



## **eNfusion™ HSD-400 High-speed Data Terminal**

### *System Description, Installation, and Maintenance Manual*

This Guide provides configuration and operation procedures for the equipment listed below.

| <u>Model</u>   | <u>PN</u>      |
|--|----------------|
| eNfusion™ HSD-400 High-speed Data Terminal 115 V ac              | 1252-A-3100    |
| eNfusion™ HSD-400 High-speed Data Terminal 28 V dc               | 1252-A-3200    |
| eNfusion™ HSD-128 Terminal Upgraded to HSD-400 Terminal 115 V ac | 1252-A-3101    |
| eNfusion™ HSD-128 Terminal Upgraded to HSD-400 Terminal 28 V dc  | 1252-A-3201    |
| eNfusion™ HSD-128 Terminal Upgraded to HSD-400 Terminal 115 V ac | 1252-A-3102    |
| eNfusion™ HSD-128 Terminal Upgraded to HSD-400 Terminal 28 V dc  | 1252-A-3202    |
| eNfusion™ HSD-400 High-speed Data Terminal SBB Mode 115 V ac     | 1252-A-3105-01 |
| eNfusion™ HSD-400 High-speed Data Terminal SBB Mode 28 V dc      | 1252-A-3205-01 |
| eNfusion™ HSD-400 High-speed Data Terminal SBB Mode 115 V ac     | 1252-A-3105-02 |
| eNfusion™ HSD-400 High-speed Data Terminal SBB Mode 28 V dc      | 1252-A-3205-02 |

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### eNfusion™ HSD-400 High-speed Data Terminal SYSTEM DESCRIPTION, INSTALLATION, AND MAINTENANCE MANUAL

Document Number: MN-1252-30020, Revision H

25 June 2008

**Revision Table**

| <b>Rev</b> | <b>ECR</b> | <b>Description</b>   |
|------------|------------|--|
| A          | 050722     | All MPU menus updated. Added Installation Planning Checklist. Other minor edits.                           |
| B          | 060326     | Added converted HSD-128 part number. Added information about Service Bulletin 1110-SB-0016.                |
| C          | 061131     | Updated installation drawings, modified to marketing lexicon, and added part numbers for HSD-128 terminals |
| D          | 061422     | Updated installation drawings and applied ATA formatting   |
| E          | 070078     | Updated interconnection drawings and removed Transmit Disable  |
| F          | 070557     | Updated address, installation drawings, and added BGAN terminals   |
| G          | 070794     | Updated caution image, figure 1-2, and figure caption 4-4  |
| H          | 080747     | Updates for SwiftBroadband content.  |

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Printed in Canada.

EMS SATCOM

400 Maple Grove Road, Ottawa, Ontario, K2V 1B8, CANADA

EMS SATCOM Reception: (613) 591-9064

EMS SATCOM Product Support: (888) 300-7415 (calls are routed to an on-call Product Support specialist after regular business hours)

+44 1684 290 020 (UK)

(613) 591-3086 (outside North America)

EMS SATCOM E-mail Help: [hsd.help@emssatcom.com](mailto:hsd.help@emssatcom.com)

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EMS SATCOM  
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Ottawa, ON K2V 1B8

E-mail: [techdocs@emssatcom.com](mailto:techdocs@emssatcom.com)

Fax: EMS SATCOM Product Support at 613-591-3086

## **Publication information:**

|                            |   |
|----------------------------|---|
| <b>Publication number:</b> | MN-1252-30020   |
| <b>Publication title:</b>  | eNfusion™ HSD-400 High-speed Data Terminal System Description, Installation, and Maintenance Manual |
| <b>Latest issue date:</b>  | 25 June 2008  |
| <b>Document revision:</b>  | H   |

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## INTRODUCTION

This manual provides the specifications, principles of operation, and information necessary to install an eNfusion™ HSD-400 High-speed Data Terminal in Stand-Alone Mode.

The information provided is presented in the following chapters:

- System Description
- System Operation
- Installation
- Test and Fault Isolation
- Maintenance and Repair
- Appendix A: Inmarsat System Overview
- Appendix B: Troubleshooting Checklist
- Appendix C: RJ-45 Cable Termination Details
- Appendix D: Installation Planning Checklist
- Appendix E: Installation Checklist
- Appendix F: Inmarsat Cause Codes

NOTE: An Illustrated Parts List is not included with this manual.

Only qualified avionics personnel, knowledgeable in the technical and safety issues related to the installation of aircraft communications equipment, should perform the installation procedures provided in this manual.

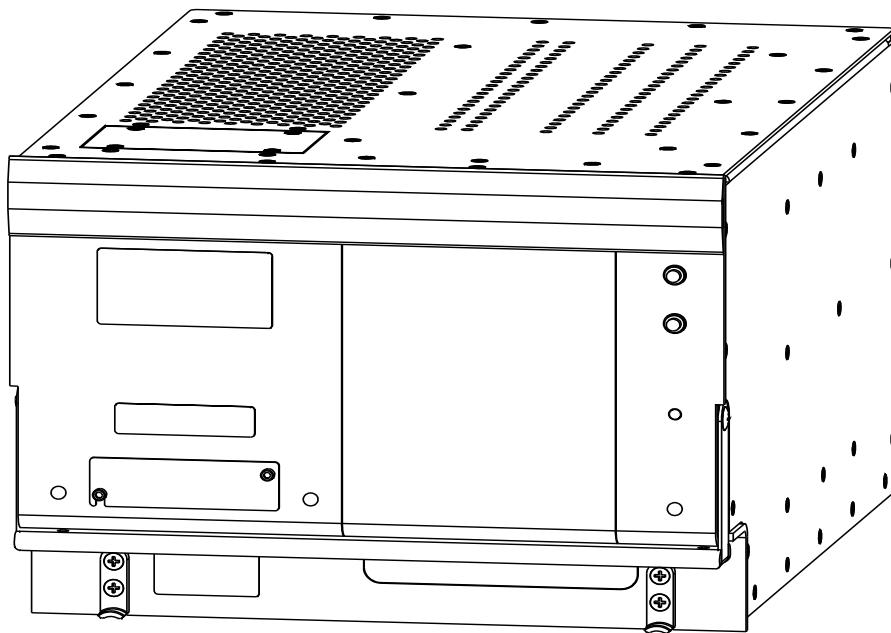
This manual includes general installation guidelines only; it is not intended to provide specific procedures for every type of installation.

If necessary, the information in this manual will be revised. Before attempting the installation procedures presented in this manual, verify that you have a complete and up-to-date release of this document.

NOTE: Depending on the version of software and configuration mode of installation of the HSD-400 terminal, the actual (live) system messages such as dialog boxes and screen displays, may differ slightly from the examples in this manual.

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## 1. Illustration of Equipment Covered



**Figure INTRO-1 HSD-400 Terminal**

## 2. Product Terms and Conditions

As stipulated in the Terms and Conditions of Sale, which accompanied the Product, EMS shall not at any time be liable for the activation, continuation or cancellation of satellite airtime services relating to the Product nor be responsible for any Product-related airtime or network charges, however incurred. In the event EMS is charged network or airtime fees relating to the customer's use of the Product, the customer shall immediately upon notification by EMS reimburse EMS in full for such charges.

## 3. Reference Documents

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| <b>Document Title</b>                                  | <b>Publication Number</b> |
|--|---------------------------|
| eNfusion™ HSD High-speed Data Terminal Setup Guide     | MN-1110-10048             |
| eNfusion™ HSD High-speed Data Terminal Quick Reference | MN-1110-10063             |

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Developer's Guide

|  |   |
|--|---|
| Guidance for Aircraft Electrical Power<br>Utilization and Transient Protection | ARINC 741. ARINC Report 413A -<br>Attachment 3-2, Wire Shielding and<br>Grounding Requirements and Appendix 7 |
|--|---|

---

## 4. Acronyms and Abbreviations

The following acronyms and abbreviations are used in this document.

ACU Antenna Control Unit (also known as BSU or Driver)

AERO Aeronautical

AMBE® Advanced Multi-Band Excitation

AWG American Wire Gauge

BGAN Broadband Global Area Network

BITE Built-In Test Equipment

BRI Basic Rate ISDN

b/s Bits per second

BSU Beam Steering Unit (also known as ACU or Driver)

CCW Counter Clockwise

CW Clockwise

DLNA Diplexer/Low-Noise Amplifier

EMI Electromagnetic Interference

EST Eastern Standard Time

EUMEA European Union Middle East Asia

FAA Federal Aviation Authority (USA)

FEC Forward Error Correction

FET Field-Effect Transistor

GND Ground

HGA High Gain Antenna

HPA High Power Amplifier

HSD High-speed Data Terminal

HTML Hyper Text Markup Language

Hz Hertz

ICAO International Civil Aviation Organization

ICD Interconnect Drawing

IMBE™ Improved Multi-Band Excitation

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|       |                                       |
|-------|---------------------------------------|
| INS   | Inertial Navigational System          |
| I/O   | Input/Output                          |
| IRS   | Inertial Reference System             |
| ISDN  | Integrated Services Digital Network   |
| JAA   | Joint Aviation Authorities (EU)       |
| kbps  | Kilobits per Second                   |
| LES   | Land Earth Station                    |
| LRU   | Line Replaceable Unit                 |
| LSB   | Least Significant Bit                 |
| LSV   | Low Speed Voice                       |
| Mb/s  | Megabit per second                    |
| MCU   | Modular Concept Unit                  |
| MES   | Mobile Earth Station                  |
| MPDS  | Mobile Packet Data Services           |
| MPU   | Maintenance Port Utility              |
| ms    | Millisecond                           |
| MSB   | Most Significant Bit                  |
| NAT   | Network Address Translation           |
| NT    | Network Terminator                    |
| OCXO  | Oven Controlled Crystal Oscillator    |
| OEM   | Original Equipment Manufacturer       |
| O&I   | Outline and Installation Drawing      |
| ORT   | Owner's Requirement Table             |
| PC    | Personal Computer (or Laptop)         |
| PN    | Part Number                           |
| POTS  | Plain Old Telephone System            |
| PPP   | Point-to-Point Protocol               |
| PPPoE | Point-to-Point Protocol over Ethernet |
| REA   | Responsible Engineering Authority     |
| RF    | Radio Frequency                       |
| RFI   | Radio Frequency Interference          |
| RFU   | Radio Frequency Unit                  |
| RMA   | Return Materials Authorization        |
| rms   | root mean square                      |
| RTN   | Return                                |

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|            |  |
|------------|--|
| Rx         | Receive  |
| SBB        | SwiftBroadband   |
| SCPC       | Single Channel per Carrier   |
| SDI        | Source/Destination Identification  |
| SDU        | Satellite Data Unit  |
| SPID       | Service Profile Identifier (ISDN)  |
| S/T (ISDN) | ISDN 'S interface' refers to the electrical interface between NT1 and NT2 devices, such as a PBX. ISDN 'T interface' refers to the electrical interface between NT1 or NT2 and ISDN devices. |
| STBD       | Starboard  |
| STE        | Secure Terminal Equipment  |
| STU        | Secure Telephone Unit  |
| TA         | Terminal Adapter   |
| TE         | Terminal Equipment   |
| Tx         | Transmit   |
| USIM       | Universal Subscriber Identity Module   |
| WOW        | Weight on Wheels   |

## 5. Safety Advisories

Warnings, cautions, and notes in this manual provide the reader with the following information:

- A **WARNING** describes an operation, procedure, or condition, which if not obeyed, could cause injury or death.
- A **CAUTION** describes an operation, procedure, or condition, which if not obeyed, could cause damage to the equipment.
- A **NOTE** provides supplementary information or explanatory text, which makes it easier to understand and perform procedures.

All personnel who install, operate, and maintain the HSD-400 terminal and associated test equipment must know and obey the safety precautions listed below. The procedures provided in this manual assume that the person performing installation or maintenance tasks is familiar with, and obeys standard aviation shop and safety practices.

**WARNING: SERVICE PERSONNEL MUST OBEY STANDARD SAFETY  
PRECAUTIONS, SUCH AS WEARING SAFETY GLASSES, TO PREVENT  
PERSONAL INJURY WHILE INSTALLING OR PERFORMING SERVICE  
ON THIS TERMINAL.**

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**WARNING: ASSOCIATED SATCOM EQUIPMENT RADIATES HIGH FREQUENCY RADIATION AND POSES A RADIATION HAZARD OF 1.6 GHZ. SERVICE PERSONNEL MUST EXERCISE CARE TO KEEP CLEAR OF THE ANTENNA'S BEAM WHILE PERFORMING OPERATIONAL TESTS OR INSTALLATION VERIFICATION PROCEDURES.**

**DO NOT APPROACH WITHIN 8 FEET (2.5 METRES) OF THE ANTENNA DURING ANTENNA OPERATION (TRANSMISSION).**

**DURING ANTENNA OPERATION (TRANSMISSION), ENSURE MINIMUM EXPOSURE OF ANY REFLECTED, SCATTERED, OR DIRECT BEAMS TO ALL PERSONNEL.**

**WARNING: TURN OFF POWER BEFORE DISCONNECTING ANY TERMINAL FROM WIRING. DISCONNECTING THE TERMINAL WITHOUT TURNING POWER OFF MAY CAUSE VOLTAGE TRANSIENTS THAT CAN DAMAGE THE TERMINAL.**



**ATTENTION**  
OBSERVE PRECAUTIONS  
FOR HANDLING  
ELECTROSTATIC  
SENSITIVE DEVICES

**CAUTION: THIS EQUIPMENT INCLUDES ITEMS THAT ARE ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. ESDS DEVICES ARE SUBJECT TO DAMAGE BY EXCESSIVE LEVELS OF VOLTAGE AND/OR CURRENT. THE LOW-ENERGY SOURCE THAT MOST COMMONLY DESTROYS ESDS DEVICES IS THE HUMAN BODY, WHICH, IN CONJUNCTION WITH NONCONDUCTIVE GARMENTS AND FLOOR COVERINGS, GENERATES AND RETAINS STATIC ELECTRICITY. TO ADEQUATELY PROTECT ESDS DEVICES, THE DEVICE AND EVERYTHING THAT CONTACTS IT MUST BE BROUGHT TO GROUND POTENTIAL BY PROVIDING A CONDUCTIVE SURFACE AND DISCHARGE PATHS. USE STANDARD INDUSTRY PRECAUTIONS TO KEEP RISK OF DAMAGE TO A MINIMUM WHEN TOUCHING, REMOVING, OR SERVICING THE EQUIPMENT.**

## SYSTEM DESCRIPTION

The HSD-400 terminal is a scalable, high-speed data, satellite communications terminal. It interfaces with an ARINC 741 compatible antenna subsystem to provide a high-speed data communication link with the Inmarsat satellite network.

This section includes basic information about the HSD-400 terminal, including the following sections:

- Equipment Overview
- Equipment Specifications
- Hardware Description
- Software Description
- Mechanical Description
- Electrical Description
- System Interfaces
- User Interfaces
- Initiated-Self-Test
- Modes of Operation

### **1. Equipment Overview**

The HSD-400 terminal is a scalable, high-speed data, satellite communications terminal that interfaces with ARINC 741 and ARINC 781-compatible antenna subsystems to communicate with the space segment of the Inmarsat Satellite Network via L-band RF signals.

HSD-400 terminals support the following services:

- Inmarsat Integrated Services Digital Network (ISDN) Single Channel Per Carrier (SCPC) Service
- Inmarsat Serial Mobile Packet Data Services (MPDS)
- AMBE® Voice Technology
- SwiftBroadband (SBB) Service

The HSD-400 terminal contains two channel cards, a high stability reference oscillator, a high power amplifier, a data processor module, and a power supply. The HSD-400 terminal receives power from the aircraft as either 28 V dc or 115 V ac, 400 Hz.

The HSD-400 terminal supports two channels of Inmarsat Swift64 MPDS or four channels of Mobile ISDN 64 kbps data links. The HSD-400 terminal supports one SBB channel on each channel card, for a total of two SBB channels—the limit of SBB channels available to any aircraft set by Inmarsat.

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To use the SBB service, the HSD-400 terminal obtains subscriber information from two SIM cards installed in the SCM. Each SIM card slot in the SCM is associated with a specific channel card—the slot next to the SCM connector is for channel card one, the third slot is for channel card two.

The HSD-400 terminal has three different ports that support the following interfaces: EURO ISDN S/T, serial (RS-232), and Ethernet (10BASE-T). Although able to support multiple configurations depending on user needs, the following constraints apply:

- EURO ISDN S/T port supports Swift64 Mobile ISDN (circuit-switched) only
- RS-232 port supports MPDS only
- 10BASE-T port supports Swift64 Mobile ISDN, SBB, and MPDS

Only one service type can be used at one time per HSD-400 terminal channel.

For information about using the HSD-400 terminal in various cabin network configurations, refer to the eNfusion® HSD High-speed Data Terminal Developer's Guide (MN-1252-13005).

## 2. Equipment Specifications

Table 1-1 lists the physical characteristics and equipment specifications for the HSD-400 terminal.

**Table 1-1. HSD-400 Terminal Equipment Characteristics and Specifications**

| <b>Characteristic</b>           | <b>Specification</b>   |
|---------------------------------|--|
| Certification/related documents |  |
| ARINC characteristics           | 600-12, Air Transport Avionics Equipment Interfaces, December 12, 1998<br>Appendix 10 of the ARINC 704-7 |
| RTCA documents                  | RTCA/DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment, July 29, 1997         |
| HSD-400 Terminal Software       | RTCA/DO-178B Level E   |
| Physical Size                   |  |
| Height                          | 19.93 cm (7.85 in)   |
| Width                           | 25.91 cm (10.20 in)  |
| Length                          | 36.45 cm (14.58 in)  |
| Weight                          | 14.55 Kg (32 lbs)  |
| Mounting information            | 8 MCU Tray (per ARINC 600, 8 MCU LRU)  |
| Maintenance requirements        | No scheduled maintenance is required   |
| Electrical specifications       |  |

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**Table 1-1. HSD-400 Terminal Equipment Characteristics and Specifications**

| <b>Characteristic</b>            | <b>Specification</b>   |
|----------------------------------|--|
|                                  | AC input power, 1252-A-3100, 1252-A-3101, 1252-A-3102, 1252-A-3103, 1252-A-3105  |
| Voltage                          | Minimum:100 V rms<br>Typical:115 V rms<br>Maximum:122 V rms  |
| Power dissipation                | Minimum:275 W<br>Maximum:425 W   |
| Frequency                        | Minimum:324 Hz (Typical: 400 Hz)<br>Maximum:596 Hz   |
|                                  | DC input power, 1252-A-3200, 1252-A-3201, 1252-A-3202, 1252-A-3203, 1252-A-3205  |
| Voltage                          | Minimum:22 V dc<br>Typical:27.5 V dc<br>Maximum:30.3 V dc  |
| Power dissipation                | Minimum:275 W<br>Maximum:425 W   |
| Power requirements               | 1252-A-3100,1252-A-3101, 115 V ac, 400 Hz nominal @ 4 A<br>1252-A-3102,1252-A-3103,<br>1252-A-3105<br><br>1252-A-3200,1252-A-3201, + 28 V dc nominal @ 15.5 A<br>1252-A-3202,1252-A-3203,<br>1252-A-3205 |
| Wire gauge                       | DC power: 12 American Wire Gauge (AWG)<br>AC power: 20 AWG (hot lead), 12 AWG (cold lead)<br>Signals: Unless otherwise specified, use 22 AWG for all signal wires  |
| Ground requirements              | ARINC 741  |
| Heating and cooling requirements |  |
| Cooling air                      | ARINC 600  |
| Flow rate                        | 206 lbs/hr   |
| Pressure drop                    | 0.05", 0.025" H <sup>2</sup> O   |
| Receive input impedance          | 50 ohms  |
| Transmit output impedance        | 50 ohms  |

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**Table 1-1. HSD-400 Terminal Equipment Characteristics and Specifications**

| <b>Characteristic</b>                                   | <b>Specification</b>  |
|---|---|
| VSWR  | 2:1 maximum   |
| Maximum output power                                    | 18 dBW  |
| External interface                                      |   |
| External parameters                                     |   |
| Antenna gain  | Minimum 8 dB, maximum 17 dB   |
| Antenna - DLNA loss                                     | Minimum 0.1 dB, maximum 0.3 dB  |
| LNA gain  | Minimum 53 dB, maximum 60 dB  |
| LNA noise   | Minimum 1.5 dB, maximum 1.8 dB  |
| LNA-HSD total loss                                      | Minimum 6 dB, maximum 25 dB (Rx)  |
| HSD-Antenna loss  | Minimum 1 dB, maximum 2.5 dB (Tx)   |
| DLNA insertion loss                                     | Minimum 1 dB, maximum <0.8 dB   |
| External digital interfaces                             |   |
| Control interface                                       | ARINC 429 high-speed (100 kbps) data bus  |
| RS-232 maintenance interface (rear and front connector) | 19 200 kbps   |
| Ethernet user interface (2)                             | 10BASE-T input and output for Single Channel Per Carrier (SCPC - Swift64 Mobile ISDN) and Mobile-Packet Data Service (MPDS) using Point-to-Point Protocol over Ethernet (PPPoE) |
| ISDN interface (2)                                      | ISDN S/T physical interface supporting external connections to Terminal Adapter (TA) or Terminal Equipment (TE) devices   |
| POTS tip/ring interface (2)                             | Plain Old Telephone System (POTS) analog interface  |

Table 1-2 lists the RTCA/DO-160D environmental characteristics and specifications for the HSD-400 terminal.

**Table 1-2. HSD-400 Terminal RTCA/DO-160D Environmental Characteristics**

| <b>Characteristic</b>     | <b>Specification</b>                           |
|---------------------------|--|
| Temp and altitude         |  |
| In-flight loss of cooling | Category A2 F2                                 |
| Temperature variation     | Category B ( $\pm 5^{\circ}\text{C}$ /minimum) |
| Temperature variation     | Category A (1252-A-3102; 1252-A-3202)          |
| Humidity                  | Category A (95%, 48 hours)                     |

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**Table 1-2. HSD-400 Terminal RTCA/DO-160D Environmental Characteristics**

| Characteristic                 | Specification   |
|--------------------------------|---|
| Shock                          | Category B (6g/20g, 11ms)                               |
| Vibration                      | Category SB (1.48grms)                                  |
| Explosion proofness            | Category E  |
| Waterproofness                 | Category X (not applicable)                             |
| Fluids susceptibility          | Category X (not applicable)                             |
| Sand and dust                  | Category X (not applicable)                             |
| Fungus resistance              | Category F  |
| Salt spray                     | Category X (not applicable)                             |
| Magnetic effect                | Category A (Tested to Z)                                |
| Power input                    | Categories A (CF)                                       |
| Voltage spike                  | Category A  |
| Audio frequency susceptibility | 115 V ac units: Category A<br>28 V dc units: not tested |
| Induced signal susceptibility  | 115 V ac units: Category Z<br>28 V dc units: not tested |
| RF susceptibility              | Category X  |
| Emission of RF Energy          | Category B  |
| Lightning Direct Effects       | Category X (not applicable)                             |
| Icing                          | Category X (not applicable)                             |
| Electrostatic Discharge (ESD)  | Category A  |

### 3. Hardware Description

All variants of the HSD-400 terminal operate with an Aero H (ARINC 741 compatible) antenna subsystem to provide circuit-switched (Swift64 Mobile ISDN), packet-switched (Swift64 MPDS), SBB, and AMBE services over the Inmarsat satellite communications network. All variants contain:

- two channel cards
- data I/O card
- control processor
- HPA
- power supply

Table 1-3 provides a comparison of the hardware models of HSD-400 terminals and lists the applicable interconnection diagram.

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**Table 1-3. Overview of HSD-400 Terminal Models**

| Model                             | Assembly PN    | Channel Card(s) | Reference Drawings | Voltage (nominal) | Power (min/max) |
|-----------------------------------|----------------|-----------------|--------------------|-------------------|-----------------|
| HSD-400                           | 1252-A-3100    | 2               | 1252-E-3100        | 115 V ac/400 Hz   | 275/425 W       |
| HSD-400                           | 1252-A-3200    | 2               | 1252-E-3100        | 28 V dc           | 275/425 W       |
| HSD-400<br>(Converted<br>HSD-128) | 1252-A-3101    | 2               | 1252-E-3100        | 115 V ac/400 Hz   | 275/425 W       |
| HSD-400<br>(Converted<br>HSD-128) | 1252-A-3201    | 2               | 1252-E-3100        | 28 V dc           | 275/425 W       |
| HSD-400<br>(Converted<br>HSD-128) | 1252-A-3102    | 2               | 1252-E-3100        | 115 V ac          | 275/425 W       |
| HSD-400<br>(Converted<br>HSD-128) | 1252-A-3202    | 2               | 1252-E-3100        | 28 V dc           | 275/425 W       |
| HSD-400<br>SBB                    | 1252-A-3105-01 | 2               | 1252-E-3105        | 115 V ac          | 275/425 W       |
| HSD-400<br>SBB                    | 1252-A-3205-01 | 2               | 1252-E-3105        | 28 V dc           | 275/425 W       |
| HSD-400<br>SBB                    | 1252-A-3105-02 | 2               | 1252-E-3105        | 115 V ac          | 275/425 W       |
| HSD-400<br>SBB                    | 1252-A-3205-02 | 2               | 1252-E-3105        | 28 V dc           | 275/425 W       |

**Note:** The HSD-128 terminal can be upgraded to an HSD-400 terminal with the accomplishment of Service Bulletin 1110-SB-0016. This Service Bulletin requires a return to the factory and results in a change to the part number of the terminal to 1252-A-3101 (115 V ac) or 1252-3201 (28 V dc).

## 4. Software Description

This section describes the software specifications and operational software components of the HSD-400 terminals.

### A. Software Specifications

The software meets the following standards:

- DO-178B
- Swift64 to Level E
- SwiftBroadband to Level E

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## B. Operational Software Part Numbers

Table 1-4 provides a list of software part numbers for the HSD-400 terminal.

**Table 1-4. HSD-400 Terminal Operational Software**

| <b>EMS SATCOM Part Number</b> | <b>Description</b>                    |
|-------------------------------|---------------------------------------|
| LI-1252-30057                 | HSD-400 Software Configuration Index  |
| LI-1252-30166                 | HSD-400 SBB Software Control Document |
| 1252-A-3457                   | HSD-400 Firmware Assembly             |
| 1110-A-0109                   | HPA Firmware – 28 V dc                |
| 1110-A-0110                   | HPA Firmware – 115 V ac               |
| 1110-A-0129                   | HPA Firmware, Rev D+ – 28 V dc        |
| 1110-A-0141                   | HPA Firmware, revised – 115 V ac      |
| 1110-A-0138                   | RF Control Card firmware              |
| 1252-SW-1242                  | HSD-400 Data I/O software             |
| 1210-A-0039                   | SBB CPU Boot/Loader code              |
| 1210-A-0038                   | Aero SBB Channel Card software        |

## 5. Mechanical Description

The HSD-400 terminal is an 8-MCU sized unit with mounting requirements according to the ARINC 600 specification. The front panel has one, socket D-Type size B (25 contacts) maintenance port connector (under protective cover) for data loading and monitoring of the terminal. Two front-panel LEDs indicate terminal status.

The rear connector complies with ARINC 600, shell size 2 and has three inserts: upper, middle, and bottom. The upper and middle inserts each have one #1 coax contact and seventy, 22-gauge signal contacts. The bottom insert connector has contact with only positions 1, 2, 3, 7, 8, and 12. The rear panel has three polarization points.

In the Installation section of this manual, Figure 3-7 and Figure 3-8 present the Outline and Installation Drawing for the HSD-400 terminal. For detailed wiring information, refer to the interconnection diagrams and contact assignments presented in the Installation section as noted in Table 1-5 below.

**Table 1-5. HSD-400 Terminal Installation Drawing Reference Matrix**

| <b>Models</b> | <b>Figures</b>  |
|---------------|---|
| ALL           | Outline and Installation: Figure 3-7 to Figure 3-10 starting on page 3-23 |
|               | System Interconnect: Figure 3-11 on page 3-31                             |
|               | Contact Assignments Figure 3-12 on page 3-33                              |

## 6. Electrical Description

The Installation section of this manual describes all ARINC 600 connector contact assignments and physical details, including part numbers, insert descriptions, and polarization keying.

The loading/gradient specifications for all HSD-400 terminal installations are provided in table format in the Installation section of this manual. These tables list all of the ARINC Top, Middle, and Bottom Plug pin designations and provide installation connection details.

The HSD-400 terminal contains a communications switch (SW) that supports Inmarsat Swift64 Mobile ISDN and MPDS service within an 8-MCU assembly built in accordance to ARINC 600 specifications.

Table 1-6 describes the HSD-400 terminal electrical interfaces:

**Table 1-6. HSD-400 Electrical Interfaces**

| Interface                       | Description  |
|---------------------------------|--|
| L-Band Rx/TX inputs and outputs | Interface directly with the DLNA   |
| ARINC 429 multi-control bus     | Interfaces with the ACU/BSU to control the RF antenna and obtain antenna-subsystem status information. Navigational data is provided to the HSD-400 by the aircraft INS. |
| Power                           | Aircraft supplies either 28 V dc or 115 V 400 Hz power.  |

## 7. System Interfaces

This section briefly describes the external HSD-400 terminal system interfaces. The system interfaces are those required to control, monitor, maintain, and supplement the terminal's functionality. The Installation section of this manual provides a detailed description of interface connections.

### A. Source Destination Identification (SDI)

The Source/Destination Identification (SDI) is provided to the HPA as per ARINC 741 specifications.

### B. Forward Address IDs

The HSD-400 terminal uses two 24-bit IDs called Forward Address IDs per channel card. The HSD-400 terminal reads the first FWD ID and performs a look-up for the other FIDs.

The 24-bit FWD ID strap pins, available on the ARINC 600 connector, form part of the Inmarsat serial number (ISN).

**Note:** Only the first FWD ID (out of four) requires strapping.

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The ISN consists of the type approval number and the FWD ID address. Each FID is associated with Inmarsat Mobile Numbers (IMN), which are the numbers that a user dials from the ground to reach the terminal on an aircraft. There is a unique IMN for each of the service types (e.g. data, voice).

ISNs are available from EMS SATCOM. To activate and obtain IMNs, please call your Inmarsat Service Provider.

### **C. WOW Pin Wiring**

Weight-On-Wheel (WOW) discretes indicate when an aircraft is on the ground and are used for flight data-logging purposes. Note 40 of ARINC 741 defines the WOW pins.

### **D. IRS ARINC 429 Interface**

Table 1-7 shows the IRS ARINC 429 bus labels and associated data types. For more details on characteristics, refer to Appendix 10 of the ARINC 704-7, Inertial Reference System document.

**Table 1-7. ARINC 429 IRS Navigational Requirements**

| <b>Label (Octal)</b> | <b>Name</b>  | <b>Interval Rate (ms)</b> |            |
|----------------------|--------------|---------------------------|------------|
|                      |              | <b>Min</b>                | <b>Max</b> |
| 310                  | Latitude     | 100                       | 200        |
| 311                  | Longitude    | 100                       | 200        |
| 312                  | Ground Speed | 25                        | 50         |
| 313                  | True Track   | 25                        | 50         |
| 314                  | True Heading | 25                        | 50         |
| 324                  | Pitch Angle  | 10                        | 20         |
| 325                  | Roll Angle   | 10                        | 20         |
| 361                  | Altitude     | 20                        | 40         |

In Stand-Alone Mode installations, the HSD-400 terminal requires high-speed ARINC 429, IRS Navigational information (as shown in Table 1-7) to compute the azimuth, elevation, and Doppler correction information required for antenna pointing.

### **E. Antenna Interface**

In Stand-Alone installations, the HSD-400 terminal interfaces to any mechanically steered, conformal-array, or phased array, ARINC 741 or ARINC 781-compatible, antenna subsystem. The antenna-pointing commands and status messages are communicated between the HSD-400 terminal and antenna subsystem over ARINC 429, Multi-Control, Top/Port and/or Starboard BITE and HPA mute busses, as defined in ARINC 741 Part 1.

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#### **F. Antenna Subsystem RF Interface**

The system RF parameters, such as cable losses and antenna gain, are defined to ensure that the HSD-400 terminal performance requirements are met. Refer to the Installation section of this manual for a definition of these parameters and their expected values.

#### **G. Remote Status Panel (Optional)**

The outputs to the optional "Remote Status Panel" provide a visual indication of the operational status of the HSD-400 terminal; they mirror the front panel LEDs labeled as Power (LED1) and Fault (LED2) as defined in Table 1-8. Refer to the Installation section of this manual for detailed installation and circuit requirements.

**Table 1-8. HSD-400 Terminal LED Output Designations**

| LED Signal | Label | LED Color | Indication Description  |
|------------|-------|-----------|---|
| LED1       | Power | Green     | Power On: HSD-400 terminal supply voltage is active. Flashes at 1 Hz when the HPA is transmitting |
| LED2       | Fault | Red       | Fault: Fault condition as described in "Fault Conditions" on page 1-10.                           |

#### **H. Fault Conditions**

A failure in the HSD-400 terminal may be due to a number of fault conditions. Upon detection of a fault condition, the HSD-400 terminal activates its red, Fault LED. The potential fault conditions are:

- Channel Card Fault
- HPA Fault
- External Reference Fault
- Internal ROM Fault
- Internal RAM Fault
- Over Temperature Fault
- Invalid LES Fault

#### **I. Remote Reset**

The remote reset output provides an external reset function for the complete HSD-400 terminal system. Pressing the momentary "normally open" (N.O.) switch resets the system's processor-card circuitry.

The remote reset has the same functionality as pressing the "test" button on the front panel of the terminal.

## **8. User Interfaces**

The HSD-400 terminal can support multiple voice and data communication configurations.

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The most likely user configurations include a networking device such as a router that allows multiple users to optimize and share the channel capability offered by the HSD-400 terminal.

The selected networking device must have the capability to decide which combination of services is required at any particular moment and activate it accordingly. Therefore, simultaneous RS-232 and BRI S/T connections are required.

Voice and fax devices are supported by direct connection to the HSD-400 terminal using EURO ISDN telephones and fax machines, or by indirect connection to a router or terminal adapter using two-wire telephone handsets or machines connected to the POTS ports.

For more information about HSD-400 terminal user interfaces, refer to the eNfusion® HSD High-speed Data Terminal Developer's Guide (MN-1252-13005).

#### **A. Stand-Alone Mode**

Four-channel HSD-400 terminals support a maximum of four simultaneous instances of Swift64 Mobile ISDN voice or SCPC data services, one instance of serial Mobile Packet Data Services (MPDS), two instances of MPDS service, or some combination of these services.

#### **B. ISDN Circuit-Switched Data Interface**

HSD-400 terminals connect to a variety of interface options. The physical interface for ISDN service is EURO S/T, which supports several types of connections to user equipment.

HSD-400 terminals provide two ISDN S/T bus interfaces. Each bus is capable of hosting up to seven external physical connections to EURO ISDN devices.

Each channel card supports communications with two, 64 kbps, ISDN B channels on an ISDN U interface bus. If the channel(s) is "busy" or "in-call", the request for service is denied (the system is busy).

For ISDN data devices that support bonding with a two-channel card HSD-400 terminal, the device uses both ISDN B channels to increase data throughput as long as no other devices are "in call."

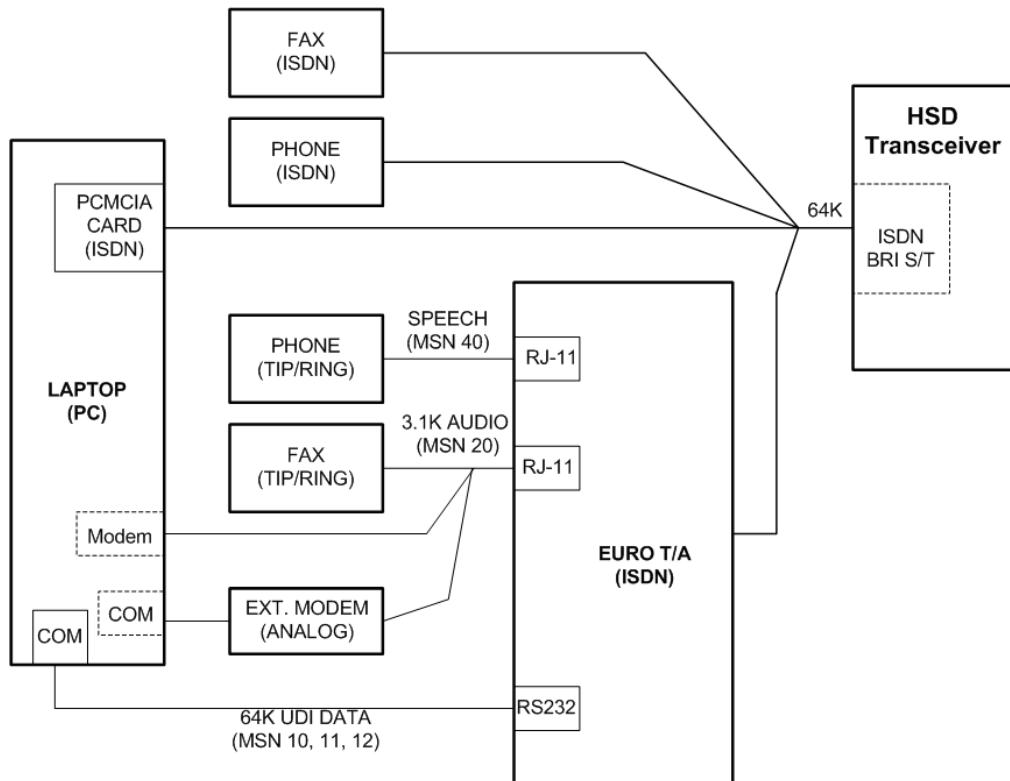
For incoming calls, each channel card (ISDN BUS) is assigned two Forward IDs. For more information about FID, ISNs, and IMNs, refer to "Forward Address IDs" on page 1-8

Several ISDN interface options are shown in Figure 1-1. The physical interface is EURO S/T, which can support up to seven external simultaneous connections to user equipment. In the illustrated example, the ISDN port is only used for circuit-switched services (Swift64 Mobile ISDN).

**Note:** Activating MPDS on a particular channel card temporarily disables the ISDN port on that channel card while MPDS service is in-use.

For connection to Inmarsat Mobile ISDN services, install an RJ-45 interface connector in the cabin area. The Installation section of this manual describes the RJ-45 connector and cable termination.

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**Figure 1-1. ISDN Connection Options**

### C. RS-232 Interface

The simplest configuration, using the RS-232 interface, allows users to connect directly to the HSD-400 terminal without any kind of networking device (i.e. router or file server). The port identified as DTE-MPDS, on the Interconnect Drawings (refer to the Installation section of this manual), is a serial data port capable of operating up to 115 kbps line speed with a maximum throughput of 64 kbps. This RS-232 port only supports Mobile Packet Data Service (MPDS).

### D. Ethernet Data Interfaces

HSD-400 terminals PN 1252-A-3100 and 1252-A-3200 provide two Ethernet interfaces. Use the Ethernet interfaces for Swift64 Mobile ISDN, MPDS, or SwiftBroadband services.

For more information about Ethernet data interfaces, refer to the eNfusion® HSD High-speed Data Terminal Developer's Guide (MN-1252-13005).

### E. ISDN S/T Interfaces

HSD-400 terminal models 1252-A-3100 and 1252-A-3200 provide two ISDN S/T physical interfaces that each support up to seven external connections to Terminal Adapter (TA) or Terminal Equipment (TE) devices.

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**Note:** An HSD-400 terminal with a Data I/O Card Type 3 uses one S/T Bus “device connection” for system use.

Install RJ-45 interface connectors in the cabin area to facilitate connection to the Ethernet interface. Refer to the Installation section of this manual for a description of the RJ-45 connector and cable termination.

#### **F. POTS Tip/Ring Interfaces**

The HSD-400 terminal includes two POTS analog interfaces. The default setting for channel 1 is 64 kbps speech, and the default setting for channel 2 is 3.1 kbps audio, which is appropriate for fax calls. These configurations can be changed in the Data I/O settings.

#### **G. CEPT-E1 Interface**

CEPT-E1 is the European equivalent to T1. Future availability.

#### **H. Maintenance Port Interface**

The HSD-400 terminal is equipped with a maintenance port, located on the front panel of the HSD-400 terminal with remote access also available through the rear ARINC 600 connector.

The maintenance port provides the physical connection to a password-protected, Maintenance Port Utility (MPU) that provides a system interface for users or service personnel who need to upgrade, monitor, or troubleshoot the system. For more information refer to "Maintenance Port Utility" on page 4-2

### **9. Initiated-Self-Test**

The Initiated-Self-Test occurs during the power up sequence or when the “TEST” button (located on the front panel of the terminal) is depressed and held down for three seconds or more. It provides the same functionality as the remote reset switch.

## **10. Modes of Operation**

HSD-400 terminals may be installed as Stand-Alone systems. The following system configuration modes are possible:

### **A. Channel Card Configurations**

Each channel card supports two channels, for a total of four channels. Each HSD-400 terminal channel works either independently or bonded to provide up to a 256 kbps data-link to the Inmarsat Communications Network.

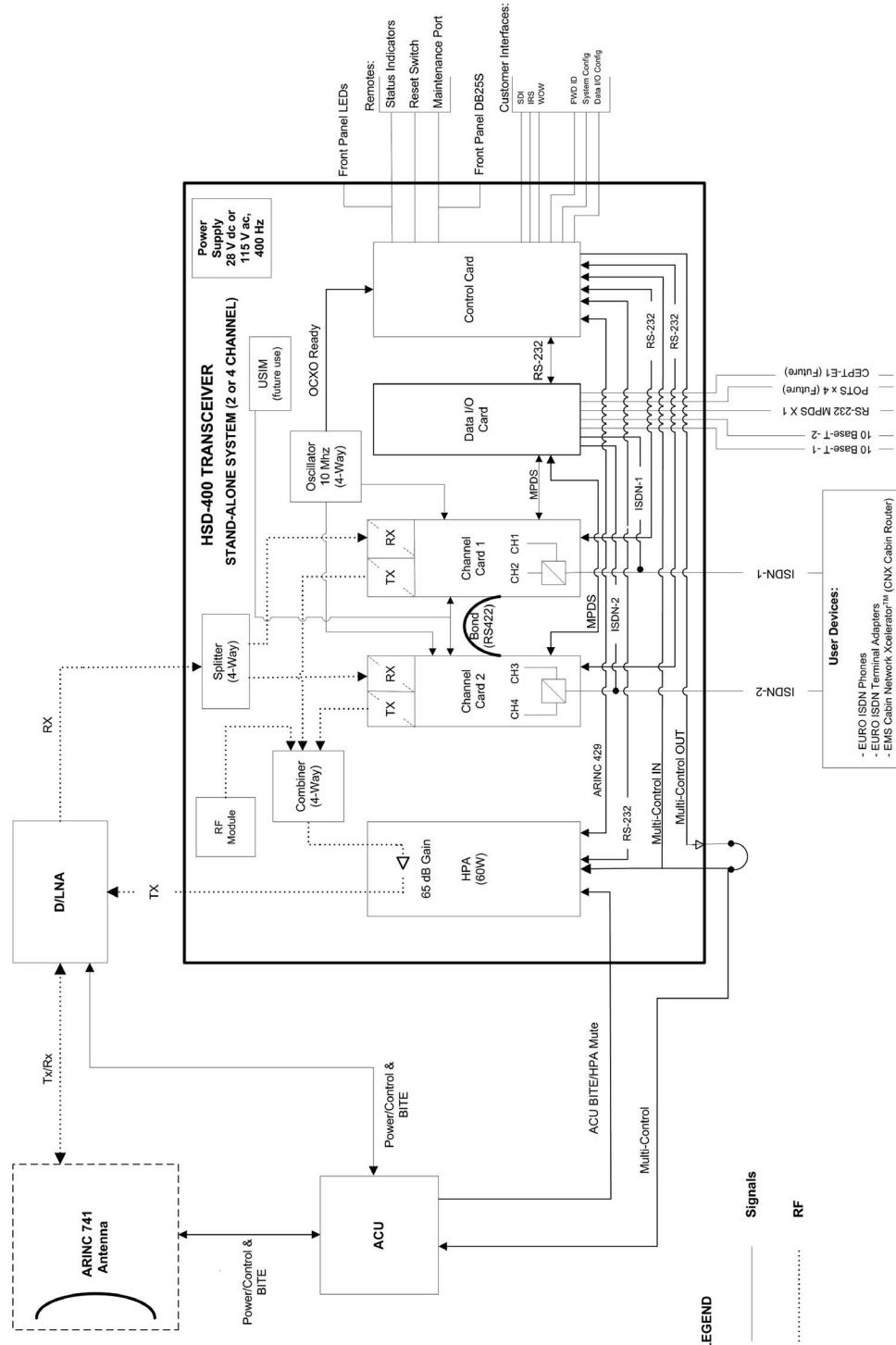
The user has the option to select the service type needed—either circuit-switched data (Swift64 Mobile ISDN) or MPDS. The HSD-400 terminal also supports four simultaneous voice or 14.4 kbps calls when not being used in data mode.

### **B. Installation Modes**

The HSD-400 terminal supports one mode of installation—stand-alone mode. In stand-alone mode, the HSD-400 terminal controls both the internal HPA and antenna.

In stand-alone mode, the HSD-400 terminal supports up to four channels in multiple combinations of Swift64 ISDN and Swift64 MPDS service. The maximum number of simultaneous Swift64 ISDN service channels is four. The maximum number of simultaneous Swift64 MPDS service channels is two. For details, refer to the system block diagram in Figure 1-2.

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**Figure 1-2. HSD-400 Terminal System Block Diagram**

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## SYSTEM OPERATION

This section provides basic information on registering and operating the HSD-400 High-speed Data terminal, including the following sections:

- Registering and Activating Terminals
- Configuring Terminals
- Using Terminals

### **1. Registering and Activating Terminals**

Registering and activating an HSD-400 terminal has the following steps:

- Preparing Terminal Information
- Selecting a Service Provider
- Registering Terminals

#### **A. Preparing Terminal Information**

Before installing the HSD-400 terminal, contact EMS SATCOM to obtain terminal information needed to register and activate the terminal with Inmarsat.

##### **(1) Obtaining ISNs**

EMS SATCOM Customer Care assigns an appropriate Terminal Type number and valid Forward IDs for the HSD-400 terminal based on the intended installation configuration.

When requesting terminal registration information, please have the following information available:

- End customer name, including contact information
- Purchase order number
- Tail registration number, aircraft type, and serial number of the aircraft the terminal is being installed on
- Serial Number of HSD-400 terminal(s)
- Intended installation configuration mode: Stand-Alone

EMS SATCOM Product Support is available Monday to Friday from 8 am to 5 pm. For contact information, refer to the second page of this manual.

##### **(2) Identifying Service Categories**

Inmarsat divides the band of frequencies assigned to Swift64 high-speed data into two separate categories: Category A and Category B. Category B frequencies are restricted to those that do not overlap with Aero H/H+ frequency allocations. HSD-400 terminals do not require restricted frequency allocations.

Table 2-1 and Table 2-2 list the terminal type, frequency category, and currently supported service types for HSD-400 terminal stand-alone mode installations.

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**Table 2-1. HSD-400 Terminal Frequency Category and Type**

| Service Type | Inmarsat Frequency Category | Terminal Type Approval |
|--------------|-----------------------------|------------------------|
| Swift64      | Category A                  | 76ES08                 |
| SBB          | Category A                  | B6ES03                 |

**Table 2-2. HSD-400 Terminal Service Types**

| Service Type | 64 kbps Speech | 3.1 kHz Audio | 56 kbps Data | 64 kpbs UDI | mini-M Voice | MPDS | AMBE+2 | PS <sup>1</sup> |
|--------------|----------------|---------------|--------------|-------------|--------------|------|--------|-----------------|
| Swift64      | X              | X             | X            | X           | X            | X    |        |                 |
| SBB          |                | X             | X            | X           |              |      | X      | X               |

1. SBB packet switched services: Background (up to 432 kbps), Streaming (32 kbps, 64 kbps, 128 kbps)

## B. Selecting a Service Provider

Contact Inmarsat for an up-to-date list of Inmarsat service providers as follows:

Inmarsat  
99 City Road, London  
EC1Y 1AX

Tel: +44 20 7728 1000  
Fax: +44 20 728 1044

Customer Care  
Tel: +44 20 7728 1777  
Fax: +44 20 7728 1142  
Email: [customer\\_care@inmarsat.com](mailto:customer_care@inmarsat.com)

Web address: [www.inmarsat.com](http://www.inmarsat.com)

## C. Registering Terminals

Contact your Inmarsat service provider and ask for a **Registration for service activation of Aircraft Earth Station** form. To complete the registration form the following information is needed:

- Customer information (address and contact information)
- Service provider details (obtain from your Inmarsat service provider)
- System and terminal information (system terminal type, manufacturer, model number, serial number of terminal and Inmarsat Serial Number)
- Aircraft information (tail number, fuselage/airframe number, manufacturer and model, and country of registration)
- List of services required (e.g. Swift64 Mobile ISDN)

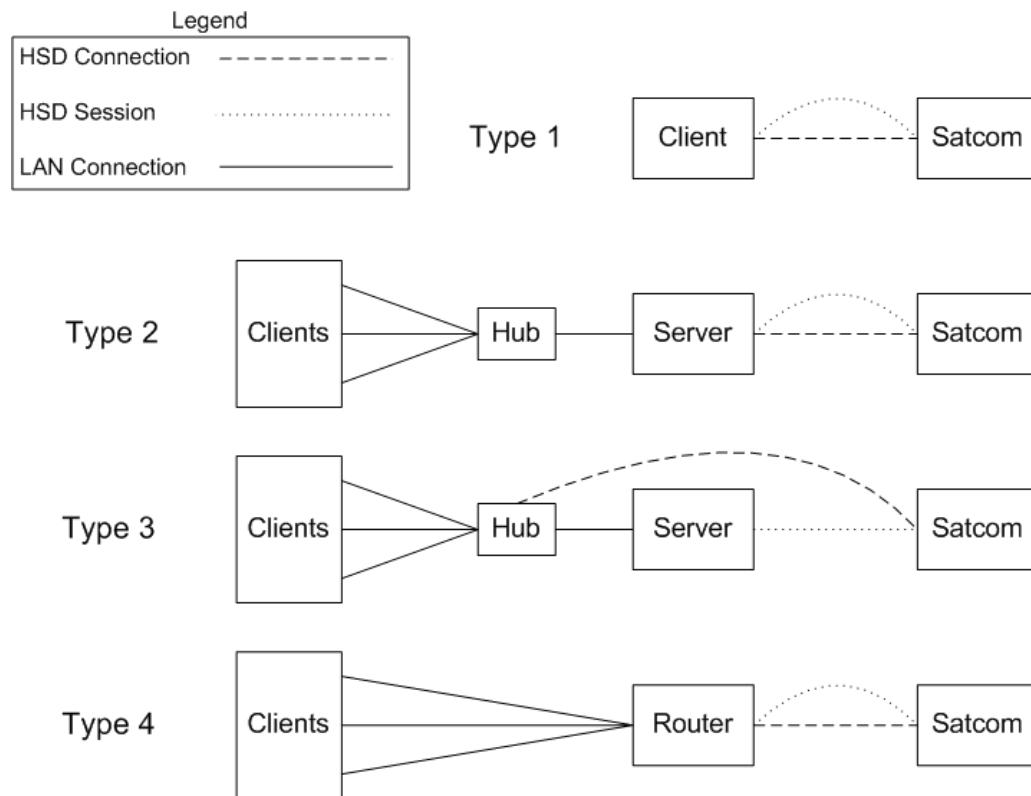
To register for SBB services, request an SBB Activation form from your service provider.

## 2. Configuring Terminals

This section provides basic information on how to configure HSD-400 terminals for operation with user devices.

### A. Setting up Airborne Networks

For information on how to set up Swift64 and SwiftBroadband networks using the HSD-400 terminal, refer to the eNfusion® HSD High-speed Data Terminal Developer's Guide (MN-1252-13005).



### B. Mapping User Devices for ISDN Services

This section describes how the HSD-400 terminal manages ISDN traffic for user devices connected to the network.

HSD-400 terminals support connection to a multitude of user devices, allowing the user to customize their system. Because each equipment setup is different, the HSD-400 terminal uses routing codes to ensure that incoming calls (whether data or voice) reach the appropriate device. These same routing codes also direct outgoing calls to the appropriate Swift64 service type supported by the Inmarsat Satellite Communications Network (3.1 kHz Audio, 64 kbps Speech, 64 kbps Data, 56 kbps Data, or in Stand-Alone systems, 4.8 kbps LSV).

The physical interface for ISDN service is EURO S/T, which supports several types of connections to user equipment. HSD-400 terminals provide two ISDN S/T (BRI) Bus interfaces.

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Each bus is capable of hosting up to 8 EURO ISDN physical devices, which means a four-channel (2 ISDN S/T bus) system supports up to 16 physical connections to EURO ISDN devices. The HSD-400 terminal reserves one “device connection” on each channel card for system use, therefore providing up to 14 possible device connections.

Each channel card provides two 64 kbps ISDN B channels that are available to either ISDN Bus. If the channels are “busy” or “in-call”, the request for service is denied (the system is busy).

For ISDN data devices that support bonding, the device will attempt to use all four ISDN B channels to increase data throughput as long as no other devices are “in call”.

For incoming calls, each channel card (ISDN BUS) is assigned a Forward ID. The Forward IDs are assigned Inmarsat Mobile Numbers (IMNs) for each service type. Two service types are assigned multiple IMNs; 64 kbps data is assigned three IMNs and 4.8 kbps LSV is assigned 16 IMNs.

Each service type IMN has associated Multiple Subscriber Number (MSN). MSNs are used to configure the user devices so that incoming calls of different service types are routed to the appropriate device.

Two IMNs are assigned to 64 kbps Speech, 56 kbps Data, and 3.1 kHz Audio; six IMNs are assigned to 64 kbps Data; and in Stand-Alone systems thirty-two IMNs are assigned to 4.8 kbps LSV.

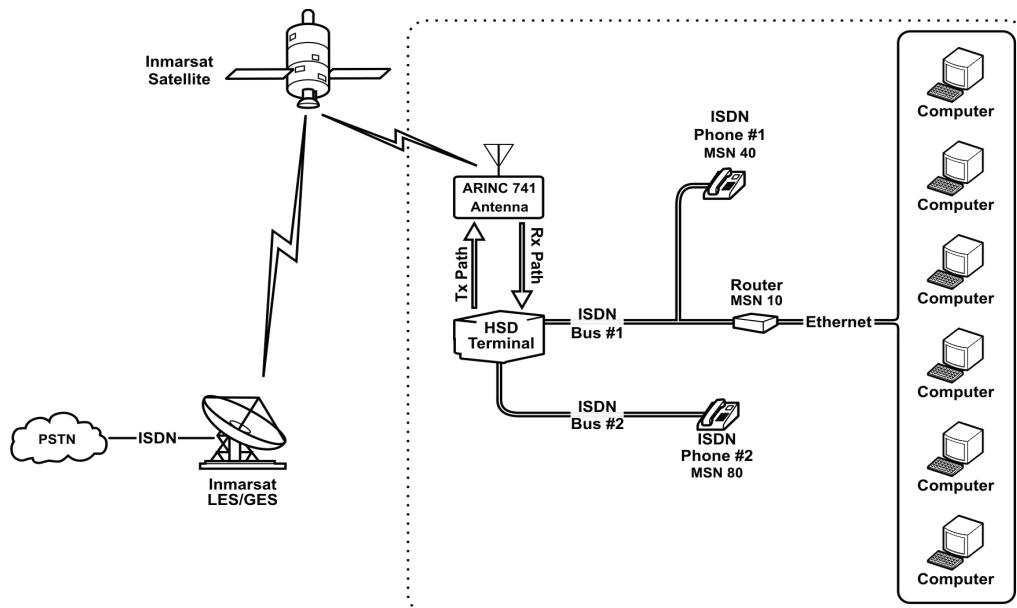
Figure 2-1 illustrates the routing assignments for an HSD-400 terminal with two ISDN buses.

Figure 2-1 and Table 2-3 illustrate the system setup routing or configuration possibilities for ISDN devices using an HSD-400 terminal in Stand-Alone Mode as an example.

The following dialing instructions provide an example based on the system setup of Figure 2-1 and the mapping programming details provided in Table 2-3 and Table 2-4:

- To call ISDN phone 1 using 64 kbps speech, dial IMN 60xxxxxx1 (MSN 40)
- To call ISDN phone 2 using 4.8 kbps LSV, dial IMN 76xxxxxx6 (MSN 80)

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**Figure 2-1. System Setup and Mapping for Incoming Calls**

Refer to Table 2-3 and Table 2-4 for the default MSNs assigned within the HSD-400 terminal.

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**Table 2-3. IMN and MSN Assignments**

| <b>ISDN Bus #1</b>                       |  |   |
|--|--|---|
| <b>Channel Card #1 Forward ID XAXXXX</b> |  |   |
| <b>Service Type</b>                      | <b>IMN</b>                             | <b>MSN</b>  |
| 64 kbps Speech                           | 60xxxxxx1 (See Note below)             | MSN 40 <sup>1</sup>   |
| 3.1 kHz Audio                            | 60xxxxxx2                              | MSN 20  |
| 56 kbps Data                             | 60xxxxxx3                              | MSN 30  |
| 64 kbps Data                             | 60xxxxxx4<br>60xxxxxx5<br>60xxxxxx6    | MSN 10 <sup>2</sup><br>MSN 11 <sup>2</sup><br>MSN 12 <sup>2</sup> |
| 4.8 kbps LSV                             | 76xxxxxx7 through to<br>760xxxx22      | MSN 80 through to 95 <sup>1</sup>                                 |
| AMBE+2                                   |  | Default SBB service—no<br>MSN required                            |
| <b>ISDN Bus #2</b>                       |  |   |
| <b>Channel Card #2 Forward ID XBXXXX</b> |  |   |
| <b>Service Type</b>                      | <b>IMN</b>                             | <b>MSN</b>  |
| 64 kbps Speech                           | 60xxxxxx23 (See Note below)            | MSN 40 <sup>1</sup>   |
| 3.1 kHz Audio                            | 60xxxxxx24                             | MSN 20  |
| 56 kbps Data                             | 60xxxxxx25                             | MSN 30  |
| 64 kbps Data                             | 60xxxxxx26<br>60xxxxxx27<br>60xxxxxx28 | MSN 10 <sup>2</sup><br>MSN 11 <sup>2</sup><br>MSN 12 <sup>2</sup> |
| 4.8 kbps LSV                             | 76xxxxxx29 through to<br>760xxxx44     | MSN 80 through to 95 <sup>1</sup>                                 |
| AMBE+2                                   |  | Default SBB service—no<br>MSN required                            |

1. Not a supported SBB service type.

2. Not used for SBB services.

**Note:** IMNs shown are examples only. Actual IMNs may not be assigned in numerical sequence.

**(1) Inmarsat Mobile Numbers**

Inmarsat Mobile Numbers (IMNs) are unique routing numbers that act similarly to telephone numbers. IMNs are assigned by Inmarsat to each service type (64 kbps Speech, 3.1 kHz Audio, 56 kbps Data, 64 kbps Data, and 4.8 kbps LSV).

When registering your system, request IMNs for each service-type device attached to the HSD-400 terminal on the Service Activation form. Although the service provider may support an unlimited number of IMNs assigned to a particular system, the number of physical connections available on a system defines the number of IMNs supported.

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**Note:** To get assigned additional or multiple IMNs for existing services (per service type), you must request them from your service provider when filling out your service registration and application form.

The numbering of IMNs varies from one type of Inmarsat service to another. For troubleshooting purposes understanding the IMN format can assist in verifying that the correct service type is assigned to connecting devices. Inmarsat IMNs (for this type of terminal) use the following nine-digit format:

IMN Format: T1- T2- X1- X2 -X3 -X4 -X5- X6- X7

Numerical Example: 760011819 (for 4.8 kbps AMBE LSV)

600221989 (for 64 kbps Data)

T1 and T2 are two-digit identifiers for Inmarsat service types. X1 through X7 can be any digit between "0" and "9". The IMNs for Mini-M (4.8 kbps LSV) service type are identified by the T1 and T2 numbers 7 and 6. The IMNs for the 56 kbps and 64 kbps service types (including ISDN Speech and 3.1 kHz audio) are identified by the T1 and T2 numbers 6 and 0.

**(2) Multiple Subscriber Numbers**

Multiple Subscriber Numbers (MSNs) act as identification and routing codes for user devices attached to the HSD-400 terminal. MSNs identify the device on the system so that incoming calls route to the appropriate device. Each device must be assigned an appropriate MSN to identify to the Inmarsat system what type of service that device needs on outgoing calls. The MSNs also provide routing information for incoming calls.

For a simplified understanding of MSNs, equate them to telephone extension numbers (where the IMN is the PBX telephone number and the MSN is the extension number).

Each HSD-400 terminal channel card is assigned one Forward ID and an IMN for each service type the system is registered for with the service provider. Table 2-4 provides the list of the MSN numbers recognized by the HSD-400 terminal. Both 64 kbps Data and Mini-M Voice (4.8 kbps LSV AMBE) services support multiple MSNs. The MSNs are assigned to each IMN as follows:

- One MSN for the service types 64 kbps Speech, 3.1 kHz Audio, and 56 kbps Data;
- Three MSNs for 64 kbps Data; and,
- Sixteen MSNs for Mini-M Voice (4.8 kbps LSV AMBE).

The three MSNs assigned to 64 kbps ISDN support connection to three separate devices mapped to the same IMN. Therefore, in four-channel systems, three ISDN devices can be connected to each channel providing twelve separate mapping extensions, as shown in Table 2-4.

The sixteen MSNs assigned to 4.8 kbps LSV support the mapping of sixteen separate phones to the same IMN. (Example: sixteen phones connected to a PBX box.) PBX devices can be connected to each channel providing up to 64 separate phone extensions.

**Note:** Incoming voice calls will ring any phone devices not programmed with an MSN (left blank) including 4.8 kbps LSV, 64 kbps speech, and 3.1 kHz audio calls.

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Configure all devices (e.g. telephones, fax machines, laptops) connected to the HSD-400 terminal with an appropriate MSN. (Refer to the device manufacturer's user documentation for specific instructions to enter or configure the MSN.) Refer to Table 2-3 for IMN and MSN assignments.

**Table 2-4. System Assignments for Incoming Calls**

| <b>Entry</b> | <b>Periph</b> | <b>MSN</b> | <b>TID</b> | <b>Call Type</b> | <b>Redir</b>               |
|--------------|---------------|------------|------------|------------------|----------------------------|
| 0            | ISDN          | NO_ID\     | 1          | 800103           | Mobile AMBE                |
| 1            | Bonded        | NO_ID\     | 1          | 800103           | Mobile AMBE                |
| 2            | ISDN          | NO_ID\     | 91         | 800124           | Mobile aero 64k speech     |
| 3            | ISDN          | 10\        | 51         | 800622           | Mobile aero 64k UDI        |
| 4            | ISDN          | 11\        | 52         | 800622           | Mobile aero 64k UDI        |
| 5            | ISDN          | 12\        | 53         | 800622           | Mobile aero 64k UDI        |
| 6            | ISDN          | NO_ID\     | 51         | 800622           | Mobile aero 64k UDI        |
| 7            | Bonded        | NO_ID\     | 51         | 800622           | Mobile aero 64k UDI        |
| 8            | ISDN          | 20\        | 61         | 800625           | Mobile aero 64k audio 3.1  |
| 9            | ISDN          | NO_ID\     | 61         | 800625           | Mobile aero 64k audio 3.1  |
| 10           | Bonded        | NO_ID\     | 61         | 800625           | Mobile aero 64k audio 3.1  |
| 11           | ISDN          | 30\        | 71         | 800623           | Mobile aero 56k UDI        |
| 12           | ISDN          | NO_ID\     | 71         | 800623           | Mobile aero 56k UDI        |
| 13           | Bonded        | NO_ID\     | 71         | 800623           | Mobile aero 56k UDI        |
| 14           | ISDN          | 40\        | 91         | 800124           | Mobile aero 64k speech     |
| 15           | Bonded        | NO_ID\     | 91         | 800124           | Mobile aero 64k speech     |
| 16           | ISDN          | 80         | 1          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 17           | ISDN          | 81         | 2          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 18           | ISDN          | 82         | 3          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 19           | ISDN          | 83         | 4          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 20           | ISDN          | 84         | 5          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 21           | ISDN          | 85         | 6          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 22           | ISDN          | 86         | 7          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 23           | ISDN          | 87         | 8          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 24           | ISDN          | 88         | 9          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 25           | ISDN          | 89         | A          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 26           | ISDN          | 90         | B          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 27           | ISDN          | 91         | C          | 800103           | Mobile AMBE (4.8 kbps LSV) |
| 28           | ISDN          | 92         | D          | 800103           | Mobile AMBE (4.8 kbps LSV) |

**Table 2-4. System Assignments for Incoming Calls (Continued)**

| Entry | Periph | MSN | TID | Call Type | Redir                      |
|-------|--------|-----|-----|-----------|----------------------------|
| 29    | ISDN   | 93  | E   | 800103    | Mobile AMBE (4.8 kbps LSV) |
| 30    | ISDN   | 94  | F   | 800103    | Mobile AMBE (4.8 kbps LSV) |
| 31    | ISDN   | 95  | 10  | 800103    | Mobile AMBE (4.8 kbps LSV) |

### **C. Configuring Terminal Categories**

This section describes how to configure the system parameters for HSD-400 terminal operation using the Maintenance Port Utility (MPU).

#### (1) Configuring Terminal Categories for Stand-Alone Mode

Refer to the Test and Fault Isolation section for detailed instructions on how to connect to and use the HSD-400 terminal MPU.

For this release, the HSD-400 terminal is in Stand-Alone Mode by default.

### **D. Configuring the APN (Access Point Name)**

The APN is the gateway between the SBB core network and the internet.

To configure the APN:

1. Connect to the Maintenance Port Utility (MPU) of the HSD-400 terminal—see "Maintenance Port Utility" on page 4-2 for connection details.
2. To navigate to maintenance menu 3, press CTRL + N.
3. To access miscellaneous EEPROM parameters, type **m**.
4. To navigate to parameters between 73 and 102, press CTRL + N.
5. To configure parameter 90, type **90**, and then press ENTER.
6. To configure your APN, type your APN IP address and press ENTER.

An EEPROM UPDATED message appears—the APN is saved in the EEPROM.

### **E. Configuring LES Access Codes**

This section describes how to configure the HSD-400 terminal with Land Earth Station (LES) access codes provided by your Inmarsat service provider.

Inmarsat Service Providers (ISPs) operate Land Earth Stations (LES). The ISPs are typically public telephone companies of the country where the LES is located.

Using satellite communications antennae and up-and-downlink communications equipment, the LES converts the space segment to a format compatible with public and private telephone and data networks. Each satellite is associated with a number of LES that fall within its coverage.

Inmarsat assigns each LES an access code. These access codes are used by the Inmarsat system to route calls to the correct Ocean Region Satellite and LES.

HSD-400 terminals are shipped with the factory default LES Access Codes set to '0' (zero). All HSD-400 terminals must be configured with the valid LES Access Codes provided by your Inmarsat Service Provider.

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(1) Changing Default LES using the MPU

The LES access codes can be configured using the HSD-400 terminal Maintenance Port Utility (MPU) accessed by connecting a computer running a VT100 terminal emulation program to the RS-232 Maintenance Port on the HSD-400 terminals (refer to the Test and Fault Isolation section of this manual for connection settings and cabling information).

**Note:** When configuring the LES access codes using the HSD-400 terminal MPU, the application requests the input of a Secondary LES Access Code. At the time of writing, the Inmarsat LES have not implemented the recognition of the secondary LES value in their systems. However, a valid Secondary LES Access Code must be entered in the HSD-400 terminal. The Secondary LES Access Code must be the same as the Primary LES Access Code.

Inmarsat usually provides LES access codes for the ISPs providing Swift64 services. Operator and access code (as of June 2004) are shown in Table 2-5. Contact Inmarsat directly for an up-to-date list of LES and Swift64 service providers. For Inmarsat contact information, refer to "Selecting a Service Provider" on page 2-2.

**Table 2-5. Inmarsat Swift64 LES Operator and Access Codes (June 2004)**

| Ocean Region | Service Provider (LES)                   | Global LES Access Code | Service Status                                     |
|--------------|--|------------------------|--|
| AORE         | Stratos Mobile Networks<br>Goonhilly LES | 002                    | Swift64 High Speed Data<br>Swift64 Low Speed Voice |
| AORE         | Telenor USA                              | 001*                   | Swift64 HSD<br>Swift64 LSV                         |
| AORE         | Xantic<br>Burum LES                      | 012                    | Swift64 HSD<br>Swift64 LSV                         |
| <hr/>        |  |                        |  |
| AORW         | Stratos Mobile Networks<br>Goonhilly LES | 002                    | Swift64 HSD<br>Swift64 LSV                         |
| AORW         | Telenor USA                              | 001*                   | Swift64 HSD<br>Swift64 LSV                         |
| AORW         | Xantic<br>Burum LES                      | 012                    | Swift64 HSD<br>Swift64 LSV                         |
| <hr/>        |  |                        |  |
| IOR          | Stratos Mobile Networks<br>Goonhilly LES | 002                    | Swift64 HSD<br>Swift64 LSV                         |
| IOR          | Telenor USA<br>"Oak" at Eik LES          | 001*                   | Swift64 LSV  |
| IOR          | Xantic<br>Perth LES                      | 022                    | Swift64 HSD<br>Swift64 LSV                         |
| IOR          | Xantic<br>Perth 2 LES                    | 222                    | Swift64 HSD<br>Swift64 LSV                         |
| <hr/>        |  |                        |  |

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**Table 2-5. Inmarsat Swift64 LES Operator and Access Codes (June 2004)**

| Ocean Region | Service Provider (LES)              | Global LES Access Code | Service Status             |
|--------------|-------------------------------------|------------------------|----------------------------|
| POR          | Stratos New Zealand<br>Auckland LES | 002                    | Swift64 HSD<br>Swift64 LSV |
| POR          | Telenor USA<br>Santa Paula LES      | 001*                   | Swift64 HSD<br>Swift64 LSV |
| POR          | Xantic<br>Perth LES                 | 022                    | Swift64 HSD<br>Swift64 LSV |
| POR          | Xantic<br>Perth 2 LES               | 012                    | Swift64 HSD<br>Swift64 LSV |
| POR          | Xantic-Netherlands<br>Perth LES     | 022                    | Swift64 HSD<br>Swift64 LSV |

\* When using the LES code 001 for Telenor, calls are automatically routed to the appropriate service (either Swift64 LSV or Swift64 HSD, as defined by the OD/ID code of the call). No additional user action is required. Contact Inmarsat for an up-to-date listing of service providers. Contact your service provider for more information on the services they provide.

**(a) Equipment Required**

The following equipment is required to change the default LES access code in an HSD-400 terminal:

- Computer (Laptop or PC)
- Windows 95® or later (Windows 2000® recommended)
- HSD-400 terminal control processor software
- Terminal emulation program (e.g. HyperTerminal)

**(b) Connecting to the Maintenance Port**

Connect a PC or laptop running a terminal emulation program to the HSD-400 terminal maintenance port, and then power up the system. (Refer to "Test and Fault Isolation" on page 4-1 of this manual for detailed connection information.)

**(c) Changing LES access codes on a call-by-call basis**

**Note:** You can also change the LES code on a call-by-call basis using the dial code prefix 901 when troubleshooting and diagnosing network problems.

The following dial-sequence uses the Xantic POR LES Access Code [022] as an example only. To change the LES access code on a call-by-call basis in all control processor software versions:

901 + LES CODE + International Code + Country Code + Area Code + Telephone Number + #

Example: 901 + 022 + 00 + 1+ 613+5551212 + #

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(d) Changing LES access codes using control processor software

To change all of the LES Access Codes simultaneously to the same LES Access Code:

- Connect to the HSD-400 terminal Maintenance Port
- Type the password maint
- In Menu 3, press I
- Follow the application prompts and enter the LES access code.

The Menu 3, I command configures the Primary and Secondary LES Access Codes for all of the Ocean Regions to the same LES Access Code.

**Note:** In cases where the Service Provider requires different LES Access Codes for different Ocean Regions, each LES Access Code must be programmed individually using Menu 3, item P.

## F. Configuring ORs

Each OR provides access to specific services. For example, POR provides access to Swift64 services, but not SBB services. ORs must be configured to support SBB where SBB services are available.

Table 2-6 lists the regions where SBB services are available at the time of publishing.

**Table 2-6 Ocean Regions Supporting SBB**

| Region Name | Sat. Long. |
|-------------|------------|
| Americas    | 52.7W      |
| EUMEA       | 64.0E      |

To configure ORs for SBB:

1. Connect to the HSD-400's MPU—see "Maintenance Port Utility" on page 4-2.
2. To navigate to Menu 3, press CTRL + N.
3. To see the current OR parameters, press P.
4. Press the number corresponding to the OR.
5. At the command prompt, type the name of the OR.
6. At the command prompt, type the default longitude of the OR.
7. At the command prompt, type the direction (E, W, N, or S) of the OR.
8. At the command prompt, type the LES ID of the OR (type 0 for SBB).
9. At the command prompt, type the default terrestrial network ID of the OR (type 0 for SBB).
10. At the command prompt, type the letter of each satellite service accessible in that OR.

You can configure the OR for two or three services. For example, **asb** configures the OR for Aero, Swift64, and SBB.

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**11.** If you are finished configuring the HSD-400 terminal, reboot the system.

Selection of ORs should be set to automatic. If the aircraft will not fly between ORs, one OR may be selected.

To set OR selection to automatic:

- 1.** Connect to the MPU of the HSD-400 terminal—see "Maintenance Port Utility" on page 4-2 for more information about connecting to the MPU.
- 2.** To navigate to Menu 4, press CTRL + N.
- 3.** To set ORs, press O.
- 4.** At the command prompt, type **-1**.

To select one OR:

- 1.** Connect to the MPU of the HSD-400 terminal—see "Maintenance Port Utility" on page 4-2 for more information about connecting to the MPU.
- 2.** To navigate to Menu 4, press CTRL + N.
- 3.** To set ORs, press O.
- 4.** To select an OR, type the number of that OR.

## **G. Configuring the Channel Cards for Swift64 and SBB**

The channel cards access and assign priority to Swift64 and SBB services according to the following rules:

- Give priority to SBB, but access Swift64 when SBB is not available
- Never permit access to Swift64
- Give priority to Swift64, but access SBB when Swift64 is not available

You can configure each channel card to follow any of these rules, and you can configure SBB as the highest priority service on both channel cards.

To configure a channel card for Swift64 and SBB

- 1.** Connect a computer to the maintenance port of the HSD-400 terminal. For more information, refer to "Maintenance Port Utility" on page 4-2.
- 2.** To access the maintenance menus, type the password **maint**.  
The password does not appear on the screen.  
Maintenance menu 1 appears.
- 3.** To navigate to maintenance menu 3, press CTRL + N.
- 4.** To access miscellaneous EEPROM parameters, press **m**.
- 5.** To access channel card configuration parameters, type **88**, and then press ENTER.

The current channel card configuration appears. In the example below, channel card one is operating as a Type 6 BGAN (SBB) terminal that can access Swift64 services when SBB is not available.

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```
CHANNEL CARD CONFIGURATION      CC #1  BGAN 6X
                                FALBACK TO SW64 PERMITTED
                                CC #2  NOT USED
S=SWIFT64  O=SWIFT64/TAL1  A=CLASSIC AERO  B=BGAN  N=NOT USED
CC #1 = ?
```

6. To configure the operating mode of channel card one, press the key corresponding to one of the options provided.

If you are configuring the channel card for SBB services, continue with Step 7 through to the end of the procedure. If you are configuring the channel card for Swift64 services, repeat Step 6 for channel card two and then jump to Step 10.

7. To configure the HSD-400 terminal to operate as a type 6 terminal, press **6**.

The HSD-400 terminal can operate only as a type 6 terminal.

```
S=SWIFT64  O=SWIFT64/TAL1  A=CLASSIC AERO  B=BGAN  N=NOT USED
CC #1 = ?  BGAN:  2=2A  3=3A  6=6X  ? 6X
```

8. To assign a priority to Swift64 and SBB services, press the key corresponding to a priority setting shown below.

```
ASSIGN PRIORITY RELATIVE TO SW64
  0 = BGAN PRIORITY, BUT FALBACK TO SW64 PERMITTED
  1 = SW64 NEVER PERMITTED
  2 = GAN PRIORITY -- BGAN ONLY IF SW64 NOT AVAILABLE
PRIORITY ? BGAN PRIORITY, BUT FALBACK TO SW64 PERMITTED
```

The prompt for channel card two configuration appears.

```
PRIORITY ? BGAN PRIORITY, BUT FALBACK TO SW64 PERMITTED
CC #2 = ?
EEPROM UPDATED
```

9. To configure channel card two, repeat steps 6 to 8.
10. To save changes, reset the HSD-400 terminal.

## **H. Removing the LED Label**

A label covers the LES Access Codes LEDs. You can remove this label once you have configured the LES Access Codes.

## **I. Activating Configurations**

After configuring the HSD-400 terminal parameters, the HSD-400 terminal must be reset using one of the following methods:

- In Menu 2, press Z to reset the system
- Cycle the power to the HSD-400 terminal
- Press the reset or remote reset button on HSD-400 terminals installed in Stand-Alone configurations.

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When the “reset” or “restart” is completed, the configuration values and parameters are activated.

#### **J. Verifying Configurations**

This section describes how to view the HSD-400 terminal configuration parameters.

To view the HSD-400 terminal ORT system configuration:

1. In Menu 3, press O.

The List ORT appears.

2. Press O to scroll through the listing.

To view the new system configurations select “List EEPROM” from Menu 3:

3. In Menu 3, press L.

The List EEPROM appears.

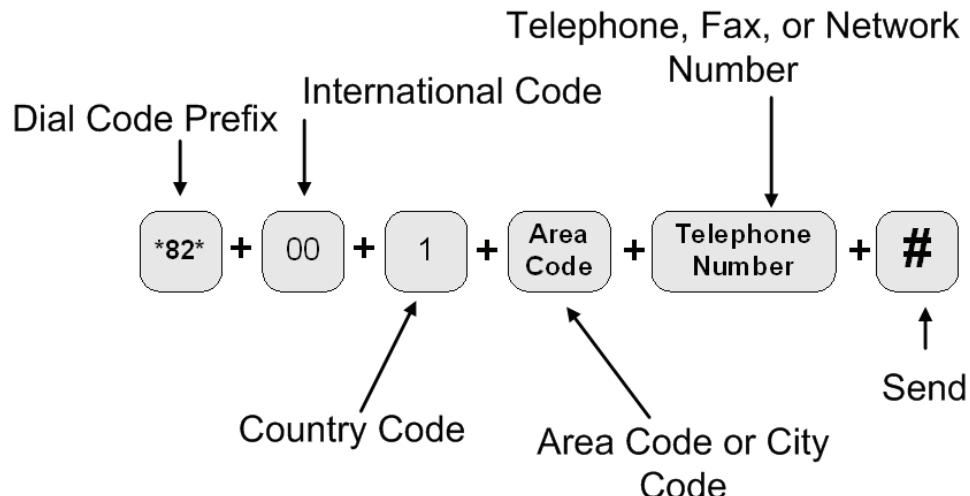
4. Press L to scroll through the listing.

### **3. Using Terminals**

This section describes how to place voice and fax calls using the ISDN interface of the HSD-400 terminal, and how to use the MPDS and Mobile ISDN data connections.

#### **A. Placing Swift64 Voice and Fax Calls**

Placing voice and fax calls using the HSD-400 terminal is similar to placing an international telephone call or entering a telephone number for dial-up networking data calls. Like international telephone numbers, the HSD-400 terminal “dialing-number-sequence” includes different routing components or codes. Figure 2-2 illustrates the required order of the dialing components.



**Figure 2-2. Dialing-Sequence Components**

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Each dialing sequence component serves a different routing function:

- **Dial Code Prefix:**

Use service-specific dial code prefixes when sending a fax or using analog modems, or for overriding system defaults to force the system to request a specific service type. Figure 2-2 uses the dial code prefix for 3.1 KHz audio service type (\*82\*). See “Dial Code Prefixes” on page 2-16 and Table 2-7 for more information about dial code prefixes.

- **International Access Code:**

Use the international code of the ground location where the call is originating when calling the aircraft during ground-to-air calls. The international access code for all airborne equipment is 00.

- **Country Code:**

Use the Public Switch Telephone Network (PSTN) number assigned to the country of your call destination. (Example: “1” is the Country Code for North America.)

- **Area Code (and City Code, if applicable):**

Use the PSTN routing number assigned to the area (and if applicable, city) of your call destination.

- **Telephone, Fax, or Network Number:**

The telephone, fax, or network number of your call destination.

- **# (SEND):**

Press # (or enter # at the end of the phone number field on data devices) to signal the system to send the call. Certain devices using the HSD-400 terminal may not have the functionality to insert the # symbol at the end of the dialing sequence. For those devices, additional Dial Code Prefixes are required to override the send command requirement. Refer to Table 2-8 for more information.

(1) **Dial Code Prefixes**

Although the system automatically selects the appropriate service types on outgoing calls for ISDN devices, a Dial Code Prefix is required to send a fax, identify an analogue modem, or force the system to override the system defaults to select a specific service type (see Table 2-7).

The system requires the Dial Code Prefix \*82\* for sending fax or when using analogue modems; it forces the system to request the required 3.1 kHz audio service from the Inmarsat Satellite Communications Network. If required, use the Dial Code Prefixes to override the system defaults for selecting specific service types. Dial Code Prefixes for all service types require an asterisk ( \* ) before and after the code number.

Other Dial Code Prefixes provide system overrides required if you are using devices that cannot add a # symbol to the dialing string or devices that are slow dialing. Table 2-7 provides a description of the additional Dial Code Prefixes used for system overrides for Swift64 and SBB services. Table 2-5 on page 2-10 provides a list of the LES and their associated codes available.

For SBB, prefix \*81\* can be used for AMBE+2 instead of 64 kbps speech. Prefix \*82\* is required for fax, modem, STU-III, and STE services. If no prefix is used, the SBB service defaults to AMBE+2.

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**Table 2-7. Dial Code Prefixes for Forcing Service Type Selection**

| Service Type             | Service Description               | Dial Code Prefix<br>(Forces service selection) |
|--------------------------|-----------------------------------|--|
| Speech 64 kbps (Swift64) | High-Speed Voice                  | *81*   |
| AMBE+2 (SBB)             |                                   |  |
| 3.1 kHz audio            | Fax, Analogue Modem, STU-III, STE | *82*   |
| 56 kbps data             | High-Speed Data                   | *83*   |
| 64 kbps data             | High-Speed Data                   | *84*   |
| 4.8 kbps speech          | AMBE<br>(Swift64 Low Speed Voice) | *80*   |

**Note:** Prefixes \*80\* and \*83\* are not supported for SBB. Prefix \*84\* can be used for SBB, but is not necessarily required.

**Table 2-8. Dial Code Prefixes for System Overrides**

| Reason for Override   | Dial Code Prefix | Example Dialing Sequence  |
|---|------------------|---|
| Use this Dial Code Prefix to override the default LES configured in the system.<br><br><i>This Dial Code Prefix signals the system to override the default LES and use the selected LES instead. (See Figure 2-7 or contact Inmarsat for Swift64 LES codes)</i> | 901 + LES CODE   | 901 + LES CODE + International Code + Country Code + Area Code + Telephone Number + #<br><br>901 + 002 + 00 + 1 + 613 + 5551212 + # |
| Use with devices that cannot produce or add a "#" character to end the dialing sequence.<br><br><i>This Dial Code Prefix signals the system to send the call after a specified delay in user input when the # symbol cannot be entered.</i>                     | 902              | 902 + International Code + Country Code + Area Code + Telephone Number<br><br>902 + 00 + 1 + 613 + 5551212                          |
| Use with slow dialing devices that cannot produce or add a "#" character to end the dialing sequence. This Dial Code Prefix signals the system to send the call after a specified delay in user input.  | 903              | 903 + International Code + Country Code + Area Code + Telephone Number<br><br>903 + 00 + 1 + 613 + 5551212                          |

**Note:** When using the System Override Dial-Code-Prefixes do not enter “\*” before or after the Dial Code Prefix as with other dial code prefixes.

**(2) Mobile-to-Mobile Communication**

The HSD-400 terminal provides a two-way link for mobile-to-mobile (aircraft-to-aircraft) communication.

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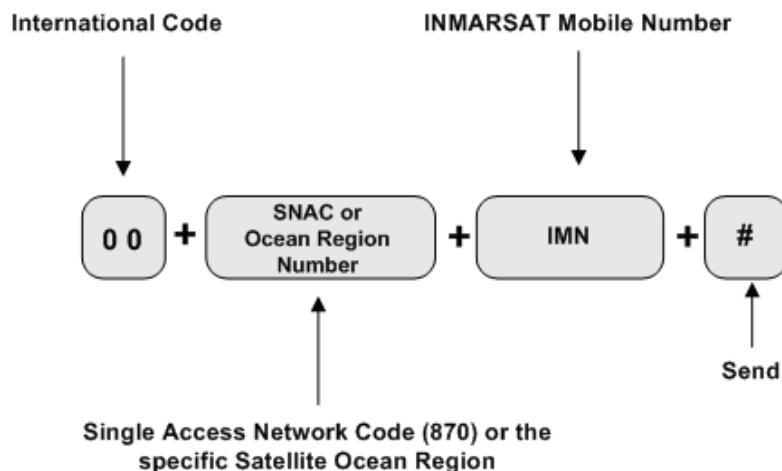
Using mobile-to-mobile calling requires additional information. You need to know the IMN of the device or service on the aircraft you are calling. If your service provider does not support Inmarsat's Single Network Access Code (SNAC) 870, you also need to know the current Satellite Ocean Region of the aircraft you are calling. Table 2-9 lists the SNAC code and the Satellite Ocean Region numbers.

**Table 2-9. Satellite Ocean Region Codes**

| <b>Satellite Ocean Region</b>      | <b>Ocean Region Number</b> |
|------------------------------------|----------------------------|
| Single Network Access Code         | 870                        |
| Atlantic Ocean Region East (AOR-E) | 871                        |
| Atlantic Ocean Region West (AOR-W) | 874                        |
| Pacific Ocean Region (POR)         | 872                        |
| Indian Ocean Region (IOR)          | 873                        |

If SNAC is unsupported, use the Ocean Regions Number that the aircraft (based on its projected flight path) is probably logged on to. If the call fails to connect to the aircraft, re-try the call using an alternate Ocean Region Number.

Figure 2-3 illustrates the Mobile-to-Mobile dialing sequence.



**Figure 2-3. Mobile-to-Mobile Dialing Sequence**

## B. Using Data Connections

This section provides a basic overview of the requirements for making data connections using the HSD-400 terminal.

Refer to the HSD Setup Guide (MN-1110-10048) for instructions on configuring dial-up networking connections.

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(1) Mobile ISDN versus MPDS

Deciding which service type to use depends how you intend on using your data connections. For more information about optimizing network usage, refer to the eNfusion® HSD High-speed Data Terminal Developer's Guide (MN-1252-13005).

(2) Connecting to Inmarsat Mobile ISDN Service

This section provides tips for connecting to the Inmarsat Mobile ISDN service (M4 Circuit-Switched Service). The transmission of data over satellite networks differs from land-based ISDN applications. Factors inherent in satellite communications (signal fading, latency, and transmission blockages) can cause data transit delays and bit errors.

Because of these challenges, it is sometimes necessary to optimize the system to achieve peak performance over the satellite network.

ISDN protocols are not designed specifically for use over satellite communication networks. To improve data transfer rates most ISDN protocols require minor adjustments. For best results, consider how the ISDN protocol you intend to use sends data over the network.

As examples, consider the protocols TCP/IP (over PPP) and V.120. As a basic protocol, PPP operates under the networking protocol TCP/IP. PPP has error checking properties but does not offer flow control.

TCP/IP is flexible and designed to run over different networks, including the Internet (which like satellite networks experiences high transit delays). When used together, PPP and TCP/IP protocols perform well over the Inmarsat network.

Improve the performance of TCP/IP (over PPP) for Mobile ISDN by changing the default parameters. Increase the maximum size of data allowed in transit at one time to a value up to approximately 255,552 bytes.

The V.120 protocol includes error correction and flow control applications. Flow control limits the amount of data that can be in transit at any one time and waits for acknowledgment of receipt from the other end of the connection before sending more data.

The default parameters of V.120 limit the maximum transit size of the data package to approximately 1764 bytes, causing poor performance results over satellite ISDN networks. Improve the performance of V.120 over Mobile ISDN by changing the default parameters. Increase the maximum size of data allowed in transit at one time to a value up to approximately 8000 bytes. (Some applications of V.120 permit the user to change the "window size".)

Both the HSD-400 terminal ISDN and Ethernet (x2) interfaces support connections to Inmarsat's Mobile ISDN service.

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(a) Using the ISDN Interface

The basic requirements for using the HSD-400 terminal ISDN interface to access Swift64 Mobile ISDN services over the satellite network are listed below:

- A EURO ISDN terminal adapter or router
- An account with an Inmarsat Service Provider
- A computer
- Dial-up Networking capabilities

The following sections describe the three main components required for Swift64 Mobile ISDN service using the ISDN interface.

1. Terminal Adapters – ISDN Modem

Terminal adapters are ISDN devices that function similarly to a modem; they dial and answer calls, and receive and transmit data. They are also referred to as TAs, ISDN cards, or ISDN modems.

**Note:** The HSD-400 terminal works with Euro S/T ISDN terminal adapters. Inmarsat Swift64 Mobile ISDN service and the HSD-400 terminal do not support the North American ISDN variant.

2. ISDN Protocols

Terminal adapters use ISDN protocols to format data between the ISDN line and the user's computer.

The HSD-400 terminal supports most ISDN protocols that run over a B channel on an ISDN line; however, it does not actually implement any of these protocols. The operating system of the user's computer implements the protocols.

3. ISDN Line

This ISDN satellite link acts similarly to an ISDN landline providing the same service, but it supports only a single B channel and emulates the D channel.

The B channel transmits data the same as an ISDN landline; it sends data at 64 kbps with full duplex. The MES translates the 16 kbps D Channel into an Inmarsat Mobile ISDN signaling system.

Despite the differences between landline ISDN and the Inmarsat Mobile ISDN link, most ISDN applications run successfully over the Inmarsat network.

(b) Using the Ethernet Interface for Inmarsat Mobile ISDN

The basic requirements for using an HSD-400 terminal Ethernet interface to access Swift64 Mobile ISDN services over the satellite network are listed below:

- A Point-to-Point Protocol over Ethernet (PPPoE) compatible router. All optional devices must be PPPoE compatible.
- An account with an Inmarsat Service Provider.
- A computer with PPPoE driver installed. PPPoE is the protocol most commonly used by Digital Subscriber Line (DSL) devices; it establishes the connection of the session and the exchanges of PPP frames over Ethernet.

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- Dial-up Networking capabilities

(3) Connecting to Inmarsat MPDS

The connection requirements for MPDS service over the satellite network differ depending on whether you access the system through an Asynchronous Serial (RS-232) or Ethernet (10BASE-T) physical connection.

(a) Using the RS-232 Interface

To make an MPDS connection using the HSD-400 terminal RS-232 port you need the following:

- An RS-232 cable (Asynchronous Serial)
- An activated account with an Inmarsat Service Provider that supports MPDS services
- A computer with an available COM port
- Dial-up Networking capabilities

When operating MPDS over the RS-232 port, no external connecting devices are required. The channel card in the HSD-400 terminal acts as a "modem" and responds to modem "AT" commands.

In order to make an MPDS over RS-232 connection, you need to select a standard modem on your computer to direct the data traffic to the PC COM port connected to the RS-232 MPDS port on the HSD-400 terminal.

(b) Using the Ethernet Interface

Connections using MPDS over the HSD-400 terminal Ethernet port require the following:

- A PPPoE driver installed. PPPoE is the protocol most commonly used by Digital Subscriber Line (DSL) devices; it establishes the connection of the session and the exchanges of PPP frames over Ethernet.
- An activated account with an Inmarsat Service Provider that supports MPDS services
- A computer with an Ethernet port
- Dial-up Networking capabilities/Web browser
- Optional devices (e.g. router) must be PPPoE compatible

(c) Optimizing the System for MPDS

To optimize your system for MPDS:

- Reduce the amount of unnecessary traffic. Ensure that the router configuration disables unnecessary Local Area Network (LAN) messages.
- Increase the window size in TCP/IP

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- Use DNS caching and Web caching. When using DNS and Web caching, the server only retrieves from the Internet IP addresses and Web pages not stored in the server cache.

**Note:** DNS caching and Web caching is effective when using a LAN configuration on the aircraft. For stand-alone computers, use a personal Web browser cache.

To optimize your e-mail client when using MPDS:

- Compress attachments (zip files)
- Under Tools, in the Options of your e-mail client (e.g. Outlook®, Eudora®) customize the settings for MPDS based on the recommendations below:
  - Disable the read receipt option
  - Send messages in text format instead of HTML format and disable signatures to reduce message size
  - Disable the “automatic download of message when in viewing panel” feature
  - Increase the time period for automatic mail checks to reduce traffic
  - Use IMAP4 mail protocol to allow for header retrieval only
  - Disable the “Save copy of send messages in the 'Sent Items' folder” option

## INSTALLATION

This section describes the procedures required to install HSD-400 terminals on an aircraft, including the following sections:

- **Advisories**
- **Pre-Installation Inspection**
- **ARINC 600 Trays and Connectors**
- **Mechanical Installation**
- **Electrical Installation**
- **Installation and Engineering Diagrams**

### **1. Advisories**

Before performing any installation procedures, read the safety advisories listed in the Introduction on page INTRO-5 of this manual.

### **2. Pre-Installation Inspection**

Before installing any HSD-400 terminal equipment, conduct a pre-installation inspection of all parts to ensure that no damage occurred during shipping:

- Unpack the HSD-400 terminal(s) from the shipping container(s).
- Verify that the part number displayed on the shipping box and equipment component matches the model and part number ordered. If components are missing from the shipment, contact the supplier or EMS SATCOM Product Support immediately and report the problem.
- Visually inspect the terminal for any shipping damage. If any shipping damage has occurred, contact the shipping carrier immediately and report the problem.
- Check the HSD-400 terminal connectors for corrosion and damage. If damage is noted, do not apply power to the terminal. Contact the supplier or EMS SATCOM Product Support immediately and report the problem.

### **3. ARINC 600 Trays and Connectors**

This section provides detailed information on the ARINC 600 trays provided in the HSD-400 terminal Installation Kits.

The HSD-400 terminal LRU is installed in a standard, ARINC 600, 8-MCU tray. Ruggedized trays designed specifically for installations on helicopter aircraft are also available.

#### **A. Installation Kits**

Installation kits for HSD-400 terminals are available from EMS SATCOM. Contact EMS SATCOM Sales department for more information on how to select and order the appropriate HSD-400 terminal Installation Kit.

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Table 3-1 lists the recommended installation kits for typical installations.

**Table 3-1. HSD-400 Terminal Installation Kits**

| Installation Kit Name                      | EMS SATCOM Part Number | Description  |
|--|------------------------|--|
| HSD-400 Installation Kit AC FAN            | 1110-F-0120-01         | Standard Installation Kit: Bottom AC Fan Tray Assembly and ARINC Connector (Un-pressurized Installation) |
| HSD-400 Installation Kit DC FAN            | 1110-F-0120-02         | Standard Installation Kit: Bottom DC Fan Tray Assembly and ARINC Connector (Un-pressurized Installation) |
| HSD-400 Installation Kit HELICOPTER AC FAN | 1110-F-0120-03         | Helicopter Installation Kit: Side AC Fan Tray Assembly and ARINC Connector                               |

## **B. Cabling Notes**

Before proceeding with the installation of the HSD-400 terminal, read all cabling notes provided on the HSD-400 terminal System Interconnection Diagram for the applicable HSD-400 terminal system operational mode (refer to Figure 3-7 and Figure 3-8).

### **(1) Cabling**

When installing the HSD-400 terminal, follow the cabling requirements listed below:

- Maximum recommended cable length should not exceed 50 feet.
- LAN cables must meet flammability, TIA/EIA568-A CAT 5 requirements, and conform to ARINC 628 specifications.
- Wire size recommendations:
  - For +28 V dc HOT (BP2), +28 V dc RTN GND (BP3), 115 V ac COLD (BP7), and Chassis GND (BP8), use 12 AWG
  - For 115 V ac HOT (BP1), use 20 AWG
  - Unless otherwise specified, for signaling use 22 AWG

### **(2) Coaxial Cable Loss Considerations**

When installing HSD-400 terminals, consider the following coaxial cable loss requirements:

- Transmit cable: Maximum loss is 2.5 dB including DLNA (typically <0.8 dB) as per ARINC 741. In installations that use a high power relay, the high power relay loss must be included.
- Receive cable: For HSD-400 terminals operating in Stand-Alone Mode the minimum loss is 6 – 25 dB (including any in-line attenuator) as per ARINC 741.

## **4. Mechanical Installation**

This section describes the mechanical installation requirements for the HSD-400 terminal. The Outline and Installation drawing, shown in Figure 3-7 and Figure 3-8, illustrates the physical and mechanical specifications of the HSD-400 terminal.

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All HSD-400 terminal ARINC installation trays are included in the Installation Kits. Table 3-1 describes the HSD-400 terminal Installation Kits available from EMS SATCOM.

**A. Physical Placement**

When selecting a location for the HSD-400 terminal, allow for adequate spacing for the installation while providing reasonable access for servicing. Leave a minimum gap of 0.5 inches between LRUs.

**B. Environmental Requirements**

The environmental requirements that must be considered during the physical placement of the HSD-400 terminals are based on the RTCA/DO-160D Environmental Specifications detailed in the System Description section of this manual.

The standard mounting trays for the HSD-400 terminal offer a number of fan configuration options depending on the physical placement of the LRU in the aircraft.

**(1) Heating and Cooling**

Refer to the System Description section of this manual for a complete listing of the RTCA/DO-160D Environmental Specifications for HSD-400 terminals.

When selecting an installation location for the HSD-400 terminal, consider the heating and cooling requirements listed below:

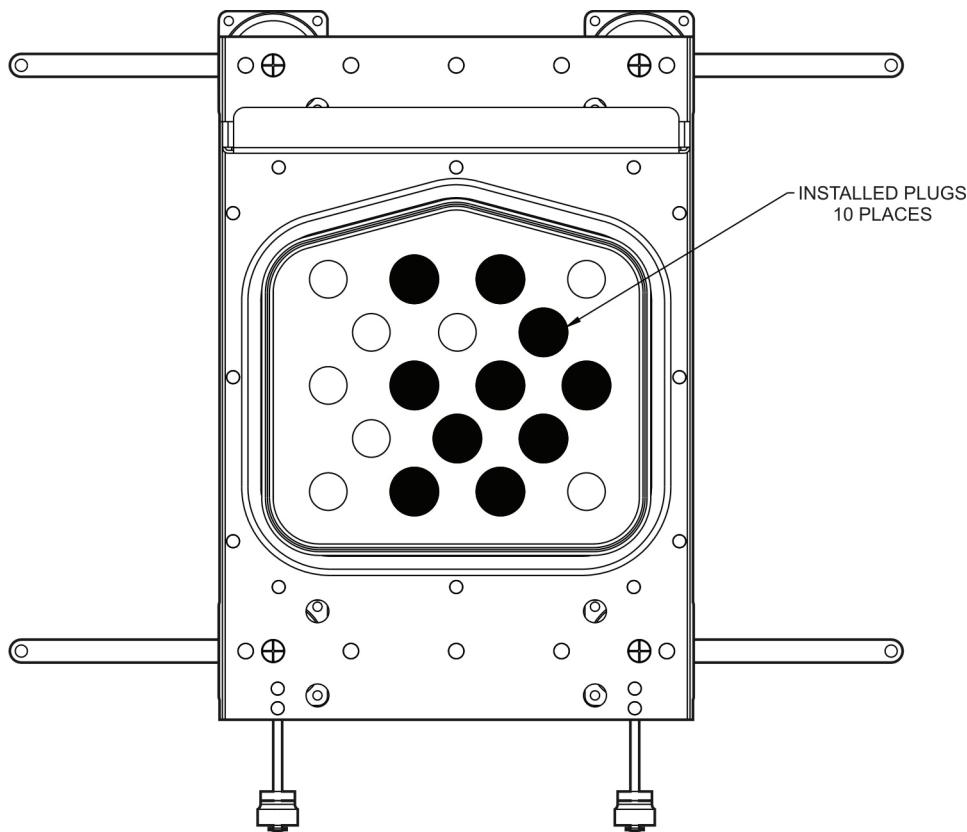
- Power Dissipation (AC models): 275 Watts nominal, 425 Watts maximum
- Power Dissipation (DC models): 275 Watts nominal, 425 Watts maximum
- Cooling Air: per ARINC 600
- Recommended Flow rate: 175 lbs/hr
- Pressure drop: 0.05",  $\pm 0.025$ " H<sub>2</sub>O

**(2) Fan Tray Requirements**

**WARNING: FAILURE TO INSTALL AND CONFIGURE THE FAN TRAY ASSEMBLY AS INSTRUCTED MAY SERIOUSLY COMPROMISE THE EXTREME TEMPERATURE OPERATION OF THE HSD-400 TERMINAL.**

Fan tray assemblies may be shipped with or without hole-plug-buttons installed. For adequate airflow to the HSD-400 terminal subassemblies, the plugs must be installed or removed in the fan/tray configuration as illustrated in Figure 3-1.

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**Figure 3-1. Fan Tray Plug Configuration (black = installed, white = removed)**

### **C. Chassis Grounding**

The HSD-400 terminal tray-mounted assemblies must be electrically bonded to the airframe. Ensure the mating surfaces are free from contaminants such as paints or other non-conductive elements. Where surface preparations are insufficient to ensure a proper bond, the use of a short, tin-coated, copper bonding strap of at least  $\frac{1}{4}$  inch wide is recommended. The LRU and tray assemblies should provide a low impedance path of  $<0.2$  ohms.

## **5. Electrical Installation**

This section provides electrical installation details for HSD-400 terminals. This section is divided into sub-sections that provide the wiring details for the currently supported modes of operation (Stand-Alone Mode only).

### **A. Cabling and Connector Requirements**

This section provides general electrical installation information on power, ground, shielding requirements, and cabling.

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**(1) Power Requirements**

The aircraft power supply provides power to the HSD-400 terminal. This power supply must be +28 V dc nominal for model 1252-A-3200. For HSD-400 terminal model 1252-A-3100, the power supply must be at 115 V ac, 400 Hz (nominal).

**(2) Ground Requirements**

Improper grounding can potentially lead to ground loops and induced Electromagnetic Interference (EMI) or Radio Frequency Interference (RFI). When installing an HSD-400 terminal, follow standard grounding practices for both chassis and cabling shields. Refer to section D on page 3-4 for chassis and tray grounding instructions.

**(3) Cable Shielding and Termination**

The preferred method of cable shield termination is in accordance with NEMA WC 27500:2000 and ARINC 741. ARINC Report 413A - Guidance for Aircraft Electrical Power Utilization and Transient Protection provides more detailed information in Attachment 3-2, Wire Shielding and Grounding Requirements and in Appendix 7.

Unless otherwise stated, all cable shields must be connected to the closest aircraft ground at both ends of the cable and on both sides on any production break in the cable. Where applicable, terminate shields with connectors via the backshell or via a pigtail with a suitable termination to the closest aircraft ground.

General aviation cable-routing guidelines apply. See Table 3-2 for detailed information.

**Note:** Typically, Ethernet and ISDN cables have multiple shields; terminate each shield separately.

**Table 3-2. Cable Shielding and Termination Specifications**

| <b>Cable Function</b> | <b>Conductor Type (Typical)</b> | <b>Single Point</b> | <b>Multiple Point</b> | <b>Minimum Conductor Coverage By Shield</b> |
|-----------------------|---------------------------------|---------------------|-----------------------|---|
| Power Lines           | Single conductor, stranded      | N/A                 | N/A                   | N/A   |
| Digital Control       | Twisted pair, stranded          |                     | Yes                   | 85%   |
| Serial Data           | Twisted pair, stranded          |                     | Yes                   | 85%   |
| Ethernet Data         | Twisted pair, stranded          |                     | Yes                   | 85%   |
| ISDN Data             | Twisted pair, stranded          |                     | Yes                   | 85%   |
| Discrete Lines        | Single conductor, stranded      | N/A                 | N/A                   | N/A   |

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**Table 3-2. Cable Shielding and Termination Specifications (Continued)**

| Cable Function   | Conductor Type (Typical) | Single Point | Multiple Point | Minimum Conductor Coverage By Shield |
|--|--------------------------|--------------|----------------|--------------------------------------|
| RF TX and RX   | Coaxial                  |              | Yes            | 95%                                  |
| <b>Definitions</b>   |                          |              |                |                                      |
| <b>Single Point:</b> Cable shield terminated at one end only via a connector or suitable crimp terminal.   |                          |              |                |                                      |
| <b>Multiple Point:</b> Cable shield terminated at both ends via a connector or suitable crimp terminal, usually at both ends of the cable and at both sides of any production break. |                          |              |                |                                      |
| <b>N/A:</b> Not applicable.  |                          |              |                |                                      |

## B. Wiring Notes

### (1) Source/Destination Identification

Source/Destination Identification (SDI) is provided for the BSU and the HPA as per ARINC 741 specifications. Pins marked "0" are left open-circuit and pins marked "1" are strapped on the airframe side of the connector to the pin assigned as "SDI Common" (TP5D). For this High Gain Antenna (HGA) HPA application, pin TP5B ("1") should be strapped and TP5A ("0") should be left open.

**Note:** The logic for the SDI/WOW is explained in ARINC 741 Characteristic Attachment 1-4, Note 19. This SDI/WOW logic in this case (where 0=open and 1=strapped to common) is the reverse of the logic applied to all other HSD-400 terminal connectors, Forward ID, System Config, and Data I/O Config, where 0=strapped to common and 1=open.

### (2) Maintenance Port Interface

The HSD-400 terminal has an RS-232 Maintenance Port interface that provides access to the Maintenance Port Utility (MPU) for data loading, system monitoring, and testing purposes.

Refer to the Test and Fault Isolation section for information on how to connect and use the maintenance port, including equipment requirements, connection and cabling requirements, software loading instructions, and configuration details.

### (3) Antenna Subsystem RF Interface

Several external RF parameters (such as cable losses and antenna gain), that must be delimited to ensure proper operation, dictate the HSD-400 terminal performance requirements.

Table 3-3 defines the RF parameters and their expected values.

**Table 3-3. RF Parameters Definition**

| Parameter         | Min. Value (DB) | Max. Value (DB) |
|-------------------|-----------------|-----------------|
| Antenna Gain      | 8               | 17              |
| Antenna-DLNA Loss | 0.1             | 0.3             |

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**Table 3-3. RF Parameters Definition**

| Parameter                                | Min. Value (DB) | Max. Value (DB) |
|--|-----------------|-----------------|
| DLNA Gain                                | 53              | 60              |
| DLNA Noise Figure                        | 1.5             | 1.8             |
| DLNA-HSD-400 (Rx) Loss                   | 6               | 25              |
| HSD-400-Antenna (Tx) Loss                | 1               | 2.5             |
| DLNA Insertion Loss (Tx to Antenna Port) | —               | 0.8             |

**(4) WOW Pin Wiring**

WOW wiring is optional for system operation.

The WOW1 and WOW2 pins are either left open circuit or connected to the airframe DC ground. The WOW Program Select (PGM) pin is either left open circuit or connected to the Forward Address Common. The three ground states, defined for any pin are:

- OPN: Open circuit
- AFG: Airframe DC Ground
- FAC: FWD Address Common (TP7K)

Resolve any conflict between WOW1 and WOW2 by assuming the aircraft is "in-air." The interpretation of the state of the WOW1 and WOW2 pins is defined by the state of the WOW program select pin. Refer to Table 3-4 for details.

Use of the WOW discretes enable the HSD-400 terminal to determine whether or not the aircraft is airborne. However, in Stand-Alone Mode installations, the HSD-400 terminal receives speed information for Doppler correction via the INS. This makes the WOW wiring redundant and optional for most installations.

The functionality of the WOW discretes was expanded to include the ability to inhibit RF transmission when the aircraft is on the ground. Please note that WOW functionality is disabled by default and must be enabled in EEPROM. If WOW wiring is not wired, normal maintenance activities should be prohibited when speed or Doppler readings are greater than zero to avoid RF exposure. Follow normal safety procedures and disable the SATCOM system before performing antenna maintenance.

The functionality will be further enhanced with the inclusion of a Transmit Disable discrete in a planned future software upgrade.

**Table 3-4. WOW Pin Wiring Table**

| Pin Name and Location |      |      | Aircraft Status            |
|-----------------------|------|------|----------------------------|
| WOW1                  | WOW2 | PGM  |                            |
| TP3G                  | TP3K | TP3J |                            |
| AFG                   | AFG  | FAC  | In-air                     |
| OPN                   | AFG  | FAC  | Not valid - Default in-air |

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**Table 3-4. WOW Pin Wiring Table**

| <b>Pin Name and Location</b> |     |     |                            |
|------------------------------|-----|-----|----------------------------|
| AFG                          | OPN | FAC | Not valid - Default in-air |
| OPN                          | OPN | FAC | On-ground                  |
| AFG                          | AFG | OPN | On-ground                  |
| OPN                          | AFG | OPN | Not valid - Default in-air |
| AFG                          | OPN | OPN | Not valid - Default in-air |
| OPN                          | OPN | OPN | In-air                     |

(5) Forward and Return Address IDs

Figure 3-2 provides an example of a Forward ID address. The Forward ID is a Hex number (example: \$ABC123) that must be converted into a binary number for strapping.

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|  |  |  |      |   |
|--|--|--|------|---|
|  |  |  | TP7J | 1 |
|  |  |  | TP7H | 0 |
|  |  |  | TP7G | 1 |
|  |  |  | TP7F | 0 |
|  |  |  | TP7E | 1 |
|  |  |  | TP7D | 0 |
|  |  |  | TP7C | 1 |
|  |  |  | TP7B | 1 |
|  |  |  | TP7A | 1 |
|  |  |  | TP6K | 1 |
|  |  |  | TP6J | 0 |
|  |  |  | TP6H | 0 |
|  |  |  | TP6G | 0 |
|  |  |  | TP6F | 0 |
|  |  |  | TP6E | 0 |
|  |  |  | TP6D | 1 |
|  |  |  | TP6C | 0 |
|  |  |  | TP6B | 0 |
|  |  |  | TP6A | 1 |
|  |  |  | TP5K | 0 |
|  |  |  | TP5J | 0 |
|  |  |  | TP5H | 0 |
|  |  |  | TP5G | 1 |
|  |  |  | TP5F | 1 |
|  |  |  | TP7K |   |

**Figure 3-2. Forward ID, Hex to Binary Conversion**

A pin strapped to the same potential as T7K (Forward address common) is considered as a logical “0”, whereas an open circuit pin is considered as a logical “1”.

**Note:** MSB is the Most Significant Bit and LSB is the Least Significant Bit.

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## (6) Remote Status Panel (Optional)

An optional “remote status panel” may be installed when HSD-400 terminals are located in inaccessible or remote locations. The installation of a “remote status panel” is recommended as it provides visual indications of the power and faults for each terminal.

A "remote reset switch" for HSD-400 terminals can also be installed and located with the Remote Status Panel. Figure 3-3 illustrates a typical wiring diagram for the remote reset circuit.

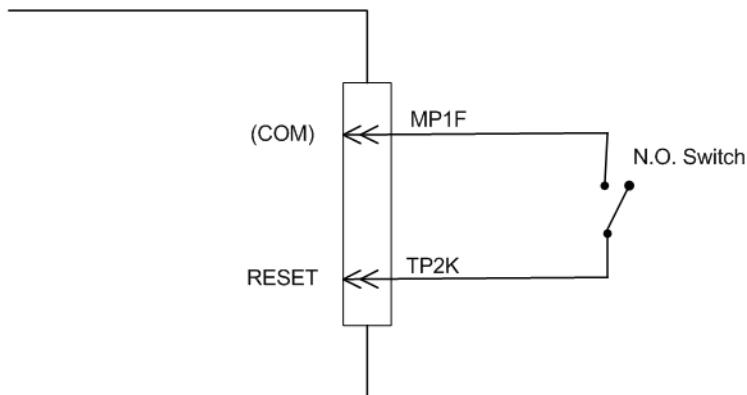
(a) Remote Reset Switch Circuit Requirements

HSD-400 terminals support the installation of a Remote Reset Switch circuit as shown in Figure 3-3.

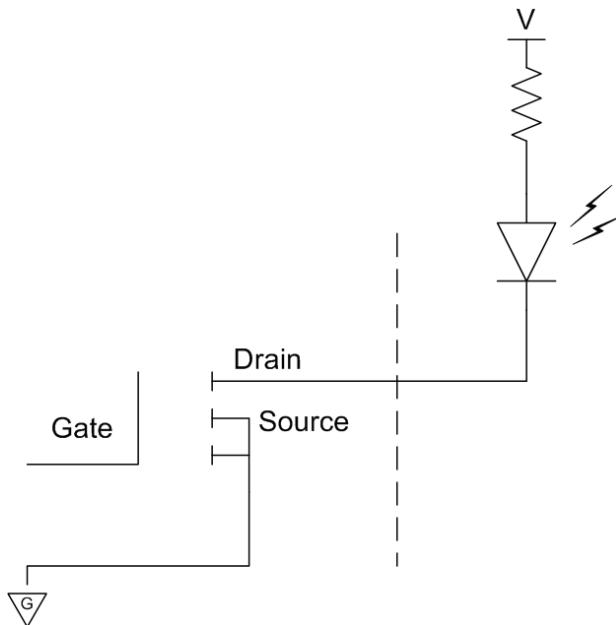
The HSD-400 terminal Remote Reset circuit requires less than 100 ohms between TP1K (RESET) and MP1F(COM) to be asserted and greater than 10K ohms to be de-asserted (includes all cable and switch contact resistance).

(b) Remote LED Driver Circuit Requirements

The circuit requirements for the HSD-400 terminal Remote Status LED drivers are shown in Figure 3-4. Each LED driver circuit provides an open-drain FET (Field-Effect Transistor) interface that has a maximum continuous drain-to-source voltage of 35 V dc and drain-to-source current of 0.5 A DC. These circuits are designed to sink current to ground only. Any external lamps or LEDs connected to these driver circuits require the appropriate external voltage and series impedance to be connected.



**Figure 3-3. Remote Reset Switch Circuit**



**Figure 3-4. Remote LED Panel Circuit**

**(7) User Interfaces**

To facilitate user access to HSD-400 terminal interfaces, install the following connectors in the appropriate cabin area.

**(a) ISDN Interface**

Install an RJ-45 connector in the cabin area for user connections to the ISDN interface. RJ-45 connector and cable termination is described in RJ-45 Connector Termination Details below.

**(b) RS-232 Interface (MPDS)**

Install a DB9S interface connector in the cabin area for connection to the RS-232 interface. Refer to the HSD-400 terminal Interconnection Drawings for pinout designation.

**(c) Ethernet Data Interface**

Install one or two RJ-45 interface connectors in the cabin area for user access to the Ethernet interfaces. The next section describes the RJ-45 connector and cable termination.

**(d) RJ-45 Connector Termination Details**

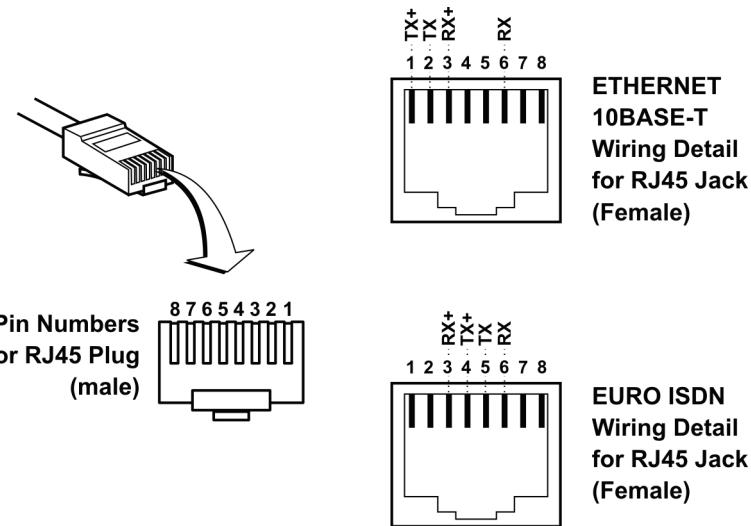
Details relating to the RJ-45 cable terminations, required for both the ISDN and/or 10BASE-T services, are shown in Table 3-5 and Figure 3-5.

Use LAN cables that meet flammability and TIA/EIA568-A CAT-5 requirements. Cables #922404 (4 conductor) and # 922408 (8 conductor), as supplied by Electronics Cable Specialists (See Appendix), are acceptable. Equivalent substitutions from other manufacturers may be used.

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**Table 3-5. RJ-45 Wiring Details**

| SIGNAL | Service   |        |                   |     |       |                                     |
|--------|-----------|--------|-------------------|-----|-------|-------------------------------------|
|        | EURO ISDN |        | ETHERNET 10BASE-T |     |       |                                     |
|        | PIN       | CABLE  |                   | PIN | CABLE |                                     |
|        |           | ECS    | OTHER             |     | ECS   | OTHER                               |
| RX +   | 3         | White  | White/Green       | 3   | White | White/Orange stripe                 |
| RX     | 6         | Blue   | Green             | 6   | Green | Orange/White stripe or solid Orange |
| TX+    | 4         | White  | Blue              | 1   | White | White/Green stripe                  |
| TX     | 5         | Orange | White/Blue        | 2   | Brown | Green/White stripe or solid Green   |



**Figure 3-5. RJ-45 Connector Terminator Details**

**(8) System Configuration Pin Strapping**

The HSD-400 terminal adjusts its configuration according to the status of several strap pins on the rear ARINC 600 connector.

Configuration pins are assigned based on system mode configuration selection and data input/output (I/O) requirements as shown in Table 3-6. Detailed pin assignment is shown in Table 3-7 and Table 3-8.

**Table 3-6. Configuration Pin Summary**

| Pin #     | Name                     | Function                                   |
|-----------|--------------------------|--|
| TP4A to D | System Config #1 to #4   | System Mode (coded, see Table 3-8)         |
| TP4E to H | System Config #5 to #8   | Not assigned (set to “1”)                  |
| MP5G to K | Data I/O Config #1 to #4 | Note: Data I/O Mode (coded, see Table 3-8) |

**Note:** The logic for the System Configuration pins is reverse to the logic explained in ARINC 741 Characteristic Attachment 1-4, Note 19.

- Pins marked “0” are signaled by strapping to “Fwd Address Common” (T7K).
- Pins marked “1” are signaled by an open circuit-no connection.
- Configurations resulting in all ones (“1”) are invalid.

**(9) System Mode Strap Pins Coding**

The HSD-400 terminal must be externally strapped according to its intended operational configuration mode. Table 3-7 illustrates the system pin strapping for currently supported HSD-400 terminal operational modes and configurations (Stand-Alone Mode only).

**Table 3-7. System Pin Strapping**

| System Modes | Pin Status |      |      |      |
|--------------|------------|------|------|------|
|              | TP4A       | TP4B | TP4C | TP4D |
| 1            | 2          | 3    | 4    |      |
| INVALID      | 1          | 1    | 1    | 1    |
| Stand-Alone  | 0          | 1    | 0    | 1    |

**Note:** The logic for the System Mode pins is reverse to the logic explained in ARINC 741 Characteristic Attachment 1-4, Note 19. For System Mode pins, 0=strapped to common and 1=open.

**(10) User Data I/O Mode Pin Strapping**

Data I/O Mode Pin strapping is required for HSD-400 terminals.

The following settings allow placing restrictions on the way both channels are used. If the user has no specific requirements then it is recommended to leave both channels as “Unrestricted.”

In HSD-400 terminals, all channels are accessible for Swift64 Mobile ISDN via the ISDN port on a first come-first served basis. All modes detailed in Table 3-8 are also described in Figure 3-6.

The following statements apply:

- The channel cards are pooled, which means that no particular card is operated in one of the selected modes.

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- If one channel card becomes inoperative, and there is a conflicting configuration (for example, 1 Reserved, 1 SCPC - for Swift64 Mobile ISDN), then the remaining card operates in "Unrestricted" mode.
- A "restricted" channel is not handled by the Data I/O Controller, which results in the channel not being accessible for SCPC via Ethernet or for MPDS via RS232 or Ethernet.
- An SCPC channel is accessible for SCPC via Ethernet.
- An MPDS channel is accessible for MPDS via RS232 and Ethernet.
- An "unrestricted" channel is accessible for SCPC via Ethernet and MPDS via RS232 and Ethernet.

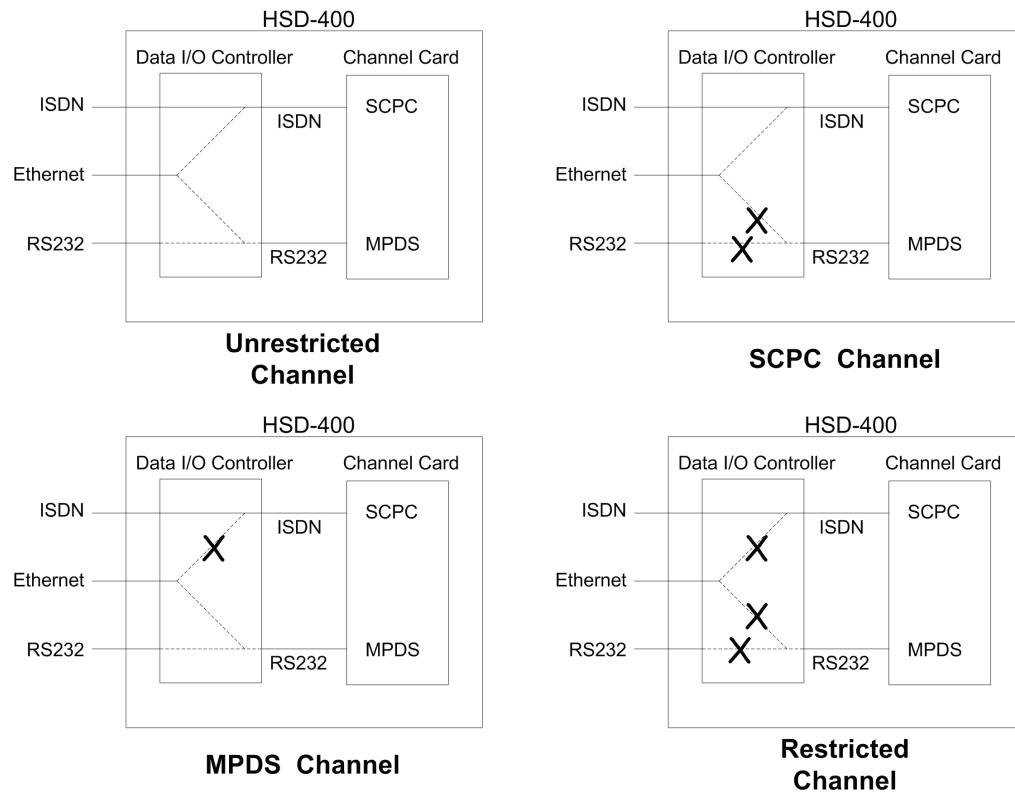
**Note:** Use a "Restricted" Data I/O Mode if only ISDN service is available.

**Table 3-8. Data I/O Mode Pin Strapping**

| Pin Status |      |      |      | Data I/O Mode   |
|------------|------|------|------|---|
| MP5G       | MP5H | MP5J | MP5K |   |
| 1          | 1    | 1    | 1    | Invalid   |
| 1          | 1    | 1    | 0    | 1 Restricted, 1 Unrestricted                                  |
| 1          | 1    | 0    | 1    | 1 Restricted, 1 SCPC  |
| 1          | 1    | 0    | 0    | 1 Restricted, 1 MPDS  |
| 1          | 0    | 1    | 1    | 2 Restricted (ISDN only)                                      |
| 1          | 0    | 1    | 0    | 2 SCPC  |
| 1          | 0    | 0    | 1    | 1 SCPC, 1 Unrestricted  |
| 1          | 0    | 0    | 0    | 2 MPDS  |
| 0          | 1    | 1    | 1    | 1 MPDS, 1 Unrestricted  |
| 0          | 1    | 1    | 0    | 1 SCPC, 1 MPDS  |
| 0          | 1    | 0    | 1    | 2 Unrestricted (recommended if no specific user requirements) |
| 0          | 0    | 0    | 0    | Reserved  |

**Note:** ('0' = FWD Address Common, '1' = No Connection)

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**Figure 3-6. User Data I/O Mode Configurations**

### C. ARINC 429 IRS Bus Interface

In Stand-Alone Mode installations, navigational information is provided to the HSD-400 terminal through the high-speed ARINC 429 IRS bus interface. Refer to the System Description section of this manual for more information. The IRS bus connects through the top plug of the ARINC 600 connector to the HSD-400 terminal as follows:

- IRS A to TP4J
- IRS B to TP4K

### D. Antenna Interface

The ARINC 741 antenna subsystem BSU is interconnected to the HSD-400 terminal as specified in Table 3-9.

**Table 3-9. HSD-400 Terminal to BSU Interconnects**

| <b>Signal Name</b> | <b>Signal Source</b>    |                       |                                      | <b>Signal Destination</b>    |
|--------------------|-------------------------|-----------------------|--------------------------------------|------------------------------|
|                    | <b>HSD-400 Terminal</b> | <b>Mechanical HGA</b> | <b>Phased-Array or Conformal HGA</b> |                              |
| HPA MUTE A         |                         |                       | Port BSU-G<br>STBD BSU-G             | HSD-400 TP3A<br>HSD-400 TP3C |

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**Table 3-9. HSD-400 Terminal to BSU Interconnects (Continued)**

| Signal Name   | Signal Source    |                |                               | Signal Destination      |
|---|------------------|----------------|-------------------------------|-------------------------|
|   | HSD-400 Terminal | Mechanical HGA | Phased-Array or Conformal HGA |                         |
| HPA MUTE B  |                  |                | Port BSU-H                    | HSD-400 TP3B            |
|   |                  |                | STBD BSU-H                    | HSD-400 TP3D            |
| BSU BITE A  |                  | BSU-W(G)*      | Port BSU-W                    | HSD-400 TP2A            |
|   |                  |                | STBD BSU-W                    | HSD-400 TP2C            |
| BSU BITE B  |                  | BSU-X(H)       | Port BSU-X                    | HSD-400 TP2B            |
|   |                  |                | STBD BSU-X                    | HSD-400 TP2D            |
| Multi-Control A   | TP3E             |                |                               | BSU-T(A) & HSD-400 TP1A |
| Multi-Control B   | TP3F             |                |                               | BSU-U(B) & HSD-400 TP1B |
| *Letters in (brackets) represent EMS SATCOM AMT-50 BSU pin designations   |                  |                |                               |                         |
| <b>Top/Port (T/P):</b> Refers to Mechanical (fin-mount) High Gain Antenna (HGA) Subsystem                       |                  |                |                               |                         |
| <b>Port:</b> Refers to Phased Array (Fuselage-mount) or Port side of Dual (side) Conformal-mount, HGA subsystem |                  |                |                               |                         |
| <b>Starboard (STBD):</b> Refers to Starboard side of Dual (side) Conformal-mount HGA subsystem                  |                  |                |                               |                         |

#### E. Connection Details

The tables in this section provide all top, middle, and bottom plug connection details for Stand-Alone Mode installations.

**Table 3-10. Stand-Alone Mode ARINC 600 Top Plug Connection Details**

| I/O | From Top Plug | Signal Name                         | To   | Description                        |
|-----|---------------|-------------------------------------|--|------------------------------------|
| I   | 1A            | Multi-control A                     | TP3E   | Multi-control from control card    |
| I   | 1B            | Multi-control B                     | TP3F   | Multi-control from control card    |
| I   | 2A            | BSU Top/Port BITE A<br>(See Note 1) | Mech. Steered Antenna (MA): BSU, Pin G or W or Other Antenna (OA): BSU, PORT-W & Starboard-P | ARINC Tx-HI BITE from Top/Port BSU |
| I   | 2B            | BSU Top/Port BITE B                 | MA: BSU, Pin H or X, or OA: BSU, PORT-X & STBD-R   | ARINC Tx-LO BITE from Top/Port BSU |

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**Table 3-10. Stand-Alone Mode ARINC 600 Top Plug Connection Details**

| I/O | From Top Plug  | Signal Name                 | To   | Description  |
|-----|----------------|-----------------------------|--|--|
| I   | 2C             | BSU Starboard (STBD) BITE A | MA: Not required<br>OA: BSU, PORT-P & STBD-W                                       | ARINC Tx-HI BITE from STBD BSU                               |
| I   | 2D             | BSU STBD BITE B             | MA: Not required<br>OA: BSU, PORT-R & STBD-X                                       | ARINC Tx-LO BITE from STBD BSU                               |
| I   | 3A             | Top/Port HPA MUTE A         | MA: Not required<br>OA: BSU, PORT-G  | HPA Mute-A, Port BSU   |
| I   | 3B             | Top/Port HPA MUTE B         | MA: Not required<br>OA: BSU, PORT-H  | HPA Mute-B, Port BSU   |
| I   | 3C             | STBD HPA MUTE A             | MA: Not required<br>OA: BSU, STBD G  | HPA Mute-A, STBD BSU   |
| I   | 3D             | STBD HPA MUTE B             | MA: Not required<br>OA: BSU, STBD-H  | HPA Mute-B, STBD BSU   |
| O   | 3E             | OUT Multi-Control A         | IN Multi Ctrl A (TP1A), and<br>MA: BSU, Pin A or T, or<br>OA: BSU, PORT-T & STBD-T | Multi-Control-HI to HSD-400 Terminal & Antenna Subsystem     |
| O   | 3F             | OUT Multi-Control B         | IN Multi Ctrl B (TP1B), and<br>MA: BSU, Pin B or U, or<br>OA: BSU, PORT-U & STBD-U | Multi-Control-LO to HSD-400 Terminal & Antenna Subsystem     |
| I   | 2K             | Remote Reset                | Normally open momentary switch-open side.<br>(Closed side to MP1F)                 | Remote System Reset  |
| I   | 3G             | WOW 1                       | TP3G   | Weight On Wheel, as defined in Note 40 of ARINC 741, Part 1. |
| I   | 3H             | WOW 2                       | TP3K   | Refer to Section 8.D WOW Pin Wiring                          |
| I   | 3J             | WOW Program Select          | TP3J   |  |
| I   | 4A, 4B, 4C, 4D | System Config 1 to 4        | 4A & 4C=0 (TP7K common), 4B & 4D=1(Open)   | Stand-Alone Mode   |
| I   | 4E to 4H       | System Config 5 to 8        | Open (1)   | System Configuration - not assigned                          |
| I   | 4J             | IRS-A                       | Aircraft main IRS  | IRS 429 Data, Rx HI  |
| I   | 4K             | IRS-B                       | Aircraft main IRS  | IRS 429 Data, Rx LO  |
| I   | 5A             | SDI 1                       | Not connected  | HPA Select Code for HGA                                      |
| I   | 5B             | SDI 2                       | SDI common (TP5D)  | HPA Select Code for HGA                                      |
| I   | 5D             | SDI Common                  | SDI 2 (TP5B)   | SDI Common for HPA select codes                              |

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**Table 3-10. Stand-Alone Mode ARINC 600 Top Plug Connection Details**

| I/O | From Top Plug | Signal Name               | To                                 | Description                                       |
|-----|---------------|---------------------------|------------------------------------|---|
| I   | 5C            | USIM + 12 V PWR           | USIM                               | Power to remote USIM (Future)                     |
| I/O | 5E            | USIM + 12 V RTN           | USIM                               | Power to remote USIM (Future)                     |
| I   | 5F            | FWD Address, BIT 24 (LSB) | 1=no connection<br>0=Common (TP7K) | Six digit Hex ID assigned by INMARSAT /EMS SATCOM |
| I   | 5G            | FWD Address, BIT 23       |                                    |   |
| I   | 5H            | FWD Address, BIT 22       |                                    |   |
| I   | 5J            | FWD Address, BIT 21       |                                    |   |
| I   | 5K            | FWD Address, BIT 20       |                                    |   |
| I   | 6A            | FWD Address, BIT 19       |                                    |   |
| I   | 6B            | FWD Address, BIT 18       |                                    |   |
| I   | 6C            | FWD Address, BIT 17       |                                    |   |
| I   | 6D            | FWD Address, BIT 16       |                                    |   |
| I   | 6E            | FWD Address, BIT 15       |                                    |   |
| I   | 6F            | FWD Address, BIT 14       |                                    |   |
| I   | 6G            | FWD Address, BIT 13       |                                    |   |
| I   | 6H            | FWD Address, BIT 12       |                                    |   |
| I   | 6J            | FWD Address, BIT 11       |                                    |   |
| I   | 6K            | FWD Address, BIT 10       |                                    |   |
| I   | 7A            | FWD Address, BIT 9        |                                    |   |
| I   | 7B            | FWD Address, BIT 8        |                                    |   |
| I   | 7C            | FWD Address, BIT 7        |                                    |   |

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**Table 3-10. Stand-Alone Mode ARINC 600 Top Plug Connection Details**

| I/O | From Top Plug | Signal Name              | To | Description   |
|-----|---------------|--------------------------|----|---|
| I   | 7D            | FWD Address, BIT 6       |    |   |
| I   | 7E            | FWD Address, BIT 5       |    |   |
| I   | 7F            | FWD Address, BIT 4       |    |   |
| I   | 7G            | FWD Address, BIT 3       |    |   |
| I   | 7H            | FWD Address, BIT 2       |    |   |
| I   | 7J            | FWD Address, BIT 1 (MSB) |    |   |
| I   | 7K            | FWD Address, Common      |    | Common GND connection for system and I/O configuration and FWD ID |

**Table 3-11. Stand-Alone ARINC 600 Middle Plug Connection Details**

| I/O | From Middle Plug | Signal Name               | To   | Description   |
|-----|------------------|---------------------------|--|---|
| O   | 1A               | LED 1                     | Remote Status Panel Green LED/Lamp                                   | HSD-400 Terminal - Power On (Optional)                |
| O   | 1B               | LED 2                     | Remote Status Panel Red LED/Lamp                                     | HSD-400 Terminal - Fault (Optional)                   |
| O   | 1F               | LED Common                | Remote Status LED Panel, and closed side of N.O. Remote Reset Switch | LED Common  |
| O   | 1G               | Maint Port Tx (OUT)       | Maint Port serial data, DB9S-2                                       | Maintenance computer (laptop/PC), for "Remote" access |
| I   | 1H               | Maint Port Rx (IN)        | Maint Port serial data, DB9S-3                                       |   |
| I/O | 1J               | Maint Port Signal Ground. | Maint Port serial data, DB9S-5                                       |   |

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**Table 3-11. Stand-Alone ARINC 600 Middle Plug Connection Details (Continued)**

| I/O        | From Middle Plug | Signal Name                   | To                                      | Description   |
|------------|------------------|-------------------------------|---|---|
| <b>O</b>   | 2A               | MPDS Rx                       | DTE-1A, DB9S-2 or DB25P-3               | User Mobile Packet Data (MPDS), RS-232, DTE-1A  |
| <b>I</b>   | 2B               | MPDS Tx                       | DTE-1A, DB9S-3 or DB25P-2               |   |
| <b>I</b>   | 2C               | MPDS RTS                      | DTE-1A, DB9S-7 or DB25P-4               |   |
| <b>O</b>   | 2D               | MPDS CTS                      | DTE-1A, DB9S-8 or DB25P-5               |   |
| <b>I</b>   | 2E               | MPDS DTR                      | DTE-1A, DB9S-4 or DB25P-20              |   |
| <b>O</b>   | 2F               | MPDS DSR                      | DTE-1A, DB9S-6 or DB25P-6               |   |
| <b>O</b>   | 2G               | MPDS CD                       | DTE-1A, DB9S-1 or DB25P-8               |   |
| <b>O</b>   | 2H               | MPDS RI                       | DTE-1A, DB9S-9 or DB25P-22              |   |
| <b>I/O</b> | 2J               | MPDS SGND                     | DTE-1A, DB9S-5 or DB25P-7               |   |
| <b>O</b>   | 2K               | USIM HEATER CNTL              | USIM                                    | For future BGAN services.<br>Only required if remote USIM will be installed.<br>Local USIM available. |
| <b>O</b>   | 1K               | USIM RESET                    | USIM                                    |   |
| <b>I</b>   | 3A               | CC (channel card) #1 USIM Rx+ | USIM TX+ Port 1                         |   |
| <b>I</b>   | 3B               | CC #1 USIM1 Rx-               | USIM Tx- Port 1                         |   |
| <b>O</b>   | 3C               | CC #1 USIM1 Tx+               | USIM Rx+ Port 1                         |   |
| <b>O</b>   | 3D               | CC #1 USIM1 Tx-               | USIM Rx- Port 1                         |   |
| <b>I</b>   | 3E               | CC #2 USIM1 Rx+               | USIM Tx+ Port 2                         |   |
| <b>I</b>   | 3F               | CC #2 USIM1 Rx-               | USIM Tx- Port 2                         |   |
| <b>O</b>   | 3G               | CC #2 USIM1 Tx+               | USIM Rx+ Port 2                         |   |
| <b>O</b>   | 3H               | CC #2 USIM1 Tx -              | USIM Rx- Port 2                         | POTS Line 1   |
| <b>I/O</b> | 3J               | USIM I2C DAT                  | USIM                                    |   |
| <b>O</b>   | 3K               | USIM I2C CLK                  | USIM                                    |   |
| <b>I/O</b> | 4A               | POTS TIP                      | 2-wire Analog Phone TIP (RJ-11, Pin 3)  |   |
| <b>I/O</b> | 4B               | POTS RING                     | 2-wire Analog Phone RING (RJ-11, Pin 2) |   |

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**Table 3-11. Stand-Alone ARINC 600 Middle Plug Connection Details (Continued)**

| I/O | From Middle Plug | Signal Name            | To                                      | Description                                   |
|-----|------------------|------------------------|---|---|
| I/O | 4C               | POTS TIP               | 2-wire Analog Phone TIP (RJ-11, Pin 3)  | POTS Line 2                                   |
| I/O | 4D               | POTS RING              | 2-wire Analog Phone RING (RJ-11, Pin 2) |   |
| I   | 4G               | BRI Rx+                | ISDN, RJ-45-3                           | User Data, ISDN-2<br>Refer to User Interfaces |
| I   | 4H               | BRI Rx-                | ISDN, RJ-45-6                           |   |
| O   | 4J               | BRI Tx+                | ISDN, RJ-45-4                           |   |
| O   | 4K               | BRI Tx-                | ISDN, RJ-45-5                           |   |
| I   | 5G to 5K         | I/O CONFIG Pins 1 to 4 | See Table 3-8                           | System Data I/O Mode Configurations           |
| I   | 6A               | BRI Rx+                | ISDN, RJ-45-3                           | User Data, ISDN-1<br>Refer to User Interfaces |
| I   | 6B               | BRI Rx -               | ISDN, RJ-45-6                           |   |
| O   | 6C               | BRI Tx+                | ISDN, RJ-45-4                           |   |
| O   | 6D               | BRI Tx-                | ISDN, RJ-45-5                           |   |
| I   | 6J               | 10BASE-T Rx+           | Ethernet 10BASE-T RJ-45, Pin 3          | Port 2<br>User Data<br>Ethernet 10BASE-T      |
| I   | 6K               | 10BASE-T Rx-           | Ethernet 10BASE-T RJ-45, Pin 6          |   |
| O   | 6G               | 10BASE-T Tx+           | Ethernet 10BASE-T RJ-45, Pin 1          |   |
| O   | 6H               | 10BASE-T Tx-           | Ethernet 10BASE-T RJ-45, Pin 2          |   |
| I   | 7C               | 10BASE-T Rx+           | Ethernet 10BASE-T, RJ-45-3              | Port 1<br>User Data<br>Ethernet 10BASE-T      |
| I   | 7D               | 10BASE-T Rx-           | Ethernet 10BASE-T, RJ-45-6              |   |
| O   | 7A               | 10BASE-T Tx+           | Ethernet 10BASE-T, RJ-45-1              |   |
| O   | 7B               | 10BASE-T Tx-           | Ethernet 10BASE-T, RJ-45-2              |   |
| O   | C1               | RF Tx Output           | Antenna Subsystem-DLNA                  | Coax Cable, RF Transmit                       |

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**Table 3-12. Stand-Alone ARINC 600 Bottom Plug Connection Details**

| I/O | From Bottom Plug | Signal Name         | To                            | Description                                |
|-----|------------------|---------------------|-------------------------------|--|
| I   | BP2              | +28 V dc HOT        | Aircraft Power Source, HOT    | +28 V dc supply<br>(PN 1252-A-3200)        |
| I   | BP3              | +28 V dc return GND | Aircraft Power Source, return |  |
| I   | BP8              | Chassis GND         | Aircraft Ground               | Aircraft Chassis Ground                    |
| I   | BP1              | 115 V ac HOT        | Aircraft Power Source, HOT    | 115 V ac 400 Hz supply<br>(PN 1252-A-3100) |
| I   | BP7              | 115 V ac COLD       | Aircraft Power Source, COLD   |  |
| I   | BP12             | RF Rx Input         | Antenna Subsystem-DLNA        | Coax Cable, RF Receive                     |

## 6. Installation and Engineering Diagrams

This section contains the Outline and Installation drawings, and Interconnection and Contact Assignment diagrams for HSD-400 terminals.

### A. Outline and Installation Diagrams

Figure 3-7 and Figure 3-8 illustrate the physical characteristics of the HSD-400 terminal and provides installation data for the terminal.

### B. Interconnection and Contact Assignment Drawings

Figure 3-11 illustrates the interconnection details for Stand-Alone Mode HSD-400 Terminals.

Figure 3-12 provides the contact assignments for Stand-Alone Mode HSD-400 Terminals.

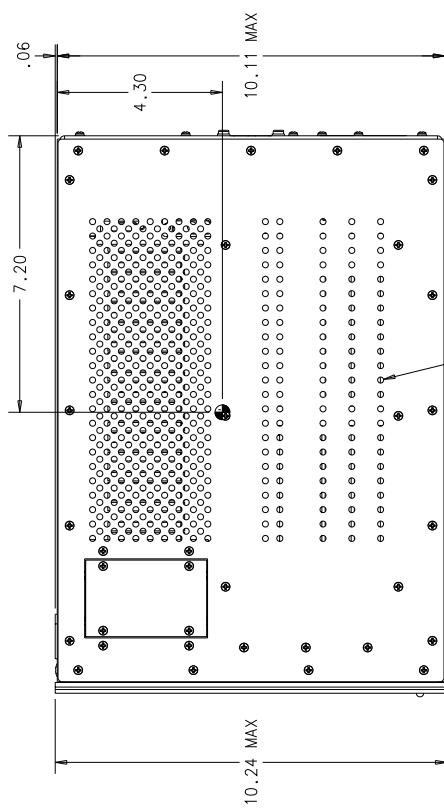
WEIGHT IS 14.1 kg.  
CENTRE OF GRAVITY IS INDICATED BY 

SHALL BE INSTALLED IN AN 8MCU TRAY,  
JBER-120-89585 WITH POLARIZATION -08  
'ZED' OR 120-89584 WITH POLARIZATION -08  
'ZED'.

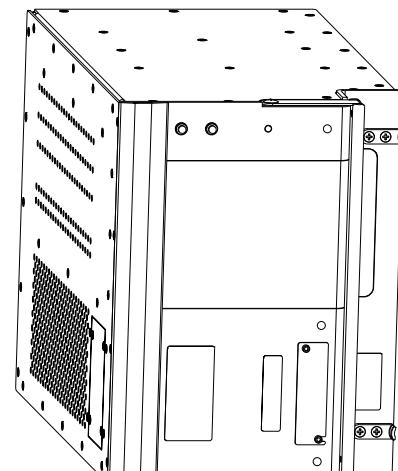
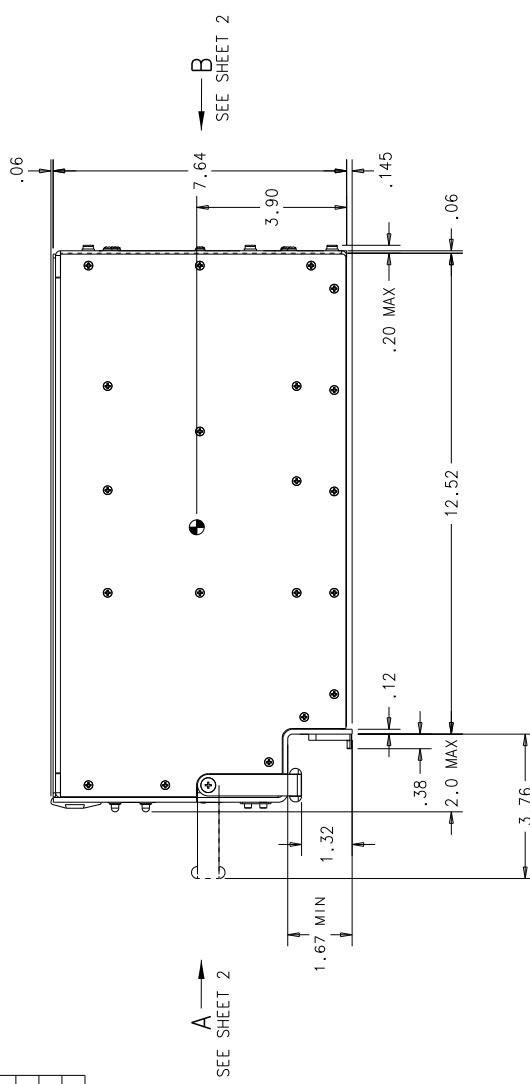
REQUIREMENTS PER AR INC 600:  
WEIGHT: 175 lbs/rr  
DROP: 0.050 inches  $\pm$  0.025 inches H<sub>2</sub>O.

TABLE 1. HSD-400 TRANSCEIVER VARIANTS

| CHANNEL<br>CARDS | OPERATION<br>MODE(S) | ASSEMBLY<br>PART No. | INTERCONNECTION<br>DIAGRAM | VOLTAGE<br>(NOMINAL) | POWER<br>NOM/MAX |
|------------------|----------------------|----------------------|----------------------------|----------------------|------------------|
| DUAL             | STAND-ALONE          | 1252-A-3100          | 1252-B-3100                | 115VAC/400Hz         | 275/420W         |
| DUAL             | STAND-ALONE          | 1252-B-3200          | 1252-B-3100                | 28VDC                | 275/420W         |
| DUAL             | STAND-ALONE          | 1252-A-3101          | 1252-B-3100                | 115VAC/400Hz         | 275/420W         |
| DUAL             | STAND-ALONE          | 1252-A-3102          | 1252-B-3100                | 115VAC/400Hz         | 275/420W         |
| DUAL             | STAND-ALONE          | 1252-B-3201          | 1252-B-3100                | 28VDC                | 275/420W         |
| DUAL             | STAND-ALONE          | 1252-A-3202          | 1252-B-3100                | 28VDC                | 275/420W         |
| DUAL             | STAND-ALONE          | 1252-A-3103          | 1252-B-3100                | 115VAC/400Hz         | 275/420W         |
| DUAL             | STAND-ALONE          | 1252-B-3203          | 1252-B-3100                | 28VDC                | 275/420W         |



COOLING HOLE PATTERN  
TOP AND BOTTOM  
PER AR INC 600-12



ISOMETRIC VIEW

Figure 3-7. HSD-400 Outline & Installation Drawing-1252-E-3100, Rev D (1 of 2)



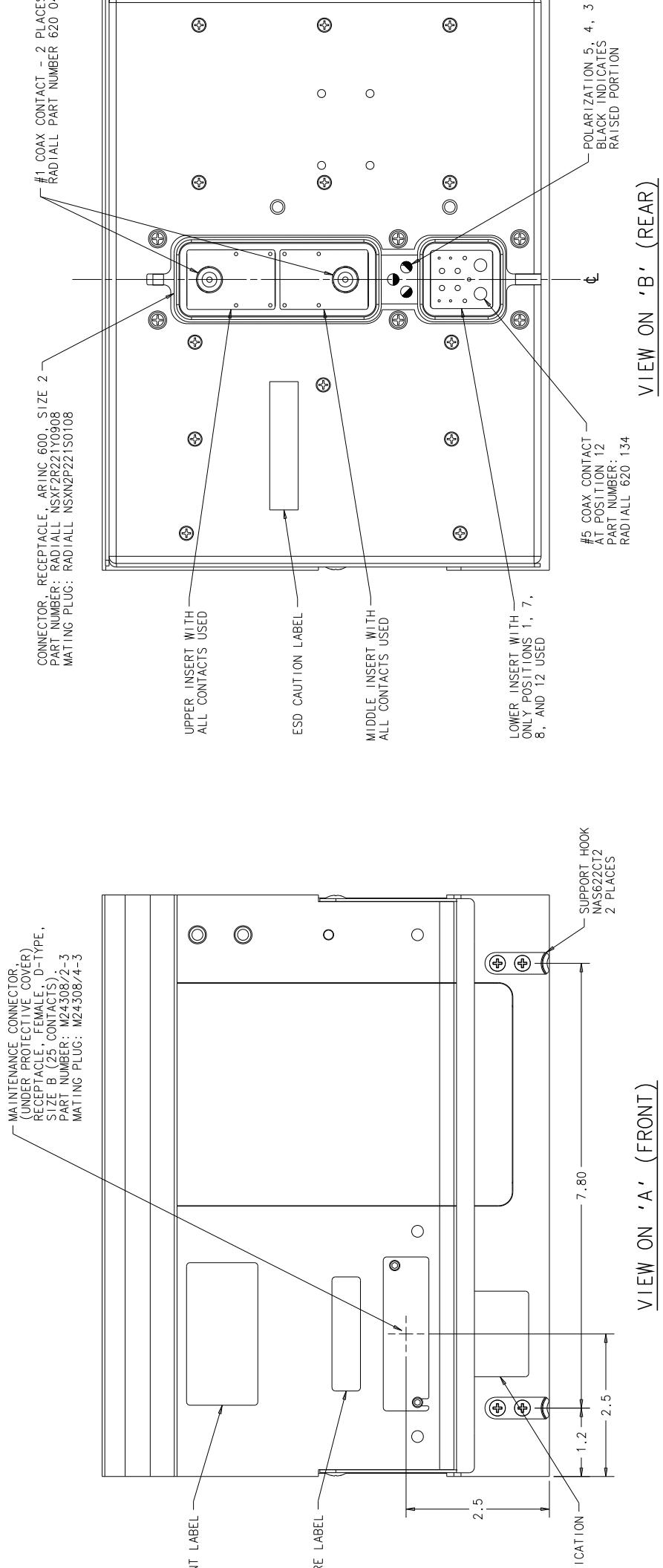


Figure 3-8. HSD-400 Outline & Installation Drawing-1252-E-3100, Rev D (2 of 2)

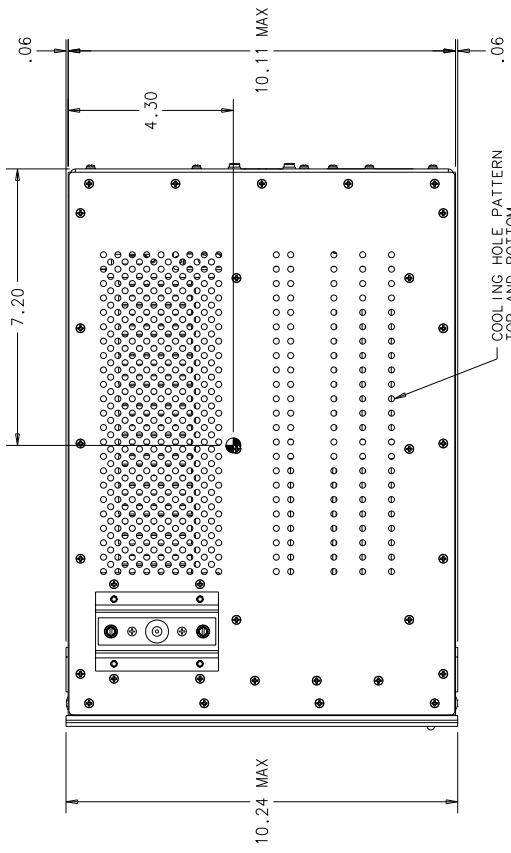


WEIGHT IS 14.1 kg.  
CENTRE OF GRAVITY IS INDICATED BY   
ALL BE INSTALLED IN AN 8MCU TRAY.  
BFR-120-89585 WITH POLARIZATION -08  
) OR 120-89584 WITH POLARIZATION -08  
ZED).

REQUIREMENTS PER AR INC 600:  
; 175 lbs/hr.  
DROP: 0.050 INCHES  $\pm$  0.025 INCHES  $H_2O$ .

TABLE 1. HSD-400 TRANSCEIVER VARIANTS

| CHANNEL | OPERATION MODE(S)   | ASSEMBLY PART No. | INTERCONNECTION DIAGRAM | VOLTAGE (NOMINAL) | POWER NOM/MAX |
|---------|---------------------|-------------------|-------------------------|-------------------|---------------|
| DUAL    | STAND-ALONE, SW/SBB | 1232-A-3105-01    | 1252-B-3100             | 115VAC/400Hz      | 275/420W      |
| DUAL    | STAND-ALONE, SW/SBB | 1232-A-3205-01    | 1252-B-3100             | 28VDC             | 275/420W      |
| DUAL    | STAND-ALONE, SW/SBB | 1232-A-3105-02    | 1252-B-3100             | 115VAC/400Hz      | 275/420W      |
| DUAL    | STAND-ALONE, SW/SBB | 1232-A-3205-02    | 1252-B-3100             | 28VDC             | 275/420W      |



COOLING HOLE PATTERN  
TOP AND BOTTOM  
PER AR INC 600-12

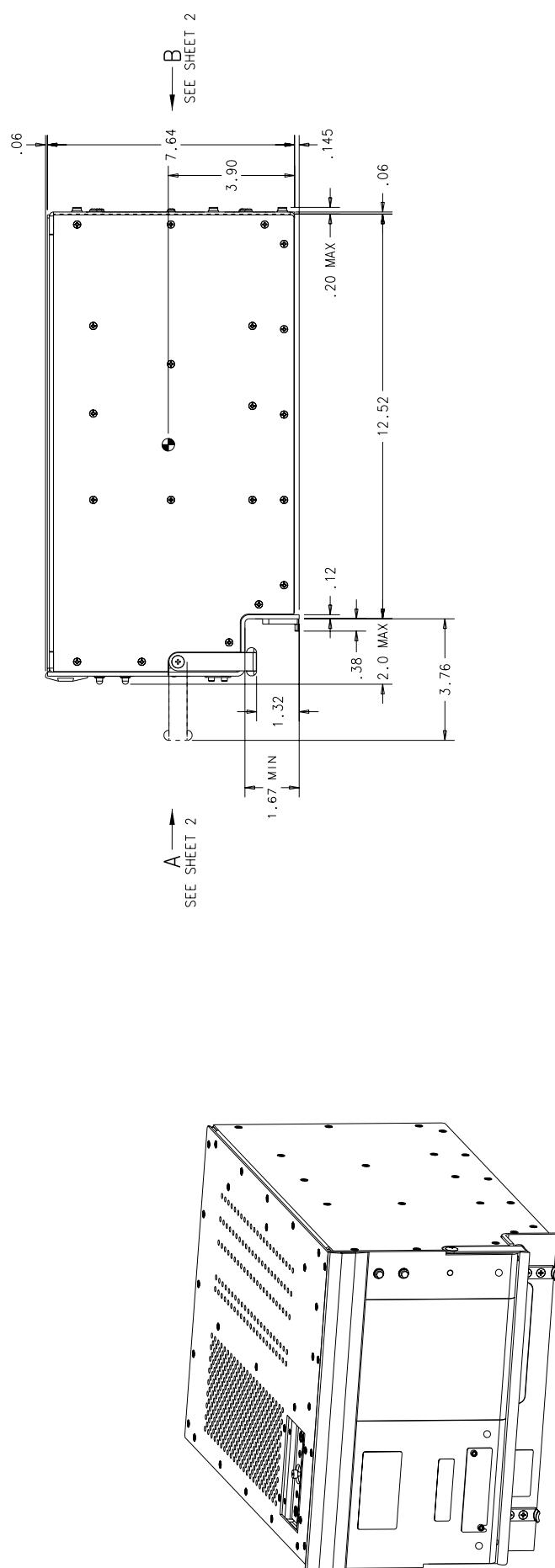


Figure 3-9. HSD-400 Outline & Installation Drawing-1252-E-3105, Rev 1 (1 of 2)



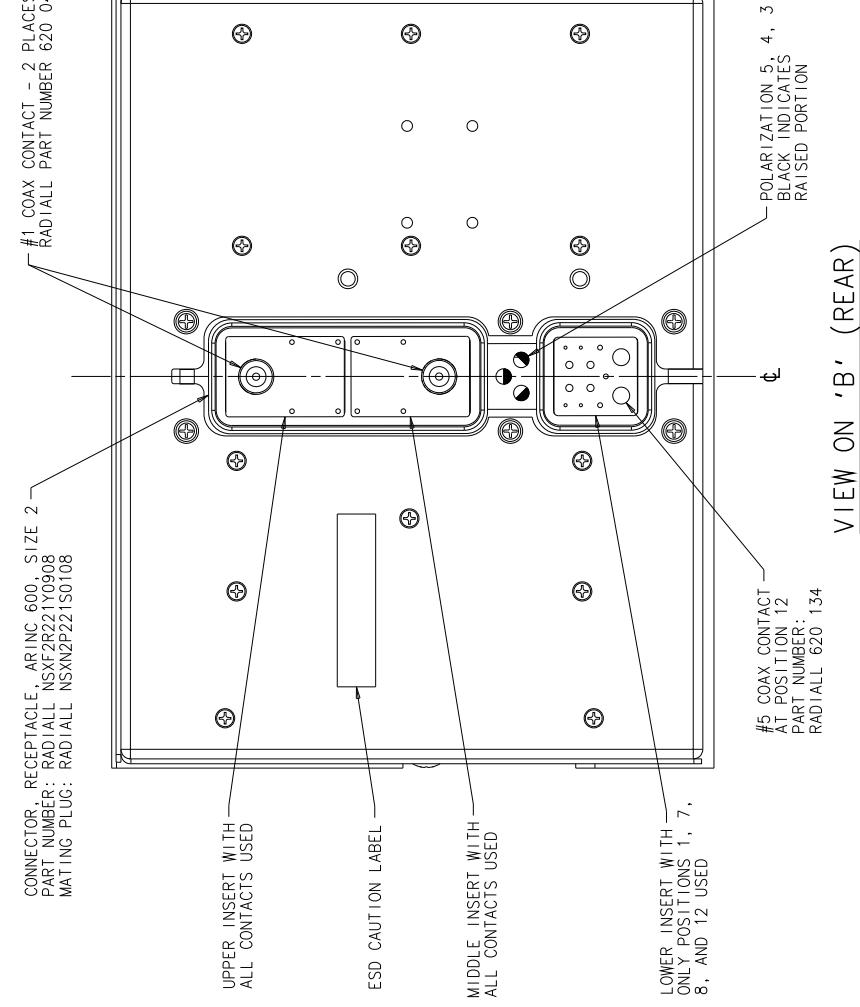
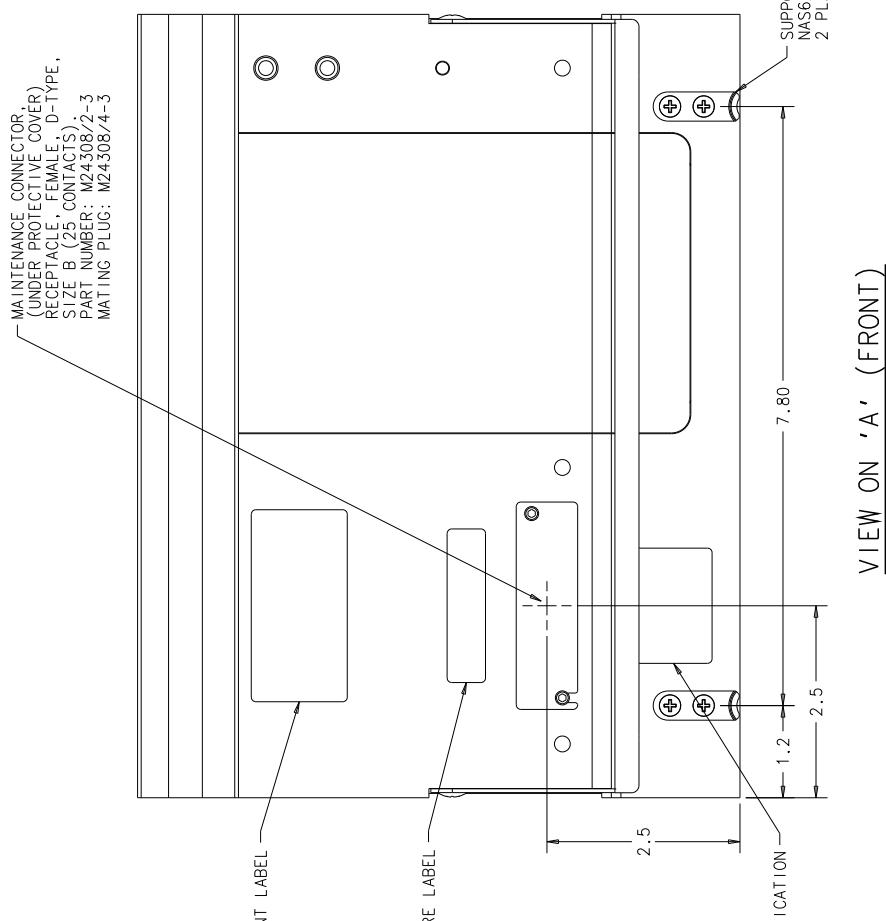


Figure 3-10. HSD-400 Outline & Installation Drawing-1252-E-3105, Rev 1 (2 of 2)



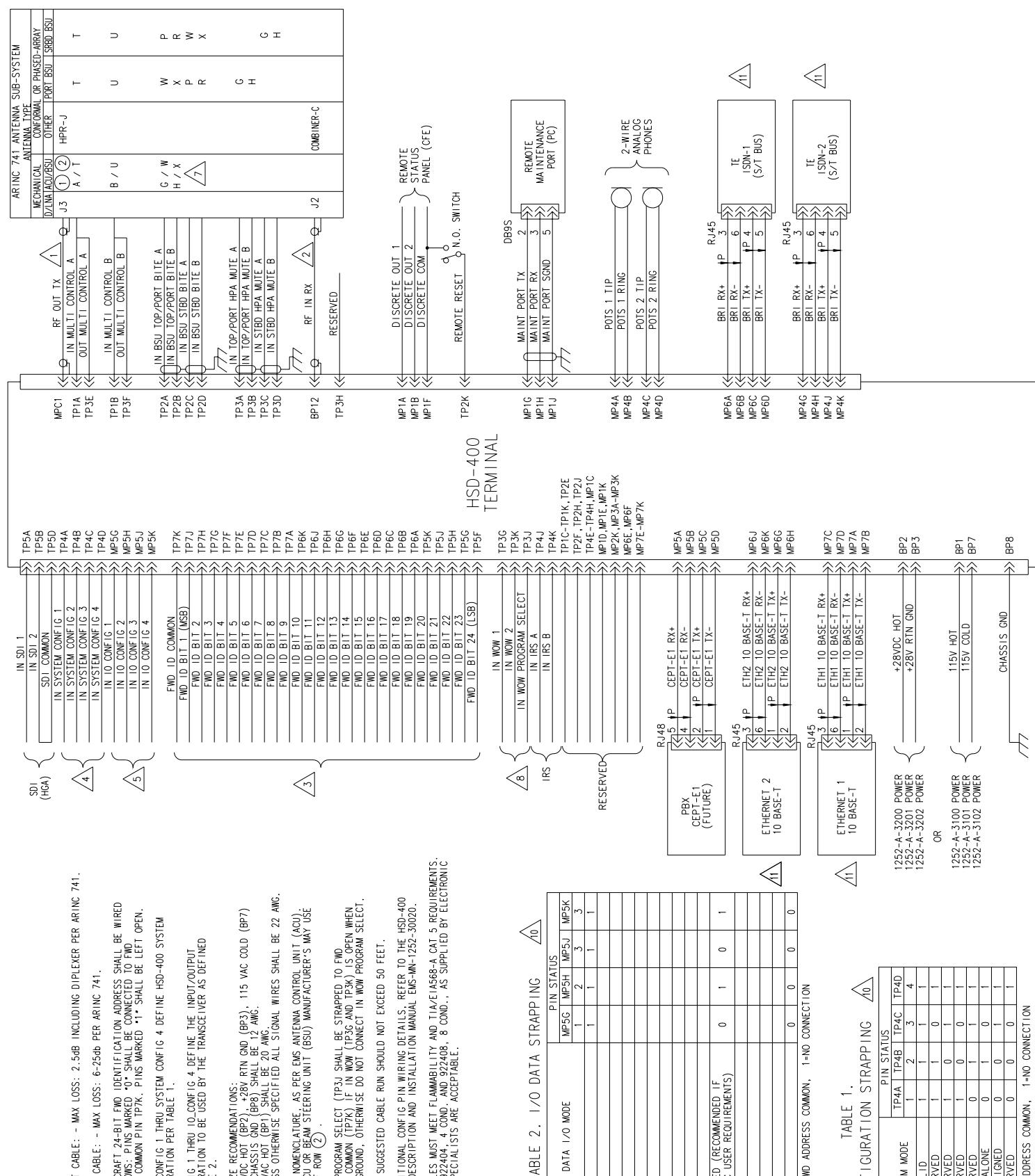


Figure 3-11. HSD-400 Interconnection Diagram—1252-B-3100, Rev C (1 of 2)



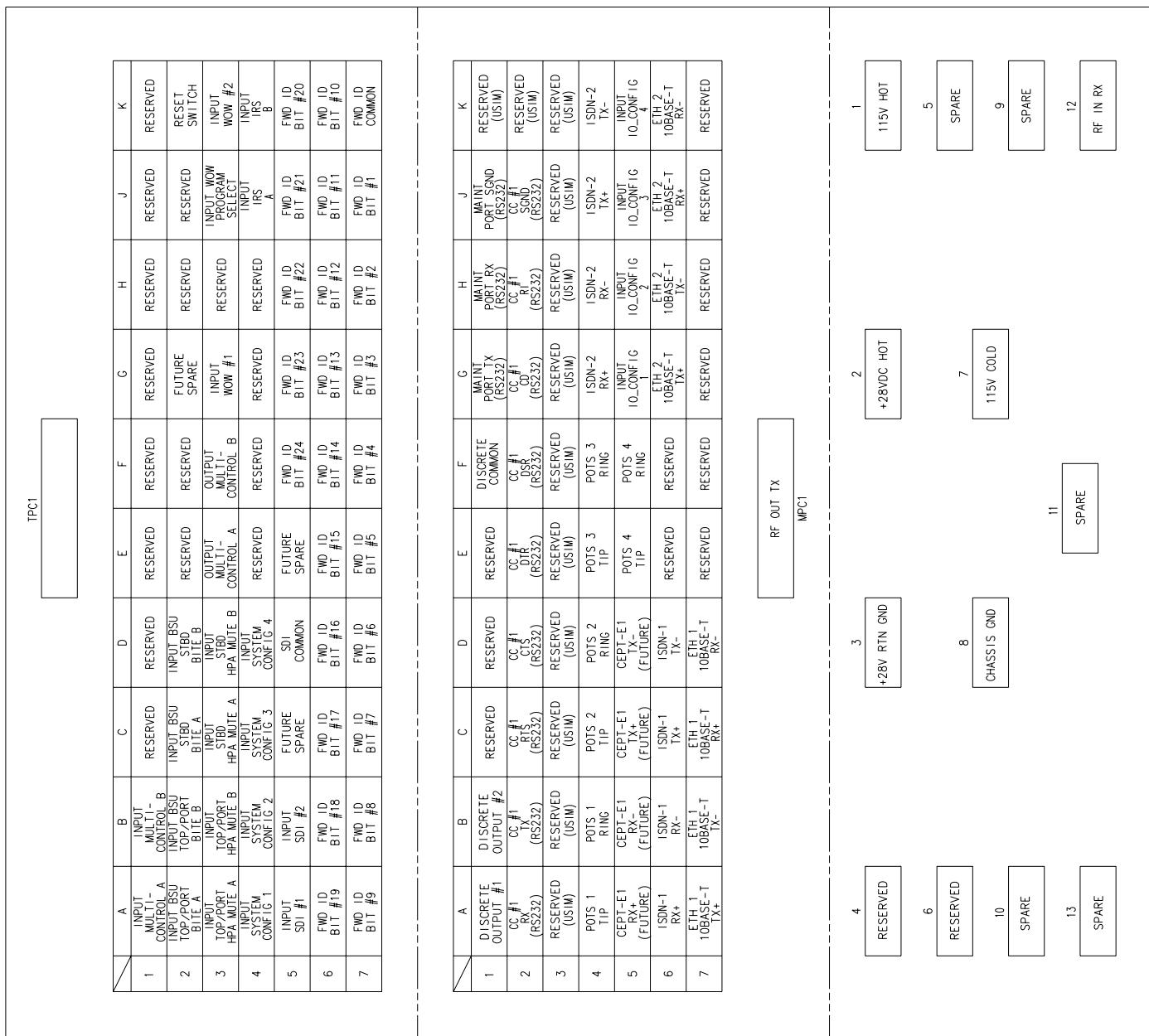


Figure 3-12. HSD-400 Interconnection Diagram–1252-B-3100, Rev C (2 of 2)



## TEST AND FAULT ISOLATION

This section provides the information required to determine the operational readiness of the HSD-400 terminals and to aid service personnel in diagnosing system faults, including the following sections:

- Operational and Diagnostic Testing
- Troubleshooting and Fault Isolation
- Adjustment/Alignment Procedures
- Modification History

The operational and diagnostic tests described in this section require using the HSD-400 terminals built-in diagnostic tool referred to as the HSD-400 terminal Maintenance Port Utility (MPU). This section provides detailed descriptions of the HSD-400 terminal MPU menus, reports, and basic user instructions. See page 4-2 for maintenance port cabling notes.

**Note:** Depending on the version of software installed, the MPU report and menu screens displayed may differ from those shown as examples in this manual.

### 1. Operational and Diagnostic Testing

Usually, terminals require testing for one of the following reasons:

- To verify the operational readiness of the terminal during and after installation on an aircraft.
- To verify that a fault exists and produce system reports for troubleshooting purposes.
- To verify the operational readiness of repaired LRUs during re-installation on an aircraft.

This section presents software loading and test and fault isolation procedures for the HSD-400 terminals. All test and load procedures require the HSD-400 terminal MPU, which is accessed by connecting to the maintenance port of the terminal.

#### A. Test and Fault Isolation Equipment Requirements

Table 4-1 lists the equipment required to access the HSD-400 terminal MPU and perform operational and diagnostic testing and software loads on the HSD-400 terminal.

Table 4-2 lists the optional equipment or information that, although not required, may increase test efficiency or allow for optional diagnostic procedures. Equivalent substitutions may be used.

**Table 4-1. List of Required Test Equipment**

| Item                              | Equipment                                    | Specification                                     | Quantity |
|-----------------------------------|--|---|----------|
| Computer                          | Standard                                     | VT-100 386 CPU, 20-MHz or higher                  | 1        |
| VT-100 terminal emulation program | HyperTerminal®, ProComm Plus®, or equivalent | Serial communication program using an RS-232 port | 1        |

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**Table 4-1. List of Required Test Equipment**

| Item                                    | Equipment  | Specification   | Quantity |
|---|--|---|----------|
| Cable, maintenance port interface cable | Special<br>See "Connection Requirements" on page 4-2 | Remote access maximum cable length 25 ft. (From ARINC 600 connector to DB9 breakout connector)<br>Test cable maximum length 25 ft. (From HSD-400 terminal to management computer)<br>Front Panel access maximum cable length 50 ft. | 1        |
| Multimeter                              | Standard   | —   | 1        |
| General purpose toolset                 | Standard   | —   | 1        |

**Table 4-2. List of Optional Test Equipment**

| Item                                 | Equipment | Specification                    | Quantity |
|--------------------------------------|-----------|----------------------------------|----------|
| Service Provider Information Package | Special   | INMARSAT service provider        | 1        |
| Internet access                      | Standard  | INMARSAT Swift64 high-speed-data | 1        |
| Time Domain Refectometer             | Standard  | —                                | 1        |

## B. Maintenance Port Utility

This section describes the HSD-400 terminal MPU and provides the connection and cabling details required to access and use the program.

The Maintenance Port Utility (MPU), built into the HSD-400 terminal's operational software, provides a system interface for fault isolation and diagnostic procedures. Connection to this program is made through the RS-232 maintenance port interface.

To use the HSD-400 terminal MPU, an RS-232, VT-100 terminal (PC or Laptop operating a terminal emulation program) must be connected to the HSD-400 terminal.

The maintenance port on the front panel of HSD-400 terminals provides a direct connection to the MPU using a DB25 connector. Optionally, remote cabin access is possible using a DB9 connector via the ARINC 600 connector.

### (1) Connection Requirements

This section describes specific cabling requirements needed to connect to and use the HSD-400 terminal Maintenance Port Utility.

#### (a) Cabling Notes

The HSD-400 terminals provide two options for physical connection to the HSD-400 terminal maintenance port and MPU: direct connection and remote connection.

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Table 4-3, Table 4-4, Figure 4-1, and Figure 4-2 provide cabling details for the HSD-400 terminal for both direct and remote connection types.

**Note:** The direct and remote connections to the HSD-400 terminal maintenance port cannot be used simultaneously.

**Table 4-3. Remote Connection Cabling**

| <b>Remote Access</b>  |                               |                     |                               |                        |
|-----------------------|-------------------------------|---------------------|-------------------------------|------------------------|
| <b>Pin Definition</b> | <b>ARINC Connector (Rear)</b> | <b>Remote (DB9)</b> | <b>Cable (See Figure 4-1)</b> | <b>Computer (DB9P)</b> |
| Maint Port SGND       | (MP1J)                        | 5                   |                               | 5                      |
| Maint Port Rx         | (MP1H)                        | 3                   |                               | 3                      |
| Maint Port Tx         | (MP1G)                        | 2                   |                               | 2                      |

**Table 4-4. Direct Connection Cabling**

| <b>Direct Connection</b> |                    |  |                               |                        |
|--------------------------|--------------------|--|-------------------------------|------------------------|
| <b>Pin Definition</b>    | <b>Front Panel</b> | <b>Maintenance Cable Connector (DB25P)</b> | <b>Cable (See Figure 4-2)</b> | <b>Computer (DB9P)</b> |
| Maint Port SGND          | 10                 | 10   |                               | 5                      |
| Maint Port Rx            | 12                 | 12   |                               | 3                      |
| Maint Port Tx            | 11                 | 11   |                               | 2                      |

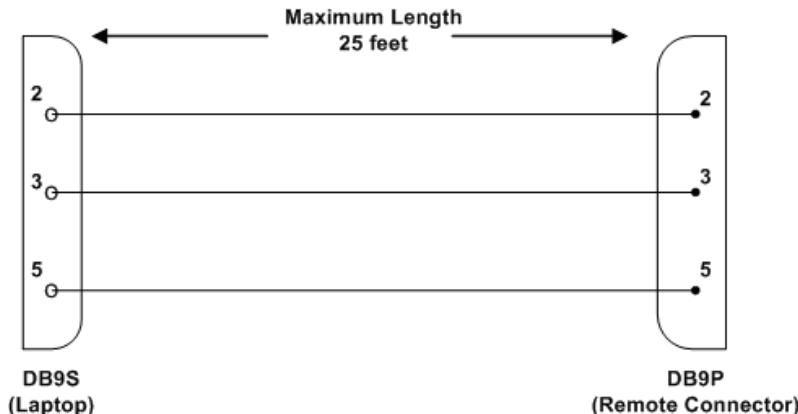
**(b) Maintenance Port Cable Assembly**

HSD-400 terminal maintenance cable connections may vary in length, type of connection used, and pinouts-depending on the access point used.

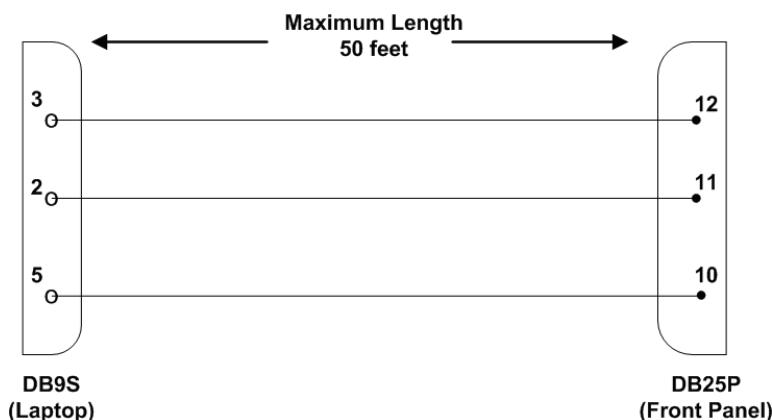
The cable assembly for HSD-400 terminals assumes that the computer's COM Port interface is a 9-Pin, D-Sub connector (DB9). Cable assembly details for HSD-400 terminals are presented in Figure 4-1 and Figure 4-2.

**Note:** The maximum cable length, shown in Figure 4-1 and Figure 4-2, assumes that the length is measured from the ARINC 600 connector to the DB9 breakout connector.

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**Figure 4-1. Remote Connection, Maintenance Cable**



**Figure 4-2. Direct Connection, Maintenance Cable**

(c) Interface Requirements

A standard VT100 compatible terminal running an emulator program (such as HyperTerminal, ProComm Plus, or similar) provides the user interface to the HSD-400 terminal MPU. The RS-232 terminal connection settings for HSD-400 terminal maintenance ports are listed in Table 4-5.

**Table 4-5. Terminal Connection Settings**

| Parameter        | Setting   |
|------------------|-----------|
| Character Format | ASCII     |
| Baud Rate        | 19200 bps |
| No. of bits      | 8         |
| Parity           | None      |

**Table 4-5. Terminal Connection Settings**

| Parameter    | Setting |
|--------------|---------|
| Stop bits    | 1       |
| Flow Control | None    |

(2) Accessing the Maintenance Port Utility

Access to the MPU menus is password protected. Each password permits access to a different level of program functionality.

This document only describes the two password-protected access levels required to perform operational testing and verification, software updates, and the basic system monitoring and troubleshooting procedures provided in this manual: End User and Field Representative.

(a) Level 1 End User Access – Password: **menu**

This limited-access level is for anyone without technical training on the product. It provides read-only access to help users diagnose problems with the assistance of product support personnel.

(b) Level 2 Field Representative Access – Password: **maint**

This level is for trained original equipment manufacturer (OEM) installers and product support personnel. This access level supports “read” and limited “write” capabilities. Users are able to disable, mask, or clear faults, change satellite or LES preferences, view and modify certain EEPROM parameters, and perform other maintenance or upgrade functions.

(3) Using the Maintenance Port Utility

This section describes the basic operating instructions for using and navigating the MPU.

(a) Entering Passwords

- For untrained users, use Level 1 access: Type **menu**, and then press ENTER.
- For trained technicians and product support personnel use Level 2 access: Type **maint**, and then press ENTER.

**Note:** The typed password does not appear on the screen.

(b) Navigating the Maintenance Port Utility

- To scroll through the available menus press CTRL+N.
- To go to the previous menu, press CTRL+O.
- To refresh the menu screen or exit from a Reports Menu press ESC.

(c) Selecting Menu Items

To enable test or data entry functions, press the letter associated with the menu items. When a menu item is selected, the application may prompt the user for additional inputs or selections.

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(d) Selecting Report Items

1. To open the list of possible system reports, press EQUAL SIGN.  
A list of report items appears. Active reports show as toggled on. Inactive reports show as toggled off.
2. To activate a report item, type the report item number and then press ENTER.  
**Note:** Multiple report items can be activated at the same time; type and enter each report item number separately.
3. To turn off individual, active report items, type the report item number you want to toggle off, and then press ENTER.
4. To turn off all active report items, press equal sign to display the report item list, and then press **X**.

(4) Menu Item Descriptions

This section provides a brief description of the Level 2, MPU menu items used for test and fault isolation procedures.

Although this section only provides illustrations and descriptions for Level 2 access, all Level 1 access menu items are covered. (All Level 1 menus are included in Level 2 Menus.)

In active HSD-400 terminal systems, menu screens display the firmware version.

**Note:** Depending on the version of software installed and the system configuration the menu and report items available to users may differ slightly from the illustrations shown and described in this document.

(a) Menu 1

Figure 4-3 shows the HSD-400 terminal MPU Menu 1 screen display. Figure 4-6 describes the items available in Menu 1.

| MENU 1                     |                          | FIRMWARE Vx.x       |                                |
|----------------------------|--------------------------|---------------------|--------------------------------|
| X                          | override forward id      | L                   | test LEDs                      |
| Y                          | explain hpa error status | S                   | set hcm attenuator             |
| R                          | hcm RF threshold         | K                   | test latency                   |
| U                          | dump debug log           | F                   | print equipment stats          |
| M                          | clear equipment stats    |                     |                                |
| <CTRL> N                   | next menu                | <CTRL> O            | previous menu = select reports |
| TERMINAL: STAND-ALONE MODE |                          | HCM MODULE DETECTED |                                |

**Figure 4-3. Menu 1 Screen Display**

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**Table 4-6. Menu 1 Item Descriptions**

| Menu Item | Parameter Name           | Description   |
|-----------|--------------------------|---|
| X         | override forward id      | Used in testing and fault isolation<br>Enter a “test or alternate” Forward ID to use during fault isolation procedures. Resetting the HSD-400 terminal or cycling the power cancels this function.  |
| Y         | explain hpa error status | Reports HPA status:<br>Displays HPA OK when no error codes are reported from the system's power up test<br>Displays HPA error code message if system's power up test fails  |
| R         | hcm RF threshold         | Not applicable for HSD-400 terminal Stand-Alone operation.<br>Displays the HCM module threshold parameters for the RF:<br>If the measured RF level is below this threshold, the “RF low” bit is set in the HPA maintenance word, which is then sent by the HSD-400 terminal control processor to the Honeywell SDU. |
| U         | dump debug log           | Deletes the current debug log.  |
| M         | clear equipment stats    | Resets the equipment statistics.(See Item F.)   |
| L         | test LEDs                | Toggles the “Power ON” (LED 1) and 'Fault' (LED 2) LEDs ON (A) and OFF (D) or returns them to software control (X).   |
| S         | set hcm attenuator       | Not applicable for HSD-400 terminal Stand-Alone operation.<br>Used to set the preferred attenuation for Honeywell Combined Mode (HCM) operation to reduce the output signal level of the HCM module.  |
| K         | test latency             | Displays the current satellite time delay in milliseconds.  |
| F         | print equipment stats    | Displays equipment statistics, such as hours up, number of powerups, temperature, and duration.   |

(b) Menu 2

Figure 4-4 shows the HSD-400 terminal MPU Menu 2 screen display. Table 4-7 describes the items available in Menu 2.

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| MENU 2                     |                             | FIRMWARE Vx.x                           |
|----------------------------|-----------------------------|---|
| A                          | set veh-relative azimuth    | E set veh-relative elevation            |
| K                          | desired az veh-rel velocity | R resume automatic steering             |
| T                          | enter time of day           | N annotate log file                     |
| L                          | re-enter logon password     | V get firmware versions                 |
| Z                          | reset HSD-400               | S set satellite longitude               |
| <CTRL> N                   | next menu                   | <CTRL> O previous menu = select reports |
| TERMINAL: STAND-ALONE MODE |                             | HCM MODULE DETECTED                     |

**Figure 4-4. Menu 2 Screen Display**

**Table 4-7. Menu 2 Item Descriptions**

| Menu Item   | Parameter Name              | Description  |
|---|-----------------------------|--|
| <b>NOTE:</b> Menu 2 selections E and K are used to manually input navigational data to point the antenna to a preferred satellite location and /or peak for a maximum signal reception. These commands are typically used where no IRS data is available. |                             |  |
| A   | set veh-relative azimuth    | Antenna azimuth pointing offset with reference to the front centerline of the aircraft<br>Offset value entered in degrees from 0 to 180, where a positive entry is clockwise (cw) and a negative entry is counterclockwise (ccw)   |
| K   | desired az veh-rel velocity | Activates continuous antenna azimuth sweep at a set elevation, as entered with menu item "E"<br>Azimuth sweep velocity entered as deg/sec value<br>Note: When combined with a signal-monitoring "reports" selection, sweep the antenna for maximum signal strength to determine optimum location coordinates |
| T   | enter time of day           | Permits the on-board entry of date and time for initial one-time setting of the "Real Time Clock"  |
| L   | re-enter logon password     | Permits a user to enter a new access level password: menu or maint   |
| Z   | reset HSD-400               | Enables a complete, soft reset of the LRU; once reset, the menu access password must be re-entered   |
| E   | set veh-relative elevation  | Antenna elevation pointing offset with respect to the aircraft horizontal "rest" position, i.e., assumed to have no pitch or roll offset<br>Offset value entered in degrees from 0 to 90   |
| R   | resume automatic steering   | Re-activates programmed automatic antenna-steering in both azimuth and elevation   |

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**Table 4-7. Menu 2 Item Descriptions (Continued)**

| Menu Item | Parameter Name          | Description  |
|-----------|-------------------------|--|
| N         | annotate log file       | Allows for input of text into a log file<br>This feature can be used to document information such as test conditions, system or aircraft identification or any pertinent information needed for later review |
| V         | get firmware versions   | Displays the system Kernel and Application software versions, and the channel card(s) and HPA firmware revisions   |
| S         | set satellite longitude | Sets the satellite longitude   |

(c) Menu 3

Figure 4-5 shows the HSD-400 terminal MPU Menu 3 screen display. Figure 4-6 shows the Menu 3, Item M: Miscellaneous parameters screen display. Table 4-8 describes the items available in Menu 3. Table 4-9 describes the items available in Menu 3, Item M.

| MENU 3                     |                        | FIRMWARE Vx.x       |                                |
|----------------------------|------------------------|---------------------|--------------------------------|
| L                          | list EEPROM            | S                   | list event log                 |
| M                          | misc. EEPROM parameter | F                   | list call log                  |
| O                          | list ORT               | P                   | ocean region parameter         |
| I                          | set all LES id's       |                     |                                |
| <CTRL> N                   | next menu              | <CTRL> O            | previous menu = select reports |
| TERMINAL: STAND-ALONE MODE |                        | HCM MODULE DETECTED |                                |

**Figure 4-5. Menu 3 Screen Display**

**Table 4-8. Menu 3 Item Descriptions**

| Menu Item | Parameter Name         | Description   |
|-----------|------------------------|---|
| L         | list EEPROM            | Displays a list of all system EEPROM parameters and their corresponding values (this function is READ only)<br>Certain parameters are set using menu 3, item M selection                            |
| M         | misc. EEPROM parameter | Enables entry or entry changes to some of the EEPROM parameters listed in function 'L'<br>NOTE: Parameters 5,6,7,8, 9, 13, 25, 26, 27, and 28 are not accessible using Level 1 or Level 2 passwords |
| O         | list ORT               | Displays all EEPROM parameters, including all cable losses and LES configurations   |

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**Table 4-8. Menu 3 Item Descriptions (Continued)**

| Menu Item | Parameter Name         | Description  |
|-----------|------------------------|--|
| I         | set all LES id's       | Configures all ocean regions to the same LES access code and service provider (including primary and secondary service providers)  |
| S         | list event log         | Lists all events and system fault codes stored in non-volatile RAM<br>When selected, several options are available:<br>0 = Most recent saved entry is displayed<br>S = Displays next most recent entry saved<br>“ = Displays all remaining logged entries<br>1 = Special events (Does not include Ocean Region Registration entries) |
| F         | list call log          | Displays call log files for the HSD-400 terminal. When selected, two options are available:<br>Press “F” to display complete list of all log files<br>Press “X” to list extended EIRP trace data   |
| P         | ocean region parameter | Configures LES access codes (primary and secondary service providers) for individual ocean regions   |

| MISCELLANEOUS PARAMETERS                         |                                     |
|--|-------------------------------------|
| 1 HPA-TO-ANTENNA TOTAL LOSS                      | 11 FRONT PANEL LEDS ENABLED         |
| 2 FORWARD ID                                     | 14 MAINTENANCE PORT INVERSE VIDEO   |
| 3 GPS PROTECTION ALGORITHMS                      | 15 MAINTENANCE PORT DEGREES SYMBOL  |
| 4 REGISTRATION REQ'D BEFORE CALLS                | 16 TERMINAL CATEGORY                |
| 10 NUMBER OF CHANNEL CARDS                       | 17 VIPER ANTENNA GAIN               |
|  |                                     |
| WHICH PARAMETER #    <CTRL> N for next page    ? |                                     |
|  |                                     |
| 18 VIPER HPA/ANT LOSS                            | 34 CO-OP MODE BACKOFF ADJUSTMENT    |
| 28 RX32 ACTIVE                                   | 42 HCM AERO/M4 PRIORITIZATION       |
| 29 DEFAULT LATITUDE                              | 45 CATEGORY B LOWER FREQUENCY LIMIT |
| 30 DEFAULT LONGITUDE                             | 46 CATEGORY B UPPER FREQUENCY LIMIT |
| 31 OBEY OXCO STATUS                              |                                     |
|  |                                     |
| WHICH PARAMETER #    <CTRL> N for next page    ? |                                     |

**Figure 4-6. Menu 3 - Item M: Miscellaneous Parameters**

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**Table 4-9. Menu 3, Item "M" EEPROM Parameter Descriptions**

| Menu Item | Parameter Name                  | Description  |
|-----------|---------------------------------|--|
| 1         | HPA-to-Antenna Total Loss       | Measures transmit coax cable loss from the HSD-400 terminal at MPC1 to the antenna including the DLNA loss-maximum is 2.5 dB   |
| 2         | Forward ID                      | Entry required ONLY if the ID is not strapped, refer to the Installation section of this document for strapping details  |
| 3         | GPS protection algorithms       | Disables the GPS algorithms the HSD-400 terminal uses to prevent calls from interfering with the GPS navigational system on the aircraft   |
| 4         | Registration req'd before calls | Changes Terrestrial Network ID (where applicable)  |
| 10        | Number of channel cards         | Selects the number of channel cards the system is configured for-default for Stand-Alone Mode installations is "2"   |
| 11        | Front panel LEDs enabled        | Future consideration is provided for additional LEDs, beyond the two currently activated-default is "2"  |
| 14        | Maintenance port inverse video  | Enables a selected "reports" item to be highlighted in Inverse Video when it is activated-default is "1" (activated)   |
| 15        | Maintenance port degrees symbol | Offers a choice of displaying the letter D or the degree symbol ° when viewing the lat/long information displayed in the 'Reports' output:<br>Select "0" to use the letter D, e.g. 180.0 D<br>Select "1" to use a degree symbol °, e.g. 180.0° |

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**Table 4-9. Menu 3, Item “M” EEPROM Parameter Descriptions (Continued)**

| Menu Item | Parameter Name     | Description  |
|-----------|--------------------|--|
| 16        | Terminal category  | Offers an LRU configuration choice of:<br>0 for SAT-906<br>1 for Stand-Alone<br>2 for HW Strapping<br>3 for MCS3000<br>4 for MCS6000<br>5 for MCS7000<br>6 for MCS Combined<br>7 for Stand-Alone without antenna<br>8 for HCM Combined (Honeywell Combined Mode)<br>9 for Cooperative Rockwell Collins SAT-906<br>10 not used<br>11 not used (HSD-X Network, Multi-Channel AERO)<br>12 not used (HSD-X Network without antenna, Multi-Channel Non AERO)<br>13 for VIPER<br>Default is “2” (where hardware is read on power-up) |
| 17        | Viper antenna gain | Configures the nominal antenna gain used by the HSD-400 terminal when operating in Viper Mode-presuming that the HSD-400 terminal is connected to an antenna that does not provide antenna status words  |
| 18        | Viper HPA/ANT loss | Configures the nominal antenna gain used by the HSD-400 terminal when operating in Viper Mode-presuming that the HSD-400 terminal is connected to an antenna that does not provide antenna status words  |
| 28        | RX32 Active        | Not applicable (applied to prototype HPA systems)  |
| 29        | Default Latitude   | Enter a default latitude value<br>Reset the HSD-400 terminal to activate revised default values  |
| 30        | Default Longitude  | Allows user to enter a default longitude value<br>Reset the HSD-400 terminal to activate revised default values  |
| 31        | Obey OCXO status   | Prevents system operation until OCXO is warmed up (unless overridden)<br>Use parameter setting to override warm-up during testing procedures   |

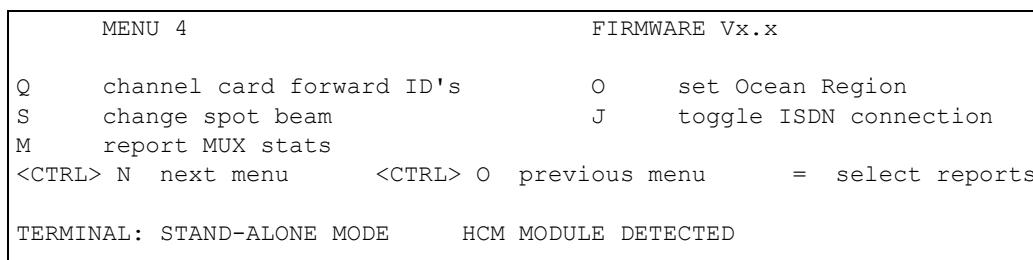
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**Table 4-9. Menu 3, Item “M” EEPROM Parameter Descriptions (Continued)**

| Menu Item | Parameter Name                   | Description  |
|-----------|----------------------------------|--|
| 34        | Co-op Mode Backoff Adjustment    | Not applicable for HSD-400 terminal Stand-Alone operation  |
| 42        | HCM AERO/M4 prioritization       | Sets HPA power allocation to Aero H/H+ or Swift64 call priority (1=M4, 0=Aero H)<br>Default set to AERO priority   |
| 45        | Category B lower frequency limit | Specifies category B terminal lower frequency range. Calls transmitting outside of this specified range may interfere with the GPS navigational system if an Aero H call occurs simultaneously; however, in this event, the GPS protection algorithm usually tears down the call |
| 46        | Category B upper frequency limit | Specifies category B terminal upper frequency range. Calls transmitting outside of this specified range may interfere with the GPS navigational system if an Aero H call occurs simultaneously; however, in this event, the GPS protection algorithm usually tears down the call |

(d) Menu 4

Figure 4-7 shows the HSD-400 terminal MPU Menu 4 screen display. Table 4-10 describes the items available in Menu 4.



**Figure 4-7. Menu 4 Screen Display**

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**Table 4-10. Menu 4 Item Descriptions**

| Menu Item | Parameter Name           | Item Description   |
|-----------|--------------------------|--|
| Q         | channel card forward IDs | Enables viewing of channel cards, # 1 and # 2 Forward IDs  |
| S         | change spot beam         | Enables manual selection of specific spot beams independently assigned for each channel card   |
| M         | report MUX stats         | Not applicable<br>Used for engineering debugging purposes only   |
| O         | set Ocean Region         | Allows for manual selection of satellite Ocean Regions:<br><br>AORW: "0"<br>AORE: "1"<br>POR: "2"<br>IOR: "3"<br>To revert to programmed selection, type -1 and press ENTER for AUTO selection |
| J         | toggle ISDN connection   | Used for testing and fault isolation<br>Connects ISDN 1 lines to Channel Card 2 (Does not work in reverse-ISDN 2 to ISDN 1)<br>Redirection only applies until the system is reset              |

**(e) Menu 10**

Menu 10 items are used to manually enter INS parameters to simulate the INS data required for HSD-400 terminal operation when INS data is unavailable.

Figure 4-8 shows the HSD-400 terminal MPU Menu 10 screen display.

Table 4-11 describes the items available in Menu 10.

| MENU 10                    |                                | FIRMWARE Vx.x       |                                 |
|----------------------------|--------------------------------|---------------------|---------------------------------|
| L                          | simul INS lat                  | G                   | simul INS long                  |
| H                          | simul INS heading              | T                   | simul INS true track            |
| P                          | simul INS pitch                | R                   | simul INS roll                  |
| S                          | simul INS speed                | A                   | activate INS simul words        |
| C                          | simul port ACU status ON 16 dB | B                   | simul sb ACU status             |
| M                          | activate antenna status words  | N                   | deactivate antenna status words |
| D                          | toggle active antenna          | X                   | deactivate INS simul words      |
| <CTRL> N                   | next menu                      | <CTRL> O            | previous menu                   |
|                            |                                |                     | = select reports                |
| TERMINAL: STAND-ALONE MODE |                                | HCM MODULE DETECTED |                                 |

**Figure 4-8. Menu 10 Screen Display**

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**Table 4-11. Menu 10 Item Descriptions**

| Menu Item | Parameter Name                  | Description  |
|-----------|---------------------------------|--|
| L         | simul INS lat                   | Simulates a latitude by overriding the data received from the aircraft INS   |
| H         | simul INS heading               | Simulates an aircraft heading by overriding the data received from the aircraft INS  |
| P         | simul INS pitch                 | Simulates aircraft pitch by overriding the data received from the aircraft INS   |
| S         | simul INS speed                 | Simulates aircraft speed by overriding the data received from the aircraft INS   |
| C         | simul port ACU status           | Enter both the port antenna gain in dB and the message rate in Hertz (Hz).   |
| M         | activate antenna status words   | Activates all set antenna status words   |
| D         | toggle active antenna           | Changes the current simulated active antenna. Choose starboard, port, or automatic. Note that this change will only take effect if antenna status words are activated using menu item "M". |
| G         | simul INS long                  | Simulates aircraft longitude by overriding the data received from the aircraft INS   |
| T         | simul ins true track            | Simulates true track by overriding the data received from the aircraft INS   |
| R         | simul INS roll                  | Simulates aircraft roll by overriding the data received from the aircraft INS  |
| A         | activate INS simul words        | Activates all input simulate parameters overriding the INS data received from the aircraft<br>Lat and Long values from the EEPROM values set in Menu 3                                     |
| B         | simul sb ACU status             | Enter the starboard antenna gain in dB and the message rate in Hz  |
| N         | deactivate antenna status words | De-activates all set antenna status words  |
| X         | deactivate INS simul words      | De-activates all simulated parameters reverting the HSD-400 terminal system back to using the INS data received from the aircraft  |

(f) Menu 13

Menu 13 items are used to query and debug the Data I/O Card.

Figure 4-9 shows the HSD-400 terminal MPU Menu 13 screen display.

Table 4-12 describes the items available in Menu 13.

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|   |               |
|---|---------------|
| MENU 13   | FIRMWARE Vx.x |
| T        query DATA IO elapsed time                    V        query DATA IO version<br>S        query DATA IO services                        C        query DATA IO config pins<br>F        DATA IO fault logging level                F        DATA IO logging level DATA<br><CTRL> N    next menu                                <CTRL> O    previous menu                =    select reports<br><br>TERMINAL: STAND-ALONE MODE                            HCM MODULE DETECTED |               |

**Figure 4-9. Menu 13 Screen Display**

**Table 4-12. Menu 13 Item Descriptions**

| Menu Item | Parameter Name              | Description  |
|-----------|-----------------------------|--|
| T         | query Data IO elapsed time  | Displays the time (in seconds) since the last Data I/O reset                         |
| S         | query Data IO services      | Displays active interfaces   |
| F         | Data IO fault logging level | Sets the level of minimum severity of events that are reported to the Data I/O card  |
| V         | query Data IO version       | Displays the firmware version of the Data I/O card                                   |
| C         | query Data IO config pins   | Display the configuration pins of the Data I/O card                                  |
| X         | Data IO console mode        | Opens a virtual TTY session to the Data I/O maintenance port on the HSD-400 terminal |
| G         | print Data IO call database | Displays the calls made and recorded in the Data IO database                         |

(g) Menu 14

Menu 14 items are used for debugging and clarifying call routing issues.

Figure 4-10 shows the HSD-400 terminal MPU Menu 14 screen display.

Table 4-13 describes the items available in Menu 14.

|   |               |
|---|---------------|
| MENU 14   | FIRMWARE Vx.x |
| N        num entries in call table                    L        list call table<br>T        get call table<br><CTRL> N    next menu                                <CTRL> O    previous menu                =    select reports<br><br>TERMINAL: STAND-ALONE MODE                            HCM MODULE DETECTED |               |

**Figure 4-10. Menu 14 Screen Display**

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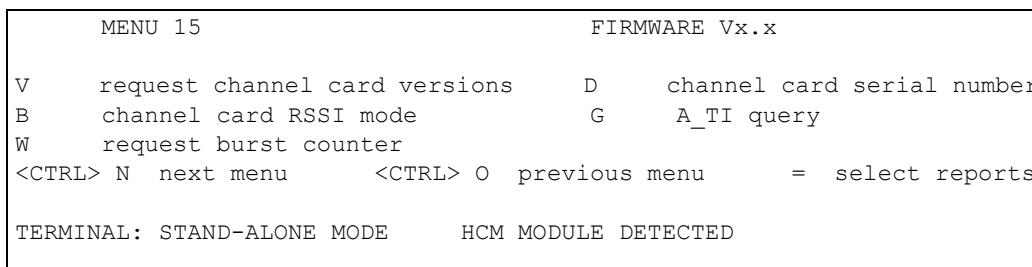
**Table 4-13. Menu 14 Item Descriptions**

| Menu Item | Parameter Name            | Item Description   |
|-----------|---------------------------|--|
| N         | num entries in call table | Displays the call table number entries for fixed-originated or mobile-originated calls for either channel card 1 or channel card 2 |
| T         | get call table            | Displays the call table lists for fixed-originated or mobile-originated calls for either channel card 1 or channel card 2          |
| L         | list call table           | Displays the call table for fixed-originated or mobile-originated calls for either channel card 1 or channel card 2                |

(h) Menu 15

Figure 4-11 shows the HSD-400 terminal MPU Menu 15 screen display.

Table 4-14 describes the items available in Menu 15.



**Figure 4-11. Menu 15 Screen Display**

**Table 4-14. Menu 15 Item Descriptions**

| Menu Item | Parameter Name                | Item Description   |
|-----------|-------------------------------|--|
| V         | request channel card versions | Displays software versions for a selected channel card   |
| B         | channel card RSSI mode        | Places the channel card in Received Signal Strength Indicator mode<br>As requested, enter the channel number, the Ocean Region, the channel type, and the RSSI period in milliseconds                |
| W         | request burst counter         | Displays the burst counter information   |
| D         | channel card serial number    | Displays the serial number of the selected channel card  |
| G         | A_T1 query                    | Manually sends an A_T1 query to the requested channel card to check on the alive/dead status of the channel card processors.<br>As requested, enter a channel card number and service type to query. |

(i) Menu 21

Figure 4-12 shows the HSD-400 terminal MPU Menu 21 screen display.

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Table 4-15 describes the items available in Menu 21.

| MENU 21                           | FIRMWARE Vx.x                  |
|-----------------------------------|--------------------------------|
| P get channel card ethernet parms | I get channel card IMEI number |
| B request SBB configuration       |                                |
| <CTRL> N next menu                | <CTRL> O previous menu         |
|                                   | = select reports               |

**Figure 4-12 Menu 21 Screen Display**

**Table 4-15. Menu 21 Item Descriptions**

| <b>Menu Item</b> | <b>Parameter Name</b>           | <b>Item Description</b>  |
|------------------|---------------------------------|--|
| P                | get channel card ethernet parms | Displays the Ethernet parameters of the channel card, including the MAC address, the IP address, the gateway IP address, the host name, the DHCP status, and the DHCP server IP address. |
| B                | request SBB configuration       | Displays the SwiftBroadband configuration.   |
| I                | get channel card IMEI key       | Displays the IMEI key of the channel card.   |

**(5) Report Descriptions**

When testing or troubleshooting the HSD-400 terminal system, monitoring real-time system data is sometimes required. Figure 4-13 shows all the report items potentially available to a Level 2 user.

Most reports are used for factory debugging purposes only. This document describes only the reports typically used in the field for operational and fault isolation testing.

**Note:** Depending on the version of software installed, the MPU report items displayed may differ from those shown in Figure 4-13.

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|                                       |   |
|---------------------------------------|---|
| 1 OFF messages to channel card #1     | 13 OFF messages to channel card #2            |
| 2 OFF hex output to channel card #1   | 14 OFF hex output to channel card #2          |
| 3 OFF responses from channel card #1  | 15 OFF responses from channel card #2         |
| 4 OFF hex input from channel card #1  | 16 OFF hex input from channel card #2         |
| 5 OFF card #1 misc info               | 17 OFF card #2 misc info                      |
| 6 OFF sb antenna arinc input          | 18 OFF port antenna arinc input               |
| 7 OFF sb antenna maintenance word     | 19 OFF port antenna maintenance word          |
| 8 OFF sb antenna status word          | 20 OFF port antenna status word               |
| 9 OFF channel card call status        | 21 OFF call codes                             |
| 10 OFF channel card THA codes         | 22 OFF spot beam selection                    |
| 11 OFF channel card errors            | 23 OFF standard output                        |
| 12 OFF INS input                      | 24 OFF doppler, antenna az/el                 |
|                                       |   |
| 25 OFF HPA arinc i/o                  | 37 OFF combined-mode spoofed output           |
| 26 OFF HPA error status               | 38 OFF combined-mode power allotment          |
| 27 OFF HPA/channel card backoffs      | 39 OFF combined-mode debugging                |
| 28 OFF miscellaneous digital inputs   | 40 OFF enthusiastic combined-mode debug       |
| 29 OFF channel card A_AM msgs         | 41 OFF delta combined-mode debugging          |
| 30 OFF multi-control arinc bus        | 42 OFF raw arinc data from ITS                |
| 31 OFF ocean region info              | 43 OFF high-precision hpa power               |
| 32 OFF hex input from data i/o        | 44 OFF hpa calibration (gain droop)           |
| 33 OFF hex output to data i/o         | 45 OFF combined mode ocean region debug       |
| 34 OFF input from data i/o            | 46 OFF hpa resets                             |
| 35 OFF changes in multi-control bus   | 47 OFF channel card temperature               |
| 36 OFF unit test call setup           | 48 OFF hexadecimal INS input                  |
|                                       |   |
| 49 OFF main loop latency              | 61 OFF non-zero channel card power            |
| 50 OFF main loop timing               | 62 OFF m4 availability status                 |
| 51 OFF one second tick                | 63 OFF enthusiastic output to RC SDU          |
| 52 OFF extended call codes            | 64 OFF channel card frequencies               |
| 53 OFF standalone w/o ant data        | 65 OFF enthusiastic messages from HPA         |
| 54 OFF RC SDU time and date           | 66 OFF channel card boot sequence             |
| 55 OFF RC arinc i/o (hex)             | 67 OFF debug honeywell combined mode          |
| 56 OFF RC misc arinc i/o (ascii)      | 68 OFF CFDS debugging                         |
| 57 OFF RC EIRP                        | 69 OFF vt100 scenario                         |
| 58 OFF RC SAT-906 Status              | 70 OFF HCM input                              |
| 59 OFF RC Satellite Position          | 71 OFF HCM power level                        |
| 60 OFF debug channel card power       | 72 OFF DATA I/O events                        |
|                                       |   |
| 73 OFF HCM power control              | 85 OFF debug CC#2 channel card power          |
| 74 OFF TIM HCM power debugging        | 86 OFF Channel card rx attenuation            |
| 75 OFF HCM BITE                       | 87 OFF interworking report                    |
| 76 OFF HSD-128-X arinc messages       | 88 OFF all words to SDU                       |
| 77 OFF HSD-X net configuration        | 89 OFF debug call teardown                    |
| 78 OFF vt100 eirp/power               | 90 OFF debug cc backoff                       |
| 79 OFF dialtone debugging             | 91 OFF HSD frequencies                        |
| 80 OFF RC CC#2 SDU time and date      | 92 OFF intermod debugging                     |
| 81 OFF RC CC#2 arinc i/o (hex)        | 93 OFF spot beam debugging                    |
| 82 OFF RC CC#2 misc arinc i/o (ascii) | 94 OFF vt100 channel card info                |
| 83 OFF RC CC#2 EIRP                   | 95 OFF vt100 debugging                        |
| 84 OFF RC CC#2 SAT-906 Status         | ... reports 96 to 121 are for engineering use |

**Figure 4-13. HSD-400 Terminal Maintenance Port Utility: Report Items**

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**(6) Activating Maintenance Reports**

In Level 1 menu access, report item 23 (standard output) is automatically generated when the EQUAL SIGN is pressed. Once activated, the report data output is repeated on the computer display at one-second intervals.

Level 2 maint access provides more flexibility in the use of the reports function. This access level permits the activation or de-activation of any one of the report items (toggle on and off).

**(a) Report General Guidelines**

- To open the report menu, press EQUAL SIGN.
- To activate a report, type the number of the report item needed, and then press ENTER. This toggles on the report number entered. To toggle the report off, type in the report number again and press ENTER.
- To disable all report items (toggles all reports off), press X.
- To display the next group of report items, press CTRL+N.
- To save all selected report items to EEPROM, press S. The selected reports will then be output automatically when the Maintenance port is accessed. If the items selected are not saved, they are de-activated when the system is reset or power is cycled to the terminal.
- To start the scrolling report display, press ESC (in Level 2 access only). To return to the menu selection screen, press ESC again.

**(b) Report Descriptions**

Not all the report items are used in the testing or troubleshooting of the system. This section describes only the more commonly used report items.

**1. Report 23**

Report 23 is the most comprehensive report, providing an overall general impression of HSD-400 terminal system health. An example of the contents of report 23 is shown in Figure 4-14. Table 4-16 provides a brief description of the parameters. Each parameter is numbered for description purposes.

|    |              |            |                 |         |              |          |             |          |         |         |          |          |
|----|--------------|------------|-----------------|---------|--------------|----------|-------------|----------|---------|---------|----------|----------|
| 1  | 45D21'16.1"N | 30D0'0.2"W | 2               | PT 0.2D | 3            | RL -0.4D | 4           | HD 13.5D | 5       | TK 0.2D | 6        | 0 knots  |
| 7  | 10:47:07     | 8          | dop 0 ppb       | 9       | az 146.2 deg | 10       | el 35.8 deg | 11       | AORE    | 12      | ant gain | 16 (p/t) |
| 13 | CHAN #1:     | 14         | C/No=53.6 dB Hz | 15      | sig=-34.5 dB | 16       | 32.0 C      | 17       | no call | 18      | beam=5   |          |
| 13 | CHAN #2:     | 14         | C/No=53.8 dB Hz | 15      | sig=-33.2 dB | 16       | 32.0 C      | 17       | no call | 18      | beam=5   |          |
| 13 | CHAN #3:     | 14         | C/No=53.5 dB Hz | 15      | sig=-34.5 dB | 16       | 32.0 C      | 17       | no call | 18      | beam=5   |          |
| 13 | CHAN #4:     | 14         | C/No=53.8 dB Hz | 15      | sig=-34.7 dB | 16       | 32.0 C      | 17       | no call | 18      | beam=5   |          |

**Figure 4-14. Example of Report 23 Output**

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**Table 4-16. Report 23 Item Descriptions**

| <b>Report 23 Item Number</b> | <b>Description</b>  |
|------------------------------|---|
| 1                            | IRS lat/long as interpreted by the HSD-400 terminal   |
| 2                            | Aircraft pitch angle, where “UP” is +ve   |
| 3                            | Aircraft roll angle, where clockwise (cw) is +ve  |
| 4                            | Aircraft true heading; where the nose of the aircraft is pointing, based on yaw offset                        |
| 5                            | Aircraft true track; direction the aircraft is flying-not necessarily the direction it is pointing (see NOTE) |
| 6                            | Aircraft velocity   |
| 7                            | Time, based on the system real time clock   |
| 8                            | Doppler frequency offset; increases with velocity (see NOTE)  |
| 9                            | Antenna azimuth pointing to the satellite, with respect to the nose of the aircraft                           |
| 10                           | Antenna elevation angle to the satellite, with respect to the horizontal position of the aircraft             |
| 11                           | Ocean Region the system is logged-on to   |
| 12                           | Reported antenna gain for the selected antenna: starboard (sbd) or port (p/t)                                 |
| 13                           | Indicates the channel card for which results 14 to 17 relate.   |
| 14                           | RF input Carrier-to-Noise (C/No) level; typically 50.0 to 55.0  |
| 15                           | RF input signal level; not to exceed 0 when “in-call”   |
| 16                           | HSD-400 terminal internal LRU temperature   |
| 17                           | System call status  |
| 18                           | Satellite beam the card is registered on  |

**Note:** When the aircraft is stationary the field may appear as a series of asterisks (“\*”).

2. Reports 5 and 17

Report 5 displays information about channel card #1 and report 17 displays information about channel card #2.

These reports are commonly used for testing and troubleshooting the system and are only available to Level 2 users.

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You are prompted to select the channel(s) for which to generate a report:

5 WHICH GAN CHANNEL (1,2,B,X) ?

Select channel 1, channel 2, Both channels, or X to deselect all channels. When using report 17 (for channel card 2), select channel 3, channel 4, Both channels, or X to deselect all channels.

**Note:** Depending on the version of software installed, and the user's selection of reports, the MPU report items displayed may differ from those shown in the example in Figure 4-15.

```
CHAN #3: C/No=52.7 dB Hz sig=-35.8 dB no call beam=5 AORE bt=OK oc=OK
          tx          0 Hz burst 1 31.5 C int=8080
CHAN #4: C/No=53.5 dB Hz sig=-36.2 dB no call beam=5 AORE bt=OK oc=OK
          tx          0 Hz burst 1 31.5 C int=8080
CHAN #3: C/No=52.7 dB Hz sig=-35.3 dB no call beam=5 AORE bt=OK oc=OK
          tx          0 Hz burst 1 31.5 C int=8080
CHAN #4: C/No=53.4 dB Hz sig=-35.9 dB no call beam=5 AORE bt=OK oc=OK
          tx          0 Hz burst 1 31.5 C int=8080
CHAN #3: C/No=52.8 dB Hz sig=-35.7 dB no call beam=5 AORE bt=OK oc=OK
          tx          0 Hz burst 1 31.5 C int=8080
CHAN #4: C/No=53.5 dB Hz sig=-35.6 dB no call beam=5 AORE bt=OK oc=OK
          tx          0 Hz burst 1 31.5 C int=8080
```

**Figure 4-15. Example of Report 17, Channel Card 2, Channels 3 and 4**

**Table 4-17. Channel Card Report Information**

| <b>Reports 5 and 17</b> | <b>Miscellaneous Channel Card Information</b>  |
|-------------------------|--|
| (C/No) -                | RF input carrier to noise level (value displayed is typically 50 to 55 when not "in-call" and 55 to 65 when "in-call"-may also show as "0s") |
| (sig) -                 | RF input signal level (typically -12 to -18 when not "in-call")  |
| (beam) -                | Satellite Beam the card is registered on   |
| (oc) -                  | Ocean region the card is logged-on to  |
| (bt) -                  | Card boot-up status  |
| (oc) -                  | Ocean region registration status   |
| (int) -                 | Interface status ( =8080 means the card is ready for dialing)  |

3. Report 8 and 20

Report item 8 displays the status of the starboard antenna and report item 20 displays the status of the port antenna.

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These reports are commonly used for testing and troubleshooting the system and are only available to Level 2 users.

**Note:** Depending on the version of software installed, and the user's selection of reports, the MPU report items displayed may differ from those shown in the example in Figure 4-16.

```
port ant: status $600241 SDI=PORT/TOP gain=16 LNA=off maint ****
port status $600241 SDI: PORT/TOP SSM: NORMAL gain=16
OMNIDIRECTIONAL MODE open loop tracking starboard active HGA LNA=off
port antenna not reporting maintenance word
port ant: status $600241 SDI=PORT/TOP gain=16 LNA=off maint ****
port ant: status $600241 SDI=PORT/TOP gain=16 LNA=off maint ****
```

**Figure 4-16. Example of Report 20**

#### 4. Report 21

Report 21 displays the call code information for the HSD-400 terminal.

```
11:41:26 #3 B60FCE E5 stop 8306 ACSE failed retry ORR 32.0 C 54 dB Hz
11:41:27 #3 B60FCE E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 54 dB Hz
11:41:33 #3 B60FCE E5 stop 8301 ACSE successful ORR 32.0 C 54 dB Hz
11:41:06 #4 BBFB7D E5 stop 8301 ACSE successful ORR 32.0 C 54 dB Hz
11:41:46 dop 0 ppb az 146.2 deg el 35.8 deg AORE ant gain 16 (min)
CHAN #1: C/No=54.3 dB Hz sig=-35.2 dB 32.0 C no call beam=5
CHAN #2: C/No=54.1 dB Hz sig=-33.9 dB 32.0 C no call beam=5
CHAN #3: C/No=54.3 dB Hz sig=-35.1 dB 32.0 C no call beam=5
CHAN #4: C/No=54.0 dB Hz sig=-35.4 dB 32.0 C no call beam=5
```

**Figure 4-17. Example Report 21**

**Table 4-18. Report 21 Item Descriptions**

| <b>Report 21</b> | <b>Call Codes</b>   |
|------------------|---|
| (Time) -         | Time based on the system real time clock  |
| (Fwd Addr) -     | Forward Address ID assigned to the system channel cards                           |
| (Alpha/no.) -    | Ocean region and beam the card is logged-on to                                    |
| (Call) -         | Call real-time status, service type code, and INMARSAT Cause Code (see Table F-1) |
| (RF power) -     | LES requested HPA power in dBW  |
| (OR status) -    | Ocean region registration status  |

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**Table 4-18. Report 21 Item Descriptions**

| <b>Report 21</b> | <b>Call Codes</b>  |
|------------------|--|
| (Call orig)      | Call originating from MES (mobile) or from a fixed location. |
| (Call type)      | Call types (for example: speech)                             |

**C. Fault Definitions**

The fault definitions that appear in the HSD-400 terminal Maintenance Menu logs are based directly on the cause code definitions provided by INMARSAT. Appendix F: Inmarsat Cause Codes on page F-1 defines the maintenance port menu fault codes of the HSD-400 terminal.

**D. Operational and Diagnostic Test Procedures**

Perform all test procedures presented in this section to test the total operational status of the HSD-400 terminal. Conduct these operational tests for all terminals returned to service after repair.

The procedures assume that the technical personnel are familiar with the test equipment used and can operate the equipment to produce the required inputs and obtain the required results. Refer to the detailed operating procedures and descriptions of the HSD-400 terminal Maintenance Port Utility (MPU) included in this section.

**CAUTION:** ONLY AUTHORIZED TECHNICAL PERSONNEL, TRAINED IN GENERAL AVIATION WORKMANSHIP, THAT HAVE A BASIC UNDERSTANDING OF SATCOM SYSTEMS, SHOULD PROCEED WITH THE OPERATIONAL AND DIAGNOSTIC TEST PROCEDURES PRESENTED IN THIS MANUAL.

**CAUTION:** CHANGES TO SOME MENU FUNCTIONS MAY SERIOUSLY DEGRADE SYSTEM OPERATION.

**Note:** This manual describes the basic MPU functions, menus, and reports required for the testing and fault isolation procedures presented in this section. Please consult EMS SATCOM support personnel before entering any unfamiliar menu selections not described in this manual.

**Note:** Using a terminal emulation program, open a log file and save all test results for future reference and test records.

**Note:** The procedures presented in this section aid technical personnel in upgrading, maintaining, or troubleshooting an HSD-400 terminal. Maintenance does not imply lubrication or adjustment activities.

Refer to the Outline and Installation Diagrams and Interconnection and Contact Assignment Drawings in the Installation section of this manual for additional information.

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**(1) Test Setup Procedure**

The following steps outline the test setup procedure. For detailed connection of test equipment and operating instructions for the HSD-400 terminal MPU, see "Maintenance Port Utility" on page 4-2.

1. Ensure that the HSD-400 terminal is neither powered up nor connected to a power source before proceeding.
2. Connect a maintenance cable to the HSD-400 terminal front panel or remote maintenance port connector.
3. Connect the other end of the cable to the serial port of the computer.
4. Open a log file to capture all test data.

**(2) Post Test**

The following steps outline the actions to take when testing is completed.

1. Save the log file of the test results (or data) for future reference.
2. Remove power from the HSD-400 terminal under test and all other test equipment.
3. Disconnect test equipment from the HSD-400 terminal.
4. Replace the maintenance port connector cover (if previously removed during the test setup.)

**(3) Installation and Operational Verification Tests**

The test procedures assume that an approved ARINC 741 compatible Antenna Subsystem has been completely installed and tested as per the manufacturer's instructions.

To facilitate and document the installation of the equipment, refer to Appendix E: Installation Checklist on page E-1.

**(a) Pre Power-up Checks**

Carry out all mechanical and electrical verification tests in the systematic order presented in this document.

**(b) Mechanical Verification**

Refer to "Installation" on page 3-1 for detailed mechanical information.

Table 4-19 itemizes the recommended mechanical checks.

**Table 4-19. HSD-400 Terminal Mechanical Verification Checklist**

| <b>Item Number</b> | <b>Item Checked</b> | <b>Verification Description</b>   |
|--------------------|---------------------|---|
| 1. 0               | Mounting Tray       | Ensure service/maintenance accessibility                                      |
|                    | Physical Placement  | Check environmental considerations are met<br>Cooling, air-flow, and pressure |

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**Table 4-19. HSD-400 Terminal Mechanical Verification Checklist (Continued)**

| Item Number | Item Checked        | Verification Description                               |
|-------------|---------------------|--|
| 2. 0        | Fan Tray            | Confirm plug configuration is correct                  |
|             |                     | Check chassis bonding                                  |
|             |                     | Ensure fan rotation is unobstructed and rotates freely |
| 3. 0        | ARINC 600 Connector | Check polarized pins                                   |

(c) Electrical Verification

Refer to "Installation" on page 3-1 for detailed electrical information. Table 4-20 itemizes the recommended electrical checks.

When conducting the following tests, do not rack the HSD-400 terminal.

**WARNING:** TO AVOID PERSONAL INJURY AND/OR EQUIPMENT DAMAGE, USE EXTREME CAUTION DURING THE VOLTAGE LEVELS MEASUREMENTS.

**Table 4-20. HSD-400 Terminal Electrical Verification Checklist**

| Item Number | Item Checked      | Verification Description  |
|-------------|-------------------|---|
| 1.0         | Power connections | Model 1252-A-3200: 28 V dc polarity   |
|             |                   | Model 1252-A-3100: 115 V ac polarity  |
|             |                   | Chassis Ground @ BP8 - resistance measurement   |
| 2.0         | Voltage levels    | <p><b>CAUTION:</b> When power is applied to the rack, the fan energizes.</p> <p>Check voltage levels:</p> <p>Model 1252-A-3200 (28 V dc): between BP2 (+ve) and BP3 (return)</p> <p>Model 1252-A-3100 (115 V ac): between BPI (115-H) and BP7 (115-C)</p> |
| 3.0         | IRS Input         | <p>IRS wiring:<br/> Inertial system wired to TP4J (A) and TP4K (B)</p> <p>IRS format:<br/> ARINC 429 Interface</p>  |

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**Table 4-20. HSD-400 Terminal Electrical Verification Checklist (Continued)**

| Item Number | Item Checked                       | Verification Description   |
|-------------|------------------------------------|--|
| 4.0         | Configuration Strap Pins           | <p>SDI:<br/>Strapped for HGA, Pin TP5B to TP5D</p> <p>System Configuration:<br/>Strapped for System mode, Pins TP4A, TP4B, TP4C, and/or TP4D strapped to TP7K</p> <p>Data I/O:<br/>User specific, default to unrestricted pins MP5G and MP5J to TP7K</p> <p>Forward Address:<br/>User specific address obtained from EMS SATCOM</p> <p>WOW: (Optional)</p> |
| 5.0         | Ethernet 1 and 2                   | <p>Strapped to RJ45 distribution points</p> <p><b>Note:</b> Optional-other service may be preferred.</p>   |
| 6.0         | ISDN 1 and 2                       | <p>Strapped to RJ45 distribution points</p> <p><b>Note:</b> Optional-other service may be preferred.</p>   |
| 7.0         | DTE - MPDS (RS232)                 | <p>Strapped to DB9 distribution connector</p> <p><b>Note:</b> Optional-other service may be preferred.</p>   |
| 8.0         | Remotes (Optional but recommended) | <p>Remote Reset switch</p> <p>Maintenance Port, remote access</p> <p>Power and Fault indicators</p>  |
| 9.0         | RF Coax                            | <p>Rx input cable loss from DLNA J2 to HSD at BP12</p> <p>Tx output cable loss from HSD at MPC1 to DLNA J3</p>   |
| 10.0        | Antenna Connection                 | <p>Antenna manufacturer and model</p> <p>Multi-Control loopbacks installed from TP3E to TP1A and TP3F to TP1B (Stand-Alone Mode)</p>   |

**(4) Configuration Parameters Verification**

You can now verify the system configuration parameters. For additional connection and access information, see "Connection Requirements" on page 4-2. Verify and document using the checklist provided in Appendix E: Installation Checklist on page E-1.(provided in the Appendix of this manual).

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(a) Parameter Verification Procedure

- From Menu 3, select item 'O' (list ORT).

The ORT listing appears on the screen as shown in Figure 4-18. Verify that the correct system configuration parameters are listed in the ORT.

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| HSD SERIAL NUMBER 190   |                                       |          |                  |                  |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
|---|---------------------------------------|----------|------------------|------------------|------|--------------------|-------|---|---|---|--------------------|-------|---|---|---|-------------------|--------|---|---|---|-------------------|-------|---|---|---|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| <p>MISCELLANEOUS PARAMETERS</p> <p>HPA-TO-ANTENNA TOTAL LOSS: [7m 6.7 dB[0m [7mMANUALLY SET[0m<br/> FORWARD ID: [7m 000000[0m [7mMANUALLY SET[0m<br/> GPS PROTECTION ALGORITHMS: [7mENABLED[0m [7mNOT SET[0m<br/> REGISTRATION REQ'D BEFORE CALLS: [7mDISABLED[0m [7mNOT SET[0m<br/> CHANNEL-CARD-TO-HPA LOSS: [7m 14.0 dB[0m [7mMANUALLY SET[0m<br/> MAX HPA GAIN: [7m 64.00 dB[0m [7mNOT SET[0m<br/> MIN ANTENNA GAIN: [7m 8.0 dB[0m [7mMANUALLY SET[0m<br/> MAX EIRP: [7m 52.5 dBm[0m [7mNOT SET[0m<br/> MAX CHANNEL_CARD POWER: [7m 0.0 dBm[0m [7mMANUALLY SET[0m<br/> NUMBER OF CHANNEL CARDS : [7m 2[0m [7mMANUALLY SET[0m<br/> HIT 'O' for MORE</p> <p>FRONT PANEL LEDS ENABLED: [7m 1[0m [7mNOT SET[0m<br/> MIN SECS BETWEEN CHAN CARD RESETS: [7m 300[0m [7mMANUALLY SET[0m<br/> MAINTENANCE PORT INVERSE VIDEO: [7m 1[0m [7mMANUALLY SET[0m<br/> MAINTENANCE PORT DEGREES SYMBOL: [7m 0[0m [7mNOT SET[0m<br/> TERMINAL CATEGORY: [7mHW STRAPPED VALUE[0m [7mMANUALLY SET[0m<br/> VIPER ANTENNA GAIN : [7m 16 dB[0m [7mNOT SET[0m<br/> VIPER HPA/ANT LOSS : [7m 6.0 dB[0m [7mMANUALLY SET[0m<br/> AUTO-ACTIVATE WINTERM: [7mDISABLED[0m [7mNOT SET[0m<br/> MAX HPA POWER: [7m 18.0 dBw[0m [7mNOT SET[0m<br/> AERO POWER ALLOCATION: [7m 15.5 dBw[0m [7mNOT SET[0m<br/> CHANNEL CARD STARTUP DELAY: [7m 30 sec[0m [7mNOT SET[0m<br/> RX32 ACTIVE: [7m 1[0m [7mNOT SET[0m<br/> DEFAULT LATITUDE: [7m 45 D 0' 0.0" N[0m [7mMANUALLY SET[0m<br/> HIT 'O' for MORE</p> <p>DEFAULT LONGITUDE: [7m 30 D 0' 0.0" W[0m [7mMANUALLY SET[0m<br/> OBEY OCXO STATUS: [7m YES[0m [7mNOT SET[0m<br/> CC DEBUG PORT: [7mNONE[0m [7mNOT SET[0m<br/> MAX CHANNEL CARD BACKOFF: [7m 28.5 dB[0m [7mNOT SET[0m<br/> CO-OP MODE BACKOFF ADJUSTMENT: [7m 6.5 dB[0m [7mNOT SET[0m<br/> ALLOW CALLS DESPITE HPA ERRORS: [7mNO (DON'T TRANSMIT IF ERRORS)[0m [7mNOT SET[0m<br/> MOBILE BURST TIMEOUT: [7m 4000 msec[0m [7mNOT SET[0m<br/> MPDS SPOTBEAM HANDOVER: [7mDISABLED[0m [7mNOT SET[0m<br/> CC RESET CONTROL: [7m0=TOGGLE POWER[0m [7mNOT SET[0m<br/> PFTU FREQ OFFSETS: [7mDISABLED[0m [7mNOT SET[0m<br/> MAX SIMULATED HPA BACKOFF: [7m 31 dB[0m [7mNOT SET[0m<br/> HCM AERO/M4 PRIORITIZATION: [7mAERO[0m [7mNOT SET[0m<br/> AERO 'C-CHANNEL' ALLOCATION: [7m 19.5[0m [7mNOT SET[0m<br/> HIT 'O' for MORE</p> <p>HPA GAIN DROOP SLOPE: [7m 0.10 dB/dB[0m [7mNOT SET[0m<br/> CATEGORY B LOWER FREQUENCY LIMIT: [7m 1644.50 MHz[0m [7mNOT SET[0m<br/> CATEGORY B UPPER FREQUENCY LIMIT: [7m 1660.50 MHz[0m [7mNOT SET[0m<br/> HIT 'O' for MORE</p> <p>DATA I/O PARAMETERS:</p> <p>HIT 'O' for MORE</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>RT OCEAN REGIONS:</th> <th>SAT LONG</th> <th>LES ID</th> <th>SECONDARY LES ID</th> <th>TNID</th> </tr> </thead> <tbody> <tr> <td>W AORW (region #0)</td> <td>54.0W</td> <td>2</td> <td>2</td> <td>0</td> </tr> <tr> <td>E AORE (region #1)</td> <td>15.5W</td> <td>2</td> <td>2</td> <td>0</td> </tr> <tr> <td>P POR (region #2)</td> <td>178.0E</td> <td>2</td> <td>2</td> <td>0</td> </tr> <tr> <td>I IOR (region #3)</td> <td>64.0E</td> <td>2</td> <td>2</td> <td>0</td> </tr> </tbody> </table> <p>ORT TOOL VERSION:<br/> ORT TOOL NAME:<br/> ORT TOOL PART NUMBER:<br/> ORT TOOL OEM VERSION:<br/> ORT PART NUMBER:</p> <p>HSD-X CABLE LOSSES:</p> <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">HSD-X #1: [7m29.5 dB[0m [7mNOT SET[0m</td> <td style="width: 50%;">HSD-X #2: [7m29.5 dB[0m [7mNOT SET[0m</td> </tr> <tr> <td>HSD-X #3: [7m29.5 dB[0m [7mNOT SET[0m</td> <td>HSD-X #4: [7m29.5 dB[0m [7mNOT SET[0m</td> </tr> <tr> <td>HSD-X #5: [7m29.5 dB[0m [7mNOT SET[0m</td> <td>HSD-X #6: [7m29.5 dB[0m [7mNOT SET[0m</td> </tr> <tr> <td>HSD-X #7: [7m29.5 dB[0m [7mNOT SET[0m</td> <td>HSD-X #8: [7m29.5 dB[0m [7mNOT SET[0m</td> </tr> </table> | RT OCEAN REGIONS:                     | SAT LONG | LES ID           | SECONDARY LES ID | TNID | W AORW (region #0) | 54.0W | 2 | 2 | 0 | E AORE (region #1) | 15.5W | 2 | 2 | 0 | P POR (region #2) | 178.0E | 2 | 2 | 0 | I IOR (region #3) | 64.0E | 2 | 2 | 0 | HSD-X #1: [7m29.5 dB[0m [7mNOT SET[0m | HSD-X #2: [7m29.5 dB[0m [7mNOT SET[0m | HSD-X #3: [7m29.5 dB[0m [7mNOT SET[0m | HSD-X #4: [7m29.5 dB[0m [7mNOT SET[0m | HSD-X #5: [7m29.5 dB[0m [7mNOT SET[0m | HSD-X #6: [7m29.5 dB[0m [7mNOT SET[0m | HSD-X #7: [7m29.5 dB[0m [7mNOT SET[0m | HSD-X #8: [7m29.5 dB[0m [7mNOT SET[0m |
| RT OCEAN REGIONS:   | SAT LONG                              | LES ID   | SECONDARY LES ID | TNID             |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| W AORW (region #0)  | 54.0W                                 | 2        | 2                | 0                |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| E AORE (region #1)  | 15.5W                                 | 2        | 2                | 0                |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| P POR (region #2)   | 178.0E                                | 2        | 2                | 0                |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| I IOR (region #3)   | 64.0E                                 | 2        | 2                | 0                |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| HSD-X #1: [7m29.5 dB[0m [7mNOT SET[0m   | HSD-X #2: [7m29.5 dB[0m [7mNOT SET[0m |          |                  |                  |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| HSD-X #3: [7m29.5 dB[0m [7mNOT SET[0m   | HSD-X #4: [7m29.5 dB[0m [7mNOT SET[0m |          |                  |                  |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| HSD-X #5: [7m29.5 dB[0m [7mNOT SET[0m   | HSD-X #6: [7m29.5 dB[0m [7mNOT SET[0m |          |                  |                  |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |
| HSD-X #7: [7m29.5 dB[0m [7mNOT SET[0m   | HSD-X #8: [7m29.5 dB[0m [7mNOT SET[0m |          |                  |                  |      |                    |       |   |   |   |                    |       |   |   |   |                   |        |   |   |   |                   |       |   |   |   |                                       |                                       |                                       |                                       |                                       |                                       |                                       |                                       |

**Figure 4-18. HSD-400 Terminal ORT Display Example**

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(5) System Power-up Checks

**Note:** Before proceeding, ensure that all pre power-up, mechanical, and electrical verifications have been successfully performed and documented using Appendix E: Installation Checklist on page E-1.

(a) Preparation

The following tests serve primarily to confirm proper system power-up; therefore, they can be performed while the aircraft is still in the hanger. Ensure that a computer is available for testing.

(b) Initial Visual LED Verification

The system's Power ON and Fault LEDs provide a visual status indication on the HSD-400 terminal front panel and on the optional remote panel.

1. Verify that the LED indicators (at both locations) repeatedly cycle ON/OFF when power is applied.
2. Once the cycle has completed (~5 seconds), verify that the LED power indicator remains illuminated.

(c) Initial Computer Power up Display

With the computer connected and configured to accept Maintenance Port data, power-up the HSD-400 terminal, and verify the initial power-up screen displays as shown in the example, Figure 4-19.

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```
KERNEL V1.0 -- Thu Jun 23 11:40:25 2005
TESTING RAM .....RAM OK.
RX: LABEL 310 DATA 640811 (IGNORED)
RX: LABEL 324 DATA 600440 (IGNORED)
RX: LABEL 311 DATA 7D5555 (IGNORED)
RX: LABEL 325 DATA 7FF7C0 (IGNORED)
RX: LABEL 314 DATA 613320 (IGNORED)
RX: [2J[0;50rARINC TESTS PASSED

HSD APPLICATION V8.304 -- Thu Aug 04 10:23:14 2005
HSD reset -- watchdog may have fired 83 seconds after powerup
ORT OCEAN REGIONS:          SAT LONG  LES ID  SECONDARY LES ID  TNID
  W AORW      (region #0)  54.0W   2      2      0
  E AORE      (region #1)  15.5W   2      2      0
  P POR       (region #2)  178.0E  2      2      0
  I IOR       (region #3)  64.0E   2      2      0

REAL TIME CLOCK PRESENT: 11:37:07 Tue Aug 23, 2005

channel card #1 forward id f5adb8
STAND-ALONE MODE

FIRMWARE VERSIONS:
  KERNEL:          V1.0 -- Thu Jun 23 11:40:25 2005
  APPLICATION:     V8.304 -- Thu Aug 04 10:23:14 2005
  CHANNEL CARD #1: 4.5.8.0 -- 0.0.0.54 -- 2.1.0.0 -- 2.3.0.0
  CHANNEL CARD #2: 4.5.8.0 -- 0.0.0.54 -- 2.1.0.0 -- 2.3.0.0
  DATA I/O CARD:  Version 1.24.4.0 built on Aug 12 2005 11:
  HPA:            S/W Ver: V4A2-Unit #00033

CHANNEL CARD STATISTICS
CARD #1 (SERIAL 3174):
  744.5 hrs powered 233.4 hrs in call since 16:57:28 May 27, 2005
CARD #2 (SERIAL 3183):
  706.9 hrs powered 189.7 hrs in call since 16:57:28 May 27, 2005

Enter your password to activate the maintenance port menus.
```

**Figure 4-19. HSD-400 Terminal Power-up Display Example**

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(6) System On-Air Checks

Conduct system on-air checks to confirm voice and data call capabilities through the satellite and ground station (LES) network. Additional testing confirms that proper signal level parameters are obtained through the antenna subsystem.

(a) Preparation

Before attempting on-air testing procedures:

1. Complete and confirm all service provider registration and activation.
2. Complete and document all pre power-up and power-up checks.
3. Position the aircraft outside, away from all obstructions in the line-of-site to the satellite used.
4. Apply the aircraft power source.
5. Power on and wait for the IRS to align.
6. Connect a computer (with a terminal emulation program) to the HSD-400 terminal maintenance port.

**Note:** Several system parameters, such as IRS data, RF signal quality, and log-on messaging, appear on the maintenance port display. Capture and save this maintenance port information to a file for later review or to serve as an historical test record.

(b) On-Air Power up and Logon Procedure

For this test procedure, use the Level 2 maintenance password to access the HSD-400 terminal Maintenance Utility Program. For information on how to connect, access, and use the MPU program, see "Connection Requirements" on page 4-2.

1. With the computer connected, powered-up, and ready to accept maintenance port data, power up the HSD-400 terminal.
2. Once the power up messages appear, enter the Level 2 password **maint**
3. To access the reports menu, press EQUAL SIGN, and then activate report items **21** (call codes) and **23** (standard output).

Remember to save these selected items by pressing **S** (save to EEPROM).

4. To reset the HSD-400 terminal, in menu 2, press **Z**, and then immediately type the password **maint** when the reset message appears.

The data from the previously selected reports 21 and 23 appears. This data refreshes on-screen every second. For easier reading of the data, capture this information in a log file for later review or pause the display by pressing SCROLL LOCK or by highlighting part of the viewed data.

5. Compare the output data to the sample shown in Figure 4-20.

Several parameters need to be reviewed and documented for operational verification purposes. Refer to the "Installation Checklist" on page E-1 for a detailed list of parameters.

6. Verify that the following system information, as shown on the System Initialization Display during the test, is accurate for the HSD-400 terminal under test.

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- FWD ID
- Installation mode
- Number of channel cards
- All channel cards trigger OR registration

The example figure has been edited for clarity. A successful log on is confirmed when the message "ACSE Successful ORR" and valid "beam" numbers are reported, e.g. beam 4.

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```
KERNEL Vx.x -- Mon Jan 01 12:40:48 2007
TESTING RAM .....RAM OK.

HSD APPLICATION Vx.x -- Mon Jan 01 12:40:51 2007
Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.
fault log sector 15 contains 116 entries
REAL TIME CLOCK NOT DETECTED

channel card forward id ABC123
STAND-ALONE MODE
powering up channel card #1
powering up channel card #2
dop 0 ppb az 0.0 deg el 45.0 deg ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz sig=**** ?? C call=??
CARD #2: C/No=0.0 dB/Hz sig=**** ?? C call=??
45D10'30.3"N 75D6'20.9"W PT 1.8D RL 1.6D HD 25.5D TK 1.8D 23 knots
dop -28 ppb az 125.6 deg el 36.3 deg AOR WEST ant gain 11 (p/t)
45D10'30.3"N 75D6'20.9"W PT 1.8D RL 1.6D HD 25.5D TK 1.8D 23 knots
dop -28 ppb az 125.6 deg el 36.3 deg AOR WEST ant gain 11 (p/t)
CARD #1: C/No=*** sig=**** ?? C call=??
CARD #2: C/No=*** sig=**** ?? C call=??
45D10'30.3"N 75D6'20.9"W PT 1.8D RL 1.6D HD 25.5D TK 1.8D 23 knots
dop -28 ppb az 125.6 deg el 36.3 deg AOR WEST ant gain 11 (p/t)
powering up channel card #2
powering up channel card #1
dop -28 ppb az 125.6 deg el 36.3 deg AOR WEST ant gain 11 (p/t)
CARD #1: C/No=*** sig=**** 26 C call=??
CARD #2: C/No=*** sig=**** 24 C call=??
45D10'30.3"N 75D6'20.9"W PT 1.8D RL 1.6D HD 25.5D TK 1.8D 23 knots
dop -28 ppb az 125.6 deg el 36.3 deg AOR WEST ant gain 11 (p/t)
CARD #1: C/No=*** sig=**** 26 C call=??
CARD #2: C/No=*** sig=**** 24 C call=??
45D10'30.3"N 75D6'20.9"W PT 1.8D RL 1.6D HD 25.5D TK 1.8D 23 knots
SENDING FIRST OC_RESTART COMMAND
!!CARD #2 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR WEST!!
SENDING FIRST OC_RESTART COMMAND
!!CARD #1 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR WEST!!
dop -28 ppb az 125.6 deg el 36.3 deg AOR WEST ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz sig=**** 26 C call=??
beam=255
CARD #2: C/No=0.0 dB/Hz sig=-999.9 dB 24 C call=??
beam=255
45D10'30.3"N 75D6'20.9"W PT 1.8D RL 1.6D HD 25.5D TK 1.8D 23 knots
dop -28 ppb az 125.6 deg el 36.3 deg AOR WEST ant gain 11 (p/t)
```

**Figure 4-20. Log-on Initialization Display Example**

(c) On-Air Voice/Data Call Verification

**Note:** Once the system has logged on, place a test voice and/or data call using the following procedure. After completing the test call, verification of all aircraft communication functions is recommended. For the purposes of

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providing a sample display, an ISDN voice call is documented. Refer to the HSD Quick Reference (MN-1110-10063) for specific instructions on how to place voice and data calls.

1. To place an on-air voice or data call: Ensure the maintenance port report items 21 and 23 are activated.
2. Place a test call. Refer to "System Operation" on page 2-1 for detailed call procedures.
3. Observe and verify the maintenance port messages are similar to the sample provided in Figure 4-21.
4. Record the test call result on the "Installation Checklist" on page E-1.

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```

12:43:24 #1 ABC123 E4 start 800124 14.00 dBW mobile aero 64k speech 28
C 47 dB/Hz
12:43:24 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=*** sig=-16.4 dB 28 C IDLE IN CALL beam=4
CARD #2: C/No=47.3 dB/Hz sig=-15.2 dB 30 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:25 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=47.3 dB/Hz sig=-16.4 dB 28 C in call beam=4
CARD #2: C/No=47.3 dB/Hz sig=-15.0 dB 30 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:26 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=47.3 dB/Hz sig=-16.8 dB 28 C in call beam=4
CARD #2: C/No=47.3 dB/Hz sig=-15.4 dB 30 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:26 #1 ABC123 E4 start 800124 22.50 dBW mobile aero 64k speech 28 C
12:43:27 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=0.0 dB/Hz sig=-999.9 dB 28 C in call beam=4
CARD #2: C/No=47.4 dB/Hz sig=-15.6 dB 30 C no call beam=4

45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:42 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=54.1 dB/Hz sig=-11.6 dB 28 C in call beam=4
CARD #2: C/No=46.9 dB/Hz sig=-15.8 dB 30 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:43 #1 ABC123 E4 start 800124 21.50 dBW mobile aero 64k speech 28
C 0 dB/Hz
12:43:43 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=*** sig=-11.6 dB 28 C in call beam=4
CARD #2: C/No=46.8 dB/Hz sig=-15.5 dB 30 C no call beam=4

12:43:55 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=0.0 dB/Hz sig=-10.7 dB 28 C in call beam=4
CARD #2: C/No=46.6 dB/Hz sig=-15.3 dB 30 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:55 #1 ABC123 E4 start 800124 18.50 dBW mobile aero 64k speech 28 C
12:43:56 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=0.0 dB/Hz sig=-999.9 dB 28 C in call beam=4
CARD #2: C/No=47.1 dB/Hz sig=-15.5 dB 30 C no call beam=4

45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:58 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 12 (p/t)
CARD #1: C/No=0.0 dB/Hz sig=-999.9 dB 28 C in call beam=4
CARD #2: C/No=46.9 dB/Hz sig=-15.8 dB 30 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:58 #1 ABC123 E4 stop 1f01 call cleared by terrestrial circuit 28 C

```

**Figure 4-21. HSD-400 Terminal Call Display Example**

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**(7) Antenna Tracking Checks**

As a final ground-based system check, verify the antenna tracking. This confirms proper signal reception and transmission for all aircraft headings.

**(a) Preparation**

- Perform all previous tests and document the results before proceeding.
- As directed in previous tests, connect a computer to the maintenance port and use the Level 2 maintenance password to access the HSD-400 terminal MPU.
- Power up all avionics and align the IRS.
- Taxi or tow the aircraft to an unobstructed, line-of-site location where a complete 360° rotation is possible.

**(b) Antenna Tracking Verification Procedure**

1. From the reports menu, enable items **8, 20, and 23**.

**Note:** Reports item 8 (starboard antenna status word) is only required where conformal antennae are installed.

2. Position the aircraft at a baseline, start-of-test heading (0 degrees true heading recommended).
3. Confirm that the baseline heading, as reported by the aircraft IRS is similar to that reported from the "HD" entry in reports item 23.
4. Record the following data on the "Installation Checklist" on page E-1:
  - Selected antenna—port or starboard (conformal only)
  - Antenna gain and azimuth angle
  - Heading
  - Channel Card C/No and Signal levels
5. Rotate the aircraft through a full 360° circle while stopping to record data at the following heading intervals:
  - For conformal or phased arrays: every 15°
  - For mechanically steered antenna: every 30°

**(8) Optional System Checks**

The following procedures are recommended—but not essential; however, they serve to confirm successful completion of all previous tests.

**(a) Preparation**

Activate report items 21 and 23 for the following checks.

**(b) Optional Voice/Data Calls Procedure**

**Note:** As in previous tests, open a log file to capture all maintenance port activity during aircraft taxiing, flight, and landing segments.

- Ground segment voice or data calls:

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- Place any combination of voice and/or data calls while the aircraft is taxied in a full circle and/or and figure 8 pattern. Note any voice or data anomalies.
- In flight voice or data calls:
  - Place any combination of voice and/or data calls during any of the segments listed above. The flight pattern may include "standard rate of turn", figure 8, or circles. Note any voice or data anomalies.

## **E. Software Load Procedures**

EMS SATCOM may occasionally release new software. Load new software with a laptop or computer connected to the maintenance port of the HSD-400 terminal, using the EMS Loader application.

**Note:** Refer to the applicable software release note or service bulletin for a specific list of the software files that need to be loaded. If in doubt, verify with EMS SATCOM product support that the software version being loaded is the latest release.

### **(1) Loading Channel Card Software**

This section describes how to load channel card software to HSD-400 terminals using the EMS Loader.

1. Remove power from the HSD-400 terminal.
2. Connect a computer to the maintenance port of the HSD-400 terminal.
3. Turn on the computer.
4. Save the EMS Loader application file (ADT\_LOAD.exe) to the same folder on your computer that contains the software files. (Recommended: Create a folder named HSD Load in the root directory and save the load program file and the software files to this folder.)
5. Apply power to the HSD-400 terminal.
6. Close all other applications running on the computer. The load program will not execute successfully if other programs are using the com port.
7. In the HSD folder, double-click **ADT\_LOAD.exe**.

The EMS Loader opens in a DOS window, displays the "Load Target" menu, and prompts you to select a "target" for the software.

8. To load all software on channel card #1, type **22**. To load all software on channel card #2, type **23**.
9. Press **Enter**.

The EMS Loader prompts you to select a COM port.

10. Type the COM port connected to the HSD-400 terminal and press **Enter**.

The EMS Loader prompts you to type in a filename.

11. Type **config.hex**, and then press **Enter**.

The prompt asks if this is RF control software for TAL2 (channel card #1) or TAL4 (channel card #2).

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**12.** Press **Enter** to indicate the default, **N** (No).

The EMS Loader will continue to prompt for the next filename.

**13.** Enter the following file names one at a time, press **Enter** after each one, type **Y** or **N**, and press **Enter** again.

- release.hex, **N**, **Enter**
- cpumain.hex, **N**, **Enter**
- tmsc33.hex, **N**, **Enter**
- tmsc64.hex, **N**, **Enter**
- rfcontrol.hex, **N**, **Enter**
- rfcontrol2.hex, **Y**, **Enter**

**14.** When finished, press **Enter** at the prompt to terminate the list.

Communication with the HSD-400 terminal is established. A percentage (%) load status indicator appears on the screen. Once the load is complete, a confirmation message briefly appears on the screen indicating that the file has been successfully loaded. The DOS window closes and the HSD-400 terminal resets.

**15.** Repeat this procedure to load software to Channel Card 2.

**16.** If no other software loads are required, proceed to "Verifying Software Loads" on page 4-41.

**Note:** If the load fails, restart the load from the beginning of the Loading Channel Card Software procedure. If after two attempts the load still does not complete successfully, assume that the software disks or files may have been corrupted or the software is incompatible with the hardware configuration. Contact EMS SATCOM product support for assistance.

## (2) Loading Control Processor Software

This section describes how to load control processor software on to HSD-400 terminals.

1. Remove power from HSD-400 terminal.
2. Connect a computer to the Maintenance Port of the HSD-400 terminal.
3. Turn on the computer.
4. Save the EMS Loader application file (ADT\_LOAD.exe) to the same folder on your computer that contains the software files. (Recommended: Create a folder named HSD Load in the root directory and save the load program file and the software files to this folder.)
5. Apply power to the HSD-400 terminal.
6. Close all other applications running on the computer. The load program will not execute successfully if other programs are using the com port.
7. In the HSD folder, double-click **ADT\_LOAD.exe** to launch the load application. The EMS Loader opens in a DOS window, displays the "Load Target" menu, and prompts you to select a "target" for the software.
8. To load control processor software to the control processor, press **0** (zero).

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**9. Press **Enter**.**

The load application prompts you to type in a filename.

**10. Type the filename for the software being loaded to the HSD-400 terminal Control Processor, and then press **Enter**.**

The EMS Loader prompts you to select a COM port.

**11. Type the COM port connected to the HSD-400 terminal, and then press **Enter**.**

**12. To start the load, press **Enter**. (To abort the software load, press **Esc**.)**

Communication with the HSD terminal is established. A percentage (%) load status indicator appears on the screen. Once the load is complete, a confirmation message briefly appears on the screen indicating that the file has been successfully loaded. The DOS window closes and the HSD-400 terminal resets.

**13. If no other software loads are required, proceed to "Verifying Software Loads" on page 4-41.**

**Note:** If the load fails, restart the load from the beginning of the Loading Control Processor Software procedure. If after two attempts the load still does not complete successfully, assume that the software disks or files may have been corrupted or the software is incompatible with the hardware configuration. Contact EMS SATCOM product support for assistance.

**(3) Loading HPA Software**

Load HPA software as required according to the applicable software service bulletin as released by EMS SATCOM.

**1. Remove power from HSD-400 terminal.**

**2. Connect a computer to the Maintenance Port of the HSD-400 terminal.**

**3. Turn on the computer.**

**4. Save the EMS Loader application file (ADT\_LOAD.exe) to the same folder on your computer that contains the software files. (Recommended: Create a folder named HSD Load in the root directory and save the load program file and the software files to this folder.)**

**5. Apply power to the HSD-400 terminal.**

**6. Close all other applications running on the computer. The load program will not execute successfully if other programs are using the com port.**

**7. In the HSD folder, double-click **ADT\_LOAD.exe** to launch the load application.**

The EMS Loader opens in a DOS window, displays the "Load Target" menu, and prompts you to select a "target" for the software.

**8. To load HPA application software, press **7**.**

**9. Press **Enter**.**

The system prompts you for a filename.

**10. Type the filename of the HPA software.**

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**Note:** Use care to ensure that the correct file name is entered for the HSD terminal's power type. For example, enter A1703006-V9A6.SX for a 28 V dc terminal or enter C0300106-V4A2.SX for a 115 V ac terminal.

**11. Press **Enter**.**

The program prompts you to select a COM port.

**12. Type the COM port connected to the HSD-400 terminal, and press **Enter**.**

**13. To start the load, press **Enter**.**

A percentage (%) progress indicator appears on the screen. A confirmation message briefly appears on the screen indicating that the file has been successfully loaded, and then the DOS window closes. This completes HPA software load.

If all software loads are finished, verify the success of the software load by following the instructions provided in "Verifying Software Loads" on page 4-41.

In the event that the load fails, restart the load from the beginning of "Loading HPA Software" on page 4-40. If after two attempts the load still does not complete successfully, assume that the software disks may have been corrupted or the software is incompatible with the hardware configuration. Contact EMS SATCOM product support for assistance.

**(4) Verifying Software Loads**

After loading all software as specified in the applicable software service bulletin, released by EMS TSATCOM, verify that all software loaded successfully.

**Note:** The screens shown in this procedure are examples only. The software and other versions may differ from your terminal.

1. Apply power to the HSD-400 terminal.
2. Open HyperTerminal (or similar) on the computer and start the HSD-400 terminal Maintenance Utility Program.
3. Connect the computer to the Maintenance Port of the HSD terminal.
4. Enter the Maintenance Utility Program password: Type **maint** and then press **Enter**.

Menu 1 appears.

5. Press **CTRL+N** to scroll to MENU 2.

Menu 2 appears as shown in Figure 4-22.

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|  |                              |
|--|------------------------------|
| MENU 2   | FIRMWARE V8.3                |
| A set veh-relative azimuth   | E set veh-relative elevation |
| K desired az veh-rel velocity  | R resume automatic steering  |
| T enter time of day  | N annotate log file          |
| L re-enter logon password  | V get firmware versions      |
| Z reset HSD-400  | S set satellite longitude    |
| <CTRL> N next menu      <CTRL> O previous menu      = select reports |                              |
| TERMINAL: STAND-ALONE MODE      HCM MODULE DETECTED                  |                              |

**Figure 4-22. Menu 2 Screen Display**

6. To display the versions of software loaded onto the HSD, press **V**.

A list of Firmware Versions appears similar to the example shown in Figure 4-23 (actual versions will differ depending on the software installed on the terminal).

|                    |   |
|--------------------|---|
| FIRMWARE VERSIONS: |   |
| KERNEL:            | V1.0 -- Thu Jun 23 11:40:25 2005          |
| APPLICATION:       | V8.304 -- Thu Aug 04 10:23:14 2005        |
| CHANNEL CARD #1:   | 4.5.8.0 -- 0.0.0.54 -- 2.1.0.0 -- 2.3.0.0 |
| CHANNEL CARD #2:   | 4.5.8.0 -- 0.0.0.54 -- 2.1.0.0 -- 2.3.0.0 |
| DATA I/O CARD:     | Version 1.24.4.0 built on Aug 12 2005 11: |
| HPA:               | S/W Ver: V4A2-Unit #00033                 |

**Figure 4-23. Example Firmware Versions**

7. Verify that all software has loaded successfully to both channel cards. Verify that the software versions (Firmware Versions) shown, match the versions listed on the load disk (or files) and in the software service bulletin.
8. Close the HyperTerminal session.
9. Remove power from the HSD.

This completes the software load verification. Section "Disconnecting Load Equipment" on page 4-42, explains how to disconnect the software load equipment.

**(5) Disconnecting Load Equipment**

After completing all required software loads and load verification:

1. Remove power from the HSD-400 terminal (if applicable).
2. Turn off the computer (if applicable).
3. Disconnect the serial cable connector from the computer COM port.

4. Disconnect the serial cable connector from the HSD-400 terminal Maintenance Port.

## **2. Troubleshooting and Fault Isolation**

This section provides troubleshooting procedures for HSD-400 terminals experiencing faults during the commissioning process or previously operational terminals now considered as "not working".

Troubleshooting procedures require data obtained using the MPU feature of the HSD-400 terminals. For specific instructions on how to access and use the Maintenance Port and Maintenance Port Utility of the terminal, refer to "Connection Requirements" on page 4-2.

### **A. Troubleshooting Practices**

Troubleshooting practices for the HSD-400 terminal fall into two categories: non-specific and specific complaints.

#### **(1) Non-specific Complaints**

When troubleshooting terminals with non-specific complaints, complete all system verification and functional tests starting on page 4-24. Document whether the terminal passes or fails each test.

If the terminal passes all tests and no fault is discovered, all associated equipment and aircraft wiring should be tested.

If the terminal fails a specific test, isolate the actual fault or faults by performing troubleshooting procedures provided in this section.

#### **(2) Specific Complaints**

When troubleshooting terminals with specific complaints, service personnel may choose not to complete some or all of the diagnostic tests and proceed directly to the applicable troubleshooting and fault isolation procedure provided in this section.

### **B. Equipment Required**

Equipment required for troubleshooting and fault isolation is the same as the equipment required for test purposes as listed in "Equipment Required" on page 4-43.

### **C. Troubleshooting Aids**

This section presents examples of maintenance screens and troubleshooting tables to assist in troubleshooting and fault isolation activities. The exact screen display may vary depending on the version of the terminal's operational software and installation configuration mode.

**Note:** The screens used in the figures presented in this section may have been edited for clarity and for illustrative purposes.

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**(1) Fault Isolation Screen Displays**

Figure 4-24 to Figure 4-34 provide example maintenance screens for reference and illustration purposes.

```
time 8.6 seconds: powering on channel card #2
card is already on
SENDING FIRST OC_RESTART COMMAND
time 22.1 seconds CHAN #2 CONTROL PROCESSOR TRIGGERING ORR IN AORE!!
SENDING FIRST OC_RESTART COMMAND
time 22.1 seconds CHAN #4 CONTROL PROCESSOR TRIGGERING ORR IN AORE!!
SENDING FIRST OC_RESTART COMMAND
time 22.5 seconds CHAN #1 CONTROL PROCESSOR TRIGGERING ORR IN AORE!!
SENDING FIRST OC_RESTART COMMAND
time 22.5 seconds CHAN #3 CONTROL PROCESSOR TRIGGERING ORR IN AORE!!
10:45:14 #4 BBFBD7 E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 54 dB Hz
10:45:14 #1 F5ADB8 E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 54 dB Hz
10:45:15 #2 8BB8DC E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 55 dB Hz
10:45:15 #3 B60FCE E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 55 dB Hz
10:45:18 #2 8BB8DC E5 stop 8301 ACSE successful ORR 32.0 C 54 dB Hz
10:45:19 #1 F5ADB8 E5 stop 8306 ACSE successful ORR 32.0 C 54 dB Hz
10:45:19 #4 BBFBD7 E5 stop 8306 ACSE successful ORR 32.0 C 54 dB Hz
10:45:19 #3 B60FCE E5 stop 8306 ACSE successful ORR 32.0 C 54 dB Hz
```

**Figure 4-24. Successful Ocean Region Registration (report 21 activated)**

```
10:45:14 #4 BBFBD7 E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 54 dB Hz
10:45:14 #1 F5ADB8 E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 54 dB Hz
10:45:15 #2 8BB8DC E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 55 dB Hz
10:45:15 #3 B60FCE E5 start 400110 14.00 dBW CT SP ocean region
registration 32.0 C 55 dB Hz
10:45:18 #2 8BB8DC E5 stop 8301 ACSE failed retry ORR 32.0 C 54 dB Hz
10:45:19 #1 F5ADB8 E5 stop 8306 ACSE failed retry ORR 32.0 C 54 dB Hz
10:45:19 #4 BBFBD7 E5 stop 8306 ACSE failed retry ORR 32.0 C 54 dB Hz
10:45:19 #3 B60FCE E5 stop 8306 ACSE failed retry ORR 32.0 C 54 dB Hz
```

**Figure 4-25. Failed Ocean Region Registration**

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```

CARD #1: C/No=52.9 dB/Hz sig=-16.9 dB 27 C no call beam=4
CARD #2: C/No=52.9 dB/Hz sig=-18.2 dB 27 C no call beam=4
45D21'29.1"N 75D1'54.6"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
CARD #1: C/No=52.4.0 dB/Hz sig=-17.6 dB 27 C in call beam=4
CARD #2: C/No=52.4 dB/Hz sig=-18.5 dB 27 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots

#1: no call (0 WT) #2: no call (0 WT) #3: no call (0 WT) #4: no call (0 WT)
11:52:17 dop 0 ppb az 146.2 deg el 35.8 deg AORE ant gain 16 (min)
21'16.1"N 30D0'0.2"W PT 0.2D RL -0.4D HD 13.5D TK 0.2D 0 knots
CHAN #1: C/No= 0.0 dB Hz sig=-34.7 dB 32.0 C bm=5 no call 0.0 dBW 0 W
CHAN #2: C/No=53.9 dB Hz sig=-33.4 dB 32.0 C bm=5 no call 0.0 dBW 0 W
CHAN #3: C/No=54.4 dB Hz sig=-34.5 dB 32.0 C bm=5 no call 0.0 dBW 0 W
CHAN #4: C/No=54.4 dB Hz sig=-34.9 dB 32.0 C bm=5 no call 0.0 dBW 0 W

```

**Figure 4-26. No Call (report 23)**

```

CARD #1: C/No=52.5 dB/Hz sig=-17.2 dB 28 C no call beam=4
CARD #2: C/No=0.0 dB/Hz sig=-999.9 dB 28 C in call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:55 dop 0 ppb az 285.4 deg el 15.3 deg AOR EAST ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz sig=-999.9 dB 28 C in call beam=4
CARD #2: C/No=47.1 dB/Hz sig=-15.5 dB 30 C no call beam=4
45D21'16.1"N 75D0'0.2"W PT -10.0D RL 0.0D HD 185.0D TK 0.2D 0 knots
12:43:55 #1 ABC123 E4 start 800124 18.50 dBW mobile aero 64k speech 28 C
[25;1H#1: speech (2 WT) #2: no call (0 WT) #3: no call (0 WT) #4: no
call (0 WT)
CHAN #1 in call -- requesting 22.50 dBW -- call code 800124
mobile aero 64k speech
11:51:56 dop 0 ppb az 146.2 deg el 35.8 deg AORE ant gain 16 (min)
21'16.1"N 30D0'0.2"W PT 0.2D RL -0.4D HD 13.5D TK 0.2D 0 knots
CHAN #1: C/No= 0.0 dB Hz sig=-1000 dB 32.0 C bm=5 speech 22.5 dBW 18 W
CHAN #2: C/No=53.4 dB Hz sig=-33.3 dB 32.0 C bm=5 no call 0.0 dBW 0 W
CHAN #3: C/No=54.3 dB Hz sig=-34.5 dB 32.0 C bm=5 no call 0.0 dBW 0 W
CHAN #4: C/No=54.0 dB Hz sig=-34.9 dB 32.0 C bm=5 no call 0.0 dBW 0 W

```

**Figure 4-27. In Call – Swift64 voice call on Channel 1 (reports 21 and 23)**

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```
12:43:55 dop**** az 285.4 deg el 15.3 deg AOR EAST ant gain 11 (p/t)
CARD #1: C/No=52.9 dB/Hz sig=-16.9 dB 27 C no call beam=4
CARD #2: C/No=52.9 dB/Hz sig=-18.2 dB 27 C no call beam=4
***** ****
CARD #1: C/No=52.4.0 dB/Hz sig=-17.6 dB 27 C in call beam=4
CARD #2: C/No=52.4 dB/Hz sig=-18.5 dB 27 C no call beam=4
***** ****
```

**Figure 4-28. No IRS Data (report 23 activated)**

```
Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.
fault log sector 15 contains 1384 entries
REAL TIME CLOCK PRESENT: 10:00:55 Tue Jan 3, 2007

**** strapping identifies forward id ffffff -- not in table ****

**** eeprom forward id 0 not in table ****
EEPROM forces STAND-ALONE MODE
!!ensure that arinc test data doesn't bother sat906
powering up channel card #1
powering up channel card #2
SENDING FIRST OC_RESTART COMMAND
!!CARD #2 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!
SENDING FIRST OC_RESTART COMMAND
!!CARD #1 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!
```

**Figure 4-29. Forward ID Not Strapped (no reports activated)**

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|  |               |
|--|---------------|
| MENU 3   | FIRMWARE Vx.x |
| <pre>L      list EEPROM           S      list event log E      reset EEPROM          C      clear event log M      misc. EEPROM parameter J      ignored faults N      system serial number  F      list call log G      clear call log &lt;CTRL&gt; N  next menu      &lt;CTRL&gt; O  previous menu    =  select reports HPA ERROR CODE 1800  hit '0' for complete log  '1' for 'special' events  '-' for specific entry  FAULT (ENTRY #1428): address ABC123: 30 seconds after powerup powerup #204  389 hours operation  Jan 01 14:19:39 2006 ERROR CODE 40 HPA FAULT -- 0x1800 HPA MAINTENANCE WORD NOT REPORTING HGA ANTENNA HPA STATUS WORD NOT REPORTING HGA ANTENNA  Continuous Power Requests From LES, Report 21 activated:  10:51:26 #2 ABC456 E5 start 400110 14.00 dBW  CT SP ocean region registration 30 C 54 dB/Hz 10:51:26 #1 ABC123 E5 start 400110 14.00 dBW  CT SP ocean region registration 29 C 54 dB/Hz 10:51:27 #2 ABC456 E5 start 400110 14.00 dBW  CT SP ocean region registration 30 C 10:51:27 #1 ABC123 E5 start 400110 14.00 dBW  CT SP ocean region registration 29 C 10:51:27 #1 ABC123 E5 start 400110 14.00 dBW  CT SP ocean region registration 29 C 0 dB/Hz 10:51:27 #2 ABC456 E5 start 400110 14.00 dBW  CT SP ocean region registration 30 C 0 dB/Hz 10:51:29 #1 ABC123 E5 start 400110 14.00 dBW CT SP ocean region registration 29 C 54 dB/Hz 10:51:29 #2 ABC456 E5 start 400110 14.00 dBW CT SP ocean region registration 30 C 54 dB/Hz 10:51:29 #2 ABC456 E5 start 400110 14.00 dBW CT SP ocean region registration 30 C</pre> |               |

**Figure 4-30. No Strap on SDI Lines, Open (no reports activated)**

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```
Log-on password entered: "Maint"

        MENU1                      FIRMWARE Vx.x

X      override forward id      L      test LEDs
Y      explain hpa error status
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
HPA UNCONTROLLED

Y command entered:

HPA MAINTENANCE WORD REPORTING ARINC ERROR
HPA MAINTENANCE WORD NOT REPORTING HGA ANTENNA
HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTED DATA)
HPA STATUS WORD NOT REPORTING HGA ANTENNA

Event log messages:

        MENU 3                      FIRMWARE Vx.x

L      list EEPROM            S      list event log
E      reset EEPROM           C      clear event log
M      misc. EEPROM parameter J      ignored faults
N      system serial number   F      list call log
G      clear call log
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports

FAULT (ENTRY #1422): address ABC123: 30 seconds after powerup
powerup #203 389 hours operation Jun 03 11:15:07 2003
ERROR CODE 40
HPA FAULT -- 0x1c80
HPA MAINTENANCE WORD REPORTING ARINC ERROR
HPA MAINTENANCE WORD NOT REPORTING HGA ANTENNA
HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTED DATA)
HPA STATUS WORD NOT REPORTING HGA ANTENNA
```

**Figure 4-31. Wrong Strap on SDI Lines (TP5A to GND)**

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|  |  |
|--|--|
| <p style="margin: 0;">MENU1</p> <pre>X      override forward id Y      explain hpa error status &lt;CTRL&gt; N  next menu      &lt;CTRL&gt; O  previous menu      =  select reports HPA UNCONTROLLED</pre> <p style="margin: 0;">Y command entered:</p> <pre>HPA MAINTENANCE WORD REPORTING ARINC ERROR HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTED DATA)</pre> <p style="margin: 0;">Event log messages:</p> <pre>MENU 3</pre> | <p style="margin: 0;">FIRMWARE Vx.x</p> <pre>L      test LEDs S      list event log C      clear event log J      ignored faults F      list call log</pre> <p style="margin: 0;">&lt;CTRL&gt; N  next menu      &lt;CTRL&gt; O  previous menu      =  select reports</p> <pre>FAULT (ENTRY #1442):  address 4ff7d4: 30 seconds after powerup powerup #207  389 hours operation  Jun 03 11:33:02 2003 ERROR CODE 40 HPA FAULT -- 0x480 HPA MAINTENANCE WORD REPORTING ARINC ERROR HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTE)</pre> |
|--|--|

**Figure 4-32. Stand-Alone Mode Multi-Control Loopback Not Wired**

|   |
|---|
| <pre>11:47:43 #2 ABC456 E4 stop 8301  ACSE successful ORR 30 C  50 dB/Hz 11:47:46 #1 ABC123 E5 stop 8301  ACSE successful ORR 28 C  50 dB/Hz 11:47:55 #1 ABC123 E5 start 800124 14.00 dBW  mobile aero 64k speech 29 C  47 dB/Hz 11:47:57 #1 ABC123 E5 start 800124 22.50 dBW  mobile aero 64k speech 28 C  47 dB/Hz calling 0116137276277# 11:48:10 #1 ABC123 E5 stop 11d2 call failed, insufficient digits in service address 28 C 0 calling 0116137276277#</pre> |
|---|

**Figure 4-33. Incorrect Dialing Format (reports 21 and 52 enabled)**

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```
OMNIDIRECTIONAL MODE open loop tracking port/top active HGA LNA on
port maintenance 0x00600003
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port status: 0x608033 SDI: ACU SSM: NORMAL OPERATION gain: 12
OMNIDIRECTIONAL MODE open loop tracking port/top active HGA LNA on
port maintenance 0x00600003
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
port ant: status 608033 SDI=ACU gain 12 maint 600003 SDI=ACU
```

**Figure 4-34. Top/Port Antenna Status (reports 18, 19, and 20 activated)**

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(2) Troubleshooting Table

Table 4-21 provides fixes for basic HSD-400 terminal faults. Before completing any fix, activate the HSD-400 terminal MPU using the maintenance password. For detailed connection and user instructions, see "Connection Requirements" on page 4-2.

**Table 4-21. Troubleshooting and Fault Isolation**

| Fault   | Description   | Maintenance Report   | Check   |
|---|---|--|---|
| RED LED remains on after powering up sequence | <ul style="list-style-type: none"> <li>• HPA Uncontrolled</li> <li>• HPA Fault</li> </ul>   | View initial power-up display of the HSD Maintenance Utility Program       | <ul style="list-style-type: none"> <li>• In Stand-Alone installations, verify that the multicontrol, loopback is wired (out to in).</li> </ul>  |
| HPA Error Status                              | <ul style="list-style-type: none"> <li>• reporting invalid SSM</li> <li>• HPA not reporting status word 143</li> <li>• HPA not reporting maintenance word 350</li> <li>• HPA maintenance word reporting ARINC error</li> <li>• HPA maintenance word not reporting HGA antenna</li> <li>• HPA maintenance word reporting VSWR error</li> <li>• HPA maintenance word reporting RAM error</li> <li>• HPA reporting ROM error</li> <li>• HPA maintenance word reporting power supply error</li> <li>• HPA maintenance word reporting temperature error</li> </ul> | In menu 1, press <b>Y</b> to obtain an explanation of the HPA error status | <ul style="list-style-type: none"> <li>• Check continuity on ARINC buses between HSD and antenna subsystem.</li> <li>• Verify SDI is strapped correctly (TP5B to TP5D).</li> <li>• Check the external power source is properly connected and meets installation requirements.</li> <li>• Check transmit path from HSD output (MPC1) to the antenna subsystem (coax cables, splitters, relays, etc...).</li> <li>• Check installation location meets the RTCA/DO-160D environmental specifications.</li> <li>• Check for proper fan-tray operation and air-cooling.</li> <li>• Verify the fan-tray plug distribution is as per the installation requirements.</li> </ul> |

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**Table 4-21. Troubleshooting and Fault Isolation (Continued)**

| Fault        | Description                                       | Maintenance Report  | Check  |
|--------------|---|---|--|
| Call Failure | IRS information not available                     | Activate maintenance reports 21 and 23<br><br>See Figure 4-28 | <ul style="list-style-type: none"> <li>• Check that the IRS systems are powered on and aligned.</li> <li>• Check that connections to the IRS systems are secured.</li> <li>• Check the polarity of IRS input lines.</li> <li>• If no IRS data is available, use Menu 10 to manually input navigational data to point the antenna to a preferred satellite location and try the call again.</li> </ul>  |
|              | System does not log onto the broadbeam            | Activate maintenance reports 21 and 23<br><br>See Figure 4-25 | <ul style="list-style-type: none"> <li>• Check that the IRS data is received and valid.</li> <li>• Ensure that a valid FWD ID is read.</li> <li>• Verify correct antenna pointing.</li> <li>• Ensure LES Access codes are configured correctly.</li> <li>• Verify all coax connections.</li> </ul>   |
|              | System does not log onto the correct Ocean Region | Activate maintenance reports 21 and 23<br><br>See Figure 4-25 | <ul style="list-style-type: none"> <li>• Check that the IRS data is received and valid.</li> <li>• Check for antenna line-of-sight interference.</li> </ul>  |
|              | terminal is not transmitting                      | Activate maintenance reports 21 and 23                        | <ul style="list-style-type: none"> <li>• Check for a defective or loose RF cable.</li> <li>• Verify the Rx RF level is acceptable.</li> <li>• Check RF power level displayed in Maintenance Port Menu Report Item 21; the EIRP should be requested at 14.00 dBW but in call should increase to 22.5 dBW then level off to approximately 16 dBW.</li> <li>• Ensure the HSD is secured properly to the ARINC connector in the tray.</li> </ul> |

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**Table 4-21. Troubleshooting and Fault Isolation (Continued)**

| Fault                 | Description  | Maintenance Report   | Check  |
|-----------------------|--|--|--|
| Call failure (cont'd) | Forward ID is invalid or strapped incorrectly                    | Activate maintenance report 21<br><br>See Figure 4-29<br><br>To check FWD ID, in Menu 4, press Q | <ul style="list-style-type: none"> <li>• The account registration process has not been completed. Check your account status with your service provider to ensure that the account registration has been processed into the LES databases and that your account is valid.</li> <li>• If the message, "Channel card stuck in boot state" appears in the event log, check that the assigned FWD IDs are strapped correctly.</li> <li>• If fault code 12B1 appears in the even log, ensure FWD ID is valid for the Inmarsat Terminal Category (If you have an HSD-128 terminal upgraded to an HSD-400 terminal, you must call EMS SATCOM to obtain additional forward IDs).</li> </ul> |
|                       | terminal is strapped to an incorrect system mode of installation | In menu 3, select Item L (List EEPROM)   | <ul style="list-style-type: none"> <li>• Verify the system mode strapping is correct.</li> <li>• Reset the system and observe the initialization display; it shows the HSD terminal's powering up, self-test results. The Initialization display lists the installation mode configuration for the terminal.</li> <li>• If the mode displayed is not strapped or is incorrectly strapped, a temporary setting may be used-in Menu 3, select M (misc. EEPROM parameters), then select parameter 16 (Channel Card Category) and configure the HSD to the correct mode ('1' for Stand-Alone). Reset the terminal and try the call again.</li> </ul>                                   |

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**Table 4-21. Troubleshooting and Fault Isolation (Continued)**

| Fault                 | Description                                  | Maintenance Report  | Check   |
|-----------------------|--|---|---|
| Call failure (cont'd) | Dialing sequence was incomplete or incorrect | Activate reports 21 and 52<br><br>See Figure 4-26             | <ul style="list-style-type: none"> <li>• Verify the number you are calling and try the number again.</li> <li>• Refer to the HSD Setup Guide (MN-1110-10048) for detailed operating instructions.</li> <li>• Ensure that you end the dialing sequence by pressing # (pound key)-pressing # at the end of the dialing string signals the system to "send" the call.</li> </ul>   |
| Log-on request fails  | terminal is not transmitting                 | Activate maintenance reports 21 and 23<br><br>See Figure 4-25 | <ul style="list-style-type: none"> <li>• Check for a defective or loose cable.</li> <li>• Check for HPA fault.</li> <li>• Ensure the HSD is secured properly to the ARINC connector in the tray.</li> </ul>   |
|                       | terminal is not receiving                    | Activate maintenance reports 21 and 23                        | <ul style="list-style-type: none"> <li>• Check for a defective or loose cable.</li> <li>• Ensure the antenna subsystem DLNA is powered.</li> <li>• Check for antenna line of sight interference.</li> <li>• Verify that the Forward ID is valid, activated, and strapped correctly.</li> <li>• Ensure your account is current and active.</li> <li>• Check for antenna line-of-sight interference.</li> <li>• Ensure the HSD is secured properly to the ARINC connector in the tray.</li> </ul> |

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**Table 4-21. Troubleshooting and Fault Isolation (Continued)**

| Fault                 | Description  | Maintenance Report         | Check   |
|-----------------------|--|----------------------------|---|
| Incoming call failure | Incoming call shows as a successful connection in report 23, but call does not ring through to the external device (telephone, computer, fax). | Activate reports 21 and 23 | <ul style="list-style-type: none"> <li>• Check the connection between the HSD and the external device.</li> <li>• Check configuration of external devices is correct. MSN must be configured correctly for each device connected to the system.</li> <li>• If MSNs are not programmed in the user devices, incoming calls will ring all devices. NOTE: Zero "0" is an invalid MSN entry.</li> </ul> |

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**Table 4-21. Troubleshooting and Fault Isolation (Continued)**

| Fault   | Description   | Maintenance Report   | Check   |
|---|---|--|---|
| Log-on successful, but fails to complete call | Authorization error (fault code 12C4)<br><br>See Figure 4-25<br><br>See Figure 4-28 | Activate reports 21 and 23<br><br>See Figure 4-25<br><br>See Figure 4-28 | <ul style="list-style-type: none"> <li>• Contact your service provider to verify that the forward ID is activated.</li> <li>• Check that the Forward ID is strapped correctly.</li> <li>• Check that IRS data is available and correct.</li> <li>• Check that the Veh Rel Az/EL to Satellite is correct.</li> <li>• Check that all coax cable connections are secure.</li> <li>• Check that the Rx C/No value is greater than 50dB.</li> <li>• Check antenna status is okay.</li> <li>• Check that the primary and secondary LES access codes are valid.</li> <li>• Contact your service provider and verify that they can "see" your Tx signal. To contact the LES operator dial 33 #.</li> <li>• Contact service provider and request that they place an incoming call to the terminal.</li> <li>• Check the reported HPA back-off in report 21; Signal should initialize at 14 dBW and increase after handshake to approximately 22.5 dBW - then slowly decrease (Range typically between 16.5 dBW to 21.5 dBW with a lower limit of 14.5 dBW).</li> </ul> |

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**Table 4-21. Troubleshooting and Fault Isolation (Continued)**

| Fault  | Description                          | Maintenance Report         | Check  |
|--|--------------------------------------|----------------------------|--|
| HSD is operating outside the normal environmental specifications | Channel card temperature fault       | Activate report 21 or 23   | <ul style="list-style-type: none"> <li>• Check channel card temperature; temperatures of over 50° C to 60° C may cause the HSD-400 terminal to shut down.</li> <li>• Check that the fan tray is operational.</li> <li>• Verify that the tray plug distribution is the same as presented in the installation requirements.</li> </ul>   |
| Calls do not complete and connection is not established          | Channel Congestion (fault code 2024) | Activate reports 21 and 23 | <ul style="list-style-type: none"> <li>• Wait five minutes and try the call again.</li> <li>• Contact the LES to verify congestion. To contact the LES operator, dial 33 #.</li> </ul>   |
|  | No call request sent                 | Activate report 52         | <ul style="list-style-type: none"> <li>• Verify that the call dial string is correct; Pressing # at the end of the dialing string signals the system to "send" the call.</li> <li>• Check that the HSD-400 terminal is transmitting by ensuring the LED power indicator flashes on and off (1 Hz) during a call request.</li> <li>• Check that the ISDN, Ethernet, or MPDS cable is connected correctly and securely.</li> </ul> |

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**Table 4-21. Troubleshooting and Fault Isolation (Continued)**

| Fault                                  | Description  | Maintenance Report         | Check   |
|--|--|----------------------------|---|
| No dial tone heard in handset          | -  | Activate report 21.        | <ul style="list-style-type: none"> <li>• Confirm ISDN lines are wired correctly.</li> <li>• Verify handset connection is secure.</li> <li>• Wait a few minutes for the system to warm-up, then log-on and try your call again.</li> <li>• Check that IRS data is available.</li> <li>• Verify that the terminal has completed beam registration.</li> </ul>             |
| Call drops after successful connection | <p>If the RF signal fades significantly (during a call) the connection may drop</p> <p>Note: A sudden, severe aircraft banking angle may obstruct the signal long enough (&gt;15 sec.)</p> | Activate reports 21 and 23 | <ul style="list-style-type: none"> <li>• Check signal strength (C/No greater than or equal to 50 dB).</li> <li>• Ensure there is a clear, unobstructed, line of sight to the satellite.</li> <li>• Select an alternate satellite or beam and try your call again (Note: works if you are located where more than one beam overlaps or satellite is in view.)</li> </ul> |

#### **D. Fault Isolation and Diagnostic Procedures**

This section provides basic information required for technical personnel to isolate faults in HSD-400 terminals. Where needed, refer to other sections of this manual (which contain important information to aid in understanding the functionality of the terminal) for additional information.

Fault isolation procedures are usually conducted on equipment that falls within one of the following categories:

- Terminals that have failed to pass operational and installation verification procedures
- Terminals that have failed during service
- Terminals repaired and returned to service

Maintenance reports are helpful in troubleshooting the HSD-400 terminal. Capturing maintenance port information from the HSD-400 terminal and forwarding the file to EMS SATCOM technical support staff will assist in troubleshooting suspected HSD system problems. Instructions on how to activate and save "reports" information is provided in the next section, Activating and Saving a Diagnostic "Reports" File.

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Perform all fault isolation procedures provided in this section. Record and document all test results including LEDs function and maintenance port data outputs (report items 21 and 23).

Enable report items 18, 19, and 20 (Port) or items 6, 7, and 8 (Starboard) to record antenna, ACU, and DLNA related faults. Enable other report items as required.

**CAUTION:** BEFORE PROCEEDING WITH FAULT ISOLATION PROCEDURES,  
REFER TO "Safety Advisories" on page INTRO-5.

**(1) Saving a Diagnostic Reports File**

Diagnostic reports are helpful in troubleshooting the HSD-400 terminal. Capturing maintenance port information from the HSD-400 terminal and forwarding the file to EMS SATCOM technical support staff will assist in troubleshooting suspected HSD-400 terminal problems.

1. To save a diagnostic report file: Open a log file on the maintenance port, terminal program. (If you are using HyperTerminal, use the "Transfer, capture text" function.)
2. Power the system on or if applicable reset the system.
3. Enter maintenance mode on the maintenance port using **maint** as the password. To activate reports 21 and 23 and toggle off all other reports, press EQUAL SIGN.
4. To save these reports as default, press **S**. This enables the user to view these reports on subsequent HSD-400 terminal power-ups or Reset entries.
5. To reset the system: cycle the power to the terminal; press the reset button on the HSD-400 terminal front panel; or in menu 2, press **Z**.
6. Log on to the maintenance port using the password: **maint**  
The system restarts and ocean registration takes place (approximately two minutes).
7. After the Beam Registration process completes, press **CTRL+N** to display menu 2.
8. Press **V** to display the software versions of the system.
9. Make a call from the system or execute the procedure or sequence that causes the call failure. Make a note of the call progress. For example: Did you get dial tone? Was the call successful?
10. If applicable, attempt calls from the remaining three channels.
11. Press **=** to display the current "reports" profile of the system (as noted in step 4).
12. To save an alternate "reports" configuration, activate the required items and then press **S** (in the "reports" menu) to save to EEPROM.
13. Using **CTRL+N**, go to menu 3 and press **O** to display the ORT List. (The ORT list displays one terminal screen of information at a time. Press **O** to display the next screen.)
14. To list the complete event log, in menu 3:
  - press **S** (list event log)
  - press zero "0"

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- press the period key "."

**15.** To list the complete call log, in menu 3:

- press **F** (list call log)
- press **F** again (complete log)
- press the period key "."
- for extended information, press **X**

**16.** Close the log file on the terminal program.

**17.** The log file is in text format (.txt file). Open the file and add notes to the beginning of the file indicating:

- System serial number (from the label on the front of the terminal)
- Aircraft and customer name
- Any notes about the problems encountered
- Contact name, telephone number, and e-mail address
- E-mail the log file to EMS SATCOM technical support at:  
[hsd.help@emssatcom.com](mailto:hsd.help@emssatcom.com)

### **3. Adjustment/Alignment Procedures**

There are no adjustment/alignment procedures required for HSD-400 terminals.

### **4. Modification History**

The HSD-400 terminal currently has no modifications.

## MAINTENANCE AND REPAIR

This section provides maintenance and repair information for the HSD-400 terminal, including the following sections:

- Maintenance
- Repair
- Instructions for Continued Airworthiness

### **1. Maintenance**

The HSD Terminal does not require routine maintenance.

### **2. Repair**

All repair procedures must be completed by EMS SATCOM approved repair facilities.

#### **A. Repair Tools and Supplies**

No special supplies are required to repair this equipment.

HSD-400 terminals that require servicing must be returned to EMS SATCOM (Canada) or to an EMS SATCOM approved service center. Refer to the Testing and Fault Isolation section of this manual for terminal testing requirements and procedures.

#### **B. Repair Procedures**

This equipment does not require any special repair procedures.

#### **C. Removal Procedures**

If an HSD-400 terminal must be removed from service for repair, with power removed, disconnect all equipment from the terminal and then remove it from the ARINC tray.

#### **D. Repair Facility Approvals**

EMS SATCOM, located at 400 Maple Grove Road in Ottawa, Ontario, Canada, is a Transport Canada Approved Maintenance Organization (AMO). In accordance with the Technical Arrangement on Maintenance between Canada and the European aviation authority JAA, and due to the Bilateral Agreement between Canada and the United States aviation authority FAA, EMS SATCOM conforms to the maintenance requirements of JAR 145 and FAR 145 respectively.

#### **E. Return for Repair Information**

To return equipment to EMS SATCOM for repair, follow the Return Materials Authorization procedure. Failure to comply with this procedure may cause shipping delays and additional charges.

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**(1) Warranty Returns**

Equipment that qualifies for warranty repair can be returned to EMS SATCOM for repair or replacement at our discretion. The customer shall pay the shipping costs to EMS SATCOM and EMS SATCOM will pay for the shipping costs to return the repaired/replaced terminal to the customer.

**(2) Non-Warranty Returns**

Equipment that fails to work properly because of improper or negligent use, abuse, shipping damage, or any other condition can still be returned to EMS SATCOM for repair or replacement at our discretion. The customer will be notified of the cost to repair or replace the terminal prior to invoicing for the repair or replacement. The customer shall pay for the shipping costs to and from EMS SATCOM.

**(3) Repackaging Requirements**

An HSD-400 terminal returned to EMS SATCOM must be returned in its original shipping container. Failure to do so may invalidate the warranty. If an HSD-400 terminal shipping container is unavailable, the customer must request a replacement container from EMS SATCOM or assume responsibility for the packaging and shipping.

**(4) Return Materials Authorization Procedure**

If it is determined that a terminal must be returned to EMS SATCOM for repair or overhaul, please follow the Return Materials Authorization (RMA) procedure below.

- 1.** Have the following information ready before calling the EMS SATCOM Customer Service Center:
  - Model (e.g. HSD-400)
  - Terminal part number (e.g. 1252-A-3100)
  - Serial number
  - Description of failure
  - Aircraft tail number, serial number, and aircraft model number
- 2.** Call EMS SATCOM Product Support at 1-888-300-7415 (North America) or +1-613-591-3086 (rest of the world).
- 3.** An EMS SATCOM Product Support Specialist will attempt to resolve the problem by telephone. If the terminal must be returned to EMS SATCOM, the Product Support Specialist will authorize the R&O Coordinator to issue an RMA number.
- 4.** Pack the HSD-400 terminal in the original shipping container or an EMS SATCOM-approved shipping-container.
- 5.** Write the RMA number on the outside of the shipping container and on all shipping documents and ship prepaid to:

**ATTN: <RMA Number>**  
**EMS SATCOM**  
**400 Maple Grove Road**  
**Ottawa, Ontario, CANADA**  
**K2V 1B8**

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**6.** Fax or email the details of the shipment to the R&O Coordinator, including the following information: Shipment date, carrier name, and the waybill number.

**Note:** The processing of LRU returns is limited to standard business hours from 8:30 am to 5:00 pm EST. For General inquiries and status requests, please contact the R&O Department directly:

Phone: 613-591-9064, extension 1214 (R&O Group)

Email: [rmareturns@emssatcom.com](mailto:rmareturns@emssatcom.com)

Fax: 613-591-8951

### **3. Instructions for Continued Airworthiness**

This section presents the instructions for continued airworthiness, as per FAR 25.1529, of the HSD-400 Satellite Terminal.

Installation of the HSD-400 terminal on an aircraft by supplemental type certificate (STC) or Form 337 obligates the aircraft operator to include the maintenance information supplied by this manual in the operator's Aircraft Maintenance manual and the operator's Aircraft Scheduled Maintenance Program.

The following paragraphs describe all maintenance requirements and instructions for continued airworthiness of the HSD-400 terminal.

- Add the LRU part numbers and other necessary part numbers contained in this manual to the aircraft operator's appropriate, aircraft illustrated parts catalog (IPC).
- Add all wiring diagram information contained in this manual to the aircraft operator's appropriate aircraft Wiring Diagram Manuals.
- HSD-400 terminals are considered on-condition terminals. No additional or routine maintenance is required.
- If an HSD-400 terminal is inoperative, remove the terminal, secure cables and wiring, collar applicable switches and circuit breakers, and placard them as "inoperative." Before flight, revise the equipment list and weight and balance data as applicable and record the removal of the terminal in the log book [refer to section 91.213 of the FAR or the aircraft's minimum equipment list (MEL)].
- HSD-400 terminals are not field-repairable. All terminals must be returned to the EMS SATCOM factory or authorized repair centers for repair.
- Repaired terminal must be re-installed on the aircraft in accordance with the instructions provided in this manual. The operation of all repaired terminals must be verified using the operational verification tests and procedures provided in this manual before being approved for return to service. All special tools required to test the terminal for approval for return to service are listed and described in the Test and Fault Isolation section of this manual. Approval for return to service must be entered in the logbook as required by section 43.9 of the FAR.
- The following scheduled maintenance tasks must be added to the aircraft operator's appropriate aircraft maintenance program:
  - Recommended periodic scheduled servicing tasks: None required.
  - Recommended periodic inspections: None required.

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- Recommended periodic scheduled preventative maintenance tests (tests to determine system condition and/or latent failures): None required.

## APPENDIX A: INMARSAT SYSTEM OVERVIEW

The satellite communication system comprises global satellite networks, Land Earth Stations (LES), and Mobile Earth Stations (MES).

The LES is the part of the satellite communication system that is on the ground. These numerous, international stations are responsible for routing voice and data calls from the MES to their destinations around the world.

The MES is the part of the satellite communication system that is on the aircraft. This station includes the following components:

- HSD-400 terminal
- Antenna subsystem
- Cabin communications system
- Analog connected telephones
- Cockpit voice system
- Other aircraft avionics

Figure A-1 illustrates a simplified satellite communications system.

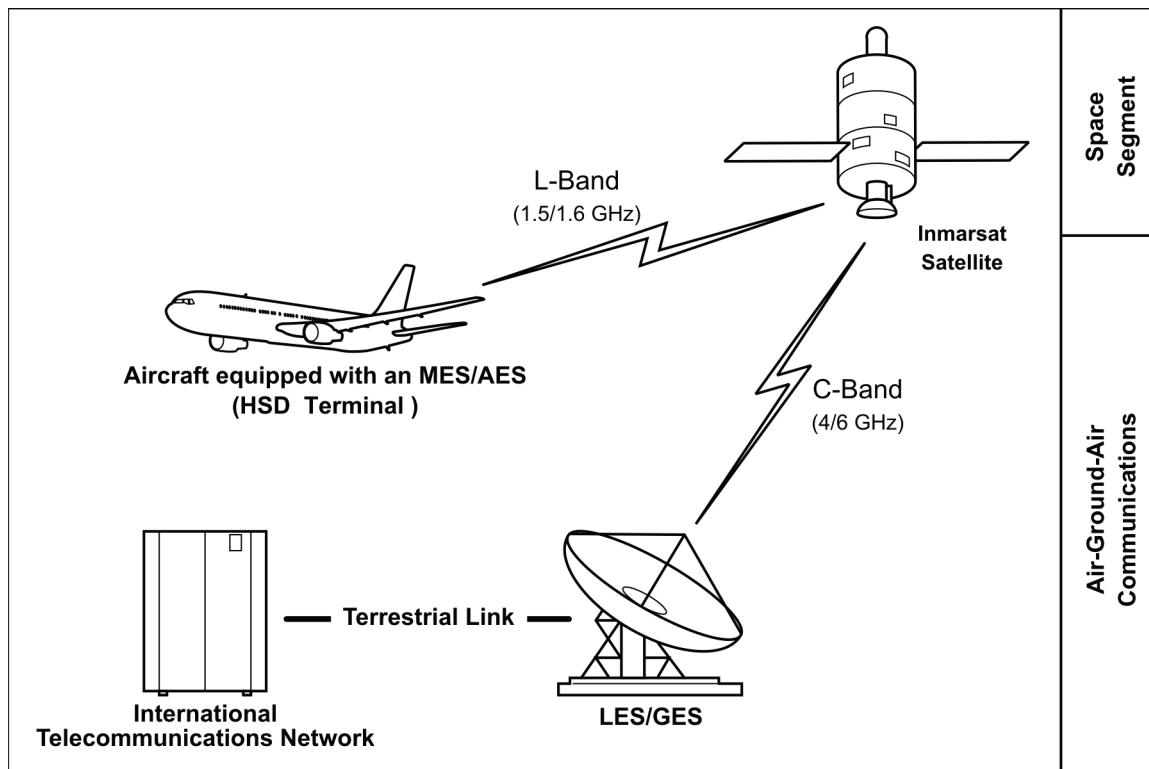


Figure A-1 Simplified Aeronautical Satellite Communications System

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Satellite communication systems provide users with long-range voice and data communication by accessing global satellite and ground communications networks.

Inmarsat is an international organization that operates and maintains the satellites and satellite networks. Inmarsat operates multiple geostationary satellites. Each satellite is located over an Ocean Region (OR); the current ocean region names are:

- Atlantic Ocean Region-East (AOR-E)
- Atlantic Ocean Region-West (AOR-W)
- Indian Ocean Region (IOR)
- Pacific Ocean Region (POR)

These satellites provide worldwide telecommunication services for aviation, shipping, and land-mobile terminal users. The satellites connect to ground telecommunication systems through the LES. For information about satellite beam coverage, refer to the Inmarsat website—[www.inmarsat.com](http://www.inmarsat.com).

The satellites that provide SwiftBroadband (SBB) services are called I-4 satellites. At the time of publishing, two I-4 satellites are operating: Americas and EUMEA (European Union Middle East Asia).

The HSD-400 terminal, in conjunction with an ARINC 741 Aero H/H+ antenna subsystem, acts as a MES. The combined system provides users with a data and voice communications link to the satellite network and global telecommunications system.

## APPENDIX B: TROUBLESHOOTING CHECKLIST

Before performing the detailed testing and troubleshooting procedures provided in this manual, read the following Troubleshooting Checklist. Use the Troubleshooting Checklist to ensure you have not missed any key steps in the HSD-400 terminal setup.

### **1. Have you registered with a service provider to activate service?**

You must register with an Inmarsat-authorized service provider to activate an account to access the Satellite Communications network using an HSD-400 Aeronautical Terminal. Contact Inmarsat for a list of available service providers at:

INMARSAT Customer Care  
99 City Road, London, EC1Y 1AX  
Tel: +44 20 7728 1777  
Fax: +44 20 7728 1142  
E-mail: [customer\\_care@inmarsat.com](mailto:customer_care@inmarsat.com)

### **2. Has your account been activated?**

Once registered, your HSD-400 terminal is assigned terminal identification numbers called Forward IDs (FWD ID). The HSD-400 terminal must be strapped accordingly. Refer to the Installation section of this manual for detailed strapping and installation instructions.

**Note:**

- The service registration information may take a few days to be incorporated into the system databases at the Land Earth Station (LES) level. New units being commissioned are not validated by the LES until their customer database has been updated by INMARSAT to reflect the registration and activation of your terminal.
- To verify that the service registration information has been validated at the LES, call 33 # for assistance. Confirm with the LES operator that the forward IDs assigned to your terminal are valid and active.
- If you upgraded to an HSD-400 terminal from an HSD-128 terminal according to Service Bulletin 1110-SB-0016 you will need to re-activate your account by giving your service provider new forward IDs.

**3. Is the HSD-400 terminal seated properly?**

In cases where the HSD-400 terminal is not fully seated into the ARINC 600 connector (to the rear of the Fan Tray), the user may experience intermittent system operation. If intermittent system operation occurs:

- Check that the polarization pins are installed correctly as indicated on the applicable Outline and Installation drawing.
- Ensure the HSD-400 terminal is fully inserted into the tray and that the front hold-down screws are properly tightened to secure the terminal.

**4. Is all cabling attached correctly and securely?**

Broken connections and improper cabling are the most common causes of HSD-400 terminals not functioning. Before proceeding with testing and troubleshooting, complete the following checks:

- Check that all cables and wiring are routed and connected correctly and securely.
- Ensure the terminal is installed with correct power source.
- Verify that all external user and networking devices (for example: terminal adapters, routers, fax, telephones, computers) are connected and configured properly.

**5. Have any changes to the system been made?**

For previously installed and functional terminals, make note of any changes made to the system since the last time the terminal functioned without problems.

- Were any new devices or systems connected to the terminal?
- Have any connecting devices or equipment been removed or replaced? If so, check that all new or replaced connections are attached and configured correctly.
- Have you changed service providers or re-configured the system in any way?

**6. Are your Primary and Secondary LES Access Codes programmed for all Ocean Regions?**

The system default for LES access codes is set to "0" (zero), which must be configured to valid LES access codes before operation. Refer to the System Operation section of this manual for details.

**7. Was the operational mode of the system strapped or configured correctly?**

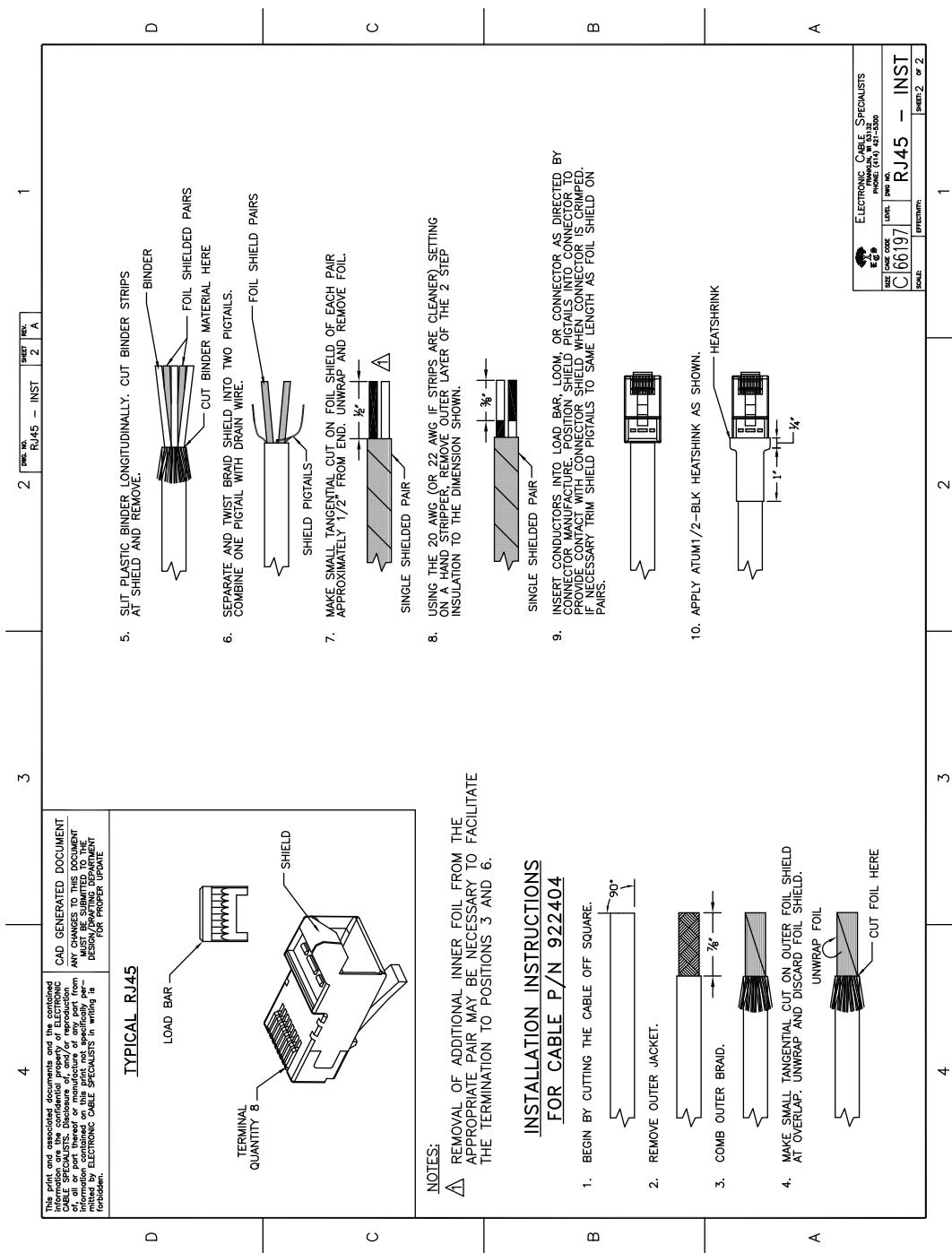
Verify that the System Mode wiring straps match the installation configuration mode, for example Stand-Alone Mode, Honeywell Combined Mode (HCM), Cooperative Mode, Multi-Channel or Selective Mode. Only Stand-Alone Mode is currently supported.

**EMS SATCOM**  
**SYSTEM DESCRIPTION, INSTALLATION, AND MAINTENANCE MANUAL**  
**eNfusion™ HSD-400 High-speed Data Terminal**

## APPENDIX C: RJ-45 CABLE TERMINATION DETAILS

|   |  |   |  |  |  |
|---|--|---|--|--|--|
| 4   | 2  |   | 3  | 1  |  |
| TYPICAL RJ45  |  |   |  |  |  |
| <p>The Print and associated documents and the contained information are the confidential property of Electronic Cable. The disclosure, distribution, or reproduction of this document, in whole or in part, is prohibited without the written consent of the author. Any changes to this document must be submitted to the Design/Engineering Department for review. The original notations and markings on the print, not specifically mentioned by the specification, are to be maintained by Electronic Cable during update or revision.</p>                         |  | <p>CAD GENERATED DOCUMENT</p> <p>ANY CHANGES TO THIS DOCUMENT MUST BE SUBMITTED TO THE DESIGN/ENGINEERING DEPARTMENT FOR REVIEW.</p>  |  | <p>REF. NO. 922408<br/>REV. B<br/>DATE 4/26/02<br/>APPROVED BY C. CHAPMAN<br/>NEW DESCRIPTION (SEE FOR COMPLETE OWNER'S MANUAL)<br/>16055 - - N/C NEW RELEASE<br/>16055 2 ALL A ADDED SHT 2.</p> |  |
| D   | <p>LOAD BAR</p> <p>TERMINAL QUANTITY</p> <p>SHIELD</p> |   | <p><b>INSTALLATION INSTRUCTIONS FOR CABLE P/N 922408</b></p> <p><b>NOTES:</b></p> <p>⚠ REMOVAL OF ADDITIONAL INNER FOIL FROM THE APPROPRIATE PAIR MAY BE NECESSARY TO FACILITATE THE TERMINATION TO POSITIONS 3 AND 6.</p> |  |  |
| <p><b>D</b></p> <p><b>5.</b> SLIT PLASTIC BINDER LONGITUDINALLY. CUT BINDER STRIPS AT SHIELD AND REMOVE.</p> <p><b>C</b></p> <p><b>6.</b> SEPARATE AND TWIST BRAID SHIELD INTO TWO PIGTAILS. COMBINE ONE PIGTAIL WITH DRAIN WIRE.</p> <p><b>B</b></p> <p><b>7.</b> MAKE SMALL TANGENTIAL CUT ON FOIL SHIELD OF EACH PAIR APPROXIMATELY 1 1/2" FROM END. UNWRAP AND REMOVE FOIL.</p> <p><b>A</b></p> <p><b>8.</b> USING THE 20 AWG (OR 22 AWG IF STRIPS ARE CLEANER) SETTING ON A HAND STRIPPER, REMOVE OUTER LAYER OF THE 2 STEP INSULATION TO THE DIMENSION SHOWN.</p> |  | <p><b>D</b></p> <p><b>5.</b> SLIT PLASTIC BINDER LONGITUDINALLY. CUT BINDER STRIPS AT SHIELD AND REMOVE.</p> <p><b>C</b></p> <p><b>6.</b> SEPARATE AND TWIST BRAID SHIELD INTO TWO PIGTAILS. COMBINE ONE PIGTAIL WITH DRAIN WIRE.</p> <p><b>B</b></p> <p><b>7.</b> MAKE SMALL TANGENTIAL CUT ON FOIL SHIELD OF EACH PAIR APPROXIMATELY 1 1/2" FROM END. UNWRAP AND REMOVE FOIL.</p> <p><b>A</b></p> <p><b>8.</b> USING THE 20 AWG (OR 22 AWG IF STRIPS ARE CLEANER) SETTING ON A HAND STRIPPER, REMOVE OUTER LAYER OF THE 2 STEP INSULATION TO THE DIMENSION SHOWN.</p> |  |  |  |
| <p><b>D</b></p> <p><b>9.</b> INSERT CONDUCTORS INTO LOAD BAR, LOOM, OR CONNECTOR AS DIRECTED BY CONNECTOR MANUFACTURE. POSITION SHIELD PIGTAILS INTO CONNECTOR TO PROVIDE CONTACT WITH CONNECTOR SHIELD WHEN CONNECTOR IS CRIMPED. IF NECESSARY TRIM SHIELD PIGTAILS TO SAME LENGTH AS FOIL SHIELD ON PAIRS. NOTE THAT CABLE JACKET IS NOT INSERTED INTO CONNECTOR BODY.</p> <p><b>C</b></p> <p><b>10.</b> APPLY ATUMI/2-BLK HEATSHRINK AS SHOWN.</p>   |  | <p><b>D</b></p> <p><b>9.</b> INSERT CONDUCTORS INTO LOAD BAR, LOOM, OR CONNECTOR AS DIRECTED BY CONNECTOR MANUFACTURE. POSITION SHIELD PIGTAILS INTO CONNECTOR TO PROVIDE CONTACT WITH CONNECTOR SHIELD WHEN CONNECTOR IS CRIMPED. IF NECESSARY TRIM SHIELD PIGTAILS TO SAME LENGTH AS FOIL SHIELD ON PAIRS. NOTE THAT CABLE JACKET IS NOT INSERTED INTO CONNECTOR BODY.</p> <p><b>C</b></p> <p><b>10.</b> APPLY ATUMI/2-BLK HEATSHRINK AS SHOWN.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>11.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>11.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>12.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>12.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>13.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>13.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>14.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>14.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>15.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>15.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>16.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>16.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>17.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>17.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>18.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>18.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>20.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>20.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>21.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>21.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>22.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>22.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>24.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>24.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>25.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>25.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>26.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>26.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>28.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>28.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>30.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>30.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>36.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>36.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>38.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>38.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>44.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>44.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>46.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>46.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>48.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>48.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>50.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>50.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>51.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>51.</b> CUT FOIL HERE.</p>  |  |  |  |
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| <p><b>D</b></p> <p><b>54.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>54.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>70.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>70.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>80.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>80.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>81.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>81.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>82.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>82.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>83.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>83.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>84.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>84.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>85.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>85.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>86.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>86.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>87.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>87.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>88.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>88.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>90.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>90.</b> HEATSHRINK.</p>   |  |  |  |
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| <p><b>D</b></p> <p><b>94.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>94.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>95.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>95.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>96.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>96.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>97.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>97.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>98.</b> HEATSHRINK.</p>   |  | <p><b>D</b></p> <p><b>98.</b> HEATSHRINK.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>99.</b> CUT FOIL HERE.</p>  |  | <p><b>D</b></p> <p><b>99.</b> CUT FOIL HERE.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>100.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>100.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>101.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>101.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>102.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>102.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>103.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>103.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>104.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>104.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>105.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>105.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>106.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>106.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>107.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>107.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>108.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>108.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>109.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>109.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>110.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>110.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>111.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>111.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>112.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>112.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>113.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>113.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>114.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>114.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>115.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>115.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>116.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>116.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>117.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>117.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>118.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>118.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>119.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>119.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>120.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>120.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>121.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>121.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>122.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>122.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>123.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>123.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>124.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>124.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>125.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>125.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>126.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>126.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>127.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>127.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>128.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>128.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>129.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>129.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>130.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>130.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>131.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>131.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>132.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>132.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>133.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>133.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>134.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>134.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>135.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>135.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>136.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>136.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>137.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>137.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>138.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>138.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>139.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>139.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>140.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>140.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>141.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>141.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>142.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>142.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>143.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>143.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>144.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>144.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>145.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>145.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>146.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>146.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>147.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>147.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>148.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>148.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>149.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>149.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>150.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>150.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>151.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>151.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>152.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>152.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>153.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>153.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>154.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>154.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>155.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>155.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>156.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>156.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>157.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>157.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>158.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>158.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>159.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>159.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>160.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>160.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>161.</b> CUT FOIL HERE.</p>   |  | <p><b>D</b></p> <p><b>161.</b> CUT FOIL HERE.</p>   |  |  |  |
| <p><b>D</b></p> <p><b>162.</b> HEATSHRINK.</p>  |  | <p><b>D</b></p> <p><b>162.</b> HEATSHRINK.</p>  |  |  |  |
| <p><b>D</b></p> <p><b>16</b></p>  |  |   |  |  |  |

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## APPENDIX D: INSTALLATION PLANNING CHECKLIST

| Installation Planning Steps   |   |   |   |   | Done                     |  |  |  |
|---|---|---|---|---|--------------------------|--|--|--|
| <b>1. Register the terminal</b>   |   |   |   |   |                          |  |  |  |
| <i>Record the following information (provided by EMS SATCOM upon purchase)</i>    |   |   |   |   |                          |  |  |  |
| Terminal Category Type—A or B   |   |   |   |   | <input type="checkbox"/> |  |  |  |
| Inmarsat Serial Numbers (ISN) x 4   |   | 1 |   |   | <input type="checkbox"/> |  |  |  |
|   |   | 2 |   |   | <input type="checkbox"/> |  |  |  |
|   |   | 3 |   |   | <input type="checkbox"/> |  |  |  |
|   |   | 4 |   |   | <input type="checkbox"/> |  |  |  |
| <i>Contact your Service Provider and provide the 4 x 12 digit ISNs from above</i> |   |   |   |   |                          |  |  |  |
| Record the Forward IDs received + corresponding Inmarsat Mobile Numbers (IMN)     |   |   |   |   | <input type="checkbox"/> |  |  |  |
|   | 1 | 2 | 3 | 4 |                          |  |  |  |
| Forward ID  |   |   |   |   |                          |  |  |  |
| ISDN Speech   |   |   |   |   |                          |  |  |  |
| ISDN<br>Audio 3.1 kHz   |   |   |   |   |                          |  |  |  |
| ISDN 56 kbps  |   |   |   |   |                          |  |  |  |
| ISDN 64 kbps  |   |   |   |   |                          |  |  |  |
| ISDN 4.8k<br>audio  |   |   |   |   |                          |  |  |  |
| MPDS  |   |   |   |   |                          |  |  |  |
| Service Provider  |   |   |   |   | <input type="checkbox"/> |  |  |  |
| LES Access Codes  |   |   |   |   | <input type="checkbox"/> |  |  |  |
| AOR-W   |   |   |   |   |                          |  |  |  |
| AOR-E   |   |   |   |   |                          |  |  |  |
| IOR   |   |   |   |   |                          |  |  |  |
| POR   |   |   |   |   |                          |  |  |  |

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| <b>Installation Planning Steps</b>  |                                  | Done                     |
|---|----------------------------------|--------------------------|
| <b>2. Pin Strapping</b>   |                                  |                          |
| <i>The following strapping is required</i>  |                                  |                          |
| Item  | Strapped pins, e.g. TP1A to BP1A | <input type="checkbox"/> |
| Fwd ID  |                                  | <input type="checkbox"/> |
| System Mode   |                                  | <input type="checkbox"/> |
| Data I/O  |                                  | <input type="checkbox"/> |
| SDI   |                                  | <input type="checkbox"/> |
| <b>3. Wiring</b>  |                                  |                          |
| Antenna   | Multi-Control                    | <input type="checkbox"/> |
|   | BITE A/B                         | <input type="checkbox"/> |
|   | HPA Mute A/B                     | <input type="checkbox"/> |
| ISDN:<br><br><i>Wire both ISDN lines (mandatory for 4 channels). Channels 1 and 2 operate over ISDN#1 and channels 3 and 4 over ISDN#2.</i> | ISDN-1                           | <input type="checkbox"/> |
|   | ISDN-2                           | <input type="checkbox"/> |
| Ethernet:<br><br><i>Wire both Ethernet ports for SBB service<br/>Wire both Ethernet ports to deploy 2 separate networks</i>                 | Ethernet-1                       | <input type="checkbox"/> |
|   | Ethernet-2                       | <input type="checkbox"/> |
| Inertial Navigation System (INS)  |                                  | <input type="checkbox"/> |
| Analog Tip/Ring (POTS)  |                                  | <input type="checkbox"/> |
| CEPT-E1, Future PBX applications (optional)   |                                  | <input type="checkbox"/> |
| <b>4. Configuration</b>   |                                  |                          |
| Program the Land Earth Stations (LES) Access Codes  |                                  | <input type="checkbox"/> |
| Program devices with the Multiple Subscriber Numbers (MSN)  |                                  | <input type="checkbox"/> |
| Configure the eNfusion™ CNX-200 Network Accelerator if required   |                                  | <input type="checkbox"/> |

## APPENDIX E: INSTALLATION CHECKLIST

|                                 |             |                            |             |  |  |
|---------------------------------|-------------|----------------------------|-------------|--|--|
| <b>Aircraft Identification:</b> |             | <b>HSD-400 Model No.:</b>  |             |  |  |
| <b>HSD-400 Install. Mode:</b>   | Stand-Alone | <b>HSD-400 Serial No.:</b> |             |  |  |
|                                 | <b>Name</b> | <b>Signature</b>           | <b>Date</b> |  |  |
| <b>Checks completed by:</b>     |             |                            |             |  |  |
| <b>Approved/Witnessed by:</b>   |             |                            |             |  |  |

| Section                   | Parameter      | Item                         | N/A | ✓ | Value |
|---------------------------|----------------|------------------------------|-----|---|-------|
| Installation / Mechanical | Physical       | Service/maintenance access   |     |   |       |
|                           |                | Environmental considerations |     |   |       |
|                           | Fan Tray       | Plug configuration           |     |   |       |
|                           |                | Chassis bonding              |     |   |       |
|                           |                | Fan rotation                 |     |   |       |
|                           | ARINC 600 Con. | Polarized pins               |     |   |       |

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| Section                   | Parameter          | Item                                   | N/A | ✓ | Value |
|---------------------------|--------------------|--|-----|---|-------|
| Installation / Electrical | Power Connections  | + 28 V dc polarity                     |     |   |       |
|                           |                    | 115 V ac polarity                      |     |   |       |
|                           |                    | Chassis grounding                      |     |   |       |
|                           | Voltage Levels     | + 28 V dc level                        |     |   |       |
|                           |                    | 115 V ac level                         |     |   |       |
|                           | IRS Input          | IRS wiring                             |     |   |       |
|                           |                    | IRS format                             |     |   |       |
|                           | Config. Strap Pins | SDI                                    |     |   |       |
|                           |                    | System configuration                   |     |   |       |
|                           |                    | Data I/O                               |     |   |       |
|                           |                    | Forward address                        |     |   |       |
|                           |                    | WOW (optional)                         |     |   |       |
|                           | Ethernet           | Strapped to RJ-45 distribution points  |     |   |       |
|                           | ISDN               | Strapped to RJ-45 distribution points  |     |   |       |
|                           | MPDS               | Strapped to DB9 distribution connector |     |   |       |
|                           | Remotes            | Manual reset switch operation          |     |   |       |
|                           |                    | Maintenance port (DB9 access)          |     |   |       |
|                           |                    | Power and Fault indicators             |     |   |       |
|                           | RF Coax            | Rx i/p cable loss                      |     |   |       |
|                           |                    | Tx o/p cable loss                      |     |   |       |
|                           | Antenna            | Antenna manufacturer and type          |     |   |       |
|                           |                    | Wired as per manufacturer              |     |   |       |
|                           |                    | Multi-control loopbacks installed      |     |   |       |
|                           | Configuration      | LES Access codes                       |     |   |       |
|                           |                    | Stand-Alone Mode                       |     |   |       |
|                           |                    | Valid beams                            |     |   |       |
|                           |                    | Forward ID                             |     |   |       |
| Test On-Air               | System Power-Up    | Visual LED indications                 |     |   |       |
|                           |                    | Power-up computer display              |     |   |       |
| Test                      | System Log-on      | Reset message observed                 |     |   |       |
|                           |                    | Log-on verified                        |     |   |       |
|                           | Optional Checks    | Ground segment                         |     |   |       |
|                           |                    | Flight segment                         |     |   |       |

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| Section          | Heading<br>(Deg) | Antenna<br>Selected | Antenna<br>Azimuth | HSD-400 |        |      |        |      |        |      |        |
|------------------|------------------|---------------------|--------------------|---------|--------|------|--------|------|--------|------|--------|
|                  |                  |                     |                    | CH 1    |        | CH 2 |        | CH 3 |        | CH 4 |        |
|                  |                  |                     |                    | C/No    | Signal | C/No | Signal | C/No | Signal | C/No | Signal |
| Operational Test | 15               |                     |                    |         |        |      |        |      |        |      |        |
|                  | 30               |                     |                    |         |        |      |        |      |        |      |        |
|                  | 45               |                     |                    |         |        |      |        |      |        |      |        |
|                  | 60               |                     |                    |         |        |      |        |      |        |      |        |
|                  | 75               |                     |                    |         |        |      |        |      |        |      |        |
|                  | 90               |                     |                    |         |        |      |        |      |        |      |        |
|                  | 105              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 120              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 135              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 150              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 165              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 180              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 195              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 210              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 225              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 240              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 255              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 270              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 285              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 300              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 315              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 330              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 345              |                     |                    |         |        |      |        |      |        |      |        |
|                  | 360              |                     |                    |         |        |      |        |      |        |      |        |

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## APPENDIX F: INMARSAT CAUSE CODES

Table F-1 defines the maintenance port menu fault codes of the HSD-400 terminal.

**Table F-1 Inmarsat Cause Code Definitions**

| Inmarsat Cause Code | Code Definition  |
|---------------------|--|
| 1001                | Call cleared by MES terminal (normal termination of call)                            |
| 1011                | Call failed, MES terminal busy   |
| 1012                | Call cleared, MES terminal busy  |
| 1021                | Call failed, MES time-out (no answer)  |
| 1081                | Call failed, MES terminal not installed  |
| 1091                | Call failed, MES terminal out-of-service   |
| 1092                | Call cleared, MES terminal out-of-service  |
| 1141                | MES preempted clear by higher priority call  |
| 1142                | MES preempted fixed call by higher priority call                                     |
| 1143                | Offered call cleared, pre-empted at MES  |
| 1144                | Call cleared, MES initiated preemption   |
| 1145                | Attempted call cleared, pre-empted at MES  |
| 1146                | Attempted call abandoned by MES terminal   |
| 1202                | Handover, MES ready  |
| 1281                | Call failed, MES cannot accept   |
| 1291                | Call failed, MES cannot accept at present  |
| 1351                | Call cleared, insufficient free memory   |
| 1361                | Call cleared by MES cable unwrap   |
| 1362                | Call cleared, long interruption in reception at MES                                  |
| 1363                | MES secondary clear due to repoint OR  |
| 1391                | Call cleared, traveled distance exceeds 700km  |
| 1392                | Call cleared, spot beam transition (call terminated because aircraft left spot beam) |
| 1393                | Call cleared, cooperative mode   |
| 1451                | Call failed, terrestrial circuits congested  |
| 1452                | Call failed, LES congested (no channel and no circuit)                               |
| 1502                | Handover, LES Ready, normal clear  |
| 1551                | Call failed, LES congested (no channel)  |
| 1581                | Call failed, service not provided at this LES  |
| 1591                | Call failed, service temporarily not available at this LES                           |
| 1592                | Call cleared, credit card type not supported   |
| 1651                | Call failed, LES congested (no channel terminal)                                     |
| 1661                | Call failed, long interruption in reception at LES                                   |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition   |
|---------------------|---|
| 1662                | LES long term blockage of SCPC MES  |
| 1790                | Call cleared, failure credit card validation process                                    |
| 1791                | Call cleared, failure authentication process  |
| 1811                | NCS MES ID busy   |
| 1812                | NCS MES ID busy IPDS  |
| 1841                | Call cleared, NCS initiated preemption for incoming Pri.1 call                          |
| 1842                | Call cleared, NCS initiated preemption for incoming Pri.2 call                          |
| 1843                | Call cleared, NCS initiated preemption for incoming Pri.3 call                          |
| 1844                | Call cleared, NCS initiated preemption  |
| 1851                | Call failed, satellite congestion NCS reject no SCPC available                          |
| 1852                | Call failed, satellite congestion NCS reject SCPC does not match request                |
| 1853                | Call failed, lease channel congestion   |
| 1854                | Call failed, MES outside spot beam coverage area  |
| 1855                | Call rejected, preemption failed, no channel available                                  |
| 1856                | Call rejected, spot beam selection failed   |
| 1857                | Handover failed, channel not available  |
| 2000                | MES int reject MES RQ invalid CNO   |
| 2001                | MES int reject MES RQ failed qualification  |
| 2010                | MES int reject MES RP invalid CNO   |
| 2011                | MES int reject MES RP failed qualification  |
| 2012                | MES int reject MES RP operation timeout   |
| 2020                | MES int reject NCSA missing   |
| 2021                | MES int reject NCSA invalid CNO   |
| 2022                | MES int reject NCSA failed qualification  |
| 2023                | Call failed, Signal lost on NCSA during call setup, check antenna and try again         |
| 2024                | Call failed, Missing channel assignment, try again                                      |
| 2025                | Call failed, Signal lost on NCSC during call setup, check antenna and try again         |
| 2030                | MES int reject LES ID failed qualification  |
| 2040                | MES int reject SCCS invalid CNO   |
| 2041                | MES int reject SCCS not paired  |
| 2048                | Call failed, invalid number dialed  |
| 2049                | Call failed, terminal not ready for call, try later                                     |
| 2050                | Call failed, Not allowed to make another mobile call yet, wait 20 seconds and try again |
| 2051                | Call failed, dialed number is barred  |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition   |
|---------------------|---|
| 2052                | Call failed, LES selected is barred                               |
| 2053                | Call failed, number dialed must be in a phonebook                 |
| 2053                | Call failed, terminal can only be used with a valid SIM           |
| 2055                | Call failed, user not logged in                                   |
| 2056                | Call failed, user not logged in to SIM                            |
| 2057                | Call failed, LES is not in SIM allowed list                       |
| 2058                | Call cleared, SIM removed during call                             |
| 2059                | Call failed, terminal is locked for outgoing calls                |
| 2060                | MES int reject NCSS failed qualification                          |
| 2061                | MES int reject spot beam invalid                                  |
| 2062                | Call failed, no spot beams in the ocean region, select another OR |
| 2063                | Terminal ID is not set correctly, check with dealer               |
| 2070                | Lost NCSC signal, seeking   |
| 2071                | Stand-Alone Mode finished, seeking network                        |
| 2080                | SIM error, check SIM is inserted correctly                        |
| 2090                | MES int reject ORR query invalid                                  |
| 2091                | MES int reject ORR invalid  |
| 2092                | MES int reject MES RR failed qualification                        |
| 2093                | MES int reject MES RR invalid CNO                                 |
| 2094                | MES int reject NCRA missing                                       |
| 2095                | MES int reject NCRA lost lock                                     |
| 2100                | MES int reject illegal call type                                  |
| 2101                | MES Int reject illegal peripheral                                 |
| 2102                | Call request failed, call already in progress                     |
| 2103                | Call failed, star code is badly formatted                         |
| 2104                | Call failed, cannot accept two address book star codes            |
| 2105                | Call failed, address book entry not found                         |
| 2106                | Call failed, star code does not exist                             |
| 2120                | MES int reject no transmit power available                        |
| 2200                | Battery flat for terminal operation                               |
| 2201                | Call cleared, used all allocated time for call type               |
| 2300                | MES int reject no coop response                                   |
| 2301                | MES int reject no power   |
| 2302                | MES int reject no location report                                 |
| 2400                | MES int reject no ORA SU found                                    |
| 8000                | ACSE Recycling  |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition                          |
|---------------------|--|
| 8001                | ACSE Top Of Find BB                      |
| 8002                | ACSE Top Of Process BB                   |
| 8010                | ACSE Finding Primary NCS Long            |
| 8011                | ACSE Finding Secondary NCS Short         |
| 8012                | ACSE Finding Primary Standalone Short    |
| 8013                | ACSE Finding Primary NCS Short           |
| 8014                | ACSE Finding Primary Standalone Long     |
| 8018                | ACSE Finding Secondary Standalone Short  |
| 8019                | ACSE Finding Secondary Standalone Long   |
| 8020                | ACSE Found Primary NCS                   |
| 8021                | ACSE Found Secondary NCS                 |
| 8022                | ACSE Found Primary Standalone            |
| 8023                | ACSE Found Secondary Standalone          |
| 8024                | ACSE found primary NGNCS                 |
| 8025                | ACSE found secondary NGNCS               |
| 8030                | ACSE NSR Invalid                         |
| 8040                | ACSE Inert                               |
| 8041                | ACSE ODU Status                          |
| 8080                | ACSE NSR Valid                           |
| 8081                | ACSE NSR Valid LES A                     |
| 8100                | ACSE Booting                             |
| 8110                | ACSE Booted                              |
| 8120                | ACSE FIDR ID Invalid                     |
| 8200                | ACSE Spot Beam Selection                 |
| 8201                | ACSE Next Spot Beam                      |
| 8202                | ACSE Successful Spot Beam Selection      |
| 8203                | ACSE Failed To Find Spot Beam            |
| 8204                | ACSE Spot Beam Selective Clear           |
| 8210                | ACSE Spot Beam Reject Mobile Call No ID  |
| 8211                | ACSE Spot Beam Reject Mobile Call No TDM |
| 8300                | ACSE ORR                                 |
| 8301                | ACSE Successful ORR                      |
| 8302                | ACSE Failed ORR                          |
| 8303                | ACSE No ORR                              |
| 8304                | ACSE ORR Tune NCRA                       |
| 8305                | ACSE ORR MES RR                          |
| 8306                | ACSE failed retry ORR                    |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition                  |
|---------------------|----------------------------------|
| 8310                | ACSE ORR Query Begin             |
| 8311                | ACSE ORR Query Burst             |
| 8312                | ACSE ORR Query Successful        |
| 8313                | ACSE ORR Query Failed            |
| 8400                | ACSE Fixed Begin                 |
| 8401                | ACSE Fixed MESRP                 |
| 8402                | ACSE Fixed Call Type Set         |
| 8410                | ACSE Fixed Tune NCSA             |
| 8411                | ACSE Fixed Channel Assignment    |
| 8420                | ACSE Fixed Clearing Call         |
| 8421                | ACSE Fixed Selective Clear       |
| 8480                | ACSE Fixed SCPC Begin            |
| 8481                | ACSE Fixed SCPC Transmitting     |
| 8482                | ACSE Fixed Authentication Begin  |
| 8483                | ACSE Fixed Authentication End    |
| 8484                | ACSE Fixed Power Control         |
| 8485                | ACSE Fixed MES Connect           |
| 8486                | ACSE Fixed Ringing Begin         |
| 8500                | ACSE Mobile Begin                |
| 8501                | ACSE Mobile MES RQ1              |
| 8502                | ACSE Mobile MES RQ2              |
| 8503                | ACSE Mobile Call Type Set        |
| 8510                | ACSE Mobile Tune NCSA            |
| 8511                | ACSE Mobile Channel Assignment   |
| 8520                | ACSE Mobile Clearing Call        |
| 8521                | ACSE Mobile Selective Clear      |
| 8580                | ACSE Mobile SCPC Begin           |
| 8581                | ACSE Mobile SCPC Transmitting    |
| 8582                | ACSE Mobile Authentication Begin |
| 8583                | ACSE Mobile Authentication End   |
| 8584                | ACSE Mobile Power Control        |
| 8585                | ACSE Mobile LES Connect          |
| 8586                | ACSE Mobile Ringing Begin        |
| 8600                | MPDS SCPC Mode Selected          |
| 8800                | ACSE cable call begin            |
| 8801                | ACSE cable call successful       |
| 8900                | ACSE Logoff Begin                |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition                             |
|---------------------|---|
| 8901                | ACSE Successful Logoff                      |
| 8902                | ACSE No ORR Logoff                          |
| 9000                | ACSE accepts call                           |
| 9003                | ACSE accepted                               |
| 9004                | ACSE rejected                               |
| 9020                | ACSE call waiting                           |
| 9021                | ACSE idle selective clear                   |
| 9022                | ACSE TDM not found                          |
| 9080                | ACSE rejected fixed call due to invalid NSR |
| 9081                | ACSE In MRSI                                |
| 9082                | ACSE sounder turned on                      |
| 9083                | ACSE sounder turned off                     |
| 9084                | ACSE in lock                                |
| 9085                | ACSE out of lock                            |
| 9086                | ACSE ext sounder turned on                  |
| 9087                | ACSE ext sounder turned off                 |
| 9088                | ACSE timer about to expire                  |
| 9090                | ACSE Smartcard activated                    |
| 9091                | ACSE Smartcard removed                      |
| 9092                | ACSE Smartcard error                        |
| 9100                | Peripheral on hook                          |
| 9101                | Peripheral off hook                         |
| 9102                | Peripheral connected                        |
| 9103                | Peripheral ringing                          |
| 9104                | Peripheral ready                            |
| 9105                | Peripheral hanging up                       |
| 9106                | Peripheral hang up                          |
| 9107                | Peripheral not responding                   |
| 9108                | Peripheral dialing                          |
| 9109                | Peripheral abort dialing                    |
| 9120                | Peripheral DTMF accepted                    |
| 9121                | Peripheral DTMF rejected                    |
| 9122                | Peripheral invalid request                  |
| 9123                | Peripheral valid request                    |
| 9124                | Peripheral bonding auto                     |
| 9125                | Peripheral bonding slave                    |
| 9126                | Peripheral bonding none                     |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition                    |
|---------------------|------------------------------------|
| 9130                | Peripheral STU enabled             |
| 9131                | Peripheral STU disabled            |
| 9200                | MSG T_AM received                  |
| 9201                | MSG A_AM received                  |
| 9202                | MSG T_HA received                  |
| 9203                | MMI normal                         |
| 9204                | MMI inert                          |
| 9205                | MMI programming                    |
| 9206                | MMI reboot                         |
| 9207                | MMI powerdown                      |
| 9208                | MMI accepted                       |
| 9209                | MMI rejected                       |
| 400000              | CT SP bad                          |
| 400000              | No call pending                    |
| 400001              | CT SP good                         |
| 400002              | CT SP full                         |
| 400003              | CT SP access denied                |
| 400080              | CT SP find                         |
| 400081              | CT SP enumerate                    |
| 400082              | CT SP no entries                   |
| 400090              | CT SP delete                       |
| 400100              | CT SP spot beam selection          |
| 400105              | CT SP MPDS                         |
| 400110              | CT SP ocean region registration    |
| 400111              | CT SP ORR query                    |
| 400112              | CT SP log off                      |
| 400120              | CT SP cable call                   |
| 400200              | CT SP go idle                      |
| 400201              | CT SP go idle due to configuration |
| 400202              | CT SP selective clear              |
| 400208              | CT SP go idle clear spot beam      |
| 400209              | CT SP go idle clear NSR            |
| 400210              | CT SP go inert                     |
| 400211              | CT SP go inert Smartcard           |
| 400212              | CT SP go inert DDS poll            |
| 400900              | CT SP ODU status                   |
| 400901              | CT SP ODU status no alarms         |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition  |
|---------------------|--|
| 400902              | CT SP ODU status DDS   |
| 400910              | CT SP prod test  |
| 400911              | CT SP prod test ODU  |
| 401000              | CT SP clear spot beam  |
| 800103              | Mobile AMBE  |
| 800124              | Mobile aero 64k speech   |
| 800404              | Mobile data  |
| 800504              | Mobile facsimile   |
| 800606              | Mobile 64k UDI   |
| 800607              | Mobile 56k UDI   |
| 800610              | Mobile 64k audio 3k1   |
| 800622              | Mobile aero 64k UDI  |
| 800623              | Mobile aero 56k UDI  |
| 800625              | Mobile aero 64k audio 3k1  |
| 11A0                | Call cleared, credit card not accepted   |
| 11D1                | Call failed, Request data invalid  |
| 11D2                | Call failed, insufficient digits in service address  |
| 11D3                | Call failed, invalid service address   |
| 11D4                | Call cleared, credit card data information invalid   |
| 11D5                | Call cleared, invalid country code   |
| 11D6                | Call cleared, PID information is not consistent  |
| 11D7                | Call rejected, invalid service for Pri.1 or 2 call   |
| 11D8                | Call cleared, dialed number not 2 or 3 digits for Pr.1 or 2 call   |
| 11E0                | Call cleared, invalid credit card PIN at this LES  |
| 11E1                | Call cleared, too many invalid credit card call attempts   |
| 12B1                | Call cleared by MES for unspecified reason, for example: <ul style="list-style-type: none"> <li>• GPS conflict</li> <li>• Insufficient HPA power available to make call</li> <li>• HPA over current</li> </ul> |
| 12C2                | Call cleared, no credit card valid message received  |
| 12C3                | Call failed, MES time-out (no terrestrial answer)  |
| 12C4                | Call cleared, authentication query not received (usually caused by call setup failure)   |
| 12C5                | Call cleared, MES missing sup service SU   |
| 12C6                | Call cleared, MES missing sup service 2SU  |
| 12C7                | Call cleared, MES missing SCPC channel release SU sup service  |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition   |
|---------------------|---|
| 12C8                | Handover failed, LES not detected                         |
| 12D1                | Call failed, Spot-beam data invalid                       |
| 12D2                | Call failed, invalid scrambling vector                    |
| 15A1                | Call failed, MES not authorized at this LES               |
| 15A2                | Call failed, service not authorized at this LES           |
| 15A3                | Call cleared, credit card not authorized                  |
| 15A4                | Call cleared, authentication reply invalid                |
| 15A5                | Call failed, PID not authorized for any service           |
| 15A6                | Call failed, PID not authorized for requested service     |
| 15B1                | Call cleared by LES for unspecified reason                |
| 15C1                | Call failed, LES time-out (no assignment)                 |
| 15C2                | Call failed, LES time-out (no service address)            |
| 15C3                | Call failed, LES time-out (no scrambling vector)          |
| 15C4                | Call failed, no service address and no scrambling vector  |
| 15C5                | Call cleared, incomplete credit card data information     |
| 15C7                | Call failed, LES time-out (no MES Connect)                |
| 15C9                | Call cleared, no authentication reply                     |
| 15CA                | Call cleared, notification ack not received               |
| 15CB                | Call cleared, invalid sequence number in notification ack |
| 15CC                | Handover failed, no response to request                   |
| 15CD                | Handover failed, MES not ready                            |
| 15D1                | Call failed, LES time-out (invalid assignment)            |
| 15D2                | LES MES already busy                                      |
| 15E1                | Call cleared but MES still transmitting (FAULT)           |
| 16C2                | LES missing MES SCPC                                      |
| 16C3                | Handover failed, MES not detected                         |
| 18A1                | NCS MES ID not found                                      |
| 18A2                | Call failed, MES not authorized                           |
| 18A3                | Call failed, LES not authorized                           |
| 18B1                | Call failed by NCS for unspecified reason                 |
| 18B2                | Call rejected, invalid service requested                  |
| 18C1                | NCS MES burst missing                                     |
| 18C3                | NCS MES busy preemption failed                            |
| 18D1                | Call failed, invalid call request                         |
| 18E1                | NCS MES busy already                                      |
| 18E2                | NCS MES busy already MPDS                                 |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition  |
|---------------------|--|
| 1F01                | Call cleared by terrestrial circuit (normal call termination from ground source) |
| 1F11                | Call failed, terrestrial party busy  |
| 1F21                | Call failed, LES time-out (no answer)  |
| 1F61                | Call failed, terrestrial circuit failure (call attempted during ORR)             |
| 1F62                | Call failed, early clear by terrestrial circuit                                  |
| 2F00                | LES int reject lack of MES RESP response   |
| 2F01                | LES int reject lack of MES ARN response  |
| 2F02                | LES int reject incorrect SVECSCPC  |
| 4000A0              | CT SP any  |
| 4000F0              | CT Terminal ID   |
| 4000F1              | CT Options   |
| 4000F2              | CT config names  |
| 80010F              | Mobile 64k speech  |
| 8D0FFF              | Mobile Mini-M  |
| 8E0FFF              | Mobile HSD   |
| 8F0FFF              | Mobile   |
| 90A0                | EXPPORT bonding started  |
| 90A1                | EXPPORT bonding ended  |
| 90A2                | EXPPORT remote panel present   |
| 90A3                | EXPPORT remote panel removed   |
| 90B0                | ACSE MPDS mode selected  |
| 90B1                | ACSE SCPC mode selected  |
| 90C0                | ACSE transmit on   |
| 90C1                | ACSE transmit off  |
| 90D0                | ACSE spot beam handover started  |
| 90D1                | ACSE spot beam termination timer started   |
| 90F0                | Event log wiped  |
| B000                | Mod error, general   |
| B001                | Mod error, tune failed   |
| B002                | Mod error, mode failed   |
| B003                | Mod error, mmr failed  |
| B004                | Mod error, not responding  |
| B010                | MOD Invalid Mode   |
| B011                | MOD Command Invalid  |
| B020                | Mod error, su underflow  |
| B021                | MOD Su overflow  |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition                                    |
|---------------------|--|
| B022                | MOD Su not transmitted                             |
| B024                | MOD invalid frame no                               |
| B025                | MOD invalid slot no                                |
| B028                | MOD cannot Tx Su while tuning                      |
| B030                | MOD channel out of range                           |
| B032                | MOD cannot tune while Tx                           |
| B033                | MOD tuning in progress                             |
| B040                | MOD error watchdog                                 |
| B100                | DEMOD error, general                               |
| B101                | DEMOD error, tune failed                           |
| B102                | DEMOD error, mode failed                           |
| B110                | DEMOD invalid mode                                 |
| B130                | DEMOD channel out of range                         |
| B133                | DEMOD tuning in progress                           |
| B200                | Generic modem error                                |
| B201                | RF error RX VHF                                    |
| B202                | RF error RX Lband                                  |
| B204                | RF error RX VHF                                    |
| B208                | RF error TX Lband                                  |
| B210                | RF error RF error                                  |
| B220                | RF error Ref error                                 |
| B27F                | Mod watchdog tripped                               |
| B280                | Generic voice codec errors                         |
| B281                | TMS spurious interrupt                             |
| B300                | Outdoor terminal failure, check connections to ODU |
| B301                | ODU error cannot set cable attenuator              |
| B310                | ODU error power response missing                   |
| B311                | ODU error tune response missing                    |
| B312                | ODU error HPA control response missing             |
| B313                | ODU error HPA status response missing              |
| B314                | ODU error alarm response missing                   |
| B315                | ODU error burst timer response missing             |
| B316                | ODU error HPA backoff response missing             |
| B320                | ODU error alarm heat                               |
| B321                | ODU error alarm burst                              |
| B322                | ODU error alarm power                              |
| B323                | ODU error alarm over voltage                       |

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**Table F-1 Inmarsat Cause Code Definitions (Continued)**

| Inmarsat Cause Code | Code Definition  |
|---------------------|--|
| B324                | ODU error alarm reverse power                                      |
| B328                | ODU failed due to tx power check                                   |
| B329                | ODU error alarm timeout  |
| B330                | ODU error alarm timeout no trip                                    |
| B400                | Internal temperature of terminal too high, turn off for 10 minutes |
| B401                | Internal temperature sensor failed                                 |
| B410                | Mod error, handshake failure, power down/up and try again          |
| B500                | Battery charging communication failure                             |
| B501                | Power supply error   |
| B580                | Battery is over temperature, charging disabled                     |
| B581                | Battery temperature is now ok, charging enabled                    |
| C00103              | Fixed AMBE   |
| C0010F              | Fixed 64k speech   |
| C00124              | Fixed aero 64k speech  |
| C00404              | Fixed data   |
| C00504              | Fixed facsimile  |
| C00606              | Fixed 64k UDI  |
| C00607              | Fixed 56k UDI  |
| C00610              | Fixed 64k audio 3k1  |
| C00622              | Fixed aero 64k UDI   |
| C00623              | Fixed aero 56k UDI   |
| C00625              | Fixed aero 64k audio 3k1   |
| CD0FFF              | Fixed Mini-M   |
| CE0FFF              | Fixed HSD  |
| CF0FFF              | Fixed  |
| FFFFD               | ACSE end marker (MPDS)   |
| FFFE                | Status undefined (MPDS)  |
| FFFF                | Status OK (MPDS)   |

# EMS SATCOM

## SYSTEM DESCRIPTION, INSTALLATION, AND MAINTENANCE MANUAL

### eNfusion™ HSD-400 High-speed Data Terminal

## Notes:

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## Notes: