TT-5000 Aero-I System

Airborne Satellite Telecommunications System

Installation Manual

(Including maintenance)

Due to the advanced nature of the material contained herein, this manual is subject to change without prior notice. This manual will be updated, as additional information becomes available

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1 Introduction

1.1 Makeup and Use of This Manual

1.1.1 Application

This Installation Manual is for the TT-5000 Series Aero-I system and is applicable to the components noted below:

Part Number	Model Number	Remarks
405033A-THR	TT-5033A	Aero-I Satellite Data Unit (SDU)
405033A-THR-NRS	TT-5033A incl. Opt. 005 NRS	Aero-I Satellite Data Unit (SDU) Incl. Opt. 005 NRS
405033A-001	TT-5033A-001-THR	SDU configuration module
405033A-005	TT-5033A-005	SDU Option 005 NRS/GPS (12 Channel)
405033A-920	Option 920	SDU Option 920: ¼ ATR Rack
405033A-921	Option 921	SDU Option 921: ¼ ATR Shock Mount
405010A-THR	TT-5010A	Aero-I High Power Amplifier (HPA)
405012A-THR	TT-5012A	Diplexer Low Noise Amplifier (DLNA)
405620A-THW	TT-5620A	Aero-I Handset (White, 4-wire)
405622A-THW	TT-5622A	Handset Cradle (White, for 4-wire Handset)
405620A-THR	TT-5620A	Aero-I Handset (Black, 4-wire)
405622A-THR	TT-5622A	Handset Cradle (Black, for 4-wire Handset)
405621B-THW	TT-5621B	Aero-I Handset (White, 2-wire)
405622B-THW	TT-5622B	Handset Cradle (White, for 2-wire handset)
405621B-THR	TT-5621B	Aero-I Handset (Black, 2-wire)
405622B-THR	TT-5622B	Handset Cradle (Black, for 2-wire handset)
405002A	TT-5002A	Mechanical Steered Antenna for top mount
405002B	TT-5002B	Mechanical Steered Antenna for tail mount
405004A	TT-5004A	Phased Array SA Antenna
405006A	TT-5006A	Satcom Antenna (Mechanically Steered with built-in NRS)
405008A	TT-5008A	NRS Antenna

1.1.2 Organization

This Installation Manual provides information about:

- **Description, installation, configuration, and commissioning of the TT-5000 Series Aero-I Satcom System components.**
- **Environmental Qualification Forms.**
- **Equipment Specifications to support selection of compatible peripherals and planning for the installation of the TT-5000 Series Aero-I components.**
- **Detailed installation and wiring requirements.**
- **Maintenance of the TT-5000 Series Aero-I.**

NOTE:

The information, drawings and wiring diagrams contained in this manual are intended as a reference for engineering planning only. The drawings and wiring diagrams contained herein do not represent any specific STC. It is the installer's responsibility to compose installation drawings specific to the aircraft. This manual and the drawings and wiring diagrams contained herein may not be used as a substitute for an STC package.

1.2 Abbreviations and Terminology

Throughout this manual you may see part numbers containing X's, refer to the Equipment Specifications Section for full part number definition.

2 Description and Operation

2.1 General

The information contained within this Installation manual describes the administrative and technical aspects, features, functions, and components of the Thrane & Thrane TT-5000 Series Aero-I Satcom System.

Any or all comments or recommendations regarding the installation, acceptance or operation of the TT-5000 Aero-I System or its accessories and components should be directed to Thrane & Thrane.

The TT-5000 Aero-I System is designed to operate on both INMARSAT Global Beam and Spot Beam satellites, utilizing advanced communication technologies. The TT-5000 Aero-I System utilizes the INMARSAT defined Spot Beams for voice and circuit mode data services (2400 bits per second (BPS)), and Global Beams for low speed packet data services (600 and 1200 BPS).

The INMARSAT Aero-I system is an evolution of the existing Aero-H system. The use of Spot Beam satellites and advanced voice coding reduces the RF power requirements significant, and enables the use of a considerable smaller intermediate gain antenna, where the Aero-H system uses a bigger high gain antenna.

Summarized the features are:

- Smaller Satcom antennas
- Significant reduction of system size and weight
- Reduction of input power
- Reduction of heat generation
- Increased number of voice channels on the satellite link

The user has a choice of three types of Satcom antennas; two are mechanically steered while the third is electronically steered. As an option, a Navigational Reference System NRS may be included to enable the TT-5000 Aero-I System to be operated independently of the aircraft's navigation, heading, and altitude reference systems (except for TT-5004A phased array antenna).

The TT-5620A handset includes a built-in LCD display for operational and diagnostic readout. The Aero-I system must be interfaced with a PC, for diagnostic readout as well as configuration setup. The TT-5000 Aero-I System can also be interconnected with a Magnastar Telephone System, using two Magnastar Analog Interface Units (AIU), to provide both Satcom and VHF FM communications.
The TT-5000 Aero-I System can also be interconnected with Global Wulfsberg WH-10 Handset.

2.2 Standard Features

By utilizing the latest state of the art technology, the TT-5000 Aero-I System provides a complete multiple channel SATCOM solution that offers the following key features:

- **Simultaneous three channel system, two voice/fax/modem channels, and one packet data channel (Packet mode data is text only).**
- **Compact and lightweight system.**
- **Low power consumption (28VDC power typically uses 2 amps in RX mode and 4.3 amps in TX mode).**
- **Designed to support up to four Full Function Handsets and 2-fax/phone or data modem ports.**
- **Stand-alone operation with NRS option installed.**
- **Provides self-test (using BITE) and LRU diagnostics.**
- **Menu driven user interface.**
- **Two electronically stored, editable phonebooks, which provide storage for up to 99 telephone numbers each.**
- **Handset to handset calling.**
- **Call forwarding and conference call capabilities.**
- **Last number re-dial.**
- **Custom configurable logon, call restriction, and security access levels.**
- **A 'speed dial' feature that enables the user to dial any number stored in the electronic phonebook with only two keystrokes.**

2.3 TT-5000 Aero-I System SDU Interfaces

(a) 2 ARINC 429 Inertial Reference System (IRS) inputs.

(b) 24 Discrete inputs for the 24-bit airplane ICAO address.

(c) 2 ARINC 429 Interfaces for future use.

(d) 6 Discrete Spares (4 connections for Input/output interface and 2 connections for input only interface).

Aircraft Avionics Interfaces:

2.4 TT-5000 Aero-I System Block Diagrams

The following block diagrams show basic Aero-I system component interconnection. Depending on antenna choice and antenna steering source, there are five installation configurations that may be selected. The TT-5000 Aero-I System can also be interfaced with Magnastar system VHF FM communication.

2.4.1 TT-5002A/B Mechanical Steered Satcom Antenna and IRS System

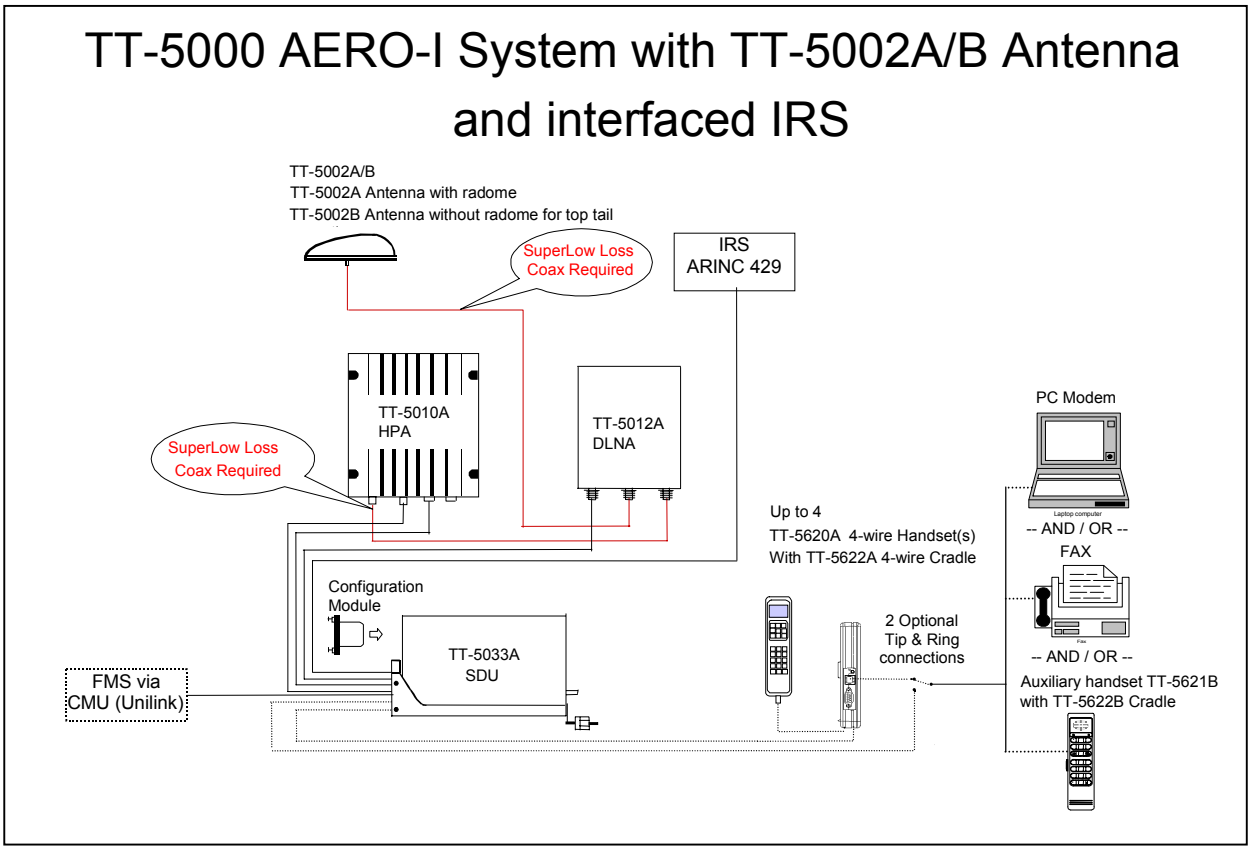


Figure 1, TT-5000 Aero-I System configuration using TT-5002A/B and IRS

2.4.2 TT-5002A/B Satcom Antenna with interfaced TT-5008A NRS Antenna

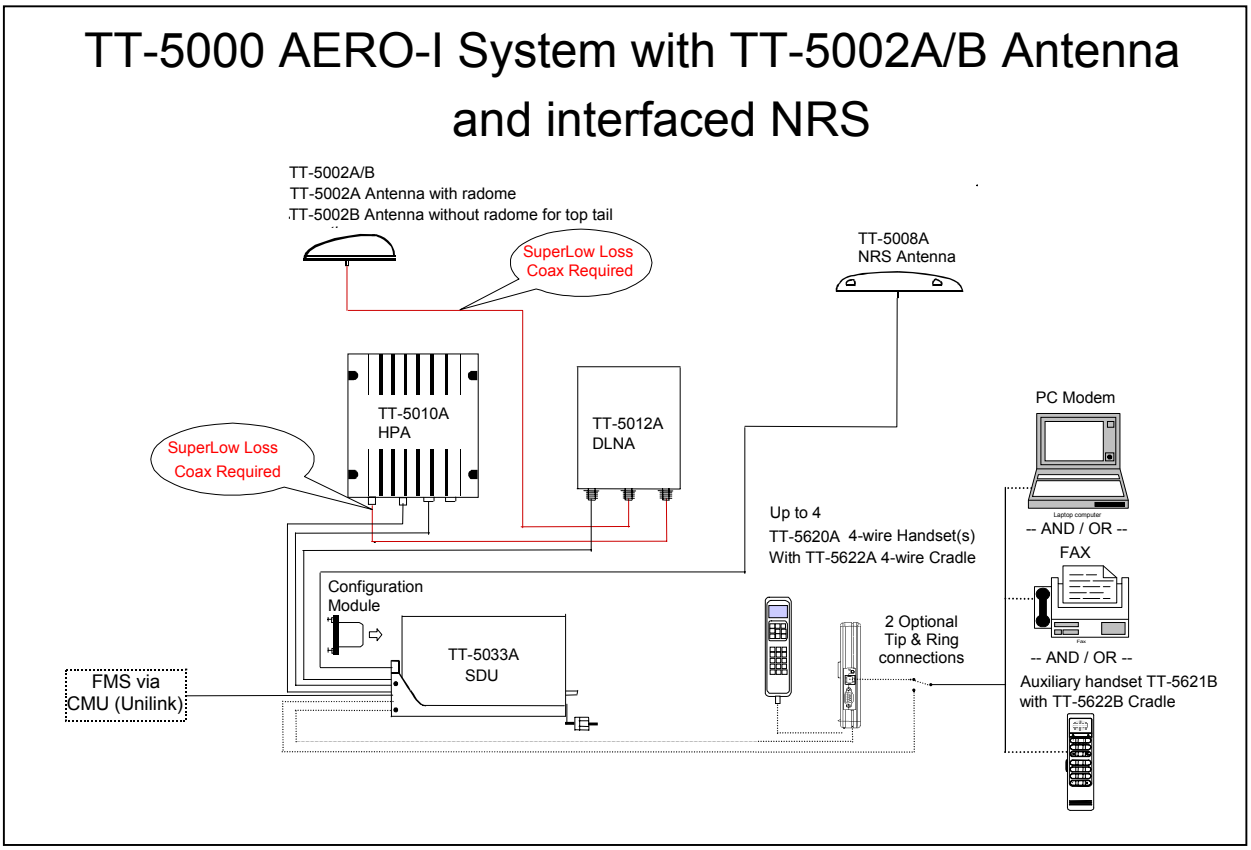


Figure 2, TT-5002A/B Satcom Antenna with interfaced TT-5008A NRS Antenna

2.4.3 TT-5004A Phased Array Satcom Antenna and interfaced to aircraft IRS

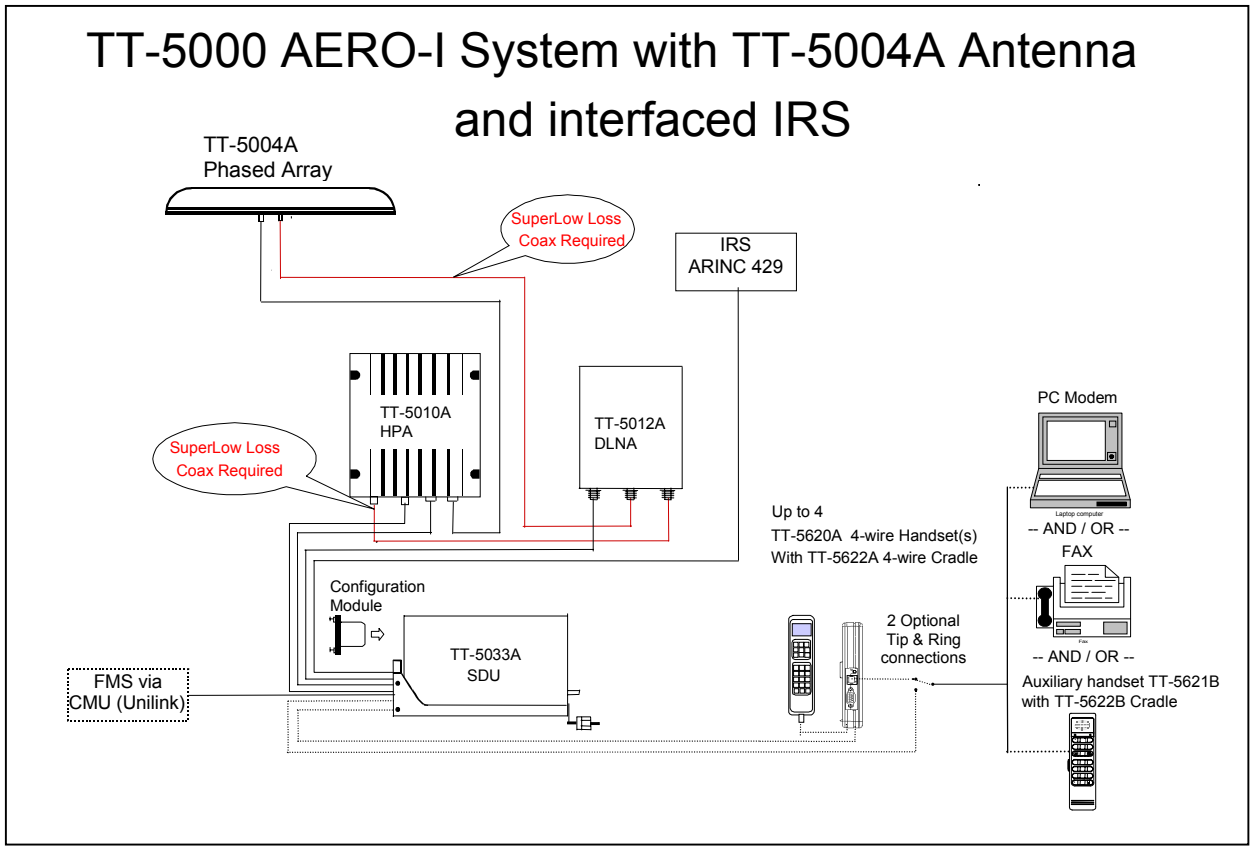


Figure 3, TT-5000 Aero-I System configuration using TT-5004A and IRS

2.4.4 TT-5006A Satcom Antenna with built-in NRS

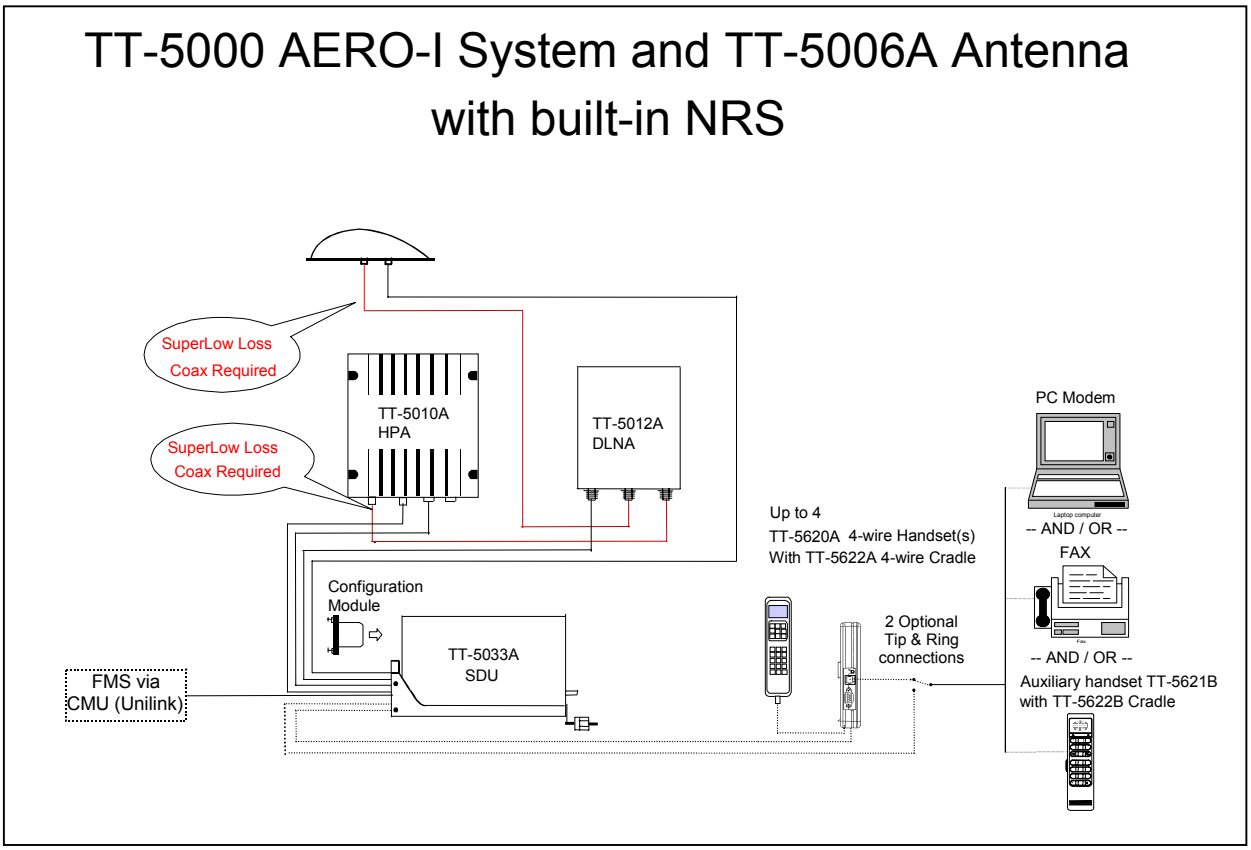


Figure 4, TT-5000 Aero-I System configuration using TT-5006A with built-in NRS

2.4.5 TT-5006A Satcom Antenna with built-in NRS and interfaced IRS.

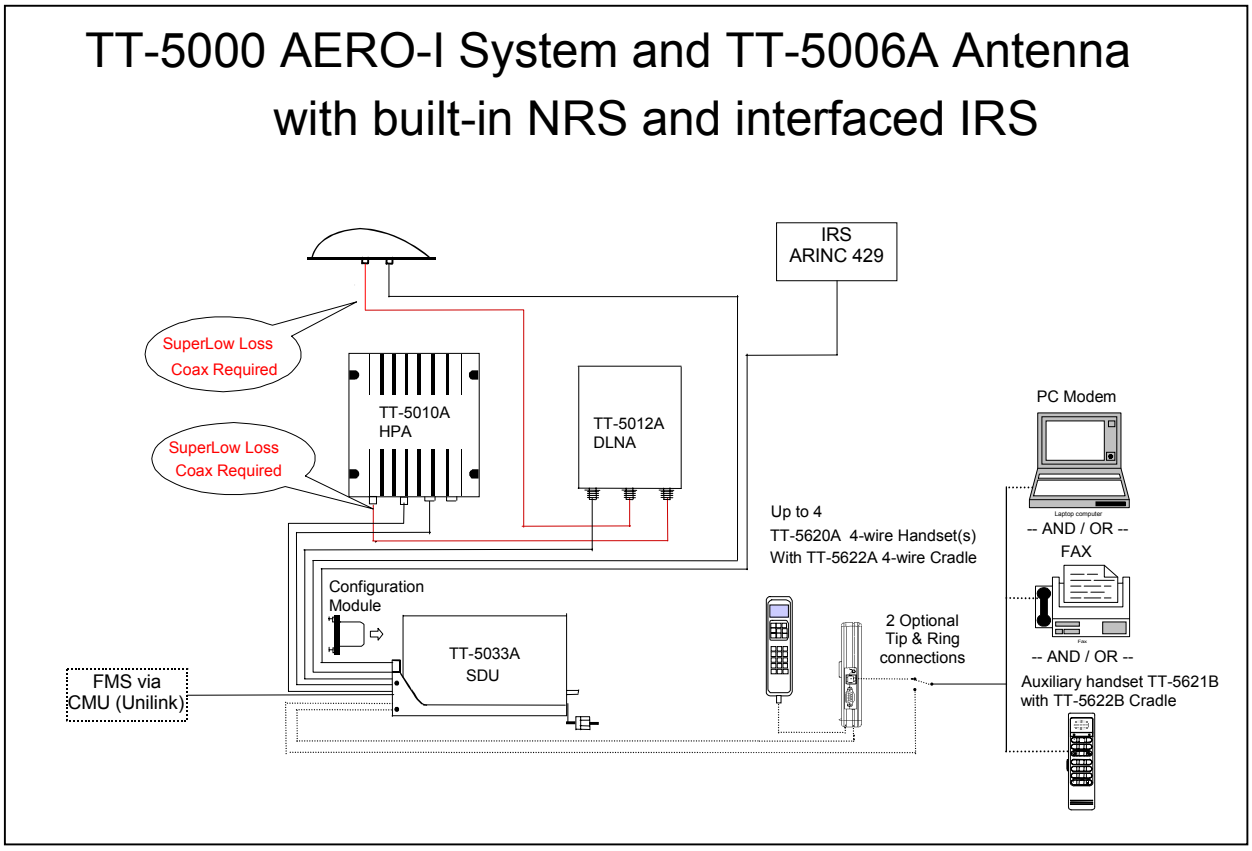


Figure 5, Configuration using TT-5006A with built-in NRS and interfaced IRS

2.5 Operation

The TT-5000 Series Aero-I System uses the system's handset (Model TT-5620A) as the main interface between the operator and the system.The Aero-I also uses a PC interface as the main configuration tool; the configuration of the Aero-I is explained later in this manual. Refer to the TT-5000 Aero-I User Manual for operating procedures. The TT-5000 Aero-I User Manual introduces and explains system capabilities and features, handset controls and functions, placing and receiving calls, and use of the menu system.

2.5.1 TT-5000 Aero-I System with Magnastar Interface

If Magnastar handset is used, see Magnastar Setup in the System Data Installation Section of this manual. Refer to the a TT-5000 Aero-I System Interfaced with Magnastar applicable Magnastar publication for Magnastar System operation.

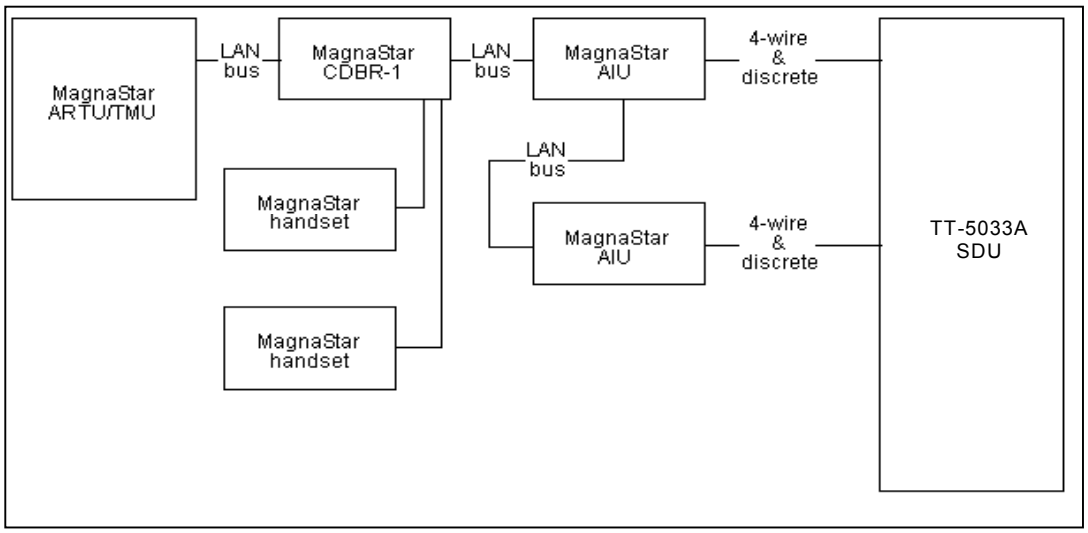


Figure 6, TT-5000 Aero-I System with Magnastar Interface

2.5.2 TT-5000 Aero-I System with Global Wulfsberg interfacing

If Global Wulfsberg handset is used, see the Global Wulfsberg interfacing configuration in the "wiring diagrams" section of this manual.
Refer to the applicable Global Wulfsberg publication for Global Wulfsberg System operation.

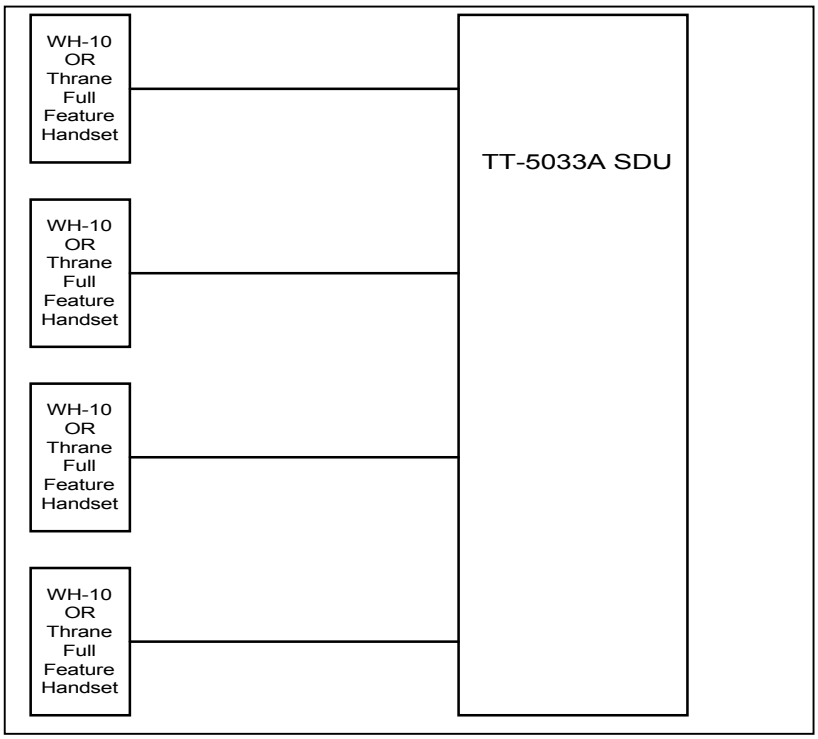


Figure 7, TT-5000 Aero-I System with Global Wulfsberg interface.

NOTE:
When interfacing Global Wulfsberg WH-10 handset with Aero-I, at least one TT full feature handset is needed for correct system operation. (e.g. 3 WH-10 handset's and one TT-5620A/TT-5621A handset with TT-5622A cradle).

3 CAA Approval

3.1 General

Approval of the TT-5000 Series Aero-I System is not authorized by this Installation Manual. Acceptance for the installation and use of the TT-5000 Series Aero-I and its associated components must be sought through the appropriate offices of the CAA or other certifying agency. It is recommended that all proposed installations be coordinated with the local jurisdiction of the CAA or other certifying agency prior to performing the installation.

3.2 Environmental Qualification Forms

The environmental categories under which all related components of the TT-5000 Aero-I is approved (Reference RTCA. DO-160C/D) and defined on the following Environmental Qualification Forms.

3.3 TT-5033A Aero-I Satellite Data Unit (SDU)

CONDITIONS	DO160C SECTION #PARA #	CATEGORY	DESCRIPTION OF CONDUCTED TESTS
Temperature and altitude Operating low temp: Ground survival: Short time high temp: Operating high temp: Ground survival:	4.0 4.5.1 4.5.1 4.5.2 4.5.3 4.5.2	A1	Inside Pressure Vessel -25°C -55°C +70°C +55°C +85°C
In-flight loss of cooling	4.5.4	-	NOT APPLICABLE
Altitude	4.6.1	A1	15,000 FT
Temperature variation	5.0	B	Equipment in non-temperature controlled internal area of the aircraft: 5°/min
Humidity	6.0	A	50°C, 95%, 48 Hours
Shock	7.0	Yes	Equipment in fixed wing and rotary wing aircraft tested for operational shock and safety.
Operational crash safety	7.2 7.3	Yes	6.0 g 15.0 g
Vibration	8.0	M N B	AC Type 3 – Fixed wing Reciprocating and Turboprop AC Type 2 – Fixed Wing Turbojet AC Type 1 – Rotary wing Reciprocating and Turbojet
Explosion	9.0	X	Not Tested
Waterproofness	10.0	X	Not Tested
Fluids susceptibility	11.0	X	Not Tested
Sand and dust	12.0	X	Not Tested
Fungus	13.0	X	Not Tested
Salt spray	14.0	X	Not Tested
Magnetic effect	15.0	A	B or better is required unless installed in FD then A or better is required. Actual class will be measured.
Power input	16.0	A,B	Supplied by aircraft electrical system from engine driven alternator/rectifier or dc generator
Voltage spike conducted	17.0	A	Equipment intended primarily for install where a lower standard of protection against voltage spikes is acceptable: 46.3V and 37.8V abnormal surge at 5 ohms Impedance
Audio frequency conducted susceptibility	18.0	A,B	Supplied by aircraft electrical system from engine driven alternator/rectifier or dc generator
Induced signal susceptibility	19.0	Z	Equipment intended for operation in systems where interference-free operation is required.
Radio frequency susceptibility Operational:	20.0	U + R	Intended for equipment and interconnecting wiring installed in partially protected environment. High Intensity Radiated Field (HIRF) associated with Normal Environment.
Radio frequency emission	21.0	Z	Equipment intended for operation in systems where interference-free operation is required.
Lightning induced trans susceptibility	22.0	A3E2	Pin Injection Test: Equipment and wiring in Moderately Exposed Environment. Cable Bundle Test: Equipment and wiring in Partially Protected Environment. Not tested for 405033A-001 Configuration Module, as unit is placed inside SDU 405033A.
Lightning direct effects	23.0	X	Not Tested
Icing	24.0	X	Not Tested

3.4 TT-5010A Aero-I High Power Amplifier (HPA)

CONDITIONS	DO160C SECTION #PARA #	CATEGORY	DESCRIPTION OF CONDUCTED TESTS
Temperature and altitude Operating low temp: Ground survival: Short time high temp: Operating high temp: Ground survival: In-flight loss of cooling Altitude	4.0 4.5.1 4.5.1 4.5.2 4.5.3 4.5.2 4.5.4 4.6.1	A2 + F2	Outside or Inside Pressure Vessel -55°C -55°C +70°C +70°C +85°C +40°C/30 minutes minimum 55,000 ft.
Temperature variation	5.0	B	Equipment in non-temperature controlled internal area of the aircraft: 5°/min
Humidity	6.0	A	50°C, 95%, 48 Hours
Shock	7.0	Yes	Equipment in fixed wing and rotary wing aircraft tested for operational shock and safety.
Operational crash safety	7.2 7.3	Yes	6.0 g 15.0 g
Vibration	8.0	C L Y	AC Type 2 - Fixed wing turbojet AC Type 3 - Fixed wing turboprop >12,500 lbs. AC Type 1 – Rotary Wing Reciprocating and Turbojet AC Zone 1 – Fuselage
Explosion	9.0	X	Not Tested
Waterproofness	10.0	X	Not Tested
Fluids susceptibility	11.0	X	Not Tested
Sand and dust	12.0	X	Not Tested
Fungus	13.0	X	Not Tested
Salt spray	14.0	X	Not Tested
Magnetic effect	15.0	A	B or better is required unless installed in FD then A or better is required. Actual class will be measured.
Power input	16.0	A,B	Supplied by aircraft electrical system from engine driven alternator/rectifier or dc generator
Voltage spike conducted	17.0	A	Equipment intended primarily for install where a lower standard of protection against voltage spikes is acceptable: 46.3V and 37.8V abnormal surge at 5 ohms Impedance
Audio frequency conducted susceptibility	18.0	A,B	DO-160C Allows Z in place of A
Induced signal susceptibility	19.0	Z	Equipment intended for operation in systems where interference-free operation is required.
Radio frequency susceptibility Operational:	20.0	U + R	Intended for equipment and interconnecting wiring installed in partially protected environment. High Intensity Radiated Field (HIRF) associated with Normal Environment.
Radio frequency emission	21.0	Z	Equipment intended primarily for operation where interference-free operation is required.
Lightning induced trans susceptibility	22.0	A3E2	Pin Injection Test: Equipment and wiring in Moderately Exposed Environment. Cable Bundle Test: Equipment and wiring in Partially Protected Environment.
Lightning direct effects	23.0	X	Not Tested
Icing	24.0	X	Not Tested

3.5 TT-5012A Aero-I Diplexer Low Noise Amplifier (DLNA)

CONDITIONS	DO160C SECTION # PARA #	CATEGORY	DESCRIPTION OF CONDUCTED TESTS
Temperature and altitude Operating low temp: Ground survival: Short time high temp: Operating high temp: Ground survival: In-flight loss of cooling Altitude	4.0 4.5.1 4.5.1 4.5.2 4.5.3 4.5.2 4.5.4 4.6.1	A2 + F2	Outside Pressure Vessel -55°C -55°C +70°C +70°C +85°C NOT APPLICABLE 55,000 ft.
Temperature variation	5.0	B	Equipment in non-temperature controlled internal area of the aircraft: 5°/min
Humidity	6.0	A	50°C, 95%, 48 Hours
Shock	7.0	Yes	Equipment in fixed wing and rotary wing aircraft tested for operational shock and safety.
Operational crash safety	7.2 7.3	Yes	6.0 g 15.0 g
Vibration	8.0	C L Y	AC Type 2 - Fixed wing turbojet AC Type 3 - Fixed wing turboprop >12,500 lbs. AC Type 1 – Rotary Wing Reciprocating and Turbojet AC Zone 1 – Fuselage
Explosion	9.0	X	Not Tested
Waterproofness	10.0	X	Not Tested
Fluids susceptibility	11.0	X	Not Tested
Sand and dust	12.0	X	Not Tested
Fungus	13.0	X	Not Tested
Salt spray	14.0	X	Not Tested
Magnetic effect	15.0	A	B or better is required unless installed in FD then A or better is required. Actual class will be measured.
Power input	16.0	A,B	Supplied by aircraft electrical system from engine driven alternator/rectifier or dc generator
Voltage spike conducted	17.0	A	Equipment intended primarily for install where a lower standard of protection against voltage spikes is acceptable: 46.3V and 37.8V abnormal surge at 5 ohms Impedance
Audio frequency conducted susceptibility	18.0	A,B	Supplied by aircraft electrical system from engine driven alternator/rectifier or dc generator
Induced signal susceptibility	19.0	Z	Equipment intended for operation in systems where interference-free operation is required.
Radio frequency susceptibility Operational:	20.0	U + R	Intended for equipment and interconnecting wiring installed in partially protected environment. High Intensity Radiated Field (HIRF) associated with Normal Environment.
Radio frequency emission	21.0	Z	Equipment intended for operation in systems where interference-free operation is required.
Lightning induced trans susceptibility	22.0	A3E2	Pin Injection Test: Equipment and wiring in Moderately Exposed Environment. Cable Bundle Test: Equipment and wiring in Partially Protected Environment.
Lightning direct effects	23.0	X	Not Tested
Icing	24.0	X	Not Tested

3.6 TT-5620A Aero-I Handset and TT5622A Handset Cradle

CONDITIONS	DO160C SECTION # PARA #	CATEGORY	DESCRIPTION OF CONDUCTED TESTS
Temperature and altitude Operating low temp: Ground survival: Short time high temp: Operating high temp: Ground survival: In-flight loss of cooling Altitude	4.0 4.5.1 4.5.1 4.5.2 4.5.3 4.5.2 4.5.4 4.6.1	A1	Inside Pressure Vessel -25°C -25°C +55°C +55°C +55°C NOT APPLICABLE 70,000FT
Temperature variation	5.0	B	Not tested
Humidity	6.0	A	Not tested
Shock	7.0	Yes	Equipment in fixed wing and rotary wing aircraft tested for operational shock and safety.
Operational crash safety	7.2 7.3	Yes	6.0 g 15.0 g
Vibration	8.0	M,N,B	Not tested
Explosion	9.0	X	Not tested
Waterproofness	10.0	X	Not tested
Fluids susceptibility	11.0	X	Not tested
Sand and dust	12.0	X	Not tested
Fungus	13.0	X	Not tested
Salt spray	14.0	X	Not tested
Magnetic effect	15.0	A	B or better is required unless installed in FD then A or better is required.
Power input	16.0	X	Supplied by aircraft electrical system from engine driven alternator/rectifier or dc generator
Voltage spike conducted	17.0	X	Equipment intended primarily for install where a lower standard of protection against voltage spikes is acceptable: 46.3V and 37.8V abnormal surge at 5 ohms Impedance
Audio frequency conducted susceptibility	18.0	X	Not tested
Induced signal susceptibility	19.0	B	Equipment intended primarily for operation where interference-free operation is required.
Radio frequency susceptibility Operational: Survival:	20.0	U + R	Intended for equipment and interconnecting wiring installed in partially protected environment. High Intensity Radiated Field (HIRF) associated with Normal Environment.
Radio frequency emission	21.0	Z	Equipment intended for operation in systems where interference-free operation is required.
Lightning induced trans susceptibility	22.0	XXE3	Cable Bundle Test: Equipment and wiring in Moderately Exposed Environment.
Lightning direct effects	23.0	X	Not tested
Icing	24.0	X	Not tested

3.7 TT-5002A/B Aeronautical Satcom Antenna

CONDITIONS	DO160D SECTION # PARA #	CATEGORY	DESCRIPTION OF CONDUCTED TESTS	SANCTION
Temperature and altitude	4.0	E1	Outside Pressure Vessel Not operating: -55°C to +85°C Operating: -55°C to +70°C	Passed
In-flight loss of cooling	4.5.4	-	NOT APPLICABLE	
Altitude	4.6.1	E1	70,000FT	Passed
Temperature variation	5.0	A	For equipment external to the aircraft:10°C/min	Passed
Humidity	6.0	C	6 Cycles +55°C 95% RH (144 hours)	Passed
Operational shocks and crash safety	7.0	A	6 g 11 ms	Passed
Vibration	8.0	S	Standard random vibration curve : E	Passed
Explosion proofness	9.0	X	NOT APPLICABLE	
Waterproofness	10.0	S (NOTE 1)	NOT APPLICABLE	Passed
Fluids susceptibility	11.0	F (NOTE 1)	Limited to de-icing, fluids solvents and cleaning fluids,	By analysis
Sand and dust	12.0	D (NOTE 1)	NOT APPLICABLE	Passed
Fungus resistance	13.0	F (NOTE 1)	NOT APPLICABLE	By analysis
Salt spray	14.0	S (NOTE 1)	NOT APPLICABLE	Passed
Magnetic effect	15.0	A	NOT APPLICABLE	Passed
Power input	16.0	X	NOT APPLICABLE	
Voltage spike	17.0	X	NOT APPLICABLE	
Audio frequency conducted susceptibility	18.0	X	NOT APPLICABLE	
Induced signal susceptibility	19.0	A	NOT APPLICABLE	Passed
Radio frequency susceptibility Radiated and conducted	20.0	Y	NOT APPLICABLE	Passed
Emission of radio frequency energy	21.0	H	NOT APPLICABLE	Passed
Lightning induced transient susceptibility	22.0	XXE3	NOT APPLICABLE	Passed
Lightning direct effects	23.0	Area 1B	NOT APPLICABLE	Passed
Icing	24.0	A (NOTE 1)	NOT APPLICABLE	Passed
Electrostatic discharge	25.0	A	NOT APPLICABLE	Passed

NOTE 1:

Test not applicable for tail mount antenna (405002B), as the antenna is encapsulated in the tail.

3.8 TT-5004A Aeronautical Phased Array Satcom Antenna

CONDITIONS	DO160D SECTION # PARA #	CATEGORY	DESCRIPTION OF CONDUCTED TESTS
TEMPERATURE AND ALTITUDE Operating Low: Operating High: Ground Survival Low: Ground Survival High: Altitude	4.0	F2 -55°C +70°C -55°C +85°C 55,000 ft	
Temperature variation	5.0	A	For equipment external to the aircraft: 10°C/min. Test combined with temperature extreme test in accordance with 5.3a.
Humidity	6.0	C	Extreme Humidity Environment
Operational shocks and crash safety Shock Crash safety	7.0 7.2.1 7.3.1	A A X	Fixed wing and helicopter standard shock N/A Not installed in areas where detachment during emergency landing could present a hazard to occupants, fuel systems, or emergency evacuation equipment.
Vibration	8.0	S	Random vibration Curve E.
Explosion proofness	9.0	X	Not tested
Waterproofness	10.0	S	
Fluids susceptibility	11.0	F	De-icing
Sand and dust	12.0	D	
Fungus resistance	13.0 13.4	F X	 By analysis of equipment design.
Salt spray	14.0	S	Not tested
Magnetic effect	15.0	Z	Less than 0.3m
Power input	16.0	X	Power provided from avionics equipment
Voltage spike	17.0	X	Power provided from avionics equipment
Audio frequency conducted susceptibility	18.0	X	Power provided from avionics equipment
Induced signal susceptibility	19.0 19.3.1 19.3.2 19.3.3 19.3.4	A	 20 Arms at 400 Hz 18 A-m from 380 Hz to 400 Hz 360 V-M from 380 Hz to 400 Hz 3.0 m coupling length.
Radio frequency susceptibility Radiated and conducted	20.0 20.4 20.5	UYX U Y S Y	 10 kHz to 400 Hz, modulated and continuos-wave signals 200 V/m (100 to 1224 MHz) 1 V/m (1224 to 2158 MHz) 200 V/m (2158 to 18000 MHz) Modulated and continuous-wave signals. Vertical and horizontal polarization. No tests performed for pulsed RF signals.
Emission of radio frequency energy	21.0 21.3 21.4	H H H	 0.15 to 100 MHz 0.15 to 6000 MHz Vertical and horizontal polarization
Lightning induced transient susceptibility	22.0 22.5.2	XXE3	 Waveform 3 at 1.0 MHz and 10.0 MHz and Waveform 1
Lightning direct effects	23.0	2A	
Icing	24.0	A	
Electrostatic discharge	25.0	X	Not installed where accessible during normal operation and/or maintenance of aircraft.

3.9 TT-5006A Aeronautical Satcom Antenna

CONDITIONS	DO160D SECTION # PARA #	CATEGORY	DESCRIPTION OF CONDUCTED TESTS
Temperature and altitude	4.0	E1	Outside Pressure Vessel -55°C to +85°C
In-flight loss of cooling	4.5.4	-	NOT APPLICABLE
Altitude	4.6.1	E1	70,000FT
Temperature variation	5.0	A	For equipment external to the aircraft: 10°C/min
Humidity	6.0	C	
Operational shocks and crash safety	7.0	E	
Vibration	8.0	C, L & M	Equipment tested to: C, L & M Standard Vibration Test.
Explosion proofness	9.0	X	Not tested
Waterproofness	10.0	S	
Fluids susceptibility	11.0	F	De-icing + jetfuel
Sand and dust	12.0	D	
Fungus resistance	13.0	F	
Salt spray	14.0	S	
Magnetic effect	15.0	A	
Power input	16.0	B	
Voltage spike	17.0	B	
Audio frequency conducted susceptibility	18.0	B	
Induced signal susceptibility	19.0	A	
Radio frequency susceptibility Radiated and conducted	20.0	Y	
Emission of radio frequency energy	21.0	H	Equipment located in areas, which are in direct view of receiver's antenna.
Lightning induced transient susceptibility	22.0	A2E2	
Lightning direct effects	23.0	2A	
Icing	24.0	A	
Electrostatic discharge	25.0	A	

4 Equipment Specifications

4.1 Equipment Specification

NOTE:

The information, drawings, and wiring diagrams contained in this manual are intended as a reference for engineering planning only. It is the installer's responsibility to compose installation drawings specific to the aircraft.

4.2 TT-5000 Aero-I System Part number specifications

The TT-5000 Series Aero-I System has two SDU configurations, and three antenna configurations. The TT-5033A SDU will be configured in one of two ways, TT-5033A SDU 3 channel (including Option 005, internal 12 channel NRS), or TT-5033A 3 channel SDU (excluding Option 005). The Aero-I has three antenna configurations.

1. TT-5002A/B Satcom Antenna with optional interfaced TT-5008A NRS antenna and/or IRS input (primary/secondary).
2. TT-5004A Phased Array Satcom Antenna and the aircrafts Navigation data supplied by IRS (primary/secondary).
3. TT-5006A Satcom Antenna with built-in NRS and/or IRS input primary/secondary).

The Part Numbers are specified Below.

Part Number	Model Number	Remarks
405033A-THR	TT-5033A	Aero-I Satellite Data Unit (SDU)
405033A-THR-NRS	TT-5033A incl. Opt. 005 NRS	Aero-I Satellite Data Unit (SDU) incl. Opt. 005 NRS
405033A-001	TT-5033A-001-THR	SDU configuration module
405033A-005	TT-5033A-005	SDU Option 005 NRS/GPS (12 Channel)
405033A-920	Option 920	SDU Option 920: ¼ ATR Rack
405033A-921	Option 921	SDU Option 921: ¼ ATR Shock Mount
405010A-THR	TT-5010A	Aero-I High Power Amplifier (HPA)
405012A-THR	TT-5012A	Diplexer Low Noise Amplifier (DLNA)
405620A-THW	TT-5620A	Aero-I Handset (White, 4-wire)
405622A-THW	TT-5622A	Handset Cradle (White, for 4-wire Handset)
405620A-THR	TT-5620A	Aero-I Handset (Black, 4-wire)
405622A-THR	TT-5622A	Handset Cradle (Black, for 4-wire Handset)
405621B-THW	TT-5621B	Aero-I Handset (White, 2-wire)
405622B-THW	TT-5622B	Handset Cradle (White, for 2-wire handset)
405621B-THR	TT-5621B	Aero-I Handset (Black, 2-wire)
405622B-THR	TT-5622B	Handset Cradle (Black, for 2-wire handset)
405002A	TT-5002B	Mech. Steered Satcom Ant. Top Mount
405002B	TT-5002B	Mech. Steered Satcom Ant. Tail Mount
405004A	TT-5004A	Phased Array Satcom Antenna
405006A	TT-5006A	Satcom Antenna (Mechanically Steered with built in NRS)
405008A	TT-5008A	NRS Antenna

4.3 TT-5000 Aero-I System Component Specifications

NOTE:

If installing a TT-5000 Aero-I System in a Rotary Wing or Turboprop Aircraft, it is necessary to install shock mount tray. Shock-mount can be obtained using SDU Option 921: ¼ ATR Shock Mount.

4.3.1 TT-5033A Aero-I Satellite Data Unit (SDU)

TT-5033A(w/Option 005) AND TT-5033A(w/o Option 005) SDU	
Characteristics	**Specification**
Size	59.4 mm (2.34")W x 193 mm (7.6")H x 317.5 mm (12.5")L
Component Weight	2.67 kg (5.95 lbs.)
Mounting	Per ARINC 404A standard tray, one hold down hook. The SDU is always placed in a pressurized cabin or avionics area.
Accessibility	Ensure that the front and rear panels can be accessed due to front connector, BITE display access, and connecting cables.
Power Requirements(nominal)	20W/ 28Vdc @ 0.7A
Electrical Specifications	
Power Recovery	200 ms
Minimum Input Voltage	18.0Vdc
Maximum Input Voltage	31.0Vdc
Environmental Categories	Refer to Environmental Qualification form in the CAA Approval section of this manual.

4.3.2 TT-5010A Aero-I High Power Amplifier (HPA)

TT-5010A HPA	
Characteristics	**Specification**
Size	243.1 mm (9.57")W x 73.9 mm (2.91")H x 275.1 mm (10.83")L
Component Weight	4.49 kg (9.9 lbs.)
Mounting	Unit shall be mounted flush on a panel in a vertical position to ensure maximum cooling. Should be mounted as close to the DLNA as possible.
Accessibility	Ensure that the front panel is accessible for connecting cables, make room for cable bending radius.
Power Requirements:	
Nominal (Idle):	25W/ 0.9A @ 28Vdc
Maximum Output:	130W/ 4.6A @ 28Vdc
Electrical Specifications	
Minimum Input Voltage	20.0Vdc
Maximum Input Voltage	31.0Vdc
Environmental Categories	Refer to Environmental Qualification form in the CAA Approval section of this manual.

4.3.3 TT-5012A Diplexer Low Noise Amplifier (DLNA)

TT-5012A Diplexer Low Noise Amplifier (DLNA)	
Characteristics	**Specification**
Size	194.1 mm (7.64")W x 49.5 mm (1.95")H x 268.7 mm (10.58")L
Component Weight	2.56 kg to 2.65 kg (5.65lbs. To 5.84lbs.)
Mounting	Should be mounted as close to the Antenna unit as possible. Should not be mounted directly on fuselage without cadmium plated washers.
Accessibility	Ensure that the front panel is accessible for connecting cables, make room for cable bending radius.
Power Requirements(nominal)	Provided By SDU via Coaxial Cable.
Electrical Specifications Minimum Input Voltage Maximum Input Voltage	Provided by SDU via Coaxial cable. N/A N/A
Environmental Categories	Refer to Environmental Qualification form in the CAA Approval section of this manual.

4.3.4 TT-5621A Full Feature Handset (4-wire)

Characteristics	**Specification**
Size	52.0 mm (2.05")W x 20.0 mm (0.79")H x 200.0 mm (7.87")L
Component Weight	0.24 kg (0.5 lbs.)
Power Requirements	Provided by SDU via Handset Cradle
Electrical Specifications: Input Voltage	Provided by SDU via Handset Cradle. 28.0 Vdc
Environmental Categories	Refer to Environmental Qualification form in the CAA Approval section of this manual.

4.3.5 TT-5622A Full Feature Cradle (4-wire)

Characteristics	Specification
Size	61.0 mm (2.40")W x 26.5 mm (1.04")H x 160.5 mm (6.32")L
Component Weight	0.31 kg (0.7 lbs.) incl. connector cable
Power Requirements	Provided by SDU
Electrical Specifications: Input Voltage	Provided by SDU via connecting cable. 28.0 Vdc
Environmental Categories	Refer to Environmental Qualification form in the CAA Approval section of this manual.

4.3.6 TT-5621B Auxiliary Handset (2-wire)

Characteristics	Specification
Size	52.0 mm (2.05")W x 20.0 mm (0.79")H x 200.0 mm (7.87")L
Component Weight	0.31 kg (0.7 lbs.) incl. cable
Power Requirements	Provided by SDU
Electrical Specifications: Input Voltage	Provided by SDU via connecting cable. 25.0 mA, approx. 70.0 Vac @ ringing signal.
Environmental Categories	Refer to Environmental Qualification form in the CAA Approval section of this manual.

4.3.7 TT-5622B Auxiliary Cradle (2-wire)

Characteristics	Specification
Size	61.0 mm (2.40")W x 26.5 mm (1.04")H x 160.5 mm (6.32")L
Component Weight	0.24 kg (0.5 lbs.) incl. connector cable
Power Requirements	none
Electrical Specifications: Input Voltage	none
Environmental Categories	Refer to Environmental Qualification form in the CAA Approval section of this manual.

4.4 TT-5000 Aero-I System Antenna Specifications

4.4.1 TT-5002A Mechanically Steered Aeronautical Antenna, Top Mount

TT-5002A Mechanically Steered Aeronautical Antenna, Top Mount	
Characteristic	**Specification**
Size	336 mm (13.25")W x 127 mm (5.0")H x 600 mm (23.6")L
Antenna Weight	4.8 kg (10.6lbs.) Fuselage mounted including radome and base plate
Frequency	TX band 1626.5 MHz-1660.5 MHz RX band 1530.0 MHz-1559.0 MHz
Polarization	Circular Right
Power Requirements	Provided by HPA
Mask Angle	5° or less elevation angle above the horizon
Mounting	Top of aircraft fuselage, centerline.
Ground Plane Requirement	None
Icing	See Environmental Qualification Form in CAA Approval section in this manual.
Lightning	See Environmental Qualification Form in CAA Approval section in this manual.

4.4.2 TT-5002B Mechanically Steered Aeronautical Antenna, Tail Mount

TT-5002B Mechanically Steered Aeronautical Antenna, Tail Mount	
Characteristic	**Specification**
Size	222 mm (8.7") diameter x 119.5 mm (4.7")H
Antenna Weight	3.8 kg (8.4lbs.) Tailmounted without radome, with limited base plate
Frequency	TX band 1626.5 MHz-1660.5 MHz RX band 1530.0 MHz-1559.0 MHz
Polarization	Circular Right
Power Requirements	Provided by HPA
Mask Angle	5° or less elevation angle above the horizon
Mounting	Inside airplane tail radome
Ground Plane Requirement	None
Icing	See Environmental Qualification Form in CAA Approval section in this manual.
Lightning	See Environmental Qualification Form in CAA Approval section in this manual.

4.4.3 TT-5004A Phased Array Satcom Antenna

TT-5004A Phased Array Satcom Antenna	
Characteristic	**Specification**
Size	116.3 mm (4.58")W x 87.6 mm (3.45")H x 886.2 mm (34.89")L
Antenna Weight	2,72 kg (6.0lbs.)
Frequency	Satcom: TX band 1626.5Mhz-1660.5Mhz RX band 1530.0Mhz-1559.0Mhz
Polarization	Circular Right
Power Requirements	Provided by HPA
Mask Angle	5° or less elevation angle above the horizon
Mounting	As far as possible from the aircraft tail section. Keep a minimum distance to the GPS Antenna unit of 3 ft.
Ground Plane Requirement	None
Icing	See Environmental Qualification Form in CAA Approval section in this manual.
Lightning	See Environmental Qualification Form in CAA Approval section in this manual.

4.4.4 TT-5006A Aeronautical Satcom Antenna (Mechanically Steered w. NRS)

TT-5006A Aeronautical Satcom Antenna (Mechanically Steered w. NRS)	
Characteristic	**Specification**
Size	150.3 mm (5.92")W x 124.0 (4.88")H x 560.0 mm (22.05")L
Antenna Weight	2.4 kg (5.3lbs.)
Frequency	NRS RX 1575.42 MHz Satcom: TX band 1626.5 MHz-1660.5 MHz RX band 1525.0 MHz-1559.0 MHz
Polarization	Circular Right
Power Requirements	Provided by SDU
Mask Angle	5° or less elevation angle above the horizon
Mounting	Top of aircraft fuselage, centerline as far forward as practical. In a location of minimum magnetic disturbance.
Ground Plane Requirement	None
Icing	See Environmental Qualification Form in CAA Approval section in this manual.
Lightning	See Environmental Qualification Form in CAA Approval section in this manual.

4.4.5 TT-5008A NRS Antenna

TT-5008A NRS Antenna	
Characteristic	**Specification**
Size	158.8 mm (6.25")W x 34.5 mm (1.36"H) x 279.4 mm (11.0")L
Antenna Weight	0.68 kg (1.5lbs.)
Frequency	1574.42MHz-1576.42MHz
Power Requirements	Provided by SDU
Mask Angle	20° or less elevation angle above the horizon.
Mounting	Top of aircraft fuselage, centerline as far forward as practical. In a location of minimum magnetic disturbance.
Ground Plane Requirement	None

4.4.6 Option 920 ¼ ATR Rack

Option 920 ¼ ATR Rack	
Characteristics	**Specification**
Size	60.8 mm (2.39")W x 111.0 mm (4.37")H x 332.5 mm (13.09") L
Component Weight	0.4 kg (0.88 lbs.)excl. rack connector

4.4.7 Option 921 ¼ ATR Shock Mount

Option 921 ¼ ATR Shock Mount	
Characteristics	**Specification**
Size	90.0 mm (3.54")W x 213.6 mm (8.41")H x 369.6 mm (14.55")L
Component Weight	0.6 kg (1.32 lbs.). excl. rack connector

5 Equipment Drawings

5.1 TT-5033A Satellite Data Unit and Installation Rack

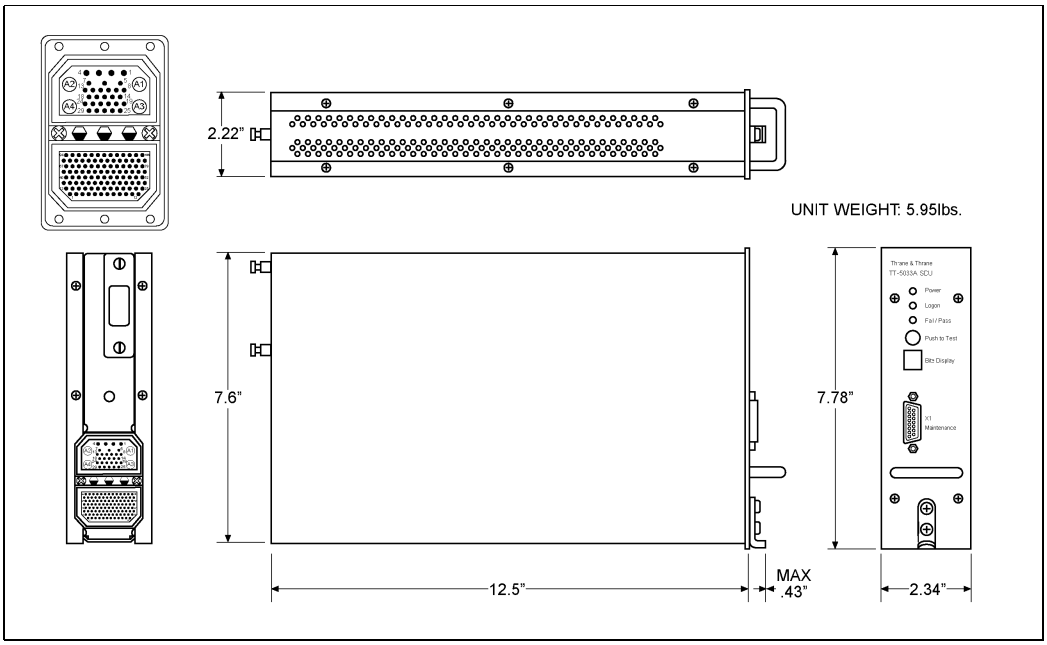


Figure 8, TT-5033A SDU with TT-5033A-001-THR Configuration Module inserted

5.1.1 TT-5033A SDU Option 920: ¼ ATR Rack

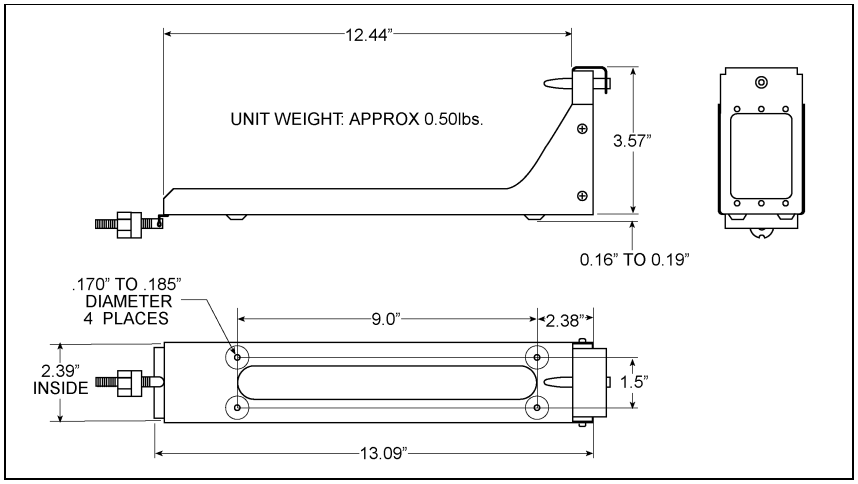


Figure 9, TT-5033A SDU Option 920: ¼ ATR Rack

5.1.2 Outline drawing SDU unit with rack and configuration module.

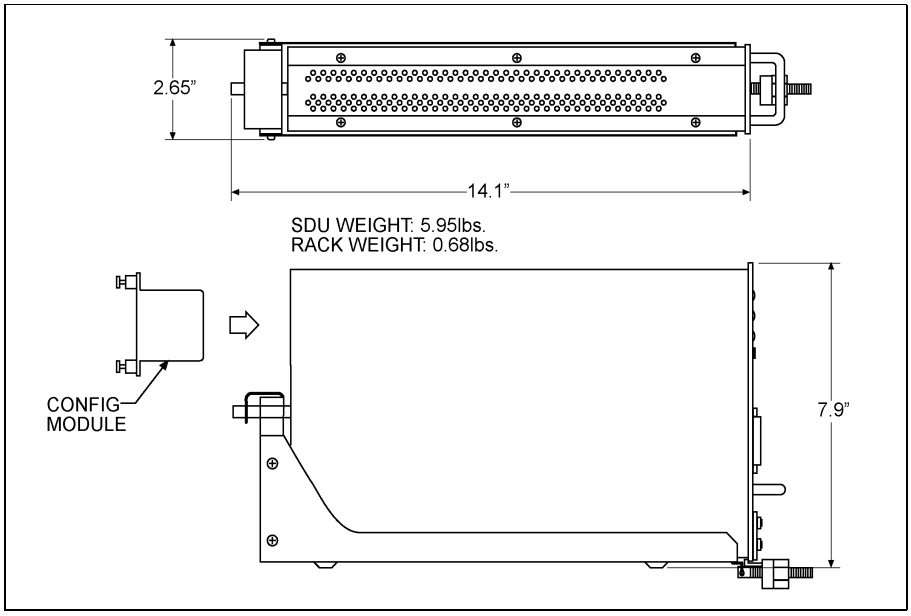


Figure 10, Outline drawing SDU unit with rack and configuration module.

5.1.3 TT-5033A–001-THR SDU Configuration Module

NOTE:

Configuration module must remain with aircraft if SDU is replaced.

The Configuration Module contains information that is specific for the aircraft.

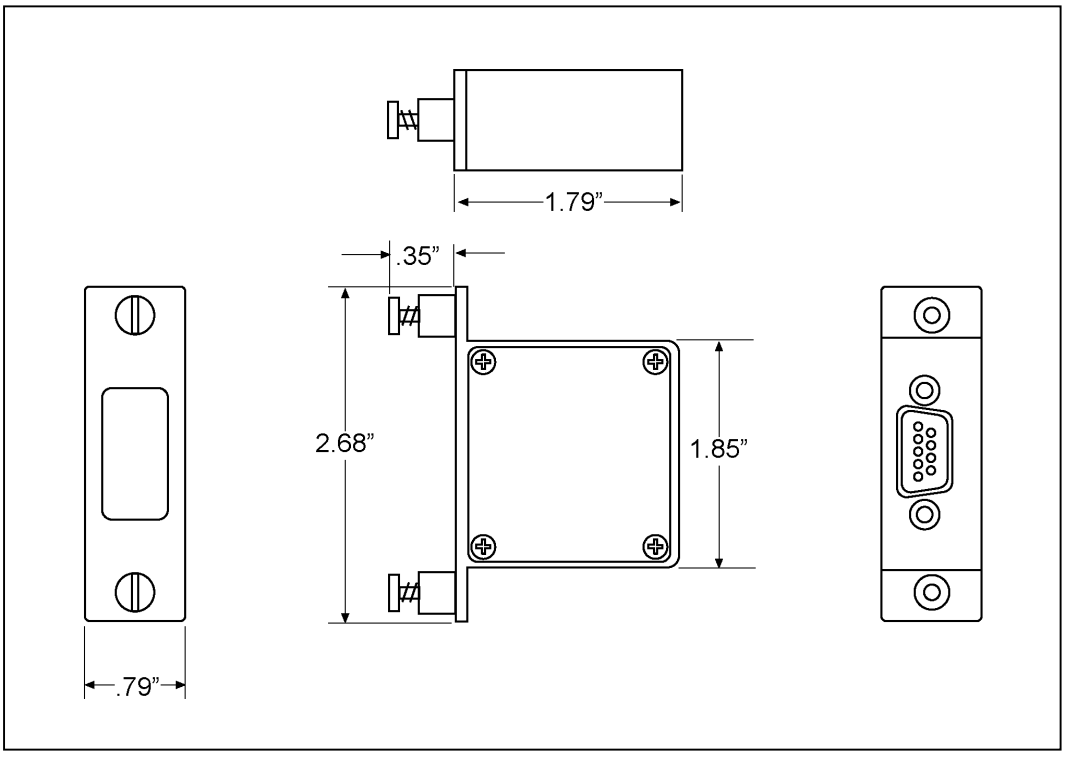


Figure 11, TT-5033A-001-THR, SDU Configuration Module

5.1.4 SDU Option 921: ¼ ATR Shock Mount for mounting of the TT-5033A SDU

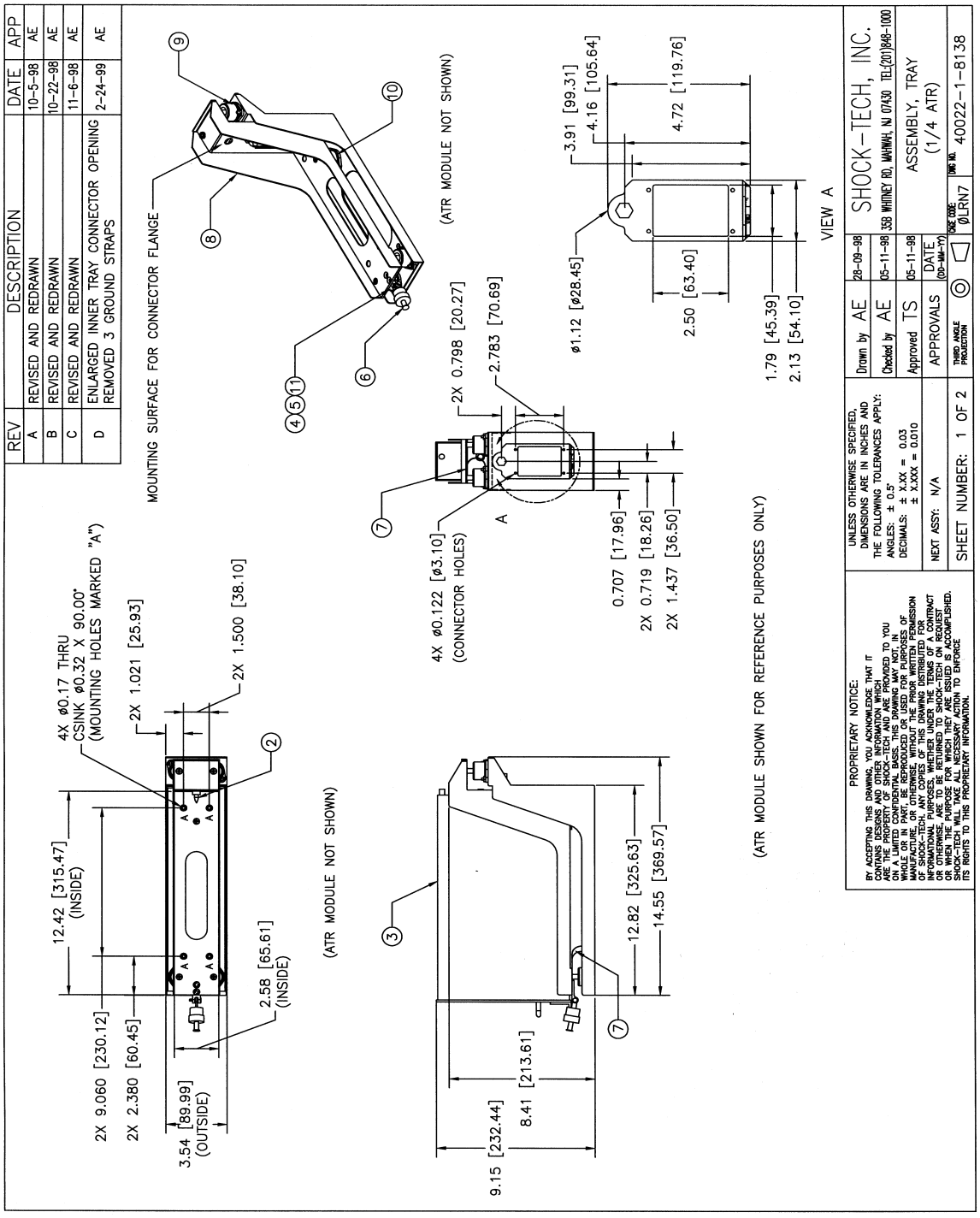


Figure 12, SDU Option 921: ¼ ATR Shock Mount for mounting of the TT-5033A SDU (1 of 2).

5.1.5 SDU Option 921: ¼ ATR Shock Mount for mounting of the TT-5033A SDU

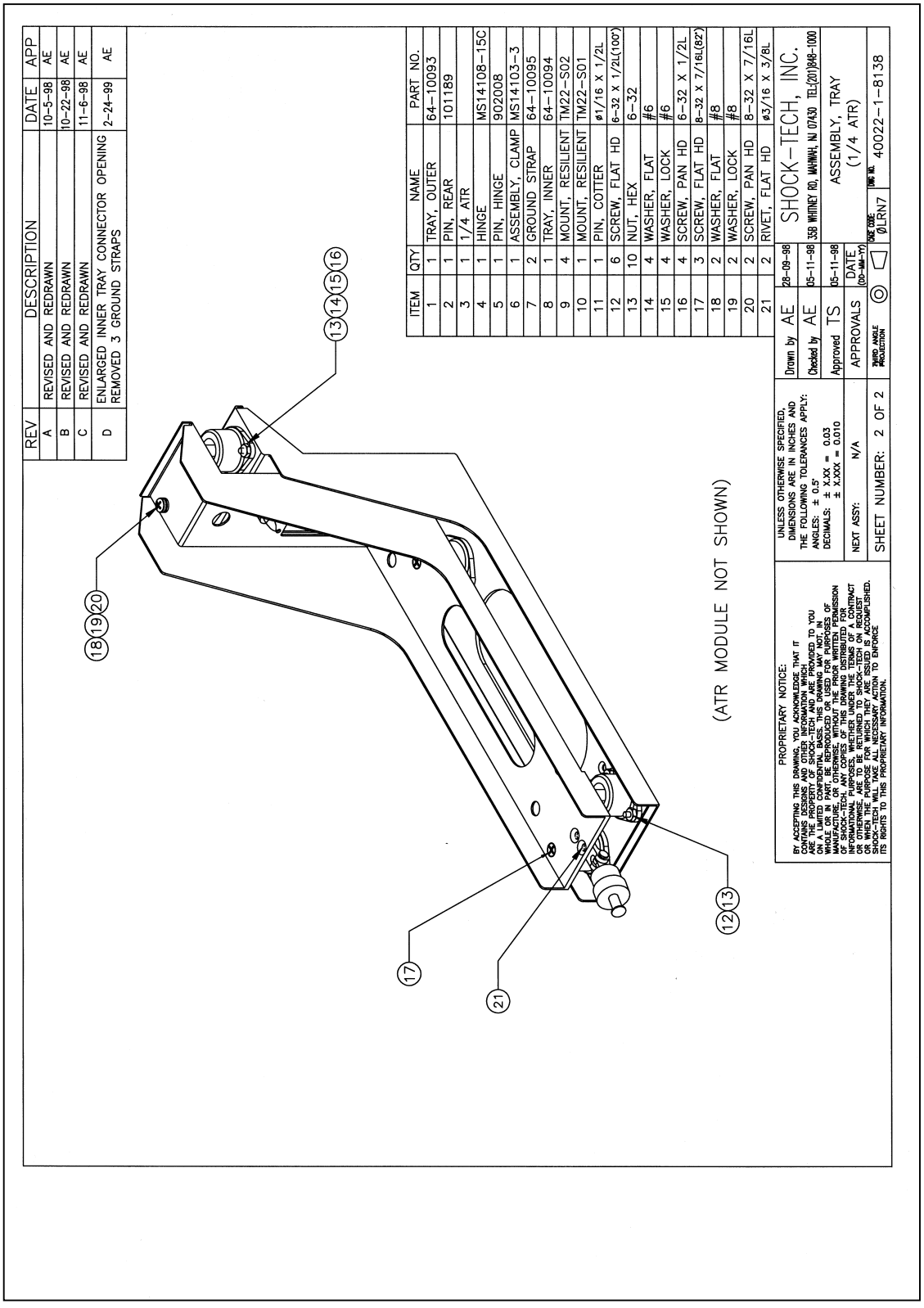


Figure 13, SDU Option 921: ¼ ATR Shock Mount for mounting of the TT-5033A SDU (2 of 2).

5.2 TT-5010A High Power Amplifier

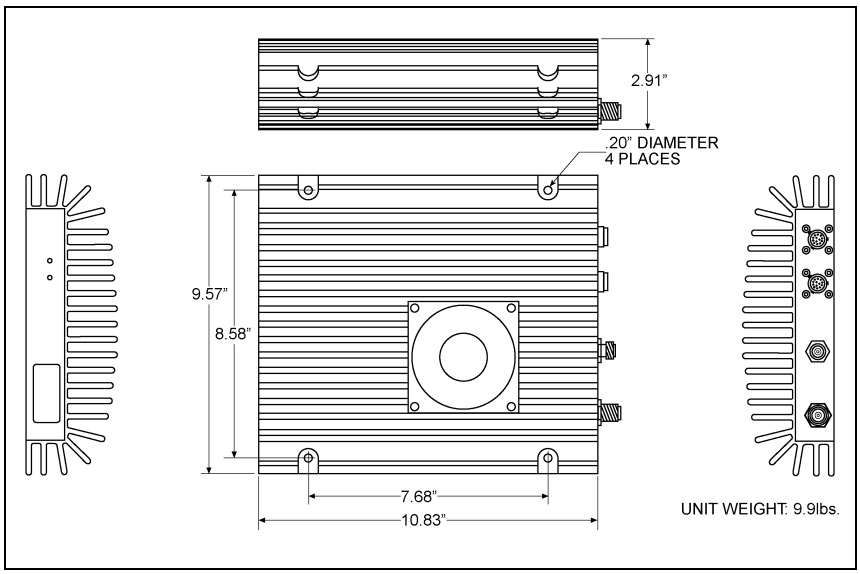


Figure 14, TT-5010A High Power Amplifier (HPA)

5.3 TT-5012A Diplexer Low Noise Amplifier

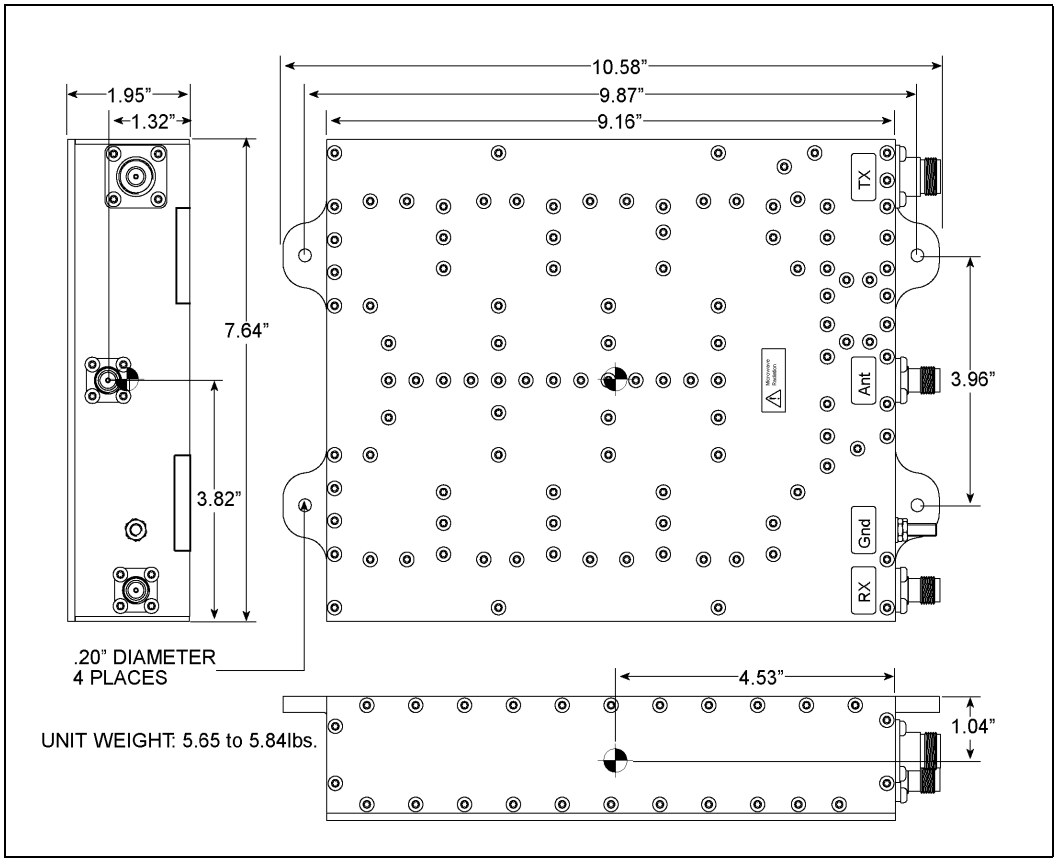


Figure 15, TT-5012A Diplexer Low Noise Amplifier (DLNA)

5.4 TT-5621A Full Feature Handset (4-wire)

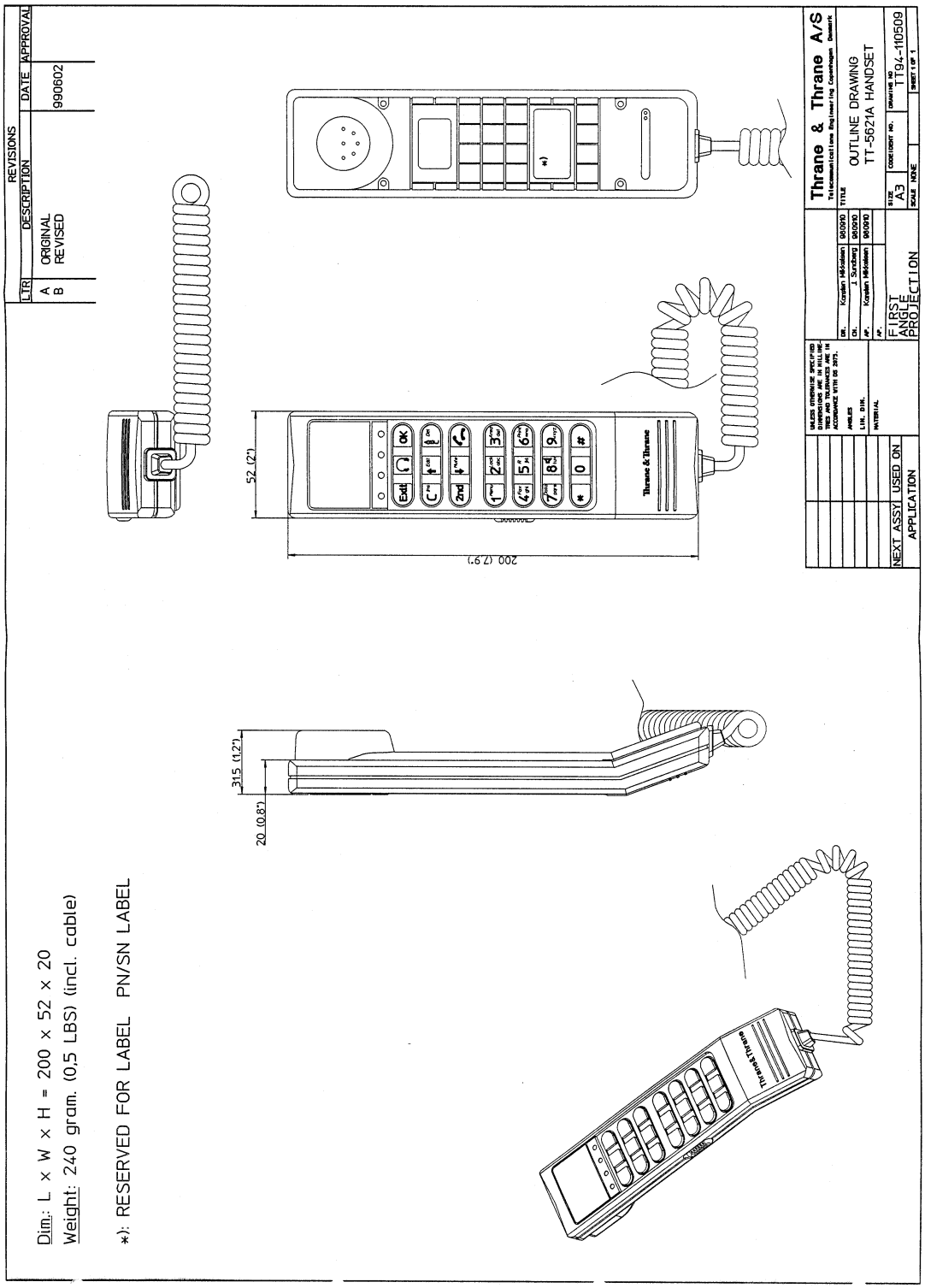


Figure 16, TT-5621A Full Feature Handset (4-wire)

5.5 TT-5622A Full Feature Cradle (4-wire)

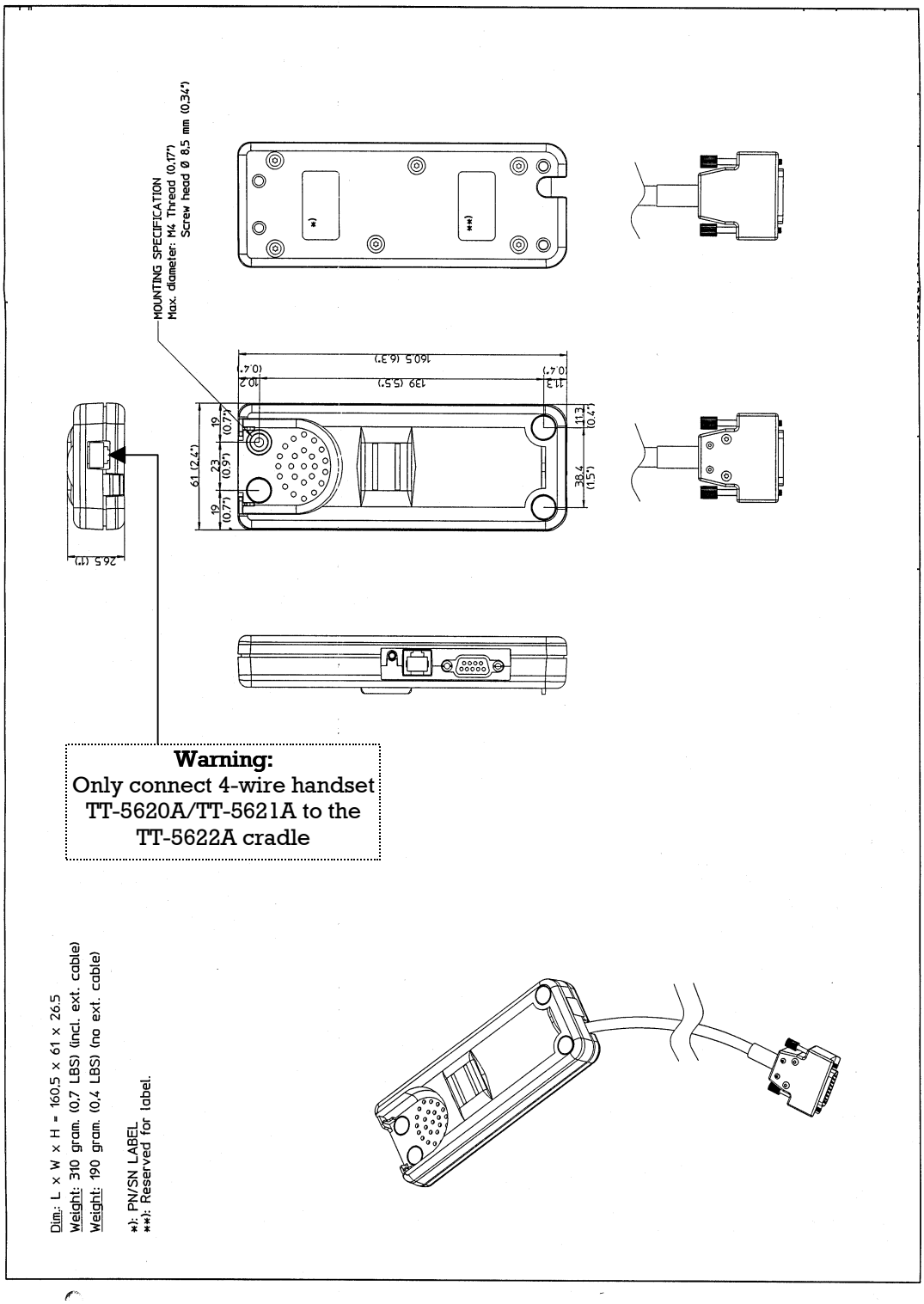


Figure 17, TT-5622A Full Feature Cradle (4-wire).

5.6 TT-5621B Auxiliary Handset (2-wire)

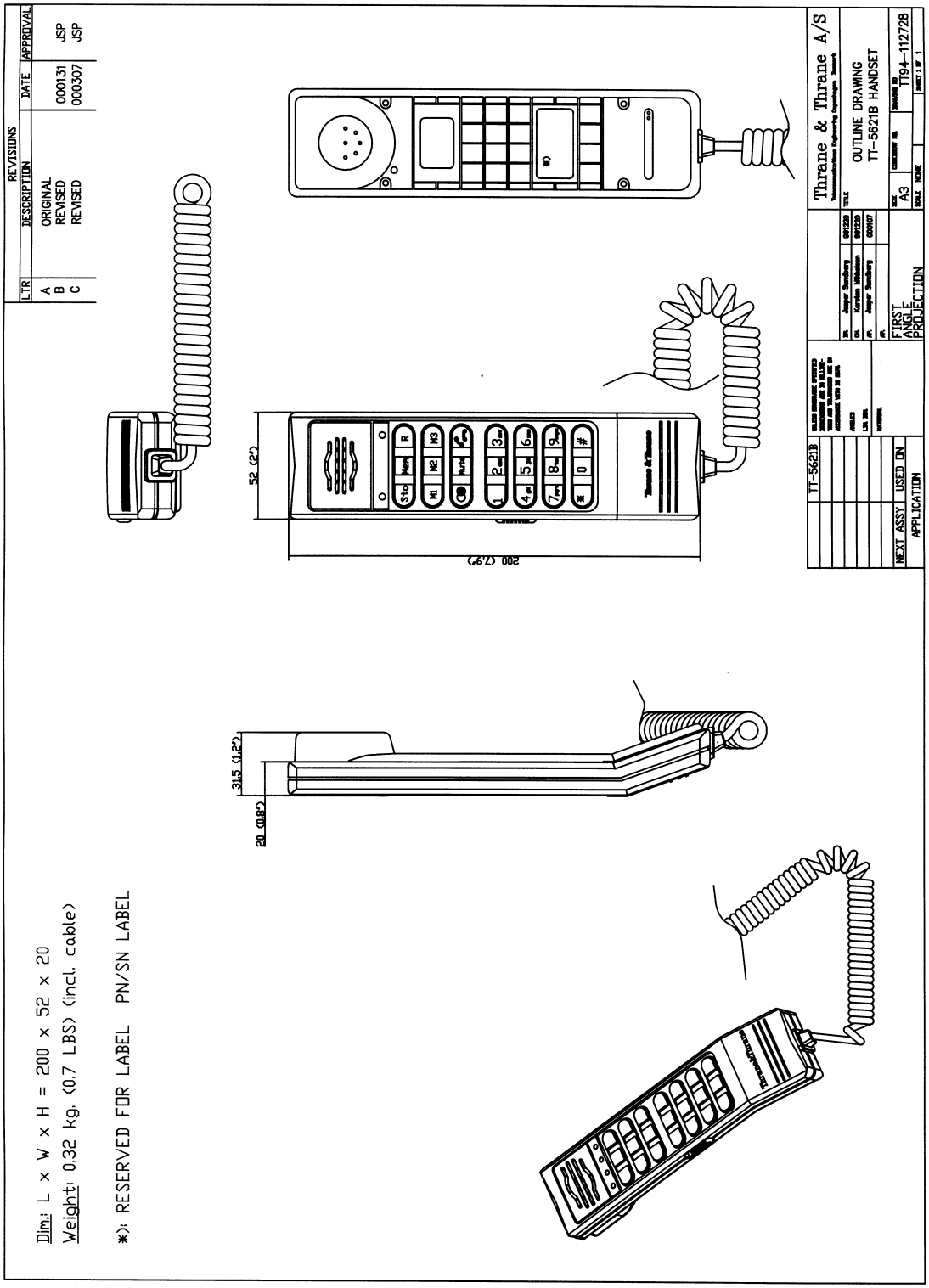


Figure 18, TT-5621B Auxiliary Handset (2-wire).

5.7 TT-5622B Auxiliary Cradle (2-wire)

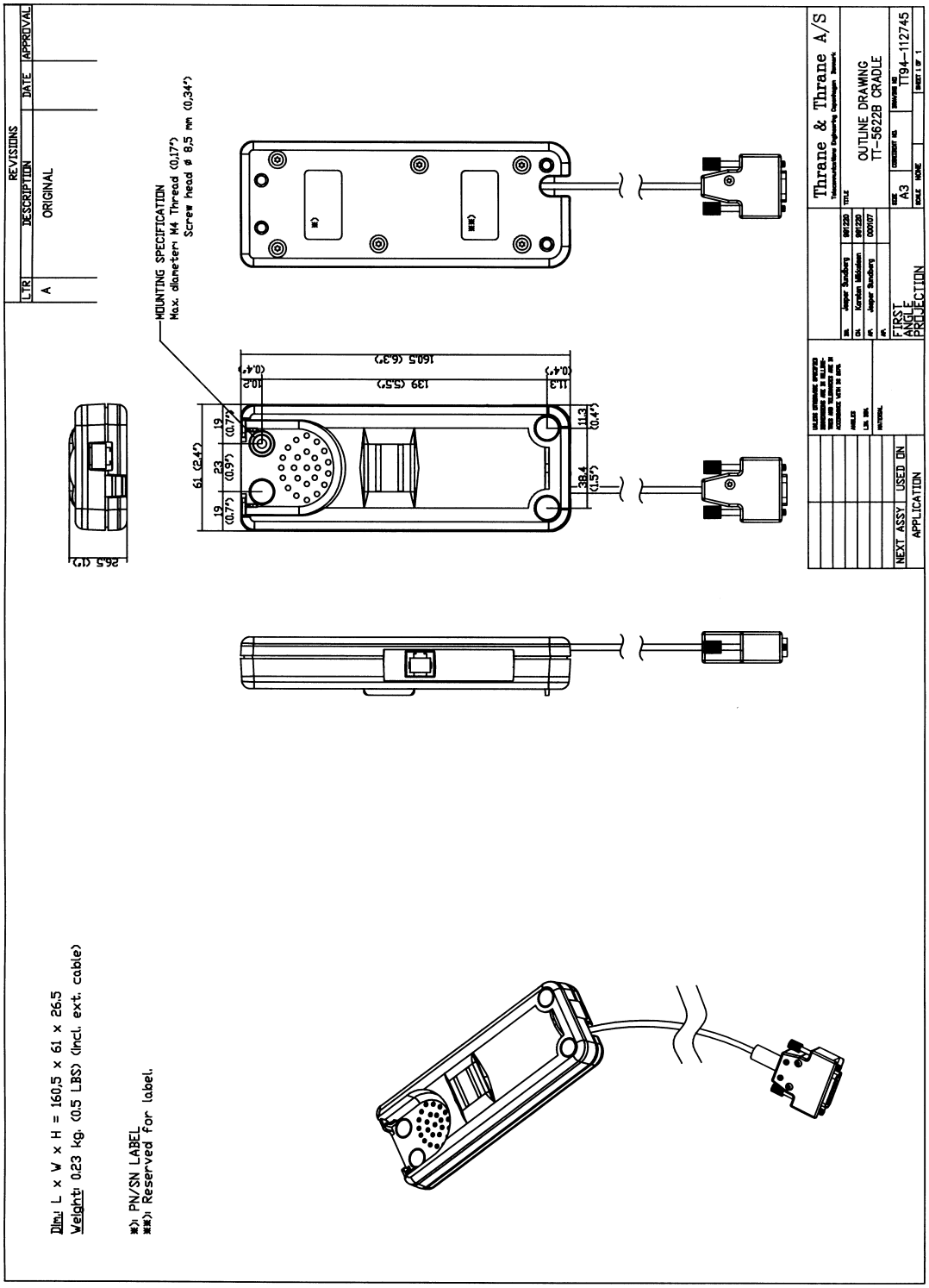


Figure 19, TT-5622B Auxiliary Cradle (2-wire).

5.8 TT-5000 Aero-I System Antennas

NOTE:

Antennas require an OEM adapter plate. Use of a non-OEM adapter plate will void warranty.

5.8.1 TT-5002A Mechanical Steered Antenna for Top Mount (topview).

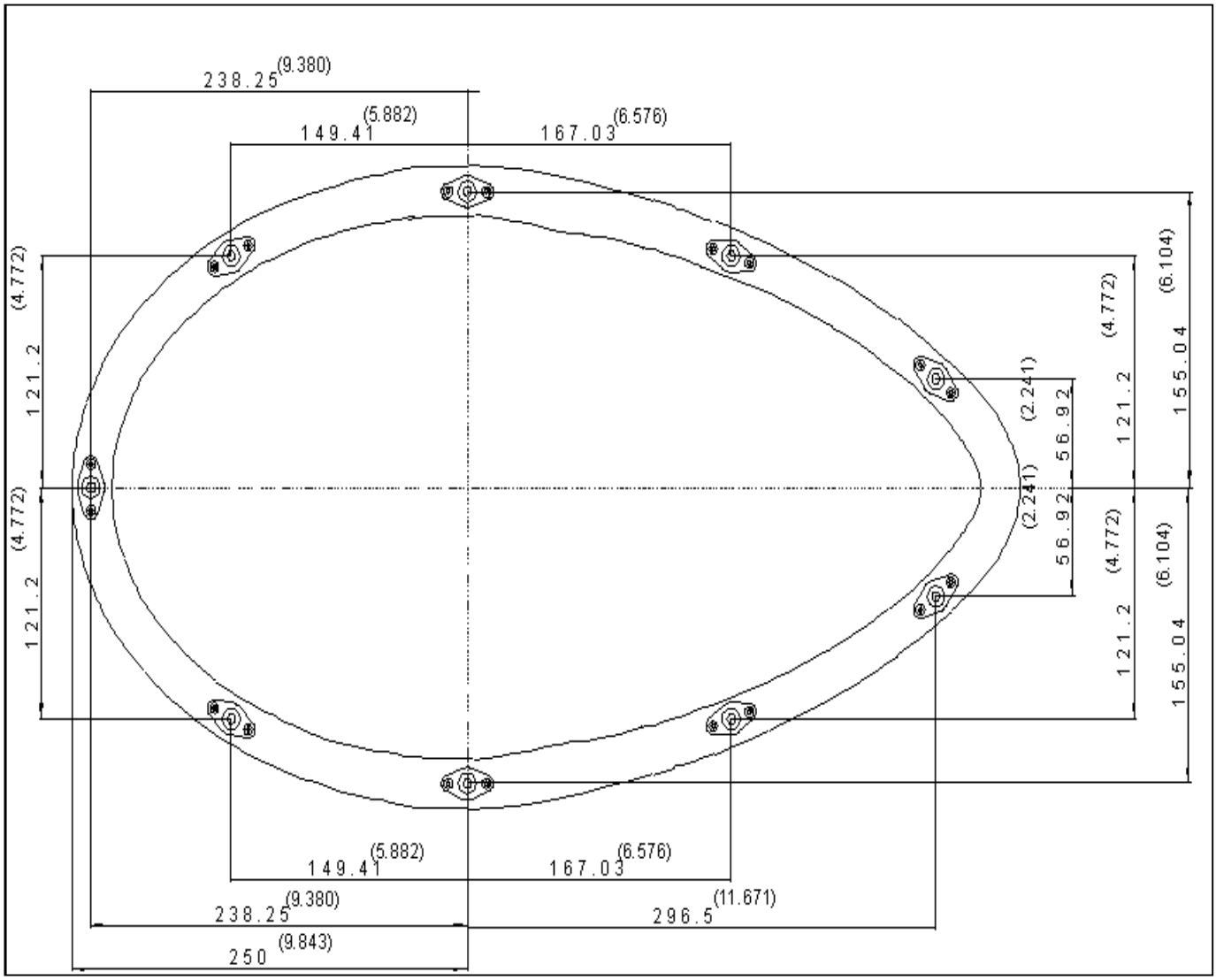


Figure 20, TT-5002A Mechanical Steered Antenna for Top Mount (topview).

5.8.2 TT-5002A Mechanical Steered Antenna for Top Mount.(Sideview)

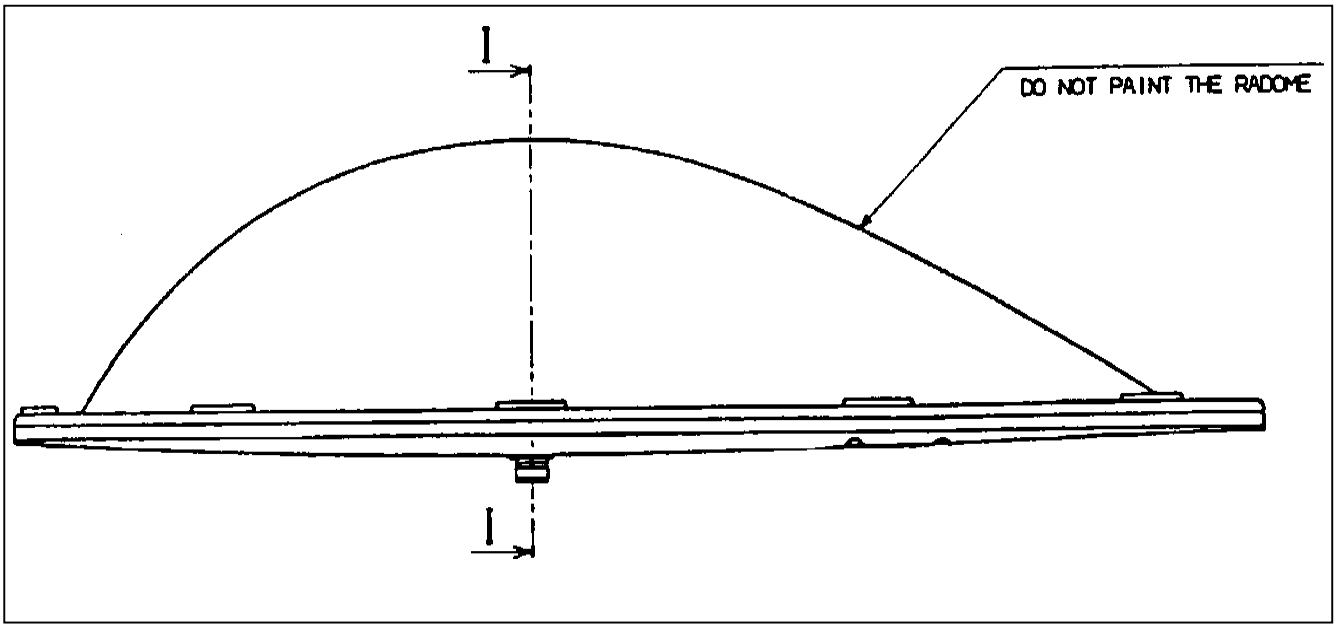


Figure 21, TT-5002A Mechanical Steered Antenna for Top Mount (sideview).

5.8.3 TT-5002A Mechanical Steered Antenna for Top Mount. (Rear view)

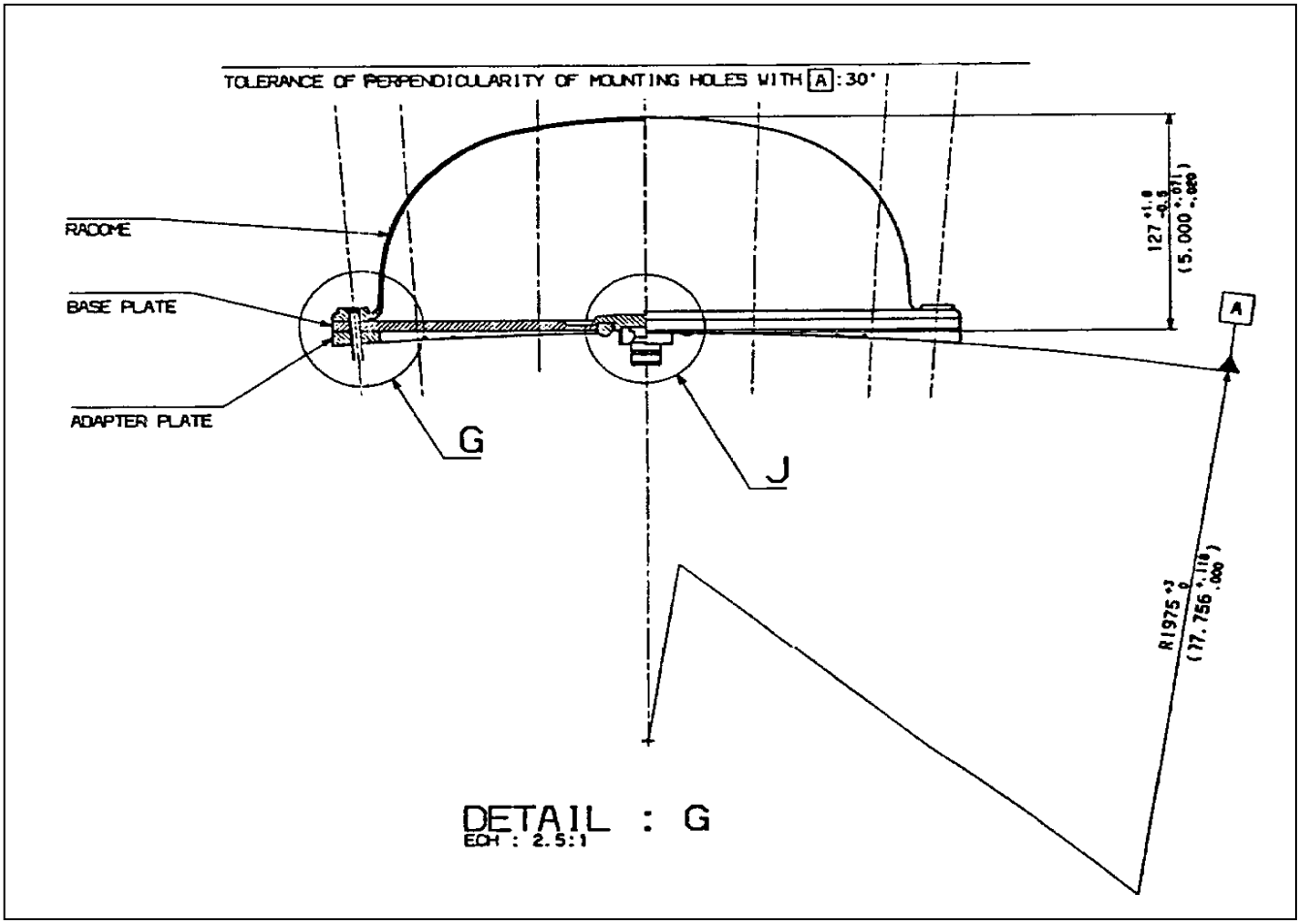


Figure 22, TT-5002A Mechanical Steered Antenna for Top Mount (rear view).

5.8.4 TT-5002B Mechanical Steered Antenna for Tail Mount (without radome)

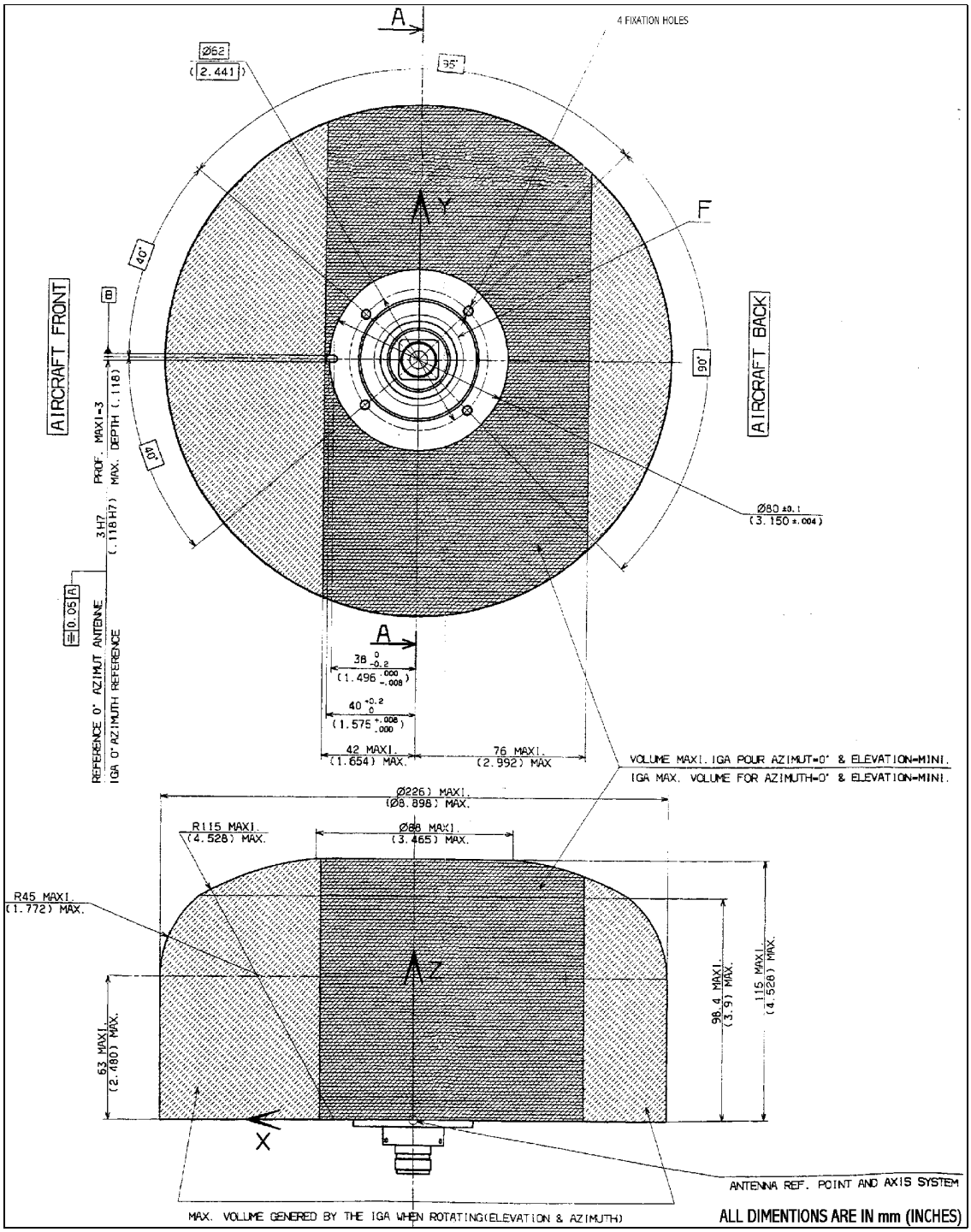


Figure 23, TT-5002B Mechanical Steered Antenna for Tail Mount (without radome)

5.8.5 TT-5004A Phased Array Satcom Antenna

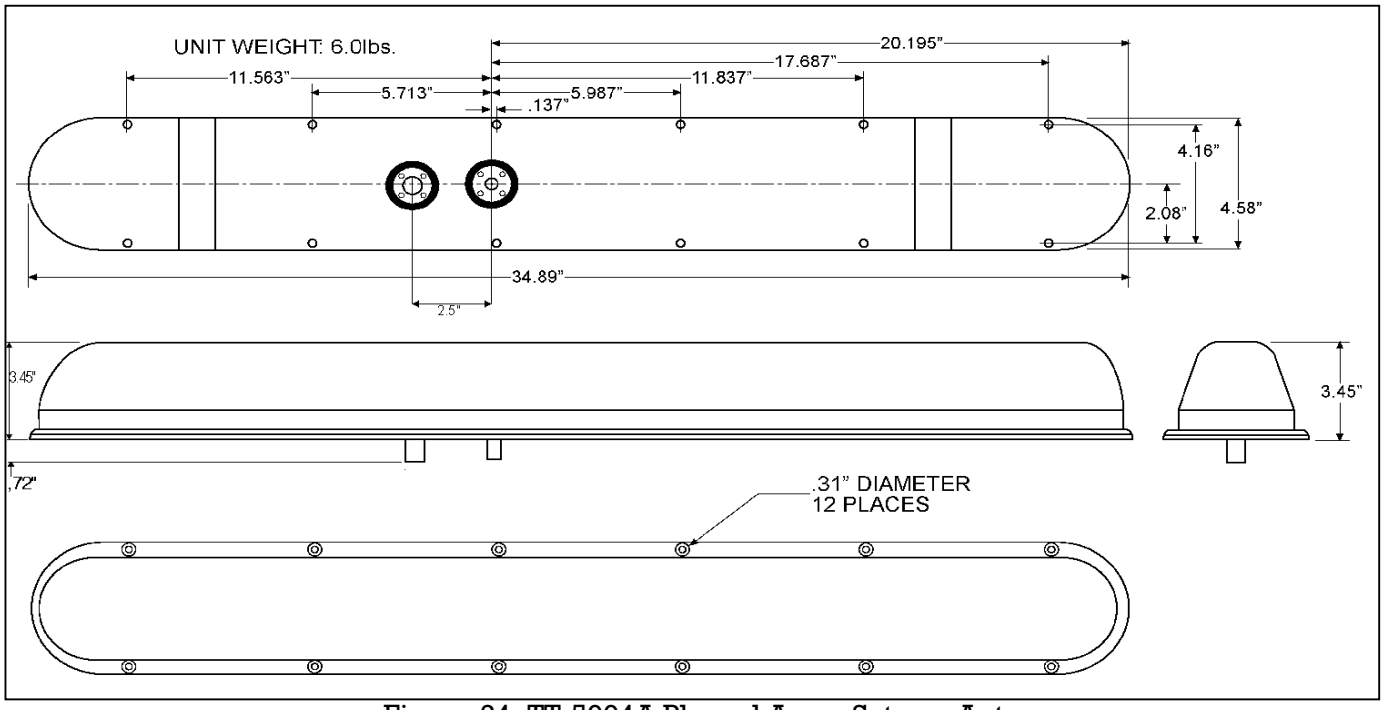


Figure 24, TT-5004A Phased Array Satcom Antenna

5.8.6 TT-5006A Satcom Antenna with built-in NRS.

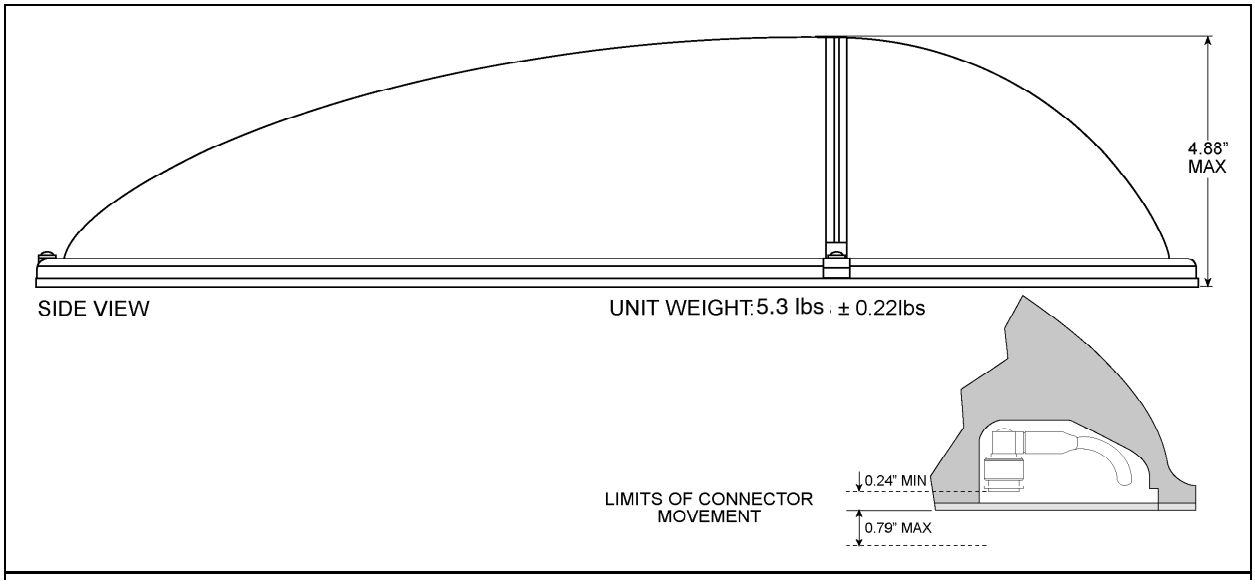


Figure 25, TT-5006A Satcom Antenna with built-in NRS (side view).

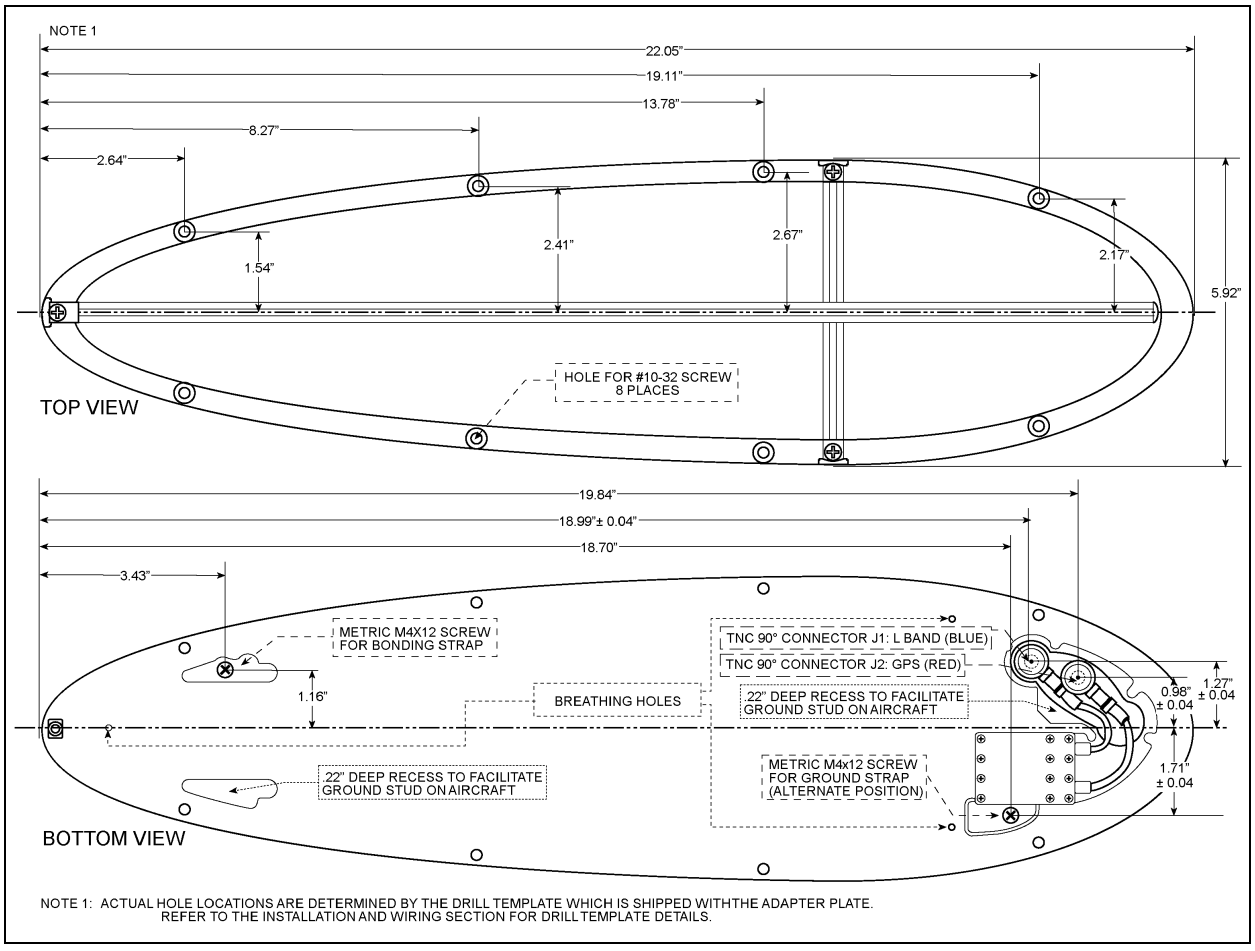


Figure 26, TT-5006A Satcom Antenna with built-in NRS (top/bottom view).

TT-5006A Satcom with built-in NRS Antenna Adapter Plate

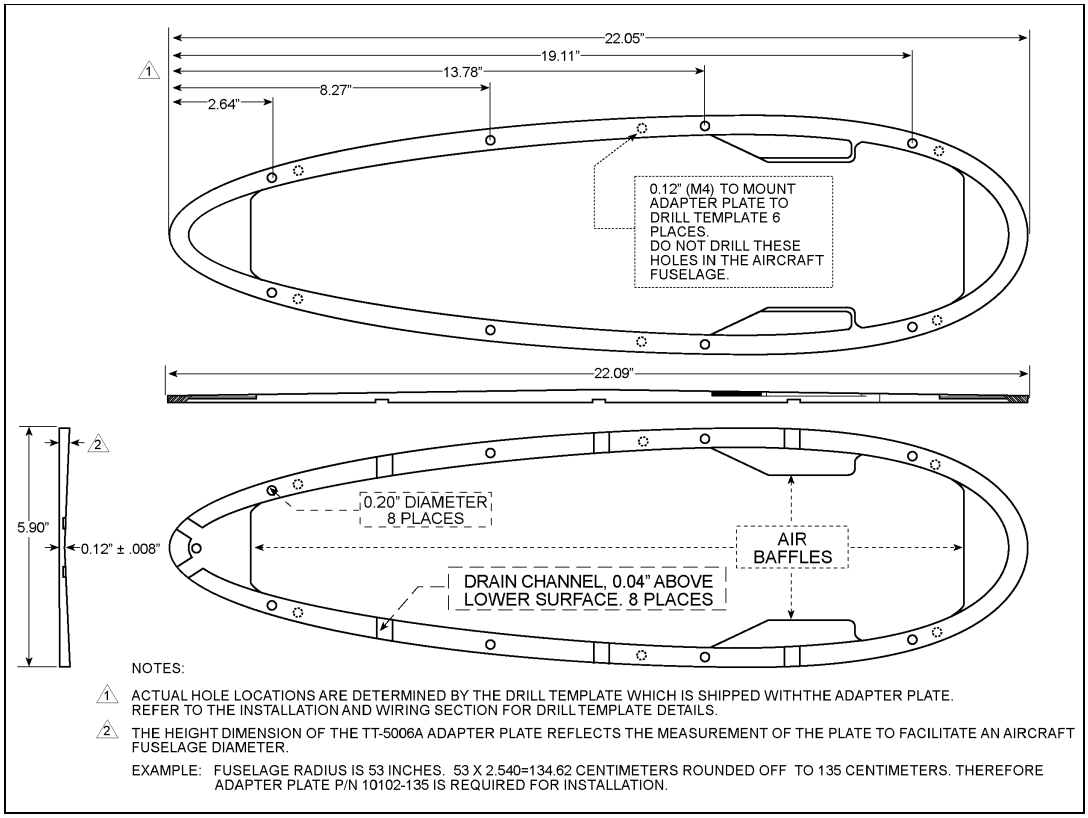


Figure 27, TT-5006A Satcom with built-in NRS Adapter Plate

5.8.7 TT-5008A Satcom NRS Antenna

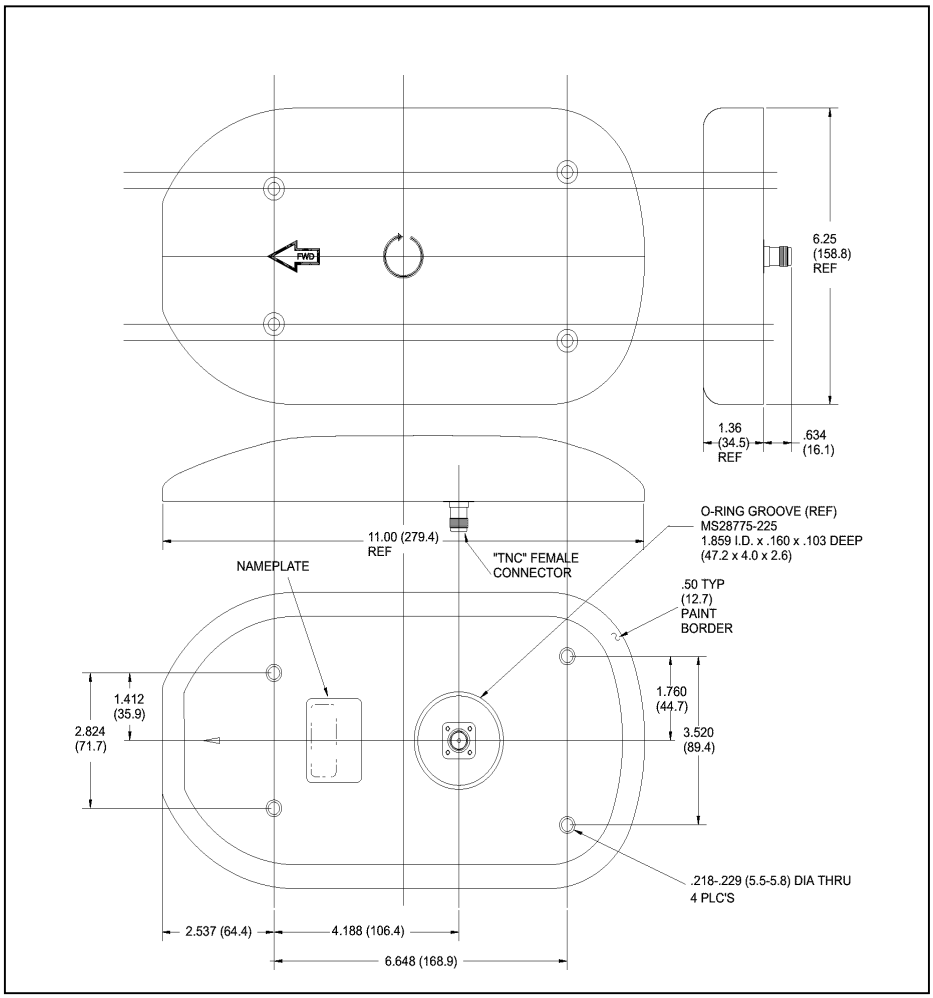


Figure 28, TT-5008A Satcom NRS Antenna

6 Installation and Wiring

6.1 General

This section contains considerations and recommendations for installation of the TT-5000 Aero-I System. Interconnect harness wiring and physical mounting must be considered as required to satisfy all applicable regulations.

The information, drawings and wiring diagrams contained in this manual are intended as a reference for engineering planning only. The drawings and wiring diagrams contained herein do not represent any specific STC. It is the installer's responsibility to compose installation drawings specific to the aircraft. This manual and the drawings and wiring diagrams contained herein may not be used as a substitute for an STC.

NOTE:

To ensure optimal performance from the TT-5000 Aero-I System, strict adherence to the Installation Considerations found in this section must be maintained.

NOTE:

You will notice in the following text, references such as "(W3 and W4)". These are references to specific cables shown in the Interconnecting and Wiring Diagrams in this section.

6.2 Commissioning

On delivery of the TT-5000 Aero-I System a registration form is supplied. This must be filled out and returned to the local service provider.

NOTE:

It is recommended that before commissioning installation of the Aero-I System, the steps for commissioning the Satcom system must be completed. This is due to the time period involved in completing the commissioning process.

6.2.1 Aero-I Service Providers

Satcom Direct, Inc.
P.O. Box 3726
Satellite Beach, FL 32937-2667, USA
Phone: +1 (321) 777-3000
Fax: +1 (321) 777-3702
Web-site:www.satcomdirect.com

Universal Weather & Aviation, Inc.
8787, Tallyho
Houston, TX 77061, USA
Phone: +1 (713) 944-1622
Fax: +1 (713) 943-4610
Web-site: www.univ-wea.com

Commissioning Time Involved?
Please calculate three days for commissioning and activation of an Aero-I system.

Commissioning Procedure?
When the customer commission their system. The customer needs to indicate where they have wired voice, Fax, and data.

Commissioning with FAX/PC_Modem
When commissioning with Fax/PC_Modem, the customer has to decide where the fax machine/PC laptop computer will be located. The service provider needs to know, this to commission with fax/PC_Modem, therefore the following applies:

- Top Plug Pin 6 & 19 and/or 4Wire handset cradle #1 and #3 = Terminal 5 with the service provider. (Normally commissioning with fax).
- Top Plug Pin 7 & 8 and/or 4Wire handset cradle #2 and #4 = Terminal 6 with the service provider. (Normally commissioning with data).

6.3 Aircraft Interface Considerations

All Aircraft Avionics interfaces follow guidelines laid out in ARINC 741 specifications. However, pin connections on the ARINC 404 rear connector are not compatible with ARINC 741 specifications.

6.3.1 Inertial Reference System

The SDU has two high speed ARINC 429 input interfaces for IRS 1 and IRS 2. Antenna positioning and Doppler correction data are computed from either the IRS data or NRS data. The priority of using either IRS or NRS data can be determined by viewing the Reference System Table in chapter 8.2.2

ARINC 429 INPUT FOR IRS 1 AND IRS 2	
Pin Name	**TT-5033A SDU**
Data from Primary IRS A (ARINC 429)	BP26
Data from Primary IRS B (ARINC 429)	BP27
Data from secondary IRS A (ARINC 429)	BP28
Data from secondary IRS B (ARINC 429)	BP29

6.3.2 24 bit Discrete ICAO Address

The TT-5033A SDU has 24 discrete inputs used to encode the 24 bit ICAO address, in which the SDU is installed. Each ICAO address consists of 8 digits, and each digit value is detemined by straping 3 bits (octal).

Pins assigned to the binary "one" state should be left open circuit (internal pull up). Pins assigned to the binary "zero" state should be strapped to BP25 (ICAO Address Common) on the airframe side of the connector.

Binary "one" = > 100kΩ

Binary "zero" = < 10Ω

1. The internal interface circuitry consists of 10kΩ Pull-up to +5Vdc.

PIN TRANSLATION FOR 24 BIT DISCRETE ICAO ADDRESS		
Pin Name	**TT-5033A SDU**	**BIT Binary Weight**
Bit #1	BP1	4
Bit #2	BP2	2
Bit #3	BP3	1
Bit #4	BP4	4
Bit #5	BP5	2
Bit #6	BP6	1
Bit #7	BP7	4
Bit #8	BP8	2
Bit #9	BP9	1
Bit #10	BP10	4
Bit #11	BP11	2
Bit #12	BP12	1
Bit #13	BP13	4
Bit #14	BP14	2
Bit #15	BP15	1
Bit #16	BP16	4
Bit #17	BP17	2
Bit #18	BP18	1
Bit #19	BP19	4
Bit #20	BP20	2
Bit #21	BP21	1
Bit #22	BP22	4
Bit #23	BP23	2
Bit #24	BP24	1
ICAO Address Common	BP25	

6.3.3 Spare Interfaces

The SDU provides one Hi speed ARINC 429 spare output, and one Hi speed ARINC 429 spare input.

6.3.4 Power Supply

The SDU and HPA are supplied from the 28-volt power bus, with a maximum power consumption of 50 W for the SDU and maximum 130 W for the HPA. The criteria for the supply wire resistance is shown in the table below together with calculated examples for AWG 16, AWG 14 and AWG 12 wire.

Description	Pin	Requirement (1)	AWG 16	AWG 14	AWG 12
SDU +28V	TP1	< 200 mΩ	< 12.8m/42 feet (2)	< 20.42m/67 feet (2)	
SDU +28V return	TP2	< 25 mΩ	< 1.52m/5 feet	< 2.44m/8 feet	
SDU Chassis Ground	TP3	< 25 mΩ	< 1.52m/5 feet	< 2.44m/8 feet	
HPA +28V	X4 pin 1, 2 & 3	< 100 mΩ	< 6.4m/21 feet (2)	<10.05m/33 feet (2)	<16.15m/53 feet (2)
HPA +28V return	X4 pin 4, 5 & 6	< 25 mΩ	<1.52m/5 feet	< 2.44m/8 feet	< 3.96m/13 feet

(1) Total resistance between pin and regulated power bus, through a circuit breaker.

(2) Actual max. Wire length is shorter due to circuit breaker resistance, which has to be included in exact calculation.

The circuit breaker for the SDU should be rated at 5 A and for the HPA at 7.5 A. The HPA is capable of short time operation with 20 Vdc. Beware though that during special situations a 7.5 A circuit breaker may unintended break. This will happen if the circuit breaker is in a warm environment and the 28V power bus has a low voltage, such as during an emergency situation. For uninterrupted operation during these conditions a 15 A circuit breaker is recommended for the HPA. Alternatively a temperature compensated 7.5 A circuit breaker can be used, e.g. as provided in the Klixon 2TC series.

6.4 Installation Considerations

TT-5000 Aero-I System uses coaxial cables to interface the SDU with the HPA amplifier and antennas. The following paragraphs list the type and specifications of cables that may be used in the installation of the TT-5000 Aero-I System.

It is highly recommended that only high quality, low loss coax cable should be used in the installation of the Aero-I system. The following coaxial cables may be used.

NOTE:

Strict physical size and maximum attenuation requirements must be observed when selecting a coaxial cable for interconnecting Aero-I System components to the size 5 coaxial sockets in the SDU rack connector.

NOTE:

Equivalent substitutes may be used for any of the following items.

CABLE TYPE	SPECIFICATIONS		
Part Number	Diameter (mm/ in.)	Bend Radius (mm/ in.)	Attenuation (dB/100ft)
RG-142/400	NOTE 1	NOTE 1	Approx. 18.0dB
PIC S22089	11.0 / 0.43	63.5 / 2.5	4.8
PIC S33141	6.9 / 0.27	35.6 / 1.4	8.6
ECS 310801	11.4 / 0.45	57.4 / 2.26	4.6
ECS 311201	8.2 / 0.32	40.6 / 1.6	6.7
ECS 311501	5.81 / 0.23	30.5 / 1.2	9.1
EMTEQ TFLX165-100	4.19 / 0.17	21.6 / 0.85	16.8
EMTEQ TFLX295-100	7.95 / 0.31	40.6 / 1.6	7.9
EMTEQ TFLX480-100	12.2 / 0.48	57.2 / 2.25	4.5

NOTE 1:
In some applications, RG-142 or RG-400 may be used where strict attenuation requirements are not an issue. Cable specifications may vary depending on manufacturer

Provided in the following two tables, is a list and respective manufacturer part numbers of the TNC and N-type RF connectors. Depending on the aircraft and space requirements, it may be necessary to use straight or 90° RF connectors when installing Aero-I system antennas. Also, provided is the manufacturer part numbers for a Size 5 coaxial contact for the ARINC 404 rack plug.

CABLE TYPE	TNC CONNECTOR PART NUMBERS				TNC BULKHEAD	
Part Numbers	Type	TNC-Male Straight	TNC-Male 90°	TNC Female	TNC Jack	Feedthru Adapter
PIC S22089	PIC	190408	190409	190423		
	KINGS	125-81-9	126-51-9	121-34-9		KA-91-02
PIC S33141	PIC	190308	190309	190323	190321	
	KINGS	125-57-9	126-35-9			KA-91-02
ECS 310801	ECS	CTS022	CTR022		BTS022	BTF101
ECS 311201	ECS	CTS122	CTR122		BTS122	BTF101
ECS 311501	ECS	CTS922	CTR922		BTS922	BTF101
EMTEQ TFLX165-100	EMTEQ	TMS165-1	TMR165-1		TFS165-2	TFBTFB-1
EMTEQ TFLX295-100	EMTEQ	TMS295-1	TMR295-1		TFS295-2	TFBTFB-1
EMTEQ TFLX480-100	EMTEQ	TMS480-1	TMR480-1		TFS480-2	TFBTFB-1

CABLE TYPE	N CONNECTOR PART NUMBERS				N JACKS	CONTACT
Part Numbers	Type	N-Male Straight	N-Male 90°	N Female	N Bulkhead	Size 5 Coax Contact
PIC S22089	PIC	190410	190411	190424		N/A
	KINGS	1205-39-9	1206-18-9	1203-12-9		
PIC S33141	PIC	190310	190311		190322	190303
	KINGS	1205-36-9	1206-17-9			
ECS 310801	ECS	CNS022	CNR022		BNS022	N/A
ECS 311201	ECS	CNS122	CNR122		BN3122	N/A
ECS 311501	ECS	CNS922	CNR922		BNS922	620033
EMTEQ TFLX165-100	EMTEQ	NMS165-1	NMR165-1	NFS165-1	NFS165-2	A65165-1
EMTEQ TFLX295-100	EMTEQ	NMS295-1	NMR295-1	NFS295-1	NFS295-2	N/A
EMTEQ TFLX480-100	EMTEQ	NMS480-1	NMR480-1	NFS480-1	NFS480-2	N/A

The following table lists the manufacturer part numbers for tool and die sets recommended for use with the listed coaxial cables.

CABLE TYPE	CONNECTOR TOOLING PART NUMBERS			SIZE 5 COAX CONTACT
PIC and ECS Part Numbers	Type Connector	Tool Frame	Die Set	Die Set
PIC S22089	KINGS	KTH-1000	KTH-2203	N/A
	PIC	110104	190418	N/A
	MILSPEC	M22520/5-01		N/A
PIC S33141	KINGS	KTH-1000	KTH-2203	
	PIC	110104	190318	
	MILSPEC	M22520/5-01		M22520/5-41
ECS 310801	DANIEL	HX-4	Y149	N/A
	MILSPEC	M22520/5-01	M22520/5-21	N/A
ECS 311201	DANIEL	HX-4	Y144	N/A
	MILSPEC	M22520/5-01	M22520/5-47	N/A
ECS 311501	DANIEL	HX-4	Y142A	
	MILSPEC	M22520/5-01	M22520/5-19	M22520/5-41
EMTEQ TFLX165-100	DANIEL	HX-4	HD240	HD240
	MILSPEC	M22520/5-01	M22520/5-43	M22520/5-43
EMTEQ TFLX295-100	DANIEL	HX-4	HD340	HD340
	MILSPEC	M22520/5-01	M22520/5-35	M22520/5-35
EMTEQ TFLX480-100	DANIEL	HX-4	HD500	HD500
	MILSPEC	M22520/5-01	M22520/5-21	M22520/5-21

6.5 Recommendation

When installing the Aero-I system, any of the previously listed coaxial cables that meet the application specifications may be used. However, Thrane & Thrane recommend the use of PIC coaxial cables P/N's S22089 and S33141, and ECS coaxial cables P/N's 310801 and 311501. These coaxial cables are well suited to the installation requirements of the TT-5000 Aero-I System. PIC P/N S22089 and ECS P/N 310801 are super low loss coaxial cables that meet the strict attenuation requirements needed for the receiving section (W3 and W4) of the Aero-I. PIC P/N S33141 and PIC P/N 311501 are low loss coaxial cables that meet the strict physical size requirement of the transmit section (W5, W6, and W7) of the Aero-I.

NOTE:

Installation kits for the TT-5000 Aero-I System are manufactured with hardware to facilitate installation of PIC P/N S22089 and S33141, ECS P/N 310801 and 311501, and RG142 coaxial cables ONLY. If you select to use another coaxial cable, compatible hardware will also be required.

The following table provides a list of coaxial cables required to interconnect TT-5000 Aero-I System components. Max attenuation and connectors for each cable are also included.

AERO-I INTERCONNECT COAX CABLE DESCRIPTION

Interconnect Cable			Max Attenuation	Coax Cable Connectors (From/To)
From		To		
W3	TT-5002A/B Antenna	DLNA	1.3dB NOTE 1	N-Male / TNC-Male
W4	DLNA	HPA		N-Male / N-Male
W3	TT-5004A Antenna	DLNA	0.6dB NOTE 2	TNC-Male Straight or 90°/TNC-Male
W4	DLNA	HPA		N-Male / N-Male
W3	TT-5006A Antenna	DLNA	1.3dB NOTE 1	TNC-Male Straight or 90° / TNC-Male NOTE 3
W4	DLNA	HPA		N-Male / N-Male
W7	TT-5008A Antenna or	SDU A3	16.0dB	TNC-Male Straight or 90° / Size 5 contact
W7	TT-5006A Antenna	SDU A3	16.0dB	TNC-Male Straight or 90° / Size 5 contact NOTE 3
W5	DLNA	SDU A1	15.0dB	TNC-Male / Size 5 contact
W6	HPA	SDU A2	12.0dB	TNC-Male / Size 5 contact

NOTES 1: Total maximum loss for Antenna to DLNA and DLNA to HPA is 2.3dB.
2: Total maximum loss for Antenna to DLNA and DLNA to HPA is 1.6dB.
3: The TT-5006A Antenna coax connections are made through two TNC Bulkhead adapters.

To aid in the installation of the TT-5000 Aero-I System, both recommended PIC, ECS, and RG142 coaxial cables have been listed with their applications. Pertinent characteristics and diagrams for each application are listed in the following paragraphs.

Due to strict attenuation requirements of the Aero-I TX side (W4) and Aero_I RX/TX side (W3), PIC P/N S22089 and ECS P/N 310801 are recommended for this application. S22089 and 310801 are super low loss with high quality coaxial cable and meets the Aero-I system requirements.

PIC P/N S22089 SUPER LOW LOSS COAXIAL CABLE					
Cable	**Attenuation (dB/100ft.)**	**Minimum Bend Radius (mm/in.)**	**Maximum Length (m/ft.)**	**Total Attenuation (dB)**	**Applicable Install Kit**
W3 (TT-5002A/B to DLNA)	4.8	63.5 / 2.5	7.62 / 25	1.3	not available
W3 (TT-5004A to DLNA)	4.8	63.5 / 2.5	3.05 / 10	0.6	K12045
W3 (TT-5006A to DLNA)	4.8	63.5 / 2.5	7.62 / 25	1.3	K12046
W4 (DLNA to HPA)	4.8	63.5 / 2.5	5.79 / 19	1.0	K12043

ECS P/N 310801 SUPER LOW LOSS COAXIAL CABLE					
Cable	**Attenuation (dB/100ft.)**	**Minimum Bend Radius (mm/in.)**	**Maximum Length (m/ft.)**	**Total Attenuation (dB)**	**Applicable Install Kit**
W3 (TT-5002A/B to DLNA)	4.6	58.4 / 2.3	7.92 / 26	1.3	not available
W3 (TT-5004A to DLNA)	4.6	58.4 / 2.3	3.35 / 11	0.6	K12045-2
W3 (TT-5006A to DLNA)	4.6	58.4 / 2.3	7.92 / 26	1.3	K12046-2
W4 (DLNA to HPA)	4.6	58.4 / 2.3	6.1 / 20	1.0	K12043-2

Due to strict physical size requirements on the TX side (W5, W6, and W7) of the Aero-I system, PIC P/N S33141 and ECS P/N 311501 are recommended for this application. S33141 and 311501 are low loss, high quality and small diameter coaxial cable that meets the Aero-I system requirements.

NOTE:

Maximum attenuation of each interconnect cable, listed in the above table, and connector attenuation (0.05dB nominal for coaxial connectors) have been calculated into the maximum length figures in the following two tables.

NOTE:

If another coaxial cable is used, consideration must be given to the physical size of the chosen cable. The cable must be able to facilitate a size 5 coaxial contact, and distance between coaxial sockets on the ARINC 404 rack connector for the SDU. RG 142 may be used in this application. However, due to higher attenuation, max. cable lengths will be much shorter.

PIC P/N S33141 LOW LOSS COAXIAL CABLE					
Cable	**Attenuation (dB/100ft.)**	**Minimum Bend Radius (mm/in.)**	**Maximum Length (m/ft.)**	**Total Attenuation (dB)**	**Applicable Install Kit**
W5 (DLNA to SDU)	8.6	35.6 / 1.4	52.73 / 173	15.0	K12043
W6 (HPA to SDU)	8.6	35.6 / 1.4	42.06 / 138	12.0	K12043
W7 (TT-5006A Ant to SDU)	8.6	35.6 / 1.4	56.38 / 185	16.0	K12046
W7 (TT-5008A Ant to SDU)	8.6	35.6 / 1.4	56.38 / 185	16.0	K12047

RG 142 STANDARD CABLE (Approx. 18.0dB/100ft at 1.5GHz)					
W5 (DLNA to SDU)	Approx. 18.0		25.3 / 83	15.0	K12043-1
W6 (HPA to SDU)	Approx. 18.0		20.42 / 67	12.0	K12043-1
W7 (TT-5006A Ant to SDU)	Approx. 18.0		27.12 / 89	16.0	K12046-1
W7 (TT-5008A Ant to SDU)	Approx. 18.0		27.12 / 89	16.0	K12047-1

ECS P/N 311501 LOW LOSS COAXIAL CABLE					
Cable	**Attenuation (dB/100ft.)**	**Minimum Bend Radius (mm/in.)**	**Maximum Length (m/ft.)**	**Total Attenuation (dB)**	**Applicable Install Kit**
W5 (DLNA to SDU)	9.1	30.5 / 1.2	50 / 164	15.0	K12043-2
W6 (HPA to SDU)	9.1	30.5 / 1.2	39.62 / 130	12.0	K12043-2
W7 (TT-5006A Ant to SDU)	9.1	30.5 / 1.2	53.34 / 175	16.0	K12046-2
W7 (TT-5008A Ant to SDU)	9.1	30.5 / 1.2	53.34 / 175	16.0	K12047-2

The following interconnection diagrams illustrate the coaxial cables needed to connect the Aero-I system components. The Aero-I system can use four antenna and NRS data configurations. The primary difference between the four configurations is how the Aero-I receives Navigation data.

If the TT-5002A/B Antenna is used, it is necessary to install the TT-5008A NRS Antenna (Unless Navigation data is supplied by IRS). The TX and RX (W3) connects to the TT-5002A/B. The NRS (W7) is connected to the TT-5008A.

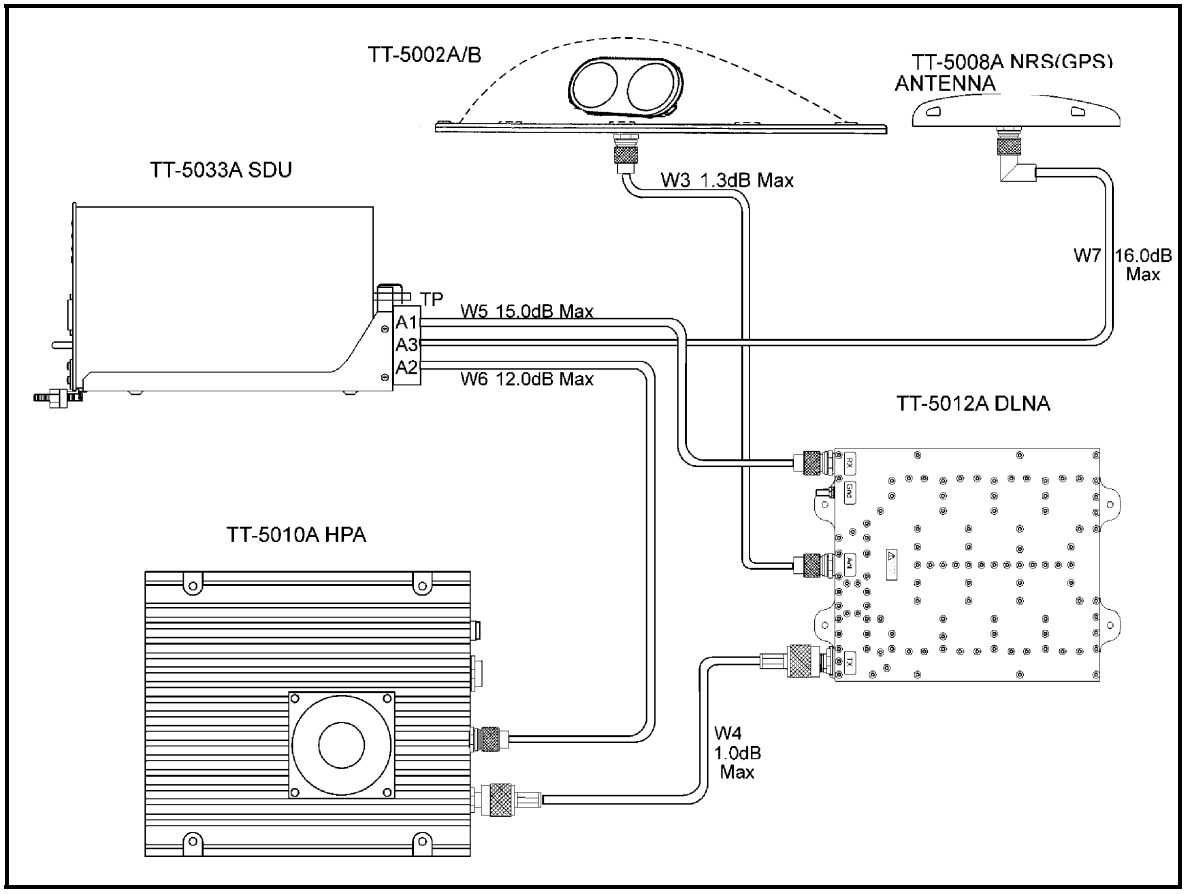


Figure 29, Interconnecting coaxial cables, using TT-5002A and TT-5008A Antennas.

If the TT-5004A Antenna is used, it is necessary to supply Navigation data by IRS. The TX and RX (W3) connection is to the TT-5004A.

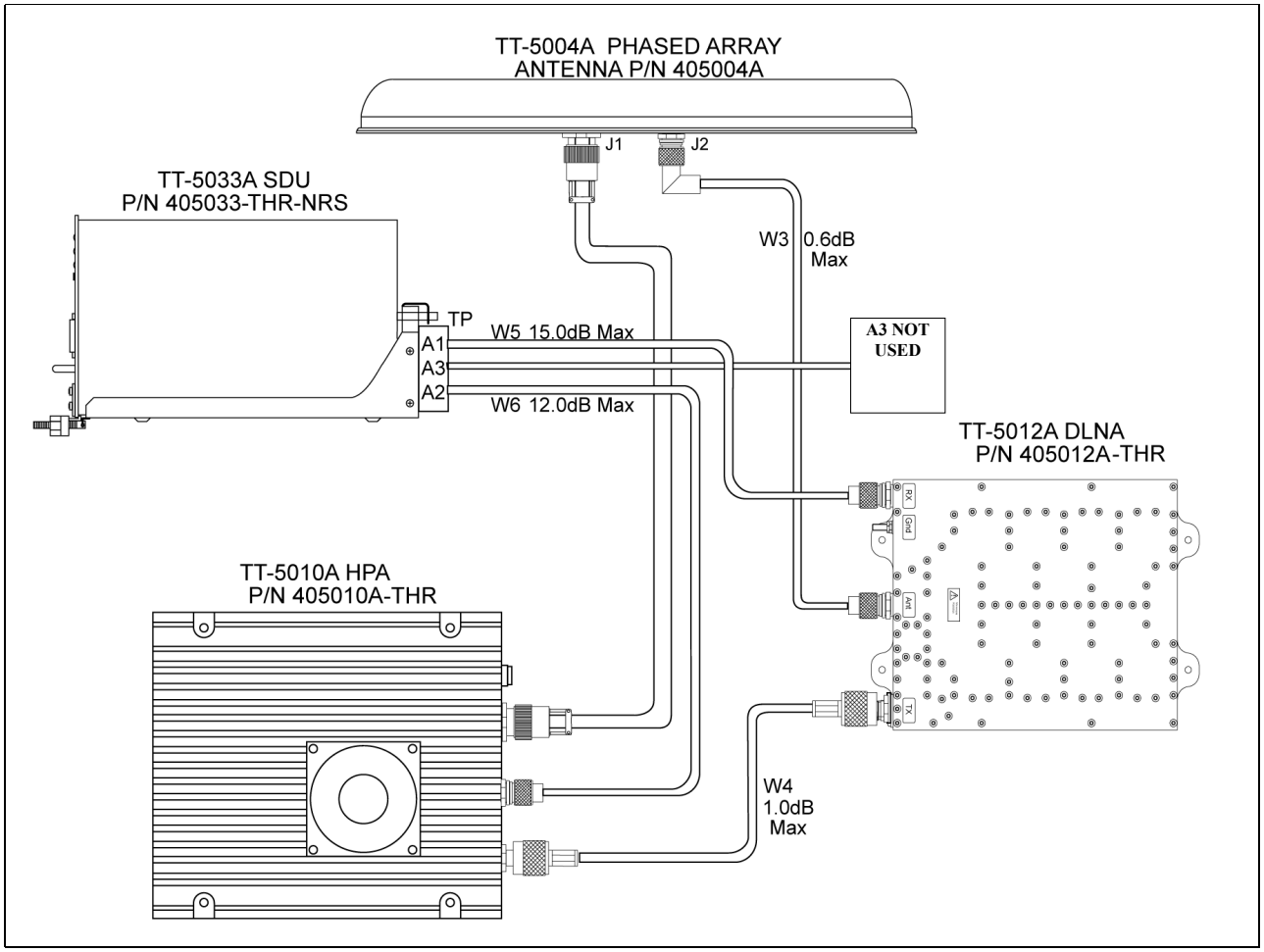


Figure 30, Interconnecting coaxial cables, using TT-5004A Antenna

The TT-5006A Antenna is a Satcom Antenna with built-in NRS. Therefore, the NRS cable (W7), as well as TX and RX cable (W3), connections are to the TT-5006A antenna.

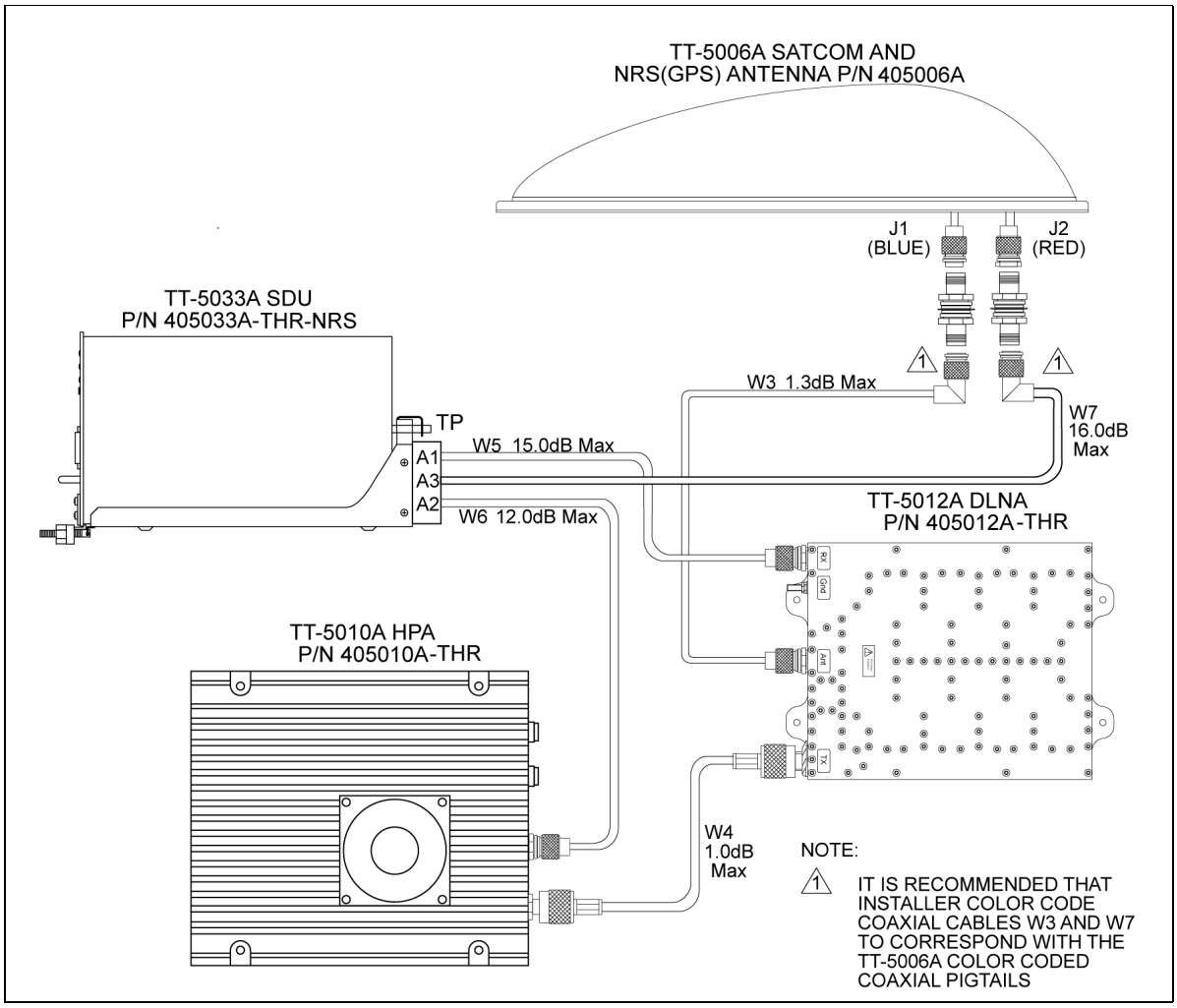


Figure 31, Interconnecting coaxial cables, using TT-5006A Antenna

If the TT-5006A antenna is used with IRS, option 005 will still be required.

The TT-5000 Aero-I System may also be configured to receive navigation data via the IRS . If this configuration is used, there will not be an Aero-I specific GPS antenna used. Information on interconnecting the Aero-I to aircraft IRS or NRS/GPS is contained in Aircraft Interface Considerations portion and the Wiring Diagrams portion of this section.

6.6 Mounting Considerations

During installation, for optimum system performance, some guidelines on where to install or mount the different components of the TT-5000 Aero-I System must be followed. Mounting, placement, and cable length details are included in this section.

(1) TT-5033A SDU

The SDU must always be placed in a pressurized (cabin avionics) area. The SDU must be mounted in an ARINC 404 standard tray, with one hold down hook. The SDU is designed to operate without forced cooling.

NOTE:

If installing a TT-5033A Aero-I SDU in a piston engine or Turboprop Aircraft, it is necessary to install shock mounts with the ARINC 404 tray.

(2) TT-5010A HPA

The HPA should be mounted vertically on a panel to ensure maximum cooling. The HPA need not be installed in a pressurized area. The HPA is designed to operate with forced cooling. "It will detect temperature of the internal cooling fan to prevent damage from overheating". The HPA should be installed as close to the DLNA as possible. The cable between the HPA and DLNA must be a special low-loss coax cable. See Attenuation tables in the Installation Considerations section of this manual for exact attenuation limits.

(3) TT-5012A DLNA

The DLNA does not have to be installed in a pressurized area. The DLNA may be mounted in an upright position. Do not block the connections or the grounding stud when mounting. The DLNA should be installed as close to the antenna as possible. Place the DLNA directly on fuselage, (not on a shelf with bad contact to fuselage), and **mount with cadmium plated washers**.

The coax cable between the DLNA and the antenna must be low loss coax cable. See Attenuation tables in the Installation Considerations section of this manual for exact attenuation limits.

(4) Common precautions for the antennas TT-5002A/B, TT-5004A, TT-5006A and TT-5008A:

WARNING:

THE RF POWER RADIATED BY THE ANTENNA CAN CAUSE BODILY HARM. A PERSON IS IN DANGER IN A ZONE WHERE THE POWER FLUX IS 1 mW/cm2, OR GREATER. DURING OPERATION THE SAFETY DISTANCE FROM THE IGA IS ≥ 1 meter (3 FEET). (This warning doesn't apply for TT-5008A, as this antenna can't transmit)

NOTE:

Antenna installation must be in accordance with the aircraft manufacturers requirements and/or FAA AC 43.13 - 1B/2A and approved by the appropriate Civil Aviation Authorities.

NOTE:

Only pre-formed RF cables shall be connected to the RF system equipment. Attempting to form cables or applying stress to the cables while they are connected to equipment connectors may cause damage to the equipment.

Satellite visibility

To ensure the continuity and quality of the Aero-I service, the installer must choose an antenna location that minimizes the shadowing of the signal between the satellite and antenna. Placing the antenna on the top of the aircraft fuselage as far away from possible obstacles (e.g. aircraft tail) can minimize the signal shadowing. The installer should be aware that during normal operations the antennas beam points in any direction of the upper hemisphere above the horizontal aircraft.

Satcom filter

If the GPS antenna for the existing GPS receiver on board the aircraft does not provide sufficient filtering it may be necessary to install a so-called Satcom filter to the GPS antenna.

Cables to the antennas

The installation designer must be aware that the shorter the cable is the better the system performance are.

NOTE:

Do not exceed minimum radius of curvature for the coaxial cable. Use dummy cables for a first installation to determine gable runs. Install the final cables only after this modeling operation.
If necessary, secure the cable by means of evenly spaced collars to prevent the cable from chafing on aircraft parts and surfaces. These collars must be of a design, which avoids damaging the cable.

(5) TT-5002A/B Mechanical Steered Satcom Antenna

Type of antenna

Depending on the aircraft, the antenna can be either top- (TT-5002A) or tail (TT-5002B) -mounted type. Note that for tail mounted installations the antenna is supposed to be housed under the A/C tail radome. For tail mount purpose the antenna is delivered without radome to minimize the antenna size. For top fuselage mounted installations the antenna is delivered equipped with its radome.

Choice of antenna location

The antenna location must be chosen in order to have no impact on the aircraft safety.

Since the antenna installation implies to drill several holes in the fuselage skin, this may weaken the aircraft structure so that it must be compensated for by local reinforcement of the fuselage skin (e.g. installation of a doubler overlapping the antenna footprint).

The feasibility of this type of modification must be determined and approved by the aircraft manufacturer.

Aerodynamic considerations

To minimize the antenna aerodynamic drag of top fuselage installations, it is recommended to install IGA in a zone where the boundary layer thickness is greater than the 5 inches antenna height dimension.

This recommendation is also valid to minimize antenna icing and noise generation.

Antenna mounting Top of the fuselage installation

The antenna is delivered equipped with an adapter base made of non-metallic material to adapt the antenna flat base plate to the aircraft

The antenna and adapter plate assembly is secured to the aircraft fuselage by mounting screws (NAS type) inserted into sealed, floating, captive stop-nuts attached to the inside surface of the fuselage. The number of peripheral screws and the length of the screws are dependent of the installation.

NOTE:

FOR THE DETERMINATION OF SCREW LENGTH:

The determination of screw length is very important, and depends on doubler and fuselage thickness but also on captive nut size. The screw must not be too long, otherwise it could result in damage to the sealing of the captive nut, or the antenna gasket not being compressed sufficiently on the fuselage.

The consequence of using too long screws is a cabin air leakage and the antenna not being safely attached to the fuselage.

On the opposite, the screw has to be long enough to have a sufficient length into the captive nut. The consequence of using too short screws is the antenna not being safely attached to the fuselage. The circular base plate is drilled to attach the antenna to the aircraft adapter by mounting screws.

Within the same installation, due to aircraft radius of curvature, screw length can differ from one antenna hole to the others, it depends on their respective position on the antenna periphery. Care must be taken to install the correct screw into the corresponding hole otherwise this can damage captive nuts with too long screws or not secure correctly the antenna with too short screws.

There is a potential risk of antenna separation using screws not having the proper length.

The antenna radome lightning diverters are grounded to the A/C metallic fuselage by the mounting screws. The screw/captive nut /fuselage assembly must provide a good electric contact. The electric resistance between the fuselage and the radome lightning diverters must not exceed 25 mΩ.

In addition to the mounting screw holes a 32 mm (1.25 inches) diameter central hole must be drilled to accommodate the antenna connector. This may weaken the aircraft structure to a degree where it must then be compensated for by local reinforcement of the fuselage skin (e.g. installation of a doubler over the entire mounting surface of the antenna). The feasibility of such a modification must be determined and approved by the aircraft manufacturer.

Once drilling is complete, the antenna is installed as follows:

Check that the antenna O-ring gasket-seating surface is clean and in good condition (not scratched or crushed).

Check that the fuselage surface corresponding to the antenna O-ring gasket seating surface is clean and in good shape (as "smooth" as possible).

Remove plastic cover from the antenna connector before installing the antenna on the aircraft.

Pull the end of the RF cable from inside the aircraft through the access hole.

Connect the RF cable to the antenna connector. Secure the cable connector to the antenna base plate.

Position the antenna onto the aircraft, inserting the connector and the RF cable trough the middle of the central hole.

Install and tighten mounting screws. Refer to the antenna outline drawing for initial torque, final torque and required sequence for tightening the screws.

The 0-ring gasket on the antenna base plate compressed by the mounting screws seals the antenna installation.

This assumes that the antenna fasteners are correctly sealed.

The head of the mounting screws can be covered with sealant, while a sealant gasket can be built all around the antenna base plate to smooth the antenna bottom edge with the fuselage.

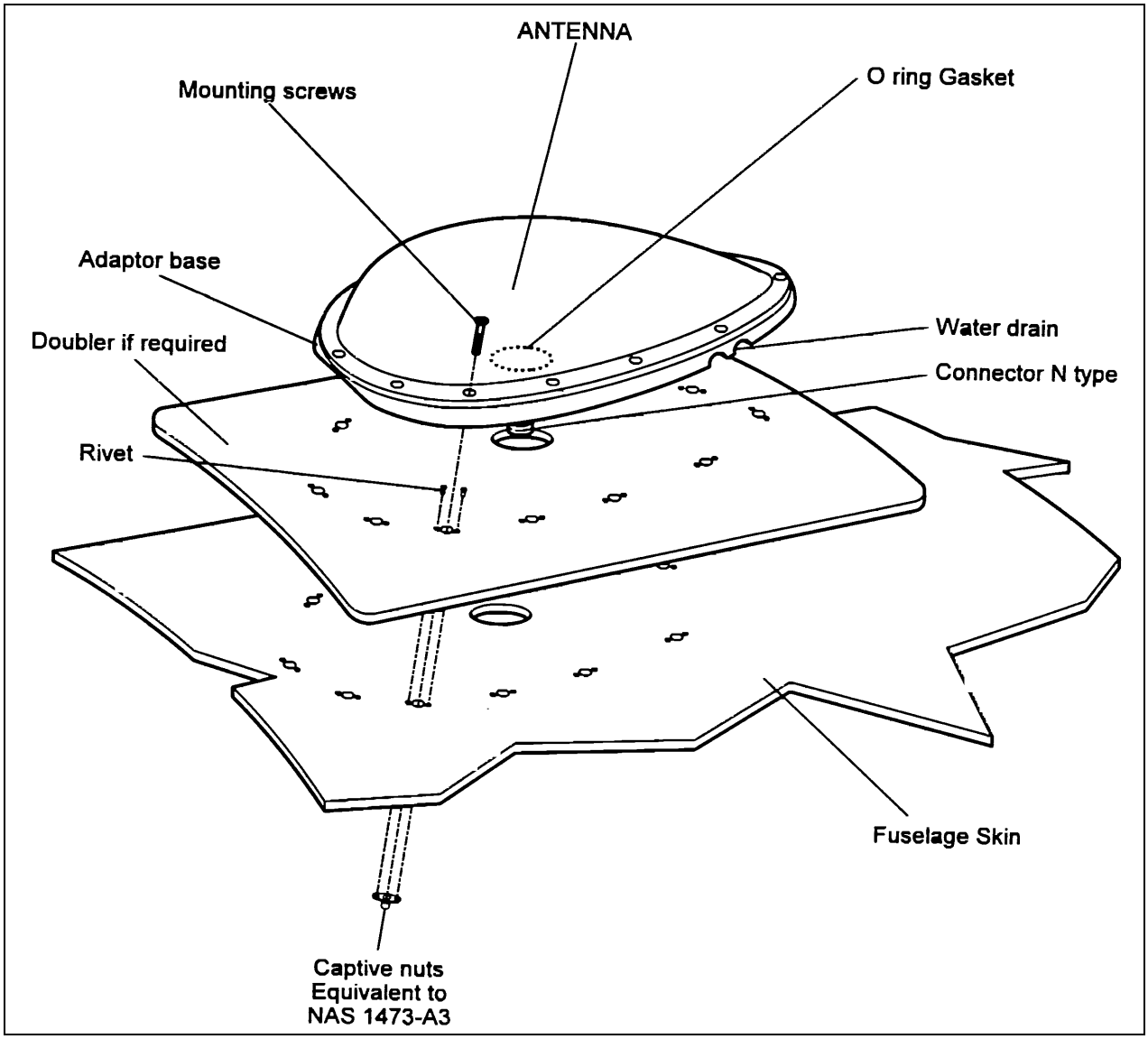
NOTE:

In this case care must be taken not to obstruct water drains and blowholes at the rear part of the adapter plate.

The fuselage metallic surface covered by the antenna can be protected against corrosion by application of a thin coat of MASTINOX for example.

NOTE:

The radome is white color painted when delivered. Do not re-paint the radome.



TT-5002A Satcom Mounting details

Top of the tail mounting

In this case the antenna is housed into the top tail aircraft radome.

This radome must provide good electric performance within the all band (from 1530 to 1660.5 MHz). The radome losses must remain not greater than 0.5 dB.

The lower the radome losses are the greater the performance is.

The tail mounted antenna is provided equipped with a circular base plate which must be used to attach the antenna to the aircraft. This circular base plate is drilled to attach the antenna to the aircraft adapter by mounting screws.

The antenna is installed as follows:

NOTE:

Do not manually move (rotate) the antenna radiating panel. Forcing the radiating panel to move in azimuth or elevation can damage the antenna mechanism.

NOTE:

Remove transportation fixations from antenna before applying power to the antenna.

Remove the plastic cover from the antenna connector before installing on the aircraft.

Extract the end of the RF cable from inside the aircraft.

Connect the RF cable to the antenna connector.

Secure the cable connector to the antenna base plate.

Position the antenna onto the aircraft, inserting the connector and the RF cable through the middle of the central hole.

Install and tighten mounting screws. Refer to the antenna outline drawing for initial torque, final torque and required sequence for tightening the screws.

NOTE:

FOR THE DETERMINATION OF SCREW LENGTH:

The determination of screw length is very important, and depends on aircraft adapter (mechanical interface) thickness. The screw must not be too long, otherwise it could create obstacles resulting in the antenna not able to rotate, and this can cause antenna damage.

On the opposite, the screws have to be long enough to have a sufficient length into the antenna circular base plate. The consequences of using too short screws are the antenna not being safely attached to the aircraft.

NOTE:

Transmissions from this antenna may affect the operation of the existing GPS receiver on board the aircraft. If the GPS antenna for the existing GPS receiver on board the aircraft does not provide sufficient filtering it may be necessary to install a so-called Satcom filter to the GPS antenna.

6.6.1 TT-5002B Satcom Antenna placement

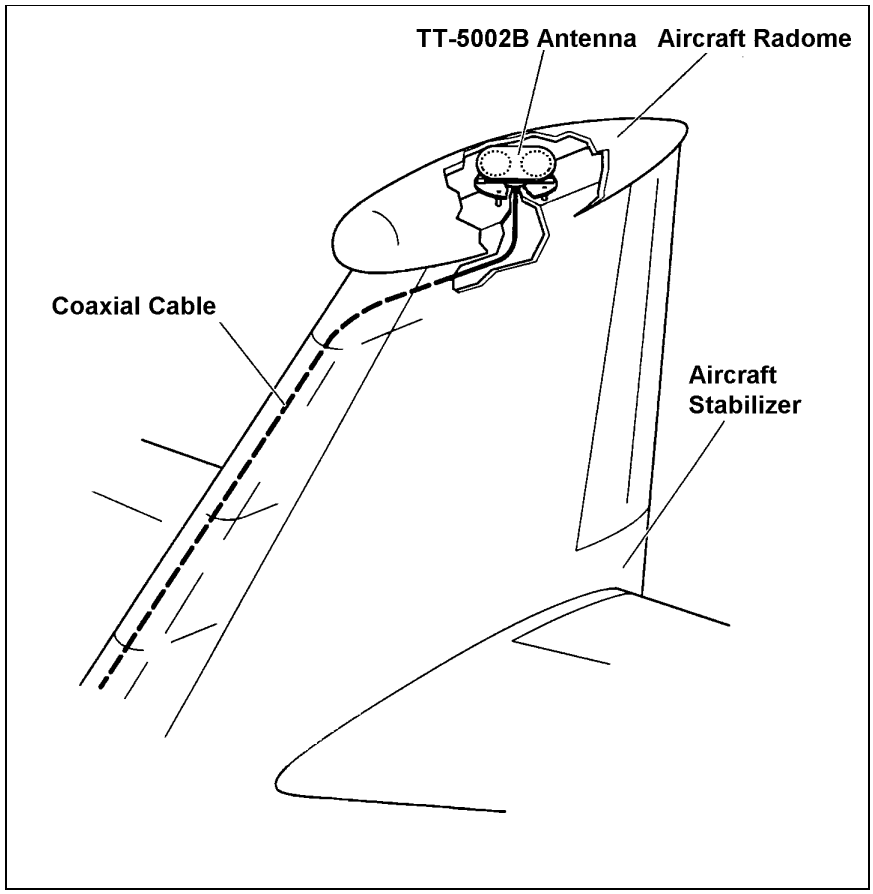


Figure 32, TT-5002B Satcom Antenna placement

Environmental considerations

Icing: Thanks to its low height (127 mm, 5 inches), it should be easy for the installation designer to select the antenna location such that the antenna unit will remain within the boundary layer thickness with no risk of ice accumulation. If for any reason, this is not the case, the icing consequences must be studied by the installation designer on a case by case basis.

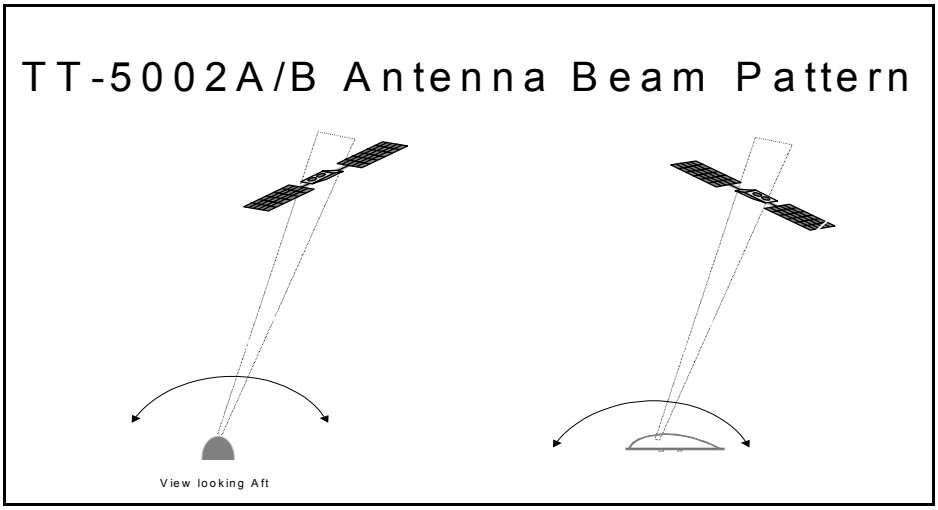


Figure 33, TT-5002A/B Satcom Antenna RF Beam Pattern

(6) TT-5004A Phased Array Satcom Antenna

The TT-5004A Antenna may be mounted directly to the aircraft fuselage or in a tail section radome. If fuselage mounted, a doubler plate is required. The doubler plate must be fabricated from aluminum that has been chem filmed and finished to flatness within 0.01". The antenna baseplate must not be painted or anodized so that a good electrical ground can be established between the antenna baseplate and the doubler plate. If tail mounted and a doubler is not used then a grounding strap must be attached between the antenna baseplate and the aircraft frame.

To ensure a good electrical bonding between the antenna baseplate and aircraft chassis, remove paint from the area of the fuselage where the antenna doubler will be mounted. If a sealant is used around the antenna base, ensure drain holes are not blocked.

The antenna is secured to the aircraft at 12 mounting points, mounting screws are provided with the antenna. The provided mounting screw or similar screws must be used (MS, qualified, corrosion resistant, steel screws). The antenna is connected to the amplifiers using low loss coax cables. Before mounting the antenna, install the two O-rings on the antenna baseplate in the grooves around each connector. For further information see the Equipment Specifications and Installation Considerations sections in this manual. The following diagram illustrates the RF Beam pattern for this antenna.

NOTE:

Check grounding by measuring the resistance between the aircraft and the antenna RF connector shell. The measured resistance should not exceed 2.5mΩ.

NOTE:

Transmissions from this antenna may affect the operation of the existing GPS receiver on board the aircraft. If the GPS antenna for the existing GPS receiver on board the aircraft does not provide sufficient filtering it may be necessary to install a so-called Satcom filter to the GPS antenna.

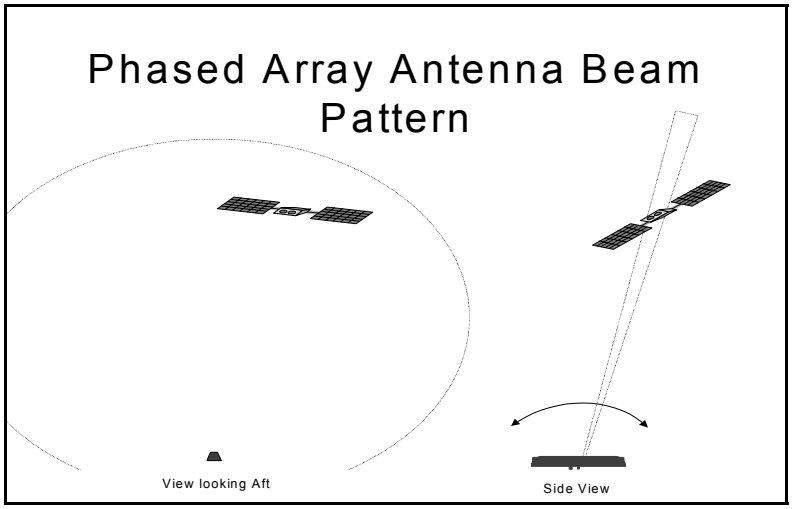


Figure 34, TT-5004A Phased Array Satcom Antenna RF Beam Pattern

(7) TT-5006A Satcom and NRS Antenna

The TT-5006A antenna is mounted using an adapter plate to secure it to the aircraft fuselage. The antenna and adapter plate are secured using MS qualified, corrosion resistant steel screws.

The antenna is provided with 3 drainage holes on its underside to prevent

pressure build up as well as provide drainage for any water accumulation inside the antenna.

A parallel surface in close proximity to the antenna base will provide such a Baffle. This also has the effect of drying humid air on descent of the aircraft by condensing the air on the baffles.

The antenna is connected to the HPA /LNA and the SDU using low loss coax cables. The antenna should be mounted as far forward as possible of the base of the Vertical Stabilizer. This is to avoid communication dropouts when transmitting in the direction of the vertical stabilizer.

The TT-5006A Antenna can be placed on either side of the centerline of the fuselage in aircraft which have a center stringer. The offset should be kept at a minimum and should not exceed the limits specified in Figure 35.

NOTE:

Transmissions from this antenna may affect the operation of the existing GPS receiver on board the aircraft. If the GPS antenna for the existing GPS receiver on board the aircraft does not provide sufficient filtering it may be necessary to install a so-called Satcom filter to the GPS antenna.

NOTE:

No speakers or other equipment containing a magnet can be mounted within 18" of this antenna, if this situation cannot be avoided then shielded speakers must be used.
Avoid mounting close to strong magnetic fields from the aircraft's power wiring. Use non-magnetic screws for mounting.

NOTE:

Any specially built adapter must be designed to work in conjunction with three breathing holes under the antenna. The holes should be baffled in such a way as to prevent the direct ingress of fluids during flight or washing/de-icing operations.

6.6.2 TT-5006A mounted to the aircraft fuselage offset from the centerline.

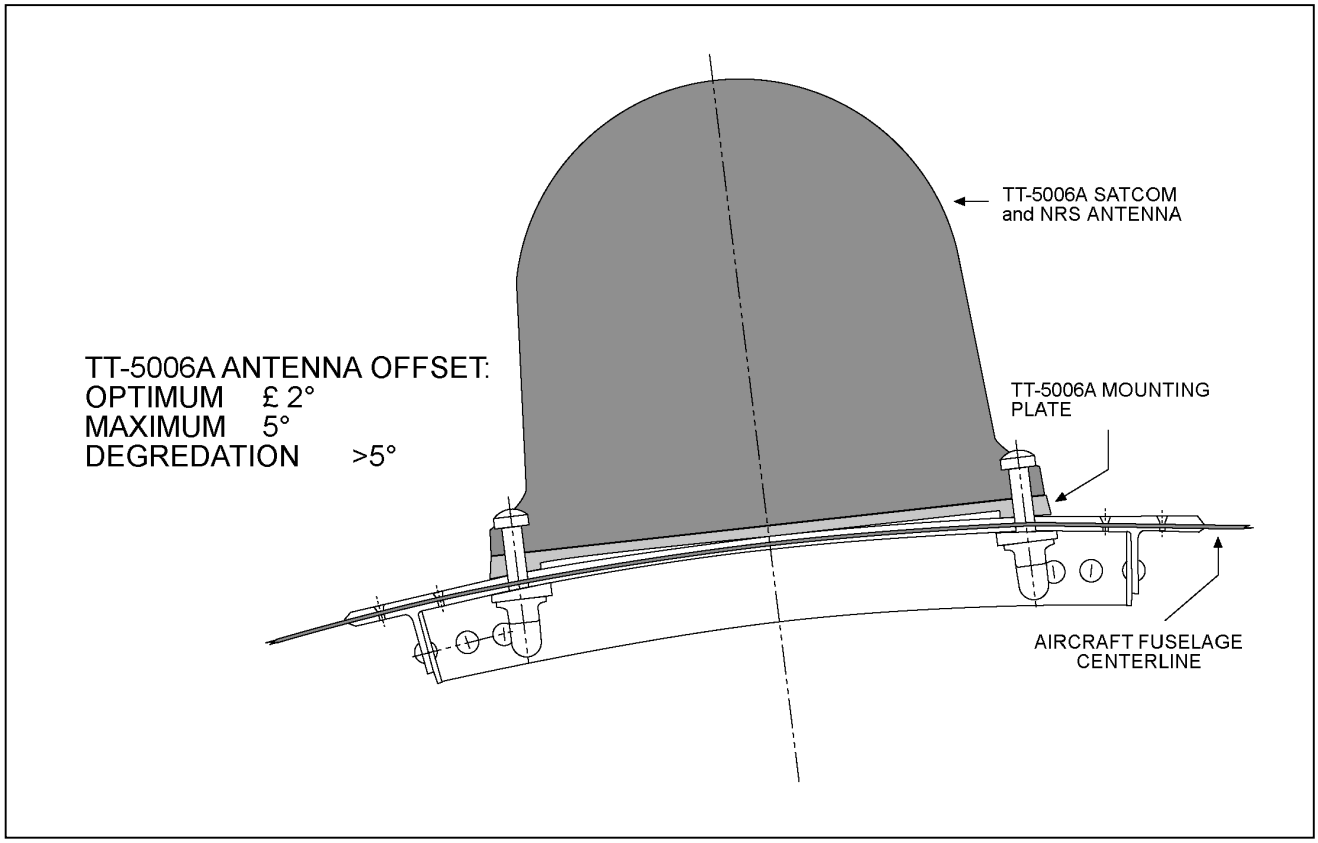


Figure 35, Mounted TT-5006A Antenna cutaway drawing

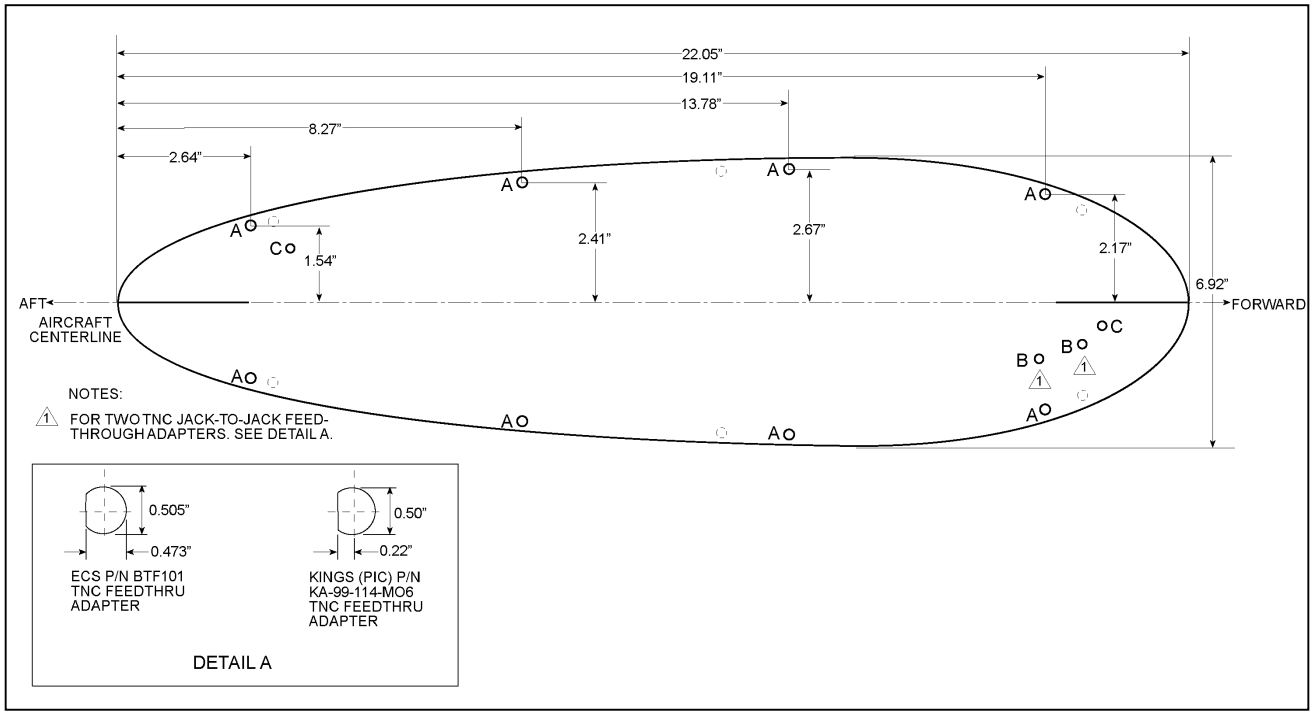


Figure 36, TT-5006A Antenna Drill Template

TT-5006A DRILL TEMPLATE HOLE DEFINITION		
HOLE	**DESCRIPTION**	**SIZE**
A	Mounting hole	To Suit UNC #10-32 screw
B	TNC Feed through adapter	To Suit TNC Feed through (See Detail A)
C	Grounding stud installation	To Suit Grounding Stud

The TT-5006A Adapter Plate is an aluminum alloy ring designed with drain channels and air baffles to the curvature radius of the aircraft. The Adapter Plate kit also contains a Drill Template, a Drill Bushing, and Nut Adapters.

If an Adapter Plate is locally manufactured, it must be designed to work in conjunction with the TT-5006A Antenna. The TT-5006A has three drainage holes on the underside of the antenna. These drainage holes prevent pressure build-up as well as provide drainage for any water accumulation inside the antenna.

Any manufactured adapter plate must be baffled in order to prevent the direct ingress of fluids during flight or washing/de-icing operations, also while the aircraft descends, dry humid air is condensed on the air baffles.
It is recommended that the Adapter Plate be purchased. The Drill Template that is provided with the adapter plate will illustrate all mounting holes that need to be provided.

Two Bonding Straps are provided with the antenna should be installed between the antenna and the fuselage for grounding purposes. The bonding straps attach to the TT-5006A in two places. The strap is screw fastened to the antenna and may be screwed or riveted to the aircraft fuselage.

Space has been provided on the bottom of the antenna and in the mounting plate to facilitate installation of the bonding strap. If another position is used to install the bonding strap and its fastener, mating problems could arise. The strap should be protected from fretting against the fuselage and antenna.

Affixing self adhesive rubber strips to both the fuselage and antenna where the strap is laid can prevent this. The thickness of the adhesive strips must properly constrain the straps when the antenna is tightly fastened to the fuselage. The cable should be 16AWG minimum and the termination must have opposing orientation (180° out).

The following illustration shows the length dimension and setup for the bonding strap. Further information can be obtained from the equipment drawing in the Equipment Specifications section of this manual.

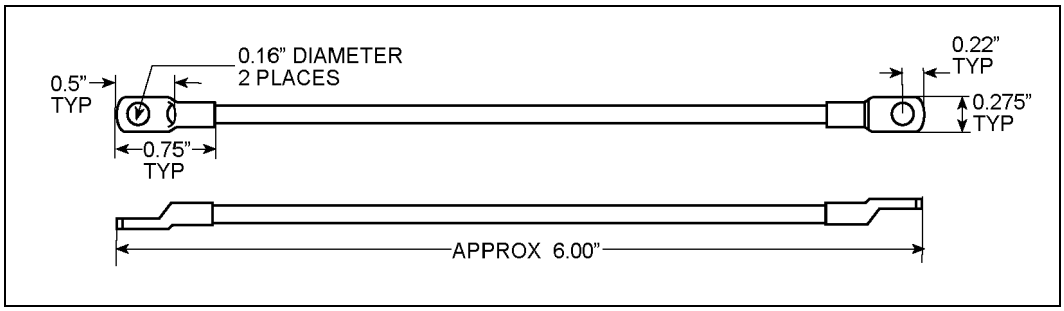


Figure 37, TT-5006A Antenna Bonding Strap

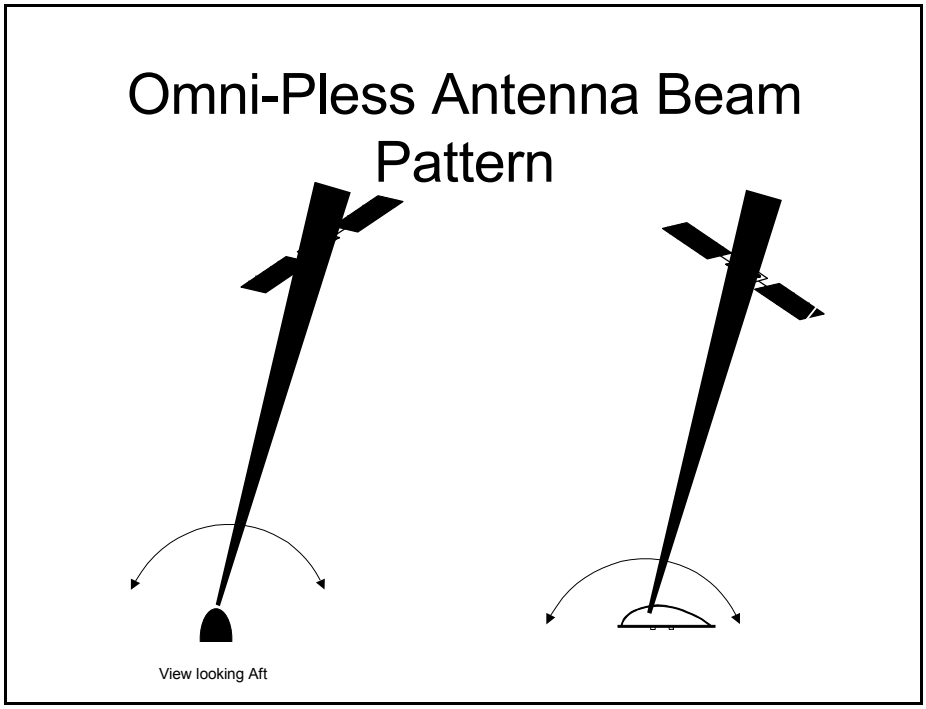


Figure 38, TT-5006A Aeronautical Satcom Antenna RF Beam Pattern

Antenna separation to TT-Aero-C antenna installations

Operating the Aero-I system and TT Aero-C/Honeywell/Satcom AFIS on the aircraft the TT-5006A (Aero-I antenna) and the TT-3002A (Aero-C antenna) must be separated in order ensure interference free operation.

The following table incorporates cable losses in an Aero-C system (SDU to RF-Pack cable loss) and corresponding distances (between Aero-I and Aero-C antennas):

Aero-C/Aero-I antenna separation		
Aero-C SDU to RF Pack cable loss	Distance between Aero-I and Aero-C antennas	
	Aero-C in front of Aero-I	Aero-C behind Aero-I
4 dB	1m / 3.5 ft.	0.76m / 2.5 ft.
8 dB	0.76m / 2.5 ft.	0.46m / 1.5 ft.
12 dB	0.6m / 2 ft	0.3048m / 1 ft.

(8) TT-5008A NRS Antenna

The TT-5008A antenna is mounted directly to the aircraft fuselage. The antenna shall be secured using MS, qualified, corrosion resistant, steel screws. The antenna is connected to the SDU using low loss coax cables, for further information see the Equipment Specifications and Installation Considerations sections in this manual.

NOTE:

No speakers or other equipment containing a magnet can be mounted within 18" of this antenna, if this situation can not be avoided then shielded speakers must be used.

7 Wiring Diagrams

NOTE:

The information, drawings and wiring diagrams contained in this manual are intended as a reference for engineering planning only. The drawings and wiring diagrams contained herein do not represent any specific STC. It is the installer's responsibility to compose installation drawings specific to the aircraft. This manual and the drawings and wiring diagrams contained herein may not be used as a substitute for an STC package.

7.1 TT-5000 Aero-I System Wiring Diagrams

Strapped ICAO Address

A unique aircraft identification code must be assigned at installation. The national authority of aeronautical identification coordinates assignment of the code. The TT-5033A Satellite Data Unit reads a strapped ICAO address, from the SDU rack connector, to ensure it is operating in the proper aircraft. If the SDU does not detect or recognize the strapped ICAO address, then the Aero-I will suspend all communications until the error is corrected.

The following illustration shows the address bits and their bit weights referenced to their perspective digits.

NOTE:

Where a binary zero = Ground (<10Ω) and a binary one = Open (>100kΩ), the ICAO Address illustration below, as an example, is strapped with a fictional ICAO Address of 01234567.

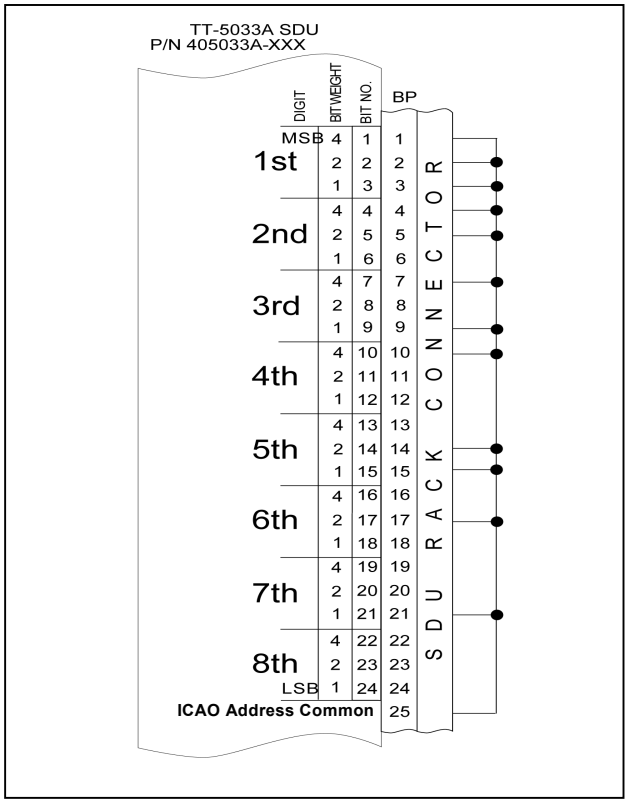
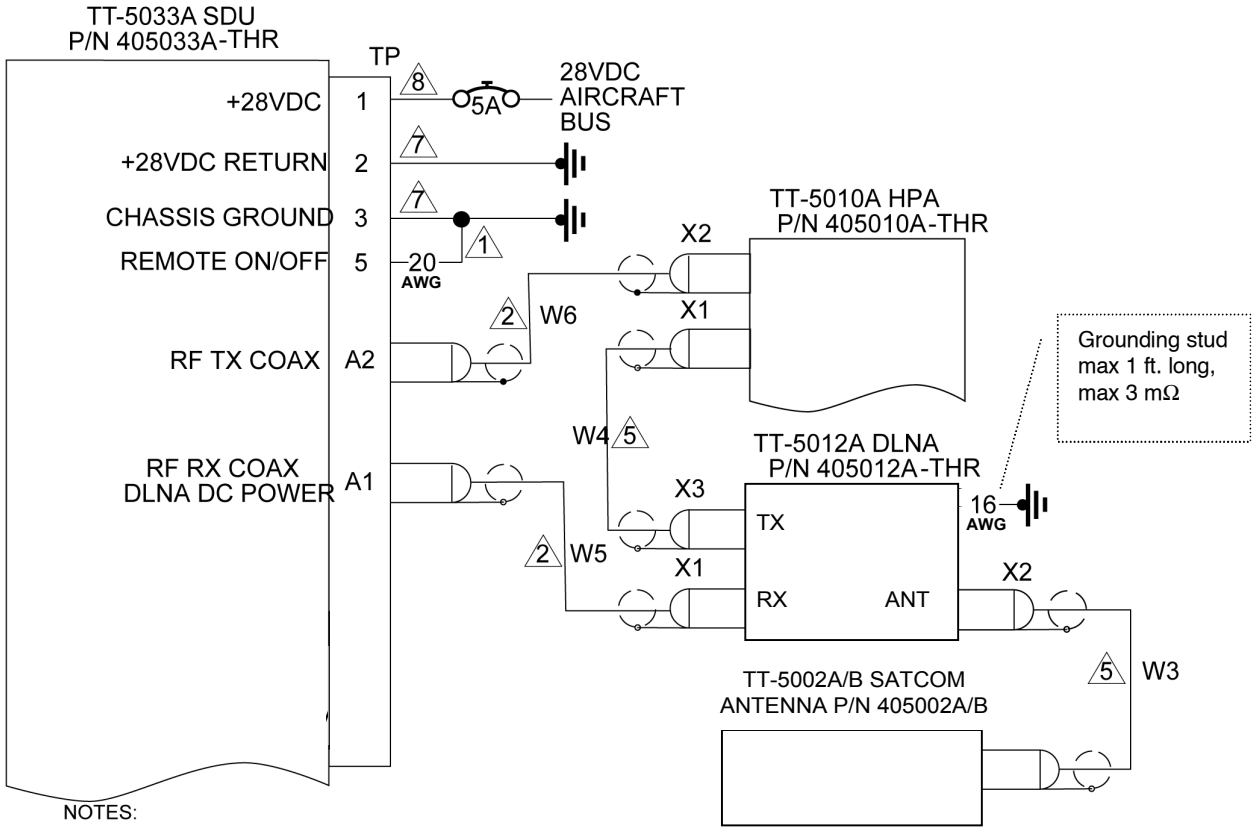


Figure 39, ICAO Address strap example

7.1.1 TT-5002A/B Antenna with IRS interface wiring.(sheet 1 of 2)



NOTES:

ALL WIRING 22 AWG UNLESS OTHERWISE INDICATED.

SHIELDING OF TWISTED PAIRS, 22 AWG PIGTAIL OR LARGER. MAX 2" LENGTH. DO NOT DAISY CHAIN SHIELD GROUNDS.CONNECT TO TRAY.

1. IF SATCOM ON/OFF SWITCH IS REQUIRED, TP5 IS ROUTED TO AN EXTERNAL SWITCH FOR GROUND.
2. LOW LOSS COAXIAL CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATION CONSIDERATIONS SECTION OF THIS MANUAL.
3. THIS WIRE IS FOR CONNECTION OF HPA TO AIR-CRAFT 28VDC BUS AND CHASSIS GROUND. THE WIRE MUST BE SPLICED INTO THREE 22 AWG WIRES. THIS ALLOWS FOR INSERTION INTO THE RACK CONNECTOR.
4. WHEN USING THE TT-5002A SATCOM ANTENNA AND IRS DATA, ALL DATA NEEDED FOR ANTENNA STEERING IS PROVIDED BY THE IRS DATA. AS A BACKUP NRS MAY BE INTERFACED TO PROVIDE A SECONDARY ANTENNA STEERING SOURCE.
5. SUPER LOW LOSS CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATIONS CONSIDERATIONS SECTION OF THIS MANUAL.
6. 100mohm MAX RESISTANCE TO POWER BUS.(USED TO DETERMINE WIRE GAGE)
7. 25mohm MAX RESISTANCE.(USED TO DETERMINE WIRE GAGE)
8. 200mohm MAX RESISTANCE TO POWER BUS.(USED TO DETERMINE WIRE GAGE)

Figure 40, TT-5002A/B Antenna with IRS interface wiring (1 of 2)

7.1.2 TT-5002A/B Antenna with IRS interface wiring (sheet 2 of 2)

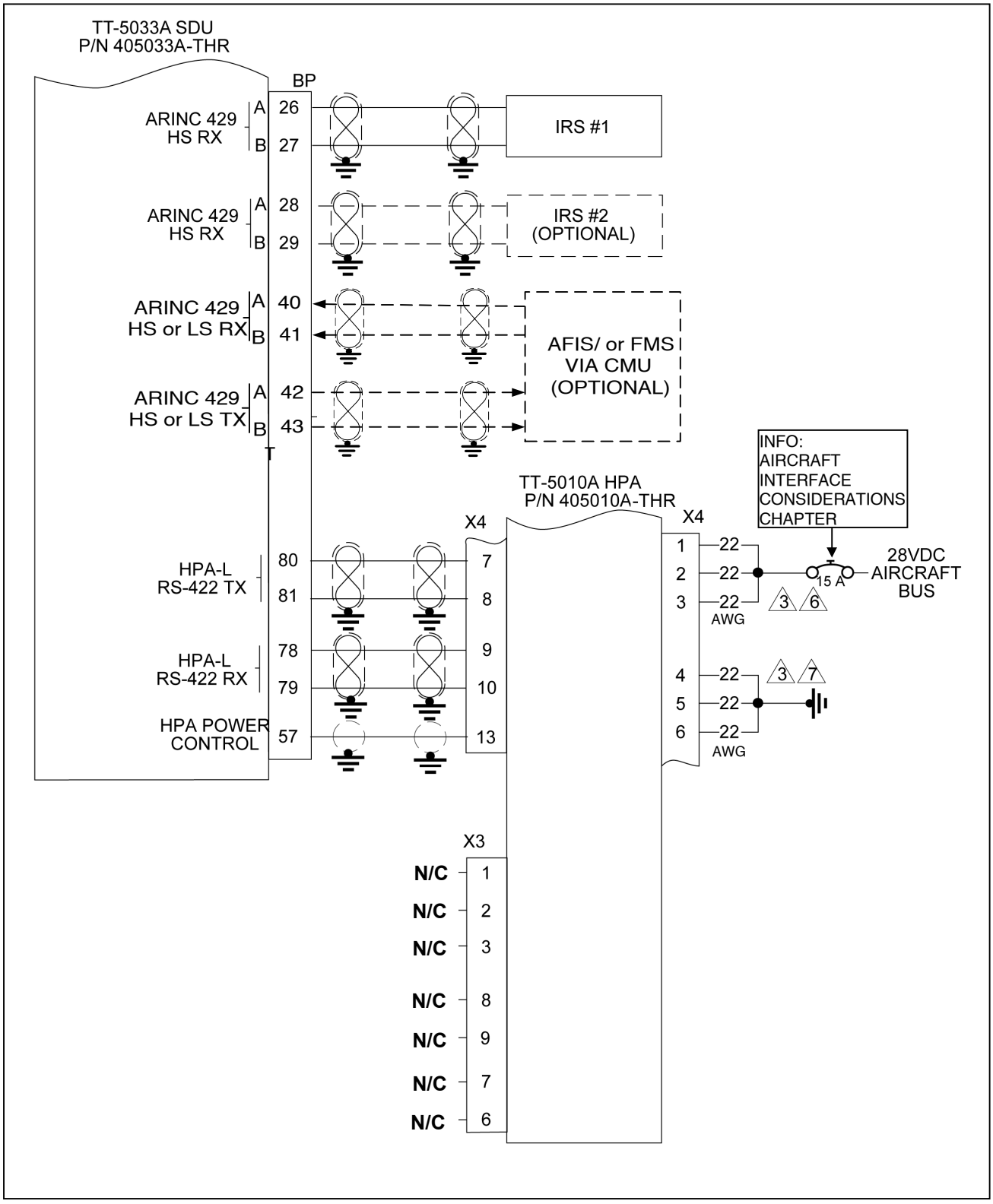
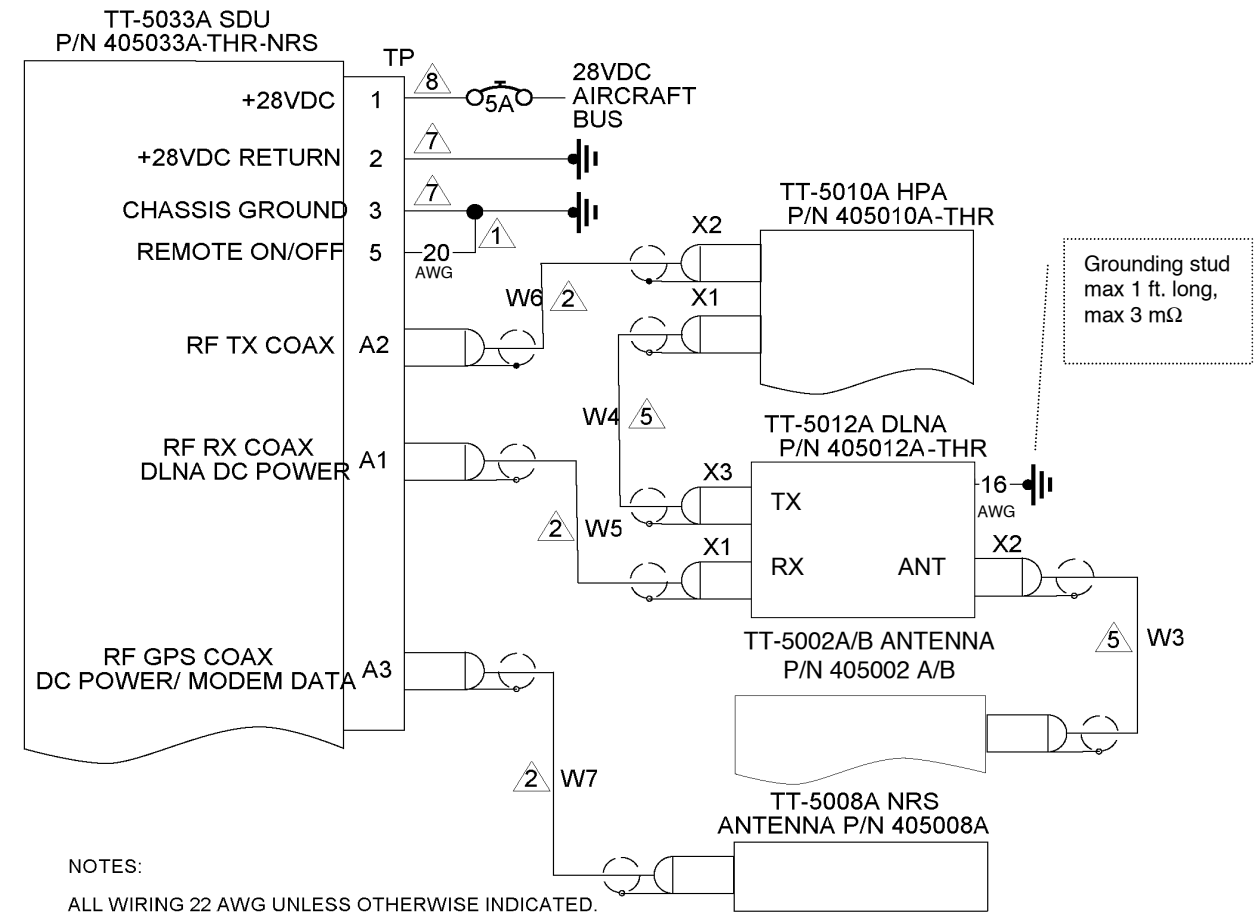


Figure 41, TT-5002A/B Antenna with IRS interface wiring (2 of 2)

7.1.3 TT-5002A/B Antenna with TT-5008A NRS interface wiring (1 of 2).



NOTES:

ALL WIRING 22 AWG UNLESS OTHERWISE INDICATED.

SHIELDING OF TWISTED PAIRS, 22 AWG PIGTAIL OR LARGER. MAX 2" LENGTH. DO NOT DAISY CHAIN SHIELD GROUNDS. CONNECT TO TRAY.

1. IF SATCOM ON/OFF SWITCH IS REQUIRED, TP5 IS ROUTED TO AN EXTERNAL SWITCH FOR GROUND.
2. LOW LOSS COAXIAL CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATION CONSIDERATIONS SECTION OF THIS MANUAL.
3. THIS WIRE IS FOR CONNECTION OF HPA TO AIR-CRAFT 28VDC BUS AND CHASSIS GROUND. THE WIRE MUST BE SPLICED INTO THREE 22 AWG WIRES. THIS ALLOWS FOR INSERTION INTO THE RACK CONNECTOR.
4. WHEN USING THE TT-5002 A/B SATCOM ANTENNA AND TT-5008A NRS ANTENNA, ALL DATA NEEDED FOR ANTENNA STEERING IS PROVIDED BY THE TT-5008A. AS A BACKUP, IRS#1 OR IRS#2 CAN BE SWITCHED ON IN CONFIG MODULE TO PROVIDE A PRIMARY AND SECONDARY ANTENNA STEERING SOURCE.
5. SUPER LOW LOSS CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATIONS CONSIDERATIONS SECTION OF THIS MANUAL.
6. 100mohm MAX RESISTANCE TO POWER BUS. (USED TO DETERMINE WIRE GAGE)
7. 25mohm MAX RESISTANCE. (USED TO DETERMINE WIRE GAGE)
8. 200mohm MAX RESISTANCE TO POWER BUS. (USED TO DETERMINE WIRE GAGE)

Figure 42, TT-5002A/B Antenna with TT-5008A NRS interface wiring. (1 of 2)

7.1.4 TT-5002A Satcom Antenna with TT-5008A NRS interface wiring (2 of 2)

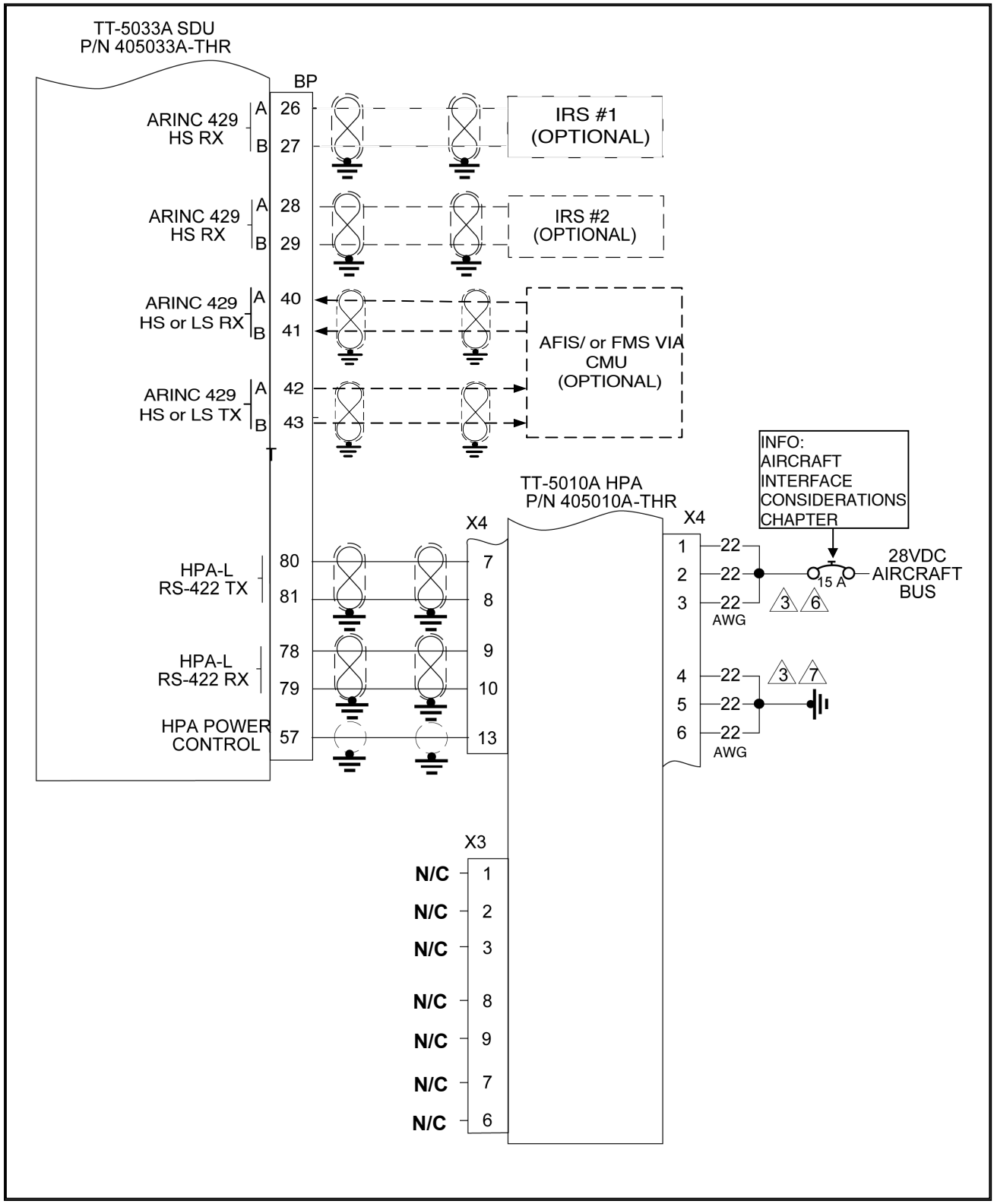
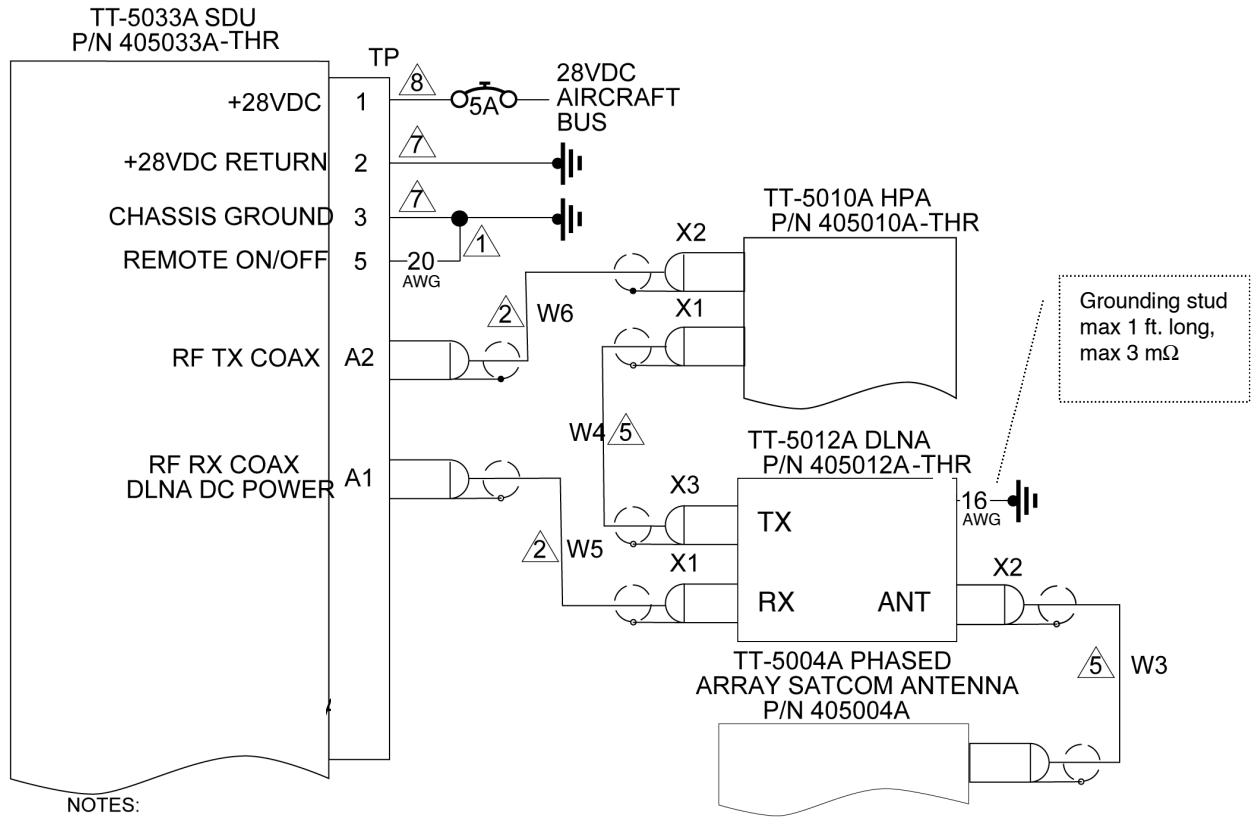


Figure 43, TT-5002A/B Antenna with TT-5008A NRS interface wiring. (2 of 2)

7.1.5 TT-5004A Satcom Antenna with IRS interface wiring (1 of 2)



NOTES:

ALL WIRING 22 AWG UNLESS OTHERWISE INDICATED.

SHIELDING OF TWISTED PAIRS, 22 AWG PIGTAIL OR LARGER. MAX 2" LENGTH. DO NOT DAISY CHAIN SHIELD GROUNDS. CONNECT TO TRAY.

1. IF SATCOM ON/OFF SWITCH IS REQUIRED, TP5 IS ROUTED TO AN EXTERNAL SWITCH FOR GROUND.
2. LOW LOSS COAXIAL CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATION CONSIDERATIONS SECTION OF THIS MANUAL.
3. THIS WIRE IS FOR CONNECTION OF HPA TO AIR-CRAFT 28VDC BUS AND CHASSIS GROUND. THE WIRE MUST BE SPLICED INTO THREE 22 AWG WIRES. THIS ALLOWS FOR INSERTION INTO THE RACK CONNECTOR.
4. WHEN USING THE TT-5004A SATCOM ANTENNA AND IRS DATA, ALL DATA NEEDED FOR ANTENNA STEERING IS PROVIDED BY THE IRS DATA.
5. SUPER LOW LOSS CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATIONS CONSIDERATIONS SECTION OF THIS MANUAL.
6. 100mohm MAX RESISTANCE TO POWER BUS.(USED TO DETERMINE WIRE GAGE)
7. 25mohm MAX RESISTANCE.(USED TO DETERMINE WIRE GAGE)
8. 200mohm MAX RESISTANCE TO POWER BUS.(USED TO DETERMINE WIRE GAGE)

Figure 44, TT-5004A Satcom Antenna with IRS interface wiring.(1of 2)

7.1.6 TT-5004A Satcom Antenna with IRS interface wiring.(2 of 2)

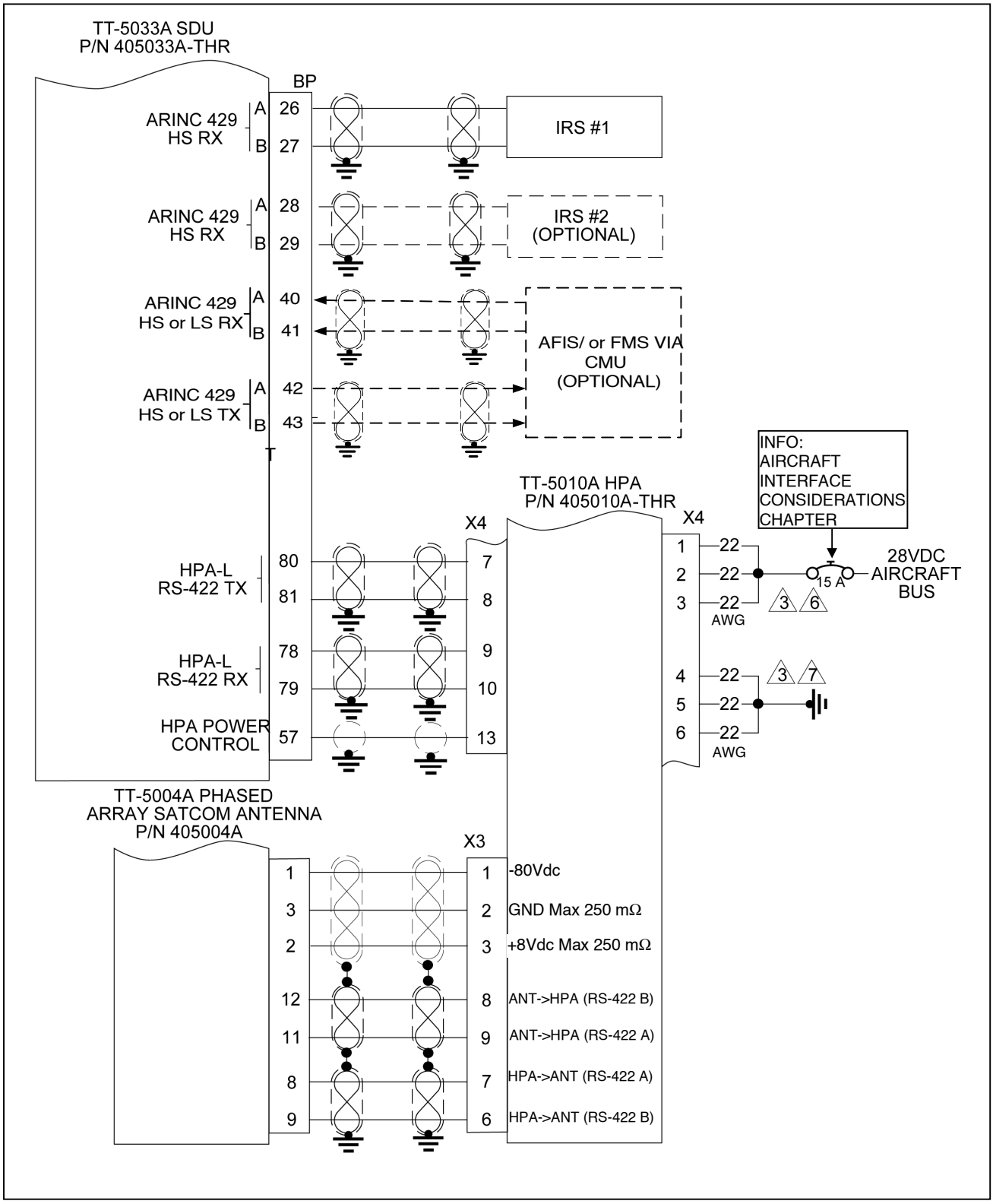
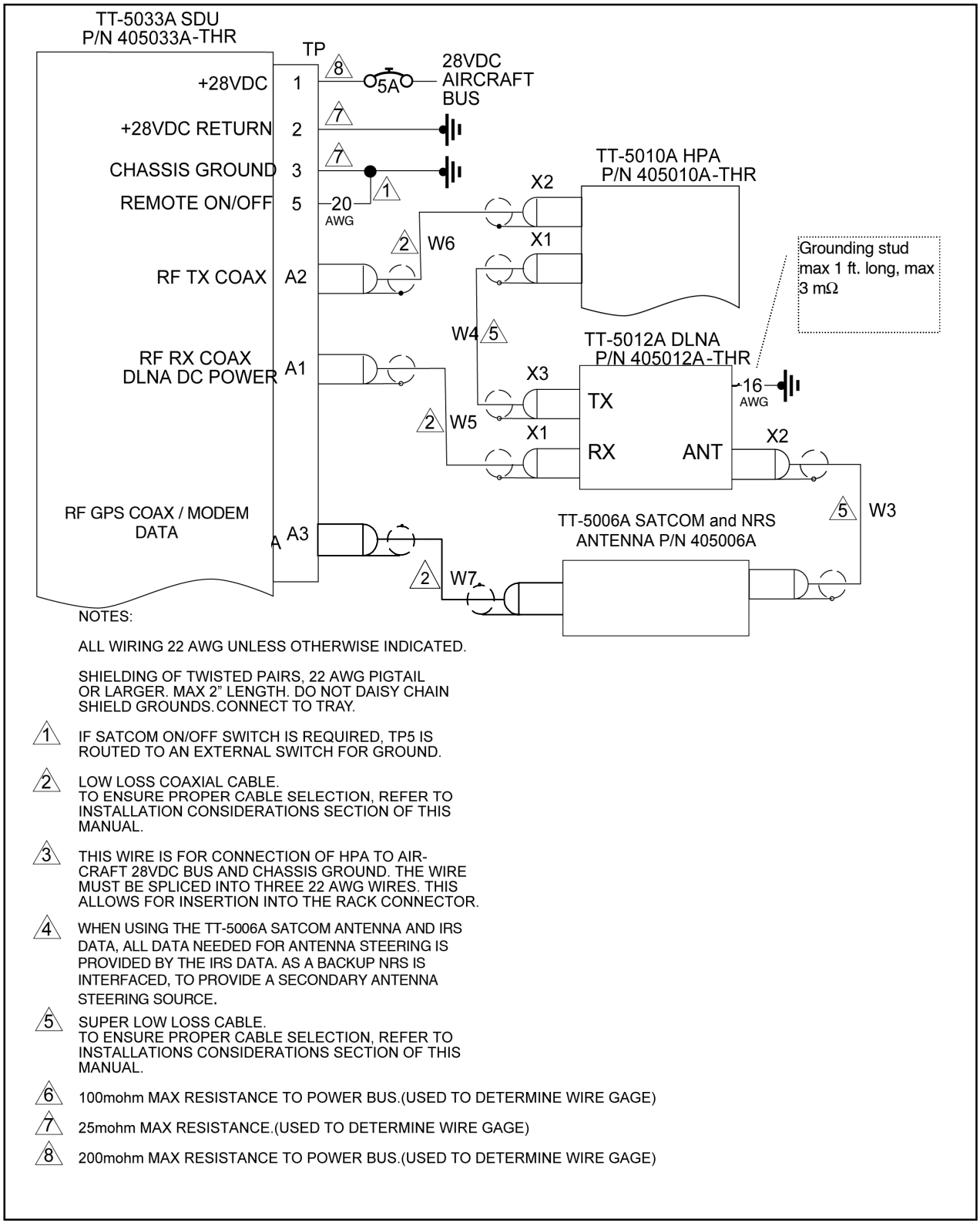


Figure 45, TT-5004A Satcom Antenna with IRS interface wiring (2 of 2).

7.1.7 TT-5006A Antenna interfaced to aircraft (1 of 2)



NOTES:

ALL WIRING 22 AWG UNLESS OTHERWISE INDICATED.

SHIELDING OF TWISTED PAIRS, 22 AWG PIGTAIL OR LARGER. MAX 2" LENGTH. DO NOT DAISY CHAIN SHIELD GROUNDS.CONNECT TO TRAY.

1. IF SATCOM ON/OFF SWITCH IS REQUIRED, TP5 IS ROUTED TO AN EXTERNAL SWITCH FOR GROUND.
2. LOW LOSS COAXIAL CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATION CONSIDERATIONS SECTION OF THIS MANUAL.
3. THIS WIRE IS FOR CONNECTION OF HPA TO AIR-CRAFT 28VDC BUS AND CHASSIS GROUND. THE WIRE MUST BE SPLICED INTO THREE 22 AWG WIRES. THIS ALLOWS FOR INSERTION INTO THE RACK CONNECTOR.
4. WHEN USING THE TT-5006A SATCOM ANTENNA AND IRS DATA, ALL DATA NEEDED FOR ANTENNA STEERING IS PROVIDED BY THE IRS DATA. AS A BACKUP NRS IS INTERFACED, TO PROVIDE A SECONDARY ANTENNA STEERING SOURCE.
5. SUPER LOW LOSS CABLE. TO ENSURE PROPER CABLE SELECTION, REFER TO INSTALLATIONS CONSIDERATIONS SECTION OF THIS MANUAL.
6. 100mohm MAX RESISTANCE TO POWER BUS.(USED TO DETERMINE WIRE GAGE)
7. 25mohm MAX RESISTANCE.(USED TO DETERMINE WIRE GAGE)
8. 200mohm MAX RESISTANCE TO POWER BUS.(USED TO DETERMINE WIRE GAGE)

Figure 46, TT-5006A Antenna interfaced to aircraft (1 of 2)

7.1.8 TT-5006A Antenna interfaced to aircraft (2 of 2)

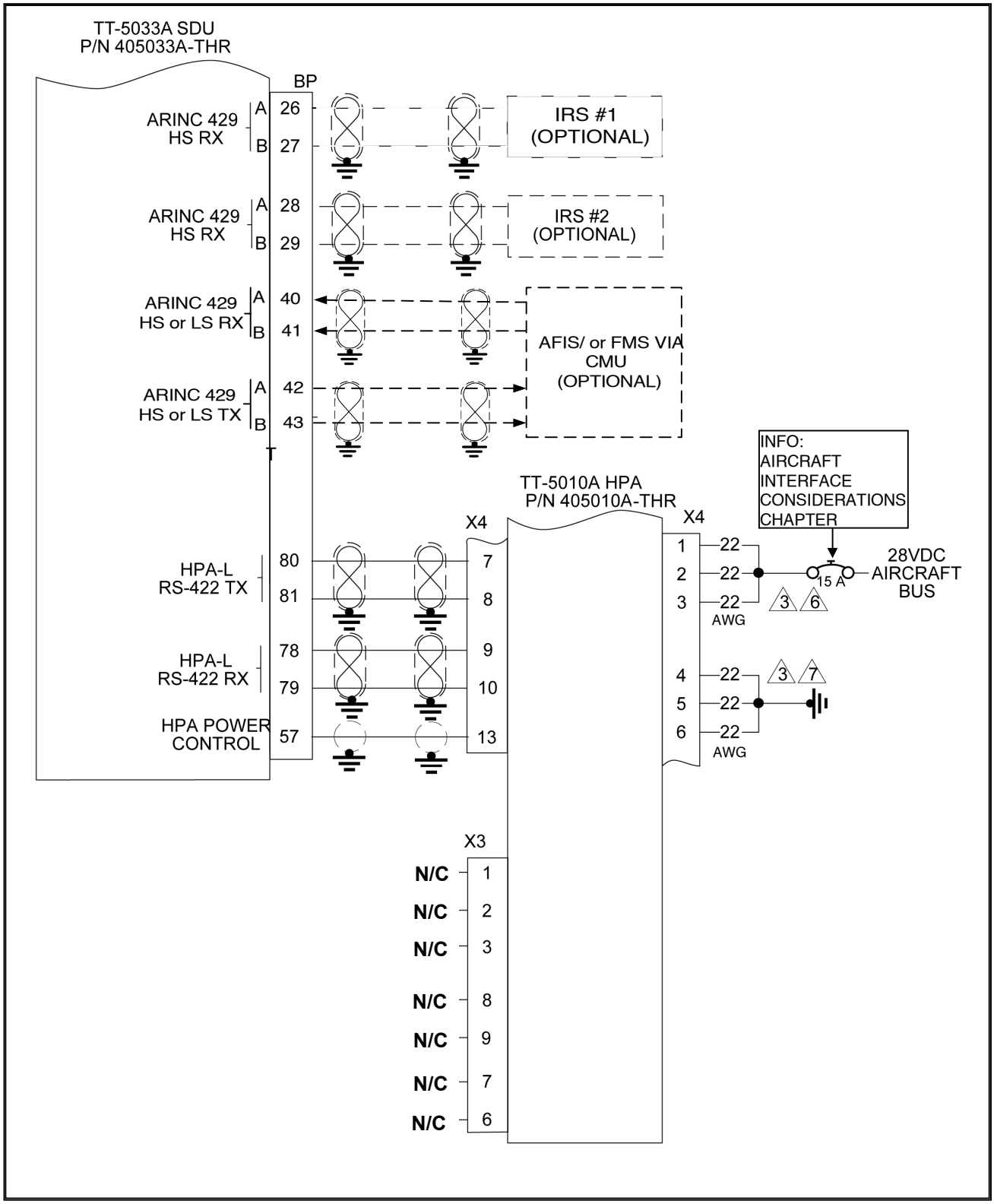


Figure 47, TT-5006A Antenna interfaced to aircraft (2 of 2)

7.1.9 TT-5033A SDU interfaced to TT-5620A Handsets and TT-5622A Cradles

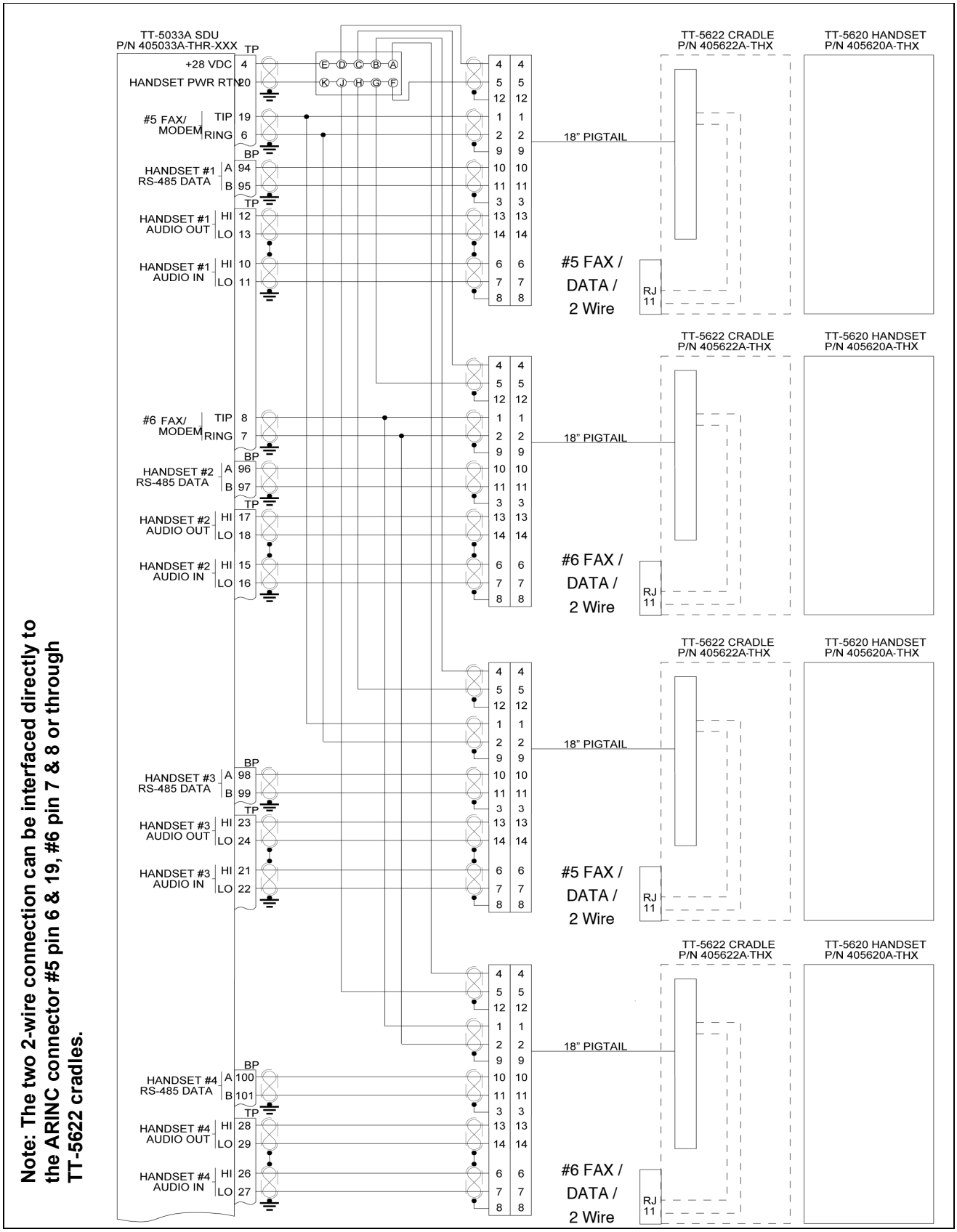


Figure 48, TT-5033A SDU interfaced to TT-5620A Handsets and TT-5622A Cradles

7.1.10 TT-5033A SDU interface to CMU (UNILINK).

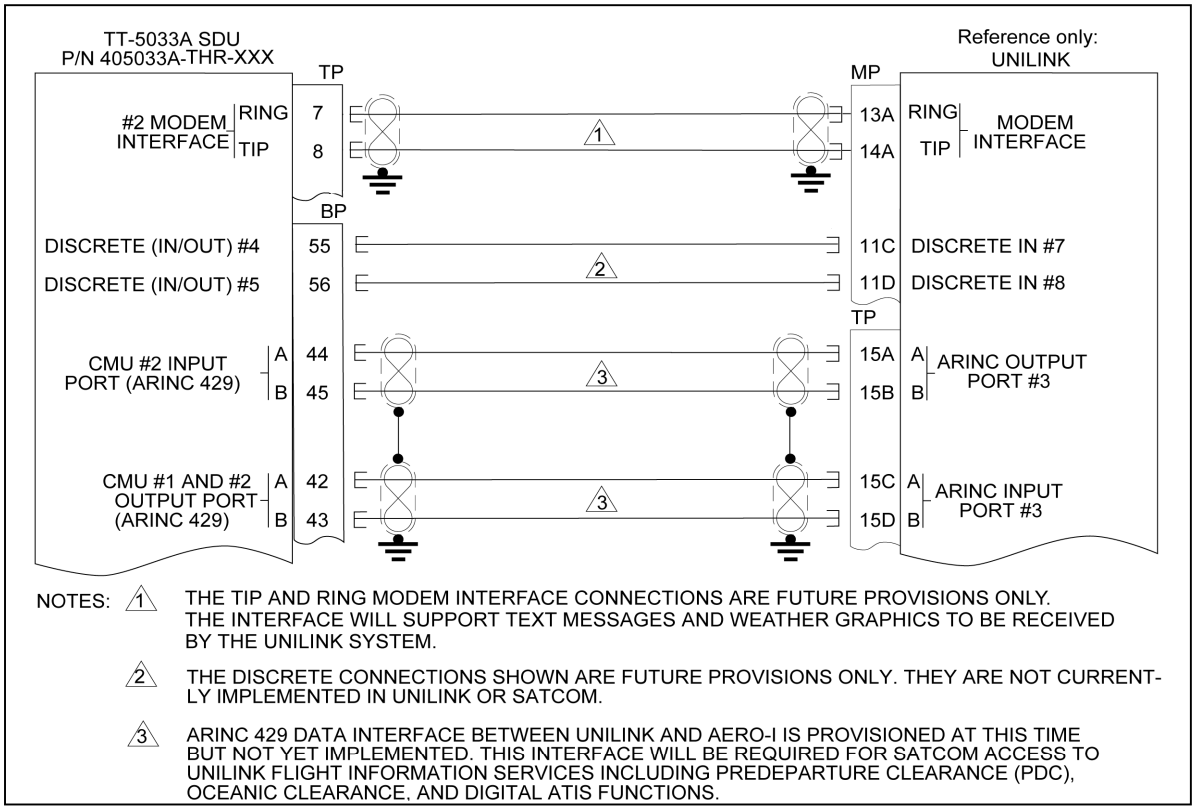


Figure 49, TT-5033A SDU interface to CMU (UNILINK)

7.1.11 Provisions for External Ringer

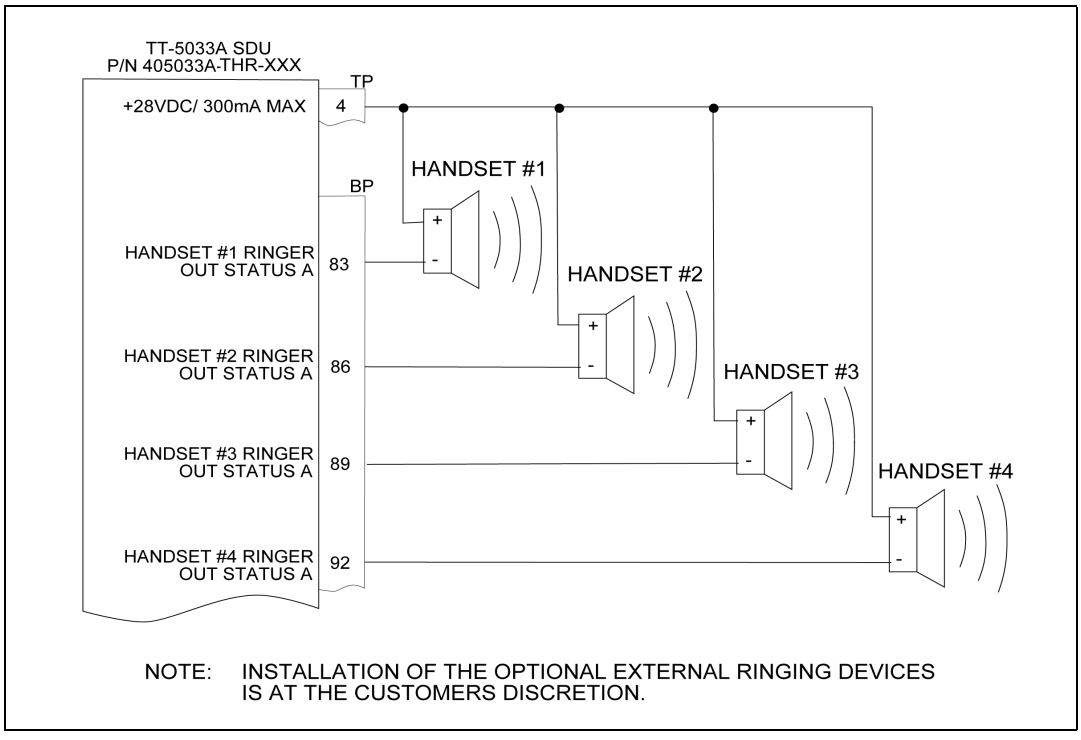


Figure 50, Provisions for External Ringer

7.1.12 TT-5033A SDU interfaced to Magnastar AIU #1 and #2

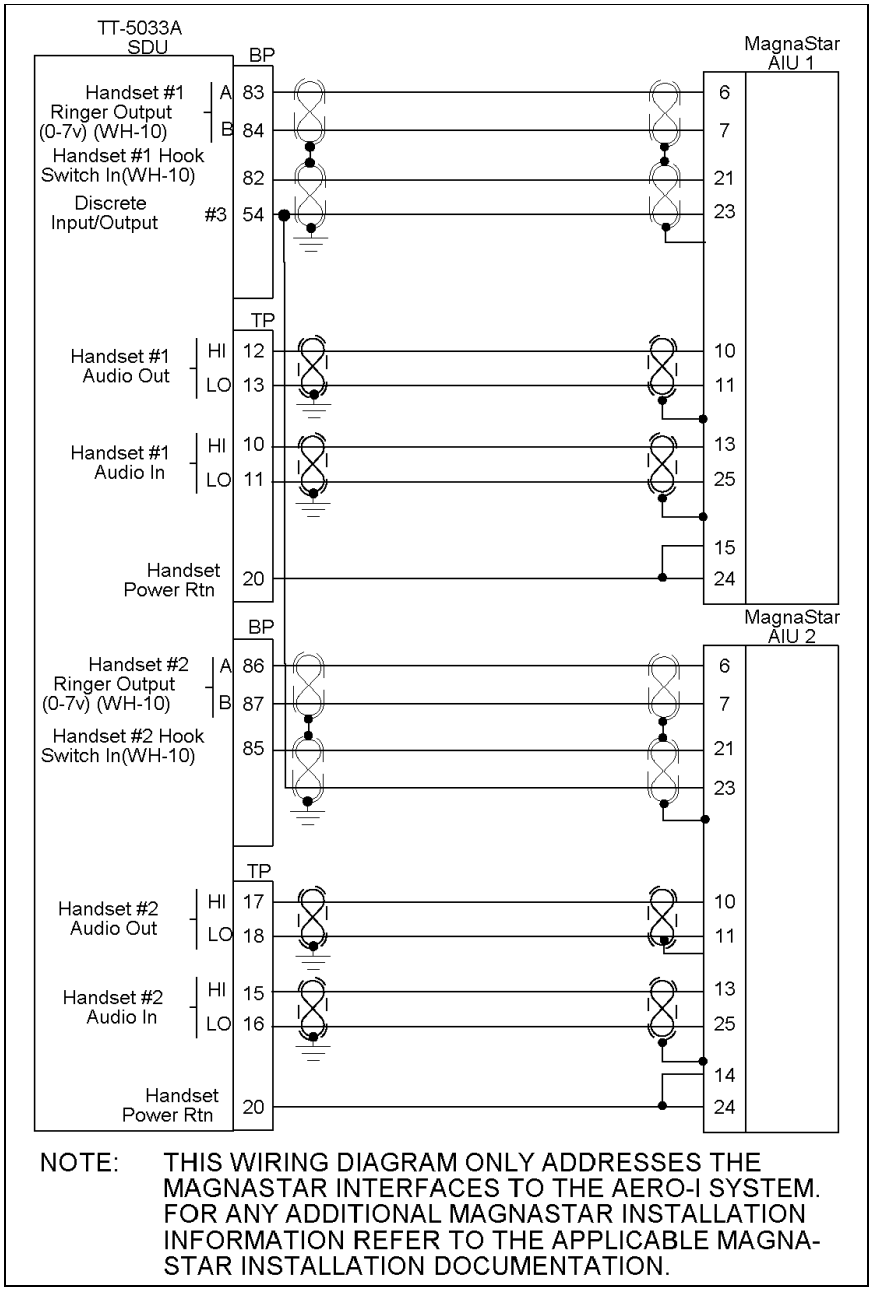


Figure 51, TT-5033A SDU interfaced to Magnastar AIU #1 and #2

7.1.13 TT-5033A SDU interfaced to Global Wulfsberg WH-10 handset.

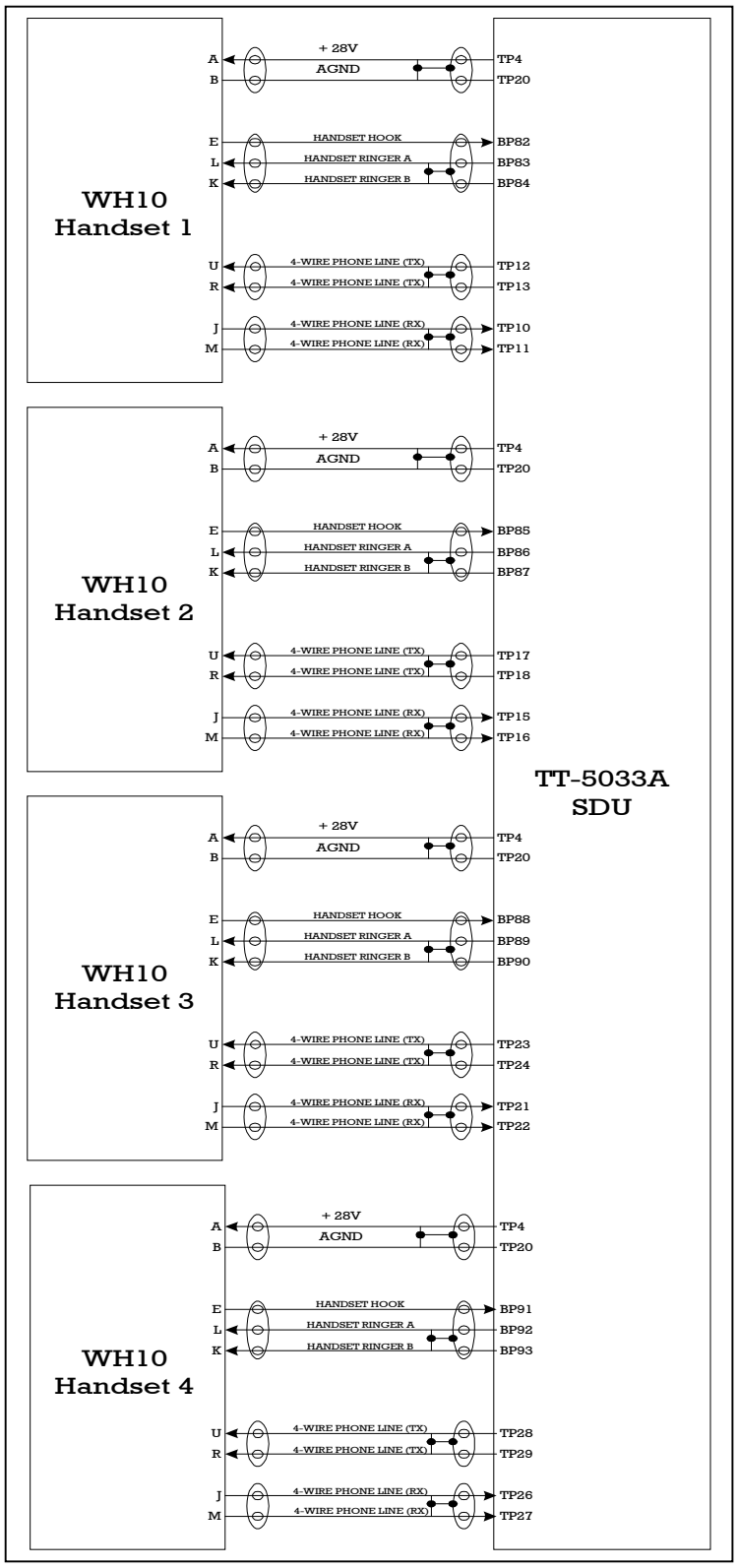


Figure 52, TT-5033A SDU interfaced to Global Wulfsberg WH-10 handset.

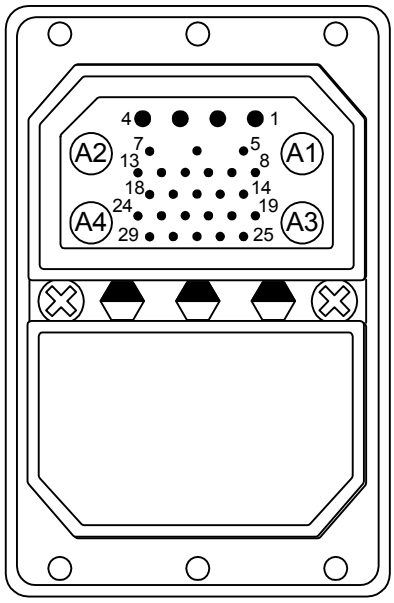
NOTE:

When Global Wulfsberg handsets are interfaced to TT-5033A SDU, at least one connected Thrane & Thrane 4-wire handset TT-5620A with cradle TT-5622A is needed for correct system operation.

7.2 Pin Out Charts

7.2.1 TT-5000 Aero-I System Pinouts

7.2.2 SDU Top Plug

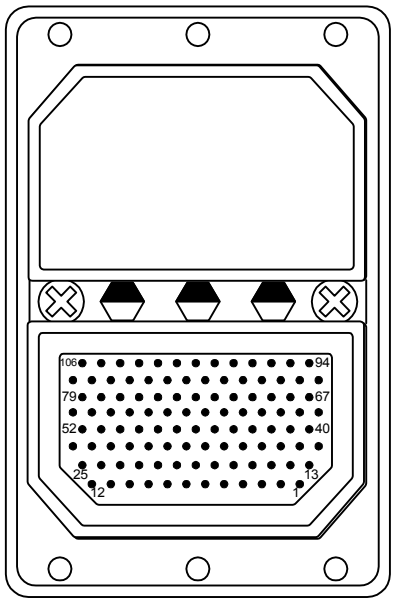


Pin	Function
A1	RF RX input from DLNA/ 12Vdc power to DLNA
A2	RF TX output to HPA
A3	RF + Modem data from GPS Ant./ 12Vdc to GPS Ant.
A4	Not Connected
1	+28Vdc Power
2	GND, Power Return
3	Chassis Ground
4	+28Vdc/ 600mA **NOTE 1&2**
5	Remote ON/OFF
6	Fax/ modem #1 (Ring)
7	Fax/ modem #2 (Ring) NC
8	Fax/ modem #2 (Tip) NC
9	Not Connected
10	Handset #1 Audio In Hi **NOTE ALL**
11	Handset #1 Audio In Lo **NOTE ALL**
12	Handset #1 Audio Out Hi **NOTE ALL**
13	Handset #1 Audio Out Lo **NOTE ALL**

Pin	Function
14	N/C
15	Handset #2 Audio In Hi **NOTE ALL**
16	Handset #2 Audio In Lo **NOTE ALL**
17	Handset #2 Audio Out Hi **NOTE ALL**
18	Handset #2 Audio Out Lo **NOTE ALL**
19	Fax/ modem #1 (Tip)
20	Handset Power Return **NOTE ALL**
21	Handset #3 Audio In Hi **NOTE 1&2**
22	Handset #3 Audio In Lo **NOTE 1&2**
23	Handset #3 Audio Out Hi **NOTE 1&2**
24	Handset #3 Audio Out Lo **NOTE 1&2**
25	+12Vdc/ 350mA
26	Handset #4 Audio In Hi **NOTE 1&2**
27	Handset #4 Audio In Lo **NOTE 1&2**
28	Handset #4 Audio Out Hi **NOTE 1&2**
29	Handset #4 Audio Out Lo **NOTE 1&2**

NOTE 1: Pin used when installing TT-5620A Handset.
2: Pin used when installing Global Wulfsberg WH-10 Handset.
3: Pin used when installing MagnaStar AIU.

7.2.3 SDU Bottom Plug



Pin	Function
1	ICAO Address Bit #1 (MSB)
2	ICAO Address Bit #2
3	ICAO Address Bit #3
4	ICAO Address Bit #4
5	ICAO Address Bit #5
6	ICAO Address Bit #6
7	ICAO Address Bit #7
8	ICAO Address Bit #8
9	ICAO Address Bit #9
10	ICAO Address Bit #10
11	ICAO Address Bit #11
12	ICAO Address Bit #12
13	ICAO Address Bit #13
14	ICAO Address Bit #14
15	ICAO Address Bit #15

Pin	Function
16	ICAO Address Bit #16
17	ICAO Address Bit #17
18	ICAO Address Bit #18
19	ICAO Address Bit #19
20	ICAO Address Bit #20
21	ICAO Address Bit #21
22	ICAO Address Bit #22
23	ICAO Address Bit #23
24	ICAO Address Bit #24
25	ICAO Address Common
26	Data from primary IRS A (ARINC 429)
27	Data from primary IRS B (ARINC 429)
28	Data from secondary IRS A (ARINC 429)
29	Data from secondary IRS B (ARINC 429)
30	AES ID input 429 A

SDU Bottom Plug (continued)

Pin	Function
31	AES ID input 429 B
32	Data bus from CPDF #1 429 A
33	Data bus from CPDF #1 429 B
34	Data bus to CPDF #1 429 A
35	Data bus to CPDF #1 429 B
36	Data bus from CPDF #2 RS-422 A
37	Data bus from CPDF #2 RS-422 B
38	Data bus to CPDF #2 RS-422 A
39	Data bus to CPDF #2 RS-422 B
40	Data bus from CMU #1 429 A
41	Data bus from CMU #1 429 B
42	Data bus to CMU #1 & #2 429 A
43	Data bus to CMU #1 & #2 429 B
44	Data bus from CMU #2 429 A
45	Data bus from CMU #2 429 B
46	429 Input A (high speed)
47	429 Input B (high speed)
48	429 Input A (high speed)
49	429 Input B (high speed)
50	N/C
51	N/C
52	N/C
53	N/C
54	Discrete Input/ Output #3 **NOTE 3**
55	Discrete Input/ Output #4
56	Discrete Input/ Output #5
57	HPA remote nON/OFF output
58	N/C
59	N/C
60	N/C
61	N/C
62	N/C
63	N/C
64	N/C
65	N/C
66	N/C
67	N/C
68	N/C

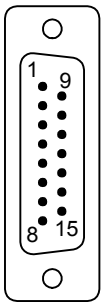
Pin	Function
69	N/C
70	N/C
71	N/C
72	N/C
73	N/C
74	N/C
75	N/C
76	N/C
77	SDU RESET/
78	Multi Control Output A
79	Multi Control Output B
80	Bite Input from HPA/IGA A
81	Bite Input from HPA/IGA B
82	Handset #1 hook switch input **NOTE 2&3**
83	Handset #1 ringer output Status A **NOTE 2&3&4**
84	Handset #1 ringer output Status B **NOTE 2&3**
85	Handset #2 hook switch input **NOTE 2&3**
86	Handset #2 ringer output Status A **NOTE 2&3&4**
87	Handset #2 ringer output Status B **NOTE 2&3**
88	Handset #3 hook switch input **NOTE 2**
89	Handset #3 ringer output Status A **NOTE 2&4**
90	Handset #3 ringer output Status B **NOTE 2**
91	Handset #4 hook switch input **NOTE 2**
92	Handset #4 ringer output Status A **NOTE 2&4**
93	Handset #4 ringer output Status B **NOTE 2**
94	Handset #1 RS-485 Data A **NOTE 1**
95	Handset #1 RS-485 Data B **NOTE 1**
96	Handset #2 RS-485 Data A **NOTE 1**
97	Handset #2 RS-485 Data B **NOTE 1**
98	Handset #3 RS-485 Data A **NOTE 1**
99	Handset #3 RS-485 Data B **NOTE 1**
100	Handset #4 RS-485 Data A **NOTE 1**
101	Handset #4 RS-485 Data B **NOTE 1**
102	Port 1 TXD Input (EIA/TIA-232-E)
103	Port 1 RXD Output (EIA/TIA-232-E)
104	Port 1 RTS Input (EIA/TIA-232-E)
105	Port 1 CTS Output (EIA/TIA-232-E)
106	Port 1 GND

NOTE 1: Pin used when installing TT-5620A Handset.
2: Pin used when installing Global Wulfsberg WH-10 Handset.
3: Pin used when installing Magnastar AIU.
4: Pin used when installing external ringer.

7.2.4 SDU Front Connector

NOTE:

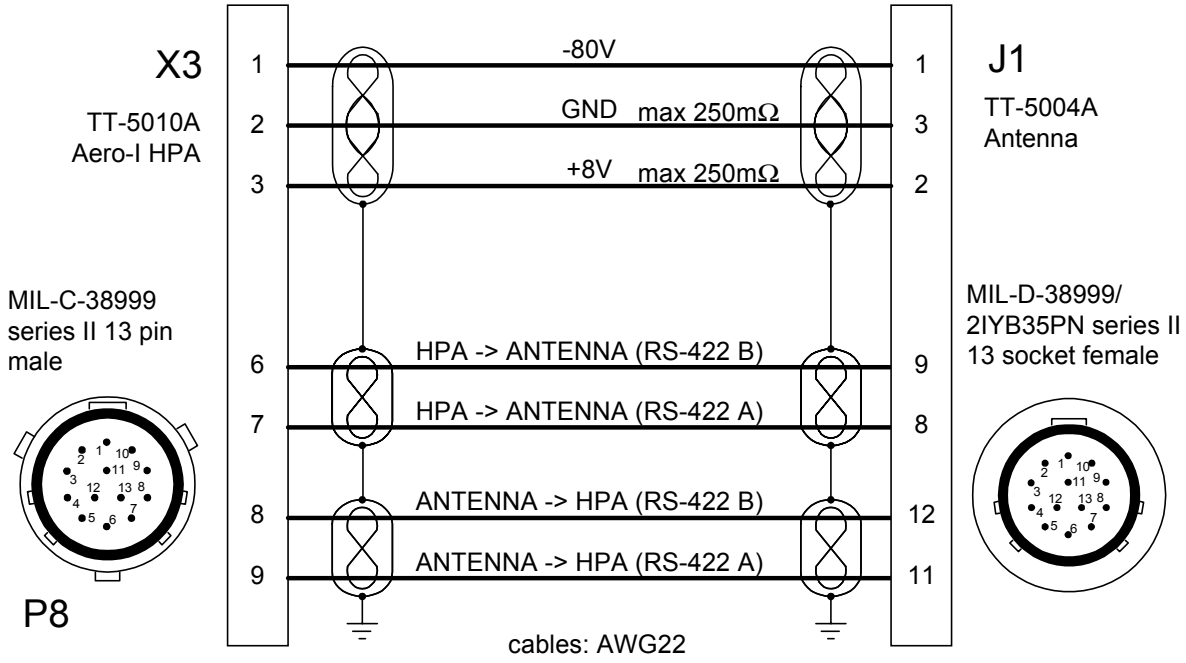
The Portable Handset #4 on the front plug will only be recognized if connected before power up. If handset #4 is connected on front panel the handset #4 on rear connector will not be recognized.



Pin	Function
1	Portable Handset #4 Audio In Hi
2	Portable Handset #4 Audio In Lo
3	Portable Handset #4 Audio Out Hi
4	Portable Handset #4 Audio Out Lo
5	Signal Ground SGND
6	Portable Handset #4 RS-485 Data A
7	Portable Handset #4 RS-485 Data B
8	+12Vdc

Pin	Function
9	+12Vdc Return
10	PC EIA/TIA-232-E RXD Output
11	PC EIA/TIA-232-E TXD Input
12	PC EIA/TIA-232-E CTS Output
13	PC EIA/TIA-232-E RTS Input
14	GND
15	Configuration Module write Protect In
	(Write protected = NC), (Write Enable = +12Vdc)

7.2.5 TT-5010A HPA (X3) to TT-5004A Phased Array Satcom Antenna (J1)



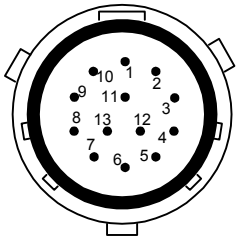
NOTE:

This cable is only used if TT-5004A Satcom Antenna is installed.
The AWG22 wire is recommended as it suit the connectors, but if longer distances needed it may be necessary to use extra wire for GND and +8V to be able to keep the resistance under the required 250 mΩ.

HPA Pin	Function		Ant Pin	Notes
X3-1	-80Vdc	to	J1-1	
-2	GND	to	-3	
-3	+8Vdc	to	-2	
-4	+8Vdc	to	N/C	
-5	GND	to	N/C	
-6	Comm HPA to Antenna HI	to	-9	
-7	Comm HPA to Antenna LO	to	-8	
-8	Comm Antenna to HPA HI	to	-12	
-9	Comm Antenna to HPA LO	to	-11	
-10	GND	to	N/C	
-11	N/C	to	N/C	
-12	N/C	to	N/C	
-13	N/C	to	N/C	

7.2.6 TT-5010A HPA (X4) to TT-5033A SDU (BP)

MIL-C-38999
series II 13
socket female

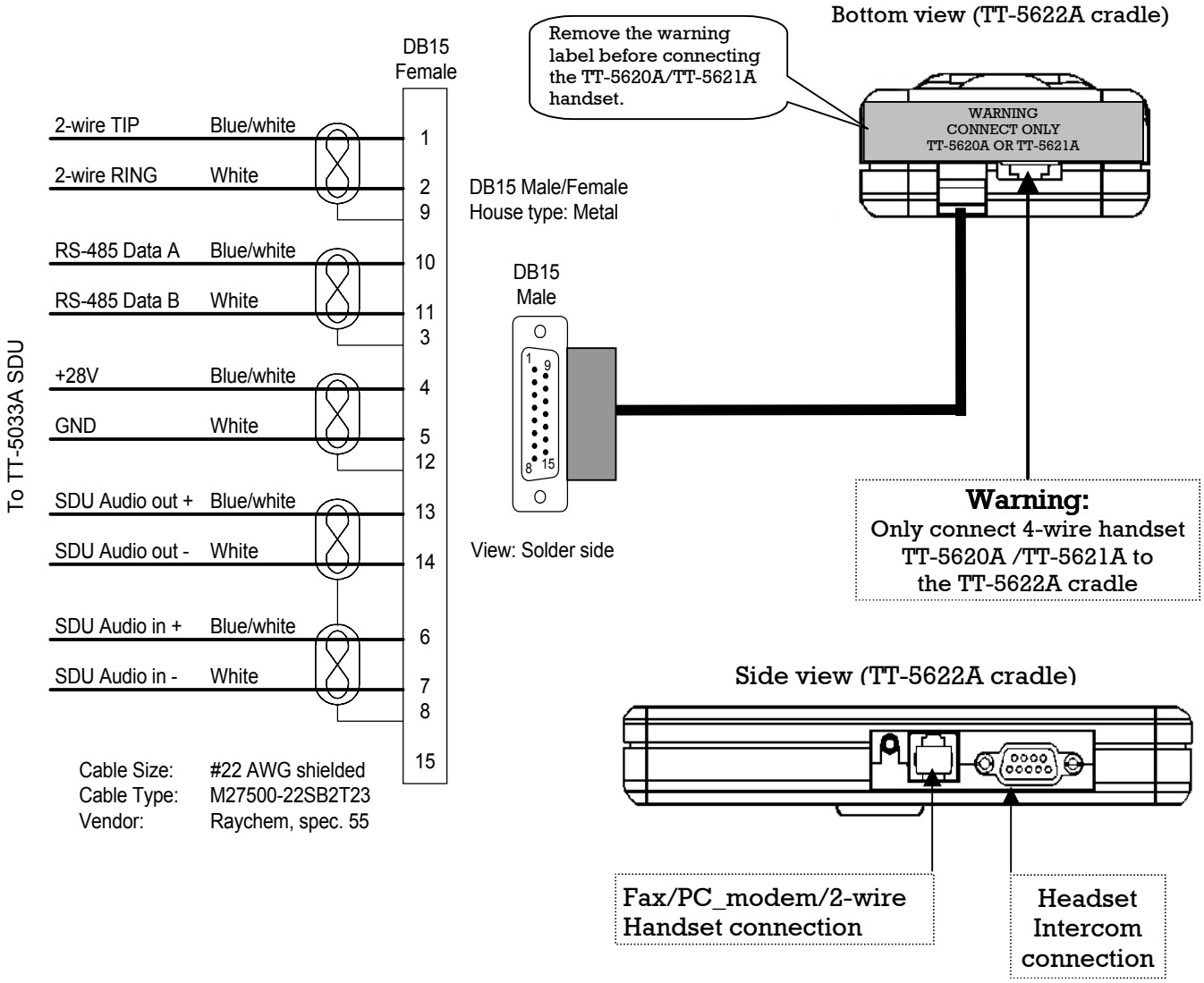


X4

View: Insert side

HPA Pin	Function		SDU Pin	Notes
X4-1	+28Vdc Supply	to		#16 AWG 28Vdc Aircraft Bus
-2	+28Vdc Supply	to		#16 AWG 28Vdc Aircraft Bus
-3	+28Vdc Supply	to		#16 AWG 28Vdc Aircraft Bus
-4	+28Vdc Return	to		#16 AWG Ground
-5	+28Vdc Return	to		#16 AWG Ground
-6	+28Vdc Return	to		#16 AWG Ground
-7	SDUOUT1	to	BP-80	HPA-H RS-422 TX
-8	SDUOUT2	to	BP-81	HPA-L RS-422 TX
-9	SDUIN1	to	BP-78	HPA-H RS-422 RX
-10	SDUIN2	to	BP-79	HPA-L RS-422 RX
-11	N/C	to		
-12	N/C	to		
-13	nON	to	BP-57	HPA Power Control

7.2.7 TT-5622A full-feature (4-wire) Cradle Connectors



Cradle DB15 Connector arrangement

The table below shows the pin configuration for the DB15 Cradle connector.

Pin	Function
1	2-wire Tip (Fax/PC_modem/Auxiliary)
2	2-wire Ring (Fax/PC_modem/Auxiliary)
3	GND
4	+28Vdc
5	GND (PWR RTN)
6	SDU Audio in +
7	SDU Audio in -
8	GND

Pin	Function
9	GND
10	RS-485 Data A
11	RS-485 Data B
12	GND
13	SDU Audio out +
14	SDU Audio out -
15	NC

Wiring for the TT-5622A cradle should be done with M27500-22SB2T23 shielded twisted pair (Vendor: Raychem, spec 55). The twisted pair shields should be connected to the connector shell.
Use connector female type, with a metal house. Make sure the connectors are securely fastened to each other, using the two mounting screws.

7.3 TT-5622B Auxiliary (2-wire) Cradle Connector

Auxiliary Cradle pigtail (2 wire)

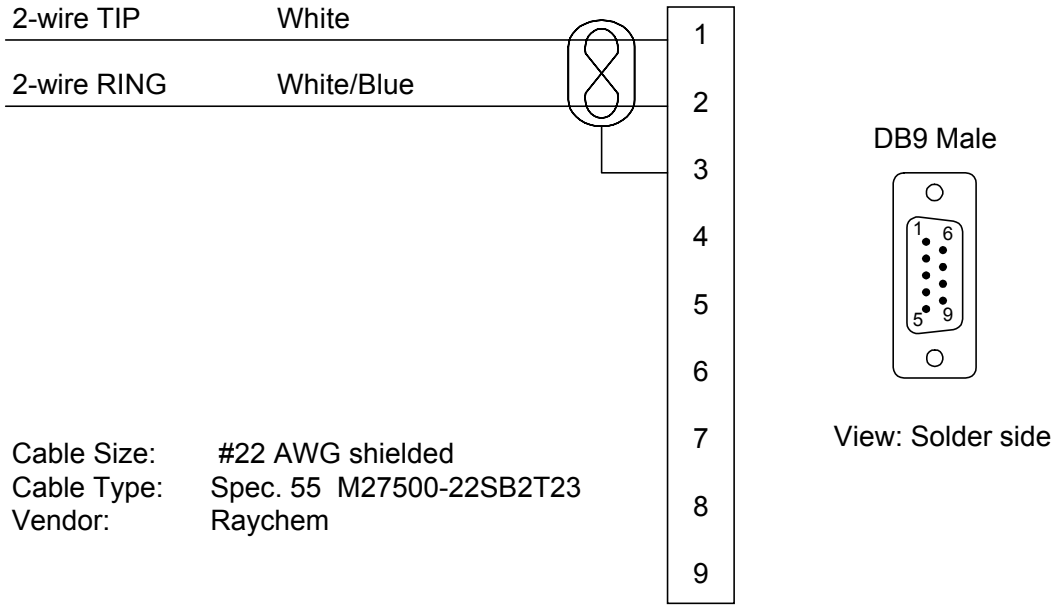


Figure 53, Auxiliary Cradle Connector arrangement

The table below shows the pin configuration for the Cradle connector.

Pin	Function
1	Auxiliary Tip
2	Auxiliary Ring
3	Shield
4	NC
5	NC
6	NC
7	NC
8	NC
9	NC

Wiring for the handset cradle should be done with M27500-22SB2T23 shielded twisted pair (vendor: Raychem, spec 55). The twisted pair shields should be connected to the connector shell. Use connector female type, with a metal house. Make sure the connectors are securely fastened to each other, using the two mounting screws.

8 System Data Installation

8.1 Description

The TT-5000 series Aero-I system utilizes a configuration terminal to configure and store necessary operating parameters. The configuration terminal consists of a PC and a PC program - The TT-5000 Series Aero-I Configuration Utilities. The configuration terminal can:

(a) Initialize the SDU with all configurable parameters.
(b) Read, Write, and Edit a complete set of operating parameters for the SDU.
(c) Save, and Load a specified configuration from a file.
(d) Calibrate the antenna.
(e) Extend and Limit access to the system.
(f) Print parameters to a printer.
(g) Provide help on relevant topics through the menu, or by pressing the <F1> key when positioned on the item in question.

8.1.1 Magnastar Setup

Magnastar setup code "8#8#8#8" in the Magnastar handset will access an enhanced setup menu. The following settings must be entered for each Magnastar handset to ensure proper operation.

1. Typical TX Gain: 070
2. Side tone: 005

8.1.2 TT-5033A SDU Configuration Module

The Aero-I SDU is a LRU (Line Replaceable Unit). To ensure that a spare or repaired SDU is configured correctly upon replacement, all configuration data is stored in the configuration module. The Configuration Module contains system information used by the SDU and other Aero-I components; for example, the HPA has different setting for mechanically steered antenna or phased array antenna. The Aero-I uses a configuration module with an EEPROM and a serial data interface. The Configuration Module is placed in the rear panel of the SDU and connected to an internal connector. This is done for easy removal and installation. Because no configuration is loaded in a new SDU, when an in service SDU is replaced the configuration module is removed from the "old" SDU and installed into the "new" SDU.

The Configuration Module consists of a write-protected and a non write-protected memory area. The write-protected memory area contains all system configuration data. The contents of the write-protected area can only be altered during installation or reconfiguring when a configuration terminal is connected to the maintenance port (X1 Maintenance) on the front panel of the SDU.

The non-write-protected area contains telephone numbers and other user definable data. This portion of the configuration module can be accessed, via the handset, without connecting to the maintenance port.

The Configuration Module must have proper inputs that identify the installation unambiguously. The ICAO address is stored in the write-protected memory area, if the ICAO address does not match the hardware strapped ICAO address; the SDU will disable all transmissions. The Configuration Module shall only be removed during service, repair, or change of installations. It is imperative that the configuration module remains with the aircraft when the SDU is removed.

8.1.3 Hardware and Software Requirements

The PC used must be equipped with Windows 9x/ME/NT4/2000/XP and have a minimum screen resolution of 640 x 480 pixels.

RS-232 cable (TT 37-112940) connection is made between the PC serial port and SDU front connector X1 (maintenance port).

Starting AERO-I_Config.exe activates theConfiguration Utilities.

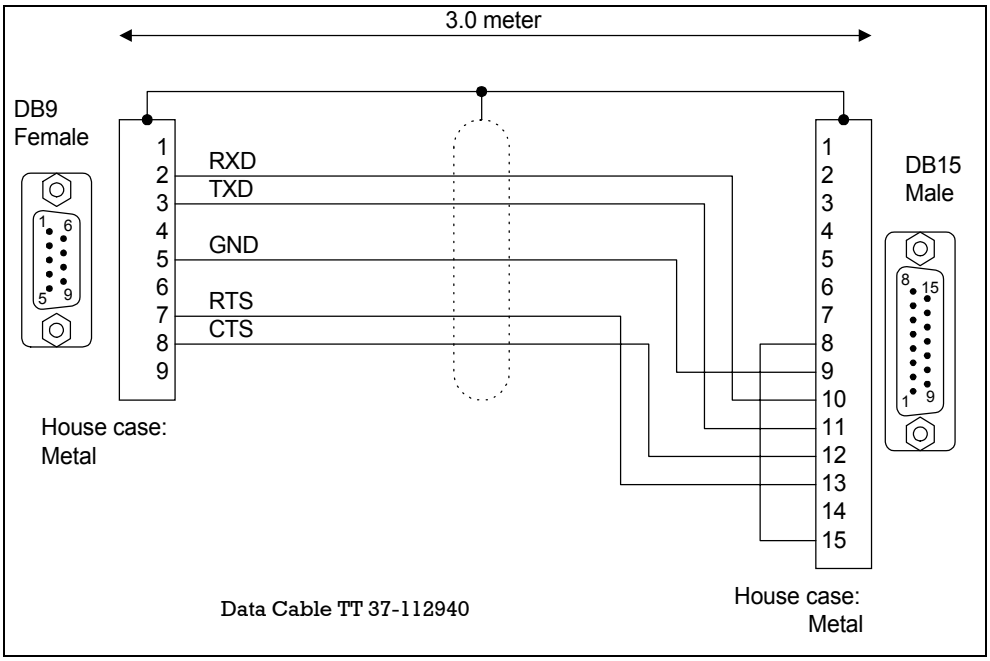
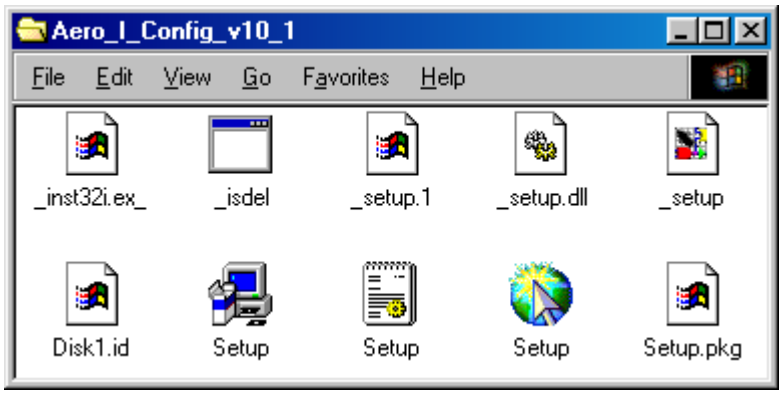


Figure 54, Interconnection of PC and SDU with Data Cable TT 37-112940

8.1.4 Loading TT-10228A TT-5000 Series Aero-I Configuration Utilities.

To install the Configuration Utilities program onto a PC, insert program disk no. 1 into 3½ inch drive and view windows. Start the installation wizard by double clicking the setup icon.

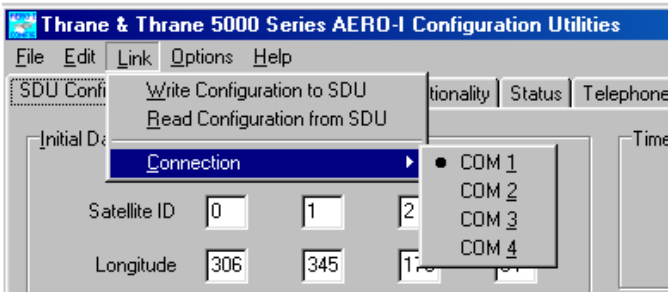


When installation is complete, the start menu will contain an entry from where the Configuration Utilities can be launched.

8.1.5 Communication with SDU

The correct Com_port must be choosed to enable communication between the PC and Aero-I SDU. (COM 1 is the default Com_port)

1. **Select the "Link" pull down menu from the menu bar.**



2. **Then select the "Connection" menu option from the Link pull down menu.**
3. **Now select the used COM-port for communication (Com 1-4).**

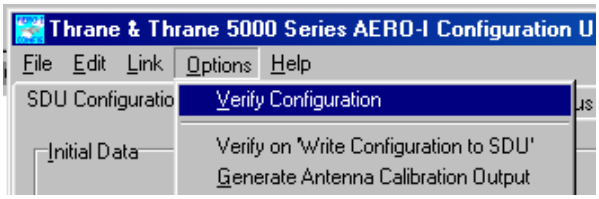
8.1.6 Verify Configuration.

To upload the operational parameters from the Configuration Utilities to configure the SDU:

Before uploading data to the SDU, the Configuration Utilities can verify if the configuration data is setup properly.

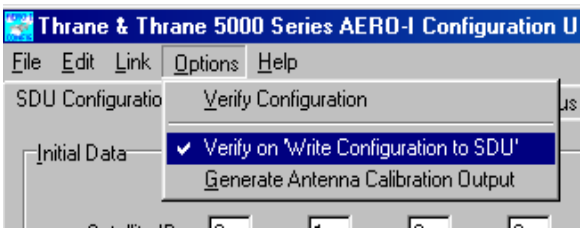
The verification of the configuration can be done in two ways.

1. Manually verify the Aero-I Configuration.



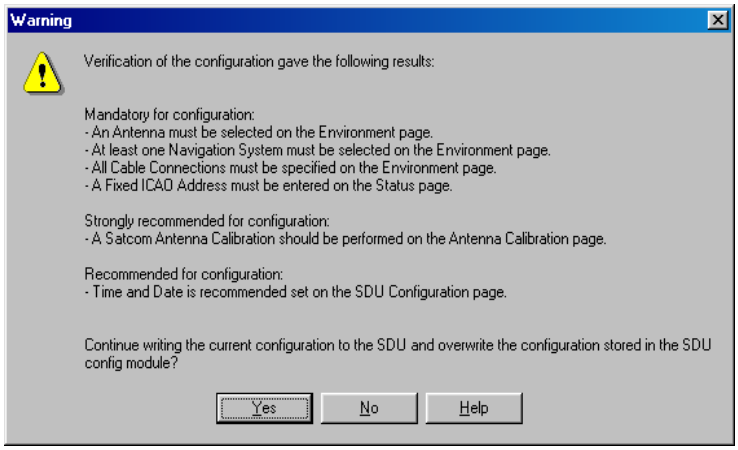
The SDU configuration is manually verified by selecting the "Verify Configuration" field in the Options pull-down menu.

2. Verify on "Write Configuration to SDU" (default).

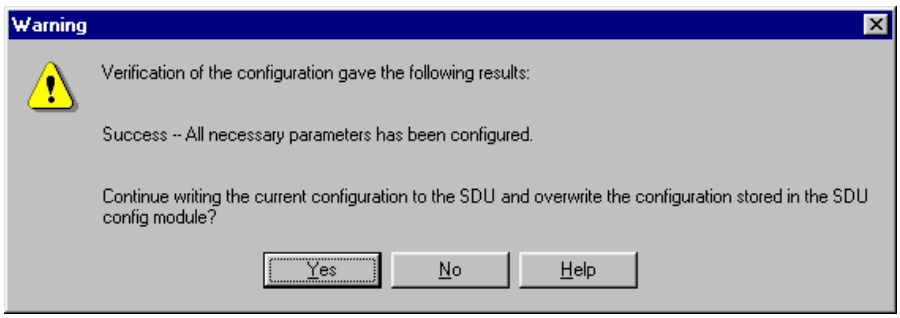


The Verify on "Write configuration to SDU" field should be checked (default), if a verification should be performed automatically before writing data to the SDU.

- Result of incomplete setup verification.



- Result of successful setup verification.



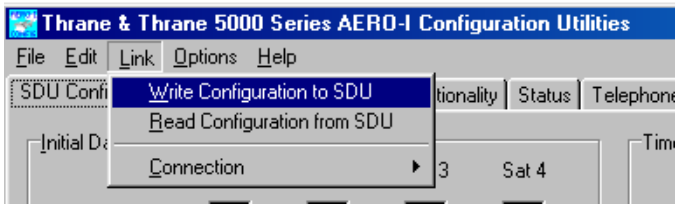
8.1.7 Writing To SDU

NOTE.

Before writing data to the SDU a new system verification should be made. Mandatory and Strongly Recommended items should be corrected in the configuration Utilities before writing the new configuration data to the SDU.

The SDU writing

1. **Select the "Link" pull down menu from the menu bar.**



2. **Select the "Write Configuration to SDU" menu option from the link pull down menu.**

   When ready to write the configuration parameters, press "Yes" for overwriting the existing configuration software in the SDU.

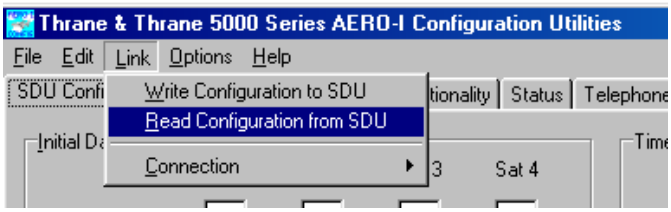
   The "Checking Mirror/SDU versions" progress window will appear and show progress to 100%.
   The "Writing Data To SDU" progress window will then appear and monitor progress to 100%.

3. **When successfully completed, an information box will appear "All Data Written successfully to the SDU", press OK to continue.**
4. **SDU now needs to be reset for use of the new configuration.**

8.1.8 Reading From SDU

To read the current configuration from the SDU to the Configuration Utilities:

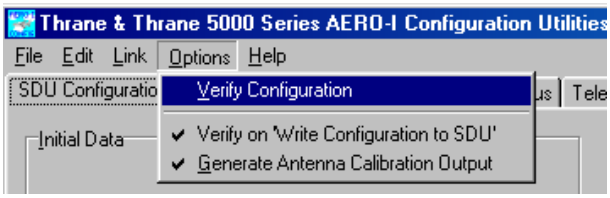
1. **Select the Link pull down menu on the menu bar.**



2. **Select the "Read Configuration from SDU" menu option on the pull down menu.**
   The "Checking Mirror/SDU versions" progress window will appear and show progress to 100%.
   The "Reading Data from SDU" progress window will then appear and monitor progress to 100%.
3. **When successfully completed, an information box will appear "Data Read successfully from the SDU", press OK to continue.**

8.1.9 Option Menu

The option menu consists of three fields.



1. Verify Configuration

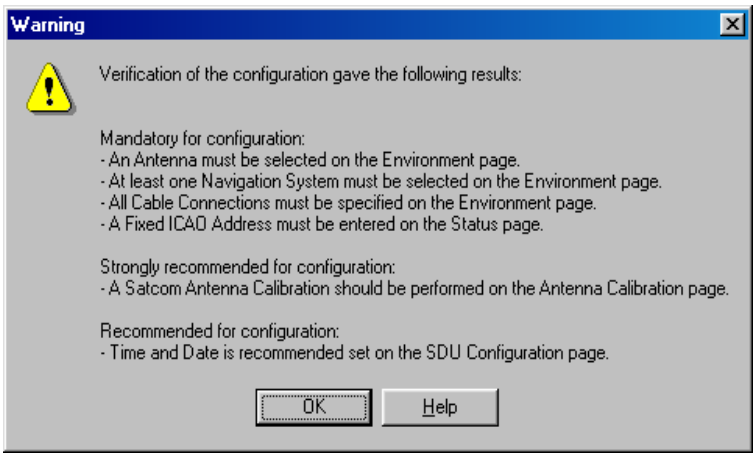


Figure 55, Verification of configuration.

When activating the Verify Configuration field, system verification is made; result of the verification is listed in the Warning Box.(Figure 55)

2. "Verify on Write configuration to SDU" field non-checked.

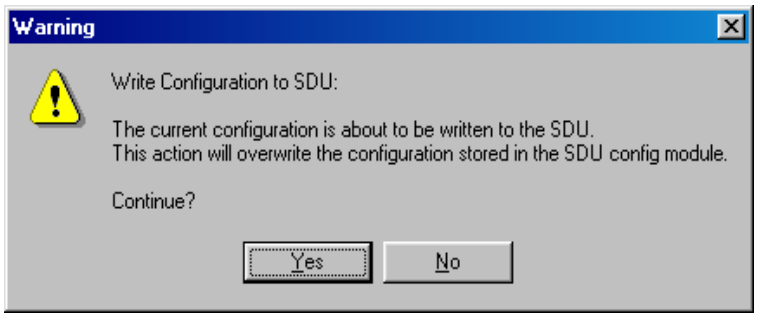


Figure 56, Simple warning before writing data to SDU.

If the "Verify on Write configuration to SDU" field is non-checked, the user only gets a simple warning before writing the new configuration to the SDU. (Figure 56).

- Verify on "Write configuration to SDU Field checked

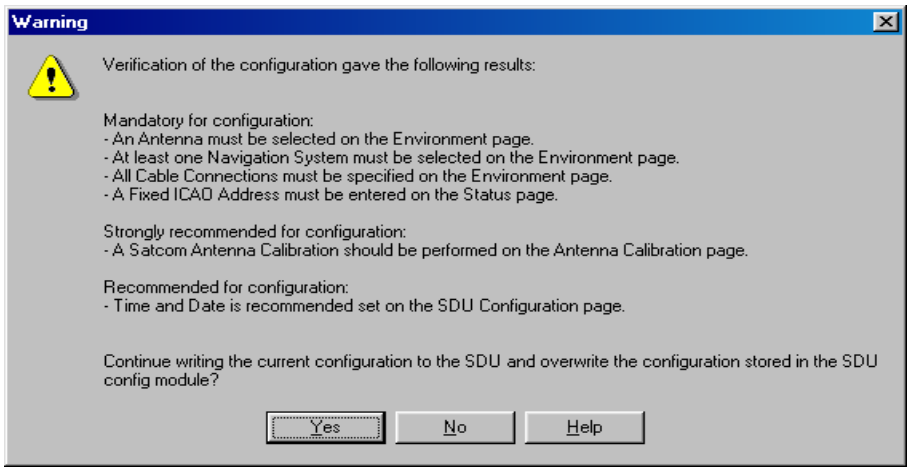


Figure 57, Result of an incomplete configuration.

When the "Verify on Write configuration to SDU" field is checked, a configuration verification is made before writing data to the SDU. Result of the verification is listed in the warning box (Figure 57).

3. Generate Antenna Calibration Output.

   When checked, the user will be prompted for an output file name before starting an antenna calibration. If a valid file name is entered, the file will contain all data collected from the antenna during the calibration (may be used for support etc.).

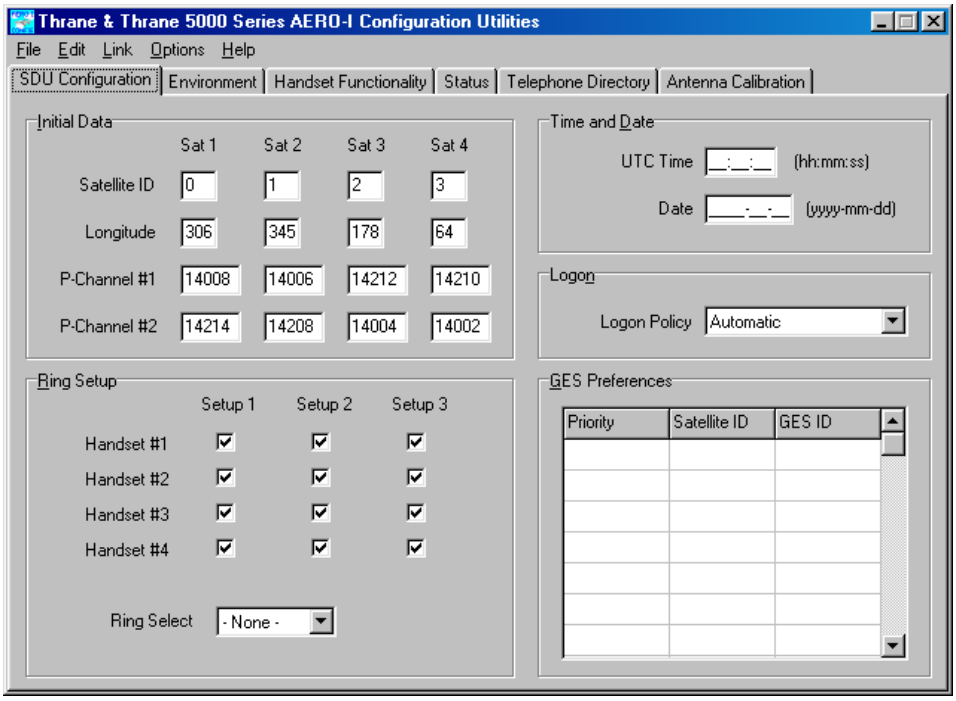
8.2 SDU Configuration

The TT-5000 Series Aero-I Configuration Utilities is the main interface for configuring the TT-5000 Aero-I system. The program allows configuration of the Aero-I to best suit the application and to store and retrieve saved configurations. The Configuration Utilities utilities is the only means to load a desired configuration to the write protected memory of the configuration module.

The Configuration Utilities is divided into six sections. The following sections will describe in detail the variables, parameters, and required data.

NOTE:
All sections can be configured OFF-LINE (computer not connected) except Antenna Calibration. When performing an Antenna Calibration a PC running the Configuration Utilities must be connected to the X1 maintenance connector.

8.2.1 SDU Configuration tab



SDU Configuration Tab Illustration

The SDU Configuration tab consists of five fields. (Field shortcut: Alt+ letter).

1. Initial Data
2. Ring Setup
3. Time and Date
4. Logon
5. GES Preferences

1. Initial Data

Data in this field is necessary as search data for finding a satellite for initial log on. First the specific satellite is located, then the satellite is acquired and information regarding other satellites is downloaded.

NOTE:
There are four parameters required for satellite identification. To ensure proper operation of the Aero-I system, use default settings-DO NOT CHANGE.

(a) Satellite ID

Identification number for a specific satellite.

(b) Longitude

Number of degrees longitude for satellite position.

NOTE:

Longitude is expressed in Degrees of Longitude East of the Prime Meridian. For example:
306° = 54°W
345° = 15°W
(Latitude = Equator (not listed)).

(c) P-Channel #1

The channel (frequency) the satellite is transmitting on. This parameter must be identified before the satellite can be acquired.

The channel (frequency) the satellite is transmitting on. This parameter must be identified before the satellite can be acquired.

2. Ring Setup

(d) P-Channel #2

This field regulates whether or not a specific handset has audible ring on an incoming call to the Aero-I Systems main number. Any combination of the handsets can have the audible ringing turned on or off. There are three setups to configure. In the SDU Configuration Tab Illustration -None- is selected for ring select. The check marks under each setup indicate which handsets will ring on an incoming call.

To select a Ring Select:

(a) Click on the Ring Select drop-down list.
(b) Select Setup 1, Setup 2, or Setup 3.

To configure a Setup:

Click on the corresponding handset checkbox in the desired Setup.

NOTE:
If "None" is selected in the "ring select" drop down list, then all handsets will ring on incoming calls.

3. Time and Date

This field is for setting the internal SDU real time clock. UTC (GMT) time and date is the only entry in this field. Setting time and date is not a mandatory for operation.

NOTE:
When a satellite has been acquired and locked, the Aero-I will automatically update the UTC Time and Date.

4. Logon

This field is necessary for how the Aero-I system initially acquires the satellite.

The Logon field consists of one entry, Logon Policy. Logon Policy is a drop-down list with two possible entries. In the SDU Configuration Tab Illustration, Logon Policy has been set to Automatic.

NOTE:
Use Default Setting Automatic. Change only with special arrangement with service provider or route planning.

(a) User Command

The AES (Airborne Earth Station) will power up, but not attempt to logon to a GES (Ground Earth Station) before being enabled by user command through the handset (for route planning).

(b) Automatic

Automatic is the default setting. The AES will acquire and logon to the most suitable satellite from the GES list. This may or may not be the satellite with best priority.

5. GES Preferences

NOTE:
Optional entry, Service provider will establish settings.

In this field the user can make a priority listing of GES stations known to be in service. The Aero-I system will choose a GES, starting with top priority, until an available satellite is found. The highest priority is 99, while the lowest is 1. Up to 20 priority GES can be made. This is not a mandatory entry.

8.2.2 Environment tab

This tab contains the information pertaining to components contained outside the SDU processor such as handsets, antenna, and cables.

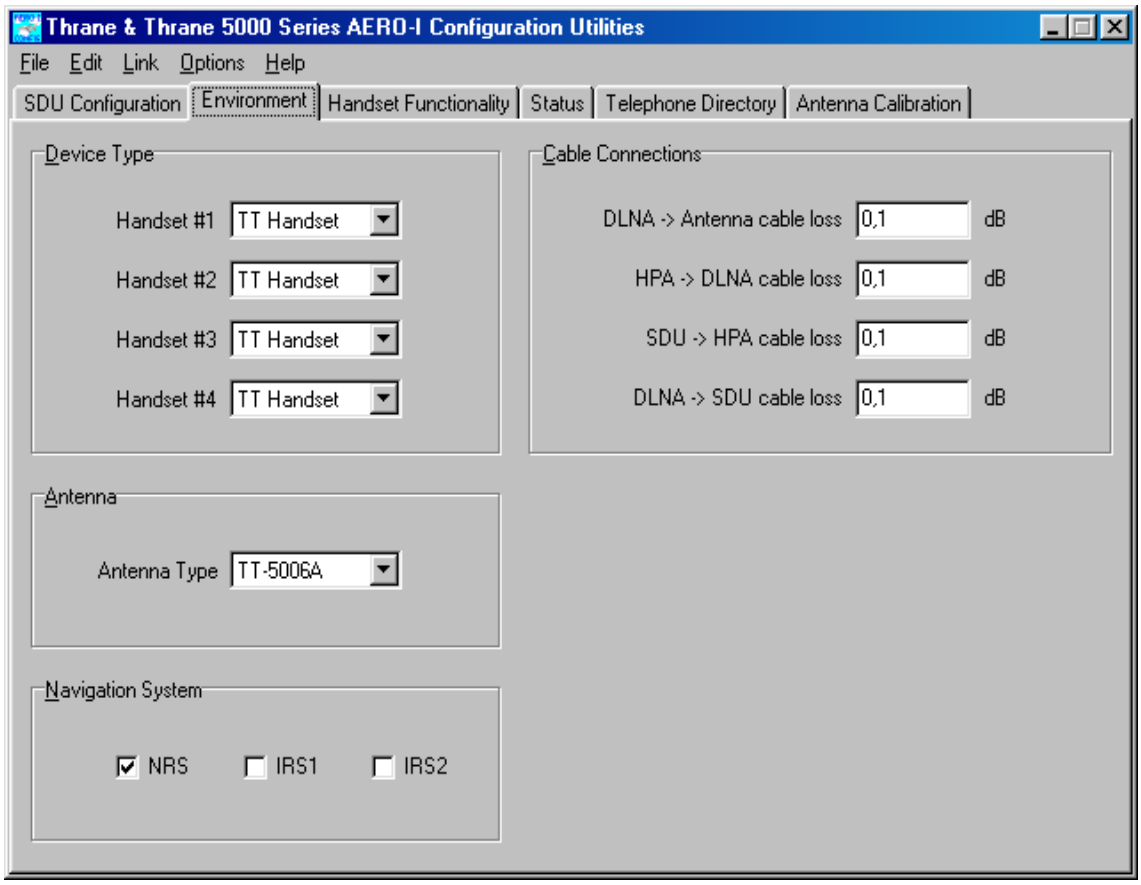


Figure 58, Environment Tab Illustration

The Environment tab consists of four fields.

1. Device Type
2. Navigation System
3. Antenna Type
4. Cable Connections

1. Device Type

Entries in this field select the communication devices used by the Aero-I. There are four communication channels: Handsets #1-#4 .

(a) Handset #1-Handset #4

Handset channels #1-#4 can be configured to use one of four devices.

1. TT Handset
2. WH10
3. Cockpit head
4. Magnastar (Only handset #1 and #2)

   -None-

To select a device, choose the drop-down list for the applicable channel and select the desired device. TT handset and WH10 is automatically detected by the SDU. In the Environment Tab Illustration, as an example all four devices have been selected.

2. Navigation System

The entry in this field selects the navigation system used. The user has three choices:

1. NRS
2. IRS1
3. IRS2

If an NRS antenna is used select NRS. If both NRS and IRS are selected, then IRS will automatically be the primary source and NRS will be secondary. If two IRS systems are supported then the NRS will be the third choice of information.

NOTE:
These settings are default not selected. Failure to configure these settings will effect the Aero-I system operation.

NOTE:
If the Aero-I is only using IRS as the Navigation System, then the SDU will receive Time and Date data from the IRS system.

Functions related to specific inputs and outputs:

The SDU will automatically switch from reference system, according to the presence of IRS#1, IRS#2 and NRS in the configuration parameters, the validity of information received from the reference systems, and the priority between the reference system. If one device is no longer active, in the next 10 seconds following the de-activation of the current source, the SDU will switch to the next available source.

Devices active	RS present in configuration	IRS#1,IRS#2,NRS	IRS#1,IRS#2	IRS#1,NRS	IRS#1	IRS#2,NRS	IRS#2	NRS	No RS configured
IRS#1, IRS#2, NRS		IRS#1 or IRS#2	IRS#1 or IRS#2	IRS#1	IRS#1	IRS#2	IRS#2	NRS	
IRS#1,IRS#2		IRS#1 or IRS#2	IRS#1 or IRS#2	IRS#1	IRS#1	IRS#2	IRS#2		
IRS#1,NRS		IRS#1	IRS#1	IRS#1	IRS#1	NRS		NRS	
IRS#1		IRS#1	IRS#1	IRS#1	IRS#1				
IRS#2,NRS		IRS#2	IRS#2	NRS		IRS#2	IRS#2	NRS	
IRS#2		IRS#2	IRS#2			IRS#2	IRS#2		
NRS		NRS		NRS		NRS		NRS	
No device active									

Sources of Reference System (RS) information by the SDU according to configuration parameters and presence of RS.

3. Antenna Type

Entry in this section is to select the type of antenna in use with the Aero-I system. To select the antenna in use, select the Antenna Type drop-down list and select one of the three configurations.

TT-5002A/B (use this entry for both antenna types TT-5002A and TT-5002B)

TT-5004A

TT-5006A

-None-

NOTE:

Antenna Type is default –None-. If an antenna is used, this field must be configured to the appropriate configuration to ensure proper operation.

4. Cable Connection

Entries in this field are for setting the cable attenuation (dB loss). The attenuation is found by measuring the cable length then multiplying the cable length by the attenuation per feet. To ensure accurate calculations, remember to include connector loss (PIC connectors are nominally .05dB per connector), and cable attenuation is given in dB per 100ft, it is necessary to divide the cable attenuation by 100 to calculate attenuation per feet.

All four of the cable losses must be entered to ensure proper operation of the Aero-I system (see the help file in Aero-I Configuration Utilities). The cable losses is compensated by increasing HPA output power and RX gain.

8.2.3 Handset Functionality tab

This tab contains the information regarding the display and operating condition for the handsets such as display modes, ringing modes, and restrictive conditions for dialing and access.

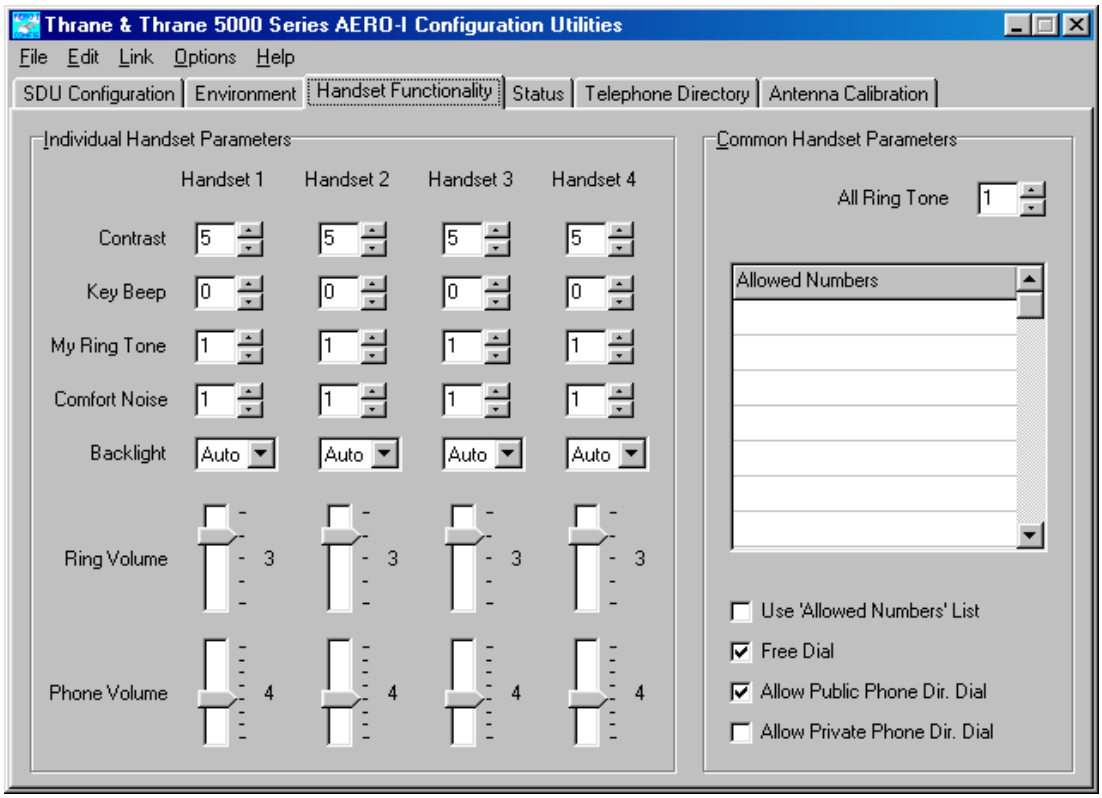


Figure 59, Handset Functionality Tab Illustration

The Handset Functionality tab consists of two fields.

1. Individual Handset Parameters
2. Common Handset Parameters

1. Individual Handset Parameters

Entries in this field control the different configurations of display and ringing for connected handsets. To set the configuration for a handset, select the desired handset column, and set the parameters to desired setting.

(a) Contrast

Changes the handset display contrast level. The Contrast levels range from 1 to 8, with 8 being the highest level of contrast.

To adjust Contrast level, click either the up or down arrow of the spin box to adjust the contrast level up or down one step.

(b) Backlight (Keypad Light)

Turns the handset Backlight (Keypad light) either On, Off, or in Auto.

To turn On, click the down arrow of the backlight drop-down list and select "On".

To turn Off, click the down arrow of the backlight drop-down list and select "Off".

To turn Auto (default), click the down arrow of the backlight drop-down list and select "Auto".

In the Backlight drop-down list the user have following options.

0. Off, no light in the display.
1. On, light in the display is always active.
2. Auto, light in the display is activated on event.

If backlight is set to "Auto", following events will activate the handset light.

- Handset is off cradle. (backlight will remain on until the handset is placed back in the cradle).
- Incomming call. (Backlight active until the call is suspended)
- Key is pressed (light only activ for 15 sec.)

NOTE:

Option 2, Auto, is only available for SDU software 10.8 or newer.

(c) Key Beep

Adjusts the volume level of the tone made when handset keys are pressed. Key Beep is default "0". Volume level ranges from 0 to 4, "0" being Off (No sound) and "4" being max volume.

To turn On and adjust volume, click the up arrow of the spin box to set to 1 to 4.

To turn Off, click the down arrow of the spin box to set to "0".

(d) My Ring Tone

Selects the Ring Tone generated when an incoming call is received to the handset. Ring Tone is default "1". There are eight ring tone settings, ranging from 1 to 8.

To adjust My Ring Tone, click either the up or down arrow of the spin box to adjust the setting up or down one step.

(e) Comfort Noise

Adjusts the background noise. Because transmission is digital, there is no audible background noise. Comfort Noise is the term given to the option of adding background noise in order to give the listener the "accustomed comfort" of background noise. Comfort Noise setting is default "1". Comfort Noise volume settings range from 0 to 3, "0" being Off and "3" being max volume.

(f) Ring Volume

Adjusts the volume level of the ring tone. Ring Volume is default "3". Volume level ranges from 0 to 4, "0" being Off (No sound) and "4" being max volume.

To adjust Ring Volume, Grab the slide (on the volume slide control) and move up or down the scale to the desired setting.

(g) Phone Volume

Entry in this field is for default speaker volume when the handset is off the hook or on system power-up. The handsets have an adjustment on the side for further adjustment of this property on each individual incoming call. Phone Volume is default "4". Phone Volume ranges from 1 to 8, "8" being max volume.

To adjust Phone Volume, Grab the slide (on the volume slide control) and move up or down the scale to the desired setting.

2. Common Handset Parameters

(a) All Ring Tone

Selects the Ring Tone generated in each handset, when an incoming call is received to the main number that is directed to all handsets. All Ring Tone is default "1". There are eight all ring tone settings, ranging from 1 to 8.

To adjust All Ring Tone, click either the up or down arrow of the spin box to adjust the setting up or down one step.

(b) Allowed Numbers

This field lists restrictions in reference to numbers that can be dialed. If enabled only calls to numbers start with one of the numbers listed in this field will be permitted.

(d) Use 'Allowed Numbers' List

Enables or Disables Allowed Numbers list. This setting is default disabled. To enable click the Use 'Allowed Numbers' List checkbox.

(c) Free Dial

Allows the user to dial any number. Free Dial is default activated. If deactivated, the user may only make local calls or calls using the entries in the Phone Directories (If access is granted).

To disable click the Free Dial checkbox.

NOTE:
All calls are restricted to Allowed Numbers if Use 'Allowed Numbers' List is activated.

(e) Phone Directory Dial

Allows user to make calls using entries in the public phone directory. If disabled the user will not have access to the phone directory. Phone directory dial is default activated.

(f) Private Phone Dir. Dial

To disable click the Free Dial checkbox.

Allows user to make calls using entries in the private phone directory. If disabled the user will not have access to the private phone directory. Private phone directory dial is default deactivated.

To enable, click the Private Phone Directory Dial checkbox.

8.2.4 Status tab

This tab consists mainly of read only information regarding software and hardware versions. There is some data that must be entered regarding the aircraft.

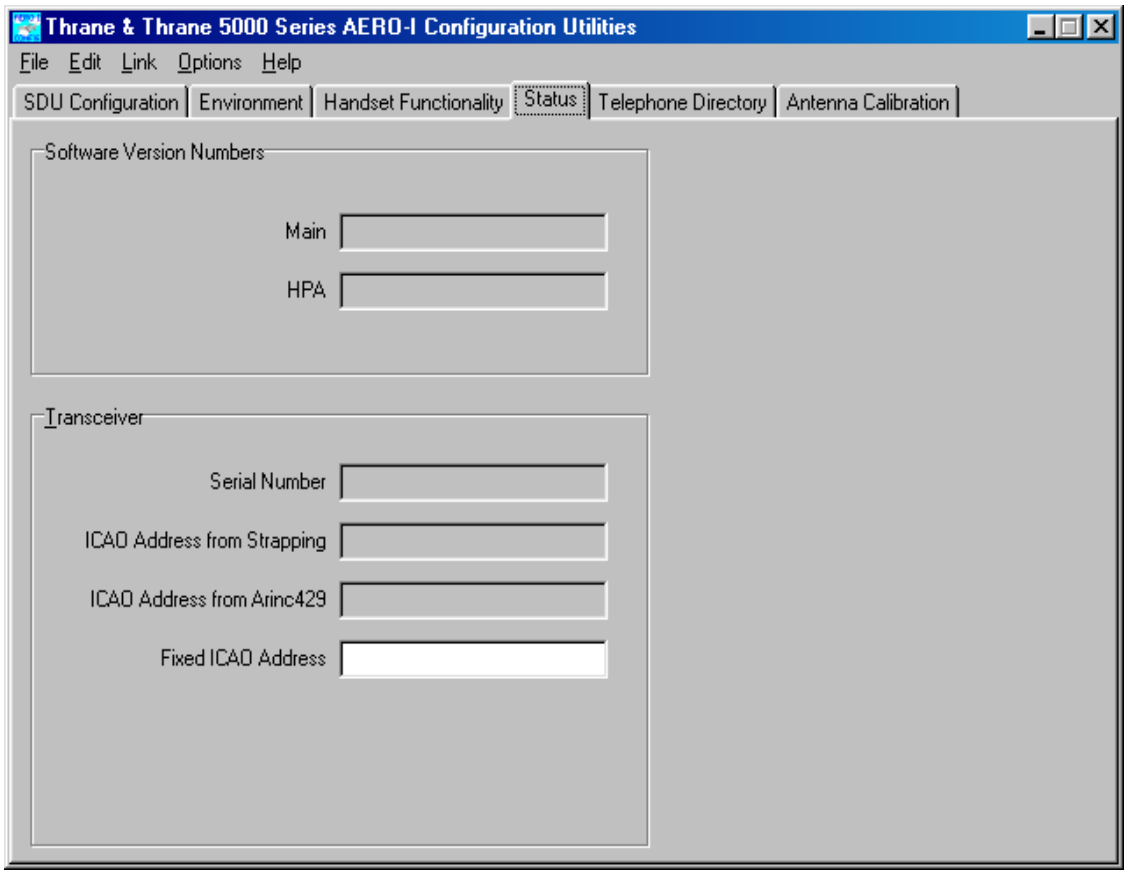


Figure 60, Status Tab Illustration

The Status tab consists of two fields.

1. Software Version Numbers
2. Transceiver

1. Software Version Numbers

This field consists of two read-only boxes.

(a) Main

This section refers to the processor dealing with telecommunication. Software Version Number of this unit will be entered here.

(b) HPA

This section refers to the High Power Amplifier that is in use to amplify TX signal. Software Version Number of this unit will be entered here.

2. Transceiver

This window consists of three read-only fields and one editable field, all fields refer to the serial numbers for the hardware as well as the aircraft.

(a) Serial Number

The transceiver is actually the SDU, which is made up of the PBX and main processors. The Serial Number for this is on the unit itself.

(b) ICAO Address from Strapping

Displays the ICAO address calculated from hardware strapping.

(c) ICAO Address from Arinc429

Displays the ICAO address received from Arinc429 bus.

(d) Fixed ICAO Address

ICAO Address that is stored in the Configuration Module. If this ICAO address does not match the ICAO address sensed from hardware strapping or Arinc429 the Aero-I system will not allow the user to activate the system.

8.2.5 Telephone Directory tab

This tab contains both the public and private telephone directories. The access of both is regulated through PIN codes in the handset.

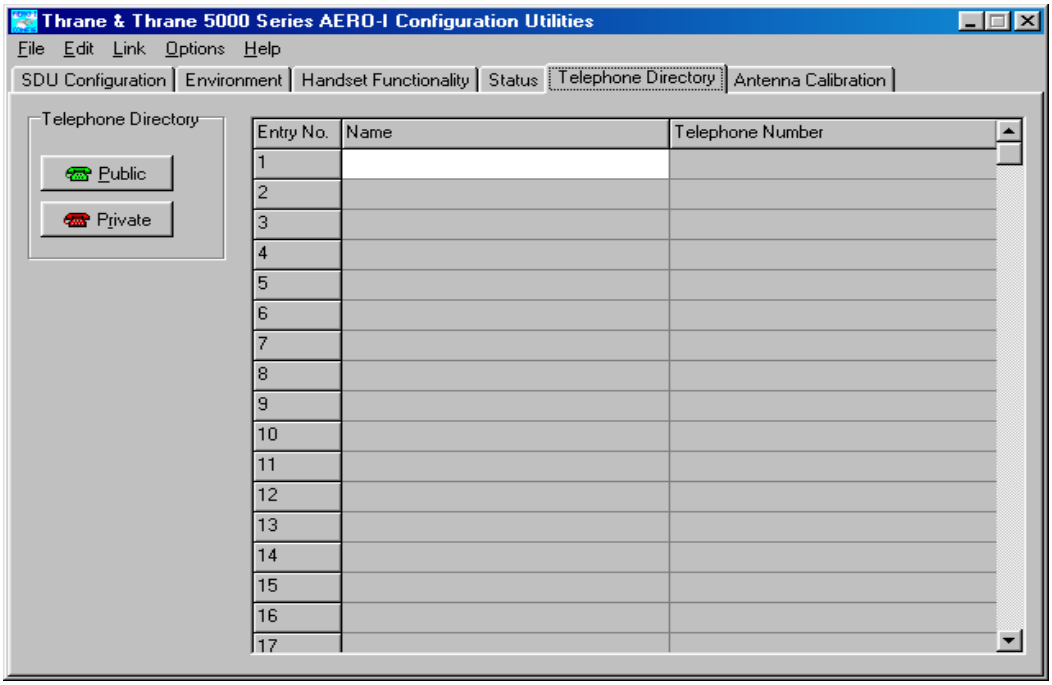


Figure 61, Telephone Directory Tab Illustration

The telephone directories are designed to allow for the input of 99 entries. Each entry is a listing which consists of a name (up to 18 characters) and a corresponding digit set (up to 18 characters). The name and corresponding number can be accessed by name or number input.

- Following entry formats should be used.

  Name : The chraracters (a-z, A-Z, 0-9, ?!,.'''$()+/ and space)

  Number : Digits or asterisks (*)

If a name is specified, a corresponding number must be entered.

The two directories are shared by all handsets. There are two types of directories.

(a) Public directory

When using the public directory, the entered telephone numbers are accessible to anyone. There is no Pin-code assigned to restrict accessibility. The directory consists of 99 directory spaces. Each space consists of a short code, a name, and phone number.

(b) Private directory

When using the private directory, the entered telephone numbers are restricted to users who know the pin-code assigned to the system. The directory consists of 99 directory spaces. Each space consists of a short code, a name, and phone number.

8.2.6 Antenna Calibration tab

The Antenna Calibration tab is used to calibrate the Satcom and NRS antennas used with the TT-5000 Series Aero-I Satcom System. Setting these parameters to the correct values helps the SDU to use the antennas in a more efficient way. The calibration is essential for the SDU to operate properly.

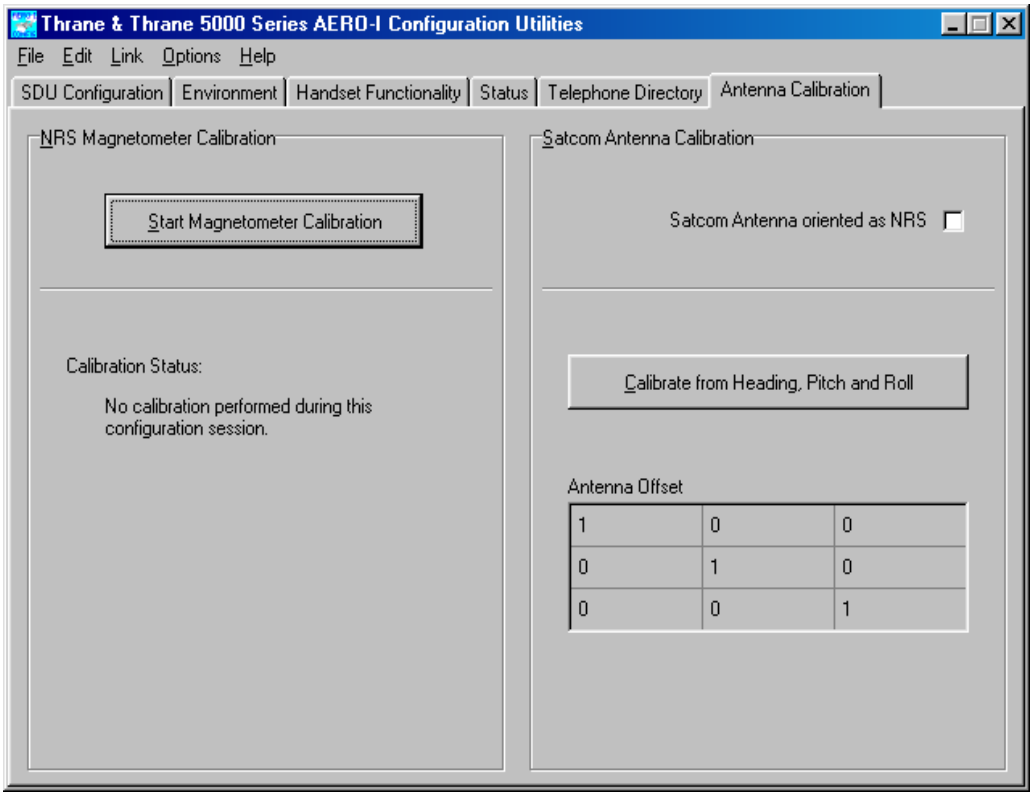


Figure 62, Antenna Calibration Tab Illustration

Antenna Calibration tab consists of two fields.

1. NRS Magnetometer Calibration
2. Satcom Antenna Calibration

1. NRS Magnetometer Calibration

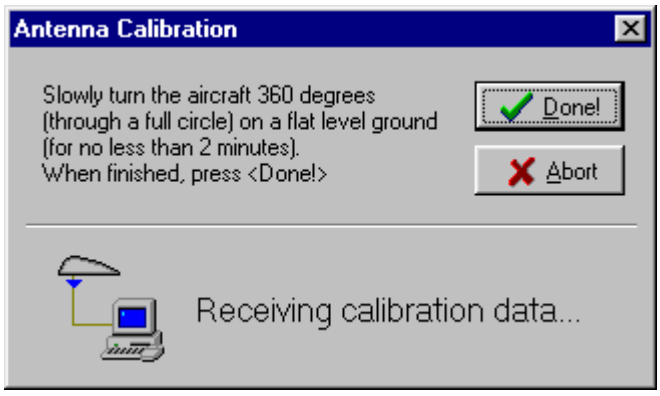
Magnetometer Calibration allows the user to calibrate the NRS-antenna to take into consideration any magnetic fields in close proximity that may affect antenna operation. These magnetic fields may influence and lead to faulty measurements of the magnetic earth field, which is necessary information to the system for steering the Satcom antenna element.

The Magnetometer Calibration procedure measure and calculate the values for:

- Soft-Iron Compensation
- Hard-Iron Compensation
- NRS Orientation Compensation

In most cases the Antenna Calibration Parameters will not be available, so an NRS Magnetometer Calibration must be performed. This is performed by pressing the "Start Magnetometer Calibration" button.

During the Calibration process data is collected by the NRS antenna and sent to the configuration program through the SDU. When the 360 degrees turn is done, the user is supposed to press <Done> in the dialog box, after which the program will calculate the calibration parameters based on the collected data.



Note.

Please note that the turn should be at least a full circle of 360 degrees. An overshoot of e.g. 20 degrees is recommended.

- Succesfull Magnetometer Calibration.

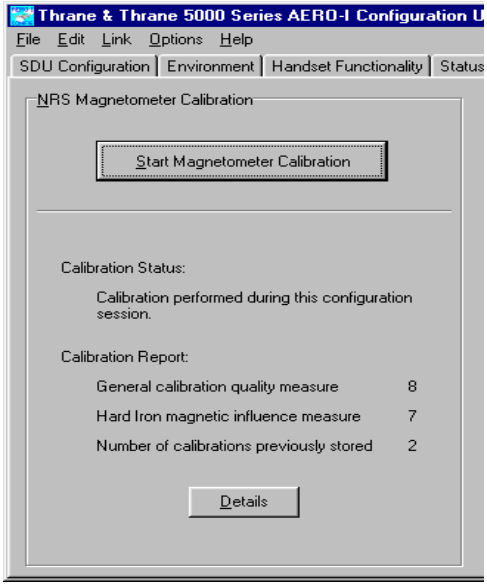


Figure 63, Succesfull Magnetometer Calibration Illustration.

When a calibration is succesfull, the text "Calibration performed during this configuration session" will apear in the Calibration Status field.

Results of the calibration session are listed in the Calibration Report field (Figure 63).

NOTE:

"Succesfull Calibration" only indicate that the calibration data could be calculated, not if the result was acceptable.
For the calibration to be of operative quality, the calibration results have to be above a certain level (see text below or Help file).

General calibration quality measure.

This measure gives an overall quality measure of the calibration. The results run from 9 (best) to 1 (worst) in the following way:

9: Best

8: Good

7: Marginal

6-1: Unacceptable: System must be recalibrated.

NOTE.
With a general calibration quality value of 6 or less, the system must be recalibrated

Hard Iron magnetic influence measure.

This measure indicates the interference as a percentage of the local magnetic field from <10% (best) to >90% (worst):

9: <10% Optimum

8: <20% Good

7: <30% Marginal

6: <40% Recalibrate

5: <50% Recalibrate

4: <60% Recalibrate

3: <70% Recalibrate

2: <80% Recalibrate

1: <90% Recalibrate

0: >90% Recalibrate

NOTE.

With a Hard Iron magnetic influence value of 6 or less, the system must be recalibrated.

For further information about the calibration, click the Details botton of the succesfull NRS magnetometer calibration (Figure 64).

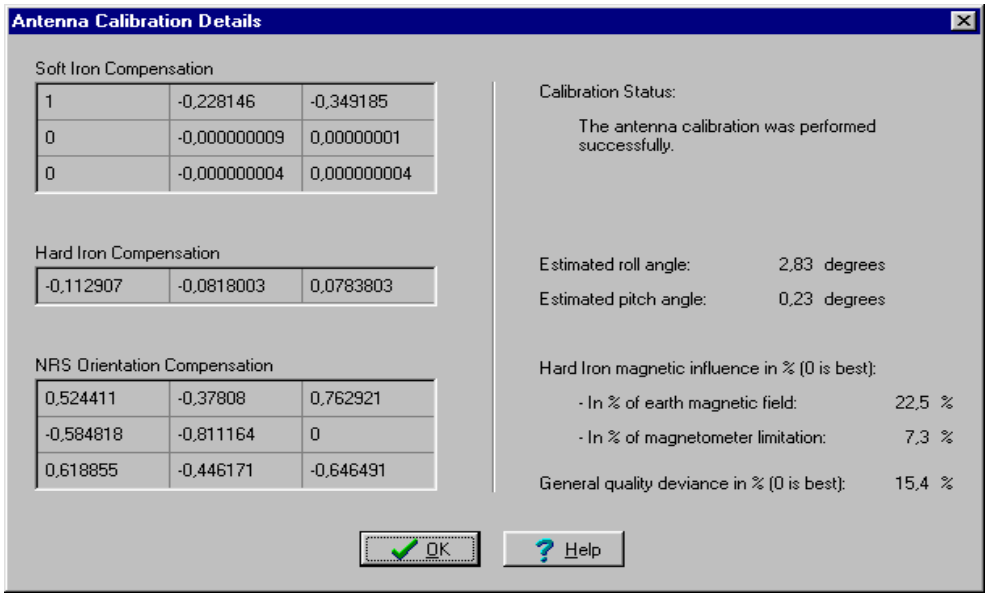


Figure 64, Details window from a succesfull magnetometer calibration.

3. Non succesfull Magnetometer calibration.

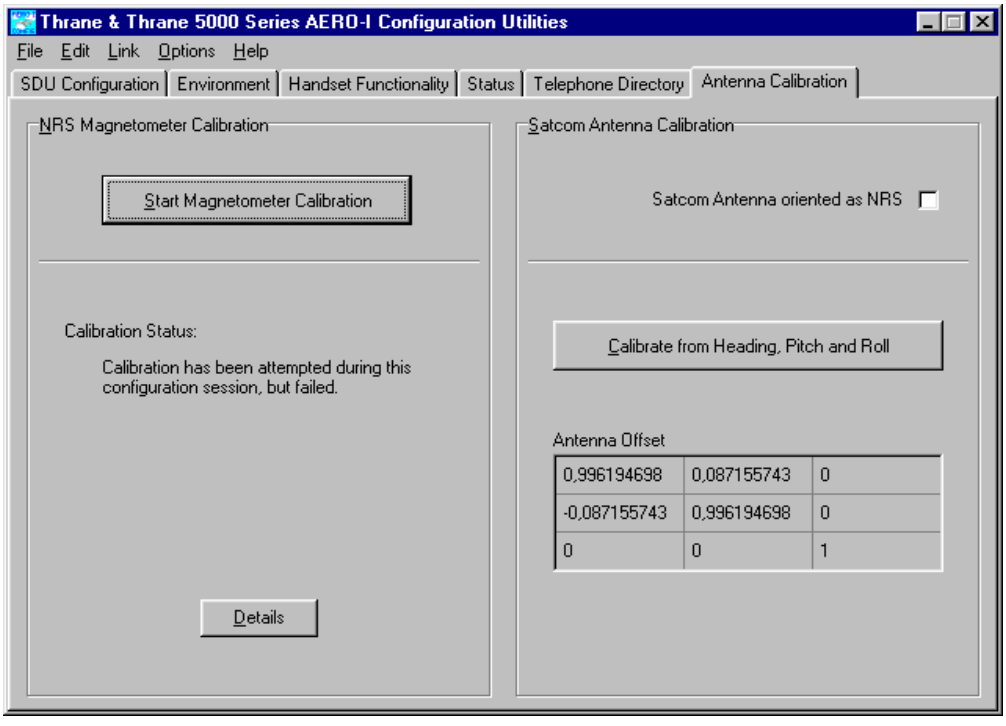


Figure 65, Non succesfull magnetometer calibration illustration.

If the Magnetometer calibration was non succesfull for some reason, the text "Calibration has been attempted during this configuration session, but failed" will apear in the Calibration Status field.

For further info about the non succesfull Magnetometer Calibration attempt, "Press the details botton".

In the example(Figure 66), the possible cause of the Magnetometer Calibration fail could be "NRS may be disconnected or is not functioning".

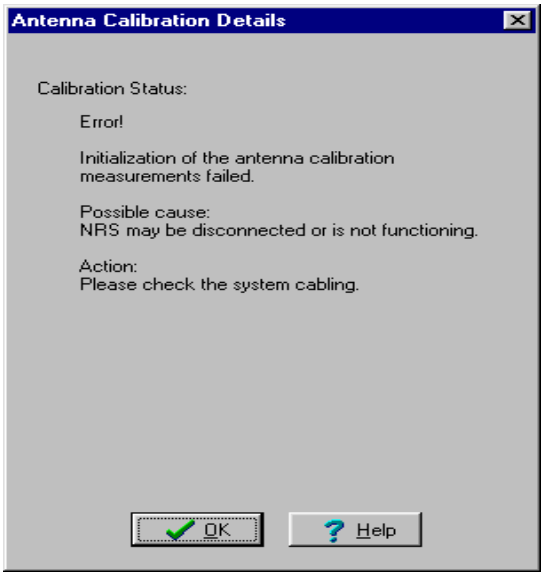
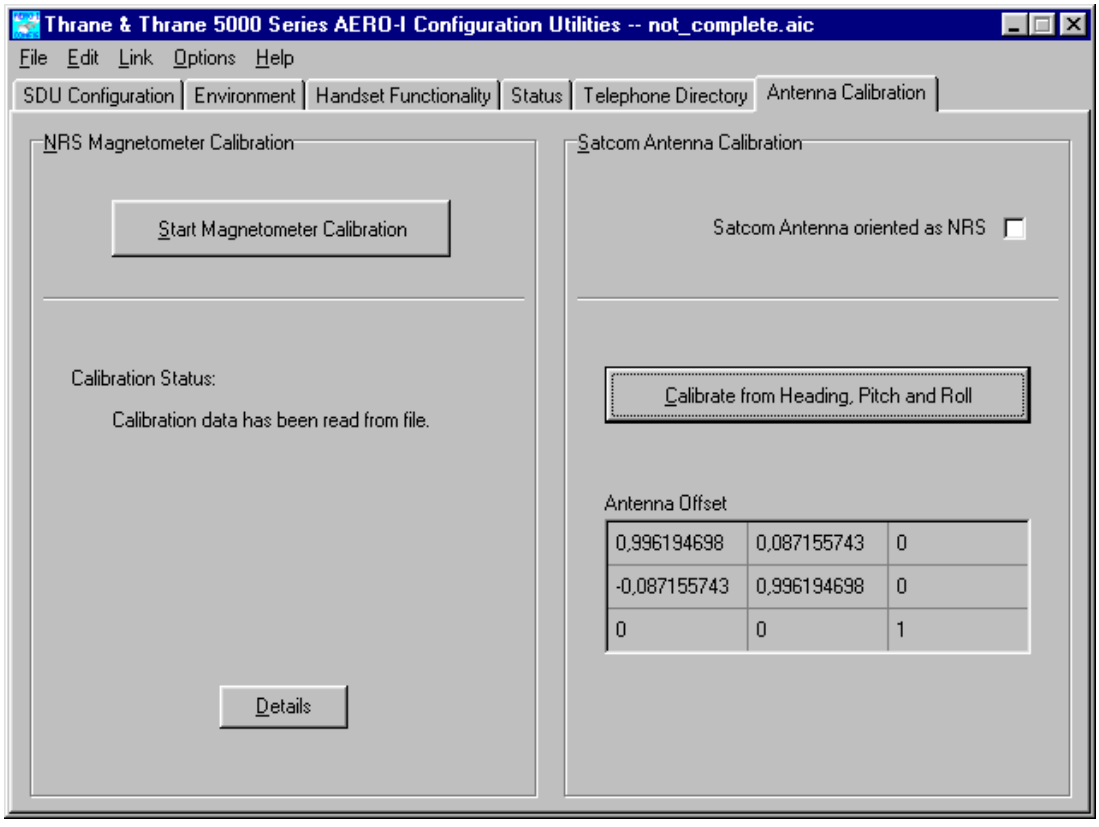


Figure 66, Details window from a Non succesfull magnetometer calibration.

2. Satcom Antenna Calibration

Satcom Antenna Calibration allows the user to calibrate the Satcom Antenna to take into consideration the heading, pitch, and roll offsets of the antenna(s) mounted on the aircraft.



The Antenna Calibration tab consists of 2 fields:

1. Satcom Antenna oriented as NRS
2. Calibrate from Heading, Pitch, and Roll.

1. Satcom Antenna oriented as NRS

Check this Checkbox if the Satcom antenna has the same mounting orientation (Heading, Pitch, and Roll offset) as the NRS antenna. This checkbox must always be checked when using the 5006A antenna.

2. Calibrate from Heading, Pitch, and Roll.

This allows the user to input the Satcom antenna mounting orientation. Offsets should be entered in **degrees ±**, using the aircraft co-ordinate system.

Heading degrees are positive clockwise, Pitch degrees are positive nose up, and Roll degrees are positive right wing down (flight direction).

NOTE.

Please consult antenna specifications for "maximum" heading, Roll, Pitch offset values.

The Satcom Antenna offset values are entered in the offset fields (Figure 67), the Antenna Offset parameters are then automatically calculated when pressing OK.

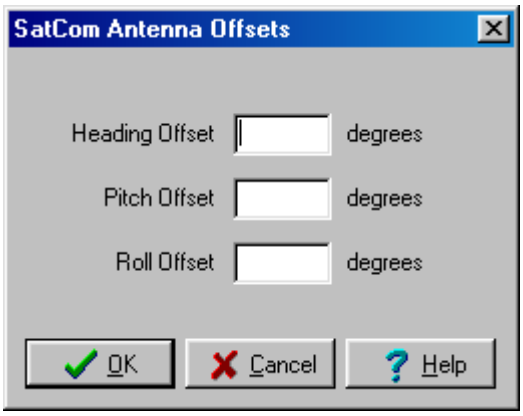


Figure 67, Satcom Antenna Offset field

9 Maintenance, Checkout, and Troubleshooting

9.1 General

The TT-5000 Aero-I System is comprised of four main components and one of two antenna configurations. All components are line replaceable units (LRU).

If any component is removed and replaced with a new or repaired unit, the following procedures should be followed.

9.2 Maintenance

9.2.1 TT-5033A Satellite Data Unit (SDU) w/o NRS and TT-5033A SDU with NRS

No scheduled maintenance is required for this component unless a problem or error is discovered.

NOTE:

If SDU is discovered to contain a fault, the configuration module must be removed, and retained with the aircraft, before returning the SDU for repair. The configuration module will need to be installed in the new or repaired SDU to configure to existing components.

9.2.2 TT-5010A High Power Amplifier (HPA)

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.2.3 TT-5012A Diplexer Low Noise Amplifier (DLNA)

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.2.4 TT-5620A Aero-I 4-wire Handset and TT-5622A 4-wire Handset Cradle

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.2.5 TT-5621B Aero-I 2-wire Handset and TT-5622B 2-wire Handset Cradle.

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.2.6 TT-5002A/B Mech. Steered Ant. Top or Tail Mount

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.2.7 TT-5004A Phased Array Satcom Antenna

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.2.8 TT-5006A Mechanical Steered Satcom Antenna with built in NRS

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.2.9 TT-5008A NRS Antenna

No scheduled maintenance is required for this component unless a problem or error is discovered.

9.3 Functional Test

The TT-5000 Aero-I System has an internal BITE test that is activated upon power-up or by pressing the test switch on the front of the SDU. The Built in Test Equipment (BITE) gives historical data for maintenance and diagnosis of all LRUs in the system. The Aero-I system utilizes LED's on the SDU, Handset, and Displays to indicate system status and current operating modes. Any errors that occur will be indicated on the Handset display and the SDU front panel BITE Code display.

9.3.1 BITE Test

The BITE display on the front panel is a green two-digit seven-segment display with two decimal points.

The front panel is provided with three LED's for:

- Power (Green)
- Logon (Green)
- Fail/Pass (two-color Red/Green)

The two-color LED is Red for Fail and Green for Pass. All LED's flash during the self-test. (Minimum of 20 sec to completion of test). The two-color LED can appear both red and green at the same time but it is actually alternating.

If an error occurs the SDU will generate a BITE code and it will be displayed on the BITE Code Display and on the Handset display. The SDU will illuminate the red Fail/Pass LED on the SDU Front Panel, and also the red Alarm LED on the Handset.

9.3.2 Handset Indicators

The Thrane & Thrane handset has colored LED's that are used to alert the user of the following indications (displayed left to right):

Green	Power Indicator
Red	Alarm (system error detected)
Yellow	Incoming Call (ringing)
Green	System is currently in sync with the communication satellite

9.4 Troubleshooting

The Aero-I System implements Built In Test Equipment (BITE) software that alerts the user to any errors that occur during operation. The Aero-I System will run a self-test when unit is powered up (POST) and will continue to monitor operation (CM). A self-test can be initiated at any time by pressing the test button on the SDU Front Panel (PAST).

If an error is detected upon power-up, self-test, or operation the Aero-I system will illuminate the Red Alarm LED on the handset and the Red Fail LED on the SDU. If this occurs the BITE test will list an error code on the BITE Display on the front panel of the SDU.

The BITE error codes are the primary means of troubleshooting the Aero-I system. If a failure occurs record the error code given in the BITE Display and/or seen in the Handset Display and translate using the BITE Error Code Identification table below.

9.4.1 Bite Error/warning definition:

BITE Warning:

Defined error level for a failure leading to system operational but some of the services might show minor reduced performances.

BITE Error:

Defined error level for a failure leading to system operational but some of the services might be unavailable or show noticeable reduced performances.

9.4.2 TT-5000 Series Aero-I Satcom System BITE Display Codes

Error ID	Description	Error type	CM/ POST	LRU
00	System is OK		POST	
01	Main CPU Boot CRC Fail	Error	POST	SDU
02	Main CPU BIOS + application CRC Fail	Error	POST	SDU
03	Main CPU UART Fail	Error	POST	SDU
04	Main CPU RAM Fail	Error	POST	SDU
05	PBX DSP software	Error	POST	SDU
06	PBX DSP hardware	Error	POST	SDU
07	Parameter block	Error	POST	SDU
08	Reserved for future use			
09	Configuration module	Error	POST	SDU
10	GPS module internal error	Error	POST	SDU
11	GPS timemark interrupt error	Error	CM	SDU
12	NRS TX	Error	POST	SDU/NRS
13	ICAO address	Error	POST	SDU
14	ARINC communication	Error	POST	SDU
15	Communication with HPA	Error	POST/CM	SDU/HPA
16	Communication with PBX	Error	POST/CM	SDU
17	PBX digital switch	Error	POST	SDU
18	PBX DSP	Error	POST	SDU
19	PBX parallel port	Error	POST	SDU
20	PBX codecs	Error	POST	SDU
21	PBX UARTs	Error	POST	SDU

Error ID	Description	Error type	CM/ POST	LRU
22	PBX Hook switch	Error	POST	SDU
23	PBX WH-10 ringer signal + codec	Error	POST	SDU
24	PBX SLICs	Error	POST	SDU
25	PBX 4-wire audio testing	Error	POST	SDU
26	PBX PCM bus interface to C-channel boards	Error	POST	SDU
27	PBX PCM bus accuracy	Error	POST	SDU
28	Main DSP software	Error	POST	SDU
29	Main DSP hardware	Error	POST	SDU
30	RF Mainboard PLL test	Error	POST/CM	SDU
31	RF C-channel board 1 PLL test	Error	POST/CM	SDU
32	RF C-channel board 2 PLL test	Error	POST/CM	SDU
33	RF Mainboard on/off test	Error	POST	SDU
34	RF C-channel board 1 on/off test	Error	POST	SDU
35	RF C-channel board 2 on/off test	Error	POST	SDU
36	RF Mainboard sweep test	Error	POST	SDU
37	RF C-channel board 1 sweep test	Error	POST	SDU
38	RF C-channel board 2 sweep test	Error	POST	SDU
39	RF Mainboard AGC/ALC test	Error	POST	SDU
40	RF C-channel board 1 AGC/ALC test	Error	POST	SDU
41	RF C-channel board 2 AGC/ALC test	Error	POST	SDU
42	BITE display failure	Warning	POST	SDU
43	Battery failure	Warning	POST	SDU
44	FPGA version	Warning	POST	SDU
45	PBX Power interrupt detect by Codec	Warning	CM	SDU
46	PBX Codec lost PCM synchronization	Warning	CM	SDU
47	Communication with GPS	Error	CM	SDU
48	Communication with NRS	Error	CM	SDU
49	NRS magnetic distortion	Error	CM	SDU/NRS
50	NRS Inclinometer out of range	Error	CM	SDU/NRS
51	NRS Magnetometer out of range	Error	CM	SDU/NRS
52	NRS internal error	Error	CM	SDU/NRS
53	NRS/IRS data valid	Error	CM	SDU/NRS/IRS
54	IRS1 unavailable	Error	CM	SDU/IRS1
55	IRS2 unavailable	Error	CM	SDU/IRS2
56	Control voltage ref. osc.	Error	CM	SDU
57	Control voltage ref. osc.	Warning	CM	SDU
58	DLNA current	Warning	CM	SDU/DLNA
59	NRS current	Warning	CM	SDU/NRS
60	RF Main board ALC level	Warning	CM	SDU
61	RF C-channel board 1 ALC levels	Warning	CM	SDU
62	RF C-channel board 2 ALC levels	Warning	CM	SDU
63	Software version check	Warning	POST	SDU
64	No connection to DLNA	Error	POST	RX SDU/DLNA
65	SDU to HPA cable cutoff	Error	CM	SDU/HPA
66	SDU to HPA cable shorted / Old HPA HW	Error	CM	SDU/HPA
67	NRS modem loop back failed	Error	CM	SDU/NRS
68	Maximum HPA output power reached.	Error	CM	HPA/SDU
69	Reserved for future use			
70-84	Antenna specific error ID's (see tables below)			
85-99	Stand alone specific error ID's (see tables below)			

9.4.3 Antenna specific BITE Display Codes

TT-5002A/B antenna specific error ID's:

Error ID	Description	Error type	CM/ POST	LRU
70	Reserved for future use			
71	Antenna temperature	Error	CM	Antenna
72	Antenna ROM	Error	POST	Antenna
73	Antenna RAM	Error	POST	Antenna
74	Antenna steering	Error	POST/CM	Antenna
75	Antenna any internal parameters	Error	POST	Antenna
76-84	Reserved for future use			

TT-5004A antenna specific error ID's:

Error ID	Description	Error type	CM/ POST	LRU
86	Antenna current high	Error	CM	Antenna/HPA
87	85V	Error	CM	Antenna/HPA
92	Antenna voltage	Warning	CM	Antenna/HPA

TT-5006A antenna (with built-in NRS) specific error ID's:

Error ID	Description	Error type	CM/ POST	LRU
70	Reserved for future use			
71	Inclinometer failure	Error	POST/CM	Antenna
72	Magnetometer failure	Error	POST/CM	Antenna
73	Motor failure	Error	POST/CM	Antenna
74	Motor thermal failure	Error	POST/CM	Antenna
75	End stop sensor failure	Error	POST/CM	Antenna
76	AAU FLASH memory failure	Error	POST/CM	Antenna
77	AAU SRAM failure	Error	POST/CM	Antenna
78	AAU EEPROM failure	Error	POST/CM	Antenna
79	Supplied power failure	Error	POST/CM	Antenna
80	Floating point error	Error	POST/CM	Antenna
81	Flash memory checksum Error	Error	POST/CM	Antenna
82	EEprom memory checksum Error	Error	POST/CM	Antenna
83-84	Reserved for future use			

9.4.4 Component specific BITE Display Codes

TT-5010A High Power Amplifier (HPA) Specific error ID's:

Error ID	Description	Error type	CM/ POST	LRU
85	ADC	Error	CM	HPA
86	Antenna current high	Error	CM	HPA
87	85V	Error	CM	HPA
88	Antenna Numeric Link-down	Error	CM	HPA
89	High Temperature	Error	CM	HPA
90	1 of 2 RF output transistors has failed	Warning	POST/CM	HPA
91	High Temperature	Warning	CM	HPA
92	Antenna voltage	Warning	CM	HPA
93	More than 4W RF return power	Error	CM	HPA
94	2 of 2 RF output transistors has failed	Error	POST/CM	HPA
95	EEPROM Checksum	Error	POST	HPA
96	RF 26V	Error	CM	HPA
97	65V Holdup Voltage	Error	CM	HPA
98-99	Reserved for future use			

9.4.5 Aero-I Logon cause coding list.

Display text	Reason ID	Description	Guidance
ClassReject	0x88	Class rejected	GES proposes class not supported
GlobChanLoss	0x82	Global channel loss	
GlobCunavlb	0x09	Global C channel not available at GES	
ManualLogRej	0x89	Manuel login rejected	Manual logon is not allowed when logon policy is automatic
NetworkFail	0x03	Network Failure	
NoGesSignal	0x81	No GES signal	
NoInitData	0x86	No valid system table available	
NoSatSignal	0x80	No satellite signal	Verify if there is no obstacle between Satellite and AES antenna
OtherReason	0x0E	Other Reason	
OutsideCover	0x84	Outside spot beam coverage	The AES is not under a spot beam of the specified GES
P/R/Tunavlb	0x07	Packet data channel unavailable	
PkdtaUnavlb	0x08	Packet data service unavailable	
SDUfailure	0x8A	SDU failure	Check the current bite errors
SpotChanLoss	0x83	Spot channel loss	
TableFull	0x00	Table Full	
UserLogoff	0x87	User logoff	
VCC&dUnavlb	0x0A	Voice not available at GES	
VoiceUnavlb	0x01	Voice Unavailable	
WrongGES	0x85	GES not existing	Check GES id validity
WrongGESid	0x06	Wrong GES identifier	Check GES id validity
WrongParam	0x02	Wrong Parameter	
WrongSatID	0x05	Wrong Satellite identifier	Check satellite id validity

NOTE:

CAUSE Codes should not be mistaken for BITE Error Codes.

9.4.6 Call reject cause coding list.

Text displayed	Coding Standard	Cause Class	Cause Value	Inmarsat description
	0	1	0	Normal clearing
AddrComplete	1	0	1	Address complete
AESabsent	1	7	3	AES absent
AnalogFail	1	2	3	Analogue data equipment not available
AnalogRate	1	6	2	Required analogue data rate not supported
Busy	0	1	1	User busy
CallBared	1	4	3	Incoming calls barred
CallPreempt	1	1	1	Call pre-empted
CallRejected	0	1	5	Call rejected
CardInvalid	1	6	1	Credit card type not supported
CardRejected	1	3	1	Credit card number rejected

Call Reject cause coding list (continued).

Text displayed	Coding Standard	Cause Class	Cause Value	Inmarsat description
ChanAbsent	0	4	2	Channel type not implemented
ContFailure	1	5	1	Continuity failure
DigitalFail	1	2	4	Digital data equipment not available
DigitalRate	1	6	3	Required digital data rate not supported
GndDestFail	0	1	11	Destination out of service
Handover	1	7	4	Spot beam handover
InvalidAddr	1	3	2	Invalid/incomplete address
InvalidNumbr	0	1	12	Invalid number format
NetworkFail	0	2	6	Network out of order
NoAnswer	0	1	2	No user responding
NoChanAvail	1	2	1	No channel available
NoCircuit	0	2	2	No circuit/channel available
NoRoute	0	0	3	No route to destination
NoUnitAvail	1	2	2	No channel unit available
SatDestFail	1	4	1	Destination out of service
ServiceType	1	6	5	Service type not supported
SwitchBusy	0	2	10	Switching equipment congestion
UnassignedNo	1	7	2	Unassigned number
Unauthorized	1	4	2	AES not authorised
Undefined	1	7	15	Undefined cause
Unspecified	0	1	15	Normal, unspecified
User Busy	1	7	1	User busy
VoiceTypeErr	1	6	4	Voice channel type not supported
WrongNumber	0	0	1	Unassigned number

NOTE:
Cause Codes should not be mistaken for BITE Error Codes.

9.4.7 Common International Country Codes

Country	Code	Country	Code
Argentina	54	Jordan	962
Aruba	294	Kenya	254
Australia	61	Kuwait	965
Austria	43	Lebanon	961
Bahamas	1-242	Liechtenstein	41
Belgium	32	Luxembourg	352
Bolivia	591	Macao	853
Brazil	55	Malaya	60
Bulgaria	359	Malta	356
Byelorussia	375	Mexico	52
Cameroon	238	Morocco	212
Canada	1	New Zealand	64
Cayman Islands	1-34	Nicaragua	505
Chile	56	Nigeria	234
China	86	Norway	47
Colombia	57	Pakistan	92
Costa Rica	506	Panama	507
Croatia	385	Paraguay	595
Cuba	53	Philippines	63
Czech Republic	420	Poland	48
Denmark	45	Portugal	351
Ecuador	593	Puerto Rico	1-787
Egypt	20	Rumania	40
El Salvador	503	Russia	7
Finland	358	Saudi Arabia	966
France	33	Singapore	65
Germany	49	South Africa	27
Ghana	233	South Korea	82
Greece	30	Spain	34
Guadeloupe	590	Sri Lanka	94
Guatemala	502	Sweden	46
Haiti	509	Switzerland	41
Holland	31	Taiwan	886
Honduras	504	Thailand	66
Hong Kong	852	Trinidad & Tobago	1-868
Hungary	36	Tuvalu	688
India	91	United Kingdom	44
Indonesia	62	U.S.A.	1
Ireland	353	Ukraine	380
Israel	972	Venezuela	58
Italy	39	Vietnam	84
Jamaica	1-876	Yugoslavia	381
Japan	81		

9.4.8 Troubleshooting Errors

When an error occurs and problem LRU is isolated, perform the following steps to ensure that the indicated component is faulty before removing the LRU.

1. **Ensure configuration is correct using the Configuration Utilities program.**
2. **Ensure that cables and connectors are connected and seated properly.**
3. **Ensure that a technician has eliminated all other potential causes of trouble before returning the SDU or any other component of the Aero-I system for repair.**

9.5 Software Update

Hardware and Software Requirements

- One IBM compatible PC
- One Aero-I Maintenance Data Cable, TT 37-112940 *)
- One unzip PC program (e.g. WinZip)
- One Terminal PC program (e.g. HyperTerminal in Windows)
- One New Aero-I software program (version xx.x), Se T&T homepage: **www.tt.dk/support**
- Access to the Internet (ftp).
- *) Contact the T&T After Sales department (**info@tt.dk**) or use a cable with the characteristic described in the Appendix.

The PC used must be equipped with Windows 95 (or later version).

9.6 Preparing Software Update

NOTE:
Software updating of the Aero-I system is only allowed with a JAR/FAR 145 Approval.

1. **Download the new Aero-I software program. Se T&T homepage: http://www.tt.dk/support.**
2. **Unzip the file downloaded. The file includes the Aero-I system software and a PC program, which makes it possible to download the software into the SDU.**
3. **Connect the SDU to the PC by using Aero-I Maintenance Data Cable (TT 37-112940). Use the COM1 serial port of the PC and the front connector X1 (maintenance port) on the SDU.**

9.7 Updating Software

In case of software update, repair, or replacement of the SDU, software update can be performed to the SDU using the connected PC.

- **Start the AERO-I software download program to activate the software download procedure.**

  Compliance: **Upon completion of this Service Bulletin, make appropriate maintenance records.**

  Testing Procedure: **Check for correct download.**

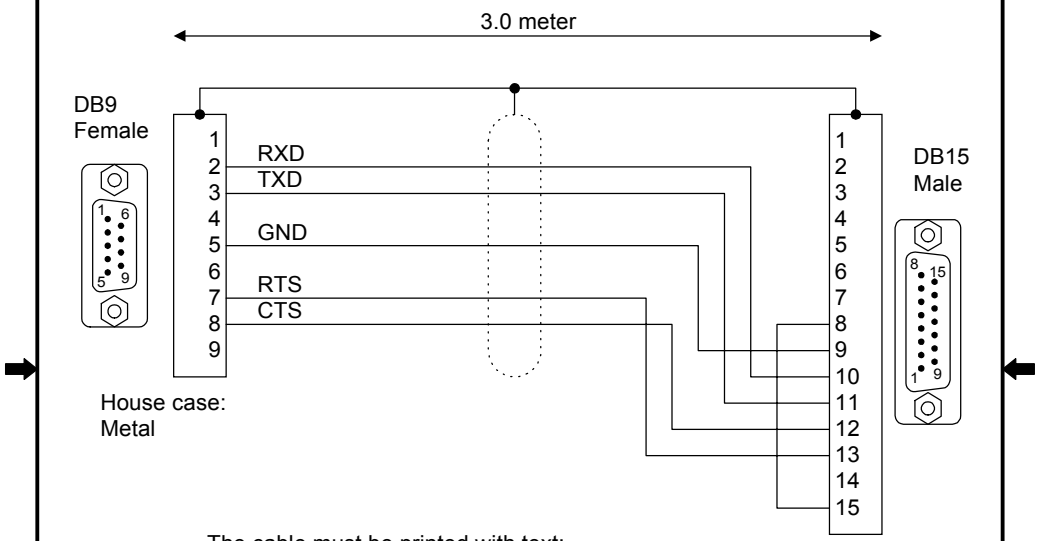
1. Configure the PC Terminal Program: speed 19200 bit/s, 8 bit/no parity, 1 stop bit, and flow control: XON/XOFF, direct connect COM1.
2. Start the Terminal program.
3. Hit the <enter> key and check that the following prompt is displayed:
   Main >
4. Reboot the SDU: type reset <enter> and verify that following is displayed in the startup message:

- **TT-5033 Aero-I SDU Main CPU RELEASE version xx.x**

  Identification Procedure:
  On the PartNumber / SerialNumber identification label make a crossmark in the correct Software MOD field.
  New SW 10.N. (cross field ”N”).

Aero-I Maintenance Data Cable TT 37-112940

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVAL
	410228A	A	ORIGINAL		



The cable must be printed with text:
TT 37-112940-A

Use 5-pole shielded data cable (0.14 mm²): LIY CY 05 x 014
Shield must be connected to metal house casing in both ends

REV STATUS OF SHEETS	REV LTR	A									
	SHEET NO.	1									

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 22768.

ANGLES

LIN.DIM.

MATERIAL

C:\PROJEKT\AERO-I\

DR.	Torben Dalsgaard	2000-01-06
CH.	Frank Rolsted Jensen	2000-01-06
AP.	Henrik O. Christensen	2000-01-06
AP.		

FIRST ANGLE PROJECTION

Thrane & Thrane A/S
Telecommunications Engineering Copenhagen Denmark

TITLE
Aero-I Maintenance Data Cable

SIZE	CODE IDENT NO.	DRAWING NO.
A4	37-112940-A.VSD	37-112940-A

SCALE | SHEET 1 OF 1

Aero-I Maintenance Data Cable TT 37-112940