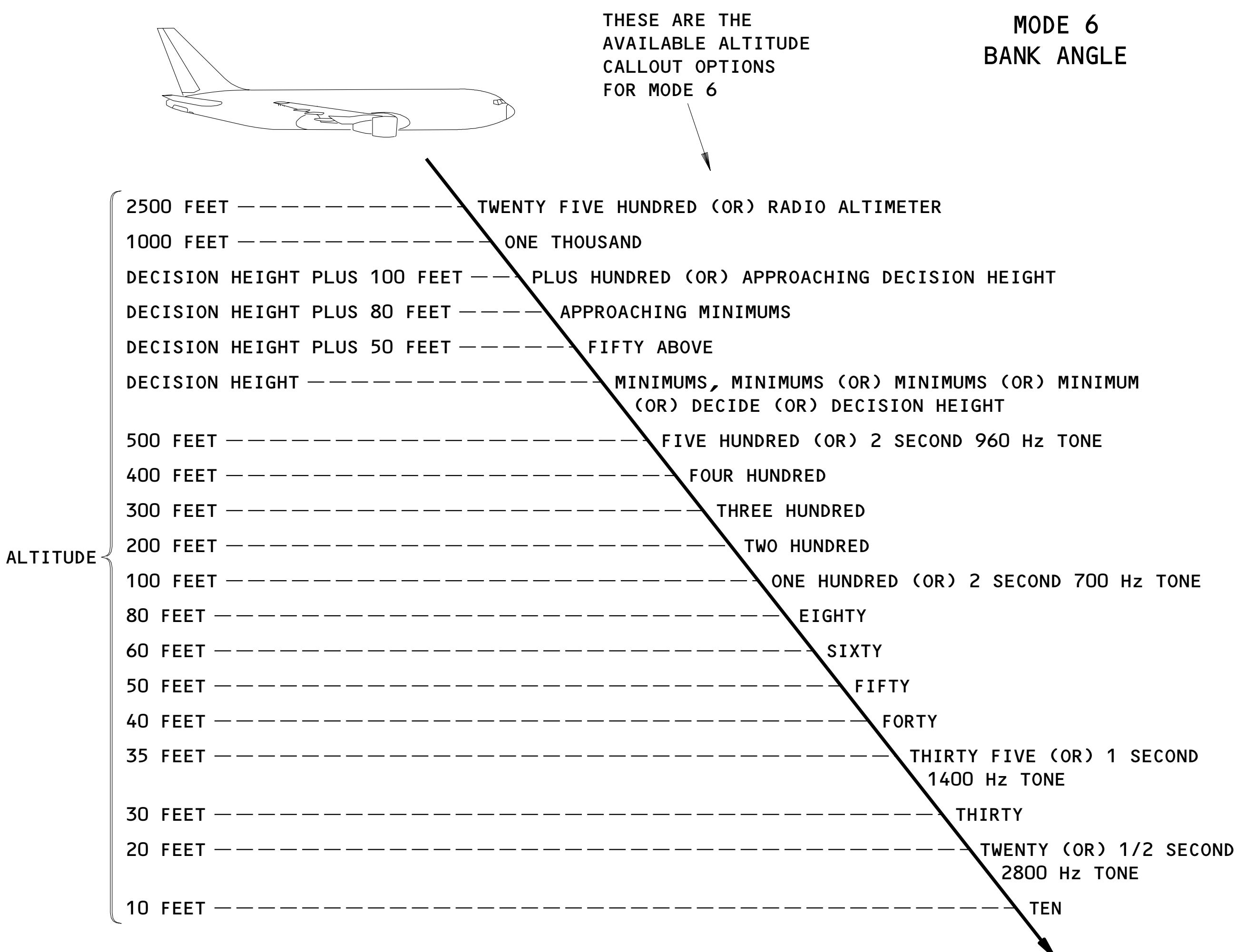


MODE 5
EXCESSIVE GLIDESLOPE DEVIATION



MODE 6
BANK ANGLE



MODE 6 ALTITUDE CALLOUTS

Ground Proximity Warning System Modes
Figure 2 (Sheet 3)

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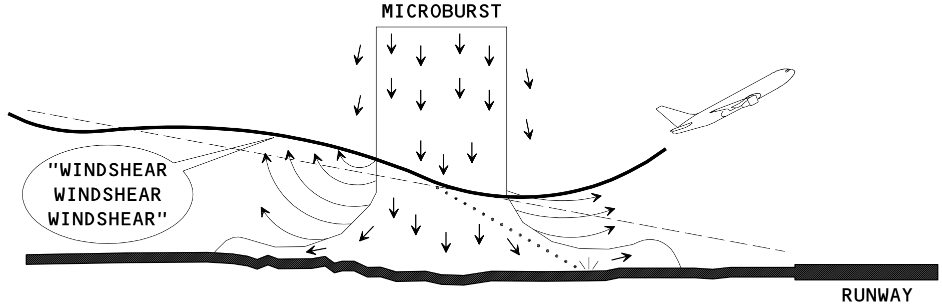

MODE 7
WINDSHEAR DETECTION

Ground Proximity Warning System Modes
Figure 2 (Sheet 4)

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(3) Mode 3 Function (Fig. 2)
   (a) The mode 3 advisory signals are provided when an excessive altitude loss occurs during takeoff or missed approach. This function occurs for either the gear or flaps up. If barometric altitude decreases excessively during the initial takeoff climb or during a go-around, the DON'T SINK aural caution sounds repeatedly, and the amber GND PROX light comes on. The caution continues until a positive rate of climb is established. If the airplane descends again before climbing to the original descent altitude, another caution sounds based on the original descent altitude.

(4) Mode 4 Function (Fig. 2)
   (a) Mode 4 advisory signals are provided for insufficient terrain clearances with and without the landing gear up. Mode 4 has three sub-modes: Mode 4A, 4B, and 4C.
      1) Mode 4A generates advisory signals for unsafe terrain clearances with the landing gear up and flaps not in landing configuration. When the airspeed is less than 190 konts, the TOO LOW GEAR aural caution is repeated, and the amber GND PROX light comes on. If the airspeed is more than 190 knots, the TOO LOW TERRAIN aural caution is repeated, and the GND PROX light comes on.
      2) Mode 4B provides a caution alert when the landing gear is down and the flaps are not in the landing position. If the airspeed is less than 159 knots, the TOO LOW FLAP aural caution is repeated and the amber GND PROX light comes on. If the airspeed is more than 159 knots, the TOO LOW TERRAIN aural caution is repeated and the amber GND PROX light comes on. If the gear is not down, the aural TOO LOW GEAR message replaces the TOO LOW FLAP caution message.
         a) The TOO LOW GEAR caution is inhibited when the GND PROX GEAR OVRD switch is pressed.
         b) The TOO LOW FLAP caution is inhibited when the GND PROX FLAP OVRD switch is pressed. This will simulate the flaps in a landing position if the pilot prefers to land with less than normal landing flaps.
      3) Mode 4C provides alerts for insufficient terrain clearance during takeoff or go-around maneuvers. Mode 4C alerts are based on radio altitude and a minimum terrain clearance, or floor, that increases with radio altitude. Floor value can equal up to 75 percent of the maximum radio altitude achieved since takeoff or go-around. If radio altitude decreases below this floor, the aural TOO LOW, TERRAIN message is heard and the amber GND PROX light comes on.

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(5) Mode 5 Function (Fig. 2)
   (a) Mode 5 provides caution alerts for excessive deviation from the glideslope beam during an ILS approach.
   (b) If the airplane deviates excessively below an ILS glideslope, when the gear lever is down and the flaps are in landing configuration, the aural GLIDESLOPE caution message is heard and the amber GND PROX light comes on. At first the GLIDESLOPE message is heard at half the volume of the other GPWS alerts. This is called a soft alert. If the glideslope deviation increases, or if the radio altitude decreases, the GLIDESLOPE message is heard more frequently. If the glideslope deviation remains excessive, the aural GLIDESLOPE message is heard at full volume. This is called a hard alert.
   (c) The GND PROX Light-G/S INHB Switch/Light can be pressed to inhibit the aural and visual mode 5 alerts.

(6) Mode 6 Function (Fig. 2)
   (a) Mode 6 provides a voice at selected radio altitudes and/or barometric altitudes to advise the flight crew of the approximate radio altitude. Mode 6 can also provide a bank angle alert that gives the aural BANK ANGLE, BANK ANGLE message if the airplane's bank angle exceeds the limits defined within the GPWC.
   (b) The radio altitude callout function is armed when the airplane is above 1000 feet radio altitude while in the approach mode or the airplane transitions from takeoff to approach mode. Each radio altitude aural callout is generated once while descending through the corresponding radio altitude band. Once the aural is called out, or its associated altitude band is transitioned, it will not function again until the airplane satisfies the above conditions to arm the radio altitude callout function. If two or more radio altitude callout bands are transitioned before the callouts can be issued, only the lowest altitude is called out.
   (c) There are no visual alerts associated with a Mode 6 alert. Different alert callouts can be set by GPWC program pins.

(7) Mode 7 Function (Fig. 2)
   (a) Mode 7 warning signals are provided when flying into an excessive windshear condition during takeoff or approach. If an excessive downdraft or tailwind condition is detected, a two tone siren followed by an aural WINDSHEAR, WINDSHEAR, WINDSHEAR warning is heard. A red WINDSHEAR message is displayed on the captain's and first officer's PFD, and the red WINDSHEAR and master warning lights come on. When the windshear warning is active, all other GPWS modes are inhibited. These modes stay inhibited as long as there is an excessive windshear condition.

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(b) Aural messages are prioritized; windshear warnings take priority over all other ground proximity warning system alerts.

(8) Envelope Modulation

(a) The GPWC envelope modulation feature provides improved alert and warning protection and reduces nuisance warnings at specific locations throughout the world.

(9) Ground Proximity Warning Computer Function (Fig. 3)

(a) The ground proximity warning computer receives input signals from several aircraft sensors and systems. These input signals are used to compute the airplane flight status. The flight status is compared with the warning and caution mode boundaries to determine if the warning and caution criteria are met. The computer generates the aural and visual messages to the warning and caution lights, displays, speakers, and the EICAS computer.

(b) Signals from the following systems are used to develop the warning and alerting modes:

1) Air Data System
2) EFIS System
3) Flight Management System
4) Inertial Reference System
5) Instrument Landing System (ILS)
6) Radio Altimeter System
7) Stall Warning System

a) Air Data System
The GPWS uses true airspeed, computed airspeed, corrected barometric altitude, uncorrected barometric altitude, static air temperature, and altitude rate from the Air Data System.

b) EFIS System
The GPWS uses decision height and PFD discrete word data (terrain select, range) from the EFIS system.

c) Flight Management System
The GPWS uses latitude, longitude, and magnetic track angle data from the Flight Management System.

d) Inertial Reference System
The GPWS uses latitude, longitude, inertial altitude, inertial vertical speed, track angle magnetic, pitch attitude, roll attitude, body longitudinal acceleration, body normal acceleration, inertial vertical acceleration, pitch rate, ground speed, true track, true heading, and IRU mode data from the Inertial Reference System.

e) Instrument Landing System (ILS)
The GPWS uses glideslope deviation, localizer deviation, and selected runway heading data from the ILS.

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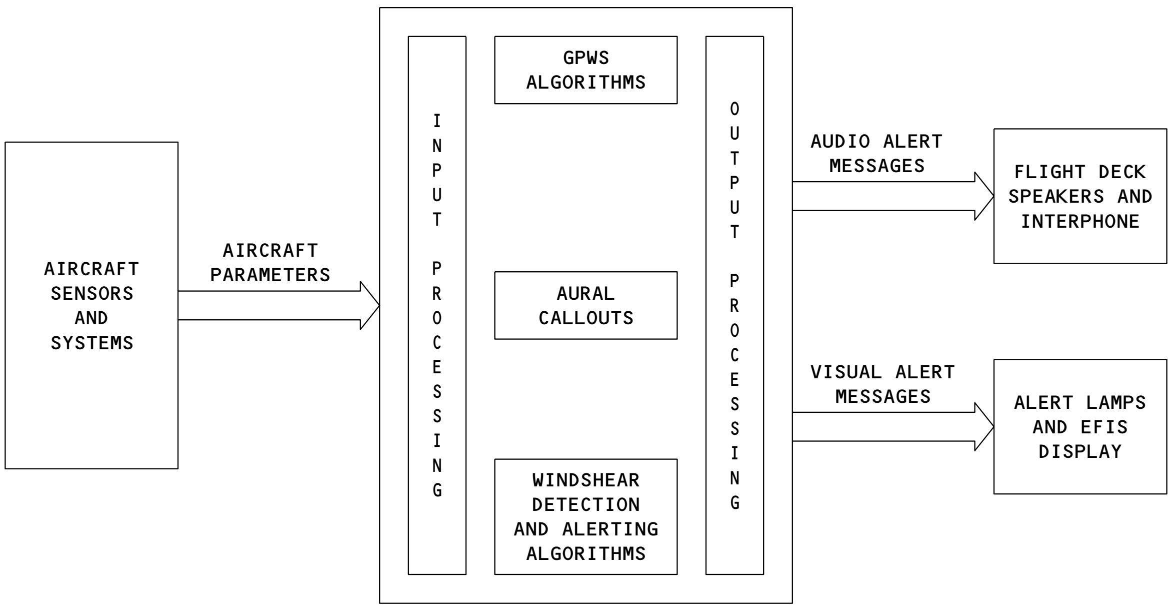

Ground Proximity Warning Computer Function
Figure 3 (Sheet 1)

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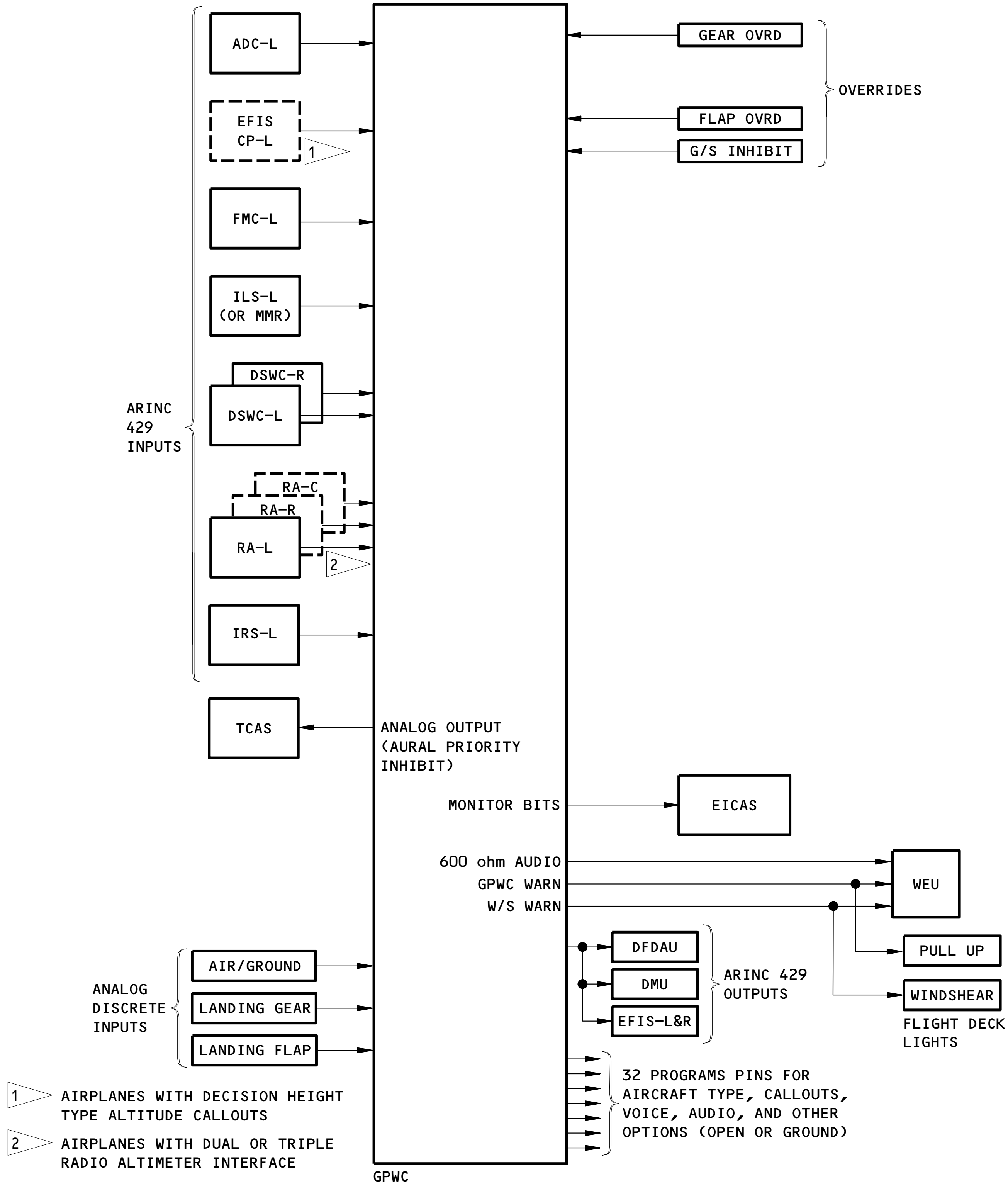

Ground Proximity Warning Computer Function
Figure 3 (Sheet 2)

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f) Radio Altimeter System
The GPWS uses radio altitude data from the Radio Altimeter System.

g) Stall Warning System
The GPWS uses indicated angle of attack, corrected angle of attack, flap position, stick shaker angle of attack, and minimum operating speed data from the Stall Warning System.

(c) The following discrete signals are used in the computer logic for the warning and alerting modes:
1) Ground Proximity Test Switch
2) Gear Override Switch
3) Flap Override Switch
4) G/S Inhibit Switch
5) Air/Ground System

(d) The Ground Proximity Test Switch is used to start the GPWC self test. The Override switches, and the G/S INHB Switch/Light are used to inhibit GPWC warnings during non-normal flight procedures. The GPWC uses the Air/Ground discrete to identify if the airplane is in the air or on the ground.

(e) The GPWS provides ARINC 429 outputs to the following LRUs:
1) EFIS Symbol Generators
2) EICAS Computer
3) Digital Flight Data Acquisition Unit (DFDAU)

(f) GPWS alerts and failures are used for alerting/advisory messages to the flight crew and are recorded by the Flight Data Recorder.

(g) Analog discretes are provided to the following:
1) GND PROX Light
2) WINDSHEAR Light
3) PULL UP Light
4) TCAS Computer

(h) Lamp driver discretes are sent to dedicated flight deck lights to annunciate GPWS alerts. Dedicated discretes are sent to TCAS to inhibit lower priority TCAS alerts.

(i) The GPWS provides an analog audio output to the Warning Electronic Unit (WEU). The WEU amplifies and outputs the audio signal to the flight deck warning speakers.

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B. BITE and Test

(1) Fault Monitoring

(a) The BITE module provides continuous tests, periodic tests and event initiated tests in the computer. The continuous tests are completely performed during each program loop. The periodic test is divided into small segments, one segment test is performed during each program loop. The event initiated test is performed during or after specific event. The faults detected inflight are stored in a non-volatile memory, and may be recalled by means of the STATUS/HISTORY switch on the front panel of the computer.

(b) A system fault is also fed to the EICAS computer. The "GND PROX BITE" ("GND PROX SYS", POST-SB 31-114 or POST-SB 31-126) message is displayed on the lower EICAS indicator when the STATUS switch on the EICAS display select panel is pressed. The "GND PROX BITE" ("GND PROX SYS", POST-SB 31-114 or POST-SB 31-126) message may also be called out when the airplane is on ground by means of the ECS/MSG switch on the EICAS maintenance panel (AMM 31-41-00/001).

(2) GPWS Front Panel Tests

(a) When the STATUS/HISTORY switch is set to the PRESENT STATUS position, the BITE display shows the system status at that time. In the FLIGHT HISTORY postion, the failure history of the system for the last ten flights is shown.

(b) AIRPLANES WITH -207 AND ON GPWC;
The GPWC front panel display will show the ARINC 429 data contained on maintenance labels 351 thru 353 after the database version. These maintenance data labels show the current status of program pins, input discretes, and selected DH validity. The maintenance labels will show for 30 seconds. Select the PRESENT STATUS two times to cancel the maintenance labels. The format for these labels is as follows:

* 1*ABCDE* label 351
* 2*ABCDE* label 352
* 3*ABCDE* label 353

(c) The present status sequence is shown as follows:

1) An all segments test of each character
2) The airplane model
3) A list of selected options
4) Message IN FLIGHT FAILURE *** SEE FLIGHT HISTORY *** (only if a failure occured on the last flight)
5) A list of current faults (if no faults occured the message SYSTEM OK or GPWS OK is shown)
6) Current software version
7) Current database version of the GPWC

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8) AIRPLANES WITH -207 GPWC AND SUBSEQUENT;
   GPWC eight character format displays for the maintenance data contained on labels 351, 352, and 353
9) The message END TEST.

(d) The flight history sequence is shown as follows:
1) A list of in-flight failures with the message shown, followed by the flights the fault occured
2) If no faults occured during the previous ten flights the message PREVIOUS TEN FLIGHTS OK or PREVIOUS TEN FLIGHTS SYSTEM OK is shown.
3) The message END TEST.

(e) The air/ground discrete input signal is used to separate each flight. The oldest data is erased from the memory so that the failures for the last ten flights are stored in memory.

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SAS ENHANCED GROUND PROXIMITY WARNING SYSTEM - DESCRIPTION AND OPERATION
SAS
SAS 1. General
SAS A. The purpose of the Enhanced Ground Proximity Warning System is to help
SAS prevent accidents caused by Controlled Flight Into Terrain (CFIT). The
SAS Enhanced Ground Proximity Warning System (Allied Signal Mk V EGPWS) is an
SAS improved ground proximity warning system to replace that already
SAS installed in the 767 fleet (Allied Signal Mk V GPWS). The most important
SAS new features of the EGPWS that were not available to the GPWS are Terrain
SAS Awareness Alerting and Display functions. These functions use the
SAS aircraft's geographic position and altitude and the internal terrain
SAS database to predict potential conflicts between the aircraft flight path
SAS and the terrain and provide graphic displays of the conflicting terrain.
SAS 2. Effectivity
SAS A. There are two simple ways of determining whether an aircraft has EGPWS
SAS installed. First of all, in the cockpit two additional annunciator
SAS panels are installed (one in P3, the other in P1). Each of these
SAS includes two annunciator/switches that are marked "WXR" and "TERR". The
SAS annunciator panel in P3 also includes a guarded switch marked
SAS "OVRD/INOP". These two annunciator panels are ONLY installed in aircraft
SAS that have been retrofitted with EGPWS. A second check is simply to check
SAS the part number of the ground proximity warning computer in the E/E bay
SAS (this computer is located on E1-5). If the part number of the computer
SAS is 965-0976-XXX-XXX-XXX (XXX may be any number) then the aircraft is
SAS installed with EGPWS.
SAS
SAS NOTE: This Maintenance Manual Revision replaces the Boeing Airplane
SAS Maintenance Manual chapter 34-46-00 Page Block 1, however, the
SAS basic GPWS modes 1 through 7 remain the same as the existing GPWS
SAS as described in AMM 34-46-00.
SAS
SAS 3. Reference
SAS A. MTO-340961
SAS 4. System Description
SAS A. General
SAS (1) The Enhanced Ground Proximity Warning System (EGPWS) provides the
SAS pilots with aural and visual warning of potentially dangerous flight
SAS paths relative to the ground. The EGPWS processes signals from
SAS left, right and center radio altimeters, left digital air data
SAS computer, left inertial reference unit, left and right digital stall
SAS warning computers, left flight management computer, left ILS
SAS receiver, flap and landing gear systems. An internal GPS receiver
SAS calculates the position and altitude.
SAS B. Main Features of EGPWS
SAS (1) Excessive Rate of Descent (Mode 1)
SAS (2) Terrain Closure Rate (Mode 2A/2B)

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SAS (3) Descent After Takeoff (Mode 3)
SAS (4) Insufficient Terrain Clearance (Mode 4A/4B/4C)
SAS (5) Descent Below Glideslope (Mode 5)
SAS (6) Altitude Callouts (Mode 6)
SAS (7) Excessive Bank Angle Callout
SAS (8) Windshear Detection (Mode 7)
SAS (9) Terrain Clearance Floor
SAS (10) Terrain Awareness Alerting and Display
SAS C. Internal Data Handling
SAS (1) Envelope Modulation
SAS (a) The envelope modulation feature consists of storing information
SAS about peculiarities of particular approaches and departures
SAS where modes 1, 2, 4, 5, and 6 are not entirely appropriate as
SAS they are generally implemented. This stored information is
SAS used to first of all verify the aircraft location and
SAS configuration, and then to alter the basic mode parameters as
SAS necessary to optimise GPWS performance.
SAS (2) Loadable Databases
SAS (a) There are six types of data that have been incorporated into
SAS programmable non-volatile memory: envelope modulation
SAS parameters, mode 6 altitude callout menus, mode 7 windshear
SAS constants and thresholds, terrain (an accurate global relief
SAS map of the world), obstacles (an overlay of man-made objects
SAS that may threaten an aircraft) and runways (the layout of
SAS runways in excess of 3,500 feet in length for the terrain
SAS clearance floor alerts).
SAS (b) This data is accompanied by version/data information. These
SAS databases are in addition to the power immune latches and
SAS flight history information that is also stored in this
SAS non-volatile memory. The main difference between these two
SAS types of information is that the data tables cannot be written
SAS to except on the bench (i.e., read only via a hardware strap).
SAS (3) BITE and Flight History
SAS (a) There exists within the GPWS software, built-in test equipment
SAS or BITE. Much of this BITE is run continuously, while some
SAS tests are run only as the result of certain events (e.g., power
SAS up, self-test, etc.). This BITE is capable of logging failure
SAS for the last 10 flight legs in non-volatile flight history
SAS memory storage for later recovery.

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SAS D. System Components
SAS (1) The EGPWS consists of an enhanced ground proximity warning computer,
SAS two warning lights: one labeled PULL UP and one labeled WINDSHEAR,
SAS two guarded override switches: one labeled GND PROX FLAP OVRD and
SAS one labeled GND PROX/CONFIG GEAR OVRD, a glideslope warning
SAS indicator/inhibit switch labeled GND PROX G/S INHIBIT, a test switch
SAS labeled GND PROX on the Miscellaneous Test Panel on the P61 right
SAS side panel, an EGPWS Terrain failure monitor INOP light, Captain's
SAS and F/O's annunciator panels, four display switching relays, and one
SAS GPS antenna.
SAS (2) Primary power for the system is 115 volts ac supplied from AC Bus
SAS Left Sect 2 in panel P11-1 through a circuit breaker labeled GND
SAS PROX. The display switching relays receive 28 volts dc from the DC
SAS Bus Left Sect 2 in panel P11-1 through a circuit breaker labeled
SAS TERR DSPL. The warning indicator and annunciator lights receive
SAS 28 volts dc power from the master dim and test system (ref
SAS Chapter 33).
SAS (3) The location of system components is shown on the following page.
SAS 5. <u>Enhanced Ground Proximity Warning Computer</u>
SAS A. Location of Computer
SAS (1) The enhanced ground proximity warning computer (EGPWC) is mounted on
SAS shelf No. 5 of electronic equipment rack E1 (E1-5).
SAS B. Computer Input Signals
SAS (1) The computer receives glideslope deviation, barometric altitude
SAS rate, radio altitude, gear and flap logic, airplane position and
SAS flight path acceleration information from other airplane systems,
SAS and GPS position signals from the GPS antenna. The input signals
SAS are processed and signals are provided to warning devices if the
SAS airplane enters an unsafe flight path.
SAS 6. <u>EGPWS Warning Light</u>
SAS A. Pull Up Light
SAS (1) A rectangular shaped red warning light labeled PULL UP is installed
SAS on the captain's instrument panel. Access to the bulb within the
SAS light assembly is provided by removing the lens cover.
SAS (2) The light comes on to provide a visual indication of mode 1, 2, 3,
SAS and 4 warnings.
SAS 7. <u>Windshear Warning Light</u>
SAS A. Windshear Warning Lights
SAS (1) A rectangular red warning light labeled WINDSHEAR is installed on
SAS the captain's right instrument panel (P1-3). The bulbs and a fuse
SAS within the light assembly may be accessed by removing the lens
SAS cover. The lights come on to provide a visual indication of a
SAS windshear condition.

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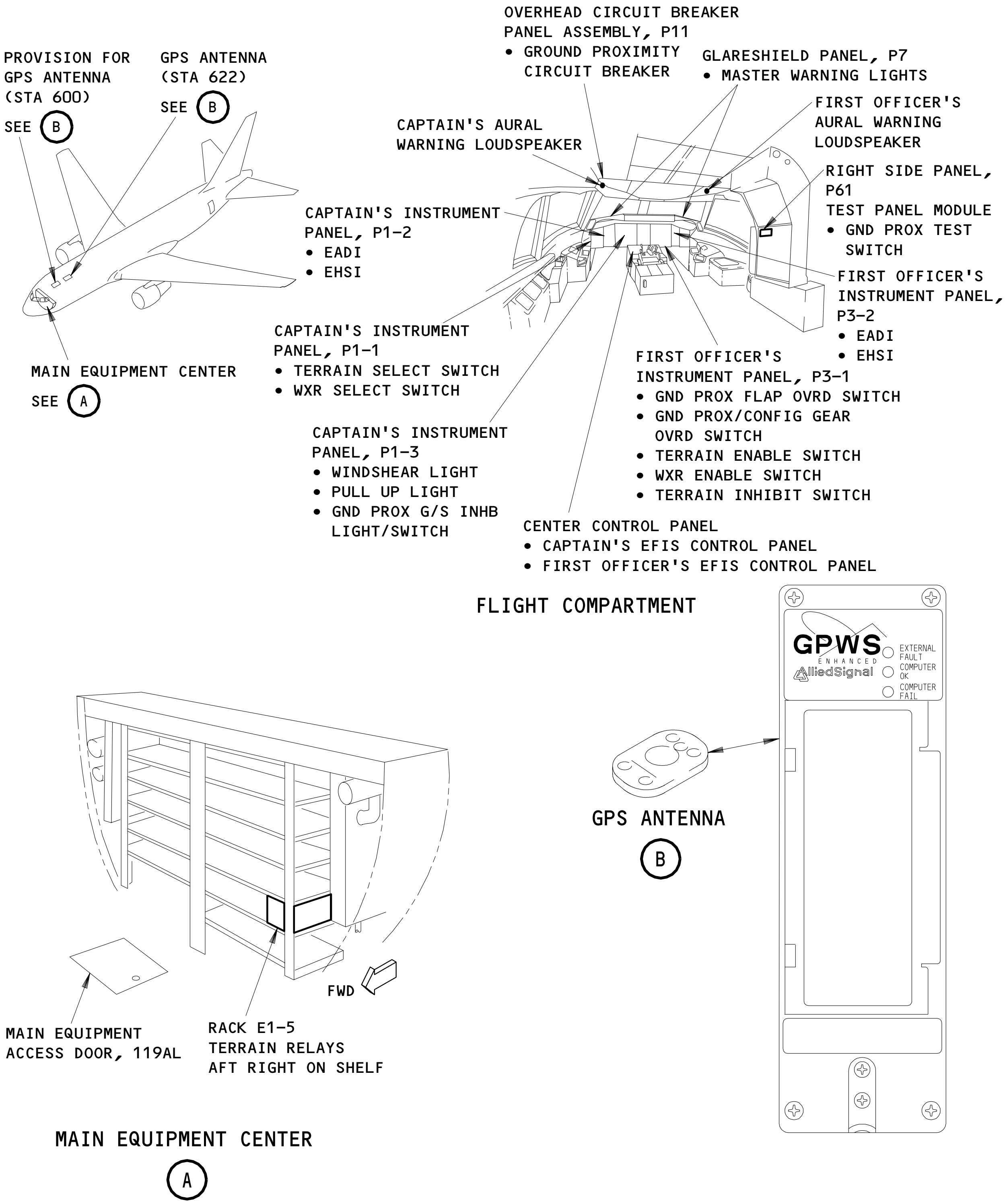

GPWS - Location of System Components
Figure 1

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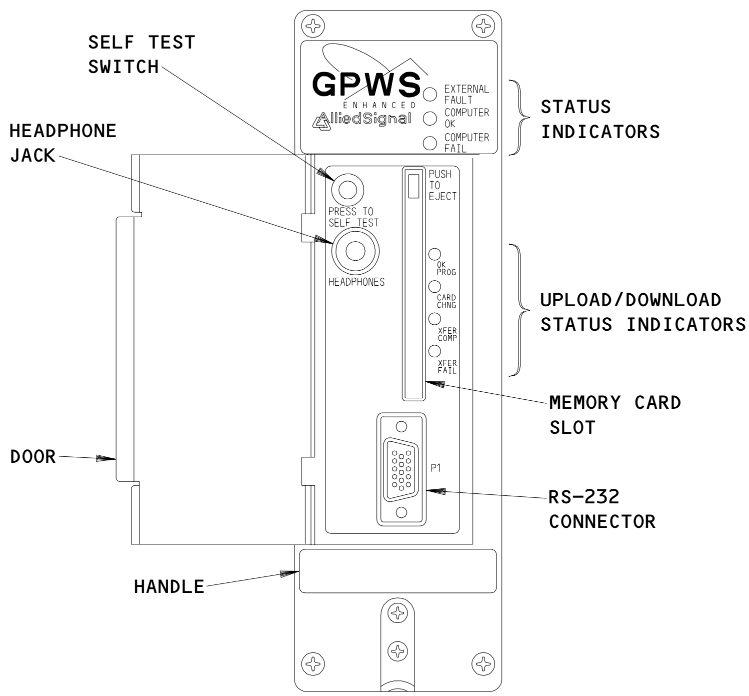

GPWS - Ground Proximity Warning Computer
Figure 2

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SAS (2) Visual indication of a windshear condition is also provided on both the captain's and first officer's EADI. During windshear conditions, WINDSHEAR will be displayed in red on the EADI ball approximately 1/3 up from the bottom.

SAS 8. Glideslope Caution Light

SAS A. GND PROX G/S INHIBIT Light

SAS (1) A rectangular amber G/S (advisory) light labeled GND PROX G/S INHIBIT is installed on the captain's instrument panel. Access to the bulbs and a fuse within the light assembly is provided by removing the lens cover. The light comes on to provide a visual indication that the airplane is below the glideslope beam when an ILS frequency is selected.

SAS (2) The G/S warning light will inhibit the glideslope deviation warning when pressed, provided the hard glideslope warning is not already on.

SAS 9. Ground Proximity Warning System Override Switches

SAS A. Located on the first officer's instrument panel are two switches: a guarded GND PROX FLAP OVRD switch and a guarded GND PROX/CONFIG GEAR OVRD switch. The GND PROX FLAP OVRD switch enables the pilots to simulate a flap down condition and the GND PROX/CONFIG GEAR OVRD switch enables the pilots to simulate a gear down condition when the switches are pressed. When pressed, the TOO LOW FLAPS and TOO LOW GEAR warnings are inhibited.

SAS 10. Warning Speaker

SAS A. The aural warning signals from the EGPWC are sent to the Siren/Owl card in the Warning Electronics Unit to be processed. The aural warnings are then broadcast over the cockpit speakers and the flight interphone system.

SAS 11. EGPWS Annunciator Panels

SAS A. The Captain's EGPWS Annunciator Panel is located in panel P1-1 of the Captain's instrument panel. It includes the TERR and WXR select switches. The F/O's EGPWS annunciator panel is located in panel P3-1 of the F/O's instrument panel. It consists of the TERR and WXR annunciator/switches as well as an OVRD/INOP annunciator. The EGPWS annunciator panels allow for selection of Weather Radar or Terrain for display on the Electronic Horizontal Situation Indicator (EHSI) via the TERR and WXR select switches. These annunciators are mutually exclusive two-position switches, which select the indicated source for display when set to the lit (on) position. The OVRD/INOP annunciator on the F/O's annunciator panel is a guarded switch, which provides for annunciation of the "Terrain Not Available" mode and activates the "Terrain Inhibit" mode when selected to the OVRD position.

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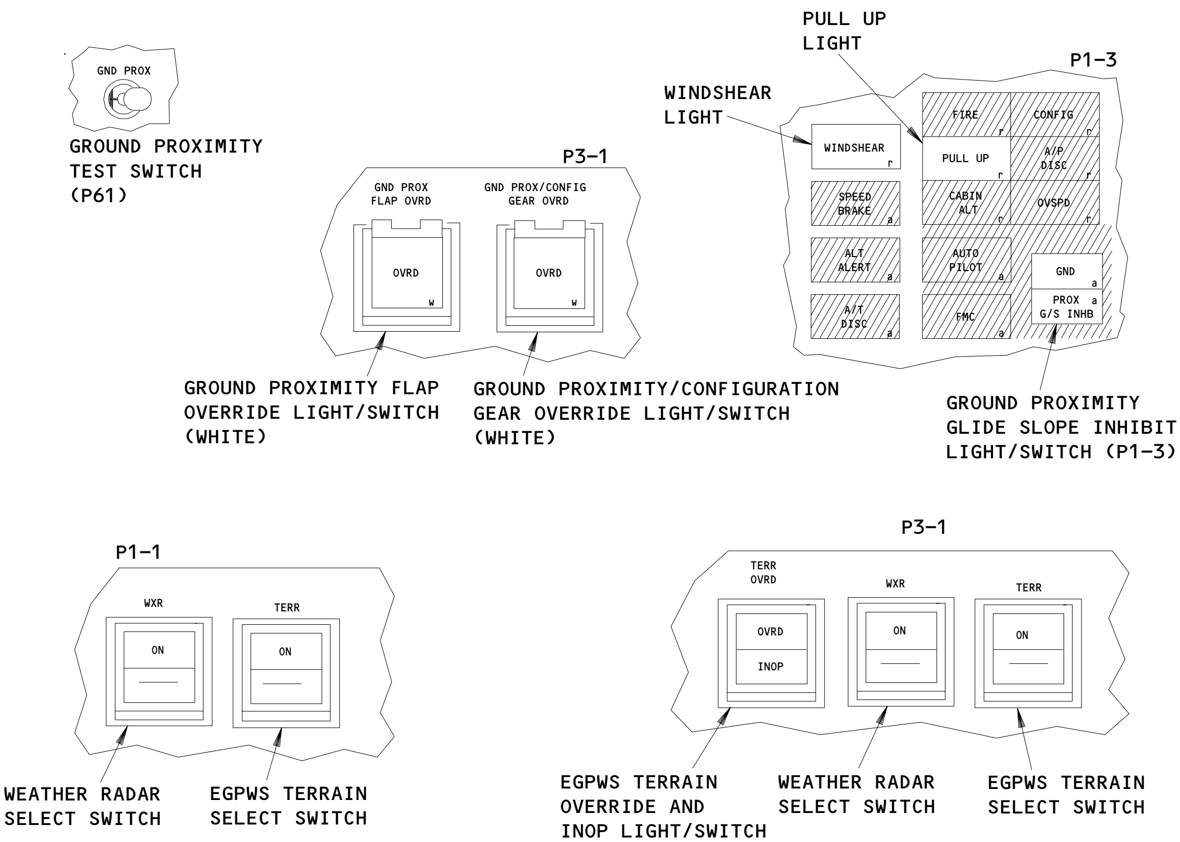

GPWS - Component Location
Figure 3

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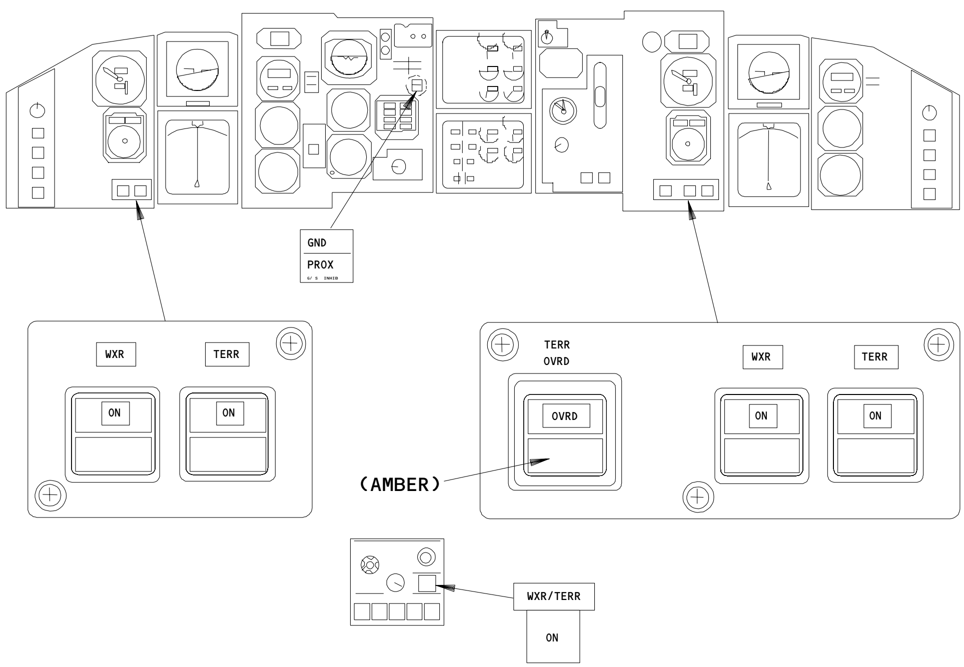

GPWS - EGPWS Panel Layout
Figure 4

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SAS 12. Display Switching Relays

SAS A. Switching between Weather Radar and Terrain for display on the Navigation Display is accomplished by the display switching relays. These are controlled by the TERR and WXR select switches located in the cockpit. The default position allows for display of Weather radar. Power for these relays is provided via the TERR DSPL circuit breaker.

SAS 13. GPS Antenna

SAS A. The GPS antenna is located on the roof of the aircraft at station 622 and is connected via coaxial cable to an internal GPS receiver within the EGPWC. The GPS provides position information to the EGPWS.

SAS 14. Operation

SAS A. Requirements for EGPWS Operation

SAS (1) The EGPWS is operational when the ground proximity warning and Terrain Display circuit breakers are closed and the following systems are powered and operational: Left, Center and Right Radio Altimeters, Left and Right air data computer, Left and Right ILS receiver, Left and Right inertial reference unit, Left and Right stall warning computer, Left and Right flight management computer, Aural Warning/flight interphone, and EFIS (symbol generators and display units).

SAS B. Signal Inputs to the EGPWC

SAS (1) Signal inputs to the EGPWC consist of position information from GPS, radio altitude information from the LRRA's, mach and altitude rate information from the air data computers, and glideslope deviation from the ILS receivers, attitude information from the inertial reference units, track information from the flight management computers and EHSI display mode information from the EFIS control panels.

SAS (2) These signals are all provided in ARINC 429 digital format.

SAS (a) Aircraft position, latitude and longitude are required for EGPWS operation and are preferably received from an integrated Global Positioning System (GPS). Flight Management System (FMS) or Inertial Reference System (IRS) data may be utilized if GPS data is not available, but the Terrain Threat Detection and Display will only be enabled if the quality of the position data is sufficiently accurate. Additionally, aircraft Ground Track and Ground Speed data are also received from the GPS (or FMS or IRS).

SAS (b) The LRRA system provides the GPWS with radio altitude. LRRA signals are used in the control of modes 1 through 6. Mode 2 requires a radio altitude rate signal (terrain closure rate), which is derived by the computer from the radio altitude signal.

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SAS (c) The Air Data Computer system provides mach and barometric altitude rate signals to the GPWS computer. Altitude rate is used for the computations of mode 1 conditions, and is used to derive altitude loss, used in the computation of mode 3 conditions. The mach signal is used to set warning thresholds for mode 2 and mode 4 computations.

SAS (d) The Instrument Landing System provides glideslope deviation signal that is used in the mode 5 computation.

SAS C. Binary Inputs to the EGPWC

SAS (1) Binary inputs to the EGPWC consist of air/ground, landing gear and flap position signals.

SAS (2) The air/ground relay supplies a binary input to the EGPWC. The air/ground input allows the EGPWC to inhibit mode functions while the airplane is on the ground to decrease nuisance warnings when the airplane is in the air, the air/ground input inhibits testing of the EGPWC.

SAS (3) The landing gear lever switch actuation is determined by the position of the landing gear control lever. When the lever is moved to the down detent position, the microswitch is actuated. Switch actuation provides a ground to the enhanced ground proximity warning system, indicating that the landing gear lever is in the down position.

SAS (4) The flap position switch is set to indicate to the EGPWC when the flaps are in the landing position. The switch opens when the flaps are in landing position and is closed otherwise (flaps NOT in landing position). With the switch closed, a ground is provided to the enhanced ground proximity warning computer, arming the TOO LOW-FLAPS warning. When the flaps are in a landing configuration, the switch is open and the warning is inhibited.

SAS D. Databases

SAS (1) The EGPWC includes three databases that are regularly updated and are used for terrain alerting and awareness.

SAS (a) Terrain Database

SAS 1) Topographic surface data is used for local terrain processing of updates of Digital Elevation Matrix Overlays that are positioned with respect to Aircraft Position. Each matrix element contains the highest terrain altitude with respect to mean sea level in that element area. Elements where terrain data are not available are marked invalid and shown as dotted magenta areas.

SAS (b) Main-made Obstacle Database

SAS 1) In addition to terrain surface data, provisions are made for use of an Obstacle Database providing obstacle data near major airports. Local Terrain Processing will update a dedicated overlay within the Digital Elevation Matrix Overlays with local obstacle altitude data.

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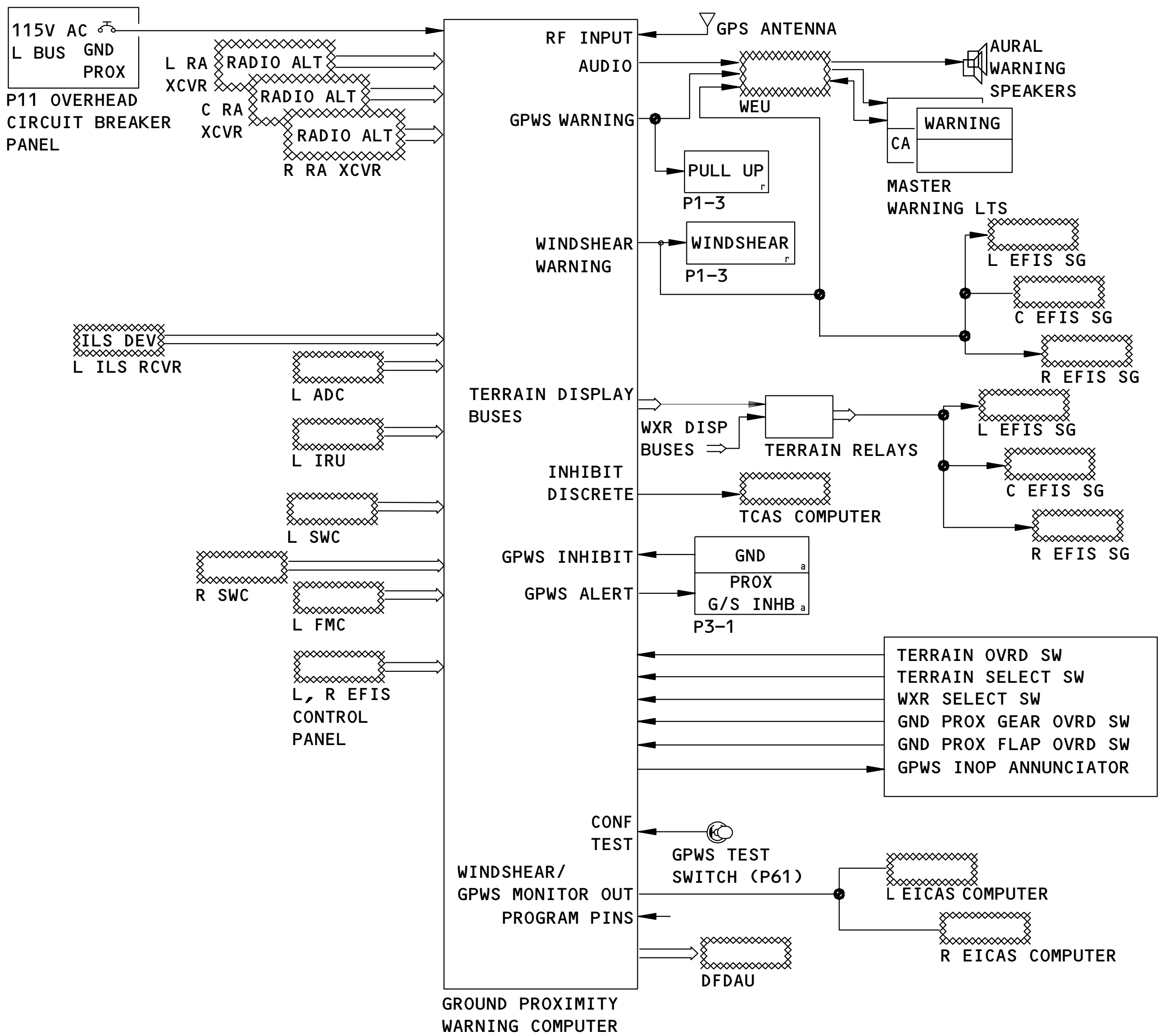

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GPWS - Component Function
Figure 5

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SAS (c) Runway Database
SAS 1) Data for the nearest runway are extracted and processed for use by the Terrain Threat Detection and Display Processing functions. Data are extracted from the same Airport Database used by the Terrain Clearance Floor functions. This database contains data on all runways 3,500 feet or more in length. The contents of the database are processed by the Local Terrain Processing into Nearest Runway Center position, Nearest Runway Threshold position and Nearest Runway Alititude for use by the EGPWS. These data are updated when the Terrain Threat Detection and Display Processing functions are performed.

SAS E. Voice Messages
SAS (1) The EGPWC provides many different voice messages. With the possibility of more than one warning occurring at the same time, the following priority has been established with the associated modes. The highest priority message is always provided. If a higher priority warning occurs, the message will immediately switch to the higher priority message. If a higher priority warning stops, the priority message will complete before switching to any lower priority message.
SAS (2) "TA" and "TCF" refer to the Enhanced GPWS "Terrain Awareness" and "Terrain Clearance Floor" functions. Refer to F.(1)(i) and F.(1)(j) below.

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Priority	Message	Modes
1	WINDSHEAR WINDSHEAR WINGSHEAR	7
2	WHOOP WHOOP PULL UP	1, 2
3	TERRAIN TERRAIN	2, TA
4	CAUTION TERRAIN	TA
5	TOO LOW TERRAIN	4, TCF
6	TOO LOW GEAR	4A
7	TOO LOW FLAPS	4B
8	SINK RATE	3
9	DON'T SINK	3
10	GLIDESLOPE	5
11	BANK ANGLE	6
12	(Altitude callouts)	6

NOTE: WINDSHEAR aural message is preceded by one cycle of siren sound.

F. Modes of Operation

(1) The EGPWC processes the input signals to provide the following warning outputs.

NOTE: Modes 1-7 are unchanged from the basic GPWS.

(a) Excessive Sink Rate Warning (Mode 1)

1) Mode 1 provides pilots with alert/warning for high descent rates into terrain. When the Alert envelope is penetrated, the message "SINK RATE" will be annunciated and the GND PROX light will illuminate. The message "PULL UP" will annunciate and the PULL UP light will illuminate when the Warning envelope is penetrated.

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SAS (b) Terrain Closure Rate (Mode 2A/2B)
SAS 1) Modes 2A and 2B each provide two types of alert/warnings to
SAS warn of dangerously high closure rates towards terrain.
SAS Mode 2A is active when flaps are NOT in landing position.
SAS Mode 2B is active when the flaps are in the landing
SAS position. The aural annunciation for this mode is "TERRAIN
SAS TERRAIN PULL UP".
SAS (c) Takeoff Altitude Loss Warning (Mode 3)
SAS 1) A warning consisting of visual PULL UP and aural DON'T SINK
SAS is provided when the airplane is in takeoff mode before
SAS acquiring 700-foot terrain clearance with landing gear or
SAS flaps up and a barometric altitude loss is detected. The
SAS altitude loss required to activate the warning varies with
SAS the height of the airplane above the ground at the time
SAS inadvertent descent occurs. At a climbout altitude of
SAS 100 feet any loss of altitude will activate the warning.
SAS At 700 feet, an altitude loss of 70 feet will activate the
SAS warning.
SAS 2) A latch provides logic between Modes 3 and 4. During
SAS takeoff, the latch is set to arm the takeoff mode and
SAS disarm the terrain clearance warning. Upon acquiring
SAS 700 feet of altitude, the latch resets, arming the terrain
SAS clearance warning.
SAS (d) Unsafe Terrain Clearance Warning (Mode 4A/4B/4C)
SAS 1) Mode 4 generates three types of alerts based on radio
SAS altitude, terrain database, position, airspeed and flight
SAS mode. These are referred to as Modes 4A, 4B and 4C. Mode
SAS 4A is active duriing cruise and approach with landing gear
SAS up. Mode 4B is active during cruise and approach with
SAS landing gear down and flaps up. Mode 4C is active during
SAS takeoff. Warnings from Modes 4A, 4B and 4C cannot happen
SAS simultaneously. The aural warnings for Mode 4A/4B/4C are
SAS "TOO LOW GEAR", "TOO LOW FLAP" and "TOO LOW TERRAIN".
SAS (e) Glideslope Deviation Warning (Mode 5)
SAS 1) The glideslope warning is armed when an ILS frequency is
SAS selected. The warning envelope consists of two regions.
SAS The BELOW G/S indicators accompanied by a reduced volume of
SAS aural warning GLIDESLOPE come on, if the deviation of the
SAS airplane below the glideslope exceeds 1.3 dots between 1000
SAS and 150 feet of radio altitude and the gear is down. The
SAS aural warning increases to full volume, hard warning, if
SAS the deviations of the airplane below the glideslope exceeds
SAS 2 dots when the airplane is between 300 and 150 feet of
SAS radio altitude.

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SAS 2) In order to allow the pilot to purposely descend below the glideslope without triggering a warning, the glideslope warning mode may be inhibited by pressing the BELOW G/S indicator when the radio altitude is below 1000 feet. To again enable Mode 5, the airplane is required to ascend to a terrain clearance of greater than 1000 feet.

SAS (f) Altitude Callouts (Mode 6)

SAS 1) The EGPWC can be programmed to enunciate Mode 6 Advisory Callouts based on menu selectable options. Mode 6 includes Altitude Awareness, Minimums/Approaching Minimums, and Bank Angle type callouts as defined in the installation configuration. See current configuration in AMM 34-46-00-5 CONFIG 2.

SAS 2) Only aural callouts are provided for Mode 6.

SAS (g) Excessive Bank Angle Callout (Mode 6)

SAS 1) The Bank Angle Callout feature provides callout enunciation for excessive bank angles based on altitude and bank angle limits defined by aircraft type. It is intended to enhance situational awareness during intentional or unintentional maneuvering, and for protection against wing or engine strikes when close to the runway.

SAS 2) When the bank angle limit is reached, the aural callout BANK ANGLE, BANK ANGLE is given. Follow-on aural messages are only provided when the aircraft roll angle increases an additional 20% from the previous callout.

SAS (h) Windshear (Mode 7)

SAS 1) Using an algorithm which provides different gain and threshold levels for takeoff and approach modes, and which also provides altitude-dependant gain levels, the windshear comparator computes both vertical and horizontal windshear components.

SAS 2) The vertical windshear component is computed from data from the stall warning computer (vane AOA), the digital air data computer (true airspeed), and the IRS (body pitch rate). These data are combined with inertial vertical speed, pitch attitude, and roll attitude in order to determine the total vertical component of windshear.

SAS 3) Horizontal windshear is computed by utilizing ADC true airspeed and flight path acceleration from the IRS.

SAS 4) Windshear warning is given for decreasing headwind (or increasing tailwind) and severe vertical down draft. The warning signal is provided by a red WINDSHEAR message on the EADI's, a red WINDSHEAR warning light and Master Warning.

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SAS 5) The audio message for a windshear condition consists of one cycle of the siren audio (250 and 950 Hz) followed by the distinct words WINDSHEAR WINDSHEAR WINDSHEAR.

SAS 6) Windshear caution or pre-alert is given for increasing headwind (or decreasing tailwind) and vertical up drafts typically associated with the leading edge microburst windshears. A caution signal is provided as a pre-alert indication of a possible windshear condition. An amber WINDSHEAR message on the Capt and F/O EADI comes on.

SAS 7) When the EGPWC is in a windshear alert mode, all other EGPWS modes are inhibited.

SAS (i) Terrain Clearance Floor

SAS 1) Terrain clearance floor (TCF) alerts the flight crew when the airplane descends too low on approach. TCF uses airplane position and a runway database to determine if an alert condition exists.

SAS 2) The EGPWC stores a runway database in memory. This database contains the location of all hard surface runways in the world that are 3,500 feet or more in length. TCF makes a terrain clearance envelope around the runway. The altitude of the envelope increases as the distance from the airport increases. EGPWC compares airplane latitude, longitude, and radio altitude with TCF envelope data. If the airplane descends through the floor of the envelope, GPWC makes an alert. TCF makes an alert even if the airplane is in landing configuration.

SAS 3) If the GPWC determines the airplane is below the TCF, it makes this caution alert:

SAS a) Aural message TOO LOW TERRAIN. This message repeats for each 20 percent loss of altitude.

SAS b) The ground proximity PULL-UP warning lights come on and stay on until the aircraft climbs above the TCF.

SAS 4) There is no TCF warning alert.

SAS 5) The GPWC inhibits TCF alerts for any of these conditions:

SAS a) Airplane is on the ground

SAS b) Less than 20 seconds after takeoff

SAS c) Less than 30 feet radio altitude

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SAS (j) Terrain Awareness Alerting and Display
SAS 1) Terrain awareness alerting algorithms continuously compute
SAS terrain clearance envelopes ahead of the aircraft. If the
SAS boundaries of these envelopes conflict with terrain
SAS elevation data in the terrain database, then alerts are
SAS issued. Two envelopes are computed, one corresponding to a
SAS Terrain Caution Alert level and the other to a Terrain
SAS Warning Alert level. The algorithms are designed to meet
SAS the following criteria:
SAS a) Operational Compatibility - Minimal unwanted alerts
SAS during normal flight operations and approach
SAS procedures.
SAS b) Improved Terrain Awareness Warning Times - Provide
SAS adequate alert times for all flight phases and
SAS conditions.
SAS c) Robustness - Tolerant of aircraft position errors,
SAS altitude signal errors, and database errors.
SAS 2) The Caution and Warning envelopes use the Terrain Clearance
SAS floor as a baseline, and virtually "look ahead" of the
SAS aircraft in a volume which is calculated as a function of
SAS airspeed, roll attitude and flight path angle.
SAS 3) If the aircraft penetrates the Caution Envelope boundary,
SAS the aural message "Caution Terrain, Caution Terrain" is
SAS generated, and alert discretes are activated for visual
SAS annunciation. Simultaneously, the conflicting terrain
SAS areas are shown in solid yellow color on the Terrain
SAS Display.
SAS 4) If the aircraft penetrates the Warning envelope boundary,
SAS the aural message "Terrain Terrain, Pull Up!" is generated,
SAS and alert discretes are activated for visual annunciation.
SAS Simultaneously, the conflicting terrain areas are shown in
SAS solid red color on the Terrain Display.
SAS 5) Provision has been included for an obstacle database
SAS providing similar annunciation when catalogued obstacles
SAS violate the same envelope boundaries.
SAS 6) The EGPWS alert lamps and audio outputs behave in the same
SAS manner as the standard GPWS mode alerts. A Terrain Caution
SAS Alert or Terrain Warning Alert will initiate a specific
SAS audio alert phrase.
SAS 7) Complementing the terrain threat alerts, the EGPWS also
SAS maintains a synthetic image of local terrain forward of the
SAS aircraft for display on EFIS EHSI's. This imposes strict
SAS timing requirements on the EGPWS functions to ensure the
SAS image is accurate and up-to-date on each synthetic radar
SAS display sweep.

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SAS 8) The EGPWS is configured to automatically de-select the
SAS Weather Display and "pop-up" a display of the terrain
SAS threats when they occur.
SAS 9) The Terrain/Obstacle Threat Detection and Display
SAS processing function performs the threat analysis on the
SAS terrain/obstacle data within computed caution and warning
SAS envelope boundaries below and forward of the aircraft path.
SAS Results of threat assessments are combined with background
SAS terrain data and nearest runway data and formatted into a
SAS terrain display immage, which can be displayed on an EFIS
SAS display in place of the weather image. In the event of
SAS terrain/obstacle caution or warning conditions, a specific
SAS audio alert is triggered, the red PULL-UP lights illuminate
SAS and the terrain display image is enhanced to highlight each
SAS of the types of terrain threats.
SAS 10) The basic Terrain Caution Envelope (or Yellow Alert
SAS Envelope) and Terrain Warning Envelope (or Red Alert
SAS Envelope) boundaries are illustrated.
SAS 11) A perspective view of the Terrain Detection envelope is
SAS illustrated.
SAS 12) The Caution Altitude Floor (or Terrain Floor) is computed
SAS as a function of Aircraft Altitude with respect to Nearest
SAS Runway Elevation and range to the Nearest Runway Threshold
SAS position. This parameter represents a distance below the
SAS aircraft. The relationship to the nearest runway threshold
SAS location prevents undesired alerts when the aircraft is
SAS taking off or landing at an airport. The system is
SAS compatible with terrain clearances allowed for by
SAS regulatory approach and departure design criteria.
SAS 13) The Caution Look Ahead Distance is computed from aircraft
SAS ground speed and turn rate to provide an advanced warning
SAS with adequate time for the crew to react safely. Depending
SAS on the situation, this distance roughly corresponds to
SAS between 40 and 60 seconds of advance alerting.
SAS 14) The Warning Altitude Floor is set to a fraction of the
SAS Caution Altitude Floor. The Warning Altitude Floor is
SAS computed as a function of Aircraft Altitude with respect to
SAS Nearest Runway Elevation and range to the Nearest Runway
SAS Threshold position. This parameter represents a distance
SAS below the aircraft. The relationship to the nearest runway
SAS threshold location prevents undesired alerts when the
SAS aircraft is taking off or landing at an airport.
SAS 15) The Warning Look Ahead Distance is a fraction of the
SAS Caution Look Ahead Distance (computed from aircraft ground
SAS speed and turn rate) to provide an advanced warning with
SAS adequate time for the crew to react safely.

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SAS 16) The Terrain Awareness Alerting and Display function
SAS maintains a Background Display of local terrain forward of
SAS the aircraft for cockpit display. In the event of terrain
SAS caution or warning conditions, an aural alert is triggered.
SAS The background image is then enhanced to highlight related
SAS terrain threats forward of the aircraft.
SAS 17) The background terrain is depicted as variable density dot
SAS patterns in green, yellow, or red. The density and color
SAS being a function of how close the terrain is relative to
SAS aircraft altitude. Terrain Alerts are depicted by painting
SAS the threatening terrain as solid yellow or red.
SAS 18) The set of Digital Elevation Matrix Overlays is processed
SAS by the terrain display algorithms into a matching set of
SAS Display Matrix Overlays and passed to the Radar Display
SAS Output Processor. The Display Matrix Overlays hold display
SAS attributes rather than elevation for each matrix element.
SAS These attributes are computed for the background and
SAS terrain threat areas and minimized (one byte) to reduce
SAS memory requirements and transfer time to the Radar Display
SAS Output Processor. The Aircraft Position and Aircraft
SAS Heading are used at the Radar Display Output Processor to
SAS extract the radar-like sweeping image ahead of the aircraft
SAS from the display overlays.
SAS 19) Each element of the output Display Matrix Overlays holds a
SAS single display attibute bytes with fields for the colors,
SAS patterns and symbols.
SAS 20) The EGPWS computer outputs a display of terrain data in
SAS weather radar format, per ARINC-708/708A (ARINC 453) bus
SAS specification. The terrain data is displayed on the EFIS
SAS EHSI's. When the Terrain Display is activated, it replaces
SAS the Weather Radar screen of the EHSI.
SAS 21) The Terrain Display can be made available to the flight
SAS crew at any time. When the conditions for either a Terrain
SAS Caution or a Terrain Warning are detected, the EGPWS
SAS computer also supplies a discrete "pop-up" signal. The
SAS "pop-up" signal is used to switch the EHSI displays from
SAS the Weather Radar to the Terrain Display.

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SAS 22) The Background Display is computed from the Aircraft
SAS Altitude with respect to the terrain data in the Digital
SAS Elevation Matrix Overlays. Where terrain data are
SAS available and sufficiently close to the aircraft altitude,
SAS they are presented in Background Color dot patterns
SAS reflecting the projected separations. Different dot
SAS density patterns and colors are used to represent terrain
SAS altitude bands with respect to the aircraft. Areas with no
SAS terrain data available are painted with the Low Density
SAS magenta dot pattern.
SAS 23) The "Peaks" Mode terrain display allows terrain below the
SAS aircraft to be viewed on the EGPWS terrain display during
SAS the cruise portion of flight. At aircraft altitudes safely
SAS above all terrain for the display range chosen, the terrain
SAS is displayed independent of aircraft altitude emphasizing
SAS the highest and lowest elevations to provide increased
SAS situational awareness. This increased awareness can be
SAS particularly valuable to the flight crew in the event of an
SAS unplanned descent or off-route deviation and for the
SAS purpose of previewing terrain prior to descent.
SAS 24) With the display, two elevation numbers indicating the
SAS highest and lowest terrain currently being displayed are
SAS overlaid on the display. The elevation numbers indicate
SAS terrain in hundreds of feet above sea level (MSL). The
SAS terrain elevation numbers are displayed with the "highest"
SAS terrain number on top, and the "lowest" terrain number
SAS beneath it. The "highest" terrain number is shown in the
SAS same color as the highest terrain color pattern on the
SAS display, and the "lowest" terrain number is shown in the
SAS color of the lowest terrain color pattern shown on the
SAS display. A single elevation number is displayed when the
SAS screen is all black as a result of flying over water or
SAS relatively flat terrain where there is no appreciable
SAS difference in terrain elevations. The elevation numbers on
SAS the display are an additional indication that the terrain
SAS display is selected.

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25) The Peaks Mode display adds a new solid green level to indicate the highest non-threatening terrain. The existing lower density green display patterns now indicate mid and upper terrain in the display area as well as terrain that is within 2000 feet below the aircraft. The red and yellow dot patterns are unchanged and continue to indicate terrain that is near or above the current altitude of the aircraft. Solid yellow and red colors are unchanged and continue to indicate alert and warning areas relative to the flight path of the aircraft. The Peaks Mode display is prioritized such that higher-level colors and densities override lower-level color and densities for maximum situational awareness of the most significant terrain relative to the altitude and flight path of the aircraft.

(k) GPWS - NON-NORMAL DISPLAYS

1) These messages show on the EFIS EHSI to alert the flight crew of GPWS non-normal conditions:
   a) System alert messages
   b) Range disagree messages

(l) GPWS System Alert Messages

1) These messages show in amber on the left side of the EHSI:
   a) TERR POS shows when the GPWS determines airplane position data is not valid.
   b) TERR OVRD shows when the terrain override switch on the Capt's panel is pushed.
   c) TERR FAIL shows when a fault occurs in the GPWS.
2) Terrain data does not show on either EHSI if there is a system alert message.

(m) Range Disagree Messages

1) These alert messages show in amber on the EHSI when there is a range disagree fault:
   a) TERR RANGE DISAGREE shows when the GPWS range disagrees with the range selected on the on-side EFIS control panel.
   b) MAP/TERR RANGE DISAGREE shows when the GPWS range, the on-side EFIS range, and the FMC range disagree.
2) Terrain data does not show on the EHSI if there is a range disagree message.

(n) EGPWS/EFIS INTERFACE

1) Before installation of Enhanced GPWS, pressing a "WXR" button to "ON" on an EFIS Control Panel would provide a ground, which, via the WXR Control Panel, would energize the Power Supply of the WXR R/T. It would also signal the respective EFIS to display the radar image at the selected range.

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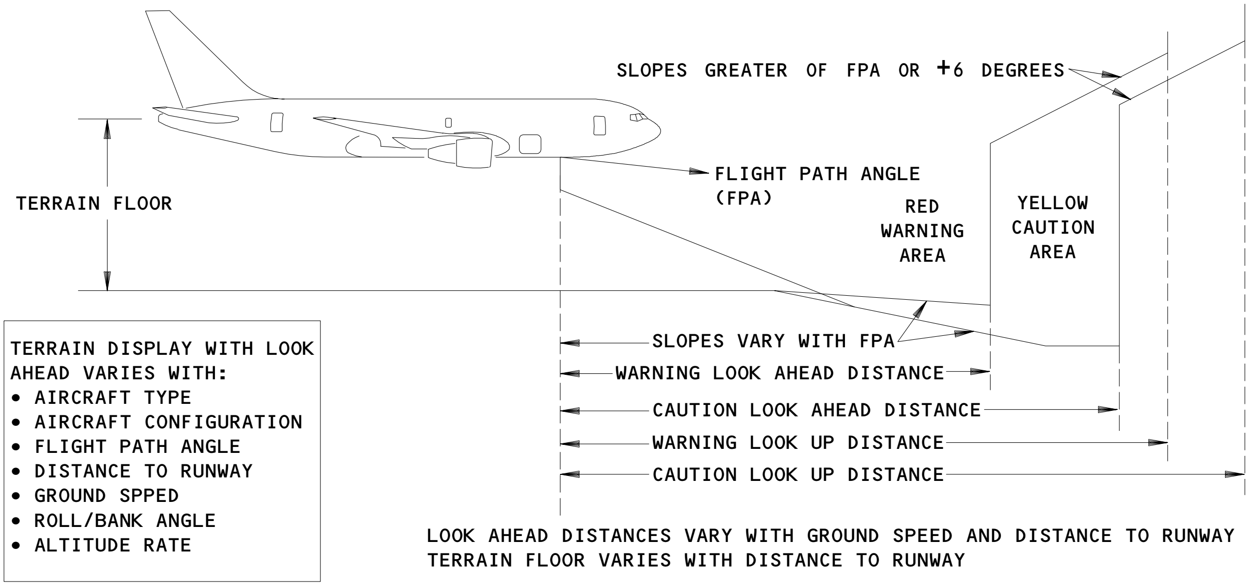
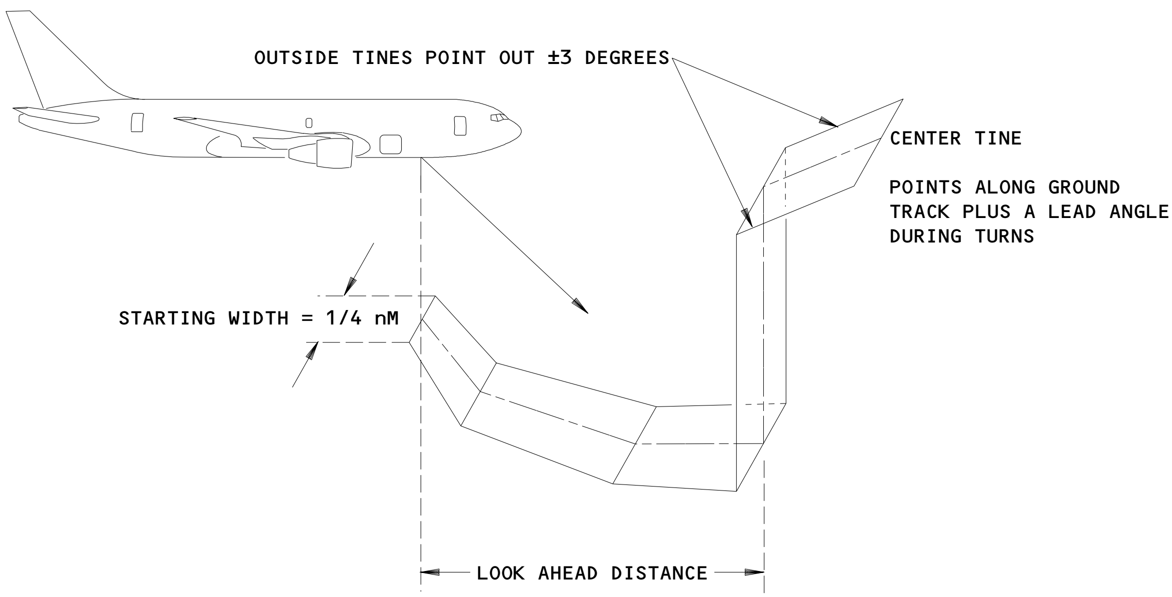


TERRAIN CAUTION AND WARNING ENVELOPE BOUNDARIES



TERRAIN DETECTION ENVELOPE - PERSPECTIVE VIEW

GPWS - Terrain Caution and Warning
Figure 6

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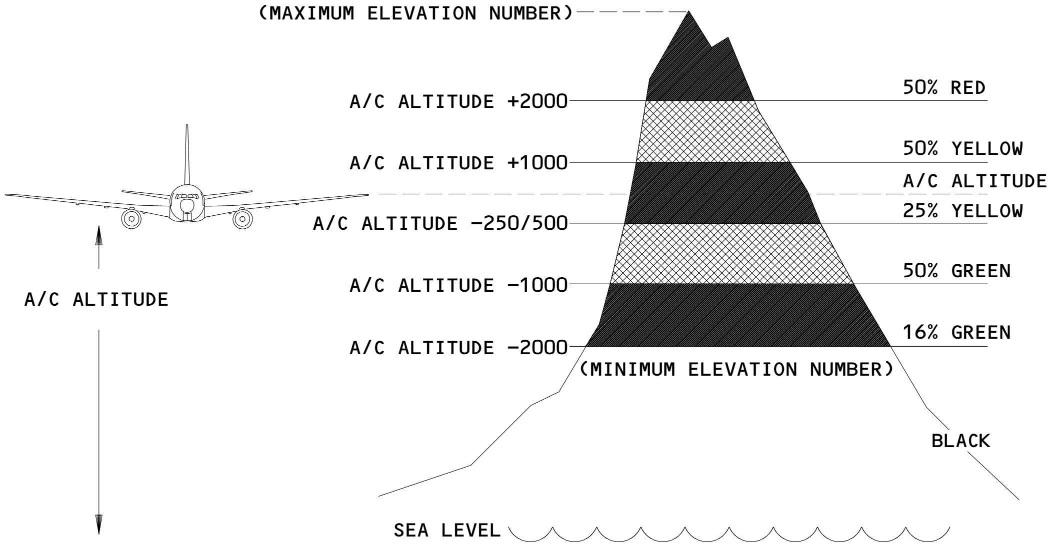
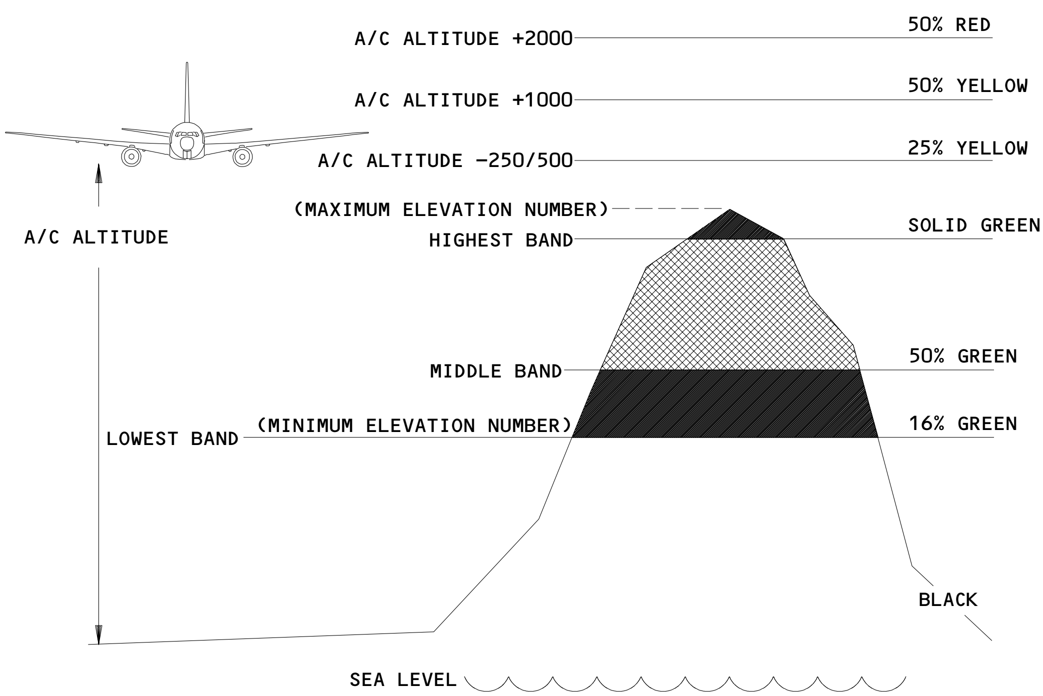


PEAKS MODE TERRAIN DISPLAY - AIRCRAFT AT LOW RELATIVE ALTITUDE



PEAKS MODE TERRAIN DISPLAY - AIRCRAFT AT HIGH RELATIVE ALTITUDE

GPWS - Peaks Mode
Figure 7 (Sheet 1)

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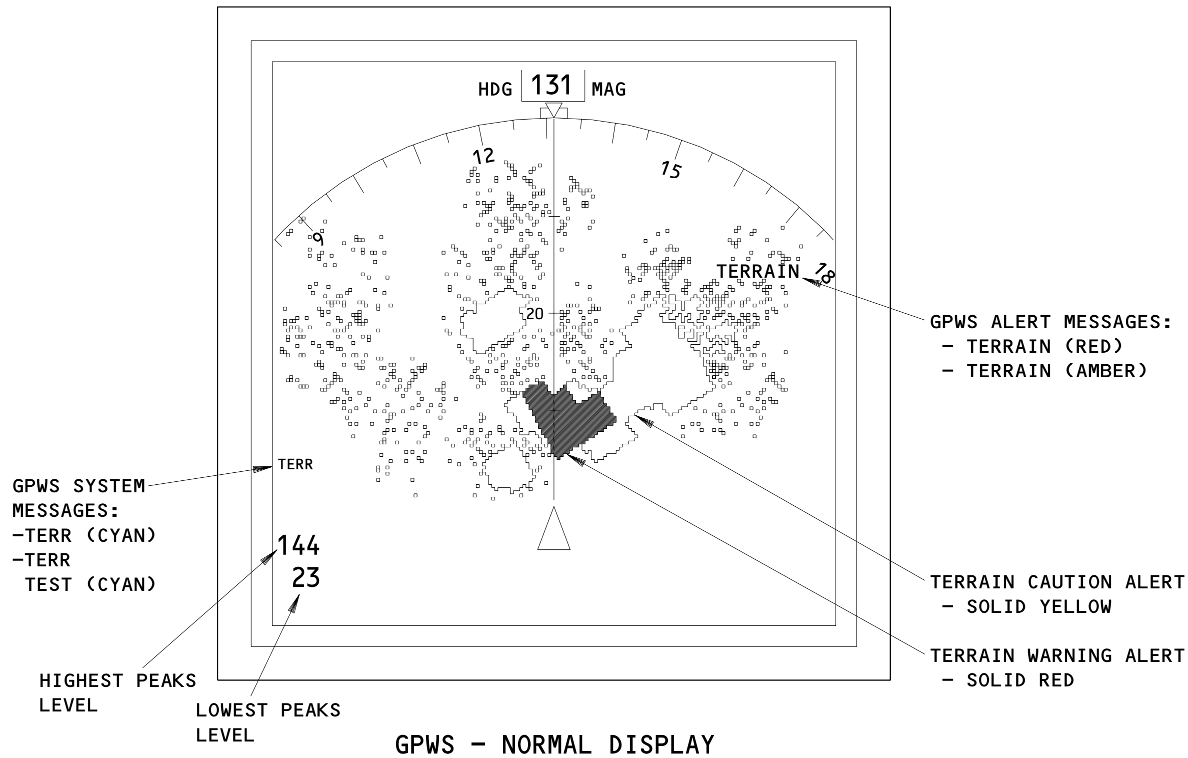

GPWS - NORMAL DISPLAY

GPWS - Peaks Mode
Figure 7 (Sheet 2)

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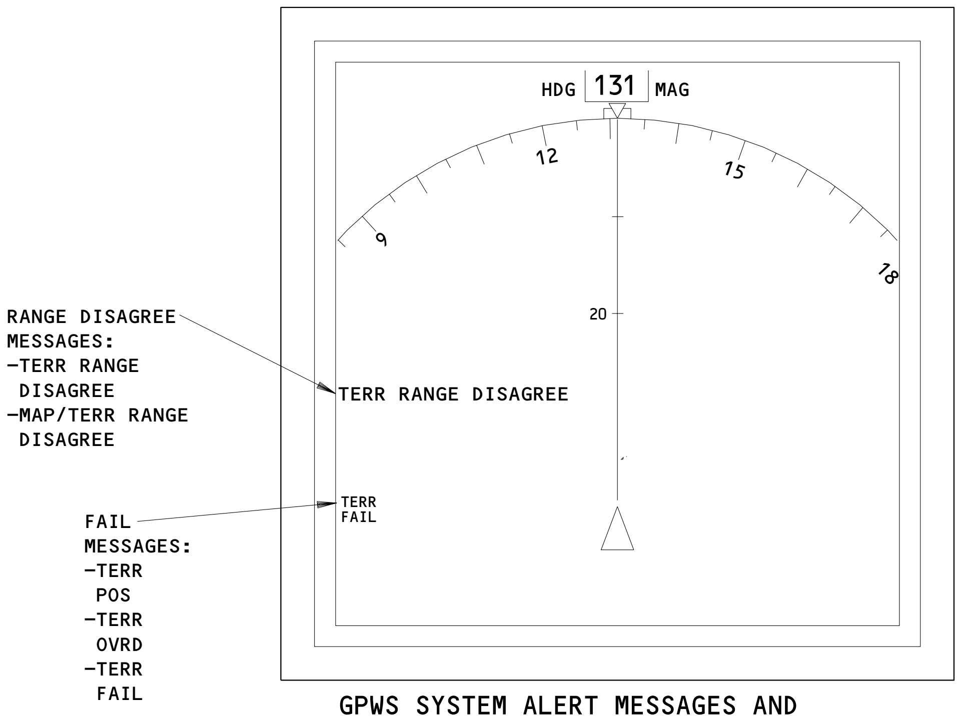

GPWS SYSTEM ALERT MESSAGES AND DISPLAY

GPWS - Non-Normal Displays
Figure 8

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SAS 2) After installation of Enhanced GPWS, pressing the button, now labeled "WXR/TERR", will still signal EFIS to display whichever data is at its ARINC 453 input port, be it Radar or Terrain.

SAS 3) With a pilot's "WXR/TERR" button "ON", momentarily pressing the; "WXR" switch will power the Radar and give a Radar image on EFIS, via a relaxed relay, and illuminate the "WXR" switch "ON".

SAS 4) With the "WXR/TERR" button "ON", momentarily pressing the "TERR" switch will trigger the GPWS Computer to energize the Terrain Display Relay.

SAS 5) This will:

SAS a) Cause the "TERR" switch to illuminate "ON" and the "WXR" switch to extinguish.

SAS b) Disconnect the power control of the Weather Radar R/T.

SAS c) Changeover the very high speed ARINC 453 port of the EFIS Symbol Generator from the Weather Radar R/T to the GPWS Computer for terrain display on the EHSI.

SAS 6) Unguardinig and pressing the F/O's "TERR OVRD" switch illuminates its "OVRD" light and inhibits the operation of Terrain display.

SAS 7) If the EGPWS System becomes unserviceable or loses position accuracy, the "TERR OVRD" switch "INOP" light illuminates.

SAS a) DC power for the relays is from the DC Bus Left via C/B "TERR DSPL".

SAS (o) System self-test may be initiated by pressing the GND PROX switch on the Miscellaneous Test Panel (on P61 panel). Two types of self-test are available, a confidence test and a full vocabulary test. The confidence test may be initiated either on the ground or in the air (inhibited between lift-off and 1000 feet radio altitude) to give the pilots an indication of system operation. The full vocabulary test, which may be initiated only on the ground, is used as an operational test of the system.

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GROUND PROXIMITY WARNING SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
CIRCUIT BREAKER - GND PROX, C592	2	1	FLT COMPT, P11 11F4	*
COMPUTER - GROUND PROXIMITY WARNING, M147	1	1	119AL, MAIN EQUIP CTR, E1-5	34-46-01
LIGHT - PULL UP	2	1	FLT COMPT, P1, DISCRETE WARNING DISPLAY MODULE, M779 (REF)	*
LIGHT - WINDSHEAR, L890	2	1	FLT COMPT, P1-3	
MODULE - (FIM 33-16-00/101) DISCRETE WARNING DISPLAY, M779				
MODULE - (FIM 32-30-00/101) LANDING GEAR CONTROL LEVER, M937				
MODULE - (FIM 27-58-00/101) LEFT FLAP/STAB POSITION, M838				
PANEL - (FIM 28-43-00/101) MISCELLANEOUS TEST, M10398				
RELAY - (FIM 31-01-36/101) SYSTEM 1 AIR/GROUND, K149				
SWITCH - GND PROX TEST, YEIS4	2	1	FLT COMPT, P61, MISC TEST PANEL, M10398 (REF)	*
SWITCH-LIGHT - GND PROX/CONFIG GEAR OVRD, S604	2	1	FLT COMPT, P3-1	*
SWITCH-LIGHT - GND PROX FLAP OVRD, S603	2	1	FLT COMPT, P3-1	*
SWITCH-LIGHT - GND PROX G/S INHBT, S16	2	1	FLT COMPT, P1-3	*

* SEE THE WDM EQUIPMENT LIST

Ground Proximity Warning System - Component Index
Figure 101

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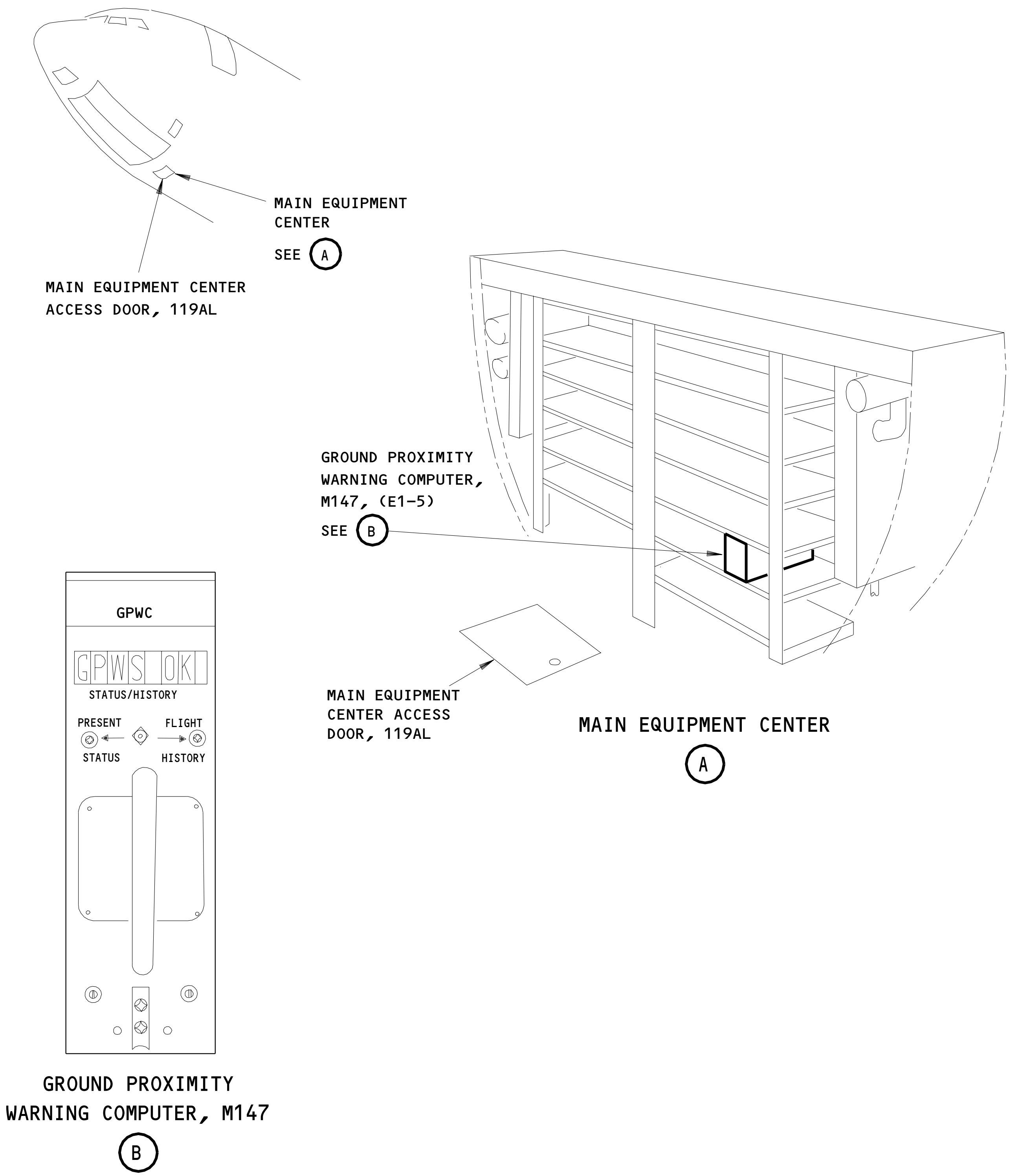

Ground Proximity Warning System - Component Location
Figure 102 (Sheet 1)

M34089

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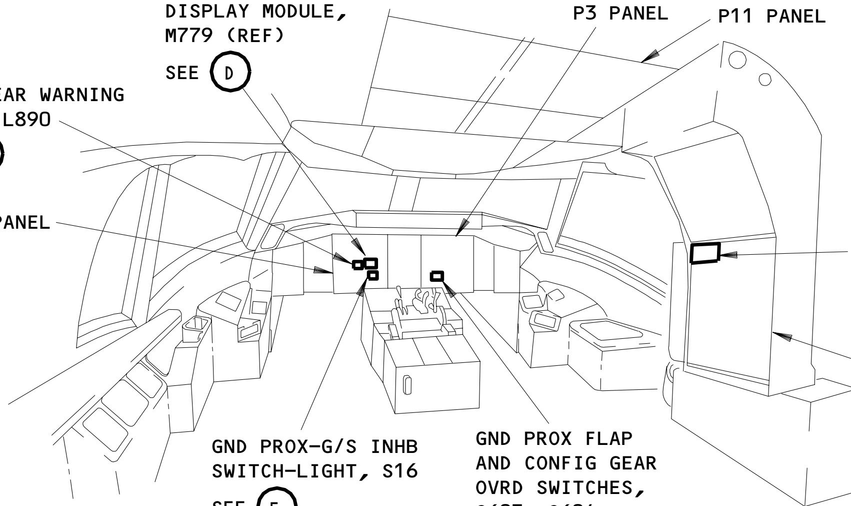
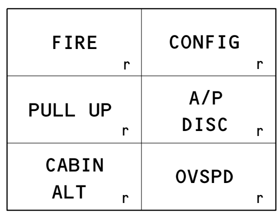


FLIGHT COMPARTMENT

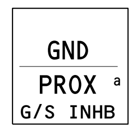


DISCRETE WARNING DISPLAY MODULE, M779 (REF)

D

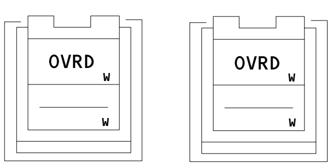
WINDSHEAR WARNING LIGHT, L890

C



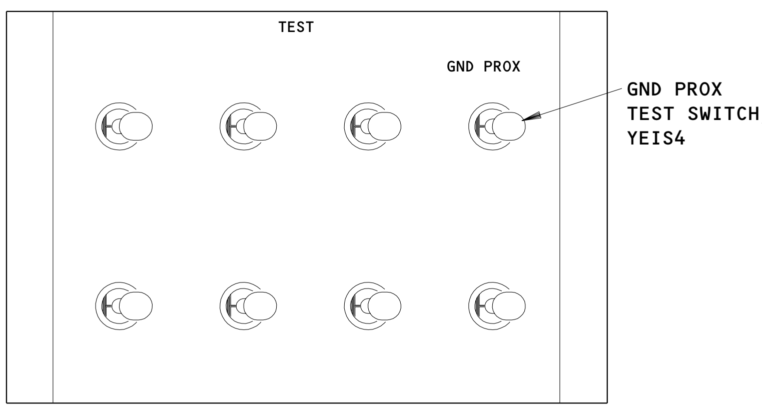
GND PROX-G/S INHB SWITCH-LIGHT, S16

E



GND PROX FLAP AND CONFIG GEAR OVRD SWITCHES, S603, S604

F



TEST PANEL MODULE, M10398 (REF)

G

Ground Proximity Warning System - Component Location
Figure 102 (Sheet 2)

M34094

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GROUND PROXIMITY WARNING SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure contains two tasks. The first task is the operational test of the Ground Proximity Warning System (GPWS), and the second task is the system test.
   B. The operational test uses BITE to do a fast check for correct operation. Test equipment or special procedures are not necessary.
   C. The system test uses the maintenance lable (hex code) to do a complete check of the GPWS.
SAS D. The SAS data was changed to show only the -207 GPWC and subsequent per
SAS SAS COC No. PR 34-01-96, dated September 20, 1996.

TASK 34-46-00-715-001-002

2. GPWS - Operational Test
   A. General
      (1) The operational test is the self-test mode of the Ground Proximity Warning Computer (GPWC). This test will make sure of the conditions that follow:
         - the GPWC modules function correctly
         - the interface and failure warning systems operate
   B. References
      (1) 24-22-00/201, Electrical Power - Control
      (2) 34-21-00/201, Inertial Reference System
   C. Access
      (1) Location Zones
          211/212 Flight Compartment

   D. Prepare for the GPWS Operational Test

      S 865-002-002
      (1) Make sure this circuit breaker is closed:
         (a) P11 Overhead Circuit Breaker Panel
            1) 11F4, GND PROX

      S 865-003-002
      (2) Supply electrical power (Ref 24-22-00/201).
   E. GPWS Operational Test

      S 865-004-002
      (1) Energize and align the IRUs (Ref 34-21-00/201).

      S 865-005-002
      (2) Push the STATUS switch on the EICAS display select panel.

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S 745-006-002

(3) Set and hold the GND PROX test switch on the miscellaneous test panel for at least 6 seconds.

(a) Make sure this sequence of visual and aural indications occurs:

NOTE: The EICAS message, GND PROX SYS, may not show on the bottom display for up to 12 seconds.

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	AURALS	WARNING LIGHTS	EADI MSG	EICAS MESSAGE
	"GLIDESLOPE"	GND PROX (A)		GND PROX SYS
	"WHOOP WHOOP PULL-UP"	MASTER (R), PULL UP (R)		GND PROX SYS
	SIREN	MASTER, WINDSHEAR (R)	WINDSHEAR (R)	GND PROX SYS
	"WINDSHEAR,	MASTER, WINDSHEAR (R)	WINDSHEAR (R)	GND PROX SYS
	WINDSHEAR,	MASTER, WINDSHEAR (R)	WINDSHEAR (R)	GND PROX SYS
	WINDSHEAR"	MASTER, WINDSHEAR (R)	WINDSHEAR (R)	GND PROX SYS
			WINDSHEAR (A)	GND PROX SYS
	"SINK RATE"			GND PROX SYS
	"WHOOP WHOOP PULL-UP"			GND PROX SYS
	"TERRAIN"			GND PROX SYS
	"WHOOP WHOOP PULL-UP"			GND PROX SYS
	"DON'T SINK"			GND PROX SYS
	"TOO-LOW TERRAIN"			GND PROX SYS
	"TOO-LOW GEAR"			GND PROX SYS
	"TOO-LOW FLAPS"			GND PROX SYS
	"TOO-LOW TERRAIN"			GND PROX SYS
	"GLIDESLOPE"			GND PROX SYS
SAS	"APPROACHING			GND PROX SYS
SAS	DECISION HEIGHT"			GND PROX SYS
SAS	"MINIMUMS"			GND PROX SYS
SAS	"TWENTY FIVE			GND PROX SYS
SAS	HUNDRED"			GND PROX SYS
SAS	"ONE THOUSAND"			GND PROX SYS
SAS	"FIFTY"			GND PROX SYS
SAS	"FORTY"			GND PROX SYS
SAS	"THIRTY"			GND PROX SYS
SAS	"TWENTY"			GND PROX SYS
SAS	"TEN"			GND PROX SYS
	SIREN			GND PROX SYS
	"WINDSHEAR,			GND PROX SYS
	WINDSHEAR,			GND PROX SYS
	WINDSHEAR"			GND PROX SYS

F. Put the Airplane Back to Its Usual Condition.

S 865-007-002

(1) Remove electrical power if it is not necessary (Ref 24-22-00/201).

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TASK 34-46-00-735-008-002

3. GPWS - System Test

A. General

(1) The system test includes the GPWS operational test, does a check of the system interfaces, and makes sure of correct operation of the different GPWS modes. You must do these mode checks in sequence.

NOTE: The mode 2 test is not done because the baro rate, radio altitude, and airspeed functions are examined by other mode tests.

B. Equipment

(1) Main Landing Gear Lock Pin, A32014-1
(2) Nose Landing Gear Lock Pin, A32014-2
(3) MLG Lock Pin Removal/Installation Tool, A32015-9
(4) Manually operated stop watch.

C. References

(1) AMM 24-22-00/201, Electrical Power - Control
(2) AMM 32-00-20/201, Landing Gear Down Lock
(3) AMM 34-22-00/501, Flight Instrument System
(4) AMM 34-46-00/501, Ground Proximity Warning System

D. Access

(1) Location Zones
211/212 Flight Compartment

E. Prepare for Test

S 865-009-002

(1) Supply electrical power (Ref 24-22-00/201).

S 865-010-002

WARNING: MAKE SURE THE FLAPS ARE CLEAR BEFORE YOU START THEM. IF YOU DO NOT, INJURY TO PERSONS CAN OCCUR.

(2) Make sure the flaps are in the normal position (zero degrees).

S 865-011-002

(3) Install the landing gear lock pins (Ref 32-00-20/201).

S 865-012-002

(4) Remove hydraulic power from the landing gear systems.

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S 755-013-002
(5) Make sure the EICAS message, GND PROX SYS, does not show on the bottom display.

S 865-014-002
(6) Make sure the Flight Instrument System is on (AMM 34-22-00/501).

S 865-015-002
(7) Make sure the EFI switches on the left and right instrument source select panels are in the NORM position.

S 865-016-002
(8) Set the COMPUTER switch on the EICAS display select panel to the L position.

S 715-017-002
(9) Do the GPWS - Operational Test (AMM 34-46-00/501).

S 865-018-002
(10) Set the EFI switch on the left instrument source select panel to the ALTN position.

S 715-019-002
(11) Do the GPWS - Operational Test again (AMM 34-46-00/501).

S 865-020-002
(12) Set the EFI switch on the left instrument source select panel to the NORM position.

F. Interface Test

S 865-021-002
(1) Set the COMPUTER switch on the EICAS display select panel to the R position.

S 865-022-002
(2) Push the STATUS switch on the EICAS display select panel.

S 865-023-002
(3) Open the RAD ALTM LEFT (11F5) circuit breaker on the P11 panel.
(a) Make sure the EICAS message, GND PROX SYS, shows on the bottom display in less than 12 seconds.

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S 865-024-002

(4) Close the RAD ALTM LEFT (11F5) circuit breaker.
   (a) Make sure the EICAS message, GND PROX SYS, does not show on the bottom display.

S 865-025-002

(5) Open the ILS LEFT (11E10) circuit breaker on the P11 panel.
   (a) Make sure the EICAS message, GND PROX SYS, shows on the bottom display in less than 18 seconds.

S 865-026-002

(6) Close the ILS LEFT (11E10) circuit breaker.
   (a) Make sure the EICAS message, GND PROX SYS, does not show on the bottom display.

S 865-027-002

(7) Open the AIR DATA CMPTR LEFT (11A10) circuit breaker on the P11 panel.
   (a) Make sure the EICAS message, GND PROX SYS, shows on the bottom display in less than 12 seconds.

S 865-028-002

(8) Close the AIR DATA CMPTR LEFT (11A10) circuit breaker.
   (a) Make sure the EICAS message, GND PROX SYS, does not show on the bottom display.

S 865-029-002

(9) Open the GND PROX (11F4) circuit breaker on the P11 panel.
   (a) Make sure the EICAS message, GND PROX SYS, shows on the bottom display in less than 6 seconds.

S 865-030-002

(10) Close the GND PROX (11F4) circuit breaker.
   (a) Make sure the EICAS message, GND PROX SYS, does not show on the bottom display.

S 865-031-002

(11) Open the WARN ELEX A (11J34) and WARN ELEX B (11B18) circuit breakers on the P11 panel.
   (a) Make sure the EICAS message, GND PROX SYS, shows on the bottom display in less than 12 seconds.

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S 865-032-002

(12) Close the WARN ELEX A (11J34) and WARN ELEX B (11B18) circuit breakers.

(a) Make sure the EICAS message, GND PROX SYS, does not show on the bottom display.

G. Gear Input Discrete Test - Mode 4A

NOTE: Ignore the hex characters where X's show.

S 865-033-002

(1) Make sure the landing gear downlock pins are installed.

S 865-034-002

(2) Make sure the left and right hydraulic systems are released of pressure.

S 865-035-002

(3) Make sure the landing gear lever is in the DOWN position.

S 865-036-002

(4) Set the STATUS/HISTORY switch on the GPWC front panel to the PRESENT STATUS position.

(a) Make sure the GPWC display shows 1*1XXXX* after the database version

S 865-037-002

(5) Set the landing gear lever to the OFF position.

(a) Make sure the GPWC display changes to 1*0XXXX*.

S 865-038-002

(6) Push the GND PROX/CONFIG GEAR OVRD switch on the first officer's panel, P3-1.

(a) Make sure these indications occur:

1) GPWC display changes to 1*1XXXX*.

2) The GEAR OVRD indication shows.

S 865-039-002

(7) Push the GND PROX/CONFIG GEAR OVRD switch.

(a) Make sure the GEAR OVRD indication does not show.

S 865-040-002

(8) Set the landing gear lever to the DOWN position.

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H. Flap Input Discrete Test - Mode 4B

NOTE: Ignore the hex characters where X's show.

S 865-041-002

WARNING: MAKE SURE THE FLAPS ARE CLEAR BEFORE YOU START THEM. IF YOU DO NOT, INJURY TO PERSONS CAN OCCUR.

(1) Supply hydraulic pressure to move the flaps.

S 865-042-002

(2) Set the flaps to 25 degrees.

S 865-043-002

(3) Set the STATUS HISTORY switch on the GPWC front panel to the PRESENT STATUS position.
   (a) Make sure the GPWC display shows 1*X1XXX* after the database version.

S 865-044-002

(4) Open the FLAP/STAB POS SENSING L (11J17) circuit breaker on the P11 panel.
   (a) Make sure the GPWC display shows 1*X0XXX*.

S 865-045-002

(5) Push the GND PROX FLAP OVRD switch.
   (a) Make sure these indications occur:
      1) The GPWC display shows 1*X1XXX*.
      2) The FLAP OVRD indication shows.

S 865-046-002

(6) Push the GND PROX FLAP OVRD switch.
   (a) Make sure the FLAP OVRD indication does not show.

S 865-047-002

WARNING: MAKE SURE THE FLAPS ARE CLEAR BEFORE YOU START THEM. IF YOU DO NOT, INJURY TO PERSONS CAN OCCUR.

(7) Set the flaps to 0 degrees.

S 865-048-002

(8) Remove hydraulic pressure from the flaps.

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I. Glideslope Inhibit Discrete Test - Mode 5

NOTE: Ignore the hex characters where X's show.

S 865-049-002
(1) Set the STATUS HISTORY switch on the GPWC front panel to the PRESENT STATUS position.
(a) Make sure the GPWC display shows 1*XX0XX* after the database version.

S 865-050-002
(2) Push and hold the yellow GND PROX G/S INHB switch/light on the captain's panel, P1-3.
(a) Make sure the GPWC display shows "1*XX1XX*".

S 865-051-002
(3) Release the GND PROX G/S INHB switch/light.

J. AIR/GND Discrete Test

NOTE: Ignore the hex characters where X's show.

S 865-052-002
(1) Set the STATUS HISTORY switch on the GPWC front panel to the PRESENT STATUS position.
(a) Make sure the GPWC display shows 1*XXX0X* after the database version.

S 865-053-002
(2) Open the LANDING GEAR POSITION AIR/GND SYS 1 (11C30) circuit breaker.
(a) Make sure the GPWC display shows 1*XXX1X*.

S 865-054-002
(3) Close the LANDING GEAR POSITION AIR/GND SYS 1 (11C30) circuit breaker.

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K. EFIS Control Panel Data Bus Test

S 865-055-002

(1) Set the STATUS HISTORY switch on the GPWC front panel to the PRESENT STATUS position.

(a) Make sure the GPWC display shows 3*XXXX8* after the database version.

NOTE: Ignore the hex characters where X's show. The maintenance label 1*XXXXX* and 2*XXXXX* will show for 30 seconds after the database version. To remove the maintenance labels, set the STATUS HISTORY switch on the GPWC front panel to the PRESENT STATUS position two times after each label shows.

L. Put the Airplane Back to Its Usual Condition

S 095-056-002

(1) Remove the test equipment.

S 865-057-002

(2) Remove electrical power if it is not necessary (Ref 24-22-00/201).

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SAS GROUND PROXIMITY WARNING SYSTEM - ADJUSTMENT/TEST
SAS
SAS 1. General
SAS A. There are two tasks in this procedure. One is an operational test and
SAS the other a system test. The operational test is self-contained and uses
SAS on-baord equipment. The system test is a complete check of the EGPWS,
SAS requiring additional equipment and successful completion of the
SAS operational test.
SAS
SAS TASK 34-46-00-715-001-003
SAS 2. Ground Proximity Warning System - Operational Test
SAS A. References
SAS (1) AMM 24-22-00/201, Electrical Power - Control
SAS (2) AMM 34-21-00/201, Inertial Reference System
SAS B. Access
SAS (1) Location Zones
SAS 211/212 Flight Compartment
SAS
SAS C. Prepare for the Test
SAS
SAS S 865-002-003
SAS (1) Supply electrical power (AMM 24-22-00/201).
SAS
SAS S 865-003-003
SAS (2) Make sure these circuit breakers on the P11 panel are closed:
SAS (a) 11F4, GND PROX
SAS (b) 11F3, TERR DSPL
SAS (c) 11F5, Left RAD ALTM
SAS (d) 11F20, Center RAD ALTM
SAS (e) 11F26, Right RAD ALTM
SAS (f) 11A10, Left AIR DATA CMPTR
SAS (g) 11E10, Left ILS
SAS (h) 11E9, Left FMCS CMPTR
SAS (i) 11J34, WARN ELEX A
SAS (j) 11B18, WARN ELEX B
SAS (k) 11F8, Left EFIS SYM GEN
SAS (l) 11F9, Center EFIS SYM GEN
SAS (m) 11F29, Right EFIS SYM GEN
SAS (n) 11E4, Left EFIS CONT PNL
SAS (o) 11E25, Right EFIS CONT PNL
SAS
SAS S 865-004-003
SAS (3) Make sure the Left and Right IRU are in the NAV mode and aligned
SAS (AMM 34-21-00/201).

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SAS
SAS S 865-005-003
SAS (4) Set both the Captain's and F/O's EFIS Control Panel WXR/TERR
SAS switches to ON.
SAS
SAS S 865-006-003
SAS (5) Ensure that the display mode for both the Captain's and F/O's
SAS Navigation Display (EHSI) are suitable for displaying weather (e.g.,
SAS MAP mode).
SAS
SAS S 865-007-003
SAS (6) Ensure that the terrain display is not selected.
SAS
SAS S 865-008-003
SAS (7) Make sure the captain's and the first officer's PULL-UP lights are
SAS off.
SAS
SAS S 865-009-003
SAS (8) Make sure the captain's and the first officer's GND PROX G/S INHIBIT
SAS lights are off.
SAS
SAS S 865-010-003
SAS (9) Make sure the captain's and the first officer's WINDSHEAR warning
SAS lights are off and the message WINDSHEAR is not shown on the EADI.
SAS
SAS S 865-011-003
SAS (10) Make sure the message GND PROX SYS is not shown on the EICAS.
SAS
SAS S 865-012-003
SAS (11) Make sure the GND PROX FLAP OVRD and GND PROX/CONFIG GEAR OVRD
SAS switches are in the NORMAL position.
SAS D. Do the Operational Test
SAS
SAS S 745-013-003
SAS (1) Push and hold the GND PROX test switch on the Miscellaneous Test
SAS Panel until the first voice message is heard.
SAS
SAS S 745-014-003
SAS (2) VERIFY the following sequence:
SAS (a) GND PROX SYS EICAS message and Terrain INOP light turns on
SAS (b) GND PROX light turns on
SAS (c) Voice: "GLIDESLOPE"
SAS (d) GND PROX light turns off
SAS (e) GPWS PULL UP light turns on
SAS (f) Voice: "PULL UP"
SAS (g) GPWS PULL UP light turns off

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SAS (h) WINDSHEAR light turns on and red WINDSHEAR annunciation is
SAS displayed on the Captain's and F/O's EADI's
SAS (i) Voice: (SIREN) "WINDSHEAR, WINDSHEAR, WINDSHEAR"
SAS (j) WINDSHEAR light and EADI WINDSHEAR annunciations turn off
SAS (k) Amber WINDSHEAR annunciation is displayed on the EADI's
SAS (l) Amber WINDSHEAR annunciations turn off
SAS (m) GPWS PULL UP light turns on
SAS (n) Voice: "TERRAIN TERRAIN PULL UP"
SAS (o) GPWS PULL UP light turns off
SAS (p) Captain's and F/O's TERR select switch ON legend is illuminated
SAS (q) Terrain Displays show terrain test pattern
SAS (r) GND PROX light turns on
SAS (s) GND PROX light turns off
SAS (t) Voice: "SINKRATE"
SAS (u) Voice: "PULL UP"
SAS (v) Voice: "TERRAIN"
SAS (w) Voice: "PULL UP"
SAS (x) Voice: "DON'T SINK DON'T SINK"
SAS (y) Voice: "TOO LOW TERRAIN"
SAS (z) Voice: "TOO LOW GEAR"
SAS (aa) Voice: "TOO LOW FLAPS"
SAS (ab) Voice: "TOO LOW TERRAIN"
SAS (ac) Voice: "GLIDESLOPE"
SAS (ad) Voice: "BANK ANGLE BANK ANGLE"
SAS (ae) Voice: "PLUS HUNDRED"
SAS (af) Voice: "MINIMUMS"
SAS (ag) Voice: "TWENTY FIVE HUNDRED"
SAS (ah) Voice: "ONE THOUSAND"
SAS (ai) Voice: "FIVE HUNDRED"
SAS (aj) Voice: "FIFTY"
SAS (ak) Voice: "FORTY"
SAS (al) Voice: "THIRTY"
SAS (am) Voice: "TWENTY"
SAS (an) Voice: "TEN"
SAS (ao) Voice: (SIREN) "WINDSHEAR WINDSHEAR WINDSHEAR"
SAS (ap) Voice: "TOO LOW TERRAIN"
SAS (aq) Voice: "CAUTION TERRAIN CAUTION TERRAIN"
SAS (ar) Voice: "TERRAIN TERRAIN PULL UP"
SAS (as) Voice: "CAUTION OBSTACLE CAUTION OBSTACLE"
SAS (at) Voice: "OBSTACLE OBSTACLE PULL UP"
SAS (au) Terrain Displays return to normal
SAS (av) All INOP lights, switch legends and EICAS messages turn off
SAS E. Put the Airplane Back to Its Usual Condition
SAS
SAS S 865-037-003
SAS (1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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SAS
SAS TASK 34-46-00-735-015-003
SAS 3. Ground Proximity Warning System - System Test
SAS A. General
SAS (1) The system test includes the GPWS operational test, it does a check of the system interfaces, and it makes sure of correct operation of the different GPWS modes. You must do these mode tests in sequence.
SAS B. Equipment and Materials
SAS (1) Main and Nose landing gear lockpins A32014-1 and A32014-2
SAS (2) MLG Lock Pin Removal/Installation Tool A32015-9
SAS (3) Stopwatch
SAS (4) Multimeter
SAS C. References
SAS (1) AMM 27-51-00/501, Trailing Edge Flaps
SAS (2) AMM 29-11-00/201, Hydraulic Power
SAS (3) AMM 32-00-20/201, Landing Gear Down Lock
SAS (4) AMM 34-11-01/501, Pitot Static
SAS (5) AMM 34-22-00/501, Flight Instrument System
SAS (6) AMM 34-33-00/501, LRRA
SAS D. Access
SAS (1) Location Zones
SAS 211/212 Flight Compartment
SAS
SAS E. Prepare for the Test
SAS
SAS S 865-016-003
SAS (1) Supply electrical power (AMM 24-22-00/201).
SAS
SAS S 865-017-003
SAS (2) Make sure these circuit breakers on the P11 panel are closed:
SAS (a) 11F4, GND PROX
SAS (b) 11F3, TERR DSPL
SAS (c) 11F5, Left RAD ALTM
SAS (d) 11F20, Center RAD ALTM
SAS (e) 11F26, Right RAD ALTM
SAS (f) 11A10, Left AIR DATA CMPTR
SAS (g) 11E10, Left ILS
SAS (h) 11E9, Left FMCS CMPTR
SAS (i) 11J34, WARN ELEX A
SAS (j) 11B18, WARN ELEX B
SAS (k) 11F8, Left EFIS SYM GEN
SAS (l) 11F9, Center EFIS SYM GEN
SAS (m) 11F29, Right EFIS SYM GEN
SAS (n) 11E4, Left EFIS CONT PNL
SAS (o) 11E25, Right EFIS CONT PNL

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S 865-018-003

(3) Make sure the Left and Right IRU are in the NAV mode and aligned (AMM 34-21-00/201).

S 865-038-003

CAUTION: ALL LANDING GEAR GROUND LOCKS MUST BE INSTALLED. NO TRY SHALL BE MADE TO MOVE LANDIING GEAR HANDLE INTO UP POSITION.

(4) Install the landing gear lockpins (AMM 32-00-20/201).

S 865-020-003

(5) Remove hydraulic power from the landing gear system (AMM 29-11-00/201).

S 865-039-003

WARNING: ENSURE THAT GROUND EQUIPMENT IS OUT OF FLAP TRAVEL AND THAT ALL PERSONNEL SAFETY PRECAUTIONS AND WARNINGS ARE IN EFFECT.

(6) Make sure the flaps are in the normal position (zero degree).

F. Do a Test of the System

S 755-022-003

(1) Make sure the GND PROX SYS message does not show on EICAS.

S 865-023-003

(2) Make sure the PULL-UP light is off.

S 865-024-003

(3) Make sure the GND PROX G/S INHIBIT light is off.

S 865-025-003

(4) Make sure the WINDSHEAR warning light is off and the message WINDSHEAR is not shown on the EADI.

S 735-026-003

(5) System Self Test
 (a) The following tests verify the installation through the Built-In-Test (BIT) capabilities of the EGPWC.
 (b) A high level of confidence in the EGPWS installation can be achieved by initiating the EGPWS self test. The EGPWS System Self Test is divided into six levels.
 (c) These are:
  1) Level 1 Go/No Go Test

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2) Level 2 Current Faults
3) Level 3 EGPWS Configuration
4) Level 4 Fault History
5) Level 5 Warning History
6) Level 6 Discrete Input Test

S 745-027-003

(6) Self Test Initiation

(a) Self Test is initiated by pressing the GND PROX test switch for less than 2 seconds. Alternatively, the Self Test may be initiated via the SELF TEST switch on the front of the EGPWC.

NOTE: The Self Test Aural volume is 6 dB lower than the Warning Aural volume.

S 745-028-003

(7) Self Test Short and Long Cancel

(a) A Short Cancel is accomplished by pressing and holding the GND PROX test switch for less than 2 seconds.

(b) A Long Cancel is accomplished by pressing and holding the GND PROX test switch for between 2 and 8 seconds.

G. Self Test Level 1 - Go/No Go Test

S 745-029-003

(1) Test Procedure

(a) Set both the Captain's and F/O's EFIS Control Panel WXR/TERR switches to ON.

(b) Ensure that the display mode for both the Captain's and F/O's Navigation Display (EHSI) are suitable for displaying weather (e.g., MAP mode).

(c) Ensure that the terrain display is not selected.

(d) Initiate the Level 1 Go/No Go test self test by pressing the GND PROX test switch for less than 2 seconds.

(e) VERIFY the following sequence:

1) GND PROX SYS EICAS message and Terrain INOP light turns on
2) GND PROX light turns on
3) Voice: "GLIDESLOPE"
4) GND PROX light turns off
5) GPWS PULL UP light turns on
6) Voice: "PULL UP"
7) GPWS PULL UP light turns off
8) WINDSHEAR light turns on and red WINDSHEAR annunciation is displayed on the Captain's and F/O's EADI's
9) Voice: (SIREN) "WINDSHEAR, WINDSHEAR, WINDSHEAR"
10) WINDSHEAR light and EADI WINDSHEAR annunciations turn off

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SAS 11) Amber WINDSHEAR annunciation is displayed on the EADI's
SAS 12) Amber WINDSHEAR annunciations turn off
SAS 13) GPWS PULL UP light turns on
SAS 14) Voice: "TERRAIN TERRAIN PULL UP"
SAS 15) GPWS PULL UP light turns off
SAS 16) Captain's and F/O's TERR select switch ON legend is
SAS illuminated
SAS 17) Terrain Displays show terrain test pattern
SAS 18) GND PROX light turns on
SAS 19) GND PROX light turns off
SAS 20) Terrain Displays return to normal
SAS 21) All INOP lights and EICAS messages turn off
SAS (f) End of Self Test Level 1.
SAS H. Self Test Level 2 - Current Faults
SAS
SAS <u>NOTE</u>: The GND PROX SYS EICAS message will be displayed and the Terrain
SAS INOP light will be illuminated throughout this test.
SAS
SAS <u>NOTE</u>: Self Test Level 2 follows Self Test Level 1 such that Self Test
SAS Level 1 must be performed to initiate Self Test Level 2.
SAS
SAS
SAS S 745-030-003
SAS (1) Test Procedure
SAS (a) Initiate the EGPWS Self Test (Level 1) and release the GND PROX
SAS test switch. Once the Level 1 Self Test audio sequence begins,
SAS press and hold the GND PROX test switch for less than 2 seconds
SAS (this will start Self Test Level 2).
SAS (b) VERIFY the following messages are enunciated:
SAS 1) "CURRENT FAULTS"
SAS 2) "NO FAULTS"
SAS 3) "PRESS TO CONTINUE"
SAS (c) End of Self Test Level 2.
SAS
SAS <u>NOTE</u>: If EGPWS computer or system faults exist, the fault(s)
SAS will be annunciated as GPWS internal faults or GPWS
SAS external faults. The aural message will provide a
SAS description of the fault. If a fault is annunciated, it
SAS should be corrected prior to proceeding with the
SAS remainder of this ground test procedure.
SAS

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SAS I. Self Test Level 3 - EGPWS Configuration
SAS
SAS NOTE: The GND PROX SYS EICAS message will be displayed and the Terrain
SAS INOP light will be illuminated throughout this test.
SAS
SAS
SAS S 745-031-003
SAS (1) Test Procedure
SAS (a) Initiate a Self Test by depressing the cockpit GND PROX test
SAS switch (this is level 1).
SAS (b) Once the Self Test audio starts, press and hold the GND PROX
SAS test switch for less than 2 seconds (this will start level 2).
SAS (c) Immediately after the Self Test Level 2 "PRESS TO CONTINUE"
SAS message is annunciated, depress the cockpit GND PROX test
SAS switch (this will start level 3). Alternatively, the EGPWS
SAS Front Panel switch may be used to initiate this test.
SAS (d) VERIFY that the following messages are annunciated and record
SAS all unspecified details.
SAS
SAS NOTE: The sequence in information may be different.
SAS

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Information	Verification
EGPWC Part Number	See IPC or other approved source
EGPWC Mod Status	Any number accepted
EGPWC Serial Number	See identification label on unit
Application Software Number	Any number accepted
Configuration Software Version	Any number accepted
Terrain Database Version	See IPC or other approved source
Envelope Modulation Database Version	Any number accepted
Boot Code Version	Any number accepted
Aircraft Type	222
Audio Menu	0
Altitude Callout Menu	97
Internal GPS Selected	-
Triple Radio Altimeter Selected	-
Bank Angle Selected	-
Peaks Enabled	-
Mode 6 Low Volume Selected	-

(e) End of Self Test Level 3

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J. Self Test Level 6 - Discrete Input Test

<u>NOTE</u>: Self Test Levels 4 and 5 are not required for this test. Self Test Level 4 enunciates faults that have occurred during past flights. Self Test Level 5 enunciates alerts/warnings that have occurred during past flights.

<u>NOTE</u>: To get to a Level 6 Self Test the operator must cycle through Self Test Levels 1 through 5. The following steps show the procedure to get to the Level 6 Self Test.

<u>NOTE</u>: The GND PROX SYS EICAS message will be displayed and the Terrain INOP light will be illuminated throughout this test.

S 745-032-003

(1) Test Procedure
- (a) Initiate the EGPWS Self Test (Level 1) and release the GND PROX test switch. Once the Level 1 Self Test audio sequence begins, press and hold the GND PROX test switch for less than 2 seconds (this will start Self Test Level 2 - Current Faults).
- (b) Within 3 seconds after the "PRESS TO CONTINUE" message is enunciated at the end of Level 2 Self Test, press the GND PROX test switch for less than 2 seconds (this will start Self Test Level 3 - System Configuration).
- (c) After "SYSTEM CONFIGURATION" is enunciated, perform a long cancel (press the GND PROX test switch for between 2 and 8 seconds). The "PRESS TO CONTINUE" message is enunciated.

  <u>NOTE</u>: The operator may skip step (a) above and start this test immediately following Level 3 Self Test as described in Section C.(9), Self Test Level 3 - System Configuration.

- (d) Within 3 seconds after the "PRESS TO CONTINUE" message is enunciated at the end of Level 3 Self Test, press the GND PROX test switch for less than 2 seconds (this will start Self Test Level 4 - Fault History).
- (e) After "FAULT HISTORY" is enunciated, perform a long cancel (press the GND PROX test switch for between 2 and 8 seconds).
- (f) Within 3 seconds after the "PRESS TO CONTINUE" message is enunciated, press the GND PROX test switch for less than 2 seconds (this will start Self Test Level 5 - Warning History).
- (g) After "WARNING HISTORY" is enunciated, perform a long cancel (press the GND PROX test switch for between 2 and 8 seconds).

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SAS (h) Within 3 seconds after the "PRESS TO CONTINUE" message is enunciated, press the GND PROX test switch for less than 2 seconds (this will start Level 6 - Self Test).

SAS (i) The EGPWC will enunciate "DISCRETE INPUT TEST PRESS TO CANCEL". The EGPWC is now at the Level 6 Self Test.

SAS NOTE: The words "DISCRETE INPUT TEST PRESS TO CANCEL" will be enunciated approximately every 60 seconds throughout this test.

SAS (j) VERIFY the correct audio message is enunciated as each discrete is set as shown in the following table.

SAS NOTE: Each discrete must be changed to be set to the value listed below (i.e., when setting (or simulating) Flaps in Landing Position, the Flaps must start in the UP position).

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NAME	STATE ==>	AUDIO PHRASE
Captain's TERR Switch *)	True => False =>	Display Discrete 1 True Display Discrete 1 False
F/O's TERR Switch *)	True => False =>	Display Discrete 2 True Display Discrete 2 False
Captain's WXR Switch *)	True => False =>	Weather Discrete 1 True Weather Discrete 1 False
F/O's WXRR Switch *)	True => False =>	Weather Discrete 2 True Weather Discrete 2 False
Landing Flaps Discrete or Flap Override	Selected => Not Selected =>	Landing Flaps Not Landing Flaps
Landing Gear Discrete or Gear Override **)	Selected => Not Selected =>	Landing Gear Down Landing Gear Up
Air/Ground Discrete	In Air => On Ground =>	Not On Ground On Ground
Glideslope Cancel Discrete	Cancel => Normal =>	Glideslope Cancelled Glideslope Enabled
Terrain Awareness and TCF Inhibit	Disabled => Normal =>	Terrain Off Terrain On

*) One "True" enunciation and one "false" enunciation is given for each activation of the switch.

**) Landing Gear Handle must be pulled or in OFF position to toggle the discrete with the Gear Override Switch.

(k) End of Discrete Input Test. Press the GND PROX test switch to cancel.

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SAS K. Secondary Input Interface Test

S 755-033-003

(1) This section verifies the redundant inputs to the EGPWC are wired correctly.

NOTE: This test requires prior completion of a Level 2 Self Test (see Section C.(8)).

S 755-034-003

(2) Test Procedure

(a) Pull the following circuit breakers:

1) 11E4, Left EFIS CONT PNL
2) 11A10, Left AIR DATA CMPTR
3) 11J34, WARN ELEX A
4) 11E9, Left FMCS CMPTR
5) 11E10, Left ILS
6) 11F26, Right RAD ALTM
7) 11F5, Left RAD ALTM

(b) Switch OFF Left IRS.

(c) Wait 1 minute.

(d) Perform a Level 2 Self Test. (Initiate the EGPWS Self Test (Level 1) and release the GND PROX test switch. Once the Level 1 Self Test audio sequence begins, press and hold the GND PROX test switch for less than 2 seconds. This will start Self Test Level 2.)

(e) VERIFY the following messages are enunciated (note order of messages is not being tested, only that all of the messages are enunciated):

1) "CURRENT FAULTS"
2) "GPWS COMPUTER OK"
3) "EXTERNAL FAULTS"
4) "IRS BUS 1 INACTIVE"
5) "FMC BUS 1 INACTIVE"
6) "AIR DATA BUS 1 INACTIVE"
7) "EFIS BUS 1 INACTIVE"
8) "ILS BUS 1 INACTIVE"
9) "LEFT RADIO ALTIMETER BUS INACTIVE"
10) "RIGHT RADIO ALTIMETER BUS INACTIVE"
11) "ENVELOPE MODULATION INOP"
12) "MODE 1 INOP"
13) "MODE 3 INOP"
14) "MODE 4 INOP"
15) "MODE 5 INOP"
16) "TERRAIN AWARENESS INOP"

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17) "WINDSHEAR INOP"
18) "PRESS TO CONTINUE"

(f) Restore the following circuit breakers:
1) 11E4, Left EFIS CONT PNL
2) 11A10, Left AIR DATA CMPTR
3) 11J34, WARN ELEX A
4) 11E9, Left FMCS CMPTR
5) 11E10, Left ILS
6) 11F26, Right RAD ALTM
7) 11F5, Left RAD ALTM

(g) Switch on and align Left IRS.

(h) Perform a Level 2 Self Test. (Initiate the EGPWS Self Test (Level 1) and release the GND PROX test switch. Once the Level 1 Self Test audio sequence begins, press and hold the GND PROX test switch for less than 2 seconds. This will start Self Test Level 2.)

(i) VERIFY the following messages are enunciated (note order of messages is not being tested, only that all of the messages are enunciated):
1) "CURRENT FAULTS"
2) "NO FAULTS"
3) "PRESS TO CONTINUE"

(j) End of Secondary Input Interface Test.

L. WXR Display, Terrain Display And Range Selection

S 755-035-003

(1) The proper WXR and Terrain Display and Range Selection is checked by selecting the WXR and Terrain Display on both EHSI's, changing the selected Range and verifying the range displayed on the EHSI's.

S 755-036-003

(2) Test Procedure

<u>WARNING</u>: WHEN YOU DO THIS PROCEDURE, MAKE SURE THE WXR CONTROL PANEL IS IN TEST MODE OR INJURY TO PERSONS CAN OCCUR DUE TO RADIATION FROM THE WXR ANTENNA.

(a) Set the Weather Radar mode select switch to TEST.

(b) Set the WXR/TERR switch on both the Captain's and F/O's EFIS Control Panel to ON.

(c) Verify the display mode for both the Captain's and F/O's EHSI is suitable for displaying weather (e.g., MAP mode).

(d) Select the 40nm range for the Captain's EHSI and the 80nm range for the F/O's EHSI.

(e) Press both the Captain's and F/O's WXR select switch to display the WXR Test Pattern on both the Captain's and F/O's EHSI.

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SAS (f) VERIFY all of the following:
SAS 1) The WXR Test Pattern is displayed on both the Captain's and F/O's EHSI.
SAS 2) Both the Captain's and F/O's WXR select switch ON legends are illuminated.
SAS (g) Select Terrain mode on the Captain's EHSI by pressing the Captain's TERR select switch.
SAS (h) VERIFY all of the following:
SAS 1) The appropriate terrain is displayed on the Captain's EHSI.
SAS 2) The Captain's TERR select switch ON legend is illuminated.
SAS 3) The Captain's WXR select switch ON legend is not illuminated.
SAS (i) VERIFY all of the following:
SAS 1) The WXR Test Pattern is displayed on the F/O's EHSI.
SAS 2) The F/O's WXR select switch ON legend is illuminated.
SAS 3) The F/O's TERR select switch ON legend is not illuminated.
SAS (j) Deselect TERR mode on the Captain's EHSI by pressing the Captain's TERR select switch.
SAS (k) VERIFY all of the following:
SAS 1) No terrain data is displayed on the Captain's EHSI.
SAS 2) No WXR Test Pattern is displayed on the Captain's EHSI.
SAS 3) The Captain's TERR select switch ON legend is not illuminated.
SAS 4) The Captain's WXR select switch ON legend is not illuminated.
SAS (l) Select WXR mode on the Captain's EHSI by pressing the Captain's WXR select switch.
SAS (m) VERIFY all of the following:
SAS 1) The WXR Test Pattern is displayed on the Captain's EHSI.
SAS 2) The Captain's WXR select switch ON legend is illuminated.
SAS 3) The Captain's TERR select switch ON legend is not illuminated.
SAS (n) Select TERR mode on the F/O's EHSI by pressing the F/O's TERR select switch.
SAS (o) VERIFY all of the following:
SAS 1) The appropriate terrain is displayed on the F/O's EHSI.
SAS 2) The F/O's TERR select switch ON legend is illuminated.
SAS 3) The F/O's WXR select switch ON legend is not illuminated.
SAS (p) VERIFY all of the following:
SAS 1) The WXR Test Pattern is displayed on the Captain's EHSI.
SAS 2) The Captain's WXR select switch ON legend is illuminated.
SAS 3) The Captain's TERR select switch ON legend is not illuminated.
SAS (q) Deselect TERR mode on the F/O's EHSI by pressing the F/O's TERR select switch.

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SAS (r) VERIFY all of the following:
SAS 1) No terrain data is displayed on the F/O's EHSI.
SAS 2) No WXR Test Pattern is displayed on the F/O's EHSI.
SAS 3) The F/O's TERR select switch ON legend is not illuminated.
SAS 4) The F/O's WXR select switch ON legend is not illuminated.
SAS (s) Select WXR mode on the F/O's EHSI by pressing the F/O's WXR select switch.
SAS (t) VERIFY all of the following:
SAS 1) The WXR Test Pattern is displayed on the F/O's EHSI.
SAS 2) The F/O's WXR select switch ON legend is illuminated.
SAS 3) The F/O's TERR select switch ON legend is not illuminated.
SAS (u) Ensure both the Captain's and F/O's EHSI's are selected for Terrain Display by pressing the Captain's and F/O's TERR select switches.
SAS (v) Set the F/O's EFIS Control Panel range to 10 nm.
SAS (w) VERIFY the Range Selection & Display per the following table.

Range Select Captain's Side	Observed Captain's EHSI Display (Midrange)	Observed F/O's EHSI Display (Midrange)
10	5	5
20	10	5
40	20	5
80	40	5
160	80	5
320	160	5

SAS NOTE: Midrange indicates one half of selected range.

SAS (x) Set the Captain's EFIS Control Panel range to 10 nm.
SAS (y) VERIFY the Range Selection & Display per the following table.

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SAS

Range Select F/O's Side	Observed Captain's EHSI Display (Midrange)	Observed F/O's EHSI Display (Midrange)
10	5	5
20	5	10
40	5	20
80	5	40
160	5	80
320	5	160

(z) End of WXR Display, Terrain Display and Range Selection Test.
(aa) Set the WXR/TERR switch on both the Captain's and F/O's EFIS Control Panel to OFF.
(ab) Put the airplane back in its usual condition.
(ac) Remove the test equipment.
(ad) Remove the electrical power if it is not required (AMM 24-22-00/201).

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GROUND PROXIMITY WARNING COMPUTER (GPWC) - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the GPWC. The other is the installation of the GPWC.
   B. The Ground Proximity Warning Computer, M147, is installed on the E1-5 rack in the main equipment center. All electrical connections are at the rear of the unit.

TASK 34-46-01-004-001-001

2. Remove the GPWC
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center
          211/212 Flight Compartment

   C. Procedure

      S 864-002-001

      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach a DO-NOT-CLOSE tag:
          (a) 11F4, GND PROX
          (b) 11F3, TERR DISPLAY

      S 024-003-001

      CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE GPWC. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE FROM YOUR BODY CAN CAUSE DAMAGE TO THE GPWC.

      (2) Remove the GPWC from the E/E rack (AMM 20-10-01/401).

TASK 34-46-01-404-004-001

3. Install the GPWC
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
      (2) AMM 24-22-00/201, Electrical Power - Control
      (3) AMM 34-46-00/501, Ground Proximity Warning System
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center
          211/212 Flight Compartment

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C. Procedure

S 864-005-001

(1) Make sure these circuit breakers on the P11 panel are open:
  (a) 11F4, GND PROX
  (b) 11F3, TERR DISPLAY

S 424-006-001

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE GPWC. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE FROM YOUR BODY CAN CAUSE DAMAGE TO THE GPWC.

(2) Install the GPWC on the E/E rack (AMM 20-10-01/401).

S 864-007-001

(3) Remove the DO-NOT-CLOSE tag and close these circuit breakers on the P11 panel:
  (a) 11F4, GND PROX
  (b) 11F3, TERR DISPLAY

D. GPWC Test

S 864-008-001

(1) Supply the electrical power (AMM 24-22-00/201).

S 864-009-001

(2) Do this task: GPWS - Operational Test (AMM 34-46-00/501).

E. Put the Airplane Back to Its Usual Condition

S 864-010-001

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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SAS GROUND PROXIMITY WARNING COMPUTER - REMOVAL/INSTALLATION
SAS
SAS 1. General
SAS A. This subject has two tasks. There is one task for the removal and one
SAS for the installation of the ground proximity warning computer.
SAS B. The ground proximity warning computer, 2 MCU enclosure weighting 7
SAS pounds, is rack-mounted and secured by a single hold-down device on rack
SAS E1-5 in the main equipment center.
SAS
SAS TASK 34-46-01-004-001-002
SAS 2. Ground Proximity Warning Computer Removal
SAS A. Reference
SAS (1) AMM 20-10-01/401, E/E Rack-Mounted Components
SAS B. Access
SAS (1) Location Zone
SAS 119/120 Main Equipment Centre
SAS
SAS C. Removal Procedure
SAS
SAS S 864-002-002
SAS (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
SAS (a) 11F4, GND PROX
SAS (b) 11F3, TERR DSPL
SAS
SAS S 034-003-002
SAS (2) Gain access to the main equipment center.
SAS
SAS CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE
SAS GROUND PROXIMITY WARNING COMPUTER. IF YOU TOUCH THESE
SAS CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO
SAS THE GROUND PROXIMITY WARNING COMPUTER.
SAS
SAS (a) Remove the ground proximity warning computer
SAS (AMM 20-10-01/401).
SAS (b) Install dust caps on the electrical connectors.
SAS
SAS TASK 34-46-01-404-004-002
SAS 3. Ground Proximity Warning Computer Installation
SAS A. References
SAS (1) AMM 20-10-01/401, E/E Rack-Mounted Components
SAS (2) AMM 24-22-00/201, Electrical Power - Control
SAS B. Access
SAS (1) Location Zone
SAS 119/120 Main Equipment Centre
SAS
SAS C. Installation Procedure

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S 434-005-002

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE GROUND PROXIMITY WARNING COMPUTER. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE GROUND PROXIMITY WARNING COMPUTER.

(1) Remove the dust caps from the electrical connectors.

S 424-006-002
(2) Install the ground proximity warning computer (AMM 20-10-01/401).

S 864-007-002
(3) Supply electrical power (AMM 24-22-00/201).

S 864-008-002
(4) Close these circuit breakers:
(a) 11F4, GND PROX
(b) 11F3, TERR DSPL

D. Ground Proximity Warning Computer Test

S 714-009-002
(1) Do this task: Ground Proximity Warning System - Operational Test

S 714-020-002
(2) Do the level 3 self test (Refer to subtask 34-46-00-745-031-003, config-3).

S 714-021-002
(3) Make sure that the Terrain Database version is correct.

NOTE: You can get the correct Terrain Database version from the approved airline department.

TASK 34-46-01-904-018-002

4. GPS Antenna - Removal/Installation

A. General
(1) This subject has two tasks. There is one task for the removal and one task for the installation of the GPS antenna.
(2) The GPS antenna is mounted on the crown of the aircraft at station 622.
(3) Access
(a) Location Zone
107 Forward Half of Cabin, Left

(4) Equipment
(a) Resistance Measuring Bridge or ohm meter, that can measure 0.025 ohms, e.g., Bonding Meter AVTRON T477W (SAS M612-213)

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(b) Consumable materials
1) Mastinox, BMS 3-27 (RMC 693-007-01)
2) RTV 732 Sealant, Black (RMC 302-030-02)
3) GPS Antenna Gasket, TA71000438

B. GPS Antenna Removal

S 024-010-002

(1) Removal Procedure

(a) Open these circuit breakers and attach DO-NOT-CLOSE tags:
1) 11F4, GND PROX

(b) Remove the screws from the antenna.

(c) Carefully remove the antenna. If the antenna stics to the gel-gasket, use a fiber scraper or wooden wedge to lift off the antenna.

<u>CAUTION</u>: DO NOT USE METAL HAND TOOL TO LIFT THE ANTENNA, AS THIS CAN DAMAGE THE AIRCRAFT SKIN.

(d) Disconnect the antenna cable.

(e) Inspect the cable connector for dirt and moisture. Clean and dry as necessary.

(f) Put a protective cover on the cable connector.

(g) Remove the gel-gasket and clean the skin as necessary.

<u>NOTE</u>: The gel-gasket may be re-used, if no sign of damage is found on the gasket.

C. GPS Antenna Installation

S 424-011-002

(1) Installation Procedure

(a) Open these circuit breakers and attach DO-NOT-CLOSE tags:
1) 11F4, GND PROX

(b) Place the antenna gasket on the fuselage, so antenna connector hole and screw holes are aligned with the holes in the fuselage.

<u>NOTE</u>: The antenna is asymmetric.

(c) Remove the O-ring from the antenna, if installed.

(d) Remove the protective cap from the antenna and cable.

(e) Connect the coax cable to the antenna.

(f) Place the antenna on top of gasket with the FWD arrow pointing forward.

(g) Apply a thin layer of Mstinox to the threads of the fasteners.

(h) Install the antenna on top of fuselage at STA 622 with three fasteners. Manually tighten to 20-25 pound-inches.

(i) Measure the bonding between the remaining hole and the fuselage. The resistance should not exceed 0.025 ohms.

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SAS (j) Install the last fastener. Manually tighten to 20-25
SAS pound-inches.
SAS (k) Seal the fastener holes with RTV weather sealing.
SAS
SAS S 724-012-002
SAS (2) GPS Antenna Installation Test
SAS (a) Supply electrical power (AMM 24-22-00/201).
SAS (b) Make sure these circuit breakers are closed:
SAS 1) 11F4. GMD PROX
SAS (c) Make sure the Left and Right IRU are in the NAV mode and
SAS aligned (AMM 34-21-00/201).
SAS (d) Move the aircraft to a position where the GPS antenna has an
SAS unobstructed view of the GPS satellites.
SAS (e) Wait 5 to 20 minutes.
SAS (f) Make sure the TERRAIN INOP light is not illuminated.
SAS
SAS S 864-013-002
SAS (3) Put the Airplane Back to Its Usual Condition
SAS (a) Remove electrical power if it is not necessary
SAS (AMM 24-22-00/201).
SAS
SAS TASK 34-46-01-904-019-002
SAS 5. EGPWS Annunicator Panel - Removal/Installation
SAS A. General
SAS (1) This subject has two tasks. One is for the removal and one is for
SAS the installation of the Annunciator Panel. These tasks have steps
SAS for the removal of the annunciator panel, the installation of the
SAS replacement annunciator panel, and a test of the lights.
SAS (2) The EGPWS annunciator panels are on the captain's instrument panel
SAS P1-1 and the first officer's instrument panel, P3-1.
SAS (3) Reference
SAS (a) AMM 24-22-00/201, Electrical Power
SAS (4) Access
SAS (a) Location Zone
SAS 211/212 Flight Compartment
SAS
SAS B. EGPWS Annunciator Panel Removal
SAS
SAS S 024-015-002
SAS (1) Procedure
SAS (a) Open these circuit breakers and attach DO-NOT-CLOSE tags:
SAS 1) 11F4, GND PROX
SAS 2) 11F3, TERR DSPL
SAS 3) 11P2, CAPT INSTR & PANEL LTS
SAS 4) 11R2, IND LTS L2
SAS 5) 11P28, F/O INSTR & PANEL LTS

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SAS 6) Remove the annunciator panel.
SAS (b) Loosen the fasteners on the panel.
SAS (c) Pull the panel from the instrument panel until the electrical
SAS connection is accessible.
SAS (d) Disconnect the electrical connector from the panel.
SAS C. EGPWS Annunciator Panel Installation
SAS
SAS S 424-016-002
SAS (1) Procedure
SAS (a) Open these circuit breakers and attach DO-NOT-CLOSE tags:
SAS 1) 11F4, GND PROX
SAS 2) 11F3, TERR DSPL
SAS 3) 11P2, CAPT INSTR & PANEL LTS
SAS 4) 11R2, IND LTS L2
SAS 5) 11P28, F/O INSTR & PANEL LTS
SAS (b) Install the panel.
SAS 1) Connect the electrical connector to the panel.
SAS 2) Lightly push the panel into the instrument panel.
SAS 3) Tighten the fasteners that attach the panel to the
SAS instrument panel.
SAS (c) Close these circuit breakers:
SAS 1) 11F4, GND PROX
SAS 2) 11F3, TERR DSPL
SAS 3) 11P2, CAPT INSTR & PANEL LTS
SAS 4) 11R2, IND LTS L2
SAS 5) 11P28, F/O INSTR & PANEL LTS
SAS (d) Supply electrical power (AMM 24-22-00/201).
SAS (e) Make sure that the panel lights are operational.
SAS (f) Return the aircraft to a serviceable condition.
SAS (g) Remove electrical power if it is not necessary
SAS (AMM 24-22-00/201).

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VHF OMNIDIRECTIONAL RANGE (VOR) SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The VOR system is a navigational aid that determines relative bearing with respect to a ground station. The system receives rf signal data from the ground station and converts it into bearing and position data. This data is routed to the RDMI (AMM 34-22-00) for display of the bearing data. The data is also sent to the electronic flight instrument system (EFIS) symbol generators. Here, VOR deviation and TO/FROM data is computed for display on the EHSI (AMM 34-22-00).
   B. The VOR ground stations broadcast direction coded rf signals within the frequency range of 108.00 MHz to 117.95 MHz. The frequency of the VOR ground station is selected on the VOR control panel. The selected ground station signals are received by the antenna and sent to the VOR receiver. The receiver processes the VOR signals to provide digital bearing output signals on an ARINC 429 digital data bus. The bearing output is a 32-bit data word that is addressed to the RDMI and to the EFIS symbol generators. It is also output to the flight management computers (FMC). The receiver also provides a VOR station audio identification signal to the interphone system.
   C. Two dual VOR systems are installed. Each system consists of a receiver and a control panel. A single antenna is installed that has dual outputs with a separate output provided for each receiver. The left system normally provides information to the captain's (left) EFIS instruments. The right system provides input to the first officer's (right) EFIS instruments. Both receivers provide input to each RDMI where both are displayed at the same time. Both receivers also provide input to the center symbol generator in case the right or left symbol generators fail.
2. Component Details (Fig. 1)
   A. VOR Control Panel
      (1) The VOR control panel provides selection of VOR frequency and course during the VOR manual mode. The VOR frequency is selected by the two left concentric knobs for manual tuning. The outer knob selects tens and units of MHz. The inner knob selects tenths and hundredths of MHz.
      (2) The VOR system is in the manual mode when the EFIS control panel is in the VOR or ILS mode settings. It is also in the manual mode when the EFIS control panel is in the MAP or PLAN mode settings and the AUTO-MAN switch on the VOR control panel is in the MAN setting.
      (3) VOR frequency is displayed in the window above the frequency select knob (FREQ). The 100 MHZ digit is fixed at 1. The other digits display the VOR frequency as selected manually by the VOR control panel or automatically by the FMC.
      (4) The VOR COURSE is selected on the ten-turn course select knob and is displayed by the three digit display above the knob.

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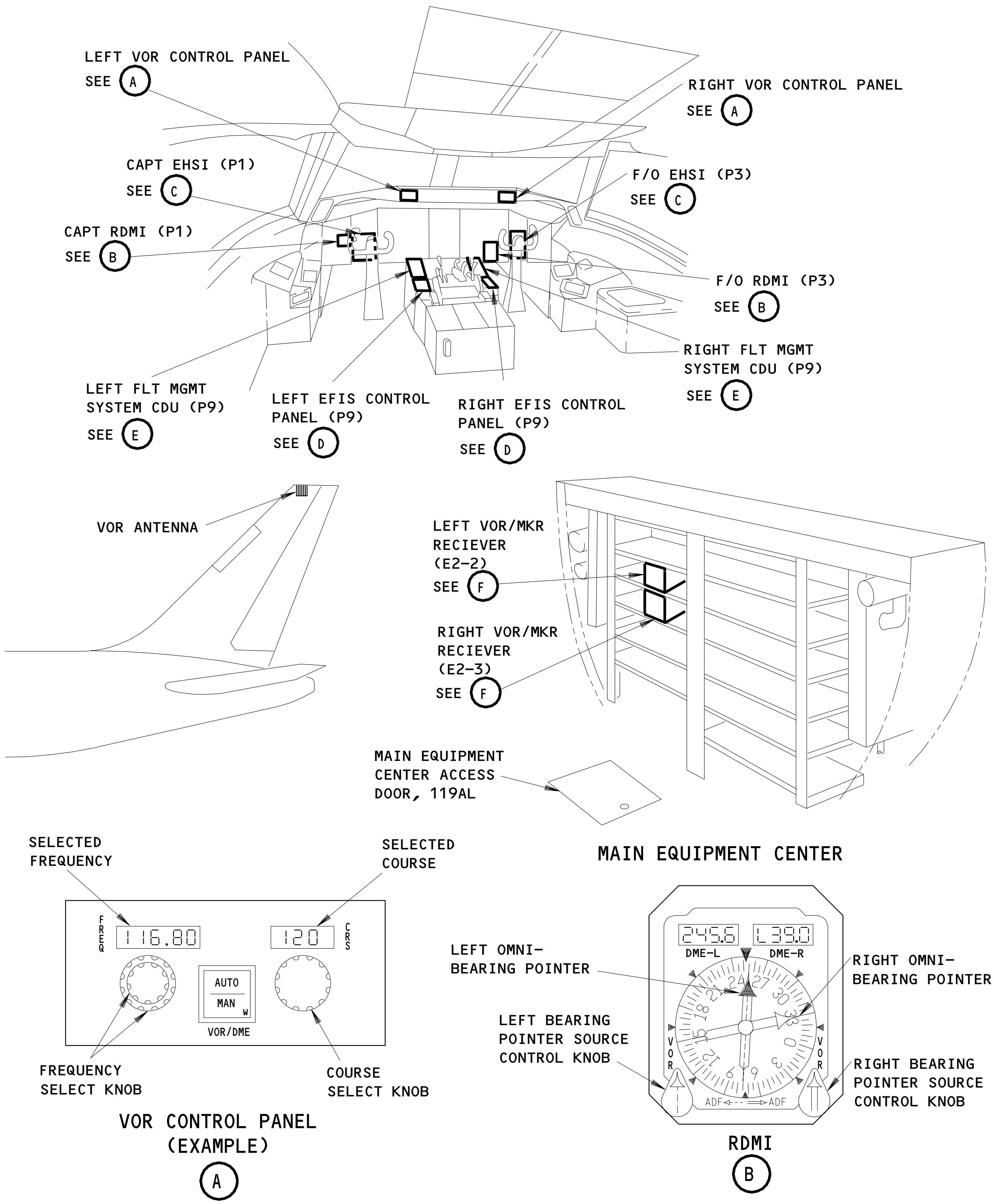

VOR System - Component Location
Figure 1 (Sheet 1)

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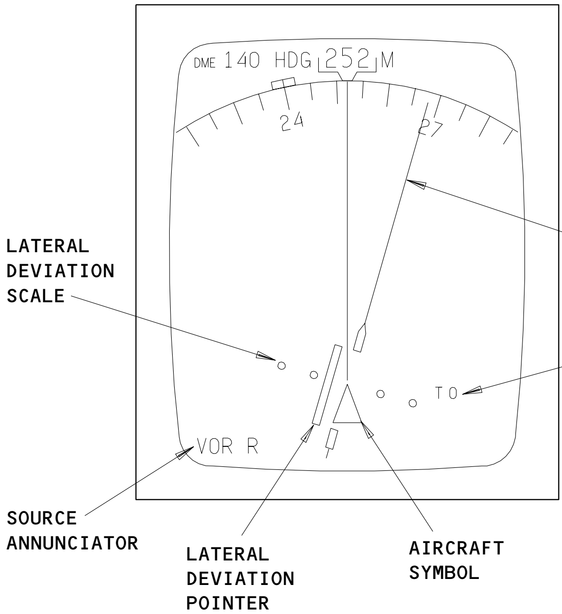
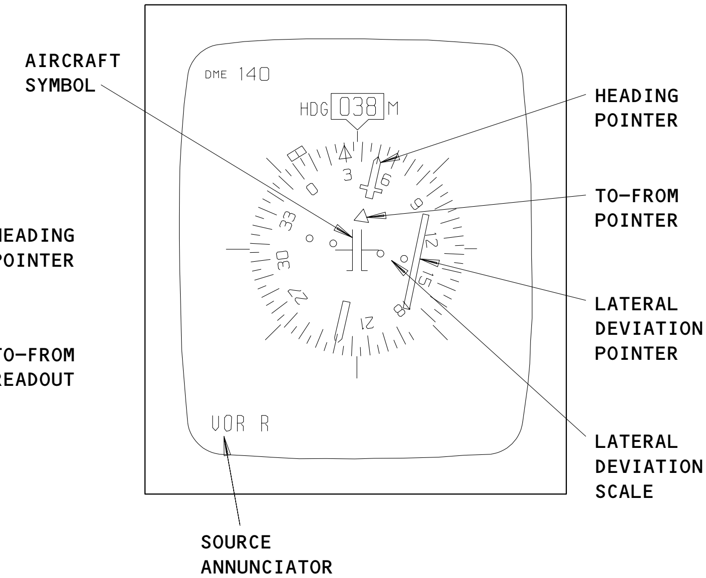


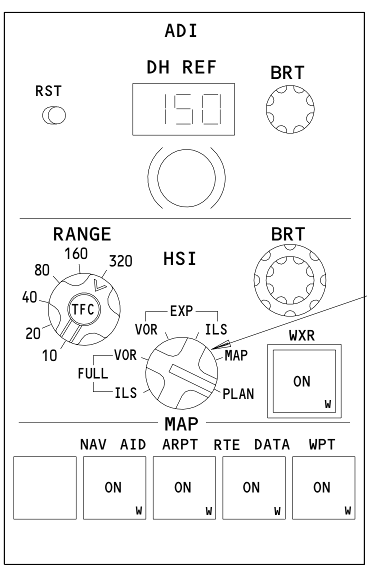
VOR - EXP MODE



VOR - FULL MODE

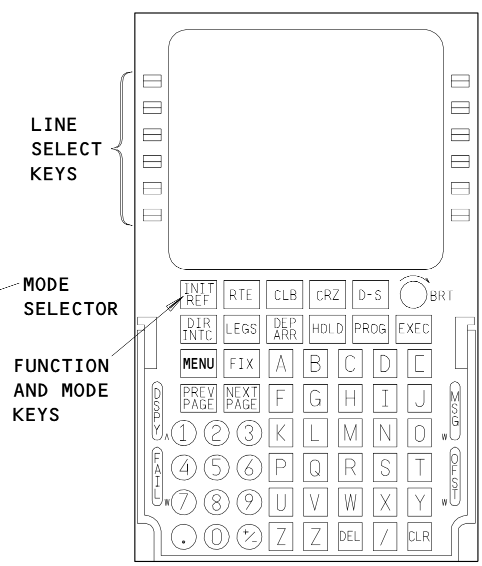
EHSI

C



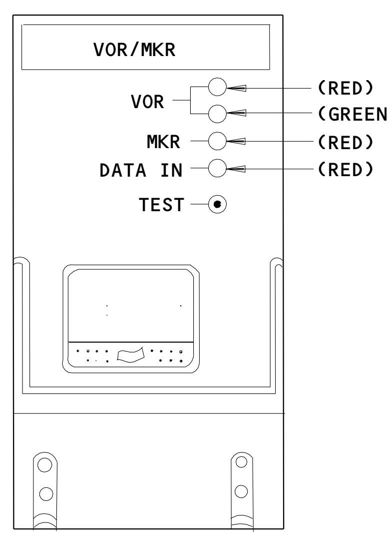
EFIS CONTROL PANEL

D



FMC CDU

E



VOR/MKR RECEIVER

F

VOR Components Location
Figure 1 (Sheet 2)

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(5) The AUTO-MAN switch is used to select the tuning mode of the VOR/MKR receiver when the EFIS mode select switch is set to MAP or PLAN. Tuning the VOR in these modes is normally controlled by the FMC (automatic) except when the AUTO-MAN switch is set to MAN. The tuning is then accomplished manually at the VOR control panel. When the EFIS switch is in the ILS or VOR position, tuning is always manually done from the VOR control panel.

(6) The captain's and first officer's VOR control panels are located on the left and right side of the glareshield (P55), respectively.

B. VOR/MKR Receiver

(1) The VOR/MKR receiver is microprocessor controlled. It provides reception of VOR signals in the frequency range of 108.00 MHz to 117.95 MHz with 50 KHz channel spacing. The receiver processes the VOR signals to provide bearing outputs in digital data format. It also provides audio signals to the flight interphone system for station identification.

(2) The receiver has a BITE self test feature that is performed as part of the microprocessor program. BITE monitoring of the receiver occurs during normal rf signal processing. This is done for the purpose of monitoring circuit operation. If a malfunction occurs during BITE, a failure warning will be coded in the bearing word output on the ARINC 429 data bus.

(3) A test switch is also provided on the front panel for manual initiation of BITE. A signal is injected internally into the VOR receiver when the test switch is pressed, which provides a bearing output of 180°. The front panel lights show the results of the receiver self-test.

(4) The receiver also contains the circuits for the marker beacon system (AMM 34-32-00).

(5) The left and right VOR/MKR receivers are located on shelf 2 and 3, respectively, of the E2 rack, in the main equipment center.

C. VOR Antenna

(1) The VOR antenna is a dual omnidirectional half-wave dipole. Its two outputs are isolated by a hybrid balun circuit for coax matching of the two antenna outputs.

(2) The VOR antenna is located at the top of the vertical stabilizer, under the fin cap.

D. RDMI

(1) The captain's and first officer's RDMIs display selected VOR or ADF bearing. The display has two rotating pointers. The two pointers display radio bearing information for two VOR stations with the compass card taken as reference. On each RDMI, the captain's selected VOR data is displayed by the left omni-bearing pointer. The first officer's selected data is displayed by the right omni-bearing pointer. The RDMIs are located on the main instrument panels.

(2) Each omni-bearing pointer has a mode switch which is used to select either VOR data or ADF data for display by that pointer.

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(3) The RDMIs also contain fault flags for the pointer data which come into view for invalid data or no computed data (AMM 34-22-00).

(4) The fault flags also come into view when the HDG REF switch is set to TRUE (AMM 34-22-00). This feature is intended to prevent the use of misleading VOR bearing information from VOR facilities that are referenced to magnetic north.

E. EHSI

(1) The EHSI displays VOR course information in either a full compass rose or an expanded scale display when the EFIS mode select switch is in the VOR-FULL or VOR-EXP mode, respectively. They are located on the main instrument panels.

(2) The system source annunciator displays the navigation system (VOR or ILS) to which the EHSI is connected.

(3) The course heading select line and pointer indicate the course selected on the control panel. The lateral deviation pointer and scale display the deviation from the selected course. When the airplane is on course, the lateral deviation pointer and heading select line will be lined up.

(4) The TO-FROM pointer indicates the direction of the tuned VOR station.

(5) The EHSI also displays VOR ground station and VOR radial positions in the MAP and PLAN modes (AMM 34-22-00).

(6) VOR failures are displayed on the EHSI. The resulting displays for no-computed data (NCD) and invalid data are as follows:

(a) NCD for the lateral deviation causes the deviation bar to be removed.

(b) Invalid data for the lateral deviation causes the scale and bar to be removed and a yellow VOR fault flag to appear.

(c) NCD or invalid data for the selected course causes the course pointer and line to be removed. Also, the lateral deviation bar is removed.

(d) NCD or invalid data for the TO-FROM annunciator causes it to be removed.

(7) VOR indications on the EHSI are unaffected by the position of the HDG REF switch.

F. EFIS Control Panel

(1) The mode selector on the EFIS control panel selects the operating mode of the EFIS displays. It also selects the tuning mode for the VOR system. The EFIS control panel is located on the forward electronics panel P9.

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(2) Two different modes of VOR data can be selected. When set to VOR-FULL, the EHSI displays VOR data in a full compass rose format. When set to VOR-EXP, the EHSI displays VOR data with the heading dial scale in an expanded mode (AMM 34-22-00). Both formats display essentially the same VOR data.

(3) When the mode selector is set to a VOR or ILS position, the EHSI displays VOR or ILS data respectively. The VOR/MKR receiver is manually tuned from the VOR control panel, which also displays the selected frequency. The AUTO/MAN switch is inactive in these modes. The RDMI bearing pointers display omnibearing to the VOR ground station.

(4) When the mode selector is set to the MAP or PLAN positions, the EHSI displays the MAP or PLAN data respectively. The VOR/MKR receiver is automatically tuned from the FMC or manually tuned by the VOR control panel, as selected with the AUTO/MAN switch. The VOR control panel displays the selected frequency in either case. The RDMI bearing pointers display omnibearing to the VOR ground station.

G. Flight Management Computer

(1) The left FMC automatically tunes the left and right VOR/MKR receivers when the respective left and right EFIS control panel mode selector is in the MAP or PLAN position. This tuning is done using information in the FMC flight data base. The right FMC will automatically tune the VOR/MKR receivers when the left FMC INSTR SOURCE SELECT switch is set to R-FMC.

(2) The FMC control and display units (CDU) provide displays of the automatic tuning data. The CDUs display both the tuned VOR frequency and the three letter identifier of the VOR station. The CDUs are located on the forward electronics panel (P9).

3. <u>Operation</u> (Fig. 2 and 3)

A. VOR System Block Diagram (Fig. 2)

(1) The VOR receivers are powered by 115v ac, 400 Hz. The left VOR is powered from the standby power bus and the right VOR from the right power bus. The 115v ac is routed through each receiver to supply its control panel.

(2) The manual/automatic tuning mode selection for each VOR receiver is determined by selection of display mode on the onside EFIS control panel. The onside VOR control panel also provides the pilot with manual tuning override capability.

(3) The VOR receiver processes rf from the VOR ground station to determine bearing, which is sent to the RDMIs, EFIS symbol generators, and FMCs.

(4) During manual or autotune modes the VOR receiver sends the frequency actually tuned back to the VOR control panel for display, and to the FMCs for display on the control and display units (CDU).

(5) During EFIS VOR mode the EFIS symbol generators compute VOR deviation and TO/FROM and display this data along with VOR SEL CRS and SYS SOURCE annunciator on the EHSIs. VOR audio is sent to the audio selector panels for station identification.

B. Functional Description (Fig. 3)

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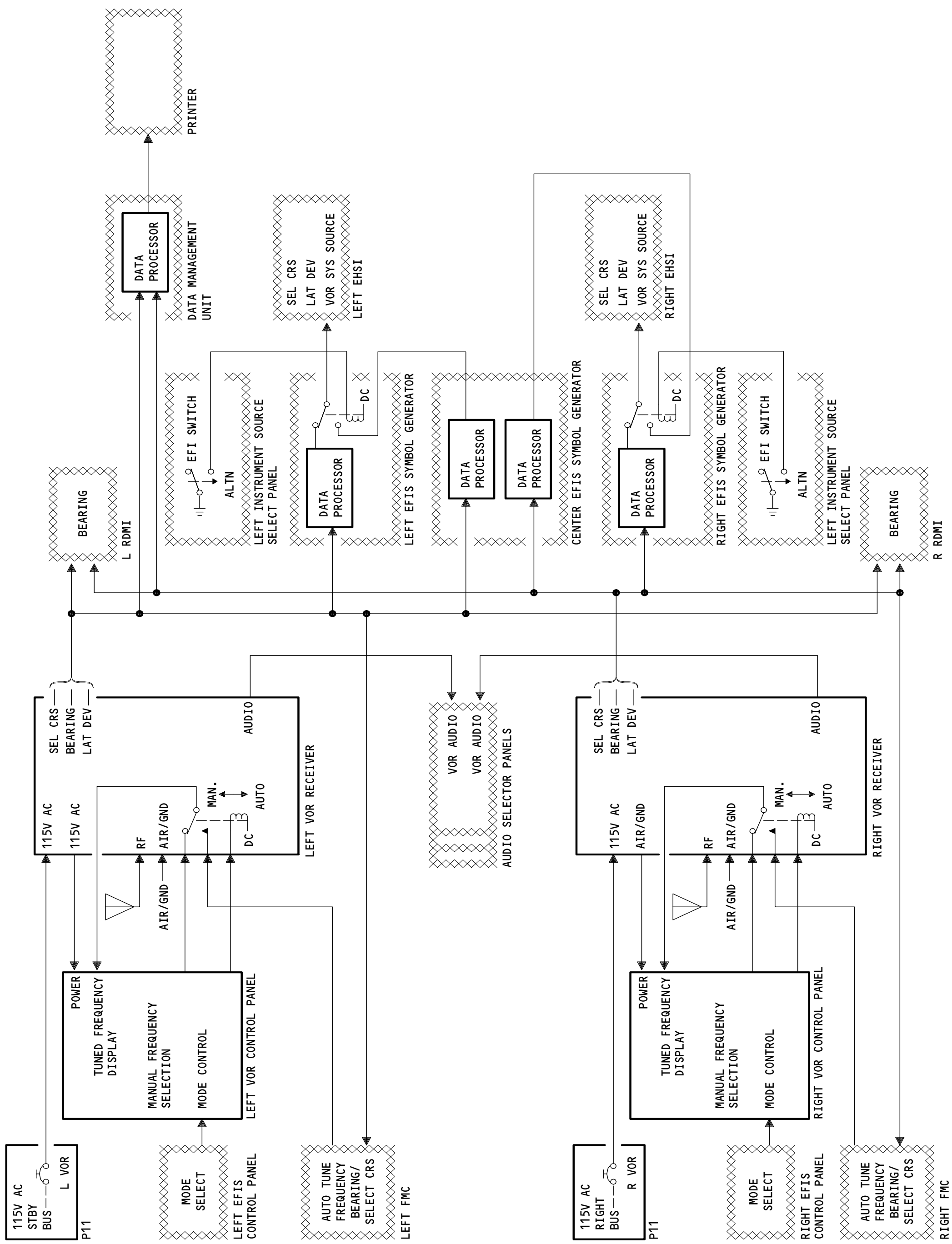

VOR System Block Diagram
Figure 2

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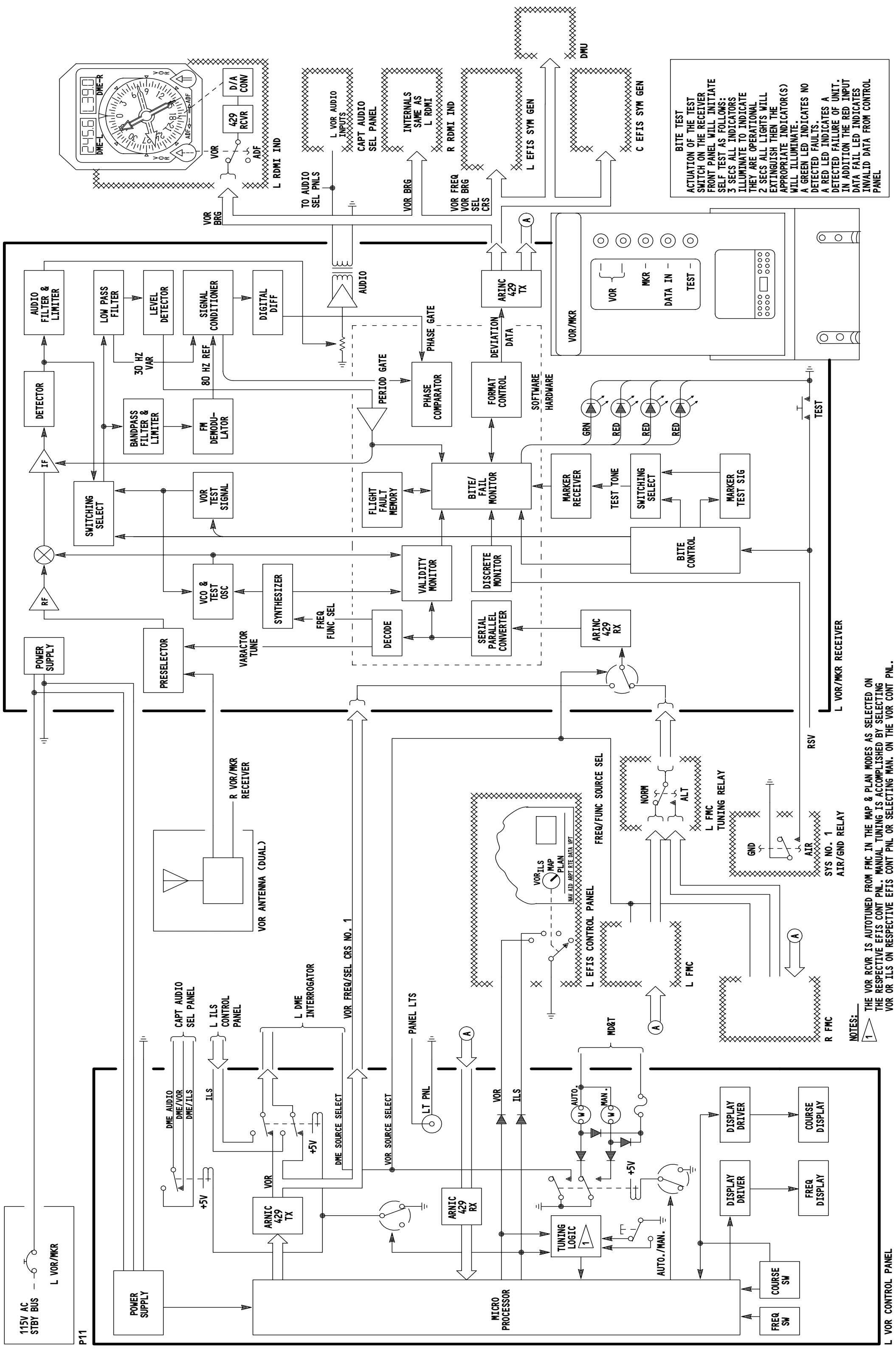

VOR System Schematic (Typical)
Figure 3

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(1) The left VOR system is shown on the schematic and is described in the following paragraphs. Operation of the right receiver is similar.

(2) A marker beacon receiver module is incorporated in each VOR/MKR receiver. This module is inhibited in the right VOR and active in the left VOR.

(3) The left VOR/MKR receiver and control panel are powered by 115v ac, 400 Hz from the standby bus. Power is supplied through the left VOR circuit breaker to both the receiver and control panel.

(4) Tuning data enters the receiver at the data ports. Selected frequency and course are provided from the VOR control panel or from the FMC, according to the function source discrete from the VOR control panel. When this discrete is set to ground, the port select circuit will switch to receive data from the FMC. The control data is received by the 429 interface module and processed by the CPU.

(5) The central processor unit (CPU) performs control, timing, logic, and computing functions required for system operation. The CPU controls operation of the receiver by means of a stored program. The CPU operations are represented by the software portion on the diagrams.

(6) When power is applied to the receiver, the power supply generates the dc voltage for the internal circuits. It also provides RESET #1 voltage for initializing the CPU.

(7) Selected course and frequency tuning data are checked for validity at the input port and passed on to the CPU. The course and frequency data are processed by the CPU. However, the course data is not used by the CPU but returned to the port for output on the data bus. VOR frequency data is also included in the output of the data bus.

(8) The CPU uses the input tuning frequency to tune the preselector in the front-end of the receiver to the selected station. The tuning voltage for the preselector is provided by a CPU controlled varactor circuit. The output frequency of the synthesizer is also controlled by outputs of the CPU module. The output signal of the stabilizer is applied to the VCO oscillator. The VCO oscillator provides a low-side injection signal that is fed to the mixer. The mixer combines the input rf signal with the VCO injection signal to produce an 18.1 MHz IF. The IF signal is fed to the detector circuit where the VOR modulation signals are recovered from the IF signal.

(9) The output of the detector circuit is applied to the audio filter and limiter. The filter passes audio frequencies within the range of 350 Hz to 2500 Hz and rejects the other outputs of the receiver. The limiter filters out all noise spikes. The voice and keyed identity tones are fed to the audio amplifier and out to the audio select panels.

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(10) The output of the detector circuit is also applied to the switching select circuit. During normal operation, this output is fed through the selector to the low pass and 9960 Hz bandpass filters. However, when the TEST switch is pressed on the front panel, the VOR test signal is substituted for the received VOR signal.

(11) The 30 Hz variable phase signal is passed through the low pass filter to a 30 Hz bandpass filter. This signal is also converted to an AGC signal to control the IF amplifier. The AGC voltage is based upon the strength of the detected audio signals.

(12) The output of the switching select circuit is applied to the bandpass filter. The 9960 Hz signal is passed through this filter and the 30 Hz variable-phase component is rejected. This 9960 Hz signal is fed to the demodulator where the 30 Hz reference signal is recovered. The variable and reference signals are conditioned and fed to the phase comparator.

(13) The phase comparator accepts the reference period and variable-phase inputs. It compares the phase relationship between the two signals. When the two signals are in phase, the output of the phase comparator is in phase with the input variable phase signal. This corresponds to a VOR bearing of zero degrees. For any bearing other than zero degrees, the output of the comparator is proportional to the bearing.

(14) The CPU processes the bearing data to provide digital bearing output signals through the ARINC 429 transmitter and output buffer. The receiver provides VOR status and bearing data on the digital data bus to the right and left RDMIs. For the manual tuning mode, it also provides bearing and selected course to the EFIS symbol generators for display on the EHSI. For the auto tune mode, deviation data from the FMC is routed to the EFIS symbol generator. TO/FROM data is generated within the EFIS symbol generator from the bearing data and displayed along with the VOR deviation on the EHSI.

(15) The selected frequency data is processed by the CPU and output on the digital data bus for display on the control panel. The display shows the tuned frequency for both manual and automatic modes.

C. BITE

(1) System Monitoring

(a) The VOR contains self-test and monitoring features that check for proper operation of the unit. This BITE program is activated as part of the CPU program. During normal rf signal processing, the BITE network continuously checks functions that affect the accuracy of the VOR. It checks the performance of the VCO, the synthesizer, and receiver AGC.

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(b) The BITE program also checks the input tuning and course data from the control panel for integrity. The BITE also monitors the output data for comparison with the calculated data output from the CPU. The BITE program also monitors performance of the CPU and CPU program execution.

(c) For detected faults, the receiver will output failure warning codes in the sign status matrix of the bearing word output on the ARINC 429 data bus. For receiver failures, this code indicates invalid data. When computed data is not available for reasons other than equipment failure, a no computed data (NCD) code is output. Fault displays on the EHSIs will be as described for the EHSI in component details. The bearing flag will come into view on the RDMIs for invalid or no computed data.

(d) All receiver faults detected during the BITE program are stored in a non-volatile fault memory. The faults are stored by flight segments for subsequent evaluation in the shop. Each flight segment starts when the airplane takes off as detected by the air/ground relay. The fault memory can store faults for up to 63 flights. The maximum number of faults that can be stored for any flight segment is 13. If a fault exists continuously, it is only stored once. If it exists intermittently, it is stored each time it occurs and remains for 1 second or more. The test data history is available on the ATE connector for shop personnel. In addition, a number corresponding to the failed module is displayed by an internal fault display for shop purposes. This internal display does not show location of intermittent faults.

(2) Self-Test

(a) Pushing the test switch on the receiver front panel initiates a BITE test of the receiver. For the test, VOR test signals are injected into either the front end of the receiver or at the switching circuit as determined by the CPU program. These signals are processed and compared to stored data. The front panel shows status of the receiver self-test.

(b) If a fault exists intermittently, it will not affect status of the receiver lights during the BITE test unless the fault exists during the test. However, if two or more identical faults are stored in the flight fault memory from at least two of the last four flight segments, the front panel lights will show a failed condition.

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(c) When the test switch is pressed and held, the lights will come on for 3 seconds. The lights will then go off for 2 seconds. The lights then come back on to show the status of the receiver and the input ARINC 429 control words as follows:
   1) The green light will come on to show a pass condition and the red light will come on for fail condition. The DATA IN indicator comes on when data from the selected tuning source is invalid.
   2) During normal operation, these lights will be off. The front panel lights are operational only when the TEST button is pushed.

(d) When the test switch is pressed and held in for 12 seconds, the three lights will come on to indicate that they are operative. The lights then extinguish for 2 seconds. The lights re-light to indicate the status of the receiver and the input ARINC 429 control words as follows:

(e) The test also causes the RDMI bearing flag to appear for 6 seconds and the RDMI pointer to drive to 180 degrees, with the RDMI set to the VOR position. The pointer will stay in this position until the test is completed.

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VOR SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
ANTENNA - DUAL VOR, M262	2	1	326A, VERTICAL STABILIZER	34-51-03
CIRCUIT BREAKER -	2		FLT COMPT, P11	
VOR/MKR LEFT, C595		1	11A1	*
VOR RIGHT, C596		1	11E33	*
INDICATOR - (FIM 34-22-00/101)				
LEFT RADIO DISTANCE MAGNETIC, N3				
RIGHT RADIO DISTANCE MAGNETIC, N43				
PANEL - (FIM 34-22-00/101)				
LEFT EFIS CONTROL, M94				
RIGHT EFIS CONTROL, M93				
PANEL - LEFT VOR CONTROL M91	2	1	FLT COMPT, P55	34-51-02
PANEL - RIGHT VOR CONTROL, M92	2	1	FLT COMPT, P55	34-51-02
RECEIVER - LEFT VOR/MARKER, M186	2	1	119AL, MAIN EQUIP CTR, E2-2	34-51-01
RECEIVER - RIGHT VOR/MARKER, M187	2	1	119AL, MAIN EQUIP CTR, E2-3	34-51-01
RELAY - (FIM 31-01-36/101)				
LEFT FMC TUNING, K757				
SYS NO. 1 AIR/GND, K124				
RELAY - (FIM 31-01-37/101)				
RIGHT FMC TUNING, K758				
SYS NO. 2 AIR/GND, K214				

* SEE THE WDM EQUIPMENT LIST

VOR System - Component Index
Figure 101

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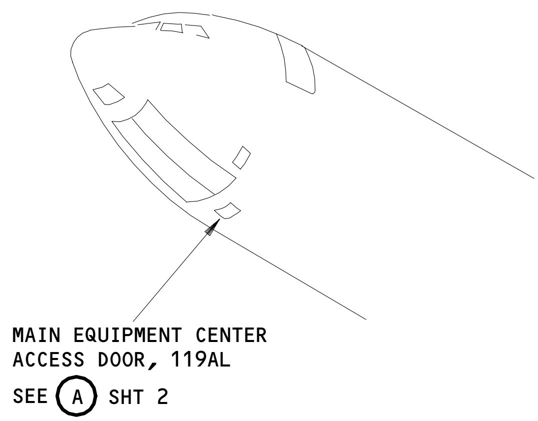

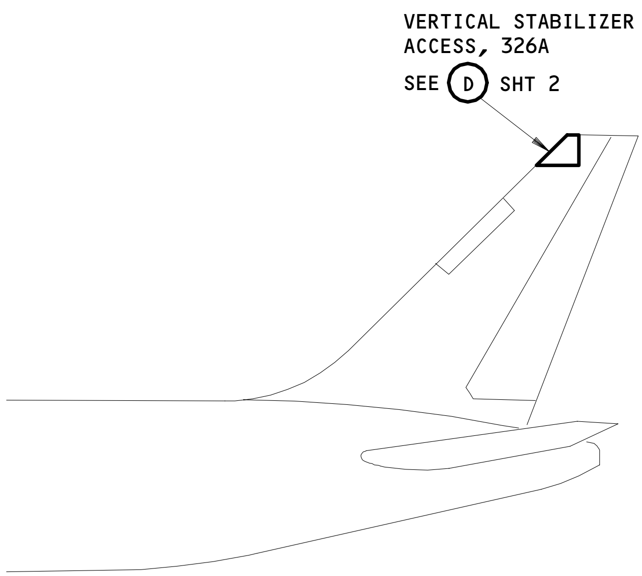

VOR System - Component Location
Figure 102 (Sheet 1)

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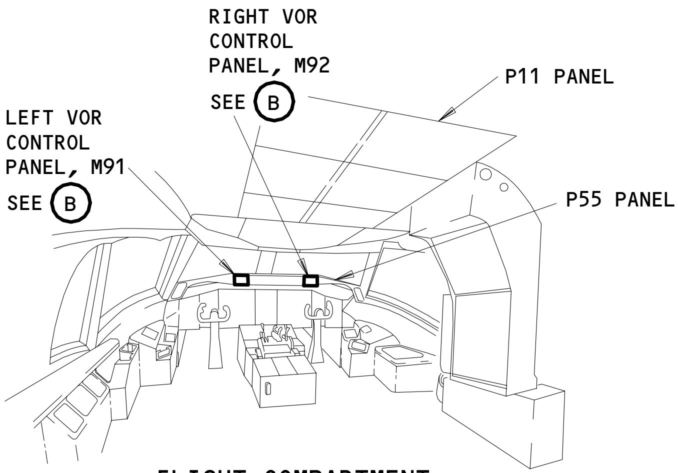
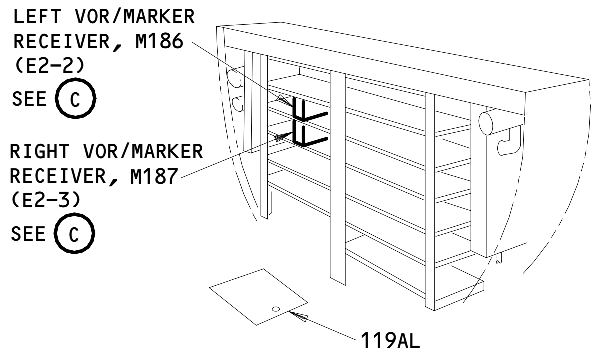
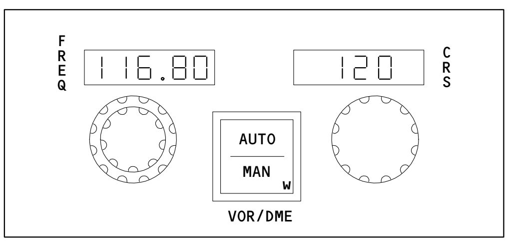


FLIGHT COMPARTMENT



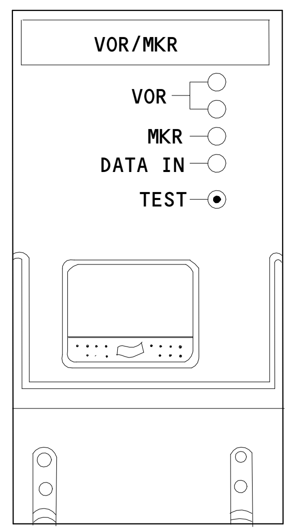
MAIN EQUIPMENT CENTER

A FROM SHT 1



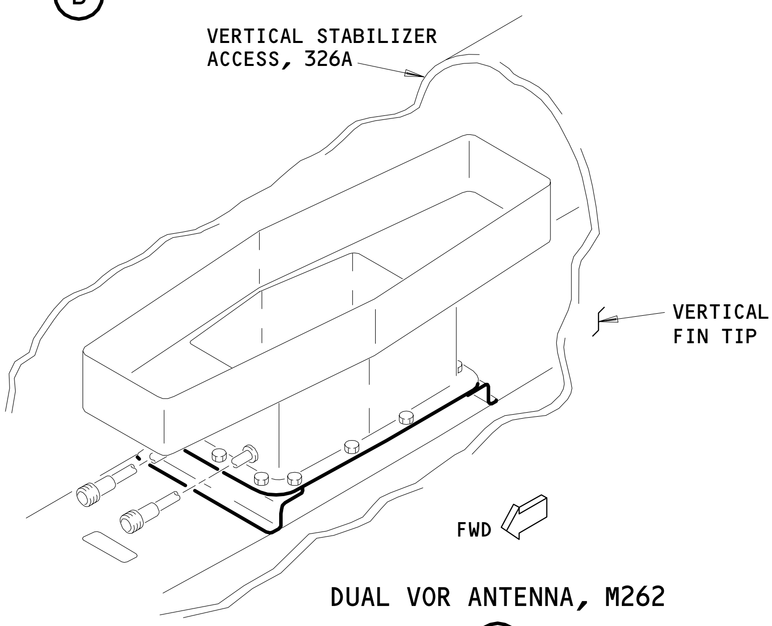
LEFT OR RIGHT VOR CONTROL PANEL,
M91 OR M92

B



LEFT OR RIGHT
VOR/MARKER RECEIVER,
M186 OR M187

C



DUAL VOR ANTENNA, M262

D FROM SHT 1

VOR System - Component Location
Figure 102 (Sheet 2)

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VHF OMNIDIRECTIONAL RANGE (VOR) SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure has two tasks. The Operational Test is a fast check of the system, and no test equipment is necessary. The System Test uses a ramp test set to do a full test of the system.

TASK 34-51-00-715-001

2. VOR System - Operational Test
   A. General
      (1) The Operational Test uses the BITE functions of the VOR system.
   B. References
      (1) AMM 24-22-00/201, Electrical Power - Control
      (2) AMM 34-21-00/501, Inertial Reference System (IRS)
   C. Access
      (1) Location Zones
          119/120 Main Equipment Center
          211/212 Flight Compartment

   D. Prepare for the Operational Test

      S 865-002
      (1) Supply electrical power (AMM 24-22-00/201).

      S 865-003
      (2) Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:
          (a) 11A1, VOR/MKR L
          (b) 11A6, RDMI L
          (c) 11E4, EFIS CONT PNL LEFT
          (d) 11E25, EFIS CONT PNL RIGHT
          (e) 11E33, VOR RIGHT
          (f) 11F1, IRS LEFT
          (g) 11F22, IRS RIGHT
          (h) 11F25, RDMI RIGHT

      S 745-004
      (3) Push and hold the indicator lights TEST switch on the overhead panel, P5.

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S 755-005
(4) Make sure the MAN and AUTO indicators on the two VOR control panels come on.

S 755-006
(5) Make sure all the display lines in the frequency and course windows come on to show 8s.

S 745-014
(6) Release the indicator lights TEST switch on the P5 panel.

S 865-016
(7) Turn the bearing source switches for the left and right pointers on each RDMI to the VOR position.

S 865-018
(8) Energize and align the left and right Inertial Reference Systems (AMM 34-21-00/501).

S 865-019
(9) Set the mode select switch on the EFIS control panels to the VOR or VOR-EXP position.

S 755-021
(10) Make sure the MAN indicator on the VOR control panels is on.

E. Procedure

S 745-022
(1) Push and hold the TEST switch on the left VOR receiver.

S 755-023
(2) Make sure this sequence occurs on the left and right RDMIs:
(a) The left bearing flag comes into view for approximately 6 seconds.
(b) The left bearing flag goes out of view, and the thin bearing pointer shows 180 ±2 degrees.

S 755-025
(3) At the same time, make sure this sequence occurs on the left VOR receiver:
(a) All the LEDs come on
(b) All the LEDs go off

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(c) The green LED comes on and stays on.

S 745-026
(4) Release the TEST switch on the left VOR receiver.

S 745-027
(5) Push and hold the TEST switch on the right VOR receiver.

S 755-028
(6) Make sure this sequence occurs on the left and right RDMIs:
(a) The right bearing flag comes into view for approximately 6 seconds.
(b) The right bearing flag goes out of view, and the thick bearing pointer shows 180 ±2 degrees.

S 755-030
(7) At the same time, make sure this sequence occurs on the right VOR receiver:
(a) All the LEDs come on
(b) All the LEDs go off
(c) The green LED comes on and stays on.

S 745-031
(8) Release the TEST switch on the right VOR receiver.

TASK 34-51-00-735-033
3. VOR System - System Test
A. General
(1) In the VOR system test, the Operational Test is done first. A ramp test set is then used to supply VOR test frequencies to do a test of the bearing indications and the audio output function.
B. Equipment
(1) VOR/ILS Ramp Test Set, NAV402AP (preferred):
NAV401L (optional),
IFR-4000 (optional),
Instrument & Flight Research Inc,
10200 West York Street,
Wichita, KS, 67215

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(2) VOR/ILS Ramp Test Set - T30A, B, C and D:
Tel-Instrument Electronics Corp.
728 Garden Street
Carlstadt, NJ 07072

C. References

(1) AMM 24-22-00/201, Electrical Power - Control

D. Access

(1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

E. Procedure

S 715-034

(1) Do the VOR Operational Test.

S 865-035

(2) Make sure these circuit breakers on the P11 panel are closed:
  (a) 11C25, INTERPHONE CAPT/OBS FLT AMPL DUAL PWR
  (b) 11C26, INTERPHONE F/O DUAL PWR
  (c) 11G29, INTERPHONE CAPT OBS FLT AMPL DUAL PWR
  (d) 11G30, INTERPHONE F/O DUAL PWR
  (e) EFIS (7 locations)

S 865-039

(3) Turn the frequency select control on the VOR control panels to 108.0 MHz of frequency.

S 755-040

(4) Make sure the bearing flags stay in view on each RDMI.

S 865-045

(5) Set the HDG REF switch to the NORMAL position.

S 865-046

(6) Follow the instructions to prepare the test set for the VOR system.

S 865-047

(7) Set these test set controls as follows:
  (a) The FREQUENCY to 108.0 MHz.
  (b) The VOR BEARING to 45.00 degree.

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(c) The ATTENUATION to -20db for test sets T30C and T30D.
(d) The TO/FROM to the FROM position

S 755-048
(8) On each RDMI, make sure the bearing flags go out of view and the thin and thick pointers show 225 ±2 degrees.

S 865-050
(9) Set the HDG REF switch to the TRUE position.

S 755-054
(10) Make sure the bearing flags on each RDMI come into view and the pointers stop at the last satisfactory bearing input.

S 865-056
(11) Set the input bearing signal from the test set, in sequence, to the 90.0, 180.0, and 270.0 degree positions.

S 755-057
(12) Make sure the bearing flags on each RDMI stay in view and the pointers stop at the last satisfactory bearing input at each position.

S 865-066
(13) Set the bearing signal from the test set to 000.0 degrees.

S 865-060
(14) Set the HDG REF switch to the NORMAL position.

S 755-062
(15) Make sure the bearing flags on each RDMI go out of view and the pointers show 180 ±2 degrees.

S 865-067
(16) Set the input bearing signal, from the test set, in sequence, to the 90.0, 180.0, and 270.0 degree positions.

S 755-068
(17) Make sure the thin and thick pointers on the RDMIs show 270 ±2, 0 ±2, and 90 ±2 degrees.

S 865-071
(18) Set the mode select switch on the EFIS control panels to the ILS-FULL position.

S 755-073
(19) Make sure no change occurs on the RDMIs or the VOR control panels.

S 865-077
(20) Set the mode select switch on the EFIS control panels back to the VOR-FULL position.

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S 865-078
(21) Supply a 1020 Hz audio tone in the VOR signal from the test set.

S 755-079
(22) On the captain's audio selector panel, do these steps as follows:
(a) Set the filter switch to the RANGE position.
(b) Set the L VOR control to the on position.
(c) Adjust the volume to a minimum.
(d) Make sure an audio tone is heard on the flight compartment speaker. Adjust the speaker volume if necessary.
(e) Set the L VOR control to the off position.
(f) Set the R VOR control to the on position.
(g) Make sure an audio tone is heard on the flight compartment speaker. Adjust the speaker volume if necessary.

S 755-080
(23) Do the audio tone test for the remaining audio selector panels.

S 865-081
(24) Use a frequency other than the test frequency on the VOR control panels.

S 755-082
(25) Make sure the bearing flags come into view on each RDMI.

S 865-084
(26) Change the frequency on the VOR control panels back to the test frequency.

S 755-085
(27) On each RDMI, make sure the bearing flags go out of view and the thick and thin pointers show 90 ± 2 degrees.

S 865-087
(28) Set the mode select switch on the EFIS control panels to the MAP position.

S 755-091
(29) Make sure the AUTO indicator on the VOR control panels comes on.

S 865-092
(30) Push the AUTO/MAN switch/light on the VOR control panels.

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S 755-093

(31) Make sure these results occur:

(a) The MAN indicator on each VOR control panel comes on.

(b) The approved test frequency is shown on the FREQ display of the VOR control panels.

(c) The pointers show a bearing of 90 ±2 degrees on each RDMI.

S 865-094

(32) Remove the test equipment.

F. Put the Airplane Back to Its Usual Condition

S 865-095

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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VOR/MKR RECEIVER - REMOVAL/INSTALLATION

1. General
    A. This procedure has two tasks. One is the removal of the VOR/MKR receiver; the other is the installation of the VOR/MKR receiver.
    B. The left, M186, and right, M187, VOR/MKR receivers are installed on the E2 rack in the main equipment center. All electrical connections are at the rear of the units.

TASK 34-51-01-004-001

2. Remove the VOR/MKR Receiver
    A. References
        (1) AMM 20-10-01/401, E/E Rack Mounted Components
    B. Access
        (1) Location Zones
            119/120 Main Equipment Center
    C. Prepare for Removal

        S 864-002

        (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
            (a) 11A1, VOR/MKR L
            (b) 11E33, VOR RIGHT
    D. Procedure

        S 024-003

        (1) Remove the VOR/MKR receiver (AMM 20-10-01).

TASK 34-51-01-404-004

3. Install the VOR/MKR Receiver
    A. References
        (1) AMM 20-10-01/401, E/E Rack Mounted Components
        (2) AMM 24-22-00/201, Electrical Power - Control
    B. Access
        (1) Location Zones
            119/120 Main Equipment Center

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C. Prepare for Installation

S 864-005

(1) Make sure these circuit breakers on the P11 panel are open:
   (a) 11A1, VOR/MKR L
   (b) 11E33, VOR RIGHT

D. Procedure

S 424-006

(1) Install the VOR/MKR receiver (AMM 20-10-01).

S 864-007

(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11A1, VOR/MKR L
   (b) 11E33, VOR RIGHT

E. VOR/MKR Receiver Test

S 864-008

(1) Supply electrical power (AMM 24-22-00).

S 744-009

(2) Push and hold the TEST switch on the applicable VOR/MKR receiver.

S 754-010

(3) Make sure the sequence that follows occurs:
   (a) All the LEDs come on
   (b) All the LEDs go off
   (c) The green LED comes on and stays on.

S 744-011

(4) Release the TEST switch on the VOR/MKR receiver.

S 864-056

(5) Do the Marker Beacon System Operational Test (AMM 34-32-00).

F. Put the Airplane Back to Its Usual Condition

S 864-012

(1) Remove electrical power if it is not necessary (AMM 24-22-00).

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VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE (VOR) CONTROL PANEL - MAINTENANCE PRACTICES

1. General
   A. This procedure has three tasks. The first is the replacement of the AUTO/MAN switch/light. The second is the removal of the VOR control panel. The last is the installation of the VOR control panel.
   B. The switch/light is replaced from the front of the panel. Lamps are on the back of the switch/light. The switch must be in the off position for replacement.
   C. The left, M91, and right, M92, VOR control panels are installed on the left and right side of the pilots' glareshield. Electrical connections are at the rear of the panel.

TASK 34-51-02-032-001

2. VOR Control Panel Switch/Light Replacement
   A. Access
      (1) Location Zones
          211/212   Flight Compartment

   B. Lamp Replacement

      S 862-003

      (1) Open these applicable circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) For the left VOR panel:
              1) 11A33, IND LIGHTS 1
          (b) For the right VOR panel:
              1) 11R30, RIGHT IND LTS 3

      S 012-002

      CAUTION: DO NOT REPLACE THE LAMPS WITH THE POWER ON. DAMAGE TO THE SWITCH CAN OCCUR.

      CAUTION: DO NOT ALLOW METER PROBE TO TOUCH THE INSIDE WALL OF SWITCH CASE WHEN PROBING THE 28V DC INPUT TERMINAL POST ON INSIDE WALL OF SWITCH CASE WHEN PROBING THE 28V DC INPUT TERMINAL POST ON INSIDE OF SWITCH CASING. GROUNDING 28V DC INPUT TERMINAL CAN DAMAGE SWITCH OR PRINTED CIRCUIT BOARD 28V DC CIRCUIT TRACE.

      (2) Use a small screwdriver or knife to pry loose the switch/light.

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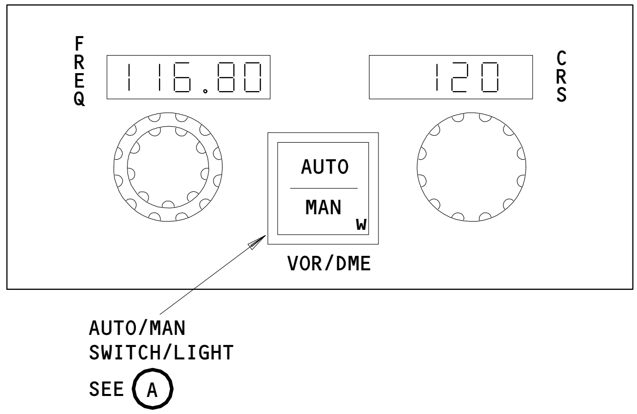
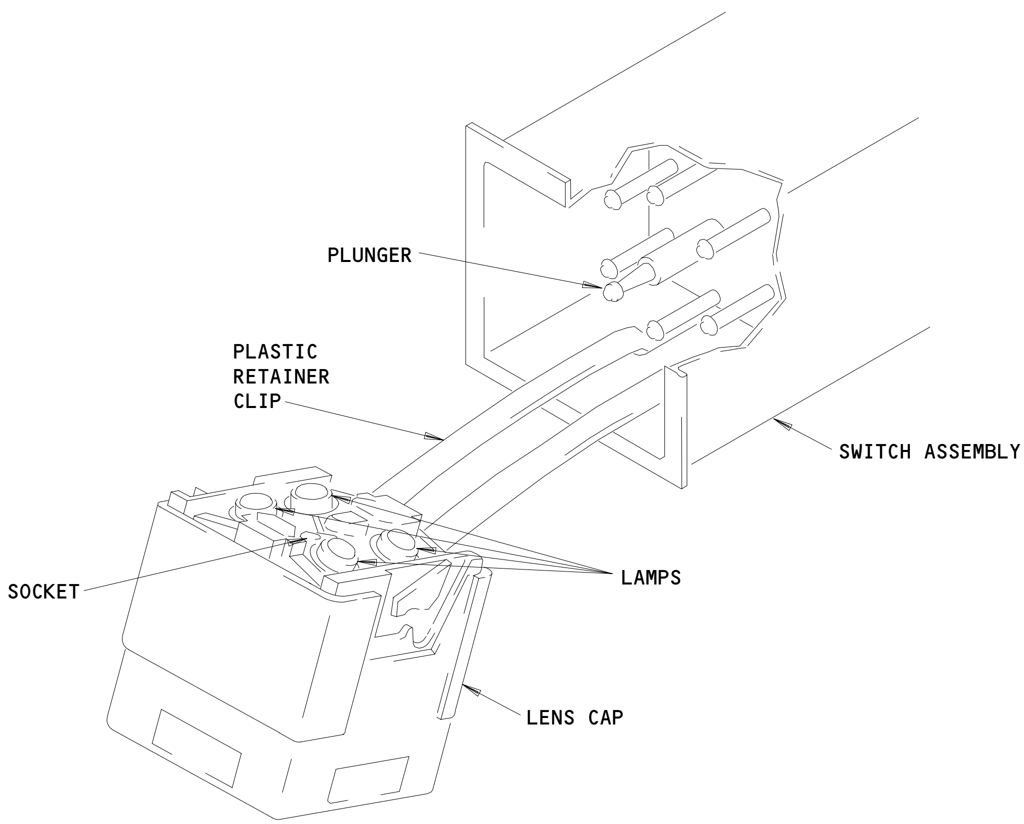


VOR CONTROL PANEL (EXAMPLE)



AUTO/MAN SWITCH/LIGHT ASSEMBLY
A

VOR AUTO/MAN Lamp Installation
Figure 201

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S 012-004
(3) Pull straight out on the lens cap assembly.

S 012-020
(4) The assembly will be held by a plastic retainer clip after removal from the panel.

S 012-036
(5) When fully extended, the lens can be turned down 90° to get access to the lamps.

S 032-021

CAUTION: MAKE SURE THE REPLACEMENT LAMPS ARE RATED FOR 28V DC AND NOT 5V DC. DAMAGE TO THE VOR/DME CONTROL PANEL CAN OCCUR.

(6) Remove and replace the necessary lamp.

C. Switch/Light Lens Assembly Installation

S 432-037

CAUTION: MAKE SURE THE SOCKET OF THE LENS CAP IS CORRECTLY MATED WITH THE PLUNGER OF THE SWITCH ASSEMBLY. IF IT IS NOT, THE PLUNGER CAN BE FORCED AGAINST ONE OF THE SWITCH CONTACTS AND CAUSE THE SWITCH TO SHORT OUT.

(1) Carefully put the lens cap into the switch assembly.

S 422-038
(2) Carefully push the lens cap in until the switch engages; then, release the switch.

S 862-039
(3) Remove the DO-NOT-CLOSE tags and close these applicable circuit breakers on the P11 panel:
   (a) For the left VOR control panel:
      1) 11A33, IND LIGHTS 1
   (b) For the right VOR control panel:
      1) 11R30, RIGHT IND LTS 3

TASK 34-51-02-002-040

3. Remove the VOR Control Panel
   A. Access
      (1) Location Zones
         211/212   Flight Compartment

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B. Prepare for Removal

S 862-041

(1) Open these applicable circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
   (a) For the left VOR control panel:
      1) 11A1, VOR/MKR L
   (b) For the right VOR control panel:
      1) 11E33, VOR RIGHT

C. Procedure

S 032-042

(1) Loosen the screws on the control panel.

S 012-043

(2) Pull out the VOR control panel.

S 032-044

(3) Disconnect the connectors at the VOR control panel.

S 022-045

(4) Remove the VOR control panel.

TASK 34-51-02-402-046

4. Install the VOR Control Panel

A. References
   (1) AMM 24-22-00/201, Electrical Power - Control

B. Access
   (1) Location Zones
      211/212 Flight Compartment

C. Prepare for Installation

S 862-047

(1) Make sure these applicable circuit breakers on the P11 panel are open:
   (a) For the left VOR control panel:
      1) 11A1, VOR/MKR L

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(b) For the right VOR control panel:
1) 11E33, VOR RIGHT

D. Procedure

S 432-048

(1) Install the connectors to the control panel.

S 422-049

(2) Install the VOR control panel.

S 432-050

(3) Tighten the screws.

S 862-051

(4) Remove the DO-NOT-CLOSE tags and close these applicable circuit breakers, on the P11 panel:
(a) For the left VOR control panel.
1) 11A1, VOR/MKR L
(b) For the right VOR control panel:
1) 11E33, VOR RIGHT

E. VOR Control Panel Test

S 862-052

(1) Supply electrical power (AMM 24-22-00).

S 752-053

(2) Make sure the VOR control panel lights come on.

F. Put the Airplane Back to Its Usual Condition

S 862-054

(1) Remove electrical power if it is not necessary (AMM 24-22-00).

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VOR ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the VOR antenna; the other is the installation of the VOR antenna.
   B. The VOR antenna, M262, is installed under the fin tip for the vertical stabilizer.

TASK 34-51-03-004-001

2. Remove the VOR Antenna
   A. References
      (1) AMM 55-31-01/401, Vertical Stabilizer Fin Tip
   B. Access
      (1) Location Zone
          326 Vertical Stabilizer - Tip

   C. Prepare for Removal

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11A1, VOR/MKR L
          (b) 11E33, VOR RIGHT
   D. Procedure

      S 014-003
      (1) Remove the fin tip for the vertical stabilizer (AMM 55-31-01/401).

      S 034-004
      (2) Disconnect the antenna cable.

      S 034-005
      (3) Remove the antenna fasteners.

      S 024-006
      (4) Lift and remove the VOR antenna.

TASK 34-51-03-404-007

3. Install the VOR Antenna
   A. Equipment

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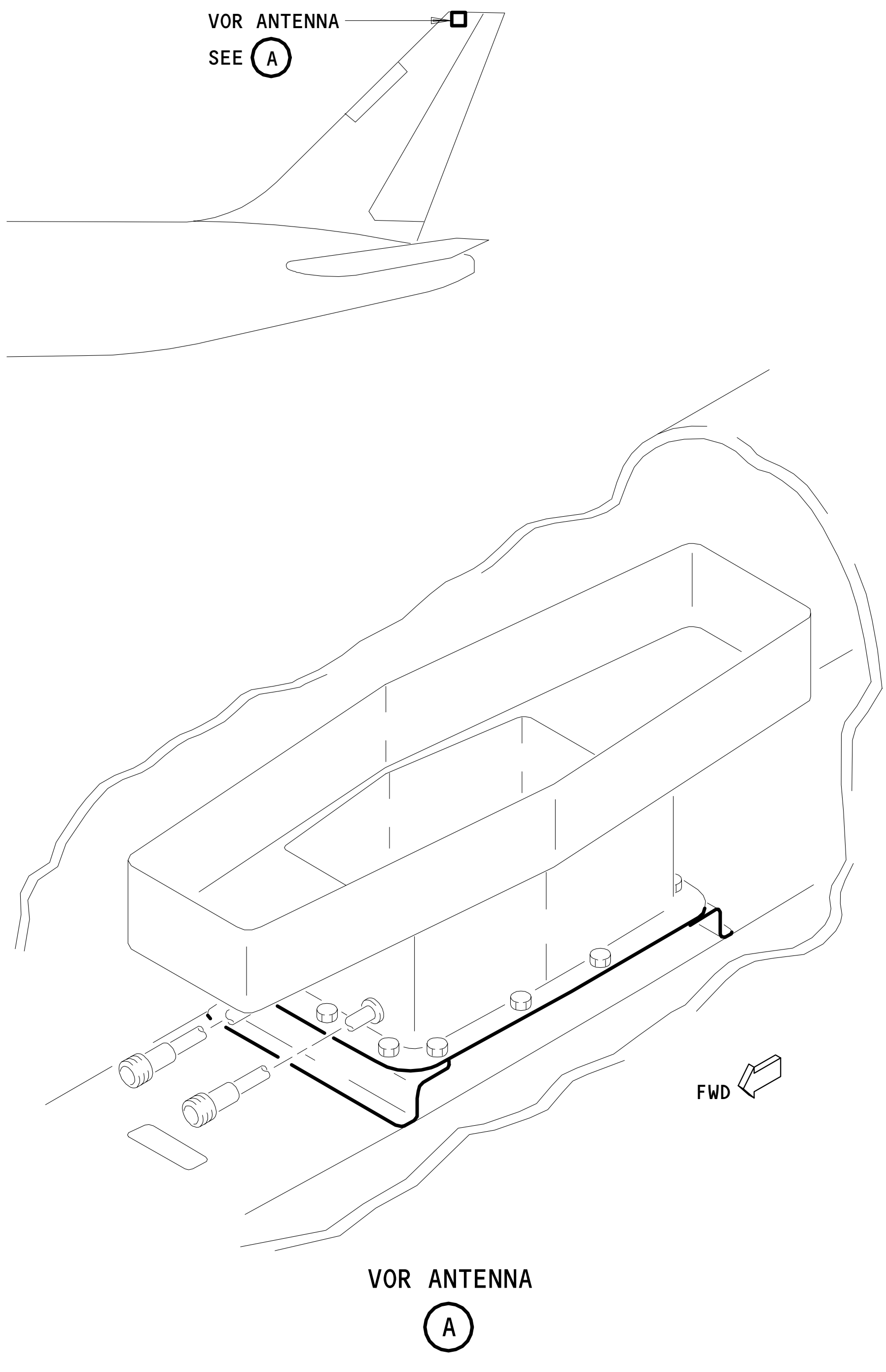

VOR Antenna Installation
Figure 401

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(1) VOR/ILS Ramp Test Set, NAV402AP preferred), NAV401L (optional), Instrument & Flight Research Inc, 10200 West York Street, Wichita, KS, 67215

B. Consumable Materials
(1) B00184 Solvent - BMS 11-7
(2) G00009 Compound - Corrosion Inhibiting - BMS 3-23

C. References
(1) AMM 20-10-22/701, Metal Surfaces
(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 55-31-01/401, Vertical Stabilizer Fin Tip
(4) SRM 51-20-01

D. Access
(1) Location Zones

211/212	Flight Compartment
326	Vertical Stabilizer - Tip

E. Prepare for Installation

S 864-008
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11A1, VOR/MKR L
(b) 11E33, VOR RIGHT

F. Procedure

S 214-009
(1) Make sure there is no corrosion on the electrical connectors or the coaxial cable.

S 214-010
(2) Visually examine the mating surfaces of the antenna and the airplane for corrosion.

S 144-011
(3) If corrosion is present, Clean the mating surfaces with a stainless steel brush until the surfaces have no corrosion (SRM 51-20-01).

NOTE: Corrosion can occur again if a material other than stainless steel is used.

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S 114-012
(4) Clean the mating surfaces with the solvent, BMS 11-7 (AMM 20-10-22).

S 624-013
(5) Apply a corrosion inhibiting compound, BMS 3-23, to the mating surfaces of the antenna and the airplane (SRM 51-20-01).

S 424-014
(6) Put the VOR antenna into position, and install the fasteners.

S 434-016
(7) Connect the antenna cable.

S 414-017
(8) Install the fin tip for the vertical stabilizer (AMM 55-31-01/401).

S 864-018
(9) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11A1, VOR/MKR L
(b) 11E33, VOR RIGHT

G. VOR Antenna Test

S 864-019
(1) Supply electrical power (AMM 24-22-00/201).

S 864-020
(2) Open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
(a) 11E11, DME LEFT
(b) 11E32, DME RIGHT

S 864-022
(3) Set the mode select switch on the EFIS control panels to the VOR-FULL or VOR-EXP position.

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S 864-023
(4) Follow the instructions to prepare the test set, and set these controls as follows:
(a) The FREQUENCY to the approved test frequency
(b) The VOR BEARING to 000.0 degrees
(c) The TO/FROM to the FROM position.

S 864-024
(5) Activate the VOR signal generator.

S 754-025
(6) Make sure the bearing pointers on the RDMIs point to 180 ±2 degrees.

S 864-027
(7) Deactivate and remove the test set.

H. Put the Airplane Back to Its Usual Condition

S 864-028
(1) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11E11, DME LEFT
(b) 11E32, DME RIGHT

S 864-029
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AIR TRAFFIC CONTROL SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The air traffic control mode select (ATC MODE S) system provides altitude and identification reply signals to an interrogating ATC ground station. These reply signals are used to identify and locate an airplane as it moves through an ATC ground station sector.
   B. Two ATC systems are installed on the airplane with each system containing a transponder, antenna switching, and an antenna. A mutual control panel provides control for both systems and selects the left or right transponder for system use. Only one transponder is used for operation at any one time.
   C. Both the ATC and DME systems operate in the same frequency range. A mutual suppression circuit is connected between both ATC transponders and the DME interrogaters. This is to prevent simultaneous transmission by any two systems.
2. Component Details (Fig. 1)
   A. Transponder
      (1) The two ATC transponders are located in the main equipment center. The left transponder is located on rack E2-2, the right on rack E2-3. Each transponder is microprocessor controlled. They operate in the L band frequency range with a transmission frequency of 1090 MHz.
      (2) The TEST switch on the transponder front panel initiates a self-test. This self-test checks the antenna, all transponder circuits, data from the control panel, data from the ADC, and the front panel status lights.
      (3) System status is displayed by six LED indicators on the transponder front panel as follows:
         (a) The TPR PASS/FAIL lights indicate operational status of the transponder.
            1) The green TPR-PASS status light, during normal operation, shows that the transponder is currently replying to a valid ATC interrogation. During self-test, it shows that the transponder passes the manual self-test.
            2) The red TPR-FAIL status light indicates a BITE detected failure of the transponder.
         (b) The red CTL light indicates faulty data from the ATC control panel.

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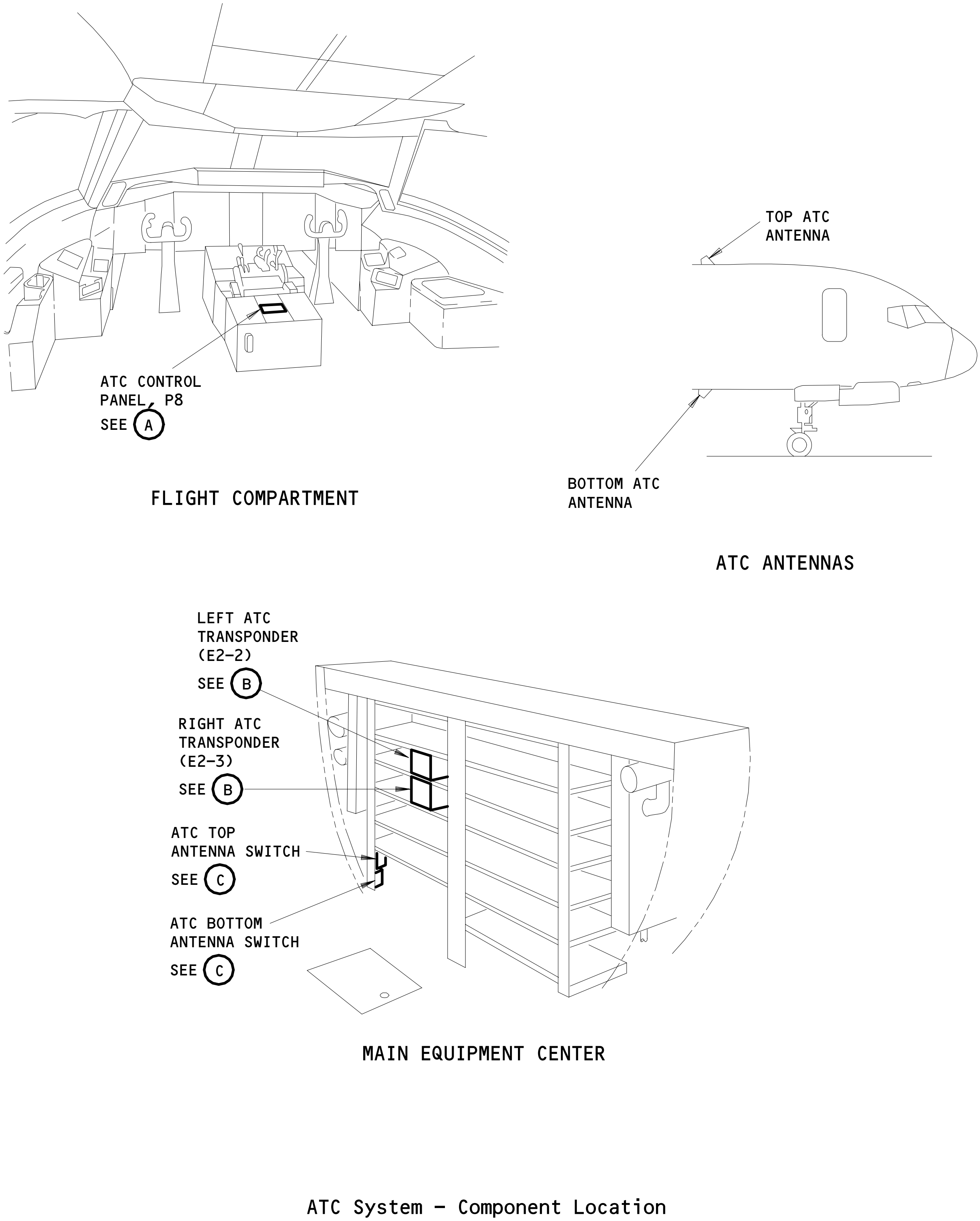

ATC System - Component Location
Figure 1 (Sheet 1)

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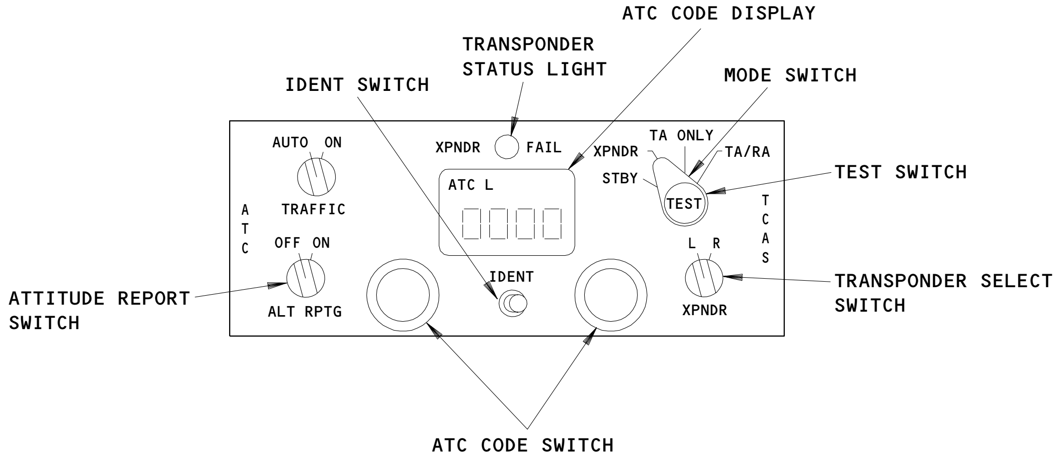
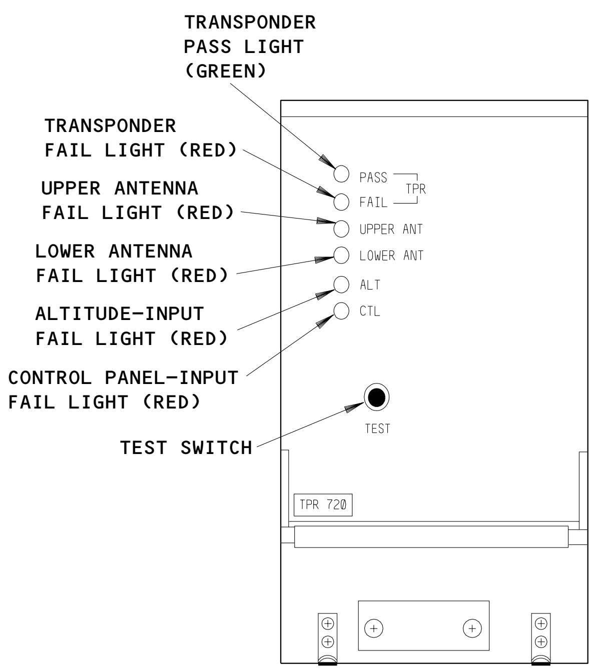


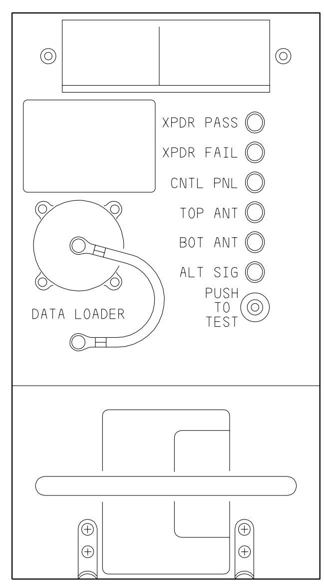
ATC/MODE S CONTROL PANEL

A



ATC/MODE S TRANSPONDER

B 1



ATC/MODE S TRANSPONDER

B 2

1 AIRPLANES WITH ROCKWELL COLLINS MODE-S TRANSFORMER

2 AIRPLANES WITH ACSS MODE-S TRANSFORMER

ATC System - Component Location
Figure 1 (Sheet 2)

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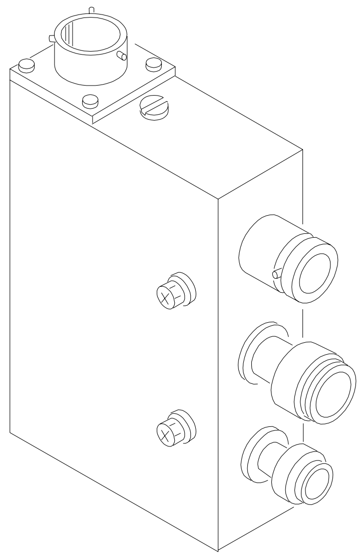

ATC System - Component Location
Figure 1 (Sheet 3)

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(c) The red ALT light indicates faulty data from the air data system.
(d) The red LOWER ANT light indicates a detected antenna fault.
(e) The red UPPER ANT light indicates a detected antenna fault.
(f) The system status lights (TPR, UPPER ANT, LOWER ANT, ALT, AND CTL) are operational only when the test button has been pressed, except the green TPR - PASS light. This light is operational whenever power is applied to the transponder. The TPR - PASS light comes on when the transponder is replying to a signal, and remains on for about 15 seconds after the transmission ends.

(4) To facilitate bench level testing, faults for up to 49 previous flights are stored in memory.

B. Control Panel

(1) The dual ATC control panel is located on the P8 electronics panel. The controls and indicators operate in the following manner.
(a) The ATC code select knobs select the 4-digit identification code which is displayed in the ATC code display window. The left hand outer knob selects the thousands and the inner knob the hundreds digits. The right hand inner knob selects the tens and the outer knob the units digits.
(b) The transponder select knob turns on the left or right unit as selected. Both transponders are off with the switch in the STBY position.
(c) The transponder select switch connects the selected left or right transponder to the top and bottom ATC antennas. The unselected transponder will be in the standby mode.
(d) The altitude reporting switch enables the transponder to reply with coded altitude information supplied by the ADC.
(e) The identification switch causes the transponder to transmit a special pulse with each ATC code generated reply. This is used to identify the airplane on the ground station scope.

C. Antenna

(1) The two ATC antennas are conventional L blade-type units located on the top and bottom of the fuselage.
(2) The antenna switch enables the left or right transponder to transmit and receive signals using both the top and the bottom ATC antenna.

3. <u>Operation</u> (Fig. 2)

A. Functional Description

(1) Each transponder is powered by 115V AC, 400 Hz from the corresponding left or right bus. Power to the transponders is controlled by the transponder select switch on the ATC control panel.

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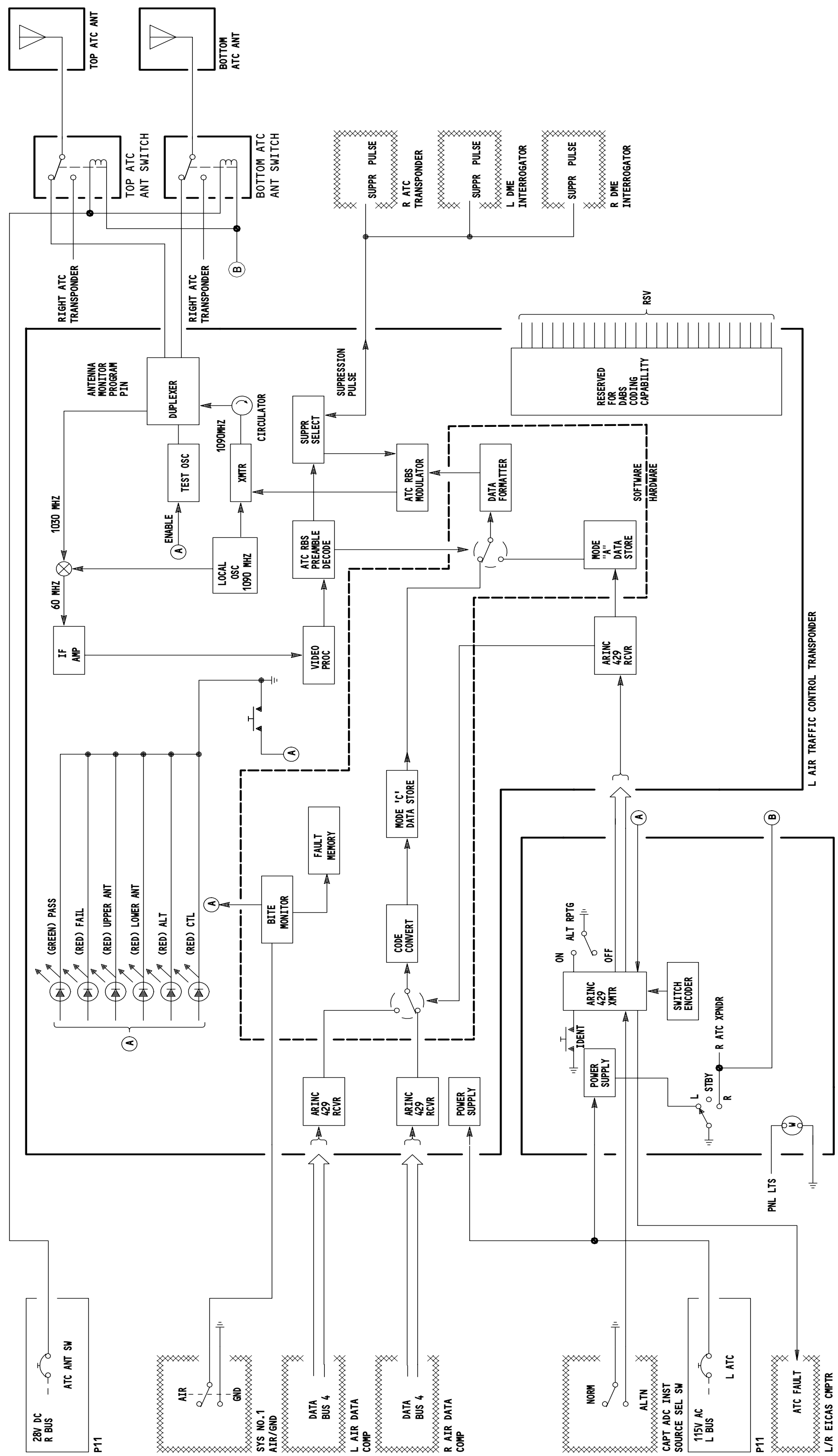

ATC System Schematic (Example)
Figure 2

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(2) The left ATC system is powered by 115v ac, 400 Hz from the left transfer bus. The Hydraulic driven generator (HDG) activates when both the left and right main AC busses are unpowered. The HDG provides AC power to the left and right AC transfer busses. This allows the left ATC system to transmit.
(3) Setting the transponder select switch to either the L or R position connect the selected transponder to the upper and lower ATC antennas which lets the selected transponder transmit its altitude data.
(4) Setting the transponder select switch to the STBY position disconnects power to the transponder, but the control panel stays powered.
(5) Control data for the transponders is generated in the control panel. This control data includes the ATC code select signals, the identification signal, the altitude reporting signals, and the ADC source select discrete. All are entered into the ARINC 429 transmitters. The encoded selection data also operates the ATC control panel display.
(6) The left and right ADCs provide altitude data to both transponders in ARINC 429 digital data format. When the altitude reporting is on, the selected transponder uses this data to form altitude coded replies. Under normal conditions, the left unit uses the signals from the left ADC and the right unit from the right ADC. The left transponder will switch to the right ADC if the captain's ADC instrument source select switch is set to ALTN. Similarly, the right transponder will switch to the left ADC if the first officers instrument source select switch is set to ALTN.
(7) Three different modes of interrogation, signals are alternately sent by the ATC ground radar systems. Mode A signals ask the transponder for just the assigned ATC (4096) code. Mode C signals ask for just pressure altitude data. Mode S signals ask for the airplanes mode S address and other surveillance information.
(8) There are two different mode S interrogation modes. The mode S all call interrogates both ATCRBS and mode S transponders. The discrete interrogation only interrogates a particular mode S transponder.
(9) Interrogation signals received at the antenna are routed to the receiver thru the rf switch. The rf switch allows one antenna to be used to both receive and transmit signals. The interrogation signals, operating at 1030 MHz, are reduced to a 60 MHz IF signal in the receiver. The IF signal is coupled to the video processor where pulse width and pulse amplitude are checked. Valid signals are converted to digital pulses and routed to the digital processor.
(10) The digital processor encodes and generates replies. Reply signals are transmitted between two framing pulses 20.3 microseconds apart. The data format between the framing pulses depends on the mode of the interrogation signals received.
   (a) If mode A signals are received, the reply signal format includes the assigned ATC code data set on the ATC control panel.

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(b) If mode C signals are received, the replay signal format includes pressure altitude data if the altitude reporting function is on. If altitude reporting is off, the transponder will reply with only the two framing pulses.

(c) If mode S signals are received, the reply signal format can include the ATC (4096) code, pressure altitude data and other surveillance information used by the TCAS system. A discrete 24-bit mode S address always accompany each reply.

(d) The mode S transponder allows bidirectional air-to-air, ground-to-air and air-to-ground data link.

(11) In addition to the information pulses, a special position identification (SPI) pulse will be included in the reply when requested by the ground station. The pulse is initiated when the IDENT pushbutton switch is pushed on the ATC control panel. The pulse is transmitted with each mode A response, and is continually sent with each response for up to 20 seconds after the IDENT switch is pressed.

(12) The reply signals are fed from the digital processor to the transmitter. The transmitter generates the replies in 1090 MHz pulse format. The reply is sent to the circulator which protects against severe impedance changes at the antenna port. The replies proceed on through the switching network and out to the antenna.

(13) When the ATC is transmitting, the mutual suppression circuit generates the suppression signal. This signal inhibits the DMEs and the other ATC from transmitting at the same time as the on-line ATC transponder.

(14) The Mode-S air/ground discrete prevents Mode-A and Mode-C transmissions on the ground.

(15) The green TPR-PASS light comes on or flickers during ATC transponder transmission.

B. BITE

(1) The BITE microprocessor monitors system functions during normal system operation. All internal circuits plus the power supply are checked. The input signals from the control panel and the selected air data computer are also checked. The BITE checks receiver performance, transmitter output and interface signal data.

(2) The BITE microprocessor includes a flight fault memory. While this memory is installed, it is used under the current mode of BITE programming. The air/ground relay discrete received by the BITE microprocessor is used with an operating flight fault memory.

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(3) All faults detected during flight are stored in a fault memory. Faults occurring on the ground are only stored when the TEST button is pushed. Faults on up to 49 flights can be recorded to assist bench level trouble shooting. The air/ground relay discrete enables the flight count. The signal increases the memory count by one each time the airplane lifts off the ground.

(4) When a fault is detected, the BITE monitor in each transponder sends a fault signal to the ATC control panel. (The transponder select knob accomplishes switching between the left and right transponder fault signals.) If the faulty transponder is selected the fault signal turns on the FAULT light on the control panel. The signal is also routed in parallel to both left and right EICAS computers. The fault is annunicated as a level C message ATC FAULT on the EICAS upper display unit.

(5) If no valid interrogations are received by the transponder, the BITE initiates a self-test. During this test, the test oscillator injects a 1030 Hz signal that is directed to the receiver path. The signal includes alternate mode A and C simulated interrogations. This signal is processed in the normal manner as previously described. The processor checks the receiver output to find out if the mode A or C signals were properly decoded. It also examines the transmit section to determine whether the correct response was made.

(6) Intermittent faults are detected during both system monitoring and during BITE initiated self-tests. If two or more intermittent faults have been detected from the previous four flight segments, the BITE monitor will consider the unit to be bad.

(7) Self-Tests

(a) Self-tests include the BITE initiated tests that occur when normal interrogations are not received as just described.

(b) The system self-test operation can also be initiated manually by pressing and holding the test button on the transponder. The test can be initiated at any time. With the test button pressed for at least 6 seconds, the following sequence will take place:

1) All LEDs come on.
2) All LEDs go off.
3) Green LED comes and stays on to indicate that the self test was successful.

C. Control

(1) Provide electrical power (AMM 24-22-00/201).
(2) Close ATC L and ATC R circuit breakers on panel P11.
(3) Select left or right transponder as desired by setting the transponder select knob on ATC control panel to L or R.
(4) To provide altitude reporting data, set ALT RPTG switch to ON.

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AIR TRAFFIC CONTROL (ATC) SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
ANTENNA - BOTTOM ATC, M259	1	1	BOTTOM OF FUSELAGE	34-53-03
ANTENNA - TOP ATC, M261	1	1	TOP OF FUSELAGE	34-53-03
CIRCUIT BREAKER -	2		FLIGHT COMPARTMENT, P11	
ATC ANT SWITCH, C4423		1	11F11	*
ATC LEFT, C616		1	11F7	*
ATC RIGHT, C617		1	11F28	*
COMPUTER - (FIM 31-41-00/101)				
EICAS LEFT, M10181				
EICAS RIGHT, M10182				
COMPUTER - (FIM 34-45-00/101)				
TCAS, M1705 [1]				
PANEL - ATC CONTROL, M81	2	1	FLIGHT COMPARTMENT, P8	34-53-02
RELAY - (FIM 31-01-36/101)				
SYS NO. 1 AIR/GND, K143				
RELAY - (FIM 31-01-37/101)				
SYS NO. 2 AIR/GND, K200				
SWITCH - (FIM 34-12-00/101)				
LEFT ADC, S482				
RIGHT ADC, S483				
SWITCH - BOTTOM ATC ANT, S10564	3	1	119AL, MAIN EQUIP CENTER, E2-2	34-53-04
SWITCH - TOP ATC ANT, S10563	3	1	119AL, MAIN EQUIP CENTER, E2-3	34-53-04
TRANSPONDER - LEFT ATC, M112	2	1	119AL, MAIN EQUIP CENTER, E2-2	34-53-01
TRANSPONDER - RIGHT ATC, M113	2	1	119AL, MAIN EQUIP CENTER, E2-3	34-53-01

* SEE THE WDM EQUIPMENT LIST

[1] AIRPLANES WITH TCAS

Air Traffic Control (ATC) System - Component Index
Figure 101

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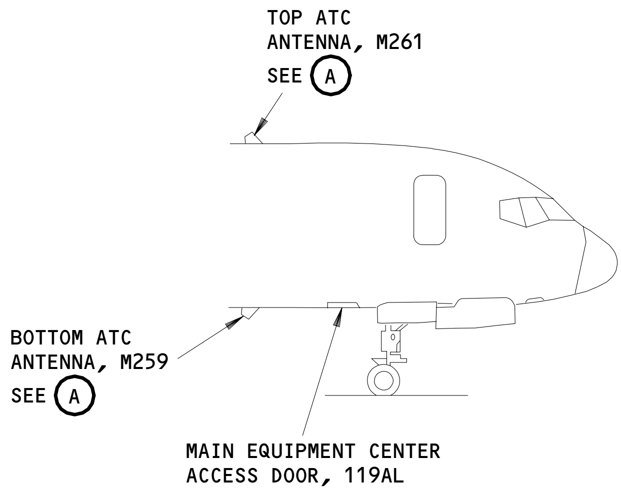

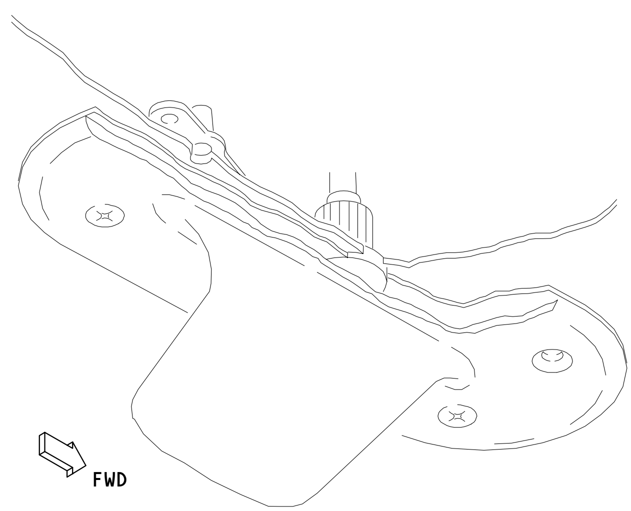

BOTTOM OR TOP ATC ANTENNA, M259 OR M261
A

Air Traffic Control (ATC) System - Component Location
Figure 102 (Sheet 1)

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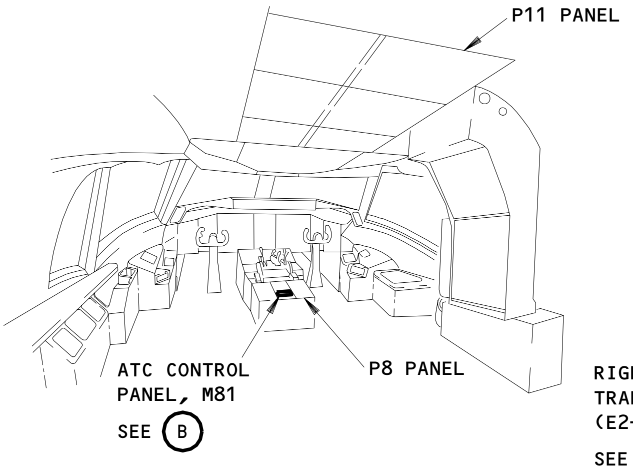
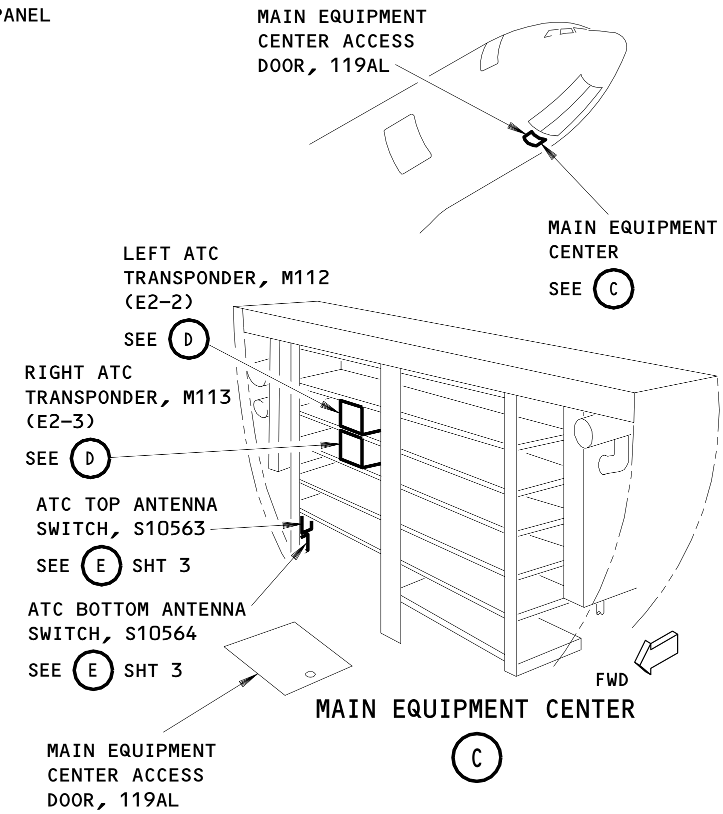
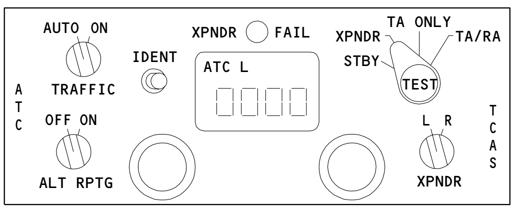


FLIGHT COMPARTMENT



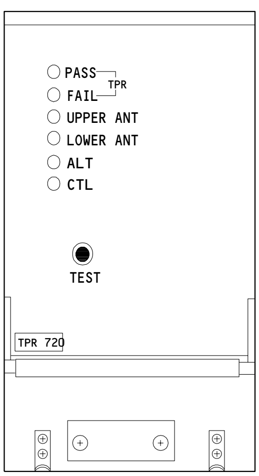
MAIN EQUIPMENT CENTER

C



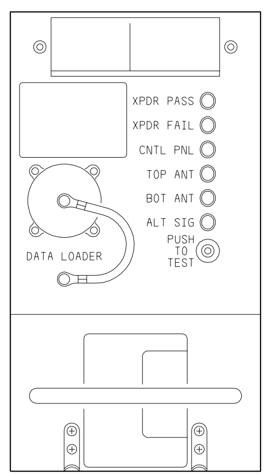
ATC/MODE S CONTROL PANEL, M81

B



LEFT OR RIGHT ATC TRANSPONDER,
M112 OR M113

D 1



LEFT OR RIGHT ATC TRANSPONDER,
M112 OR M113

D 2

1 AIRPLANES WITH ROCKWELL COLLINS MODE-S TRANSFORMER

2 AIRPLANES WITH ACSS MODE-S TRANSFORMER

Air Traffic Control (ATC) System - Component Location
Figure 102 (Sheet 2)

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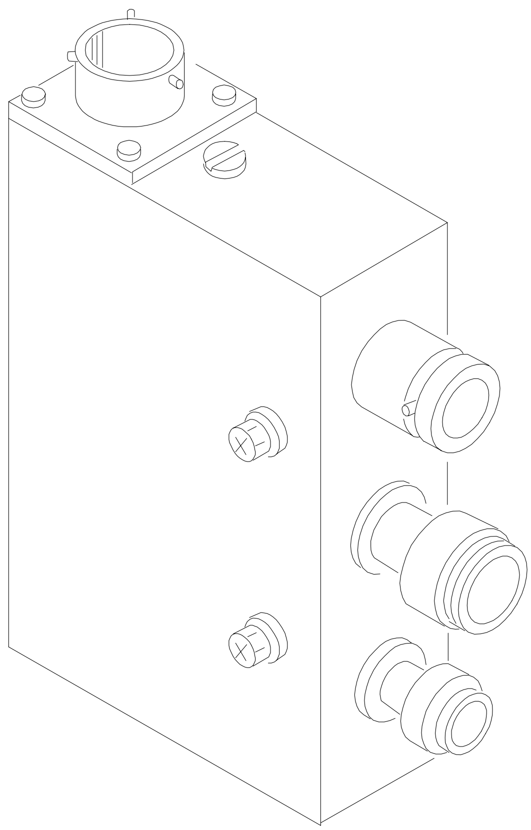

TOP OR BOTTOM ATC ANTENNA SWITCH,
S10563 OR S10564

E

Air Traffic Control (ATC) System - Component Location (Detail from Sht 2)
Figure 102 (Sheet 3)

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AIR TRAFFIC CONTROL SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure contains two tasks. One is an operational test; the other is a system test. The operational test is a fast check of the ATC system. The system test first does the operational test. Then, it uses test equipment to examine ATC code reception and altitude reporting. Steps to measure transponder sensitivity, side lobe suppression, and the transmitter frequency are also given.

TASK 34-53-00-715-094-003

2. Operational Test - ATC System
   A. General
      (1) This test examines the ATC system for proper operation. It uses only the system's BITE function, and no special test or ground equipment is necessary.
   B. References
      (1) 24-22-00/201, Electrical Power - Control
   C. Access
      (1) Location Zones
          119/120 Main Equipment Center
          211/212 Flight Compartment

   D. Prepare for the Operational Test

      S 865-002-003
      (1) Supply electrical power (Ref 24-22-00/201).

      S 865-003-003
      (2) Make sure these circuit breakers are closed:
          (a) P11 Overhead Circuit Breaker Panel:
              1) 11A10, AIR DATA CMPTR LEFT
              2) 11A11, AIR DATA AOA SENSOR LEFT
              3) 11A12, AIR DATA BARO CORRECT LEFT
              4) 11E2, ALTM LEFT
              5) 11E23, ALTM RIGHT
              6) 11F7, ATC LEFT
              7) 11F28, ATC RIGHT
              8) 11F30, AIR DATA CMPTR RIGHT
              9) 11F31, AIR DATA AOA SENSOR RIGHT
              10) 11F32, AIR DATA BARO CORRECT RIGHT

      S 865-004-003
      (3) On panel P11, make sure the six EICAS circuit breakers are closed.

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S 865-006-003
(4) Set the transponder select switch on the ATC control panel to the L position.

S 755-099-003
(5) Make sure the message, ATC FAULT, does not come into view on EICAS.

NOTE: If necessary push the CANCEL switch on the EICAS DISPLAY select panel to see more messages.

E. Procedure

S 865-018-003
(1) Push and hold the TEST switch on the left ATC transponder.
(a) Make sure the sequence that follows occurs:
1) All the LEDs come on momentarily
2) All the red LEDs go off
3) The green LED stays on.

S 865-027-003
(2) Release the TEST switch on the ATC transponder.

NOTE: The green LED will come on if the ATC transponder is interrogated.

S 865-028-003
(3) Set the transponder select switch on the ATC control panel to the R position.

S 745-032-003
(4) Do the self-test procedure again for the right ATC transponder.

F. Put the Airplane Back to Its Usual Condition

S 865-101-003
(1) Remove electrical power if it is not necessary (Ref 24-22-00/201).

TASK 34-53-00-735-033-003

3. System Test - ATC System

A. General
(1) This system test is a more complete check of the ATC system. The system test first does the ATC - Operational Test. Then it uses ground test equipment to examine the left and right ATC systems.

B. Equipment
(1) Transponder/DME Ramp Test Set - IFR Model ATC600A; Instruments and Flight Research Inc., 10200 West York Street, Wichita, KA 67215.
(2) Angular displacement measuring tool - Boeing A34012-24

C. References
(1) 24-22-00/201, Electrical Power - Control

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(2) 34-12-00/501, Air Data Computing (ADC) System

D. Access

(1) Location Zones

119/120	Main Equipment Center
119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment

E. Prepare for the System Test

S 215-034-003

(1) Read the offset value found on the trailing edge of the left and right angle of attack (AOA).

S 865-035-003

(2) Set the left AOA VANE to (0 plus offset) degrees and the right AOA VANE to (0 minus offset) degrees.

NOTE: Failure to do this step can give incorrect altitude indication.

S 865-067-003

CAUTION: DO NOT OPERATE THE TEST SET WHEN ITS ANTENNA IS LESS THAN 15 INCHES FROM THE AIRPLANE ANTENNA. DAMAGE TO THE TEST SET CAN OCCUR.

(3) Adjust the remote test antenna to the same height as the left ATC antenna.

S 865-039-003

(4) Put the test antenna a specified horizontal distance from the left ATC antenna. The test antenna coax cable shows the necessary distance (about 21 inches).

S 865-042-003

(5) Put the loose end of the coaxial cable into the flight compartment and connect it to the test set.

S 865-044-003

(6) Supply electrical power (Ref 24-22-00/201).

S 715-045-003

(7) Do the ATC System - Operational Test.

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S 865-046-003

(8) Open these circuit breakers and attach DO-NOT-CLOSE tags:
   (a) P11 Overhead Circuit Breaker Panel:
      1) 11F28, ATC RIGHT
      2) 11F30, AIR DATA CMPTR RIGHT

S 865-048-003

(9) Set the transponder select switch on the ATC control panel to the L position.

S 865-053-003

(10) Set the altitude reporting switch on the ATC control panel to the OFF position.

F. The Left ATC System Test

S 725-057-003

(1) Do a transponder sensitivity test as follows:
   (a) On the test set, make sure the % REPLY meter shows 100.
   (b) Slowly turn the XPDR SIG control clockwise until the % REPLY meter shows 90.
   (c) Make sure the XPDR SIG control is between 69 and 77.
   (d) Write down the control value. This is the minimum triggering level (MTL) for the transponder system.
   (e) Set the mode switch on the test set to the A/C ALT position.
   (f) Set the altitude reporting switch on the ATC control panel to the ON position.
   (g) Slowly turn the XPDR SIG control clockwise until the % REPLY meter shows 90.
   (h) Make sure the XPDR SIG control is between 69 and 77.
   (i) Make sure the XPDR SIG control value is not different from the first value by more than 1.
   (j) Turn the XPDR SIG control back to the fully counterclockwise position.
   (k) Set the mode switch on the test set to the A/C CODE position.

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S 725-058-003

(2) Do the side lobe suppression test as follows:

(a) Adjust the XPDR SIG control on the test set to 3 dB above the MTL. This is the control value from before, minus 3.

NOTE: The transponder's sensitivity can possibly be near the limit of sensitivity. If necessary, move the antennas closer together to get 3 dB above the MTL. At a closer than usual antenna distance, set the control again for the MTL. Adjust the control to 3 dB above the MTL and do the side lobe suppression test.

(b) Set the SLS switch on the test set to 0 dB. Make sure the transponder gives no reply.

(c) Set the SLS switch on the test panel to -9 dB. Make sure the transponder gives a reply of 90% (minimum) to 100% on the % REPLY meter.

(d) Turn the XPDR SIG control on the test set to the fully counterclockwise position.

S 725-059-003

(3) Do the transmitter frequency test as follows:

(a) Set the FREQ/POWER meter switch on the test set to the FREQ position.

(b) On the ATC control panel, do these steps as follows:

1) Set the ATC code switches to 0000.

2) Set the altitude reporting switch to the OFF position.

(c) Adjust the gain control on the test set for a middle value on the FREQ/POWER meter.

(d) Turn the frequency control for a maximum meter value.

(e) Make sure the frequency control value is 0 plus or minus 3.

S 725-096-003

(4) Do the transponder power output test as follows:

(a) Set the FREQ/POWER meter switch to the POWER position.

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(b) Make sure the transponder power output is in the range of 125 watts to 500 watts.

S 725-060-003

(5) Do the identification test as follows:

(a) In sequence, set the ATC code switches on the ATC control panel to 1275, 1661, 4336, and 5225.

(b) Make sure you receive the ATC codes of 1275, 1661, 4336 and 5225 in sequence at the transponder test set.

(c) Push the IDENT switch on the ATC control panel.

(d) Make sure you receive an identification pulse as a reply.

(e) Set the transponder select switch on the ATC control panel to each of the other two positions.

(f) Make sure there is no reply at the test set for the two positions.

(g) Set the transponder select switch on the ATC control panel to its initial position.

S 725-095-003

(6) Do the altitude reporting test as follows:

(a) Set the altitude reporting switch on the ATC control panel to the ON position.

(b) Make sure the captains's ADC switch on the INSTR SOURCE SEL panel is in the NORM position.

(c) Set and hold the ADC test switch on the miscellaneous test panel, P61, in the L position.

(d) Make sure you receive 10,000 feet in the altitude reply code for 2 seconds at the ATC test set.

(e) Release the ADC test switch.

(f) Make sure the altitudes on the captain's altimeter and the ATC test set are less than 100 feet apart.

G. The Right ATC System Test

S 865-061-003

(1) Move the remote test antenna to the correct position adjacent to the right ATC antenna.

S 865-063-003

(2) On the ATC control panel, do these steps as follows:

(a) Set the altitude reporting switch to the OFF position

(b) Set the transponder select switch to the R position.

S 865-066-003

(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers:

(a) P11 Overhead Circuit Breaker Panel:

1) 11F3, AIR DATA CMPTR RIGHT

2) 11F28, ATC RIGHT

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S 865-100-003

(4) Open these circuit breakers and attach DO-NOT-CLOSE tags:
   (a) P11 Overhead Circuit Breaker Panel:
      1) 11A10, AIR DATA CMPTR LEFT
      2) 11F7, ATC LEFT

S 725-069-003

(5) Do the transponder sensitivity test as follows:
   (a) On the test set, make sure the % REPLY meter shows 100.
   (b) Slowly turn the XPDR SIG control clockwise until the % REPLY meter shows 90.
   (c) Make sure the XPDR SIG control is between 69 and 77.
   (d) Write down the control value. This is the minimum triggering level (MTL) for the transponder.
   (e) Set the mode switch on the test set to the A/C ALT position.
   (f) Set the altitude reporting switch on the ATC control panel to the ON position.
   (g) Slowly turn the XPDR SIG control clockwise until the % REPLY meter shows 90.
   (h) Make sure the XPDR SIG control is between 69 and 77.
   (i) Make sure the XPDR SIG control value is not different from the first value by more than 1.
   (j) Turn the XPDR SIG control back to the fully counterclockwise position.
   (k) Set the mode switch on the test set to the A/C CODE position.

S 725-070-003

(6) Do the side lobe suppression test as follows:
   (a) Adjust the XPDR SIG control on the test set to 3 dB above the MTL. This is the control value from before, minus 3.

      NOTE: The transponder's sensitivity can possibly be near the limit of sensitivity. If necessary, move the antennas closer together to get 3 dB above the MTL. At a closer than usual antenna distance, set the control again for the MTL. Adjust the control to 3 dB above the MTL and do the side lobe suppression test.

   (b) Set the SLS switch on the test set to 0 dB. Make sure the transponder gives no reply.
   (c) Set the SLS switch on the test panel to -9 dB. Make sure the transponder gives a reply of 90% (minimum) to 100% on the % REPLY meter.
   (d) Turn the XPDR SIG control on the test set to the fully counterclockwise position.

S 725-071-003

(7) Do the transmitter frequency test as follows:
   (a) Set the FREQ/POWER meter switch on the test set to the FREQ position.

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(b) On ATC control panel, do these steps as follows:
    1) Set the ATC code switches to 0000.
    2) Set the altitude reporting switch to the OFF position.
(c) Adjust the gain control on the test set for a middle value on the FREQ/POWER meter.
(d) Turn the frequency control for a maximum meter value.
(e) Make sure the frequency control value is 0 ±3.

S 725-097-003

(8) Do the transponder power output test as follows:
  (a) Set the FREQ/POWER meter switch to the POWER position.
  (b) Make sure the transponder power output is in the range of 125 watts to 500 watts.

S 725-072-003

(9) Do the identification test as follows:
  (a) In sequence, set the ATC code switches on the ATC control panel to 1275, 1661, 4336, and 5225.
  (b) Make sure you receive the ATC codes of 1275, 1661, 4336, and 5225 in sequence at the transponder test set.
  (c) Push the IDENT switch on the ATC control panel.
  (d) Make sure you receive an identification pulse as a reply.
  (e) Set the transponder select switch on the ATC control panel to each of the other two positions.
  (f) Make sure there is no reply at the test set for the two positions.
  (g) Set the transponder select switch on the ATC control panel to its initial position.

S 725-098-003

(10) Do the altitude reporting test as follows:
  (a) Set the altitude reporting switch on the ATC control panel to the ON position.
  (b) Make sure the first officer's ADC switch on the INSTR SOURCE SEL panel is in the NORM position.
  (c) Set and hold the ADC test switch on the miscellaneous test panel, P61, in the R position.
  (d) Make sure you receive 10,000 feet in the altitude reply code for 2 seconds at the ATC test set.
  (e) Release the ADC test switch.
  (f) Make sure the altitudes on the first officer's altimeter and the ATC test set are less than 100 feet apart.

H. Put the Airplane Back to Its Usual Condition

S 865-073-003

(1) Set the first officer's ADC switch on the INSTR SOURCE SEL panel back to the NORM position.

S 865-076-003

(2) Set the transponder select switch on the ATC control panel to the OFF position.

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S 865-075-003

(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers:

(a) P11 Overhead Circuit Breaker Panel:

1) 11A10, AIR DATA CMPTR LEFT

2) 11F7, ATC LEFT

S 865-089-003

(4) Remove electrical power if it is not necessary (Ref 24-22-00/201).

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AIR TRAFFIC CONTROL SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure contains two tasks. One is an operational test; the other is a system test. The operational test is a fast check of the ATC mode S system. The system test first does the operational test. Then, it uses test equipment to examine ATC code reception and altitude reporting. Steps to measure transponder sensitivity, side lobe suppression, and the transmitter frequency are also given.

TASK 34-53-00-715-163-004

2. Operational Test - ATC System
   A. General
      (1) This test examines the ATC system for proper operation. It uses only the system's BITE function, and no special test or ground equipment is necessary.
   B. Reference
      (1) AMM 24-22-00/201, Electrical Power - Control
   C. Access
      (1) Location Zones
          119/120 Main Equipment Center
          211/212 Flight Compartment

   D. Prepare for the Operational Test

      S 865-432-004
      (1) Supply electrical power (AMM 24-22-00/201).

      S 865-003-004
      (2) Make sure these circuit breakers are closed:
          (a) P11 Overhead Circuit Breaker Panel:
              1) 11A10, AIR DATA CMPTR LEFT
              2) 11A11, AIR DATA AOA SENSOR LEFT
              3) 11A12, AIR DATA BARO CORRECT LEFT
              4) 11E2, ALTM LEFT
              5) 11E23, ALTM RIGHT
              6) 11F7, ATC LEFT
              7) 11F11, ATC ANT SWITCH
              8) 11F28, ATC RIGHT
              9) 11F30, AIR DATA CMPTR RIGHT
              10) 11F31, AIR DATA AOA SENSOR RIGHT
              11) 11F32, AIR DATA BARO CORRECT RIGHT

      S 865-004-004
      (3) On panel P11, make sure the six EICAS circuit breakers are closed.

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S 865-006-004

(4) Set the transponder select switch on the ATC control panel to the L position.

S 865-448-004

(5) Set the mode switch on the ATC control panel to the XPDR position.

E. Procedure

S 755-399-004

(1) Make sure the message, ATC FAULT, does not show on EICAS.

NOTE: If necessary push the CANCEL switch on the EICAS DISPLAY select panel to see more messages.

S 865-410-004

(2) Push and release the TEST switch on the left ATC transponder.

NOTE: For the TPR-900/901, press the TEST switch less than 5 seconds. When the TEST switch is pressed more than 5 seconds, nonvolatile memory from the last four flights is displayed on the fault lights.

(a) Make sure the sequence that follows occurs:
1) All the LEDs come on momentarily.
2) All the red LEDs go off.
3) The green LED stays on.
4) AIRPLANES WITH ACSS XS-950 MODE-S TRANSPONDER;
The green LED stays on for approximately 10 seconds.

(b) Make sure the EICAS message, ATC FAULT, comes on momentarily during the transponder self-test.

S 865-433-004

(3) Release the TEST switch on the ATC transponder.

S 865-028-004

(4) Set the transponder select switch on the ATC control panel to the R position.

S 745-032-004

(5) Do the self-test procedure again for the right ATC transponder.

S 865-449-004

(6) Set the ATC transponder mode switch on the ATC control panel to the STBY position.

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F. Put the Airplane Back to Its Usual Condition

S 865-434-004

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-53-00-735-419-004

3. ATC System - System Test (With the IFR ATC-601)

A. General

(1) This system test is a more complete check of the ATC system. The system test first does the ATC - Operational Test. Then it uses ground test equipment to examine the left and right ATC systems and a transponder check.

(2) The IFR 601 test set is used to test the functionality of the mode S transponder. All 20 tests can be run automatically in the AUTO mode or individually in single test mode. Results from the last test are shown on each test page. The PASSED/FAILED indication is shown on top of the page. To do a single test, use the select keys to get to the desired test and push the RUN/STOP key.

B. Equipment

(1) ATC Transponder Ramp Test Set IFR ATC-601

C. References

(1) AMM 24-22-00/201, Manual Control
(2) AMM 32-09-02/201, Flight Mode Simulation
(3) AMM 34-12-00/501, Air Data Computing (ADC) System

D. Access

(1) Location Zones

119/120	Main Equipment Center
119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment
223/224	Area Above Passenger Cabin Ceiling (Exterior)

E. Prepare for the System Test

S 845-232-004

CAUTION: DO NOT PLACE THE REMOTE TEST SET ANTENNA CLOSER THAN 15 INCHES (.40 METERS) TO THE AIRCRAFT ANTENNA WITH THE TEST SET ON. THIS WILL CAUSE DAMAGE TO THE TEST SET.

(1) Put the test antenna at a convenient distance from the airplane.

NOTE: The test set antenna must be with in the line of sight of the ATC antennas.

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S 845-233-004
(2) Put the test set antenna in position towards the aircraft antenna.

S 845-235-004
(3) Connect the coax cable from the remote test set antenna to the test set.

S 715-355-004
(4) Do the ATC Operational Test.
(a) Make sure the operational test passes.

S 865-237-004
(5) Set the PWR swtich on the test set to the ON position.

NOTE: The test set is a source of interference for radio and L-band radar equipment operating near the test set. To avoid possible interference set the interrogation rate (PFR) to 50 for Mode S interrogation and turn the test set off as soon as the test is completed or when you must perform other radio checks on the airplane.

S 865-238-004
(6) Push the SETUP key to enter the SETUP menu.

NOTE: For information regarding the battery test, timing and recharging, refer to the operation section of the test set operators manual.

S 865-356-004
(7) Push the SELF TEST key on the test set.

S 865-357-004
(8) Push the RUN/STOP key to start the self-test.
(a) Make sure the test set display shows PASSED.

S 865-358-004
(9) Push the SETUP key on the test set.

S 865-239-004
(10) Enter the distrancefrom the test set to the aircraft antenna in the RANGE field for the top and bottom antenna.

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S 865-359-004

(11) Enter 24 feet for the HEIGHT field for the TOP antenna and 6 feet for the BOTTOM antenna.

S 865-361-004

(12) Choose the bottom antenna on the SELECTED field.

S 865-362-004

(13) Enter the gain listed on the test set antenna into the GAIN_1030 and GAIN_1090 field.

S 865-363-004

(14) Enter the cable loss listed on the cable in the LOSS field.
  (a) Use the SLEW keys to change the values.
  (b) Use the SELECT keys to change the items.
  (c) Use the SELECT keys to select the antenna which you must test.

S 865-364-004

WARNING: PERFORM FLIGHT MODE SIMULATION DEACTIVATION PROCEDURE PER AMM 32-09-02/201 PRIOR TO OPENING AIR/GROUND CIRCUIT BREAKERS. OPENING AIR/GROUND CIRCUIT BREAKERS WILL SIMULATE FLIGHT MODE FOR MANY AIRPLANE SYSTEMS AND COULD CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT IF INSTRUCTIONS ARE NOT FOLLOWED.

(15) Perform the flight mode simulation deactivation procedure (AMM 32-09-02/201).

S 865-365-004

(16) Open these circuit breakers and attach DO-NOT-CLOSE tags:
  (a) P11 Overhead Circuit Breaker Panel:
    1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
    2) 11U15, AIR/GND SYS 1
    3) 767-300 AIRPLANES;
       11U23, LDG GR POS AIR/GND SYS 2
    4) 767-200 AIRPLANES;
       11U24, LDG GR POS AIR/GND SYS 2

S 865-366-004

(17) Set the captain's and first officer's altimeter to 29.92 inches of mercury.

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F. ATC System Test

S 865-436-004

(1) Set the code switches on the ATC control panel to a desired ATC ID code.

NOTE: Do not use codes 7500, 7600, and 7700. These are emergency codes.

S 865-368-004

(2) Set the transponder select switch on the ATC control panel to the left or No. 1 system.

S 865-369-004

(3) Set the altitude reporting switch on the ATC control panel to the ON position.

S 865-596-004

(4) AIRPLANES WITH ACSS XS-950 MODE-S TRANSPONDER;
Set the mode switch on the ATC control panel to the XPNDR position.

S 865-211-004

(5) Push the AUTO TEST key on the test set.

S 865-378-004

(6) Use the RUN/STOP key to start or stop individual tests.

S 865-379-004

(7) Use the SELECT key to select each individual test.

S 735-240-004

(8) Do a check of the REPLY DELAY TEST.
   (a) Make sure the reply delay is 128.00 ±0.25us for mode S.
   (b) Make sure the reply delay is 128.00 ±0.50us for ITM.

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(c) Make sure the reply delay is 3.00 ±0.50us for ATC A and C.

S 735-241-004

(9) Do a check of the REPLY JITTER TEST.
   (a) Make sure the reply jitter is ≤ 0.08us for mode S.
   (b) Make sure the reply jitter is ≤ 0.1us for ITM A and C.
   (c) Make sure the reply jitter is ≤ 0.1us for ATC A and C.

S 735-242-004

(10) Do a check of the ATCRBS REPLY TEST.
   (a) Make sure the spacing of the F1 to F2 pulse is 20.3 ±0.10us.
   (b) Make sure the duration of the F1, F2 pulse is 0.45 ±0.10us.

S 735-243-004

(11) Do a check of the SLS LEVEL TEST.
   (a) Make sure the reply is received when the SLS pulse is -9dB and no reply is received when the SLS pulse is 0dB.

   NOTE: Run the SLS level test in less than 95 feet (28.96 meters) of the UUT antenna.

S 735-244-004

(12) Do a check of the ATC ONLY ALL-CALL TEST.
   (a) Make sure the mode S transponder did not reply to the interrogation (PASSED TEST).

S 735-245-004

(13) Do a check of the MODE S ALL CALL TEST.
   (a) Make sure the test set shows PASSED and the airplane mode S address.

S 735-246-004

(14) Do a check of the INVALID MODE S ADDRESS TEST.
   (a) Make sure the mode S transponder did not reply (PASSED TEST).

S 735-247-004

(15) Do a check of the SPR ON/OFF TEST.
   (a) Make sure a reply is receive when SPR is ON and no reply is receive when SPR is OFF.

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S 735-248-004

(16) Do a check of the MODE S UF0 TEST.

(a) Make sure (Down-link format) DF=0, AC=(airplane altitude) and ADDRESS=(airplane mode S address).

NOTE: Make sure the reported altitude is within ± 100 feet of the altitude shown on captain's and first officer's altimeter (applicable for all the altitude reporting checks).

S 735-249-004

(17) Do a check of the MODE S UF4 TEST.

(a) Make sure DF=4, AC=(airplane altitude) and ADDRESS=(airplane mode address).

S 735-250-004

(18) Do a check of the MODE S UF5 TEST.

(a) Make sure DF=5, ID=(selected ATC ID code on the ATC control panel) and ADDRESS=(airplane mode S address).

S 735-251-004

(19) Do a check of the MODE S UF11 TEST.

(a) Make sure DF=11 and AA=(airplane address).

(b) Make sure the CA field is not void.

NOTE: The value of the CA field is determined by the manufacturer.

S 735-252-004

(20) Do a check of the MODE S UF16 TEST.

(a) Make sure DF=16, AC=(airplane altitude) and ADDRESS=(airplane mode S address).

NOTE: No reply to the UF16 test is not a failure of the ATC system.

S 735-253-004

(21) Do a check of the MODE S UF20 TEST.

(a) Make sure DF=20, AC=(airplane altitude) and ADDRESS=(airplane mode S address).

NOTE: No reply to the UF20 test is not a failure of the ATC system.

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S 735-254-004

(22) Do a check of the MODE S UF21 TEST.

(a) Make sure DF=21, ID=(selected ATC ID code on the ATC control panel) and ADDRESS=(airplane mode S address).

NOTE: No reply to the UF21 test is not a failure of the ATC system.

S 735-255-004

(23) Do a check of the SQUITTER TEST.

(a) Make sure the squitter's period is between 0.8 to 1.2 seconds.

NOTE: If the test set antenna is in line of sight with only one of the ATC antennas, the squitter period will be between 1.6 to 2.4 seconds.

S 735-256-004

(24) Do a check of the FREQUENCY TEST.

(a) Make sure the reply frequency of the transponder is 1090 ±3 MHz.

S 865-394-004

(25) Move the test set to less than 50 feet from the top ATC antenna.

NOTE: Make sure the top ATC antenna is not in the line of sight of the test set antenna. Follow the test set operator's quide to reduce multipath errors. Do the test several times with the test set at different locations until you get valid results.

S 865-395-004

(26) Push the SETUP key on the test set and enter the appropriate range for the top and bottom antenna.

S 735-257-004

(27) Do a check of the DIVERSITY TEST.

(a) Make sure the power level difference is ≥ 20dB between "on" antenna squitters and "off" antenna squitters.

NOTE: To make sure the dynamic range is ≥ 20dB, a diversity test must be run at a distance of less than 50 feet (15.2 meters) from the airplane antenna.

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S 735-258-004

(28) Do a check of the MTL DIFFERENCE TEST.

(a) Make sure the Minimum Threshold Level (MTL) difference between mode A and mode C is $\leq$ 1.0dBm.

S 865-380-004

(29) Push the PWR TEST key on the test set.

S 865-381-004

(30) Use the SELECT key on the test set and select the bottom antenna.

NOTE: Make sure the top ATC antenna is not in the line of sight of the test set antenna during the POWER TEST.

S 865-382-004

(31) Push the antenna pushbutton switch.

S 865-383-004

(32) Slowly move the test set antenna 6 feet (1.8 meters) vertically from the ground, at less than 1 FT/SEC (30 CM/SEC).

S 865-384-004

(33) Push the antenna pushbutton switch a second time to stop the test when the test set antenna is approximately 6 feet high.

S 735-259-004

(34) Do a check of the POWER TEST.

(a) Make sure the test set shows PASSED.

S 865-385-004

(35) Insert the antenna shield over the bottom ATC antenna.

S 865-386-004

(36) Move the test set so that it is in the line of sight of the top ATC antenna.

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S 865-387-004
(37) Push the SETUP key on the test set.
(a) Enter the appropriate range for the top antenna.
(b) Choose the top antenna on the SELECTED field.

S 865-388-004
(38) Push the PWR TEST key on the test set.

S 865-389-004
(39) Use the SELECT key on the test set and select the top antenna.

S 735-390-004
(40) Do a check of the POWER TEST.
(a) Make sure the test set shows PASSED.
(b) AIRPLANES WITH ACSS XS-950 MODE-S TRANSPONDER;
1) On Overhead Circuit Breaker Panel open the following circuit breakers:
a) 11F7, ATC LEFT when testing left or No. 1 ATC system
b) 11F28, ATC RIGHT when testing right or No. 2 ATC system
2) Make sure the EICAS message, ATC FAULT, comes on.
3) On Overhead Circuit Breaker Panel close the following circuit breakers:
a) 11F7, ATC LEFT
b) 11F28, ATC RIGHT
4) Make sure the message, ATC FAULT, does not show on EICAS.

S 735-391-004
(41) Do the system test again for the right or No. 2 ATC system.

NOTE: On the test set, select the other ATC antenna.

S 865-597-004
(42) AIRPLANE WITH ACSS XS-950 MODE-S TRANSPONDER;
Set the mode switch on the ATC control panel to the STBY position.

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G. Put the Airplane Back to Its Usual Condition

S 865-397-004

(1) Put the safety-sensitive systems back to their initial conditions (AMM 32-09-02/201).

S 845-260-004

(2) Remove the ATC ramp test set and antenna shield.

S 865-392-004

(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
   (a) P11 Overhead Circuit Breaker Panel:
      1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
      2) 11U15, AIR/GND SYS 1
      3) 767-300 AIRPLANES;
         11U23, LDG GR POS AIR/GND SYS 2
      4) 767-200 AIRPLANES;
         11U24, LDG GR POS AIR/GND SYS 2

S 845-261-004

(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-53-00-735-451-004

4. ATC System - System Test (With the IFR ATC-601-2)

A. General

(1) This system test is a more complete check of the ATC system. The system test first does the ATC - Operational Test. Then it uses ground test equipment to examine the left and right ATC systems and a transponder check.

(2) Requirements for Elementary Surveillance, Enhanced Surveillance and Extended Squitter require transponder testing be done with the IFR-601 (-2) with software version 3.0 or greater.

(3) For this procedure, IFR-601-2 refers to a IFR ATC-601 with software version 3.0 or greater. The only difference is the software version. The hardware is the same.

(4) The IFR-601-2 test set uses thirty-nine (39) different tests to check the functionality of the ATC transponder. All thirty-nine (39) tests can be run automatically in the AUTO mode, or individually in the single test mode.

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(5) Results from the last test are shown on each test page. The PASSED/FAILED indication is shown on top of the page. To do a single test, use the select keys to get to the desired test and push the RUN/STOP key.
(6) The details of individual tests conducted during the AUTO TEST are stored in memory and may be reviewed by using the SELECT keys.
(7) When a individual test is selected, the test may be started by the RUN/STOP key, and will continue to run until the RUN/STOP key is pressed again.

B. Equipment
(1) ATC Transponder Ramp Test Set IFR ATC-601

C. References
(1) AMM 22-10-00/501, Autopilot Flight Director System (AFDS)
(2) AMM 24-22-00/201, Manual Control
(3) AMM 32-09-02/201, Flight Mode Simulation
(4) AMM 34-12-00/501, Air Data Computing (ADC) System
(5) AMM 34-21-00/501, Inertial Reference System (IRS)
(6) AMM 34-58-00/501, Global Positioning System (GPS)
(7) AMM 34-61-00/501, Flight Management Computer System (FMCS)

D. Access
(1) Location Zones

119/120	Main Equipment Center
119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment
223/224	Area Above Passenger Cabin Ceiling (Exterior)

E. Prepare for the System Test

S 845-452-004

CAUTION: DO NOT PLACE THE REMOTE TEST SET ANTENNA CLOSER THAN 15 INCHES (.40 METERS) TO THE AIRCRAFT ANTENNA WITH THE TEST SET ON. THIS WILL CAUSE DAMAGE TO THE TEST SET.

(1) Put the test antenna at a convenient distance from the airplane.

NOTE: The test set antenna must be with in the line of sight of the ATC antennas.

S 845-453-004
(2) Put the test set antenna in position towards the aircraft antenna.

S 845-454-004
(3) Connect the coax cable from the remote test set antenna to the test set.

S 715-455-004
(4) Do the ATC Operational Test.
(a) Make sure the operational test passes.

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S 865-456-004

(5) Set the PWR swtich on the test set to the ON position.

NOTE: The test set is a source of interference for radio and L-band radar equipment operating near the test set. To avoid possible interference set the interrogation rate (PFR) to 50 for Mode S interrogation and turn the test set off as soon as the test is completed or when you must perform other radio checks on the airplane.

(a) The Start-Up screen will display.
    1) The software version is shown on this screen.
(b) Make sure the software version is 3.0 or greater.

S 865-458-004

(6) Push the SELF TEST key on the test set.

S 865-459-004

(7) Push the RUN/STOP key to start the self-test.
    (a) Make sure the test set display shows PASSED.

S 865-460-004

(8) Push the SETUP key on the test set, to enter the setup menu.
    (a) Enter the required data into the Setup Menu.

NOTE: Refer to the IFR ATC-601-2 Operation Manual for detailed information.

S 865-461-004

(9) Enter the distance from the test set to the aircraft antenna in the RANGE field for the top and bottom antenna.

S 865-462-004

(10) Enter 24 feet for the HEIGHT field for the TOP antenna and 6 feet for the BOTTOM antenna.

S 865-463-004

(11) Choose the bottom antenna on the SELECTED field.

S 865-464-004

(12) Enter the gain listed on the test set antenna into the GAIN_1030 and GAIN_1090 field.

S 865-465-004

(13) Enter the cable loss listed on the cable in the LOSS field.
    (a) Use the SLEW keys to change the values.
    (b) Use the SELECT keys to change the items.
    (c) Use the SELECT keys to select the antenna which you must test.

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S 865-466-004

WARNING: PERFORM FLIGHT MODE SIMULATION DEACTIVATION PROCEDURE PER AMM 32-09-02/201 PRIOR TO OPENING AIR/GROUND CIRCUIT BREAKERS. OPENING AIR/GROUND CIRCUIT BREAKERS WILL SIMULATE FLIGHT MODE FOR MANY AIRPLANE SYSTEMS AND COULD CAUSE INJURY TO PERSONNEL OR DAMAGE TO EQUIPMENT IF INSTRUCTIONS ARE NOT FOLLOWED.

(14) Perform the flight mode simulation deactivation procedure (AMM 32-09-02/201).

S 865-467-004

(15) Open these circuit breakers and attach DO-NOT-CLOSE tags:
  (a) P11 Overhead Circuit Breaker Panel:
    1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
    2) 11U15, AIR/GND SYS 1
    3) 767-300 AIRPLANES;
       11U23, LDG GR POS AIR/GND SYS 2
    4) 767-200 AIRPLANES;
       11U24, LDG GR POS AIR/GND SYS 2

S 865-468-004

(16) Set the captain's and first officer's altimeter to 29.92 inches of mercury.

F. ATC System Test

S 865-469-004

(1) Set the code switches on the ATC control panel to a desired ATC ID code.

NOTE: Do not use codes 7500, 7600, and 7700. These are emergency codes.

S 865-470-004

(2) Set the transponder select switch on the ATC control panel to the left or No. 1 system.

S 865-471-004

(3) Set the altitude reporting switch on the ATC control panel to the ON position.

S 865-482-004

(4) Push the AUTO TEST key on the test set.

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S 865-483-004

(5) Use the RUN/STOP key to start or stop testing.
  (a) The AUTO test will run until it is finished. The results are stored in the tester memory for review.

    NOTE: Refer to the IFR ATC-601-2 Operation Manual for detailed information.

S 865-484-004

(6) To run individual tests, use the SELECT key to select each individual test.
  (a) Use the RUN/STOP key to start or stop the individual tests.

S 735-559-004

(7) Review the test results screens.

S 735-485-004

(8) Do a check of the REPLY DELAY TEST.
  (a) Make sure the reply delay is 128.00 ±0.25us for mode S.
  (b) Make sure the reply delay is 128.00 ±0.50us for ITM.
  (c) Make sure the reply delay is 3.00 ±0.50us for ATC A and C.

S 735-486-004

(9) Do a check of the REPLY JITTER TEST.
  (a) Make sure the reply jitter is ≤ 0.08us for mode S.
  (b) Make sure the reply jitter is ≤ 0.1us for ITM A and C.
  (c) Make sure the reply jitter is ≤ 0.1us for ATC A and C.

S 735-487-004

(10) Do a check of the ATCRBS REPLY TEST.
  (a) Make sure the spacing of the F1 to F2 pulse is 20.3 ±0.10us.
  (b) Make sure the duration of the F1, F2 pulse is 0.45 ±0.10us.

S 735-488-004

(11) Do a check of the SLS LEVEL TEST.
  (a) Make sure the reply is received when the SLS pulse is -9dB and no reply is received when the SLS pulse is 0dB.

    NOTE: Run the SLS level test in less than 95 feet (28.96 meters) of the UUT antenna.

S 735-489-004

(12) Do a check of the ATC ONLY ALL-CALL TEST.
  (a) Make sure the mode S transponder did not reply to the interrogation (PASSED TEST).

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S 735-490-004

(13) Do a check of the MODE S ALL CALL TEST.

(a) Make sure the test set shows PASSED and the airplane mode S address.

S 735-491-004

(14) Do a check of the INVALID MODE S ADDRESS TEST.

(a) Make sure the mode S transponder did not reply (PASSED TEST).

S 735-492-004

(15) Do a check of the SPR ON/OFF TEST.

(a) Make sure a reply is receive when SPR is ON and no reply is receive when SPR is OFF.

S 735-493-004

(16) Do a check of the MODE S UFO TEST.

(a) Make sure (Down-link format) DF=0, AC=(airplane altitude) and ADDRESS=(airplane mode S address).

NOTE: Make sure the reported altitude is within ± 100 feet of the altitude shown on captain's and first officer's altimeter (applicable for all the altitude reporting checks).

S 735-494-004

(17) Do a check of the MODE S UF4 TEST.

(a) Make sure DF=4, AC=(airplane altitude) and ADDRESS=(airplane mode address).

S 735-495-004

(18) Do a check of the MODE S UF5 TEST.

(a) Make sure DF=5, ID=(selected ATC ID code on the ATC control panel) and ADDRESS=(airplane mode S address).

S 735-496-004

(19) Do a check of the MODE S UF11 TEST.

(a) Make sure DF=11 and AA=(airplane address).

(b) Make sure the CA field is not void.

NOTE: The value of the CA field is determined by the manufacturer.

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S 735-497-004

(20) Do a check of the MODE S UF16 TEST.

(a) Make sure DF=16, AC=(airplane altitude) and ADDRESS=(airplane mode S address).

NOTE: No reply to the UF16 test is not a failure of the ATC system.

S 735-498-004

(21) Do a check of the MODE S UF20 TEST.

(a) Make sure DF=20, AC=(airplane altitude) and ADDRESS=(airplane mode S address).

NOTE: No reply to the UF20 test is not a failure of the ATC system.

S 735-499-004

(22) Do a check of the MODE S UF21 TEST.

(a) Make sure DF=21, ID=(selected ATC ID code on the ATC control panel) and ADDRESS=(airplane mode S address).

NOTE: No reply to the UF21 test is not a failure of the ATC system.

S 735-500-004

(23) Do a check of the SQUITTER TEST.

(a) Make sure the squitter period is between 0.8 to 1.2 seconds.

NOTE: If the test set antenna is in line of sight with only one of the ATC antennas, the squitter period will be between 1.6 to 2.4 seconds.

S 735-501-004

(24) Do a check of the FREQUENCY TEST.

(a) Make sure the reply frequency of the transponder is 1090 ±3 MHz.

S 735-598-004

(25) Do a check of the FLIGHT ID TEST.

(a) Make sure DF=20, Flight ID=(selected Flight Number on the FMS CDU) and ADDRESS=(airplane mode S address).

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S 735-599-004
(26) Do a check of the SEL VERT INTENT RPT #1.
(a) Make sure that the MCP/FCU SEL ALT correspond with the altitude selected and displayed on the AFCS Mode Control Panel.

S 735-600-004
(27) Do a check of the TRACK & TURN REPORT (Left ATC Transponeder)
(a) Make sure that following values correspond with actual aircraft data:
1) ROLL ANGLE = 0.0 DEG
2) T_TRACK ANGLE = 0.00 DEG (True Track Angle)
3) GND SPEED = 0 KTS (Ground Speed)
4) RATE = 0.0 DEG/S (True Track Angle Rate)
(b) Set the capt's IRS Source Select switch to the NORMAL position.
(c) Do a self-test for the left IRU (AMM 34-21-00/501).
(d) Make sure that following values displayed on the TRACK & TURN REPORT page correspond with the test values provided during the IRS self-test for seconds 10 and on.
1) ROLL ANGLE = 45.0 DEG
2) T_TRACK ANGLE = 0.00 DEG (True Track Angle)
3) GND SPEED = 200 KTS (Ground Speed)
4) RATE = 4.0 DEG/S (True Track Angle Rate)
(e) Set the capt's IRS Source Select switch to the ALTN position.
(f) Do a self-test for the center IRU (AMM 34-21-00/501).
(g) Make sure that the valves displayed on the TRACK & TURN REPORT page correspond with the test values provided during the IRS self-test for seconds 10 and on, see subchapter (d).
(h) Set the capt's IRS Source Select switch to the NORMAL position.

S 735-601-004
(28) Do a check of the TRACK & TURN REPORT (Right ATC Transponder)
(a) Make sure that following values correspond with actual aircraft data:
1) ROLL ANGLE = 0.0 DEG

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2) T_TRACK ANGLE = 0.00 DEG (True Track Angle)
3) GND SPEED = 0 KT (Ground Speed)
4) RATE = 0.0 DEG/S (True Track Angle Rate)

(b) Set the F/O's IRS Source Select switch to the NORMAL position.
(c) Do a self-test for the right IRU (AMM 34-21-00/501).
(d) Make sure that the following values displayed on the TRACK & TURN REPORT page correspond with the test values provided during the IRS self-test for seconds 10 and on.
1) ROLL ANGLE = 45.0 DEG
2) T_TRACK ANGLE = 0.00 DEG (True Track Angle)
3) GND SPEED = 200 KTS (Ground Speed)
4) RATE = 4.0 DEG/S (True Track Angle Rate)

(e) Set the F/O's IRS Source Select switch to the ALTN position.
(f) Do a self-test for the center IRU (AMM 34-21-00/501).
(g) Make sure that the valves displayed on the TRACK & TURN REPORT page correspond with the test values provided during the IRS self-test for seconds 10 and on, see subchapter (d).
(h) Set the F/O's IRS Source Select switch to the NORMAL position.

S 735-602-004

(29) Do a check of the HEADING & SPEED REPORT (Left ATC Transponder)
(a) Make sure that the following values correspond with the actual aircraft data.
1) IND AIRSPEED = 0 ±1 Kt (Indicated Airspeed)
2) MACH = 0.0 ±0.010 (Mach Number)
3) BARO ALT RATE = 0 ±30 ft/min (Barometric Altitude Rate)
4) MAG HDG = XX.X DEG (Magnetic Heading)

(b) Set the capt's IRS Source Select switch to the NORMAL position.
(c) Do a self-test for the left IRU (AMM 34-21-00/501).
(d) Make sure that the following value displayed on the HEADING & SPEED REPORT page corrospond with the test values provided during the IRS self-test for secounds 10 and on.
1) MAG HDG = 15.0 DEG (Magnetic Heading)

(e) Set the capt's IRS Source Select switch to the ALTN position.
(f) Do a self-test for the center IRU (AMM 34-21-00/501).
(g) Make sure that the values displayed on the HEADING & SPEED REPORT page correspond with the test values provided during during the IRS self-test for seconds 10 and on, see subchapter (d).
(h) Set the capt's IRS Source Select switch to the NORMAL position.
(i) Set the capt's AIR DATA Source Select switch to the Normal position.
(j) Perform Left ADC - Functional Test (AMM 34-12-00/501).
(k) Make sure that the following values displayed on the HEADING & SPEED REPORT page correspond with the test values provided during the ADC self-test.
1) IND AIRSPEED = 367 ±1 Kts (Indicated Airspeed)
2) MACH = 0.666 ±0.010 (Mach Number)
3) BARO ALT RATE = 600 ±30 ft/min (Barometric Altitude Rate)

(l) Set the capt's AIR DATA source Select switch to the ALTN position.

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(m) Perform Right ADC - Functional Test (AMM 34-12-00/501).
(n) Make sure that the values displayed on the HEADING & SPEED REPORT page correspond with the test values provided during the ADC Functional Test, see subchapter (k).
(o) Set the capt's AIR DATA Source select switch to the NORMAL position.

S 735-603-004
(30) Do a check of the HEADING & SPEED REPORT (Right ATC Transponder).
(a) Make sure that following values corrospond with the actual aircraft data:
1) IND AIRSPEED = 0 ±1 Kt (Indicated Airspeed)
2) MACH = 0.0 ±0.010 (Mach Number)
3) BARO ALT RATE = 0 ±30 ft/min (Barometeric Altitude Rate)
4) MAG HDG = XX.X DEG (Magnetic Heading)
(b) Set the F/O's IRS Source Select switch to the NORMAL position.
(c) Do a self-test for the RIGHT IRU (AMM 34-21-00/501).
(d) Make sure that the following value displayed on the HEADING & SPEED REPORT page corrospond with the test values provided during the IRS self-test for seconds 10 and on.
1) MAG HDG = 15.0 DEG (Magnetic Heading)
(e) Set the F/O's IRS Source Select switch to the ALTN position.
(f) Do a self-test for the center IRU (AMM 34-21-00/501).
(g) Make sure that the values displayed on the HEADING & SPEED REPORT page correspond with the test values provided during during the IRS self-test for seconds 10 and on, see subchapter (d).
(h) Set the F/O's IRS Source Select switch to the NORMAL position.
(i) Set the F/O's AIR DATA Source Select switch to the Normal position.
(j) Perform RIGHT ADC - Functional Test (AMM 34-12-00/501).
(k) Make sure that the following values displayed on the HEADING & SPEED REPORT page correspond with the test values provided during the ADC self-test.
1) IND AIRSPEED = 367 ±1 Kts (Indicated Airspeed)

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2) MACH = 0.666 ±0.010 (Mach Number)
3) BARO ALT RATE = 600 ±30 ft/min (Barometric Altitude Rate)

(l) Set the F/O's AIR DATA source Select switch to the ALTN position.
(m) Perform Left ADC - Functional Test (AMM 34-12-00/501).
(n) Make sure that the values displayed on the HEADING & SPEED REPORT page correspond with the test values provided during the ADC Functional Test, see subchapter (k).
(o) Set the F/O's AIR DATA Source select switch to the NORMAL position.
(p) Set the capt's IRS Source Select switch to the NORMAL position.

S 865-502-004

(31) Move the test set to less than 50 feet from the top ATC antenna.

NOTE: Make sure the top ATC antenna is not in the line of sight of the test set antenna. Follow the test set operator's quide to reduce multipath errors. Do the test several times with the test set at different locations until you get valid results.

S 865-503-004

(32) Push the SETUP key on the test set and enter the appropriate range for the top and bottom antenna.

S 735-504-004

(33) Do a check of the DIVERSITY TEST.
(a) Make sure the power level difference is ≥ 20dB between "on" antenna squitters and "off" antenna squitters.

NOTE: To make sure the dynamic range is ≥ 20dB, a diversity test must be run at a distance of less than 50 feet (15.2 meters) from the airplane antenna.

S 735-505-004

(34) Do a check of the MTL DIFFERENCE TEST.
(a) Make sure the Minimum Threshold Level (MTL) difference between mode A and mode C is ≤ 1.0dBm.

S 865-506-004

(35) Push the PWR TEST key on the test set.

S 865-507-004

(36) Use the SELECT key on the test set and select the bottom antenna.

NOTE: Make sure the top ATC antenna is not in the line of sight of the test set antenna during the POWER TEST.

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S 865-508-004
(37) Push the antenna pushbutton switch.

S 865-509-004
(38) Slowly move the test set antenna 6 feet (1.8 meters) vertically from the ground, at less than 1 FT/SEC (30 CM/SEC).

S 865-510-004
(39) Push the antenna pushbutton switch a second time to stop the test when the test set antenna is approximately 6 feet high.

S 735-511-004
(40) Do a check of the POWER TEST.
(a) Make sure the test set shows PASSED.

S 865-512-004
(41) Insert the antenna shield over the bottom ATC antenna.

S 865-513-004
(42) Move the test set so that it is in the line of sight of the top ATC antenna.

S 865-514-004
(43) Push the SETUP key on the test set.
(a) Enter the appropriate range for the top antenna.
(b) Choose the top antenna on the SELECTED field.

S 865-515-004
(44) Push the PWR TEST key on the test set.

S 865-516-004
(45) Use the SELECT key on the test set and select the top antenna.

S 735-517-004
(46) Do a check of the POWER TEST.
(a) Make sure the test set shows PASSED.

S 735-560-004
(47) Do a check of the other test results for Elementary Surveillance, Enhanced Surveillance,and Extended Squitter functions.

NOTE: Refer to the IFR-601-2 Operations Manual for details of these tests.

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S 865-561-004
(48) Do the identification test.

NOTE: For the IFR-601-2, use the ATCRBS individual test. Refer to the IFR ATC-601-2 Operation Manual for detailed information.

S 735-518-004
(49) Do the system test again for the right or No. 2 ATC system.

NOTE: On the test set, select the other ATC antenna.

G. Put the Airplane Back to Its Usual Condition

S 865-519-004
(1) Put the safety-sensitive systems back to their initial conditions (AMM 32-09-02/201).

S 845-520-004
(2) Remove the ATC ramp test set and antenna shield.

S 865-521-004
(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
(a) P11 Overhead Circuit Breaker Panel:
1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
2) 11U15, AIR/GND SYS 1
3) 767-300 AIRPLANES;
11U23, LDG GR POS AIR/GND SYS 2
4) 767-200 AIRPLANES;
11U24, LDG GR POS AIR/GND SYS 2

S 845-522-004
(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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TASK 34-53-00-735-294-004

5. System Test - ATC System (With the TIC T-48 or T-49)

A. General

(1) This system test is a more complete check of the ATC system. The system test first does the ATC - Operational Test. Then it uses ground test equipment to examine the left and right ATC systems and a transponder check. The test may be run in either the automatic mode followed by some manual tests or in manual mode for all tests. At the end of this task there is a procedure to return the airplane to its usual condition.

(2) This system test uses the TIC T-48 or T-49 test set to test the functions of the ATC transponder. The test set can do all the tests automatically or each test by itself. Each test shows while it is done. If a test fails, the test sequence stops and a fail message shows. All data will show at the end of the test if the test is satisfactory. You must do the diversity test and either the automatic test or the individual tests to completely test the ATC system.

(3) Operation with the antenna coupler, TAP-115, TAP-118, or TAP 125 used with the applicable test set, is necessary when the test is to do a check of the output power, receiver, sensitivity and radio frequency. For mode S diversity channel isolation check, the TAP 125 is necessary.

B. Equipment

(1) ATC Transponder Ramp Test Set TIC T-48 or T-49

(2) RF through-line wattmeter with type 500J element, Bird Model 43P or Model 4314B, Bird Electronic Corporation, 30303 Aurora Rd., Cleveland, OH 44139

C. References

(1) AMM 24-22-00/201, Manual Control

(2) AMM 32-09-02/201, Flight Mode Simulation

(3) AMM 34-12-00/501, Air Data Computing (ADC) System

D. Access

(1) Location Zones

119/120	Main Equipment Center
119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment
223/224	Area Above Passenger Cabin Ceiling (Exterior)

E. Prepare for the System Test

S 735-437-004

(1) Do the ATC Operational Test.

(a) Make sure the operational test passes.

S 865-438-004

(2) Prepare to tests the ATC System:

(a) Install the Antenna Test Equipmment.

1) Pull the pull-ring to separate the spring-loaded clamp.

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(b) Insert the antenna coupler over the lower ATC antenna.
1) If test set has TAP 125 option and access to top ATC antenna is available, insert TAP125-10 coupler over the bottom antenna.

NOTE: Make sure the orientation of the antenna coupler setup is correct.

2) Center the couplers over the antennas and compress the EMI gasket.
3) Use the coupler with the long lead to test the upper antenna.

(c) Connect the antenna coupler connector to the test set antenna connector.
(d) Supply power to the test set and follow procedures to operate.
(e) Supply electrical power (AMM 24-22-00/201).

WARNING: PREPARE THE SAFETY-SENSITIVE SYSTEMS FOR THE AIR MODE BEFORE YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS. IN THE AIR MODE, MANY OF THE AIRPLANE SYSTEMS CAN OPERATE AND CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(f) Prepare the safety-sensitive systems for air mode simulation (AMM 32-09-02/201).
(g) Open these circuit breakers and attach DO-NOT-CLOSE tags:
1) P11 Overhead Circuit Breaker Panel:
a) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
b) 11U15, AIR/GND SYS 1
c) 767-300 AIRPLANES;
11U23, LDG GR POS AIR/GND SYS 2
d) 767-200 AIRPLANES;
11U24, LDG GR POS AIR/GND SYS 2

(h) Set the captain's and first officer's altimeter to 29.92 inches of mercury.

F. ATC System Test

S 865-439-004

(1) On the ATC control panel, set the code switches to a desired ATC ID code.

NOTE: Do not use codes 7500, 7600, and 7700. These are emergency codes.

S 865-396-004

(2) Put the ATC system on standby.

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S 865-306-004

(3) Push the INTERROGATE switch.

(a) Test set display will initially be as follows:

NOTE: This is a momentary display, to read, hold the switch.

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TEL Instrument
T-4X Rev.XX
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(b) After the tester has determined the type of transponder under test (Mode S, Mode A, Mode C, etc.) the display will change to "no reply from xpdr".

NOTE: The test set will automatically turn itself off after 2 minutes of inactivity.

S 865-307-004

(4) Set the transponder select switch on the ATC control panel to the left or No. 1 system.

S 865-308-004

(5) Set the altitude reporting switch on the ATC control panel to the ON position.

S 865-319-004

(6) Close these circuit breakers.

(a) P11, Overhead Circuit Breaker Panel:

1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
2) 11U15, AIR/GND SYS 1
3) 767-300 AIRPLANES;
11U23, LDG GR POS AIR/GND SYS 2
4) 767-200 AIRPLANES;
11U24, LDG GR POS AIR/GND SYS 2

S 865-320-004

(7) Push the INTERROGATE switch.

(a) Make sure the test set shows "no reply from xpdr".

S 865-321-004

(8) Open these circuit breakers and attach DO-NOT-CLOSE tags:

(a) P11, Overhead Circuit Breaker Panel:

1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
2) 11U15, AIR/GND SYS 1
3) 767-300 AIRPLANES;
11U23, LDG GR POS AIR/GND SYS 2

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4) 767-200 AIRPLANES;
11U24, LDG GR POS AIR/GND SYS 2

S 735-266-004

(9) Push the INTERROGATE switch.

(a) Make sure the test set shows the correct transponder type.

NOTE: If the test set shows "no reply from xpdr", do a check on the test antenna connections. Also, make sure the ATC system is operational.

S 735-440-004

(10) Push the INTERROGATE switch again and the test set will initiate and run a sequence of tests on the transponder.

NOTE: It will stop at any failed test. To continue push the TEST button.

(a) When the tests are completed the test display should be as follows:

CCCC XXXXXX YYYYY'
ZZZ W mmm dbm nnn MHZ

1) CCCC is code selected.
2) XXXXXX is aircraft identifier.
3) YYYYY is aircraft altitude in feet (must be ± 125 feet of Capt's and F/O's altimeter.
4) ZZZ is the transmitter power output (must be > 125 and < 500 W).
5) mmm is the receiver sensitivity (must be between -77 and -71 dbm).
6) nnn is the frequency deviation (± 1 MHz max allowed).

S 735-445-004

(11) Do the steps that follow to do the DIVERSITY CHECK:

(a) For a test set with the TAP 125 option, push the TEST button on the test set until you get to the DIVERSITY CHECK.

1) Make sure to pause between each push of the test button to allow the test set to execute that test step.
2) Make sure the test set shows DIVERSITY and then either PASS or FAIL.

NOTE: The test may initially fail due to strong local radiation. This is usually a temporary situation. Repeat the test. Any PASS indicates a good system.

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(b) For a test set without the TAP 125 option, do the Mode S Diversity Channel Isolation Test as follows:
   1) Disconnect the antenna cable at the antenna switch connector and connect the RF through-line wattmeter in its place.
   2) Make a note of the maximum power output and the minimum power output measured by the RF through-line wattmeter during Mode S squitter transmission period.
      a) Make sure the minimum power output is 100 times or 20 db lower than the maximum power output.
   3) Disconnect the RF through-line wattmeter.
   4) Connect the antenna cable to the antenna switch connector.

S 735-441-004

(12) Do the steps that follow to do the MAX TRUE AIRSPEED TEST:
   (a) Push the TEST button on the test set until you get to the MAX TRUE AIRSPEED TEST.
      1) Be sure to pause between each push of the test button to allow the tester to execute that test step.
   (b) Make sure the Test set shows the max true airspeed that is pin-programmed in each transponder.
      1) The tester display must be:

         MAX TRUE AIRSPEED
         GT300 & LE 600 Kts

S 735-442-004

(13) Do the steps that follow for the IDENT BUTTON CHECK:
   (a) On the ATC control panel:
      1) Set the Code Select switch to a desired ATC ID code.

         NOTE: Do not use codes 7500, 7600, and 7700. These are emergency codes.

      2) Set the transponder select switch to L or No. 1.
      3) Set the transponder switch to XPDR.
   (b) Make sure the test set shows the desired ATC ID code.
   (c) Turn the test set off.
   (d) Wait a moment, then push INTERROGATE.
      1) Allow the tester to acquire and determine the type of transponder under test.
   (e) Simultaneously push the control panel IDENT button and the test set TEST button.
   (f) Make sure that the message IDENT is shown on the tester.

S 735-443-004

(14) Do the test again as necessary for the right system:
   (a) To test the right system put the control panel switch to the R or 2 position.

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S 845-444-004

(15) If all the tests passed, do the "Put the Airplane Back to its Usual Condition" steps at the end of this task.

G. Manual ATC System Test

NOTE: If the automatic system test passed, the manual test is not required.

S 735-446-004

(1) Do the individual tests as follows:
  (a) Change the ATC ID code on the ATC control panel to its compliment.

    NOTE: The compliment of the code is 7777 minus the code.

    EXAMPLE: If the code is 0340, its compliment is:

    7777 - 0340 = 7437 compliment.

  (b) Push the identification switch on the ATC control panel.
  (c) Push the TEST switch on the test set to run ATCRBS/A test.
    1) Make sure the test set shows the IDENT indication, the ATC ID code selected on the ATC control panel, and a %REPLY greater than 90%.
  (d) Push the TEST switch on the test set to run the ATCRBS/C test.
    1) Make sure the test set shows the airplane altitude and %REPLY greater than 90%.
  (e) Set the altitude reporting switch on the ATC control panel to the OFF position.
  (f) Push the STORE switch on the test set to run the ATCRBS/C test again.
    1) Make sure the test set shows no altitude data and %REPLY greater than 90%.
  (g) Set the altitude reporting switch on the ATC control panel to the ON position.
  (h) Push the TEST switch on the test set to run the ATCRBS/A Mode S ALL test.
    1) Make sure the test set shows the airplane mode S address, and %REPLY greater than 90%.
  (i) Push the TEST switch on the test set to run the ATCRBS/C Mode S ALL test.
    1) Make sure the test set shows the airplane mode S address, and %REPLY greater than 90%.
  (j) Push the TEST switch on the test set to run the ATCRBS/A only test.
    1) Make sure the test set shows "no reply from XPDR".
  (k) Push the TEST switch on the test set to run the ATCRBS/C only test.
    1) Make sure the test set shows "no reply from XPDR".

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(l) Push the TEST switch on the test set to run the Mode S Surv (Identity/Altitude/Short) test.
1) Make sure the test set shows the airplane mode S address, the airplane altitude, and %REPLY greater than 90%.

(m) Push the TEST switch on the test set to run the Mode S Comm (Identity/Altitude/Short) test.

NOTE: The test set will not do the Mode S Comm Test (Identity, Altitude, Short) if the transponder does not have Mode S comm C capability.

1) Make sure the test set shows the airplane mode S address, the airplane altitude, and %REPLY greater than 99%.

NOTE: Failure to reply by the transponder is not a failure of the ATC system. Contact the transponder vendor about the capability of the transponder.

(n) Push the TEST switch on the test set to run the Undesired replies test.
1) Make sure the test set shows No Replies.

(o) Push the TEST switch on the test set to run the Squitter test.
1) Make sure the test set shows PASS.

S 865-420-004

(2) For test set with the TAP 125 option, push the TEST switch on the test set to run the Mode S Diversity Channel Isolation Test.

NOTE: The test set should show the Diversity test page.

(a) Make sure the test set shows PASS.

S 865-421-004

(3) For test set without the TAP 125 option, do the Mode S Diversity Channel Isolation Test as follows:
(a) Disconnect the antenna cable at the top antenna switch connector, D2191, and connect the RF through-line wattmeter in its place.
(b) Make a note of the maximum power output and the minimum power output measured by the RF throught-line wattmeter during mode S squitter transmission period.
1) Make sure the minumum power output is 100 times or 20 db lower than the maximum power output.
(c) Disconnect the RF through-line wattmeter.
(d) Connect the antenna cable at the top antenna switch connector, D2191.

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S 865-323-004
(4) Remove the antenna coupler from the lower ATC antenna and insert it to the top ATC antenna.

NOTE: Make sure the orientation of antenna coupler setup is correct.

S 735-288-004
(5) Do the system test again for the right or No. 2 ATC system.

NOTE: Use the other ATC antenna.

H. Put the Airplane Back to its Usual Condition

S 865-398-004
(1) Put the safety-sensitive systems back to their initial conditions (AMM 32-09-02/201).

S 845-263-004
(2) Remove the antenna coupler and the test set.

S 865-393-004
(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
(a) P11 Overhead Circuit Breaker Panel:
1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
2) 11U15, AIR/GND SYS 1
3) 767-300 AIRPLANES;
11U23, LDG GR POS AIR/GND SYS 2
4) 767-200 AIRPLANES;
11U24, LDG GR POS AIR/GND SYS 2

S 845-262-004
(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-53-00-735-523-004
6. System Test - ATC System (With the TIC TR-220)
A. General
(1) This system test is a full check of the ATC system. The system test first does the ATC operational test and then uses the TR-220 test set to examine the left and right ATC systems.
(2) The test set can perform all the tests automatically, or each test individually. Each test is shown as it is being performed. If a test has failed, the test sequence will abort, and a failed message is displayed. All data will be shown at the end of the test, if the test is successful.

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(3) When conducting tests in the MANUAL sequence, you initialize the sequence by toggling the AUTO/TEST/MANUAL switch to the MANUAL position. The Test Set runs a series of tests, and displays the individual results of each test, ending in the POWER, RECEIVER EFFICIENCY and FREQUENCY page.
(4) After each test is completed, you must toggle the MANUAL switch to advance to the next test in the series.
(5) Operation with the antenna coupler TAP-135 used with the test set, reduces Radio Frequency emissions from the transponder being tested. It is not necessary to use the coupler to perform these tests.
(6) If it is necessary to simulate the aircraft being tested as being at altitude, notify the local ATC that the transponder testing is in progress.

B. Equipment
(1) ATC Transponder Ramp Test Set TIC TR-220

C. References
(1) AMM 22-10-00/501, Autopilot Flight Director System (AFDS)
(2) AMM 24-22-00/201, Manual Control
(3) AMM 31-41-00/501, Engine Indication And Crew Alerting System (EICAS)
(4) AMM 32-09-02/201, Flight Mode Simulation
(5) AMM 34-12-00/501, Air Data Computing (ADC) System

D. Access
(1) Location Zones

119/120	Main Equipment Center
119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment
223/224	Area Above Passenger Cabin Ceiling (Exterior)

E. Prepare for the System Test

S 735-524-004
(1) Do the ATC Operational Test.
(a) Make sure the operational test passes.

S 865-525-004
(2) Prepare to test the ATC System:
(a) Supply electrical power (AMM 24-22-00/201).

WARNING: PREPARE THE SAFETY-SENSITIVE SYSTEMS FOR THE AIR MODE BEFORE YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS. IN THE AIR MODE, MANY OF THE AIRPLANE SYSTEMS CAN OPERATE AND CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(b) Prepare the safety-sensitive systems for air mode simulation (AMM 32-09-02/201).
(c) Open these circuit breakers and attach DO-NOT-CLOSE tags:
1) P11 Overhead Circuit Breaker Panel:
a) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
b) 11U15, AIR/GND SYS 1

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c) 767-300 AIRPLANES;
11U23, LDG GR POS AIR/GND SYS 2
d) 767-200 AIRPLANES;
11U24, LDG GR POS AIR/GND SYS 2

(d) Set the captain's and first officer's altimeter to 29.92 inches of mercury.

F. ATC System Test

S 865-526-004
(1) On the ATC control panel, set the code switches to a desired ATC ID code.

NOTE: Do not use codes 7500, 7600, and 7700. These are emergency codes.

S 865-527-004
(2) Put the ATC system on standby.

S 865-528-004
(3) Put the TEST SET switch in the ON position.
(a) The test set will display a start-up screen, then do a self-test.
(b) If the self-test passes, the display will indicate SELF TEST PASS.

S 865-529-004
(4) Set the transponder select switch on the ATC control panel to the left or No. 1 system.

S 865-530-004
(5) Set the altitude reporting switch on the ATC control panel to the ON position.

S 865-541-004
(6) Turn the UUT FUNCTION switch on the test set to the XPDR position.
(a) The test set will determine the transponder type and display the correct Start Page.
(b) Make sure the test set shows the correct transponder type.

NOTE: If the test set shows "no reply from xpdr", do a check on the test antenna connections. Also, make sure the ATC system is operational.

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S 735-544-004

(7) Press the AUTO/TEST/MANUAL switch to the AUTO position and the test set will start and run a sequence of tests on the transponder.

NOTE: It will stop at any failed test. To continue push the AUTO/TEST/MALUAL switch to the AUTO position.

(a) To repeat a failed test, push the AUTO/TEST/MANUAL switch to the MANUAL position.

(b) When the tests are completed, the test set display will alternate between two screens. The screens displayed depend on which type of transponder was found and tested by the test set.

NOTE: Refer to the TR-220 Operating Manual for detailed information.

S 735-547-004

(8) Do the steps that follow for the IDENT BUTTON CHECK:

NOTE: The IDENT test must be run in the Manual Mode on the test set.

(a) Select either the MODE A, or the MC Test on the test set.
(b) Allow the test set to complete the test.
(c) Press the IDENT switch on the transponder control panel.
(d) Make sure that the message IDENT is displayed on the tester.

S 735-548-004

(9) Do the test again as necessary for the right system:
(a) To test the right system put the control panel switch to the R or 2 position.

S 845-549-004

(10) If all the tests passed, do the "Put the Airplane Back to its Usual Condition" steps at the end of this task.

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G. Put the Airplane Back to its Usual Condition

S 865-555-004

(1) Put the safety-sensitive systems back to their initial conditions (AMM 32-09-02/201).

S 865-557-004

(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
    (a) P11 Overhead Circuit Breaker Panel:
        1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
        2) 11U15, AIR/GND SYS 1
        3) 767-300 AIRPLANES;
           11U23, LDG GR POS AIR/GND SYS 2
        4) 767-200 AIRPLANES;
           11U24, LDG GR POS AIR/GND SYS 2

S 845-558-004

(3) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-53-00-735-617-004

7. System Test - ATC System (With the IFR-6000)

A. General

(1) This system test is a full check of the ATC system. The system test first does the ATC - Operational Test and then uses the IFR-6000 ramp test set to examine the left and right ATC systems.

(2) The XPDR Mode of the IFR-6000 ramp test set, provides flight line test capability for ATCRBS and Mode S transponders using an Auto Test. The XPDR Auto Test contains one main screen (the Auto Test Screen) and up to 17 additional test screens. The Auto Test can complete a full FAR Part 43, Appendix F Test, providing decode and display of Elementary and Enhanced surveillance GICB extracted DAPs (Downlinked Aircraft Parameters).

(3) All data normally required to verify transponder operation in accordance with FAR 91.413, Part 43, Appendix F, is shown on the Auto Test Screen. Details of individual tests conducted during the AUTO TEST are stored in memory in the Test Sets TEST LIST. Tests in the TEST LIST can be reviewed or run individually by use of DATA keys and SELECT soft keys.

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(4) Different classes of transponders are tested to built-in test limits by selection of configuration files. If the class of transponder is unknown, generic configuration files are provided for ATCRBS and Mode S transponders that apply the widest system limits.
(5) Mode S transponder level is automatically determined when running a test.
(6) The IFR-6000 is also capable of testing ADS-B functions. The ADS-B tests are not included with the AUTO TEST and have separate setup and test screens.
(7) The test is applicable to the left and the right ATC system. Set the transponder select switch on the ATC control panel to the applicable position to do a test of that system.

B. Equipment
(1) ATC Transponder Ramp Test Set IFR-6000

C. References
(1) AMM 22-10-00/501, Autopilot Flight Director System (AFDS)
(2) AMM 24-22-00/201, Manual Control
(3) AMM 31-41-00/501, Engine Indication And Crew Alerting System (EICAS)
(4) AMM 32-09-02/201, Flight Mode Simulation
(5) AMM 34-12-00/501, Air Data Computing (ADC) System
(6) AMM 34-21-00/501, Inertial Reference System (IRS)
(7) AMM 34-58-00/501, Global Positioning System (GPS)
(8) AMM 34-61-00/501, Flight Management Computer System (FMCS)

D. Access
(1) Location Zones

119/120	Main Equipment Center
119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment
223/224	Area Above Passenger Cabin Ceiling (Exterior)

E. Prepare for the System Test

S 865-665-004
(1) Supply electrical power (AMM 24-22-00/201).

S 735-644-004
(2) Do the ATC Operational Test.
(a) Make sure the operational test passes.

S 865-645-004
(3) Prepare to test the ATC System:
(a) On the ATC control panel, set the code switches to a desired ATC ID code.

NOTE: Do not use codes 7500, 7600, and 7700. These are emergency codes.

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(b) Put the ATC system on standby.
(c) Set the transponder select switch on the ATC control panel to the left or No. 1 system.
(d) Set the altitude reporting switch on the ATC control panel to the ON position.
(e) AIRPLANES WITH ELEMENTARY AND ENHANCED SURVEILLANCE;
Do the following steps:
  1) Enter a flight ID number at the FMC CDU.
    a) Select the RTE function key on the FMC CDU.
    b) Make sure that page 1 is shown.

      NOTE: If needed, push the next page function key on the FMC CDU until page 1 is shown.

    c) Enter BOE123 in the FMC CDU scratchpad.
    d) Select line select key 2R on the FMC CDU.
  2) Set a Selected Altitude.
    a) Set a desired altitude in the AFDS MCP ALT window.
  3) Make sure that the Inertial Reference System is aligned in the NAV MODE (AMM 34-21-00/201 or AMM 34-26-00/201).

WARNING: PREPARE THE SAFETY-SENSITIVE SYSTEMS FOR THE AIR MODE BEFORE YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS. IN THE AIR MODE, MANY OF THE AIRPLANE SYSTEMS CAN OPERATE AND CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.

(f) Prepare the safety-sensitive systems for air mode simulation (AMM 32-09-02/201).
(g) Open these circuit breakers and attach DO-NOT-CLOSE tags:
  1) P11 Overhead Circuit Breaker Panel:
    a) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT
    b) 11U15, AIR/GND SYS 1
    c) 767-300 AIRPLANES;
       11U23, LDG GR POS AIR/GND SYS 2
    d) 767-200 AIRPLANES;
       11U24, LDG GR POS AIR/GND SYS 2

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S 865-657-004

(4) Prepare the IFR-6000 ramp test set for the ATC system test.

NOTE: There are several manufacturers of transponder ramp test sets. The operating instructions for those ramp test sets can vary by the manufacturer model and date, level of hardware/software installed, internal ramp test set modifications and custom programming/sequence of ramp test set "soft" keys. Most ramp test sets have an "auto test" function which checks more parameters of the transponder under test, than are required by FAR 43, Appendix F. Ramp test set operating instructions may provide charts, distance limitations or required airplane antenna configurations for acceptable ramp test set results. It is recommended that the ramp test set operator have the most current operating instructions for the ramp test set that is being used and be familiar with the operation when determining the acceptability of transponder results and compliance with FAR 43, Appendix F.

(a) Mount the Directional Antenna on the Test Sets friction hinge and connect the Directional Antenna ANT Connector to the Test Set ANT Connector via the 12-inch coaxial cable.

NOTE: You can use the direct cable connection procedure to perform this test. If you do the direct cable connection, follow the instructions in the ramp test set operations manual.

(b) Push the POWER key to energize the Test Set On.

NOTE: The IFR-6000 is equipped with a Self Test for quick performance evaluation. An abbreviated Self Test is run at Power-Up. The full Self Test is initiated manually. Refer to the IFR-6000 Operations Manual for the full Self Test procedure.

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(c) Push the SETUP control key to show the setup screens. Continue pushing the SETUP control key to cycle to the SETUP-GENERAL screen. Use the NEXT PARAM and PREV PARAM soft keys to set each parameter.

NOTE: Refer the IFR-6000 Operting Manual for detailed information on setup.

(d) Push the SETUP control key to show the setup screens. Continue pushing the SETUP control key to cycle to the SETUP-XPDR screen. Use the NEXT PARAM and PREV PARAM soft keys to set each parameter.

NOTE: Setup XPDR screen contains parameters which determine operational characteristics of the XPDR functional mode. Unless otherwise stated, last used values are retained on power-up.

1) Select ANTENNA. Set to TOP or BOTTOM depending on which aircraft antenna is under test.
2) Select RF PORT. Set to ANTENNA.
3) Select ANT RANGE. Set to setup range from IFR-6000 antenna to the Unit Under Test (UUT) antenna.
4) Select ANT HEIGHT. Set to setup height from IFR-6000 antenna to the UUT antenna.
5) Select ANT CABLE LOSS. Set to cable loss found on cable.
6) Select ANT GAIN (dBi). Set 1.03 and 1.09 GHz antenna gain to figures marked on supplied directional antenna.
7) Select UUT ADDRESS. Set to AUTO (defaults to AUTO on power-up). AUTO selection Mode S address is obtained via ATCRBS/Mode S All Call (FAR Part 43, appendix F approved method).

NOTE: Refer to the IFR-6000 Operations Manual for more detailed information on UUT address selection.

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8) Select DIVERSITY. Set to ON.

NOTE: If Diversity Isolation Test is enabled, make sure the antenna shield is installed to the top or bottom UUT antenna prior to running the test. Refer to IFR-6000 Operations Manual for the Antenna Shield mounting procedure.

NOTE: For the DIVERSITY test, the test set must be at a distance of less than 50 feet (15.2 meters) from the airplane antenna.

9) Select CHECK CAP. Set to YES.
10) Select PWR LIM. Set to FAR 43

CAUTION: DO NOT OPERATE THE TEST SET WHEN ITS ANTENNA IS LESS THAN 15 INCHES (381 MM) FROM THE AIRPLANE ANTENNA. DAMAGE TO THE TEST SET CAN OCCUR.

(e) Position the Test Set ≤ 50 feet from and in line of sight with the UUT antenna.
(f) Insert the antenna shield over the ATC antenna not under test.

NOTE: Refer to the IFR-6000 ramp test set Operations Manual for the antenna shield mounting procedure.

NOTE: When testing the bottom antenna and shielding the top antenna is not possible or practical, move the test set so that it is not in the line of sight of the top ATC antenna.

F. ATC System Test

S 735-658-004
(1) Do the ATC System Test:

NOTE: When first powered up, the test set displays blank data fields. The last test results are displayed while test set remains powered on.

(a) Push the XPDR mode key on the IFR-6000 ramp test set to return to XPDR auto test screen.

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(b) Push the CONFIG soft key to show the XPDR CONFIG screen. Use the data keys to select the desired configuration file. Push the RETURN soft key to confirm the selection.

NOTE: Eight predefined configurations are provided to determine the PASS/FAIL limits applied to ERP, Frequency and MTL measurements. Configurations are named by class and option. Refer to the IFR-6000 ramp test set for predefined configuration details.

If the transponder class is not known, select the GNERIC ATCRBS or GENERIC MODE S configuration file.

(c) To do the Auto Test, push the RUN TEST soft key. When the Auto Test completes, a PASS or FAIL indication is shown at the top of the Auto Test screen.

NOTE: The Auto Test screen is the primary test screen and displays most UUT parameters requiring user verification.

NOTE: Refer to the IFR-6000 ramp test set for detailed information on test screens and interpreting results of the tests.

(d) Push the TEST LIST soft key to show the complete Auto Test List. Tests may be reviewed or run individually by use of the DATA and SELECT keys.

NOTE: When a Mode S configuration is selected, the test list is displayed over two screens. When an ATCRBS configuration is selected, the test list is displayed on one screen.

(e) To do the tests individually in the Test List, do these steps:
1) Use the DATA keys to select desired test. Push the SELECT TEST soft key to show the selected test.
2) Push the RUN TEST soft key to the start test.

NOTE: The test runs until stopped. Each pass through the test sequence updates the PASS/FAIL indication.

3) Push the STOP TEST soft key to the stop test.
4) Push the NEXT TEST soft key to show the next test.
5) Push the PREV TEST soft key to show the previous test.
6) Push the RETURN soft key to show the test list and select desired test.

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7) Push the RETURN soft key to return to the XPDR auto test screen.

S 735-659-004

(2) AIRPLANES WITH ADS-B;
To do the tests for ADS-B, do the following:

(a) Do the ADS-B test setup.

NOTE: Refer to the IFR-6000 Operating Manual for detailed information on ADS-B test setup.

1) Push the SETUP key until the SETUP-XPDR screen is shown.
2) Push the ADS-B SETUP soft key.
3) Set the parameters by pushing the NEXT PARAM soft key. Push the PREV PARAM to select the field. Use DATA keys to slew the data.
   a) Select POS DECODE: Set to LOCAL.
   b) Select LAT: Set the local latitude position.

      NOTE: Position data is on the FMC CDU POS REF page. Use GPS position if GPS antennas have a clear view of the GPS satellites, if not, use the IRS position.

   c) Select LONG: Set the local longitude position.

      NOTE: Position data is on the FMC CDU POS REF page. Use GPS position if GPS antennas have a clear view of the GPS satellites, if not, use the IRS position.

   d) Select ADS-B MON: Set to DF17.
   e) Select GICB: Set to DF20.

(b) Do the ADS-B tests.

NOTE: Refer to the IFR-6000 Operating Manual for detailed information on test screens and interpreting results of the tests.

1) Push the XPDR mode key twice to show the ADS-B/GICB main menu.
2) Push the ADS-B MON soft key to show the ADS-B MON list screen.
   a) The ADS-B MON list screen will show the following extended squitter BDSs:
      1. 0.5 AIRBORNE POS
      2. 0.6 SURFACE POS
      3. 0.8 IDENT & CAT
      4. 0.9 AIRBORNE VEL
      5. 6.1 A/C STATUS
      6. 6.2 TARG STATE

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7. 6.3 A/C OP STATUS

3) Push the RUN TEST soft key to start the test. When a specific extended squitter BDS is captured, AVAIL will be shown to the right of the BDS name.

NOTE: The test will continue to run until the STOP TEST soft key is pushed.

NOTE: Airplane must be in the Ground Mode to capture the 0.6 SURFACE POS BDS. Only the top ATC antenna will transmit the 0.6 SURFACE POS BDS.

4) You can use the data keys to select a specific BDS and push the BDS DATA soft key to show the selected BDS screen.

NOTE: To show the next or previous BDS screen, push the NEXT TEST or PREV TEST soft keys.

5) Push the RETURN soft key to return to the ADS-B MON list screen.

(c) Do a check of the ADS-B test results.

NOTE: The test results that follow satisfy the EASA AMC 20-24 requirements for ADS-B.

1) Do a check of the Airborne Position.
   a) Select the 0,5 BDS with the BDS Data soft key.
   b) Make sure that the LAT and LONG fields show the position data entered in the ADS-B setup screen.
2) Do a check of the Pressure Altitude.
   a) Select the 0,5 BDS with the BDS Data soft key.
   b) Make sure that the BARO PRESS ALT field shows the airplane Barometric Pressure Altitude +/- 125 ft.
3) Do a check of the Aircraft Identity.
   a) Select the 0,8 BDS with the BDS Data soft key.
   b) Make sure that the correct data is shown in the following fields:
      1. The AA (aircraft address) field shows the Mode S Address (WDM 34-53-13 and WDM 34-53-23).
      2. The FLIGHT ID field shows the same Flight ID entered into the FMC.
4) Do a check of the Emergency Status.
   a) Notify local ATC facilities that transponder testing of the Emergency Status will be performed.
   b) Select the 6,2 BDS with the BDS Data sofy key.
   c) Set the code switches on the ATC control panel to 7600.
   d) Make sure that the EMERG/PRIOR CODE field shows NO COMM.
   e) Set the code switches on the ATC control panel back to original code.

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5) Do a check of the Quality Indicator.
   a) Select the 6,3 BDS with the BDS Data soft key.
   b) Make sure that the TYPE field does not show 0.
6) Do a check of the Special Position Indicator (SPI).
   a) Select the 6,3 BDS with the BDS Data soft key.
   b) Push the IDENT switch on the ATC control panel.
   c) Make sure that the IDENT field shows YES.
7) Do a check of the version number (VER NBR).
   a) Select the 6,3 BDS with the BDS Data soft key.
   b) Make sure that the VER NBR field shows DO-260/DO-242 or DO-260A/DO-242A.

G. Repeat ATC System Tests

S 735-661-004

(1) Repeat the Sysem Test for the other antenna.

S 735-662-004

(2) Do the system test again for the right or No. 2 ATC system on the upper and lower antennas.

<u>NOTE</u>: To meet FAR requirements, both the left and right systems must be tested on both upper and lower antennas.

H. Put the Airplane Back to Its Usual Condition

S 865-666-004

(1) Set the mode switch on the ATC control panel to the STBY position.

S 845-663-004

(2) Remove the IFR-6000 test set.

S 865-664-004

(3) Put the safety-sensitive systems back to their initial conditions (AMM 32-09-02/201).

S 865-618-004

(4) Remove the DO-NOT-CLOSE tags and close these circuit breakers:
   (a) P11 Overhead Circuit Breaker Panel:
      1) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALT

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2) 11U15, AIR/GND SYS 1
3) 767-300 AIRPLANES;
   11U23, LDG GR POS AIR/GND SYS 2
4) 767-200 AIRPLANES;
   11U24, LDG GR POS AIR/GND SYS 2

S 845-619-004

(5) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AIR TRAFFIC CONTROL (ATC) TRANSPONDER - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is for the ATC transponder removal, the other is for the ATC transponder installation.
   B. The left M112, and right, M113, ATC transponders are found on the E2 rack in the main equipment center.

TASK 34-53-01-004-080

2. Remove the ATC Transponder
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center

      (2) Access Panel
          119AL Main Equipment Center

   C. Prepare for Removal

      S 864-002

      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11F7, ATC LEFT
          (b) ON SAS 150-154 WITH SB 34-82 AND ALL MTH AIRPLANES AND SAS 050-149, 155-999;
              11F11, ATC ANT SWITCH
          (c) 11F28, ATC RIGHT
   D. Procedure

      S 024-082

      CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTORS ON THE ATC TRANSPONDER. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE ATC TRANSPONDER.

      (1) Remove the ATC transponder (AMM 20-10-01/401).

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S 034-083
(2) Install dust caps on the electrical connectors.

TASK 34-53-01-404-004
3. Install the ATC Transponder
A. References
(1) AMM 20-10-01/401, E/E Rack Mounted Components
(2) AMM 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
119/120 Main Equipment Center

(2) Access Panel
119AL Main Equipment Center

C. Prepare for Installation

S 754-005
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11F7, ATC LEFT
(b) ON SAS 150-154 WITH SB 34-82 AND ALL MTH AIRPLANES AND SAS 050-149, 155-999;
11F11, ATC ANT SWITCH
(c) 11F28, ATC RIGHT
D. Procedure

S 434-084

CAUTION: DO NOT TOUCH THE CONNECTOR PINS OR OTHER CONDUCTOR ON THE ATC TRANSPONDER. IF YOU TOUCH THESE CONDUCTORS, ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE ATC TRANSPONDER.

(1) Remove the dust caps from the electrical connectors.

S 424-006
(2) Install the ATC transponder (AMM 20-10-01/401).

S 864-007
(3) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11F7, ATC LEFT
(b) ON SAS 150-154 WITH SB 34-82 AND ALL MTH AIRPLANES AND SAS 050-149, 155-999
11F11, ATC ANT SWITCH
(c) 11F28, ATC RIGHT
E. ATC Transponder Test

S 864-085
(1) Supply electrical power (AMM 24-22-00/201).

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S 864-094
(2) Set the transponder select switch on the ATC control panel to the applicable transponder.

S 864-100
(3) Set the mode select switch on the ATC control panel to ALT ON position.

S 744-086
(4) Push and hold the TEST switch on the applicable ATC transponder.
- (a) Make sure this sequence occurs:
  - 1) All the LEDs come on
  - 2) All the red LEDs go off.
  - 3) The green LED stays on.

S 744-089
(5) Release the TEST switch on the ATC transponder.

<u>NOTE</u>: The green LED will stay on for a while and then will go off.

S 864-035
(6) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AIR TRAFFIC CONTROL (ATC) CONTROL PANEL - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is for the ATC control panel removal. The other is for the ATC control panel installation.
   B. The ATC control panel, M81, is installed on the aisle control stand, P8. Electrical connections are found at the rear of the control panel.

TASK 34-53-02-004-001

2. Remove the ATC Control Panel
   A. Access
      (1) Location Zones
          211/212   Flight Compartment

   B. Prepare for Removal

      S 864-010
      (1) Open these circuit breakers and attach DO-NOT-CLOSE tags:
          (a) On the overhead circuit breaker panel, P11:
              1) SAS 150-154 POST-SB 34-82;
                 ALL MTH AIRPLANES;
                 SAS 050-149, 155-999;
                 11F11, ATC ANT SWITCH
              2) 11F7, ATC LEFT
              3) 11F28, ATC RIGHT

   C. Procedure

      S 034-003
      (1) Loosen the screws on the control panel.

      S 014-004
      (2) Move the panel out to get to the electrical cable.

      S 034-005
      (3) Disconnect the electrical cable.

      S 024-006
      (4) Remove the ATC control panel.

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TASK 34-53-02-404-007

3. <u>Install the ATC Control Panel</u>

A. References

(1) AMM 24-22-00/201, Electrical Power - Control

B. Access

(1) Location Zones

211/212 Flight Compartment

C. Prepare for Installation

S 864-008

(1) Make sure these circuit breakers are open:

(a) On the P11 panel:

1) SAS 150-154 POST-SB 34-82;
ALL MTH AIRPLANES;
SAS 050-149, 155-999;
11F11, ATC ANT SWITCH

2) 11F7, ATC LEFT

3) 11F28, ATC RIGHT

D. Procedure

S 434-009

(1) Connect the electrical cable to the control panel.

S 424-010

(2) Install the control panel.

S 434-011

(3) Tighten the screws on the control panel.

S 864-012

(4) Remove the DO-NOT-CLOSE tags and close these circuit breakers:

(a) On the P11 panel:

1) SAS 150-154 POST-SB 34-82;
ALL MTH AIRPLANES;
SAS 050-149, 155-999;
11F11, ATC ANT SWITCH

2) 11F7, ATC LEFT

3) 11F28, ATC RIGHT

E. ATC Control Panel Test

S 864-013

(1) Supply electrical power (AMM 24-22-00/201).

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S 864-014
(2) Set the transponder select switch on the ATC control panel to the L position.

S 864-230
(3) Set the mode select switch on the ATC/TCAS control panel to ALT ON position.

S 864-018
(4) Push and hold the TEST switch on the front panel of the left ATC transponder.

S 214-019
(5) Make sure the sequence that follows occurs:
(a) All the LEDs come on
(b) All the red LEDs go off
(c) The green LED stays on.

S 744-115
(6) Release the TEST switch on the ATC transponder.

NOTE: The green LED will stay on for a while and then will go off.

S 864-024
(7) Set the transponder select switch on the ATC control panel to the R position.

S 864-028
(8) Push and hold the TEST switch on the front panel of the right ATC transponder.

S 214-029
(9) Make sure the LED test sequence occurs on the right ATC transponder.

S 864-030
(10) Release the TEST switch on the ATC transponder.

F. Put the Airplane Back to Its Usual Condition.

S 864-035
(1) SAS 150-154 PRE-SB 34-82;
Set the transponder select switch on the ATC control panel to the OFF position.

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S 864-040
(2) SAS 150-154 POST-SB 34-82;
SAS 050-149, 155-999;
ALL MTH AIRPLANES;
Set the transponder select switch on the ATC control panel to the STBY position.

S 864-027
(3) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AIR TRAFFIC CONTROL (ATC) ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is for the ATC antenna removal; the other is for the ATC antenna installation.

   TASK 34-53-03-004-001

2. Remove the ATC Antenna (Fig. 401)

   A. Consumable Materials
      (1) B00184 Solvent - BMS 11-7
   B. References
      (1) AMM 20-10-22/701, Metal Surfaces
      (2) AMM 51-31-01/201, Seals and Sealing
   C. Access
      (1) Location Zones
          119/120 Main Equipment Center (Exterior)
          223/224 Area Above Ceiling (Section 41 - Exterior)

   D. Prepare for Removal

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11F7, ATC LEFT
          (b) AIRPLANES WITH MODE S TRANSPONDER;
              11F11, ATC ANT SWITCH
          (c) 11F28, ATC RIGHT

   E. Procedure

      S 034-003
      (1) Remove the screws from the antenna base.

      S 034-004

      CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

      (2) Remove the sealant around the antenna until the seal is fully broken (AMM 51-31-01/201).

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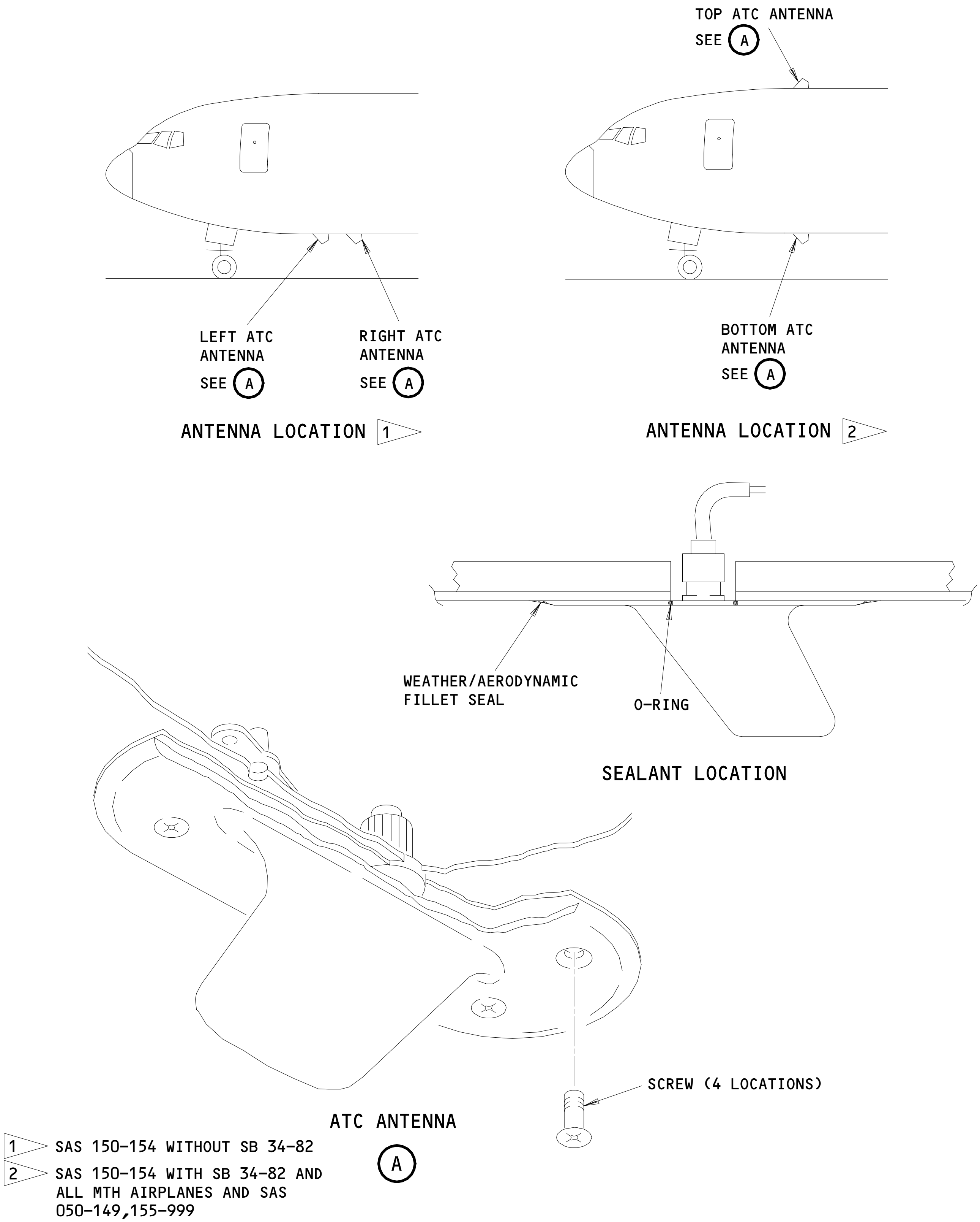

ATC Antenna Installation
Figure 401

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S 014-005

CAUTION: MOVE THE ANTENNA ONLY AS FAR AS NECESSARY TO DISCONNECT THE CABLE. DAMAGE TO THE ANTENNA CABLE CAN OCCUR IF YOU PULL THE CABLE.

(3) Move the antenna until you can get access to the antenna cable connector.

S 034-006

(4) Disconnect the antenna cable.

NOTE: Do not let the antenna cable fall into the fuselage.

S 024-007

(5) Remove the ATC antenna.

S 024-206

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(6) Remove the sealant from the airplane skin in the antenna area (AMM 51-31-01/201).

S 114-010

(7) Clean the airplane surface in the antenna area with the solvent (BMS 11-7) and a clean rag (AMM 20-10-22/701).

TASK 34-53-03-404-008

3. Install the ATC Antenna (Fig. 401)

A. Equipment
   (1) Resistance measuring bridge or ohmmeter that can measure .025 ohm.

B. Consumable Materials
   (1) B00148 Solvent - Methyl Ethyl Ketone (MEK)
   (2) A00145 Sealant - BMS 5-95 Class B-2

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(3) C00175 Primer - BMS 10-79 type III
(4) C00855 Alodine
(5) D00633 Grease - BMS3-33 (Preferred)
(6) D00015 Grease - BMS 3-24 (Alternate)
(7) G01395 Corrosion Inhibiting Compound - BMS 3-27 (Preferred)
(8) C50056 Compound - Non-drying Corrosion Inhibiting Resin Mix , BMS 3-38 (Alternate)
(9) G50136 Paste - Corrosion Inhibiting Non-drying, BMS 3-38 (Alternate)
(10) G50237 Compound - Corrosion Inhibiting, Non-drying Cor-Ban 27L , BMS 3-38 (Alternate)

C. References
(1) AMM 20-10-22/701, Metal Surfaces
(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 51-24-03/701, Corrosion Inhibiting Coating
(4) AMM 51-31-01/201, Seals and Sealing

D. Access
(1) Location Zones
119/120 Main Equipment Center
119/120 Main Equipment Center (Exterior)
211/212 Flight Compartment
223/224 Area Above Ceiling (Section 41 - Exterior)

E. Prepare for Installation

S 754-011
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11F7, ATC LEFT
(b) AIRPLANES WITH MODE S TRANSPONDER;
11F11, ATC ANT SWITCH
(c) 11F28, ATC RIGHT

F. Procedure

S 114-155

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(1) Clean the mating surface and the antenna with solvent, Series 88 (AMM 20-30-88/201) and a clean rag (AMM 20-10-22/701).

S 394-097
(2) SAS 050, 051, 150-157, 162-167, 275-280 WITHOUT SL 51-23;
If the airplane corrosion preventative surface is damaged, do these steps to prepare the airplane skin surface:
(a) Apply a layer of alodine on the airplane skin as far as 0.25 inch beyond the edge of the antenna base (AMM 51-24-03/701 and AMM 51-31-01/201).

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(b) On top of the alodine, apply two layers of primer, BMS 10-79 type III.
1) Let each layer dry for the correct cure time.

S 394-139

(3) SAS 050, 051, 150-157, 162-167, 275-280 WITH SL 51-23, AND SAS 052-149, 158-161, 168-274, 281-999;
If the airplane corrosion preventative surface is damaged, do these steps to prepare the airplane skin surface:
(a) Apply a layer of alodine on the airplane skin as far as 0.25 inch beyond the edge of the antenna base (AMM 51-24-03/701 and AMM 51-31-01/201).
(b) On top of the alodine, apply two layers of primer, BMS 10-79 type III.
1) Let each layer dry for the correct cure time.

S 624-025

(4) Apply a very thin coat of BMS 3-27 (preferred) or BMS 3-38 (alternate) on the mating surface, screw holes, and connector hole.

S 624-023

(5) Lubricate the O-ring with BMS 3-33.

S 434-016

(6) Install the O-ring on the antenna.

NOTE: Do not get BMS 3-27 or BMS 3-38 on the O-ring or in the O-ring groove.

S 624-024

(7) Apply a layer of Dow Corning Compound No. 4 on the coaxial connector if a moisture guard is used on the installation.

S 434-014

(8) Connect the coaxial cable to the antenna.

S 434-025

(9) Put the antenna into position.

S 624-026

(10) Apply a layer of BMS 3-27 (preferred) or BMS 3-38 (alternate) on the threads and shank of the cadmium plated screws.

S 424-022

(11) Lightly tighten the cadmium plated screws to hold the antenna in position.

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S 434-026

<u>CAUTION</u>: TIGHTEN THE SCREWS MANUALLY TO THE CORRECT TORQUE VALUE. USE OF POWER OR AIR TOOLS TO TIGHTEN THE SCREWS CAN CAUSE DAMAGE TO THE ANTENNA SURFACE.

(12) Manually tighten the screws to 25-35 pound-inches of torque.

S 764-020

(13) Make sure the resistance from the antenna base to the airplane skin is not greater than 25 milliohms.

S 114-027

(14) Carefully remove excess BMS 3-27 (preferred) or BMS 3-38 (alternate) from the screw heads and around the edge of the antenna base with solvent, Series 95 (AMM 20-30-95/201).

<u>NOTE</u>: Care must be taken to completely remove excess BMS 3-27 or BMS 3-38. If the BMS 3-27 or BMS 3-38 is not completely removed, poor adhesion of the weather proof sealant will result.

S 434-019

(15) Apply the weather aerodynamic sealant (BMS 5-95) to the edge of the antenna base, and screw heads (AMM 51-31-01/201).

S 144-207

<u>CAUTION</u>: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(16) Remove the unwanted sealant from around the antenna base (AMM 51-31-01/201).

S 864-023

(17) Remove the DO-NOT-CLOSE tags, and close these circuit breakers on the P11 panel:
   (a) 11F7, ATC LEFT
   (b) AIRPLANES WITH MODE S TRANSPONDER;
       11F11, ATC ANT SWITCH
   (c) 11F28, ATC RIGHT

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G. ATC Antenna Test

S 864-028
(1) Supply electrical power (AMM 24-22-00/201).

S 864-025
(2) Set the transponder select switch on the ATC control panel to the applicable L or R position.

S 864-259
(3) Set the mode select switch on the ATC/TCAS control panel to ALT ON position.

S 744-031
(4) Push and hold the TEST switch on the applicable left or right ATC transponder.

S 754-030
(5) Make sure the sequence that follows occurs:
(a) All the LEDs come on
(b) All the red LEDs go off
(c) The green LED stays on.

S 744-027
(6) Release the TEST switch on the ATC transponder.

NOTE: The green LED will stay on for a while and then will go off.

H. Put the Airplane Back to Its Usual Condition

S 864-039
(1) SAS 150-154 PRE-SB 34-82;
Set the transponder select switch on the ATC control panel to the OFF position.

S 864-041
(2) SAS 150-154 POST-SB 34-82;
ALL MTH AIRPLANES;
SAS 050-149, 155-999;
Set the transponder select switch on the ATC control panel to the STBY position.

S 864-034
(3) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AIR TRAFFIC CONTROL ANTENNA SWITCH - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the ATC antenna switch; the other is the installation of the ATC antenna switch.
   B. The top and bottom ATC antenna switch, S10563 and S10564, installations are the same. The ATC antenna switches are installed on the E2 rack.

TASK 34-53-04-004-001

2. Remove the ATC Antenna Switch
   A. Access
      (1) Location Zones
         119/120 Main Equipment Center

   B. Prepare for the Removal

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11F7, ATC LEFT
         (b) 11F11, ATC ANT SWITCH
         (c) 11F28, ATC RIGHT
   C. Procedure

      S 034-003
      (1) Remove the electrical connector from the ATC antenna switch.

      S 034-004
      (2) Remove the nuts and screws from the ATC antenna switch.

      S 024-005
      (3) Remove the ATC antenna switch.

TASK 34-53-04-404-006

3. Install the ATC Antenna Switch
   A. Equipment
      (1) Resistance measuring bridge or ohmmeter which can measure 0.001 ohm

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B. References
   (1) AMM 20-10-21/401, Electrical Bonding
   (2) AMM 20-10-22/701, Metal Surface
   (3) AMM 24-22-00/201, Electrical Power - Control

C. Access
   (1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

D. Prepare for the Installation

S 864-007
(1) Make sure these circuit breakers on the P11 panel are open:
   (a) 11F7, ATC LEFT
   (b) 11F11, ATC ANT SWITCH
   (c) 11F28, ATC RIGHT

S 214-008
(2) Make sure the bracket for the ATC antenna switch has no corrosion. If it is necessary, clean the mating surfaces (AMM 20-10-22/701).

S 424-009
(3) Install the ATC antenna switch on the bracket with the electrical bond fastener (SWPM 20-20-00).

NOTE: Make sure both of the ATC antenna switches has the same mod level of the same part number.

S 434-010
(4) Tighten the screws on the ATC antenna switch.

S 764-011
(5) Make sure the resistance from the ATC antenna switch to the E2 rack is less than 0.001 ohm.

S 864-012
(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11F7, ATC LEFT

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(b) 11F11, ATC ANT SWITCH
(c) 11F28, ATC RIGHT

E. ATC Antenna Switch Test

S 864-013
(1) Supply electrical power (Ref 24-22-00).

S 864-015
(2) Set the transponder select switch on the ATC control panel to the (L)eft or No. (1) system.

S 864-051
(3) Set the mode select switch on the ATC/TCAS control panel to ALT ON position.

S 744-016
(4) Push and hold the TEST switch on the left ATC transponder.
(a) Make sure the sequence that follows occurs:
1) All the LEDs come on
2) All the red LEDs go off
3) The green LED stays on.

S 744-028
(5) Release the TEST switch on the ATC transponder.

NOTE: The green LED will stay on for a short time and then go off.

(a) Make sure an antenna fail light is not on.

S 864-020
(6) Set the transponder select switch on the ATC control panel to the (R)ight or NO. (2) system.

S 744-021
(7) Do the ATC antenna switch test again with the right ATC transponder.
(a) Make sure the LED test sequence occurs for the right ATC transponder.
(b) Make sure an antenna fail light is not on.

F. Put the Airplane Back to Its Usual Condition

S 864-026
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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DISTANCE MEASURING EQUIPMENT (DME) SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The distance measuring equipment (DME) system measures the airplane-to-station slant-range (line-of-sight) distance. This distance is displayed as nautical miles to go on flight deck instruments. Two DME systems are installed.
   B. Each system has an interrogator (receiver/transmitter), an antenna, and two distance indicators on the RDMIs.
   C. The DME transmits pulsed rf signals to a ground station and receives replies from that station. It determines distance by measuring the time it takes to receive a reply from the station. The signals travel at a constant rate (light speed) and thus distance is proportional to travel time.
   D. The DME system operates in the L-band frequency range. It has a transmit frequency of 1025 to 1150 MHz and a receive frequency of 962 to 1213 MHz.
   E. The DME, ATC, and TCAS (if installed) systems operate in the same L-band frequency range. To prevent intersystem interference only one system is allowed to transmit at any one time. A mutual transmission suppression signal is provided from the on-line system to prevent the others from transmitting.
   F. Distance to the DME station is displayed on both RDMIs and the selected EHSIs. Distance is also transmitted to the FMCs on ARINC 429 serial digital data buses. Audio from the ground station is fed to the audio selector panels.
2. Component Details
   A. DME Antenna
      (1) The DME antennas are L-band blades which are the same as the ATC antennas. Each antenna has a 52 ohm coax output with a VSWR of 5:1 or less over the DME frequency band. The two DME antennas are located on the bottom of the fuselage.
   B. DME Interrogator
      (1) The DME interrogators transmit and receive rf signals to compute distance to a station. The transmitter section operates between 1025 and 1150 MHz at 700 watts peak power. The receiver section operates between 962 and 1213 MHz. The interrogation range is 400 nautical miles with a dynamic range capability of 0 to greater than 1000 knots of airspeed.
      (2) The front panel lights operate only in conjunction with the test button. Pushing the test switch initiates a BITE test of the interrogator. The lights indicate status of the system after test. At the end of the test, a good LRU is indicated by the green PASS LRU status light on and the red light off. A bad LRU is indicated by the red LRU status light on. The CONTROL INPUT FAIL light comes on when data from the VOR or ILS control panel is invalid.
      (3) The left and right interrogators are located in the main equipment center on E/E Racks E2-2, E2-3.

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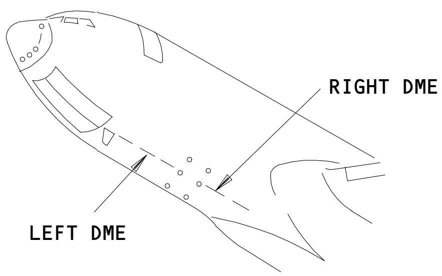
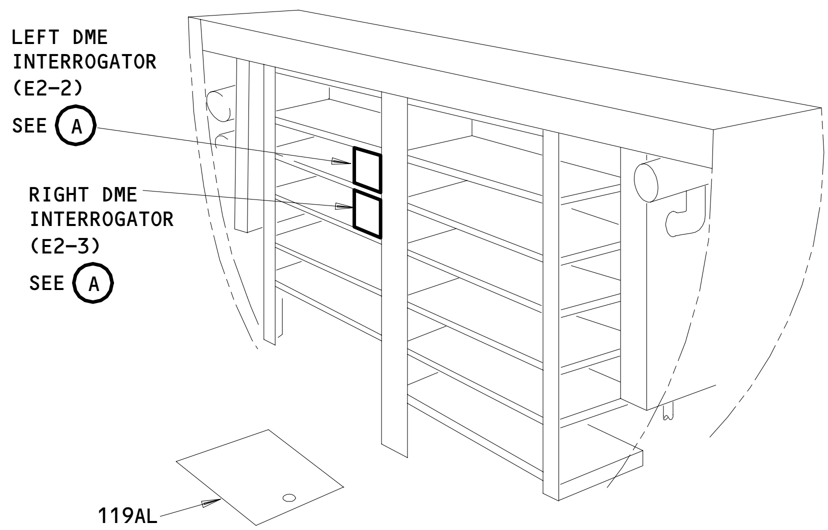
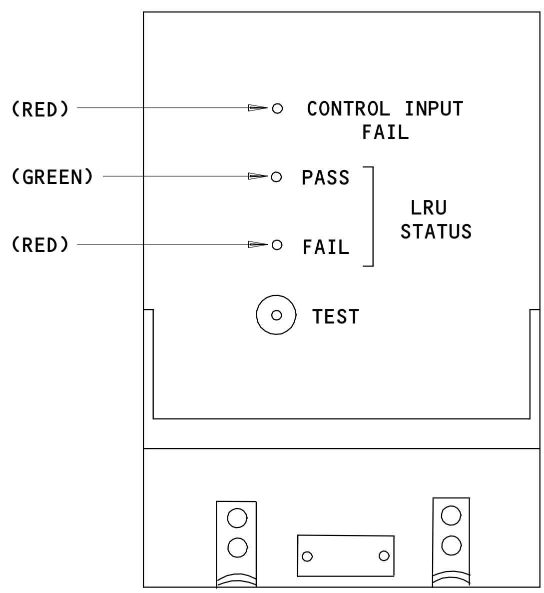




MAIN EQUIPMENT CENTER



DME INTERROGATOR

A

DME System Components
Figure 1 (Sheet 1)

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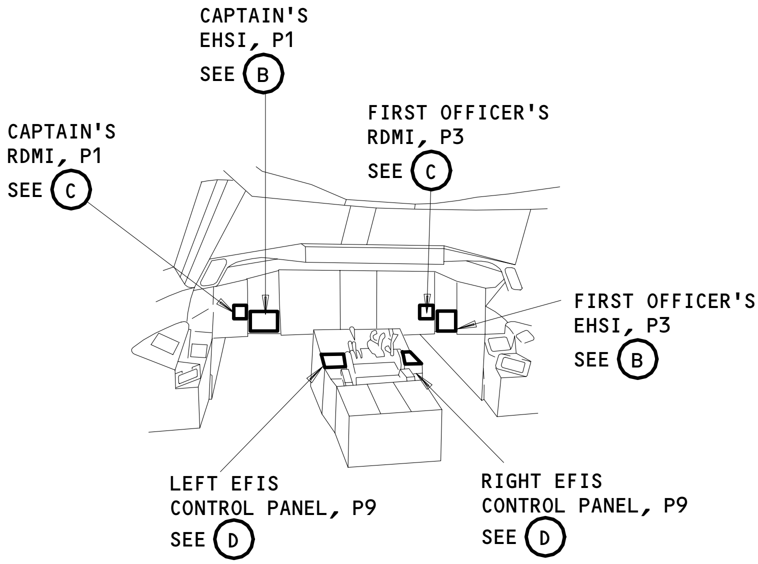
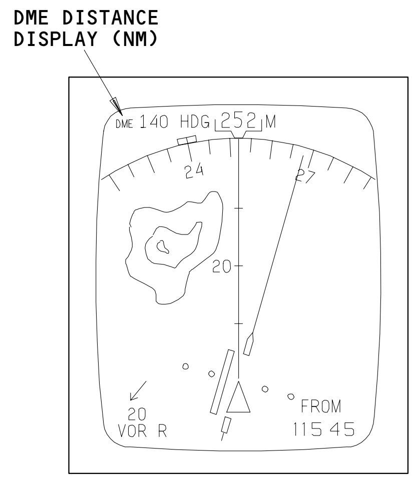
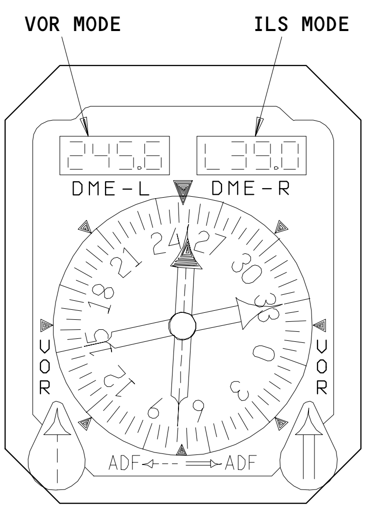


FLIGHT COMPARTMENT



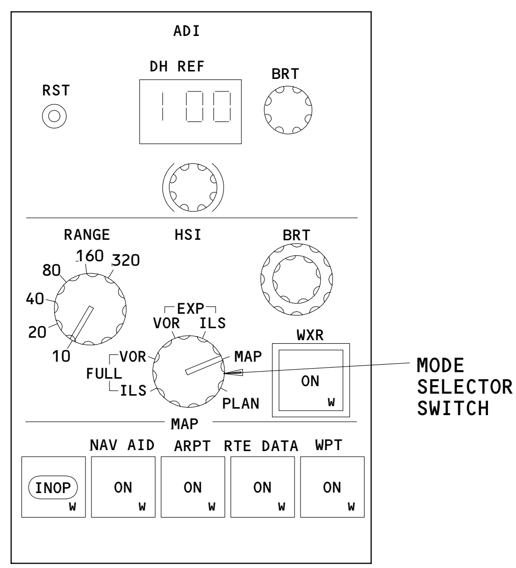
EHSI DISPLAY

B



RDMI

C



EFIS CONTROL PANEL

D

DME System Components
Figure 1 (Sheet 2)

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C. EFIS Control Panel

(1) DME mode control is accomplished from the EFIS control panel. When the EFIS control panel mode select switch is set to VOR, the DME frequency is paired with the VOR frequency. The VOR frequency is manually tuned at the VOR control panel (Ref 34-51-00). In the ILS mode, the DME frequency is paired with the ILS frequency and tuning is done at the ILS control panel (Ref 34-31-00).

(2) When the left or right EFIS control panel mode select switch is set to MAP or PLAN, the left flight management computer (FMC) automatically tunes the respective left or right DME. Appropriate DME station tuning is fed to the DME from the FMC database as the flight progresses (Ref 34-61-00). The right FMC will automatically tune the DME interrogators when the left instrument source select switch is set to the alternate posision.

D. RDMI

(1) The RDMI provides a digital display of computed slant range distance for both DME systems.

(2) DME no computed data is indicated by the readout showing all dashes. All digits in the display go blank if there is a malfunction in the DME system (Ref 34-22-00). For EFIS ILS mode, the readout also shows dashes when the distance is ≥ 100 nmi.

(3) The DME display will also go blank if the tuned DME frequency does not correspond with the ILS or VOR station selected.

E. EHSI

(1) DME range is displayed on the top left corner of the EHSIs. The DME display is blanked for invalid data. A no computed data condition is annunciated by dashes.

(2) The EHSI DME display will also go blank if the tuned DME frequency does not correspond with the ILS or VOR station selected.

3. Operation

A. DME System Block Diagram (Fig. 2)

(1) The DME interrogator power supply receives 115 volt ac, 400 Hz through the overhead circuit breaker panel P11.

(2) The EFIS control panel selects DME modes of operation by sending open/ground logic discretes to the VOR control panel. The tuning logic circuit trips the ILS and manual relays to the appropriate tuning mode.

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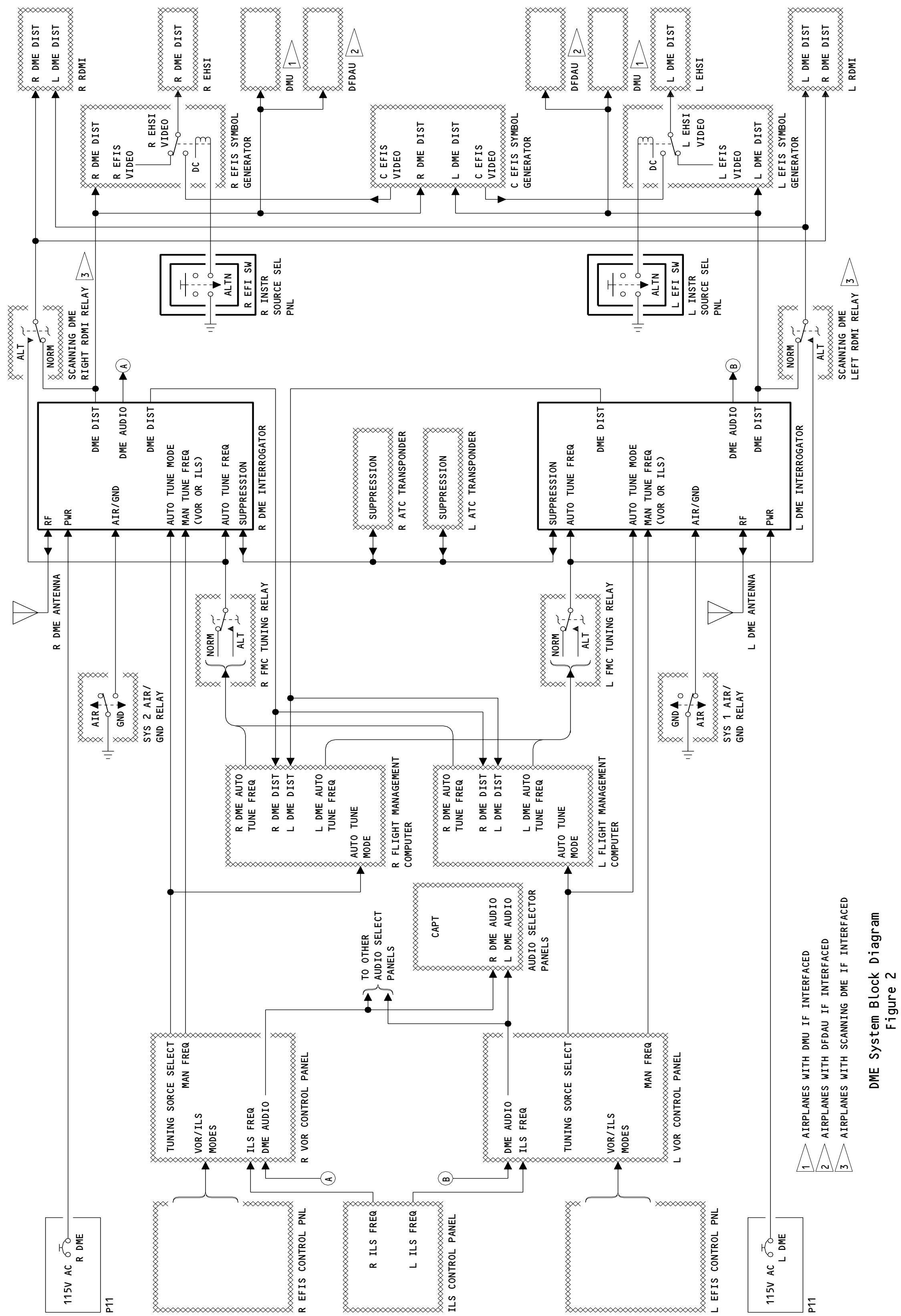

DME System Block Diagram
Figure 2

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(3) Each DME interrogator generates a suppression pulse for use internally and for suppressing the receivers of the opposite DME, TCAS computer (if installed) and ATC transponders when interrogation pulses are being transmitted. In addition, the DME interrogator accepts suppression pulses to protect its receiver when the other L-band equipment is transmitting.
(4) Each DME ground station periodically transmits an identification signal along with distance data. This identification signal is decoded in the DME interrogator and routed back through the onside VOR control panel to the audio selector panels.
(5) The DME interrogator determines the slant range distance to the tuned ground station. DME distance data is sent from each interrogator to both FMCs for navigation position fixing, and is sent for display to both RDMIs and to onside and center EFIS symbol generators for display on EHSIs.
(6) The FMC tuning relays located between the L and R FMCs send bus outputs to the DME tuning input port A. In the normal position the relay connects the L FMC bus output to the DME port A. When the instrument source select switches the relay to the alternate position, the R FMC is connected to the DME port A.
(7) The scanning DME L and R RDMI relays are located between the FMC distance outputs from the FMC tuning relays and the distance output from DME interrogator. The output of the scanning DME relay is sent to the L and R RDMIs. In the normal position the scanning DME relays send DME distance from the L DME or R DME to the RDMIs. In the alternate position the FMC sends distance data to the RDMIs. The relay is set to the alternate position by a discrete signal from the L or R FMC.
(8) The EHSIs display DME distance in EFIS VOR and ILS modes, but display FMC generated distance-to-go to the next waypoint in EFIS MAP and PLAN modes.
(9) The air/ground relays identify flight legs for the nonvolatile fault memory.

B. Functional Description
(1) DME Modes of Operation (Fig. 3)
(a) DME modes of operation are shown on the graphic. A description of the operation of each mode is given along with the RDMI display for that mode. The conditions for each mode are as follows:
1) The STANDBY mode occurs at initial turn-on and is the fall-back mode when ground station pulses are absent. In this mode, the transmitter is off but the receiver counts the number of pulse pairs received from the ground station. When the DME is within range of the ground station, sufficient pulse pairs will be counted by the receiver. This causes the DME to operate in the search mode.

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MODE	DESCRIPTION OF OPERATION	RDMI DISPLAY
STANDBY	TRANSMISSION INHIBITED; RECEIVER (AND AUDIO) OPERATIVE	4 DASHES (NO COMPUTED DATA)
SEARCH	>650 PULSE PAIRS PER SECOND RECEIVED TRANSMITTER ON AND OPERATING WITH HIGH PRF	4 DASHES
TRACK	THREE-OR-MORE (OUT OF 5) CORRECT PULSE PAIRS RECEIVED IN SEARSH MODE	SLANT RANGE
SCAN	MULTIPLE STATION TUNING FIVE STATIONS OR LESS SPECIFIED IN FOREGROUND LOOP UP TO 15 MAY BE SCANNED IN BACKGROUND LOOP	SELECTED STATION SLANT RANGE
MEMORY	LOSS OF RETURN PULSES FOR 2 SECONDS COMPUTES RANGE (EXTRAPOLATED FROM PREVIOUS DISTANCE RATE OF CHANGE FOR 10+2 SECONDS	SLANT RANGE
FAULT	SYSTEM MALFUNCTION (DURING CONTINUOUS MONITORING OPERATION)	BLANK DISPLAY
SELF- TEST	AUTOMATICALLY STEPS THROUGH SELF - TEST, SWITCH MUST BE HELD (ABOUT 5 SEC) UNITL TEST COMPLETED.	SEQUENCES THRU: 1. BLANK DISPLAY 1 2. DASHES 3. 0.0 NM

1 BLANK DISPLAY MAY OR MAY NOT BE SEEN.

DME Modes of Operation
Figure 3

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2) In the SEARCH mode, the interrogator transmits pulse pairs and looks for ground station replies. Reply pulses are stored in memory for later analysis. Upon reception of synchronous reply pulses, the DME converts the time to distance and switches to the track mode.
3) The TRACK mode occurs after lock-on in the previous search mode. Slant range distance is displayed on the indicator and updated as the airplane moves closer to or farther from the station.
4) In the DIRECTED SCAN mode, the DME has the capability of interrogating and providing distance information for one to five frequencies. However, by system design, the DME only has to provide distance information for one frequency. The bit logic of the input digital frequency tuning word is always set to command the DME to perform in the one frequency DIRECTED SCAN mode.
5) Three abnormal conditions exist that will cause the DME not to operate in the one frequency DIRECTED SCAN mode. Under these conditions, the DME will automatically revert to FREE SCAN operation. The three abnormal conditions are:
    a) If the digital tuning signal falls below 5 words per second.
    b) The tuning word sign/status matrix indicates an invalid condition.
    c) The word parity is incorrect.
6) In FREE SCAN mode, the DME provides distance information for all stations that are in the DME range. The DME can independently scan all available channels and form a foreground and a background loop. The foreground loop is defined as a set of up to five of the closest stations. If the FMC selects fewer than five, the DME will fill in the remainder if told to do so. Foreground stations are given priority service at frequent intervals. The background loop consists of all of the remaining available stations. The DME delivers an output from up to fifteen of these background stations in addition to the five stations in the foreground loop. The background stations are scanned as time permits between foreground station outputs. One of the foreground stations is selected through the FMCs for flight deck display. The identification of the selected station is available on the PROGRESS page of the FMC control display unit (CDU).
7) The system operates in the MEMORY mode when station reply pulses are lost. The airplane range is then extrapolated from the most recent range data stored in memory. This occurs for approximately 10 seconds or, until sufficient signal strength is regained.
8) The DME enters the FAULT mode whenever it detects a fault. DME monitoring circuits continuously check the system and alert the flight crew if a fault has been detected.

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9) The SELF-TEST mode is initiated by pressing the test switch on the interrogator front panel. Indicators on the interrogator front panel show pass/fail and input status of the LRU.

(2) System Operation (Fig. 4)

(a) The left DME system is shown on the schematic. The right DME system is similar. The DME system receives 115 vac, 400 Hz power through the overhead circuit breaker panel, P11. A power supply circuit in the interrogator develops regulated DC voltages. Power for the VOR control panel comes from the VOR receiver.

(b) The EFIS control panel selects DME modes of operation by sending open/ground logic discretes to the VOR control panel. The tuning logic circuit trips the ILS and manual relays to the appropriate tuning mode.

(c) In the VOR mode, the ILS relay and the manual relay are in the VOR and MAN positions, respectively. DME channels are automatically paired with the selected VOR frequency. The VOR frequency is encoded and sent to the DME interrogator on an ARINC 429 data bus. VOR/DME audio is routed from the interrogator to the audio select panels by the ILS relay.

(d) In the ILS mode, the ILS relay and the manual relay are in the ILS and MAN positions, respectively. The ILS control panel selects the DME frequency in the same manner as the VOR control panel. ILS/DME audio is fed to the audio select panels.

(e) When park is selected on the ILS control panel, the receiver continues to monitor the last valid tuned frequency entered from the control panel and the audio output may reflect that frequency.

NOTE: The control panel park selection is positioned below 108.xx and above 111.xx (one detent from 108.xx ccw, and one detent from 111.xx cw). If the receiver was previously tuned to 108.xx or 111.xx and then park is selected, te receiver will remain tuned to that frequency and the audio may be heard on the audio control panel. However, if the receiver was previously tuned to 109.xx or 110.xx and then park is selected, the audio may not be heard on the audio control panel.

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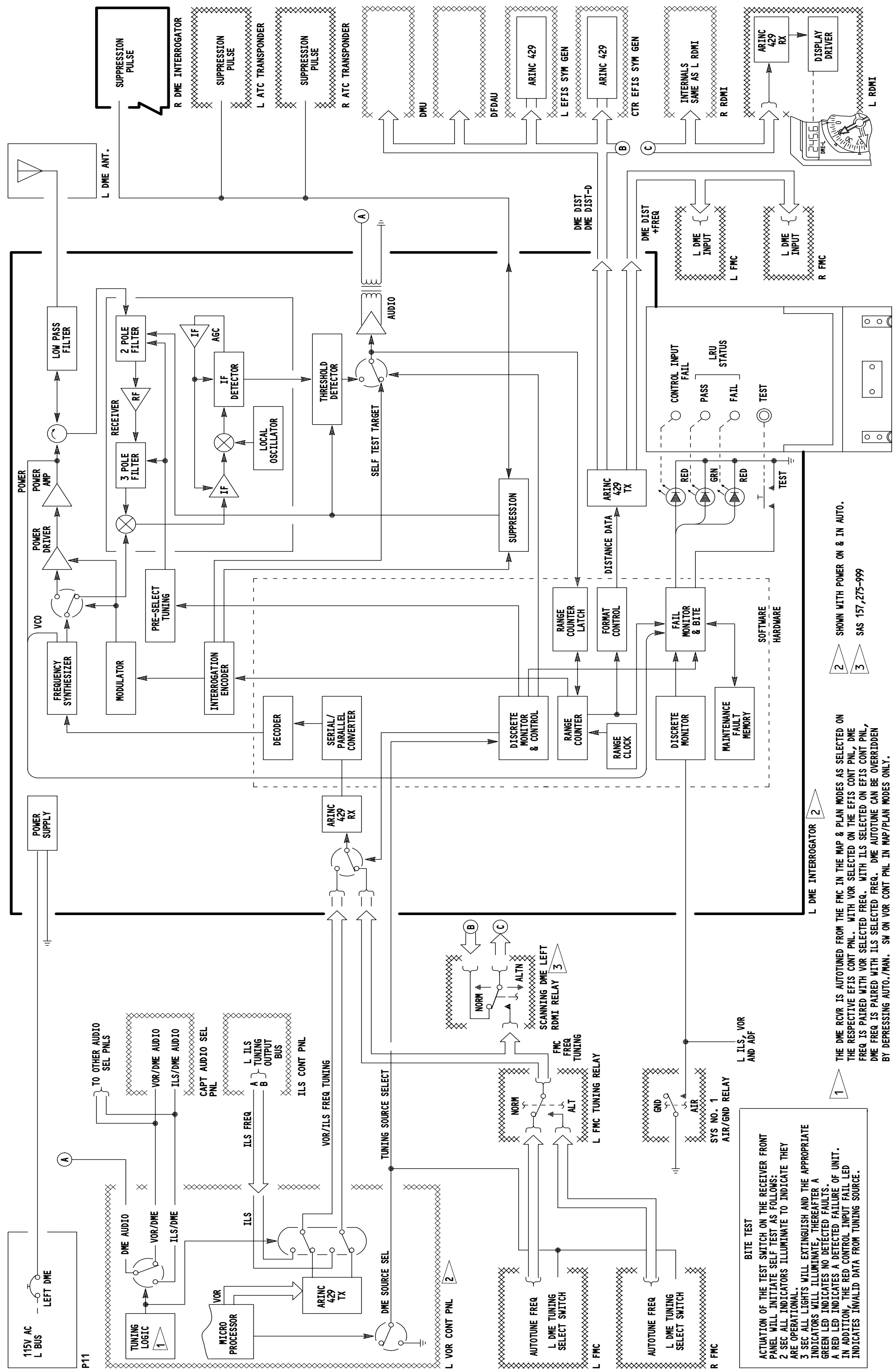

DME System Schematic (Example)
Figure 4

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(f) The EFIS symbol generator monitors the DME to verify that the tuned DME frequency corresponds with the ILS or VOR station selected. If the tuned DME frequency does not correspond with the selected ILS or VOR station, the DME display will blank on both the RDMI and EHSI.

(g) In the EFIS MAP or PLAN mode, the manual relay switches to AUTO, sending a discrete to the FMC. This activates the FMC autotune frequency allowing automatic selection of DME stations. If power to the VOR control panel is lost, the DME switches to FMC autotuning.

(h) Coaxial suppression lines interconnect the ATC, TCAS (if installed) and DME L-band systems on the airplane. A suppression pulse is transmitted by a system whenever it is transmitting. The pulse goes to the other three systems, keeping them from transmitting. This prevents interference between L-band systems. When the DME receives a suppression pulse, it detunes its front end. This is done to protect the receiver section from close range, high power transient signals from the other L-band systems.

(i) The ARINC 429 bus interface contains two ports for frequency and mode control. A source select discrete from the VOR control panel determines which input port is to be used. Frequency tuning commands are received over the ARINC 429 data bus and stored in the range processor. The range processor, hereafter called the CPU, is the central processing unit of the DME interrogator. It controls DME operations by means of a stored program. The CPU is represented by the software portion on the diagram.

(j) The CPU initiates ground station interrogations. It also computes range from the ground station reply pulse pairs after they are received and decoded by the video processor. The CPU also controls the pulse pair decoding, IF AGC, and ARINC 429 interface functions of the video processor. It also provides the monitor and self-test functions.

(k) The CPU sends tuning commands to the receiver and to the frequency synthesizer. The synthesizer generates an IF signal at the desired transmit frequency in the 1025-1150 MHz band. The synthesizer uses a crystal oscillator as a frequency source. It uses a phase locked loop to select frequency. The L-band output of the synthesizer is sent to both the receiver and to the power driver as a local oscillator signal.

(l) The power driver amplifies and modulates the L-band signal to generate a square waveform output signal. The waveform of the output signal is controlled by the modulator. Modulation is controlled by a square trigger pulse applied to the modulator from the range count network in the CPU. This produces an RF pulse pair output from the power driver with a 700-watt peak level.

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(m) The rf pulse pair output is connected to the antenna through a circulator. It is then transmitted as an interrogation to the ground station. The multiport circulator provides VSWR protection for the transmitter.

(n) The circulator directs received rf signals from the antenna to the input of the receiver. The receiver is tunable over the frequency range of 962 to 1213 MHz. Tuning is controlled by the VCO signal from the synthesizer. The receiver uses the local oscillator signal from the synthesizer to produce video pulse IF output signals. The IF output signals are routed to the video processor.

(o) The video processor decodes the IF video pulses and sends the data to the CPU when a valid pulse pair is received. It also sends the IF video signals to the IDENT filter. The filter detects the 1350 Hz tone and sends it to the audio select panels by way of the VOR control panel.

(p) The received video data pulse pairs are applied to the range counter network in the CPU. This network latches and deposits the range count of the first pulse into the CPU memory. The range count of each additional received pulse pair is sequentially deposited into the memory until the end of the interrogation cycle. The memory now contains the distance (or time) of all random (squitter) and reply pulse pairs received during the interrogation cycle.

(q) The CPU then initiates a second interrogation, and the range counts of all decoded receiver pulse are again entered into memory. This process continues for as many interrogations as required. The CPU compares the range count of successive interrogations to locate the reply pulses that occur at the same distance. It then computes range from the selected reply and formats the distance for output over the ARINC 429 data bus. Separate outputs are used for the FMCs and the flight instruments.

(r) The DME interrogator also outputs DME data to the Digital Flight Data Acquisition Unit (DFDAU if installed). The DFDAU receives this data for recording by the flight data recorder system (Ref 31-31-00).

(s) Suppression pulses are sent to the DME by other onboard L-band systems which are about to transmit a high energy signal. The interrogator protects the front end of the receiver by switching in an attenuator when this signal is received. The interrogator also sends out a suppression pulse.

C. BITE (Fig. 4)

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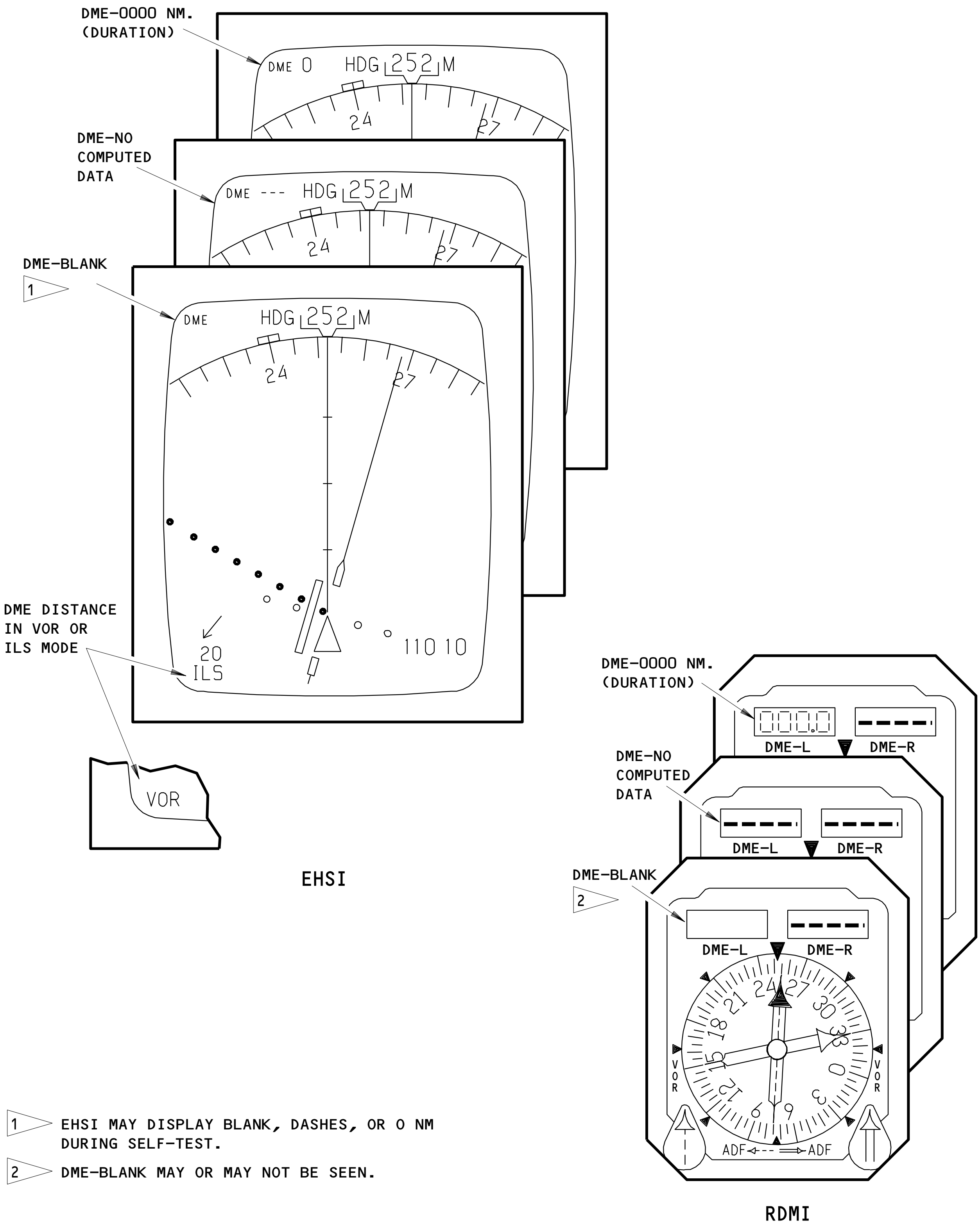

1 EHSI MAY DISPLAY BLANK, DASHES, OR 0 NM DURING SELF-TEST.

2 DME-BLANK MAY OR MAY NOT BE SEEN.

DME Displays - Test Sequence
Figure 5

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(1) The DME contains self-test and monitoring features that check for proper operation of the unit. During in-flight modes, the BITE network continuously checks functions that affect the accuracy of the DME. It checks synthesizer lock, range clock accuracy, CPU program execution, and ARINC 429 tuning data and polarity. Also, during each interrogation cycle, a test target signal of 150 miles is injected into the receive circuits. The self-test distance computation is then checked for accuracy.

(2) Detected faults are output to the FMCs and flight instruments on the ARINC 429 data bus. On the EHSIs and RDMIs for a DME invalid data fault, the distance numerics are removed, and for a no computed data fault, the numerics are replaced with dashes.

(3) The DME display will also go blank if the tuned DME frequency does not correspond with the ILS or VOR station selected.

(4) Other functions are checked at intermittent times. These include receiver sensitivity, transmitter power level, data bus operation, AGC tracking and lock on and track of the self- test distance signal. Checks are run on these functions at power turn-on and when a mode change command is made from the data bus. They are also run when the DME fails to lock on a signal and when the manual self-test button is pressed.

(5) All faults detected during the intermittent and continous monitoring self-tests are stored in a nonvolatile fault memory. The faults are stored by flight segments for subsequent evaluation in the shop. Each flight segment starts when the airplane takes off as detected by the air to ground relay. The BITE memory can store a minimum of 10 failures for each flight segment and can store a minimum of 50 flight segments. The test data history is available on the ATE connector for shop personnel.

(6) The interrogator front panel LEDs work only in conjunction with the manual self-test switch. Pushing and holding the test switch initiates a BITE test of the interrogator. When the test switch is pressed and held the following sequence takes place:

(a) All three LEDs come on for one to four seconds to indicate they are operational.

(b) All three LEDs go off for one to four seconds and then come on to indicate system status as follows:

1) Green LRU STATUS-PASS LED comes on to indicate a good LRU.

2) Red LRU STATUS-FAIL LED comes on to indicate a bad LRU.

3) Red CONTROL INPUT FAIL LED comes on to indicate invalid or missing ARINC 429 data from the VOR or ILS control panel.

D. Control

(1) DME frequency control is determined by the position of the EFIS control panel mode switch.

(2) The following describes DME frequency control for EFIS control panel mode switch settings:

(a) VOR position - Tune DME with the VOR control panel.

(b) ILS position - Tune DME with ILS control panel.

(c) MAP or PLAN position - DME is tuned automatically by the FMC.

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DISTANCE MEASURING EQUIPMENT (DME) SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
ANTENNA - L DME, M263	--	1	BOTTOM FUSELAGE	34-55-02
ANTENNA - R DME, M264	--	1	BOTTOM FUSELAGE	34-55-02
CIRCUIT BREAKERS -			FLT COMPT, P11	
DME LEFT, C582		1	11E11	*
DME RIGHT, C583		1	11E32	*
INDICATOR - (REF 34-22-00, FIG. 101)				
L RADIO DISTANCE MAGNETIC, N3	--	1		
R RADIO DISTANCE MAGNETIC, N43	--	1		
INTERROGATOR - L DME, M123	--	1	119AL, MAIN EQUIP CTR, E2-2	34-55-01
INTERROGATOR - R DME, M124	--	1	119AL, MAIN EQUIP CTR, E2-3	34-55-01
PANEL - (REF 34-22-00, FIG. 101)				
L EFIS CONTROL, M94				
R EFIS CONTROL, M93				
PANEL - (REF 34-51-00, FIG. 101)				
L VOR CONTROL, M91				
R VOR CONTROL, M92				
RELAY - (REF 31-01-36, FIG. 101)				
SYS NO. 1 AIR/GND, K124				
SYS NO. 2 AIR/GND, K214				
UNIT - (REF 31-31-00, FIG. 101)				
DIGITAL FLIGHT DATA ACQUISITION, M138				

* SEE THE WDM EQUIPMENT LIST

Distance Measuring Equipment (DME) System - Component Index
Figure 101

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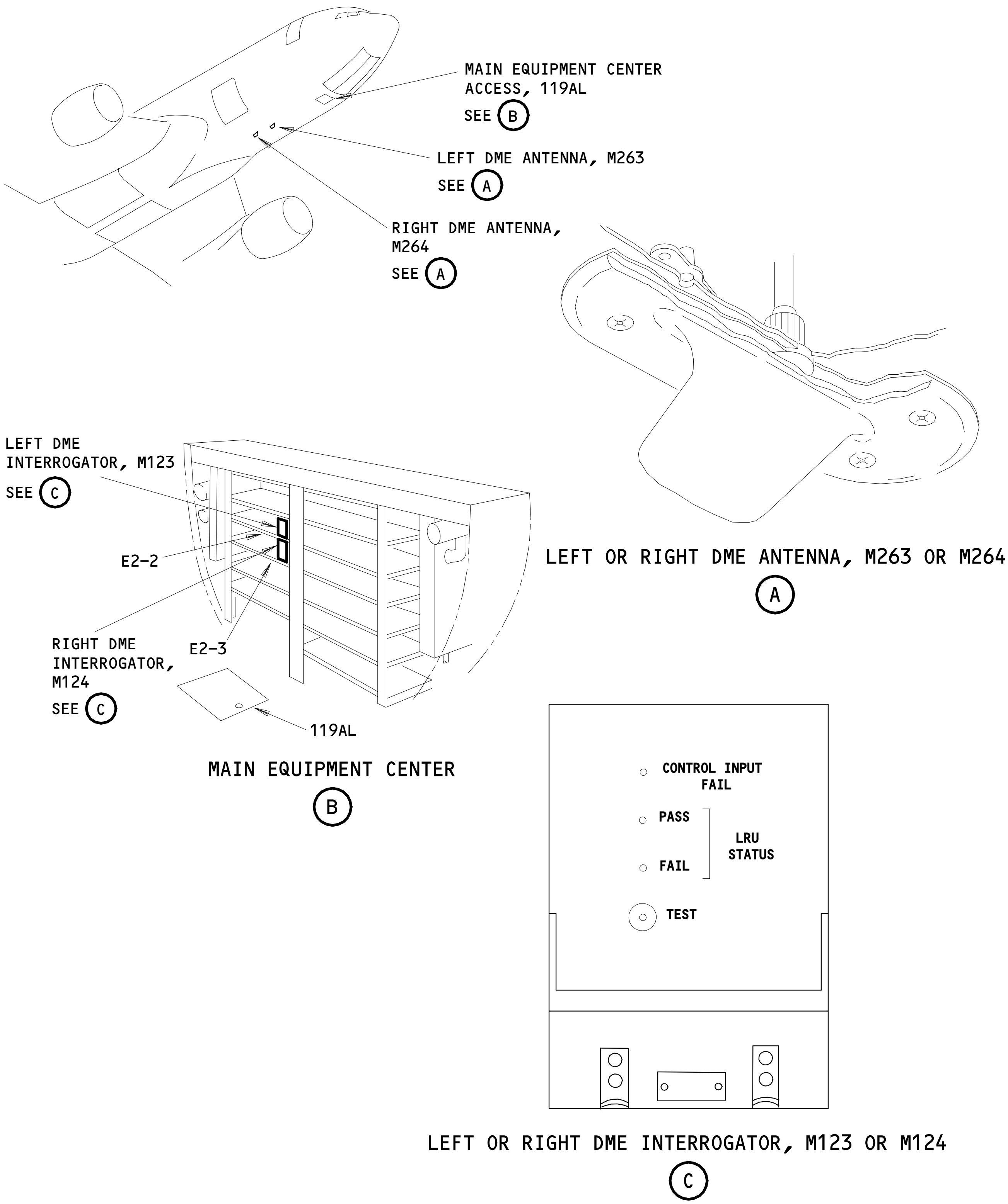

Distance Measuring Equipment (DME) System - Component Location
Figure 102

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DISTANCE MEASURING EQUIPMENT (DME) SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure has two tasks for the Distance Measuring Equipment (DME) system:
      (1) An operational test
      (2) A system test.
   B. The operational test is a fast check of the DME system by the system BITE. The system test makes sure all functions of the DME operate correctly. The system test also does a test of the DME identification reception. An external DME test set is used in the system test.

TASK 34-55-00-715-115

2. DME System - Operational Test
   A. General
      (1) The operational test has these tasks:
         (a) The prepare for a DME operational test
         (b) The test of the VOR control panel indicator
         (c) The DME system self test.
   B. References
      (1) AMM 21-58-00/501, Equipment Cooling
      (2) AMM 23-41-00/501, Service Interphone System
      (3) AMM 24-22-00/201, Electrical Power Control
      (4) AMM 34-21-00/501, Inertial Reference System
      (5) AMM 23-51-00/501, Flight Interphone System
      (6) AMM 34-31-00/501, Instrument Landing System
      (7) AMM 34-51-00/501, VHF Omnidirection Range (VOR) System
   C. Access
      (1) Location Zones
         119/120 Main Equipment Center
         211/212 Flight Compartment
   D. Procedure

      S 865-117
      (1) Prepare for the DME operational test:
         (a) Supply electrical power (AMM 24-22-00/201).

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CAUTION: MAKE SURE THE EQUIPMENT COOLING SYSTEM OPERATES BEFORE THE ELECTRONIC SYSTEMS ARE OPERATED. THE EQUIPMENT COOLING SYSTEM MUST BE SET FOR CORRECT COOLING. IF THESE CAUTIONS ARE NOT OBEYED, DAMAGE TO THE ELETRONIC SYSTEMS CAN OCCUR.

(b) Supply equipment cooling (AMM 21-58-00/501).
(c) Make sure that the Service Interphone System is serviceable (AMM 23-41-00/501).
(d) Make sure the Flight Interphone System is serviceable (AMM 23-51-00/501).
(e) Align the Inertial Reference System in the nav mode (AMM 34-21-00/501).
(f) Make sure the Instrument Landing System is serviceable (AMM 34-31-00/501).
(g) Make sure the VOR System is serviceable (AMM 34-51-00/501).
(h) Make sure these circuit breakers on the overhead circuit breaker panel P11 are closed:
1) 11E11, DME LEFT
2) 11E32, DME RIGHT
(i) Set the mode select switch on the left (right) EFIS control panel to the VOR or VOR FULL, or VOR CTR position.

S 715-118
(2) Do a test of the VOR control panel indicators:
(a) Push the TEST switch on the overhead lights control panel, P5.
1) Make sure the AUTO and MAN indicators on the L and R VOR controls panel come on.
(b) Push the TEST switch again on the overhead lights panel to remove electrical power from the test circuits.
1) Make sure the AUTO indicator on the L and R VOR control panels go off.

S 715-119
(3) Do the left (right) DME system self test:

NOTE: During the DME left self-test the DME-L indicator on the left and right RDMI's show the test progress. During the DME right self-test the DME-R indicator on the left and right RDMI's show the test results.

(a) Push and hold the TEST switch on the left (right) interrogator.

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(b) Make sure this sequence occurs:
   1) All three LEDs come on for one to four seconds to indicate they are serviceable.
   2) All three LEDs go off for one to four seconds, and then come on to indicate system status as follows:
      a) Green LRU STATUS-PASS LED shows interrogator passed the BITE self-test.
      b) Red LRU STATUS-FAIL LED shows interrogator failed the BITE self-test.
      c) Red CONTROL INPUT FAIL LED shows invalid or no ARINC 429 data to the interrogator.
   3) Release the TEST switch on the left (right) interrogator.

(c) Push and hold the TEST switch on the left interrogator.

(d) Make sure the DME-L (DME-R) indicator on the left and right RDMIs shows this sequence:
   1) No data for the first second.

      NOTE: May or may not be seen.

   2) All dashes for approximately two seconds.
   3) 000.0 ±0.5 NM for the remaining time of the test.

      NOTE: In the test, the DME may momentarily show the distance to the tuned station and not the displayed sequence which is the usual condition.

(e) Release the TEST switch on the left interrogator.

(f) Push and hold the TEST switch on the right interrogator.

(g) Make sure the DME-L (DME-R) indicator on the left and right RDMIs shows this sequence:
   1) No data for the first second.

      NOTE: May or may not be seen.

   2) All dashes for approximately two seconds.
   3) 000.0 ±0.5 NM for the remaining time of the test.

      NOTE: In the test, the DME may momentarily show the distance to the tuned station and not the displayed sequence which is the usual condition.

(h) Release the TEST switch on the right interrogator.

(i) If no more tests of the DME system are necessary, Do the DME System Shutdown (AMM 34-55-00/501).

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TASK 34-55-00-735-116

3. DME System - System Test

A. General

(1) The system test does a full test of the DME system which includes range calculations in the interrogator and distance displayed on the DME distance indicators. In addition, the system test includes a DME audio tone and an auto-tune mode test.

(2) The DME system test has these tasks:

(a) The Prepare for the System Test

(b) The VOR/DME Mode and Audio Test

(c) The ILS/DME Mode and Audio Test

(d) The Auto-Tune Mode Test.

B. Equipment

(1) Use one of the ramp test sets listed below:

(a) Transponder/DME Ramp Test Set - Tel Instrument Electronics Corp. (TIC) Model T24B

(b) Transponder/DME Ramp Test Set - Tel Instrument Electronics Corp. (TIC) Model T48D

(c) Transponder/DME Ramp Test Set - IFR Systems, INC.(IFR) Model ATC-600A

C. References

(1) AMM 23-41-00/501, Service Interphone System

(2) AMM 23-51-00/501, Flight Interphone System

(3) AMM 24-22-00/201, Electrical Power Control

(4) AMM 34-21-00/501, Inertial Reference System

(5) AMM 34-31-00/501, Instrument Landing System

(6) AMM 34-51-00/501, VHF Omnidirection Range (VOR) System

(7) AMM 34-61-00/501, Flight Management Computer System

D. Access

(1) Location Zones

119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment

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E. Prepare for the Test

S 865-121

(1) Supply electrical power (AMM 24-22-00/201).

S 865-122

(2) Make sure that the Service Interphone System is serviceable (AMM 23-41-00/501).

S 865-124

(3) Make sure the Flight Interphone System is serviceable (AMM 23-51-00/501).

S 865-149

(4) Make sure the Inertial Reference System is aligned in the nav mode (AMM 34-21-00/501).

S 865-125

(5) Make sure the Instrument Landing System is serviceable (AMM 34-31-00/501).

S 865-126

(6) Make sure the VOR System is serviceable (AMM 34-51-00/501).

S 865-150

(7) Make sure the Flight Management Computer System is serviceable (AMM 34-61-00/501).

S 865-127

(8) Make sure these circuit breakers on the overhead circuit breaker panel, P11, are closed:
   (a) 11E11, DME LEFT
   (b) 11E32, DME RIGHT

S 715-128

(9) Do the DME operational test (AMM 34-55-00/501).

S 865-147

(10) Connect the test set antenna to the antenna (ANTENNA) connector on the test set.

S 865-151

CAUTION: NEVER PLACE REMOTE TEST SET ANTENNA CLOSER THAN 15 INCHES TO AIRPLANE ANTENNA WITH TEST SET ON. DAMAGE TO TEST SET WILL RESULT.

(11) Put the test set antenna between and at the same level of the airplane left and right DME antennas.

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S 865-130
(12) Set the bearing source select switches on the RDMIs to the VOR position.

S 865-132
(13) Set the mode select switch on the left (right) EFIS control panel to the VOR, VOR FULL, or VOR-CTR position.

S 865-142
(14) Set the other VOR control (unit not under test) to a frequency different than the test frequency.

S 865-133
(15) Set these controls and switches on the TIC Model T24B test set:
- (a) Frequency channel - approved VOR or ILS-paired test frequency
- (b) Squitter - ON (NOTE: average of 2700 PPS)
- (c) IDENT switch - OFF
- (d) DIST/VEL- DIST
- (e) DISTANCE N.M. - 150.0 nautical miles (NM)
- (f) EFF - 70 percent.

S 865-134
(16) Set these controls and switches on the TIC Model T48D test set:
- (a) DME MODE - 108.00 (978)
- (b) IDENT switch - off
- (c) RANGE/VELOCITY - 130.

S 865-135
(17) Set these controls and switches on the IFR Model ATC 600A test set:
- (a) PWR switch - AC or BAT
- (b) Mode switch - DME
- (c) VELOCITY Select switch - RANGE
- (d) Velocity HI/LO switch - HI
- (e) Squitter SQTR/OFF switch OFF
- (f) X/Y switch - Y
- (g) SLEW switches - 150 NM range

F. VOR/DME Mode and Audio Test

S 735-136
(1) Do the left (right) VOR/DME mode test:
- (a) Set an approved test frequency on the left (right) VOR control.
  - 1) Make sure the DME-L (DME-R) indicator on the RDMIs shows all dashes.

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(b) TIC MODEL T24B DME TEST SET;
Set the POWER switch to the ON position.
1) Make sure the DME-L (DME-R) indicator on the RDMIs show 150.0 ±1.0 NM.

(c) TIC MODEL T48D DME TEST SET;
Set the DC power switch to the ON position.
1) Make sure the DME-L (DME-R) indicator on the RDMIs show 130.0 ±1.0 NM.

(d) IFR MODEL ATC-600A DME TEST SET;
Do these steps:
1) Set the X/Y switch to the 17X (108.00 MHz) position.
2) Set the SQTR/OFF switch to SQTR.
3) Make sure the DME-L (DME-R) indicator on the RDMIs show 150.0 ± 1.0 NM.

(e) Change the range to 90.0 NM on the DME test set.
1) Make sure the DME-L (DME-R) indicator on the RDMIs show 90.0 ±0.5 NM.

S 735-140

(2) Do the left (right) VOR/DME audio test at each of the audio select panels:

(a) Make sure the mode select switch on the left (right) EFIS control panel is set to the VOR, VOR FULL OR VOR-CTR position.

(b) Set the controls on the left, right or first observers audio select panel as follows:
1) Set the VOR switch to the on position.
2) Adjust the VOR volume if it is necessary.

(c) TIC MODEL T24B DME TEST SET;
Set the IDENT switch on the DME test set to the ON position.

(d) TIC MODEL T48D DME TEST SET;
Hold the IDENT switch on the DME test set to the on position.

(e) IFR MODEL ATC 600A DME TEST SET;
Hold the IDENT/50% RPLY switch to the IDENT position.

1) Make sure an audio tone is heard.

(f) Set the VOR switch on the audio select panel to the off position.
1) Make sure there is no audio tone.

(g) TIC MODEL T24B DME TEST SET;
Set the IDENT switch to the OFF position.

(h) TIC MODEL T48D DME TEST SET;
Release the IDENT switch to the off position.

(i) IFR MODEL ATC-600A DME TEST SET;
Release the IDENT/50% RPLY switch.

(j) If no more tests of the DME system are necessary,
Do the DME System Shutdown.

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G. ILS/DME Mode and Audio Test

S 735-138

(1) Do the left (right) ILS/DME mode test:
   (a) TIC MODEL T24B DME TEST SET;
       Do these steps:
       1) Set the POWER switch to the ON position.
       2) Set the 108.10 MHz FREQ switch to the on position.
   (b) TIC MODEL T48D DME TEST SET;
       Set the DC power switch to the ON position.
   (c) IFR MODEL ATC-600A DME TEST SET;
       Do these steps:
       1) Set the X/Y switch to the 17Y (108.05 MHz) position.
       2) Set the SQTR/OFF switch to SQTR.

   (d) Make sure the RANGE OR DISTANCE switch on the DME test set is set to the 90 mile position.
   (e) Set the mode select switch on the left (right) EFIS control panel to the ILS or APP or ILS FULL, or ILS-CTR position.
       1) Make sure the MAN indicator on the VOR control panel stays on.
   (f) TIC MODEL T24B DME TEST SET;
       Set the 108.10 MHz FREQ switch to the on position.
   (g) TIC MODEL T48D DME TEST SET;
       Set the DME MODE switch to the 108.10 position.
   (h) IFR MODEL ATC-600A DME TEST SET;
       Set the X/Y switch to the 18X (108.10 MHz) position.

   (i) Set the same frequency on the ILS control as shown on the DME test set.
       1) Make sure the DME-L (DME-R) indicator on the RDMIs show L 90 ±0.5 NM.
   (j) Set the frequency on the ILS control to a frequency other than the test frequency.
       1) Make sure the left distance indicators change to all dashes.
   (k) Set the frequency on the ILS control back to the test frequency.
       1) Make sure the left distance indicators again show L 90 ±0.5 NM.

S 735-141

(2) Do the left (right) ILS audio test:
   (a) Set the mode select switch on the EFIS control panel to the ILS or APP or ILS-FULL or ILS-CTR position.

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(b) Set the controls on the left, rights or first observers audio select panel as follows:
  1) Set the ILS switch to the on position.
  2) Adjust the ILS volume as necessary.
(c) TIC MODEL T24B DME TEST SET;
  Set the IDENT switch on the DME test set to the ON position.
(d) TIC MODEL T48D DME TEST SET;
  Hold the IDENT switch on the DME test set to the on position.
(e) IFR MODEL ATC 600A DME TEST SET;
  Hold the IDENT/50% RPLY switch to the IDENT position.
  1) Make sure an audio tone is heard.
(f) Set the ILS switch to the off position.
  1) Make sure there is no audio tone.
(g) Set the IDENT switch on the DME test set to the off position.
(h) If no more tests of the DME system are necessary,
  Do the DME System Shutdown.

H. Auto-Tune Mode Test

S 735-139

(1) Do the left (right) auto tune mode test:
(a) Set the mode select switch on the left (right) EFIS control panel to the VOR or VOR FULL, or VOR-CTR position.
(b) Make sure the L(R) VOR control frequency is set to 108.00 MHz.
(c) TIC MODEL T24B DME TEST SET;
  Set the POWER switch to the ON position.
(d) TIC MODEL T48D DME TEST SET;
  Set the DC power switch to the ON position.
(e) IFR MODEL ATC-600A DME TEST SET;
  Do these steps:
  1) Set the X/Y switch to the 17X (108.00) position.
  2) Set the SQTR/OFF switch to SQTR.

(f) Make sure the RANGE OR DISTANCE switch on the DME test set is set to the 90 mile position.
(g) Set the mode select switch on the left (right) EFIS control panel to the MAP position.
  1) Make sure the DME-L (DME-R) indicator on the RDMIs show all dashes.

  NOTE: Step shows the DME system is tuned by the Flight Management Computer System.

  2) Make sure the AUTO indicator on the left (right) VOR control panel comes on.
(h) Push the AUTO/MAN switch/light on the left (right) VOR control panel.
  1) Make sure the MAN indicator on the left (right) VOR control panel comes on.

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2) Make sure the DME-L (DME-R) indicator on the RDMIs show 90.0 ±0.5 NM.

(i) If no more tests of the DME system are necessary, Do the DME System Shutdown.

TASK 34-55-00-845-146

4. DME System Shutdown

A. General

(1) Do the DME system shutdown when the DME operational tests or system tests are done. Remove the DME test set, set the circuit breakers to the shutdown configuration and shutdown the interface systems.

B. References

(1) AMM 23-41-00/501, Service Interphone System
(2) AMM 23-51-00/501, Flight Interphone System
(3) AMM 24-22-00/201, Electrical Power Control
(4) AMM 34-21-00/501, Inertial Reference System
(5) AMM 34-31-00/501, Instrument Landing System
(6) AMM 34-51-00/501, VHF Omnidirection Range (VOR) System
(7) AMM 34-61-00/501, Flight Management Computer System

C. Access

(1) Location Zone

221 Control Cabin, Left
222 Control Cabin, Right

D. Procedure

S 845-143

(1) Shut down the DME system as follows:
(a) Remove power from the test set.
(b) Disconnect the test set antenna from the test set connector.
(c) Put the test set antenna into the test set case.
(d) Make sure these circuit breakers are closed.
1) P11 Overhead Circuit Breaker Panel
a) 11E11, DME LEFT
b) 11E32, DME RIGHT

S 865-144

(2) Shutdown these interface systems if they are no longer necessary:
(a) Service Interphone System (AMM 23-41-00/501).
(b) Inertial Reference System (AMM 34-21-00/501).
(c) Flight Interphone System (AMM 23-51-00/501).
(d) Instrument Landing System (AMM 34-31-00/501).
(e) VHF Omnidirection Range (VOR) System (AMM 34-51-00/501).
(f) Flight Management Computer System (AMM 34-61-00/501)

S 865-145

(3) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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DISTANCE MEASURING EQUIPMENT (DME) INTERROGATOR - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the DME interrogator; the other is the installation of the DME interrogator.
   B. The left, M123, and right, M124, DME interrogators are installed on the E2 rack in the main equipment center. All the electrical connections are at the rear of the unit.

TASK 34-55-01-004-001

2. Remove the DME Interrogator
   A. References
      (1) 20-10-01/401, E/E Rack Mounted Components
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center

   C. Prepare for Removal

      S 864-002

      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11E11, DME LEFT
          (b) 11E32, DME RIGHT
   D. Procedure

      S 024-003

      (1) Remove the DME interrogator (Ref 20-10-01).

TASK 34-55-01-404-004

3. Install the DME Interrogator
   A. References
      (1) 20-10-01/401, E/E Rack Mounted Components
      (2) 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center

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C. Prepare for Installation

S 864-005

(1) Make sure these circuit breakers on the P11 panel are open:
   (a) 11E11, DME LEFT
   (b) 11E32, DME RIGHT

D. Procedure

S 424-006

(1) Install the DME interrogator (Ref 20-10-01).

S 864-007

(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11E11, DME LEFT
   (b) 11E32, DME RIGHT

E. DME Interrogator Test

S 864-008

(1) Supply electrical power (Ref 24-22-00).

S 744-009

(2) Push and hold the TEST switch on the applicable DME interrogator.
   (a) Make sure the sequence that follows occurs:
      1) All the LEDs come on
      2) All the LEDs go off
      3) The green LED comes on and stays on.

F. Put the Airplane Back to Its Usual Condition

S 864-011

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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DISTANCE MEASURING EQUIPMENT (DME) ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the DME antenna; the other is the installation of the DME antenna.
   B. The left, M263, and right, M264, DME antenna installations are the same.

TASK 34-55-02-004-039

2. Remove the DME Antenna (Fig. 401)

   A. Consumable Materials
      (1) B00184 Solvent - BMS 11-7
   B. References
      (1) AMM 20-10-22/701, Metal Surfaces
      (2) AMM 51-31-01/201, Seals and Sealing
   C. Access
      (1) Location Zones
          119/120 Main Equipment Center (Exterior)

   D. Prepare for Removal

      S 864-001
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11E11, DME LEFT
          (b) 11E32, DME RIGHT
   E. Procedure

      S 034-002
      (1) Remove the screws from the antenna base.

      S 034-003

      CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.
      (2) Remove the sealant around the antenna until the seal is fully broken (AMM 51-31-01/201).

      S 144-004

      CAUTION: LOWER THE ANTENNA ONLY AS FAR AS NECESSARY TO DISCONNECT THE CABLE. DAMAGE TO THE ANTENNA CABLE CAN OCCUR IF YOU PULL THE CABLE.

      (3) Lower the antenna until you can get access to the antenna cable connector.

      S 034-005
      (4) Disconnect the antenna cable.

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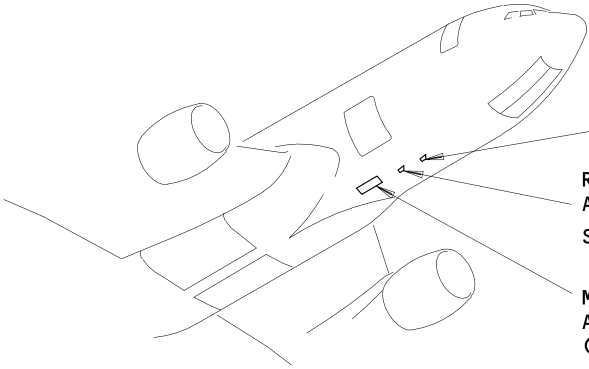
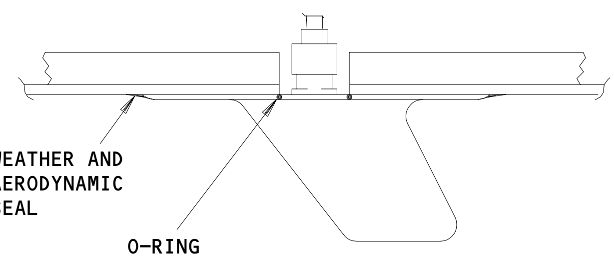
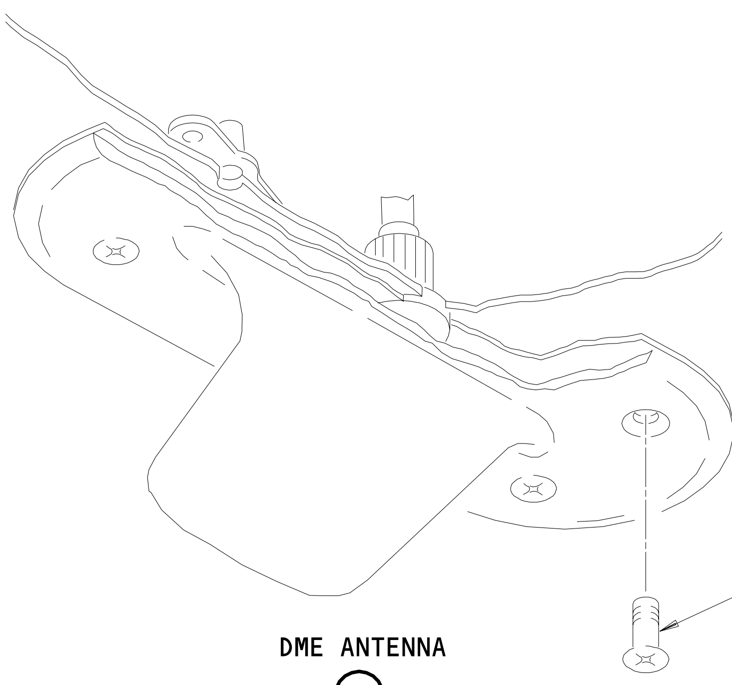




SEALANT LOCATION



DME ANTENNA
A

DME Antenna Installation
Figure 401

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S 024-030

(5) Remove the DME antenna.

S 144-167

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(6) Remove the sealant from the airplane skin in the antenna area (AMM 51-31-01/201).

S 114-032

(7) Clean the airplane surface in the antenna area with the solvent ,BMS 11-7, and a clean rag (AMM 20-10-22/701).

TASK 34-55-02-404-006

3. Install the DME Antenna (Fig. 401)

A. Equipment

(1) Bonding Meter (SWPM 20-20-00)
(2) Brush, soft-bristle (fiber); commercially available
(3) Container, stainless steel or acid resistant; commercially available
(4) Gloves, neoprene or rubber; commercially available
(5) Resistance measuring bridge or ohmmeter that can measure 0.025 ohm
(6) Respirator; commercially available
(7) Sealing gun - 6 inch cartridge
(8) Spatula
(9) ATC Transponder/DME Ramp Test Set, IFR ATC600A

B. Consumable Materials

(1) A00626 Compound - Sealing - BMS 5-95, Class B-1/2
(2) B00107 Chamois Scotchbrite Sheet, Finishing Pads, Type A
(3) B00148 Solvent - Methyl Ethyl Ketone (MEK), TT-M-261
(4) C00064 Coating - Surface Treatment - MIL-C-5541, Type II, Grade C - Alodine 1000 Clear
(5) C00175 Primer - BMS 10-79, Type III

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(6) D00633 Grease - BMS3-33 (Preferred)
(7) D00015 Grease - BMS 3-24 (Alternate)
(8) G00034 Cheese Cloth - Lint Free
(9) G01395 Compound - Corrosion Inhibiting - Mastinox 6856K, BMS 3-27 (Preferred)
(10) C50056 Compound - Non-drying Corrosion Inhibiting Resin Mix, BMS 3-38 (Alternate)
(11) G50136 Paste - Corrosion Inhibiting Non-drying, BMS 3-38 (Alternate)
(12) G50237 Compound - Corrosion Inhibiting, Non-drying Cor-Ban 27L, BMS 3-38 (Alternate)

C. References
(1) AMM 20-10-22/701, Metal Surfaces
(2) AMM 24-22-00/201, Electrical Power - Control
(3) AMM 51-21-04/701, Alodine Coating
(4) AMM 51-31-01/201, Seals and Sealing
(5) SWPM 20-20-00, Electrical Bonding and Grounding

D. Access
(1) Location Zones

119/120	Main Equipment Center
119/120	Main Equipment Center (Exterior)
211/212	Flight Compartment

E. Prepare for Installation

S 864-007
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11E11, DME LEFT
(b) 11E32, DME RIGHT

F. Procedure

S 374-086
(1) SAS 050, 051, 150-157, 162-167, 275-280 WITHOUT SL 51-23;
Do these steps to prepare the airplane surface:
(a) Do this task to apply a layer of alodine 1000 to the airplane mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

(b) Apply two layers of BMS 10-79 type III primer to the airplane mating surface.
1) Let each layer dry for the correct cure time.

S 374-129
(2) SAS 050, 051, 150-157, 162-167, 275-280 WITH SL 51-23, AND SAS 052-149, 158-161, 168-274, 281-999;
If the airplane surface has corrosion or other damage, do these steps to prepare the airplane surface:

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(a) Do this task to apply a layer of alodine 1000 to the airplane mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

(b) Apply two layers of BMS 10-79 type III primer to the airplane mating surface.
1) Let each layer dry for the correct cure time.

S 864-041

(3) Prepare the airplane skin:
(a) Make sure the O-ring is not damaged.
(b) Apply a layer of BMS 3-33 grease in the O-ring groove.
(c) Apply a layer of BMS 3-33 grease on the O-ring.
(d) Install the O-ring in the O-ring groove.
(e) Apply a layer of BMS 3-27 (preferred) or BMS 3-38 (alternate), corrosion inhibiting compound, to the surfaces that follow:
1) The opening for the coaxial cable
2) The nutplates
3) The threads of the bolts.
(f) Apply a very thin layer of the corrosion inhibiting compound, BMS 3-27 (preferred) or BMS 3-38 (alternate) on the mating surfaces of the antenna.
1) Do not get BMS 3-27 or BMS 3-38 in the O-ring groove.

S 424-042

(4) Install the DME antenna.
(a) Connect the coaxial cable to the antenna.
(b) Apply a layer of Dow Corning No. 4 to the connector.
(c) Put the antenna into position on the airplane surface, and install all but one of the screws (Use cadmium-plated stainless steel screws).
(d) Lightly tighten the cad plated stainless steel screws to hold the antenna in the correct position.

CAUTION: TIGHTEN THE SCREWS MANUALLY TO THE CORRECT TOURQUE VALUE. USE OF POWER OR AIR TOOLS TO TIGHTEN THE SCREWS CAN CAUSE DAMAGE TO THE ANTENNA SURFACE.

(e) Manually tighten the screws to 20-25 pound-inches of torque.

G. Resistance Measurement

S 764-043

(1) Do a check of the continuity between the antenna baseplate and the airplane skin (SWPM 20-20-00):
(a) Connect the bonding meter between the antenna baseplate in the empty screw hole and the airplane skin.
(b) Make sure each measurement of continuity is less than 25 milliohms.
(c) Install the last screw.

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S 114-146

(2) If BMS 3-27 or BMS 3-38 is around the edge of the antenna or is on the screw heads, clean the surfaces with solvent, Series 95 (AMM 20-30-95/201) until all of the BMS 3-27 or BMS 3-38 is removed (AMM 51-31-01/201).

NOTE: Sealing compound will not bond to BMS 3-27 or BMS 3-38.

S 394-147

(3) Apply a weather/aerodynamic fillet seal around the base of the antenna with BMS 5-95 sealing compound (AMM 51-31-01/201).

S 624-044

(4) Apply the weather aerodynamic sealant, BMS 5-95, to the head of each screw (AMM 51-31-01/201).

S 144-168

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(5) Remove the unwanted sealant from around the antenna base (AMM 51-31-01/201).

S 864-018

(6) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11E11, DME LEFT
   (b) 11E32, DME RIGHT

H. DME Antenna Test

S 864-019

(1) Supply electrical power (AMM 24-22-00/201).

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S 864-045

CAUTION: DO NOT OPERATE THE TEST SET WHEN ITS ANTENNA IS LESS THAN 15 INCHES FROM THE AIRPLANE ANTENNA. DAMAGE TO THE TEST SET CAN OCCUR.

(2) Adjust the remote test antenna to the same height as the applicable (left or right) DME antenna.

S 864-020

(3) Put the test antenna a specified horizontal distance from the applicable DME antenna. The test antenna coaxial cable shows the necessary distance (approximately 21 inches).

S 864-022

(4) Put the loose end of the coaxial cable into the flight compartment and connect it to the test set.

S 864-034

(5) Set the mode select switch on the applicable EFIS control panel to the VOR-FULL position.

S 864-024

(6) Set an approved test frequency on the applicable VOR control panel.

S 864-025

(7) Energize the DME signal generator and set the controls to these positions:
   (a) Frequency channel - approved test frequency (VOR channel)
   (b) Squitter - ON
   (c) IDENT switch - ON
   (d) Range/Velocity - Range
   (e) Distance - 150.0 nautical miles (NM)
   (f) Reply rate - 100 percent

S 864-037

(8) On the captain's audio select panel, turn on the applicable L VOR or R VOR switch, and adjust the volume.

S 864-038

(9) On the captain's audio select panel, set the filter switch to the RANGE position.

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S 754-027

(10) Make sure a DME audio tone is heard on the flight compartment speakers. Adjust the gain control if necessary.

I. Put the Airplane Back to Its Usual Condition

S 864-028

(1) Turn off and remove the test set.

S 864-029

(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AUTOMATIC DIRECTION FINDER SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The Automatic Direction Finder (ADF) system is a navigational aid. It provides bearing to selected ground stations and is used as an audio receiver. It processes frequencies from 190 kHz to 1750 kHz. This includes the standard AM broadcast and low frequency non-directional beacons.
   B. Two ADF systems are installed. Each system includes one receiver and one fixed sense/loop antenna. A dual system control panel provides control for both systems. Left and right system operation is identical. Only the left system is covered herein.
   C. The ADF system interfaces with the captain's and F/O's radio direction magnetic indicators (RDMI). These display the ADF bearing when they are placed in the ADF mode.
   D. The ADF system also displays bearing on the EFIS EHSI.
   E. The ADF system receives an electromagnetic wave transmitted by a ground station. The loop antenna intercepts the magnetic portion of the wave and couples this signal to the ADF receiver. The sense antenna intercepts the electric portion and couples this signal to the receiver. The receiver processes both signals. If the bearing mode (ADF) has been selected on the control panel, the receiver provides bearing output signals to drive the RDMI and EHSI bearing pointers. The receiver also provides an audio signal to the interphone system.
2. Component Details (Fig. 1)
   A. ADF Antenna
      (1) Each ADF sense/loop antenna is a fixed integrated design. The antennas are located on the top centerline of the airplane.
      (2) The ADF antenna is comprised of one omnidirectional sense and two bidirectional loop antennas. They are enclosed in a tear-drop shaped synthetic shell. This shell also contains three pre-amplifiers and three transformers. These are mounted on the antenna's electronic assembly.
      (3) The loop antennas provide bearing signals to the ADF receiver. They are mounted at 90° to each other. One winding is mounted parallel to the airplane centerline.
      (4) The sense antenna is used for audio reception. It also provides a reference phase signal. In the ADF mode, this signal resolves the 180° phase ambiguity of the loop antennas.

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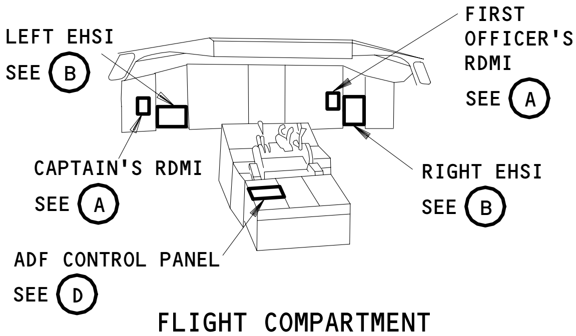
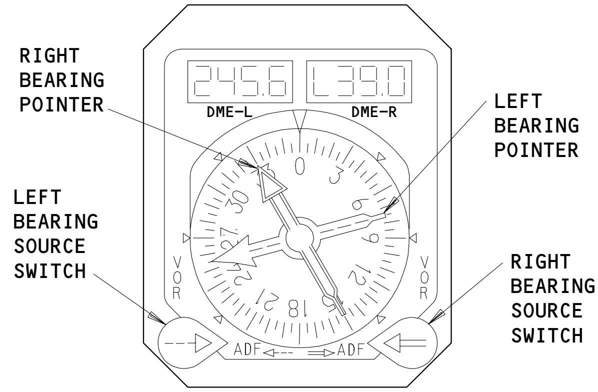
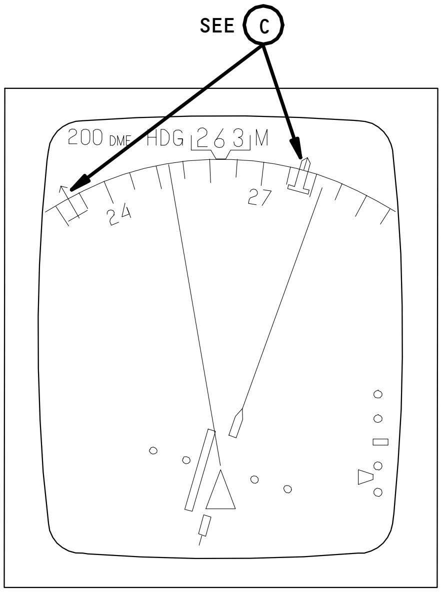


FLIGHT COMPARTMENT



RDMI

A



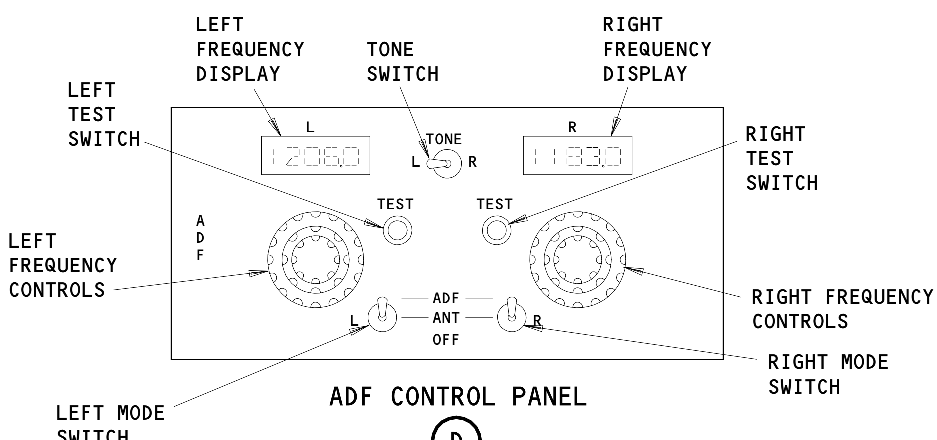
EHSI (INTERFACE)

B

SYMBOL	NAME	CONDITION
	L ADF	WHEN L ADF SYS ON, SYMBOL DISPLAYED (WHEN IN VIEW) ON COMPASS ROSE FOR ALL EFIS MODES
	L ADF RECIPROCAL	
	R ADF	WHEN R ADF SYS ON, SAME CONDITIONS AS ABOVE.
	R ADF RECIPROCAL	

EFIS EHSI-ADF SYMBOLOGY

C



ADF CONTROL PANEL

D

Automatic Direction Finder (ADF) System - Component Location
Figure 1 (Sheet 1)

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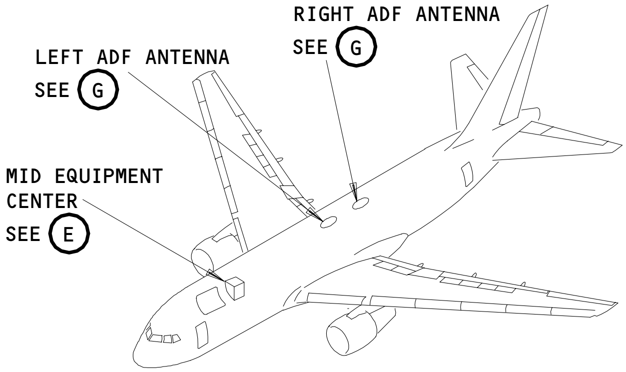
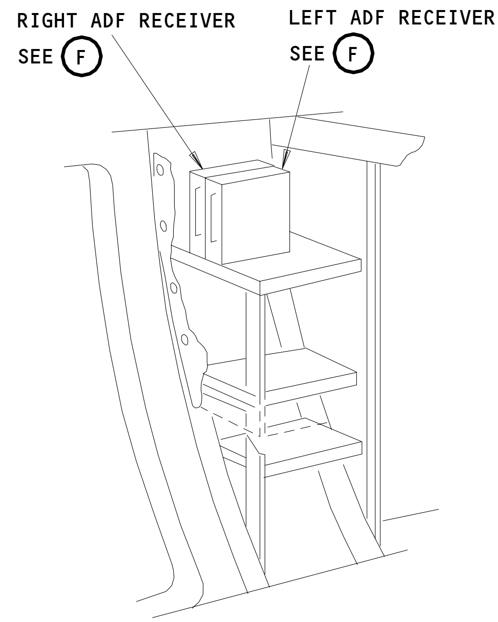
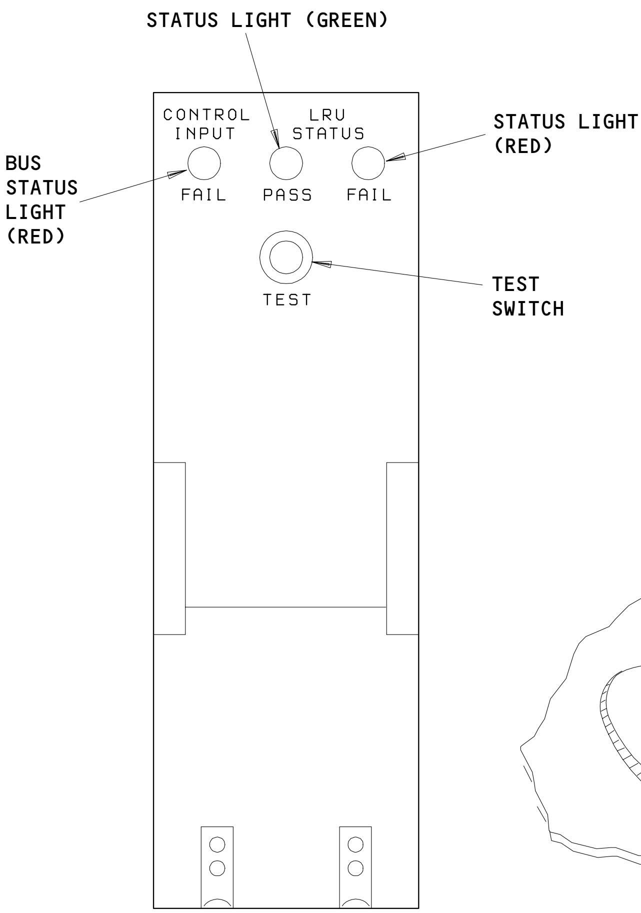




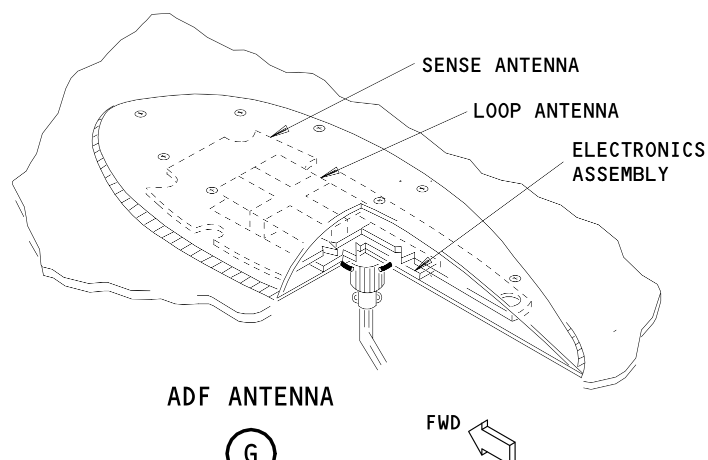
MID EQUIPMENT CENTER

E



ADF RECEIVER

F



ADF ANTENNA

G

ADF System - Component Location
Figure 1 (Sheet 2)

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B. ADF Control Panel

(1) The Single ADF control panel (1 or 2) or Dual ADF control panels (1 or 2) are located on the AFT electronics panel (P8).

(2) The left ADF control panel controls the left ADF receiver (if installed) and the right control panel controls the right ADF receiver (if installed).

(3) AIRPLANES WITH ADF, ANT, OR OFF SWITCH ON THE ADF CONTROL PANEL;
The ADF control panel selects the frequency and mode of operation for the ADF system. The two modes of operation of the ADF system are selected on the mode selector switch. The mode of operation of the left ADF system are selected on the left system mode selector switch (if installed). The right system mode selection is done independently on the right system mode selector switch (if installed). The ANT mode is used to receive AM radio or weather broadcasts. No bearing information is displayed. In the ANT mode, only the sense antenna circuits are used. In the ADF mode, all ANT modes are performed. Also, bearing to the selected station is determined and displayed on the RDMI or RMI and EHSI (if installed). This mode requires both sense and loop antenna inputs. The OFF mode turns the system off (if Installed). A mode indication of ADF or ANT will show on the left side of the frequency display (if installed).

(4) Each ADF receiver's operating frequency is selected on one of the two sets of three concentric knobs. The left knob controls the left RCVR (IF INSTALLED). The right knob controls the right RCVR (IF INSTALLED) . The outer knobs select kHz in thousands and hundreds. The middle knob selects the 10 kHz range and the inner knob selects units in 0.5 kHz increments. The selected frequency is displayed in the respective window above each set of knobs.

(5) AIRPLANES WITH TFR SWITCH ON THE ADF CONTROL PANEL;
The frequency transfer (TFR) switch selects which knob set is used for frequency selection. The light above the frequency display comes on for the selected side.

(6) AIRPLANES WITH ANT SWITCH ON THE ADF CONTROL PANEL;
When the control panel is placed in the ANT mode, a BFO tone (1020Hz) is automatically injected into the receivers audio output. This is done to verify station reception.

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(7) AIRPLANES WITH TONE ON/OFF SWITCH ON THE ADF CONTROL PANEL;
The TONE ON/OFF switch is used during ANT mode operation and enable a BFO tone (1020 Hz) to be injected into the left or right receivers' audio output to verify station reception.

(8) ARIPLANES WITH ADF, ANT, OFF AND TONE SWITCH ON THE ADF CONTROL PANEL;
The TONE switch is used during ANT mode operation to inject a BFO tone (1020 Hz) into the left or right receivers' audio output to verify station reception.

(9) AIRPLANES WITH TEST SWITCH ON THE ADF CONTROL PANEL;
The TEST buttons initiate a system self-test for the corresponding left (L=1) or right (R=2) receiver unit.

C. ADF Receiver

(1) The ADF receivers (2) are located on shelf 1 of rack E5, in the mid equipment center.

(2) The ADF receiver processes the rf signals from the antenna. It operates in the mode and frequency selected on the control panel. The receiver provides bearing and/or audio output signals accordingly. The front panel of the receiver contains a self test switch and three pass/fail status lights.

D. RDMI (Interface)

(1) The two RDMIs are located on the captain's and first officer's instrument panels (P1 and P3) respectively.

(2) The RDMI displays ADF bearing when either VOR/ADF switch is in the ADF position. Bearing is displayed by the two pointers. For an ADF system malfunction, the respective bearing flag will show.

E. Electronic Horizontal Situation Indicator (EHSI) (Interface)

(1) The two EHSIs are located on the captain's and first officer's instrument panels (P1 and P3) respectively.

(2) The EHSIs continuously display the ADF bearing pointers on the compass rose. For an ADF malfunction, the respective fail flags will show (AMM 34-22-00/001).

F. Flight Interphone System (Interface)

(1) The flight interphone system provides audio output as received from the ADF receiver. This can be standard AM radio, weather, or identification tone audio output. The output depends upon the frequency (ground station) selected on the ADF control panel.

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3. Operation (Fig. 2)
   A. Functional Description
      (1) The left ADF system receives 115v ac from the left main power bus.
      (2) The right ADF system receives 115v ac from the standby power bus.
      (3) The receiver's internal dc power supplies provide dc voltage for system operation. They also supply ±12 volts dc to the applicable antenna pre-amplifiers.
      (4) Operation is started by the control panel when it provides digital control data to the ADF receiver. The selected frequency, the tone (when selected), and the mode select discretes enter the corresponding switch encoder. The information is sent to a digital processor for each channel. For the selected channel, the data is sent to the ADF receiver via an ARINC 429 digital data bus.
      (5) In the receiver, the control panel data is examined in the function decoder. If the data is valid, frequency data is sent to the frequency tuning control circuits. Here, tuning is performed. Selected frequency, control, ADF/ANT, and BFO mode select data are also sent to the synthesizer circuit. This circuit provides mode and modulation control signals to other circuits.
      (6) The rf inputs are provided by the ADF antenna. These inputs include an input from the omni-directional sense antenna and an input from each of the two loop antennas.
      (7) In the ANT mode, the sense signal is processed by the receiver. The signal is transformed into an audio output signal and sent to the flight interphone system.
      (8) In the ADF mode, the loop signals are summed with the sense signal. This eliminates the 180° phase ambiguity. (180° phase ambiguity is the inability of the loop antenna to detect which of two relative bearings are correct that come from 180° apart). The combined signal is used to compute bearing information to the transmitting station. Audio is also sent to the flight interphone system.
      (9) The antenna loop inputs are first amplitude modulated by a 92 Hz signal. The modulation signal, to one antenna input, is shifted 90° with respect to the other signal. The two loop signals are summed to produce a composite modulated signal. The phase relationship of this signal is proportional to the bearing to the selected transmitting station. The composite signal is summed with the sense antenna input. This deletes the 180 degree ambiguity to produce a composite rf signal. The composite rf signal is then filtered and mixed. This converts the input frequency to a 15 MHz first IF frequency. The injection input to the mixer is tunable over the range from 15.19 to 16.75 MHz. This range corresponds to a receiver tuning range of 190 to 1750 kHz. The 15 MHz signal is converted to a second IF frequency of 3.6 MHz. The mixer input from the frequency synthesizer is a fixed frequency of 18.6 MHz. The output of the 3.6 MHz IF is connected to a 3.6 MHz coherent detector.

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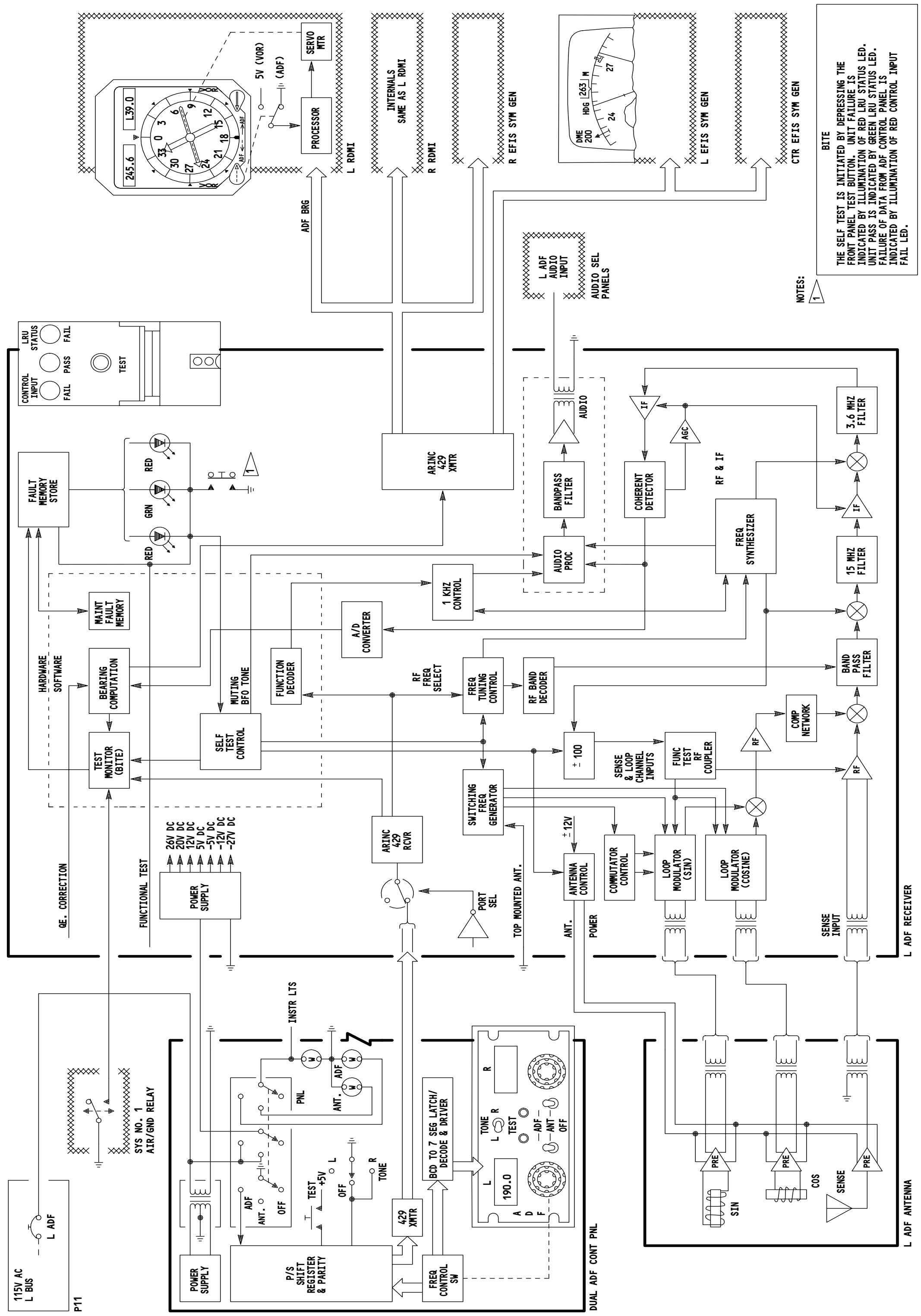

ADF System Schematic (Example)
Figure 2

191639

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(10) The coherent detector provides three outputs: an AGC signal which controls the gain of the two IF stages; an audio output connected to the flight interphone system; and a composite audio output connected to an A/D converter. Here, the composite signal and a 92 Hz reference signal are converted to digital form. The processor computes the phase relationship between the reference and composite signals. It then applies quadrantal error correction (QEC) to this phase data to produce bearing to the tuned station.

(11) QEC compensates for signal distortion due to airplane structure. It is unique for each type of airplane. QEC is programmed on the receiver connector. Pins are connected (open or ground) to reflect the QEC required for that type of airplane.

(12) The bearing information is sent to the RDMIs via an ARINC 429 digital data bus. In the RDMI, the data is converted to analog data and then to electromechanical information which drives the bearing needles (Ref 34-22-00).

(13) The bearing information is also sent to the EFIS Symbol Generators via an ARINC 429 digital data bus. The information is displayed on the EHSIs when the EFIS is in the MAP, EXP ILS, EXP VOR, FULL ILS or FULL VOR modes (Ref 34-22-00).

(14) For audio signals, the output is applied to the audio processor. When a CW station is selected, a BFO tone (1020 Hz) and muting signal are also applied to the processor. The muting signal prevents an audio output when a weak or no signal is being received. The output passes through the filter and transformer to the audio select panels.

B. ADF - BITE

(1) The ADF receiver continuously monitors system operation. All detected faults are stored in the fault memory. Any active faults will be annunciated on the RDMIs or on the RCVR front panel during a self-test. The system stores fault conditions for the past 49 flights. Each flight segment is marked by operation of the air/ground relay. Fault memory may be accessed on the ground by an ATE connector on the rear of the unit. Also, a seven segment LED readout inside the receiver shows detected faults. It is used for shop maintenance.

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C. ADF Self Test

(1) System self-test is always initiated at power turn on. It also can be initiated at any other time by pressing the TEST button on the ADF control panel or the ADF receiver front panel. The receiver front panel self-test indications are displayed only during a receiver initiated test.

(2) In the receiver, BITE circuits inject an rf signal into the modulator and sense amplifier circuits. Processing of the signals is performed as previously described. The data is sent to the RDMIs.

(3) At the start of the test, the lights on the receiver front panel illuminate for approximately three seconds and then turn off. The RDMI bearing flag and EHSI ADF fail flag appear for approximately six seconds and for the duration of the test, the bearing pointer is driven to 135°. If the test passes, the green PASS light will illuminate at the end of the test. If the test fails, the corresponding red FAIL light(s) will illuminate at the end of the test.

(4) An rf and audio circuit test is accomplished by setting the control panel mode selector to ANT. A local radio station is tuned and the audio output is monitored on the flight interphone system (Ref 23-51-00).

D. Control

(1) To place the ADF system in operation, the following steps are required:

(a) Supply electrical power (AMM 24-22-00/201).

(b) Close the following overhead panel P11 circuit breakers:

1) ADF (2 locations)

2) RDMI (2 places)

(c) On the ADF control panel, set the frequency controls to a known broadcast frequency and set the mode switch to the ADF position.

(d) On the RDMIs, place applicable mode switches in ADF.

(e) On the RDMIs, check that bearing flags are out of view and applicable bearing needles are pointing to the selected station.

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(f) On the audio select panels, adjust ADF volume and listen for selected station.

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AUTOMATIC DIRECTION FINDER (ADF) SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
ANTENNA - LEFT ADF, M265	1	1	TOP OF FUSELAGE	34-57-03
ANTENNA - RIGHT ADF, M266	1	1	TOP OF FUSELAGE	34-57-03
CIRCUIT BREAKER -	2		FLIGHT COMPARTMENT, P11	
ADF LEFT, C607		1	11F6	*
ADF RIGHT, C632		1	11A3	*
INDICATOR - (FIM 34-22-00/101)				
LEFT RDMI, N3				
RIGHT RDMI, N43				
PANEL - ADF CONTROL, M1046	2	1	FLIGHT COMPARTMENT, P8	34-57-02
RECEIVER - LEFT ADF, M215	2	1	821, MID EQUIPMENT CENTER, E5-1	34-57-01
RECEIVER - RIGHT ADF, M216	2	1	821, MID EQUIPMENT CENTER, E5-1	34-57-01
RELAY - (FIM 31-01-36/101)				
SYS NO. 1 AIR/GND, K124				
SYS NO. 2 AIR/GND, K214				

* SEE THE WDM EQUIPMENT LIST

Automatic Direction Finder (ADF) System - Component Index
Figure 101

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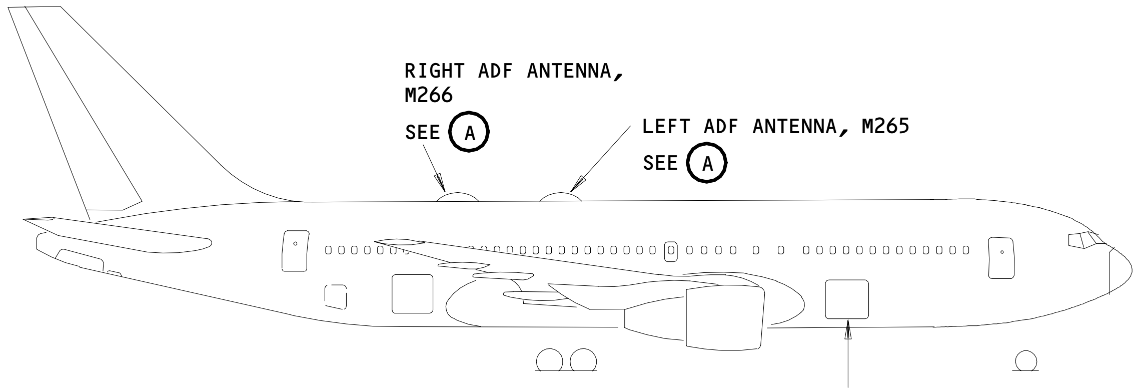

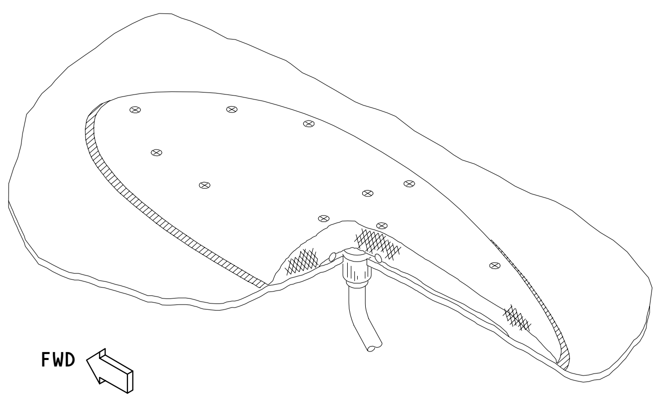

LEFT OR RIGHT ADF ANTENNA, M265 OR M266
A

Automatic Direction Finder (ADF) System - Component Location
Figure 102 (Sheet 1)

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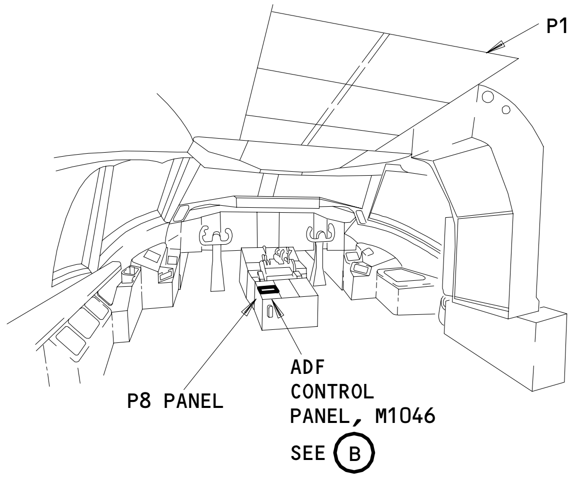
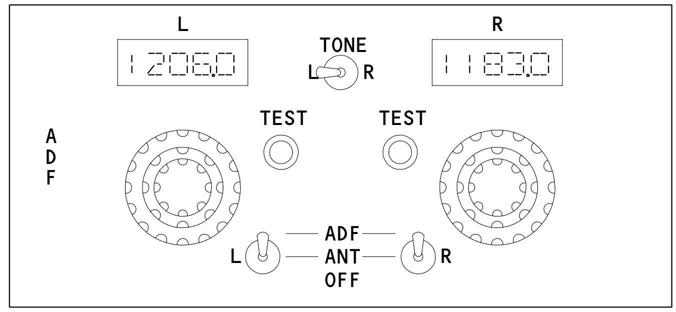
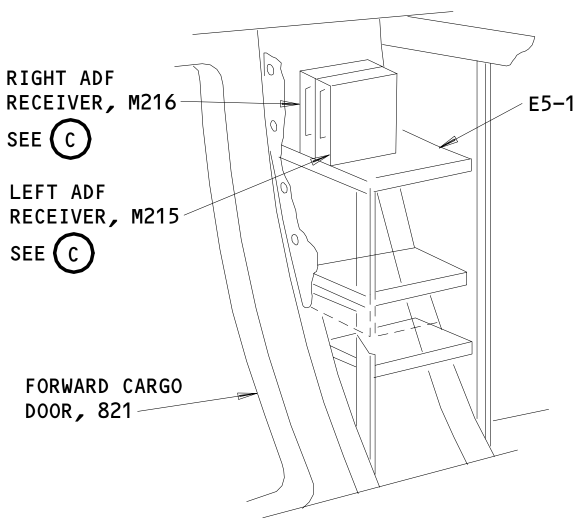


FLIGHT COMPARTMENT

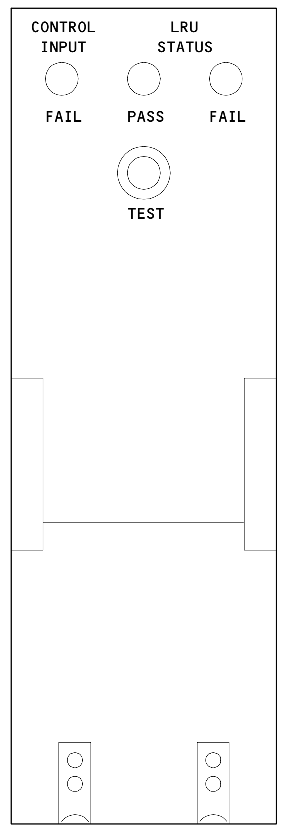


ADF CONTROL PANEL, M1046

B



MID EQUIPMENT CENTER



LEFT OR RIGHT ADF RECEIVER,
M215 OR M216

C

Automatic Direction Finder (ADF) System - Component Location
Figure 102 (Sheet 2)

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AUTOMATIC DIRECTION FINDER (ADF) SYSTEM - ADJUSTMENT/TEST

1. General
   A. This procedure is an operational test of all the units in the ADF system. It is necessary to have operational standard broadcast and low frequency transmitting stations in the area.

      NOTE: Bearing checks made in an airplane hangar are not satisfactory.

TASK 34-57-00-715-001

2. ADF System - Operational Test
   A. Equipment
      (1) Headphone
   B. References
      (1) 24-22-00/201, Electrical Power - Control
      (2) 34-22-00/501, Electronic Flight Instrument System (EFIS) - Adjustment/Test
      (3) 34-61-00/501, Flight Management Computer (FMC) - Adjustment/Test
   C. Access
      (1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

   D. Prepare for the Operational Test

      S 865-002
      (1) Supply electrical power (Ref 24-22-00).

      S 865-123
      (2) Make sure the Flight Interphone System is on (AMM 23-51-00/501).

      S 865-133
      (3) Make sure the Electronic Flight Instrument System (EFIS) is on (AMM 34-22-00/501).
   E. Left ADF Test

      S 865-008
      (1) On the RDMIs, set the left and right bearing source switches to the ADF position.

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S 865-015
(2) Set the mode switches on the EFIS control panels to the MAP position.

S 745-016
(3) Push and hold the TEST switch on the left ADF receiver.

S 755-017
(4) Make sure this sequence occurs as follows on the left ADF receiver:
   (a) All the LEDs come on
   (b) All the LEDs go off
   (c) The green LED comes on and stays on.

S 755-018
(5) Make sure this sequence of indications occurs as follows:
   (a) The left ADF/VOR warning flags on the RDMIs come into view.
   (b) The ADFL fail flag comes into view on the EHSIs at the same time as the RDMI warning flags come into view.
   (c) On the RDMIs, the flags go out of view and the thin bearing pointers go to 135° (±5) fixed markers on the instrument cases.
   (d) On the EHSIs, the flags go out of view and the ADF pointer goes to 135° (±5) relative to the top of the display.

S 745-019
(6) Release the TEST switch on left ADF receiver.

F. Right ADF Test

S 715-024
(1) Do the right ADF test the same as the left ADF test. Use the right ADF receiver, the right ADF/VOR warning flags on the RDMIs, and the ADFR fail flags on the EHSIs.

G. Prepare for the Left ADF Audio Test

S 865-030
(1) On the ADF control panel, set the controls as follows:
   (a) The left mode switch to the ANT position

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(b) The TONE switch to the L position.

S 755-037
(2) Make sure the left ADF/VOR warning flags on the RDMIs come into view.

H. The Left ADF Audio Test

S 865-052
(1) On the captain's audio selector panel, set the controls as follows:
(a) The L ADF audio switch to the ON position
(b) All other audio switches to the off position
(c) The filter switch to the BOTH position.

S 865-091
(2) Connect the headphones.

S 865-045
(3) On the ADF control panel, turn the left frequency switch to a CW broadcast frequency.

S 755-047
(4) Make sure a 1020 CW identification tone is heard on the headphones.

S 865-048
(5) On the captain's audio selector panel, adjust the L ADF volume if necessary.

S 715-049
(6) Do the Audio Test for the remaining audio selector panels.

I. Prepare for the Right ADF Audio Test

S 865-053
(1) On the ADF control panel, set the controls as follows:
(a) The right mode switch to the ANT position
(b) The TONE switch to the R position.

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J. The Right ADF Audio Test

S 715-070

(1) Do the right ADF audio test the same as the left ADF audio test. Use the right system ADF controls, and the R ADF interphone controls (Turn off the L ADF interphone controls).

K. Prepare for the ADF Bearing Test

S 865-057

(1) On the ADF control panel, set the controls as follows:
    (a) The mode switches to the ADF position
    (b) The TONE switch to the off position.

L. The Right ADF Bearing Test

S 865-073

(1) On the ADF control panel, turn the right frequency switch to a standard broadcast frequency between 190 and 1750 kHz.

S 755-074

(2) Make sure the thick bearing pointer on the RDMIs points to the correct bearing.

S 755-076

(3) On the captain's audio selector panel, make sure a clear signal is heard on the headphones.

S 715-077

(4) Do the Right ADF Bearing Test again for each audio selector panel.

M. The Left ADF Bearing Test

S 865-080

(1) On the captain's audio selector panel, turn off the R ADF volume and adjust the L ADF volume as necessary.

S 865-083

(2) On the ADF control panel, turn the left frequency switch to a standard broadcast frequency between 190 and 1750 kHz.

S 755-084

(3) Make sure the thin bearing pointer on the RDMIs points to the correct bearing.

S 755-086

(4) On the captain's audio selector panel, make sure a clear signal is heard on the headphones.

S 865-087

(5) On the ADF control panel, turn the left and right frequency switches to the same broadcast frequency.

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S 755-089

(6) Make sure the thin and thick bearing pointers on the RDMIs point to the correct bearing.

N. Put the Airplane Back to Its Usual Condition

S 865-079

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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AUTOMATIC DIRECTION FINDER (ADF) RECEIVER - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the ADF receiver and the other is the installation of the ADF receiver.

TASK 34-57-01-004-001

2. ADF Receiver Removal
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
   B. Access
      (1) Location Zone
          122 Forward Cargo Compartment (Right)

   C. Procedure

      S 864-003
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11A3, ADF RIGHT
          (b) 11F6, ADF LEFT
   D. Procedure

      S 014-004
      (1) Open the door to the E5 rack.

      S 024-005
      (2) Remove the ADF receiver (AMM 20-10-01/401).

TASK 34-57-01-404-006

3. ADF Receiver Installation
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
      (2) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          122 Forward Cargo Compartment (Right)
          211/212 Flight Compartment

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C. Procedure

S 864-008
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11A3, ADF RIGHT
(b) 11F6, ADF LEFT

S 214-009
(2) Make sure the pins on the electrical connectors are not loose, dirty, or broken.

S 424-010
(3) Install the ADF receiver (AMM 20-10-01/401).

S 864-012
(4) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11A3, ADF RIGHT
(b) 11F6, ADF LEFT

D. ADF Receiver Test

S 864-013
(1) Make sure these circuit breakers on the P11 panel are closed:
(a) 11A6, RDMI L
(b) 11F25, RDMI RIGHT

S 864-014
(2) Supply electrical power (AMM 24-22-00/201).

S 864-017
(3) Set the ADF/VOR switches on the RDMIs to the ADF position.

S 864-031
(4) Make sure the ADF receiver is not tuned to a valid AM broadcast station in the area.

S 744-022
(5) Push and hold the TEST switch on the applicable ADF receiver.

S 754-023
(6) Make sure this sequence occurs on the ADF receiver:
(a) All the LEDs come on

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(b) All the LEDs go off
(c) The green LED comes on and stays on.

S 754-041
(7) Make sure these indications occur on the RDMI:
(a) The ADF/VOR warning flags come into view.
(b) The flags go out of view and the thin and thick pointers stop at the 135° (±5°) fixed markers on the instrument cases.

S 744-026
(8) Release the TEST switch on the ADF system.

E. Put the Airplane Back to Its Usual Condition

S 414-024
(1) Close the door to the E5 rack.

S 864-025
(2) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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AUTOMATIC DIRECTION FINDER (ADF) CONTROL PANEL - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the ADF control panel; the other is the installation of the ADF control panel.
   B. The ADF control panel is installed on the aisle control stand, P8.

TASK 34-57-02-004-001

2. ADF Control Panel Removal
   A. Access
      (1) Location Zones
          211/212 Flight Compartment

   B. Procedure

      S 864-002
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11A3, ADF RIGHT
         (b) 11F6, ADF LEFT

      S 034-004
      (2) Loosen the screws on the control panel.

      S 014-005
      (3) Move the control panel out to get access to the electrical connections.

      S 034-006
      (4) Disconnect the electrical cable.

      S 024-007
      (5) Remove the ADF control panel.

TASK 34-57-02-404-008

3. ADF Control Panel Installation
   A. References
      (1) 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

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C. Procedure

S 864-009
(1) Make sure these circuit breakers on the P11 panel are open:
(a) 11A3, ADF RIGHT
(b) 11F6, ADF LEFT

S 434-011
(2) Connect the electrical cable to the control panel.

S 424-012
(3) Install the ADF control panel.

S 434-013
(4) Tighten the screws.

S 864-015
(5) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11A3, ADF RIGHT
(b) 11F6, ADF LEFT

S 864-016
(6) Supply electrical power (Ref 24-22-00/201).

S 754-017
(7) Make sure the control panel lights come on.

D. Put the Airplane Back to Its Usual Condition

S 864-018
(1) Remove electrical power if it is not necessary (Ref 24-22-00/201).

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AUTOMATIC DIRECTION FINDER (ADF) ANTENNA - REMOVAL/INSTALLATION

1. General
   A. This procedure has two tasks. One is the removal of the ADF antenna; the other is the installation of the ADF antenna.
   B. Two ADF antennas are installed on the top of the fuselage. The left system antenna is installed in the forward position. The right antenna is installed in the aft position.

TASK 34-57-03-004-001

2. ADF Antenna Removal

   A. References
      (1) AMM 20-10-22/701, Metal Surfaces
      (2) AMM 51-31-01/201, Seals and Sealing
   B. Access
      (1) Location Zones
         243/244 Area Above Passenger Cabin Ceiling (Exterior)

   C. Procedure

      S 864-003
      (1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
         (a) 11A3 or 11F6, ADF LEFT
         (b) 11A3 or 11F27, ADF RIGHT

      S 034-004
      (2) Remove the screws from the antenna.

      S 034-072

      CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

      (3) Remove the sealant around antenna until the seal is fully broken (AMM 51-31-01/201).

      S 014-005

      CAUTION: MOVE THE ANTENNA ONLY AS FAR AS NECESSARY TO DISCONNECT THE CABLE. DAMAGE TO THE ANTENNA CABLE CAN OCCUR IF YOU PULL THE CABLE.

      (4) Move the antenna until you can get access to the antenna cable connector.

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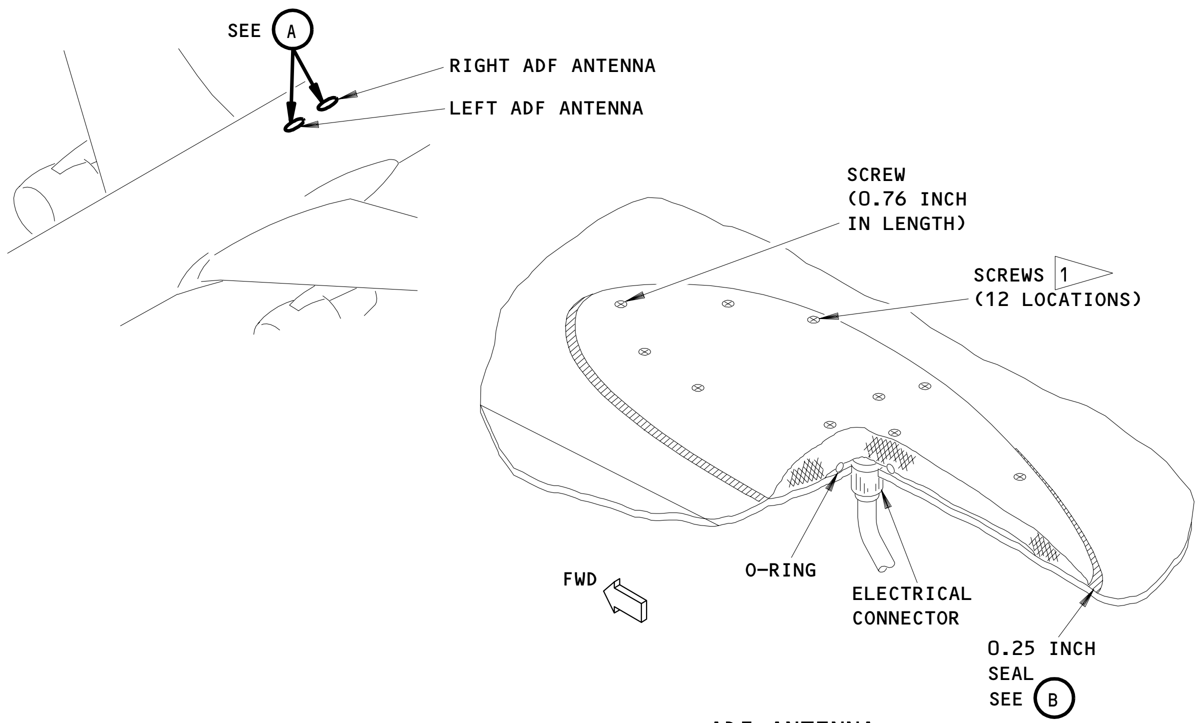
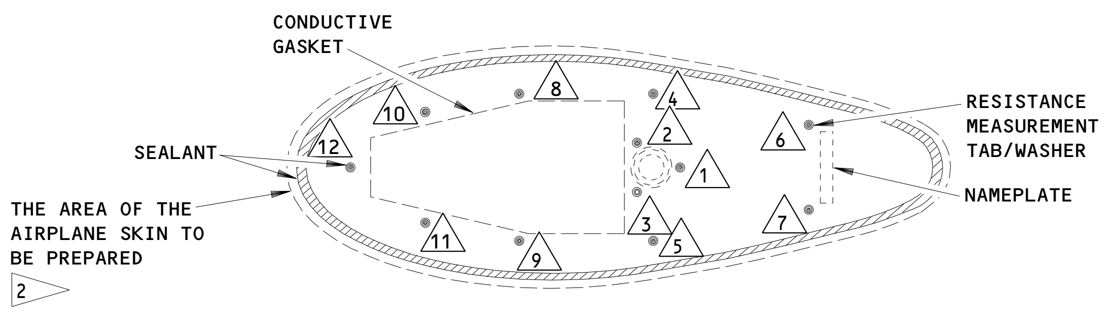


ADF ANTENNA

A



AERODYNAMIC WEATHERPROOF SEAL
(TOP VIEW)

B

NOTE: 1 THROUGH 12 INDICATES TORQUING SEQUENCE OF SCREWS.

1 NO. 10 5/32 TYPE SCREW, 1.55 INCHES IN LENGTH

2 MAKE SURE THAT THE EDGE OF THE PREPARED AREA IS NO FARTHER THAN 0.25 INCH OUT FROM THE EDGE OF THE ANTENNA.

ADF Antenna Installation
Figure 401

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S 034-006
(5) Disconnect the antenna cable.

NOTE: Do not let the antenna cable fall into the fuselage.

S 434-007
(6) Put a protective cover on the cable connector.

S 024-008
(7) Remove the ADF antenna.

S 024-360

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE AND APPLY THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(8) Remove the sealant from the airplane skin in the antenna area (AMM 51-31-01/201).

TASK 34-57-03-404-021

3. ADF Antenna Installation

A. Equipment
(1) Resistance measuring bridge or ohmmeter that can measure 0.025 ohms

B. Consumable Materials
(1) A00145 Sealant (alternative) - Aerodynamic BMS 5-95 Class B2
(2) A00706 Sealant (alternative) -
PR1826, Class B 1/2 and B 1/4 (with primer) dark grey
PR1828, Class B 1/2 and B 1/4, white
(3) B00512 Solvent (alternative) - Naphta, Commercially available
(4) B00148 Solvent (alternative) - Methyl Ethyl Ketone (MEK), TT-M-261
(5) A02315 Sealant (alternative) - Aerodynamic BMS 5-142
(6) C00175 Primer - BMS 10-79 Type III
(7) C00855 Alodine
(8) G00034 Cheesecloth - New, Clean, Dry, Lint Free
(9) G01395 Compound - Corrosion Inhibiting Mastinox 6856K, BMS 3-27 (Preferred)

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(10) C50056 Compound - Non-drying Corrosion Inhibiting Resin Mix, BMS 3-38 (Alternate)
(11) G50136 Paste - Corrosion Inhibiting, Non-drying, BMS 3-38 (Alternate)
(12) G50237 Compound - Corrosion Inhibiting, Non-drying Cor-Ban 27L, BMS 3-38 (Alternate)
(13) D00633 Grease - BMS 3-33 (Preferred)
(14) D00015 Grease - BMS 3-24 (Alternate)

C. References
(1) AMM 24-22-00/201, Control
(2) AMM 51-21-04/701, Alodine Coating
(3) AMM 51-31-01/201, Seals and Sealing
(4) SWPM 20-20-00, Electrical Bonding and Grounding

D. Access
(1) Location Zones

211/212	Flight Compartment
243/244	Area Above Passenger Cabin ceiling (Exterior)

E. Procedure

S 864-081
(1) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
(a) 11A3 or 11F6, ADF LEFT
(b) 11A3 or 11F27, ADF RIGHT

S 114-260

WARNING: DO NOT GET SOLVENTS IN YOUR MOUTH, OR YOUR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENTS. SOLVENTS ARE HAZARDOUS MATERIALS. SOLVENTS MAY BE FLAMMABLE OR HARMFUL TO THE ENVIRONMENT. REFER TO PRODUCT MATERIAL SAFETY DATA SHEETS (MSDS) AND LOCAL REQUIREMENTS FOR PROPER HANDLING PROCEDURES.

(2) Clean the airplane mating surface with solvent, Series 88 (AMM 20-30-88/201):
(a) Make a clean cheesecloth moist (not soaked) with solvent, Series 88 (AMM 20-30-88/201).
(b) Rub the airplane mating surface with the cheesecloth until the surface is clean.

S 374-200
(3) SAS 050, 051, 150-157, 162-167, 275-280 WITHOUT SL 51-23;
Do these steps to prepare the airplane surface:
(a) Do this task to apply a layer of alodine 1000 to the airplane mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

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(b) Apply two layers of BMS 10-79 type III primer to the airplane mating surface.
   1) Let each layer dry for the correct cure time.

S 374-244

(4) SAS 050, 051, 150-157, 162-167, 275-280 WITH SL 51-23, AND SAS 052-149, 158-161, 168-274, 281-999;
If the airplane surface has corrosion or other damage, do these steps to prepare the airplane surface:
(a) Do this task to apply a layer of alodine 1000 to the airplane mating surface: Apply the Alodine Coating (AMM 51-21-04/701).

NOTE: This task removes corrosion, cleans the surface, and applies the alodine.

(b) Apply two layers of BMS 10-79 type III primer to the airplane mating surface.
   1) Let each layer dry for the correct cure time.

S 394-126

(5) Do these steps to do the corrosion protection for the mating surface and to install the o-ring.
(a) Apply a layer of BMS 3-27 (preferred) or BMS 3-38 (alternate) in the the fastener holes and the connector hole.
(b) Apply a layer of BMS 3-33 on the o-ring and o-ring groove.
(c) Install the o-ring on the new antenna.
(d) Apply one very thin layer of the BMS 3-27 (preferred) or BMS 3-38 (alternate) to the antenna base plate.

NOTE: Make sure BMS 3-27 or BMS 3-38 does not get on the o-ring or in the o-ring groove.

(e) Apply a layer of BMS 3-27 (preferred) or BMS 3-38 (alternate) on the threads and shanks of the fasteners.

S 424-074

(6) Install the ADF antenna:
(a) Remove the protective cover from the cable connector.
(b) Connect the electrical cable to the antenna.
(c) Put the new antenna into position on the airplane surface.
(d) Lightly tighten the screws in sequence as shown in Figure 401.

CAUTION: TIGHTEN THE SCREWS MANUALLY TO THE CORRECT TORQUE VALUE. USE OF POWER OR AIR TOOLS TO TIGHTEN THE SCREWS CAN CAUSE DAMAGE TO THE ANTENNA SURFACE.

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(e) Manually tighten the screws to 20-25 pound-inches of torque in sequence as shown in Figure 401.

(f) Carefully remove excess BMS 3-27 or BMS 3-38 from around the fastener heads and around the periphery of the antenna with solvent, Series 95 (AMM 20-30-95/201).

NOTE: Care must be taken to completely remove excess BMS 3-27 or BMS 3-38. If BMS 3-27 or BMS 3-38 is not completely removed, poor adhesion of the weather proof sealant will result.

S 764-079

(7) Do the resistance measurement as follows:

(a) Use an ohmmeter to make sure the resistance is less than 25 milliohms between the tab/washer on the right rear screw and the airplane skin (SWPM 20-20-00).

S 434-056

(8) Apply a weatherproof sealant, BMS 5-95 or BMS 5-142, in a 1/4 inch seal, at 45 degrees, around the outer edge of the antenna base (AMM 51-31-01/201).

NOTE: PR 1826 and PR 1828 sealants are recommended when a short cure time is important.

S 434-057

(9) Apply the sealant, BMS 5-95 or BMS 5-142, on all the screw hole, counter-bored areas to make the antenna surface smooth (AMM 51-31-01/201). Do not fill the recessed areas of the screw heads (use cotton to fill these areas).

NOTE: PR1826 and PR1828 sealants are recommended when a short cure time is important.

S 144-359

CAUTION: OBEY THE INSTRUCTIONS IN THE PROCEDURE TO REMOVE AND APPLY THE SEALANT. IF YOU DO NOT OBEY THE INSTRUCTIONS, DAMAGE TO THE AIRPLANE SURFACE CAN OCCUR.

(10) Remove the unwanted sealant from around the antenna base (AMM 51-31-01/201).

S 864-060

(11) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:

(a) 11A3, ADF RIGHT

(b) 11F6, ADF LEFT

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F. ADF Antenna Test

S 864-061
(1) Supply electrical power (AMM 24-22-00/201).

S 864-063
(2) On the ADF control panel, set the controls to these positions as follows:
(a) The mode switch to the ADF position
(b) The TONE switch to the system that was not replaced.
(c) The frequency select switches to a local broadcast station between 190 and 1750 kHz.

S 864-065
(3) Set the bearing source switches on the RDMIs to the ADF position.

S 754-067
(4) Make sure the RDMIs show the correct bearing.

G. Put the Airplane Back to Its Usual Condition

S 864-070
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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FLIGHT MANAGEMENT COMPUTER SYSTEM - DESCRIPTION AND OPERATION

1. General (Fig. 1)
   A. The Flight Management Computer System (FMCS) provides flight information to the pilots in the form of navigation, performance management, guidance, and integrated displays. It provides lateral and vertical steering signals for the roll and pitch channels of the autopilot/flight director system (Ref 22-10-00, Autopilot (Flight Control)). It also provides commands to the thrust management system for vertical path guidance (Ref 22-32-00, Thrust Management System). Flight plan mapping and path data are displayed on flight instrument system horizontal situation indicators (Ref 34-22-00, Flight Instrument System). Any FMCS recorded in-flight faults are sent to a maintenance control display panel (Ref 22-41-00, Maintenance Monitor).
   B. The FMCS hardware consists of two Flight Management Computers (FMC) and two Control/Display Units (CDU). The FMCs, located in the main electrical/electronic compartment, are the central signal processors for the flight management functions. The CDUs, located on aisle stand forward electronic panel P-9, provide the interfaces between the pilot and FMC.
   C. The pilots can manually input data to the FMCS through four units: Control Display Unit, AFCS Mode Control Panel, EFIS Control Panel, and Thrust Mode Select Panel.
   D. FMC Interface - Inputs (Fig. 2)
      (1) General
         (a) Each FMC receives sensor information on ARINC 429 digital input buses. The IRS and offside FMC (Intersystem) buses are high speed. None of the input buses are switched.
         (b) The FMCS uses these inputs for computation of navigation, performance, and guidance functions. The two types of FMCS outputs consist of navigation information for display and guidance commands for autopilot/flight director or thrust management systems.
         (c) Each FMC can operate independent of the other, but receives identical information from the interfacing sensors and controls. The multiple input of identical information allows source selection and averaging of data within the FMC. The FMC continuously receives input data from all inputs except the data base loader which must be connected in order to receive data.

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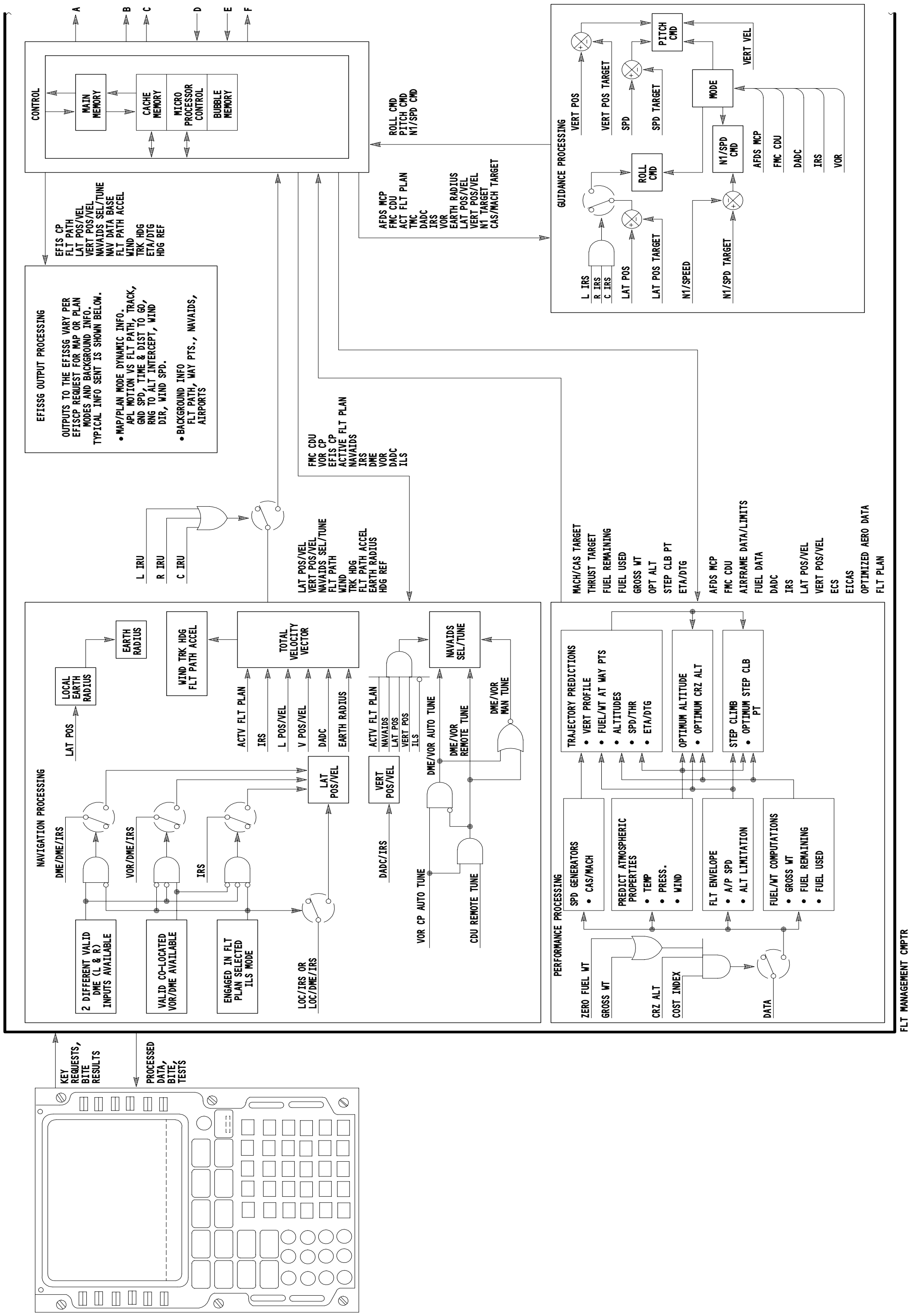

Flight Management Computer Schematic
Figure 1 (Sheet 1)

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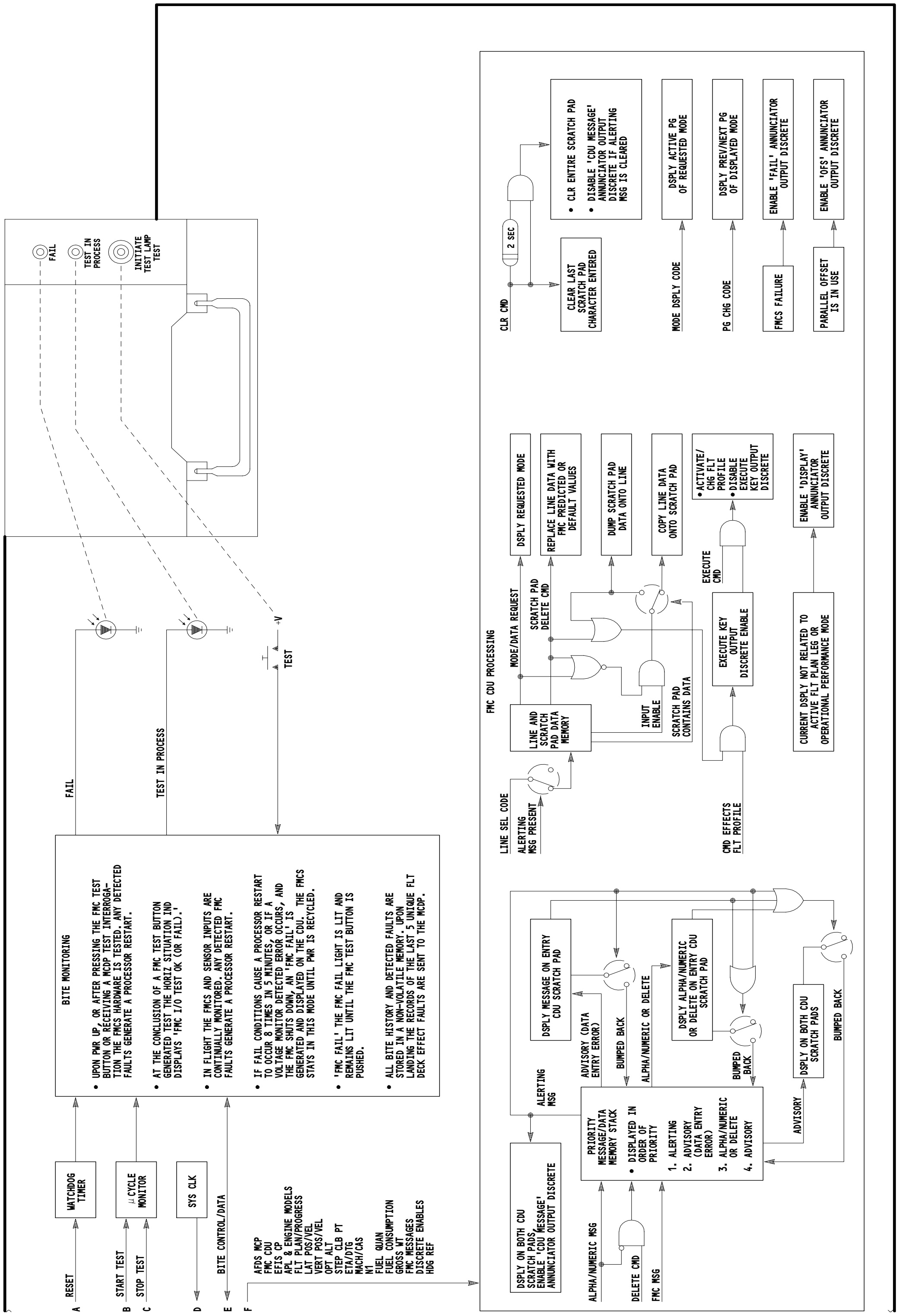

Flight Management Computer Schematic
Figure 1 (Sheet 2)

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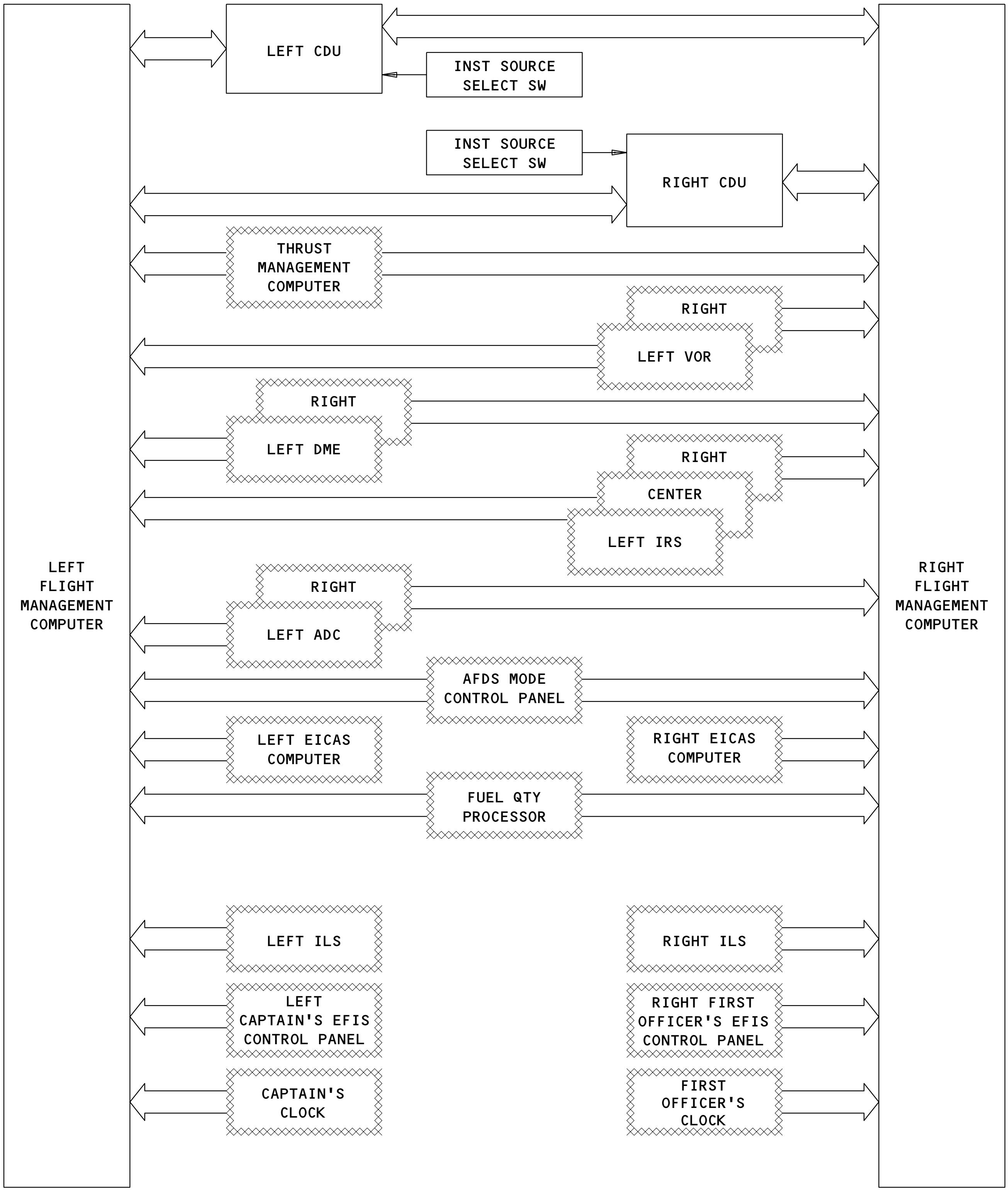

FMC Digital Inputs
Figure 2 (Sheet 1)

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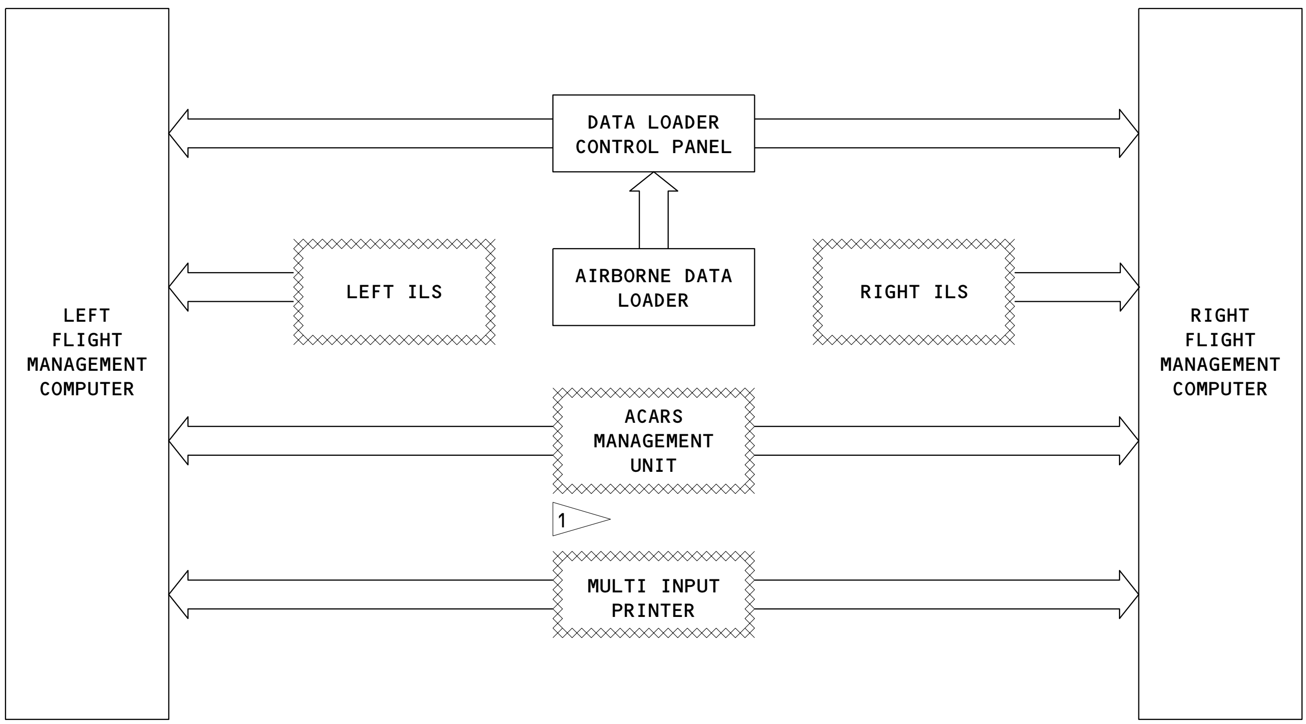

1 AIRPLANES WITH ACARS MANAGEMENT UNIT INSTALLED OR AIRPLANES POST-SB 34-241

FMC Digital Inputs
Figure 2 (Sheet 2)

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(2) FMC Digital Input Data Sources
   (a) Air Data System
      1) The air data system sends data used in performance computations over ARINC 429 buses. Bus data consists of altitude, Mach, computed airspeed (CAS), true airspeed (TAS), true air temperature (TAT), static air temperature (SAT), maximum operating schedule, and an ADC discrete word.
   (b) Inertial Reference System (IRS)
      1) The Inertial Reference System provides data through the ARINC 429 bus. The bus data consists of present position, heading, attitude, inertial altitude, speed (three axes), velocity (three axes), and acceleration (three axes). The bus also contains a discrete word identifying IRS status.
      2) The FMC uses the weighted average from the three IRUs for position data and the arithmetic average for velocity data.
      3) If an IRS fails or downgrades to attitude mode, the FMCs operate in "split mode" (each FMC receives data only from its onside IRU). Navigation differences are likely to occur after interruption of radio updating.
   (c) Clock
      1) Each of the two clocks is connected to its onside FMC. Both FMCs use the left clock if it is valid but switch to the right clock when the left clock is invalid. The FMCs use the minutes and seconds inputs from the clocks and maintain the hours internally.
   (d) SAS ALL;
      DME/VOR
      1) The DME and VOR position data is received independently from the NAV sensors over ARINC 429 buses and an auto/manual tuning discrete is also supplied. The FMCS provides DME/VOR tuning frequencies for automatic tuning of the receivers.
         a) The DME system (AMM 34-55-00/501) provides data which contains DME distance and DME frequency.

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b) The VOR system (Ref 34-51-00) provides data that contains VOR bearing and VOR frequency.

(e) MTH ALL;
Distance Measuring Equipment (DME)

1) The FMC receives distance and frequency data from both left and right DMEs. The FMC also sends a commanded tuning frequency to each DME via the FMC master switch relays. The DME is capable of automatically tuning 252 frequencies, five of these tuned frequencies will be used by the FMC for VHF NAV radio position updating. The FMC will control the tuning of these five frequencies as well as control the allocation of the DME data for the five tuned navaids. This is explained further in the navigation function section.

(f) MTH ALL;
VHF Omnidirectional Receivers (VOR)

1) VOR receivers are used for VHF NAV radio positioning. The FMC receives bearing and frequency data from both the left and right VORs for navigation purposes. The FMC transmits a commanded tuning frequency via the FMC master switch relays. The data transmitted and received will be over low speed digital buses.

(g) ILS

1) The ILS, Instrument Landing System (AMM 34-31-00), provides ARINC 429 bus data that contains the ILS frequency, localizer deviation, and glide slope deviation. The localizer deviation and ILS frequency are used for navigation computations. Glideslope deviation is not presently used by the FMCS.

2) Each ILS receiver is connected to its own FMC. Both FMCs normally use the left ILS data, if it is valid, but will switch to the right ILS if the left data is invalid. The ILS data is transmitted between FMCs over the intersystem bus.

(h) Fuel Quantity Indicating System and EICAS

1) The FMCs uses fuel flow, provided by EICAS (Engine Indicating and Crew Alerting System, Ref 31-41-00), and fuel quantity, provided by the Fuel Quantity Indicating System (Ref 28-41-00), for calculating the fuel status. If the fuel quantity data from the fuel quantity indicating processor unit totalizer is invalid, the FMC uses only the fuel flow data. If one or both of the fuel flow inputs are invalid, the FMC uses the totalizer data only.

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(i) TMS
1) The TMS, Thrust Management System (AMM 22-32-00), provides ARINC 429 bus data containing flap position, assumed outside air temperature, TMS mode status, engine bleed air status, actual EPR, reference EPR, and EPR derating. The TMS data is used in performance and guidance calculations.
2) If the TMC data is invalid, the FMC uses the flap position data from the AFCS MCP, and the bleed air analog discrete inputs from the EEC (Electronic Engine Control).

(3) FMC Interface - Analog Discretes (Fig. 3)
(a) The FMC interface analog discretes consist of two types - condition dependent and hardwired discretes.
1) The condition dependent discretes are:
a) The VOR/DME automatic or manual tune selection for the left and right receivers.
b) The bleed air conditions for each engine that sense the status of the cowl anti-ice valve, isolation valve, wing anti-ice valve, and ECS Packs.
c) The AIR/GND relay, which sets the oleo strut discrete and enables the data base update.
2) The hard-wired discretes select the airplane and engine identification codes and determine FMC position (left or right).

(4) FMC Interface Program Pins (Fig. 4)
(a) The program pins are used to identify the configuration and location of the FMCs and enable certain FMC options. The pins may be connected to ground, left open, or connected to a dc voltage through airplane wiring. The program pin configuration is defined in the airplane wiring diagram (WDM 34-61-00).
(b) Pins C11, D11, E11, F11, G11, H11, J11, H15, and C15 select the airplane type engine model and FMC configuration. Pin K07 selects which FMC is the master for autotune frequency selections. While each FMC tunes its corresponding VOR/DME, the master FMC normally selects the frequency. Pins K01 and K03 (connector B) identify the left and right FMCs respectively. This determines the master/slave protocol. With pin K05 grounded, the FMC does not respond to the OFF-side CDU.

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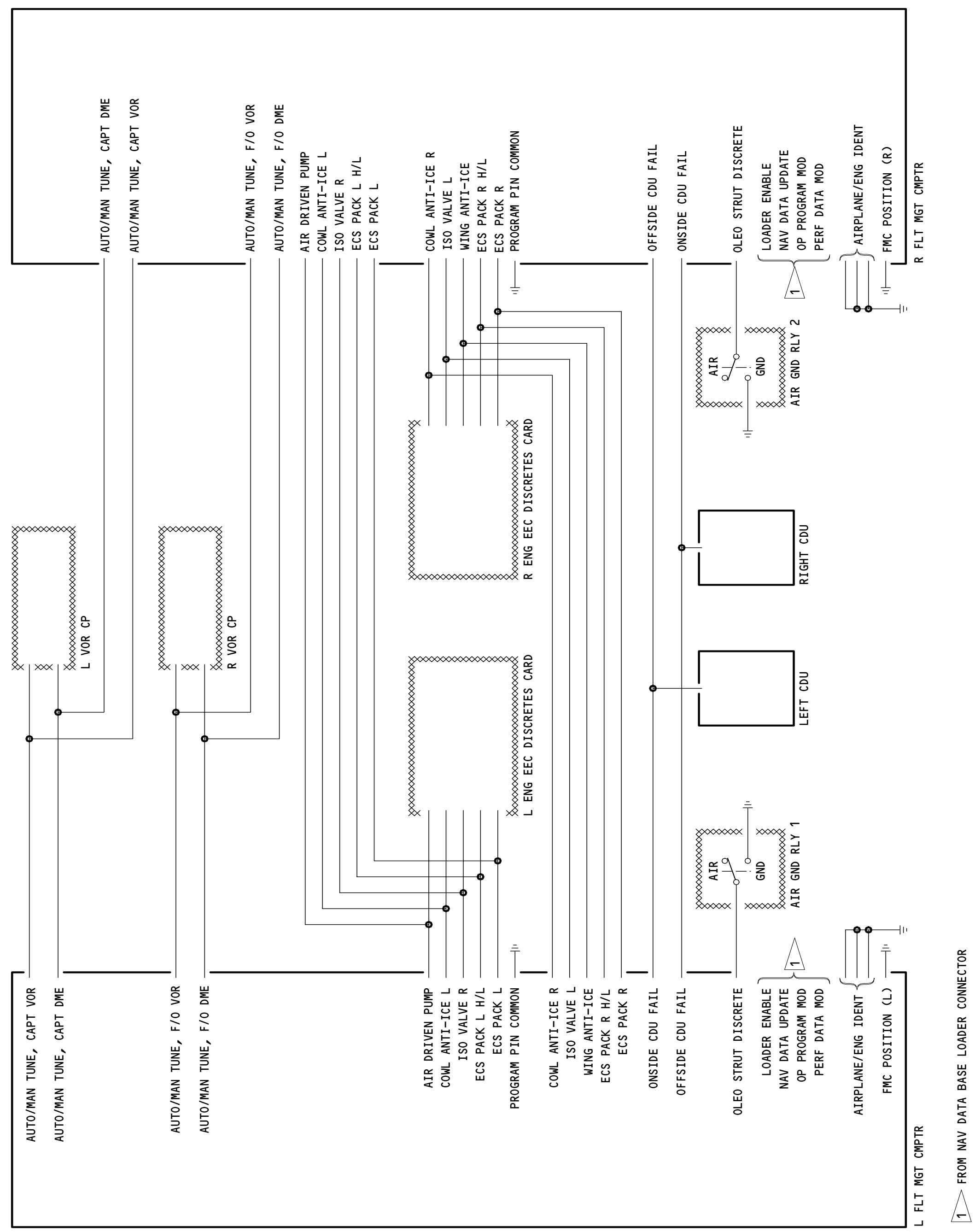

FMC Interface - Analog Discretes
Figure 3

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PROGRAM PINS	CONNECTOR LEFT D323 RIGHT D353	PINS	CONDITION LEFT FMC			CONDITION RIGHT FMC			CONFIGURATION
			OPEN	GND	+28VDC	OPEN	GND	+28VDC	
AIRFRAME/ENGINE IDENT	B	C11	X			X			767-200.1 PW4056
		D11	X			X			
		E11	X			X			
		F11	X			X			
		G11		X			X		
		H11	X			X			
		J11		X			X		
		C15		X			X		
		H15	X			X			
AIRFRAME/ENGINE IDENT [5]	B	C11	X			X			767-300.3 PW4060
		D11	X			X			
		E11	X			X			
		F11	X			X			
		G11		X			X		
		H11		X			X		
		J11		X			X		
		C15	X			X			
		H15	X			X			
AIRFRAME/ENGINE IDENT [6]	B	C11	X			X			INCREASE THE PW4060 ENGINE THRUST RATE TO THE PW4062
		D11		X			X		
		E11	X			X			
		F11	X			X			
		G11	X			X			
		H11	X			X			
		J11		X			X		
		C15		X			X		
		H15	X			X			
AUTOTUNE MASTER/SLAVE	A	K07	X				X		OPEN=MASTER,GND=SLAVE
CAA RULES OPTION [1]	B	C13	X			X			GND=OPTION USED
METRIC OPTION (KILOGRAMS) [1] [7]	B	B13	X			X			GND=METRIC OPTION USED
ACARS ENABLE [4]	B	C13		X			X		GND=ENABLE
CARBON BRAKE [2]	B	B15		X			X		GND=CARBON

[1] SAS ALL

[2] MTH ALL

[3] SAS 150-274

[4] MTH POST-SB 34-205

[5] SAS 166 PRE-SB 71-117;
SAS 167 PRE-SB 71-118

[6] SAS 166 POST-SB 71-117;
SAS 165, 167 POST-SB 71-118

[7] SAS 153 POST-SB 31-208

FMC Interface - Program Pins
Figure 4 (Sheet 1)

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PROGRAM PINS	CONNECTOR LEFT D323 RIGHT D353	PINS	CONDITION LEFT FMC			CONDITION RIGHT FMC			CONFIGURATION
			OPEN	GND	+28VDC	OPEN	GND	+28VDC	
MCDU INSTALLATION 2	B	K14		X			X		GND=MCDU
OFFSIDE CDU ENABLE	A	K05	X			X			GND=INHIBIT,OPEN=ENABLE
CLIMB DERATE AND WASHOUT ALTITUDE CODE	B	D15 E15 G15 K15	X X X 	 X		X X X 	 X		GROWTH CAPABILITY
CLIMB DERATE	B	F15	X			X			GND=ENABLE
REMOTE TUNE ENABLE 1	B	D13	X			X			GND=ENABLE
SOURCE DESTINATION IDENT 1	B	K01		X		X			GND=L FMC (MASTER)
SOURCE DESTINATION IDENT 2	B	K03	X				X		GND=R FMC (SLAVE)
ASSUMED TEMP DERATE OPTION 1	B	B15	X			X			GND=FMC DERATE ENABLE
SPEEDTAPE 1	B	J15		X			X		GND=SPEEDTAPE ENABLE
MAGVAR EXTENDED RANGE 3	B	K11		X			X		GND=ENABLE

FMC Interface - Program Pins
Figure 4 (Sheet 2)

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(c) Metric units are enabled by grounding pin B13 and CAA (British Civil Aviation Authority) rules are enabled by grounding pin C13. Leaving pin K04 open allows the use of magnetic heading and track between latitudes of 70 degrees North and 60 degrees South. If pin K04 is grounded, true heading and track is used. Pin K03 (connector A) controls the maintenance test enable function.

(d) AIRPLANES WITH REMOTE TUNE ENABLE;
the Remote Tune Enable discrete is enabled by grounding pin D13. If this discrete is enabled, then only the VOR receivers can be remote tuned. When the discrete is not enabled both the VORs and DMEs can be remote tuned. The VORs and DMEs can be autotuned in either configuration.

(e) MTH ALL;
these options are set by the Airline Policy File (APF), which is included in the Navigational Database information:
- Metric units
- CAA (British Civil Aviation Authority) rules
- Remote Tape Enable
- Speedtape

E. FMC Interface - Outputs (Fig. 5)

(1) All user systems except the DME and VOR (which receive data from one FMC at a time) receive inputs from both FMCs thru one of the following buses:
(a) General bus 1 or 2
(b) Intersystem bus
(c) EFIS bus
(d) Onside CDU bus
(e) Offside CDU bus
(f) Data Base Update bus
(g) ACARS bus

2. Component Details (Fig. 6)

A. Flight Management Computer

(1) The Flight Management Computers (FMC) which are on the E2 rack in the main E/E Bay are 8 MCU. The FMC requires 400 Hz, 115 vac and dissipates 145 watts.

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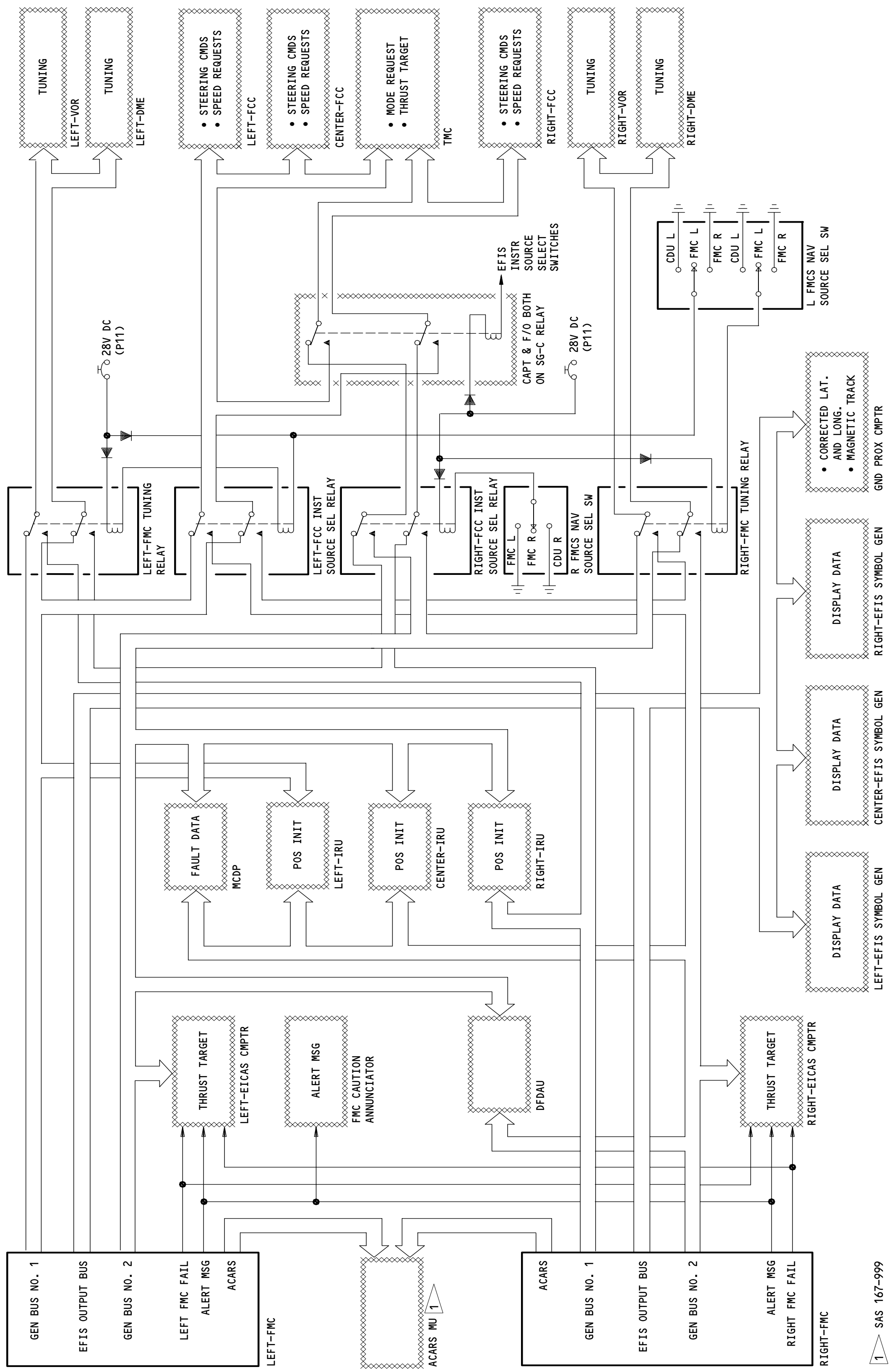

FMCS Outputs Schematic
Figure 5

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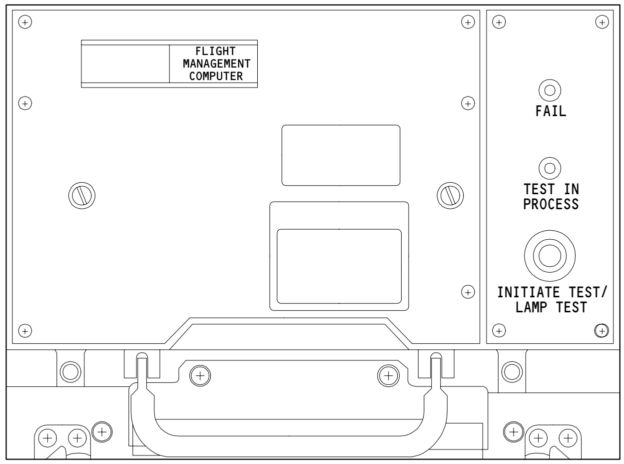
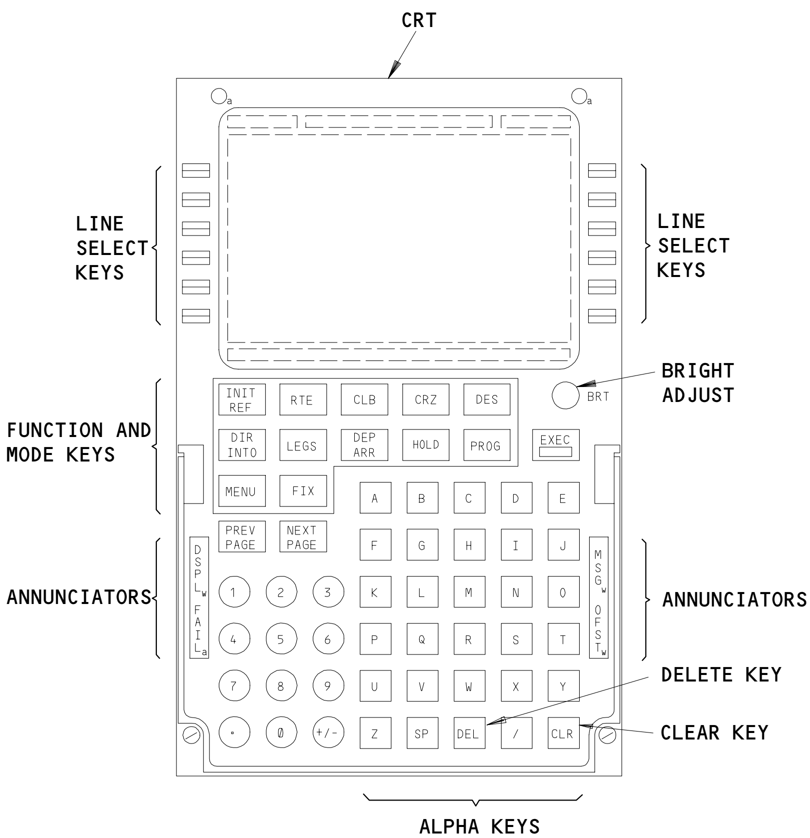
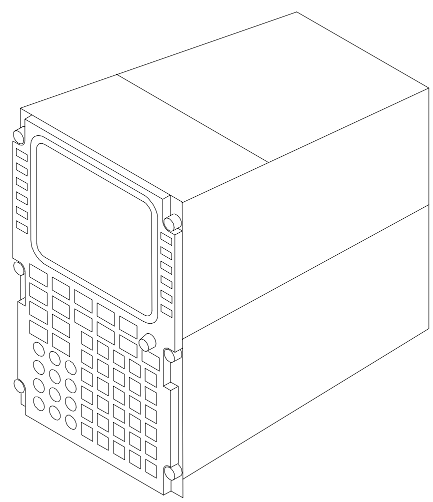


FLIGHT MANAGEMENT COMPUTER



LEFT OR RIGHT FLIGHT MANAGEMENT COMPUTER
CONTROL DISPLAY UNIT, M76 OR M77



CONTROL DISPLAY UNIT

FMCS Components
Figure 6

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(2) The fail annunciator is reset when the test switch is pressed.
(3) The test switch starts the self-test.
(4) The advanced FMC is a 16-bit digital computer with ARINC 429 input and output capabilities, a power supply, and three basic functional subsystems.
(5) Power Supply
   (a) The FMC power supply consists of 400 Hz, 115 vac that is rectified and filtered. The power supply provides the following unregulated dc voltages to the switch regulator stage: +5v; -5v; +12v; -12v; +15v; -15v; and +5v with four second hold-up for RAM use. The positive and negative 15v output are regulated to within ten percent, and all other power supply outputs are regulated to within five percent.
      1) Reference voltage generation
      2) Oscillator
      3) Regulation
      4) DC to pulse-width conversion
      5) Overcurrent shutdown
      6) Soft start
(6) Basic Subsystems
   (a) The master processor subsystem accomplishes principle decision making and complex arithmetic tasks such as performance and navigation.
      1) The SDP 175-3 processor provides 16-bit fixed point arithmetic and 32-bit floating point arithmetic. The 175-3 processor has 16k words of private fast access memory, thirteen general purpose registers, and a comprehensive instruction set.
      2) The DRAM/CMOS memory consists of the following elements:
         a) The DRAM provides 256k words of working memory to the SDP 175-3 organized as 256k by 17 bits, with a 16-bit data field and the seventeenth bit reserved for parity detection.
         b) The CMOS static RAM (SRAM) provides 16k words of memory protection from short term power transients. Integrity of data in SRAM is quaranteed for at least four seconds.
         c) The electrically erasable PROM array (EEPROM) provides 2k words of memory to store the SDP 175-3 boot program.
   (b) The mass memory subsystem controls bubble memory operation, checkpoints valuable data, and responds to memory requests from other subsystems.
      1) The mass storage memory unit consists of 8 one million bit bubble memory devices operating in parallel. A Bubble Processor/Sequencer element contains an eight-bit microprocessor based processing subsystem and a CMOS sequenced gate array. This element controls the bubble memory and is the interface between the bubble memory and bus masters.

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(c) The input/output subsystem formats and filters data used externally, and by subsystems.
  1) The Discrete I/O circuit is capable of outputting 8 ground-open discrete signals and inputting 56 discrete signals.
  2) Two identical ARINC 429 transmitter/receiver cards: function to convert two TTL signal, 16-bit data words to and from a single 32-bit ARINC 429-5 return to zero formatted bit stream.
  3) The I/O Processor Controller Arbitration Monitor reduces the burden of real-time input/output data processing on the Master Processor Subsystem. The unit combines a 16-bit microprocessor and supporting circuitry to form the Direct Memory Access (DMA) system. The DMA system maintains block pointers, screens input data validity, enables ARINC 429 receivers, and provides interrupt and status for data in order to handle the large volume of FMC I/O data.

(d) FMC BITE (Built in Test Equipment) combines both hardware monitors and software check programs. BITE detected failures are reported on the CDU and are recorded in nonvolatile (bubble) memory for future maintenance use.

B. FMCS Control Display Unit (Fig. 6)

(1) The CDUs are on the left and right sides of the forward electronic control stand in the flight compartment. They are forced air cooled. Each CDU is 5.8 x 9 x 11 inches deep and weigh 20 lb. Each unit requires 400 Hz, 115 vac and dissipates 65 watts. A handle on the CDU assists in removal and installation of the unit. One multi-pin connector is at the rear of the unit.
  (a) The FMCS control display unit allows data entry, selection, and display for the flight crew. The CDU consists of a keyboard, a display CRT, line select keys and annunciators.
  (b) The CRT is about 4.5 inches wide and 3.5 inches high. Twenty four characters can be displayed on each line. The fourteen display lines are used for page title, data titles, and scratch pad and data display. Data entries appear in the scratch pad (bottom line) and are moved to the proper line by line select keys.
  (c) The keyboard has 54 keys including the complete alphabet, all decimal numbers, eleven mode keys, three function keys, delete key, clear key, slash (/), plus/minus, and a decimal point.
  (d) Keyboard switches are back lighted and do not light when pressed.

(2) Line select keys provide three functions:
  (a) Move data from the scratch pad to the selected line.
  (b) Move data from the selected line to the scratch pad.
  (c) Access data that is identified by the selected line.

(3) Pressing an alpha key enters the selected alphabet character into the scratch pad. Pressing a numeric key enters the selected number into the scratch pad.

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(4) The mode keys are used to control the type of data currently accessible on the CDU. Data is associated with data page type and page number. Insertion, modification, or display of data is only accomplished when the proper page is active.

(a) The INIT/REF (initialization/reference) key provides access to data needed to initialize the FMC and IRS for flight. It also provides access to reference data.

(b) The RTE (route) key provides access to routes entered in FMCS. If the key is pressed with no active flight plan designated, RTE 1 is displayed. Otherwise, the current leg of the route and continuation of the active route is displayed.

(c) The LEGS key allows entry and display of detailed data for each leg of a flight plan.

(d) AIRPLANES WITH -103, -104, -130 OR -131 CDU;
The DIR/INTC (direct/intercept) key allows development of a guidance path to fly the airplane from the present position to any waypoint, or to intercept a course to a specified waypoint. This function is performed on the RTE LEGS page.

(e) The DEP/ARR (departure/arrival) key is used to display departure or arrival data for designated airports. If the DEP/ARR key is pressed and no active route has been designated, an index is displayed. Otherwise, the display is determined by airplane location. Departure/arrival data can be line selected into the active route.

(f) The FIX key allows creation of waypoint fixes used with the EFIS map display. The waypoint fix is the intersection point of the present route and a selected radial from a known waypoint.

(g) The HOLD key allows entry of a holding pattern at a waypoint.

(h) The PROG (progress) key displays current dynamic flight navigation information. The PROG key also allows comparison of current data with distance to go, ETA, and fuel remaining for manually entered alternate destinations.

(i) AIRPLANES WITH -103, -104, -130, OR -131 CDU
The CLB (climb) key provides display of the current or planned climb mode. It also allows evaluation and selection of other climb modes.

(j) AIRPLANES WITH -103, -104, -130, OR -131 CDU;
The CRZ (cruise) key provides display of the current or planned cruise mode. It also allows evaluation and selection of other cruise modes.

(k) AIRPLANES WITH -103, -104, -130, OR -131 CDU;
The DES (descent) key provides display of the current or planned descent mode. It also allows evaluation and selection of other descent modes.

(l) AIRPLANES WITH -130, -131, -155, OR -156 CDU;
The MENU key provides access to subsystems for CDU control as well as alternate EICAS/EFIS control functions.

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(5) The CDU keyboard has three function keys that control data displayed on the CDU.
   (a) The EXEC (execute) key is used to activate the flight plan, change the flight plan, or change the active guidance mode. The EXEC key is the FMCS command key.
   (b) The NEXT PAGE key causes the CDU to display the next higher page number of multiple page displays.
   (c) The PREV PAGE (previous page) key causes the CDU to display the next lower page number of multiple page displays.

(6) The CLR (clear) key erases data from the scratch pad. A single brief press of the key erases either the last character of a data entry or a complete message. A longer press of the key erases the entire data entry.

(7) The DEL (delete) key removes data entered in a data line. Pressing the DEL key inserts DELETE into the scratch pad. Pressing a line select key then replaces data entered on that line with computer predicted values or with default values.

(8) The CDU has four annunciators to alert the flight crew to some condition.
   (a) The MSG (message) annunciator lights when a FMC message is in the scratch pad.
   (b) The DSPY (display) annunciator lights when the current display is not related to the active flight plan leg or to the current performance mode.
   (c) The FAIL annunciator lights when selected FMCS failures occur.
   (d) The OFST (offset) annunciator lights when a parallel offset is in use.

(9) The control display unit receives data to be displayed from the FMC. It also decodes and transmits CDU key closures to the FMC.

(10) The CDU receives 115 vac input for its power supply and 5 vac input for panel lighting.

(11) The CDU receives digital data from both flight management computers. Each FMC has a dedicated ARINC 429 data bus to each CDU.

(12) The CDU receives analog discretes from the master dim and test system (for lamp test and bright/dim control) and the FMC.

(13) Data for CRT display is stored in the display buffer/memory and stroke written on the CRT. The CRT brightness is controlled by the BRT control and by the ambient light sensors.

(14) The keyboard/annunciator control decodes data and drives annunciators. It also decodes key closures and transfers the data to the CDU processor.

(15) The processor formats data for output to the FMC and displays key closures on the CRT.

(16) CDU failures are sent to both FMCS as analog discretes.

3. <u>Operation</u> (Fig. 7)

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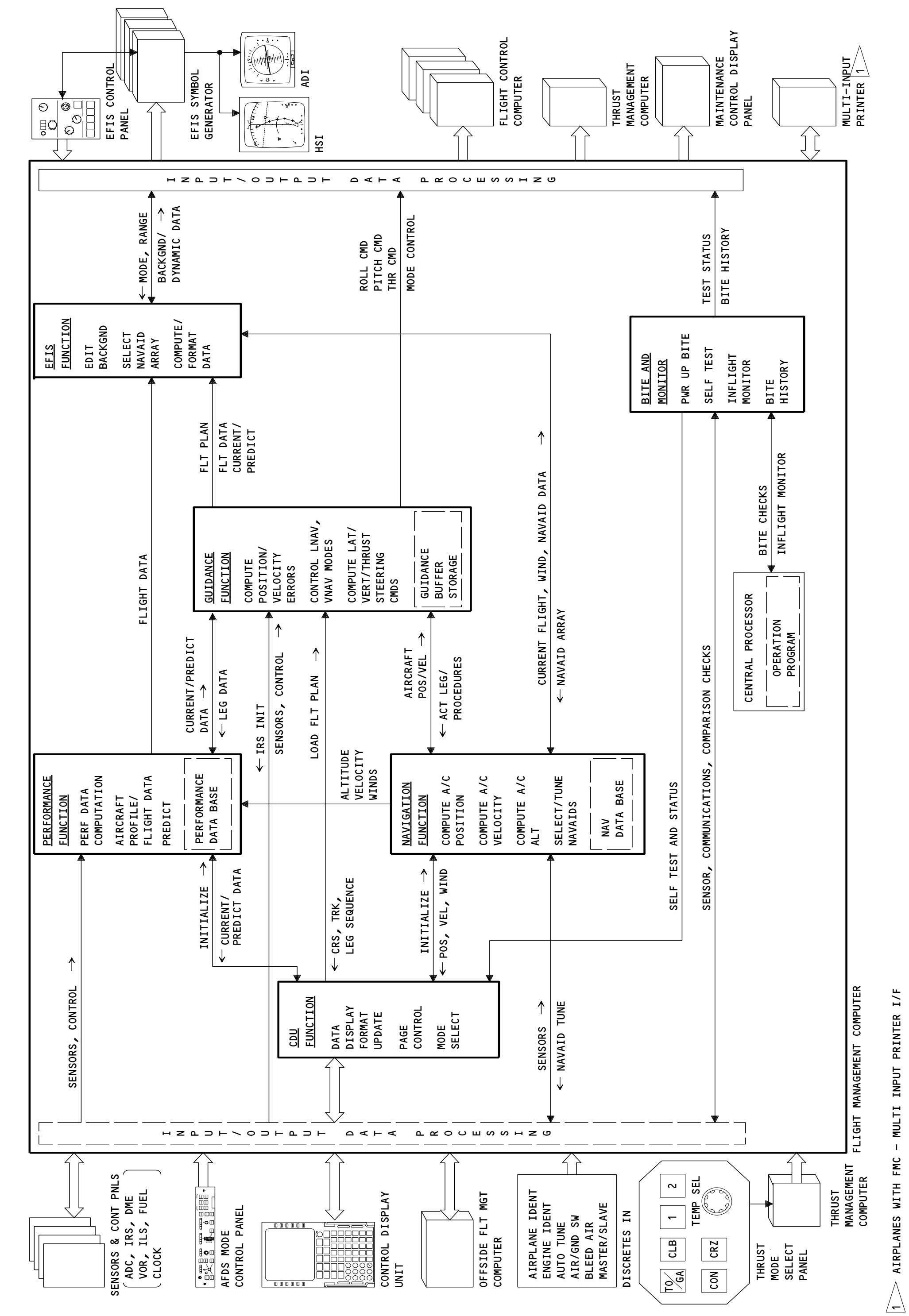

FMC Functional Block
Figure 7

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A. Functional Description
(1) General
(a) The FMC receives control and sensor inputs and calculates display and steering outputs. There are seven major FMC functions: input/output, navigation, performance, display, CDU, Guidance, and BITE and Monitor.
(b) The FMC Input/Output (I/O) function uses 23 standard ARINC 429 digital receivers and 9 transmitters to communicate with the systems components. Analog discretes provide switching identification and process the enabling functions.
(c) The received digital data is identified, reformatted (from Binary Coded Decimal-BCD, to Binary Numerical Representation-BNR), scaled, and stored for routing to the other functions. Validation checks consisting of Sign Status Matrix (SSM) checks, parity checks, and activity monitoring are performed on input data.
(d) The output data is formatted and scaled before being transmitted to the other systems.
(e) The FMC navigation function determines the airplane latitude and longitude by using radio and IRS data. The navigation function computes horizontal and vertical velocity, computes winds and airplane altitude, and performs automatic tuning of the VOR and DME receivers.
(f) The FMC performance function computes the airplane performance factors, flight profile, and associated data. It predicts airplane vertical position and velocities for each segment of the entire route.
(g) The FMC display function uses the data from the other functions that are stored in the guidance buffer or NAV Data base. It provides data to the EFIS symbol generators for display on the EADI and EHSI.
(h) The FMC CDU function provides for the formatting and updating of the displayed pages on the CDU. It provides page control from leg sequencing and mode control based on CDU selections. It also provides advisory and alert messages based on conditions.
(i) The FMC guidance function stores the active route for lateral and vertical navigation, determines airplane position, and determines the sequencing points. The guidance function provides HDG, PATH, CLB, and CRZ mode control for LNAV and VNAV. It provides SPD, THR, PATH, and VSPD mode requests for VNAV and HDG HLD, HDG SEL, CRS CAPT (course capture), and PATH mode requests for LNAV. It provides roll and pitch commands to the FCCs, and thrust commands to the TMC.
(j) The FMC BITE and monitoring function:
1) provide diagnostic and fault consolidation functions.
2) performs a comprehensive self-test on power up and when the self-test button is pushed.
3) monitors FMC interfaces and communications.
4) records failures in non-volatile memory.
(2) Control and Display (Fig. 8)

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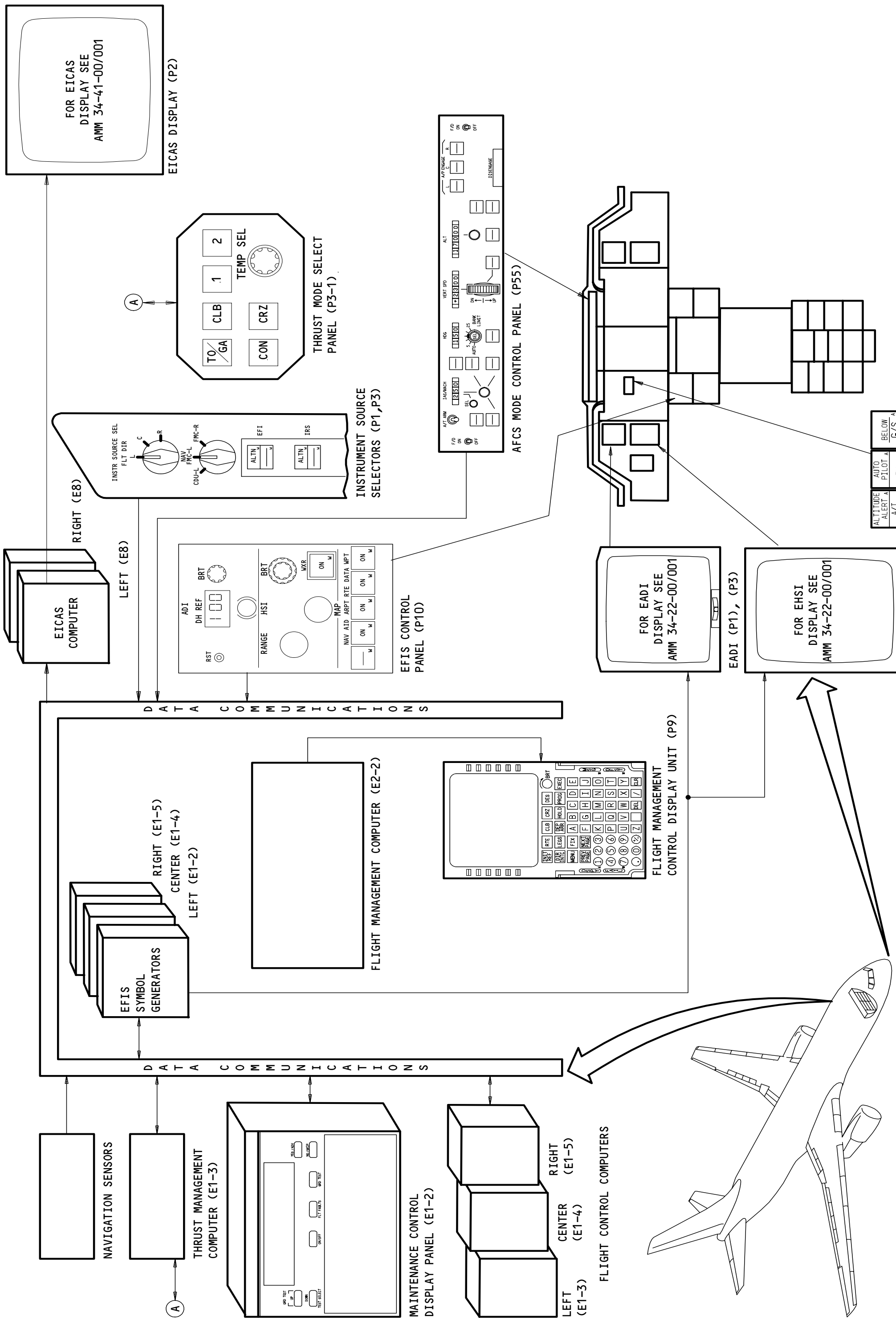

Flight Management System - Control and Display
Figure 8

D16551

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(a) In addition to the FMC and the CDU, four other components control FMC operation. These are the EFIS control panel, the AFCS mode control panel, the FMC instrument source select switches, and the Thrust Mode Select Panel (TMSP).
   1) The EFIS control panel controls the display of FMC data. The range selector controls the range display in all modes and selects the FMC map edit area in map and plan modes. The mode selector allows the pilot to view VOR or ILS data or view a track orientated map, or north oriented plan display of his selected route.
   2) The AFCS mode control panel provides a LNAV and VNAV selection and annunciation for FMC lateral (roll channel) and vertical (pitch channel) steering and provides and displays the selected IAS/MACH and altitude for use in the VNAV mode. The IAS/MACH display indicates the target airspeed selected for VNAV mode. The altitude selected must be higher or lower than the current altitude to allow a climb or descent in VNAV mode. The autopilot does not fly the airplane away from the MCP selected altitude except under manual or glideslope control.
   3) The FMC instrument source select switches allow the captain and first officer (F/O) to select which FMC is used with his CDU. With the source select switches in the normal position FMC-L (FMC-R), each CDU communicates with its onside FMC. If the opposite FMC is selected for a CDU, that CDU communicates with its offside FMC. The left FMC source select switch controls which FMC is tuning the NAV aids.
   4) The Thrust Mode Select Panel (TMSP) provides for manual selection of an assumed temperature for derating the FMC calculated thrust setting (Ref 22-31-00).

(b) The annunciators in the lower left corner of the Electronic Attitude Director Indicator (EADI) are for TMC autothrottle and AFDS pitch modes. The lower right annunciators are for the AFDS roll modes (Ref 34-22-00).
   1) The bottom line of the pitch mode annunciator shows which pitch or thrust mode is engaged. The engaged pitch or thrust mode annunciator is green. The AFDS pitch mode displays VNAV when the FCC is using vertical steering commands from the FMC. The VNAV mode does have an armed pitch mode on the ground.
   2) The second line of the roll mode annunciator shows which roll mode is armed. The armed mode is displayed in white. When EADI displays LNAV white, it indicates that the AFDS is ready to use LNAV data. The roll engaged mode displays LNAV green when the FCC is using lateral steering commands from the FMC.

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(c) When the Electronic Horizontal Situation Indicator (EHSI) is in MAP or PLAN modes, the selected route and background data from the FMC are displayed. The FMC provides dynamic data to the EFIS in all modes (VOR, ILS, MAP, PLAN). The dynamic data includes position, drift angle, track, vertical and lateral errors, speed, winds, and radio frequencies (Ref 34-22-00).

(d) There is an EPR (Engine Pressure Ratio) indicator on the Engine Indication and Crew Alerting System (EICAS) display for each engine. The reference bug is automatically set to the FMC EPR computed value when VNAV is engaged (Ref 31-41-00).

(e) The Flight Management Computer (FMC) annunciator light is on the P1-3 instrument panel. The FMC annunciator is an amber caution light that indicates a FMC alert message has occurred.

(3) FMC Functional Block - Navigation (Fig. 9)

(a) SAS ALL;
FMC Navigation Requirements

1) The FMC navigation function generates data representing airplane location and motion for use by other FMC functions. Data includes:
   a) Airplane present position above the surface of the earth.
   b) Airplane attitude above the surface of the earth.
   c) Airplane velocity relative to present position.
2) The FMC navigation function uses data from the navigation data base, internal computations, and sensor systems. The FMC selects and autotunes navaids and manages the data base.
3) The airplane position is determined from the three IRU positions and radio determined position.
   a) First priority radio position is from two DME systems.
   b) Second priority radio position is from one DME and one VOR system.
   c) IRS data is used alone if radio data is not valid to solve radio position.
   d) Localizer data is used for position update during an ILS approach.
4) At least one co-located VOR/DME is required to determine radio position. Radio position is not used when the airplane is on the ground.
5) Data from all sources is combined to compute airplane position in latitude and longitude. Position computations are filtered to provide smoothing.
6) Computed LAT/LON error is used for IRS correction.
7) Local earth radius is computed based on airplane present position.
8) The airplane altitude is determined from a combination of ADC barometric and IRS inertial altitudes. Computations are filtered to prevent transients due to source switching or barometric adjustment.

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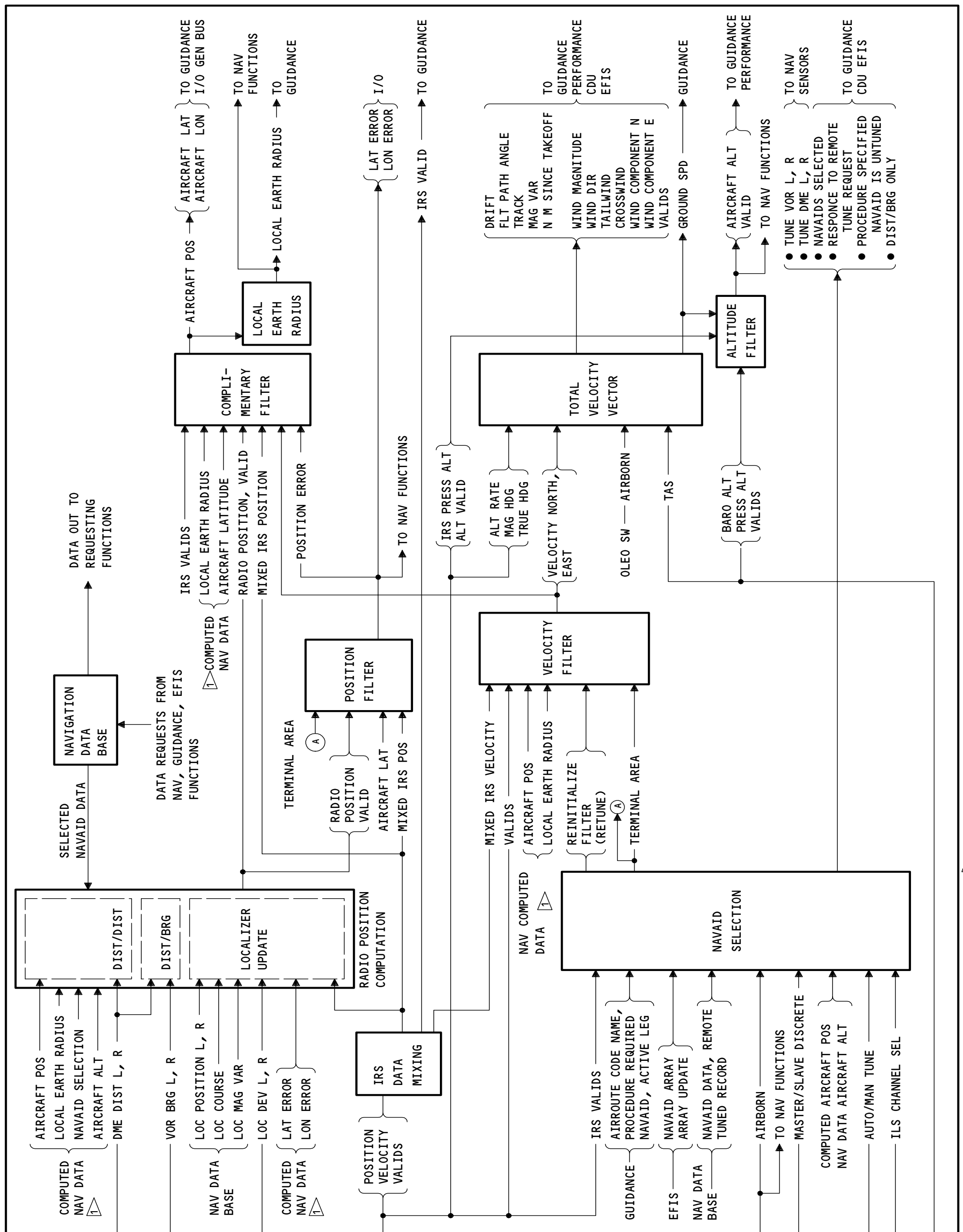

FMC Functional Block - Navigation
Figure 9

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9) The FMC computes altitude so that total system error does not exceed 130 feet under any condition from takeoff through landing.
10) Airplane velocity is determined from IRS velocity and navigation computed parameters.
11) Computed velocity is combined with other navigation data to compute airplane dynamic conditions.
    a) Drift angle is the difference between true heading and track.
    b) Track is the path of the airplane on the earth's surface.
    c) Ground speed is the speed of the airplane along the track.
    d) Distance since takeoff is airplane distance along track.
    e) Magnetic variation is difference between true heading and magnetic heading.
    f) Wind data consists of wind magnitude and direction relative to true north and wind magnitude along the desired course.
    g) Flight path angle is the vertical angle between the flight path and the horizontal.
12) The EFIS function provides an edited list of 20 navaids closest to the airplane. Navaids are selected as required by the guidance buffer or as specified by the pilot on the navaid control panel.
13) The FMC monitors the navaids near the airplane and selects two to provide needed position information. The best navaids are chosen within the constraints of any remote tune request. The FMC then determines procedures, distance to navaid, type of navaid, and airplane altitude.
14) The FMC transmits navaid channel numbers via the I/O function for tuning.
15) Data needed for radio navigation, route selection, and guidance is stored on disk memory in the navigation data base. User functions access the data base for data needed in computations.
16) The navigation data base is updated periodically using a data base loader.

(b) MTH ALL;
FMC Navigation Requirements
1) The FMC's navigation function provides airplane present postion and velocity data. This data is used by the guidance function for airplane control and the EFIS.
    a) The basic navigational output data is computed using optimally mixed inputs of:
    b) IRS's position, velocity, heading and altitude data
    c) Data from the FMCS Navigational Data Base (NDB)
    d) Distance information from the two DMEs
    e) Bearing information from the two VORs

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f) Altitude and true airspeed data from the Air Data Computer (ADC)
g) ILS localizer and glideslope deviation data when the airplane is in the approach mode.

2) This information is combined and filtered by the FMC to produce the following navigation outputs:
a) Airplane position (latitude and longitude)
b) Track angle
c) Wind vectors (north and east wind components, wind magnitude, wind bearing, tail wind and crosswind)
d) Baro-corrected altitude
e) Airplane velocity (ground speed)
f) Local earth radius

3) The FMC will control the tuning of navaids as well as directing navaid information into channels (memory slots) while in autotune. The FMC uses the NDB to select the navaids which will be tuned. The FMC also directs the navaid information into DME channels in a logical manner to obtain the best VHF NAV radio positioning mode. These VHF NAV radio positions are then combined with the mixed inertial position from the IRSs to obtain the best positioning mode. These nav modes are listed in order of preference:
a) IRS/ILS (approach only)
b) IRS/DME/DME (distance and distance)
c) IRS/DME/VOR (distance and bearing)
d) IRS only

4) The FMC also uses information from the IRSs and the ADC to calculate inertial and wind vectors.

(c) Initialization of position and velocity filters
1) The FMC's position and velocity is automatically initialized when the following occurs:
a) An IRU becomes valid after power up and entry of a valid position on the POS INIT page.
1. The FMCs position will become valid when it receives a valid signal from any of the IRUs. The position and velocity filters will then be initialized.
b) AT takeoff
1. The FMCs position is initialized to the runway's threshold latitude and longitude. If any displacement has been entered by the crew, then the displacement is used to correct the IRS errors at takeoff.
c) Recovery from an FMC power interrupt.
1. For short term power interrupts, the filters are initalized to their last position. There is no observable position change.

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2. If both FMCs are powered up simultaneously, the master FMC will be selected by the FMC master logic. The FMC position will be initialized to the IRU selected by the master FMC. If they are not powered up simultaneously then the FMC which is powered up first will be the initializing FMC.

2) Initialization of radio corrections IRS validation

a) The FMC's I/O process performs a check on the validity of the IRS activity and SSM status. If they are both valid and the airplane is on the ground then radio corrections (velocity and position) are set to zero and there is no softfault status.

b) After a short-term power interrupt, the radio corrections (velocity and position) sent to the IRS, will retain their values, previous to the power interrupt.

c) After a long term power interrupt the radio corrections to the IRS velocity are set to zero. The position radio corrections will be set to zero if the offside FMC position is invalid. If not, the position radio correction to the IRS will be an adjusted position in which the onside FMC position equals the offside FMC position. The softfault will be reset.

(d) Position and Velocity Determination

1) IRS position and velocity processing

a) The IRS provides the basic position and velocity which the FMC uses for navigation. These IRS outputs are used in conjunction with radio positioning and will be used alone if radio updating is not possible. Due to the importance of the IRS outputs, processing of these signals are quite extensive.

b) Each individual IRU will go through a signal validation process. This process will validate both the position and velocity signals. If either of these signals are not valid the corresponding IRU will not be used.

c) If any of the IRUs are invalid each FMC will choose only one IRU for position and velocity updating. The FMC will choose the closest IRU for source data. For example the L-FMC will choose either the left or center IRU depending upon their validity.

d) If all three IRUs are valid then their positon and velocity will be mixed and averaged, respectively. The individual IRU positions and velocities will be compared to the mixed and averaged values. If the difference between the individual values and the mixed and averaged values differ by more than predetermined value, then a softfault failure will occur for the respective IRU.

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e) If a softfault failure exists for an IRU, that IRU will not be used for navigational purposes by the FMC. All or none of the IRUs may be used for navigation by the FMC. The IRU's data will be routed in a manner corresponding to the number of failed IRUs as follows:

1. IRS (3) indicates all three IRUs are valid and each FMC will use the mixed IRS position and the averaged velocity. In this case both FMCs will contain the same data.
2. IRS (2) indicates only two valid IRUs. In this case, the FMCs will use the closest IRU. The left FMC will use either the left IRU or center IRU. The right FMC will use either the right IRU or the center IRU. The FMCs will contain different data and the master FMCs data will be used for navigation.
3. IRS (1) indicates one valid IRU. In this case the valid IRU's data will be used by both FMCs for navigational purposes.
4. IRS (0) means there are no valid IRUs and the FMCs must revert to VHF NAV radio updating for navigational purposes.

2) Radio position processing

a) The FMC selects the best VHF NAV radio positioning NAVMODE to be used. These NAVMODES, listed in order of priority, are ILS/DME, DME/DME and VOR/DME. The FMC bases its selection of these NAVMODES on the type of navaids available and the geometry of the navaids with respect to the airplane. The ILS/DME NAVMODE will only be used during airplane approach.

b) ILS/DME positioning is derived from calculating the airplane deviation from the ILS center beam as well as using the IRS estimated position. Both FMCs will use data from a selected ILS sensor to prevent divergence of the two navigation solutions. If one of the FMCs fail, the operating FMC will only use the onside ILS for positioning.

c) The DME/DME NAVMODE calculates airplane position by using the slant range distance from two DME stations. There are five high priority channels or memory slots which are used by the FMC. The FMC controls the allocation of DME data into these channels.

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d) The tuning procedure is explained in more detail in the tuning management section.
e) VOR/DME NAVMODE uses the DME slant range distance data along with the collocated VOR bearing data to compute airplane position. This data is used in geodetic equations in which latitude and longitude positions are calculated. The bearing of the airplane with respect to the VOR navaids north reference must be corrected to true north by adding the magnetic variance to the VORs north bearing.

3) FMCS Optimal Position and Velocity Processing
a) The FMC combines the VHF NAV radio position and IRS inertial data in order to produce the most accurate airplane position and velocity.
b) Position optimization
1. In order to produce an optimum position, the FMC combines the position error filter and the complementary filter to ensure that the airplane position is valid.
2. The position filter combines IRS inertial position and the radio derived position. Two filters will be used, one for latitude and one for longitude.
3. The IRS is short-term stable while radio position is long-term stable. By realizing the long-term position and the inertial short-term position the drift error and Schuler errors can be determined. These errors are summed to produce a filtered airplane position error in both latitude and longitude. These filtered position errors will then be used by the complementary filter for airplane position.
4. The complementary filter combines the north and east velocity components from the velocity filter, the earths local radius, latitude and longitude errors from the position filter, radio position and mixed latitude and longitude positions from the IRS to continually update and enhance the IRS position. This filter is operational only when there is at least one valid IRS velocity and position and the radio position is valid.
c) Velocity optimization
1. IRS velocity (the mixed velocity if all IRSs are valid) and radio position are combined to derive an estimate for the IRS velocity error. These derived velocity error components are then added to the IRS velocity components to produce filtered north and east velocity components.

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2. Filtering the velocity components will only be done when in the DME/DME radio mode in order to cut down on biases. These errors will gradually be bled-off while not in the DME/DME NAVMODE. While the airplane is on the ground the error is bled-off at a quicker rate.

(e) Inertial and Wind Vector Computations

1) The inertial vectors are those vectors related to the airplanes north and east velocity components. They consist of:
   a) Track angle
   b) Ground speed (GS)
   c) Flight path angle
   d) Drift angle
   e) Magnetic variation
2) The track angle filter combines the computed track angle and the track to derive the degree/frame track angle rate. The computed track angle is the true heading while the airplane is on the ground otherwise is computed by taking the arctangent of the velocity components supplied by the velocity filter. The degree/frame track angle rate is then calculated by combining the computed track angle with the previous value of track angle. The filter calculates the degree/frame track at a rate of 20 Hz.
3) Ground velocity magnitude is calculated by using the filtered velocity components. This value is calculated a 5 Hz rate.
4) Vertical flight path is calculated by combining the ground velocity magnitude and the airplane velocity. This value is calculated at a 5 Hz rate.
5) Drift angle is calculated by using computed track angle and the true heading. It is processed a rate of 20 Hz.
6) Magnetic variation is computed by using the true heading and magnetic heading from the IRS. It is processed at a 5 Hz rate.
7) North and east wind velocity components are only valid when:
   a) Vertical flight path angle is valid
   b) Airplane velocity is valid
   c) True heading is valid
   d) Airplane ground speed is greater than 80 knots
   e) True air speed (TAS) is valid
8) Calculations of the wind components are accomplished through taking the difference between the TAS along the true heading and the ground speed along the track. These calculations will produce the raw north and east components. These components are then filtered to produce filtered north and east wind velocity components.
9) Wind magnitude, bearing, tailwind and crosswind are then calculated by combining the filtered north and east wind components at a 1 Hz rate.

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(f) Altitude Computation

1) FMC's airplane altitude is computed by filtering the ADC 's barometric pressure and altitude inputs and combining this with the IRS pressure altitude. If both the ADC altitude inputs are valid, then the baro correction is derived by taking the difference of the two inputs. The derived baro correction is then filtered and added to the IRS's pressure altitude if valid or to the ADC pressure altitude if the IRS's pressure altitude is invalid. The altitude valid flag is then set to true.

(g) Local Earth Radius Computation

1) Calculations of the earths radius will be done at a rate of 0.1 Hz when the IRS position has been entered. The initialization radius or base radius will be 3437.74677 nm. The computed earth radius will be used in the complementary position filter described previously.

(h) Tuning management

1) In order to improve airplane position, the FMC's navigation function combines VHF NAV radio information and IRS's derived position to enhance airplane position.

a) ILS receivers provide angular deviation measurements from a fixed bearing. This data has the highest accuracy but is only used on airplane approach due to its short range.

b) DME interrogators provide distance information from the airplane to ground facilities. These VHF NAV radios provide the second highest accuracy and are usable at distances from 9 to over 200 nm.

c) VOR receivers provide bearing measurements between the airplane and the ground facilities north reference. There VHF NAV radios provide the poorest accuracy with a 130 nm range. These receivers will operate in conjunction with the DME interrogators.

2) DME tuning

a) AIRPLANES WITH NON-SCANNING DME;
When scanning DME option is disabled, in this mode of operation, each DME can tune only one station at a time. When the DMEs are in a single channel operation and there is no manual, procedure or remote tuning, the FMC chooses the best available navaids for DME/DME updating. If one DME is in manual, procedure or remote tuned, then the FMC will autotune the remaining DME to a station which provides the best DME/DME updating from the tuned staion. If that is not posible, then the FMC will attempt VOR/DME updating using first the FMC the closer, then the farther of the two staions.

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b) AIRPLANES WITH SCANNING DME;
When the scanning DME option is enabled, in this mode of operation the DME interrogator has the capability of free scanning 252 separate frequencies. Five of these frequencies will be used by the FMC for VHF NAV radio updating. The frequency command for these five frequencies originates in the FMC. The FMC automatically generates tunning commands, as a function of the available navigation aid ground stations relative to the navigation position estimate and the airplane altitude, by the station selection process in the FMC navigation data base.

c) The DME will tune the FMC's selected stations. These stations will be stored in the memory slots within the DME in accordance with the FMC.

d) There are two station types which are required by the FMC to be tuned and placed into one of the five memory slots. These are listed in order of priority.
   1. Manually tuned stations are those stations which are manually entered into the CDU. These stations will be used for displaying distance data on the EHSI displays and have top tuning priority.
   2. Procedure tuned stations are associated with a particular flight plan procedure. The tuning frequency will be supplied by the FMC navigational data base.
   3. A operator selected option is also available for selection of a third type tuning procedure. This option is the tuning of route tuned stations. Route tuned stations are stations along the active route which are being used as waypoints. The tuning frequencies will be supplied by the FMCs navigation data base.

e) The DME will tune and store station information in accordance with the FMC. The memory slot preference in which the station information will be stored is controlled by the FMC logic. This memory slot allocation logic is described as follows:
   1. Memory slots 1 and 2 will always contain distance data from autotuned stations making the best DME/DME pairing, which will be used for VHF NAV radio position updating.
   2. If there is a DME/DME pair in memory slots 1 and 2 and there is no manual, procedure or route tuned stations required, then the FMC will direct the second best DME/DME pair into memory slots 3 and 4. This second best DME/DME pair will be directed into memory slots 1 and 2 for VHF NAV radio position updating if the primary DME/DME pair previously in memory slots 1 and 2 become invalid.

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3. If there is a manual, procedure or route tuned station required, this station will be directed into memory slot 3. The FMC will attempt to find a station which will create a DME/DME pair with this manual, procedure or route tuned station. If found, will direct this stations distance information into memory slot 4.
4. If there is a manual, procedure or route tuned station in which the FMC can create its only DME/DME pairing, then memory slots 3 and 4 will be used for VHF NAV radio position updating with memory slot 3 containing the manual, procedure or route tuned station.

3) DME/VOR tuning
   a) The VOR receivers will only be able to tune in one frequency corresponding to a station selected by the FMC. This VOR station, which is colocated with the DME station, will provide bearing information.
   b) These DME/VOR colocated stations can be tuned by the FMC for VHF NAV radio position updating. The FMC will use this mode of radio position updating if no DME/DME pair is available and the airplane is not in the approach mode thereby using the ILS station for VHF NAV radio position updating.
   c) The FMC will automatically down mode to DME/VOR VHF NAV radio positioning when the following occurs:
      1. If no DME/DME pairing can be created and there is no manual, procedure or route tuned stations. Then memory slot 2 will retain distance and bearing information for the closest DME/VOR station.
      2. If there can be no DME/DME pair created and there is a manual, procedure or route tuned station, then the FMC will tune the closest DME/VOR station into channel 4 for radio position updating. If the manual, procedure or route tuned station in channel 3 is the closest then it will be used for radio position updating.

4) Station allocation priority
   a) A procedure or route tuned station will go into memory slot 3 unless there is a manually tuned station, in which case, the procedure or route tuned station will be directed to memory slot 4. Manual will always take precedence over procedure and route tuned stations. Procedure will always take precedence over route tuned stations.

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5) Station display priority
   a) In general all manual, procedure and route tuned stations will be displayed on the EHSI map display. If there is only one manual, procedure or route tuned station, it will be the only one displayed, regardless of a paired autotuned station. These displays vary corresponding to the EHSI CP configuration.

(i) VHF NAV Radio Validation
1) The initial radio validation occurs in the input/output processor of the FMC. The activity of the bus is first checked. This check determines if the data being received has changed between two consecutive inputs. If the data from either the VOR, DME or ILS has not changed within two consecutive inputs, the data is considered invalid. If the data is determined active, the input/output processor determines the state of the sign signal matrix (SSM). If the SSM is not on normal configuration, then the data is considered invalid. If the SSM is normal then the data goes through further validation.
2) The ILS is considered valid by the FMC if:
   a) Raw data passes the input processing validation.
   b) The localizer deviation is less than 1.25 degrees.
   c) Received frequency matches the frequency stored in the NDB for the selected runway.
3) The VOR and DME go through two validation processes. These are short-term and long-term validation. The long term validation will be dependent upon the short-term validation. These processes are described as follows:
4) Short-term validation
   a) The DME is short term valid if:
      1. Raw data passes the I/O process validation.
      2. The frequency is between 108.00 and 117.95 mega Hertz.
      3. The DME ground distance does not exceed a rate of change of 1nm per second with respect to the FMCs calculated ground distance.
      4. The tuned frequency is the same as the received frequency.
      5. The airplane is not within the zone of confusion (inverted cone with an apex of 60 degrees).
      6. The actual DME ground distance does not differ from the FMC's estimated distance by a predetermined tolerance.
      7. The ground range is less than 300 nm.
      8. There are two DME/DME pairs which are considered for updating and the position of the airplane given by these two pair does not differ by 0.8 or 0.5 nm in the case where one is a procedure tuned navaid.

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9. The DME/DME pair is geometrically valid, the crossing angle between the two DMEs must not exceed more than 150 degrees or be less than 30 degrees. The optimal crossing angle is 90 degrees.

b) The VOR is considered short-term valid if:

1. Raw data passes the I/O process validation.
2. The tuned frequency is equal to the received frequency.
3. The airplane is not within the zone of confusion (an inverted cone with an apex of 60 degrees, or ground range is less than 1.5 nm) for the respective ground station.
4. The airplane is flying away from the VOR station at a range no greater than 25 nm, or flying towards the station at a range no greater than 40 nm.
5. The noise amplitude on the VOR signal does not exceed 2.5 degrees.

5) Long-term validation of both DMEs and VORs are the basis for autoselection and NAV MODE selection. If either become long-term invalid, they will not be selected as navigational candidates. If either become long-term valid, they will then again become candidates for navigation.

a) Both the DMEs and the VORs will be declared long-term invalid if 50 percent or less of the last 20 data samples were considered short-term valid. If 70 percent or more of the last 20 data samples were short-term valid, then the DMEs or VORS are considered valid. The 4 sample dead band provides some hysteresis between selection of long-term valid and long-term invalid. Both the DME and VOR are initially long-term valid except when they are procedure specified as long-term invalid.

(j) Polar Navigation

1) When the airplane is greater than 85 degrees north or south latitude, it is considered, by the FMC, to be in the polar region. While in the polar region, each FMC will automatically use only one individual IRU position instead of the mixed position of all three IRUs for airplane positioning .
2) The left FMC will select either the left or center IRU and the right FMC will select either the right or center IRU. The selection proccess will be based on the two IRUs having the least distance between them following a comparison of each IRU with the other two.
3) After reaching the polar region, each FMC's mixed IRU position will gradually change to equal the selected single IRU position. This gradual change will minimize airplane maneuvering and prevent any sudden movement of the ND's display.

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4) If the FMCs were using single IRU postions prior to entering the polar region, they will continue to use the same IRU for position data. However, the FMC function which gradually makes equal the IRS position and the FMC position will automatically become active.
5) When exiting from the polar region (less than 83.5 degrees north or south) the FMCs will automatically resume using the mixed IRS position, if the mixed IRS position is considered valid. There will be no instantaneous change in either FMC position when returnig to the mixed IRS position.

(k) Navaid Blackballing and Inhibiting
1) Blackballing or inhibiting of navaids can be accomplished in several ways.
   a) Automatically
   b) Pilot entry
   c) Through the navigational data base.
   d) When a navaid is inhibited automatically through long-term validation criteria, this navaid cannot be used for radio updating in the autoselection mode. However, they can be tuned through manual, procedure or route tuning and can be used for radio updating when in one of these modes.
2) Several options are available to the pilot through entries in the REF NAV DATA page.
   a) Entries in the NAV INHIBIT field inhibit both DME/DME and DME/VOR VHF NAV radio updating through autoselection. It will not inhibit the navaid to be used in manual, procedure or route tuned modes.
   b) Entries in the VOR INHIBIT field will inhibit VOR/DME VHF NAV radio updating in autoselection. It will not inhibit DME/DME VHF NAV radio updating in either autoselection or manual, procedure or route tuned modes.
   c) Entries in the VOR/DME INHIBIT field result in all VOR/DME VHF NAV radio updating modes being inhibited.
3) Navaids blackballed through the navigation data base are inhibited for use in VHF NAV radio updating. If the VOR only portion is specified as blackballed in the data base, only the VOR is inhibited for use. If the DME portion is specified as blackballed in the data base, the DME is inhibited for use and the VOR will not be used. If both the VOR and DME portions of the navaid facilities are specified as blackballed, the whole navaid is inhibited. Whenever the DME portion of a navaid is inhibited for use through the navigation data base, the navaid will not be used, regardless of the tuning mode inluding manual, procedure or route tuned stations.

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(l) CDU Independent Functions
1) The CDU allows crew/system interface with other systems besides the FMC. It also has the capability to provide alternate functions for navigation.

(m) Alternate Navigation
1) When the two FMCs have failed, the CDU provides alternate navigation functions through the LEGS and PROGRESS pages. The ACT IRS LEGS page will be shown when the LEGS mode key is selected and the onside FMC has failed. This page provides the means of data input and display details of each leg of the route.
2) The IRS PROGRESS page will be shown when the PROG mode key is pushed and the two FMCs have a failure. This page will show data in relation to the progress of the flight.

(n) FMC Nav Data Base
1) The navigation data base contains data needed to support airline route structures. The data base is customized according to airline requirements, providing data for the geographic areas of the airline routes.
2) Data stored in the data base is displayed on the CDU IDENT page but is not accessable for update. The navigation data base can be cross-loaded between FMCs through CDU action.
3) The data base contains identifier, location, frequency, elevation, and type for the following navaids:
a) VOR
b) VORTAC
c) VOR/DME
d) DME
e) TACAN
4) Airport data includes reference point, threshold location, runway length and heading, elevation, and ILS facilities.
5) Supporting data such as waypoints, intersections, and turnpoints is provided for high level enroute airways and for low level terminal area airways.
6) The data base contains terminal area procedures for departures, arrivals, transitions, and approach. Supporting data includes navaids, waypoints, intersections, and details such as course, heading, distance, and crossing altitude.
7) Supporting data such as frequency, identifier, course, crossing altitude, distance, and missed approach procedures are provided for ILS approach.
8) The navigation data base also includes data for company routes as required by individual airlines.
9) Any data in the navigation data base is available for display on the CDU or EFIS.
10) The data base is loaded into the FMC through the airborne data loader located on the P61 panel.
11) A selector switch located on the P61 panel selects which FMC is to be loaded. Either FMC can then be cross-loaded from the other FMC.

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12) The FMC hardware manufacturer makes an updated data base available every 28 days.

(4) FMC Functional Block - Performance (Fig. 10)

(a) General

1) The FMC makes calculations for guidance input limit, optimum speed and altitude, and vertical trajectory predictions.

2) Data stored in the performance data base is used to model the atmosphere, airplane aerodynamics, and type of engine installed. Inputs from external sources and other FMC functions provide data needed to complete FMC calculations.

3) Data entered through the CDU includes cost index, gross weight, cruise altitude, fuel reserves, winds and temperature, drag factor, and fuel flow factor.

a) Cost index, used for ECONOMY calculations, is the ratio of time-costs to fuel-costs.

4) Individual functions of the performance calculations compute the following:

a) Reference parameters
b) Models and utilities
c) Optimum speeds
d) Vertical trajectory predictions

5) The reference parameter computations provide data for other FMC computations and for display. Data is generated in ten categories.

6) Fuel/weight continuously computes the following functions for display on the CDU PERF INIT page:

a) Gross weight or zero fuel weight (ZFW) which must be entered on the CDU.
b) Fuel used (computed from fuel flow).
c) SAS 275-278;
fuel remaining (If the FMC computed fuel differs from the totalizer fuel value by more than 3000 pounds for 5 minutes, either can be selected for use).

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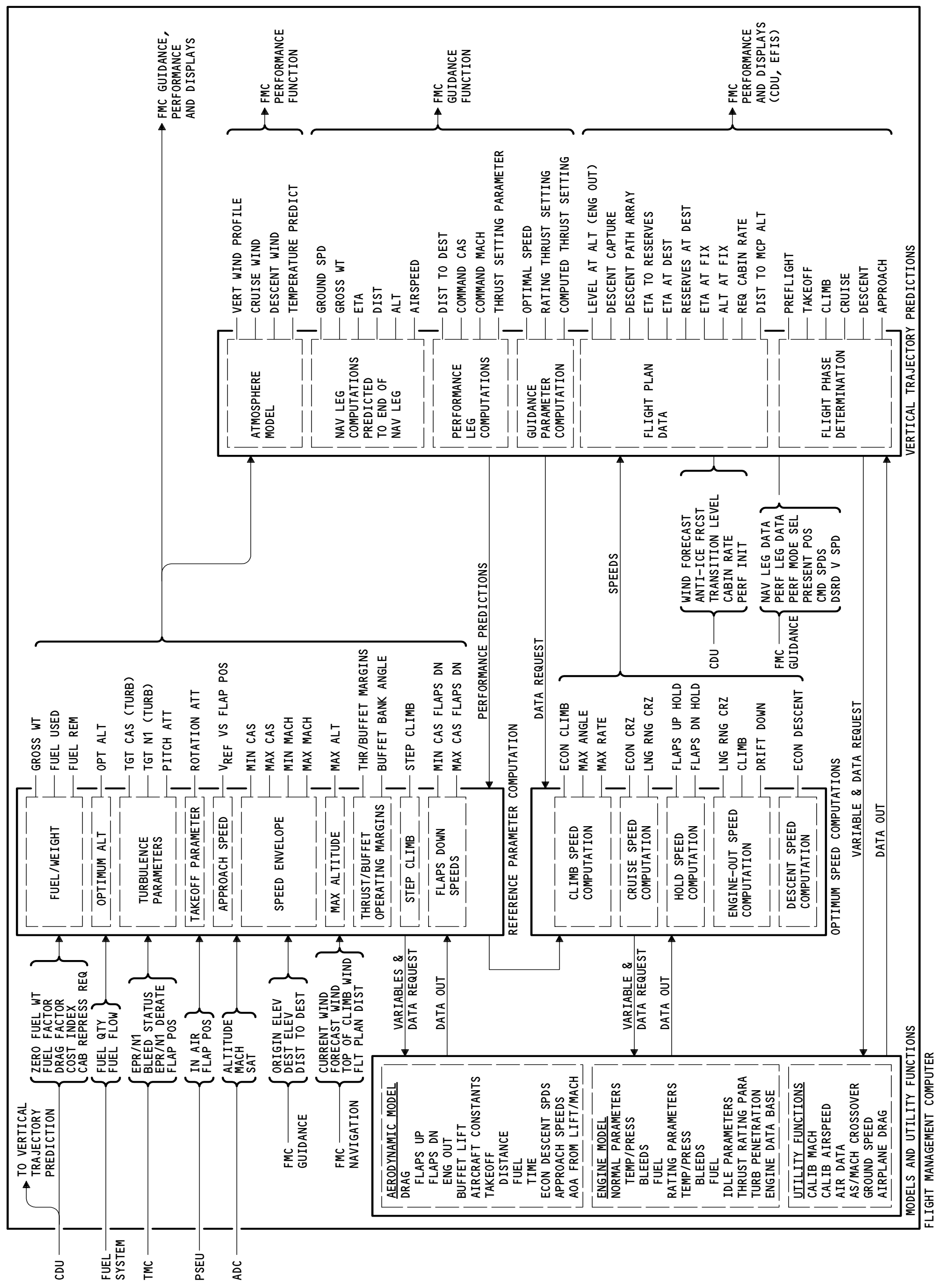

FMC Functional Block - Performance
Figure 10

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d) SAS 050, 051, 150-274;
fuel remaining (If the FMC computed fuel differs from the totalizer fuel value by more than 2000 pounds for 6 minutes and the difference is more than 3000 pounds, either can be selected for use).

7) Optimum altitude computes minimum cruise cost based on altitude and is displayed on the CDU CRZ pages.
   a) Data used includes distance, weight, temperature, climb profile, descent profile, and winds.
8) Turbulence parameters compute target CAS, target N1, and pitch attitude for turbulence penetration.
9) Takeoff parameter computes rotation attitude based on in-air flap position.
10) Approach speed computes speed based on weight and flap position and is displayed on the CDU APPROACH REF page.
11) Speed envelope computes min/max Mach and airspeeds for normal and engine out operation.
   a) Minimum and maximum speeds are calculated based on altitude, available thrust, weight, and airplane operating limits.
   b) Speed envelope outputs establish limits for command speeds to guidance and limits to CDU entries.
12) Maximum altitude continuously computes airplane altitude limits for normal conditions and for one engine-out conditions.
   a) Maximum altitude is calculated based on airplane weight, thrust, air temperature, wind velocity, and mode of operation.
   b) Maximum altitude limited by airplane certified altitude, maneuvering and climb capabilities are used to limit other FMC computations and to limit CDU entries.
13) Thrust/buffet operating margins computes margin values and checks airplane operation to determine if margins are satisfied.
   a) Thrust/buffet margins are computed based on airplane weight, altitude, Mach, air temperature, and available thrust.
   b) Margins are computed for low speed buffet and for high speed buffet. Climb thrust and cruise thrust are computed for normal conditions and for one engine-out conditions.
14) Step climb computes the best point along the flight plan to climb to a higher cruise altitude.
15) Flaps down speed computes minimum airspeed and maximum airspeed for flight with flaps down.
16) Models and utilities includes aerodynamic model data, engine model data, and utilities.

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17) Aerodynamic model provides airplane dependant data to other FMC functions.
    a) Variable data stored in the data base includes drag, lift, distance, speed, and angle of attack.
    b) Constant data includes flap airspeeds, turbulence penetration, target rotation angle and input limits.
18) Engine model computes normal parameters, rating parameters, idle parameters, thrust rating EPR, and fuel flow. Engine data is provided to other FMC functions on request.
    a) The engine model data base includes bleed flows, thrust setting adjustments and conversions, and fuel flow adjustments for bleeds and altitude. Also stored are thrust ratings with adjustments for bleeds and altitude for cruise thrust, climb thrust, and one engine-out thrust.
19) Utilities perform conversions and computations and provide data to other FMC functions.
    a) Utilities converts between Mach and airspeed.
    b) Utilities computes Mach, static air temperature (SAT), speed of sound, Mach/airspeed crossover, drag, and ground speed.
20) Optimum speeds are computed as requested by other FMC functions for climb, cruise, hold, one engine-out, and descent.
    a) Speed computations are based on airplane weight, altitude, airplane speed and thrust limits, air temperature, and, for ECON only, cost index and winds.
    b) Speeds are used for performance predictions and as target speeds for guidance.
21) The vertical trajectory predictions computes data relative to performance legs, vertical profile, and mode control panel altitude setting.
22) Frequency of computation varies with the type of data.
    a) Data for active nav leg, next nav leg, climb to mode control panel altitude, descent to mode control panel altitude, and active performance leg (except cruise) is computed every five seconds.
    b) Data for the remainder of the flight is computed every five minutes.
23) Predictions are made for:
    a) Fixed points which include waypoints, fix, and destination.
    b) Computed points which include target altitude, top-of-climb, step climb, and top-of-descent.

(b) Speed Envelope Characteristics
1) The FMC computes speed limits for internal use from:
    a) Maximum operating airspeed/maximum operating Mach limit (Vmo/Mmo)
    b) Low speed (stall) buffet margin.
    c) High speed (Mach) buffet margin.

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d) Maximum cruise thrust for low and high speed operation.

2) The airplane cannot maneuver outside the speed envelope at 1.3 g without encountering stall or Mach buffet. The speed envelope is defined by the buffet boundary computed internally by the FMC.

3) The FMC computes Vmo/Mmo limits from structural and aerodynamic limitations of the airplane.

4) Sustained speeds at a given altitude are limited by maximum cruise thrust. The FMC normally does not command speeds outside this limit.

(c) Optimum Step Climb Calculations

1) The FMC investigates many points along the cruise segment of flight for cost savings at a higher altitude then selects the optimum point for a step-climb.

2) Cost index is considered for all computations involving speed/fuel trades for best economy.

(d) Economy Climb Profile

1) Economy climb is a two-part climb that approximates the optimum climb speed.

a) The initial climb airspeed is an average of the economy speed at 9000 feet and at the crossover altitude.

b) The final climb airspeed is at cruise Mach for the next leg.

c) The crossover altitude is the altitude at which the economy climb speed at 9000 feet is the same as the cruise Mach for the next leg.

2) Cost index is used to determine the best economy speed for all segments.

(e) Long Range Cruise Speed Calculation

1) The long range cruise speed is slightly higher than maximum range cruise speed and provides 99 percent of the maximum range for given fuel and weight.

2) Long range cruise is used at pilot option.

(f) Vertical Trajectory Predictions

1) Vertical trajectory predictions are performed at different times and updated at different rates depending on flight conditions. Predictions are used for the following purposes:

a) Provide information for EFIS and CDU display.

b) Enable the pilot to determine the best course of action based on current conditions.

c) Provide projected guidance conditions at the end of the current leg and during following legs.

d) Provide data for performance legs calculations.

e) Compute flight phase and active guidance parameters.

2) The vertical profile is made up of performance legs defined by flight plan entered points, performance computed points, and manually controlled points. Those points may or may not be the same with points defining the lateral profile.

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3) Flight plan entered points include:
   a) Origin elevation.
   b) Destination elevation.
   c) Waypoint constraints.
   d) Cruise altitude.
   e) Climb and descent target altitudes.
4) Performance computed points include:
   a) Top-of-climb.
   b) Step climb.
   c) Top-of-descent.
5) Manually controlled points are mode control panel selected altitudes.
6) Legs can also be defined for drift down on a single engine or a step climb.
7) Combinations of altitude, airspeed, ground speed, flight path, distance to destination, estimated time of arrival, and gross weight are computed for points along the profile. The FMC also computes speeds, Mach, thrust, distances, gross weight, and winds along each performance leg of the vertical profile.
8) Termination positions are predicted for navigation legs that terminate at an altitude. A great circle path is assumed between waypoints where a flight plan discontinuity exists.

(g) Descent Path Calculations
1) The FMC produces a descent path array containing all data necessary to provide guidance along the path. Data consists of:
2) Constraining factors include:
   a) Mach/speed restrictions.
   b) Altitude constraints.
   c) Standard procedures.
   d) Repressurization constraints.
3) Computed factors include:
   a) Speed for descent legs.

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b) Path for descent legs.
c) Thrust for descent legs.
d) Top of descent.
e) Repressurization segment.
f) Acceleration/deceleration path.
g) Required cabin rate of repressurization.

4) The FMC computes the descent path beginning with the last altitude restriction before airplane destination. Descent path segments of constant speed or economy descent are computed in reverse order and include segments necessary for acceleration or deceleration.

5) The repressurization segment is defined so that cabin altitude and airplane altitude are equal at the airplane destination without exceeding the maximum allowable cabin repressurization rate.

6) The top of descent point is determined from the intersection of the descent path with the cruise altitude.

7) Path changes may be made at set altitudes, calculated altitudes, or geographical locations.

(5) FMC Functional Block - Display (Fig. 11)

(a) General

1) For a description of the EHSI symbols, refer to AMM 34-22-00/001.

2) The FMC provides data to the display system over a dedicated ARINC 429 bus. The bus carries:

a) Dynamic data is transmitted for all EFIS modes and is updated every 50 milleseconds.
b) Background data is transmitted for EFIS map and plan modes and is updated every five seconds.

3) The display reference position for the map mode is the airplane position. The map mode is oriented with the airplane track at the top of the display. The reference position is dynamic, moving as the airplane moves.

4) The map displays selected routes. Desired background data may be selected at the EFIS control panel for display.

5) Data provided by the FMC includes:

a) Wind speed

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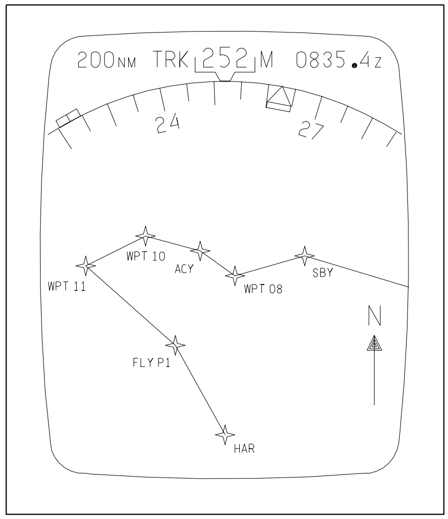
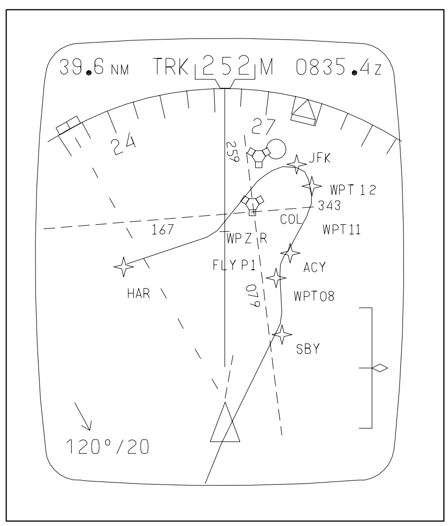


DISPLAY (PLAN MODE)



DISPLAY (MAP MODE)

Display (Map and Plan Modes)
Figure 11

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b) Wind angle
c) Track angle
d) Time to go/distance to go
e) Range to altitude
f) Curved trend vector
g) Compass scale
h) Vertical deviation
i) Lateral deviation

6) The display reference position for the plan mode is a waypoint selected on the CDU RTE LEGS page or the current active waypoint. If no waypoints are entered, the display is referenced to the airplane origin. The plan mode is oriented with north at the top of the display. The reference position does not move.
7) Data provided by the FMC includes:
   a) Track angle
   b) Time to go/distance to go
   c) Compass scale
8) Desired background data may be selected at the EFIS control panel for display.
9) Dynamic data is displayed for the VOR/ILS mode.
10) Data provided by the FMC includes:
   a) Wind speed
   b) Wind angle
   c) Track angle
11) Data provided to the display system by the FMC includes both FMC generated data and data received by the FMC from external sources.
12) Data generated within the FMC comes from four functions:
   a) The FMC guidance function provides flight plan definition, leg data, leg transition data, vertical and lateral errors, and drift.
   b) The FMC performance function provides distance to destination.
   c) The FMC navigation function provides airplane position, track, speed, altitude, wind data, and nav aid frequencies.

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d) The FMC CDU function provides map reference position, offset path, page identity, and selected reference points and their radials.

13) Data generated outside the FMC comes from three external sources.
    a) The inertial reference system provides acceleration and heading.
    b) The VOR provides selected course.
    c) The EFIS control panel provides data, range selection, and EFIS mode.
14) Data from all sources is transmitted by the FMC directly to the display system over the EFIS data bus.
15) The FMC computes a map edit area for the EFIS. The edit area includes all map points currently displayed and all map points that could appear in the next 10 seconds. Background data is provided only for the edit area.
16) The FMC selects an array of navaids from the navigation data base. Selection is made beginning with the navaid nearest the airplane and working out to the maximum range, but limited to the 20 nearest navaids. Autotune navaids are selected from the array by the navigation function.
17) Flight plan data required for display is computed by the EFIS function and stored in the guidance buffers. Time to waypoint and range to altitude are computed by the EFIS function and are transmitted to the display system as dynamic data.
18) The FMC transmits 64-word blocks of background data to the display system once every five seconds. The block contains only data that has been updated since the previous block was transmitted. A maximum of eight blocks, or 512 words, are used for background data.
19) Complete background data is transmitted within one second of a mode change, scale change, EFIS map data selection, or a CDU action. The EFIS control inputs respond to CDU actions within 100 msec.

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20) The FMC establishes the priority for data sent to the EFIS symbol generator. If background data exceeds 512 words, the most important data is displayed.

(6) FMC Functional Block - Guidance (Fig. 12)

(a) General

1) The guidance function of the FMC performs flight plan storage of navigation and performance legs and guidance initialization for both lateral and vertical profiles. The guidance initialization process includes flight plan activation, leg sequencing, leg updating, and path definition.

2) With each leg of the lateral path defined, three modules are used to determine roll steering commands along each leg or transition between legs.

3) The lateral position module compares current airplane position to the desired position (defined track) and generates errors. Error calculation uses planar approximations about computed lateral reference points.

4) The lateral mode control module controls the engagement and disengagement of the LNAV mode, selects the proper mode control to steer and performs leg sequencing.

5) Using path and/or heading errors and mode control inputs, the lateral controllers compute roll attitude commands that let the FCCs control the airplane.

6) Each leg of the vertical profile is defined and in some cases broken into smaller segments by the performance function of the FMC. Five modules are used to determine pitch and thrust steering commands for each segment of each vertical leg.

7) The vertical position module compares current airplane altitude and altitude rate with the desired flight path and generates errors for this path and the next.

8) The vertical mode control module controls the engagement and disengagement of the VNAV mode. It also selects the proper mode for control of the pitch axis and the throttles and sends appropriate requests to the submode logic. At the proper time, the vertical mode control module performs leg and segment sequencing.

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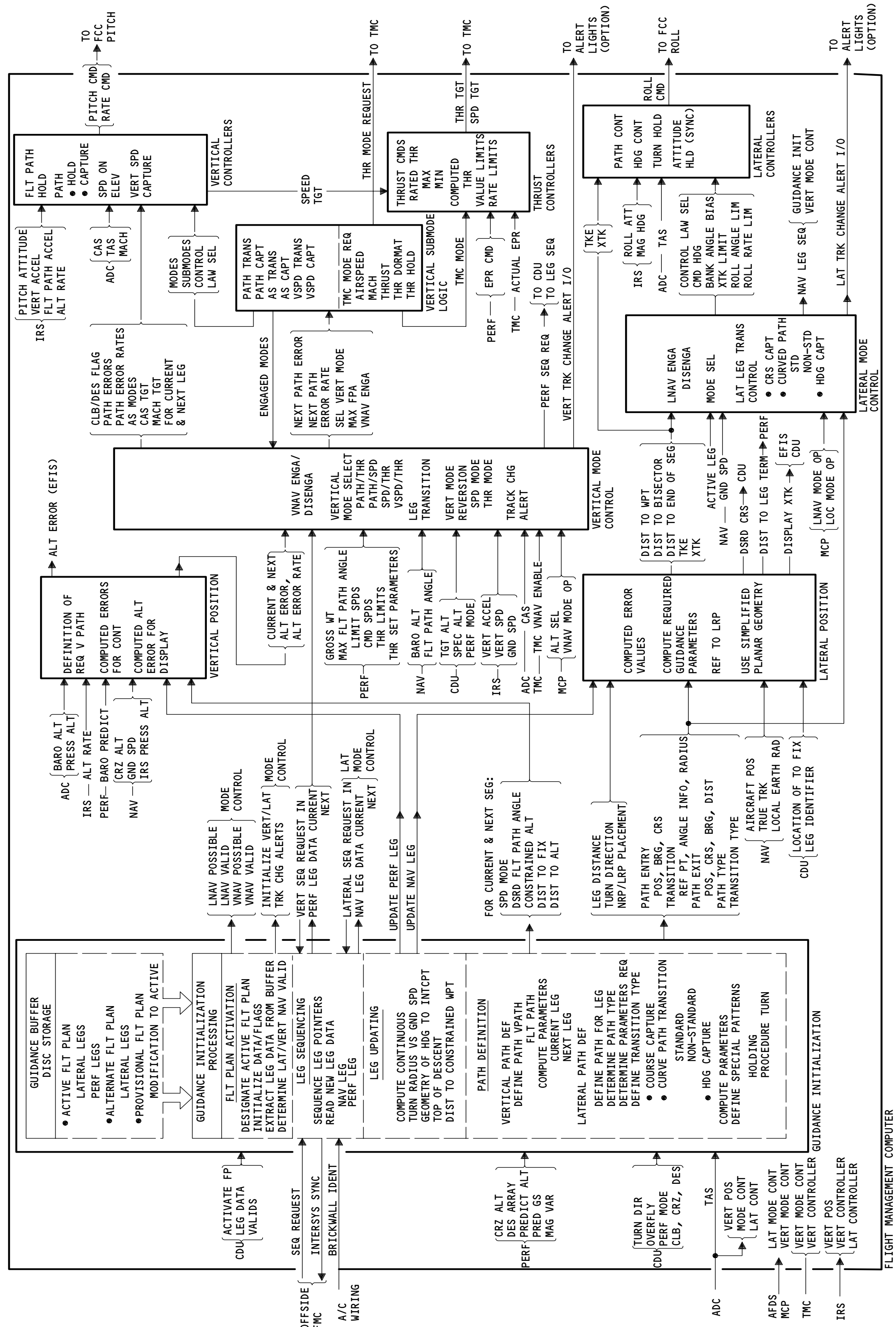

FMC Functional Block Guidance
Figure 12

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9) The vertical submode logic module flies the plane to defined legs and transitions as requested by vertical mode control. It also performs all switching required during transitions and capture maneuvers, and sends mode request logic to the TMC.

10) Vertical controllers use errors, ratio, targets, mode and submode selections to compute pitch displacement and pitch rate commands. They return the necessary quantities back to submode logic to enable switching at appropriate times and supply airspeed targets to the thrust controllers which provide thrust and airspeed targets to the TMC.

(b) Flight Plan Records

1) Three flight plans are stored in the guidance buffer:

a) The active flight plan: This is selected by activating and executing a route through the CDU. It contains performance legs which define the vertical profile; and navigation legs which define the lateral profile. Some NAV waypoints may place altitude constraints on the vertical path, but generally the two records are independent. Only the active flight plan is used for VNAV and LNAV guidance computations.

b) The inactive flight plan: Containing only the navigation legs this may be a company route or a pilot-selected string of waypoints and procedures. To be used for guidance, the inactive flight plan must be activated and executed. The vertical profile is defined only after activation.

c) The provisional flight plan: This is a temporary plan which is eliminated when its modifications to the NAV or performance legs are executed. The modifications must be executed before they affect the active flight plan.

(c) LNAV Guidance - General (Fig. 13)

1) The LNAV Route consists of lateral legs connected by transitions. These transitions are automatically initiated to allow smooth control between legs. Heading control is used for straight paths and path control for curved paths. Normal guidance is provided across discontinuities if certain criteria are met (close proximity or intercept heading).

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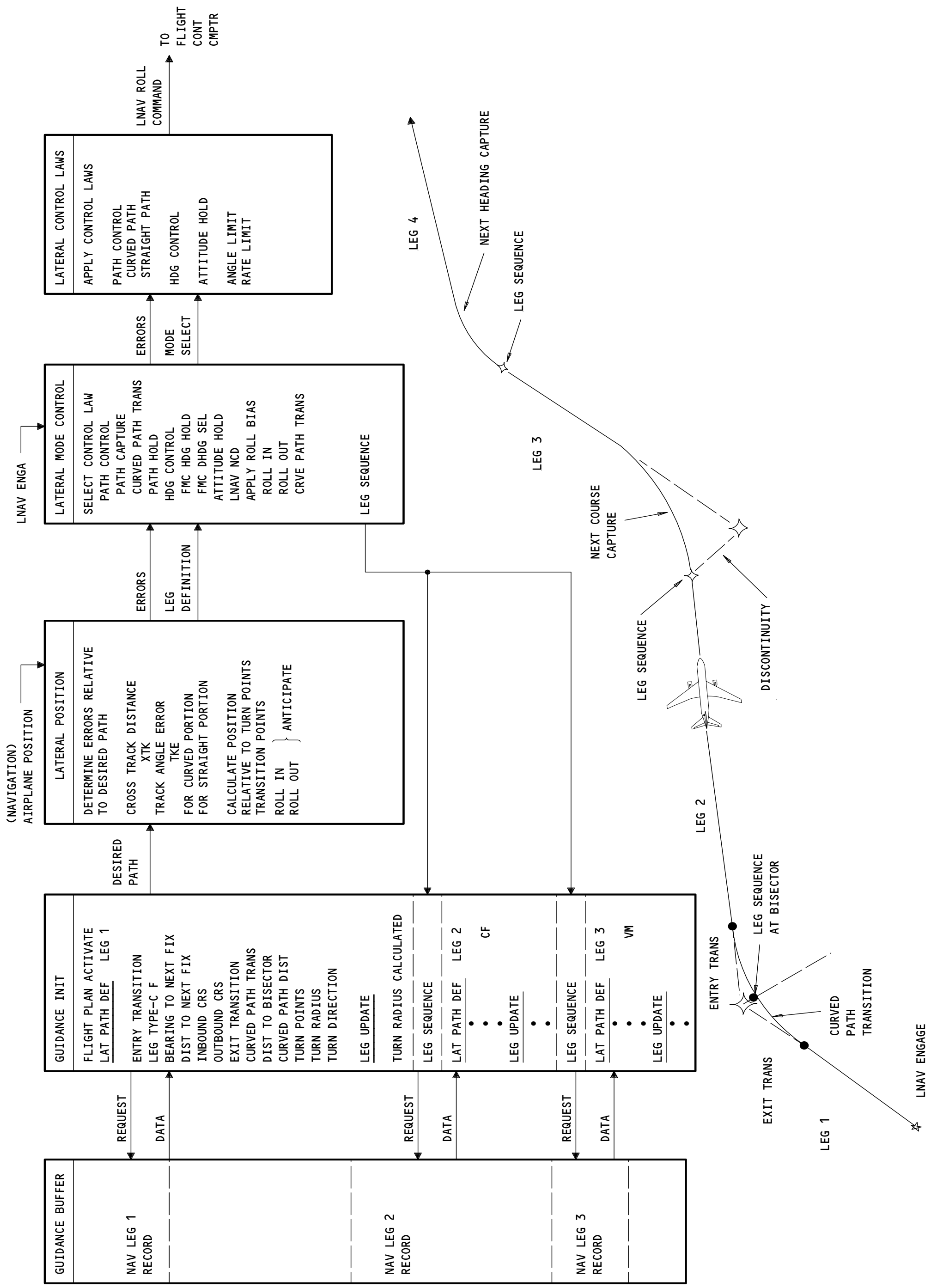

LNAV Guidance General
Figure 13

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2) If LNAV is still engaged at the end of the defined route, or at a discontinuity where capture of the next leg is impossible, control reverts to HDG HOLD.
3) The guidance buffer stores records of each defined LNAV leg. Guidance initialization activates the flight plan, selects data from correct NAV leg record, and assembles data to define a lateral path in a manner usable to the guidance function. Guidance initialization also updates dynamic leg parameters and responds to leg sequence requests with next leg data.
4) Lateral position determines airplane position errors relative to the path; calculates airplane position relative to transition points, turn points, etc.; and provides leg sequence requests at the proper time.
5) Lateral mode control properly routes the signals for processing. It enables transition (path, course, or heading capture), and leg guidance (path control, heading select, or heading hold). Lateral mode control also enables synchronization during LNAV disengaged.
6) Lateral control laws use mode control and signal inputs to perform steering computations, filtering, and limiting. Lateral control laws provide roll attitude commands to the FCC.
7) The LNAV guidance is capable of steering the airplane through all normal transitions between the 15 possible navigation legs. Transitions are divided into three categories: curved path transition, course capture transition, and heading capture transition.
8) Curved path transition is the normal transition for an automatic course change at a waypoint. A circular path tangent to the active course and the next course is calculated. Errors are measured from the arc during the transition. When the errors are zero, a bank angle bias maintains the proper bank for the turn. Roll-in and roll-out anticipation are computed for accurate tracking of the path. Leg sequencing takes place at the bisector.

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9) Non-standard curved path transition is the same as the standard curved path transition except that no bisector is calculated. Leg sequencing occurs at the beginning of transition. This method is used for course intercept or direct-to-fix legs.
10) Whenever off-path conditions occur, the course capture transition is used. The turn direction may be specified but no circular path is computed. Path errors, cross track distance (XTK) and track angle error (TKE), steer the airplane back to the path.
11) Heading capture transition is used whenever the next leg requires guidance to a specified heading. The transition begins at the termination of the active leg. Heading error provides the only guidance.

(d) LNAV Engage

1) The LNAV mode is initiated by pressing the LNAV switch/light on the MCP which generates an LNAV mode request to the FCC. The FCC determines if the A/P is currently capable of engaging in LNAV and if so it sends an LNAV arm signal to the MCP, which then sends an LNAV mode operate signal to the FMC.
2) Two conditions will prevent LNAV ENGAGE. One occurs when the airplane is flown beyond the defined route. The other occurs when the airplane is not in position to capture the route (proximity test failed). The proximity test requires that the transmitter is within 2.5 nautical miles ; or that the airplane satisfies the capture criteria based on speed and intercept angle. Once LNAV is engaged, neither of these conditions causes disengagement.
3) For continued LNAV engagement, the following conditions must exist:
   a) LNAV is possible - navigation data and critical sensors are valid.
   b) LNAV is valid - route and additional data and sensor inputs are valid.

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c) Lateral leg defined - path, HDG, or HDG HOLD.
d) No FMC failure.

4) Anytime LNAV ENGAGE goes low for any reason, the LNAV mode operate must be cycled low to high before LNAV ENGAGE can occur.

5) Data management provides true airspeed and magnetic heading to the heading control logic and roll angle to the horizontal steering circuits. Path control provides a roll signal based on track errors (TKE and XTK).

6) When LNAV is disengaged, steering signals are transmitted with a Sign Status Matrix (SSM) indicating No Computed Data (NCD). The steering signals are generated by using actual airplane roll angle as a roll command. Path control and heading control outputs are isolated from the summing point at the input to the roll command limiter. The steering signal is therefore synchronized to airplane bank angle so that no transients occur at LNAV engage. The steering signal is not used by the FCC until the SSM goes from NCD to a valid condition.

(e) LNAV Heading Control

1) There are two methods of heading control from the FMC:

a) Heading select (HDG SEL) control begins at the termination of the active leg when the next leg is a heading leg. The difference between current airplane heading and selected heading generates a heading error and consequently a roll steering command.

b) Heading hold (HDG HOLD) is used whenever a path mode is called for but capture criteria are not satisfied (proximity test), or when the airplane reaches the terminating waypoint of the last defined route leg. Heading hold causes the airplane to maintain the current heading, which is sampled and held at the time of HDG HOLD engage. Any deviation from this held heading causes roll commands to be generated to return the airplane to that heading.

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(f) LNAV Course Capture

1) Course capture is used to capture a navigational leg whenever an off-path condition exists. The following reasons can cause an off-path condition:
   a) Pilot using the F/D and not following the commands.
   b) The terminal fix of this leg does not overlie the next leg.
   c) The offset path is cancelled automatically or manually.
   d) Procedures require the airplane to overfly a waypoint.
2) A required turn direction may be specified to capture a course.
3) If a course change of less than 3 degrees or greater than 135 degrees is required, and the airplane is on-path, the airplane will overfly the terminal fix and a course capture is used to acquire the next course.
4) Course capture uses path errors, cross-track distance, and track angle error to fly the airplane to the desired path. During a capture, the airplane will turn through the smallest angle to the new course unless a turn direction is specified. The course capture point is calculated so that by using the maximum bank angle (17 deg) and bank rate (2 deg/sec) the airplane will fly to the desired course with no overshoot.
5) In the off-path condition the airplane turns through the smallest angle and makes a normal capture at the proper capture point. There is no overshoot.
6) In overfly, the airplane crosses over the desired course and turns through the smallest angle to the new course. Capture is latched at the capture point. If the overshoot is large, normal capture is accomplished by approaching the new course from the far side at an angle of 45 degrees.
7) Maximum bank in a specified turn direction is commanded by bank angle bias. This bias is removed if the specified turn direction is the smallest angle. In this type of capture the airplane crosses the desired course and intercepts it at a 45 degree angle (for large overshoot). Normal capture takes place as the airplane returns to the desired course.

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8) Capture distance is computed based on TKE and ground speed. If the capture detector output is high, lateral path capture logic is maintained through leg sequencing. If no turn direction is specified, path errors (XKT and TKE) are used to steer the airplane toward the desired course. Undesirable transients during course capture or leg sequencing are eliminated through the roll command limiter and the roll command rate limiter.
9) After LATL PATH CAPTURE logic goes high, the airplane may turn opposite of normal course capture turn direction, in which case a 25 degree bank angle bias is inserted.
10) The airplane maintains this 25 degree bank in the correct direction until the normal course capture takes over.
11) The LATL PATH CAPTURE logic closes the switch allowing the output of path control to be applied to the roll command limiter.
12) Path errors continue to control the airplane when it is established on the path. Since leg sequencing normally occurs at the capture point, the pilot's only indication that he is on the path is when the airplane rolls to wings level and the correct map is displayed on the EHSI.

(g) LNAV Path Control
1) Most legs of a navigational route consist of defined paths between pairs of waypoints. Each such leg is divided into three segments: a curved entry path, a straight path, and a curved exit path. Leg sequencing takes place at the bisector of the course change angle.
2) The LNAV guidance uses path errors to steer the airplane to the defined path segment whether it is a curved or straight segment.
3) During a curved path transition, the airplane is constantly under path control. A turn radius is computed by the FMC based on ground speed and course change angle. This curved path is tangent to both the active leg and the next leg.
4) A nominal bank angle, based on ground speed and less than applicable limits, is computed and used as a bias to fly the curved path. When the path errors (TKE and XTK) are zero, the airplane maintains the nominal bank angle. A roll-in anticipation and a roll-out anticipation distance is computed for each transition. The bank angle bias is applied only after roll-in logic and after roll-out logic and is not used for straight path segments.

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5) No attitude change should occur at leg sequencing since the curved exit path of the active leg and the entry segment of the next leg are identical.
6) The nominal bank angle bias is removed during straight path segments. Path errors alone steer the airplane to maintain the desired path. If path errors are zero, the commanded bank angle returns to zero.

(h) VNAV Guidance General (Fig. 14)
1) The vertical flight profile is comprised of climb, cruise, and descent performance legs.
2) The performance legs are separated into smaller segments is individually controlled by use of the proper pitch and thrust controllers. The controllers provide smooth, transient free transitions between segments. The FMC accommodates VNAV mode transitions between the following vertical leg segments:
   a) Speed Climb to Speed Climb (speed or thrust change)
   b) Speed Climb to Cruise
   c) Cruise to Speed Climb
   d) Cruise to Cruise (speed change)
   e) Cruise to Speed Descent
   f) Cruise to Path Descent
   g) Speed Descent to Speed Climb (go around)
   h) Speed Descent to Cruise
   i) Speed Descent to Speed Descent (speed change)
   j) Speed Descent to Path Descent
   k) Path Descent to Speed Climb (go around)
   l) Path Descent to Cruise
   m) Path Descent to Speed Descent
   n) Path Descent to Path Descent (path change)
3) The VNAV guidance function of the FMC is divided into seven sections as shown in Fig. 14.

(i) VNAV Performance Leg Definition - Climb
1) Each climb leg begins or ends at a transition altitude or an altitude constraint. The climb mode ends upon reaching the selected cruise altitude. One of five performance modes may be selected for each climb.
   a) Economy

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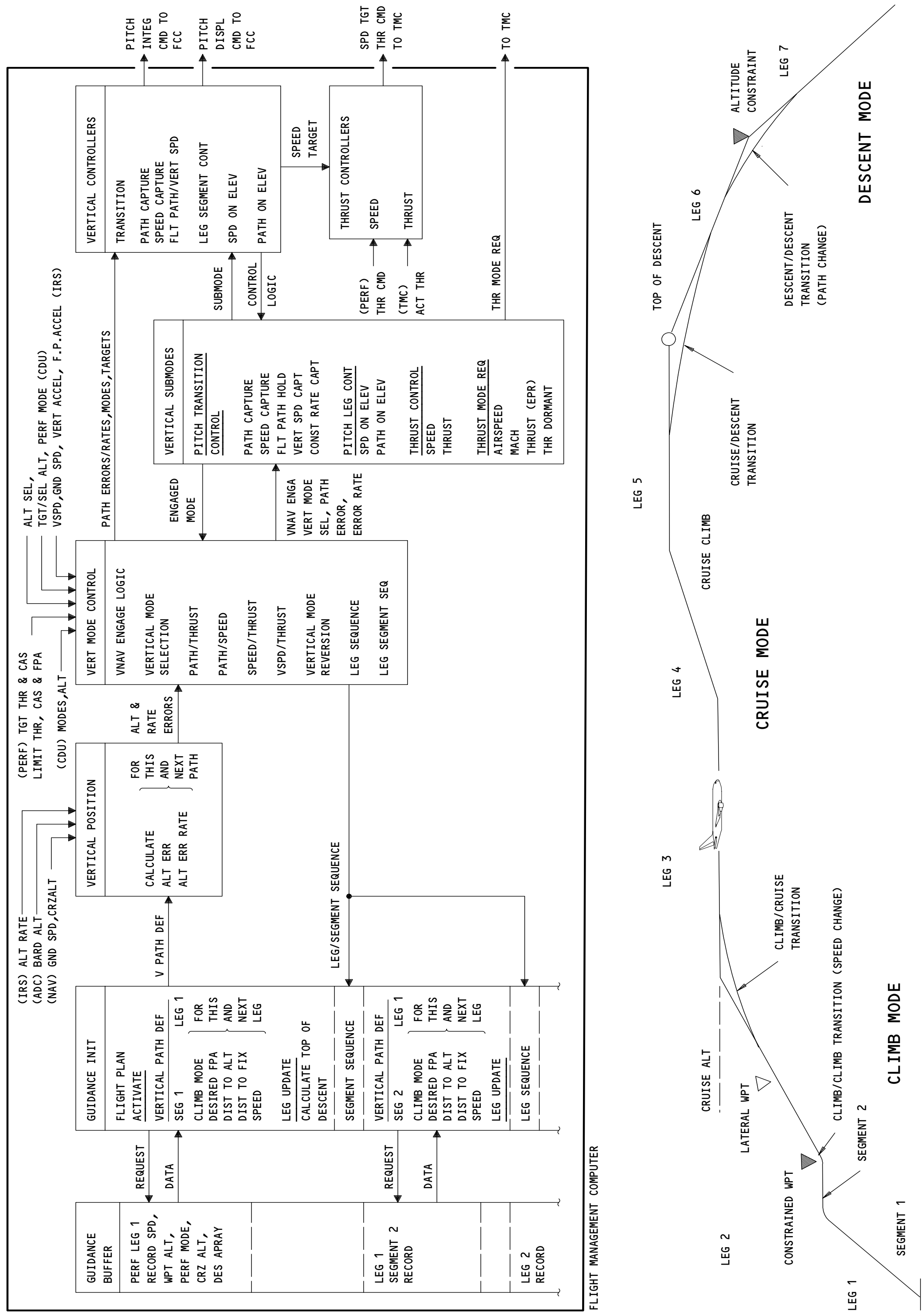

V NAV Guidance General
Figure 14

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b) Manual
c) Maximum rate
d) Maximum angle
e) Engine out
2) Each climb leg may be divided into segments. A segment change allows level flight when reaching a constraining altitude while remaining in the climb mode.
3) The FMC mode and submode logic determine which vertical controllers are used during climb. When at a climb leg or segment transition, new vertical controllers or new altitude and speed targets cause guidance to the new segment. The following transitions occur with controller changes:
a) Speed on elevator to path on elevator
b) Thrust on throttles to speed on throttles
4) New altitude and speed targets provide transitions without controller changes.

(j) VNAV Performance Leg Definition - Cruise
1) The cruise mode of a flight plan begins when the cruise altitude is reached. One of four performance modes may be selected for cruise legs.
a) Economy
b) Long range cruise
c) Manual cruise
d) Engine out
2) Only one cruise performance mode is used at any time. The cruise mode ends at the calculated top of descent point if VNAV is allowed to transition to a descent mode (lower MCP altitude selected).
3) The only automatic transitions involving cruise legs are transitions into cruise at the top-of-climb, and out of cruise at the top-of-descent. Cruise climb and cruise descent are initiated through CDU action. Mode and submode logic determines which vertical controllers are used during cruise legs. The normal control is path on elevators and speed on throttle.

(k) VNAV Performance Leg Definition - Descent
1) Each descent leg begins or ends at a transition point. One of the following performance modes may be selected:
a) Economy descent
b) Manual descent

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2) The descent profile contains lateral overlaps or discontinuities between legs. The airplane maneuvers either vertically or horizontally to capture the next leg. The descent mode begins at the top of descent and ends at a defined or default end of descent.
3) The performance function of the FMC provides a descent path array that divides each descent leg into small segments. Segment transitions normally require a change in flight path angle. This occurs at approximately 3000 ft. intervals. Acceleration, deceleration, descents across discontinuities, anti-ice, and repressurization segments use non-standard control.
4) Mode and submode logic determine which vertical controllers are used to control each segment. Normal descents require path on elevator and thrust (idle) on throttles for most segments (speed is not directly controlled). Speed reversion is used if the airplane approaches maximum or minimum speed limits.

(l) VNAV Engage
1) The VNAV mode is initiated by pressing the VNAV switch on the Mode Control Panel (MCP). This generates a VNAV mode request to the Flight Control Computer (FCC) which determines if the autopilot is currently capable of engaging in VNAV. If the validity check is passed, the FCC sends a VNAV ARM signal back to the MCP. This illuminates the VNAV switch/light and allows a VNAV MODE OPERATE signal to be sent to the FMC and TMC.
2) The VNAV mode cannot be engaged if the airplane has flown beyond the defined navigation route. This will not disengage the system but, the FMC automatically defines altitude hold as the active leg (vertical path/speed).
3) VNAV engagement requires the following:
   a) VNAV POSSIBLE - the critical IRS and ADC sensor inputs must be valid.
   b) VNAV VALID - the vertical leg must be defined, the FMC navigation data must be valid, and the performance function must be initialized.
   c) No FMC Failure - When an FMC FAIL occurs, the VNAV MODE OPERATE signal must be cycled to high to re-engage VNAV.
   d) FMC Target Altitude/MCP Clearance Altitude - If the FMC climbs through, descends through, or flies away from the MCP clearance altitude VNAV will disengage.

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4) If VNAV is engaged between the FMC target altitude and the MCP clearance altitude the result is a command to level the airplane and maintain speed if the airplane is more than 150 ft. from the FMC target altitude. If it engages within 150 ft. of the target altitude, the FMC maneuvers to capture the target regardless of the MCP setting. A CDU alerting message is generated when the FMC cannot fly the airplane to its target altitude.

5) Thrust targets for the speed/Mach modes and the thrust mode are continuously generated with VNAV engaged. The TMS receives either a speed target or a thrust target, depending on the performance mode selected. Speed targets are used for cruise and VFR approach modes and are in terms of CAS or Mach. Thrust targets are used for climb and descent modes. An idle thrust target is used for most descents. Thrust mode requests to the TMC enabling the use of these targets require a TMC VNAV ENABLE signal from the TMC. This signal assumes that A/T ARM is selected on the MCP and the TMC is ready to accept FMC commands.

(m) VNAV Climb

1) Primary control during VNAV climb is speed on elevators and thrust on throttles.

2) The GAMMA HOLD function prevents the plane from going to descent to attain a higher commanded speed during climb. It also prevents a descent to climb transition to capture lower speed.

3) The FLIGHT PATH HOLD function maintains a zero flight path during a speed transition or GAMMA HOLD.

a) The current value of inertial speed is held and compared to the dynamic value of vertical speed from the IRS. Any difference causes a vertical speed error.

b) The steering and steering rate paths, which use the vertical speed error, are sent to the pitch channel of the FCC. Here they cause proper elevator command.

4) The THRUST HOLD function is generated when speed and EPR errors require one target to increase and the other to decrease. It is used only during speed transition to prevent change to the thrust target in the TMC.

a) The maximum value of current EPR from either engine is sampled and held to be used as an EPR target value for the TMC.

b) Since the THRUST HOLD logic also generates a THRUST MODE REQUEST, the TMC controls the throttles to maintain the actual (current) EPR.

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5) The Mach or Computed Airspeed (CAS) target for the active performance leg is converted to true airspeed (TAS). If the MCP SPEED SEL knob is pressed with VNAV engaged, the MCP displayed speed becomes the current target for speed mode operation. The TAS from external sources is compared to the target to generate a SPD ON ELEV STRG RATE CMD. The differentiated TAS target is combined with filtered TAS and flight path acceleration to generate the SPD ON ELEV STRG CMD. The two commands are used whenever the SPD ON ELEVATOR logic is high (from the submode logic).

6) The STRG and STRG RATE commands are smoothed and limited to a vertical acceleration of 0.1g and to a total pitch altitude command of +15° or -10°. The vertical steering signal causes immediate elevator deflection and the FCC pitch command integrator to ramp to establish a new reference pitch attitude. Gain adjustments in the steering rate command determine how quickly a new reference should be established.

(n) VNAV Cruise - Path/Speed Control

1) Primary control during cruise is path on elevators and speed on throttles. The PATH HOLD control uses path error and path error rate to control the airplane. Path errors and error rates are measured from the next path during capture, and from the active path once established on the path (path hold) .

2) When transitioning to a path leg, the guidance function computes a path capture point. The capture point allows the airplane to smoothly maneuver to the next path with no overshoot. The transition is achieved without exceeding the pitch attitude limits or vertical acceleration limits.

a) The normal capture is controlled by the path error signal (which causes the airplane to continue flying toward the next path) and the path error rate (which is a damping signal). Once the airplane has flown to the new path and the path error and error rate have reduced below certain thresholds, the path capture control ends and path hold begins.

b) The DEVIATION SIGN (from signal flow) determines whether the airplane is above or below of the capture point. When the DEVIATION SIGN changes state, the airplane has passed through the capture point. Also, PATH CAPTURE goes high and is latched, which causes the speed mode request (AS or Mach), defined for the next path, to be sent to the TMC.

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c) The path capture control law provides steering and steering rate signals which these signals cause the airplane to fly a 0.05 g circular arc to the new path. A positive or negative bias (gain programmed by TAS) is summed with the steering rate command during the initial part of the capture maneuver. This aids in flying the airplane to the new path and to more quickly establish a new reference pitch attitude. Steering and steering rate commands are smoothed and limited and sent to the FCC.

3) During PATH/SPEED capture and hold maneuvers the throttles are controlled to maintain the speed commanded by the active performance mode. The SPEED and MACH targets from the performance function are used. The next leg values are used during capture. The established leg values are used after capture. Target values are sent as CAS and Mach to the TMC along with the proper speed mode request (AIRSPEED REQUEST or MACH REQUEST).

(o) VNAV Descent

1) Primary control during most descents is path-on-elevator and thrust-on-throttles. Speed is not directly controlled during this type of descent. If the speed comes close to Vmax or Vmin during a VPATH/Thrust descent, the FMC reverts to speed/thrust control.

2) For a normal capture vertical speed error is used, with a gain difference, in both the steering and steering rate path to the pitch channel. The STRG and STRG RATE commands are smoothed in mode transition smoothing. They are limited to a vertical acceleration of 0.1 g and limited to a total pitch attitude command of +15 degrees and -10 degrees. The signals are then sent to the pitch channel of the FCC where they cause the proper elevator command.

3) The cruise descent mode may be used to accomplish the following:

a) A pilot initiated cruise descent

b) An early descent (before reaching top of descent)

c) A fly across to a lateral discontinuity in the descent path.

4) For a cruise descent, a vertical speed of 1000 ft/min is captured while the throttles maintain airspeed. Then, the elevators hold airspeed while the throttles go dormant. With the throttles dormant, the pilot can adjust throttle position to adjust descent rate without the TMC returning the throttles to their original position.

5) Constant rate capture is utilized under the following conditions:

a) Late capture before crossing the next path

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b) Late capture after crossing the next path with the path errors still within limits.
c) Capture change - capture request during a path capture.

6) A constant rate capture may occur with either a VPATH/SPD or VPATH/Thrust request.
7) For a capture requiring pitch up, the constant rate capture control commands pitch up to the maximum flight path angle as computed by the performance function. The airplane overshoots the desired path and performs a normal capture from the far side.
8) For a capture requiring pitch down, the constant rate capture control commands pitch down to achieve a 75 ft/sec descent rate. The airplane flies through the desired path and performs a normal capture from the far side. Normal path capture is inhibited during a constant rate capture request.

(p) MTH ALL;
Altitude Intervention
1) The Altitude Intervention function is operated when the applicable Airline Policy File (APF) option is set.
2) Altitude Intervention represents the FMC functions associated with the MCP altitude window value and the altitude knob pushbutton.
3) If the MCP altitude is set appropriately and VNAV is engaged, the FMC shall provide the capability, with the MCP altitude knob pushbutton, to depart altitude, change the cruise altitude and remove waypoint constraints from the active VNAV profile.
4) If the MCP altitude is set appropriately and VNAV is not engaged, the FMC shall provide the capability, with the MCP altitude knob pushbutton, to change the cruise altitude and remove waypoint constraints from the active VNAV profile, the same as if VNAV was engaged.

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5) When the FMC receives the VNAV DIRECT request command from the MCP, it shall provide appropriate guidance and manipulation of VNAV profile targets; the FMCs response upon dependant current vertical situation conditions. These are as follows:

- VNAV control mode (VNAV ALT, VNAV PTH or VNAV SPO)
- Active VNAV flight phase (CLB, CRZ or DES)
- Aircraft altitude
- MCP selected altitude
- VNAV profile target altitude

When the VNAV DIRECT digital discrete results in automatic execution of a profile change (i.e., cruise altitude change or constraint deletion), a map update shall be initiated. The VNAV DIRECT digital discrete will affect ly the cons traints in a possible flight plan modification. The discrete will only remove the same constraint on the same waypoint that is to be removed in the active flight plan. This is correct when no intermediate constraint exists in the modified flight plan before the waypoint whose constraint is to be removed. Any change to the cruise altitude in the active flight plan shall also be reflected in the modified flight plan if a cruise altitude is in the modified flight plan.

(7) SAS 157 POST-SB 34-544;
FMC Functional Block - FANS

(a) General

1) The Futurn Air Navigation System (FANS) includes intefaces with the Airplane Communications Addressing and Reporting System (ACARS), the Global Positioning System (GPS), and the flight deck printer to perform the following functions:

a) Air traffic services which includes the Air Traffic Services Facilities Notification (AFN), the Automatic Dependent Serveillance (ADS), and the Air Traffic Control (ATC) Data Link.

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b) Airline Operational Communication (AOC) Data Link.
c) Global Positioning System (GPS)/FMC Integration.
d) Required Navigation Performance (RNP).
e) Required Time of Arrival (RTA).
f) Printer Interface.

(b) Air Traffic Services Facilities Notification (AFN)

1) The FMC provides the capability to initiate notification both manually through flight crew action and automatically by uplink. The AFN function provides the capability to exchange data link application names, versions, and addresses. The FMC requires the flight crew to perform a successful logon through the AFN before ATC data link communication may be conducted. The FMC transmits and receives AFN messages over the ACARS.

(c) Automatic Dependent Surveillance (ADS)

1) The FMC provides standard ADS application functionality which includes the periodic reporting, event reporting, and on-demand reporting. The type and content of the report are defined in the uplink request. The FMC is capable to simultaneously process reports from up to four ATC centers and one airline address. The FMC also provides a capability for the flight crew to disable this function.

(d) Air Traffic Control (ATC) Data Link

1) The FMC provides the capability for two way data link communications. This function uses a standard message set which contains the defined uplink and downlink message element text formats.
2) The FMC provides the capability to encode the downlink requests to an ATS facility for route changes, lateral offset, speed and vertical clearances, and for voice contact. The uplink message contains the pre-departure clearances, lateral route clearances and offset clearances for flight plan modification.
3) The FMC provides the capability to receive and display the uplink requests for report of confirmation. The FMC formats the message and makes the report available to the flight crew for downlink.
4) The FMC solicits the crew decision for each uplink message and sends to the originator ot the uplink.
5) The uplink and downlink messages are stored in the FMC by means of the ATC log. The stored messages are tagged with time of receipt or transmission, and type of response. The stored messages can be printed through the printer interface function.

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(e) Airline Operational Communication (AOC) Data Link

1) The AOC data link is designed to reduce crew workload of input data into the FMC. The AOC supports the data link for: flight plan routing, way point winds, descent forcast data, performance initialization data, takeoff data, position reporting way points, alternates for diversion routing, and route modification. Data are prepared at an airline ground station and sent to the data link service provider to be uplinked to the FMC.

2) The AOC uplink data are formatted and displayed for flight crew to review. The ground station can uplink message to request for the entered performance initialization data, entered takeoff data, position information, progress report of ETA and fuel at destination, and current flight plan routing from the FMC. The crew can initiate downlinks to request for flight plan information.

(f) Global Positioning System (GPS)/FMC Integration

1) When the GPS option is enable, the primary mode of operation is to use GPS position to estimate errors in the inertial reference system position and velocity. As the airplane progresses along its flight path, the FMC uses its current estimate of the airplanes's position and its internal database to automatically tune the VOR and scanning DME receivers to the station which yield the most accurate radio position.

2) If the localizer approach procedure is active, the locali localizer deviation data is used to update the FMC position in the direction normal to the runway centerline while the GPS is used to update the FMC position in the direction along the runway centerline. runway centerline

(g) Required Navigation Performance (RNP)

1) Required navigation performance is the requirement of the navigation performance necessary for operation within a defined airspace. The RNP can be manually entered through the CDU, or extracted from the OPC based on navigation flight phase.

(h) Printer Interface

1) The FMC provides the capability to interface with the printer for manually print the uplink and downlink messages. Each print will include the time and date of the message, flight number, and tail number.

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(8) FMC Functional Block - CDU

(a) General

1) The CDU allows control of the FMC and is the primary display for the pilot.

2) Four flight management functions are performed through the CDU.

a) Flight planning includes establishing navigation parameters, route selection, route leg definition, and departure/arrival data. Flight planning also includes monitoring flight progress and selection of waypoint fixes.

b) Navigation function selection includes defining direct-to flight paths, intercept flight paths, and holding patterns.

c) Performance function selection includes selecting climb modes, cruise modes, and descent modes for the flight path.

d) Flight data inputs include altitudes, winds, temperatures, and cabin repressurization rate.

3) Data from the CDUs is received on dedicated ARINC 429 data buses. The FMC checks data for validity and rejects invalid data. If the onside CDU fails, data from the offside CDU is available.

4) The FMCS CDU display is controlled by the FMC. Each FMC contains two independent display buffers, one for each CDU.

5) The FMC formats all data for display on the CDU. The data is updated when dynamic conditions change, when there is a CDU request for data, or when there is a change in the active leg.

6) The identity and format of information displayed on the CDU is determined by the FMC processing.

7) The FMC alert condition is displayed on the CDU scratch pad, CDU annunciators, and the FMC annunciator light.

(b) FMCS Maintenance Index Schematic - IDENT (Fig. 15)

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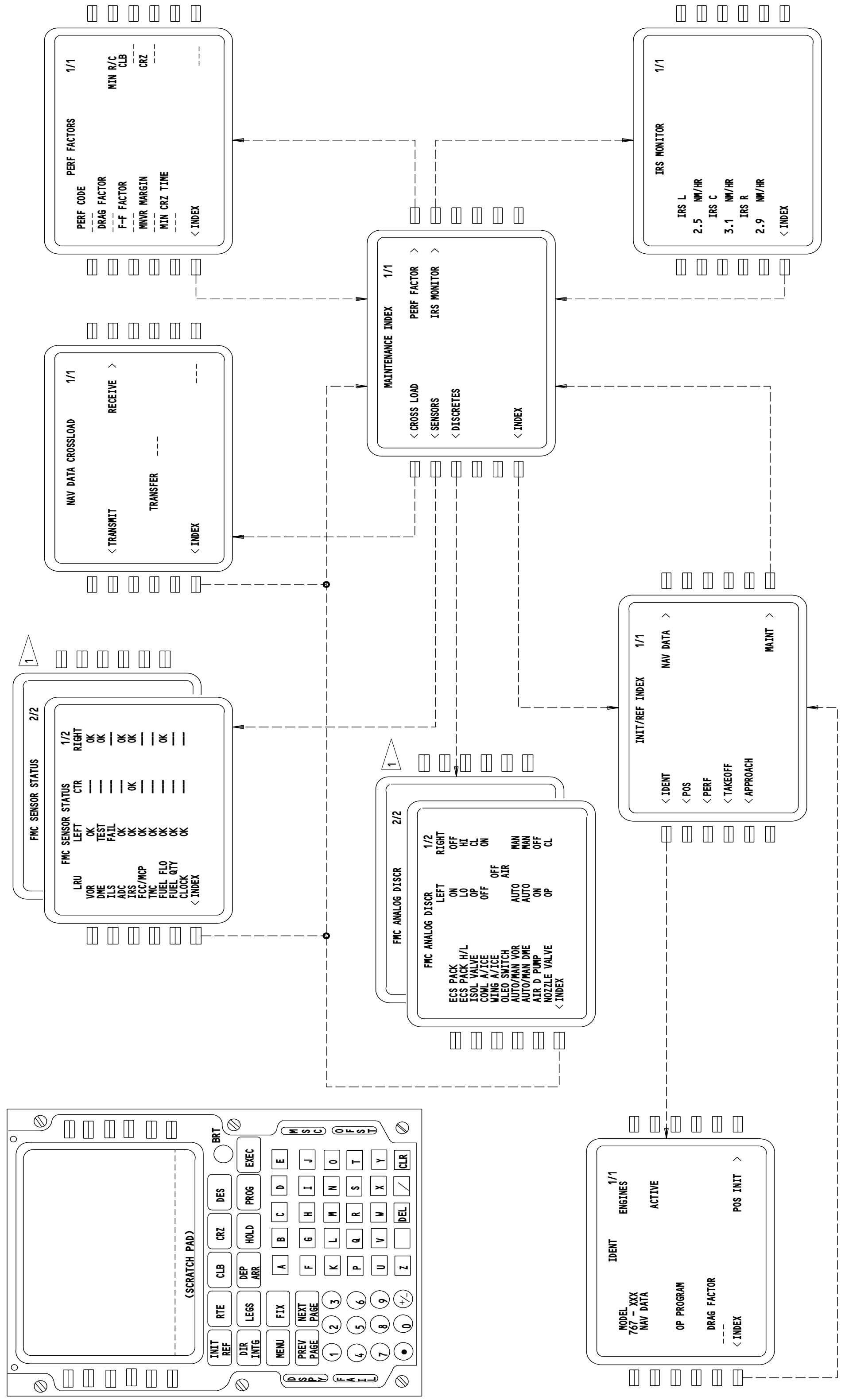

1 FOR MULTIPLE-PAGE DISPLAYS, PREV/NEXT PAGE BUTTONS ALLOW YOU TO CHANGE PAGES

FMCS Maintenance Index
Figure 15 (Sheet 1)

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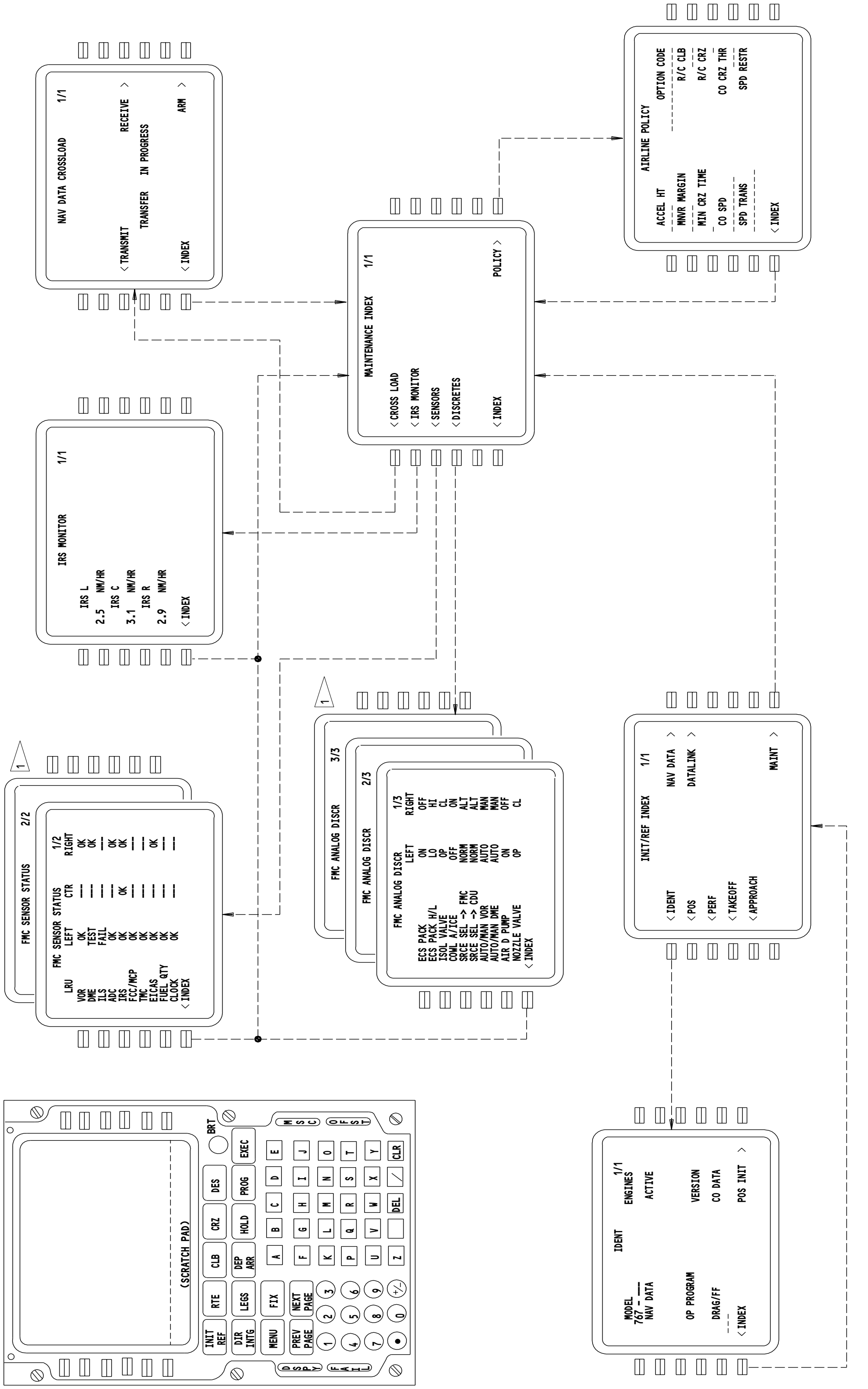

FOR MULTIPLE-PAGE DISPLAYS, PREV/NEXT PAGE BUTTONS ALLOW YOU TO CHANGE PAGES

FMCS Maintenance Index
Figure 15 (Sheet 2)

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1) The IDENT page is automatically displayed when power is applied to the FMCS or when the self-test has been successfully completed.
2) The IDENT page can also be line-selected from the INDEX page.
3) The IDENT page displays information about the airplane, FMC software program, and the navigation data base. Information includes:
   a) Airplane Model.
   b) Engine Type.
   c) Current and new navigation data base.
   d) Operational program part number.
   e) Drag adjustment factor.
   f) Fuel flow adjustment factor.
4) A new data base can be activated when the airplane is on the ground.
   a) Press line select key 3R to write the new data base identity in the scratch pad.
   b) Press line select key 2R to transfer the data base identity to line 2. The previous data base is then cleared and the new data is active.

(c) FMCS CDU Displays - Initialization (Fig. 16)
1) POS INIT and PERF INIT pages are line-selected from the INIT/REF INDEX page (press INIT REF key).
2) The POS INIT page can be line-selected from the IDENT page.
3) Initialization pages can be selected only when the airplane is on the ground. The POS INIT page should be selected if the IRS has not been initialized. The PERF INIT page should be selected if the IRS has been initialized.
4) The initialization pages provide a means to initialize the IRS and the FMC performance calculations.
5) The POS INIT page provides three options for selecting IRS present position:
   a) Select the last position of the IRS - from line 1R.
   b) Select the current position from the data base - Enter the airport identifier in line 2L to request LAT/LON from the data base. If necessary, enter gate identifier in line 3L to request LAT/LON from the data base.

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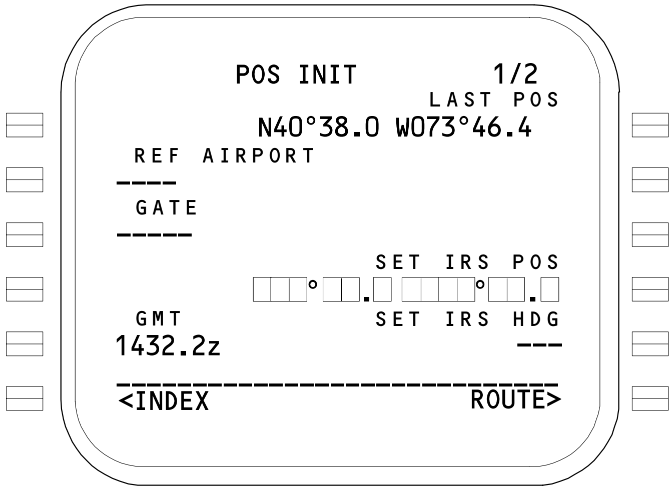

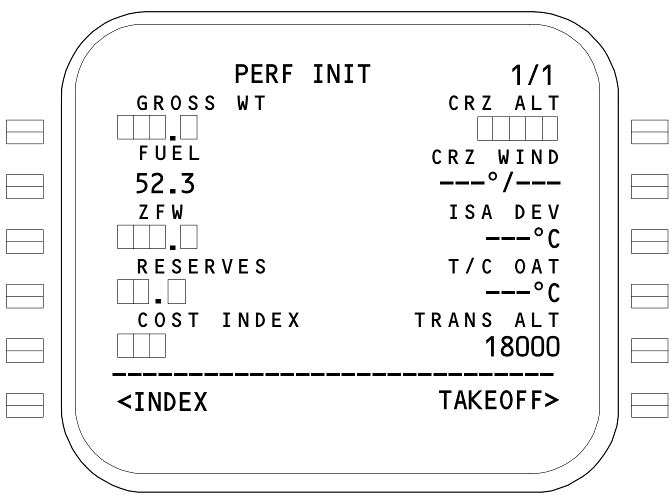

FMCS CDU Displays - Initialization
Figure 16 (Sheet 1)

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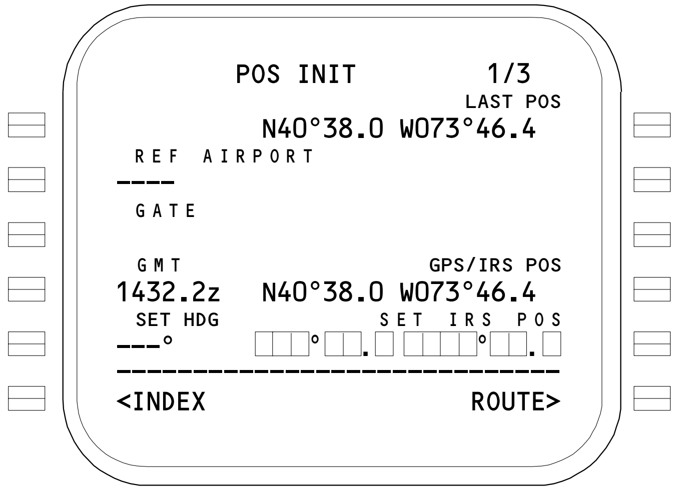

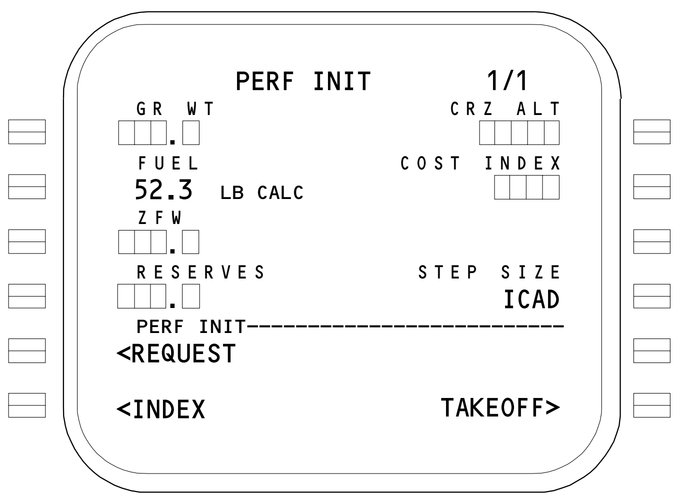

FMCS CDU Displays - Initialization
Figure 16 (Sheet 2)

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c) Manually set the IRS position - Enter LAT/LON into the scratch pad and transfer to line 4R.

6) The GMT must be entered whenever the airplane clocks are set to local time.
7) IRS heading must be entered when the IRS is operated in the altitude mode.
8) POS REF page 2 displays LAT/LON and ground speed from the FMC and each IRS.
9) Performance initialization data is entered on the PERF INIT page. The page displays boxes for data that must be entered and dashes for data that is optional to enter.
10) Either gross weight or zero fuel weight must be entered in the CDU through the scratch pad. When either value has been entered, the FMC computes and displays the other value.
11) The FMC provides fuel quantity from the fuel totalizer for display. The fuel totalizer value for fuel can be manually overwritten. Boxes indicate a value must be manually entered. If fuel is manually entered the FMC ignores fuel totalizer inputs for the rest of the flight.
12) The COST INDEX is initialized to the default value in the company route. The default value can be manually overwritten. A manual entry is needed if boxes are displayed. Acceptable values are 000 through 999.
13) The CRZ ALT (cruise altitude) must be entered. Any altitude value exceeding the maximum for the airplane configuration is rejected by the FMC.
14) The CRZ WIND may be entered but is not required.
15) The ISA DEV (International Standard Atmosphere) and estimated T/C OAT (Top of Climb Outside Air Temperature) may be entered but are not required. If either value is entered, the FMC computes the other. Format for both must be a two digit number.
16) The transition altitude is initialized to a default value of 18000 ft. The value is automatically changed when entering a departure procedure with a stored transition altitude. The transition altitude can be manually overwritten.

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17) Fuel reserves must be manually entered through the CDU.

(d) FMCS CDU Displays - ROUTE (Fig. 17)

1) Route pages are accessed by pressing the RTE key on the CDU, line select key 6R on the POS INIT page or POS REF page, or line select key 4R on the TAKEOFF REF page.

2) The route pages let you enter a desired route into the FMC. The complete route is displayed in clearance language and includes origin, destination and intermediate waypoints.

3) The company route is a stored standard route it can be requested from the FMC data by entering the company route identifier in the scratch pad and pressing line select key 2L.

4) Route data other than stored company routes must be manually entered. Three route pages are available.

(e) FMCS CDU Displays - Route Legs (Fig. 17)

1) Route legs pages are accessed by pressing the LEGS or DIR INTC key on the CDU, or line select key 6R on the ACT RTE data pages.

2) The route legs pages let you enter vertical and lateral leg data in the FMC.

3) The route legs pages display leg heading, leg speed and altitude profile, and leg length for each leg.

a) Predicted data values are displayed in small sized numerals.

4) Extended data is displayed on the ACT RTE DATA page when the EHSI is not in the plan mode.

5) If the EHSI is in the PLAN mode, the MAP CTR STEP prompt on the CDU RTE LEGS page is used to change the center of the EHSI display.

a) The center symbol (CTR) appears next to the waypoint that is centered on the EHSI display.

6) Direct/Intercept is performed on a RTE LEGS page after pressing the DIR INTC key on the CDU. DIRECT TO and display INTC LEG will be displayed at the bottom of the page.

7) Any valid waypoint being displayed can be selected for direct to flight, or a valid waypoint can be manually entered. The EXEC key must be pressed to initiate the direct to flight.

8) Any valid waypoint being displayed can be selected for intercept leg. When the desired waypoint is line selected into the scratch pad and line select key 6R pressed, MOD RTE LEGS is displayed, allowing insertion of an intercept course.

(f) Route Modification (Fig. 18)

1) A new waypoint can be inserted into a route on the RTE LEGS pages.

a) Insert the waypoint identifier in the scratch pad.

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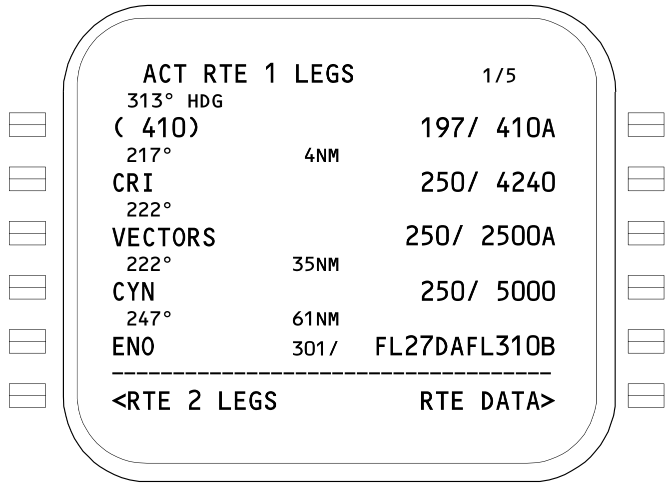

FMCS CDU Displays - Route and Legs
Figure 17 (Sheet 1)

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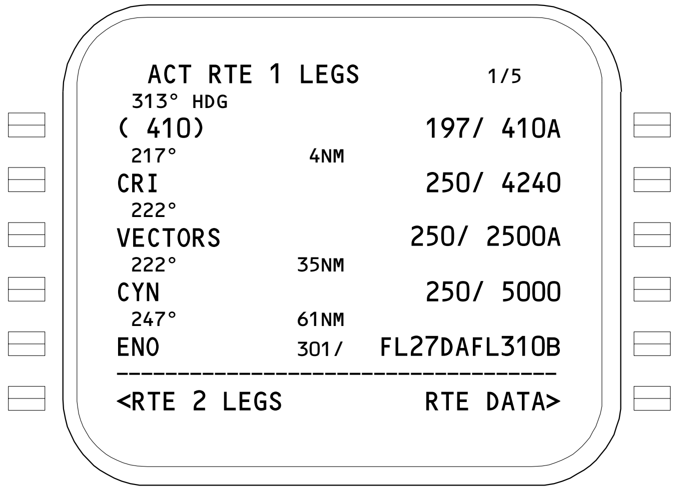

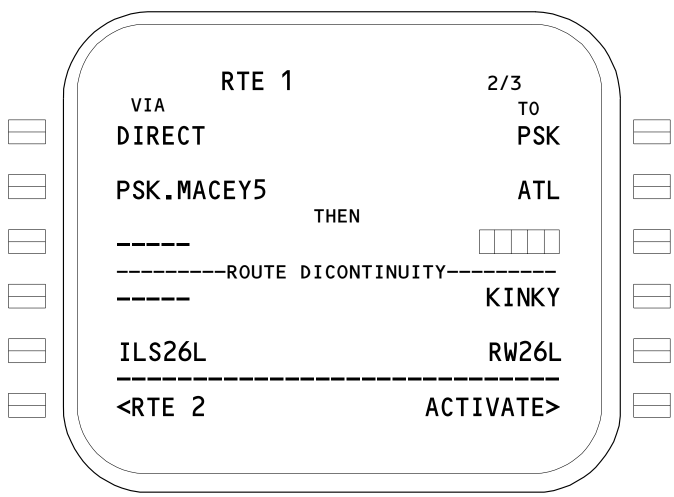

FMCS CDU Displays - Route and Legs
Figure 17 (Sheet 2)

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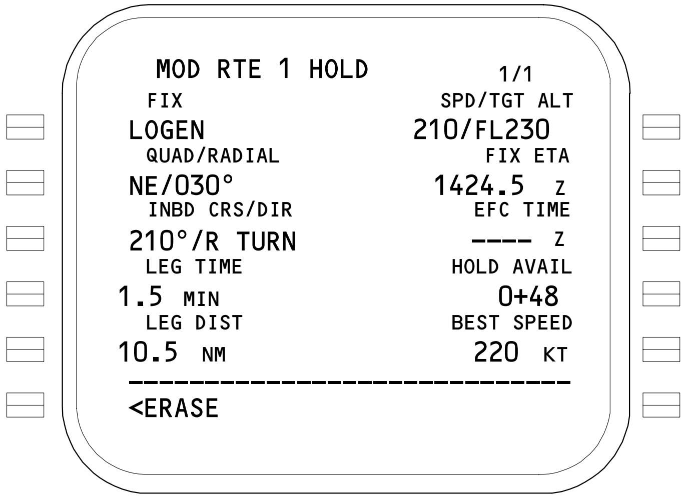

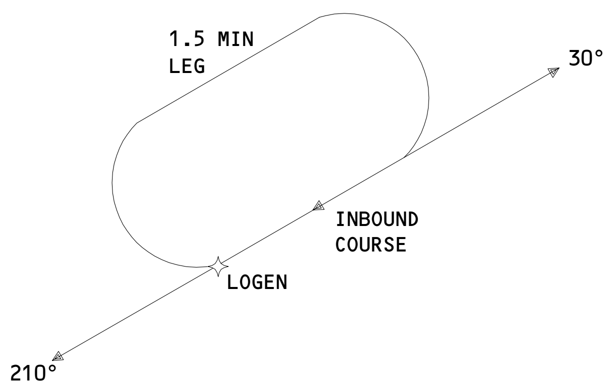

FMCS CDU Displays - Route Modification and Hold
Figure 18 (Sheet 1)

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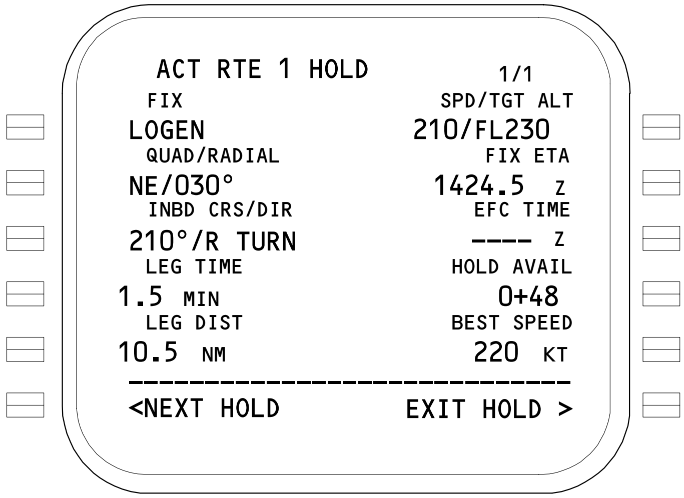

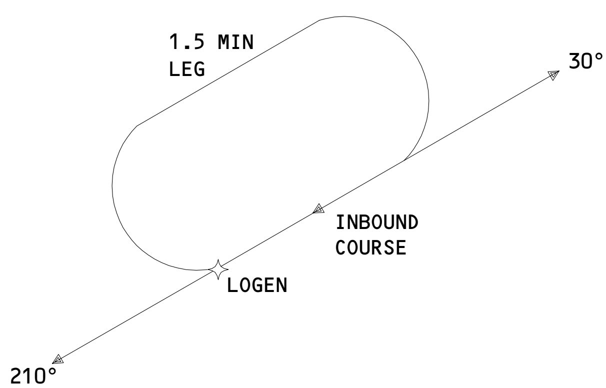

FMCS CDU Displays - Route Modification and Hold
Figure 18 (Sheet 2)

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b) Line select the existing waypoint that the new waypoint is to precede.

NOTE: Any route discontinuity is displayed on a MOD RTE LEGS page and must be resolved.

c) Line select the waypoint intended to follow the new waypoint into the scratch pad and then into line 4L.

2) A waypoint can be removed from a leg by overwriting it with the next waypoint in the leg.

(g) FMCS CDU Displays - Hold (Fig. 18)

1) Hold is displayed by:

a) pressing HOLD key on CDU after a holding fix has been entered into the route

b) automatically after a holding fix has been entered in the RTE LEGS page.

2) Hold provides a means of entering and displaying holding pattern details into the FMC. Display details are:

a) FIX identifies location of the hold.

b) QUAD/RADIAL identifies the holding quadrant (NE, NW, SE, or SW) and valid radial.

c) INBD CRS/DIR identifies course to enter the holding pattern and direction of turns in the holding pattern.

d) LEG TIME displays time to fly the holding pattern.

e) LEG DIST displays length of the holding pattern flight path, and is normally computed.

f) SPD/TGT ALT displays assigned holding speed and altitude.

g) FIX ETA displays computed time to next pass of the FIX location.

h) EFC TIME displays time to expected further clearance, or expected time to exit the holding pattern.

i) HOLD AVAIL displays time left before exit is needed to reach the destination with required reserves.

j) BEST SPEED displays the best speed for the current altitude.

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3) Some items have default values if data is not manually entered.
   a) Inbound course defaults to a course-to-fix from the preceding leg, and turn direction defaults to a right turn.
   b) Leg time defaults to 1.5 minutes for altitudes above 14,000 feet and 1.0 minute for altitudes under 14,000 feet.
   c) Speed defaults to the best speed for the assigned altitude.
4) ERASE deletes a holding fix and returns the display to RTE LEGS pages.

(h) FMCS CDU Displays - PROGRESS (Fig. 19)
1) The PROGESS page is displayed by pressing the PROG key on the CDU. It provides a display of data relative to the progress of the flight.
2) Current dynamic flight data is displayed on two pages. Page 1 of 2 data includes:
   a) Distance to go (DTG), ETA and FUEL remaining for TO waypoint, NEXT waypoint and destination.
   b) Identity, actual time of arrival, and altitude of the last waypoint crossed.
   c) TO data can be top of climb (T/C), step climb, top of descent (T/D), advisory top of descent (T/D Advisory), and end of descent (E/D).
   d) Navaid tuning and navigation mode. Navigation mode includes the number of valid IRSs and the nav mode currently in use.
3) Page 2 of 2 data includes:
   a) Head wind and cross wind speed.
   b) Cross track (XTK) and vertical track (VTK) error.
   c) Static air temperature, fuel used and fuel quantity.
   d) Current command speed (CMD SPD), wind direction and speed (WIND), and true airspeed (TAS).
4) Both computed fuel quantity and totalizer fuel quantity are displayed. If there is a discrepency of 1362 kilograms or more the source of data (computed or totalizer) can be line-selected using key 5L or 5R.
5) SAS 275-278;
   both computed fuel quantity and totalizer fuel quantity are displayed. If there is a discrepency of 3000 pounds or more for 5 minutes, the source of data (computed or totalizer) can be line-selected using key 5L or 5R.
6) SAS 050, 051, 150-274;
   both computed fuel quantity and totalizer fuel quantity are displayed. If there is a discrepancy of 2000 pounds or more for 6 minutes and the difference is more than 3000 pounds, the source of data (computed or totalizer) can be line-selected using key 5L or 5R.

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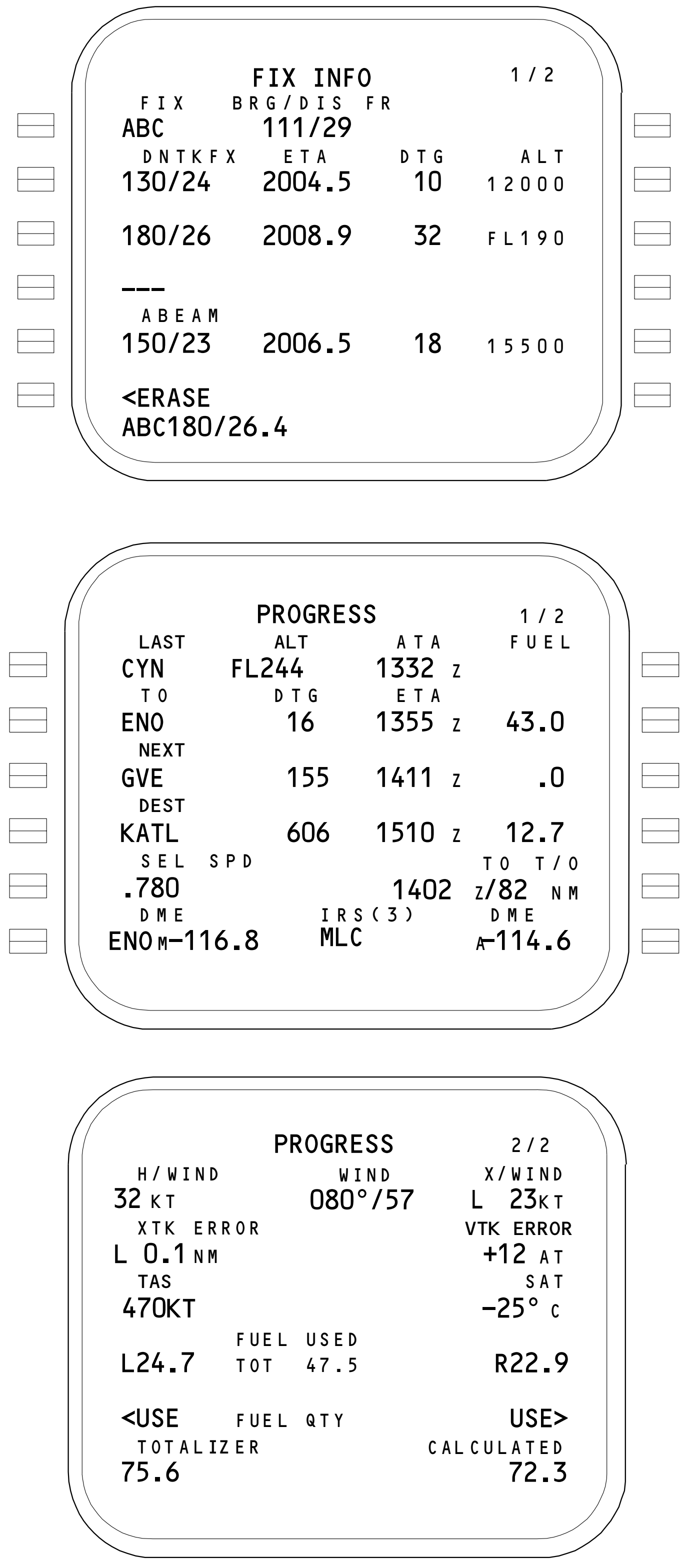

PAGE 2 PROGRESS

FMCS CDU Displays - Progress and Fix
Figure 19 (Sheet 1)

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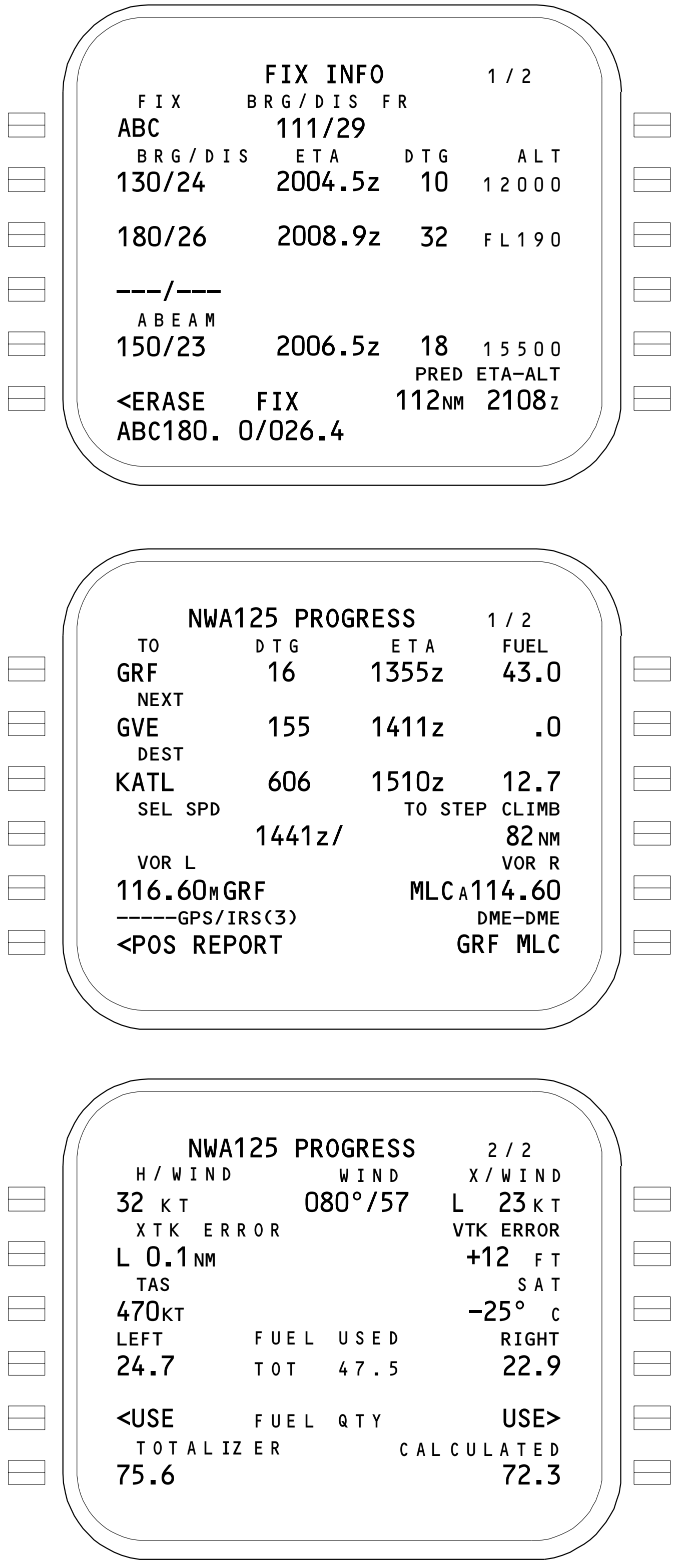

PAGE 2 PROGRESS

FMCS CDU Displays - Progress and Fix
Figure 19 (Sheet 2)

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7) If the destination has been overwritten with an alternate destination, leaving the page and then returning deletes the alternate.
8) Nav aid tuning is indicated by the small letter following the station identifier.
   a) M - manually tuned via control panel.
   b) A - Auto tuned via FMC search algorithm.
   c) P - auto tuned via FMC data base procedure.

(i) FMCS CDU Displays - FIX (Fig. 19)
1) The FIX page is displayed by pressing the FIX key on the CDU.
2) The FIX page provides a means of creating waypoint fixes and waypoints from the intersection points between the preset flight plan and selected radials from known waypoints. Waypoint fixes and waypoints are used with the EHSI map display.
3) Two FIX pages are available allowing creation of two fixes.
4) A waypoint fix for airplane present position can be created for valid navaids and waypoints held in the data base.
5) Down Track fixes are created on CDU lines 2 through 4.
6) A down-track-fix for the shortest distance between the waypoint and the flight path can be line selected.
7) A waypoint can be created at any down-track-fix location by line selecting the fix into the scratch pad. Now display the desired route page and line select the fix into the route.
8) Pressing line select key 6L (ERASE) deletes all fix data from the CDU and from the EHSI.

(j) FMCS CDU Displays - DEPARTURES/ARRIVALS (Fig. 20)
1) Departure and arrival pages are displayed by pressing the DEP ARR key on the CDU.
   a) The departure page is displayed when the airplane is on the ground and an active route exists.
   b) The arrival page for the origin airport is displayed if the plane is less than 50 miles from the origin or less than halfway to the destination. Otherwise, the arrival page for the destination is displayed.

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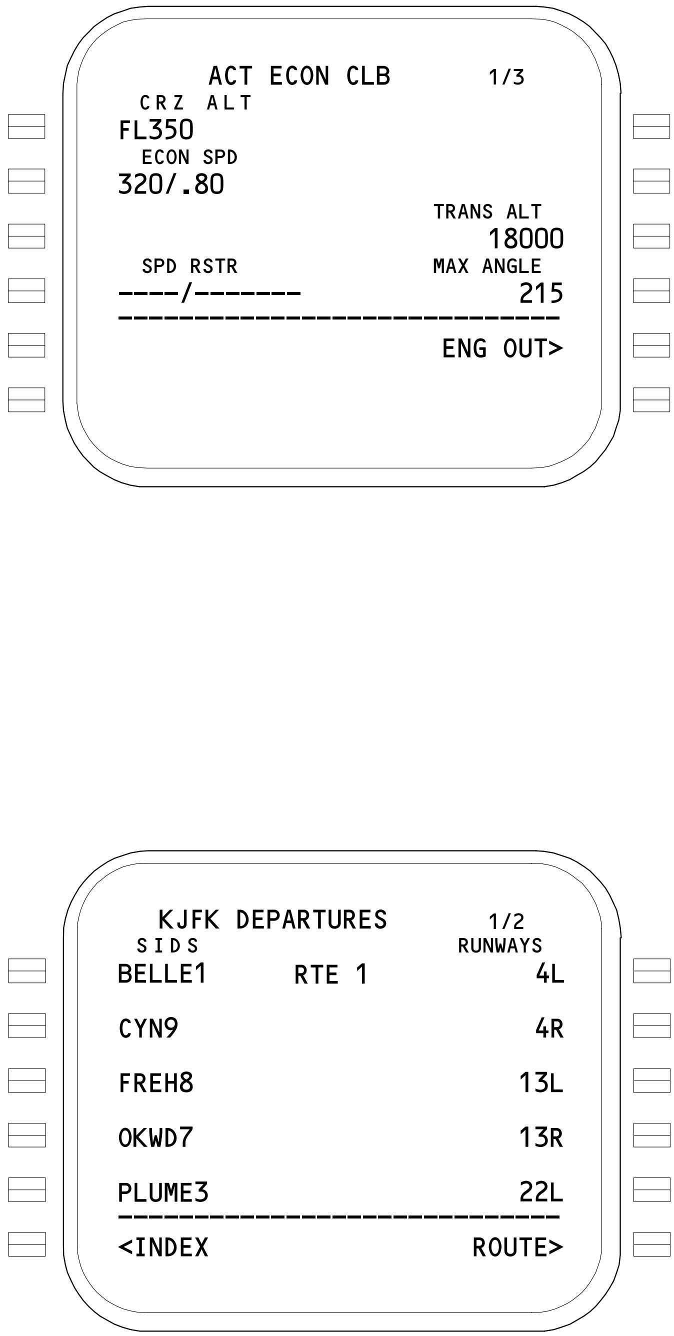

FMCS CDU Displays - Departures/Arrivals and Climb
Figure 20

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c) If an active route does not exist, the DEP/ARR INDEX page is displayed. Departure arrival pages can be displayed using line select keys.

2) The departure and arrival pages provide lists of procedures related to selected airports. The pilot can select procedures and insert them into the active flight plan.

3) The departure page displays SIDs and runways for the selected airport. Departure selections are displayed on the EHSI.

4) Line selection of an SID displays that SID on line one, limits runways to those associated with that SID, and displays applicable transitions.

5) The arrival page displays STARs and approaches for the selected airport. Arrival selections are also displayed on the EHSI.

6) Line selection of a STAR displays that STAR on line one, limits approaches to those associated with that STAR, and displays applicable transitions.

7) If a non-ILS runway is selected, the FMC computes and enters a VFR approach.

a) Flight path angle is 3 deg. A default flight path angle can be manually overwritten. Limits are 2.4 through 3.7 degrees.

b) Final approach is created along the extended runway centerline, from 1500 feet to 50 feet above runway elevation.

(k) FMCS CDU Displays - CLIMB (Fig. 20)

1) There are six climb mode pages available for display.

a) The selectable speed mode is displayed by pressing the CLB key on the CDU when MAX RATE, MAX ANGLE, and ENG OUT are not active. The selectable speed page is automatically displayed anytime a new speed is entered on any other climb page.

b) Economy mode (ECON) is displayed by pressing line select key 4L on any other climb page.

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c) Maximum rate mode (MAX RATE) is displayed by pressing the CLB key on the CDU when maximum rate is the active climb mode. Maximum rate is also displayed by pressing line select key 5L on any other climb page.
d) Maximum angle mode (MAX ANGLE) is displayed by pressing the CLB key on the CDU when maximum angle is the active climb mode. Maximum angle is also displayed by pressing line select key 6L on any other climb page.
e) Engine out mode (ENG OUT) is displayed by pressing the CLB key on the CDU when engine out is the active climb mode. Engine out is also displayed by pressing line select key 5R on any other climb page.
f) Cruise climb mode (CRZ CLB) is displayed by pressing the CLB key on the CDU when cruise or descent is active. A cruise climb is automatically displayed any time a new higher altitude is entered on a CRZ or LEGS page when cruise is active.

2) Any climb page except CRZ CLB can be displayed by pressing the PREV PAGE/NEXT PAGE keys when any climb page is displayed.
3) Multiple climb segments can be defined. Climb pages provide a means of evaluating and selecting current or planned climb segments.
4) Data displayed on climb mode pages is similar regardless of mode:
   a) Altitude
   b) Command speed (CMD SPD)
   c) Computed EPR
   d) Waypoint identifier (if applicable)
   e) Predicted ETA and distance to go to target altitude.
   f) Predicted altitude undershoot at the waypoint (if applicable).
5) Command speed can be overwritten at the CDU, resulting in display of selectable speed climb pages.
6) Manual intervention is possible using speed select on the AFCS MCP. Manual intervention does not change page format.

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7) Capture lights the EXEC key on the CDU and deletes all CLB pages previous to the displayed page.

(l) FMCS CDU Displays - CRUISE (Fig. 21)

1) Pressing the CRZ key on the CDU displays the active cruise mode page. If an active mode has not been selected the ECON CRZ page is displayed.
2) Transition from climb to cruise automatically displays the active cruise mode page.
3) Line select keys are used to display ECON CRZ, LCR CRZ and ENG OUT CRZ pages when a cruise page is being displayed.
4) Selectable speed cruise is displayed when a speed is entered on any other CRZ pages.
5) Cruise pages provide a means of evaluating and selecting current or planned cruise mode. Cruise modes can be modified. However, only one cruise segment can exist at a time. Any change to cruise mode will propagate to Top of Descent (T/D) in the flight plan.
6) Data is displayed for four cruise modes; economy (ECON), selectable speed, long range cruise (LRC), and engine out (ENG OUT).
   a) Cruise altitude (CRZ ALT)
   b) Computed command speed (CMD SPD)
   c) Computed EPR
   d) Turbulence penetration EPR for reference
   e) Next higher altitude in the flight plan. Altitude can be overwritten.
   f) ETA and DTG
   g) Wind direction and magnitude.
   h) Predicted savings or penalty for a step climb
   i) Predicted fuel at destination.
7) The FMC rejects any altitude that exceeds maximum altitude for the airplane. Changes in altitude result in display of cruise climb (CRZ CLB) or cruise descent (CRZ DES) pages.
8) If the airplane is less than 100 miles from top-of-descent, the data is for top-of-descent. Otherwise, data is for the step-point to the next higher altitude. After passing the optimum step-point, NOW is displayed as long as savings are greater than zero.

(m) FMCS CDU Displays - DESCENT (Fig. 21)

1) Pressing the DES key on the CDU displays the active descent page.
   a) If the selectable speed mode is active or if the airplane has passed the top of descent, selectable speed descent is displayed.
   b) If selectable speed is not active or the airplane is below the top of descent, economy descent is displayed.
   c) If no other mode is active or the airplane has not reached top of descent, cruise descent is displayed.
2) Line select keys are used to display economy descent and CRZ DES pages when a descent page is being displayed.

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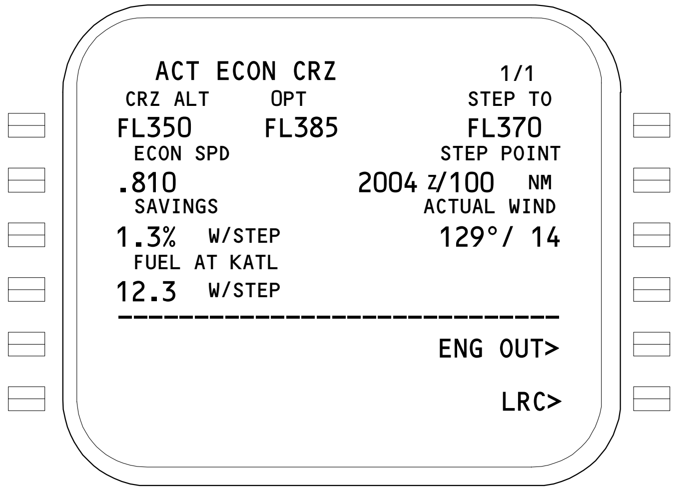

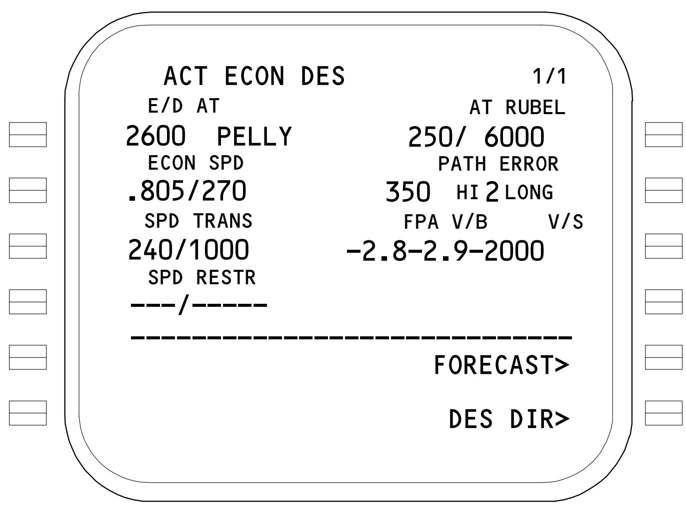

FMCS CDU Displays - Cruise and Descent
Figure 21 (Sheet 1)

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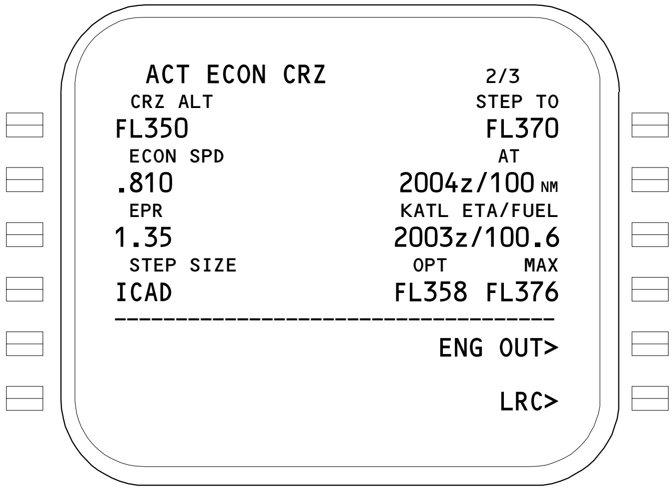

FMCS CDU Displays - Cruise and Descent
Figure 21 (Sheet 2)

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3) If any descent page is being displayed, any other descent page can be displayed by pressing the NEXT PAGE/PREV PAGE keys on the CDU.
4) If the speed on the ECON DES page is overwritten, the selectable speed descent page is displayed.
5) If an altitude less than cruise altitude is entered on a cruise page, CRZ DES is displayed.
6) Economy descent and selectable speed descent provide a means of evaluating, selecting, and revising current or planned segments of descent modes.
7) CRZ DES provides a means to initiate an early descent and a step descent.
8) The descent mode pages provide a means of creating multiple segments for the descent phase of flight.
9) Descent pages display data on airplane altitude and rate of descent.
   a) Target altitude (TGT ALT) and cruise altitude (CRZ ALT).
   b) Computed command speed (CMD SPD) (Command speed can be overwritten. If speed is manually entered, the selectable speed page is automatically displayed).
   c) Computed EPR
   d) Target error (This identifies the first downtrack waypoint with an altitude constraint, and computed error caused by deviations from normal descent path. A scratch pad message to add a drag factor may also be displayed).
   e) The waypoint at which the displayed altitude constraint occurs.
   f) Predicted ETA and DTG to target altitude, top of descent altitude, or cruise descent altitude.
   g) Computed speed desired at target altitude.
10) DESCENT FORECASTS page provides a means of entering forecasted values for transition level, cabin rate, wind, and altitude at which anti-ice is expected to start.

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(n) FMCS CDU Displays - Messages

1) Advisory or alerting messages are generated by FMC software when a condition exists which degrades the operational viability of the system.
2) Alerting messages appear in the scratch pad regardless of the prior contents of the line.
3) Messages are cleared from the scratch pad line by the reset logic defined below.
4) Any uncleared messages or alpha-numeric data are stored in a message stack. An alerting message that has been pushed out of the scratch pad by another alerting message, is put in the top of the stack. Alpha-numeric data is stored below alerting messages. Uncleared advisory messages are stored below both data and alerting messages.
5) As the CLR key is pressed, the stack is displayed sequentially from top to bottom.
6) Advisory and alerting messages illuminate the message (MSG) annunciator light.
7) Only the alerting message sets the CDU MESSAGE output discrete.
8) Clearing the message and/or reset of the message logic cancels the message unless the logic causing the message is reset.
9) Alerting Messages
    a) VOR AAA INVALID - VOR input signal lost when remotely tuned through the CDU.
    b) END OF ROUTE - passing last route leg termination.
    c) END OF OFFSET - Five NM, until end of last offset leg termination.
    d) Limit ALT FLXXX - FMC attempts to attain or VNAV is selected at an altitude greater than the VNAV limit altitude.
    e) RESYNCING OTHER FMC - Offside FMC has just powered up or failed comparison data check and is being resynchronized to onside FMC.

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f) RESYNC FAIL - SINGLE FMC - FMCS resynchronization attempts are unsuccessful.
g) SINGLE FMC OPERATION - Onside FMC has determined that offside FMC is not available.
h) DISCONTINUITY - passing last waypoint prior to a discontinuity.
i) NO ACTIVE ROUTE - no active lateral route and LNAV selected on MCP.
j) PERF/VNAV UNAVAILABLE - insufficient data in FMC.
k) FUEL QTY DISCR - PROG PG 2 - fuel quantity totalizer and computed fuel quantity disagree by 3000 lb.
l) IRS NAV ONLY - dual radio navigation inputs lost and FMC in IRS mode only for navigation.
m) VERIFY POSITION - The difference between computed radio position and FMC position using IRUs or between left and right FMC positions exceeds comparison threshold.
n) TUNE NAVAID XXXXX - terminal area procedure requires a specific navaid be tuned and it is not tuned.
o) DRAG REQUIRED - airplane unable to maintain tracking of descent path due to unforecast tailwind.
p) THRUST REQUIRED - The aircraft is unable to maintain precomputed nominal descent path without increasing thrust and autothrottle is not engaged.
q) UNABLE NEXT ALT - next climb restriction cannot be met due to undershoot.
r) RESET MCP ALT - passing top of descent point without lowering MCP selected altitude.
s) INSUFFICIENT FUEL - change in flight conditions or route causes computed fuel burn to exceed total fuel.
t) CHK ALT TGT - VNAV is engaged when the airplane is between MCP selected altitude or FMC target altitude (VNAV holds level flight).
u) DESCENT PATH DELETED - The last remaining altitude constraint required to define the descent profile is deleted.

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v) NAV DATA OUT OF DATE - Clock calendar data exceeds the NAV database valid calendar cycle.
w) VIA OFFSET INVALID - Flight condition in-validate diversion via OFFSET while OFFSET is selected VIA option and the ALTN or XXXX ALTN page is displayed.
x) RW/ILS FREQ ERROR - When an ILS is selected for autotuning and it is not tuned.
y) RW/ILS CRS ERROR - When ILS is selected for autotuning and the course of the localizer center beam bearing is not tuned.
z) CHECK AIRLINE POLICY - When one or more AMI parameters which are displayed on the AIRLINE POLICY page are invalid forcing the FMC to use the default values.
aa) FMC X OUTPUT LOSS - Single FMC transmitter and/or FMC output discrete failure.
ab) TAKEOFF SPEEDS DELETED - A change is detected in the parameters required for QRH speeds computation.
ac) UNABLE TO SEND MSG - Message cannot be delivered due to protocol breakdown between the FMC and the ACARS MU or due to the FMC data link queue being full.
ad) IRS POS/ORIGIN DISAGREE - Valid inertial position differs from active origin airport position by more than 6NM.
ae) UNABLE RTA - The RTA is not achievable within the applicable arrival time tolerance.
af) UNABLE FLXXX AT RTA FIX - The predicted crossing altitude at the RTA fix is less than the FLXXX, but the predicted ETA is still within tolerance.
ag) RTA FIX DELETED - The RTA fix has been deleted from the MOD flight plan.
ah) VERIFY RNP-POS REF 2 - Manually entered RNP exceeds the default RNP value for the current flight phase.
ai) ATC REPORT LIST FULL - When 10 reports have been generated in response to ATC REPORT or CONFIRM requests.

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aj) INVALID ATC UPLINK - When ant ATC uplink message received by the FMC contains format or other errors.
ak) PARTIAL CLEARANCE LOADED - FMC was able to load only a portion of the data contained in the uplink message.
al) RE-LOGON TO ATC COMM - No ATC data link connections exist.
am) UNABLE TO LOAD CLEARANCE - FMC was unable to load any of the data contained in the uplink message.
an) ATC COMM ESTABLISHED - ATC data link is successfully established.
ao) MESSAGE LIMIT EXCEEDED - Crew attempts to select more than 5 message elements to include in the downlink message.
ap) RESPONSE TO ATC UPLINK - An ATC uplink is received while the pending uplink storage is full.
aq) SET CLOCK TO UTC TIME - The GPS UTC time on the POS INIT page disagrees with the flight deck clock by more than 12 seconds.
ar) SET THRUST MODE TO X - Accepted thrust mode is not the same as the thrust mode being received from the TMC.
as) SPLIT IRS OPERATION - An inertial unit is failed resulting in change to number of inertial units used for navigation.
at) ATC COMM TERMINATED - ATC COMM terminated without transfer.
au) ROUTE X UPLINK READY - Receipt of a flight plan uplink message that contains the route data that ready to be loaded into RTE1 or RTE2.
av) PARTIAL ROUTE X UPLINK - Receipt of an uplink message that contains route data and part of the route data can be loaded into RTE1 or RTE2.
aw) PERF INIT UPLINK - Receipt of a performance initialization uplink message.
ax) TAKEOFF DATA UPLINK - Receipt of a take off data uplink message.

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ay) TAKEOFF DATA LOADED - Execution of a new departure runway or entry of a new runway on the TAKEOFF REF page.
az) WIND DATA UPLINK READY - Receipt of an uplink message that contains en route wind data.
ba) DES FORECST UPLINK READY - Receipt of a wind uplink data message that contains descent forecast data.
bb) ALTN UPLINK - Receipt of an alternate uplink message that contains the Company Preferred Alternates data.
bc) ALTN LIST UPLINK - Receipt of an alternate uplink message that contains alternate flight list data.
bd) ALTN INHIBIT UPLINK - Receipt of an alternate unlink message that contains only alternate inhibit data.
be) FLT NUMBER UPLINK - Receipt of a flight uplink message that contains only flight number data.
bf) INVALID TAKEOFF XXX/YYY - The loaded runway/intersection takeoff data record has invalid data.

10) Advisory Messages
a) NOT IN DATA BASE - required data not found in NAV data base or in route.
b) UNABLE RNP - This message is not a failure. This is a response to navigation processing when actual nav (ANP) performance does not meet required nav performance (RNP).
c) RE-ENTER IRS POSITION - five seconds after entering present position, different position data was received back from any IRS.
d) MAX ALT FLXXX - maximum attainable altitude is displayed for reference on the performance initialization page, or an altitude greater than maximum altitude has been entered on any other page.
e) MAX ALT XXXXX MSL - Maximum single engine altitude (displayed when engine out climb or descent page is displayed).
f) RUNWAY N/A FOR SID - runway not compatible with selected departure.
g) XXXX (origin airport) - origin airport on page 1 of RTE page contains no data. Origin airport from POS INIT page displayed for reference.

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h) ARR N/A FOR APPROACH - selected approach is not compatible with the selected arrival.
i) STANDBY ONE - the FMC requires more than one half second to display data.
j) VOR AAA INVALID - VOR input signal lost when remotely tuned through the CDU.
k) NOT ON INTERCEPT HEADING - LNAV selected on MCP but airplane cannot make capture on the present heading.
l) INVALID ENTRY - entry has an incorrect format or range or both.
m) INVALID DELETE - delete key has no application for the selected data.
n) XXXXX (MCP altitude) - MCP altitude is displayed when the target altitude does not equal MCP selected altitude.
o) NO ACTIVE ROUTE - DIR/INTC key pressed when no active route exists.
p) XXXKT (MCP selected airspeed) or .XXM (MCP selected Mach) - manual speed control is activated via MCP while VNAV is engaged.
q) USE PREVIOUS PAGE - target altitude entry attempted which is incompatible with the target waypoint/altitude restriction on the previous page.
r) RW/ILS FREQ DISCR - at localizer capture the tuned ILS frequency does not match the frequency for the runway displayed on the active RTE LEGS page.
s) SELECT RUNWAY - selected procedure is runway dependent and no compatible runway has been selected.

B. FMC BITE and Monitoring (Fig. 22)
(1) General
(a) The FMC BITE/Monitoring functions consist of: Power-Up BITE, BITE Monitoring function, FMCS System Test, Failure Indications, and Crew Alert Monitoring function.
(b) These functions are a combination of internal software and hardware monitors, with the majority of the capability provided by BITE software in the FMC and CDU.

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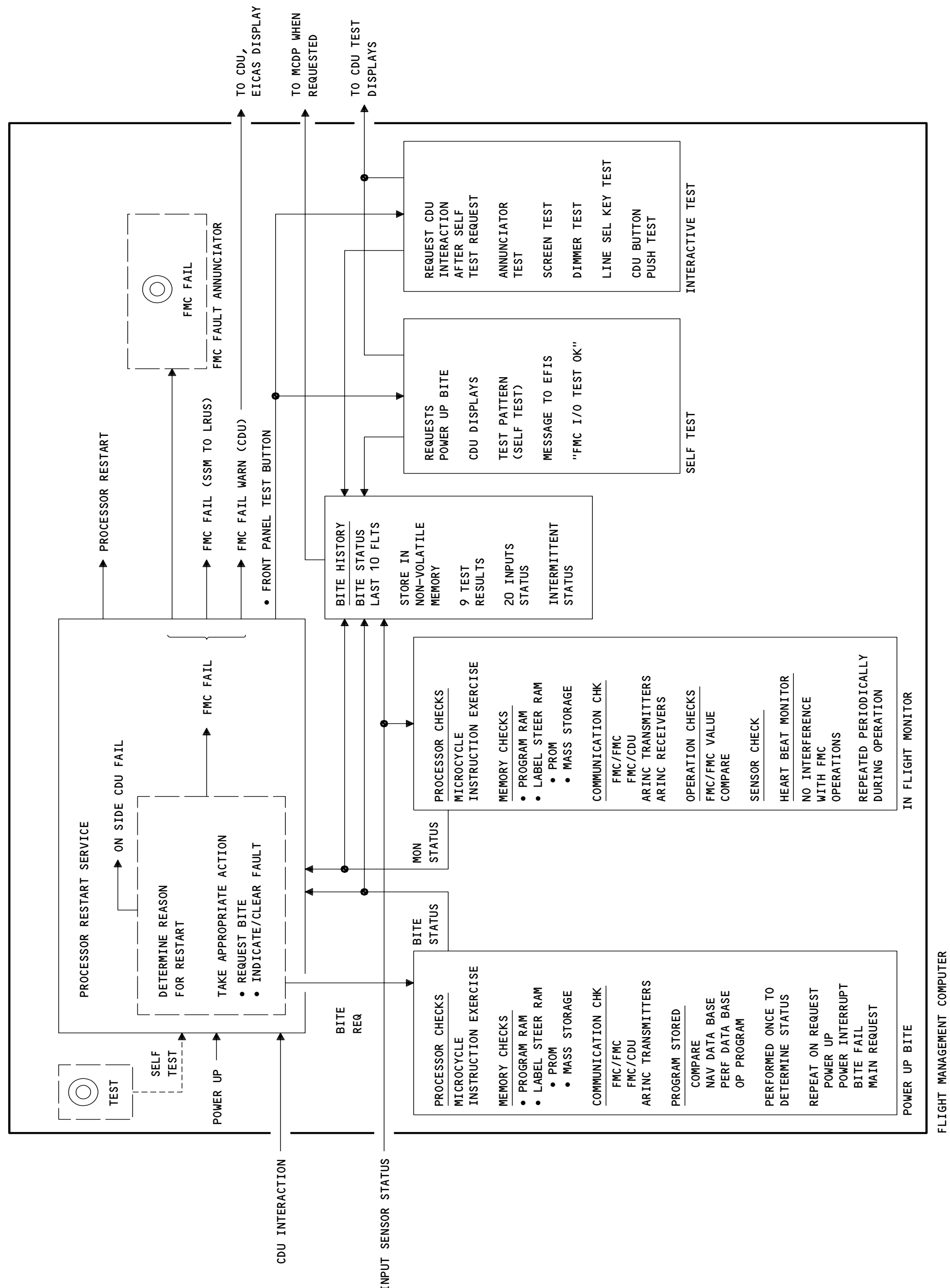

FMC Functional Block - Bite and Monitoring
Figure 22

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(c) The BITE function also includes Maintenance Control and Display Panel (MCDP) software which allows FMCS faults to be sent to the MCDP for recording.

(2) Power Up BITE

(a) Power-Up BITE performs the internal FMC hardware and software checks below:

1) RAM, PROM, and mass storage memory devices
2) ARINC 429 transmitters
3) Program pin configuration
4) Onside and offside data base comparison
5) Power supply voltage
6) I/O controller operation
7) Software configuration
8) Microprocessor operation

(b) CDU BITE is also performed during Power Up BITE which performs internal CDU checks similar to those performed by FMC BITE.

(3) Monitoring Function

(a) The monitoring function provides a continuous check of FMCS components. Monitoring includes power up checks, which do not affect normal system operation, heartbeat monitor, exception checks, and interface monitors.

(b) Interface Monitoring: Sensors

1) If no activity is detected on any sensor bus, the AFMC test receiver is aligned to that receiver, and if no activity is still detected, the sensor is assumed failed. If the test receiver detects activity, then the FMC receiver is assumed failed and the FMC is failed.

(c) Interface Monitoring: CDUs

1) The FMC checks the onside CDU during normal operation, and if no response is detected, the test receiver is aligned with the CDU receiver in the FMC. If no activity is detected by the test receiver, the CDU transmitter is assumed to be failed. If the test receiver does detect activity, then the FMC CDU receiver is assumed failed and the FMC is failed. Either onside or offside CDUs are checked in this test depending upon position of FMC source select switch.

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(d) Interface Monitoring: Intersystem Bus
   1) If no activity is detected on the Intersystem Bus (ISB) receiver, the FMC test receiver is aligned to the ISB receiver. If the test receiver detects no activity, the transmitter is assumed failed, and that FMC is failed.
(e) Data Comparison
   1) When operating in a dual FMC environment, a comparison check is performed between the master and slave FMC utilizing data exchanged via the intersystem bus. If such data falls outside of comparison tolerances, the master FMC will resynchronize the slave FMC to maintain the FMC's in synchronism in identical operational states.

(4) FMCS System Test
   (a) The FMCS System Test is initiated by pressing the "TEST" button on the FMC front panel.
   (b) For the first 15 seconds of the FMCS system test, the FMC outputs test data onto both general busses. The FMC then performs a restart, which causes all power-up/BITE tests to be run.

(5) Failure Indications
   (a) An FMC failure produces the indications below:
      1) Blank onside CDU screen with the message "FMC FAIL" displayed.
      2) Fail light illuminated on the corresponding CDU panel.
      3) FAIL light illuminated on FMC front panel.
   (b) A CDU failure produces the following indications:
      1) Blank CDU screen
      2) CDU fail indication on offside FMC sensor status page.

(6) Crew Alert Monitoring Function
   (a) The FMC monitors the crew activity by monitoring the changes on the various control panels. When there is no activity for a defined period, the FMC generates alerts to the crew. No alerts will be generated below 20,000 feet, during climb, or during descent unless an alert occurred at top of descent and was not cleared through pilot action or flight below 20,000 feet.

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(7) Resynch Activity/Indications
(a) Occurs when one FMC passes data via the FMC intersystem bus to the other FMC to keep both FMCs in an identical operating state. In dual FMC mode, both FMCs operate independently but must maintain data synchronization. If one FMC detects a problem an extensive set of self-tests are run and a resynch will occur to restore data synchronization.
(b) The time required for single resynch is approximately 15 seconds. During the resynch process, the FMC cannot continue to output data. All output buses on receiving FMC, except for intersystem bus to other FMC are deactivated during the resynch process.
(c) In case of a normal single event resynch, RESYNCHING OTHER FMC will appear and MSG annunciator illuminates.
(d) L or R FMC FAIL message may also occur temporarily during a resynch.

NOTE: CDU keys should not be pressed and power should not be turned off while a resynch is in progress.

(8) BITE History
(a) BITE history is a disk record of the BITE status of the system covering the last 10 flights of the aircraft. BITE history contains information on most recent test failure reasons for FMC latch as well as additional failure isolation data.
(b) BITE history records intermittent sensor failures when airborne, but does not record intermittent failures for test failures or for CDU BITE.
(c) The FMC stores fault conditions in BITE history and transmits formatted fault data to the Maintenance Control Display Panel (AMM 22-00-02/201 - Autoflight BITE). Inflight fault informa tion is limited to those detected faults which produce FMC failures or an LNAV/VNAV mode failure. Fault data is transmitted to the MCDP at airplane touchdown.
(d) Reference Sensor Status Pages (Fig. 15)
1) Line selection of SENSORS on the Maintenance Index Page displays the REF SENSOR STATUS page. This verifies proper operation of all input sensors. The unit status has one of the following labels:
a) OK - the unit is connected and operating properly.

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b) TEST - The unit is connected but is in the SELF-TEST mode.
c) FAIL - The unit is either not connected, not powered, or not operating properly.
d) (- - -) - The unit is not required for the airplane configuration or is not required for this FMC.

2) Other indications used for troubleshooting, functional test, and fault isolation are the following:
a) CDU annunciations - FAIL, DSPY, MSG, and OFST
b) FMC caution light
c) CDU messages
d) Normal CDU operation

C. Control

(1) The flight management computer system operates whenever power is applied. Proper operation requires that interfacing systems are operational. An IDENT page is then displayed on each CDU.

(2) Ensure circuit breakers are closed for the following systems:
(a) Air/Ground Relays (32-09-02, Maintenance Practices)
(b) Clocks (31-25-00, Adjustment/Test)
(c) Engine Indication and Crew Alerting System (31-41-00, Adjustment/Test)
(d) Air Data Computing System (34-12-00, Adjustment/Test)
(e) Inertial Reference System (34-21-00, Adjustment/Test)
(f) Flight Instrument System (34-22-00, Adjustment/Test)
(g) ILS Navigation System (34-31-00, Adjustment/Test)
(h) VOR System (34-51-00, Adjustment/Test)
(i) DME System (34-55-00, Adjustment/Test)
(j) Autopilot (Flight Control) (22-10-00, Adjustment/Test)
(k) Thrust Management System (22-32-00, Adjustment/Test)
(l) Fuel Flow Indicating System (73-31-00, Adjustment/Test)
(m) Integral Panel Lighting (33-13-00, Maintenance Practices)

(3) Make sure the FMC source select switches on panels P1 and P3 are in the usual position.

(4) Ensure FMCS circuit breakers on panel P11 are closed.
(a) L FMCS CMPTR
(b) L FMCS CDU
(c) R FMCS CMPTR
(d) R FMCS CDU

(5) The flight management computer system is turned OFF by removing power.

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FLIGHT MANAGEMENT COMPUTER SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	AMM REFERENCE
CIRCUIT BREAKER -	1		FLT COMPT, P11	
DATA LOADER, C627		1	11B1	*
FMCS CDU LEFT, C597		1	11E8	*
FMCS CDU RIGHT, C598		1	11E29	*
FMCS CMPTR LEFT, C609		1	11E9	*
FMCS CMPTR RIGHT, C610		1	11E30	*
COMPUTER - (FIM 31-41-00/101)				
EICAS L, M10181				
EICAS R, M10182				
COMPUTER - FLIGHT MANAGEMENT L, M134	2	1	119AL, MAIN EQUIP CTR, E2-2	34-61-01
COMPUTER - FLIGHT MANAGEMENT R, M135	2	1	119AL, MAIN EQUIP CTR, E2-3	34-61-01
INDICATOR - (FIM 34-22-00/101)				
CAPT ELECTRONIC ATTITUDE DIRECTOR, N4				
CAPT ELECTRONIC HORIZONTAL SITUATION, N5				
F/O'S ELECTRONIC ATTITUDE DIRECTOR, N44				
F/O'S ELECTRONIC HORIZONTAL SITUATION, N45				
LIGHT - FMC ANNUNCIATOR, L603	1	1	FLT COMPT, P1-3	*
LOADER - AIRBORNE DATA, M1736	2	1	FLT COMPT, P61	34-61-05
PANEL - (FIM 22-11-00/101)				
AFCS MODE CONTROL, M90				
PANEL - (FIM 34-22-00/101)				
EFIS CONTROL L, M94				
EFIS CONTROL R, M93				
PANEL - DATA LOADER CONTROL, M1737	2	1	FLT COMPT, P61	34-61-06

* SEE THE WDM EQUIPMENT LIST

Flight Management Computer System - Component Index
Figure 101 (Sheet 1)

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FLIGHT MANAGEMENT COMPUTER SYSTEM

COMPONENT	FIG. 102 SHT	QTY	ACCESS/AREA	REFERENCE
PRINTER - (REF 31-35-00, FIG. 101)				
MULTI-INPUT, M1631				
RELAY	2		119AL, MAIN EQUIP CTR, E2-2	
CDU NAV ENABLE L, K2065		1		*
FCC SOURCE SELECT L, K2067		1		*
RELAY	2		119AL, MAIN EQUIP CTR, E2-3	
CAPT & F/O SOURCE SELECT R, K2069		1		*
CDU NAV ENABLE R, K2066		1		*
FCC SOURCE SELECT R, K2068		1		*
RELAY - (REF 31-01-36, FIG. 101)				
FMC TUNING L, K757				
RELAY - (REF 31-01-37, FIG. 101)				
FMC TUNING R, K758				
SWITCH - LEFT FMC, S2	1	1	FLT COMPT, P1	*
SWITCH - RIGHT FMC, S10	1	1	FLT COMPT, P3	*
SYMBOL GENERATOR - (REF 34-22-00, FIG. 101)				
EFIS L, M148				
EFIS C, M149				
EFIS R, M150				
UNIT - FLIGHT MANAGEMENT COMPUTER CONTROL/ DISPLAY L, M76	1	1	FLT COMPT, P9	34-61-02
UNIT - FLIGHT MANAGEMENT COMPUTER CONTROL/ DISPLAY R, M77	1	1	FLT COMPT, P9	34-61-02

* SEE THE WDM EQUIPMENT LIST

Flight Management Computer System - Component Index
Figure 101 (Sheet 2)

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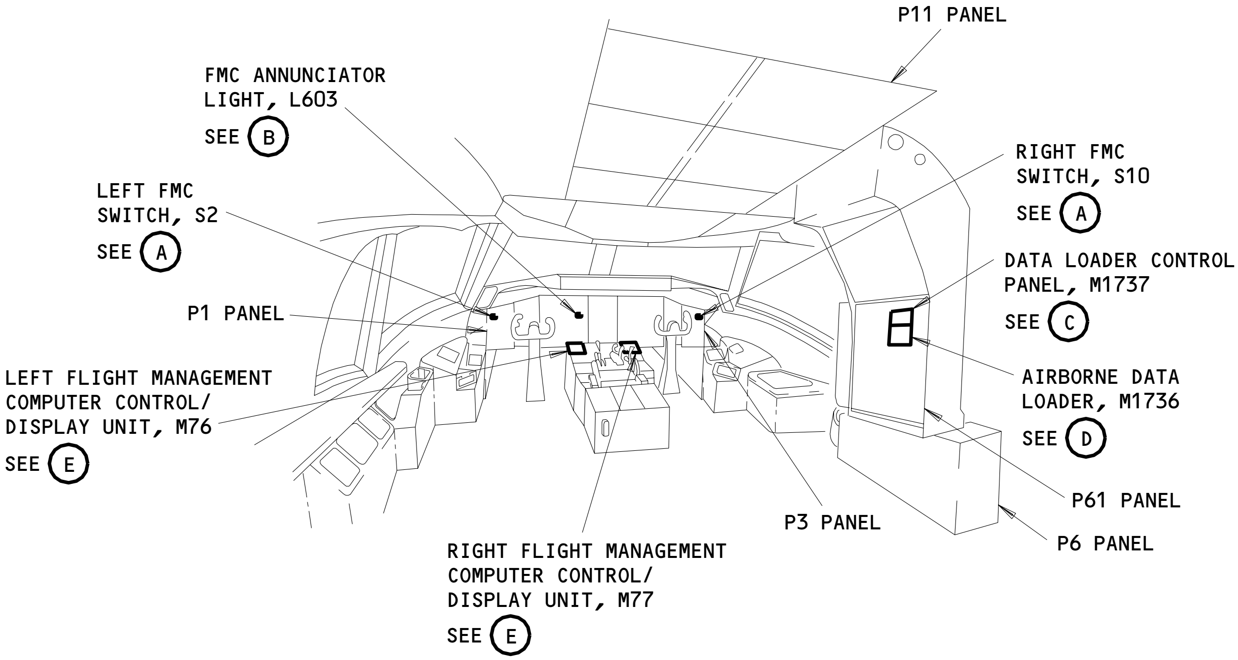
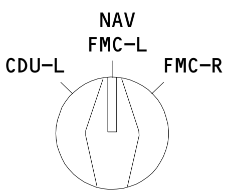
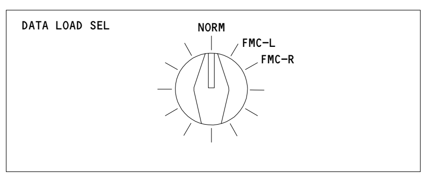


FLIGHT COMPARTMENT



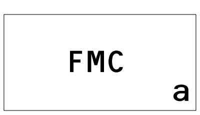
FMC SWITCH
(EXAMPLE),
S2 OR S10

A



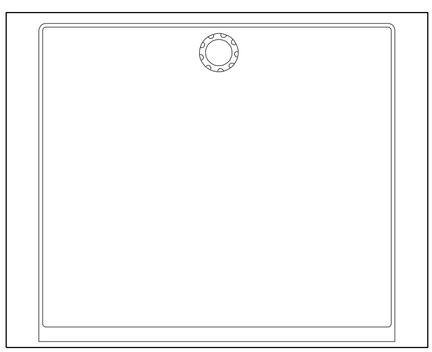
DATA LOADER CONTROL PANEL, M1737

C



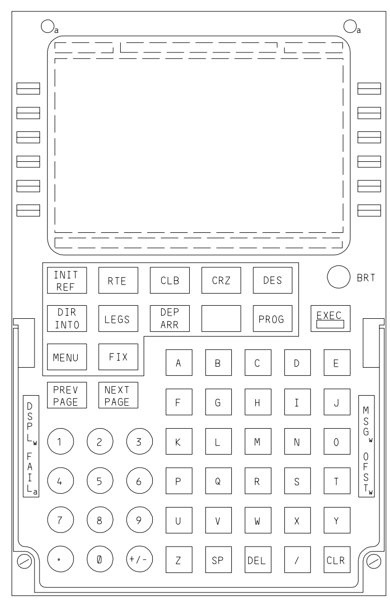
FMC ANNUNCIATOR
LIGHT, L603

B



AIRBORNE DATA LOADER

C



LEFT OR RIGHT FLIGHT MANAGEMENT
COMPUTER CONTROL DISPLAY
UNIT, M76 OR M77

E

Flight Management Computer System - Component Location
Figure 102 (Sheet 1)

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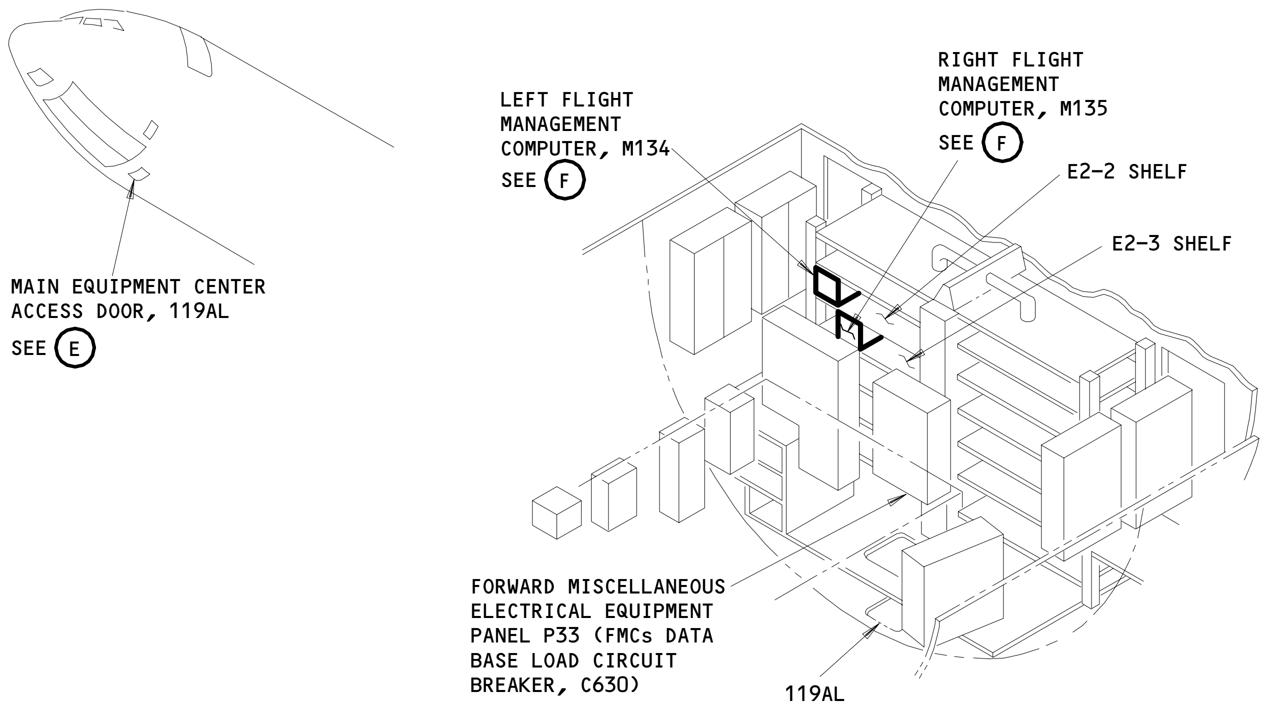
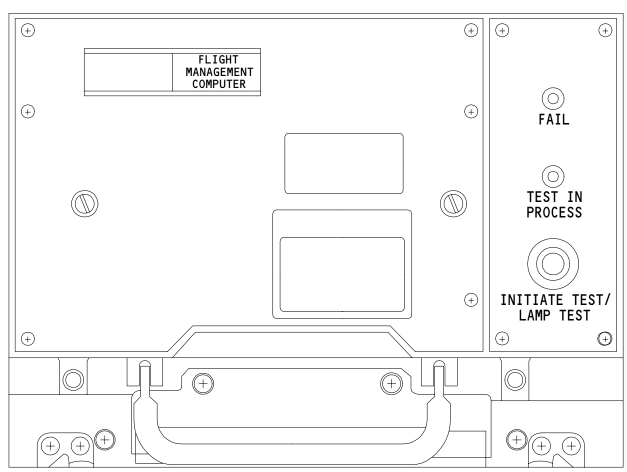


MAIN EQUIPMENT CENTER

E



LEFT OR RIGHT FLIGHT MANAGEMENT COMPUTER, M134 OR M135

F

Flight Management Computer System - Component Location
Figure 102 (Sheet 2)

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FLIGHT MANAGEMENT COMPUTER SYSTEM - MAINTENANCE PRACTICES

1. General
   A. The flight management computer system is made up of two complete systems. Each has a flight management computer (FMC) and a control display unit (CDU). Each FMC contains a bubble memory for the operational program, performance database, and navigation database.
   B. The navigation database has nav aid data, geographic data, and also two different company route data sets. The company route data sets give arrival, departure, and route data valid for a specific four week period. One data set becomes out of date as the other data set starts to be used.
   C. These are four procedures to load the FMC data in the flight management computer system:
      (1) Load the Navigation Database With the Airborne Data Loader (ADL).
      (2) Load the Operational Program With the ADL.
      (3) Crossload the Navigation Database From one FMC to the Other FMC.
      (4) Change the Drag Factor and Fuel Flow Factor.

TASK 34-61-00-422-171-002

2. Load the Navigation Database With the Airborne Data Loader (ADL)
   A. General
      (1) All control of data movement is automatically done by the ADL.

         NOTE: The performance factors are set to their default values when you load a new navigation database. You can change the performance factors of the FMC after you load a new database if necessary.

      (2) The LED indicators on the front panel of the ADL give the status during data transfer. The LED indicators are as follows:
         (a) PROG(Progress) - Indicates the data transfer is in progress.
         (b) CHNG(Change) - Indicates you must change the diskette when the CHNG indicator comes on.
         (c) COMP(Complete) - Indicates the data transfer is complete.
         (d) RDY(Ready) - Indicates the ADL is ready for operation.
         (e) XFER(Transfer) - Indicates the data transfer has failed.
         (f) R/W(Read/Write)- Indicates the ADL cannot read or write the data on the diskette.

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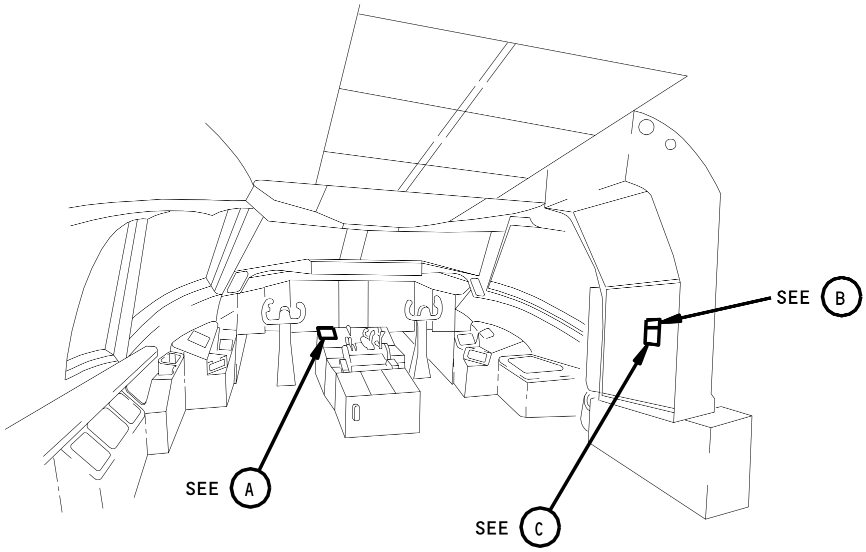
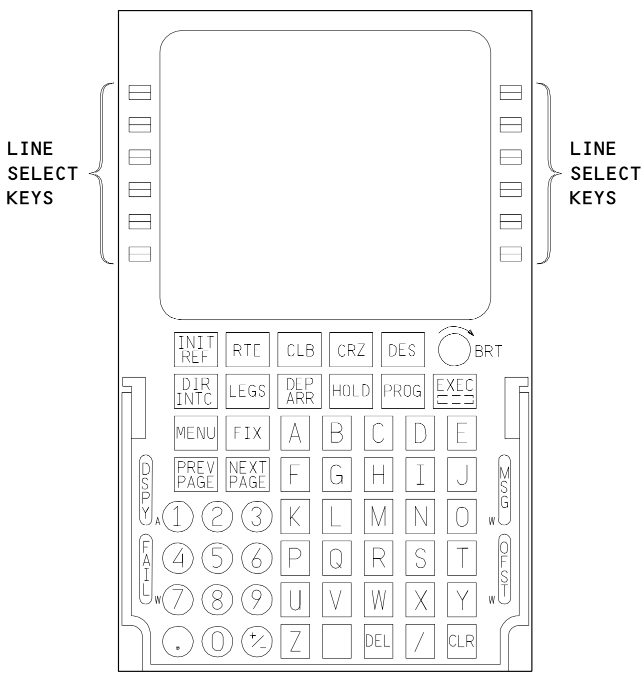
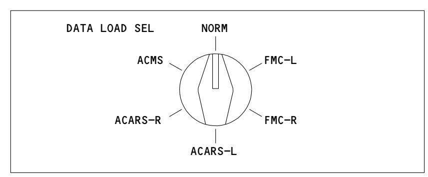


FLIGHT COMPARTMENT

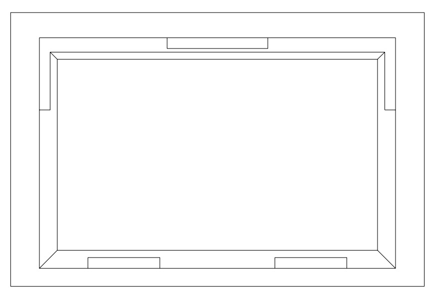


A



DATA LOADER CONTROL PANEL

B



AIRBORNE DATA LOADER

C

FMC Data Loading
Figure 201

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(g) HRDW(Hardware) - Indicates the ADL has failed its self-test.

(3) To read about software installation times and data loaders, do this task: On-Airplane Software Installation (AMM 20-15-11/201).

B. Equipment

(1) Current navigation database diskette.

C. References

(1) AMM 20-15-11/201, On-Airplane Software Installation

(2) AMM 24-22-00/201, Electrical Power - Control

D. Access

(1) Location Zones

211/212 Flight Compartment

E. Prepare to Load the Navigation Database

S 862-172-002

(1) Supply electrical power (AMM 24-22-00/201).

S 862-173-002

(2) Make sure the FMC NAV Source Select switch on the P1 panel is in the FMC-L position.

S 862-224-002

(3) Make sure the FMC NAV Source Select switch on the P3 panel is in the FMC-R position.

S 862-174-002

(4) Close these circuit breakers on the P11 overhead panel:

(a) 11E8, FMCS CDU LEFT

(b) 11E29, FMCS CDU RIGHT

S 422-175-002

(5) FMC Navigation Database Input Procedure

(a) Make sure these circuit breakers are open on the P11 panel:

1) 11E9, FMCS CMPTR LEFT

2) 11E30, FMCS CMPTR RIGHT

(b) Open this circuit breaker on the P11 panel:

1) 11G24, FMC DATA LOADER

(c) At the P61 panel, set the data load selection switch to the NORMAL position on the data loader control panel (DLCP).

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(d) Open the disk drive access door on the ADL which is directly below the DLCP switch on the P61 panel.

(e) Close the circuit breaker 11E9 LEFT FMCS CMPTR (11E30 RIGHT FMCS CMPTR). Make sure the circuit breaker for the other FMC is open.

(f) Close this circuit breaker on the P11 panel:

1) 11G24, FMC DATA LOADER

(g) Make sure the LED indicators on the ADL flash on and off until self-test is complete.

(h) Set the DLCP switch on the P61 panel to the position for the FMC that you will load the navigation database.

(i) Put the navigation database diskette into the disk drive.

(j) Make sure the RDY indicator comes on after the diskette has been put into the ADL.

(k) Make sure this sequence occurs:

(l) Make sure the PROG indicator comes on after the RDY indicator comes on. The two indicators should be on at the same time.

NOTE: The time before the PROG indicator comes on is not always constant because the data can be different.

(m) If the RDY indicator goes off and the CHNG indicator comes on, do these steps:

NOTE: The CHNG indicator shows that there are more diskettes and you must put in the next diskette.

1) Push the eject button and remove the first diskette. Make sure the CHNG indicator goes off and the PROG indicator comes on.

2) Put in each subsequent diskette until completed. Make sure that the RDY and PROG indicators come on.

(n) The COMP indicator comes on and the RDY and PROG indicators go off when the navigation database load is complete.

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(o) Push the eject button and remove the diskette.
(p) If it is necessary to load the navigation database into the other FMC, repeat the Load the Navigation Database with the Airborne Data Loader (ADL) for that FMC.
(q) Set the DLCP switch on the P61 panel to the NORMAL position.
(r) Open this circuit breaker on the P11 panel:
1) 11G24, FMC DATA LOADER

S 862-176-002
(6) Approval of Data Input
(a) Make sure the MENU page shows on the left (Right) CDU.
(b) Make sure the <FMC prompt shows on the MENU page of the left (Right) CDU.
(c) If the <FMC prompt does not show on the MENU page, do this procedure: Load the Operational Software with the ADL.
(d) Push the line select key (LSK) adjacent to the <FMC prompt to get the IDENT page on the left (Right) CDU.
(e) Make sure the part number of the NAV DATA on the Left (Right) CDU is correct.

NOTE: Get the correct NAV DATA part number from the approved airline department.

(f) If the NAV DATA CROSSLOAD page shows on the left CDU, do one of these procedures:

NOTE: The NAV DATA CROSSLOAD page shows because the two FMCs have different navigation databases. If this occurs, you must crossload the correct navigation database into the FMC that has the incorrect one.

1) Crossload the Navigation Database From one FMC to the Other FMC
2) Load the Navigation Database With the Airborne Data Loader (ADL).

NOTE: The procedure must be done with the DLCP switch position set to the FMC that will be receiving the new database because it is incorrect.

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(g) Look at and note the NAV DATA part number on the left and right CDU.

(h) Put the correct navigation database into the two FMCs, if one of these conditions occurs:

1) The NAV DATA part number does not show.
2) The NAV DATA part number shows but is not correct.
3) Today's date is not in the range between the two dates that are directly under ACTIVE or between the two dates on the third line.
4) If today's date is in between the two dates on the third line. Do a Company Data Set Interchange as follows:

NOTE: Operation of a new NAV DATA base will erase all flight plan data that was put in for the two active and inactive flight plans before the change of dates.

a) Push the 3R LSK on the CDU.
b) Make sure the data on the third line of the CDU shows on the bottom line of the CDU.
c) Push the 2R LSK on the CDU.
d) Make sure the dates on the two lines have changed positions with each other.

(i) The MODEL and ENGINES show the correct airplane configuration on the CDUs.

(j) Close this circuit breaker on the P11 panel:

1) 11G24, FMC DATA LOADER

F. Put the Airplane Back to Its Usual Condition

S 862-177-002

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

TASK 34-61-00-422-178-002

3. Load the Operational Program With the ADL

A. General

(1) To read about software installation times and data loaders, do this task: On-Airplane Software Installation (AMM 20-15-11/201).

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B. Equipment
   (1) Current operational program software diskette.
C. References
   (1) AMM 20-15-11/201, On-Airplane Software Installation
   (2) AMM 24-22-00/201, Electrical Power - Control
D. Access
   (1) Location Zones
       211/212 Flight Compartment

E. Prepare to Input Data

   S 862-179-002
   (1) Supply electrical power (AMM 24-22-00/201).

   S 862-180-002
   (2) Make sure the FMC NAV Source Select switches on panels P1 and P3 are in the FMC-L (FMC-R) position.

   S 862-181-002
   (3) Close these circuit breakers on the P11 overhead panel:
       (a) 11E8, FMCS CDU LEFT
       (b) 11E29, FMCS CDU RIGHT

   S 422-182-002
   (4) FMC Operational Software Program Data Input
       (a) Make sure these P11 panel circuit breakers are open:
           1) 11E9, FMCS CMPTR LEFT
           2) 11E30, FMCS CMPTR RIGHT
       (b) Open this circuit breaker on the P11 panel:
           1) 11G24, FMC DATA LOADER
       (c) Set the DLCP switch on the P61 panel to the NORMAL position.
       (d) Open the disk drive access door found directly below the DLCP switch on the P61 panel.
       (e) Make sure the 11E30 FMCS RIGHT CMTR (11E9 LEFT FMCS CMTR) is open.

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(f) Close the circuit breaker 11E9 LEFT FMCS CMPTR (11E30 RIGHT FMCS CMPTR).

(g) Open this circuit breaker on the P11 panel:

1) 11G24, FMC DATA LOADER

(h) Make sure all the ADL indicators flash on and off until self-test is complete.

(i) Set the DLCP switch on the P61 panel to the FMC-L (FMC-R) position.

(j) Remove the diskette from its protective plastic container.

CAUTION: MAKE SURE THE PART NUMBER OF THE OPERATIONAL PROGRAM SOFTWARE IS CORRECT BEFORE YOU PUT THE DISKETTE INTO THE DISK DRIVE.

(k) Put the operational program software diskette into the disk drive on the ADL.

NOTE: When you install a complete set of the FMC software, you should install the OPS first. Loading the OPS will clear any loaded OPC, NDB, FIDO, and AMI, therefore, these programs need to be reloaded.

(l) Make sure this sequence occurs:

(m) Make sure the RDY indicator comes on after the diskette has been put into the ADL.

(n) Make sure that the PROG indicator comes on after the RDY indicator comes on. The two indicators should be on at the same time.

NOTE: The time before the PROG indicator comes on is not always constant because the data can be different.

(o) If the RDY indicator goes off and the CHNG indicator comes on, do these steps:

NOTE: This shows that more than one diskette is necessary for a complete software load for this system. If the loader indicates the load is complete after only 1 disk, this indicates the software is already installed and no further disks need to be loaded.

1) Push the eject button and remove the first diskette. Make sure the CHNG indicator goes off and the PROG indicator comes on.

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2) Put in each subsequent diskette until completed. Make sure that the RDY and PROG indicators come on.

(p) The COMP indicator comes on and the RDY and PROG indicators go off when the software load is complete.

(q) Push the eject button and remove the diskette.

(r) If the right FMC needs the operational program software to be input, do these steps:

1) Set the DLCP switch to the FMC-R position.

2) Do this procedure for the right FMC: Load the Operational Program With the ADL.

(s) Set the DLCP switch to the NORMAL position when the operational program software load is completed.

(t) Open this circuit breaker on the P11 panel:

1) 11G24, FMC DATA LOADER

S 862-183-002

(5) Approval of Data Input

(a) Make sure the MENU page shows on the left CDU.

(b) Make sure the <FMC prompt shows on the MENU page for the left CDU.

(c) If the <FMC prompt does not show on the MENU page, do this procedure: Load the Operational Program With the ADL.

(d) Push the line select key (LSK) adjacent to the <FMC prompt to get the IDENT page on the left CDU.

(e) Make sure the MENU page shows on the right CDU.

(f) Make sure the <FMC prompt shows on the MENU page for the right CDU.

(g) If the <FMC prompt does not show on the MENU page, do this procedure: Load the Operational Program With the ADL.

(h) Push the line select key (LSK) adjacent to the <FMC prompt to get the IDENT page on the right CDU.

(i) Make sure the part number for the OP PROGRAM on the right CDU is correct.

NOTE: Get the correct OP PROGRAM part number from the approved airline department.

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(j) If the NAV DATA CROSSLOAD page shows on the left CDU, do one of these procedures:

NOTE: The NAV DATA CROSSLOAD page shows on the left CDU because the two FMCs have different navigation databases. If this occurs, you must crossload the correct navigation database into the FMC that has the incorrect one.

1) The Crossload the Databases From one FMC to the Other FMC procedure.
2) The Load the Navigation Database with the Airborne Data Loader (ADL) procedure.

NOTE: You must set the DLCP switch position to the FMC that has the incorrect database.

(k) Make sure the part number of NAV DATA is correct on the left and right CDU.
(l) Put the correct navigation database into the two FMCs if one of these conditions occurs:
1) NAV DATA part number is not shown
2) NAV DATA part number is not correct
3) Today's date is not in the range between the two dates that are directly under ACTIVE or between the two dates on the third line.
4) If today's date is in between the two dates on the third line. Do a Company Data Set Interchange as follows:

NOTE: Operation of a new NAV DATA base will erase all flight plan data that was put in for the two active and inactive flight plans before the change of dates.

a) Push the 3R LSK on the CDU.

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b) Make sure the data on third line of CDU shows on the bottom of the CDU.
c) Push the 2R LSK on the CDU.
d) Make sure dates on the two lines have changed positions with each other.

(m) MODEL and ENGINES show the correct airplane configuration.
(n) Close this circuit breaker on the P11 panel:
1) 11G24, FMC DATA LOADER

F. Put the Airplane Back to Its Usual Condition.

S 862-184-002
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-61-00-422-185-002

4. Nav Data Crossload

A. General
(1) The flight management computer (FMC) system can transfer the complete navigation database from one FMC to the other FMC . A Nav Data Crossload can be done only when the airplane is on the ground and when the navigation databases are different.

B. References
(1) AMM 24-22-00/201, Electrical Power - Control

C. Access
(1) Location Zones
211/212 Flight Compartment

D. Prepare to Crossload the Data

S 862-186-002
(1) Supply electrical power (AMM 24-22-00/201).

S 862-187-002
(2) Follow airline procedures and identify FMC with correct nav data base.

NOTE: Throughout this procedure, the FMC with the correct nav data base is referred to as the FMC that transmits. The FMC with the nav data base that is to be changed is referred to as the FMC that receives.

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S 862-188-002

(3) Set the FMC NAV Source Select switch to the FMC-L position on the P1 panel and to the FMC-R position on the P3 panel.

S 862-189-002

(4) Close these P11 panel circuit breakers:
   (a) 11E8, FMCS CDU LEFT
   (b) 11E29, FMCS CDU RIGHT

S 862-190-002

(5) Open these P11 panel circuit breakers:
   (a) 11E9, FMCS CMPTR LEFT
   (b) 11E30, FMCS CMPTR RIGHT

S 862-191-002

(6) Close FMCS CMPTR circuit breaker for the FMC that transmits.

S 862-192-002

(7) Let that FMC start to operate and then close the FMCS CMPTR circuit breaker for the FMC that receives.

S 862-193-002

(8) Make sure the CDU for the FMC that transmits shows the IDENT page.

S 862-194-002

(9) Make sure the CDU for the FMC that receives shows the NAV DATA CROSSLOAD page.

E. Do a Crossload of the Navigation DataBase

S 862-195-002

(1) Do these actions on CDU for the FMC that transmits:
   (a) Push the LSK adjacent to the <INDEX prompt on the lower left side of the CDU display.
   (b) Make sure the CDU page title is INIT/REF INDEX.

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(c) Push the LSK adjacent to the MAINT> prompt on the lower right side of the CDU display.
(d) Make sure the CDU page title is MAINTENANCE INDEX.
(e) Push the LSK adjacent to the <CROSS LOAD prompt on top left side of CDU display.
(f) Make sure the display is as shown below.

```
 NAV DATA CROSSLOAD 1/1


<TRANSMIT       RECEIVE>









<INDEX              ---
 SINGLE FMC OPERATION
```

S 862-196-002
(2) Push the CLR key on the two CDUs (removes the message).

S 862-197-002
(3) Use the CDU keyboard to put in the word ARM on the two CDUs.

S 862-198-002
(4) Make sure the word ARM shows on the bottom line of the two CDUs.

S 862-199-002
(5) Push the bottom LSK on the right side of the two CDUs.

S 862-200-002
(6) Make sure the word ARM shows on the bottom line of the two CDUs adjacent to the LSKs that were pushed.

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S 862-201-002

CAUTION: THE TRANSMIT AND RECEIVE LINE SELECT KEYS MUST BE USED CAREFULLY TO MAKE SURE NAVIGATION DATA BASE MOVEMENT GOES INTO THE APPLICABLE FMC. THE TWO FMCs WILL NEED THE INITIAL DATA BASE LOADED INTO THEM IF THE INCORRECT DIRECTION IS USED.

(7) Push the LSK adjacent to the <TRANSMIT prompt on the left side of the CDU display for the FMC that is to transmit.

S 862-202-002

(8) Push the LSK adjacent to the RECEIVE> prompt on the right side of the CDU display for the FMC that is to receive.

S 862-203-002

(9) Make sure TRANSFER IN PROGRESS shows on the CDU for the FMC that transmits.

NOTE: It takes approximately 15 minutes to crossload the navigation database. If the cross load is interrupted, the FMC can get into a mode where it will no longer accept a crossload or even a direct load using the data loader. You should power off both FMCs for approximately 10 seconds and power them up again. Leave FMCs powered without interruption for approximately 30 minutes and then do the data load again, either crossload or direct load.

(a) The TRANSFER COMPLETE replaces TRANSFER IN PROGRESS on the CDU when the data movement is done.

(b) A failure to complete data transfer causes the TRANSFER IN PROGRESS to be replaced by TRANSFER ABORTED on the CDU.

F. Data Crossload Check

S 862-204-002

(1) If the message RESYNCING FMC shows, do no actions to the FMCS and wait until the message goes out.

S 862-205-002

(2) Push the LSK adjacent to the <INDEX prompt on the CDU display.

S 862-206-002

(3) Make sure the MAINTENANCE INDEX page shows.

S 862-207-002

(4) Push the LSK adjacent to the <INDEX prompt on the CDU display.

S 862-208-002

(5) Make sure the INIT REF INDEX page shows.

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S 862-209-002

(6) Push the LSK adjacent to the <IDENT prompt on the CDU display.

S 862-210-002

(7) Make sure the IDENT page shows.

S 862-211-002

(8) Make sure the data on the two CDUs are the same.

S 862-212-002

(9) The data to compare are shown below:
   (a) MODEL and ENGINES show the correct airplane configuration.
   (b) NAV DATA is the same for the two CDUs.
   (c) Today's date is in the range between the two dates that are directly under ACTIVE.
   (d) If today's date is in between the two dates on the third line. Do a Company Data Set Interchange as follows:
      1) Push the third LSK on the right side of CDU.
   (e) Make sure the data on the third line of the CDU shows on the bottom line of the CDU.
      1) Push the second LSK on the right side of CDU.
   (f) Make sure the dates on the two lines have changed positions with each other.
   (g) Do these steps:
      1) Make sure the part number of the OP PROGRAM on the two CDUs is correct.

         NOTE: Get the correct OP PROGRAM part number from the approved airline department.

      2) If the OP PROGRAM part number is incorrect , do this procedure: Load the Operational Program With the ADL.
   (h) Program identification must be the same on the two CDUs.
   (i) Make sure the NAV data base is the last applicable data base released .
   (j) Make sure the values for the performance factors are correct.
   (k) If performance factors are incorrect, do this procedure: Change the Drag Factor and Fuel Flow Factor.

G. Put the Airplane Back to Its Usual Condition.

S 862-213-002

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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TASK 34-61-00-422-214-002

5. Drag Factor/Fuel Flow Factor Modification Procedure

A. General

(1) This procedure provides instructions to change the drag factor and the fuel flow factor. The drag factor and fuel flow factor go to the default values when new Operational Program Software (OPS) is put in. If other than the default values are used, then they must be put in again. When the two FMCs are on, the factors are changed in the two FMCs at the same time. The new values are kept in the FMC when power is removed.

B. References

(1) 24-22-00/201, Electrical Power-Control

C. Access

(1) Location Zones

211/212 Flight Compartment

D. Procedure

S 862-215-002

(1) Close these circuit breakers on the P11 panel:

(a) 11E8, FMCS CDU LEFT

(b) 11E9, FMCS CMPTR LEFT

(c) 11E29, FMCS CDU RIGHT

(d) 11E30, FMCS CMPTR RIGHT

S 862-217-002

(2) Do these steps to change the drag factor and the fuel flow factor:

(a) Make sure the IDENT page shows on the CDU.

(b) Push the alphanumeric keys A, R, M, and ARM will show in the scratchpad area.

(c) Push the LSK for the DRAG and FUEL FLOW FACTORS line.

(d) Make sure ARM shows below the DRAG/FF line on the CDU.

(e) You can put the drag factor and the fuel flow factor in at the same time, or you can put them in one at a time. If you put them in at the same time, you must put them in this order: drag factor/fuel flow factor. You must put the slash (/) between the two numbers. If you put them in one at a time, you must put a slash after the drag factor. (Include the negative sign (-) if necessary, and decimal sign if a decimal number is put in.) If no value is entered, these defaults will be o.

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(f) After you put in the number, push the applicable LSK on the CDU to move the number into the FMC.

S 862-220-002

(3) Push the LSK adjacent to the DRAG/FF prompt.

S 862-221-002

(4) Open these circuit breakers on the P11 panel for 15 seconds and then close them:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E30, FMCS CMPTR RIGHT

S 862-222-002

(5) Make sure the CDU IDENT page shows the value that you put in.

E. Put the Airplane Back to Its Usual Condition.

S 862-223-002

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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FLIGHT MANAGEMENT COMPUTER SYSTEM - MAINTENANCE PRACTICES

1. General
   A. The flight management computer system is made up of two complete systems. Each has a flight management computer (FMC) and a control display unit (CDU). Each FMC contains the memory for the operational program software, the navigation database, the operational program configuration, the airline modification information, and the flight information and data output files.
      (1) The Operational Program Software (OPS) is the application software resident in the FMC. This software is required for normal operation and to implement the features in the FMC.
      (2) The navigation database has nav aid data, geographic data, and two different company route data sets. The company route data sets give arrival, departure, and route data for a specific twenty eight day period. When the current data set is out of date, the other data set becomes active for the FMC to use.
      (3) The Operational Program Configuration (OPC) is used to enable the features in the FMC. The OPC contains the FMC features that are one to one correlated to the features in the OPS.
      (4) The Airlines Modification Information (AMI) software contains the airplane parameters and the datalink tables according to the airline policies and airplane characteristics.
      (5) The Flight Information and Data Output (FIDO) file defines the specific FMC data that outputs on the dedicated ARINC 429 data bus for recording and analysis purposes.
   B. There are two procedures to load the software into the FMC.
      (1) Load the FMC software with the Airborne Data Loader (ADL)
      (2) Crossload the software from one FMC to the other FMC.
   C. The Drag Factor and Fuel Flow Factor Modification procedure provides instruction to change the drag factor and the fuel flow factor. These values are usually set to zero as default.

TASK 34-61-00-422-001-004

2. Load the FMC Software with the Airborne Data Loader
   A. General
      (1) The FMC software consists of the operational program software, the navigational database, the operational program configuration, the airline modification information, and the flight information and data output. You can load each of the software separately as necessary. The FMC requires all five software to operate correctly.

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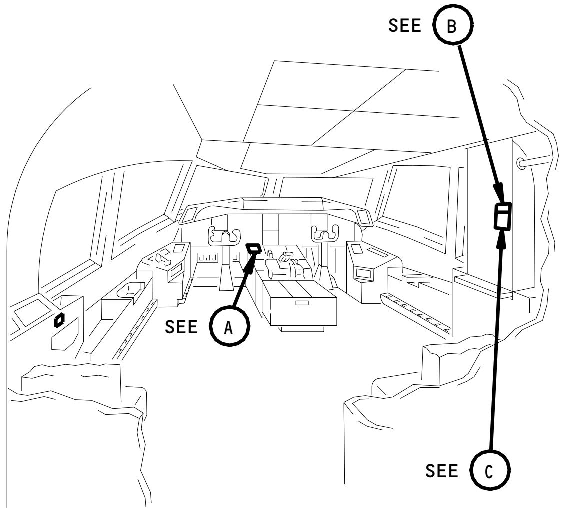
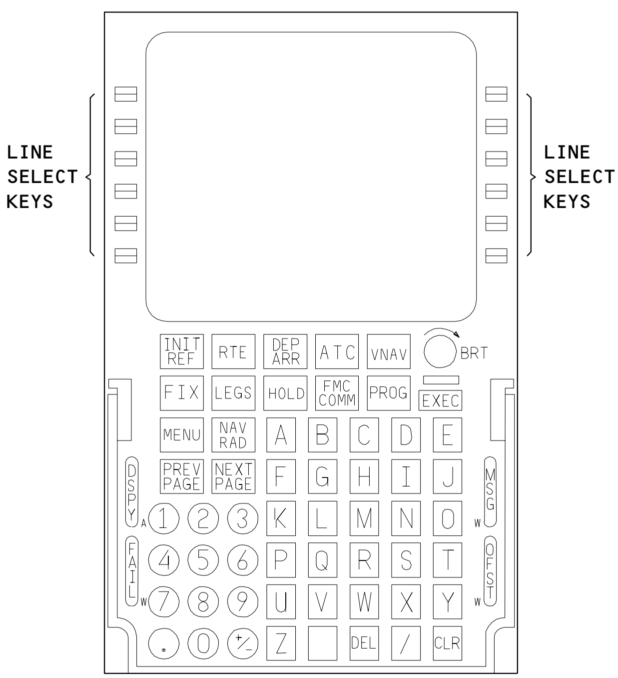
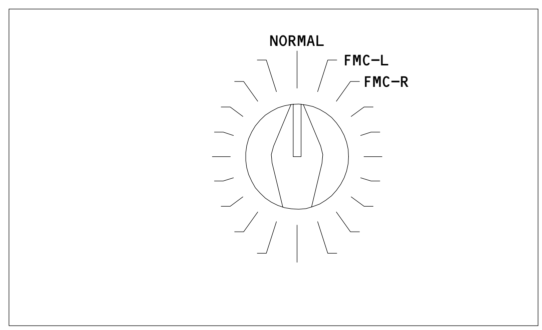


FLIGHT COMPARTMENT

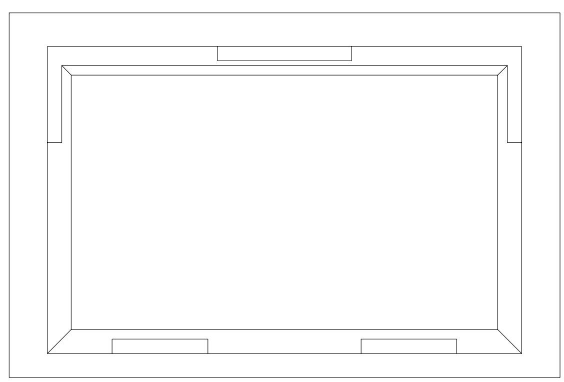


A



DATA LOADER CONTROL PANEL

B



AIRBORNE DATA LOADER

C

FMC Data Loading
Figure 201

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(2) You can use the Airborne Data Loader (ADL) to load the software from the diskette into the FMC memory.

(3) The indicators on the front panel of the ADL give the status of the ADL during data load. The indicators are as follows:

(a) PROG(Progress) - Indicates the data transfer is in progress.

(b) CHNG(Change) - Indicates that you must change the diskette when the CHNG indicator comes on.

(c) COMP(Complete) - Indicates the data transfer is complete.

(d) RDY(Ready) - Indicates the ADL is ready for operation.

(e) RDY(Flashing Ready) - Indicates the ADL is in standby operation mode and the data is approved.

(f) XFER(Transfer) - Indicates the data transfer has failed.

(g) R/W(Read/Write)- Indicates the ADL cannot read or write the data on the diskette.

(h) HRDW(Hardware) - Indicates the ADL has failed its self-test.

(4) To read about software installation times and data loaders, do this task: On-Airplane Software Installation (AMM 20-15-11/201).

B. Equipment

(1) The most up-to-date data diskettes.

C. References

(1) AMM 20-15-11/201, On-Airplane Software Installation

(2) AMM 24-22-00/201, Electrical Power - Control

D. Access

(1) Location Zones

211/212 Flight Compartment

E. Prepare to Load the Software

S 862-002-004

(1) Supply electrical power (AMM 24-22-00/201).

S 862-003-004

(2) Make sure the FMC NAV Source Select switches on panels P1 and P3 are in the FMC-L and FMC-R position.

S 862-004-004

(3) Close these circuit breakers on the overhead panel P11:

(a) 11E8, FMCS CDU LEFT

(b) 11E29, FMCS CDU RIGHT

S 862-005-004

(4) Open these circuit breakers on the overhead panel P11:

(a) 11E9, FMCS CMPTR LEFT

(b) 11E30, FMCS CMPTR RIGHT

(c) 11G24, DATA LOADER

S 422-006-004

(5) Do these steps to load the software into the left FMC:

(a) Set the DLCP switch on the P61 panel to the NORMAL position.

(b) Close this circuit breaker on the overhead panel P11:

1) 11E9, FMCS CMPTR LEFT

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(c) Make sure this circuit breaker on the overhead panel, P11, is open:
   1) 11E30, FMCS CMPTR RIGHT
(d) Open the disk drive access door of the ADL on the P61 panel.
(e) Close this circuit breaker on the overhead panel, P11:
   1) 11G24, DATA LOADER
(f) Make sure the indicators on the ADL flash on and off until the self-test is complete.
(g) Set the DLCP switch on the P61 panel to the FMC-L position.
(h) Make sure the MENU page shows on the left CDU.
(i) Make sure the <FMC prompt does not show on the left CDU.

CAUTION: BEFORE YOU INSTALL THE DISKETTE INTO THE ADL, MAKE SURE THE SOFTWARE PART NUMBER IS CORRECT.

(j) Put the first data diskette into the disk drive.

   NOTE: If you install a complete set of the FMC software , you must install the OPS first. Loading the OPS will clear any loaded OPC, NDB, FIDO and AMI, therefore, these programs need to be reloaded.

(k) Make sure the RDY indicator comes on after you insert the diskette into the ADL.
(l) Make sure the PROG indicator comes on after the RDY indicator goes on. The two indicators should be on at the same time.
(m) If the RDY indicator goes off and the CHNG indicator comes on, do these steps:

   NOTE: The CHNG indicator shows that there are more than one diskette and you must insert the next diskette. If the loader indicates the load is complete after only 1 disk, this indicates the software is already installed and no further disks need to be loaded.

   1) Push the eject button and remove the first diskette. Make sure the CHNG indicator goes off and the PROG indicator comes on.
   2) Put in each subsequent diskette until you finish. Make sure the RDY and PROG indicators come on during data transfer.
(n) When the software load is complete, the COMP indicator comes on and the RDY and PROG indicators go off.
(o) Set the DLCP switch on the P61 panel to the NORMAL position.
(p) Open this circuit breaker on the overhead panel, P11:
   1) 11G24, DATA LOADER

S 862-007-004
(6) Approval of Data Input
   (a) Make sure the MENU page shows on the left CDU.

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(b) Make sure the <FMC prompt shows on the MENU page of the left CDU.
(c) Push the line select key (LSK) adjacent to the <FMC prompt.
(d) Make sure the IDENT page shows on the left CDU.
(e) Make sure the OPS, OPC, and the NAV DATA sotware part numbers on the IDENT PAGE that show on the left CDU are correct.
(f) Make sure the AMI and FIDO software part numbers on the CROSSLOAD PAGE that show on the left CDU are correct.
(g) Close these circuit breakers on the overhead panel, P11:
1) 11E30, FMCS CMPTR RIGHT
2) 11G24, DATA LOADER
(h) After you close the circuit breaker of the left and right FMCs, If the FMC detects a difference in the software between the two FMCs, the FMC CROSSLOAD page will shown on the CDU. You must do the data crossload procedure or repeat the FMC data load procedure (AMM 34-61-00/201) to load the data into the FMC that has the incorrect databases.
(i) Make sure the NAV DATA, the OP PROGRAM, and the OPC part numbers that show on the L and R CDUs are correct.

F. Put the Airplane Back to Its Usual Condition

S 862-008-004
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-61-00-422-009-004

3. FMC Data Crossload

A. General
(1) The flight management computer (FMC) data can be crossloaded from one FMC to the other FMC. A FMC Data Crossload can be done only when the airplane is on the ground and when there are differences between the two FMC software.
(2) During the FMC self-test, if the FMC detects a condition that the software part numbers of the two FMCs are different, the FMC CROSSLOAD pages will show and lock on the CDUs. You must do the data crossload procedure or do the software load procedure to correct this condition.

B. References
(1) AMM 24-22-00/201, Electrical Power - Control

C. Access
(1) Location Zones
211/212 Flight Compartment

D. Data Crossload Procedure

S 862-010-004
(1) Supply electrical power (AMM 24-22-00/201).

S 862-011-004
(2) Set the FMC NAV Source Select switches on the P1 panel to the FMC-L position and on the P3 panel to the FMC-R postion.

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S 862-012-004

(3) Close these circuit breakers on the overhead panel, P11:
   (a) 11E8, FMCS CDU LEFT
   (b) 11E29, FMCS CDU RIGHT
   (c) 11E9, FMCS CMPTR LEFT
   (d) 11E30, FMCS CMPTR RIGHT

S 862-013-004

(4) After the FMC self-test is complete, if the FMC detects a condition that the software part numbers do not match, the FMC CROSSLOAD pages show on the two CDUs.

NOTE: If the FMC CROSSLOAD page does not show on the CDU, you do not need to do the data crossload.

S 862-014-004

(5) Make sure the FMC CROSSLOAD page show on the CDU.

S 862-015-004

(6) Make sure the ARM> prompt shows adjacent to the software part numbers.

NOTE: The ARM> prompt only shows adjacent to the software part number that does not match between the two CDUs and you must do the datab crossload to correct this condition .

S 862-016-004

(7) Identify the FMC that has the correct software. This FMC will be the transmit FMC and refer to as the FMC/CDU that transmits.

S 862-017-004

(8) Do these steps to transmit the data from one FMC to another FMC:
   (a) Push the LSK adjacent to the ARM> prompt on the FMC/CDU that transmits.

   NOTE: You can arm more than one softwares that you want to crossload at the same time.

   (b) Make sure the ARM> prompt changes to ARMED on the FMC/CDU that transmits.
   (c) Make sure the TRANSMIT> prompt shows adjacent to the LSK 6R on the FMC/CDU that transmits.
   (d) Push the LSK adjacent to the TRANSMIT> prompt on the FMC/CDU that transmits.

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(e) Make sure the TRANSFER IN PROGRESS shows on the FMC/CDU that transmits.

NOTE: It takes approximately 15 minutes to crossload a navigation database. If the crossload is interrupted, the FMC can get into a mode where it will no longer accept a crossload or even a direct load using the data loader. You should power off both FMCs for approximately 10 seconds and power them up again. Leave the FMCs powered without interruption for approximately 30 minutes and then do the data load again, either crossload or direct load.

(f) Make sure the MENU page shows on the FMC/CDU that recieves.
(g) Make sure the FMC> prompt does not show on the FMC/CDU that receives.
(h) After the data transfer is complete, the TRANSFER COMPLETE will replace the TRANSFER IN PROGRESS on the FMC/CDU that transmits.
(i) Failure to complete the data transfer, the TRANSFER ABORTED will replace the TRANSFER IN PROGRESS on the FMC/CDU that transmits.

S 862-018-004
(9) Do these steps to do the data crossload check:
(a) After the data transfer is complete, make sure the IDENT page shows on the FMC/CDU that receives.
(b) Push the INIT REF function key on the FMC/CDU that transmits.
(c) Push the LSK adjacent to the <INDEX prompt on the FMC/CDU that transmits.
(d) Make sure the INIT/REF INDEX page shows on the FMC/CDU that transmits.
(e) Push the LSK adjacent to the <IDENT prompt on the FMC/CDU that transmits.
(f) Make sure the IDENT page shows on the FMC/CDU that transmits.
(g) Make sure the OPS, OPC, and the NAV DATA software part numbers on the IDENT PAGE that show on CDU's are correct.

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(h) Make sure the AMI and FIDO software part numbers on the CROSSLOAD PAGE that show on CDU's are correct.
(i) Make sure the drag factor and the fuel flow factor values are correct. If not, do the Drag Factor/Fuel Flow Factor Modification procedure to correct it.

E. Put the Airplane Back to Its Usual Condition.

S 862-019-004

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-61-00-422-020-004

4. Drag Factor/Fuel Flow Factor Modification Procedure

A. General

(1) This procedure provides instructions to change the drag factor and the fuel flow factor. If other than the standard values are used, you need to change the values. When the two FMCs are on, the factors are changed in the two FMCs at the same time. The new values are kept in the FMC when power is removed.

B. References

(1) AMM 24-22-00/201, Electrical Power-Control

C. Access

(1) Location Zones

211/212 Flight Compartment

D. Procedure

S 862-021-004

(1) Close these circuit breakers on the P11 panel:
(a) 11E8, FMCS CDU LEFT
(b) 11E9, FMCS CMPTR LEFT
(c) 11E29, FMCS CDU RIGHT
(d) 11E30, FMCS CMPTR RIGHT

S 862-022-004

(2) Do these steps to change the drag factor and the fuel flow factor:
(a) Make sure the IDENT page shows on the CDU.
(b) Push the alphanumeric keys A, R, M, and ARM will show in the scratchpad area.
(c) Push the LSK for the DRAG and FUEL FLOW FACTORS line.
(d) Make sure ARM shows to the left of the DRAG/FF line on the CDU.
(e) You can put the drag factor and the fuel flow factor in at the same time, or you can put them in one at a time. If you put them in at the same time, you must put them in this order: drag factor/fuel flow factor. You must put the slash (/) between the two numbers. If you put them in one at a time, you must put a slash after the drag factor. (Include the negative sign (-) if necessary, and decimal sign if a decimal number is put in.) . If no value is entered, these defaults will be 0.

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(f) After you put in the number, push the applicable LSK on the CDU to move the number into the FMC.

S 862-023-004

(3) Open these circuit breakers on the P11 panel for 15 seconds and then close them:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E30, FMCS CMPTR RIGHT

S 862-024-004

(4) Make sure the CDU IDENT page shows the value that you put in.

E. Put the Airplane Back to Its Usual Condition

S 862-025-004

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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FLIGHT MANAGEMENT COMPUTER SYSTEM - ADJUSTMENT/TEST

1. General
   A. There are two Flight Management Computers (FMC) and two Control Display Units (CDU) in the Flight Management Computer System (FMCS).
   B. The CDU has twelve Line-Select Keys (LSK). There are six LSK on each side of the CDU. These keys are identified as 1L thru 6L and 1R thru 6R. The 6L LSK refers to the sixth key down from the top left hand side of the CDU.
   C. This procedure has these tasks:
      (1) The operational test makes sure the flight management computer system operates correctly.
      (2) The system test make sure the FMCS operates with other airplane systems.

TASK 34-61-00-715-006

2. Flight Management Computer System - Operational Test
   A. References
      (1) AMM 22-10-00/501, Autopilot (Flight Control)
      (2) AMM 22-32-00/501, Thrust Management System
      (3) AMM 24-22-00/201, Electrical Power - Control
      (4) AMM 27-61-00/201, Spoiler/Speed Control System
      (5) AMM 28-41-00/501, Fuel Quantity Indicating System
      (6) AMM 31-25-00/501, Clocks
      (7) AMM 31-41-00/201, Engine Indication and Crew Alerting System
      (8) AMM 31-51-00/501, Warning System
      (9) AMM 32-09-02/201, Air/Ground Relays
      (10) AMM 33-16-00/501, Master Dim and Test
      (11) AMM 34-12-00/501, Air Data Computing System
      (12) AMM 34-21-00/501, Inertial Reference System
      (13) AMM 34-22-00/501, Flight Instrument System
      (14) AMM 34-31-00/501, ILS Navigation System
      (15) AMM 34-51-00/501, VOR System
      (16) AMM 34-55-00/501, DME System
   B. Access
      (1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

      (2) Access Panels

119BL	Main Equipment Center

   C. Prepare For Test

      S 865-002
      (1) Supply electrical power (AMM 24-22-00/201).

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S 865-003

(2) Close these circuit breakers on the overhead circuit breaker panel, P11:
   - (a) 11E8, FMCS CDU LEFT
   - (b) 11E9, FMCS CMPTR LEFT
   - (c) 11E29, FMCS CDU RIGHT
   - (d) 11E30, FMCS CMPTR RIGHT
   - (e) 11F13, FMC TUNING LEFT, or
     11B1, NAV L FMC TUNING, or
     11B1, FMS SW L
   - (f) 11F33, FMC TUNING RIGHT, or
     11F33, FMS SW R

S 865-004

(3) Make sure these systems operate:
   - (a) Air/Ground Systems (AMM 32-09-02/501)
   - (b) Air Data System (AMM 34-12-00/501)
   - (c) Autopilot/Flight Director System (AMM 22-10-00/501)
   - (d) Clock System (AMM 31-25-00/501)
   - (e) DME (AMM 34-55-00/501)
   - (f) Flight Instrument System (AMM 34-22-00/501)
   - (g) Engine Indication and Crew Alerting System (AMM 31-41-00/501)
   - (h) Fuel Quantity Indicating System (AMM 28-41-00/501)
   - (i) Inertial Reference System (AMM 34-21-00/501)
   - (j) ILS (AMM 34-31-00/501)
   - (k) Thrust Management System (AMM 22-32-00/501)
   - (l) VOR (AMM 34-51-00/501)
   - (m) Warning System (AMM 31-51-00/501)

D. Test Flight Management Computer System Operation

S 715-005

(1) Do the test as follows:
   - (a) Set the left FMC NAV Source Select switch on the P1 panel to the FMC-L position, and the right FMC NAV Source Select switch on the P3 panel to the FMC-R position.
   - (b) Momentarily push the TEST switch on the front of the FMC.

     NOTE: The CDU cannot send any entered data or update the display when the FMC is in the self-test mode.

   - (c) Make sure the FAIL indicator is off after the TEST IN PROGRESS indicator goes off.

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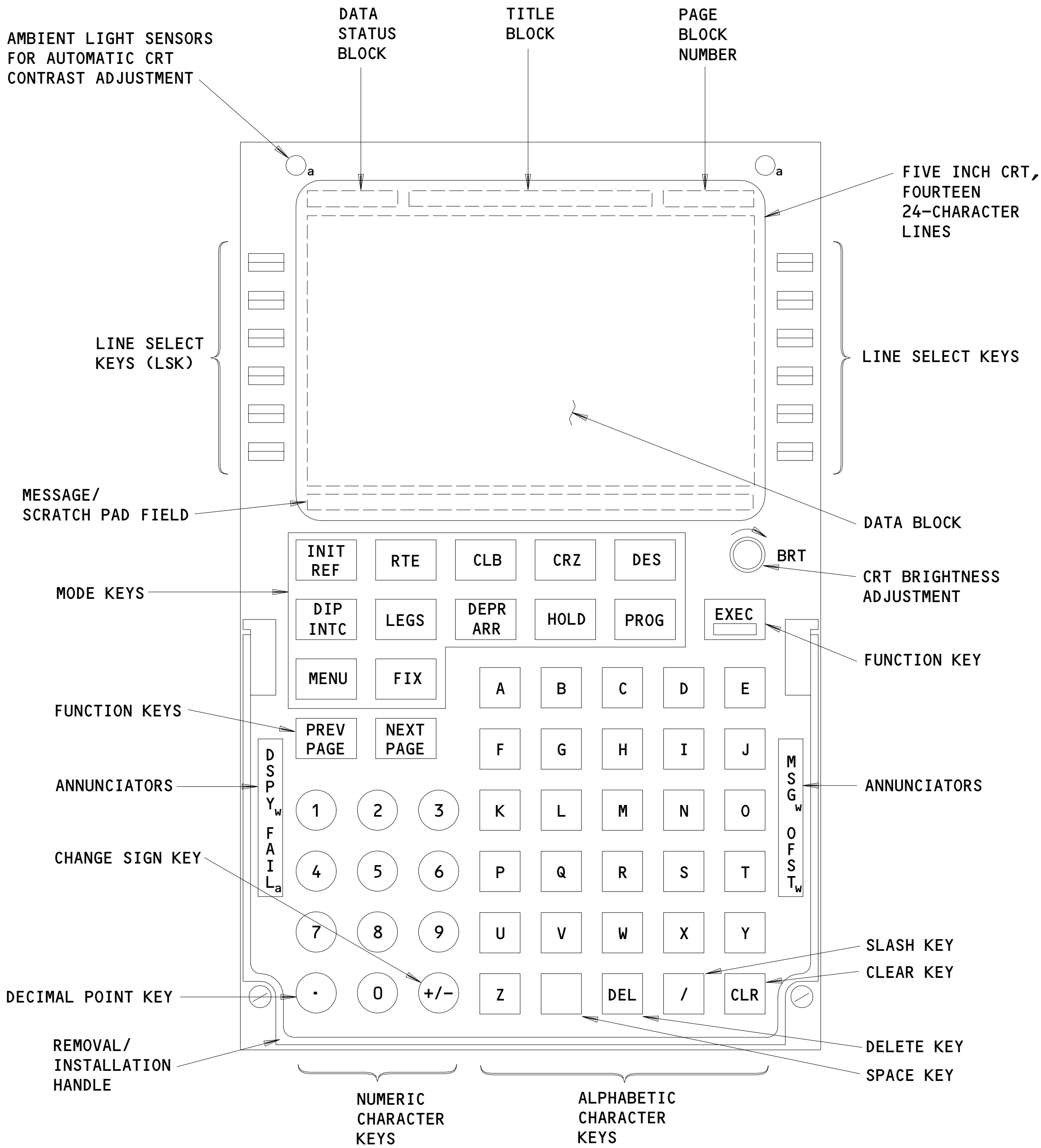

FMCS Control Display Unit
Figure 501

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(d) Make sure the IDENT pages show the same data on the two CDUs as follows:

NOTE: If one CDU shows the Nav Data Crossload page, there is a difference in the navigation database between the two FMCs. Do the Navigation Database Crossload procedure (AMM 34-61-00/201).

1) MODEL and ENGINES data is correct for the airplane configuration.
2) ACTIVE dates must be the same for the two CDU displays and from the last applicable database released. The second set of dates should be for the time immediately before or after the ACTIVE dates.

(e) SAS 157 PRE-SB 34-544;
SAA 001-156, 158-999;
Push this sequence of Line Select Keys (LSK) on the left and right CDUs to get to the PERF FACTORS page.
1) Push the mode key, INIT REF.
   a) Make sure the CDU display shows the POS INIT or the PERF INIT page.
2) Push the LSK adjacent to the INDEX prompt on the CDU.
   a) Make sure the CDU display shows the INIT REF INDEX page.
3) Push the LSK adjacent to the MAINT prompt on the CDU.
   a) Make sure the CDU display shows the MAINTENANCE INDEX page.
4) Push the LSK adjacent to the PERF FACTOR prompt.
   a) Make sure the CDU display shows the PERF FACTORS page.
5) Make sure the performance factors are correct.

NOTE: If you need to change the performance factors, do the Change the Performance Factors procedure (AMM 34-61-00/201).

(f) SAS 157 POST-SB 34-544;

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Push this sequence of Line Select Keys (LSK) on the left CDU and then the right CDU.

1) Push the mode key, INIT REF.
   a) Make sure the CDU display shows the POS INIT or the PERF INIT page.
2) Push the LSK adjacent to the INDEX prompt on the CDU.
   a) Make sure the CDU display shows the INIT REF INDEX page.
3) Push the LSK adjacent to the IDENT prompt on the CDU.
   a) Make sure the CDU display shows the IDENT page.
4) Make sure FUEL FLOW FACTOR and DRAG FACTOR on the IDENT page are correct (AMM 34-61-00/210).

E. Put the Airplane Back to Its Usual Condition.

S 865-007

(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-61-00-735-008

3. <u>Flight Management Computer System - System Test</u>

A. General

(1) The Autopilot/Flight Director System Adjustment Test (Ref 22-10-00) is used to test these Flight Management Computer System Interfaces:
   (a) Thrust Management Computer
   (b) Flight Control Computers
   (c) AFCS Mode Control Panel
   (d) Maintenance Control Display Panel

B. Test Flight Management Computer System

S 735-010

(1) Do a test of the FMC - CDU Interface
   (a) Set the left FMC NAV Source Select switch on the P1 panel to the FMC-L position and the right FMC NAV Source Select switch on the P3 panel to the FMC-R position.
   (b) Open these circuit breakers on the P11 panel:
      1) 11E9, FMCS CMPTR LEFT
      2) 11E30, FMCS CMPTR RIGHT
   (c) Make sure these circuit breakers on the P11 panel are closed:
      1) 11E8, FMCS CDU LEFT
      2) 11E29, FMCS CDU RIGHT
   (d) SAS 157 PRE-SB 34-544;
      SAS 001-156, 158-999;
      Make sure the FAIL annunciator is on for the two CDUs.

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(e) SAS 157 POST-SB 34-544;
Make sure the MENU page shows and the FAIL annunciator is on for the two CDUs.

(f) Turn the IND LIGHTS switch on the overhead panel P5 between the DIM and BRT positions.

(g) Make sure the FAIL annunciators change the brightness levels on the two CDUs.

(h) Close these circuit breakers on the P11 panel:
1) 11E9, FMCS CMPTR LEFT
2) 11E30, FMCS CMPTR RIGHT

(i) Make sure the FAIL annunciator goes out on two CDUs.

(j) Make sure the two CDU displays are the same and show the correct IDENT page data.

S 735-018

(2) Do a test of the FMC - CDU FMC NAV Source Select Switch

(a) Set the left FMC NAV Source Select switch on the P1 panel to the FMC-L position and the right FMC NAV Source Select switch on the P3 panel to the FMC-R position.

(b) Open this circuit breaker on the P11 panel:
1) 11E9, FMCS CMPTR LEFT

(c) Make sure the left CDU display is off momentarily and then comes back on.

(d) Make sure the left CDU display shows the MENU page.

(e) Make sure the FAIL light on the left CDU is on.

(f) Turn the left FMC NAV source select switch to the FMC-R position.

(g) Make sure the FAIL light on the left CDU is off.

(h) Push the LSK adjacent to the "<FMC" prompt on the left CDU display.

(i) Make sure the left CDU display shows the IDENT or the INIT/REF page.

(j) Make sure the top EICAS display shows the message L-FMC FAIL.

(k) Turn the left FMC NAV source select switch to the FMC-L position.

(l) Close this circuit breaker on the P11 panel:
1) 11E9, FMCS CMPTR LEFT

(m) Open this circuit breaker on the P11 panel:
1) 11E30, FMCS CMPTR RIGHT

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(n) Make sure the right CDU display is off momentarily and then comes back on.
(o) Make sure the right CDU display shows the MENU page.
(p) Make sure the FAIL light on the right CDU is on.
(q) Turn the right FMC NAV source select switch to the FMC-L position.
(r) Make sure the FAIL light on the right CDU is off.
(s) Push the LSK adjacent to the "<FMC" prompt on the right CDU display.
(t) Make sure the right CDU display goes back to the display that was shown before the circuit was opened.
(u) Make sure the top EICAS display shows the message R-FMC FAIL.
(v) Turn the right FMC NAV source select switch to the FMC-R position
(w) Open this circuit breaker on the P11 panel:
    1) 11F33, FMS SW, R
(x) Turn the right FMC NAV source select switch to the FMC-L position.
(y) On the left and right EFIS control panel, put the mode select switch in the MAP position.
(z) Make sure the left HSI did not change.
(aa) Make sure the VTK and MAP flags do not show on the left HSI.
(ab) Turn the left FMC NAV source select switch to the FMC-R position.
(ac) Make sure the VTK and MAP flags show on the left HSI.
(ad) Make sure the VTK and MAP flags do not show on the right HSI.
(ae) Turn the left FMC NAV source select switch to the FMC-L position.
(af) Turn the right FMC NAV source select switch to the CDU-R position.
(ag) Make sure the left HSI did not change.
(ah) Make sure the VTK and MAP flags do not show on the left HSI.
(ai) Turn the right FMC NAV source select switch to the FMC-R position.
(aj) On the left and right instrument source select panel, put the EFI switch in the ALTN position.

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(ak) Make sure the top EICAS display shows the message INSTR SWITCH.

(al) On the left and right instrument source select panel, put the EFI switch in the NORM position.

(am) Close this circuit breaker on the P11 panel:
1) 11E30, FMCS CMPTR RIGHT
2) 11F33, FMS SW, R

(an) Push the CLEAR key on the two CDUs until there are no longer messages on the bottom line of the CDUs.

S 735-089

(3) Do a test of the FMC-OLEO Switch.

(a) Energize and align the Inertial Reference Units in NAV mode (AMM 34-21-00/201).

(b) Open this circuit breaker on the P11 panel:
1) 11F15, TMC DC

(c) Push this sequence of Line Select Keys (LSK) on the left CDU.
1) Push the mode key, INIT REF.
   a) Make sure the CDU display shows the POS INIT or the PERF INIT page.
2) Push LSK adjacent to the INDEX prompt on the CDU.
   a) Make sure the CDU display shows the INIT REF INDEX page.
3) Push LSK adjacent to the MAINT prompt on the CDU.
   a) Make sure the CDU display shows the MAINTENANCE INDEX page.
4) Push LSK adjacent to the DISC (discretes) prompt on the CDU.
   a) Make sure the CDU display shows the L FMC ANALOG DISCR page.
5) SAS 157 POST-SB 34-544;
   Push the NEXT PAGE key on the CDU to get the second ANALOG DISCR page.

(d) Make sure the OLEO SWITCH shows GND.

WARNING: DO THE DEACTIVATION PROCEDURE FOR FLIGHT MODE SIMULATION BEFORE YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS. WHEN YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS THE AIRPLANE IS IN FLIGHT MODE. IN FLIGHT MODE, MANY OF THE AIRPLANE SYSTEMS CAN ACTIVATE AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(e) Do the deactivation procedure for flight mode simulation (Ref 32-09-02).

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WARNING: MAKE SURE YOU DO THE FLIGHT MODE SIMULATION CORRECTLY. IF THE PROCEDURE IS NOT DONE CORRECTLY, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(f) Do the Flight Mode Simulation procedure for the No. 1 air/ground system (Ref 32-09-02).
(g) Open this circuit breaker on the P11 panel.
 1) 11U15, LANDING GEAR AIR/GND SYS 1
(h) Make sure the OLEO SWITCH shows AIR.

WARNING: DO THE DEACTIVATION PROCEDURE FOR THE SPOILERS OR MOVE ALL PERSONS AND EQUIPMENT AWAY FROM THE SPOILERS. THE SPOILERS CAN RETRACT QUICKLY AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(i) Do the deactivation procedure for the spoilers (Ref 27-61-00) or move all persons and equipment away from the spoilers.
(j) Close this circuit breaker on the P11 panel:
 1) 11U15, LANDING GEAR AIR/GND SYS 1
(k) Push this sequence of Line Select Keys (LSK) on the right CDU.
 1) Push the mode key, INIT REF.
  a) Make sure the CDU display shows the POS INIT or the PERF INIT page.
 2) Push LSK adjacent to the INDEX prompt on the CDU.
  a) Make sure the CDU display shows the INIT REF INDEX page.
 3) Push LSK adjacent to the MAINT prompt on the CDU.
  a) Make sure the CDU display shows the MAINTENANCE INDEX page.
 4) Push LSK adjacent to the DISC (discretes) prompt on the CDU.
  a) Make sure the CDU display shows the R FMC ANALOG DISCR page.
 5) SAS 157 POST-SB 34-544;
 Push the NEXT PAGE key on the CDU to get the second ANALOG DISCR page.

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(l) Make sure the OLEO SWITCH shows GND.

WARNING: DO THE DEACTIVATION PROCEDURE FOR FLIGHT MODE SIMULATION BEFORE YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS. WHEN YOU OPEN THE AIR/GROUND CIRCUIT BREAKERS THE AIRPLANE IS IN FLIGHT MODE. IN FLIGHT MODE, MANY OF THE AIRPLANE SYSTEMS CAN ACTIVATE AND CAUSE INJURY TO PERSONS OR DAMAGE TO EQUIPMENT.

(m) Do the deactivation procedure for flight mode simulation (Ref 32-09-02).

WARNING: MAKE SURE YOU DO THE FLIGHT MODE SIMULATION CORRECTLY. IF THE PROCEDURE IS NOT DONE CORRECTLY, INJURY TO PERSONS OR DAMAGE TO EQUIPMENT CAN OCCUR.

(n) Do the Flight Mode Simulation procedure for the No. 2 air/ground system (AMM 32-09-02/201).
(o) Open these circuit breakers on the P11 panel:
  1) 767-200 AIRPLANES;
     11U24, LANDING GEAR POSITION AIR/GND SYS 2
  2) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALTN
  3) 767-300 AIRPLANES;
     11U23, LANDING GEAR POSITION AIR/GND SYS 2
(p) Make sure the OLEO SWITCH shows AIR.
(q) Close these circuit breakers on the P11 panel:
  1) 767-200 AIRPLANES;
     11U24, LANDING GEAR POSITION AIR/GND SYS 2
  2) 11C29, LANDING GEAR POSITION AIR/GND SYS 2 ALTN
  3) 767-300 AIRPLANES;
     11U23, LANDING GEAR POSITION AIR/GND SYS 2
  4) 11F15, TMC DC
(r) Make sure the OLEO SWITCH shows GND.
(s) Do these steps to do a check of the HDG REF switch:
  1) SAS 157 PRE-SB 34-544;
     SAS 001-156, 158-999;
     Push the NEXT PAGE key on the CDU to get the second ANALOG DISCR page.

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2) Set the HDG REF switch on P3-1 panel to NORM.
3) Make sure the MAG/TRUE is set to MAG.
4) Set the HDG REF switch to TRUE.
5) Make sure the MAG/TRUE is now set to TRUE.
6) Set the HDG REF switch to NORM.

S 735-020

(4) Do a test of the FMC - EICAS MESSAGE Interface.

NOTE: This test uses two people, one in the flight compartment and one in the main equipment center. For non-pip and non-GPS airplanes, In a normal operation, "L GPS" or "R GPS" is momentarily displayed when the self-test is initiated from the front panel of the Left (or Right) FMC , You should ignore the "L GPS" or "R GPS" advisory message.

(a) Open this circuit breaker on the P11 panel:
   1) 11E30, FMCS CMPTR RIGHT
(b) Push the CLR key on the left CDU to clear all the messages on the left CDU.
(c) Push the TEST button on the front of the left FMC.
(d) Make sure message FMC MESSAGE shows on the EICAS display.
(e) Make sure the yellow FMC warning light on the P1 panel is on.
(f) Close this circuit breaker on the P11 panel:
   1) 11E30, FMCS CMPTR RIGHT
(g) Open this circuit breaker on the P11 panel:
   1) 11E9, FMCS CMPTR LEFT
(h) Push the CLR key on the right CDU to clear all the messages on the right CDU.
(i) Push the TEST button on the front of the right FMC.
(j) Make sure message FMC MESSAGE shows on the EICAS display.
(k) Make sure the yellow FMC warning light on the P1 panel is on.
(l) Close this circuit breaker on the P11 panel:
   1) 11E9, FMCS CMPTR LEFT

S 865-142

(5) Do a test of the FMC Discrete Inputs
(a) Do these steps to go to the FMC ANALOG DISCR page on the left and right CDUs.

NOTE: The FMC ANALOG DISCR has three pages. You can use the NEXT PAGE or PREV PAGE key to go to a different FMC ANALOG DISCR page.

   1) Push the mode key INIT/REF.

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2) Push the LSK adjacent to the INDEX prompt.
3) Push the LSK adjacent to the MAINT prompt.
4) Push the LSK adjacent to the DISCRETES prompt.
5) AIRPLANES WITH PEGASUS FMC;
   Make sure the L FMC ANALOG DISCR 1/3 page shows on the left CDU.
6) AIRPLANES WITHOUT PEGASUS FMC;
   Make sure the L FMC ANALOG DISCR 1/2 page shows on the left CDU.
7) AIRPLANES WITH PEGASUS FMC;
   Make sure the R FMC ANALOG DISCR 1/3 page shows on the right CDU.
8) AIRPLANES WITHOUT PEGASUS FMC;
   Make sure the R FMC ANALOG DISCR 1/2 page shows on the right CDU.

(b) Make sure the L PACK and R PACK switches on the overhead panel P5 are set to the AUTO position.
(c) Make sure the Anti-Ice Engine/Wing switches on the overhead panel P5 are set to the OFF position.
(d) Make sure the Air Demand Pumps switch on the overhead panel P5 is set to the OFF position.
(e) Make sure the left and right Isolation Valve switches on the overhead panel P5 are set to the OPEN position.
(f) Make sure the thrust reverser levers are not activated.
(g) Make sure the discrete ECS PACK reads OFF on the left and right CDUs.
(h) Make sure the discrete ECS PACK H/L reads LO on the left and right CDUs.
(i) Disconnect the electrical connector, D2770, from the left pack flow control vale.
(j) Make sure the discrete left ECS PACK reads ON the left and right CDU.
(k) Make sure the discrete left ECS PACK H/L reads HI on the left and right CDUs.
(l) Reconnect the electrical connector, D2770, from the left pack flow control vale.

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(m) Make sure the discrete left ECS PACK reads OFF on the left and right CDUs.
(n) Make sure the discrete left ECS PACK H/L reads LO on the left and right CDUs.
(o) Disconnect the electrical connector, D1276, from the right pack flow control vale.
(p) Make sure the discrete right ECS PACK reads ON the left and right CDU.
(q) Make sure the discrete right ECS PACK H/L reads HI on the left and right CDUs.
(r) Reconnect the electrical connector, D1276, from the right pack flow control vale.
(s) Make sure the discrete right ECS PACK reads OFF the left and right CDU.
(t) Make sure the discrete right ECS PACK H/L reads LO on the left and right CDUs.
(u) Set the FMC NAV switch on the Captain's instrument source select panel P1 to the FMC-L position.
    1) Make sure the discrete SRCE SEL-CDU (LEFT) reads NORM on the left and right CDUs.
    2) Make sure the discrete SRCE SEL-FMC (LEFT) reads NORM on the left and right CDUs.
(v) Set the FMC NAV switch on the F/O's instrument source select panel P3 to the FMC-R position.
    1) Make sure the discrete SRCE SEL-CDU (RIGHT) reads NORM on the left and right CDUs.
    2) Make sure the discrete SRCE SEL-FMC (RIGHT) reads NORM on the left and right CDUs.
(w) Set the left Engine Anti Ice switch on the overhead panel P5 to the ON position.
    1) Make sure the discrete COWL A/I (LEFT) reads ON on the left and right CDUs.
(x) Set the left Engine Anti Ice switch on the overhead panel P5 to the OFF position.
    1) Make sure the discrete COWL A/I (LEFT) reads OFF on the left and right CDUs.
(y) Set the right Engine Anti Ice switch on the overhead panel P5 to the ON position.
    1) Make sure the discrete COWL A/I (RIGHT) reads ON on the left and right CDUs.
(z) Set the right Engine Anti Ice switch on the overhead panel P5 to the OFF position.
    1) Make sure the discrete COWL A/I (RIGHT) reads OFF on the left and right CDUs.
(aa) Set the left Isolation Valve switch on the overhead panel P5 to the CLOSED position.
    1) Make sure the discrete ISOL VALVE (LEFT) reads CL on the left and right CDUs.

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(ab) Set the left Isolation Valve on the overhead panel P5 to the OPEN position.
   1) Make sure the discrete ISOL VALVE (LEFT) reads OP on the left and right CDUs.

(ac) Set the right Isolation Valve on the overhead panel P5 to the CLOSED position.
   1) Make sure the discrete ISOL VALVE (RIGHT) reads CL on the left and right CDUs.

(ad) Set the right Isolation Valve on the overhead panel P5 to the OPEN position.
   1) Make sure the discrete ISOL VALVE (RIGHT) reads OP on the left and right CDUs.

(ae) Set the Fuel Jettition switch on the overhead panel P5 to the OFF position.

(af) Open these circuit breakers on the P6 panel:
   1) 6G15, FUEL BOOST PUMP, L AFT
   2) 6G18, FUEL BOOST PUMP, R FWD
   3) 6F15, FUEL OVRD PUMP, LEFT
   4) 6F21, FUEL OVRD PUMP, RIGHT
   5) 6G21, FUEL BOOST PUMP R AFT
   6) 6G24, FUEL BOOST PUMP, L FWD

(ag) Open this circuit breaker on the P36 panel:
   1) 36G07, FUEL JTSN PUMP, LEFT

(ah) Open this circuit breaker on the P37 panel:
   1) 37G04, FUEL JTSN PUMP, RIGHT

(ai) Open these circuit breakers on the P11 panel:
   1) 11M13, FUEL JTSN CONT - LEFT
   2) 11M14, JTSN NOZZLE VALVE - LEFT
   3) 11M22, FUEL JTSN CONT - RIGHT
   4) 11M23, JTSN NOZZLE VALVE - RIGHT

(aj) Set the left Fuel Jettison Nozzle Valve on the overhead panel P5 to the ON position.
   1) Make sure the discrete NOZZLE VALVE (LEFT) reads OP on the left and right CDUs.

(ak) Set the left Fuel Jettison Nozzle Valve on the overhead panel P5 to the OFF position.
   1) Make sure the discrete NOZZLE VALVE (LEFT) reads CL on the left and right CDUs.

      NOTE: It takes approximately two minutes for the valve status to change from OP to CL after the valve is switched to the OFF position.

(al) Set the right Fuel Jettison Nozzle Valve on the overhead panel P5 to the ON position.
   1) Make sure the discrete NOZZLE VALVE (RIGHT) reads OP on the left and right CDUs.

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(am) Set the right Fuel Jettison Nozzle Valve on the overhead panel P5 to the OFF position.
    1) Make sure the discrete NOZZLE VALVE (RIGHT) reads CL on the left and right CDUs.

    NOTE: It takes approximately two minutes for the valve status to change from OP to CL after the valve is switched to the OFF position.

(an) Set the EFIS selector switch on the left EFIS control panel to the MAP position.
    1) Make sure the discrete AUTO/MAN VOR (LEFT) reads AUTO on the left and right CDUs.
    2) Make sure the discrete AUTO/MAN DME (LEFT) reads AUTO on the left and right CDUs.

(ao) Set the EFIS selector switch on the left EFIS control panel to the ILS or APP position.
    1) Make sure the discrete AUTO/MAN VOR (LEFT) reads MAN on the left and right CDUs.
    2) Make sure the AUTO/MAN DME (LEFT) reads MAN on the left and right CDUs.

(ap) Set the EFIS selector switch on the left EFIS control panel to the VOR position.
    1) Make sure the discrete AUTO/MAN VOR (LEFT) reads MAN on the left and right CDUs.
    2) Make sure the discrete AUTO/MAN DME (LEFT) reads MAN on the left and right CDUs.

(aq) Set the EFIS selector switch on the right EFIS control panel to the MAP position.
    1) Make sure the discrete AUTO/MAN VOR (RIGHT) reads AUTO on the left and right CDUs.
    2) Make sure the discrete AUTO/MAN DME (RIGHT) reads AUTO on the left and right CDUs.

(ar) Set the EFIS selector switch on the right EFIS control panel to the ILS or APP position.
    1) Make sure the discrete AUTO/MAN VOR (RIGHT) reads MAN on the left and right CDUs.
    2) Make sure the discrete AUTO/MAN DME (RIGHT) reads MAN on the left and right CDUs.

(as) Set the EFIS selector switch on the right EFIS control panel to the VOR position.
    1) Make sure the discrete AUTO/MAN VOR (RIGHT) reads MAN on the left and right CDUs.
    2) Make sure the dicsrete AUTO/MAN DME (RIGHT) reads MAN on the left and right CDUs.

(at) Set the Wing Anti Ice switch on the overhead panel P5 to the ON position.
    1) Make sure the discrete WING A/ICE reads ON on the left and right CDUs.

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(au) Set the Wing Anti Ice switch on the overhead panel P5 to the OFF position.
   1) Make sure the discrete WING A/ICE reads OFF on the left and right CDUs.
(av) Push and hold the Wing Anti Ice test switch on the P61 panel.
   1) Make sure the discrete WING A/ICE reads ON on the left and right CDUs.
(aw) Release the Wing Anti Ice test switch.
   1) Make sure the discrete WING A/ICE reads OFF on the left and right CDUs.

S 735-030

(6) Do a test of the CDU Analog Discretes

NOTE: Refers to Figure 502 for the bit positions of the CDU memory location.

(a) Set the HDG REF switch on the P3-1 panel to the TRUE position.
(b) Push the MENU key on the left and the right CDUs.
(c) Push the LSK adjacent to the MEMORY> prompt on the left and the right CDUs.
(d) Push "400210" on the left and the right CDUs.
(e) Push the 1L LSK on the left and the right CDUs.

NOTE: The X's in these steps can have values from 0 through 9 or letters from A through F.

(f) Make sure the data for memory address 400210 is one of these two XXX8 or XXXA on the two CDUs.
(g) Set the HDG REF switch on the P3-1 panel to the NORM position.
(h) Make sure the data for memory address 400210 is one of these two XXXC or XXXE on the two CDUs.

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(7) SAS 157 POST-SB 34-544;

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HEX	BINARY
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

LOCATION "400210" [1]

LOCATION "882601" [2]

LOCATION "882605" [3]

LOCATION "88260A" [4]

NOTES: 0 = GROUND
1 = OPEN
XXXX/XXXX/XXXX/XXXX
15.../...8/...4/...0 ← BIT POSITION

[1] AIRPLANES WITH -130 THRU -131 CDU

[2] AIRPLANES WITH CDU -155

[3] AIRPLANES WITH CDU -156

[4] AIRPLANES WITH CDU -161

CDU - Memory Locations
Figure 502

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Do a test of the IRS Inputs to the CDU:
(a) Do the IRS initialization procedure (AMM 34-21-00/201).
(b) Set the mode select switches on the IRS control panel to NAV.
(c) Open these circuit breakers on the P11 panel:
1) 11E9, FMCS CMPTR LEFT
2) 11E30, FMCS CMPTR RIGHT
(d) Make sure the CDU display shows the MENU page.
1) Make sure the MENU page shows the FAIL indicator.
(e) Push the PROG key on the left and right CDU.
1) Make sure the CDU display shows the IRS PROGRESS page.
2) Make sure the IRS position data shows below the IRS L on the left CDU.
3) Make sure the IRS position data shows below the IRS R on the right CDU.

S 735-118
(8) SAS 157 PRE-SB 34-544;
SAS 001-156, 158-999;
Do a test of the FMC-IRS Initialization Interface
(a) Set mode select switches on the IRS control panel to ALIGN.
(b) Make sure the two CDUs show the POS INIT page 1.
(c) Use the left CDU keyboard to put in the geographic position of the airplane in the form NXXXX.XWXXXXX.X. Data that was put in will appear on the bottom line of the left CDU display.

NOTE: The geographic position that was put in must include the zeros in the front and decimal point between minutes and tenths of minutes.

(d) Push the 4R LSK (between SET IRS POS and SET IRS HDG) and stop ten seconds before you go to the subsequent step.
(e) Make sure the ENTER IRS POS message does not show on the bottom line of the CDU display.
1) Push the NEXT PAGE key on the CDU and make sure the CDU shows as follows (figure 503):
2) Make sure the positions shown for IRS L, IRS C, and IRS R are the same.

S 735-022
(9) Do a test of the Input Sensor Status
(a) Push this sequence of Line Select Keys (LSK) on the left and right CDUs.
1) Push the mode key, INIT REF.
a) Make sure the CDU display shows the POS INIT or the PERF INIT page.
2) Push LSK adjacent to the INDEX prompt on the CDU.
a) Make sure the CDU display shows the INIT REF INDEX page.
3) Push LSK adjacent to the MAINT prompt on the CDU.
a) Make sure the CDU display shows the MAINTENANCE INDEX page.

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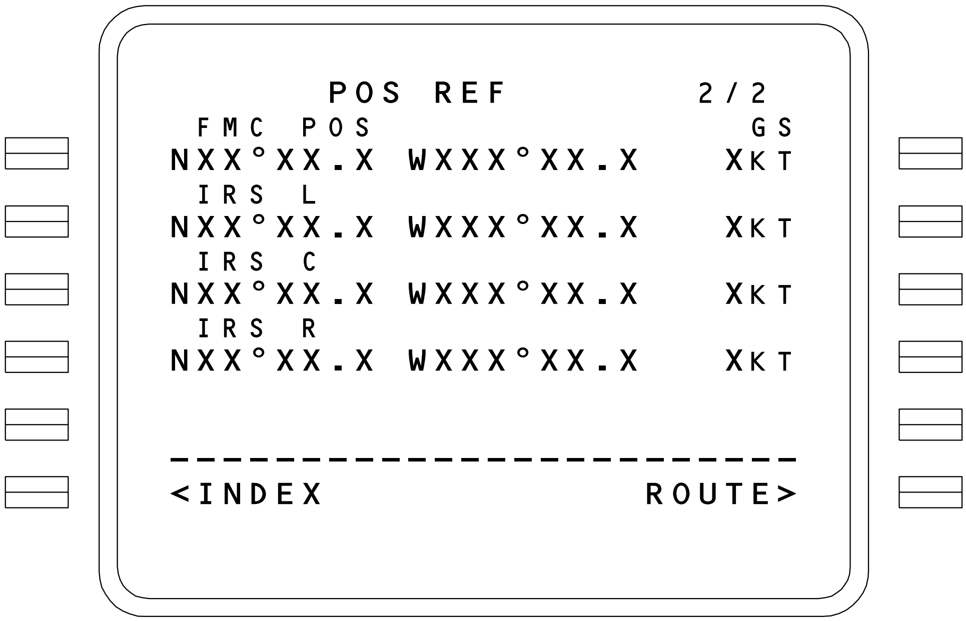

POS REF Page
Figure 503

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4) Push LSK adjacent to the SENSORS prompt on the CDU.
   a) Make sure the CDU display shows the FMC SENSOR STATUS page.
   b) Make sure the sensor status is as shown in figure 504.

   NOTE: Unit status will be shown in one of these conditions:

   OK = connected and correctly operates.

   TEST = connected but in self test mode.

   FAIL = not connected, or not powered, or will not operate.

   --- = interface is not in the airplane.

5) Push the NEXT PAGE key on the CDU.
   a) Make sure the FMC SENSOR STATUS page 2/2 shows.
   b) Make sure the sensor status is as shown in figure 504.

   NOTE: Displays for right and left CDUs are different since some sensors are connected to only one FMC.

S 735-023

(10) Do a test of the FMC - VOR/DME Interface
  (a) Set the left and right EFIS control panels to MAP.
  (b) MTH ALL;
      Set the left and right VOR control panels to AUTO.
  (c) Set the left FMC NAV Source Select switch on the P1 panel to the FMC-L position and the right FMC NAV Source Select switch on the P3 panel to the FMC-R position.
  (d) Push the test button on the left FMC.
      1) Make sure the SENSOR STATUS page, on the right CDU, shows the left and right DME as FAIL, then TEST, then OK.

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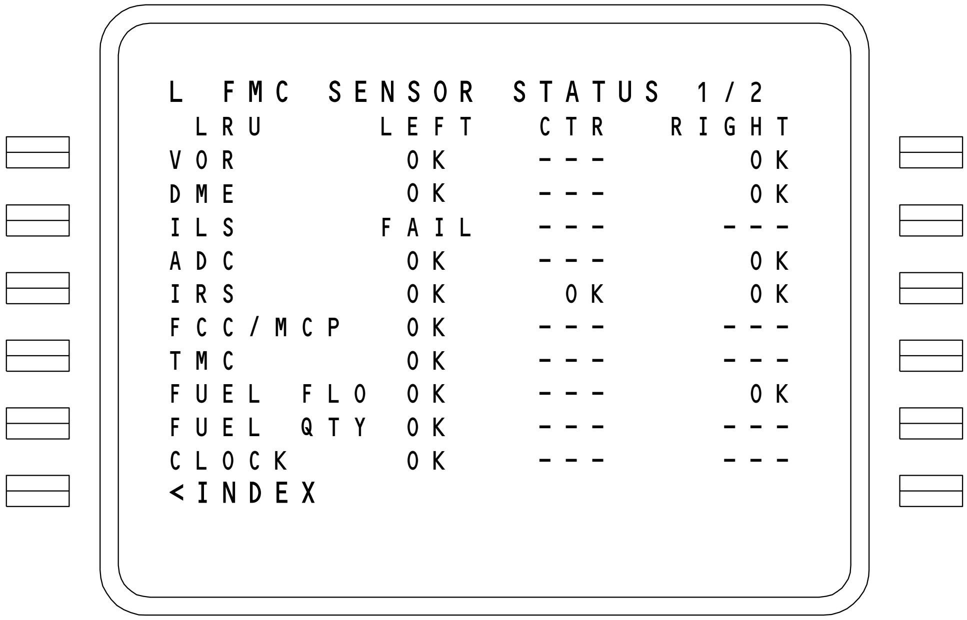

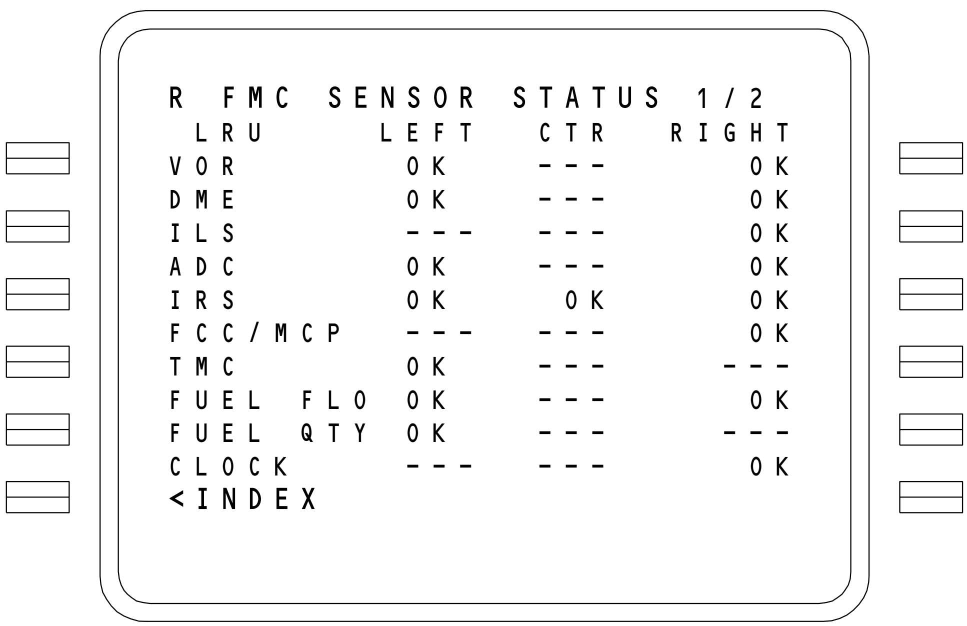

Sensor Status Page
Figure 504 (Sheet 1)

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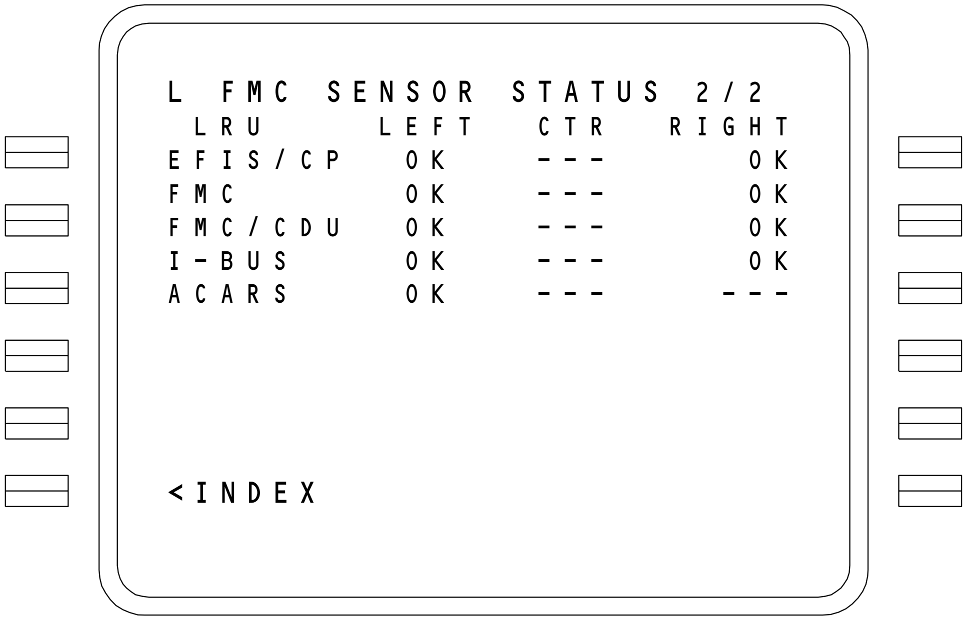

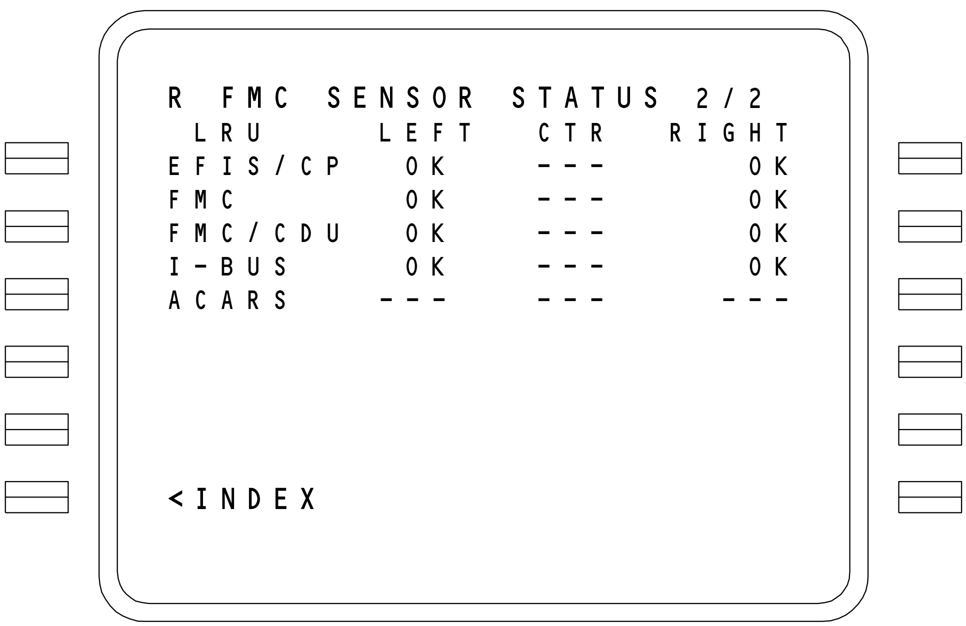

Sensor Status Page
Figure 504 (Sheet 2)

G32841

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Not Used
Figure 504A

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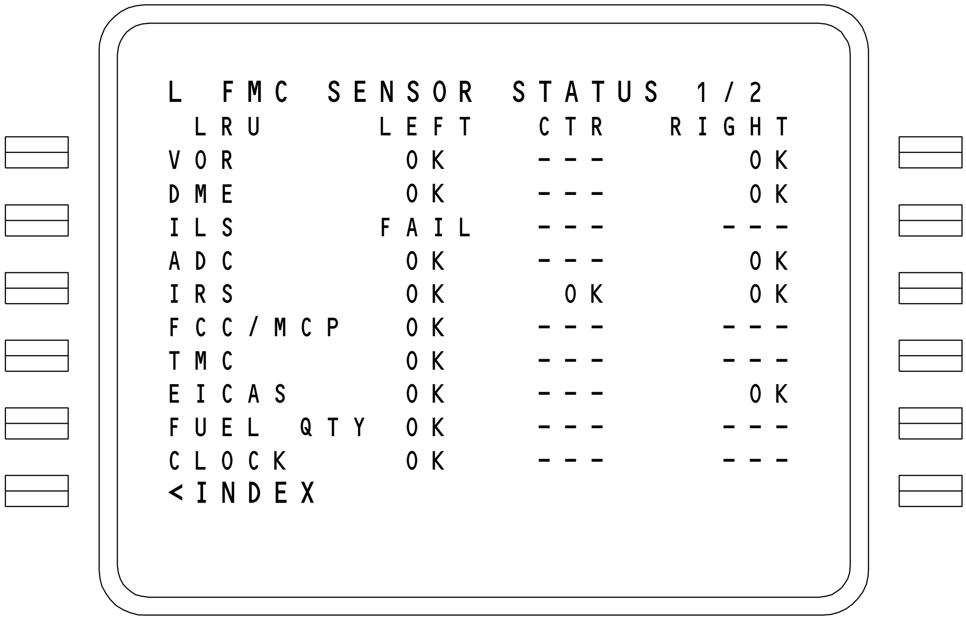

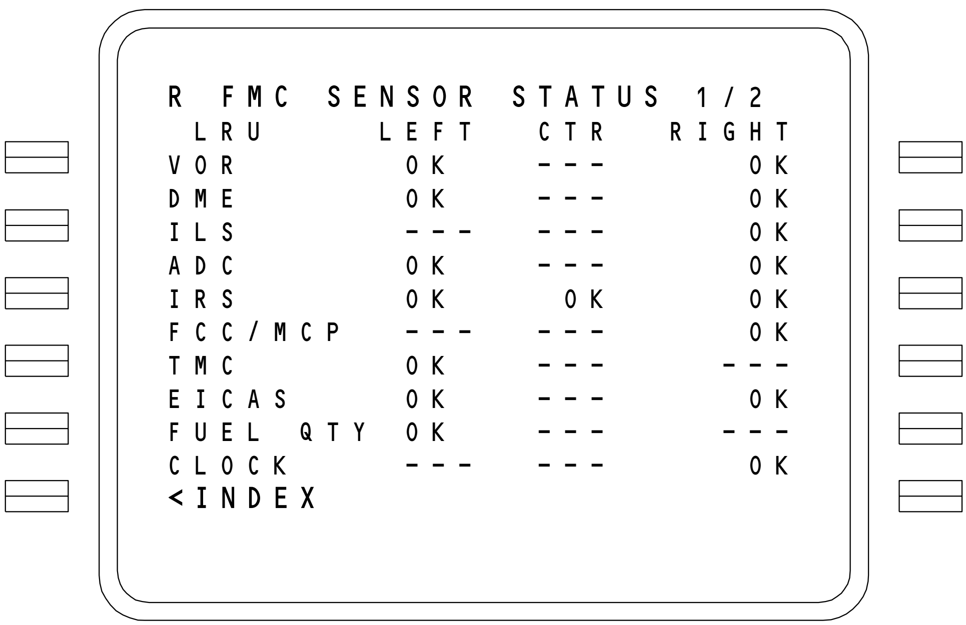

Sensor Status Page
Figure 504B (Sheet 1)

H91754

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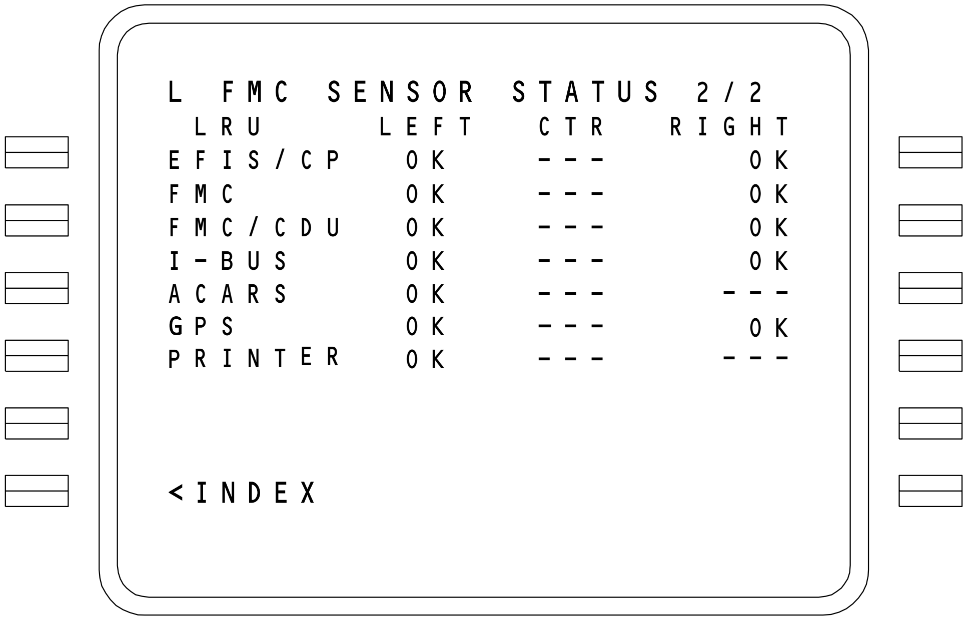

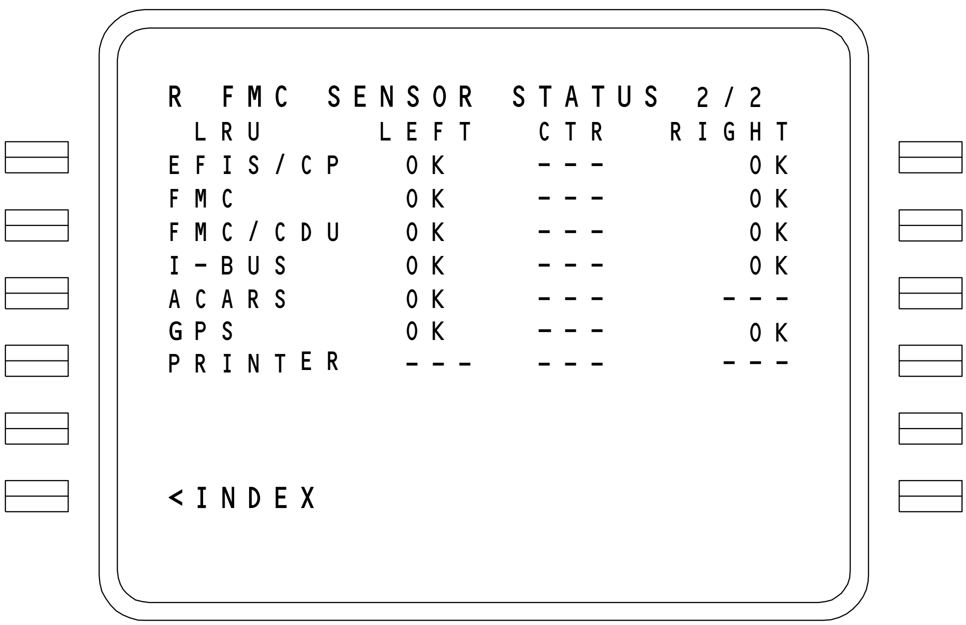

Sensor Status Page
Figure 504B (Sheet 2)

H61571

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2) If the DME does not show FAIL, then push the test button again.
3) See if the FAIL shows this time.

NOTE: It is not important that FAIL shows. If the FAIL does not show, make sure the display changes to TEST, then OK. This will make sure the FMC to DME interface is correct.

(e) Set the left FMC NAV Source Select switch on the P1 panel to the FMC-R position and the right FMC NAV Source Select switch on the P3 panel to the FMC-L position.
(f) Push the test button on the right FMC.
1) Make sure the SENSOR STATUS page, on the right CDU, shows the left and right DME as FAIL, then TEST, then OK.
2) If the DME does not show FAIL, then push the test button again.
3) See if the FAIL shows this time.

NOTE: It is not important that FAIL shows. If the FAIL does not show, make sure the display changes to TEST, then OK. This will make sure the FMC to DME interface is correct.

(g) Set the left FMC NAV Source Select switch on the P1 panel to the FMC-L position and the right FMC NAV Source Select switch on the P3 panel to the FMC-R position.
(h) Open this circuit breaker on the P11 panel:
1) 11E30, FMCS CMPTR RIGHT
(i) Push the PROG mode key on left CDU.
(j) Push and hold the CLR key on left CDU for 5 seconds.
(k) Use left CDU keyboard to put in the three letter code of a local VOR station.
(l) Push the LSK adjacent to the VOR L on the left CDU.
(m) Make sure the VOR station code and frequency are shown adjacent to that LSK.
(n) Make sure the left VOR control panel shows the same frequency as the left CDU.
(o) Use left CDU keyboard to put in a different three letter code of a local VOR station.
(p) Push the LSK adjacent to the VOR R on the left CDU.
(q) Make sure the VOR station code and frequency are shown adjacent to that LSK.
(r) Make sure the right VOR control panel shows the same frequency as the left CDU.
(s) Open this circuit breaker on the P11 panel:
1) 11E9, FMCS CMPTR LEFT
(t) Close this circuit breaker on the P11 panel:
1) 11E30, FMCS CMPTR RIGHT
(u) Turn the left FMC NAV source select switch to the FMC-R position.

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(v) Push the LSK adjacent to the "<FMC" prompt on the right CDU after the FAIL light on the right CDU is off.
(w) Push the PROG mode key on the right CDU.
(x) Push and hold the CLR key on right CDU for 5 seconds.
(y) Use the right CDU keyboard to put in the three letter code of a local VOR station.
(z) Push the LSK adjacent to the VOR L on the right CDU.
(aa) Make sure the VOR station code and frequency are shown adjacent to that LSK.
(ab) Make sure the left VOR control panel shows the same frequency as the right CDU.
(ac) Use the right CDU keyboard to put in a different letter code of a local VOR station.
(ad) Push the LSK adjacent to the VOR R on the right CDU.
(ae) Make sure the VOR station code and frequency are shown adjacent to that LSK.
(af) Make sure the right VOR control panel shows the same frequency as the right CDU.

S 735-111

(11) AIRPLANES WITH CAM FUNCTION ENABLE;
Do a test of the Crew Alert Monitoring.
(a) Make sure the IRS is aligned and in the NAV mode.
(b) Make sure the flap lever is in the 0 unit position.
(c) Do the flight mode simulation procedure for the Air/Ground system (AMM 32-09-02/201).
(d) Do the cruise mode simulation at an altitude above 20,000 feet and an airspeed greater than 100 knots for the Air Data System (AMM 34-12-00/501).
(e) Use the left or right CDU to enter the gross weight, fuel weight, cruise altitude, and cost index to initialize the FMCs.
(f) Make sure the FMC cruise altitude is the same as the ADC altitude.

NOTE: The CRZ page on the CDU must be active with the ACT shown on the heading.

(g) Make sure you do not touch any knobs or switches on the EFIS control panel, MCP, EICAS control panel, CDUs, VOR radio panel panel, and the microphone key for a period of time that is defined in the Airline Policy file for the crew alert monitoring.
(h) After the period of no crew activity, make sure the PILOT RESPONSE message shows on the top of the EICAS display.

NOTE: If there is no crew response for an additional period time, you will hear a level B caution aural.

(i) To clear the EICAS message and the aural warning, you need to enter an input from any of the control panels.

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C. Put the Airplane Back to Its Usual Condition.

S 865-027

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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FLIGHT MANAGEMENT COMPUTER - MAINTENANCE PRACTICES

1. General
   A. This procedure has one task and is applicable to only pegasus FMC. This task is to do the download of the BITE history data from the Flight Management Computer (FMC) to a Data Loader. The BITE history data is a record of recent FMC fault that gives sufficient data to find the cause of the fault. To support such an investigation, it is necessary to get the BITE data from the left and right FMC.
   B. The software has the capability to do a download of BITE history from the L FMC and R FMC at the same time to a single diskette, by connecting to only one of the FMC (either one). Make sure the FMCs are powered on. Make sure that the correct diskette software for pegasus 2000 and on is used. The diskette software for pegasus 97 or pegasus 98 will not work for pegasus 2000 and on.
   C. After the download is complete the diskette(s) contain(s) "lbithist.dmp" and "rbithist.dmp" files from the left FMC and right FMC respectively.
   D. After you get the BITE data, send the diskette(s) to Honeywell for Boeing/Honeywell investigation:

      Honeywell Inc.
      Air Transport Systems
      P. O. Box 21111
      Phoenix, AZ   85036-1111

      ATTENTION:
      Customer Support Engineering
      B757/767 FMC BITE Information
      M/S: K25C5

TASK 34-61-01-972-001

2. FMC BITE History Data Download
   A. Equipment
      (1) A formatted 3-1/2 inch high density floppy diskette which contained the applicable configuration file.

         NOTE: You can get a copy of this diskette from your local Honeywell Customer Support Representative or Customer Engineering at Honeywell Commercial Flight Systems Group in Phoenix, AZ.

   B. Reference
      (1) AMM 24-22-00/201, Electrical Power - Control

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C. Access

(1) Location Zones

211/212 Flight Compartment

D. Procedure

S 862-002

(1) Supply electrical power (AMM 24-22-00/201).

S 862-003

(2) Make sure these circuit breakers on the P11 panel are closed:

(a) 11E8, FMCS CDU LEFT

(b) 11E9, FMCS CMPTR LEFT

(c) 11E29, FMCS CDU RIGHT

(d) 11E30, FMCS CMPTR RIGHT

S 862-004

(3) Set the left NAV SOURCE SELECT switch on the P1 main instrument panel to the FMC L position.

S 862-005

(4) Set the right NAV SOURCE SELECT switch on the P3 main instrument panel to the FMC R position.

S 862-008

(5) Close this circuit breaker on the P11 panel:

(a) 11G24, DATABASE LOADER

S 862-011

(6) Set the selector switch on the data loader control panel to the applicable position (FMC L or FMC R).

S 862-012

(7) Set the Single System switch on the Data Load Selector panel, P61, to the applicable L or R position.

NOTE: L is for the left FMC and R is for the right FMC.

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S 862-014
(8) Set the System Select switch on the Data Load Selector panel, P61, to the FMC position.

S 972-016
(9) Put the diskette into the data loader to download the data from the FMC.

NOTE: If there is a diskette in the data loader, push the eject key and then put the diskette back into the data loader.

NOTE: The blank MENU page will show on the CDU during the data download. You can not get access to other pages when a download is in progress.

S 972-017
(10) After approximately 3 to 5 minutes, the data loader will indicate that the download is complete.

S 862-018
(11) Remove the diskette from the data loader.

S 862-020
(12) After you get the BITE data from the FMCs, set the selector switch on the data loader control panel to the NORMAL position.

E. Put the Airplane Back to Its Usual Condition

S 862-025
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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FLIGHT MANAGEMENT COMPUTER - REMOVAL/INSTALLATION

1. General
   A. Two flight management computers (FMC) are installed in main equipment center. They are found on the second and third shelves of the E-2 rack. There are two hooks that hold the front of each computer down. Removal/Installation steps are the same for each FMC.

TASK 34-61-01-024-001

2. Remove the Flight Management Computer
   A. References
      (1) AMM 20-10-01/401, E/E Rack Mounted Components
      (2) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
      (3) AMM 24-22-00/201, Electrical Power - Control
   B. Access
      (1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

      (2) Access Panels

119AL	Main Equipment Center

   C. Prepare To Remove Flight Management Computer

      S 864-002
      (1) Open these circuit breakers on the overhead panel P11 and attach DO-NOT-CLOSE tags:
         (a) 11E8, FMCS CDU LEFT
         (b) 11E9, FMCS CMPTR LEFT
         (c) 11E29, FMCS CDU RIGHT
         (d) 11E30, FMCS CMPTR RIGHT

      S 864-011

CAUTION: DO NOT TOUCH THE FMC BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE FMC.

      (2) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

      S 024-004
      (3) Remove the FMC (AMM 20-10-01/401).

TASK 34-61-01-424-005

3. Install the Flight Management Computer
   A. General
      (1) The FMC keeps in memory the position it was removed from. The FMC will possibly not operate if energized with the Air/Ground relays in the air position.

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(2) If this type of failure occurs, put the Air/Ground relays to the ground position. Remove electrical power from the FMCs for a minimum of 10 seconds and then supply the FMCs with electrical power.
(3) The FMC will go through initial FMC operations if energized in the ground position. This will set new start up parameters in the FMC installed.

B. References
(1) AMM 20-10-01/401, E/E Rack Mounted Components
(2) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
(3) AMM 24-22-00/201, Electrical Power - Control
(4) AMM 32-09-02/201, Air/Ground Relays
(5) AMM 34-61-00/201, Flight Management Computer System

C. Access
(1) Location Zones

119/120	Main Equipment Center
211/212	Flight Compartment

(2) Access Panels

119AL	Main Equipment Center

D. Procedure

S 864-012

CAUTION: DO NOT TOUCH THE FMC BEFORE YOU DO THE PROCEDURE FOR DEVICES THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE. ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE FMC.

(1) Do the procedure for devices that are sensitive to electrostatic discharge (AMM 20-41-01/201).

S 864-015
(2) Make sure these circuit breakers on the overhead panel P11 are open:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E30, FMCS CMPTR RIGHT

S 864-007
(3) Set the Air/Ground relays to the ground position (AMM 32-09-02/201).

S 424-008
(4) Install the Flight Management Computer (AMM 20-10-01/401).

S 714-010
(5) Test Flight Management Computer
(a) Supply electrical power (AMM 24-22-00/201).
(b) Set the L FMC NAV Source Select switch on the P1 panel to the FMC-L position.

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(c) Set the R FMC NAV source select switch on the P3 panel to the FMC-R position.
(d) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   1) 11E8, FMCS CDU LEFT
   2) 11E29, FMCS CDU RIGHT
(e) Make sure the FAIL annunciators on the two CDUs are on.
(f) Do these steps to do a check of the FMC operation:

   NOTE: The steps that follow make sure the software in the FMCs is the same. This will prevent a failure in one of the FMCs.

   1) Close the FMCS COMPUTER circuit breaker for the FMC that was not removed.
   2) Close the FMCS COMPUTER circuit breaker for the other FMC.
   3) Make sure the FAIL annunciators on the two CDUs are off.
   4) Make sure the <FMC prompt shows on MENU pages for the two CDUs.

      NOTE: If the <FMC prompt does not show on the MENU page, install the operational (OP) program (AMM 34-61-00/201). Make sure the <FMC prompt shows after you install the OP program.

   5) If the NAV DATA CROSSLOAD page shows on one of the CDUs, do the data crossload procedure (AMM 34-61-00/201).
   6) Push the line select keys (LSK) adjacent to <FMC prompts on the two CDUs.
   7) Make sure the IDENT pages show on the two CDUs.
   8) Make sure the two CDU displays are the same. It is neccessary for the MODEL and the ENGINES to show the correct airplane configuration.
   9) AIRPLANES WITHOUT PEGASUS FMC;
      Make sure the OPS part number on the CDUs is correct.

      NOTE: You can get the correct OPS part number from the approved airline department.

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10) AIRPLANES WITH PEGASUS FMC;
Make sure the OPS, OPC, and the NAV DATA software program part numbers on the IDENT PAGE that show on the CDUs are correct.

NOTE: You can get the correct software program part numbers from the approved airline department.

11) AIRPLANES WITH PEGASUS FMC;
Make sure the AMI and FIDO software program part numbers on the CROSSLOAD PAGE that show on CDUs are correct.

NOTE: You can get the correct software program part numbers from the approved airline department.

12) Make sure the NAV database date is the same on the two CDUs.
13) Make sure the values for DRAG FACTOR and F-F FACTOR are correct.
14) Make sure the airline route data is the same on the two CDUs.

E. Put the Airplane Back to Its Usual Condition

S 864-009
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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FLIGHT MANAGEMENT COMPUTER CONTROL DISPLAY UNIT - MAINTENANCE PRACTICES

1. General
   A. Two flight management computer system (FMCS) control display units (CDU) are installed in the forward electronic control panel, P9, on the forward electronics control stand. Each CDU is held in place by six quick release fasteners and has one multiple pin connector at the rear of the unit. Removal/Installation steps are identical for each CDU.
   B. This section contains procedures for CDU removal/installation, CRT face cleaning and the CDU annunciator lamps replacement.

TASK 34-61-02-022-001

2. FMCS Control Display Unit Removal
   A. References
      (1) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Prepare for Removal

      S 862-002
      (1) For the LEFT FMC, open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11E9, FMCS CMPTR
          (b) 11E8, FMCS CDU

      S 862-192
      (2) For the RIGHT FMC, open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11E29, FMCS CDU
          (b) 11E30, FMCS CMPTR

      S 862-176
      (3) Open these circuit breakers on the overhead circuit breaker panel, P11, and attach DO-NOT-CLOSE tags:
          (a) 11P1, LIGHTING INSTRUMENT & PANEL AISLE STAND
          (b) 11R3, LEFT IND LIGHTS 3
          (c) 11R30, LIGHTING R IND LTS 3 or RIGHT IND LTS 3
   D. Remove the FMCS CDU

      S 912-003

      CAUTION: DO NOT TOUCH THE FMC CDU BEFORE YOU DO THE PROCEDURE FOR ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE FMC CDU.

      (1) Do the procedure for electrostatic discharge sensitive devices (AMM 20-41-01/201).

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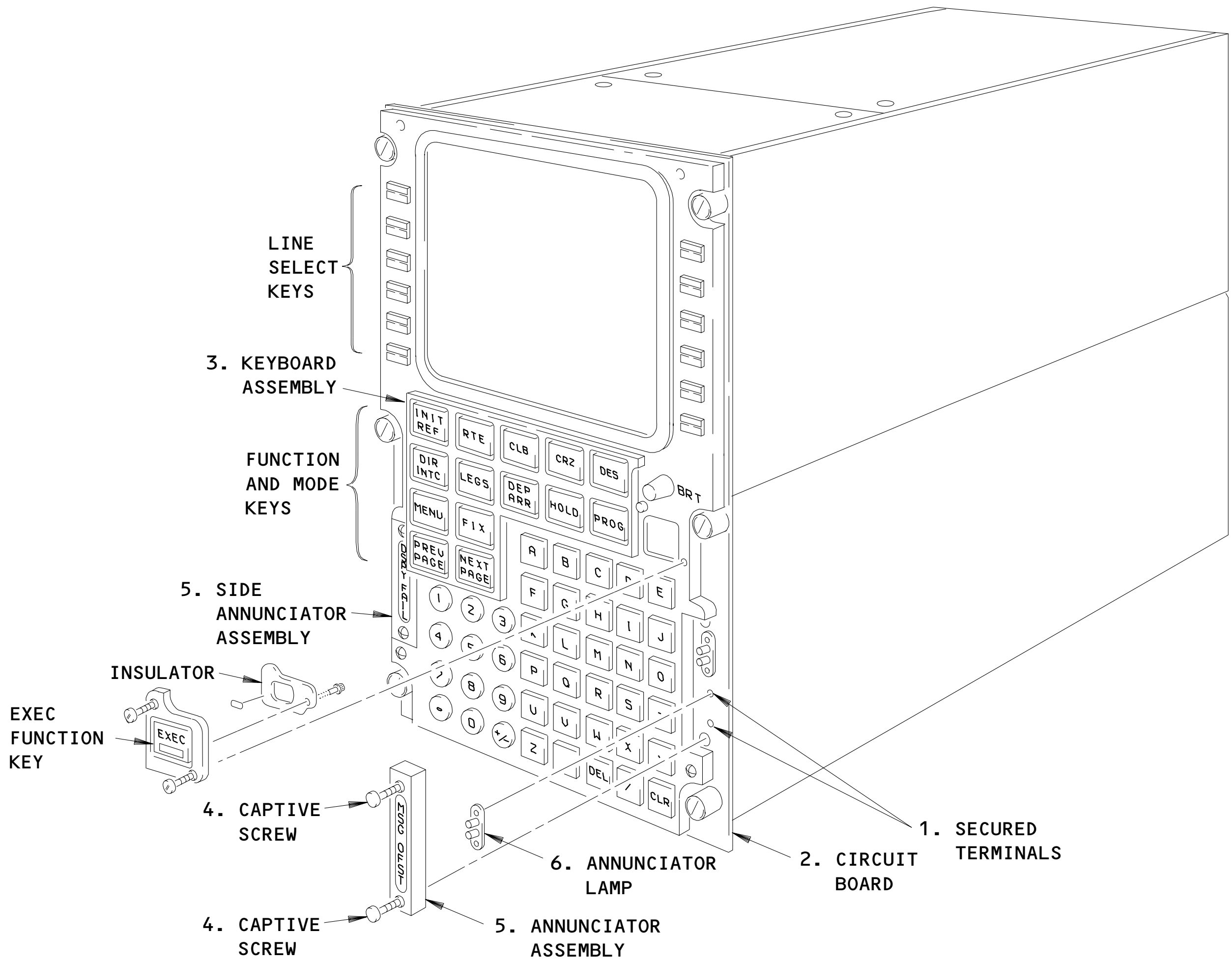

FMCS Control Display Unit
Figure 201

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S 032-004
(2) Loosen the six quick-release fasteners on the front panel of the CDU.

S 032-005
(3) Lift the handle and pull the CDU out of the panel until you can disconnect the cable attached to the rear of the CDU.

S 032-006
(4) Disconnect the cable from the CDU.

S 432-007
(5) Install the dust covers.

S 022-008
(6) Remove the unit from the control stand.

TASK 34-61-02-102-191
3. Cooling Air Inlet Screen Cleaning
A. General
(1) The inlet screen for the cooling air is installed on the rear of the CDU.
B. Standard Tools and Equipment
(1) Vacuum Source
C. Access
(1) Location Zones
211/212 Flight Compartment

D. Procedure

S 022-187
(1) Do the "FMCS Control Display Unit Removal" task (AMM 34-61-02/201).

S 862-188
(2) Put the CDU on a stable surface.

S 102-189
(3) Remove all the dirt from the inlet screen with a vacuum source.

S 422-190
(4) Do the "FMCS Control Display Unit Installation" task (AMM 34-61-02/201).

TASK 34-61-02-422-036
4. FMCS Control Display Unit Installation
A. References
(1) AMM 20-41-01/201, Electrostatic Discharge Sensitive Devices

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B. Access
   (1) Location Zones
         211/212   Flight Compartment

C. Install the FMCS CDU

   S 862-009
   (1) For the LEFT FMC, open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
      (a) 11E9, FMCS CMPTR
      (b) 11E8, FMCS CDU

   S 862-177
   (2) For the RIGHT FMC, open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
      (a) 11E29, FMCS CDU
      (b) 11E30, FMCS CMPTR

   S 862-178
   (3) Open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
      (a) 11P1, LIGHTING INSTRUMENT & PANEL AISLE STAND
      (b) 11R3, LEFT IND LIGHTS 3
      (c) 11R30, LIGHTING R IND LTS 3 or RIGHT IND LTS 3

   S 912-010

   CAUTION: DO NOT TOUCH THE FMC CDU BEFORE YOU DO THE PROCEDURE FOR ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE FMC CDU.

   (4) Do the procedure for electrostatic discharge sensitive devices (AMM 20-41-01/201).

   S 862-011
   (5) Make sure the air inlet screen for the CDU is clean. Clean inlet screen if necessary.

   S 032-012
   (6) Remove dust covers on the rear of the CDU.

   S 432-013
   (7) Connect cable to rear of CDU.

   S 412-014
   (8) Carefully lower CDU into the panel.

   S 862-015
   (9) Push down the CDU handle.

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S 432-016
(10) Tighten the six quick-release fasteners.

S 862-094
(11) Do these steps to make sure that cooling air is suplied to the CDU:
(a) Make sure the EQUIP COOLING switch on the P5 panel is in the AUTO position.
(b) Put the LIFT TO TEST lever on the indicator to the UP position.
(c) Make sure the left CDU ball on the Avionics Cooling Monitor on the P61 panel shows.
(d) If the ball does not show, examine and repair the cooling air ducting for any breaks or no connection.

S 712-168
(12) Do the FMCS Control Display Unit Test (AMM 34-61-02/201).

TASK 34-61-02-712-035
5. FMCS Control Display Unit Test
A. References
(1) AMM 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Prepare for Test

S 862-017
(1) Supply electrical power (AMM 24-22-00/201).

S 862-018
(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel.
(a) 11P1, LIGHTING AISLE STAND INSTRUMENT & PANEL
(b) 11R3, LEFT IND LIGHTS 3
(c) 11R30, LIGHTING R IND LTS 3 or RIGHT IND LTS 3

S 862-024
(3) Set the FMC NAV Source Select switches on the P1 (P3) panel to the FMC-L (FMC-R) positions.
D. Test the FMCS CDU

S 862-025
(1) Open these circuit breakers on the P11 panel for the two FMCs and attach DO-NOT-CLOSE tags:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E30, FMCS CMPTR RIGHT

S 862-026
(2) Make sure the FAIL indicators on the CDUs come on.

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S 862-095
(3) Make sure the MENU page shows on the two CDUs.

S 862-027
(4) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
(a) 11E9, FMCS CMPTR LEFT
(b) 11E30, FMCS CMPTR RIGHT

S 862-028
(5) Make sure the FAIL indicators on the CDUs go off.

S 862-069
(6) Make sure the <FMC prompt shows on the two CDUs.

S 862-096
(7) Push the line select keys (LSK) adjacent to the <FMC prompts to get the IDENT page on the two CDUs.

S 712-120
(8) Make sure the title line on the CDUs shows IDENT.

S 862-029
(9) Push the line select button adjacent to the POS INIT prompt on replaced CDU.

S 862-030
(10) Make sure the title line on the CDU display is POS INIT.

E. Put the Airplane Back to Its Usual Condition

S 862-031
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-61-02-162-032
6. Clean CRT Face (Optional Procedure)

A. Equipment
(1) Brush - Soft bristle (commercially available)

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B. Consumable Materials
(1) B50012 Cleaner, Optical Cleaning, Calotherm Solution - Supaspray (use with Supacloth)
(2) B50013 Cloth, Calocoat Hi-Tech Lenscloth - Supacloth (use with Supaspray)
(3) G02457 Cleaner, Wet/Dry Anti-static Sachet - ALGLAS Visial ALG/CR 215

C. Access
(1) Location Zones
211/212 Flight Compartment

D. Clean the CRT Face

S 102-170
(1) Remove all particles from the display surface with a clean, soft, natural-bristle brush.

S 102-171
(2) Carefully clean the display surface with the Supaspray and Supacloth or the wet/dry sachets:
(a) Apply 2 or 3 sprays of the Supaspray to the Supacloth, or open the wet sachet.
(b) Use the moist cloth or wet sachet to carefully clean the display surface in a straight line from top to bottom.
(c) Gradually move from one side of the display surface to the other side while you clean from top to bottom.
(d) When the display surface is clean, use a clean, dry area of the cloth or the dry sachet in a straight line from top to bottom to carefully dry the display surface.

TASK 34-61-02-342-155
7. AIRPLANES WITH REMOVABLE LAMPS;
<u>CDU Annunciator Lamp Replacement</u> (Fig. 201)

A. General
(1) The front panel of the CDU contains four annunciators. The DSPY and FAIL annunciators are on the left side of the CDU. The MSG and OFST annunciators are on the right side of the CDU. Each annunciator has two lamps. The lamps are installed on the circuit board assembly.

B. Reference
(1) AMM 24-22-00/201, Electrical Power - Control

C. Access
(1) Location Zones
211/212 Flight Compartment

D. Procedure

S 862-046
(1) For the LEFT FMC, open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
(a) 11E9, FMCS CMPTR
(b) 11E8, FMCS CDU

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S 862-179

(2) For the RIGHT FMC, open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
   (a) 11E29, FMCS CDU
   (b) 11E30, FMCS CMPTR

S 862-180

(3) Open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
   (a) 11P1, LIGHTING INSTRUMENT & PANEL AISLE STAND
   (b) 11R3, LEFT IND LIGHTS 3
   (c) 11R30, LIGHTING R IND LTS 3 or RIGHT IND LTS 3

S 022-047

(4) Remove the annunciator lamp as follows:
   (a) Loosen the two captive screws (4) that connect the left or right annunciator assembly (5).
   (b) Remove the annunciator assembly (5) to get to the two annunciator lamps (6).
   (c) Remove the defective lamp (6) from the terminals (1) on the circuit board (2).

S 422-048

(5) Install the annunciator lamp as follows:
   (a) Install the annunciator lamp (6) on the terminals (1) on the circuit board (2).
   (b) Install the annunciator assembly (5) on the keyboard assembly (3).
   (c) Tighten the two captive screws (4).

E. CDU Annunciator Lamp Test

S 862-049

(1) Supply electrical power (AMM 24-22-00/201).

S 862-050

(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11E9, FMCS CMPTR LEFT
   (b) 11E8, FMCS CDU LEFT
   (c) 11E29, FMCS CDU RIGHT
   (d) 11E30, FMCS CMPTR RIGHT
   (e) 11P1, LIGHTING INSTRUMENT & PANEL AISLE STAND
   (f) 11R3, LEFT IND LIGHTS 3
   (g) 11R30, LIGHTING R IND LTS 3 or RIGHT IND LTS 3

S 712-051

(3) Do a test of the CDU annunciator lamps as follows:
   (a) Push and hold the IND LTS switch, on the P5 pilots overhead panel, in the TEST position.

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(b) Make sure the lamps for the CDU annunciators (DSPL, FAIL, MSG and OFST) come on.
(c) Release the IND LTS switch.
(d) Make sure that the lamps for the CDU annunciators go off.

S 862-052
(4) Remove electrical power if it is not necessary (AMM 24-22-00/201).

TASK 34-61-02-902-142
8. AIRPLANES WITH A REMOVABLE EXEC KEY;
<u>CDU EXEC Key/Lamp Replacement</u> (Fig. 201)
A. General
(1) The front panel of the CDU contains an EXEC key. The EXEC key is on the right side of the CDU below the BRT knob.
B. References
(1) AMM 24-22-00/201, Electrical Power - Control
C. Access
(1) Location Zones
211/212 Flight Compartment

D. Procedure

S 862-103
(1) For the LEFT FMC, open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
(a) 11E9, FMCS CMPTR
(b) 11E8, FMCS CDU

S 862-181
(2) For the RIGHT FMC, open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
(a) 11E29, FMCS CDU
(b) 11E30, FMCS CMPTR

S 862-182
(3) Open these circuit breakers on the P11 panel and attach DO-NOT-CLOSE tags:
(a) 11P1, LIGHTING INSTRUMENT & PANEL AISLE STAND

S 022-104
(4) Remove the EXEC key assembly as follows:
(a) Loosen the two captive screws in the EXEC key assembly.
(b) Remove the EXEC key assembly from the keyboard assembly.
(c) Remove the two screws from the EXEC key assembly.
(d) Remove the lamp circuit board from the EXEC key assembly.

S 422-105
(5) Install the EXEC key assembly as follows:
(a) Install the lamp circuit board in the EXEC key assembly.
(b) Tighten the two screws on the EXEC key assembly.
(c) Install the EXEC key assembly on the keyboard assembly.

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(d) Tighten the two captive screws.

E. EXEC Key/Lamp Test

S 862-106

(1) Supply electrical power (AMM 24-22-00/201).

S 862-107

(2) Remove the DO-NOT-CLOSE tags and close these circuit breakers on the P11 panel:
   (a) 11E9, FMCS CMPTR LEFT
   (b) 11E8, FMCS CDU LEFT
   (c) 11E29, FMCS CDU RIGHT
   (d) 11E30, FMCS CMPTR RIGHT
   (e) 11P1, LIGHTING INSTRUMENT & PANEL AISLE STAND

S 712-108

(3) Do a test of the EXEC key assembly as follows:
   (a) Push the RTE key on the CDU that has the replaced EXEC key assembly.
   (b) If the RTE 1 or RTE 2 page is displayed, do these steps:
      1) Push the LSK adjacent to the ACTIVATE> prompt.
      2) Make sure the EXEC lamp is on.
      3) Push the LSK adjacent to the ERASE> prompt.
      4) Make sure the EXEC key lamp is off.
   (c) If the ACT RTE 1 or ACT RTE 2 page is displayed, do these steps:
      1) Push the first LSK on the left side of the CDU display to erase the current flight plan.
      2) Make sure the EXEC lamp is on.
      3) Push the LSK adjacent to the ERASE> prompt.
      4) Make sure the EXEC key lamp is off.

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FLIGHT MANAGEMENT COMPUTER ENGINE PROGRAM PINS - MAINTENANCE PRACTICES

1. General
   A. This procedure changes the engine program pin configuration to help with engine model changes. To set the engine model, the program pins are put to an electrical ground. These pins are in the connector part on the shelf behind where the Flight Management Computers (FMC) are installed.

TASK 34-61-03-902-006

2. Change Engine Program Pins
   A. References
      (1) AMM 34-61-00/201, Flight Management Computer
      (2) AMM 34-61-01/401, Flight Management Computer
      (3) SWPM 20-20-00
      (4) SWPM 20-71-14
      (5) WDM 34-61-14, Wire Diagram Manual
      (6) WDM 34-61-24, Wire Diagram Manual
   B. Access
      (1) Location Zones
          119/120 Main Equipment Center

      (2) Access Panels
          119AL Main Equipment Center

   C. Change Engine Program Pins

      S 022-001
      (1) Remove the Flight Management Computer (AMM 34-61-01/401).

      S 902-002
      (2) Change the pin wires to agree with Fig. 201 (SWPM 20-20-00, SWPM 20-71-14, WDM 34-61-14, WDM 34-61-24).

      S 422-003
      (3) Install the Flight Management Computers (AMM 34-61-01/401).

      S 862-005
      (4) If you do not put in the same FMCs removed, put the drag factors and the fuel factors into the FMCs (AMM 34-61-00/201).

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PROGRAM PINS	CONNECTOR LEFT D323 RIGHT D353	PINS	PIN CONNECTION LEFT FMC OPEN	PIN CONNECTION LEFT FMC GND	PIN CONNECTION LEFT FMC +28VDC	PIN CONNECTION RIGHT FMC OPEN	PIN CONNECTION RIGHT FMC GND	PIN CONNECTION RIGHT FMC +28VDC	CONFIGURATION
AIRFRAME/ENGINE IDENT	B	C11	X			X			767-300.3 PW4060 1 3 7
		D11	X			X			
		E11	X			X			
		F11	X			X			
		G11		X			X		
		H11		X			X		
		J11		X			X		
		C15	X			X			
		H15	X			X			
AIRFRAME/ENGINE IDENT	B	C11	X			X			INCREASE THE PW4060 ENGINE THRUST RATE TO THE PW4062 2 4 8
		D11		X			X		
		E11	X			X			
		F11	X			X			
		G11	X			X			
		H11	X			X			
		J11		X			X		
		C15		X			X		
		H15	X			X			
AIRFRAME/ENGINE IDENT	B	C11	X			X			767-300 PW4062 5
		D11		X			X		
		E11	X			X			
		F11	X			X			
		G11	X			X			
		H11	X			X			
		J11		X			X		
		C15		X			X		
		H15		X			X		
AIRFRAME/ENGINE IDENT	B	C11	X			X			767-300 PW4062/PW4060 INTERMIX 6
		D11	X			X			
		E11	X			X			
		F11	X			X			
		G11		X			X		
		H11		X			X		
		J11		X			X		
		C15	X			X			
		H15		X			X		

1 PRE-SB 71-117
2 POST-SB 71-117
3 PRE-SB 71-118
4 POST-SB 71-118
5 PRE-SB 71-133
6 POST-SB 71-133
7 PRE-SB 71-136
8 POST-SB 71-136

FMC Program Pin Data
Figure 201

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AIRBORNE DATA LOADER-MAINTENANCE PRACTICES

1. General (Fig. 201)
   A. This task contains the steps on how to load an LRU with the Airborne Data Loader (ADL). The task gives instructions for the installation of software into different airplane systems and the NAV database installation into the Flight Management Computer System (FMCS). These software installations are called data loads.

TASK 34-61-05-422-002

2. Software Installation
   A. General
      (1) The ADL and the Data Loader Control Panel (DLCP) are located on the Right Side Panel P61.
   B. Equipment
      (1) The most up to date diskette of the system that is to be data loaded.
   C. References
      (1) AMM 34-61-00/201, Flight Management Computer System
   D. Access
      (1) Location Zone
          211/212 Flight Compartment
   E. Procedure

      S 432-003
      (1) Perform software installation.
          (a) To load the FMC operational software or the NAV data base, open both the 11E9 LEFT FMCS CMPTR and 11E30 RIGHT FMCS CMPTR circuit breakers located on the overhead circuit breaker panel P11.
          (b) Open the 11G24 DATA LOADER circuit breaker located on the P11 panel.
          (c) Set the DLCP switch located on the P61 panel to the NORMAL position.
          (d) Open the disk drive access door found directly below the DLCP switch on the P61 panel.

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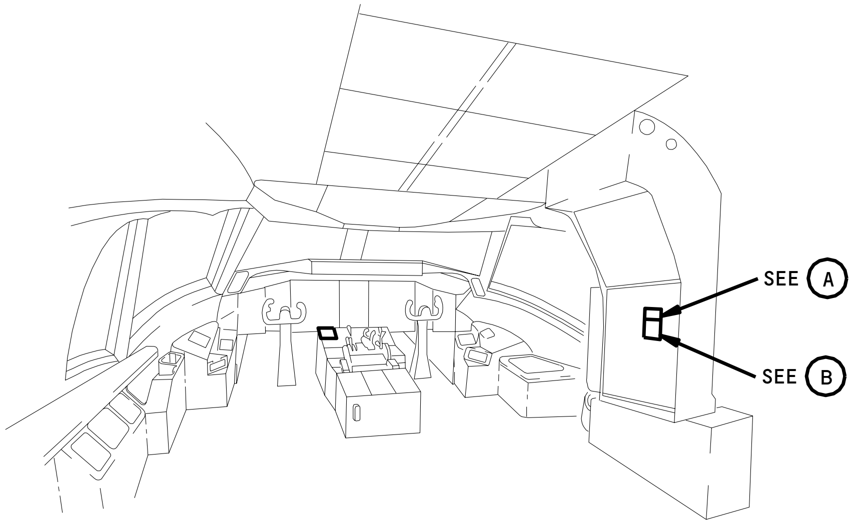
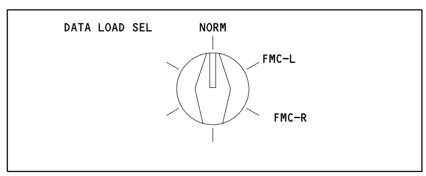
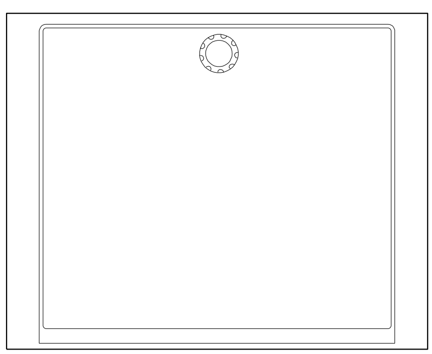


FLIGHT COMPARTMENT



DATA LOADER CONTROL PANEL
A



AIRBORNE DATA LOADER
B

FMC Data Loading
Figure 201

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(e) Close the 11G24 DATA LOADER circuit breaker, found on the P11 panel.
(f) Make sure that the INSERT DISK #1 message is shown on the data loader.
(g) Set the DLCP switch to the position for the LRU that is to have software installed in it.

CAUTION: BEFORE THE DISKETTE IS PUT INTO THE ADL, THE SOFTWARE PART NUMBER SHOULD BE EXAMINED WITH THE APPROVED AIRLINE DEPARTMENT FOR THE CORRECT NUMBER TO BE INSTALLED.

(h) Put the diskette into the disk drive.

NOTE: ON MTH 275-276, the TRANSFER FAIL message may be shown on the data loader during the installation of software. If the TRANSFER FAIL message is shows, remove the diskette from the ADL and do the FMC Navigational Database Input procedure from the start.

(i) If the L FMC (R FMC) is to be loaded with the operational software or the NAV data base close the 11E9 LEFT FMCS CMPTR (11E30 RIGHT FMCS CMPTR) circuit breaker. Make sure the circuit breaker for the other FMC is open.
(j) Make sure that this sequence occurs:
1) The data loader shows the disk volume label, adjacent to the title "VOL:".
2) During the data movement the ADL will cause these effects to occur for each file on the diskette.
a) The data loader shows the filename and the percentage of the file that has been moved.
b) The data loader shows the number of blocks moved adjacent to the title TRANSFERRED after the complete file has been moved.
(k) If the data loader shows the message INSERT DISK #2, then do these steps:

NOTE: The INSERT DISK #2 display shows that it is necessary for the LRU to use more than one diskette to complete data input.

1) Push the eject button and remove the diskette from the disk drive. Make sure the display goes blank.
2) Insert the subsequent diskette into the disk drive.

NOTE: If the message INSERT DISK #"n" is shown then an out of sequence diskette was put in. "n" is a number which shows the subsequent diskette in a sequence of diskettes.

3) Make sure the data loader goes through the same indications as it did for diskette No. 1.

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4) When the software load is complete the data loader will show COMPLETE.

(l) Push the eject button and remove diskette.

(m) Any software installation into other LRUs is to be done the same way.

(n) Set the DLCP switch to the NORMAL position.

(o) Open the 11G24 DATA LOADER circuit breaker located on the P11 panel.

S 862-004

(2) At the end of the software load into the FMC, do drag factor/fuel flow factor modification (AMM 34-61-00/201).

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AIRBORNE DATA LOADER-REMOVAL/INSTALLATION

1. General
   A. Three tasks are given in this procedure. The first task gives instructions to remove the Airborne Data Loader (ADL) from the right side panel, P61, found in the flight compartment. The second task gives instructions to install the ADL in the P61 panel. The third task gives instructions on how to test the ADL after installation and make sure that it has been installed correctly.
   B. The ADL is installed in the P61 panel in the flight compartment. It is found below the Data Loader Control Panel (DLCP) selector switch.
   C. Electrical connections are made through a connector found at the rear of the ADL. The ADL is held in place by four quick-release fasteners which are on the front of the ADL.

TASK 34-61-05-024-027

2. Remove Airborne Data Loader
   A. Reference
      (1) AMM 20-41-01/201, Electrostatic Sensitive Devices
   B. Access
      (1) Location Zones
          211/212 Flight Compartment

   C. Procedure

      S 864-006
      (1) Open this circuit breaker on the overhead circuit breaker panel, P11:
          (a) 11G24, DATA LOADER

      S 864-007

      CAUTION: DO NOT TOUCH THE ADL BEFORE YOU DO THE PROCEDURE FOR ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE ADL.

      (2) Do the procedure for electrostatic discharge sensitive devices (AMM 20-41-01/201).

      S 034-008
      (3) Loosen the four quick-release fasteners on the front of the ADL.

      S 024-009
      (4) Carefully remove the ADL from P61 panel.

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S 034-010
(5) Disconnect the electrical connector from the rear of the ADL.

TASK 34-61-05-424-011

3. Install Airborne Data Loader

A. References
(1) AMM 20-41-01/201, Electrostatic Sensitive Devices

B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 864-012
(1) Make sure this circuit breaker on the overhead circuit breaker panel, P11, is open:
(a) 11G24, DATA LOADER

S 214-013
(2) Make an inspection for loose, bent, dirty or broken pins on the ADL connector.

S 864-014

CAUTION: DO NOT TOUCH THE ADL BEFORE YOU DO THE PROCEDURE FOR ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201) ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE ADL.

(3) Do the procedure for electrostatic discharge sensitive devices (AMM 20-41-01/201).

S 434-015
(4) Connect the electrical cable to the rear of the ADL.

S 424-016
(5) Carefully install ADL in the P61 panel.

NOTE: The unit should be installed with the handle at the top.

S 434-010
(6) Tighten the four quick-release fasteners.

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S 864-025
(7) Close this circuit breaker on the P11 panel.
(a) 11G24, DATA LOADER

TASK 34-61-05-714-017
4. Test Airborne Data Loader
A. References
(1) AMM 24-22-00/201, Electrical Power - Control
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 864-018
(1) Supply electrical power (AMM 24-22-00/201).

S 864-019
(2) Set the DLCP selector switch on the P61 panel to the NORMAL positon.

S 864-020
(3) Open the disk drive access door on the front of the ADL.

S 864-022
(4) Close this circuit breaker on the P11 panel.
(a) 11G24, DATA LOADER

S 864-028
(5) Make sure that the INSERT DISK #1 message is shown on the data loader.
D. Put the Airplane Back to Its Usual Condition.

S 864-024
(1) Remove electrical power if it is not necessary (AMM 24-22-00/201).

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DATA LOADER CONTROL PANEL-REMOVAL/INSTALLATION

1. General
    A. Three tasks are given in this procedure. The first task gives instructions to remove the Data Loader Control Panel (DLCP) from the right side panel, P61, found in the flight compartment. The second task gives instructions to install the DLCP in the P61 panel. The third task gives instructions on how to test the DLCP after installation and make sure that it has been installed correctly.
    B. The DLCP is installed in the P61 panel in the flight compartment. It is found above the Airborne Data Loader (ADL).
    C. Electrical connections are made through four connectors found at the rear of the DLCP. The DLCP is held in place by four quick-release fasteners which are on the front of the DLCP.

TASK 34-61-06-024-026

2. Remove Data Loader Control Panel
    A. Reference
        (1) 20-41-01/201, Electrostatic Sensitive Devices
    B. Access
        (1) Location Zones
            211/212 Flight Compartment
    C. Procedure

        S 864-028
        (1) Open this circuit breaker on the overhead circuit breaker panel, P11:
            (a) 11G24, DATA LOADER

        S 864-007

        CAUTION: DO NOT TOUCH THE DLCP BEFORE YOU DO THE PROCEDURE FOR ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE DLCP.

        (2) Do the procedure for electrostatic discharge sensitive devices (AMM 20-41-01/201).

        S 034-027
        (3) Loosen the four quick-release fasteners on the front of the DLCP.

        S 024-029
        (4) Carefully remove the DLCP from P61 panel.

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S 034-030
(5) Disconnect the electrical connectors from the rear of the DLCP.

TASK 34-61-06-424-031
3. <u>Install Data Loader Control Panel</u>
A. References
(1) 20-41-01/201, Electrostatic Sensitive Devices
B. Access
(1) Location Zones
211/212 Flight Compartment

C. Procedure

S 864-032
(1) Make sure this circuit breaker on the overhead circuit breaker panel, P11, is open:
(a) 11G24, DATA LOADER

S 214-033
(2) Make an inspection for loose, bent, dirty or broken pins on the DLCP connectors.

S 864-034

<u>CAUTION</u>: DO NOT TOUCH THE DLCP BEFORE YOU DO THE PROCEDURE FOR ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (AMM 20-41-01/201). ELECTROSTATIC DISCHARGE CAN CAUSE DAMAGE TO THE DLCP.

(3) Do the procedure for electrostatic discharge sensitive devices (AMM 20-41-01/201).

S 434-035
(4) Connect the electrical cables to the rear of the DLCP.

S 424-036
(5) Carefully install DLCP in the P61 panel.

S 434-037
(6) Tighten the four quick-release fasteners.

S 864-038
(7) Close this circuit breaker on the P11 panel.
(a) 11G24, DATA LOADER

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TASK 34-61-06-714-039

4. Test Data Loader Control Panel

A. References

(1) 24-22-00/201, Electrical Power - Control

B. Access

(1) Location Zones

211/212 Flight Compartment

C. Procedure

S 864-040

(1) Supply electrical power (Ref 24-22-00).

S 864-041

(2) Set the DLCP selector switch on the P61 panel to the NORMAL positon.

S 864-042

(3) Open the disk drive access door on the front of the ADL.

S 864-043

(4) Close this circuit breaker on the P11 panel.

(a) 11G24, DATA LOADER

S 864-049

(5) Make sure that the INSERT DISK #1 message is shown on the data loader.

D. Put the Airplane Back to Its Usual Condition.

S 864-047

(1) Remove electrical power if it is not necessary (Ref 24-22-00).

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