*TM 1-5855-265-T

TECHNICAL MANUAL

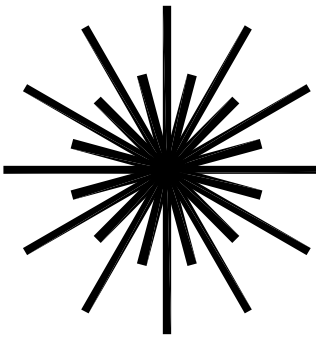
AVIATION UNIT TROUBLESHOOTING MANUAL

PILOT NIGHT VISION SENSOR (PNVS) ASSEMBLY AN/AAQ-11 (NSN 5855-01-120-7831)

*This manual supersedes TM 1-5855-265-T dated 31 August 1992, including all changes.

AH-64A ATTACK HELICOPTER

HEADQUARTERS, DEPARTMENT OF THE ARMY
6 AUGUST 2001



INVISIBLE LASER RADIATION
AVOID EYE EXPOSURE TO DIRECT RADIATION

NEODYMIUM LASER
WAVELENGTH - 1064 NANOMETERS
CLASS IV LASER

02712

The laser associated with the TADS system is very hazardous. Exposure to the invisible beam or reflections from the beam could cause blindness or serious eye injury.

Procedures in this manual do not require any firing of the laser into open space while on the ground. Boresighting is accomplished in a protective enclosure which prevents exposure to the potentially dangerous laser radiation.

Your supervisor will have laser safety goggles available if any problem presents a possible exposure to the laser radiation. A standard laser safety goggle, NSN 4240-00-258-2054, will provide adequate protection if required. Other laser safety goggles can be used, but should be specific for and labeled with the 1064 nanometer wavelength, and with a neutral density of ND6 or greater.

If you routinely work with rangefinder/designator lasers, you will be included in an occupational vision program in accordance with AR 40-46 and TB MED 524.

WARNING

HIGH VOLTAGE

is used in the operation of this equipment

DEATH ON CONTACT

May result if personnel fail to observe safety precautions. Learn the areas containing high voltage in each piece of equipment. Be careful not to contact high-voltage connections when installing or operating this equipment. Before working inside the equipment, turn power off and ground points of high potential before touching them.
For artificial respiration, refer to FM 21-11.

WARNING

RADIATION HAZARD

The anti-reflective coating on all infrared optics contains thorium fluoride which is slightly radioactive. The only potential hazard involves ingestion (swallowing or inhaling) of this coating material. Dispose of broken lenses, etc., in accordance with AR 385-11.

WARNING

HAZARDOUS SOLVENTS

When you use solvents, be sure that the place you work in is well-ventilated. WEAR GLOVES AND EYE PROTECTION. If you don't have good ventilation, read TB MED 223 and use the recommended respiratory (breathing) protection.

DON'T USE FLAMMABLE SOLVENTS AROUND HEAT, OPEN FLAME, OR SPARKS.

IF YOU GET SOLVENT IN YOUR EYES OR ON YOUR SKIN, FLUSH THE SOLVENT AWAY WITH WATER FOR 15 MINUTES; THEN GET MEDICAL HELP.

Freon reacts with highly active free metals such as sodium, barium, or potassium, and may produce toxic byproducts, fires, or explosions. Do not use Freon near highly active free metals.

WARNING

TOXIC AND FLAMMABLE CHEMICALS

Use the same care for toxic and flammable chemicals as you would for hazardous solvents.

WARNING

CHEMICAL, BIOLOGICAL, AND RADIOLOGICAL CONTAMINATION

Notify you supervisor if you think you have been exposed to chemical, biological, or radiological contamination. TM 9-1300-275/2 gives procedures for decontamination.

WARNING

NOISE

Sound of running engines (helicopter main engines, APU, and AGPU) can exceed U.S. Surgeon General's Noise Limits (TB MED 251). Ear plugs or aviation helmet must be worn when working on helicopter at these times.

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGE PAGES. DESTROY SUPERSEDED PAGES.

NOTE: The portion of the text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and change pages are:

Original 0. . . . . 6 August 2001

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 173, CONSISTING OF THE FOLLOWING:

Page No.	*Change No.	Page No.	*Change No.
Title	0		
a - b	0		
A	0		
B Blank	0		
i - iii	0		
iv Blank	0		
1-1 - 1-17	0		
1-18 Blank	0		
2-1 - 2-31	0		
2-32 Blank	0		
3-1 - 3-66	0		
4-1 - 4-16	0		
A-1- A-3	0		
A-4 Blank	0		
Glossary -1 - Glossary -3	0		
Glossary -4 Blank.	0		
Index-1 - Index-11	0		
Index-12 Blank	0		

*Zero in this column indicates an original page.

TECHNICAL MANUAL

No. 1-5855-265-T

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 6 AUGUST 2001

AVIATION UNIT TROUBLESHOOTING MANUAL
PILOT NIGHT VISION SENSOR
(PNVS) ASSEMBLY AN/AAQ-11 (NSN 5855-01-120-7831)
(AH-64A ATTACK HELICOPTER)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any errors or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual directly to: Commander, U.S. Army Aviation and Missile Command, ATTN: AMSAM-MMC-MA-NP, Redstone Arsenal, AL 35898-5000. A reply will be furnished to you. You may also send in your comments electronically to our e-mail address: 2028@redstone.army.mil or FAX us at (256) 842-6546/DSN 788-6546. Instructions for sending an electronic 2028 may be found at the end of this TM immediately preceding the hard copy 2028.

*This manual supersedes TM 1-5855-265-T, dated 31 August 1992, including all changes.
Distribution Statement A: Approved for public release; distribution is unlimited.

HOW TO USE THIS MANUAL

If you cannot find the information you are looking for, you cannot properly do your job. Take a few minutes to look through this manual. You will find it easier to use once you have become familiar with it.

Each chapter and section is set up to lead you through it step by step. For example:

1. On the chapter page, you will see a listing of the sections in that chapter. Listed under the section titles is a listing of the tasks for that section. Find the task (by title) that you have been assigned. Now, look across from the task title and you will find the paragraph and page number for the task. Notice that the chapter number forms part of the page number.

2. Now that you have located the page number, turn to that page and review the task requirements before starting the procedures.

3. Did you notice that each task or job begins with an initial setup?

    a. INITIAL SETUP lists the configuration, test equipment, tools and special tools, materials/parts, military occupational specialty (MOS), references, safety instructions, condition equipment should be in, and general instructions for you to complete the task. FOLLOWUP lists the procedures to be performed after you have completed the basic task.

    b. Now, what exactly does INITIAL SETUP mean to you? The term “INITIAL SETUP” means, “DO THIS FIRST BEFORE STARTING THE TASK.” Review one of the initial setup tables and become familiar with the requirements.

4. An explanation of the initial setup headings is presented below.

    a. Tools and Special Tools. Special tools needed to perform the task. Be sure to acquire all the tools before you start the task.

    b. Materials/Parts. Materials and parts needed to perform the task. Materials can be found in Appendix C. Next to the name of the material listed in the initial setup you will find an item number. This number matches the item number in column (1) of Appendix C. Be sure to acquire all the materials and parts before you start the task.

    c. Personnel Required. MOS required to do the task. This will also tell you the number of persons needed to perform the task.

5. You can also use the table of contents on page i of this manual to locate page number for chapters, sections, and the appendixes.

6. Let’s see if you understand how to find a specific task. Suppose your supervisor wants you to replace a part or assembly.

Here’s how you would find it:

    a. Obtain the correct TM for the task and look up the procedure in the chapter covering the type of task you are to perform.

    b. For example: Replacement is a maintenance task you can find located in the maintenance chapter.

HOW TO USE THIS MANUAL (cont)

c. Looking at the section titles listed in the maintenance chapter index, you should have located the page number for the maintenance procedures. Going to that page you found the section index and located the paragraph and page number of the replacement task.

7. Another approach would be to look in the alphabetical index in the rear of the manual.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. SCOPE

This manual covers electrical component location and configuration (ECLC), theory of operation, power up, power down, maintenance operational checks (MOC), wiring interconnects, and fault isolation procedures (FIP) for PNVS system functions.

1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and instructions for completing them are included in DA PAM 738-751, The Army Maintenance Management System-Aviation (TAMMS-A).

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Destruction procedures are in TM 750-244-1-5.

1-4. PREPARATION FOR STORAGE OR SHIPMENT

Refer to TM 1-5855-265-20 for procedures regarding storage and shipment of line replaceable units (LRUs) and electrostatic discharge sensitive (ESDS) devices.

1-5. QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Quality assurance information is explained in FM 1-511.

1-6. DEFICIENCY REPORTING

If your equipment needs improvement, let us know. Send us a Quality Deficiency Report (QDR). You, the user, are the only one who can tell us what you don't like about your equipment. Let us know what you don't like about the design. Tell us why a procedure is hard to perform. Put it on Standard Form (SF) 368 (Quality Deficiency Report). Mail it to us at:

Commander
U.S. Army Aviation and Missile Command
ATTN: AMSAM-MMC-MA-NM
Redstone Arsenal, AL 35898-5230

We'll send you a reply.

1-7. CORROSION PREVENTION AND CONTROL (CPC)

a. Corrosion prevention and control (CPC) of Army material is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

b. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

c. If a corrosion problem is identified, it can be reported using SF 368, Quality Deficiency Report. Use of the key words such as "corrosion," "rust," "deterioration ," or "cracking" will assure that the information is identified as a CPC problem. The form should be submitted to: Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSAV-QF/Customer Feedback Center, Rock Island, IL 61299-6000.

1-8. WARRANTY INFORMATION

Refer to TM 1-5855-265-20.

Section II. TROUBLESHOOTING INFORMATION

1-9. MANUAL CONTENT AND ORGANIZATION

a. Equipment descriptions and theory of operation for systems and functions are presented in chapter 2. Troubleshooting for the system and functions is presented in chapters 3 and 4. Each troubleshooting chapter presents only one system or function.

b. Chapter contents are provided in the chapter index, located at the beginning of every chapter. Before troubleshooting, learn the content and organization of this manual and how it relates to other manuals. For more information on manual content and usage refer to HOW TO USE THIS MANUAL.

1-10. ELECTRICAL DATA

a. Electrical Units. Unless otherwise specified, the values indicated for electrical units in this manual are as follows:

- Phase (Ø)
- Resistance (R) in ohms
- Voltage (E) in volts (V)
- Current (I) in amperes (A)
- Frequency in Hertz (Hz)
- Power in watts (W)

b. Electrical Measurement Tolerances. Unless otherwise specified, tolerances for resistance and voltage are ±10%.

c. Grounds. Except as otherwise indicated (such as chassis ground), all grounds are common AC, DC, and signal grounds.

d. DC Voltage Polarities. DC voltages are positive polarity (+28 VDC, etc.) unless otherwise specified.

e. AC Voltages. All indicated AC voltages are 3 Ø, 400 Hz.

f. Circuit Breakers. Circuit breakers are to be at closed (ON) position. Troubleshooting procedures for all circuit breakers and all electrical circuits supplying electrical power to circuit breakers are in TM 1-1520-238-T-6.

g. Signal Names, States, Conditions, and Values. Signal values shown exist for the conditions and states indicated by signal names.

1-10. ELECTRICAL DATA (cont)

h. Coaxial Cable Resistance Measurements. When both ends of a coaxial cable are disconnected, resistance measurements from the shield to the center conductor shall indicate open.

i. Electrically Operated Devices. Relays, solenoids, and other electrically activated devices shown in the interconnect diagrams are shown in de-energized state.

j. Terminal Board Connections. Electrical connections at terminal boards are shown (fig. 1-1) as follows:

- Vertical and horizontal lines indicate electrical separation between terminals and blocks of terminals.
- Absence of lines indicates no separations.
- Terminal board connections may be illustrated horizontally, vertically, or a combination of both.

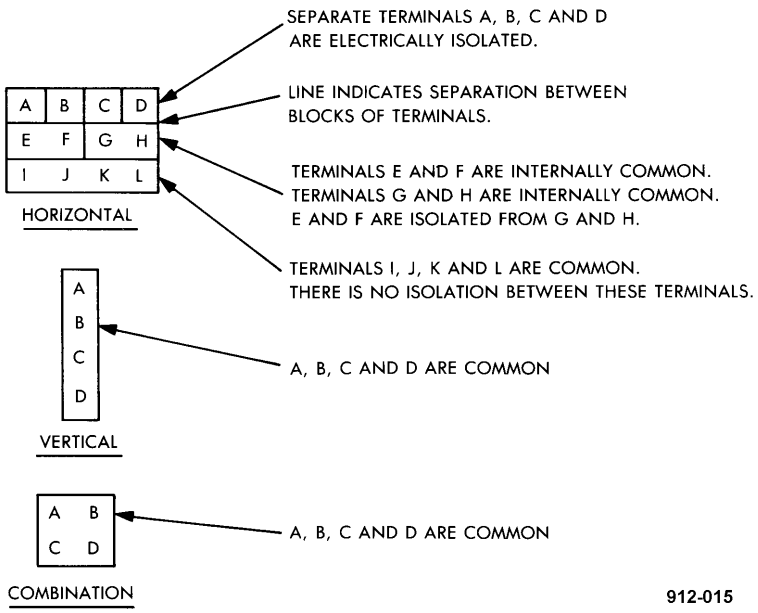


Figure 1-1. Typical Terminal Board Connections

1-11. WIRING INFORMATION

a. Interconnect diagrams in this manual are used for wiring checks. Helicopter reference designators for LRUs are shown in the lower right corner of the LRU on the diagrams. TADS and PNVS reference designators are shown after the LRU nomenclature in the upper left corner of the LRU. Electrical wiring repairs peculiar to the AH-64A are in TM 1-1520-238-23. Electrical wiring repairs not peculiar to the AH-64A are in TM 55-1500-323-24.

b. The wiring diagram volume, TM 1-1520-238-T-10, contains the following additional information:

(1) Part number index listing reference designator, item name, part number, and wiring harness.

(2) End view of all connectors.

(3) Wiring diagram of AH-64A wire harness including wire numbers, exact connector, terminal board, and ground stud locations, etc., in the helicopter.

1-12. WIRING CHECKS

Where repair or replace wiring or connections is specified, a check is to be made for short or open (as specified) for each wire segment, terminal board, connector pin, and connection over the entire length of wiring between pins or terminals indicated. The electrical interconnect diagram for the equipment being checked is used in making the wiring check. Instructions to repair wire(s) include repair or replacement of wires, connections at end of connector pins, terminals, etc. (all required end-to-end repair and replacement between wiring points specified). The component location and configuration illustration (for the equipment being checked) is used to locate wiring connectors and components in the helicopter.

Section III. TROUBLESHOOTING METHODS

1-13. FAILURE SYMPTOMS AND TROUBLESHOOTING

Troubleshooting begins with failure symptoms. Failure symptoms are organized by system/equipment in master failures symptoms TM 1-1520-238-T-2. Use the manual to locate what system(s) the failure is in and perform the appropriate FIPs as directed.

1-14. FAULT DETECTION/LOCATION SYSTEM (FD/LS) CHECK

The fault detection/location system (FD/LS) checks are located in TM 1-1520-238-T-1 along with a description of the FD/LS operating modes and power application.

1-15. MAINTENANCE OPERATIONAL CHECKS (MOC)

A maintenance operational check (MOC) is provided for each system or function as required. These checks test the system by using operator panel switches, controls, and indicators. When a desired result is not obtained, a reference is made to a FIP or to the multiplex read codes, TM 1-1520-238-T-3, as based on the failure symptom.

1-16. FAULT ISOLATION PROCEDURES (FIP)

The FIPs are referenced from the results of the MOC and depend on the switch control setting of the MOC.

1-17. STARTING TROUBLESHOOTING

NOTE

If faulty equipment is not known and a failure symptom exists, use failure symptom list in TM 1-1520-238-T-2 to determine what system/equipment has a malfunction.

a. Refer to TM 1-1520-238-T-2 to determine the proper troubleshooting procedures.

1-17. STARTING TROUBLESHOOTING (cont)

b. Select the chapter, section, and paragraph to use.

c. For use of external power and ground service utility connectors, refer to TM 1-1520-238-23. If external power is not available, refer to TM 1-1520-238-T-1 for application of the auxiliary power unit (APU). Refer to TM 1-1520-238-23 and TM 55-1730-229-12 for application of external electrical and hydraulic power, and pressurized air. External power is preferred; however, the APU may be used. Refer to TM 1-5855-265-20 and check PNVS electronic unit fuses.

d. If circuit breakers do not stay closed during power-up procedures, refer to TM 1-1520-238-T-2 to identify and correct the fault.

e. If power is not available to the equipment during power-up procedures, refer to TM 1-1520-238-T-2 to troubleshoot the electrical system.

f. First perform the FD/LS check in TM 1-1520-238-T-1. If the FD/LS check does not find the fault, do not perform the power-down procedure. Perform the MOC.

g. If there is no FD/LS check, perform the MOC.

h. Troubleshoot using the specific procedures in the selected paragraph.

1-18. DURING TROUBLESHOOTING

CAUTION

When making resistance, open, short, or other ohmmeter checks on circuits, always de-energize the circuit to avoid damage to the meter.

a. Correct faults and repair any equipment where damage is obvious.

CAUTION

Make sure helicopter environmental control system (ECS) fans are operating while electrical power is applied to helicopter to prevent equipment damage.

b. ALWAYS maintain required cooling of units while operating equipment.

1-18. DURING TROUBLESHOOTING (cont)

NOTE

For information on cooling requirements, refer to the ECS in TM 1-1520-238-T-8.

c. If troubleshooting procedures indicate that an LRU is faulty, it is replaced a second time only under one of the following conditions:

(1) When a preexisting failure in the wiring or system caused the newly replaced LRU to fail and the preexisting failure has been corrected.

(2) The replacement LRU is known to be defective and the interconnecting wiring is known to be OK.

d. The LRU is not to be replaced under any of the following conditions:

(1) If the interconnecting wiring is not absolutely known to be OK.

(2) If the newly replaced LRU is not absolutely known to be defective.

(3) If, under any circumstances, the LRU has already been replaced a second time.

1-19. C0MPLETING TROUBLESHOOTING

a. Prior to application of power -

- Connect items disconnected during troubleshooting.
- Reinstall or replace items removed during troubleshooting.

b. To make sure that trouble is corrected -

- If trouble is found and corrected using a FD/LS check, repeat the FD/LS check.
- If trouble is found and corrected using a MOC, repeat the MOC - then perform any applicable FD/LS check.

c. Secure all doors, panels, and opened areas.

Section IV. LRU TROUBLESHOOTING - OFF THE HELICOPTER

1-20. TROUBLESHOOTING LINE REPLACEABLE UNITS (LRUs) AND SHOP REPLACEABLE UNITS (SRUs) OFF THE HELICOPTER

Troubleshooting beyond the scope of this manual for LRUs and shop replaceable units (SRUs) with built-in test equipment, is done with Electronic Equipment Test Facility (EETF) Van (TM 11-6625-3085-12) or at a depot repair facility.

Section V. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) INDEX

1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC)

The ECLC index will help locate electrical components and their connectors on theAH-64A helicopter and PNVS, during troubleshooting. This index contains a list of connectors and wiring harness which is shown by component location. Component locations are shown from the helicopter's forward section to its aft sections by horizontal and vertical grid numbers. Connectors are listed numerically in **FROM/TO** columns of the index. Every connector is referenced to a grid area within the illustrations. Use the index to find connectors on the aircraft as follows:

- Locate the connector reference designator number in the **FROM Connector Ref Des** column of the index.
- Cross-reference the **FROM Connector Ref Des** column with the:
- • **FROM Component/Harness** column to locate the wiring harness number.
- • **TO Connector Ref Des** column to locate the mating connector number.
- • **TO Component/Harness** Column to locate the mating wiring harness number.
- • **Grid Area** Column to find the grid zone (within the illustration) depicting the location on the aircraft.

To locate connector P853 on the aircraft for example, find connector P853 in the **FROM Connector Ref Des** column, then refer to the **FROM Component/Harness** column. This column shows that P853 is part of component harness W255, and the **TO Connector/Ref Des** column shows that P853 connects to J3 on TADS TEU 3 **(TO Component/Harness** column). The **Grid Area** column indicates that P853 is shown at illustration grid zone 18D, and that **Access** to the connector is obtained through the L90 door. For detailed information about access, refer to TM 1-1520-238-23, TM 1-1270-476-20, and TM 1-5855-265-20.

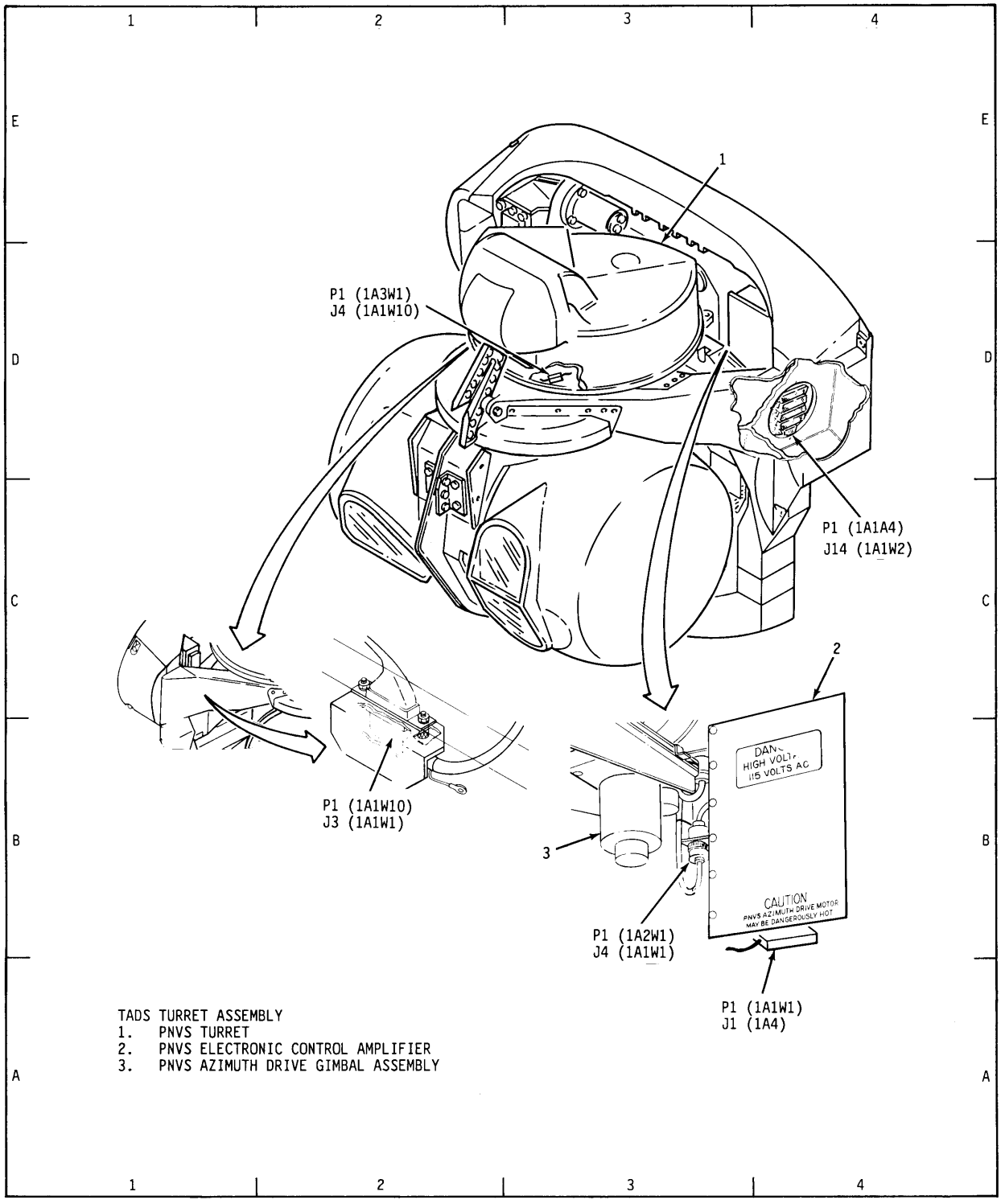
1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) (cont)

FROM COLUMN		TO COLUMN			
Connector Ref Des	Component/ Harness	Connector Ref Des	Compoent/ Harness	Grid Area	Access
P1	1A1A4	J14	1A1W2	4D	TTA LEFT ACCESS COVER
P1	1A1W1	J1	1A4	4B	TTA
P1	1A1W10	J3	1A1W1	2B	TTA
P1	1A2W1	J4	1A1W1	3B	TTA
P1	1A3W1	J4	1A1W10	3D	NSSA
P418	W116	J418	W255	15A	R60 FAIRING
P631	W255	J1	A626	19A	L90 DOOR
P670	W255	J1	A61	10C	R40 COVER
P672	W116	J3	A62	15D	R60 FAIRING
P680	W116	J1	A62	15D	R60 FAIRING
P699	W255	J3	A61	10C	R40 COVER
P835	W255	J1	1A1W1	7B	R40 COVER
P836	W255	J2	1A1W1	7C	R40 COVER
P837	W255	J1	2	14A	R90 DOOR
P838	W255	J2	2	14A	R90 DOOR
P839	W255	J3	2	14A	R90 DOOR
P840	W255	J4	2	14B	R90 DOOR
P841	W255	J5	2	14A	R90 DOOR
P853	W255	J3	3	18D	L90 DOOR

1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) (cont)

FROM COLUMN		TO COLUMN			
Connector Ref Des	Component/ Harness	Connector Ref Des	Compoent/ Harness	Grid Area	Access
P861	W255	J7	3	18D	L90 DOOR
P862	W255	J8	3	18D	L90 DOOR
P863	W255	J9	3	18D	L90 DOOR
P903	W255	J1	A613	14B	R90 DOOR

1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) (cont)



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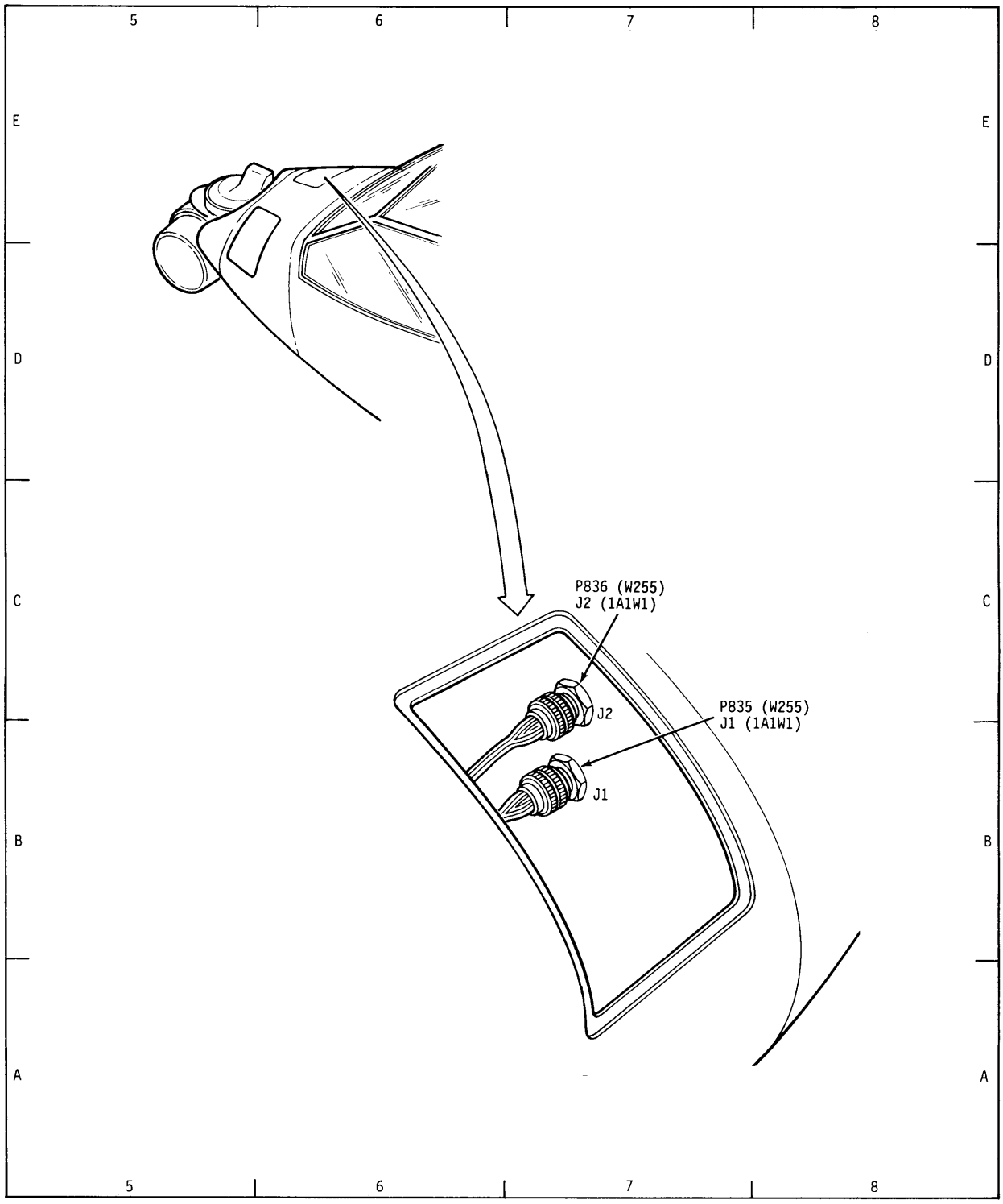
1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) (cont)



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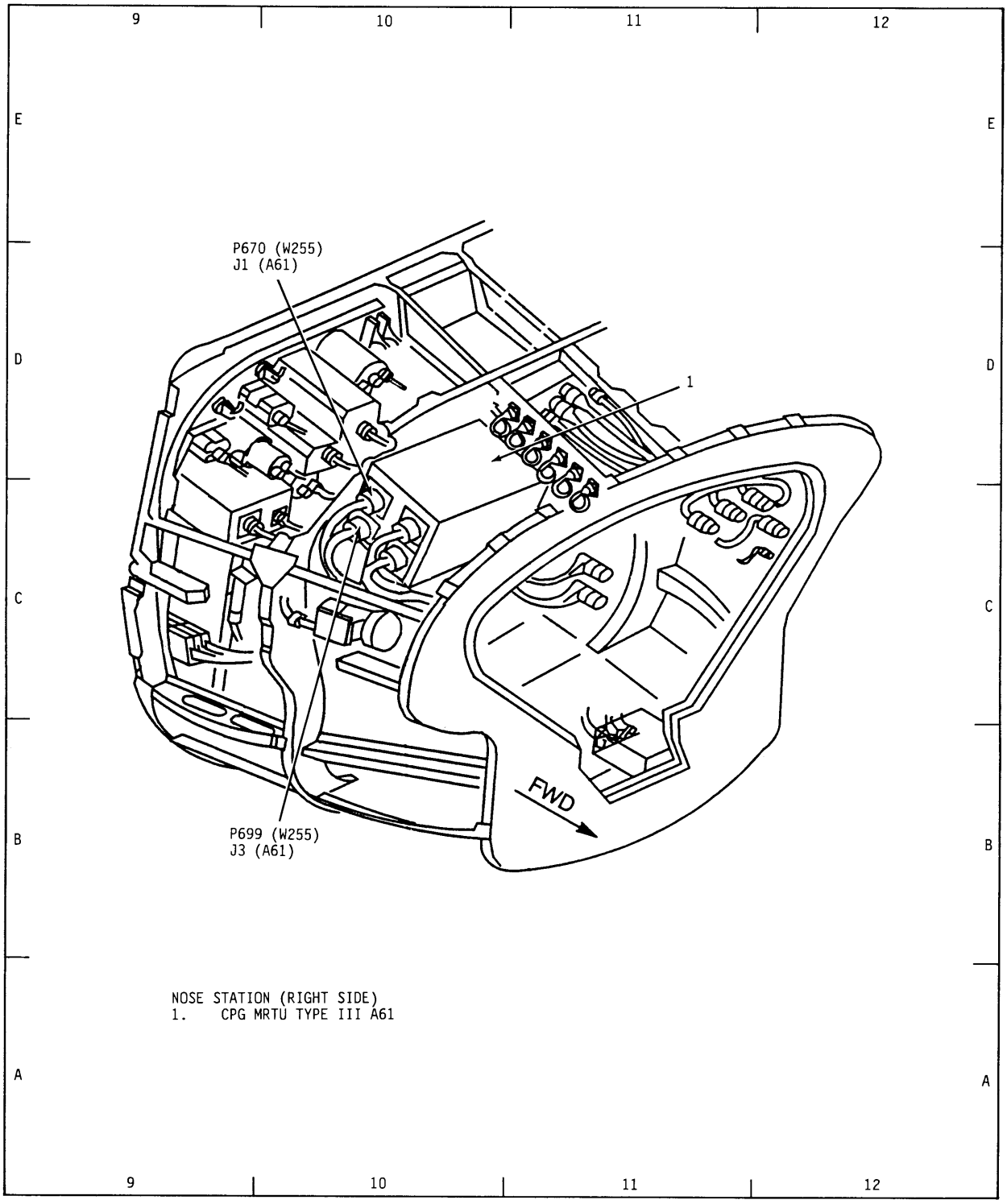
1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) (cont)



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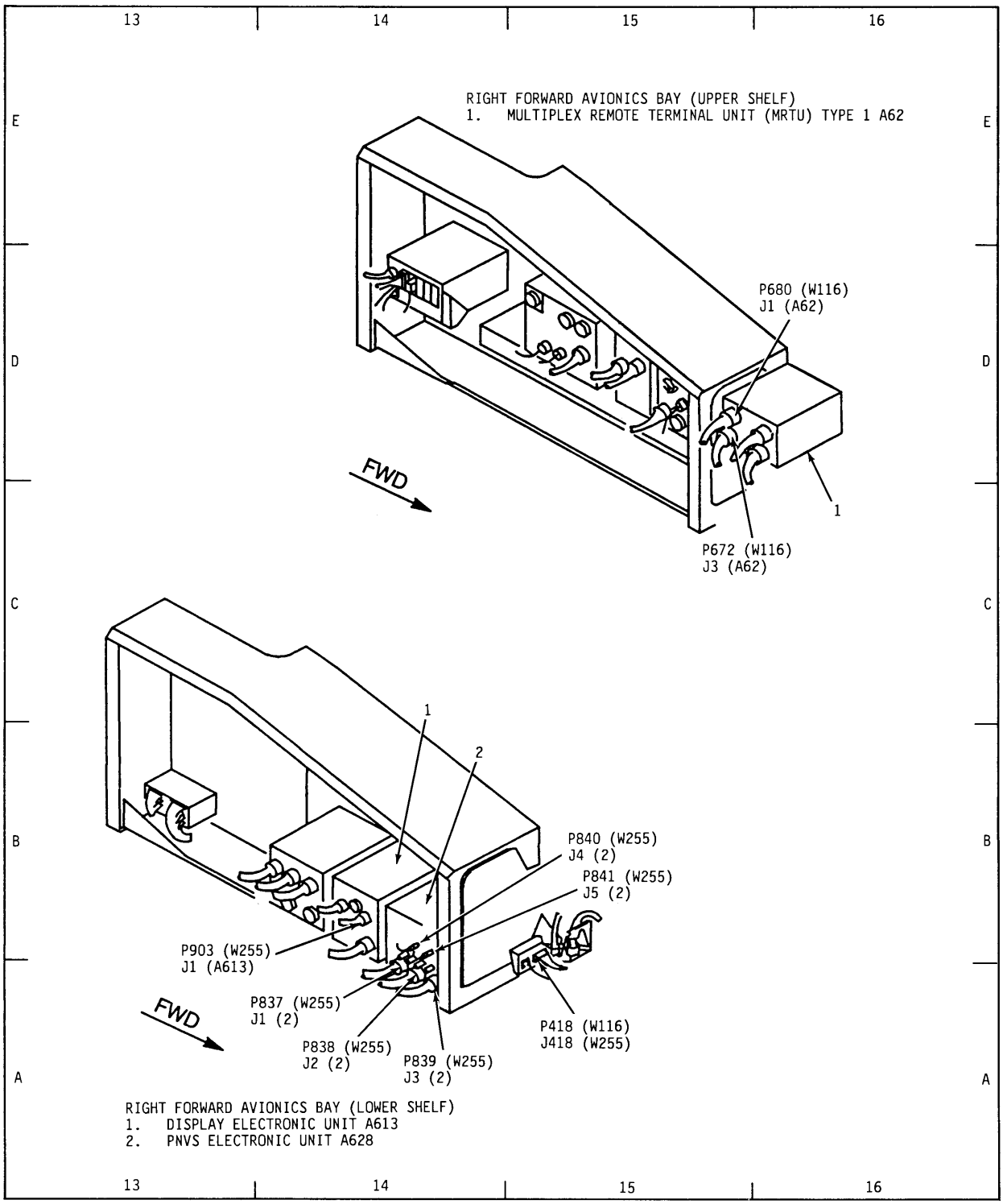
1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) (cont)



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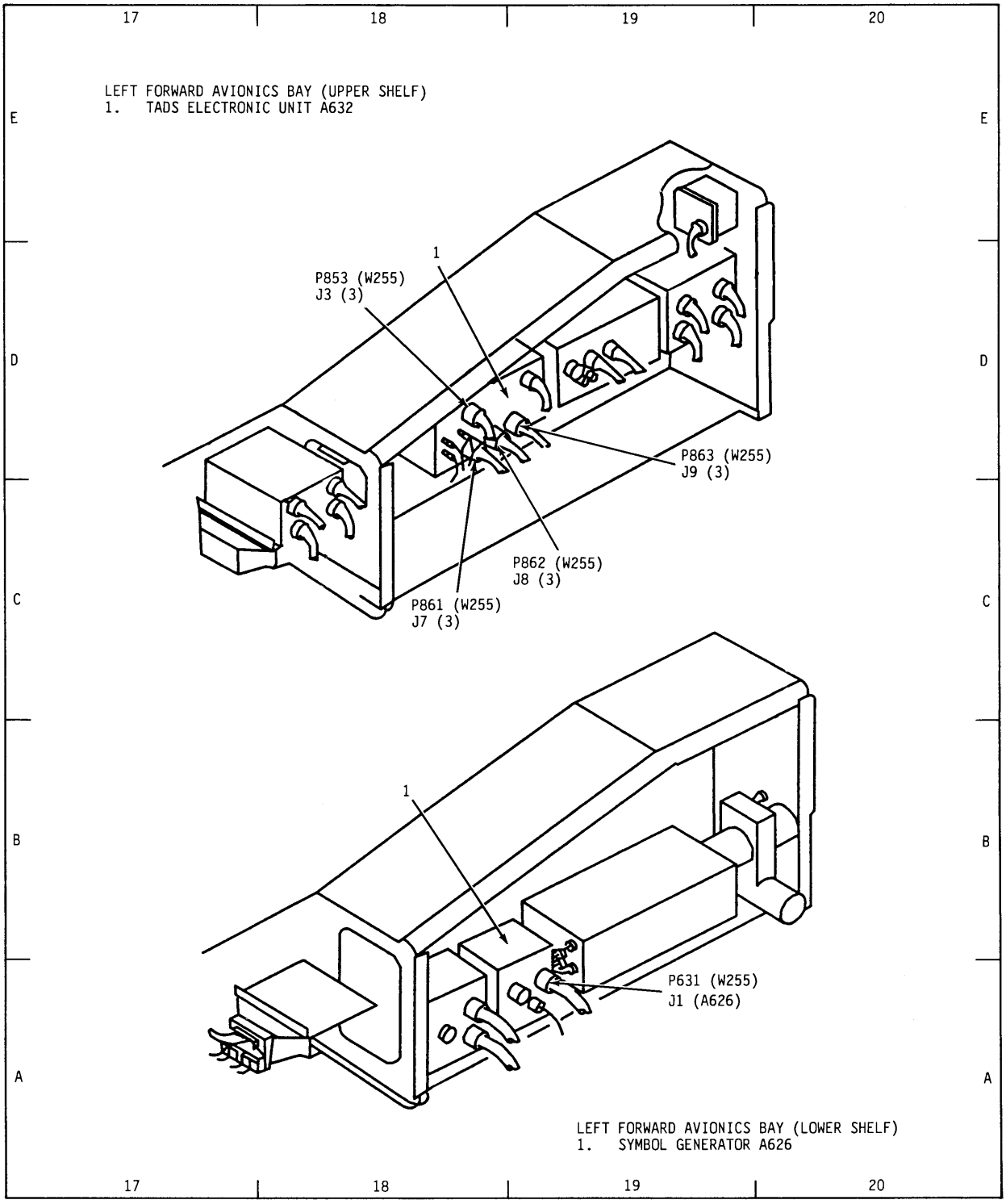
1-21. ELECTRICAL COMPONENT LOCATION AND CONFIGURATION (ECLC) (cont)



CHAPTER 2

THEORY OF OPERATION

Section I. GENERAL INFORMATION

2-1. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

a. Characteristics. The PNVS system uses a forward looking infrared (FLIR) sensor to see in the dark or in adverse weather, permitting the pilot to fly nap-of-the-earth and enhancing navigation at night or in adverse weather.

b. Capabilities.

(1) Can be slaved to follow pilot or copilot gunner (CPG) visual line-of-sight (LOS).

(2) Can be electronically fixed to look straight forward relative to the helicopter horizontal and vertical centerline (helicopter LOS).

(3) Provides pilot with a gun or rocket aiming capability at night or in adverse weather.

c. Features.

(1) Provides CPG with an alternate FLIR sight for the TADS.

(2) Contains anti-ice heaters to permit operation in adverse weather.

(3) Uses conditioned air from TADS environmental control system to enhance operation in adverse weather.

(4) Synchronizes television (TV) cameras in PNVS and TADS night sensor assemblies (NSA) and TADS day sensor assembly for jitter-free operation when switching from sensor to sensor.

(5) Contains built-in test (BIT) circuits to permit helicopter fault detection/location system (FD/LS) to troubleshoot to a line replaceable unit (LRU).

2-2. DESCRIPTION

The PNVS system is made up of the major components (fig. 2-1) listed below:

- PNVS Turret Assembly
- PNVS Electronic Control Amplifier
- Azimuth Drive Gimbal Assembly (PECA)
- PNVS Electronic Unit (PEU)

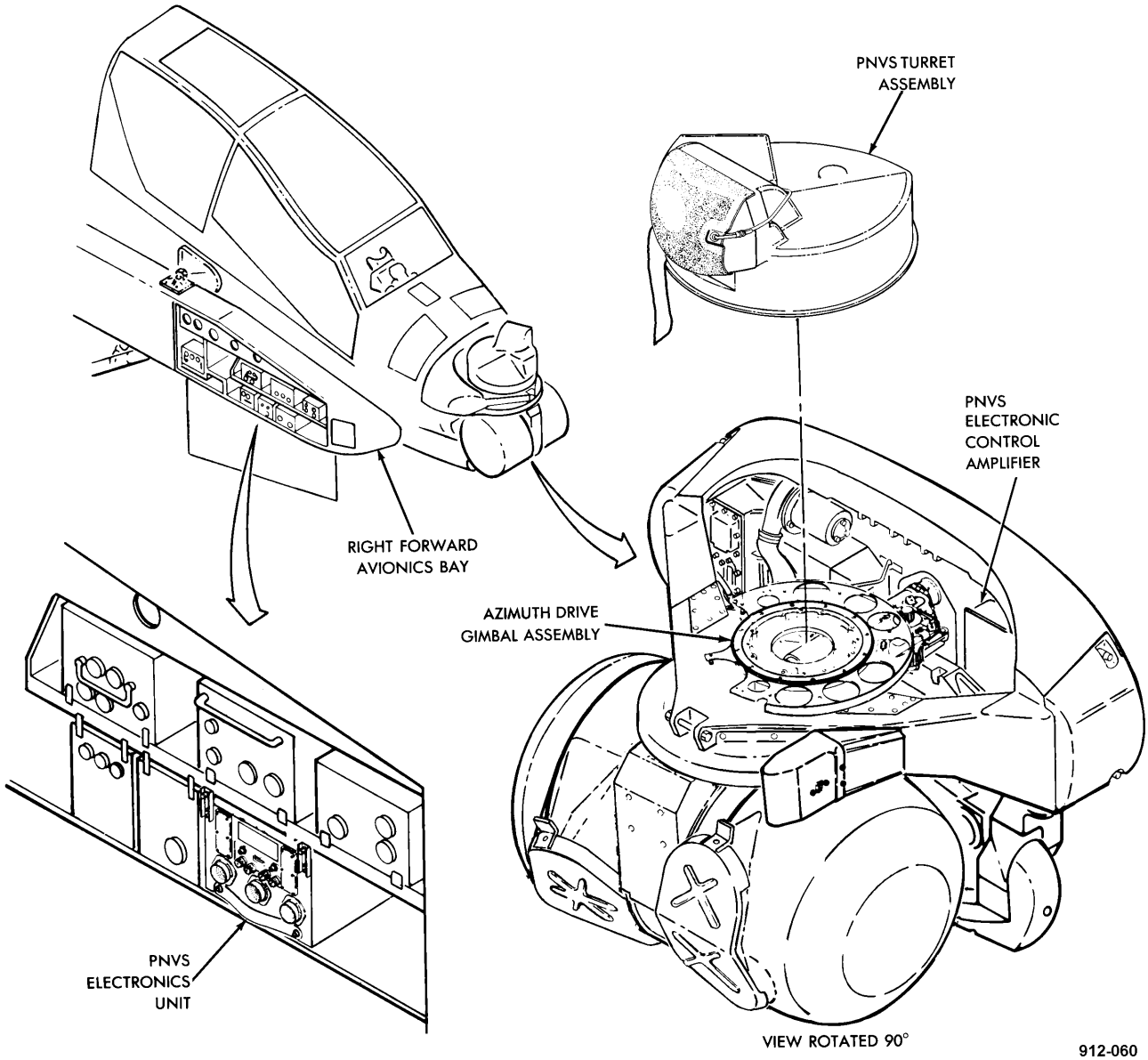


Figure 2-1. PNVS System Major Components

2-2. DESCRIPTION (cont)

a. PNVS Turret Assembly. The PNVS turret assembly is made up of the major components (fig. 2-2) listed below:

(1) Night Sensor Assembly. The night sensor assembly (NSA) is a FLIR detection system used for viewing during night and adverse conditions. The NSA contains FLIR common modules and elevation servo system components (elevation mirror assembly and afocal lens).

(2) PNVS Shroud Assembly. The PNVS shroud assembly is a waterproof and dustproof assembly that covers and protects the NSA. The germanium window permits infrared energy to enter the NSA. The PNVS window cover assembly protects the window when the PNVS is not being used or maintained.

(3) Rim Clenching Clamp. The rim clenching clamp secures the PNVS shroud assembly to the PNVS turret assembly. There are two types of rim clenching clamps, type I and type II. The difference between type I and type II is the latch and safety mechanism.

b. Azimuth Drive Gimbal Assembly. The azimuth drive gimbal assembly consists of a gear and an azimuth gimbal drive motor. The gear is the PNVS turret assembly mounting base. A rubber seal mates with the bottom of the turret assembly to prevent loss of conditioned air from the TADS environmental control system. The azimuth drive motor has a brake that locks the drive motor to prevent turret movement when the power is off.

c. PNVS Electronic Control Amplifier. The PNVS electronic control amplifier (PECA) processes elevation and azimuth command and drive signals for the PNVS servo system.

d. PNVS Electronic Unit. The PNVS electronic unit (PEU) processes video and interfaces input commands to apply power to the PNVS system and control servo loops.

e. TADS System Assemblies. The TADS system is used by PNVS. The following paragraphs give a brief description of TADS components as they relate to the PNVS. Refer to TM 1-1270-476-T for a description of these items.

(1) TADS Electronic Unit (TEU). The TEU provides the following functions:

- Signal processing and multiplex remote terminal unit (MRTU) interfacing for PNVS servo system.
- Signal processing, timing, and MRTU interfacing for PNVS portion of FD/LS.

(2) Optical Relay Tube (ORT) Assembly. The ORT assembly contains controls and electronics by which CPG selects and displays PNVS video on the heads out display (HOD) or heads down display (HDD).

(3) TADS/PNVS Brake Release Switch. The brake release switch is used to apply power to release the PNVS azimuth drive gimbal assembly brake. This allows the PNVS turret assembly to be manually positioned during maintenance.

2-2. DESCRIPTION (cont)

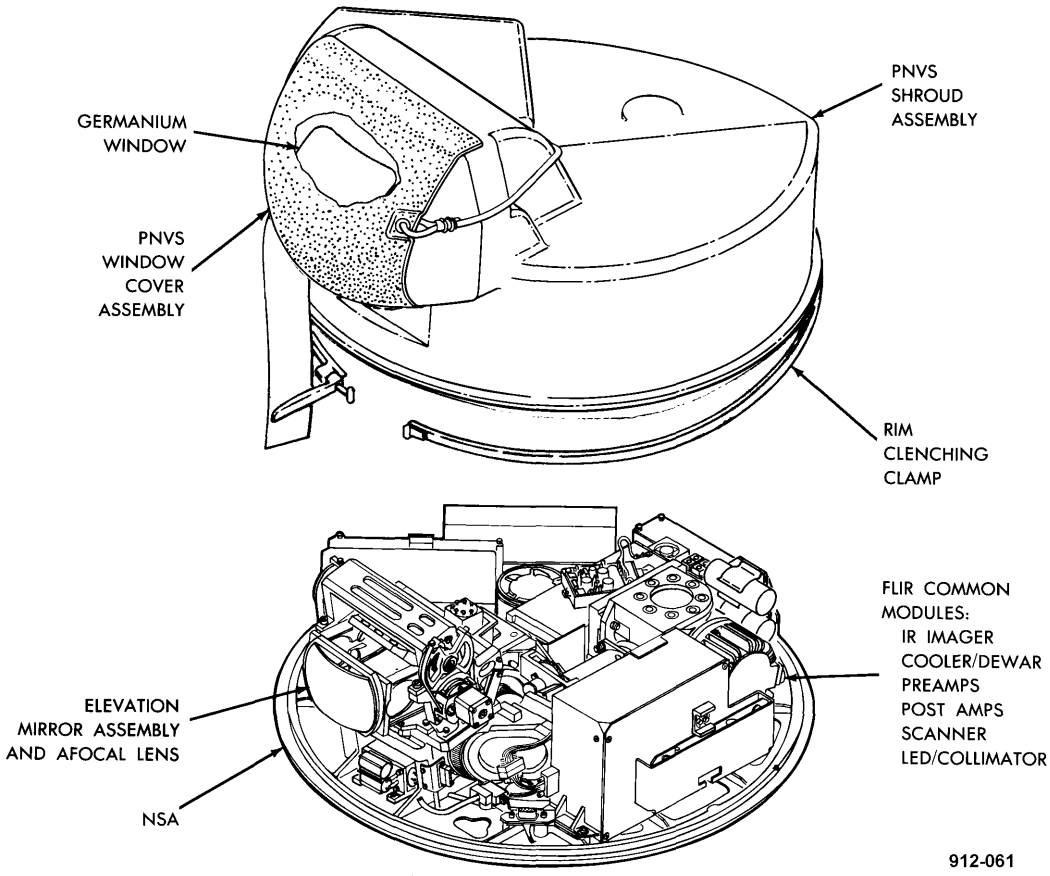


Figure 2-2. PNVS Turret Assembly Major Components

2-3. EQUIPMENT DATA

Azimuth viewing range from fixed forward position	90° cw and ccw
Azimuth stow position from fixed forward position	118° or greater ccw
Elevation viewing range from fixed forward position	20° up and 45° down
Field-of-view	30° by 40°
Maximum slew rate	120°/1.25 seconds
Maximum overshoot	2.4°
Electrical: 28 VDC	15 amperes
115 VAC, 400 Hz, 30	5 amperes
Weight: PNVS turret assembly	50 pounds
PNVS shroud assembly	12 pounds
PNVS electronic control amplifier	4 pounds
PEU	19 pounds
Azimuth drive gimbal assembly	11 pounds
Dimensions (in inches): PNVS turret assembly (DIA x H)	23 x 11
PNVS shroud assembly (DIA x H)	23 x 10
PNVS electronic control amplifier (L x W x H)	8 x 6 x 3
PEU (L x W x H)	12 x 10 x 8

2-4. SAFETY, CARE, AND HANDLING

a. Safety. The following precautions are necessary to ensure the safety of AVUM technicians working on PNVS equipment. For more safety precautions refer to TB 385-4, Safety Precautions for Maintenance of Electrical/Electronic Equipment.

(1) It is very important that TADS power is always off when any maintenance, except FD/LS functional check, is performed on the equipment. The reasons are -

- The TADS laser beam can cause serious eye injury or blindness.
- A TADS turret assembly rotating under power has enough force to cause serious bodily injury.

2-4. SAFETY, CARE, AND HANDLING (cont)

(2) The azimuth drive gimbal assembly motor is located above and behind the TADS turret assembly. This motor gets very hot (about 250°F (121.1°C)) during operation. The hot motor can cause serious burns. If the PNVS has recently been operated, use extreme care when reaching up and behind the TADS turret assembly.

(3) Electrical current passes through TADS and PNVS shroud windows during anti-ice operation. An electrical shock hazard exists on the window surfaces when the anti-ice circuits are energized. When TADS or PNVS are turned on, the anti-ice circuits can be energized; therefore, personnel must not touch the window surfaces when power is on.

(4) The anti-reflective coating on all infrared optics contains thorium fluoride which is slightly radio active. The only potential hazard involves ingestion (swallowing or inhaling) of this coating material. Dispose of broken lenses, etc., in accordance with AR 385-11. If the broken item is a shroud window, refer to TM 1-5855-265-20 before disposing of the item.

b. Care. Special care must be used to not touch optical surfaces of the PNVS or TADS. Do not clean optical surfaces routinely. Cleaning optics too often will wear away the special coating. Only clean optical surfaces when directed by your supervisor. Keep window cover on when PNVS is not being used or maintained.

c. Handling.

(1) Assemblies. When removing and installing assemblies, be careful not to bump one assembly into another or into any optics. Always grasp an assembly firmly to prevent dropping it.

(2) Shrouds. The PNVS shroud assembly window and housing are fragile and easily broken or damaged beyond AVIM repair capabilities. Use extreme care when handling the PNVS shroud assembly to prevent dropping or jarring the assembly. Put the PNVS shroud assembly on clean, soft material for temporary storage.

(3) Optical Relay Tube Assembly Controls. The ORT assembly control panel **GAIN, LVL, AND BRT,** and **SYH BRT** controls are easy to damage. If these controls are forced into mechanical stops, control shafts or knobs can be broken. To prevent damage, use care when adjusting these controls.

2-4. SAFETY, CARE, AND HANDLING (cont)

d. Special Environmental Conditions.

(1) Extreme Cold. When the outside (ambient) air temperature is -24 to +32°F (-31 TO 0°C), PNVS warmup time depends on ambient temperature. If the helicopter cockpit temperature is below +40°F (4.4°C) or the helicopter has been cold soaking for a period of time at that temperature or below, the helicopter environmental control system (ECS) must be turned on (para d(7) below) before PNVS is powered up. PNVS warmup is performed with PNVS in standby. The maximum allowable warmup is 40 minutes at an ambient temperature of -24°F (-31°C) and decreases linearly with increasing temperature to 15 minutes at +32°F (0°C). Maximum allowable warmup time is 15 minutes from +32 to +131°F (0 to 55°C). Specified performance is immediate on completion of warmup, provided FLIR cooldown is complete. When PNVS warmup requires less than the specified warmup time and is completed before FLIR cooldown, specified performance may be degraded until completion of FLIR cooldown.

(2) Extreme Heat. If the helicopter cockpit temperature is above +85°F (29.4°C) or the helicopter has been heat soaking for a period of time at that temperature or above, the helicopter ECS must be turned on (para d(7) below) before PNVS is powered up. PNVS warmup is described in paragraph d(1) above. Do not use plastic sheets to cover optics. When temperature is high, the plastic will outgas and contaminate the optics.

(3) High Winds. Do not remove PNVS turret assembly, window cover, or shroud assemblies in dry sandy areas when blowing sand or dust prevail. Sand and dirt will pit optical surfaces and damage mechanical components.

(4) Rain and Sow. Do not remove the PNVS turret assembly, window covers, or shroud assemblies during rain or snow. Rain or snow will damage exposed components of the aircraft interface assembly and turret assembly.

(5) Salt Air. Avoid removing PNVS turret assembly, window covers, or shroud assemblies when in salt air environments. Salt air deposits on optical surfaces will contaminate optical components. When a shroud assembly is removed, check optical surfaces for salt deposits and clean as necessary.

(6) Humidity. Keep reusable shipping and storage containers closed when not in use, even when empty. This will prevent the foam insert from absorbing moisture. Any time you are required to handle a container, look at the humidity indicator. If it indicates over 40% humidity, change the desiccant bags (TM 1-8145-476-23).

2-4. SAFETY, CARE, AND HANDLING (cont)

(7) Conditioned Air. For PNVS to meet specified performance requirements, cockpit temperature must be maintained at +40 to +85°F (4.4 to 29.4°C). If cockpit temperature is within limits, PNVS will operate to specified performance with an outside (ambient) temperature range of -24 to +131°F (-31 to 55°C). (Refer to para d(1) and d (2) above.) If the helicopter cockpit temperature is below +40 (4.4°C) or above +85°F (29.4°C) (or the helicopter has been cold or heat soaking for a period of time at or beyond those temperatures), PNVS performance will be degraded. The helicopter ECS must be turned on (TM 1-1520-238-23) to maintain proper environmental conditions. A closed loop system forces conditioned air over electronic units in each avionics bay, TADS turret, cockpit, and ORT assembly. When an assembly or electronic unit is removed, conditioned air will dump overboard through the opening. To prevent loss of conditioned air, cover the opening. This allows other assemblies and units to maintain proper operation and prevents damage.

2-5. MULTIPLEX READ CODES

PNVS and TADS communicate with the fire control computer (FCC). Block diagrams and wiring interconnects show multiplex read codes (status and control messages). The FCC uses these codes to issue instructions and determine system/line replaceable unit status. Refer to TM 1-1520-238-T-3 and use codes to troubleshoot PNVS.

Section II. THEORY OF OPERATION

2-6. PILOT NIGHT VISION SENSOR

The PNVS is a forward looking infrared (FLIR) sensor used to see in the dark or in adverse weather. The PNVS turret position is slaved to the pilot or copilot/gunner (CPG) integrated helmet and display sighting system (IHADSS). Paragraphs a and b below describe FLIR video and servo loops. Paragraph c gives a brief description of the fault detection/location system.

a. PNVS FLIR Video. The PNVS FLIR (fig. 2-3) is used to detect heat radiating images at night or in adverse weather conditions. The PNVS night sensor assembly (NSA) and PNVS electronic unit (PEU) process the infrared (IR) energy to produce a video output for display on IHADSS or the optical relay tube (ORT) assembly. FLIR polarity, gain, and level control signals are applied to the NSA from MRTU type I RH FAB or CPG MRTU type III. The PEU has two video outputs. One output is applied to the helicopter symbol generator where PNVS symbology is added to the video for display. If the symbol generator fails, the FCC switches from the symbol generator to the display electronic unit output. PNVS video from the display electronic unit will be displayed without symbology. When PNVS is on, TADS video is synchronized to the PEU horizontal and vertical blanking outputs. This allows sensor to sensor display switching without scrambling the video signals during switchover.

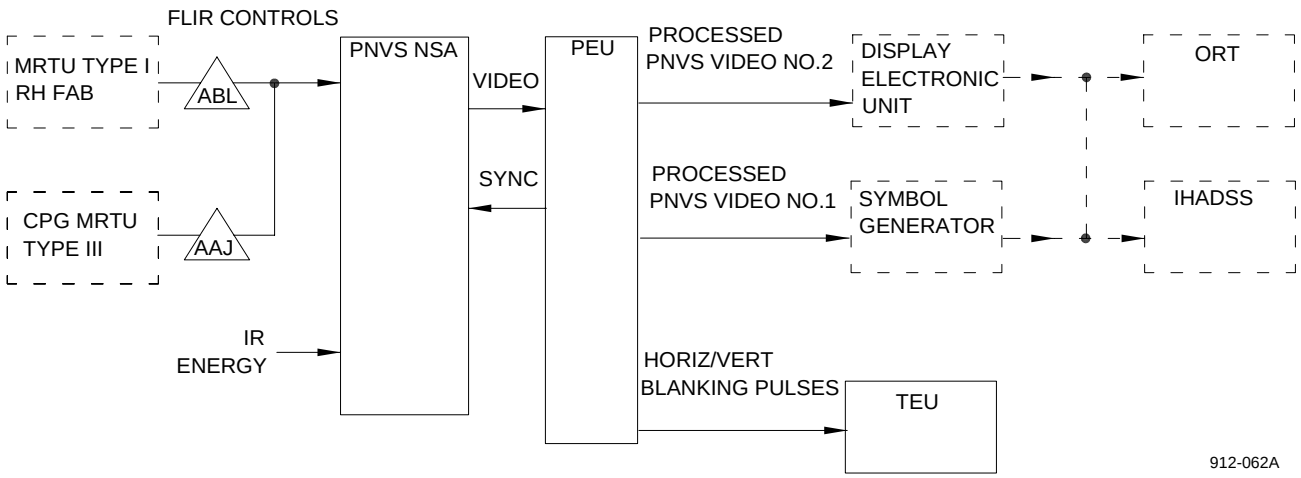


Figure 2-3. PNVS FLIR Video Block Diagram

2-6. PILOT NIGHT VISION SENSOR (cont)

b. PNVS Servo Loops. Movement of the PNVS in azimuth and elevation (fig. 2-4) is controlled by the position of the pilot or CPG IHADSS helmet mounted sight. There is no manual control for PNVS movement. The TEU processes the IHADSS position data and applies position inputs to the PEU. The PEU and the PNVS electronic control amplifier (PECA) process and amplify the inputs and apply them to an NSA elevation mirror and the PNVS azimuth drive gimbal assembly. The drive signals, along with rate and position feedback, cause movement so that the turret line-of-sight (LOS) corresponds to the generated LOS.

(1) If the TEU fails, PNVS DIRECT is applied to the PEU and the PECA. When the PNVS DIRECT signal is applied, PNVS turret movement is controlled by IHADSS and the PEU. In PNVS direct, azimuth coverage is limited to ±75° with degraded LOS accuracy. PNVS turret movement may become erratic beyond ±75°.

(2) If IHADSS video or position control commands fail, the helicopter video display unit control switch is set to **PLT** and the acquisition switch is set to **NVS.** This displays the PNVS image on a fixed panel without azimuth or elevation correction.

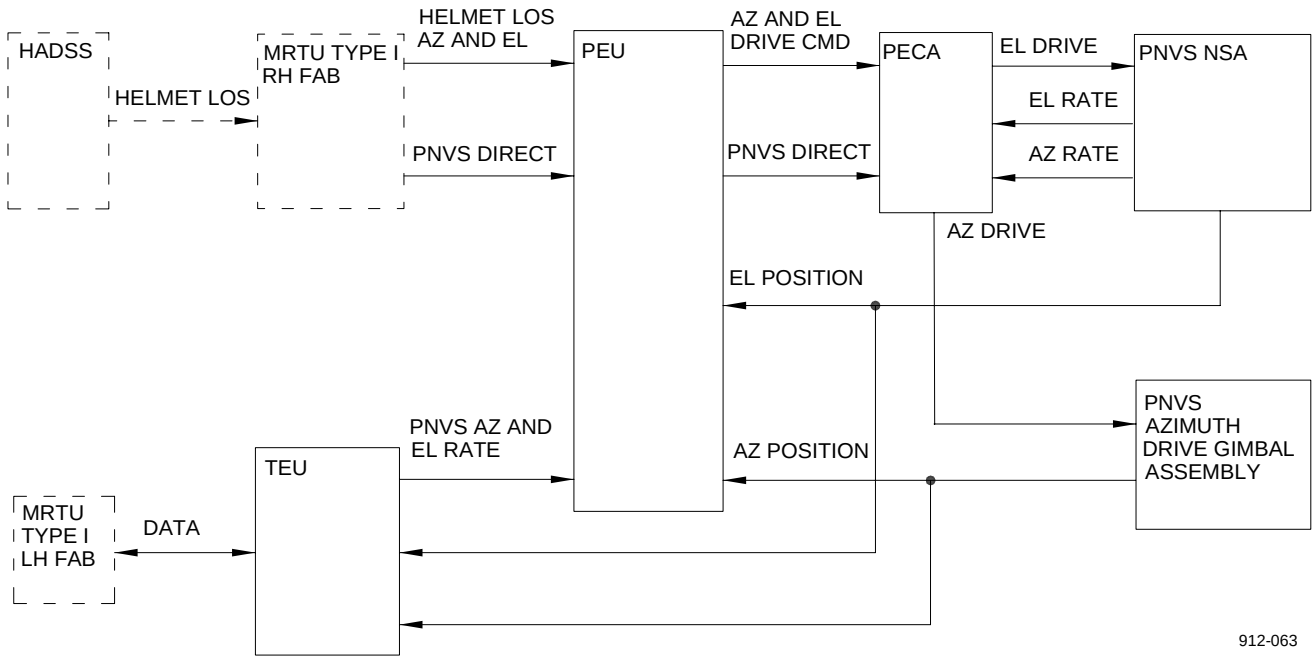


Figure 2-4. Azimuth and Elevation Servo Loops Block Diagram

2-6. PILOT NIGHT VISION SENSOR (cont)

c. Fault Detection/Location System (FD/LS). The fault detection/location system (FD/LS) is a built-in test (BIT) used to detect faults in PNVS assemblies and verify repair after maintenance. There are three parts of FD/LS: start-up, continuous, and initiated.

(1) Start-up BIT is performed immediately when power is first applied to the TADS system. This BIT checks out critical computer functions.

(2) Continuous BIT is on when PNVS or TADS operate power is on. This BIT monitors overall system functions.

(3) Initiated BIT requires operator action to perform. The operator enters a code to test the PNVS system. Some of these tests require the operator to perform certain tasks. These tasks are displayed on the HOD or HDD.

2-7. AC/DC POWER CONTROL AND POWER BIT

The following paragraphs describe power control and BIT used for PNVS standby, operate, and power down with TADS power off. See block diagram (fig. 2-5) and wiring interconnect diagram (fig. 3-32).

a. Standby. PNVS is in standby when the pilot station fire control panel SIGHT SEL switch is set to **STBY** and the **PNVS** switch is set to **PNVS.** Controls and voltage are applied to TADS and PNVS assemblies as follows:

(1) The fire control panel applies a sight select standby input to MRTU type I LH FAB.

(2) MRTU type I LH FAB applies a logic 1 PNVS STANDBY to the TADS power supply and to the PEU through MRTU type I RH FAB.

(3) Environmental control system (ECS) operating voltage is applied to the ECS blower and duct heaters (TM 1-1270-476-T).

(4) PNVS standby voltages are applied to PNVS assemblies as described in paragraphs 2-8 and 2-9 below.

(5) A PEU delayed operate timer starts when the standby input is applied. The PNVS DELAYED OPERATE output is logic 0 for approximately 1 minute and changes to a logic 1 after the delay.

2-7. AC/DC POWER CONTROL AND POWER BIT (cont)

b. Operate. PNVS is in operate when the pilot station fire control panel SIGHT SEL switch is set to NVS and the PNVS switch is set to PNVS. Controls and voltage are applied to TADS and PNVS assemblies as follows:

(1) The fire control panel applies a sight select operate input to MRTU type I LH FAB and a PNVS ON input to MRTU type I RH FAB.

(2) MRTU type I LH FAB applies a logic 1 PNVS OPERATE to the TADS power supply and to the PEU through MRTU type I RH FAB (TM 1-1270-476-T).

(3) The TADS power supply applies a logic 1 PNVS OPERATE CMD to the TEU.

(4) The TADS power supply applies a logic 1 PNVS OPERATE CMD to the TEU.

(5) PNVS operating voltages are applied to PNVS assemblies as described in paragraphs 2-8 and 2-9.

(6) While PNVS DELAYED OPERATE is logic 0 to the TEU, the PNVS turret is not allowed to move out of stow by the TEU. After the time delay has elapsed, PNVS DELAYED OPERATE changes to a logic 1 and the PNVS turret is commanded to fixed forward by the TEU. (Refer to paragraph 2-11.)

c. Power Down. PNVS is powered down when the pilot station fire control panel SIGHT SEL switch is set to STBY and the PNVS switch is set to OFF. The TEU commands the PNVS turret to stow before power is removed from PNVS assemblies and the TEU. For the TEU and PNVS to operate for the length of time required to stow the PNVS turret and the TEU to store data, logic 0 standby and operate commands to the PEU and TADS power supply are overridden by logic 1 PNVS and TADS STOW COMPLETE inputs. After the PNVS turret is stowed and the TEU stores data, the PNVS and TADS STOW COMPLETE inputs to the PEU and TADS power supply are changed to logic 0, and power is removed from PNVS assemblies and the TEU.

d. Power Built-In Test (BIT). BIT circuits monitor PNVS OPERATE CMD, PNVS DELAYED OPERATE, PNVS COOLER OVERCURRENT, and PEU power supply DC voltage outputs (PNVS POWER). FD/LS periodically monitors the BIT functions described below during continuous BIT.

(1) When the TEU reads a logic 1 PNVS OPERATE CMD during normal operation, the TEU delays 1 minute and reads a logic 1 PNVS DELAYED OPERATE input. If the PNVS DELAYED OPERATE input is a logic 0, the TEU sends a PNVS ELECTRONIC UNIT NO-GO RH FAB fail message to MRTU type I LH FAB on the serial interface bus. After the PNVS DELAYED OPERATE command becomes a logic 1, the condition will remain set as long as the PEU PNVS STANDBY input is logic 1.

2-7. AC/DC POWER CONTROL AND POWER BIT (cont)

(2) PEU BIT circuits monitor the PEU power supply DC voltage outputs and apply a logic 1 PEU PNVS POWER output to the TEU when all voltages are within tolerance. During normal operation, after the PEU operate delay time has elapsed, the TEU reads a logic 1 PNVS OPERATE CMD, delays 3.6 seconds, reads a logic 1 PNVS DELAYED OPERATE, then reads a logic 1 PNVS POWER input. A logic 0 PNVS POWER input to the TEU, with the condition just described, will cause the TEU to send a PNVS ELECTRONIC UNIT NO-GO RH FAB fail message to MRTU type I LH FAB on the serial interface bus. A PNVS ELECTRONIC UNIT NO-GO RH FAB fail message will be sent to MRTU type I LH FAB when the TEU reads a logic 0 PNVS OPERATE CMD, delays 3.6 seconds, then reads a logic 1 PNVS POWER input.

(3) PEU BIT circuits monitor the PNVS night sensor assembly cooler/dewar and fan current and apply a logic 1 PNVS COOLER OVERCURRENT input to the TEU during normal operation. If too much current is detected, a PEU 14 second delay relay energizes and disconnects the AC voltage from the PNVS night sensor cooler/dewar and fan. A logic 0 PNVS COOLER OVERCURRENT input is applied to the TEU for the overcurrent condition. A PNVS TURRET NO-GO fail message will be sent to MRTU type I LH FAB when the TEU reads a logic 0 PNVS COOLER OVER CURRENT input.

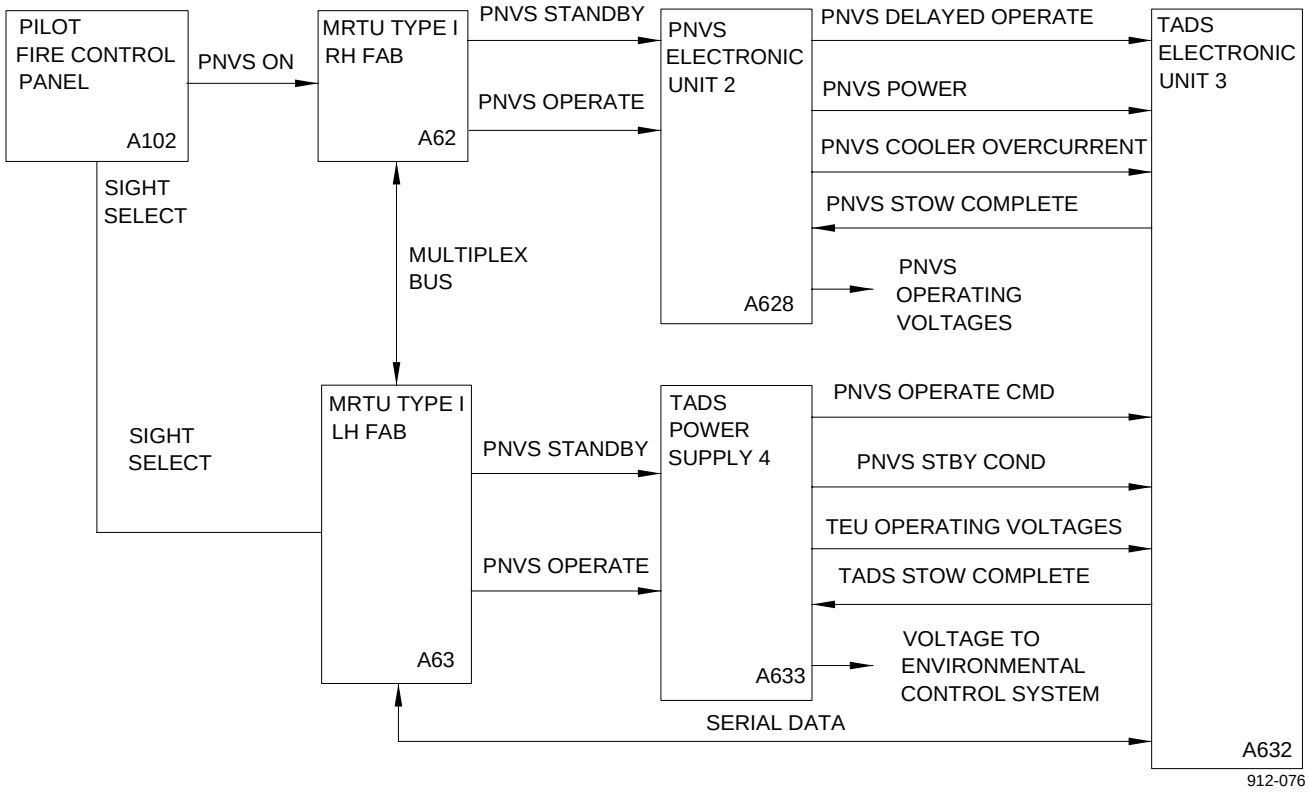


Figure 2-5. AC/DC Power Control and Power BIT Block Diagram

2-8. AC POWER DISTRIBUTION

AC voltage is applied to PNVS assemblies through the PEU when PNVS is in standby (para 2-7 above). See block diagram (fig. 2-6) and wiring interconnect diagrams (fig. 3-33 and 3-34).

a. Aircraft 115 VAC. Unstitched aircraft 115 VAC is applied to the PEU from pilot station forward circuit breaker panel **MISSION PNVS AC** circuit breaker CB81 through the electrical power distribution box.

b. PNVS Electronic Unit AC Outputs. When PNVS STANDBY is applied to the PEU, AC voltage is applied to PNVS and TADS assemblies as follows:

(1) Aircraft 115 VAC ØA is switched to the PNVS night sensor assembly cooler/dewar and fan through the PEU power frame assembly and BITE/control CCA.

(2) A PEU power frame assembly step-down transformer 26 VAC output (gyro excitation and pickoff reference) is applied to the PNVS night sensor assembly azimuth and elevation gyros.

(3) A PEU power frame assembly step-down transformer 26 VAC output (resolver reference) is applied to the PNVS night sensor assembly elevation mirror resolver, PNVS azimuth drive gimbal assembly resolver, and the TEU resolver to digital CCA 3A12.

(4) A PEU power frame assembly isolation transformer 115 VAC ISOLATED output (operating voltage) is applied to the PNVS elapsed time indicator, PNVS azimuth drive gimbal assembly drive motor, and PECA.

2-8. AC POWER DISTRIBUTION (cont)

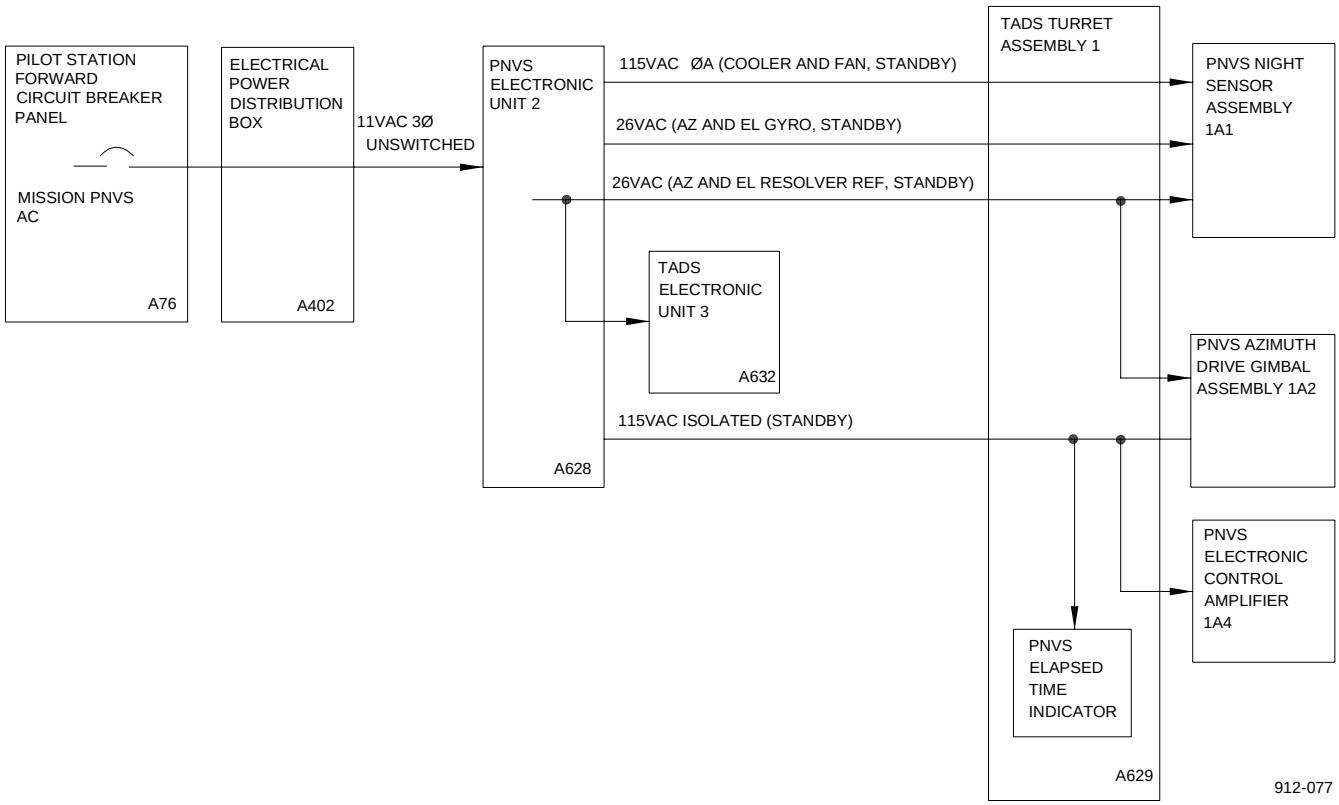


Figure 2-6. AC Power Distribution Block Diagram

2-9. DC POWER DISTRIBUTION

Aircraft 28 VDC and PEU DC output voltages are applied to PNVS assemblies in standby and operate (para 2-7). See block diagram (fig. 2-7) and wiring interconnect diagrams (fig. 3-35, 3-36 and 3-37.

a. Aircraft 28 VDC. Unswitched aircraft 28 VDC is applied to the PEU from pilot station forward circuit breaker panel MISSION PNVS DC circuit breaker CB61 through the electrical power distribution box. When the operate input is applied to the PEU, aircraft 28 VDC is switched to PNVS assemblies as follows:

(1) PECA for operating voltage. The 28 VDC is switched by the PECA to the brake release switch (para 2-12).

(2) PNVS NSA electronic component assembly to switch 15 VDC standby to the visual multiplexer assembly.

b. PNVS Electronic Unit Standby DC Outputs. When PNVS STANDBY is applied to the PEU, PEU regulated DC voltages are applied to PNVS assemblies as follows:

(1) 15 VDC is applied to PNVS NSA electronic component assembly 1A1A40. When PNVS is in operate, the 28 VDC input to 1A1A40 switches the 15 VDC input to the visual multiplexer assembly.

(2) 5 VDC is applied to the PNVS NSA elevation mirror and afocal lens assembly.

(3) ±15 VDC are applied to the PECA.

c. PNVS Electronic Unit Operate DC Outputs. When PNVS OPERATE is applied to the PEU, PEU regulated DC voltages are applied to PNVS NSA FLIR assemblies as follows:

(1) 14.4 and -11 VDC are applied to the post amplifiers.

(2) ±15.3 VDC are applied to post amplifier, scan interlace, and focus control CCAs.

2-9. DC POWER DISTRIBUTION (cont)

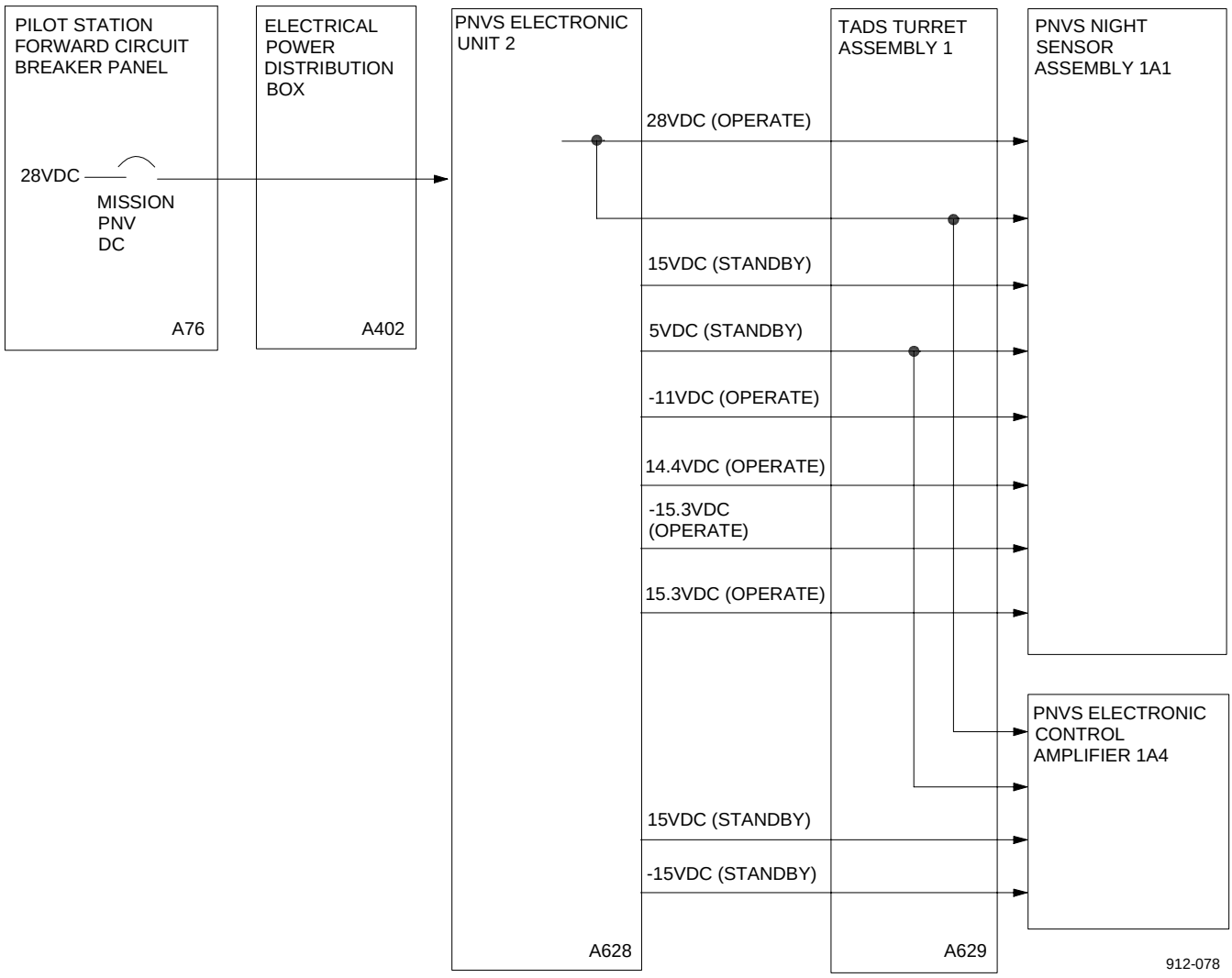


Figure 2-7. DC Power Distribution Block Diagram

2-10. NIGHT SENSOR VIDEO

The PNVS receives an IR image, scans and detects the image, and processes the image to produce electronic video outputs to the display electronic unit and symbol generator. The PEU produces video timing and synchronization for the video circuits. When PNVS is on, the PEU sends horizontal and vertical blanking signals to the TEU. The blanking signals synchronize TADS video timing to the PNVS video. This stabilizes the video display when sensors are switched. One video frame consists of 875 horizontal lines and is displayed at a rate of 60 frames/second. See video block diagram (fig. 2-8), night sensor block diagram (fig. 2-9), and wiring interconnect diagrams (fig. 3-39 and 3-40).

a. Video Control.

(1) Gain and Level. FLIR gain and level are adjusted or set to fixed levels with pilot station fire control panel controls. If the CPG is using PNVS, ORT assembly controls are used to adjust the gain and level. Gain and level DC analog inputs, from the MRTU to ACM CCA 1A1A21, vary with the pilot station or CPG control settings. A logic 1 AUTO/MAN input to the PNVS NSA reduces the range of variable inputs and selects fixed gain and level voltages on ACM CCA 1A1A21. Gain and gated level outputs from ACM CCA 1A1A21 are applied to PNVS NSA post amplifiers to control video level.

(2) Polarity. White or black hot images are selected with the pilot or CPG station collective control stick **PLRT/BRSIT HMD** switch. With the switch set to off, a logic 1 is applied to the PNVS night sensor assembly FLIR PLRT input from the MRTU and white hot images are selected. With the switch set to **PLRT,** a logic 0 is applied and black hot images are selected. The PLRT output from ACM CCA 1A1A21 is applied to PNVS NSA post amplifiers to select polarity.

b. FLIR. The PNVS NSA receives an IR image, scans and detects the IR image, produces a visible light image, and processes the visible light image to produce an electronic video output.

(1) IR Image Detection. An IR image enters the NSA through the elevation mirror and afocal lens assembly. The image is scanned and reflected by the scanner mirror to the cooler/dewar assembly through the IR imager and focusing assembly. To maintain proper focus with changes in temperature, IR imager mass temperature controls the position of a focusing assembly focus wedge through the focus control CCA. The image is detected by the cooler/dewar assembly and changed to analog detector outputs.

2-10. NIGHT SENSOR VIDEO (cont)

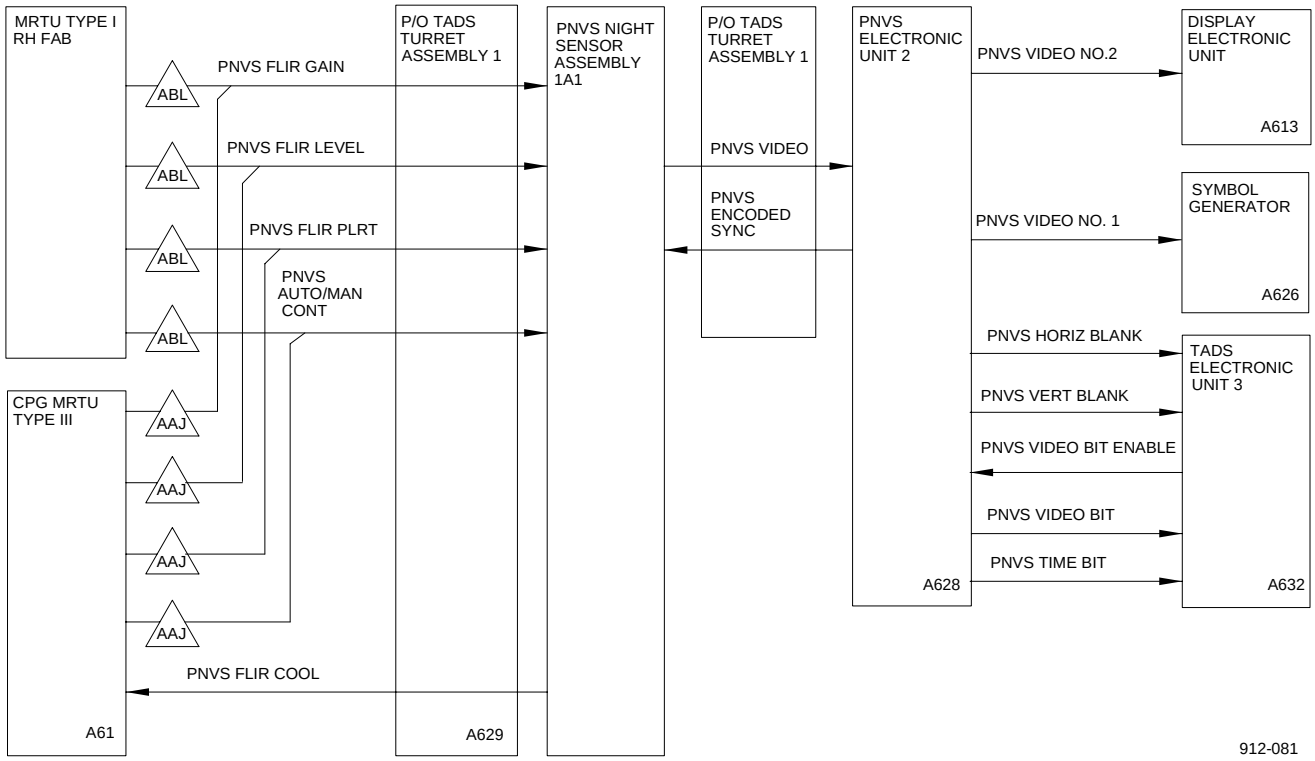


Figure 2-8. Video Block Diagram

2-10. NIGHT SENSOR VIDEO (cont)

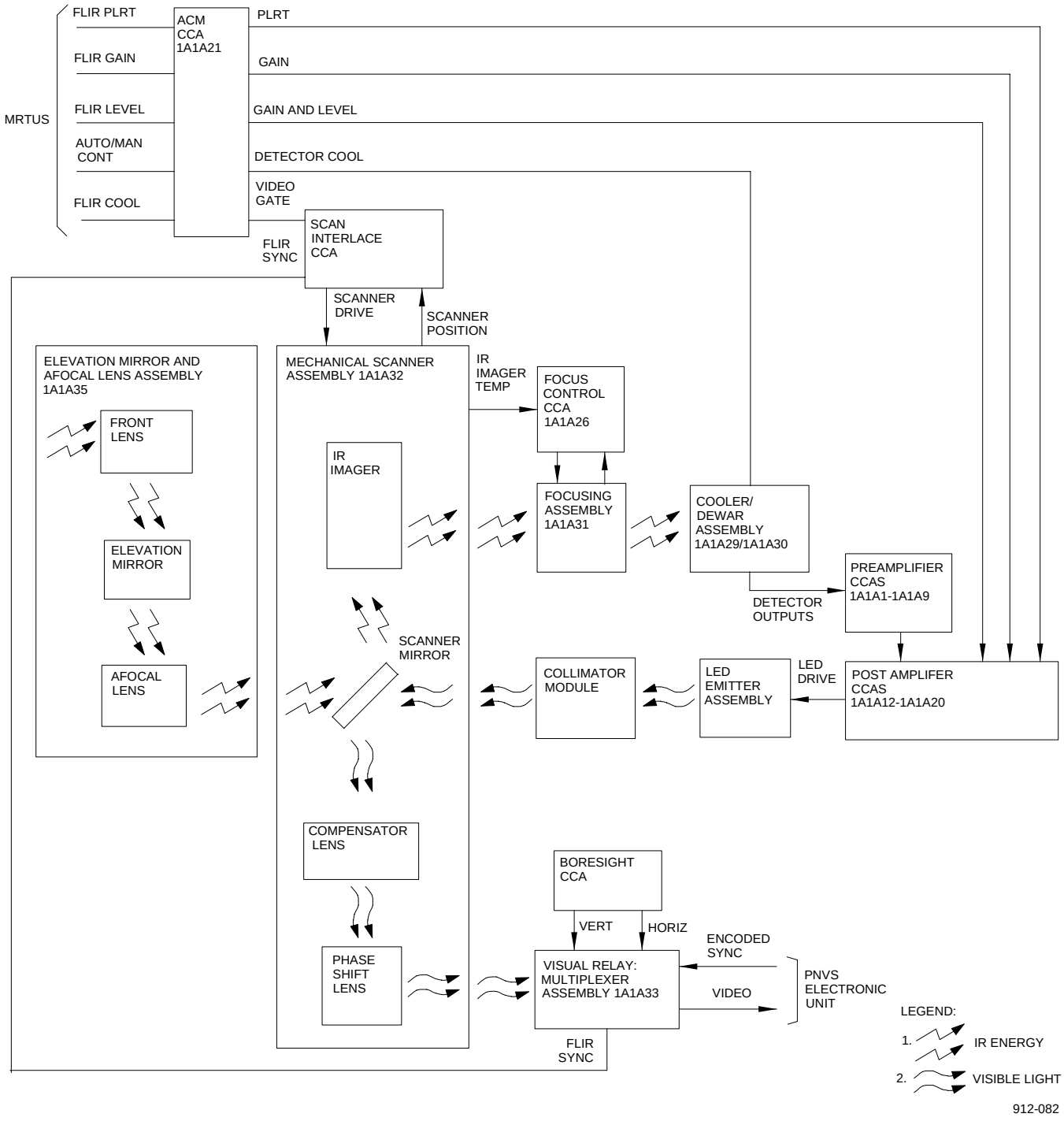


Figure 2-9. Night Sensor Assembly Block Diagram

2-10. NIGHT SENSOR VIDEO (cont)

(a) For the cooler/dewar assembly detectors to work properly and detect small variations in IR levels, the detector array is cooled to 77 K (-244°F (-153°C)). When the correct temperature is reached, a logic 0 FLIR COOLED output is applied to the CPG MRTU type III. A FLIR NOT COOLED message is displayed until the logic 0 input is applied. AC voltage used to drive the cooler is applied when PNVS is in standby.

(b) The cooler/dewar assembly detector array consists of 180 detectors. The IR image is scanned across the array and each detector output represents one horizontal video line (channel). To produce 360 horizontal lines for each video frame, the scanner mirror is driven to two vertical positions. A different part of the image is horizontally scanned across each detector in each vertical position. The scanner mirror drive is synchronized to the video output. The detector outputs vary in amplitude as the scanned IR level changes. The detector outputs are amplified to usable levels by preamplifiers and post amplifiers before they are applied to the light emitting diode (LED) emitter assembly.

(2) Conversion to Visible Light. The light emitting diode (LED) emitter assembly converts post amplifier LED drive outputs to visible light. Red LEDs are illuminated to produce a visible light image for the visual relay/multiplexer assembly. The LED emitter visible light output is collimated then reflected by the scanner mirror through the compensator lens and phase shift lens to the visual relay/multiplexer assembly. Like the cooler/dewar detector and scanner detect the IR image, the LED emitter assembly and the scanner work together to produce the visible light image.

(3) Video Output. The visual relay/multiplexer assembly 1A1A33 is a camera used to change the visible light image to an electronic video output. Assembly 1A1A33 also processes the ENCODED SYNC input from the PEU to synchronize scanner mirror operation. Horizontal and vertical outputs from the boresight CCA are adjusted to center the video output. PNVS system boresight is accomplished through azimuth and elevation servo loop control corrections.

c. Video Built-In Test (BIT). PNVS video timing signals are monitored during continuous BIT. Video processing circuits are tested during PNVS initiated BIT. See block diagram (fig. 2-8) and wiring interconnect diagram (fig. 3-41).

(1) Video Timing BIT. PEU video timing signals are monitored by BIT and the PNVS TIMING BIT output is read by the TEU during continuous BIT. If the PEU is generating all video timing signals, the PNVS TIME BIT output is logic 0. If the TEU reads a logic 1 output, a PNVS ELECTRONIC UNIT NO-GO RH FAB message is sent to the MRTU type I LH FAB on the serial interface bus.

2-10. NIGHT SENSOR VIDEO (cont)

(2) Video Processing BIT. PEU video processing circuits are tested during PNVS initiated BIT. To initiate the test, the TEU applies a logic 1 to the PEU PNVS VIDEO BIT ENABLE INPUT. (If a PNVS DIRECT MODE NO. 1 input is applied to the PEU, the test will not be initiated.) After the test is initiated, the PEU applies a synthetic video signal to video processing circuits. The synthetic signal produces adjacent black and white squares on a gray background. The PNVS VIDEO NO. 2 output is applied to black, gray, and white level sample-and-hold and window comparator circuits and to a video sync test circuit. If the levels are good and the sync test output is good, a logic 1 is applied to the PEU VIDEO BIT output. Ten seconds after the TEU initiates the video processing BIT test, the TEU reads the PEU VIDEO BIT output. If the output is logic 0, the TEU sends a PNVS ELECTRONIC UNIT NO-GO RH FAB fail message to the MRTU type I LH FAB on the serial interface bus.

2-11. AZIMUTH AND ELEVATION SERVO LOOPS

a. Servo Control. Movement of the PNVS in azimuth and elevation is controlled by the position of the pilot or CPG IHADSS helmet mounted sight. There is no manual control for movement of the PNVS.

(1) Normal Operation. The PNVS DIRECT MODE NO. 1 and P STOW CMD inputs to the PEU control servo mode of operation. See block diagram (fig. 2-10) and wiring interconnect diagram (fig. 3-42). During normal operation, the PNVS DIRECT MODE NO. 1 output from MRTU type I is logic 1 and the P STOW CMD output from the TEU is a logic 0.

(2) PNVS Direct. If the TEU fails, a logic 0 PNVS DIRECT MODE NO. 1 is applied to the PEU by MRTU type I RH FAB. A logic 0 DIRECT TO TORQUE output from the PEU is applied to the PECA. When the PNVS DIRECT signal is applied, PNVS turret movement is controlled by the IHADSS through MRTU type I RH FAB and servo feedback through the PEU. In PNVS direct, azimuth coverage is with degraded LOS accuracy. PNVS turret movement may If IHADSS video or position control commands fail, the video display unit control switch is set to **PLT** and the acquisition switch is set to **NVS.** This displays the PNVS image on a fixed panel without azimuth or elevation correction.

(3) PNVS Stow. The PNVS turret is in stow when power is applied to PNVS and commanded back into stow when PNVS is in standby or power is removed using normal power-down procedures. After power is applied to PNVS, delayed operate time has elapsed, and PNVS is in operate (para 2-7), the P STOW CMD output from the PEU changes from a logic 1 to a logic 0. This, along with drive commands from the TEU, commands the PNVS turret out of stow to a fixed forward position. When PNVS is set to standby, the P STOW CMD output from the PEU changes from a logic 0 to a logic 1 and the PNVS turret is commanded to the stow position.

2-11. AZIMUTH AND ELEVATION SERVO LOOPS (cont)

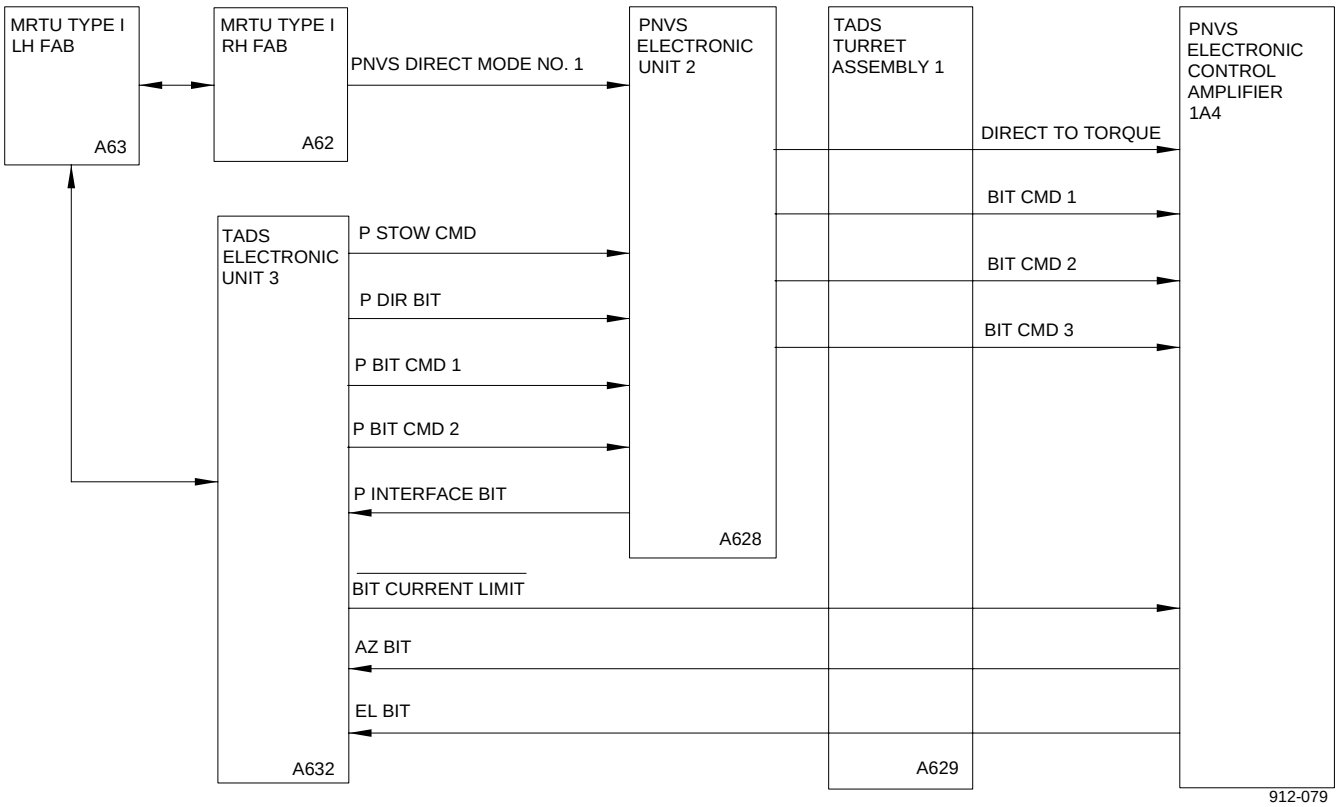


Figure 2-10. Servo Control and BIT Block Diagram

2-11. AZIMUTH AND ELEVATION SERVO LOOPS (cont)

b. Azimuth and Elevation Servo Loops. IHADSS generates azimuth and elevation LOS position signals that are applied to the TEU through the MRTU type I LH FAB serial interface. The TEU processes the IHADSS position data and applies position inputs to the PEU. The PEU and the PECA, process and amplify the inputs and apply them to a NSA elevation mirror and the PNVS azimuth drive gimbal assembly. The drive signals, along with rate and position feedback, move the turret LOS to the generated LOS. See block diagram (fig. 2-11) and wiring interconnect diagrams (fig. 3-34 and 3-44).

(1) Normal Operation. During normal operation, the TEU compares the IHADSS position to azimuth and elevation resolver P SIN/COS AZ and EL outputs and produces PNVS AZ and EL RATE DC analog voltages that are relative to the error between IHADSS and turret position. The PNVS AZ and EL RATE DC analog voltages are processed by the PEU and are applied to the PECA AZ and EL SERVO inputs. The EL SERVO DC analog input is amplified by the PECA and applied to the PNVS NSA elevation drive motor ELEVATION DRIVE input. The AZ SERVO DC analog input controls the amplitude of PECA AC amplifier AZIMUTH ∠ ±90° outputs. The AZIMUTH ∠ ±90 ° azimuth drive gimbal assembly drive motor. The elevation mirror assembly and azimuth drive gimbal assembly are driven until the azimuth and elevation resolver outputs are at the IHADSS position. Turret movement is stabilized using elevation and azimuth gyro AZIMUTH and ELEVATION RATE outputs. Both gyros are located in the PNVS NSA. The gyro rate outputs are a result of commanded turret rate and helicopter movement. The outputs are algebraically summed with AZ and EL SERVO inputs in the PECA to stabilize turret movement. The TEU also monitors the resolver outputs to determine when the turret is nearing mechanical limits. When a limit is approached, the TEU sends a limits message to the MRTU type I LH FAB. The PNVS AZ RATE output is reduced by the TEU to prevent the azimuth drive gimbal assembly from driving into a mechanical stop too hard. Elevation mirror assembly optical couplers produce ELEVATION UP and DOWN LIMIT inputs to the PECA and directly reduce ELEVATION DRIVE when a limit is approached.

(2) PNVS Direct. If the PNVS is commanded to direct mode as described in paragraph a above, the PEU controls the servo loops. The PEU compares IHADSS position HSY and HSZ LOS AZ and EL ANGLE DC analog inputs from MRTU type I RH FAB to azimuth and elevation resolver AZ and EL SIN/COS PSI outputs. The PEU produces PNVS AZ AND EL RATE DC analog voltages that are relative to the error between IHADSS and turret position. All other turret positioning functions are the same as described above with degraded operation as described in paragraph a above.

2-11. AZIMUTH AND ELEVATION SERVO LOOPS (cont)

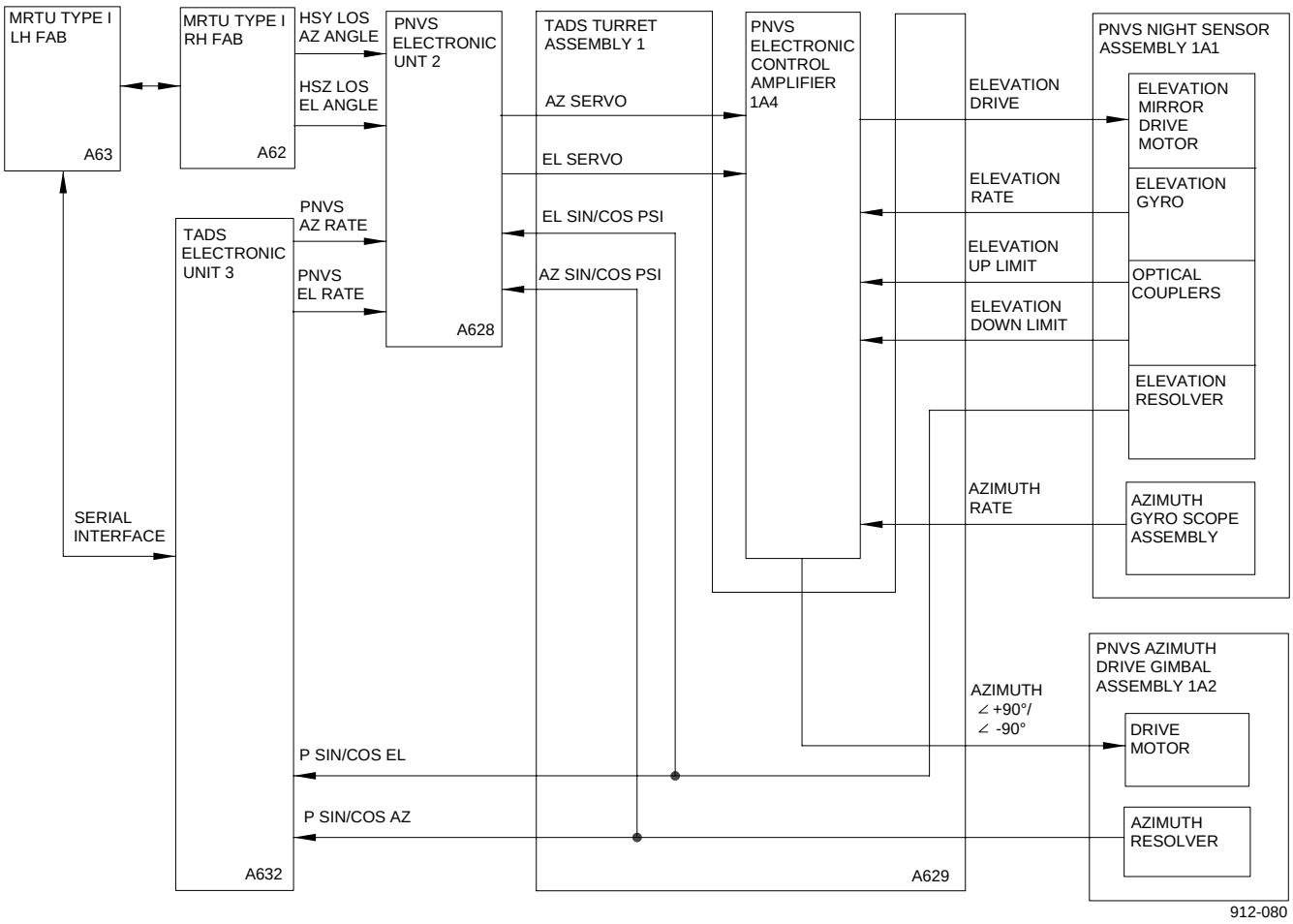


Figure 2-11. Azimuth and Elevation Servo Loop Block Diagram

2-11. AZIMUTH AND ELEVATION SERVO LOOPS (cont)

c. Servo Built-In Test (BIT). PNVS servo functions are checked during PNVS initiated BIT. See block diagram (fig. 2-10) and wiring interconnect diagram (fig. 3-42). The following functions are tested during BIT:

- Normal mode box slew
- Servo interface
- PNVS electronic control amplifier
- PNVS direct mode box slew

(1) Normal Mode Box Slew Test. The TEU commands the PNVS turret to slew from the fixed forward position, through a box scan pattern (clockwise then counterclockwise direction), and back to the fixed forward position. The TEU sets a time limit for the PNVS turret to slew to each position. If the correct position is not reached within the time limit, the TEU sends a PNVS servo subsystem fail message to the MRTU type I LH FAB on the serial interface bus.

(2) Servo Interface Test. The servo interface BIT tests PEU interface CCA 2A2 electronic circuits. The TEU applies a logic 0 P BIT CMD 1 input to the PEU to apply 28 VDC BIT CMD 1 and BIT CMD 2 inputs to the PECA. This disables the PECA azimuth and elevation drive outputs and gyro inputs. The TEU then applies a sequence of DC analog PNVS AZ and EL RATE (fig. 2-11) inputs to the PEU. The DC analog PNVS AZ and EL RATE inputs are algebraically summed in the PEU and applied to a comparator. If the voltage sum is in tolerance, the PEU P INTERFACE BIT output is logic 1. If the TEU reads a logic 0 P INTERFACE BIT, a PNVS ELECTRONIC UNIT NO-GO RH FAB message is sent to the MRTU type I LH FAB on the serial interface bus.

(3) PNVS Electronic Control Amplifier (PECA) Test. The PECA BIT tests the PECA's ability to drive the azimuth and elevation drive motors during normal operation and current limit capabilities when the turret reaches azimuth or elevation servo limits.

(a) The PECA BIT tests the ability to drive the azimuth and elevation drive motors by disabling the drive motors and switching dummy loads into the PECA drive motor outputs. First, the TEU applies a logic 0 P BIT CMD 1 input to the PEU to apply 28 VDC BIT CMD 1 and BIT CMD 2 inputs to the PECA. This disconnects the PECA azimuth and elevation drive input voltages. Second, the TEU applies a logic 0 P BIT CMD 2 input to the PEU to apply a 28 VDC BIT CMD 3 input to the PEU. This switches dummy loads to the PECA elevation and azimuth drive motor outputs. Third, the TEU applies a logic 1 P BIT CMD 1 input to the PEU to remove 28 VDC BIT CMD 1 and BIT CMD 2 inputs from the PECA. This connects the PECA azimuth and elevation drive input voltages. The TEU then applies DC analog PNVS AZ and EL RATE (fig. 2-11) inputs to the PEU and measures AZ and EL BIT analog outputs. The analog outputs represent PECA drive motor outputs under normal operating conditions.

2-11. AZIMUTH AND ELEVATION SERVO LOOPS (cont)

(b) The PECA BIT tests azimuth and elevation drive motor drive current output when a limit is approached. Dummy loads are switched as described above to test the drive motor output and the TEU applies a logic 0 BIT CURRENT LIMIT input to the PECA. The TEU then applies DC analog PNVS AZ and EL RATE (fig. 2-11) inputs to the PEU and measures AZ and EL BIT analog outputs. The analog outputs represent reduced PECA drive motor outputs under a condition where azimuth and elevation limits are approached.

(c) If either test fails, the TEU sends a PNVS TORQUER AMP NO-GO TURRET BULKHEAD message to the MRTU type I LH FAB and exits FD/LS.

(4) Direct Mode Box Slew Test. The TEU applies a logic 1 P DIR BIT to the PEU and commands the PNVS turret to slew from the fixed forward position, through a two position pattern, and back to the fixed forward position. The TEU sets a time limit for the PNVS turret to slew to each position. If the correct position is not reached within the time limit, the TEU sends a PNVS ELECTRONIC UNIT NO-GO RH FAB message to the MRTU type I LH FAB on the serial interface bus.

2-12. BRAKE RELEASE

The PNVS azimuth drive gimbal assembly has an electronic brake that must have voltage applied to release the brake. See block diagram (fig. 2-12) and wiring interconnect diagram (fig. 3-38). During normal operation, AZ BRAKE (28 VDC) is applied to the PNVS azimuth drive gimbal assembly through the normally closed contacts of TADS turret brake release switch assembly 1A1A4 BRAKE RELEASE switch. This releases the brake and allows the PNVS turret to rotate, in azimuth, as commanded through the servo loop circuits. During maintenance, the BRAKE RELEASE switch is held in the normally open position to apply aircraft 28 VDC to the brake. This releases the brake and allows the PNVS turret to be moved by hand to the desired position. If aircraft power is not available, a TADS/PNVS brake release power supply is connected to TADS turret connector 1A1W1J1 to supply the voltage.

2-12. BRAKE RELEASE (cont)

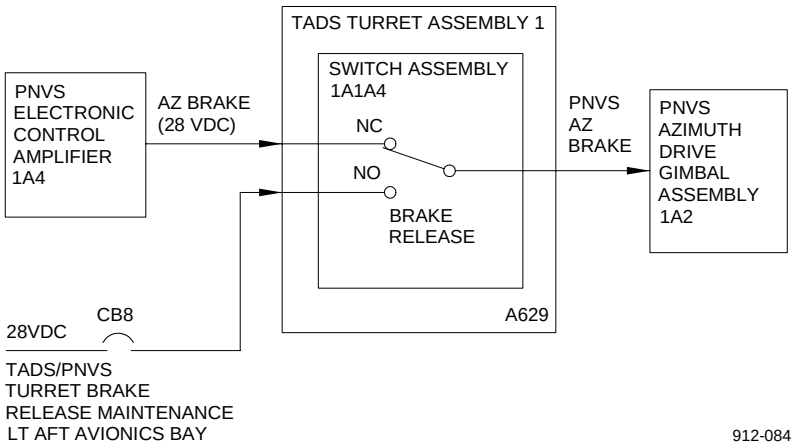


Figure 2-12. PNVS Brake Release Block Diagram

2-13. ANTI-ICE

The PNVS anti-ice function is selected by the pilot or CPG when icing conditions are present. See block diagram (fig. 2-13) and wiring interconnect diagram (fig. 4-13). When the pilot anti-ice panel or CPG auxiliary **TADS/PNVS** switch is set to **ON** and the helicopter is off the ground, 28 VDC is applied to MRTU type I LH FAB or CPG MRTU type III from aft pilot circuit breaker panel circuit breaker CB70 through contacts of the energized squat relay. The squat relay can be bypassed by setting either TADS/PNVS anti-ice switch to **GND.** The 28 VDC input to MRTU type I LH FAB or CPG MRTU type III causes MRTU type I RH FAB to apply the PNVS ANTI-ICE CMD input (28 VDC) to the PEU. With the PNVS ANTI-ICE CMD input to the PEU –

- 115 VAC ØB is applied to the PNVS shroud window, frame heater, and anti-ice CCA 1A3A1
- 22 VAC is applied to 1A3A1

a. Anti-Ice Power Application. When the ANTI-ICE ON input is applied to the PEU BITE/control CCA 2A3, the ANTI-ICE output energizes a relay on power frame assembly 2A5A1 to switch 115 VAC ØB WINDOW and FRAME to the PNVS shroud. The 115 VAC input is also switched to a step-down transformer on 2A5A1 to produce a 22 VAC output. Bite control CCA 4A5 senses the 115 VAC ØB WINDOW and 22 VAC outputs of 2A5A1 and applies a logic 0 (DC return) to the PEU PNVS WINDOW PWR output at 2J1-106.

2-13. ANTI-ICE (cont)

b. Window Power Control. The PEU output voltages are routed through helicopter wiring harness W255, the TADS turret assembly, and PNVS night sensor assembly to the PNVS shroud assembly. 115 VAC ØB WINDOW is applied to the shroud window and anti-ice CCA 1A3A1 and 22 VAC is applied to 1A3A1. The 22 VAC input to 1A3A1 is used to produce DC operating voltage for the CCA. Anti-ice CCA 1A3A1 adjusts the power applied to the shroud window by sensing the window temperature and changing the amount of time during each 115 VAC ØB WINDOW AC cycle that current is allowed to flow through the window. The 115 VAC input to 1A3A1 is used to synchronize pulses to triacs on 1A3A1 that apply an AC return to the window. This supplies power on demand to maintain window temperature above icing conditions.

c. Anti-Ice Built-In-Test (BIT). Anti-ice CCA 1A3A1 BIT is active only during the first 350 milliseconds after power is applied to the CCA. The BIT circuits, when activated by input voltage, allow full 115 VAC ØB WINDOW AC current to flow through the window. The current is sensed by 1A3A1 and a DC return (logic 0) is applied to the SHROUD FAIL output through the SHROUD FAIL RTN. If the proper current is not sensed by 1A3A1, the DC return is not applied to the fault output. This allows the TEU to pull the fault input up to logic 1 (5 VDC). After the 350 millisecond time period, 1A3A1 begins a soft-start sequence that gradually increases the power applied to the window over a 2 minute period. After the soft-start sequence, window power is controlled by 1A3A1 to maintain the proper window temperature.

d. Shroud Heater. The shroud assembly frame heater is on when shroud temperature (12.7°C) and anti-ice is selected. The frame heater is not controlled by anti-ice CCA 1A3A1 and does not have any FD/LS BIT. When shroud temperature is (12.7°C), the thermostatic switch is closed to allow 115 VAC ØB FRAME HTR current to flow through the frame heater. When the shroud temperature rises above (21.1°C), the thermostatic switch opens and the shroud temperature must fall (12.7°C) for the thermostatic switch to close again.

e. Anti-Ice FD/LS. PNVS WINDOW POWER and SHROUD FAIL logic is applied to TEU serial/discrete I/O CCA 3A10. During continuous FD/LS, TEU central processor unit (CPU) reads an anti-ice status word (refer to TM 1-1270-476-T for a description of TADS anti-ice) sent through the serial interface bus from MRTU type I LH FAB and the PNVS WINDOW POWER input. When the status word indicates that anti-ice has been selected and PNVS WINDOW POWER is logic 0, the CPU reads the SHROUD FAIL bit. If the SHROUD FAIL bit is a logic 1, the TEU sends a PNVS SHROUD NO-GO fault message on the serial interface bus to MRTU type I LH FAB. If the PNVS WINDOW POWER input is a logic 0 when the status word indicates that anti-ice has not been selected, the TEU sends a PNVS ELECTRONIC UNIT NO-GO RH FAB fail message to MRTU type 1 LH FAB on the serial interface bus. BIT circuits can be reset by setting anti-ice switches to **OFF** and then setting one switch to **GND** to reapply anti-ice power to the window.

2-13. ANTI-ICE (cont)

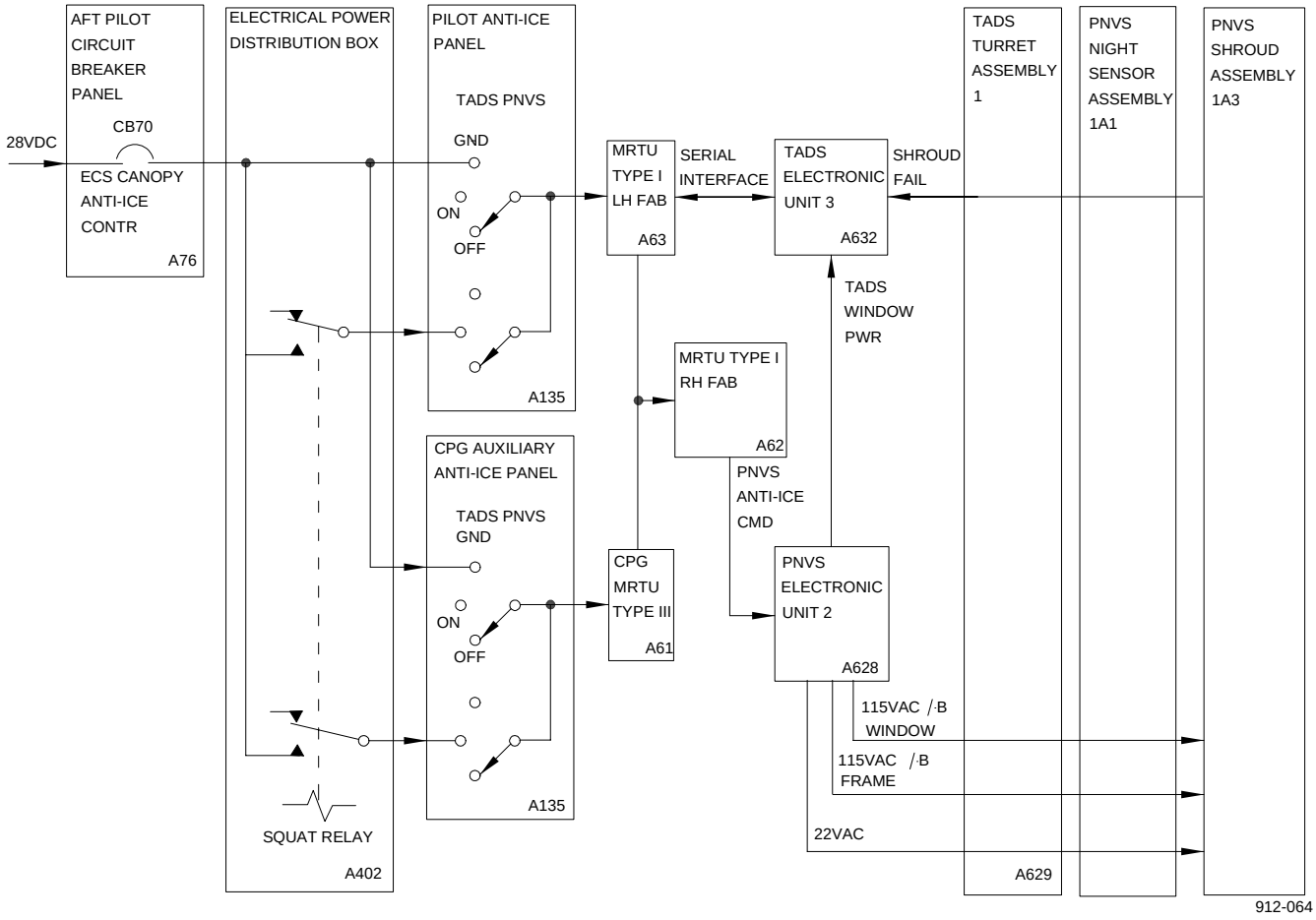


Figure 2-13. Anti-Ice Block Diagram

CHAPTER 3

PILOT NIGHT VISION SENSOR

TROUBLESHOOTING PROCEDURES

3-1. POWER-UP PROCEDURE

INITIAL SETUP

Personnel Required:

68X Aircraft Armament/Electrical Repairer
67R Attack Helicopter Repairer

References:

TM 1-1270-476-T
TM 1-1270-476-20
TM 1-1520-238-T-1
TM 1-1520-238-T-2
TM 1-5855-265-20
TM 9-1230-476-20-2
TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1270-476-T	TADS initial switch setting performed
TM 1-1270-476-20	TADS window cover assemblies removed
TM 1-5855-265-20	PNVS window cover assembly removed

1. Access pilot station (fig. 3-1) (TM 1-1520-238-23).
2. Close aft circuit breaker panel circuit breakers (fig. 3-2):

   ECS AFT FAN
   ECS CAD
   ECS FAD FANS
   POWER XFMR RECT 1
   POWER XFMR RECT 2

3. Close forward circuit breaker panel circuit breakers (fig. 3-3):

   MISSION PNVS DC
   MISSION PNVS AC
   MISSION SYM GEN
   MISSION IHADSS
   MISSION FC DC
   MISSION FC AC

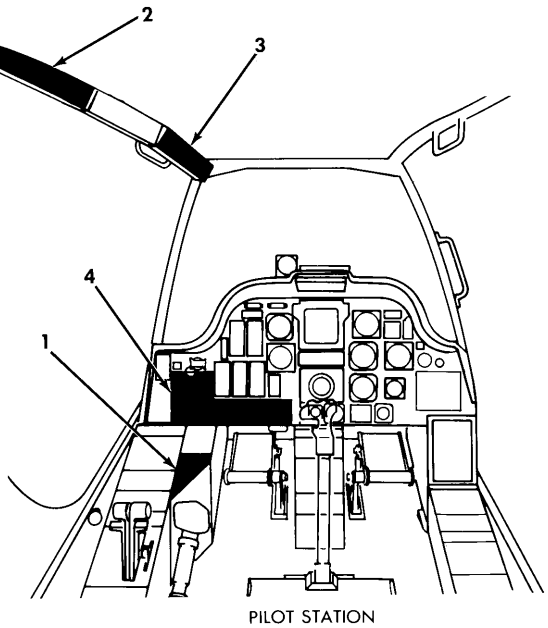


Figure 3-1. Pilot Station Panel Location

3-1. POWER-UP PROCEDURE (cont)

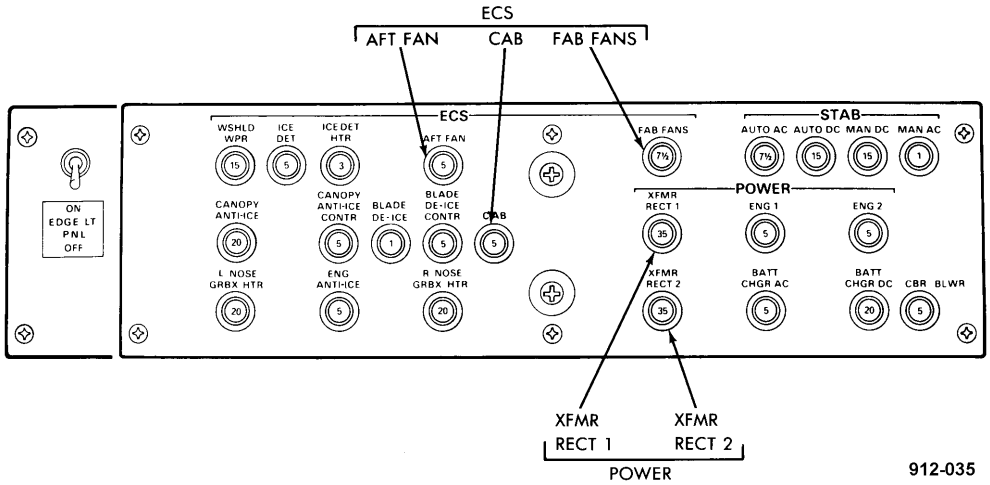


Figure 3-2. Aft Circuit Breaker Panel Circuit Breaker Location

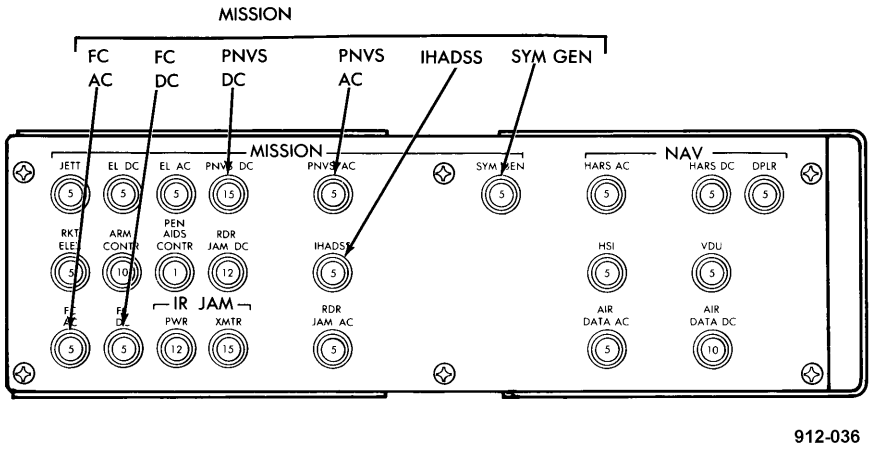
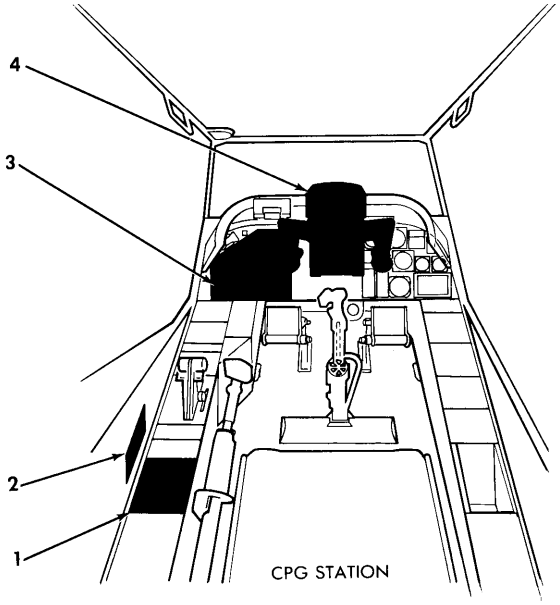


Figure 3-3. Forward Circuit Breaker Panel Circuit Breaker Location

3-1. POWER-UP PROCEDURE (cont)

4. Access copilot/gunner (CPG) station (fig. 3-4) (TM 1-1520-238-23).



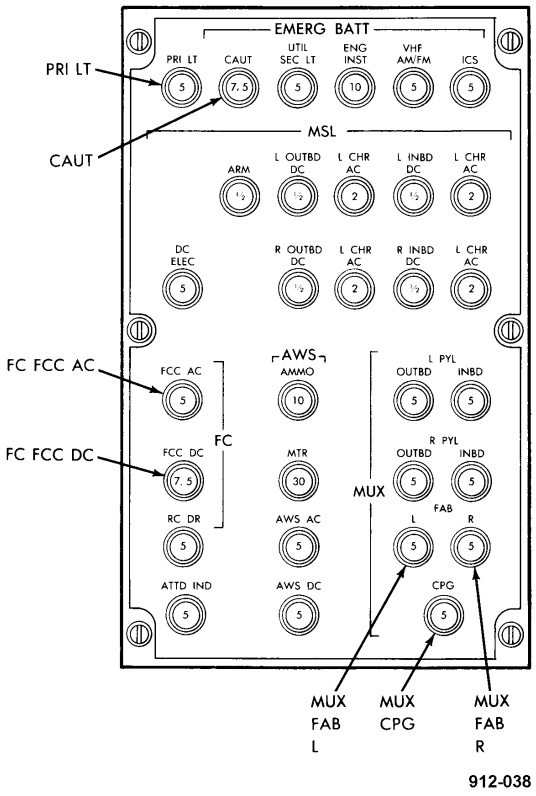
LEGEND
1. CIRCUIT BREAKER PANEL NO. 1
2. CIRCUIT BREAKER PANEL NO. 2
3. FIRE CONTROL PANEL
4. OPTICAL RELAY TUBE

912-037

Figure 3-4. CPG Station Panel Location

5. Close circuit breaker panel No. 1 circuit breakers (fig. 3-5):

PRI LT
CAUT
FC FCC AC
FC FCC DC
MUX FAB L
MUX FAD R
MUX CPG

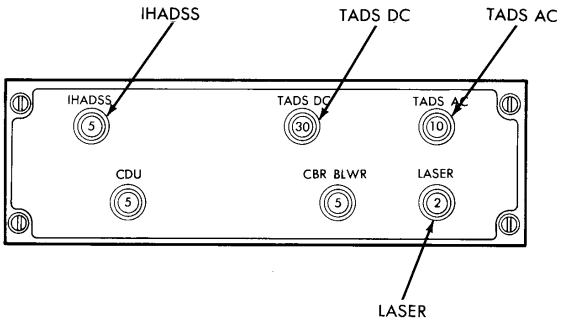


912-038

Figure 3-5. Circuit Breaker Panel No. 1 Circuit Breaker Location

6. Close circuit breaker panel No. 2 circuit breakers (fig. 3-6):

IHADSS
TADS DC
TADS AC
LASER



912-039

Figure 3-6. Circuit Breaker Panel No. 2 Circuit Breaker Location

3-1. POWER-UP PROCEDURE (cont)

7. If TADS power-up procedures have not been performed, operate APU or apply external power - electrical and air (TM 1-1520-238-23).

NOTE

If the following conditions do not exist, go to step 10.

- Cockpit temperature is above 85°F (29.4°C) or helicopter has been heat soaking for a period of time at that temperature.
- Cockpit temperature is below 40°F (4.4°C) or helicopter has been cold soaking for a period of time at that temperature.

8. Access pilot station (fig. 3-1) (TM 1-1520-238-23).

9. Adjust ECS panel **TEMP** control (fig. 3-7) as desired. Wait 10 to 15 minutes and proceed to step 10 below.

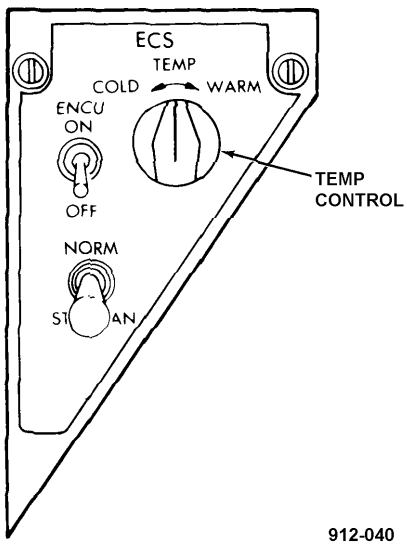


Figure 3-7. ECS Panel Control Location

10. Access CPG station (fig. 3-4) (TM 1-1520-238-23).

11. Set CPG fire control panel switches (fig. 3-8)

Switch	Position
SYSTEM FC/SYM GEN	**SYM GEM**
SYSTEM IHADSS	**IHADSS**

If symbology is not displayed on HOD, refer to TM 1-1520-238-T-2 for troubleshooting.

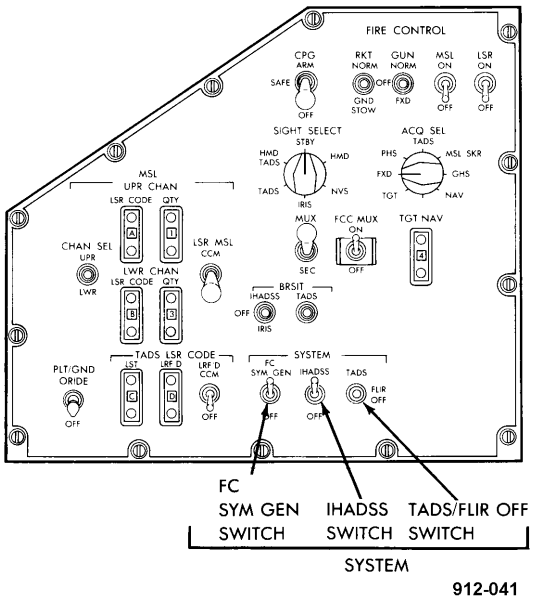


Figure 3-8. CPG Fire Control Panel Control Location

3-1. POWER-UP PROCEDURE (cont)

12. Access pilot station (fig. 3-1) (TM 1-1520-238-23).

CAUTION

Do not turn PNVS power on immediately after power was turned off. This will damage the PEU. If **PNVS** switch was just set to OFF, wait a minimum of 10 seconds before doing step 13 below.

13. Set pilot fire control panel **PNVS** switch to **PNVS** (fig. 3-9). Note time when switch is set to **PNVS.** The PNVS initially needs 20 minutes to cool down for good video.

    a. If PNVS NOT COOLED message will not discontinue after 20 minutes, troubleshoot PNVS using DTA (TM 1-4931-727-13&P).

    b. If fault still exists, replace PNVS electronic unit (TM 1-5855-265-20).

    c. If **MISSION PNVS AC** circuit breaker (fig. 3-3) opens, refer to paragraph 3-25 for troubleshooting.

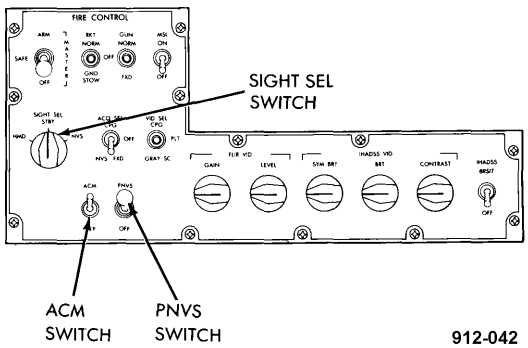


Figure 3-9. Pilot Station Fire Control Panel Control Location

NOTE

PNVS can be selected (step 17 below) before completion of step 14 below. However, PNVS performance may be degraded until completion of warmup and FLIR cooldown.

14. Wait for maximum allowable warmup time. The maximum allowable warmup time versus ambient temperature is shown in figure 3-10.

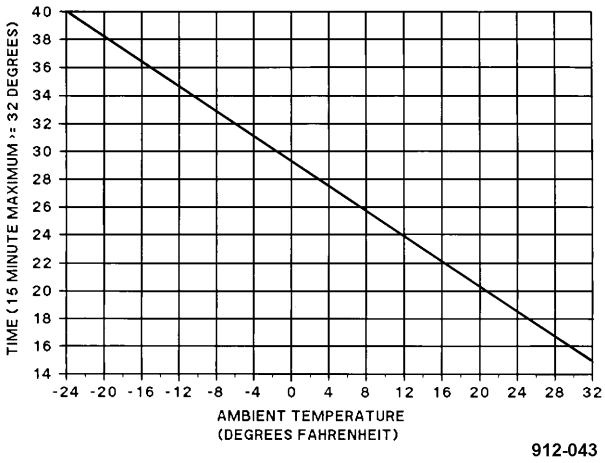


Figure 3-10. PNVS Warmup Time Versus Ambient Temperature

3-1. POWER-UP PROCEDURE (cont)

NOTE

The PNVS needs 1 minute for gyro runup before PNVS turret assembly can be commanded out of stow (step 17 below).

15. Wait 1 minute before proceeding.

16. Set pilot station fire control panel **ACM** switch to **ON** (fig. 3-9).

WARNING

Personnel are not allowed closer than 3 feet from PNVS turret assembly. The PNVS turret assembly rotating under power has enough force to cause serious injury.

CAUTION

Failure to enter PNVS interactive FD/LS quickly if PNVS turret assembly does not come out of stow may damage PNVS assemblies.

17. Set pilot station fire control panel SIGHT SEL switch to NVS.

    a. Verify PNVS turret assembly comes out of stow to fixed forward position. If PNVS turret assembly does not come out of stow, quickly enter PNVS initiated BIT (TM 1-1520-238-T-1) to determine location of fault and perform MOC (para 3-5).

    b. If caution/warning panel PNVS warning indicator is flashing, perform MOC (para 3-5).

    c. If **MISSION PNVS DC** circuit breaker (fig. 3-3) opens, refer to paragraph 3-23 for troubleshooting.

NOTE

Do steps 18 thru 20 below to view PNVS video on HOD or HDD.

18. Access CPG station (fig. 3-4) (TM 1-1520-238-23).

19. Set CPG station fire control panel **SYSTEM TADS/FLIR OFF** switch to **FLIR OFF** (fig. 3-26).

20. Set ORT assembly control panel VID SEL switch to **PNVS** (fig. 3-11).

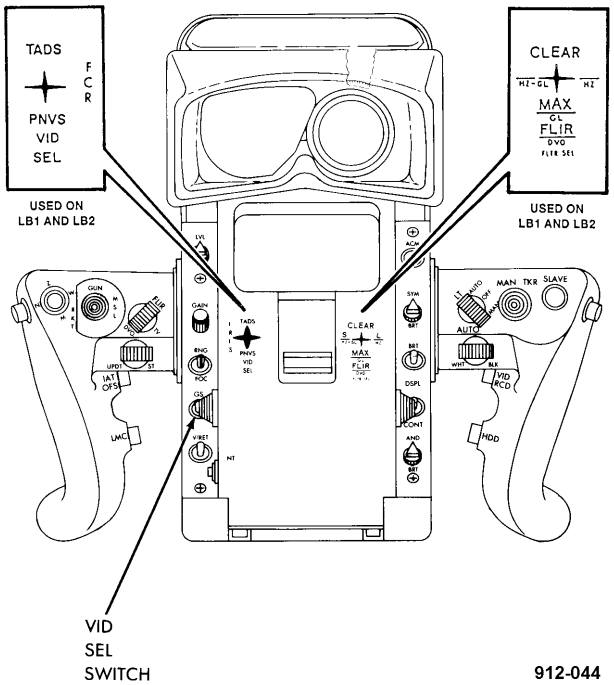


Figure 3-11. Optical Relay Tube Assembly Control Location

3-2. POWER-DOWN PROCEDURE

INITIAL SETUP

Personnel Required:

68X Aircraft Armament/Electrical Repairer
67R Attack Helicopter Repairer

References:

TM 1-1520-238-23

Equipment Conditions:

Ref	Condition
TM 1-1270-476-T	TADS powered up

1. Access pilot station (fig. 3-12) (TM 1-1520-238-23).

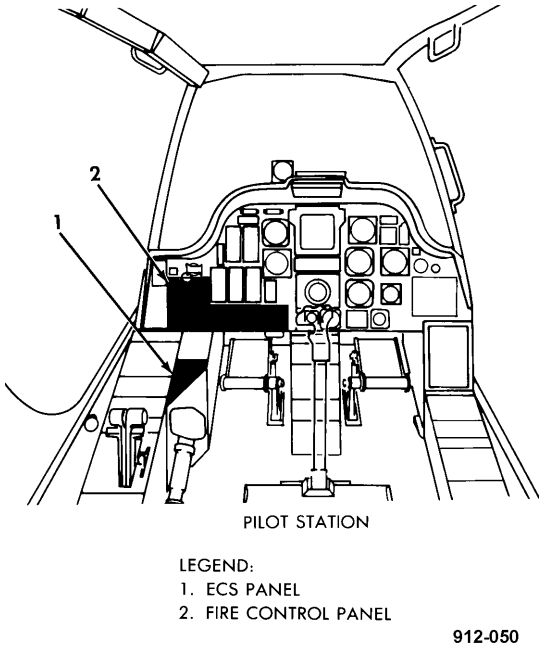


Figure 3-12. Pilot Station Control Panel Location

WARNING

Personnel are not allowed closer than 3 feet from PNVS turret assembly. The PNVS turret assembly rotating under power has enough force to cause serious injury.

2. Set pilot station fire control panel **SIGHT SEL** switch to **STBY** (fig. 3-13).

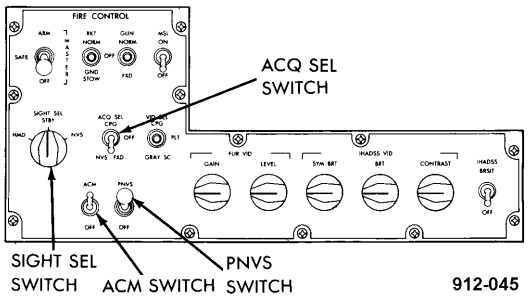


Figure 3-13. Pilot Station Fire Control Panel Control Location

3. Set pilot station fire control panel **PNVS** switch to **OFF**. If PNVS turret does not go to stow, perform **MOC** (para 3-5).

3-2. POWER-DOWN PROCEDURE (cont)

4. Access CPG station (fig. 3-14) (TM 1-1520-238-23).

5. Set CPG fire control panel switches (fig. 3-15):

Switch	Position
SYSTEM FC SYM GEM	**OFF**
SYSTEM IHADSS	**OFF**

NOTE

If TADS is not on, omit step 6 below.

6. Set CPG fire control panel **SYSTEM TADS/ FLIR OFF** switch to **OFF**.

7. Access pilot station (fig. 3-12) (TM 1-1520-238-23).

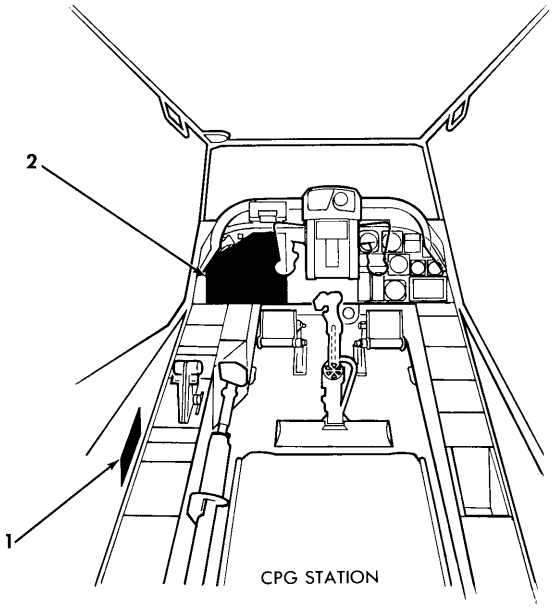
8. Set ECS panel **ENCU** switch to **OFF** (fig. 3-16)

9. Set pilot station fire control panel **ACQ SEL** switch to **OFF** and **ACM** switch to **OFF** (fig. 3-13)

10. Access CPG station (fig. 3-14) (TM 1-1520-238-23).

11. Open circuit breaker panel No. 2 **LASER** circuit breaker (fig. 3-17).

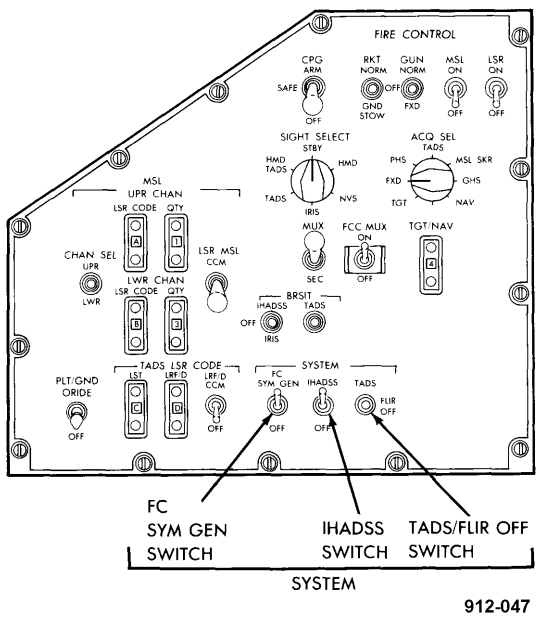
12. Turn off APU or remove external power-electrical and air (TM 1-1520-238-23).



LEGEND
1. CIRCUIT BREAKER PANEL NO. 2
2. FIRE CONTROL PANEL

912-046

Figure 3-14. CPG Station Control Panel Location



912-047

Figure 3-15. CPG Station Fire Control Panel Control Location

3-2. POWER-DOWN PROCEDURE (cont)

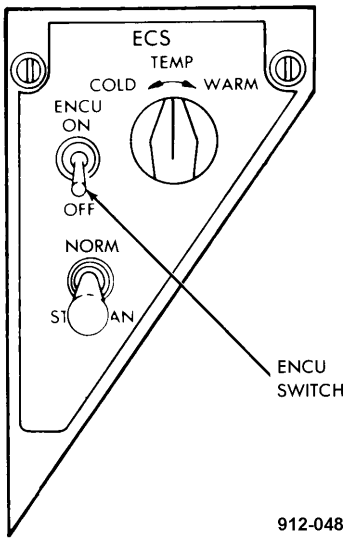


Figure 3-16. ECS Panel Switch Location

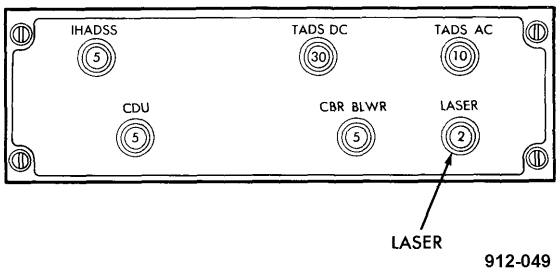


Figure 3-17. Circuit Breaker Panel No. 2 Circuit Breaker Location

3-3. MANUAL FD/LS

Manual fault detection/location system (FD/LS) is done before PNVS initiated built-in test (BIT) or in response to direction from FD/LS procedures in TM 1-1520-238-T-1. Manual FD/LS verifies heads out display (HOD), heads down display (HDD), and alphanumeric display (AND) operation. The maintenance operational check (MOC) (para 3-5) is used to do manual FD/LS.

3-4. FD/LS INFORMATION

a. PNVS Interactive FD/LS. PNVS FD/LS is a combination of continuous monitoring and operator initiated test procedures. BIT circuits monitor PNVS functions and send data to the TEU for evaluation. The TEU initiates a start-up BIT when power is applied and initiates continuous BIT after start-up BIT is complete. Operator initiated BIT is selected by a technician to evaluate PNVS functions.

b. Start-up BIT. Start-up BIT checks TEU computer functions and is enabled when power is applied. A fault isolated by start-up BIT causes pilot and CPG caution/warning panel PNVS warning indicators to flash. A fault also causes FD/LS and PNVS FAIL messages to flash on the HOD or HDD. Turning the CPG DATA ENTRY keyboard (DEK) rotary switch to **FD/LS** after the above indications occur causes a PNVS NO-GO failure message to appear on the HOD or HDD.

c. Continuous BIT. Continuous BIT constantly monitors system status and PNVS functions after start-up BIT is completed. A fault isolated by continuous BIT causes pilot and CPG caution/warning panel PNVS warning indicators to flash. A fault also causes the FD/LS message to flash on the HOD or HDD. Turning the CPG DEK rotary switch to **FD/LS** after the above indications occur causes a message such as PNVS SERVO MODULE NO-GO to appear on the HOD or HDD.

d. PNVS Initiated BIT. PNVS initiated BIT is done by a maintenance technician as directed in FD/LS procedures (TM 1-1520-238-T-1) or during the maintenance operational check (para 3-5). Initiated BIT checks PNVS subsystem functions. Parts of the test require operator interaction by way of manual response to prompts. Prompts are instructions displayed on the HOD or HDD that direct the maintenance technician to:

- Set switches on the optical relay tube (ORT) assembly or aircraft
- Make observations of TADS/PNVS operation
- Make yes/no/acknowledge responses on the DEK

e. Display Messages and Prompts. Display messages and prompts are used to aid in testing and fault isolation of assemblies. Messages and prompts used during initiated BIT are listed in paragraph 3-6. The automatic part of the test requires no maintenance technician interaction. When a fault is isolated during any part of the test, a message appears on the HOD or HDD. The faulty component and its location, such as PNVS ELECTRONIC UNIT NO-GO RH FAB, is identified.

f. Manual MOC. Manual MOC is used by the maintenance technician to verify PNVS operation not tested during PNVS interactive FD/LS. Manual MOC is performed after initiated BIT and operator interactive test.

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK

INITIAL SETUP

Personnel Required:

68X Aircraft Armament/Electrical Repairer
67R Attack Helicopter Repairer

References:

TM 1-1270-476-T
TM 1-1270-476-20
TM 1-1520-238-T-1
TM 1-1520-238-T-2
TM 1-5855-265-20
TM 9-1230-476-20-1
TM 9-1230-476-20-2
TM 9-1270-221-23
TM 1-1520-238-23

Equipment Conditions:

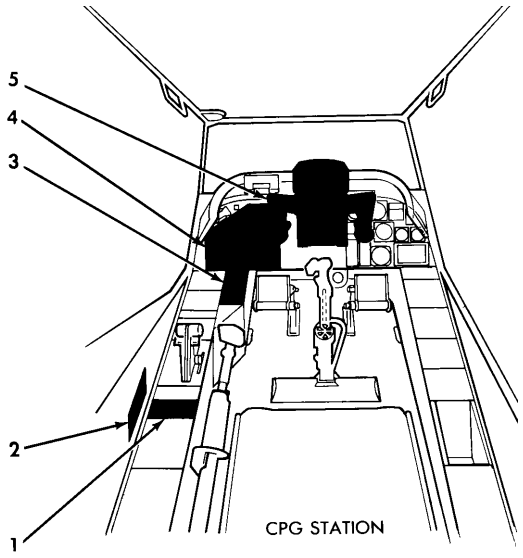
Ref	Condition
TM 1-1270-476-T	TADS powered-up
Para 3-1	PNVS powered-up

NOTE

Prior to performing any maintenance and/or fault isolation procedures, always observe TADS/PNVS caution/warning panel indicators and messages and prompts that are displayed on HOD/HDD. If faults are indicated, refer to display messages and prompts (para 3-6) for maintenance and/or fault isolation procedures to correct the fault.

Task	Results
1. Verify that TADS and PNVS moved to approximate fixed forward by observing solid crosshairs are centered on display and cueing box is centered on cueing dot during power-up procedure.	If TADS and PNVS turrets did not move to fixed forward, perform PNVS initiated BIT (TM 1-1520-238-T-1).
2. Adjust CPG station (fig. 3-18) instrument light control panel **INST** control to **BRT** (fig. 3-19). Verify ORT assembly control panel edgelights are lit then set **INST** control to **OFF.**	If ORT assembly edgelights are not lit, refer to TM 1-1270-476-T for troubleshooting.
3. Adjust ORT assembly control panel **SYM BRT** control (fig. 3-20) fully clockwise and verify symbology is displayed on HOD or HDD. If symbology is displayed on HOD or HDD, adjust **SYN BRT** control for best display.	If symbols are not displayed on HOD or HDD, refer to TM 1-1520-238-T-2 for troubleshooting.

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)



LEGEND
1. INSTRUMENT LIGHT CONTROL PANEL
2. CIRCUIT BREAKER PANEL NO. 2
3. DATA ENTRY KEYBOARD
4. FIRE CONTROL PANEL
5. OPTICAL RELAY TUBE

912-056

Figure 3-18. CPG Station Panel Location

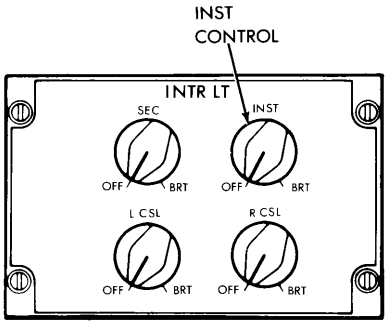


Figure 3-19. Instrument Light Control Panel Control Location

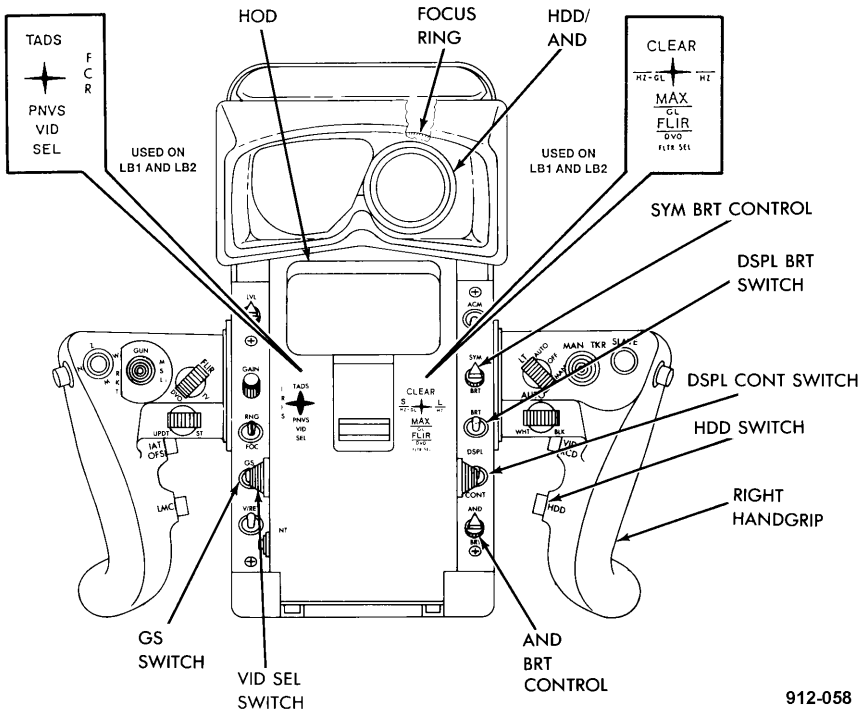


Figure 3-20. Optical Relay Tube Assembly Control Location

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
4. Observe video raster on HOD or HDD. If raster is on HOD or HDD, verify TADS or PNVS warning indicators are not flashing.	If raster is not visible on HOD or HDD hold ORT assembly control panel **DSPL BRT** switch up to increase brightness. If raster is not visible and warning indicators are not flashing, refer to TM 1-1270-476-T for troubleshooting. If TADS or PNVS warning indicator is flashing: **On first no-go:** • Perform PNVS power-down procedure (para 3-2). • Perform TADS power-down procedure (TM 1-1270-476-T). • Perform TADS power-up procedure (TM 1-1270-476-T). • Perform PNVS power-up procedure (para 3-1). **On second no-go:** Set DEK **DATA ENTRY** switch (fig. 3-21) to **FD/LS,** back to **STBY,** then to **FD/LS** to clear erroneous **FD/LS** messages. If subsystem failure MUX NO-GO, SYM GEN NO-GO, or ECS NO-GO is displayed on HOD/ HDD, refer to TM 1-1520-238-T-2 for troubleshooting. If the smell of smoke is detected: • Perform PNVS power-down procedure (para 3-2). • Perform TADS power-down procedure (TM 1-1270-476-T). • Perform helicopter safety procedure (TM 1-1520-238-23) and refer to TM 1-1270-476-T for troubleshooting.

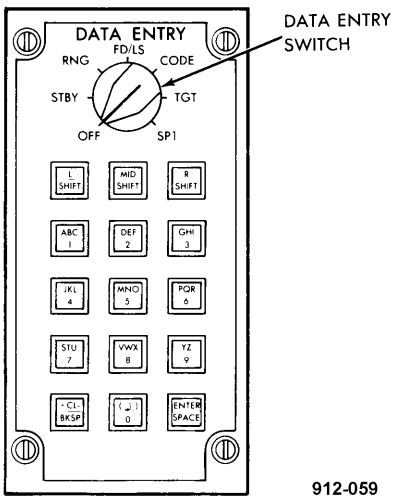


Figure 3-21. Data Entry Keyboard Control Location

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
	On third no-go: Replace TADS power supply (TM 1-1270-476-20). **On fourth no-go:** Troubleshoot multiplex system (TM 9-1230-476-20-2).
5. Press and release ORT assembly right handgrip **HDD** switch. Verify raster switches from HOD to HDD.	If raster does not change displays, enter FD/LS operator interactive tests and select entry point number 3 when prompted (TM 1-1520-238-T-1).
6. Observe alphanumeric display (AND) on HDD and adjust ORT assembly control panel **AND BRT** control fully CW and CCW. Verify AND brightness increases and decreases.	If AND is not displayed on HDD, refer to TM 1-1270-476-T for troubleshooting. If AND brightness does not change, refer to TM 1-1270-476-T for troubleshooting.
7. Adjust CPG station instrument light control panel **INST** control to **BRT** (fig. 3-19). Verify AND edgelight is lit, then set **INST** control to **OFF.**	If AND edgelight is not lit, refer to TM 1-1270-476-T for troubleshooting.
8. Adjust ORT assembly control panel AND BRT control (fig. 3-20) for desired viewing level. Verify AND is fully visible.	If AND is not fully visible, replace optical relay column (TM 1-1270-476-20).
9. Adjust ORT assembly focus ring for best AND and video raster image. Verify focus is good for both images.	If focus ring will not turn, replace eyepiece assembly (TM 1-1270-476-20). If all displays cannot be focused within 1/4 turn of focus ring (includes DVO image when selected): • Replace indirect view display (TM 1-1270-476-20). • Replace optical relay column (TM 1-1270-476-20).

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
10. Check AND characters for readability and completeness.	If AND characters are completely missing or have missing segments, replace AND (TM 1-1270-476-20). If AND display is unstable, replace optical relay column (TM 1-1270-476-20).
11. Press ORT assembly right handgrip HDD switch to display video raster on HOD.	
12. Press ORT assembly control Panel **GS** switch. Observe grayscale on HOD.	If grayscale does not appear on HOD, enter FD/LS operator interactive tests and select entry point 4 when prompted.
13. Adjust grayscale for 10 shades of gray: a. Hold ORT assembly control panel **DSPL CONT** switch down until grayscale just disappears. b. Hold ORT assembly control panel **DSPL BRT** switch down until raster just disappears. c. Hold ORT assembly control panel **DSPL CONT** up until 10 distinct shades of gray are visible. The third bar from top should be same shade as background. d. If necessary, alternate **DSPL BRT** and **DSPL CONT** switch positions to optimize grayscale.	If grayscale cannot be adjusted, enter FD/LS operator interactive tests and select entry point 2 when prompted.
14. Press and release ORT assembly right handgrip **HDD** switch. Verify grayscale is displayed on HOD. Do step 13 above to adjust grayscale.	If grayscale does not appear on HOD, replace indirect view display (TM 1-1270-476-20).
15. Press ORT assembly right handgrip **HDD** switch to display video raster on HOD.	
16. Set ORT assembly **VID SEL** switch to PNVS.	

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
17. Manual FD/LS has been completed. If directed to do manual FD/LS from another task, continue with task in progress.	
18. Do PNVS initiated BIT with operator interactive tests (TM 1-1520-238-T-1).	If faults are detected by FD/LS, refer to paragraph 3-6 for troubleshooting.
19. Set CPG fire control panel **PLT GND ORIDE** switch to **OFF** (fig.).	

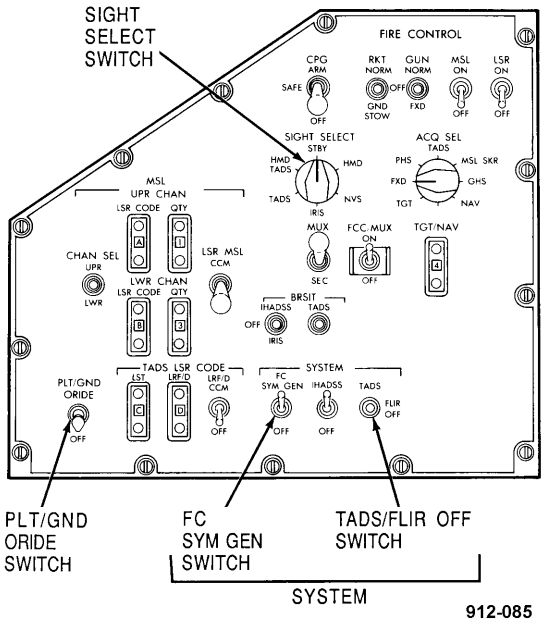


Figure 3-22. CPG Fire Control Panel Control Location

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results

20. Access pilot station (fig. 3-23) (TM 1-1520-238-23).

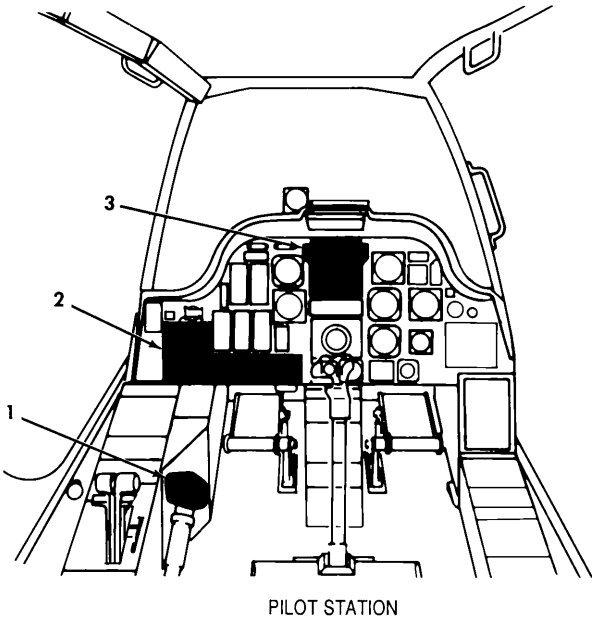


Figure 3-23. CPG Fire Control Panel Control Location

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
21. Set pilot fire control panel **ACM** switch to **ACM** (fig. 3-24). Verify PNVS video is displayed on pilot IHADSS.	If PNVS video is not displayed on IHADSS and was displayed on HOD during operator interactive BIT: • Set pilot fire control panel **ACM** switch to **OFF.** • Adjust pilot fire control panel **FLIR VID GAIN** and **LEVEL** controls for best video display. • If video is displayed troubleshoot pilot fire control panel **ACM** switch (TM 1-1520-238-T-2). • If video is not displayed on IHADSS, troubleshoot video path (TM 1-1520-238-T-2).
22. Set pilot fire control panel **ACM** switch to **OFF.**	
23. Adjust pilot fire control panel **FLIR VID GAIN** and **LEVEL** controls fully ccw and cw and verify increase and decrease in video contrast for adjustments of both controls.	If video contrast does not change and ORT assembly control panel **LVL** and **GAIN** controls functioned properly during operator interactive BIT, troubleshoot pilot fire control panel **FLIR VID GAIN** and **LEVEL** controls (TM 1-1520-238-T-2).
24. Set pilot fire control panel **ACM** switch to **ACM.**	

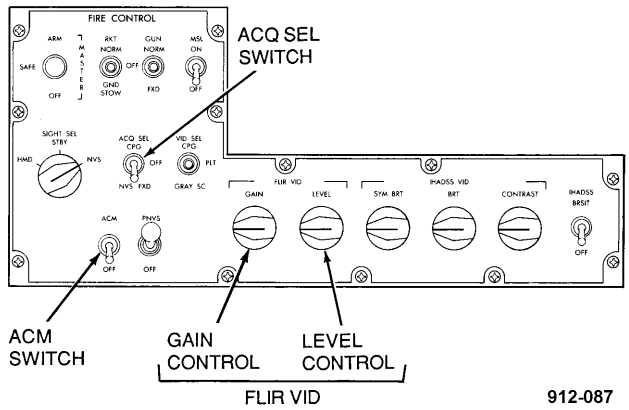


Figure 3-24. Pilot Station Fire Control Panel Control Location

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
25. Adjust pilot fire control panel **FLIR VID GAIN** and **LEVEL** controls fully ccw and cw and verify no large increase and decrease in video contrast for adjustments of both controls.	If a large increase in video contrast was not noticed during interactive BIT, troubleshoot pilot fire control panel **ACM** switch (TM 1-1520-238-T-2).
26. Set pilot fire control panel **ACM** switch to **OFF.** Adjust pilot fire control panel **FLIR VID GAIN** and **LEVEL** controls for best video display.	
27. Toggle pilot collective control stick **PLRT/ BRST HMD** switch between center (off) and **PLRT** (fig. 3-25). Verify PNVS video changes between white hot and black hot.	If video polarity changed during operator interactive BIT and does not change with pilot collective control stick **PLRT/BRST HMD** switch. troubleshoot pilot collective control stick (TM 1-1520-238-T-2).

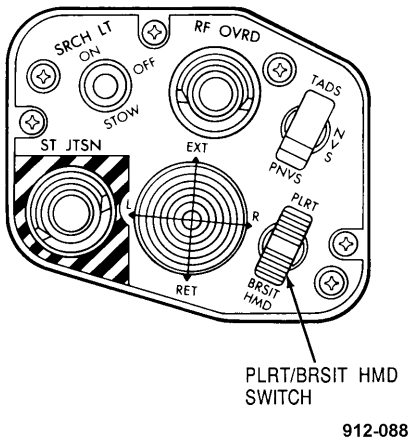


Figure 3-25. CPG/Pilot Collective Control Stick Control Location

28. Verify PNVS video is stable with helicopter symbols stable.	If PNVS video is jittery with helicopter symbols stable, refer to paragraph 3-27 for troubleshooting.

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
29. Set pilot station fire control panel **ACQ SEL** switch to **OFF** (fig. 3-24).	
30. Using pilot IHADSS, move PNVS turret and verify PNVS video does not smear while moving PNVS turret.	If PNVS video smears, replace PNVS turret assembly (TM 1-5855-265-20).
31. Access CPG station (fig. 3-18) (TM 1-1520-238-23).	
32. Set ORT assembly control panel **VID SEL** switch to **TADS** (fig. 3-20) to display TADS video on HOD. Verify TADS video and/or helicopter symbols do not become scrambled.	If TADS video and/or symbols jittery with helicopter symbols stable, refer to paragraph 3-26 for troubleshooting.
33. Set ORT assembly control panel **VID SEL** switch to **PNVS** to display PNVS video on HOD.	
34. Access pilot station (fig.) (TM 1-1520-238-23).	

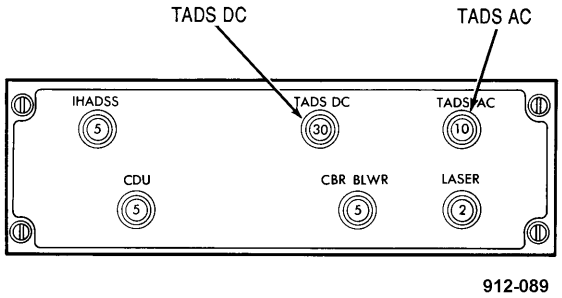
3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
35. Using pilot IHADSS (TM 9-1270-221-23), move PNVS turret through azimuth and elevation limits. Verify PNVS turret moves smoothly through IHADSS travel and LIMITS message is displayed when limits are reached.	If turret oscillates in azimuth at certain positions: • Replace PNVS azimuth gimbal assembly (TM 1-5855-265-30). • If fault still exists, replace PNVS turret assembly (TM 1-5855-265-20). If PNVS turret slews with reduced speed and torque: • Replace PNVS electronic control amplifier (TM 1-5855-265-20). • If fault still exists, replace PNVS azimuth gimbal assembly (TM 1-5855-265-30). If no LIMITS messages are displayed: • Perform IHADSS boresight (TM 9-1230-476-20-1) • If fault still exists, replace TADS electronic unit. If LIMITS message does not appear when movement exceeds azimuth left or right limit: • Replace PNVS azimuth gimbal assembly (TM 1-5855-265-30). • If fault still exists, replace TADS electronic unit (TM 1-1270-476-20). If LIMITS message does not appear when movement exceeds elevation upper or lower limit: • Replace PNVS turret assembly (TM 1-5855-265-20). • If fault still exists, replace TADS electronic unit (TM 1-1270-476-20).

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
36. Verify PNVS registration is correct (outside scene-is alined with IHADSS display).	If PNVS registration is not correct: • Perform IHADSS FD/LS (TM 1-1520-238-T-1). • Perform BRU boresight (TM 9-1230-476-20-1). • Perform boresighting TADS/PNVS procedure (TM 9-1230-476-20-1). • If PNVS azimuth registration cannot be corrected, replace PNVS azimuth drive gimbal assembly (TM 1-5855-265-30). • If PNVS elevation registration cannot be corrected, replace PNVS turret assembly (TM 1-5855-265-20).
37. Access CPG station (fig. 3-18) (TM 1-1520-238-23).	
38. Set CPG fire control panel **SYSTEM FC SYM GEN** switch to **OFF** (fig. 3-22). Verify PNVS FLIR video is displayed on IHADSS without symbols.	If no FLIR video (with symbol generator inoperative) is displayed on IHADSS, refer to paragraph 3-28 for troubleshooting.
39. Set CPG fire control panel **SYSTEM FC SYM GEN** switch to **SYM GEN.**	
40. Set CPG fire control panel **SIGHT SEL** switch to **STBY.**	
41. Set CPG fire control panel **TADS FLIR OFF** switch to **OFF.**	
42. Wait for TADS turret to stow.	

3-5. PNVS - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
43. Open circuit breaker panel no. 2 **TADS AC** and **TADS DC** circuit breakers (fig. 3-26).	 Figure 3-26. Circuit Breaker Panel No. 2 Circuit Breaker Location
44. Access pilot station (fig.) (TM1-1520-238-23). Verify that PNVS DIRECT message is displayed on pilot video display unit.	If PNVS DIRECT message is not displayed, troubleshoot multiplex system (TM 9-1230-476-20-2).
45. Verify that PNVS turret follows pilot IHADSS movement. PNVS azimuth turret movement may be erratic beyond ±75°.	If PNVS turret does not slave to IHADSS, refer to paragraph 3-28 for troubleshooting.
46. Access CPG station (fig. 3-18) (TM 1-1520-238-23).	
47. Close circuit breaker panel no. 2 **TADS AC** and **TADS DC** circuit breakers (fig. 3-26).	
48. Set CPG fire control panel **SIGHT SEL** switch to **TADS** (fig. 3-24).	
49. Set CPG fire control panel **TADS/FLIR OFF** switch to **FLIR OFF.**	
50. Perform PNVS power-down procedure (para 3-2).	
51. Perform TADS power-down procedure (TM 1-1270-476-T).	
END OF TASK	

3-6. DISPLAY MESSAGES AND PROMPTS

Display messages and prompts are listed in table 3-1 and are displayed during interactive FD/LS. The messages and prompts appear on the HOD or HDD. There maybe slight differences in the wording of messages and/or prompts. A message provides information. A prompt gives an instruction. The messages and prompts are listed in the general sequence in which they may appear. The actual sequence of appearance for messages and prompts depends on computer tests and the response to prompts. As a result, a prompt or message may be listed more than once. The "Remarks (Reference)" column provides an explanation of the message or prompt. See figure 3-27 for location of ORT assembly switches and controls.

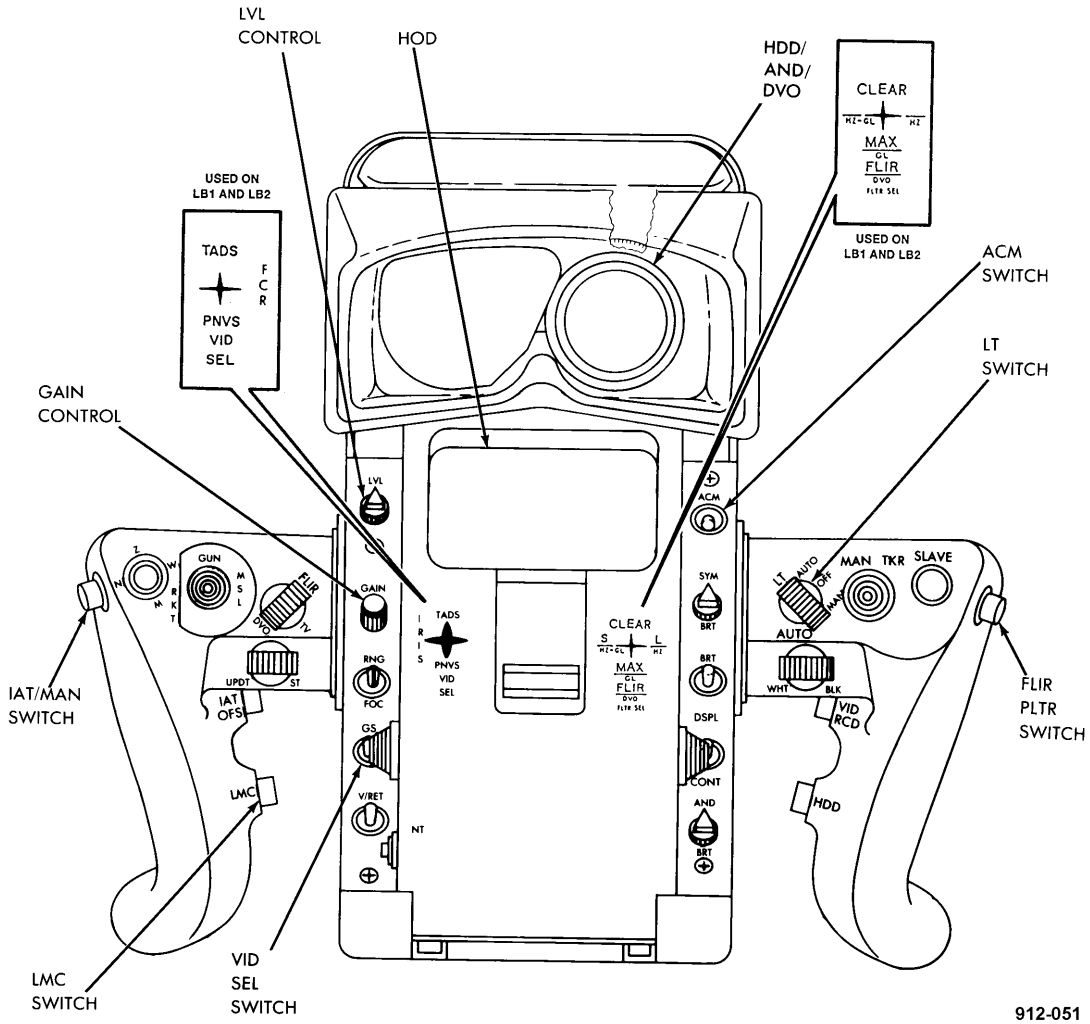


Figure 3-27. Optical Relay Tube Assembly Control and Indicator Location

3-6. DISPLAY MESSAGES AND PROMPTS (cont)

Table 3-1. Display Messages and Prompts

Item No.	Message/Prompt	Remarks **(Reference)**
1	PNVS TADS NO-GO NO-GO	These messages appear if TADS or PNVS faults are detected during continuous BIT. If TADS NO-GO message is displayed, perform TADS MOC (TM 1-1270-476-T). If PNVS NO-GO message is displayed, perform PNVS interactive FD/LS (TM 1-1520-238-T-1).
2	PNVS SERVO MODULE NO-GO	This message appears if the PNVS servo function has failed and PNVS initiated BIT has been entered.
3	PNVS VIDEO NO-GO	This message appears if the PNVS video function has failed and the FD/LS mode has been entered.
4	PNVS BORESIGHT NO-GO RAM CHECKSUM	This message appears if the FCC has detected an alteration of internal values affecting PNVS boresight harmonization. The PNVS system will function, but without CBHK correction. Reenter captive boresight harmonization kit (CBHK) data using DEK (TM 9-1230-476-20-1). If problem still exists, perform boresighting TADS/PNVS procedure (TM 9-1230-476-20-1).
5	FRONT SEAT MUST NOW TAKE OVER PNVS VIA PILOT/GND ORIDE. (ACK)	This prompt appears after code 09 is entered using DATA ENTRY keyboard. Set CPG fire control panel **PLT GND ORIDE** switch to **ORIDE** and respond as indicated.
6	PROMPT TIMED OUT REENTER PROMPT (Y) OR EXIT FD/LS. (N)	This prompt appears whenever too much time is taken before responding to a prompt (30 seconds).
7	SET LT SW O(FF). (ACK)	This prompt appears if the ORT assembly right handgrip **LT** switch is not set to **OFF.** Set **LT** switch to **OFF** and respond as indicated.
8	SET ACM SW OFF. (ACK)	This prompt appears if the ORT assembly control panel **ACM** switch is not set to off (down position). Set **ACM** switch to off and respond as indicated.

3-6. DISPLAY MESSAGES AND PROMPTS (cont)

Table 3-1. Display Messages and Prompts (cont)

Item No.	Message/Prompt	Remarks **(Reference)**
9	PRESS AND RELEASE LMC SW. (ACK)	This prompt appears if LMC is not off. Press and release ORT assembly left handgrip **LMC** switch and respond as indicated.
10	PRESS AND RELEASE IAT/MAN SW. (ACK)	This prompt appears if the image automatic tracker function is in the autotrack mode. Press and release ORT assembly left handgrip **IAT MAN** switch and respond as indicated.
11	PUSH VID SEL SW TO PNVS AND RELEASE. (ACK)	This prompt appears if PNVS video is not selected for display. Push ORT assembly control panel **VID SEL** switch to **PNVS** and release and respond as indicated.
12	TEST IN PROGRESS	This message appears while PNVS initiated automatic tests are in progress.
13	ARE OPERATOR INTERACTIVE TESTS REQUIRED? (Y/N)	This prompt appears if no faulty LRUs are found by the PNVS initiated automatic tests. Respond with yes or no.
14	SET ACM SW TO ON. IS PNVS FLIR VISIBLE? (Y/N)	This prompt appears if the response to the previous prompt was Y. Observe display, set ORT assembly control panel **ACM** switch to **ACM,** and respond with yes or no.
15	SET ACM SW OFF. (ACK)	This prompt appears if response to the previous prompt was Y and the **ACM** switch is set to **ACM.** Set ORT assembly control panel **ACM** switch to off (down) and respond as indicated.
16	TURN LVL FULLY CW THEN FULLY CCW: CENTER. (ACK)	This prompt appears if the **ACM** switch is set to off (down position) in responding to the previous prompt. Observe display, adjust ORT assembly **LVL** control as indicated, and respond as indicated.
17	DID BRT INCREASE THEN DECREASE? (Y/N)	This prompt appears if the brightness **LVL** control functioned correctly in responding to the previous prompt. Respond with yes or no.
18	TURN GAIN FULLY CW THEN FULLY CCW: CENTER. (ACK)	This prompt appears if the response to the previous prompt was Y. Observe display, adjust ORT assembly control panel **GAIN** control as indicated, and respond as indicated.

3-6. DISPLAY MESSAGES AND PROMPTS (cont)

Table 3-1. Display Messages and Prompts (cont)

Item No.	Message/Prompt	Remarks **(Reference)**
19	DID CONT INCREASE THEN DECREASE? (Y/N)	This prompt appears if the contrast **GAIN** control functions correctly in responding to the previous prompt. Respond with yes or no.
20	ADJUST GAIN AND LVL FOR BEST IMAGE. IMAGE QUALITY GOOD? (Y/N)	This prompt appears if the response to the previous prompt was Y. Adjust ORT assembly control panel **GAIN** and **LVL** controls as indicated and respond with yes or no.
21	POOR IMAGES MAY BE DUE TO OUTSIDE CONDITIONS. (ACK)	This prompt appears if the response to the previous prompt was N. Respond as indicated.
22	COULD OUTSIDE CONDITIONS BE CAUSING BAD QUALITY?(Y/N)	This prompt appears after response is made to the previous prompt. Respond with yes or no.
23	DO YOU WISH TO CONTINUE TESTING? (Y/N)	This prompt appears if the response to the previous prompt was Y. Respond with yes or no.
24	SET ACM SW TO ON. (ACK)	This prompt appears if the response to item 20 and item 23 was Y. Set ORT assembly control panel **ACM** switch to **ACM** and respond as indicated.
25	ADJUST BOTH GAIN AND LVL CW THEN CCW. IS THERE A LARGE CHANGE IN IMAGE CONT OR BRT? (Y/N)	This prompt appears if the **ACM** switch was set to **ACM** in responding to the previous prompt. Adjust ORT assembly control panel **GAIN** and **LVL** controls as indicated, observe display, and respond with yes or no.
26	SET ACM SW TO OFF. ADJUST GAIN AND LVL FOR BEST IMAGE. (ACK)	This prompt appears if the response to the previous prompt was N. Set ORT assembly control panel **ACM** switch to off (down) and respond as indicated.
27	PRESS AND RELEASE FLIR PLRT SW. DID FLIR PLRT CHANGE? (Y/N)	This prompt appears after response is made to the previous prompt. Observe display, press and release ORT assembly right handgrip **FLIR PLRT** switch, and respond with yes or no.

3-6. DISPLAY MESSAGES AND PROMPTS (cont)

Table 3-1. Display Messages and Prompts (cont)

Item No.	Message/Prompt	Remarks **(Reference)**
28	ARE THERE ANY BAD LINES DISPLAYED (NOISY, BLK, OR WHT)? (Y/N)	This prompt appears if the response to the previous prompt was Y. Observe display (fig. 3-28) and respond with yes or no.

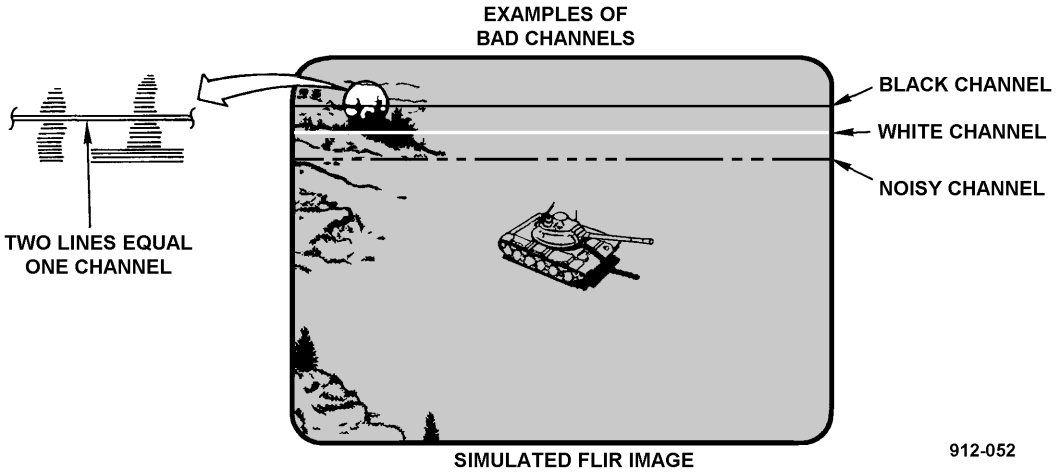


Figure 3-28. Examples of Bad Channels

29	ARE THERE ANY BAD LINES IN THE CENTER 20% OF THE DISPLAY? (Y/N)	This prompt appears if the response to the previous prompt was Y. Observe display (fig. 3-29) and respond with yes or no.

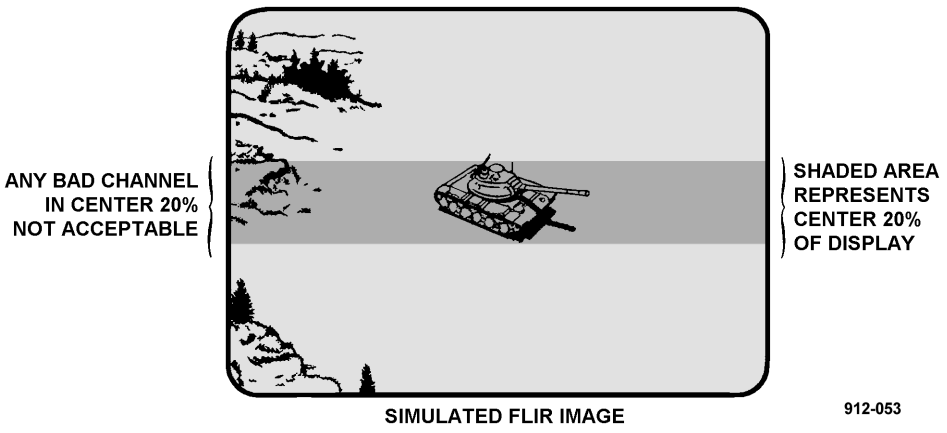


Figure 3-29. Example of Bad Channels in Center 20% of Display

3-6. DISPLAY MESSAGES AND PROMPTS (cont)

Table 3-1. Display Messages and Prompts (cont)

Item No.	Message/Prompt	Remarks **(Reference)**
30	ARE BAD LINES EXCES-SIVE? (Y/N)	This prompt appears if the response to the previous prompt was N. Observe display (fig. 3-30 and 3-31) and respond with yes or no.

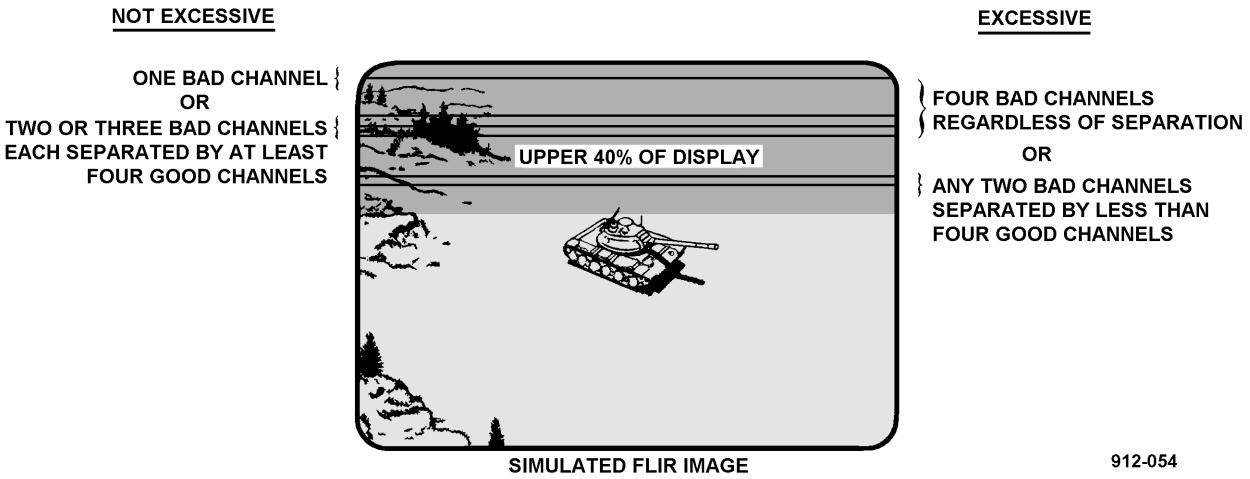


Figure 3-30. Example of Excessive Bad Channels in Upper 40% of Display

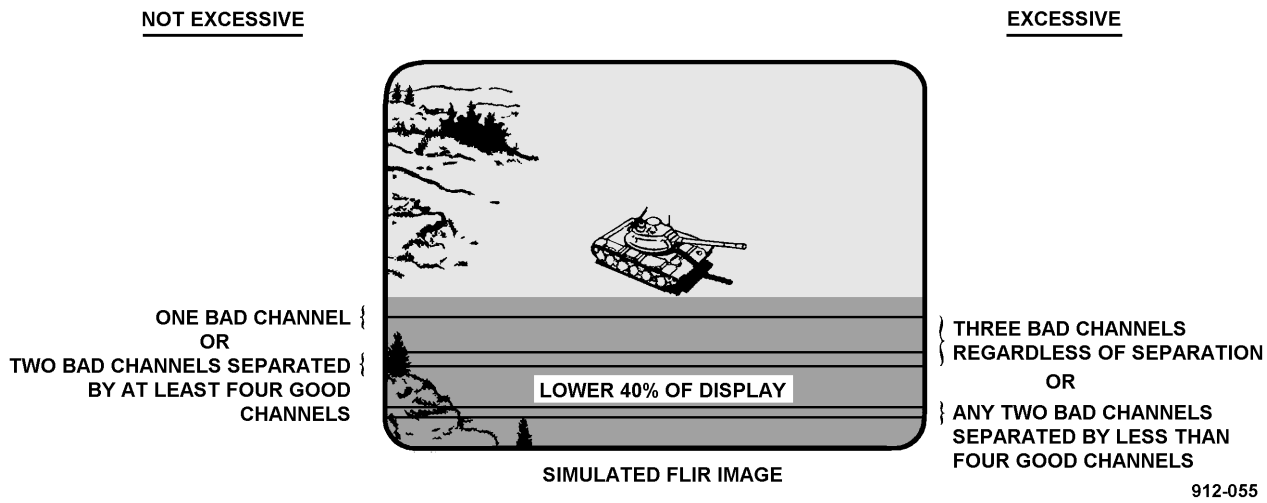


Figure 3-31. Example of Excessive Bad Channels in Lower 40% of Display

3-6. DISPLAY MESSAGES MD PROMPTS (cont)

Table 3-1. Display Messages and Prompts (cont)

Item No.	Message/Prompt	Remarks **(Reference)**
31	RETURN CONTROL OF PNVS TO PILOT. (ACK)	This prompt appears if the response to item 28 and item 30 was N. Perform action and respond as indicated.
32	PNVS GO ANY KEY FOR FD/LS MENU	This message appears when PNVS interactive FD/LS is completed with no failures found.
33	TADS POWER SUPPLY NO-GO LH FAB	This message appears if the TADS power supply failed during PNVS interactive FD/LS. Replace TADS power supply (TM 1-1270-476-20).
34	TADS ELECTRONIC UNIT NO-GO LH FAB	This message appears if the TADS electronic unit (TEU) failed during PNVS interactive FD/LS. Replace TADS electronic unit (TM 1-1270-476-20).
35	PNVS TURRET NO-GO	This message appears if the PNVS turret assembly failed during PNVS Interactive FD/LS. Replace PNVS turret assembly (TM 1-5855-265-20). If fault still exists with a video fault, refer to paragraph 3-21 for troubleshooting. If fault still exists with a video fault, replace TADS electronic unit (TM 1-1270-476-20).
36	PNVS ELECTRONIC UNIT NO-GO RH FAB	This message appears if the PNVS electronic unit (PEU) failed during FD/LS functional check. Check fuses F1 and F2, do not remove PEU assembly to check fuses (TM 1-5855-265-20). If any fuse is bad, replace fuse and perform PNVS Interactive FD/LS. If fuses are good, replace PNVS electronic unit (TM 1-5855-265-20). If fault still exists as a result of continuous BIT with anti-ice selected, perform anti-ice MOC (para 4-1). If fault still exists as a result of continuous BIT, troubleshoot PNVS using DTA (TM 1-4931-727-13&P).

3-6. DISPLAY MESSAGES AND PROMPTS (cont)

Table 3-1. Display Messages and Prompts (cont)

Item No.	Message/Prompt	Remarks **(Reference)**
36 cont		If fault still exists as a result of Initiated BIT with a servo fault identified, replace PNVS azimuth drive gimbal assembly (TM 1-5855-265-30). If fault still exists as a result of initiated BIT with a servo fault identified, replace PNVS turret assembly (TM 1-5855-265-20). If fault still exists as a result of initiated BIT with a video fault Identified, troubleshoot TADS using DTA (TM 1-4931-727-13&P). If fault still exists, replace TADS electronic unit (TM 1-1270-476-20).
37	PNVS SHROUD NO-GO	This message appears if the PNVS shroud assembly failed during PNVS continuous BIT and anti-ice is selected. Perform MOC (para 4-1).
38	ORT RIGHT HAND GRIP NO-GO CPG COMPARTMENT	This message appears if the right handgrip failed during PNVS interactive FD/LS. Replace right handgrip (TM 1-1270-476-20).
39	ORT HOD CONTROLS NO-GO CPG COMPARTMENT	This message appears if the ORT assembly control panel failed during PNVS interactive FD/LS. Replace ORT assembly control panel (TM 1-1270-476-20).
40	ORT LEFT HAND GRIP NO-GO CPG COMPARTMENT	This message appears if the left handgrip (LHG) assembly failed during PNVS interactive FD/LS. Replace left handgrip (TM 1-1270-476-20).
41	PNVS AZ GEAR NO-GO TURRET BULKHEAD	This message appears if the azimuth drive gimbal assembly failed during initiated BIT. Replace PNVS azimuth drive gimbal assembly (TM 1-5855-265-30).

3-6. DISPLAY MESSAGES AND PROMPTS (cont)

Table 3-1. Display Messages and Prompts (cont)

Item No.	Message/Prompt	Remarks **(Reference)**
42	PNVS TORQUER AMP NO-GO TURRET BULK-HEAD	This message appears If the PNVS electronic control amplifier failed during initiated BIT. Replace PNVS electronic control amplifier (TM 1-5855-265-20). If fault still exists, troubleshoot PNVS using DTA (TM 1-4931-727-13&P). If fault still exists, replace PNVS azimuth drive gear assembly (TM 1-5855-265-30). If fault still exists, replace PNVS turret assembly (TM 1-5855-265-20). If fault still exists, replace TADS electronic unit (TM 1-1270-476-20).

3-7. AC/DC POWER CONTROL AND BIT WIRING INTERCONNECT DIAGRAM

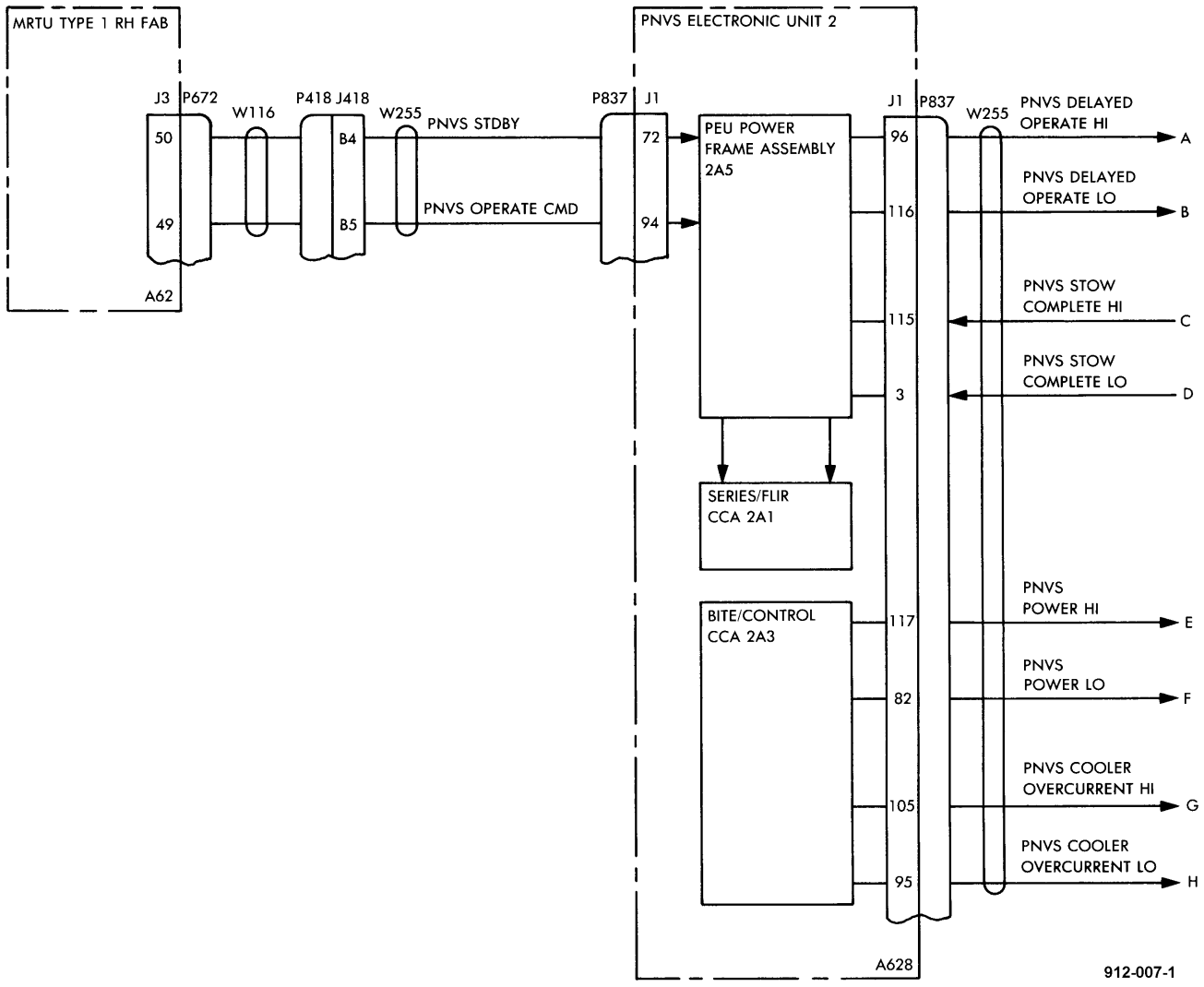


Figure 3-32. AC/DC Power Control and BIT Wiring Interconnect Diagram (Sheet 1 of 2)

3-7. AC/DC POWER CONTROL AND BIT WIRING INTERCONNECT DIAGRAM (cont)

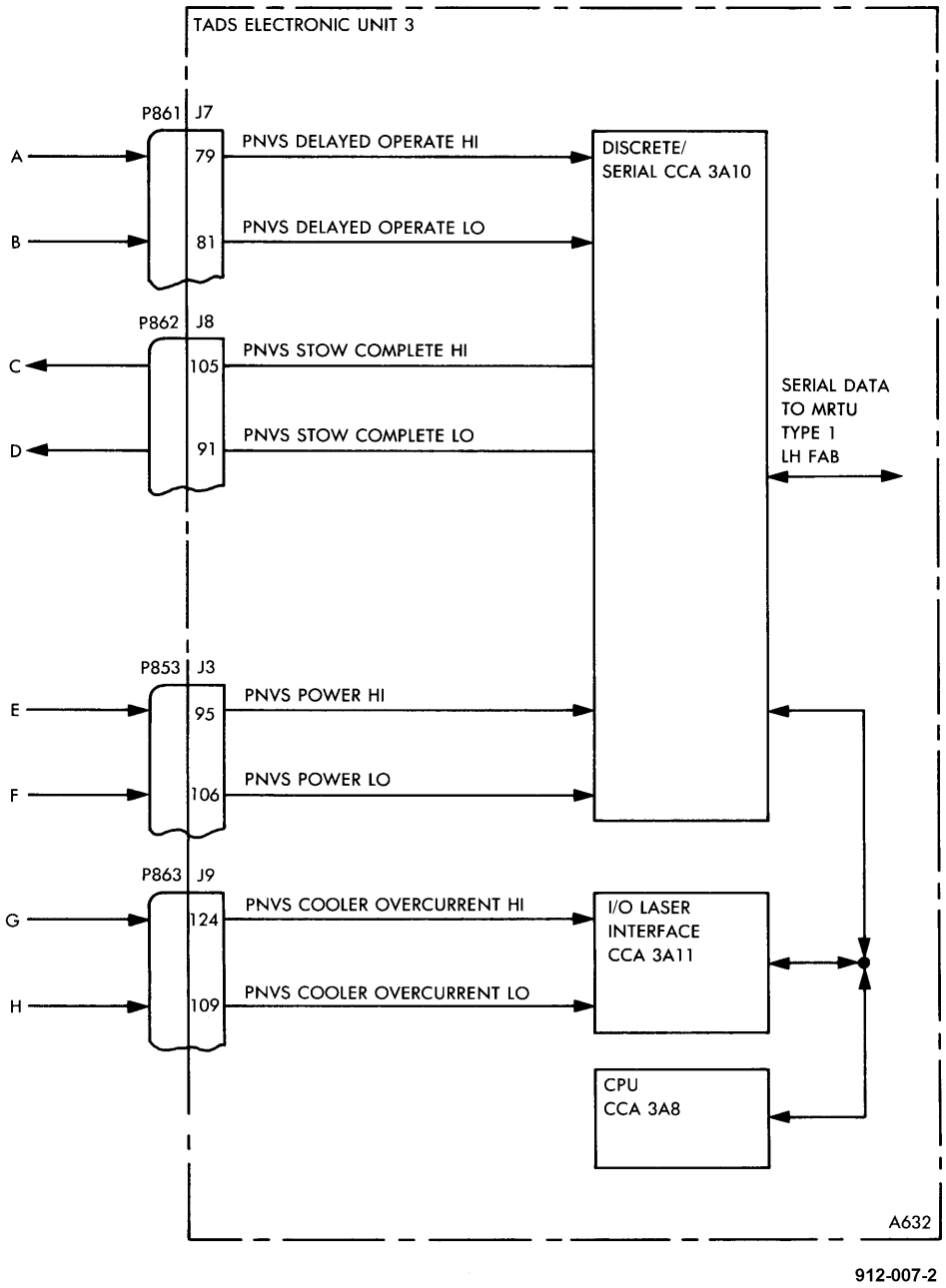


Figure 3-32. AC/DC Power Control and BIT Wiring Interconnect Diagram (Sheet 2 of 2)

3-8. AC POWER DISTRIBUTION (AIRCRAFT UNSWITCHED) WIRING INTERCONNECT DIAGRAM

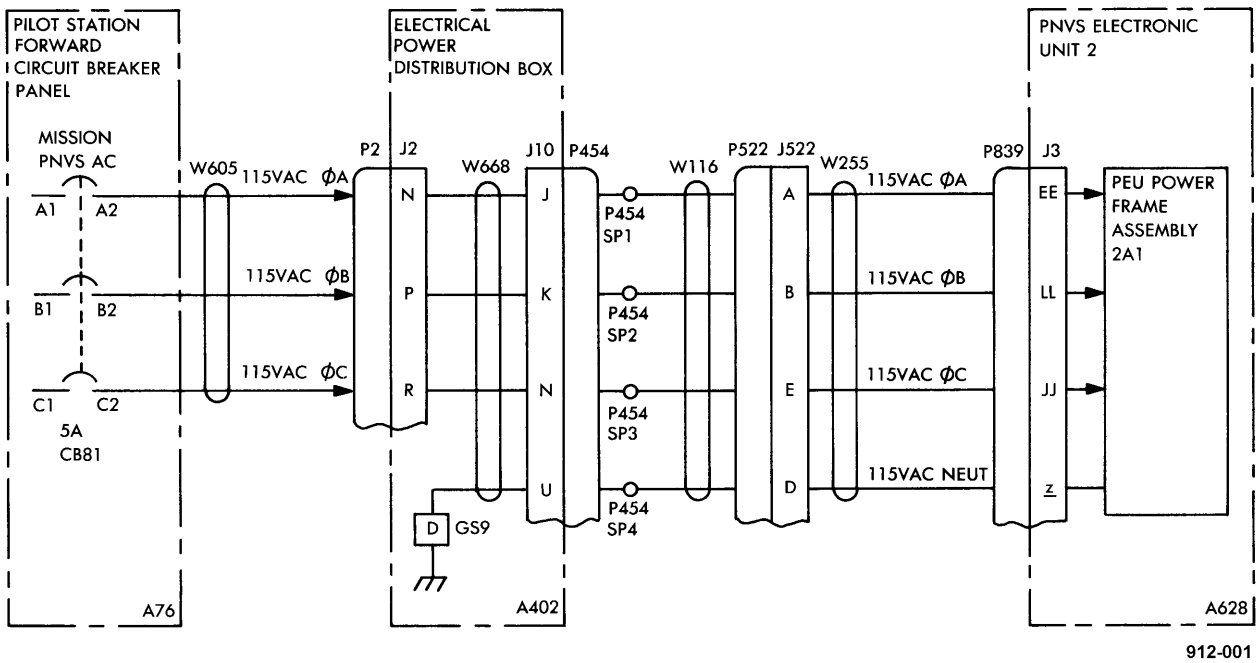


Figure 3-33. AC Power Distribution (Aircraft Unswitched) Wiring Interconnect Diagram

3-9. AC POWER DISTRIUTION (SWITCHED) WIRING INTERCONNECT DIAGRAM

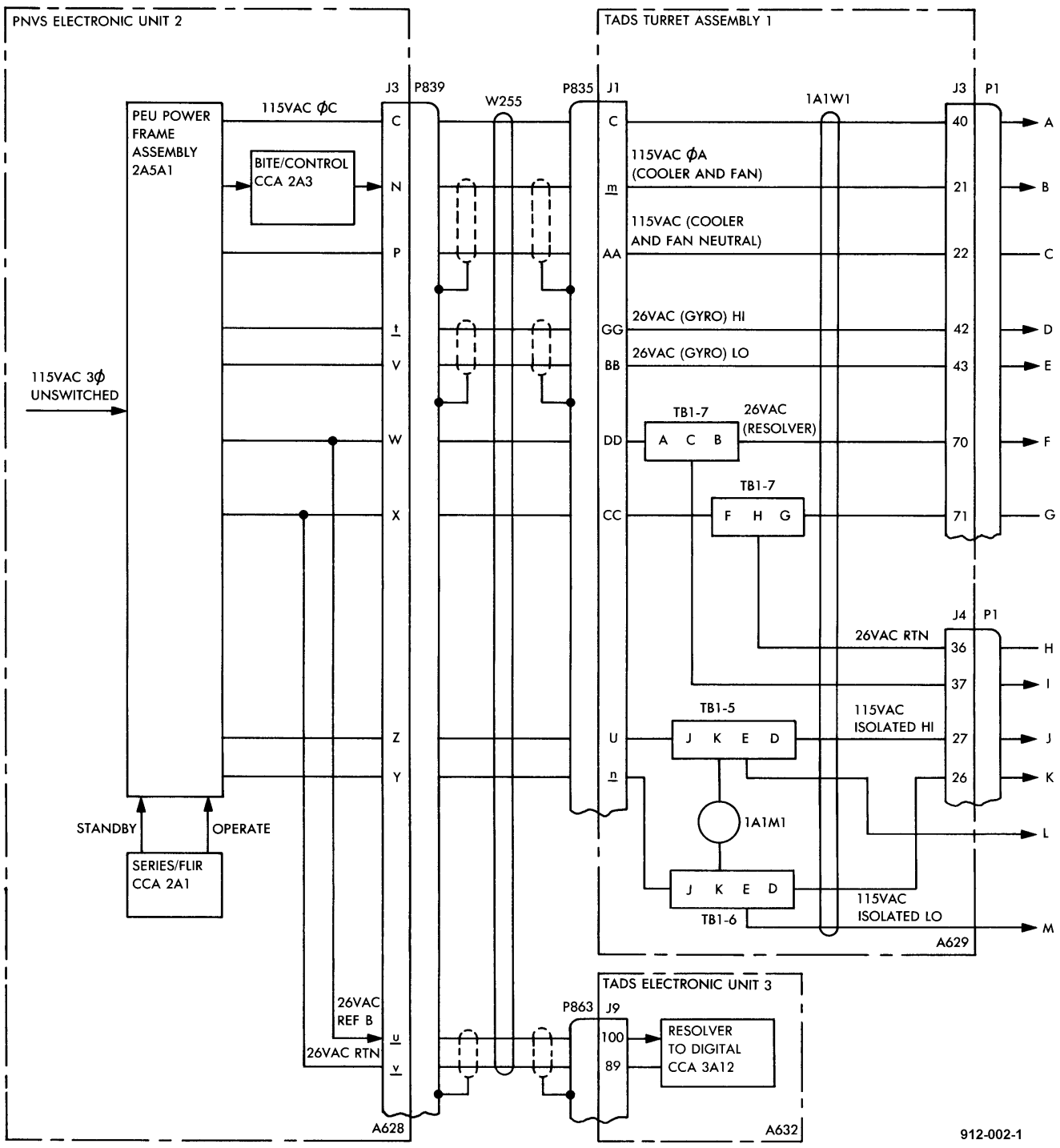


Figure 3-34. AC Power Distribution (Switched) Wiring Interconnect Diagram (Sheet 1 of 2)

3-9. AC POWER DISTRIBUTION (SWITCHED) WIRING INTERCONNECT DIAGRAM (cont)

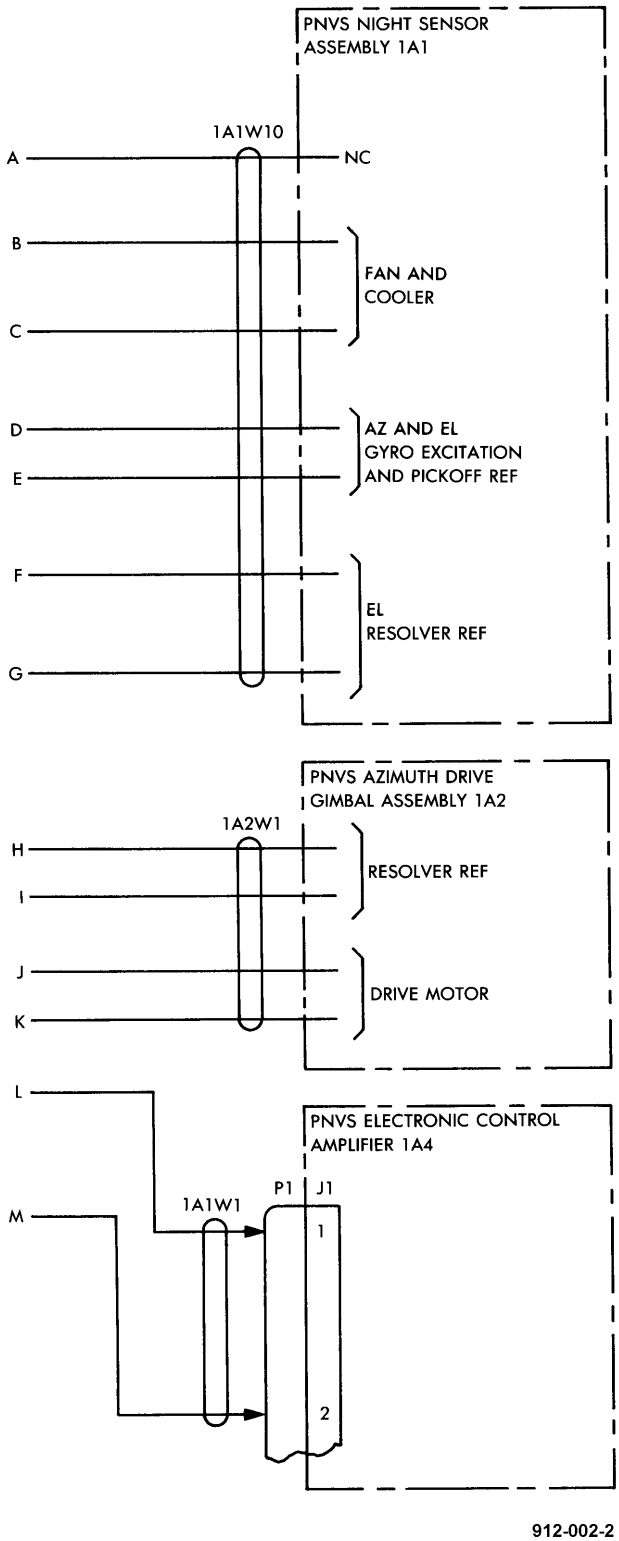


Figure 3-34. AC Power Distribution (Switched) Wiring Interconnect Diagram (Sheet 2 of 2)

3-10. DC POWER DISTRIBUTION (AIRCRAFT 28 VDC) WIRING INTERCONNECT DIAGRAM

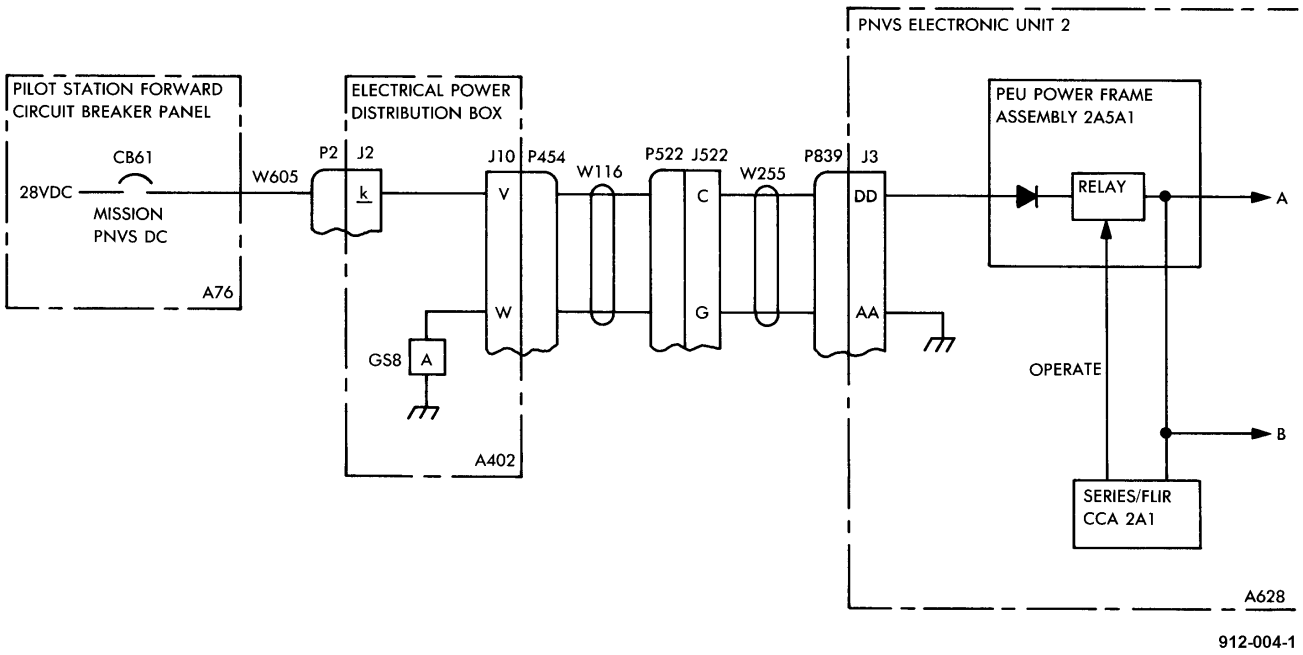


Figure 3-35. DC Power Distribution (Aircraft 28 VDC) Wiring Interconnect Diagram (Sheet 1 of 2)

3-10. DC POWER DISTRIBUTION (AIRCRAFT 28 VDC) WIRING INTERCONNECT DIAGRAM (cont)

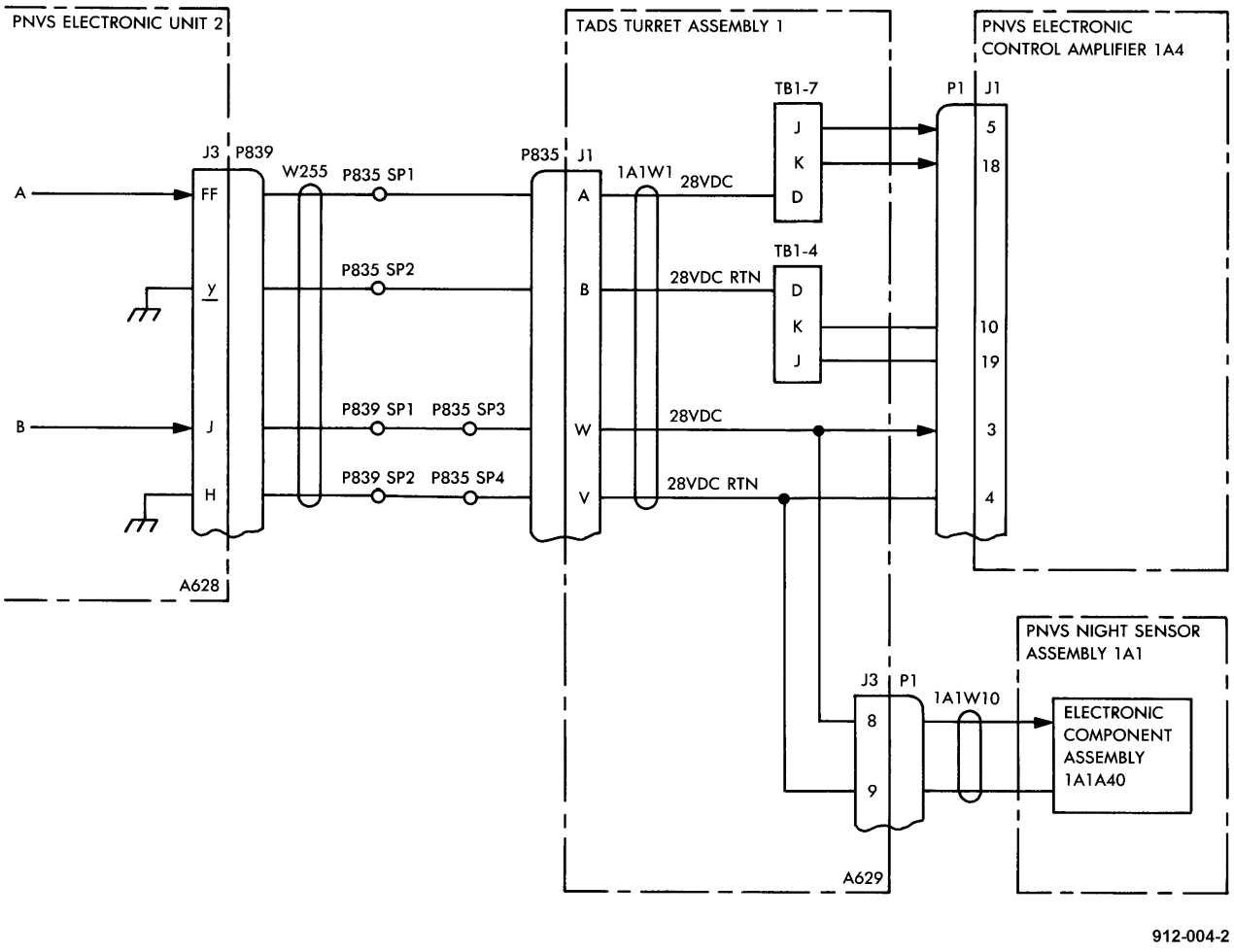


Figure 3-35. DC Power Distribution (Aircraft 28 VDC) Wiring Interconnect Diagram (Sheet 2 of 2)

3-11. DC POWER DISTRIBUTION (PNVS ELECTRONIC UNIT, STANDBY) WIRING INTERCONNECT DIAGRAM

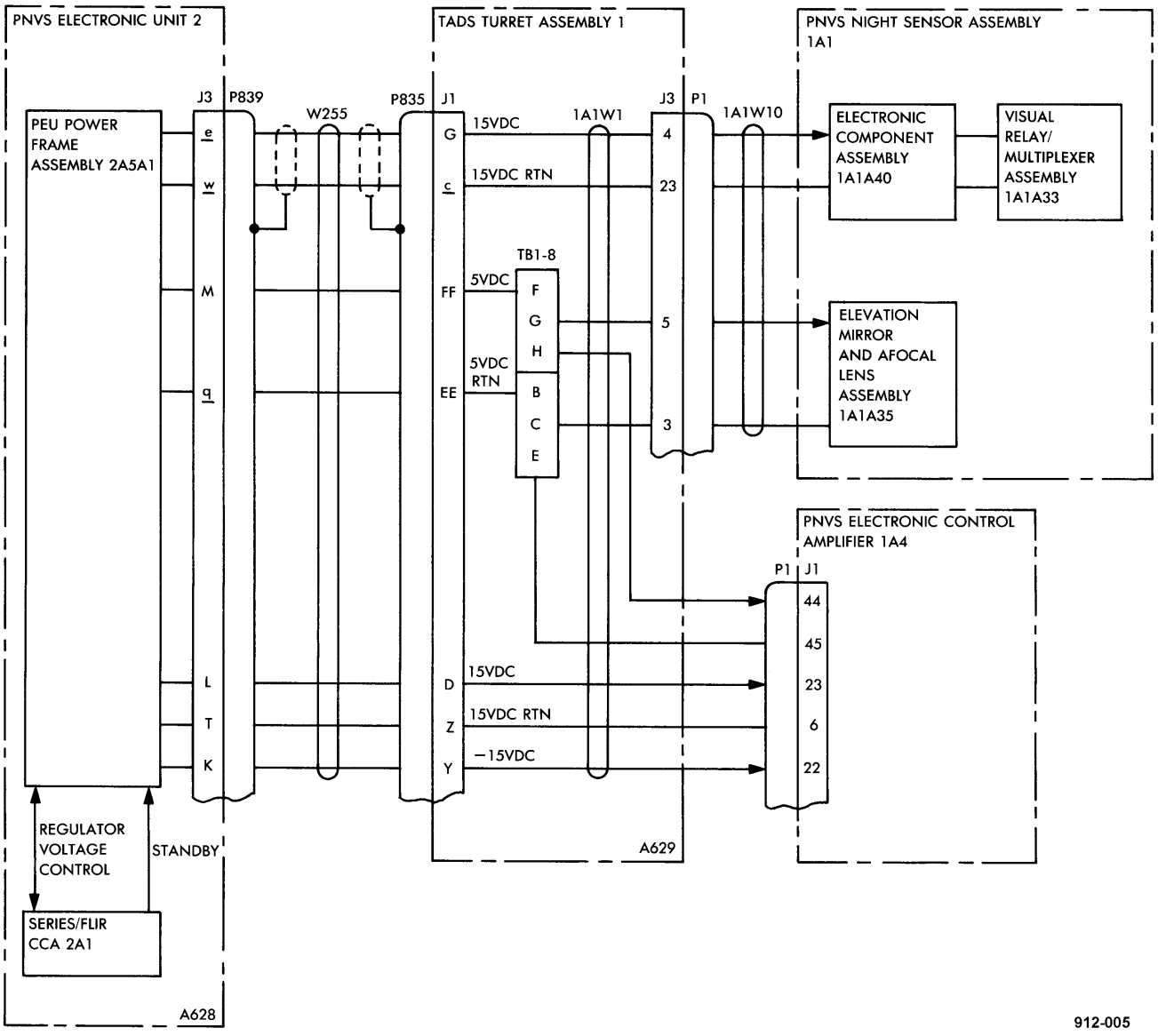


Figure 3-36. DC Power Distribution (PNVS Electronic Unit, Standby) Wiring Interconnect Diagram

3-12. DC POWER DISTRIBUTION (PNVS ELECTRONIC UNIT, OPERATE) WIRING INTERCONNECT DIAGRAM

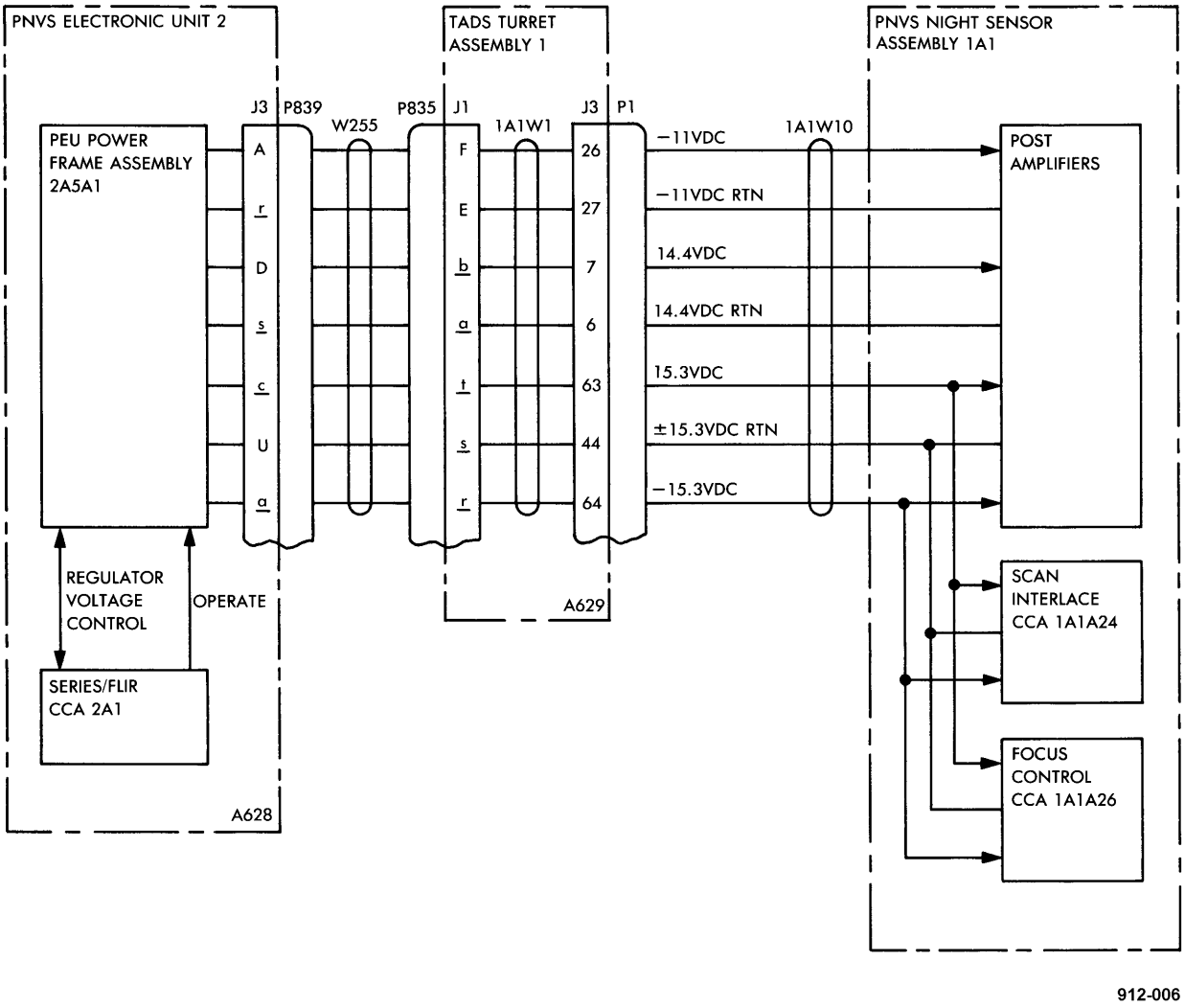


Figure 3-37. DC Power Distribution (PNVS Electronic Unit, Operate) Wiring Interconnect Diagram

3-13. PNVS BRAKE RELEASE WIRING INTERCONNECT DIAGRAM

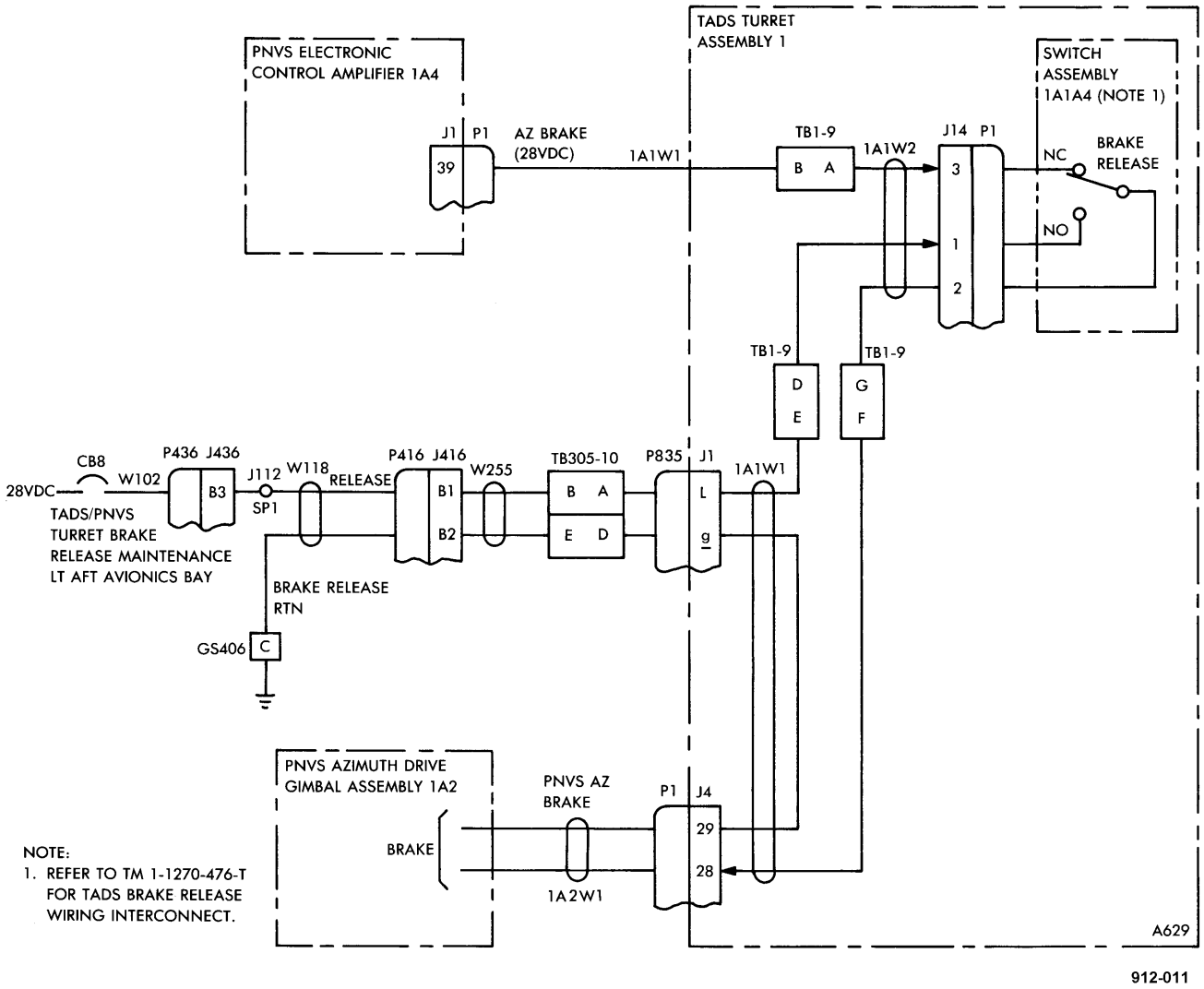


Figure 3-38. PNVS Brake Release Wiring Interconnect Diagram

3-14. VIDEO CONTROL WIRING INTERCONNECT DIAGRAM

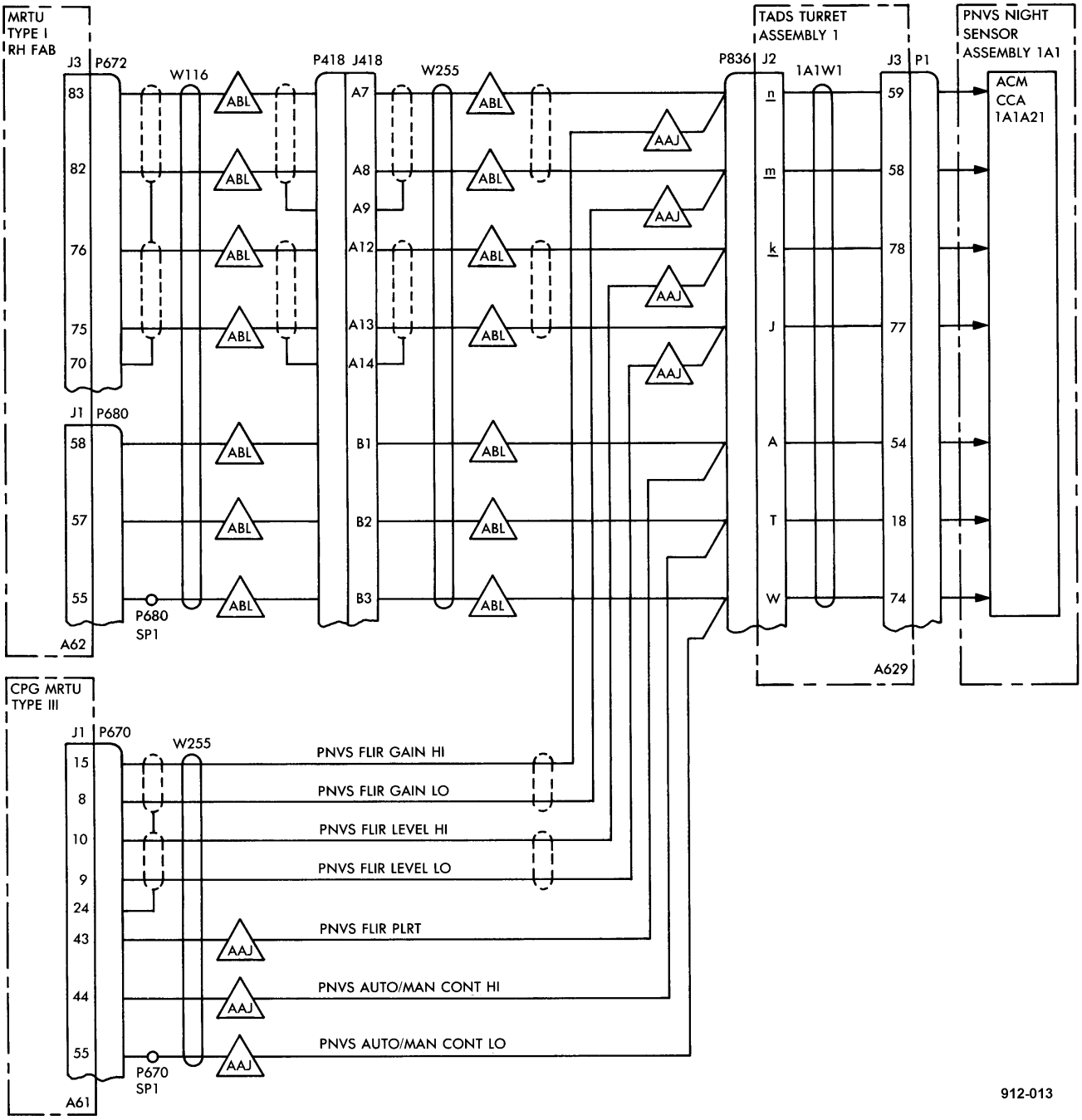


Figure 3-39. Video Control Wiring Interconnect Diagram

3-15. VIDEO WIRING INTERCONNECT DIAGRAM

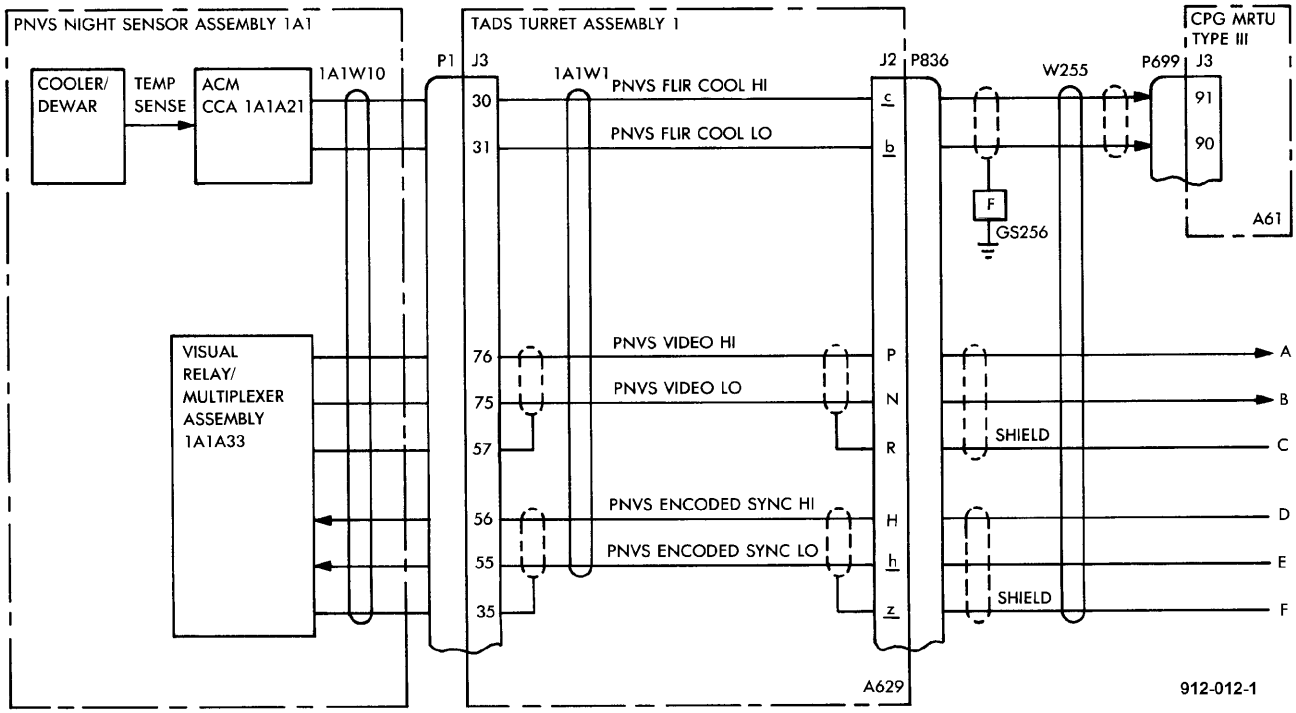


Figure 3-40. Video Wiring Interconnect Diagram (Sheet 1 of 2)

3-15. VIDEO WIRING INTERCONNECT DIAGRAM (cont)

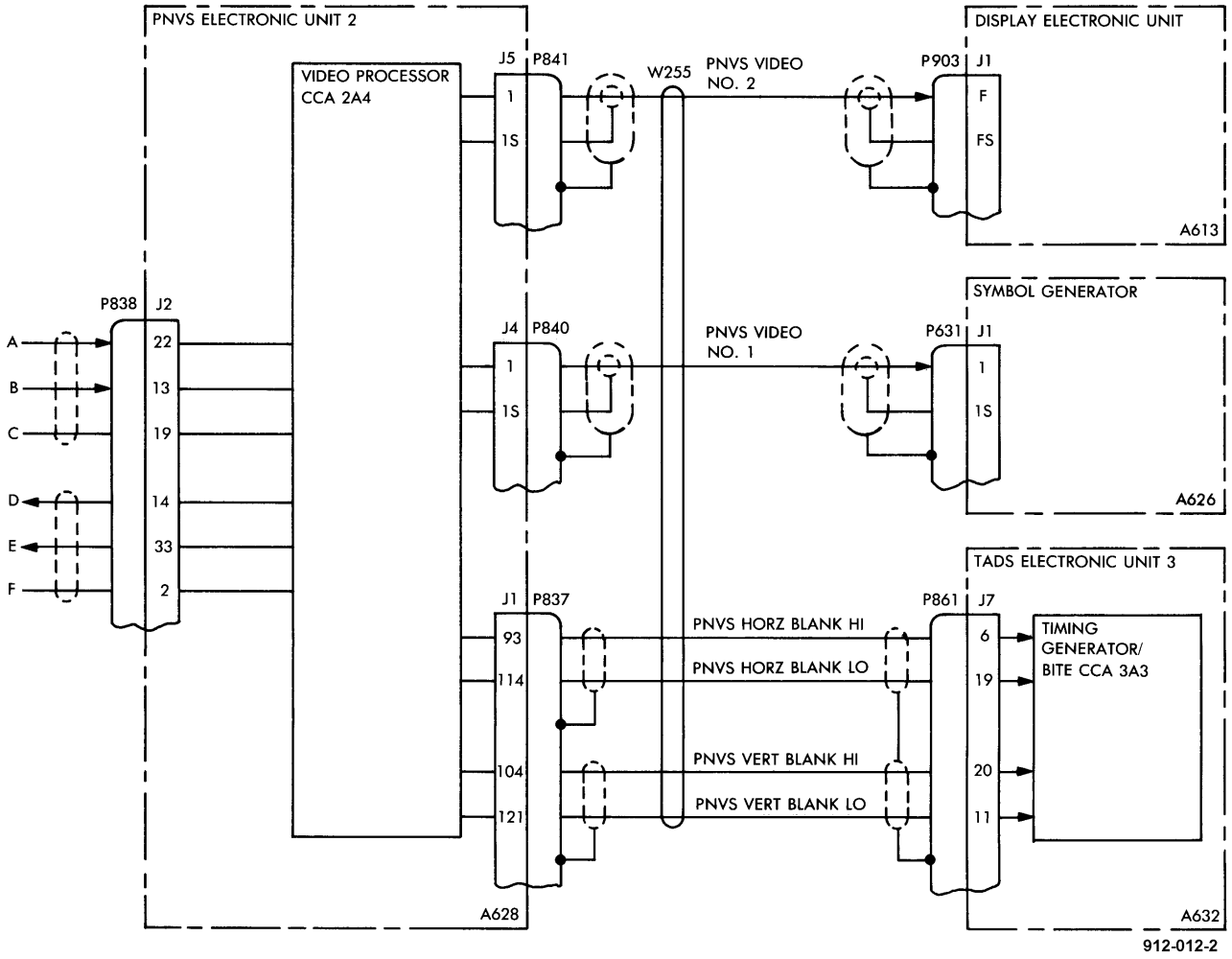


Figure 3-40. Video Wiring Interconnect Diagram (Sheet 2 of 2)

3-16. VIDEO BIT WIRING INTERCONNECT DIAGRAM

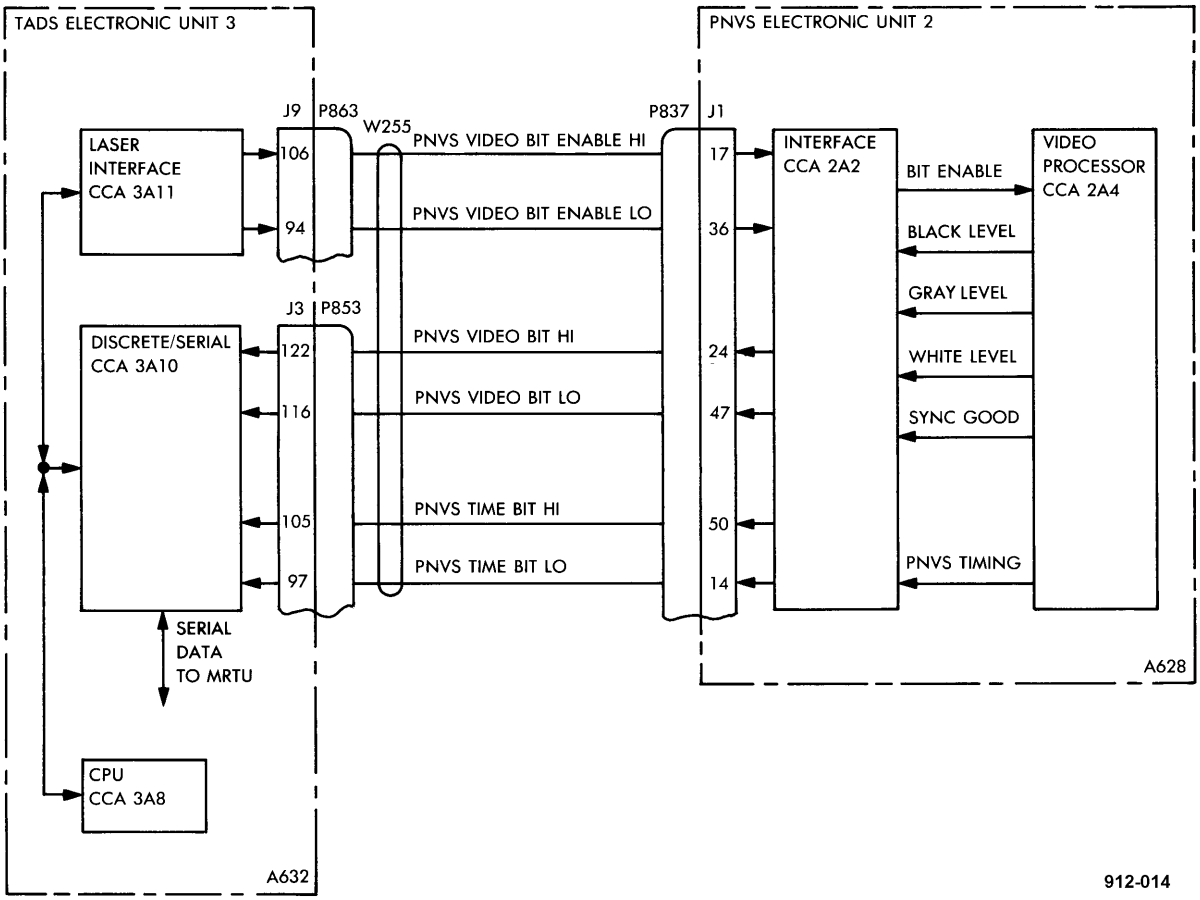


Figure 3-41. Video BIT Wiring Interconnect Diagram

3-17. SERVO LOOP CONTROL AND BIT WIRING INTERCONNECT DIAGRAM

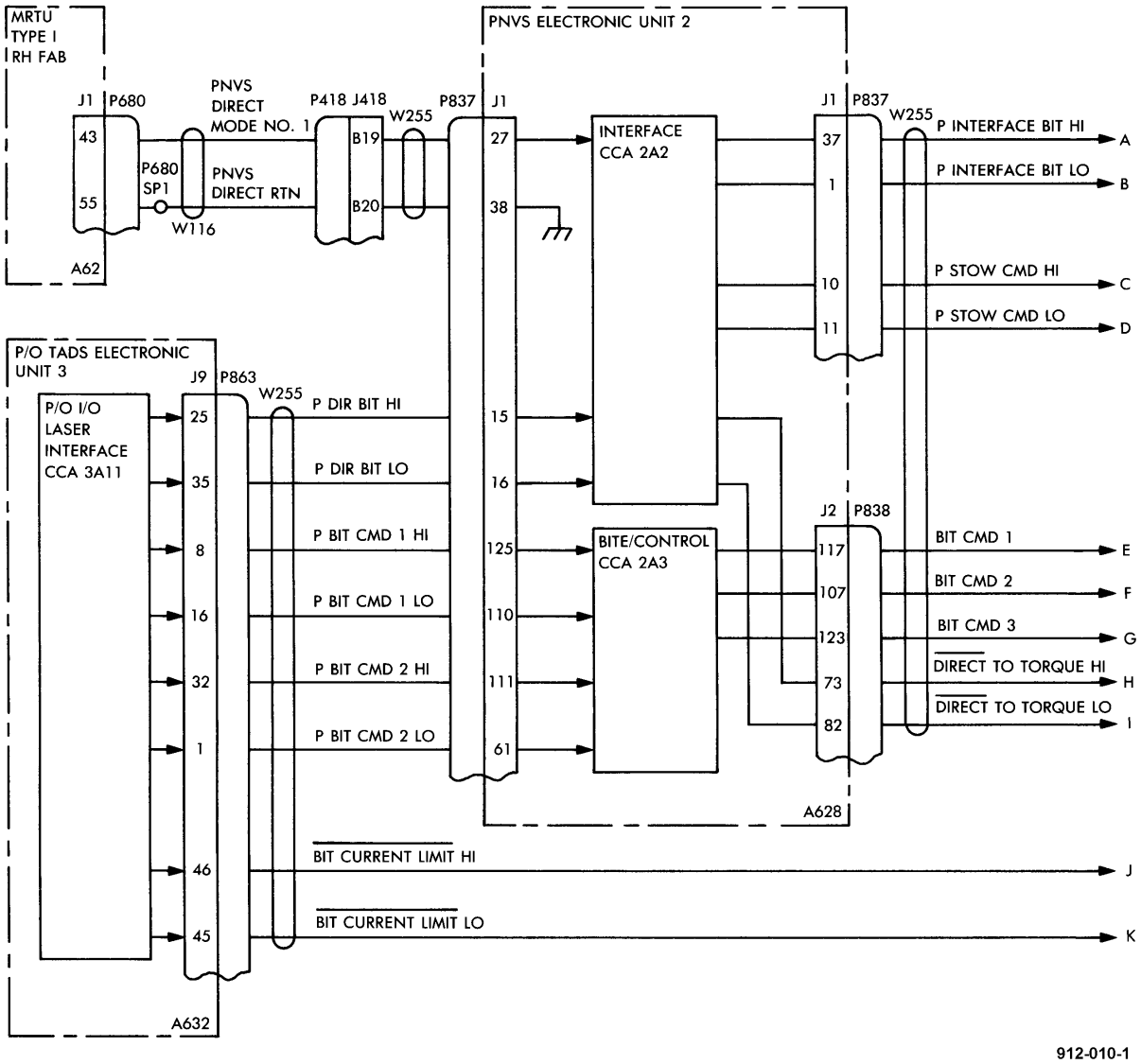


Figure 3-42. Servo Loop Control and BIT Wiring Interconnect Diagram (Sheet 1 of 2)

3-17. SERVO LOOP CONTROL AND BIT WIRING INTERCONNECT DIAGRAM (cont)

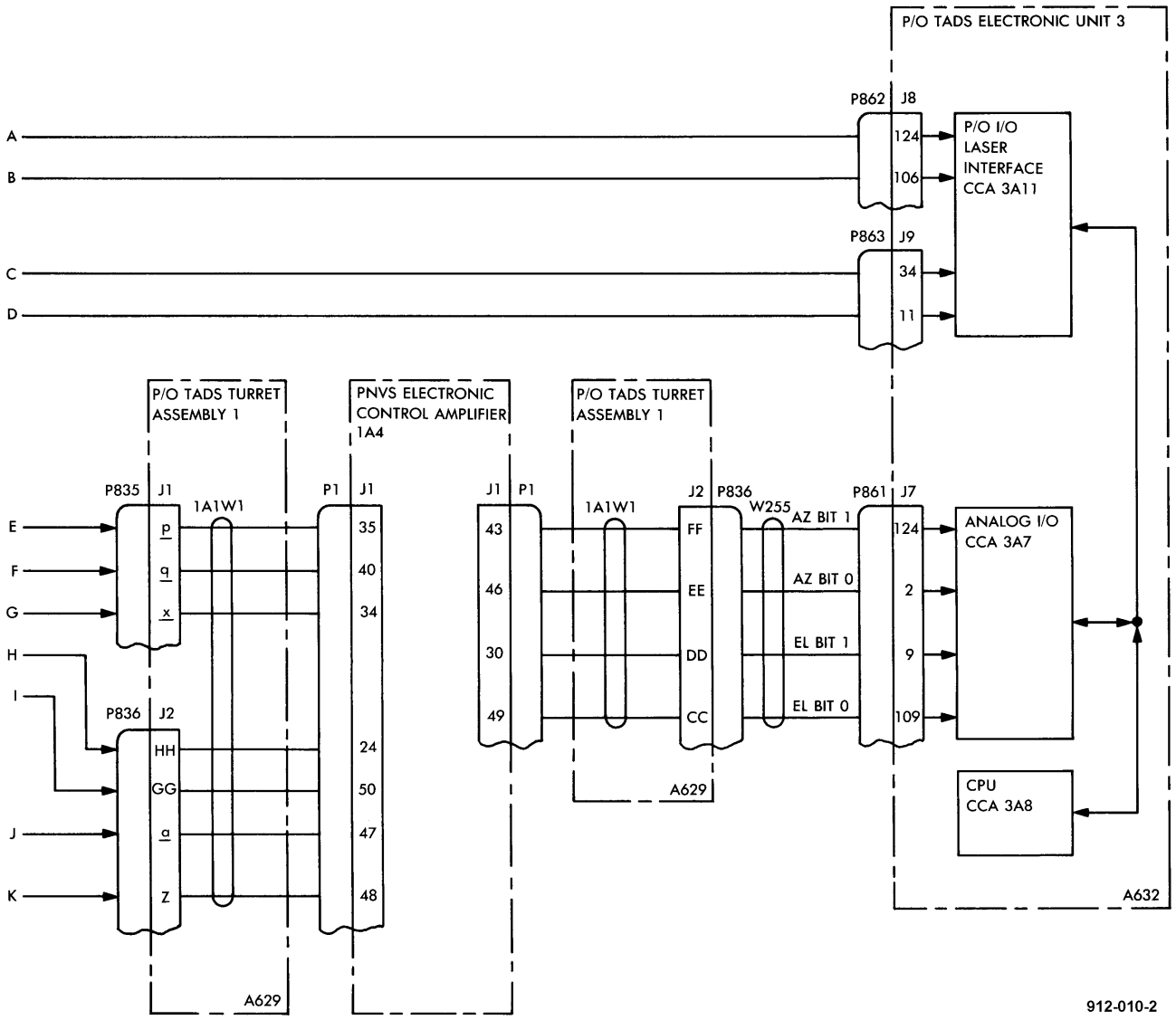


Figure 3-42. Servo Loop Control and BIT Wiring Interconnect Diagram (Sheet 2 of 2)

3-18. AZIMUTH SERVO LOOP WIRING INTERCONNECT DIAGRAM

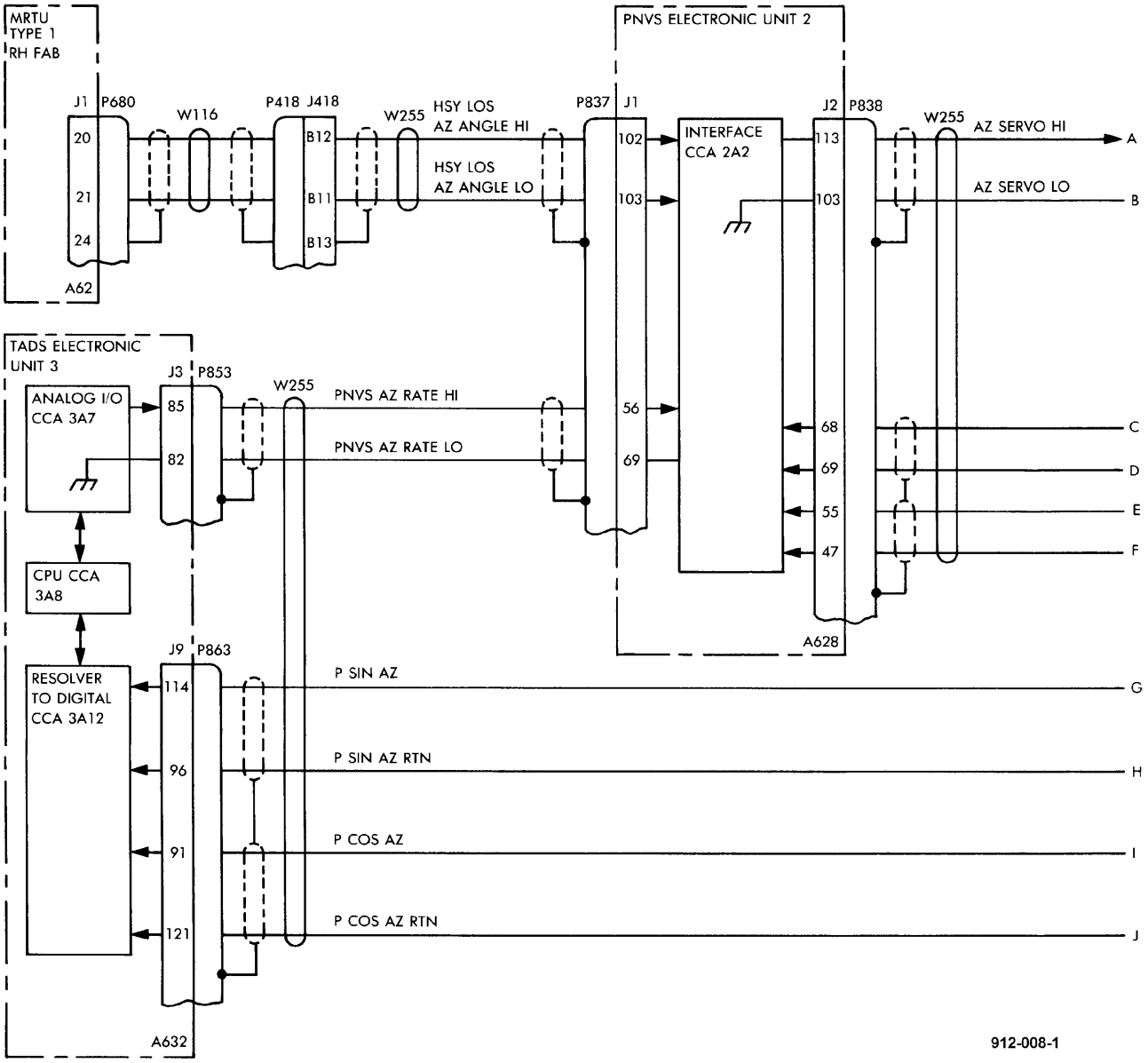


Figure 3-43. Azimuth Servo Loop Wiring Interconnect Diagram (Sheet 1 of 2)

3-18. AZIMUTH SERVO LOOP WIRING INTERCONNECT DIAGRAM (cont)

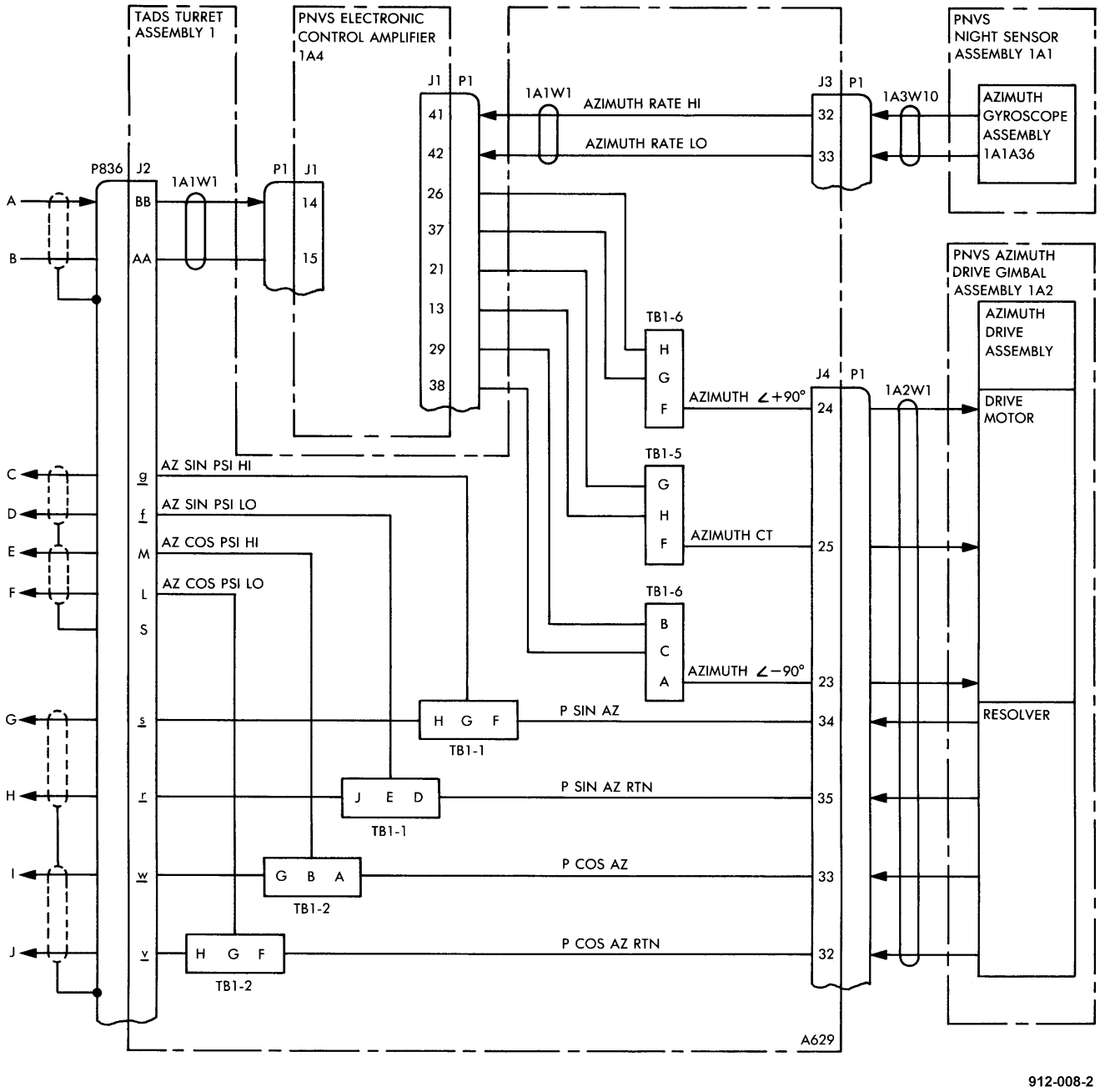


Figure 3-43. Azimuth Servo Loop Wiring Interconnect Diagram (Sheet 2 of 2)

3-19. ELEVATION SERVO LOOP WIRING INTERCONNECT DIAGRAM

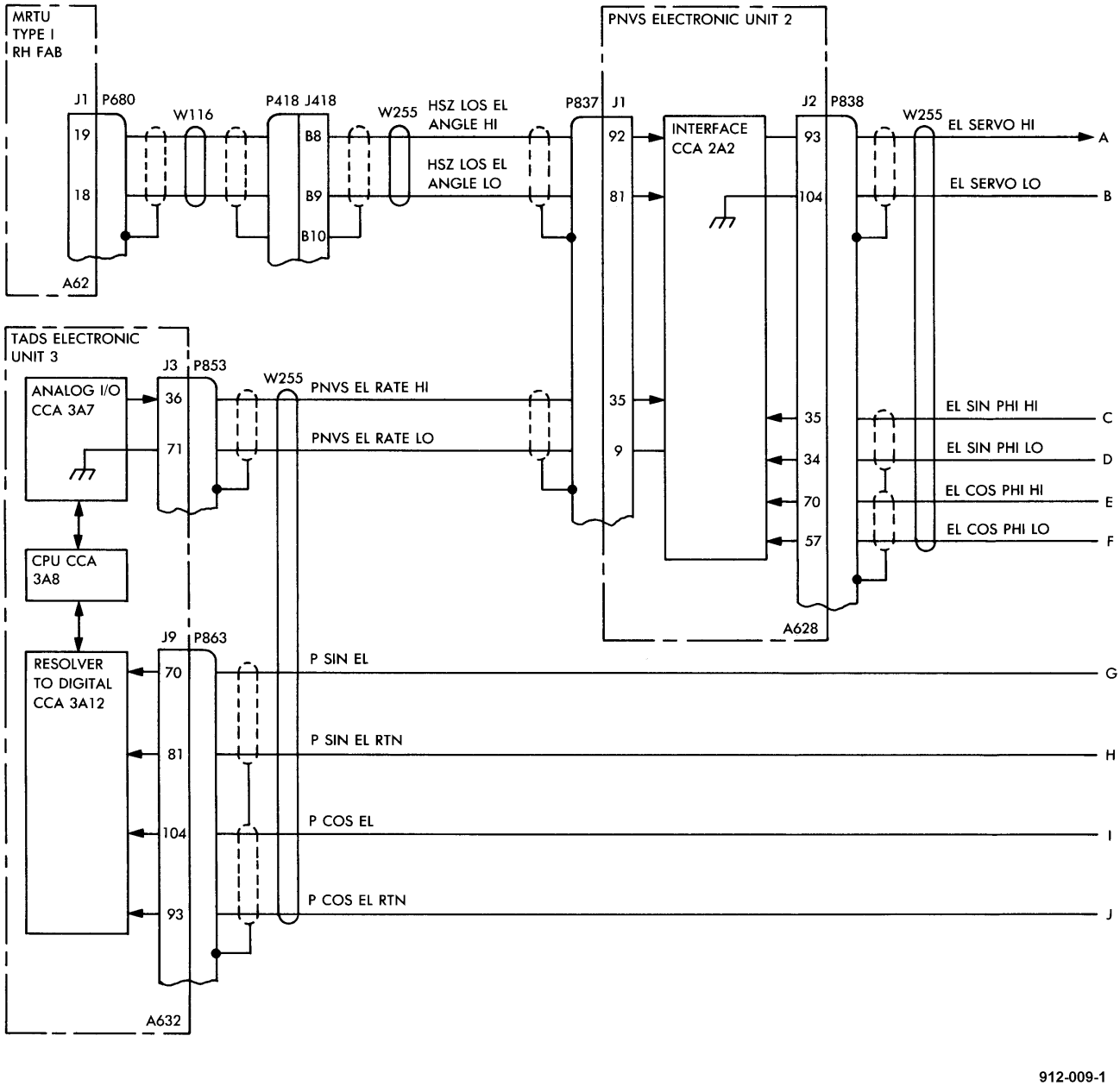


Figure 3-44. Elevation Servo Loop Wiring Interconnect Diagram (Sheet 1 of 2)

3-19. ELEVATION SERVO LOOP WIRING INTERCONNECT DIAGRAM (cont)

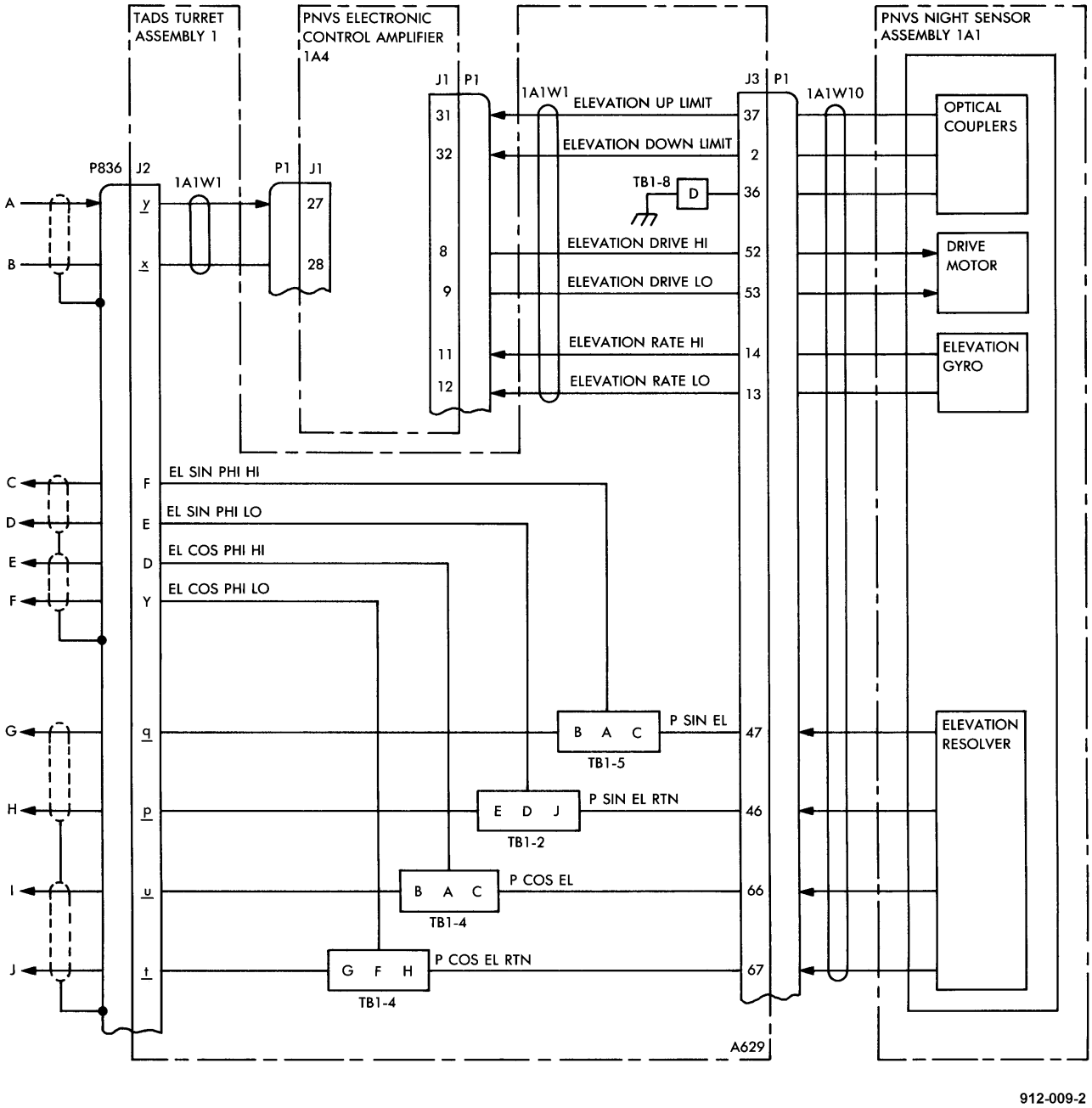


Figure 3-44. Elevation Servo Loop Wiring Interconnect Diagram (Sheet 2 of 2)

3-20. PILOT'S COLLECTIVE NVS SWITCH FAILURE

INITIAL SETUP

Personnel Required:

68X Aircraft Armament/Electrical Systems Repairer (2)

References:

TM 1-1500-204-23-4
TM 1-1520-238-T-10
TM 1-1520-238-23-7
TM 9-1230-476-20-2

Equipment Conditions:

Ref	Condition
	HME System MOC with TSGMS completed

WARNING

Turn off power before detaching or attaching wires and connectors. High current 28V DC and/or 115V AC are present. Failure to do so could result in death or serious injury.

NOTE

After each troubleshooting step, reconnect connectors to their original configuration.

1. Check for open between Pilot Collective Stick connector J107-f and Pilot Fire Control Panel connector P278-27.
   Does continuity exist?

   YES — Repair open wire (TM 1-1500-204-23- 4). Perform HME System MOC with TSGMS.
   NO — Go to step 2.

2. Check for open between Pilot Collective Stick connector J107-e and MRTU Type I LH FAB connector P684-29.
   Does open exist?

   YES — Repair open wire. (TM 1-1500-204-23-4). Perform HME System MOC with TSGMS.
   NO — Go to step 3.

3. Ensure the Pilot Collective Stick NVS Switch is set to PNVS. Check for open between Pilot Collective Stick connector J107 pin f and e.
   Does open exist?

   YES — Replace Pilot Collective Stick. (TM 1-1520-238-23-7). Perform HME System MOC with TSGMS.
   NO — Replace MRTU Type I LH FAB. (TM 9-1230-476-20-2). Perform MOC with TSGMS. If failure persist, replace Pilot Fire Control Panel. (TM 9-1230-476-20-2). Perform HME System MOC with TSGMS.

4. With CPG MRTU Type III connector P668 disconnected, check for short between Optical Relay Tube connector P870-44 and P870-45.
   Does short exist?

   YES — Repair shorted wire (TM 1-1500-204-23-4). Perform HME System MOC with TSGMS.
   NO — Repair shorted wire (TM 9-1230-476-20-2). Perform HME System MOC with TSGMS.

END OF TASK

3-21. PNVS TURRET NO-GO - APPEARS ON HOD (VIDEO FAULT)

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1270-476-30
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-35, 3-36 3-37, 3-39, 3-40

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions - R40 cover removed CPG MRTU type III removed

1. Disconnect PNVS night sensor assembly connector 1A1W10P1 from TADS turret assembly connector 1A1W1J3.

2. Disconnect P835 from TADS turret assembly connector 1A1W1J1 and check for open between:

   1A1W1J38 and 1A1W1J1-W
   1A1W1J3-9 and 1A1W1J1-V
   1A1W1J3-21 and 1A1W1J1-m
   1A1W1J3-22 and 1A1W1J1-AA
   1A1W1J3-4 and 1A1W1J1-G
   1A1W1J3-23 and 1A1W1J1-c
   1A1W1J3-26 and 1A1WIJ1-F
   1A1W1J3-27 and 1A1W1J1-E
   1A1W1J3-7 and 1AIWIJ1-b
   1A1W1J3-6 and 1A1W1J1-a
   1A1W1J3-63 and 1A1W1J1-t
   1A1W1J3-44 and 1A1W1J1-s
   1A1W1J3-64 and 1A1W1J1-r
   Does open exist?

   YES — Replace TADS turret assembly (TM 1-1270-476-30).
   NO — Go to step 3.

3-21. PNVS TURRET NO-G0 - APPEARS ON HOD (VIDEO FAULT) (cont)

3. Check for open between:

   P839-J and P835-W
   P839-H and P835-V
   P839-N and P835-m
   P839-P and P835-AA
   P839-e and P835-G
   P839-w and P835-c
   P839-A and P835-F
   P839-r and P835-E
   P839-D and P835-b
   P839-s and P835-a
   P839-c and P835-t
   P839-U and P835-s
   P839-a and P835-r
   Does open exist?

   YES Repair open wire.
   Perform MOC (para 3-5).
   NO Go to step 4.

4. Connect P835 to TADS turret assembly connector 1A1W1J1.

5. Disconnect P836 from TADS turret assembly connector 1A1W1J2 and check for open between:

   1A1W1J3-59 and lAlWlJ2-n
   1A1W1J3-58 and lAlWlJ2-m
   1A1W1J3-78 and 1A1W1J2-k
   1A1W1J3-77 and 1A1W1J2-J
   1A1WLJ3-54 and 1A1W1J2-A
   1A1W1J3-18 and 1A1W1J2-T
   1A1W1J3-74 and 1A1W1J2-W
   1A1W1J3-76 and 1A1W1J2-P
   1A1W1J3-75 and 1A1W1J2-N
   1A1W1J3-57 and 1A1W1J2-R
   1A1W1J3-56 and 1A1W1J2-H
   1A1W1J3-55 and lAlWlJ2-h
   1A1W1J3-35 and 1A1W1J2-Z
   Does open exist?

   YES Replace TADS turret assembly (TM 1-1270-476-30).
   NO Go to step 6.

6. Check for open between:

   P838-22 and P836-P
   P838-13 and P836-N
   P838-19 and P836-R
   P838-14 and P836-H
   P838-33 and P836-h
   P838-2 and P836-z
   Does open exist?

   YES Repair open wire.
   Perform MOC wire. (para 3-5).
   NO Go to step 7.

NOTE

For AAJ config, perform steps 7 and 8. For ABL configuration perform steps 9 thru 13.

7. **[AAJ]** Check for open between:

   P670-15 and P836-n
   P670-8 and P836-m
   P67O-10 and P836-k
   P670-9 and P836-J
   P670-43 and P836-A
   P670-44 and P836-T
   P670-55 and P836-W
   Does open exist?

   YES Repair open wire.
   Perform MOC (para 3-5).
   NO Go to step 8.

3-21. PNVS TURRET NO-G0 - APPEARS ON HOD (VIDEO FAULT) (cont)

8. [AAJ] Disconnect P836 and check for short between:

   P670-15 and P670-24
   P670-8 and P670-24
   P67O-10 and P670-24
   P670-9 and P670-24
   Does short exist?

   YES Repair shorted wire. Perform MOC (para 3-5)
   NO Go to step 14.

9. **[ABL]** Check for open between:

   P672-83 and P836-n
   P672-82 and P836-m
   P672-76 and P836-k
   P672-75 and P836-J
   Does open exist?

   YES Repair open wire. Perform MOC (para 3-5).
   NO Go to step 10.

10. **[ABL]** Check for open between:

    P418-A9 and P672-70
    P418-A14 and P672-70
    Does open exist?

    YES Repair open wire. Perform MOC (para 3-5).
    NO Go to step 11.

11. **[ABL]** Disconnect P836 and check for short between:

    P672-70 and P672-83
    P672-70 and P672-82
    P672-70 and P672-76
    P672-70 and P672-75
    Does short exist?

    YES Leave ohmmeter connected to shorted wire and go to step 12.
    NO Go to step 13.

12. **[ABL]** Disconnect P418.
    Does short still exist?

    YES Repair shorted wire between P672 and P418. Perform MOC (para 3-5).
    NO Repair shorted wire between P836 and J418. Perform MOC (para 3-5).

13. **[ABL]** Check for open between:

    P836-A and P680-58
    P836-T and P680-57
    P836-W and P680-55
    Does open exist?

    YES Repair open wire. Perform MOC (para 3-5).
    NO Go to step 14.

14. Check for open between:

    P840-1 and P631-1
    P840-1S and P631-1S
    Does open exist?

    YES Repair open wire. Perform MOC (para 3-5).
    NO Go to step 15.

15. Disconnect P631 and check for short between:

    P840-1 and P840-1S
    P840-1 and P840 backshell
    P840-1S and P840 backshell
    Does short exist?

    YES Repair shorted wire. Perform MOC (para 3-5).
    NO Replace PNVS electronic unit (TM 1-5855-265-20).

END OF TASK

3-22. MISSION PNVS AC CIRCUIT BREAKER OPENS WHEN POWER IS APPLIED

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1270-476-20
TM 1-1270-476-30
TM 1-5855-265-30
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-34

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions - R90 door opened

1. Check for short between ground and:

   P839-C
   P839-N
   P839-t
   P839-V
   P839-W
   P839-X
   P839-Z
   P839-Y
   P839-u
   P839-v

   Does short exist?

   YES — Leave ohmmeter connected to shorted wire and go to step 2.
   NO — Replace PNVS electronic unit (TM 1-5855-265-20).

2. Disconnect PNVS night sensor assembly connector 1A1W10P1 from TADS turret assembly connector 1A1W1J3.

   Does short still exist?

   YES — Go to step 3.
   NO — Replace PNVS turret assembly (TM 1-5855-265-20).

3. Disconnect TADS turret assembly connector 1A1W1P1 from PNVS electronic control amplifier connector 1A4J1.

   Does short still exist?

   YES — Go to step 4.
   NO — Replace PNVS electronic control amplifier (TM 1-5855-265-20).

3-22. MISSION PNVS AC CIRCUIT BREAKER OPENS WHEN POWER IS APPLIED (cont)

4. Disconnect PNVS azimuth drive gimbal assembly connector 1A2W1P1 from TADS turret assembly connector 1A1W1J4.
   Does short still exist?

YES	Go to step 5.
NO	Replace PNVS azimuth drive gimbal assembly (TM 1-5855-265-30).

5. Disconnect P835 from TADS turret assembly connector 1A1W1J1.
   Does short still exist?

YES	Go to step 6.
NO	Replace TADS turret assembly (TM 1-1270-476-30).

6. Connect PNVS night sensor assembly connector 1A1W10P1 to TADS turret assembly connector 1A1W1J3.

7. Connect PNVS turret assembly connector 1A1W1P1 to PNVS electronic control amplifier connector 1A4J1.

8. Connect PNVS azimuth drive gimbal assembly connector 1A2W1P1 to TADS turret assembly connector 1A1W1J4.

9. Disconnect P863 from TADS electronic unit connector 3J9.
   Does short still exist?

YES	Repair shorted wire. Perform MOC (para 3-5).
NO	Replace TADS electronic unit (TM 1-1270-476-20).

END OF TASK

3-23. MISSION PNVS DC CIRCUIT BREAKER OPENS WHEN POWER IS APPLIED

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1270-476-30
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-35

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions - R90 door opened

1. Check for short between ground and:

   P839-FF
   P839-J
   Does short exist?

   YES — Leave ohmmeter connected to shorted wire and go to step 2.
   NO — Replace PNVS electronic unit (TM 1-5855-265-20).

2. Disconnect PNVS night sensor assembly connector 1A1W10P1 from TADS turret assembly connector 1A1W1J3.
   Does short still exist?

   YES — Go to step 3.
   NO — Replace PNVS turret assembly (TM 1-5855-265-20).

3. Disconnect TADS turret assembly connector 1A1W1P1 from PNVS electronic control amplifier connector 1A4J1.
   Does short still exist?

   YES — Go to step 4.
   NO — Replace PNVS electronic control amplifier (TM 1-5855-265-20).

4. Disconnect P835 from TADS turret assembly connector 1A1W1J1.
   Does short still exist?

   YES — Repair shorted wire. Perform MOC (para 3-5).
   NO — Replace TADS turret assembly (TM 1-1270-476-30).

END OF TASK

3-24. PNVS BRAKE RELEASE DOES NOT OPERATE

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer
One person to assist

References:

TM 1-1270-476-20
TM 1-1270-476-30
TM 1-1520-238-T-6
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-38

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed

1. Disconnect PNVS azimuth drive gimbal assembly connector 1A2W1P1 from TADS turret assembly connector 1A1W1J4.

2. Disconnect TADS turret assembly connector 1A1W1P1 from PNVS electronic control amplifier connector 1A4J1 and check for open between 1A1W1P1-39 and 1A1W1J4-28.
Does open exist?

YES Go to step 6.
NO Go to step 3.

3. Disconnect P835 from TADS turret assembly connector 1A1W1J1 and check for open between 1A1W1J1-g and 1A1W1J4-29.
Does open exist?

YES Replace TADS turret assembly (TM 1-1270-476-30).
NO Go to step 4.

4. Hold brake release switch in position to turn PNVS turret and check for open on PNVS turret assembly between 1A1W1J1-L and 1A1W1J4-28.
Does open exist?

YES Replace TADS turret assembly (TM 1-1270-476-30).
NO Go to step 5.

WARNING

- Lethal voltage is exposed in this fault isolation procedure. Death on contact may result if personnel fail to observe the following safety precautions.
- Remove watches and rings and exercise extreme caution when measuring voltages throughout this procedure.
- Turn off power before disconnecting or connecting wires and connectors. High current 28 VDC or 115 VAC is present. Failure to turn off power could result in death or serious injury

CAUTION

Voltage measured during this fault isolation procedure can damage electronic equipment connected to adjacent connector pins. Make sure that test equipment does not contact surrounding connector pins during voltage measurements,

3-24. PNVS BRAKE RELEASE DOES NOT OPERATE (cont)

5. Connect aircraft battery (TM 1-1520-238-23) and check for 28 VDC between P835-L and P835-g (ref).
   Is 28 VDC present?

   YES Go to step 8.
   NO Refer to TM 1-1520-238-T-6 to troubleshoot battery and battery charger.

6. Connect PNVS azimuth drive gimbal assembly connector 1A2W1P1 to TADS turret assembly connector 1A1W1J4.

7. Connect TADS turret assembly connector 1A1W1P1 to PNVS electronic control amplifier connector 1A4J1.

8. Connect P835 to TADS turret assembly connector 1A1W1J1.

9. Disconnect TADS turret assembly brake release switch assembly connector 1A1A4P1 from TADS turret assembly connector 1A1W2J14 and check for open on switch assembly between 1A1A4P1-3 and 1A1A4P1-2.
   Does open exist?

   YES Replace switch assembly 1A1A4 (TM 1-1270-476-20).
   NO Go to step 10.

10. Hold brake release switch in position to turn PNVS turret and check for open on switch assembly between 1A1A4P1-1 and 1A1A4P1-2.
    Does open exist?

    YES Replace switch assembly 1A1A4 (TM 1-1270-476-20).
    NO Replace TADS turret assembly (TM 1-1270-476-30)

END OF TASK

3-25. NO FLIR VIDEO (WITH SYMBOL GENERATOR INOPERATIVE)

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-40

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions - R90 door open.

1. Check for open between:

   P841-1 and P903-F
   P841-1S and P903-FS
   Does open exist?

YES	Repair open wire. Perform MOC (para 3-5).
NO	Go to step 2.

2. Disconnect P903 and check for short between:

   P841-1 and P841-1S
   P841-1 and P841 backshell
   P841-1S and P841 backshell
   Does short exist?

YES	Repair shorted wire. Perform MOC (para 3-5).
NO	Replace PNVS electronic unit (TM 1-5855-265-20).

END OF TASK

3-26. TADS VIDEO AND/OR SYMBOLS JITTERY WITH HELICOPTER SYMBOLS STABLE

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-40

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions - R90 door opened L90 door opened

1. Check for open between:

   P837-93 and P861-6
   P837-114 and P861-19
   P837-104 and P861-20
   P837-121 and P861-11
   Does open exist?

   YES — Repair open wire. Perform MOC (para 3-5).
   NO — Go to step 2.

2. Disconnect P861 and check for short between P837 backshell and:

   P837-93
   P837-114
   P837-104
   P837-121
   Does short exist?

   YES — Repair shorted wire. Perform MOC (para 3-5).
   NO — Replace PNVS electronic assembly (TM 1-5855-265-20).

END OF TASK

3-27. PNVS VIDEO JITTERY WITH HELICOPTER SYMBOLS STABLE

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1270-476-30
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-40

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions - R40 cover removed CPG MRTU type III removed

1. Disconnect PNVS night sensor assembly connector 1A1W10P1 from TADS turret assembly connector 1A1W1J3.
2. Disconnect P836 from TADS turret assembly connector 1A1W1J2 and check for open between:

   1A1W1J3-56 and 1A1W1J2-H
   1A1W1J3-55 and 1A1W1J2-h
   1A1W1J3-35 and 1A1W1J2-Z
   Does open exist?

   YES — Replace TADS turret assembly (TM 1-1270-476-30).
   NO — Go to step 3.

3. Check for open between:

   P836-H and P838-14
   P836-h and P838-33
   P836-z and P838-2
   Does open exist?

   YES — Repair open wire. Perform MOC (para 3-5).
   NO — Replace PNVS turret assembly (TM 1-5855-265-20).

END OF TASK

3-28. PNVS TURRET WILL NOT SLAVE TO IHADSS IN DIRECT MODE

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 3-42, 3-43, 3-44

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions -R40 cover 3. removed R90 door opened

1. Check for open between:

   P837-102 and P680-20
   P837-103 and P680-21
   P837-92 and P680-19
   P837-81 and P680-18
   P837-27 and P680-43
   P837-38 and P680-55
   Does open exist?

   YES — Repair open wire. Perform MOC (para 3-5).
   NO — Go to step 2.

2. Disconnect P680 and check for short between P837 backshell and:

   P837-102
   P837-103
   P837-92
   P837-81
   Does short exist?

   YES — Leave ohmmeter connected to shorted wire and go to step 3.
   NO — Replace PNVS electronic unit (TM 1-5855-265-20).

3. Disconnect P418.

   Does short still exist?

   YES — Repair shorted wire between P837 and J418. Perform MOC (para 3-5).
   NO — Repair shorted wire between P418 and P680. Perform MOC (para 3-5).

END OF TASK

CHAPTER 4

ANTI-ICE

TROUBLESHOOTING PROCEDURES

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK

INITIAL SETUP

Personnel Required:

68X Aircraft Armament/Electrical Repairer
67R Attack Helicopter Repairer

References:

TM 1-1520-238-23
TM 1-1270-476-20
TM 1-1270-476-T
TM 1-1520-238-T-3
TM 1-5855-265-20

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
TM 1-5855-265-20	PNVS window cover assembly removal
TM 1-1270-476-20	TADS window cover assemblies removed
TM 1-1270-476-T	TADS initial switch settings

NOTE

This maintenance operational check verifies that anti-ice circuits are functioning. If ambient temperature is not cold enough to close the shroud thermostatic switch and ice is not beginning to form on the shroud, frame heater operation may be difficult to verify. Window anti-ice will be tested by FD/LS regardless of environment.

Task	Results

1. Access pilot station (fig. 4-1) (TM 1-1520-238-23).
2. Close pilot station aft circuit breaker panel circuit breakers (fig. 4-2):

   ECS AFT FAN
   ECS FAB FANS
   ECS CANOPY ANTI-ICE CONTR
   POWER XFMR RECT 1
   POWER XFMR RECT 2

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont)

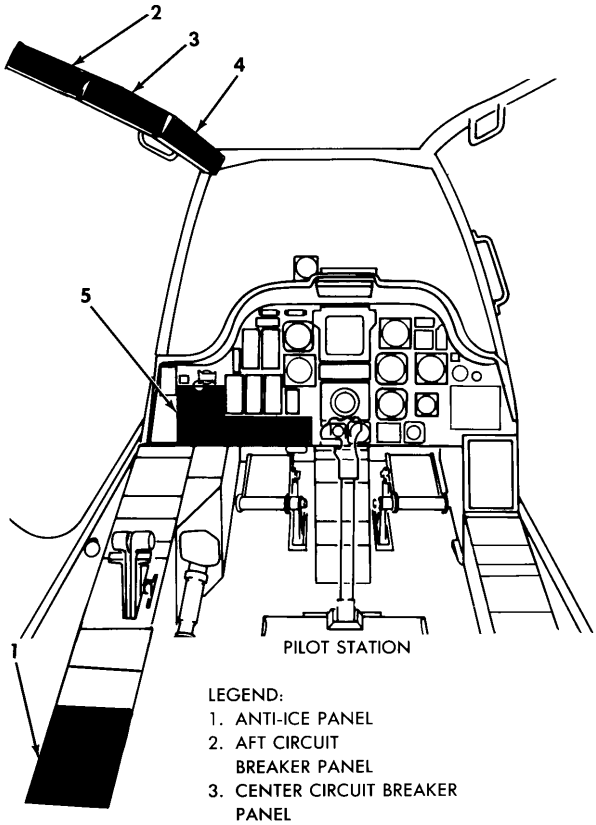


Figure 4-1. Pilot Station Panel Location

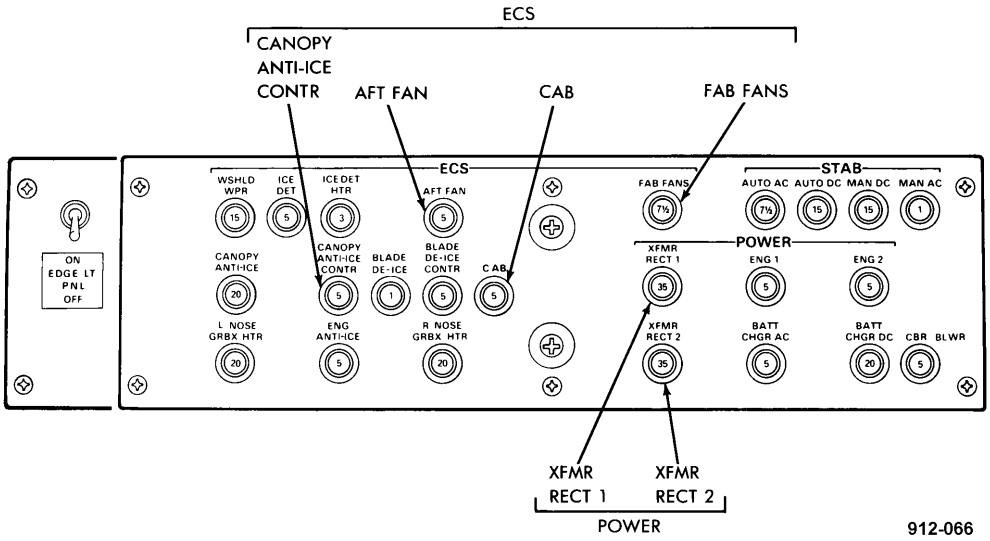


Figure 4-2. Aft Circuit Breaker Panel Circuit Breaker Location

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont) 4-1

Task	Results

3. Close pilot station center circuit breaker panel circuit breakers (fig. 4-3):

   ASE AC
   ASE DC

4. Close pilot station forward circuit breaker panel circuit breakers (fig. 4-4):

   MISSION PNVS DC
   MISSION PNVS AC
   MISSION SYM GEN
   NAV HARS AC
   NAV HARS DC
   MISSION IHADSS
   MISSION FC DC
   MISSION FC AC

5. Access copilot/gunner (CPG) station (fig. 4-5) (TM 1-1520-238-23).

6. Close CPG station circuit breaker panel No. 2 circuit breakers (fig. 4-6):

   IHADSS
   TADS DC
   TADS AC

7. Close CPG station circuit breaker panel No.1 circuit breakers (fig. 4-7):

   PRI LT
   CAUT
   FC FCC AC
   FC FCC DC
   MUX FAB L
   MUX FAB R
   MUX CPG

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont)

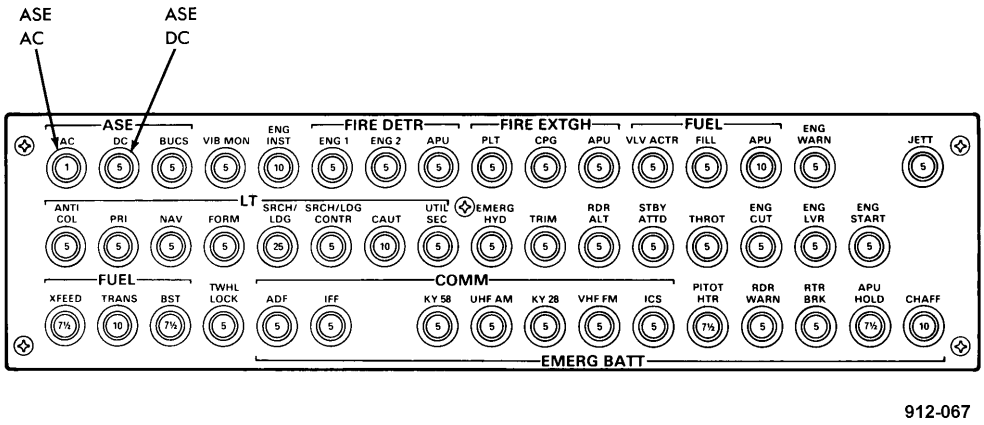


Figure 4-3. Center Circuit Breaker Panel Circuit Breaker Location

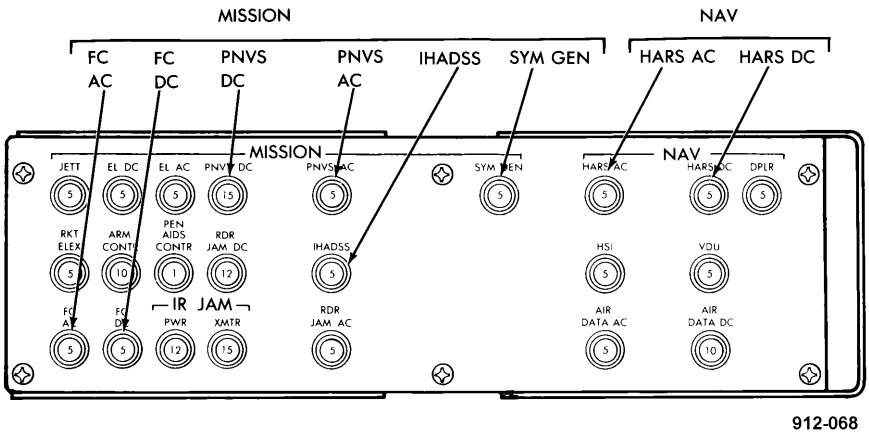


Figure 4-4. Forward Circuit Breaker Panel Circuit Breaker Location

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont)

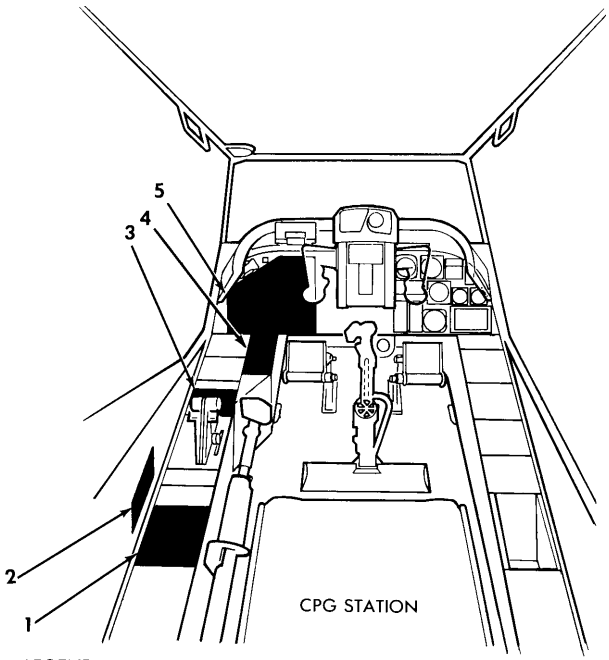


Figure 4-5. CPG Station Panel Location

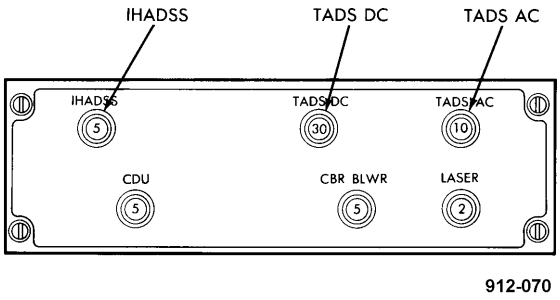


Figure 4-6. Circuit Breaker Panel No. 2 Circuit Breaker Location

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont) 4-1

Task	Results

8. Apply external power - electrical or operate APU (TM 1-1520-238-23).

9. Set CPG fire control panel switches (fig. 4-8):

Switch	Position
CPG	**SAFE**
PLT/GND	**ORIDE**
SYSTEM FC SYM GEM	**SYM GEN**

10. Access pilot station (fig. 4-1) (TM 1-1520-238-23).

WARNING

Stand away from the TADS turret assembly. The TADS turret assembly rotates rapidly when power is applied. Contact with the TADS turret assembly while it is in motion can cause serious injury.

CAUTION

Do not set the **PNVS** switch to **PNVS** immediately after being set to **OFF.** Damage to the PEU could result.

NOTE

If **PNVS** switch was just set to OFF, wait 10 seconds before performing step 11 below.

11. Set pilot fire control panel **PNVS** switch to **PNVS** (fig. 4-9).

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont)

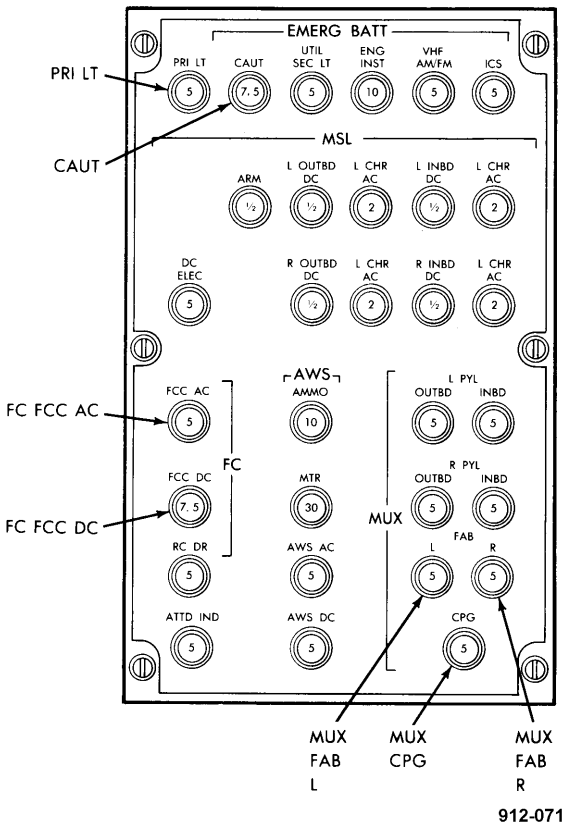


Figure 4-7. Circuit Breaker Panel No. 1 Circuit Breaker Location

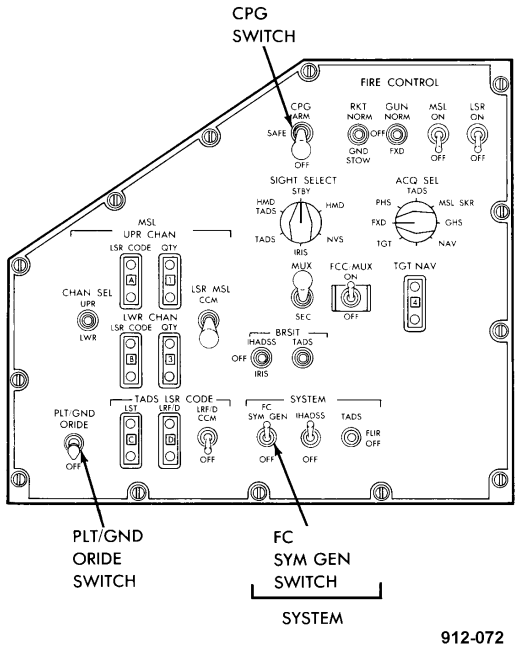


Figure 4-8. CPG Fire Control Panel Control Location

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
WARNING • Hazardous voltage is applied to the PNVS shroud during this maintenance operational check. Injury or death on contact may result if personnel touch the PNVS shroud while power is applied. • Make sure aircraft power is removed before touching the PNVS shroud or starting any fault isolation procedures.	
12. Set auxiliary/anti-ice panel **TADS/ PNVS** switch to **GND** (fig. 4-10). If ice has started to form on shroud assembly, verify that ice appears to melt around shroud window frame. Set DEK **DATA ENTRY** switch to **FD/ LS** (fig. 4-11).	If pilot station forward circuit breaker panel **MISSION PNVS AC** circuit breaker opens, refer to paragraph 4-4 for troubleshooting. If PNVS anti-ice appears inoperative, refer to paragraph 4-5 for troubleshooting.
13. Set DEK **DATA ENTRY** switch to OFF.	If PNVS SHROUD NO-GO appears on HOD: • Replace PNVS shroud assembly (TM 1-5855-265-20). • If fault still exists, refer to paragraph 4-3 for troubleshooting. If PNVS ELECTRONIC UNIT NO-GO RH FAB appears on HOD: • Replace PNVS electronic unit (TM 1-5855-265-20). • If fault still exists, refer to paragraph 4-3 for troubleshooting.
14. Set DEK **DATA ENTRY** switch to OFF.	
15. Set auxiliary/anti-ice panel **TADS/ PNVS** switch to **OFF** (fig. 4-10).	

4-1. ANTI-ICE - MAINTENANCE OPERATIONAL CHECK (cont)

Task	Results
16. Set anti-ice panel **TADS/PNVS** switch to **GND** (fig. 4-12).	If anti-ice appears to be inoperative, refer to TM 1-1520-238-T-3 and troubleshoot pilot anti-ice panel.
17. Set anti-ice panel **TADS/PNVS** switch to **OFF.**	
18. Perform PNVS power down procedure (para 3-2).	
19. Perform helicopter safety procedure (TM 1-1520-238-23).	

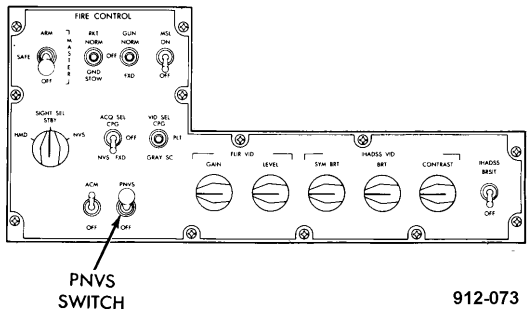


Figure 4-9. Pilot Fire Control Panel Control Location

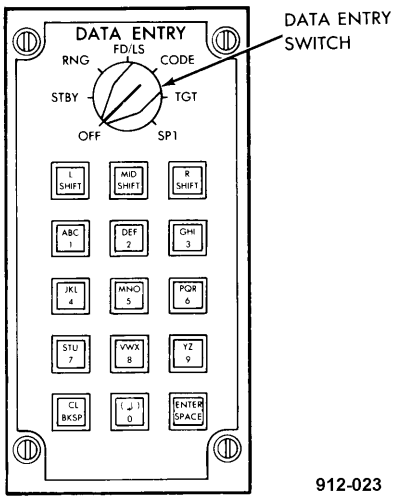


Figure 4-10. Data Entry Keyboard Control Location

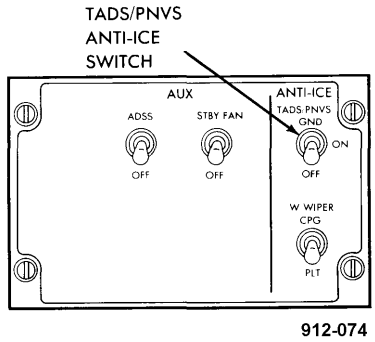


Figure 4-11. Auxiliary/Anti-Ice Panel Control Location

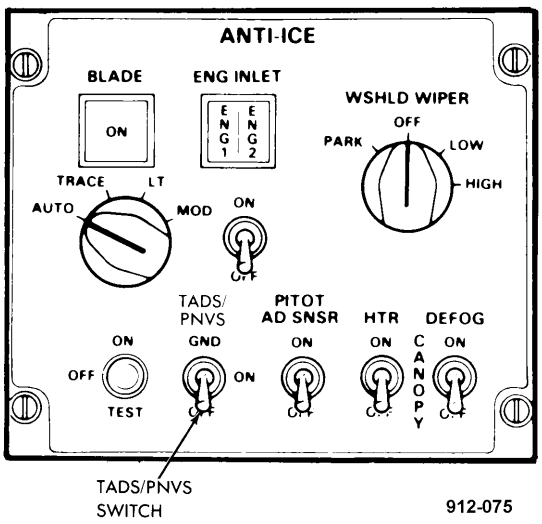


Figure 4-12. Anti-Ice Panel Control Location

END OF TASK

4-2. ANTI-ICE - WIRING INTERCONNECT DIAGRAM

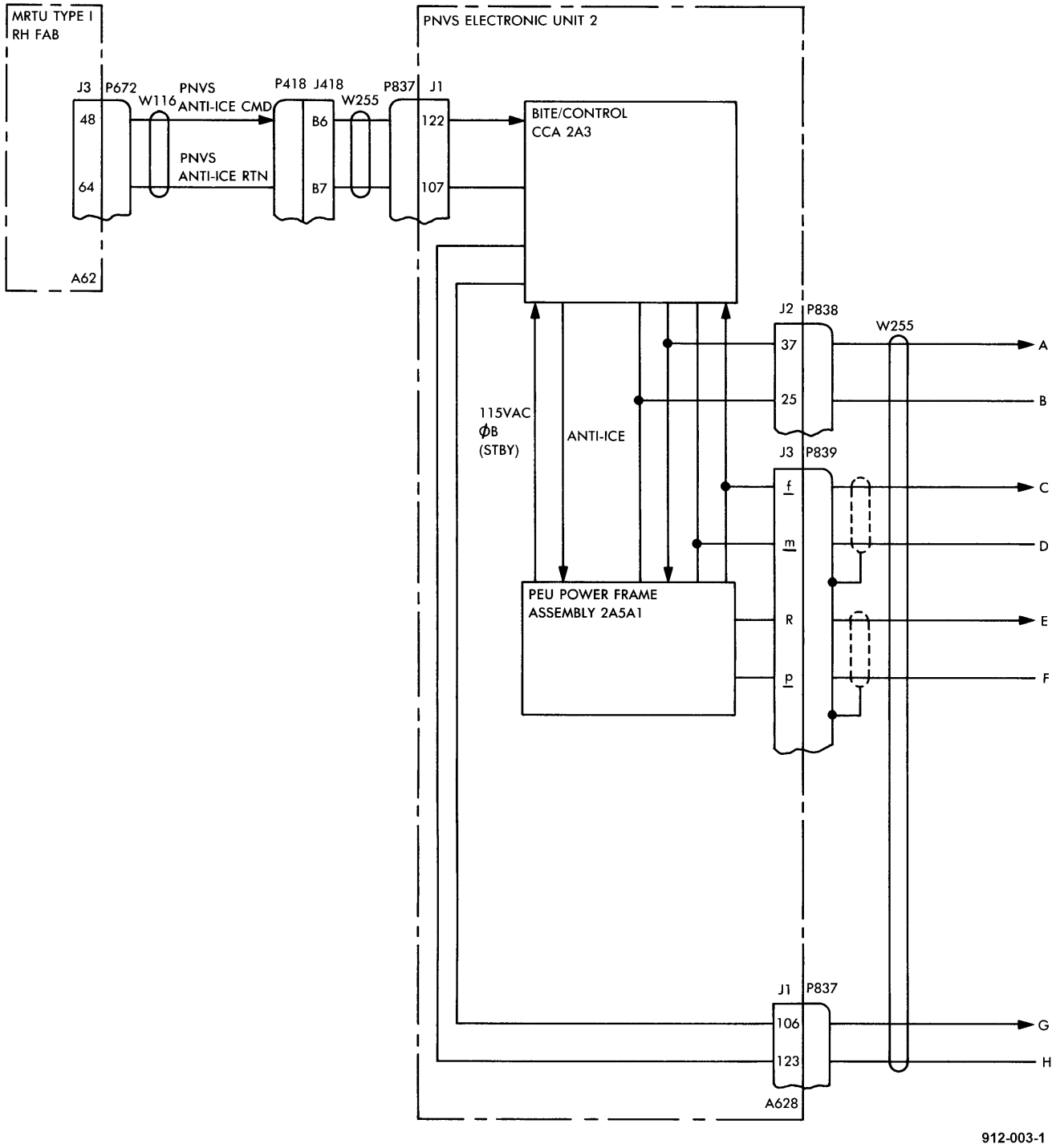


Figure 4-13. Anti-Ice Wiring Interconnect Diagram (Sheet 1 of 2)

4-2. ANTI-ICE - WIRING INTERCONNECT DIAGRAM (cont)

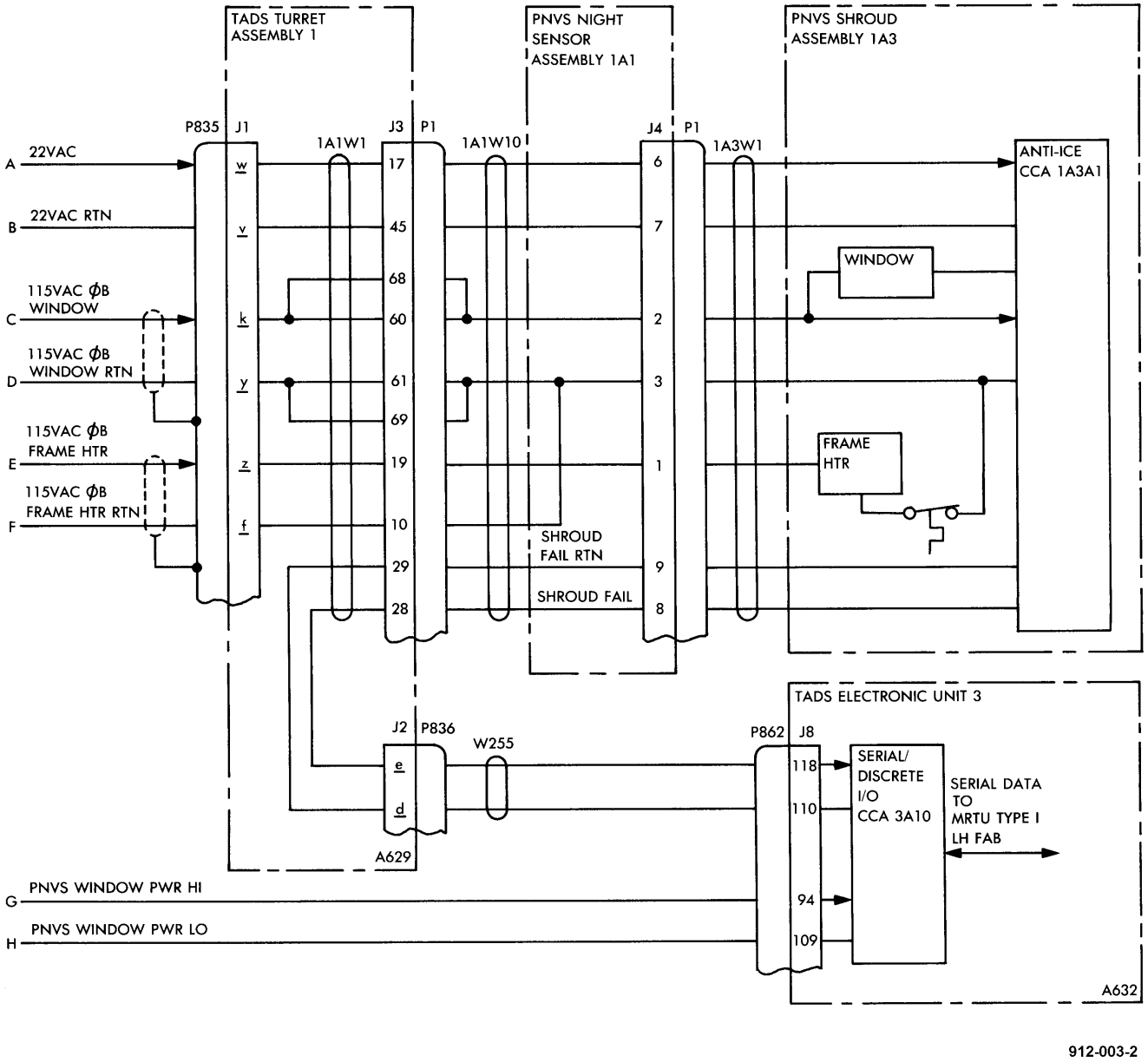


Figure 4-13. Anti-Ice Wiring Interconnect Diagram (Sheet 2 of 2)

4-3. PNVS SHROUD NO-GO - APPEARS ON HOD

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1270-476-30
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 4-13

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
TM 1-5855-265-20	PNVS shroud assembly removed

1. Disconnect PNVS night sensor assembly connector 1A1W10P1 from TADS turret assembly connector 1A1W133 and check for open on PNVS night sensor between:

   1A1W10J4-6 and 1A1W10P1-17
   1A1W10J4-7 and 1A1W10P1-45
   1A1W10J4-2 and 1A1W10P1-60
   1A1W10J4-2 and 1A1W10P1-68
   1A1W10J4-3 and 1A1W10P1-61
   1A1W10J4-3 and 1A1W10P1-69
   1A1W10J4-9 and 1A1W10P1-29
   1A1W10J4-8 and 1A1W10P1-28
   Does open exist?

   YES — Replace PNVS turret assembly (TM 1-5855-265-20).
   NO — Go to step 2.

2. Disconnect P835 and P836 from TADS turret connector 1A1W1J1 and 1A1W1J2, respectively and check for open between:

   1A1W1J1-w and 1A1W1J3-17
   1A1W1J1-v and 1A1W1J3-45
   1A1W1J1-k and 1A1W1J3-68
   1A1W1J1-k and 1A1W1J3-60
   1A1W1J1-y and 1A1W1J3-61
   1A1W1J1-y and 1A1W1J3-69
   1A1W1J2-e and 1A1W1J3-28
   1A1W1J2-d and 1A1W1J3-29
   Does open exist?

   YES — Replace TADS turret assembly (TM 1-1270-476-20).
   NO — Go to step 3.

3. Check for open between:

   P835-w and P838-37
   P835-v and P838-25
   P835-k and P839-f
   P835-y and P839-m
   Does open exist?

   YES — Repair open wire. Perform MOC (para 4-1).
   NO — Go to step 4.

4-3. PNVS SHROUD NO-GO - APPEARS ON HOD (cont)

4. Check for open between:

P836-e and P862-118
P836-d and P862-110
Does open exist?

YES	Repair open wire. Perform MOC (para 4-1).
NO	Replace PNVS electronic unit (TM 1-5855-265-20).

END OF TASK

4-4. MISSION PNVS AC CIRCUIT BREAKER OPENS WHEN ANTI-ICE IS SELECTED

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1270-476-30
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 4-13

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed Access provisions R90 door opened
TM 1-5855-265-20	PNVS shroud assembly removed

1. Check for shorts to ground and:

   P838-37
   P838-25
   P839-f
   P839-R
   Does short exist?

   YES — Leave ohmmeter connected to shorted wire and go to step 2.
   NO — Replace PNVS electronic unit (TM 1-5855-265-20).

2. Remove PNVS shroud assembly (TM 1-5855-265-20).
   Does short still exist?

   YES — Go to step 3.
   NO — Replace PNVS shroud assembly (TM 1-5855-265-20).

3. Install PNVS shroud assembly (TM 1-5855-265-20).

4. Disconnect PNVS night sensor assembly connector 1A1W10P1 from TADS turret assembly connector 1A1W1J3.
   Does short still exist?

   YES — Go to step 5.
   NO — Replace PNVS turret assembly (TM1-5855-265-20).

5. Disconnect P835 from TADS turret assembly connector 1A1W1J1.
   Does short still exist?

   YES — Repair shorted wire. Perform MOC (para 4-1).
   NO — Replace TADS turret assembly (TM 1-1270-476-30).

END OF TASK

4-5. PNVS ANTI-ICE APPEARS INOPERATIVE

INITIAL SETUP

Tools:

Nomenclature	Part Number
Aircraft armament repairman tool set	SC5180-95-CL-B09-HR
Multimeter, digital	AN/PSM-45

Personnel Required:

68X Aircraft Armament/Electrical Repairer

References:

TM 1-5855-265-20
TM 1-1270-476-30
TM 1-1520-238-23

Associated Wiring Interconnect Diagrams:

Fig. 4-13

Equipment Conditions:

Ref	Condition
TM 1-1520-238-23	Helicopter safed
TM 1-5855-265-20	PNVS shroud assembly removed

1. Disconnect PNVS night sensor assembly connector 1A1W10P1 from TADS turret assembly connector 1A1W1J3 and check for open between PNVS night sensor connectors:

   1A1W10J4-1 and 1A1W10P1-19
   1A1W10J4-3 and 1A1W10P1-61
   1A1W10J4-3 and 1A1W10P1-69
   1A1W10J4-3 and 1A1W10P1-10
   Does open exist?

   YES — Replace PNVS turret assembly
   NO — Go to step 2.

2. Disconnect P835 and P836 from TADS turret connectors 1A1W1J1 and 1A1W1J2, respectively and check for open between:

   1A1W1J1-y and 1A1W1J3-61
   1A1W1J1-y and 1A1W1J3-69
   1A1W1J1-Z and 1A1W1J3-19
   1A1W1J1-f and 1A1W1J3-10
   Does open exist?

   YES — Replace TADS turret assembly (TM 1-1270-476-30).
   NO — Go to step 3.

3. Check for open between:

   P835-z and P839-R
   P835-f and P839-p
   Does open exist?

   YES — Repair open wire. Perform MOC (para 4-1).
   NO — Replace PNVS shroud (TM 1-5855-265-20)

END OF TASK

APPENDIX A

REFERENCES

A-1. SCOPE

This appendix lists all army regulations, common tables of allowances, field manuals, forms, pamphlets, technical bulletins and technical manuals referenced in this manual.

A-2. ARMY REGULATIONS

Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety) . . . . . AR 385-11

Control of Health Hazards from Lasers and Other High Intensity Optical Sources . . . . . AR 40-46

A-3. FIELD MANUALS

First Aid for Soldiers. . . . . FM 21-11

Army Aircraft Quality Control and Technical Inspection . . . . . FM 1-511

A-4. FORMS

Recommended Changes to Publications or Blank Forms . . . . . DA Form 2028

Recommended Changes to Equipment Technical Manuals . . . . . DA Form 2028-2

Quality Deficiency Report . . . . . SF 368

A-5. PAMPHLETS

The Army Maintenance Management System-Aviation (TAMMS-A) . . . . . DA Pam 738-751

A-6. TECHNICAL BULLETINS

Respiratory Protection Program (AFOSH STD 161-1) . . . . . TB MED 223

U.S. Surgeon General's Noise Limits . . . . . TB MED 251

Control of Hazards to Health from Laser Radiation . . . . . TB MED 524

Safety Precautions for Maintenance of Electrical/Electronic Equipment . . . . . TB 385-4

REFERENCES (cont)

A-7. TECHNICAL MANUALS

Aviation Unit Maintenance Manual : AH-64A Helicopter, Fi re Control System . . . . TM 9-1230-476-20-1

Aviation Unit Troubleshooting Manual: AH-64A Helicopter, Fire Control System . . . TM 9-1230-476-20-2

Aviation Unit Maintenance Manual, Target Acquisition Designation Sight (TADS) Assembly AN/ASQ-170 AH-64A Helicopter . . . . . .TM 1-1270-476-20

Aviation Unit Troubleshooting Manual, Target Acquisition Designation Sight (TADS) Assembly AN/ASQ-170 AH-64A Helicopter . . . . . TM 1-1270-476-T

Aviation Unit and Intermediate Maintenance Manual for Target Acquisition Designation Sight/Pilot Night Vision Sensor Assembly (TADS/PNVS) Shipping and Storage Containers . . . . . TM 1-8145-476-23

Aviation Intermediate Maintenance Manual, Pilot Night Vision Sensor (PNVS) Assembly AN/AAQ-11, AH-64A Attack Helicopter TM1-5855-265-30

Organizational, DS and GS, and Depot Maintenance Manual: Installation Practices for Aircraft Electrical and Electronic Wiring . . . . . .TM 1-1500-323-24

Aviation Unit and Intermediate Maintenance Manual: AH-64A Helicopter . . . TM 1-1520-238-23 Series

Procedures for Destruction of Electronic Materiel to Prevent Enemy Use . . . . . TM 750-244-1-5

Operator and Aviation Unit Maintenance Manual: Aviation Ground Unit, Multi-Output GTED, Electrical, Hydraulic, and Pneumatic . . . . . .TM 55-1730-229-12

Technical Manual, Operator and Aviation Unit Maintenance (AVUM) Deployment, Operation and Teardown Procedures AH-64A Electronic Equipment Test Facility (EETF) OQ-290(V)2/MSM. . . . . .TM 11-6625-3085-12

Aviation Unit Maintenance Manual for Army AH-64A Helicopter Fault Detection/Location System . . . . . TM 1-1520-238-T-1

Aviation Unit Maintenance Manual for Army AH-64A Helicopter Master Failure Symptom Index . . . . . TM 1-1520 -238-T-2

Aviation Unit and Intermediate Maintenance Manual for Army AH-64A Helicopter Multiplex Read Codes . . . . . TM 1-1520-238-T-3

Aviation Unit and Intermediate Troubleshooting Manual for Army AH-64A Helicopter . . . . . TM 1-1520-238-T-6

Aviation Unit and Intermediate Troubleshooting Manual for Army AH-64A Helicopter . . . . . TM 1-1520-238-T-8

REFERENCES (cont)

Aviation Unit and Intermediate Troubleshooting Manual for Army AH-64A Helicopter Wiring Diagrams . . . . . TM 1-1520-238-T-10

Aviation Intermediate Maintenance Manual Target Acquisition Designation Sight (TADS) Assembly AN/ASQ-170 AH-64A Attack Helicopter . . . . . TM 1-1270-476-30

Aviation Unit Maintenance Manual, Pilot Night Vision Sensor (PNVS) Assembly AN/AAQ-11 AH-64A Attack Helicopter . . . . . TM 1-5855-265-20

Aviation Unit and Intermediate Maintenance Manual: AH-64A Helicopter, Fire Control Subsystem, Helmet Directed: M142 (IHADSS) . . . . . TM 9-1270-221-23

GLOSSARY

Section I. ABBREVIATIONS

A	Amperes
AC	Alternating current
ACK	Acknowledge
ACM	Automatic control module
AGPU	Aviation ground power unit
AND	Alphanumeric display
APU	Auxiliary power unit
AUTO	Automatic
AVIM	Aviation intermediate maintenance
AVUM	Aviation unit maintenance
AZ	Azimuth
BIT	Built-in test
BITE	Built-in test equipment
CCA	Circuit card assembly
CMD	Command
CONT	Control
CONTR	Control
COS	Cosine
CPC	Corrosion prevention and control
CPG	Copilot/gunne
CPU	Central processing unit
CT	Center tap
DC	Direct current
DEK	Data entry keyboard
DIR	Direct
ECLC	Electronic component location and configuraion
ECS	Environmental control system
EETF	Electronic equipment test facility
EIR	Equipment improvement recommendations
EL	Elevation
EO	Electro-optical
ESDS	Electrostatic discharge sensitive
F	Fahrenheit
FAB	Forward avionics bay
FCC	Fire control computer
FD/LS	Fault detection/location system
FIP	Fault isolation procedure
FLIR	Forward looking infrared
GND	Ground
HDD	Heads down display
HI	High
HOD	Heads out display
HORZ	Horizontal
HSY	Azimuth angle differential voltage

Glossary (cont)

HSZ	Elevation angle differential voltage
HTR	Heater
HZ	Hertz
I/O	Input/output
IHADSS	Integrated helmet and display sighting system
IR	Infrared Indirect view display
IVD	Indirect view display
K	Degrees kelvin
LED	Light emitting diode
LH	Left hand
LO	Low
LOS	Line -of -sight
LRU	Line replaceable unit
LT	Left
MAN	Manual
MOC	Maintenance operational check
MOS	Military occupational specialty
MRTU	Multiplex remote terminal unit
MUX	Multiplex
NC	Not connected
NC	Normally closed (switches)
NEUT	Neutral
NO	Number
NO	Normally open (switches)
NSA	Night sensor assembly
NSSA	Night sensor shroud assembly
ORC	Optical relay column
ORT	Optical relay tube
PECA	PNVS electronic control amplifier
PEU	PNVS electronic unit
PLRT	Polarity
PNVS	Pilot night vision sensor
PWR	Power
QA	Quality assurance
QC	Quality control
QDR	Quality deficiency report
REF	Reference
RH	Right hand
RTN	Return
SIN	Sine
SRU	Shop replaceable unit
STBY	Standby
STDBY	Standby
TADS	Target acquisition designation sight
TAMMS-A	The Army Maintenance Management System - Aviation

Glossary (cont)

TEU	TADS electronic unit
TM	Technical manual
TTA	TADS turret assembly
V	Volt
VAC	Volts alternating current
VDC	Volts direct current
VERT	Vertical

Section II. DEFINITION OF UNUSUAL TERMS

TRIAC	Bidirectional gated switch

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ALPHABETICAL INDEX

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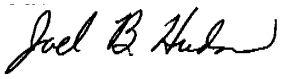

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Administrative Assistant to the
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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = 0.39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hect.ometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = 0.15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = 0.035 ounce
1 dekagram = 10 grams = 0.35 ounce
1 hectogram = 10 dekagrams 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Temperature

5/9 (°F-32) = °C
212° Fahrenheit = 100° Celsius
90° Fahrenheit = 32.2° Celsius
32° Fahrenheit = 0° Celsius
9/5 C° +32 = F°

Liquid Measure

1 centiliter = 10 milliliters = 0.34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = 0.155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = 0.386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = 0.06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	To	Multiply by
inches	centimeters	2.540
feet	meters	0.305
yards	meters	0.914
miles	kilometers	1.609
square inches	square centimeters	6.451
square feet	square meters	0.093
square yards	square meters	0.836
square miles	square kilometers	2.590
acres	square hectometers	0.405
cubic feet	cubic meters	0.028
cubic yards	cubic meters	0.765
fluid ounces	milliliters	29,573
pints	liters	0.473
quarts	liters	0.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	0.454
short tons	metric tons	0.907
pound-feet	newton-meters	1.356
pound-inches	newton-meters	0.11296

To change	To	Multiply by
ounce-inches	newton-meters	0.007062
centimeters	inches	0.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	0.621
square centimeters	square inches	0.155
square meters	square feet	10.764
square meters	square yards	1.196
square kilometers	square miles	0.386
square hectometers	acres	2.471
cubic meters	cubic feet	35.315
cubic meters	cubic yards	1.308
milliliters	fluid ounces	0.034
liters	pints	2.113
liters	pints	1.057
liters	quarts	0.264
grams	ounces	0.035
kilograms	pounds	2.205
metric tons	short tons	1.102
Newton-meters	pound-feet	0.738
Kilo pascals	pounds per square inch	0.145

PIN: 070536-000