eNfusion™ HSD-440 High-speed Data Terminal

System Description, Installation, and Maintenance Manual

MN-1252-33077, Revision C00

This document provides configuration and operational procedures for the equipment listed below.

Model	PN
eNfusion™ HSD-440 High-speed Data Terminal 115 V ac or 28 V dc	1252-A-3400
eNfusion™ HSD-440 High-speed Data Terminal SBB Mode 115 V ac or 28 V dc	1252-A-3420-02
eNfusion™ HSD-440 High-speed Data Terminal SBB Mode 115 V ac or 28 V dc for Multi-Channel Operation	1252-A-3420-03

Revision Table

Revision	ECR	Description
001	N/A	Draft release
002	070167	Draft release to benchmark changes
003	070243	Updated environmental specifications table
004	070460	Updated with final software
A00	070701	Official release to customers
B00	080592	Added new part numbers, SCM installation instructions, SBB updates
C00	090725	Added updated drawing (Rev B) of 1252-E-3420. Updated Table 1-3. Updated return shipping information, Updated I-4 Satellite info

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RECORD OF REVISIONS

When revisions are received, insert revised pages, record the date, and initial.

Revision Number	Issue Date	Date Inserted	Inserted by (initial)	Revision Number	Issue Date	Date Inserted	Inserted by (initial)

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SERVICE BULLETIN LIST

Service Bulletin Number	Subject	Manual Rev. Number	Manual Rev. Date
1252-SB-3410	Upgrade Software Certification to Level D	B00	22 July 08
1252-SB-3411	Upgrade to Single Channel SBB	B00	22 July 08
1252-SB-3412	HSD-440 SBB Upgrade to Level D Certification	C00	24 June 09
1252-SB-3413	Transceiver Software MOD To Enable Smith MCDU	C00	24 June 09
1252-SB-3415	HSD 440 NTWK Upgrade	C00	24 June 09
1252-SB-3416	Update HSD ORT Satellite LOC	C00	24 June 09
1252-SB-3417	HSD-440 SBB Software Upgrade	C00	24 June 09
1252-SB-3418	HSD-440 High-speed Data Terminal (1252-A-3420) Upgrade for Network Mode (HSD-X and HSD-Xi) and SBB Priority Mode	C00	24 June 09

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LIST OF EFFECTIVE PAGES

***** An asterisk indicates pages changed, added, or deleted by the current revision.

F indicates a right foldout page with a blank back.

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3	3-29 to 3-36	June 8, 2009
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Introduction	INTRO-2	22 Jul 08
System Description	All	22 Jul 08
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Installation	3-3, 3-14 to 3-32	22 Jul 08
Test and Fault Isolation	4-39, 4-46, 4-50 to 4-55	22 Jul 08
Installation and Planning Checklist	All	22 Jul 08
Service Bulletin List	SBL-1	24 JUN 09
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INTRODUCTION

This manual provides the specifications, principles of operation, and information necessary to install an eNfusion™ HSD-440 High-speed Data Terminal in Stand-Alone Mode.

The information is presented in the following chapters:

- System Description
- System Operation
- Installation
- Test and Fault Isolation
- Maintenance and Repair
- Appendix A: Inmarsat Satellite Beam Coverage
- Appendix B: Troubleshooting Checklist
- Appendix C: RJ45 Cable Termination Details
- Appendix D: Installation Planning Checklist
- Appendix E: Installation Checklist
- Appendix F: ACARS/CMU Messages
- Appendix G: International Access and Country Codes
- Appendix H: 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-440 terminal, the actual (live) system messages, such as dialog boxes and screen displays, may differ slightly from the examples in this manual.

1. Illustration of Equipment

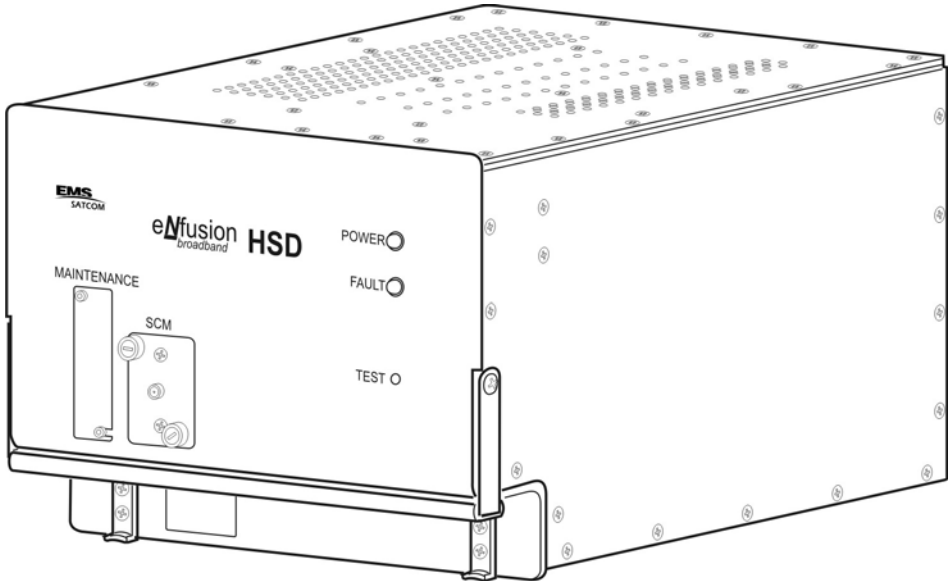

Figure INTRO-1 HSD-440 Terminal

2. Product Terms and Conditions

As stipulated in the Terms and Conditions of Sale, which accompanied the Product, EMS SATCOM 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 SATCOM is charged network or airtime fees relating to the customer's use of the Product, the customer shall immediately upon notification by EMS SATCOM reimburse EMS SATCOM in full for such charges.

3. Reference Documents

Table INTRO-1 EMS SATCOM Reference Documents

Document Title	EMS SATCOM Publication Number
Guidance for Aircraft Electrical Power Utilization and Transient Protection	ARINC 741. ARINC Report 413A—Attachment 3-2, Wire Shielding and Grounding Requirements and Appendix 7
eNfusion™ HSD-440 High-speed Data Terminal Pilot's Guide	MN-1252-33138
eNfusion™ HSD High-speed Data Terminal Developer's Guide	MN-1252-13005

4. Acronyms and Abbreviations

The following acronyms and abbreviations are used in this document.

AC	Access Concentrator
ACP	Audio Control Panel
ACSE	Access Control and Signalling Equipment
ACU	Antenna Control Unit (also known as BSU or Driver)
AERO	Aeronautical
AES	Aircraft Earth Station
AMBE	Advanced Multi-Band Excitement
AORE	Atlantic Ocean Region-East
AORW	Atlantic Ocean Region-West
APN	Access Point Name
ATC	Air Traffic Control
AWG	American Wire Gauge
BGAN	Broadband Global Area Network
BITE	Built-In Test Equipment
BOP	Bit Oriented Protocol
bps	Bits per second
BRI	Basic Rate ISDN
BSU	Beam Steering Unit (also known as ACU or Driver)
C/No	Carrier-to-Noise
CCW	Counter Clockwise
CFDS	Centralized Fault Display System
CMU	Communications Management Unit
CRC	Cyclic Redundancy Check
CW	Clockwise
DITS	Digital Information Transfer System
DLNA	Diplexer/Low-Noise Amplifier
DSL	Digital Subscriber Line
EIRP	Effect Isotropic Radiated Power
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
EST	Eastern Standard Time
FAA	Federal Aviation Authority
FET	Field-Effect Transistor

FMS	Flight Management System
FRLP	Forward Link Pairs
FWD ID	Forward ID
GES	Ground Earth Station
GND	Ground
HGA	High-gain Antenna
HPA	High Power Amplifier
HTML	Hyper Text Markup Language
Hz	Hertz
I/O	Input/Output
ICAO	International Civil Aviation Organization
ICD	Interconnection Drawing
IMN	Inmarsat Mobile Number
INS	Inertial Navigational System
IOR	Indian Ocean Region
IRS	Inertial Reference System
ISDN	Integrated Services Digital Network
ISN	Inmarsat Serial Number
ISP	Inmarsat Service Providers
ISP	Internet Service Provider
JAA	Joint Aviation Authorities
kbps	Kilobits per Second
LAN	Local Area Network
LES	Land Earth Station
LRU	Line Replaceable Unit
LS	line select
LSB	Least Significant Bit
MA	Mechanical Steered Antenna
Mbps	Megabit per second
MCDU	Multipurpose Control Display Unit
MCU	Modular Concept Unit
MES	Mobile Earth Station
MPDS	Mobile Packet Data Services
MPU	Maintenance Port Utility
ms	Millisecond

MSB	Most Significant Bit
MSN	Mobile Serial Number
MSN	Multiple Subscriber Number
NAT	Network Address Translation
NO	normally open
NT	Network Terminator
O&I	Outline and Installation Diagram
OA	Other Antenna
OCXO	Oven Controlled Crystal Oscillator
OEM	Original Equipment Manufacturer
ORR	Ocean Region Registration
ORT	Owner Requirements Table
PAST	Person Activated Self Test
PC	Personal Computer (or laptop)
PN	Part Number
POR	Pacific Ocean Region
POST	Power On Self Test
POTS	Plain Old Telephone System
PPP	Point-to-Point Protocol
PPPoE	Point-to-Point Protocol over Ethernet
PSTN	Public Switch Telephone Network
PTT	Push-to-Talk
RAM	Random Access Memory
REA	Responsible Engineering Authority
RF	Radio Frequency
RFI	Radio Frequency Interference
RFU	Radio Frequency Unit
rms	root mean square
ROM	Read-only Memory
RTN	Return
Rx	Receive
S/T (ISDN)	Key interfaces of an ISDN network are known as Reference Points. Reference Point T is on the user's side of the network and allows a single TE/TA to be connected. Reference Point S is on the user's side of the network and allows multiple TEs/TAs to be connected. Electrically, point T and point S are the same point.

SBB	SwiftBroadband
SCM	Software Configuration Module
SCPC	Single Channel per Carrier
SDI	Source/Destination Identification
SDU	Satellite Data Unit
SNAC	Single Network Access Code
SPID	Service Profile Identifier
STBD	Starboard
STE	Secure Terminal Equipment
STU	Secure Telephone Unit
TA	Terminal Adapter
TE	Terminal Equipment
Tx	Transmit
USIM	Universal Subscriber Identity Module
VHF	very high frequency
VSWR	Voltage Standing Wave Ratio
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 that, if not obeyed, could cause injury or death.
- A CAUTION describes an operation, procedure, or condition that, if not obeyed, could cause damage to the equipment.
- A NOTE provides supplementary information or explanatory text that makes it easier to understand and perform procedures.

All personnel who install, operate, and maintain the HSD-440 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.

The general safety advisories include the following:

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.

WARNING: **ASSOCIATED SATELLITE COMMUNICATIONS 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), MAKE SURE THAT PERSONNEL ARE EXPOSED TO A MINIMUM OF ANY REFLECTED, SCATTERED, OR DIRECT BEAMS.

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.**

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.

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SYSTEM DESCRIPTION

This section includes basic information about the HSD-440 terminal, including the following sections:

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

1. Inmarsat System Overview

The satellite communication system includes global satellite networks, Land Earth Stations (LESs), Ground Earth Stations (GESs), Aircraft Earth Stations (AESs), and Mobile Earth Stations (MESs).

The LES/GES 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 to/from the MES/AES to/from their destinations around the world.

The MES/AES is the part of the satellite communication system that is on the aircraft. This station includes the following components:

- HSD-440 terminal
- Antenna subsystem
- Cabin communications system
- Analog connected telephones
- Cockpit voice system
- Other aircraft avionics

Figure 1-1 illustrates a simplified satellite communications system.

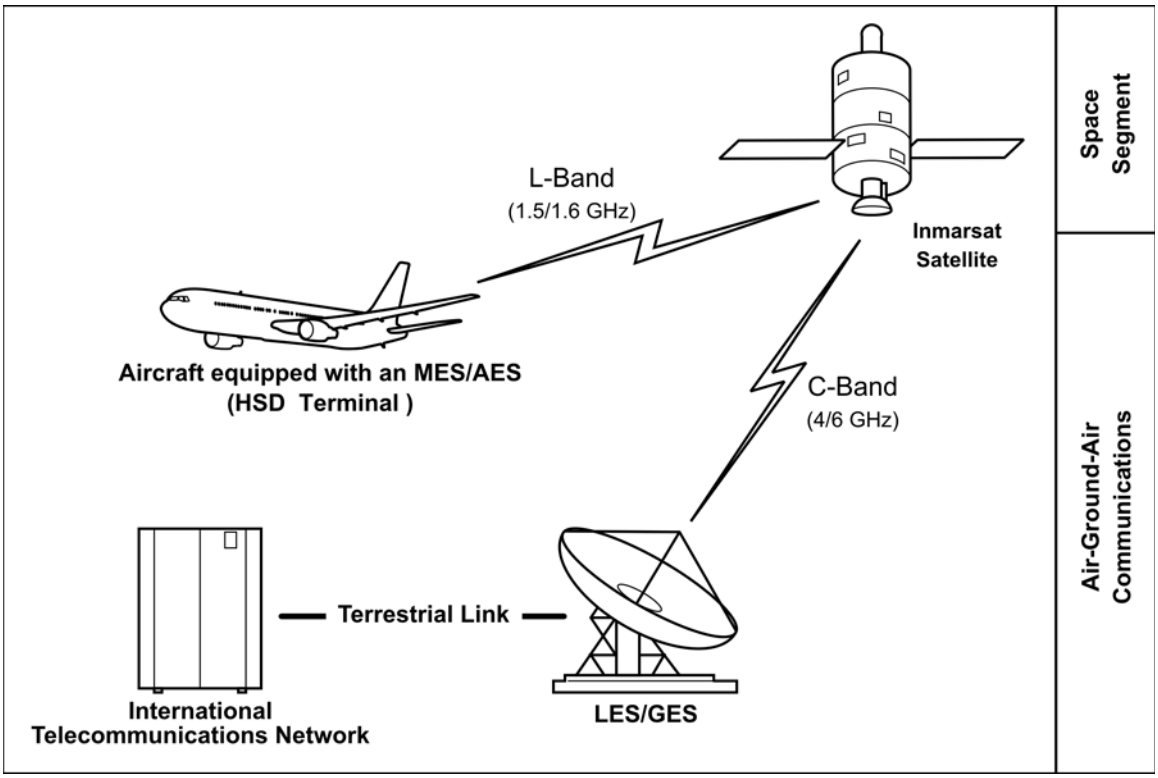

Figure 1-1 Simplified Aeronautical Satellite Communications System

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 multiple geostationary satellites and satellite networks. The satellites that provide Swift64 services are called I-3 satellites. Each satellite is located over an Ocean Region (OR); the current OR 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/GES. The LES converts the space segment of the communication link to a format compatible with public and private telephone and data networks. Each satellite is associated with a number of LESs that fall within its coverage.

The satellites that provide SBB services are called I-4 satellites. At the time of publishing, three I-4 satellites are operating: Americas, EMEA. and Asia-Pacific.

The HSD-440 terminal, in conjunction with an ARINC 741/781 High-gain Antenna (HGA), acts as an MES/AES. The combined system provides users with a data and voice communications link to the satellite network and global telecommunications system.

2. Equipment Overview

The HSD-440 terminal is a scalable, high-speed data, satellite communications terminal that provides world-wide voice and data services to aircraft through a high-speed communication link with the Inmarsat Satellite Network. The HSD-440 terminal interfaces with ARINC 741-compatible antenna subsystems to communicate with the space segment of the Inmarsat Satellite Network via L-band RF signals.

The HSD-440 terminal communicates with various avionics equipment, such as the aircraft's IRS and CMU, in order to coordinate and access a wide range of services. The HSD-440 terminal also communicates with cabin and cockpit voice and data equipment to provide phone, fax, internet connection, and other services on board the aircraft.

The HSD-440 terminal also provides access to the CMU short message system. The HSD-440 terminal ensures that high-priority safety and flight-operation communication is not blocked or delayed by other types of low-priority transmissions.

HSD-440 terminals contain the following:

- Two (2) channel cards
- Data input/output (I/O) card
- Control processor
- High Power Amplifier (HPA)
- Universal (110 V ac 400 Hz / 28 V dc) power supply

The HSD-440 terminal operates with a high-gain antenna subsystem to provide circuit-switched (Swift64 Mobile ISDN), packet-switched (Swift64 MPDS) services, 1 PRT channel, 1 C channel, 2 Swift64 channels, and SBB over the Inmarsat satellite communications network.

HSD-440 terminals support the following services and functions:

- Inmarsat Integrated Services Digital Network (ISDN) Single Channel Per Carrier (SCPC) Service
- Inmarsat Serial Mobile Packet Data Services (MPDS)
- Inmarsat Aero P, R, T channel data
- Inmarsat Aero C channel H+ voice
- SwiftBroadband (SBB) service
- Cockpit communications for ground-to-air and air-to-ground calls using the MCDU

The HSD-440 terminal is a high-speed data terminal that contains two channel cards, a high stability reference oscillator, a high power amplifier, a data processor module, and a power supply. The HSD-440 terminal receives power from the aircraft as either 28 V dc or 115 V ac, 400 Hz.

The HSD-440 terminal supports one channel of Inmarsat Swift64 MPDS or two channels of Mobile ISDN 64 kbps data links, and one SBB channel. To use the SBB service, the HSD-440 terminal obtains subscriber information from a SIM card installed in the SCM. The SCM slot is located on the front of the HSD-440 terminal next to the maintenance connector.

The HSD-440 terminal has three ports that support the following interfaces: EURO ISDN S/T, Ethernet (10BASE-T), and POTS. 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
- 10BASE-T port supports SBB, Swift64 Mobile ISDN, or MPDS
- POTS port supports ISDN (speech) or 3.1 kHz audio (fax)

NOTE: Only one service type can be used at one time on an HSD-440 terminal channel card. The first channel card can support one channel of MPDS, two channels of Swift64 service, or one channel of SwiftBroadband. The second channel card supports a single Classic Aero service (Aero-H/H++).

The most likely configurations include connecting a networking device such as a router or a file server to allow multiple users to share the channel(s) provided by the HSD-440 terminal.

3. Equipment Specifications

Table 1-1 lists the physical characteristics and equipment specifications for the HSD-440 terminal.

Table 1-1 HSD-440 TE Characteristics and Specifications

Characteristic	Specification	
Certification/related documents		
ARINC characteristics	600-12, Air Transport Avionics Equipment Interfaces, December 12, 1998	
	Appendix 10 of the ARINC 704-7	
RTCA documents	RTCA/DO-160E, Environmental Conditions and Test Procedures for Airborne Equipment, July 29, 1997	
HSD-440 Terminal Software	RTCA/DO-178B Level D	
Physical Size		
Height	19.41 cm (7.64 in)	
Width	25.91 cm (10.20 in)	
Length	36.45 cm (14.58 in)	
Weight	15.75 kg (34.7 lbs)	
Mounting information	8-MCU Tray (per ARINC 600, 8-MCU LRU)	
Maintenance requirements	No scheduled maintenance is required	
Electrical specifications		
HSD-440 terminal AC input power		
Voltage	Minimum:	100 V rms
	Typical:	115 V rms
	Maximum:	122 V rms

Table 1-1 HSD-440 TE Characteristics and Specifications (Continued)

Characteristic	Specification
Power consumption	Maximum: 460 W NOTE: Of this power consumption, 400 W is dissipated internally and 60 W of RF power is dissipated externally.
Frequency	Minimum: 300 Hz Typical: 400 Hz Maximum: 800 Hz
Frequency band	Tx: 1626.5 to 1660.5 MHz Rx: 1525.0 to 1559.0 MHz
HSD-440 terminal DC input power	
Voltage	Minimum: 22 V dc Typical: 28 V dc Maximum: 30.3 V dc
Power consumption	Maximum: 460 W NOTE: Of this power consumption, 400 W is dissipated internally and 60 W of RF power is dissipated externally.
Power requirements	
AC	115 V ac, 400 Hz nominal, @ 4 A (460 W maximum)
DC	+ 28 V dc @ 15.5 A (460 W maximum)
Wire gauge	DC power: 12 AWG AC power: 20 AWG (hot lead), 12 AWG (cold lead) Signals: Unless otherwise specified, use 22 AWG for all signal wires
Ground requirements	ARINC 741
Circuit breakers	Install circuit breakers according to the maintenance requirements of the aircraft.
Heating and cooling requirements	
Cooling air	ARINC 600
Flow rate	88 kg/hr (194 lbs/hr)
Pressure drop	5 ± 3 mm (0.20 ± 0.12 in.) of H_2O
Receive input impedance	50 ohms
Transmit output impedance	50 ohms
VSWR	2:1 maximum
External interfaces	
External parameters	
Antenna gain	Minimum: 8 dB Maximum: 17 dB

Table 1-1 HSD-440 TE Characteristics and Specifications (Continued)

Characteristic	Specification	
Antenna to DLNA loss	Maximum:	0.3 dB
DLNA gain	Minimum:	53 dB
	Maximum:	60 dB
DLNA noise	Maximum:	1.8 dB
DLNA to HSD-440 terminal total Rx total loss	Minimum:	6 dB
	Maximum:	25 dB
HSD-440 terminal to antenna total Tx cable loss including DLNA insertion loss	Minimum:	1 dB
	Maximum:	2.5 dB
DLNA insertion loss	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, N81, None	
Ethernet user interface (2)	10BASE-T input and output for SBB, SCPC (Swift64 Mobile ISDN) and MPDS using Point-to-Point Protocol over Ethernet (PPPoE)	
ISDN	ISDN S/T physical interface supporting up to seven 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-160E environmental characteristics for the HSD-440 terminal.

Table 1-2 HSD-440 Terminal RTCA/DO-160E Environmental Characteristics

Section	Environmental Condition	Category
4.0	Temperature and Altitude	
4.5.1	Ground Survival Low	F2
4.5.1	Short Time Operating Low	F2
4.5.2	Operating Low Temperature	F2
4.5.3	Ground Survival High Temperature	F2
4.5.3	Short Term Operating High Temperature	F2
4.5.4	Operating High Temperature	F2
4.5.5	In Flight Loss of Cooling	Z
4.6.1	Altitude Test	F2

Table 1-2 HSD-440 Terminal RTCA/DO-160E Environmental Characteristics (Continued)

Section	Environmental Condition	Category
4.6.2	Decompression Test	A2
4.6.3	Over Pressure Test	A2 (modified)
5.3.1	Temperature Variation	B
6.3.2	Humidity	B (modified)
7.0	Operational Shock and Crash Safety	B
7.2.1	Operational Shock	B
7.3	Crash Safety Impulse	B
7.3.2	Crash Safety Sustained	B
8.0	Vibration—Fixed Wing	S (CURVE B)
8.4	Vibration—Heli	U (CURVE G)
9.7.2	Explosive Atmosphere	E (modified)
10.0	Waterproofness	X
11.0	Fluids Susceptibility	X
12.4 12.5	Sand and Dust	X
13.0	Fungus Resistance	F
14.3.6	Salt Fog	S
15.3	Magnetic Effect	Z
16.0	Power Input	
16.6.1.1	DC Input	BZ
16.6.1.1	Emergency Operation	BZ
16.6.1.2	Ripple Voltage	BZ
16.6.1.3	Momentary Power Interruptions	BZ
16.6.1.4	Normal Surge Voltage	BZ
16.6.1.5	Engine Starting Under voltage Operation	BZ
16.6.2.1	Abnormal Voltage Steady State	BZ
16.6.2.3	Momentary Under Voltage Operation	BZ
16.6.2.4	Abnormal Surge Voltage	BZ
16.5.1.1	AC Input	A(WF)H
16.5.1.2	Voltage Modulation	A(WF)H
16.5.1.3	Frequency Modulation	A(WF)H
16.5.1.4	Momentary Power Interruptions	A(WF)H
16.5.1.5	Normal Surge Voltage	A(WF)H
16.5.1.6	Normal Frequency Variations	A(WF)H
16.5.1.7	Voltage DC Content	A(WF)H
16.5.1.8	Harmonic Distortion	A(WF)H

Table 1-2 HSD-440 Terminal RTCA/DO-160E Environmental Characteristics (Continued)

Section	Environmental Condition	Category
16.5.2.1	Abnormal Operating Conditions	A(WF)H
16.5.2.2	Momentary Under Voltage Operation	A(WF)H
16.5.2.3	Abnormal Surge Voltage	A(WF)H
17.4	Voltage Spike	A
18.0	Audio Frequency Conducted Susceptibility	[K(WF)Z]
19.3	Induced Signal Susceptibility	ZW
20.0	Radio Frequency Susceptibility	
	Conducted Susceptibility	R
	Radiated Susceptibility	R
21.0	Emission of RF Energy	
	Conducted (Power Lines)	B
	Conducted RF Emission	B
	Radiated RF Emission	B
22.0	Lightning Induced Transient Susceptibility	A3J33 (modified)
23.0	Lightning Direct Effects	X
24.0	Icing	X
25.0	Electrostatic Discharge (ESD)	A (modified)
26.0	Fire Flammability	C

4. Software Description

This section describes the software specifications and operational software components of HSD-440 terminals.

A. Software Specifications

The software meets the following DO-178B standards:

- Swift64 to Level D
- Classic Aero voice and data to Level D
- SwiftBroadband to Level E

B. Operational Software Part Numbers

Table 1-3 provides a list of software part numbers for the HSD-440 terminal.

Table 1-3 HSD-440 Terminal Operational Software

EMS SATCOM Part Number*	Description
LI-1252-33222 L1-1252-33374	HSD-440 (1252-A-3420-02) Software Control Document HSD-440 (1252-A-3420-03) Software Control Document
1252-SW-3305	HSD-440 Terminal data I/O software
1252-SW-3315	Control processor software
1210-A-0039 CC 1 1210-A-0038-03 CC 1 1210-A-0039 CC 2 1210-A-0038 CC 2	Aero SBB channel card software
* Software levels are not available.	

5. Mechanical Description

The HSD-440 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 coaxial contact and seventy, 22-gauge signal contacts. The bottom insert connector has contact with only positions 1, 2, 3, 7, 8, 12, and 13. The rear panel has three polarization points.

Figure 3-7 through Figure 3-10 present the Outline and Installation diagrams for the HSD-440 terminal. For detailed wiring information, refer to the Interconnection and Contact Assignment drawings presented in "Installation" on page 3-1 and shown in Table 1-4.

Table 1-4 HSD-440 Terminal Installation Drawing Reference Matrix

Models	Figures
ALL	Outline and Installation diagrams: Figure 3-7 through Figure 3-10
	System Interconnect: Figure 3-11

6. Electrical Description

"Installation" on page 3-1 describes all ARNC 600 connector contact assignments and physical details, including part numbers, insert descriptions, and polarization keying.

The loading/gradient specifications for all HSD-440 terminal installations are provided in table format in "Installation" on page 3-1. These tables list all of the ARINC top, middle, and bottom plug pin designations and provide installation connection details.

The HSD-440 terminal contains a communications switch that supports Inmarsat Swift64 Mobile ISDN and MPDS service within an 8-MCU assembly built in accordance to ARINC 600 specifications.

The HSD-440 terminal uses the ARINC 429 multi-control bus to interface with the ACU/BSU to control the RF antenna and obtain antenna-subsystem status information over the Built-in Test Equipment (BITE) lines. The HSD-440 terminal receives the required navigational data, provided by the aircraft Inertial Navigational System (INS), via the ARINC 429 IRS bus. The aircraft supplies either 28 V dc or 115 V ac 400 Hz power to the HSD-440 terminal.

The HSD-440 terminal also uses an ARINC 429 bus to interface with the Communications Management Unit (CMU) and the Multipurpose Control Display Unit (MCDU).

Detailed pin and connector descriptions for HSD-440 terminals are provided for all supported installation modes and configurations in "Installation" on page 3-1.

7. System Interfaces

This section briefly describes the external HSD-440 terminal system interfaces, as shown in Figure 1-2, required to control, monitor, maintain, and supplement the terminal. "Installation" on page 3-1 provides a detailed description of interface connections.

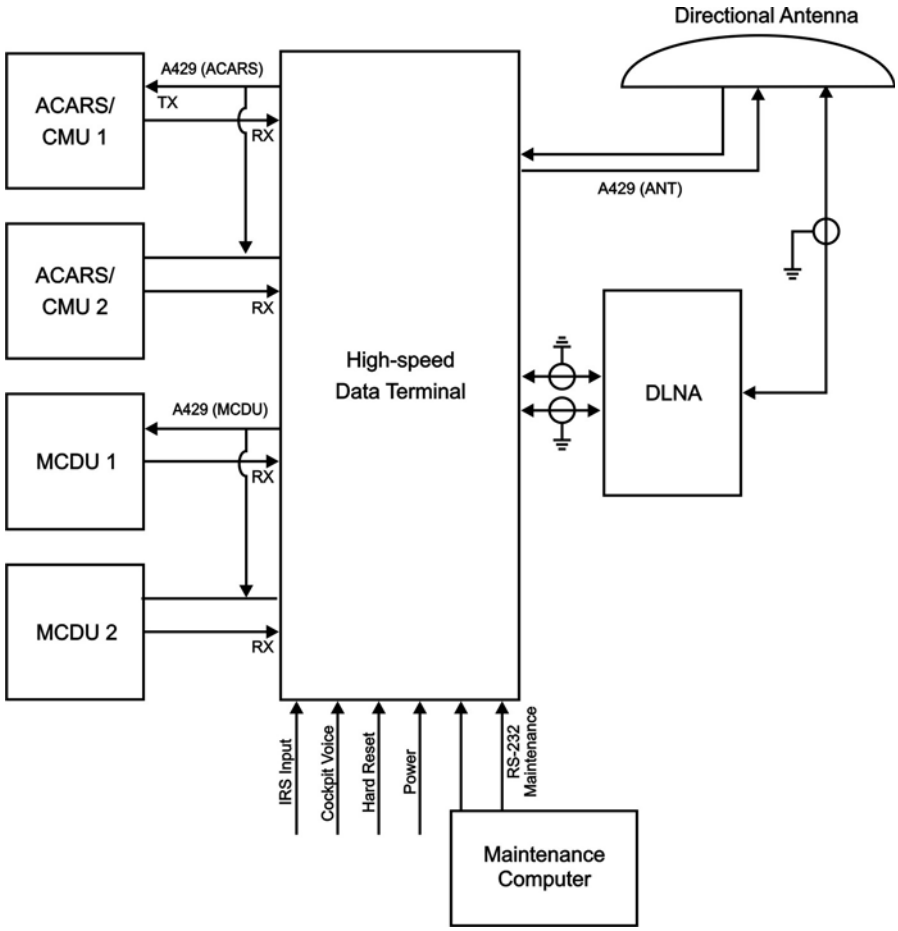

Figure 1-2 HSD-440 Terminal Interfaces

A. Source Destination Identification (SDI)

The SDI is provided to the HPA as per ARINC 741 specifications.

B. ICAO IDs and Forward IDs

The ICAO ID is a 24Bit address that identifies the AES on the network much like a FWD ID. Each aircraft has a single unique ICAO ID.

The HSD-440 terminal uses two 24-bit IDs called Forward Link Pairs (FRLPs) for the Swift64 service, which include a Forward ID (FWD ID). The HSD-440 terminal reads the first channel FWD ID from the EEPROM and performs a look-up for the second channel FWD ID.

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

C. Weight-On-Wheel (WOW) Pin Wiring

WOW discretes indicate when an aircraft is on the ground and are used for flight data-logging purposes. These discretes are not required on the typical installation, as equivalent data indicating the aircraft is airborne is available (for example, true track and groundspeed IRS information) and supplied to the HSD-440 terminal. Note 40 of ARINC 741 specification documentation defines the requirement for WOW data.

D. IRS ARINC 429 Interface

Table 1-5 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 1-5 ARINC 429 IRS Navigational Requirements

Label (Octal)	Name	Interval Rate	
		Min (ms)	Max (ms)
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 installations, the HSD-440 terminal requires high-speed, ARINC 429, IRS Navigational information (as shown in Table 1-5) to compute the azimuth/elevation for antenna pointing and aircraft attitude information for Doppler correction.

E. Antenna Interface

In Stand-Alone Mode installations, the HSD-440 terminal interfaces to any mechanically-steered, conformal-array, or phased-array antenna subsystems compatible with ARINC 741 or 781. The antenna-steering commands and status messages are communicated between the HSD-440 terminal and antenna subsystem over ARINC 429, multi-control, Top/Port and/or Starboard BITE and HPA mute buses, as defined in ARINC 741, Part 1.

F. Owner's Requirements Table (ORT)

The ORT preserves information relevant to the operation and configuration of the HSD-440 terminal when the terminal is shut down.

G. CMU

Each HSD-440 terminal can be connected to up to two CMUs. The CMUs operate in two modes: it can select from a number of Satellite Service Providers rather than Inmarsat only, or it can operate with no preferred Satellite Service Provider.

The HSD-440 terminal exchanges information with the CMU over ARINC 429 interfaces. The default speed is low, but you can set the speed of the buses to high in the ORT.

H. MCDU

The MCDU is an interface display that lets you communicate with systems on an aircraft, including CMU and the HSD-440 terminal.

At power up, the HSD-440 terminal broadcasts its subsystem identifier word, with label 172 and subsystem SAL 307, approximately once per second. The MCDU finds this label and sends an ENQ (enquiry) word to request menu text. This exchange proceeds, as per ARINC 739 requirements, to transfer data between the MCDU and the HSD-440 terminal.

Once active communication has been established between the units and the menu text has been loaded to the MCDU, the HSD-440 terminal continues scanning its ARINC 429 receiving port for activity from the MCDU. The MCDU transfers information to the HSD-440 terminal one character at a time.

Users can make air-to-ground voice calls with the MCDU. Incoming calls are announced by a combination of lights or chimes according to the way in which the terminal is strapped.

I. Antenna Subsystem RF Interface

The system RF parameters, such as cable losses and antenna gain, are delimited to make sure that the HSD-440 terminal performance requirements are met. Refer to "Installation" on page 3-1 for a definition of these parameters and their expected values.

J. Remote Status Panel (Optional)

The outputs to the optional remote status panel provide a visual indication of the operational status of the HSD-440 terminal; they mirror the front panel LEDs labeled as Power (LED1) and Fault (LED2), as defined in Table 1-6. Refer to "Installation" on page 3-1 for detailed installation and circuit requirements.

Table 1-6 HSD-440 Terminal LED Output Designations

LED Signal	Label	LED Color	Indication Description
LED1	Power On	Green	Power On: HSD-440 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 1-14

K. Fault Conditions

A failure in the HSD-440 terminal may be due to a number of fault conditions. Upon detection of a fault condition, the HSD-440 terminal activates its red, Fault LED. The potential fault conditions are as follows:

- Channel card fault
- HPA fault
- Internal ROM fault
- Internal RAM fault
- Over temperature fault

L. Remote Reset

The remote reset output provides an external reset function for the complete HSD-440 terminal. Pressing the momentary normally open (NO) switch resets the system's processor-card circuitry.

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

8. User Interfaces

The HSD-440 terminal can support multiple voice and data communication configurations.

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-440 terminal.

The networking device must be able to decide which combination of services is required at any particular moment and activate it accordingly. Therefore, simultaneous Ethernet and ISDN connections are required.

A different way to achieve this effect is for one of the Ethernet ports to carry a PPPoE virtual connection between the networking device (typically a router) and the HSD-440 terminal. Support for PPPoE is also required on the user's side. HSD-440 terminals support two Ethernet interfaces. Ethernet can provide SBB, SCPC, or MPDS services; whereas, ISDN (BRI-ST) is only capable of SCPC service.

Voice and fax devices are supported by direct connection to the HSD-440 terminal via EURO ISDN telephones and fax machines or by indirect connection to a router or TA. Two-wire telephone handsets or voice devices (PBXs) may be directly connected to the POTS ports.

HSD-440 terminals support two Swift64 Mobile ISDN voice or SCPC data services, one instance of MPDS over Ethernet (PPPoE), or a single SBB connection.

A. ISDN Circuit-Switched Data Interface

HSD-440 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-440 terminals provide one ISDN S/T bus interface, which is capable of hosting up to seven external physical connections to EURO ISDN devices.

The Swift64 channel card supports communications with two, 64 kbps, ISDN B channels on the ISDN interface. If the channels are busy or in-call, the request for service is denied.

Several ISDN interface options are shown in Figure 1-3. In the illustrated example, the ISDN port is used for circuit-switched services (Swift64 Mobile ISDN) or SBB voice.

NOTE: Activating an MPDS session temporarily disables the ISDN port while MPDS service is in-use.

For connection to Inmarsat Mobile ISDN services, install an RJ45 interface connector in the cabin area. "Installation" on page 3-1 describes the RJ45 connector and cable termination.

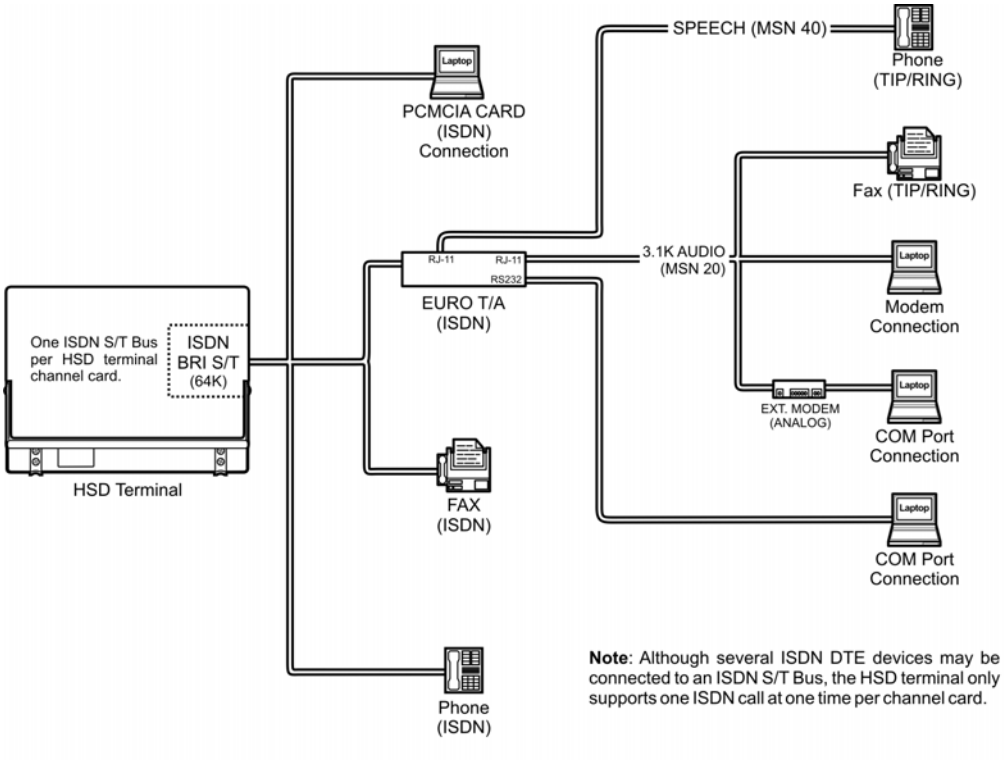

Figure 1-3 ISDN Connection Options

B. Ethernet Data Interfaces

HSD-440 terminals provide two Ethernet data interfaces.

Each Ethernet port provides a 10 Mbps access, with a 10BASE-T physical interface. The HSD-440 terminal data I/O controller takes the PPP data stream and directs it to the required port on the channel card, depending on the type of service selected by the user. PPPoE is required on the user equipment to allow the establishment of virtual connections to either service. You can use the Ethernet ports for either SBB, Swift64 Mobile ISDN, or MPDS service.

C. ISDN S/T Interface

HSD-440 terminals provide one ISDN S/T physical interface that supports up to seven external connections to TA or TE devices.

NOTE: An HSD-440 terminal data I/O card type 4 uses one S/T bus device connection for system use.

You can install RJ45 interface connectors in the cabin area to facilitate connection to the ISDN interface. Refer to "Installation" on page 3-1 for a description of the RJ45 connector and cable termination.

D. POTS Tip/Ring Interfaces

The HSD-440 terminal includes two POTS analog interfaces. The default setting for channel 1 is 64 kbps speech (Swift64) or AMBE+2 (SBB), and the default setting for channel 2 is 3.1 kbps audio (Swfit64 and SBB), which is appropriate for fax calls. These settings can be changed in the data I/O settings using the MPU.

E. Maintenance Port Interface

The HSD-440 terminal is equipped with a maintenance port, located on the front panel of the HSD-440 terminal, with remote access also available through the rear ARINC 600 connector.

NOTE: Access to maintenance functions of the HSD-440 terminal in flight is only available through the remote access port.

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.

The user connects to the maintenance port either through the maintenance 25-pin socket D-Sub (DB25) connector on the front panel of the HSD-440 terminal or through a remote 9-pin socket D-Sub (DB9) connector via the ARINC 600 connector, as described in "Connection Requirements" on page 4-3.

The HSD-440 terminal supports two different end user access levels within the maintenance port architecture: End User and Field Representative. End User access is only available when the WOW straps indicate that the aircraft is on the ground.

"Terminal MPU" on page 4-2 provides a detailed description of the two levels of user access and the menus, report selections, functions, and system diagnostic procedures of the HSD-440 terminal MPU.

9. Initiated Self-Test

The initiated self-test occurs during the power up sequence or you depress and hold down the TEST button on the front panel of the terminal for 100 milliseconds or more. The initiated self-test provides the same function as the remote reset switch.

10. Modes of Operation

The HSD-440 terminal currently operates in Stand-Alone Mode only. In Stand-Alone Mode, the HSD-440 terminal controls both the internal HPA and antenna.

The system supports up to two channels in multiple combinations of Swift64 ISDN and Swift64 MPDS service or one channel SBB. The maximum number of simultaneous Swift64 ISDN service channels is two.

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SYSTEM OPERATION

This section provides basic information on registering and operating the HSD-440 terminal, including the following sections:

- Registering and Activating Terminals
- Configuring Terminals
- Using Terminals

1. Registering and Activating Terminals

Registering and activating an HSD-440 terminal has the following steps:

- Preparing Terminal Information
- Obtaining ICAO Addresses
- Choosing Service Providers
- Registering Terminals

A. Preparing Terminal Information

Before installing the HSD-440 terminal, obtain an ISN and identify the Swift64 terminal type and service category.

(1) Obtaining ISNs

EMS SATCOM provides ISNs for the HSD-440 terminal based on the intended installation configuration. The last six digits of the ISN are the Forward ID.

When requesting ISNs, 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 on which the terminal is being installed
- Serial number of the HSD-440 terminal(s)

EMS SATCOM Product Support is available Monday to Friday from 8 am to 5 pm (EST). On-call support is available outside business hours, Eastern Standard Time.

Contact information for EMS SATCOM:

Product Support	1.888.300.7415
Product Support direct	1.613.591.3086
Canada and USA toll-free Sales	1.800.600.9759
Outside Canada and USA	1.613.591.9064
Fax:	1.613.591.9120
Web:	www.emssatcom.com

(2) Identifying the Service Category and Terminal Type

Register HSD-440 terminals as Category A systems.

Table 2-1and Table 2-2 list the terminal type, frequency category, and currently supported service types for the HSD-440 terminal stand-alone mode installations.

Table 2-1 HSD-440 Terminal Frequency Category and Type

Service Type	Inmarsat Frequency Category	Terminal Type Approval
Swift64	Category A	76ES10
SBB	Category A	B6ES04

Table 2-2 HSD-440 Terminal Service Types

Service Type	Supported Services
Classic	C-channel Voice P/R/T Data
Swift64	64 kbps Speech 3.1 kHz Audio 56 kbps Data 64 kbps UDI MPDS
SwiftBroadband	3.1 kHz Audio 56 kbps Data 64 kbps UDI AMBE+2 Packet-switched services: Background (up to 432 kbps), Streaming (32 kbps, 64 kbps, 128 kbps)

B. Obtaining ICAO Addresses

Obtain your ICAO address from your local aeronautical authority. Your service provider will require this address when you register.

C. Choosing Service Providers

Contact Inmarsat for an up-to-date list of Inmarsat Service Providers using the following contact information:

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

Web address: www.inmarsat.com

D. Registering Terminals

Contact your Inmarsat service provider and ask for a **Registration for service activation of Aircraft Earth Station** form. With this form, you can register for both Swift64 services and Aero H+ services. Both of these activations are required for the terminal to operate. The services available depend on your service provider.

To complete the registration form, the following information is needed:

- Customer information (address and contact information)
- Service provider details (obtained from your ISP)
- System and terminal information (terminal type, manufacturer, model number, serial number of terminal)
- ICAO 24 bit technical address for Aero H+ services
- ISN for Swift64 services
- Aircraft information (tail number, fuselage/airframe number, manufacturer and model, and country of registration)
- List of services required (e.g., Swift64 Mobile ISDN, Aero H+ data-2)

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

2. Configuring Terminals

This section provides basic information about configuring HSD-440 terminals for operation with user devices.

You can follow the procedures in the following sections to configure the HSD-440 terminal:

- "Setting up Airborne Networks" on page 2-3
- "Mapping User Devices for ISDN Services" on page 2-3
- "Configuring Terminal Categories" on page 2-6
- “Configuring the APN (Access Point Name)” on page 2-7
- "Configuring LES Access Codes" on page 2-7
- “Configuring ORs” on page 2-9
- “Configuring the Channel Cards for Swift64 and SBB” on page 2-10
- “Removing the LED Label” on page 2-11
- "Activating Configurations" on page 2-11
- "Verifying Configurations" on page 2-11

A. Setting up Airborne Networks

For information about setting up airborne networks, refer to the eNfusion™ High-speed Data Terminal Developer’s Guide, MN-1252-13005.

B. Mapping User Devices for ISDN Services

This section describes how the HSD-440 terminal manages ISDN traffic for user devices connected to the network.

HSD-440 terminals support connection to a multitude of user devices, allowing the user to customize their system. Because each equipment setup is different, the HSD-440 terminal uses routing codes to make sure 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, or 56 kbps data).

The physical interface for ISDN service is EURO S/T, which supports several types of connections to user equipment. HSD-440 terminals provide one ISDN S/T (BRI) Bus interface.

The ISDN bus is capable of hosting up to 8 EURO ISDN physical devices.

The channel card provides two Swift64 channels. If the channels are busy or in-call, the request for service is denied (the system is busy).

Refer to Table 2-3, Table 2-4, and Table 2-5 for the default MSNs assigned within the HSD-440 terminal.

Table 2-3 Service Types and MSNs

Service Type	IMN	MSN
64 kbps speech	60xxxxxx1 (See Note below)	MSN 40[1]
3.1 kHz audio	60xxxxxx2	MSN 20
56 kbps data	60xxxxxx3	MSN 30
64 kbps data	60xxxxxx4 60xxxxxx5 60xxxxxx6	MSN 10[2] MSN 11[2] MSN 12[2]
AMBE+2		Default SBB service—no 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) IMNs

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, and 64 kbps data).

When registering your system, request IMNs for each service-type device attached to the HSD-440 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.

NOTE: To get assigned extra or multiple IMNs 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: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 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) MSNs

MSNs act as identification and routing codes for user devices attached to the HSD-440 terminal ISDN bus. 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).

The HSD-440 terminal channel card is assigned one FWD ID and an IMN for each service type for which the system is registered with the service provider. Table 2-4 provides the list of the MSNs recognized by the HSD-440 terminal. 64 kbps data service supports 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

The three MSNs assigned to 64 kbps ISDN support connection to three separate devices mapped to separate but similar IMNs.

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

Configure all devices (e.g., telephones, fax machines, laptops) connected to HSD-440 terminals with an appropriate MSN. Refer to the device manufacturer's user documentation for specific instructions to enter or configure the MSN.

Table 2-4 MSNs

FWD ID	Service Type	IMN	MSN
Channel card 1 (XAXXXX)	64 kbps speech	60xxxxxxx	40
Channel card 1 (XAXXXX)	3.1 kHz audio	60xxxxxxx	20
Channel card 1 (XAXXXX)	56 kbps data	60xxxxxxx	30
Channel card 1 (XAXXXX)	64 kbps data	60xxxxxxx	10, 11, 12

Table 2-5 System Assignments for Incoming Calls

Entry	Periph	MSN	TID	Call Type	Redir
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

C. Understanding CMU Messages

The CMU communicates with the HSD-440 terminal using two types of communications: Broadcast messages and Bit Oriented Protocol (BOP) messages. Both types of communication are supported at the same time.

Appendix F: “ACARS/CMU Messages” on page F-1 includes descriptions of the messages that the CMU will transmit to the HSD-440 terminal and receive from the HSD-440 terminal.

D. Configuring Terminal Categories

This section describes how to configure the system parameters using the MPU.

For this release, the HSD-440 terminal is in Stand-Alone Mode by default. The factory default for the Terminal Category is configured to 2=HW Strapping. If the HSD-440 terminal does not have the recommended hardware strapping for the system configuration, the terminal category must be configured using the HSD-440 terminal maintenance port EEPROM parameters.

To configure the Terminal Category:

1. Connect a computer to the maintenance port of the HSD-440 terminal as described in "Test and Fault Isolation" on page 4-1, and then power up the system.
2. To select misc. EEPROM parameters, in Menu 3, press M.

   The Miscellaneous Parameters list appears. The available parameters may differ depending on the version of control processor software.
3. To select the Terminal Category, type **16**, and then press ENTER.

   The Terminal Category Menu appears.

4. To select Stand-Alone, press 1, and then press ENTER.

   A system message appears stating that the EEPROM has been updated. This completes the configuration of the terminal category for Stand-Alone Mode.

5. To activate the new configuration, reset the HSD-440 terminal.

E. Configuring the APN (Access Point Name)

The APN is the gateway between the SBB core network and the internet. To obtain the APN, contact your service provider.

To configure the APN:

1. Connect to the Maintenance Port Utility (MPU) of the HSD-400 terminal—see "Terminal MPU" 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 99, type **99**, 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.

F. Configuring LES Access Codes

This section describes how to configure the HSD-440 terminal with the LES Access Codes provided by your Inmarsat service provider.

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

NOTE: You can remove the label that covers the LES Access Codes LEDs once you have configured the LES Access Codes.

NOTE: HSD-440 terminals are shipped with the factory default LES Access Codes set to 0 (zero). All HSD-440 terminals must be configured with the valid LES Access Codes provided by your ISP.

NOTE: When configuring the LES Access Codes using the HSD-440 terminal MPU, the application requests the input of a Secondary LES Access Code. At the time of writing, Inmarsat has 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-440 terminal. The Secondary LES Access Code must be the same as the Primary LES Access Code.

Table 2-6 Inmarsat Swift64 LES Operator and Access Codes

Land Earth Station Operator	Country	OR			
		AOR-E	AOR-W	IOR	POR
Vizada	USA	001	001	001	001
Stratos	UK/Canada	002	002	002	002
Stratos (Auckland LES) Xantic (Burum LES) Xantic (Perth LES)	New Zealand Netherlands Australia	012	012	012	012

(1) Changing LES Access Codes using the Control Processor Software

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

1. Connect to the Maintenance Port Utility (MPU) of the HSD-440 terminal—see "Terminal MPU" on page 4-2 for connection details.
2. Type the password **maint**.
3. To navigate to maintenance menu 3, press CTRL + N.
4. In Menu 3, press K.
5. Follow the application prompts, and enter the LES Access Code.

(2) Changing LES Access Codes on a Call-by-Call Basis

To change the LES Access Code on a call-by-call basis in all control processor software versions:

- Enter the following dial-sequence (Xantic POR LES Access Code [012] as an example only):

> 901 + LES CODE + International Code + Country Code
>
> + Area Code + Telephone Number + POUND/HASH KEY
>
> Example: 901 + 012 + 00 + 1+ 613+5551212 + #

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.

G. Configuring Forward IDs

To configure Forward IDs:

1. Connect to the Maintenance Port Utility (MPU) of the HSD-440 terminal—see "Terminal MPU" on page 4-2 for connection details.
2. Type the password **maint**.
3. To navigate to maintenance menu 3, press CTRL + N.
4. To set control processor ORT parameters, press K.
5. To configure the Forward ID, type **32**, and then press ENTER**.**

6. Type the Forward ID, and then press ENTER.

NOTE: The HSD-440 terminal must be reset for the Forward ID to take effect.

H. Configuring ORs

Each OR provides access to specific services. ORs must be configured to support SBB where SBB services are available.

Table 2-7 lists the regions where SBB services are available at the time of publishing.

Table 2-7 Ocean Regions Supporting SBB

Region Name	Sat. Long.
Americas	98.0W
EMEA	25.0E
Asia-Pacific	178.0E

To configure ORs for SBB:

1. Connect to the HSD-440 terminal's MPU—see "Terminal MPU" 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, press ENTER to accept the default OR name.
6. At the command prompt, press ENTER to accept the default longitude.
7. At the command prompt, press ENTER to accept the default terrestrial network ID.
8. 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.
9. If you are finished configuring the HSD-440 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-440 terminal—-see "Terminal MPU" 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-440 terminal—see "Terminal MPU" 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.

I. 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

To configure a channel card for Swift64 and SBB

1. Connect a computer to the maintenance port of the HSD terminal. For more information, refer to “Terminal MPU” 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 **97**, 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.

```
CHANNEL CARD CONFIGURATION     CC #1  BGAN 6X
                                 FALLBACK 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.
7. To configure the HSD-440 terminal to operate as a type 6 terminal, press **6**.

   The HSD-440 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 FALLBACK TO SW64 PERMITTED
  1 = SW64 NEVER PERMITTED
  2 = GAN PRIORITY -- BGAN ONLY IF SW64 NOT AVAILABLE
PRIORITY ? BGAN PRIORITY, BUT FALLBACK TO SW64 PERMITTED
```

   The prompt for channel card two configuration appears.

```
PRIORITY ? BGAN PRIORITY, BUT FALLBACK TO SW64 PERMITTED

CC #2 = ?
 EEPROM UPDATED
```

9. To save changes, reset the HSD-440 terminal.

J. 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.

K. Activating Configurations

After configuring the HSD-440 terminal parameters, the HSD-440 terminal must be reset using one of the following methods:

- In Menu 2, press Z
- Cycle the power to the HSD-440 terminal
- Press the reset or remote reset button on HSD-440 terminals installed in Stand-Alone Mode

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

L. Verifying Configurations

This section describes how to view the HSD-440 terminal configuration parameters.

To view the HSD-440 terminal ORT system configuration:

1. In Menu 3, press H.

   The List ORT appears.

2. Press 1 to display the CP ORT.
3. To scroll through the listing, press H.

3. Using Terminals

This section describes how to:

- Place Swift64 voice and fax calls using the ISDN interface of the HSD-440 terminal
- Use the MPDS and Mobile ISDN data connections
- Operate the MCDU
- Operate Cockpit Communications

A. Placing Swift64 Voice and Fax Calls

Placing voice and fax calls using the HSD-440 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-440 terminal dialing-number-sequence includes different routing components or codes. Figure 2-1 illustrates the required order of the dialing components.

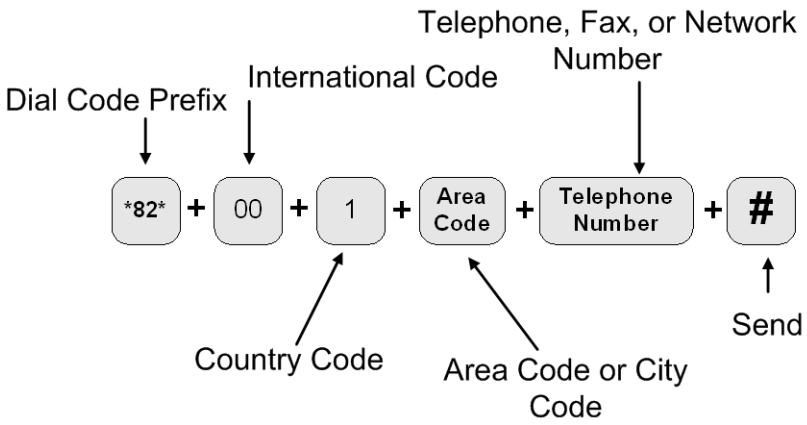

Figure 2-1 Dialing-Sequence Components

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 2-1 uses the Dial Code Prefix for 3.1 KHz audio service type (*82*). See Table 2-8 for other Dial Code Prefixes.

- International Access Code:

  Use the international access code of the ground location when making 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.

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

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

- POUND SIGN (#):

  To signal the system to send the call, at the end of the telephone dial string, press or enter POUND SIGN. Certain devices using the HSD-440 terminal may not have the function to insert the POUND SIGN 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 2-9 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 2-8).

The system requires the Dial Code Prefix *82* for sending faxes 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 POUND SIGN to the dialing string or devices that are slow dialing. Table 2-8 provides a description of the additional Dial Code Prefixes used for system overrides for Swift64 and SBB. Table 2-6 provides a list of the LESs and their associated codes.

Note: Prefix *83* is not supported for SBB.

Table 2-8 Dial Code Prefixes for Forcing Service Type Selection

Service Type	Service Description	Dial Code Prefix (Forces service selection)
Speech 64 kbps	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*

Table 2-9 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. *This Dial Code Prefix signals the system to override the default LES and use the selected LES instead. (See Figure 2-8 or contact Inmarsat for Swift64 LES codes).*	901 + LES CODE	901 + LES CODE + International Code + Country Code + Area Code + Telephone Number + POUND KEY 901 + 002 + 00 + 1+ 613 +5551212 + POUND KEY
Use with devices that cannot produce or add a POUND SIGN to end the dialing sequence. *This Dial Code Prefix signals the system to send the call after a specified delay in user input when the POUND SIGN cannot be entered.*	902	902 + International Code + Country Code + Area Code + Telephone Number 902 + 00 + 1+ 613 + 5551212
Use with slow dialing devices that cannot produce or add a POUND SIGN 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 903 + 00 + 1+ 613 + 5551212

(2) Mobile-to-Mobile Communication

The HSD-440 terminal provides a two-way link for aircraft-to-aircraft communication.

Calling an aircraft requires additional information. You need to know the IMN of the device or service on the aircraft you are calling. Table 2-10 lists the SNAC and the Satellite OR number.

Table 2-10 Satellite OR Codes

Code Name	Code Number
SNAC	870

B. Using Data Connections

For information about data connections, optimizing your airborne network and selecting the service that best meets your needs, refer to the HSD High-speed Data Terminal Developer's Guide, MN-1252-13005.

Refer to the HSD High-speed Data Terminal Setup Guide, MN-1110-10048, for instructions on configuring dial-up networking connections.

C. Operating the MCDU

The MCDU interface includes output and input ports, the screen, and the keyboard.

NOTE: The following descriptions apply to a Universal MCDU. Other MCDU types may differ slightly.

(1) Output Ports

The MCDU transfers its identification and commands to the HSD-440 terminal using 32 bit words and a 12-14.5 kbps output port, as defined in ARINC Specification 429, Digital Information Transfer System (DITS).

(2) Input Ports

The MCDU receives identification information and display data from individual subsystems using seven input ports, as defined by ARINC Specification 429. Ports 1 and 2 are reserved for FMSs, and they operate at 100 kbps. Ports 3–7 are available for the MCDU to communicate with the HSD-440 terminal, and they operate at 12-14.5 kbps.

(3) Screen

The MCDU displays all data on the screen, as shown in Figure 2-2.

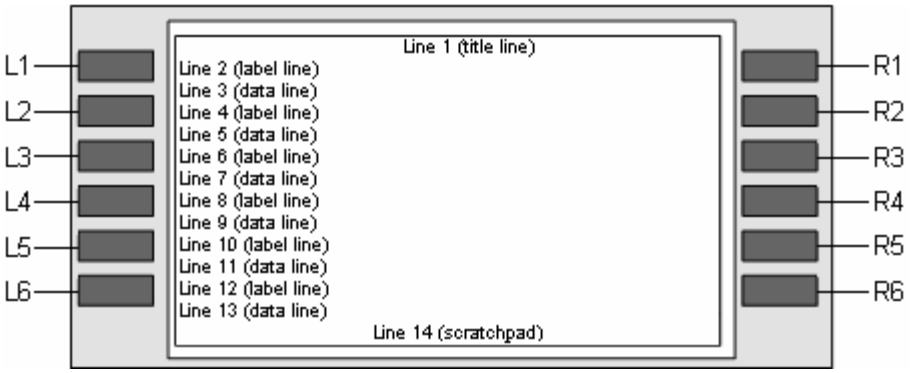

Figure 2-2 MCDU Screen

The screen is divided into 14 rows and 24 columns. The first line is usually the title line for the displayed menu. The last line, called the scratchpad, is where you can see the data you have entered on the keyboard.

Between the title line and the scratchpad are six pairs of lines that correspond to the six line select (LS) keys on either side of the screen. The upper line of each pair is the label line, and the lower line is the data line. The six keys are designated left (L) and right (R) and numbered 1–6 from top to bottom.

(4) Keyboard

The MCDU's keyboard includes a set of numeric keys and a set of alphabetic keys, both of which you can use to enter data into the MCDU.

The keyboard may include preset keys, such as the following:

- The **IDX** or **MAIN MENU** key: this key returns you to the MCDU's main menu.

- The **CLR** key: this key clears any text you type into the scratchpad.
- The **NEXT PAGE** key: this key brings up the next page of a menu if one is available.

You can program the other keys in the keyboard according to your requirements.

(5) Special Symbols

Because of space constraints on the screen, the MCDU uses a number of special symbols to indicate actions:

- **<** and **>** appear at the far left or right to indicate that another menu page is available in that direction.
- **NUMBER/NUMBER** appears to tell you which page out of how many pages you are viewing. For example, **1/2** would appear when you are on page 1 of 2 pages in total.
- ***** appears when an action is associated with that key. For example, pushing the key beside the ***** could make a phone call, enter a password, or initiate a log off.
- **[** and **]** appear around the first item in a list. Each instance of a list should be below a line item with a * beside it. You can push the key beside the * repeatedly to display the other items in the list. See ARINC 739A, section 3 and Attachment 10 for details.

(6) Navigating the MCDU

The MCDU includes a number of menus, as shown in Figure 2-3.

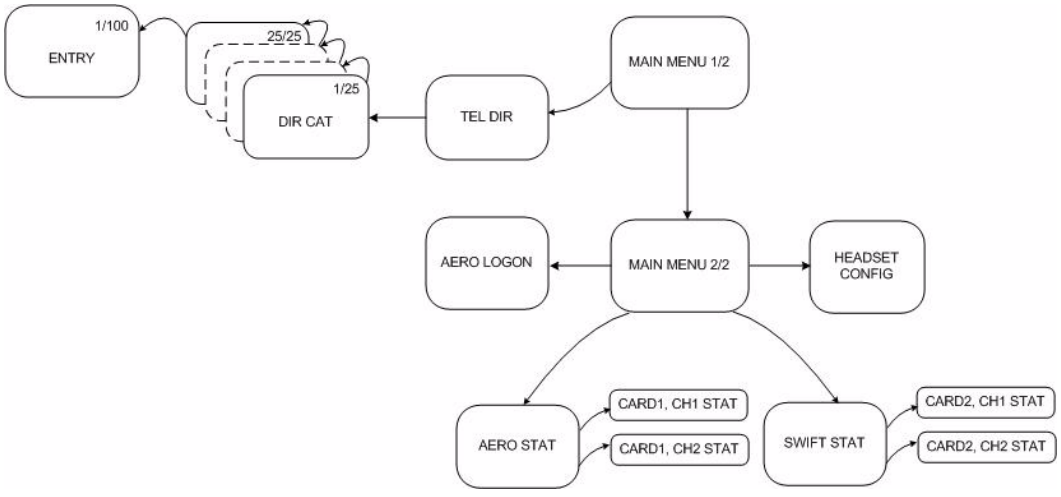

Figure 2-3 MCDU Menus

This section will help you perform the following tasks:

- Modifying Logon Settings
- Viewing Channel Status
- Performing Maintenance

(7) Modifying Logon Settings

You can control how the HSD-440 terminal logs onto the network with the MCDU.

(a) Viewing the Logon Status

The logon status defines whether the HSD-440 terminal is currently logged on or logged off.

To view the logon status:

1. On the second page of the MCDU's main menu, press the key next to **AERO LOGON**.

   The SATCOM AERO LOGON menu appears, as shown in Figure 2-4. The MCDU displays the log status on the line below **SATCOM AERO LOGON** as **LOGGED ON** or **NOT LOGGED ON**.

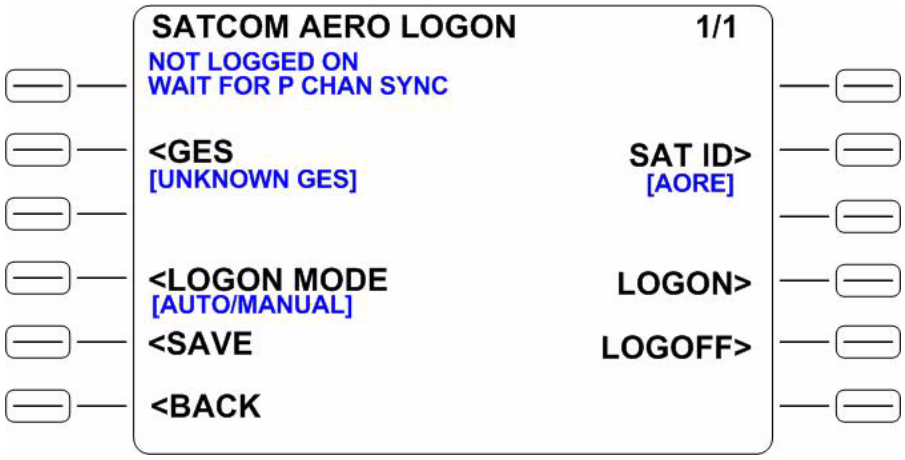

Figure 2-4 SATCOM AERO LOGON Menu

(b) Selecting GESs

You can change the GES preferences using the MCDU.

To select a GES:

1. On the second page of the MCDU's main menu, press the key next to **AERO LOGON**.

   The SATCOM AERO LOGON menu appears.

2. Press the key next to **GES** until the MCDU displays the GES you want to associate with that channel.

3. Press the key next to **SAVE**.

(c) Changing Logon Mode

You can set the HSD-440 terminal to log on automatically or manually.

To change the logon mode:

1. On the second page of the MCDU's main menu, press the key next to **AERO LOGON**.

   The SATCOM AERO LOGON menu appears.

2. Press the key next to **LOGON MODE** until the MCDU displays the desired logon mode.

3. Press the key next to **SAVE**.

(d) Changing Logon Satellite ID

You can change the satellite ID to which the HSD-440 terminal will log on.

To change the logon satellite ID:

1. On the second page of the MCDU's main menu, press the key next to **AERO LOGON**.

   The SATCOM AERO LOGON menu appears.

2. Press the key next to **SAT ID** until the MCDU displays the satellite ID to which you want the HSD-440 terminal to log on.

3. Press the key next to **SAVE**.

(e) Logging on Manually

If you have configured the HSD-440 terminal to require a manual logon, you can log on manually using the MCDU.

To log on manually:

1. On the second page of the MCDU's main menu, press the key next to **AERO LOGON**.

   The SATCOM AERO LOGON menu appears.

2. To start the manual logon sequence, press the key next to **LOGON**.

   CONFIRM appears on the line below **LOGON** when the logon sequence is complete.

(f) Logging Off

You can initiate the log off sequence from the HSD-440 terminal with the MCDU.

To log off:

1. On the second page of the MCDU's main menu, press the key next to **AERO LOGON**.

   The SATCOM AERO LOGON menu appears.

2. Press the key next to **LOGOFF**.

(8) Viewing Channel Status

From the second page of the MCDU's main menu, you can view the status of each of the four channels on the HSD-440 terminal.

To view the status menu for a channel:

1. On the second page of the MCDU's main menu, as shown in Figure 2-5, press the key next to AERO STAT to view the SATCOM AERO STAT menu or press the key next to HSD STAT to view the SATCOM HSD STAT menu.

   The SATCOM AERO STAT menu is shown in Figure 2-6. The SATCOM HSD STAT menu is shown in Figure 2-7.

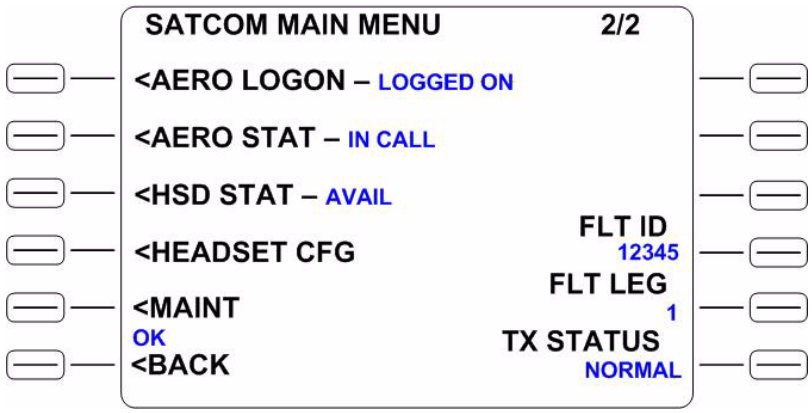

Figure 2-5 SATCOM MAIN MENU (Page 2)

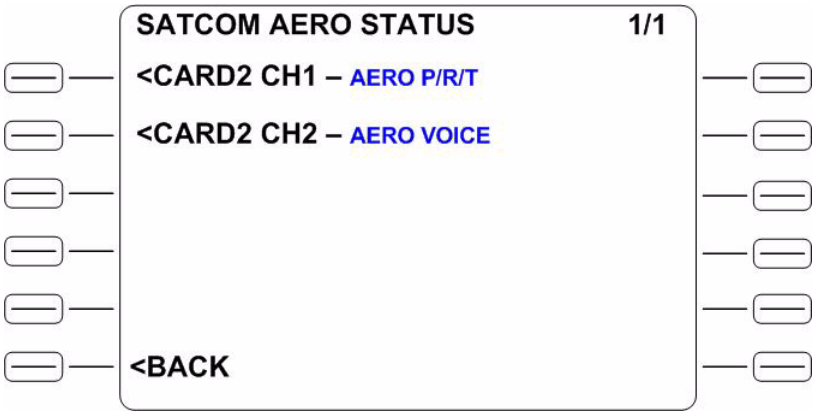

Figure 2-6 SATCOM AERO STATUS Menu

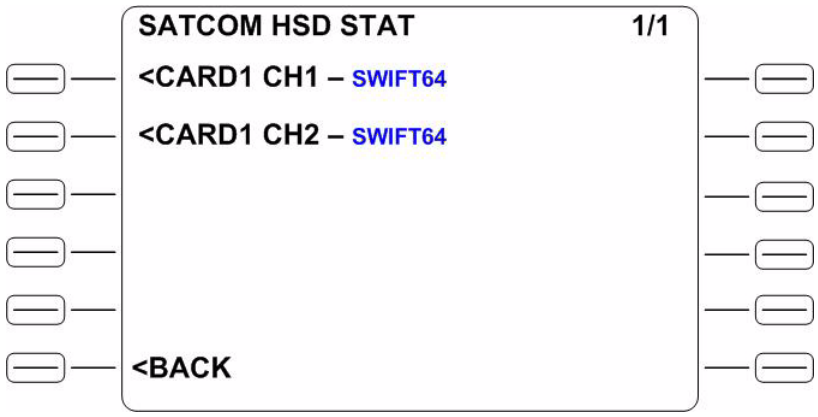

Figure 2-7 SATCOM HSD STATUS Menu

2. On the SATCOM AERO STAT menu or the SATCOM HSD STAT menu, press the key next to the channel for which you wish to view the status.

   The menu for Aero Card 2, Channel 1 is shown in Figure 2-8. The menu for HSD Card 1, Channel 1 is shown in Figure 2-9. Similar menus are available for the remaining channel cards.

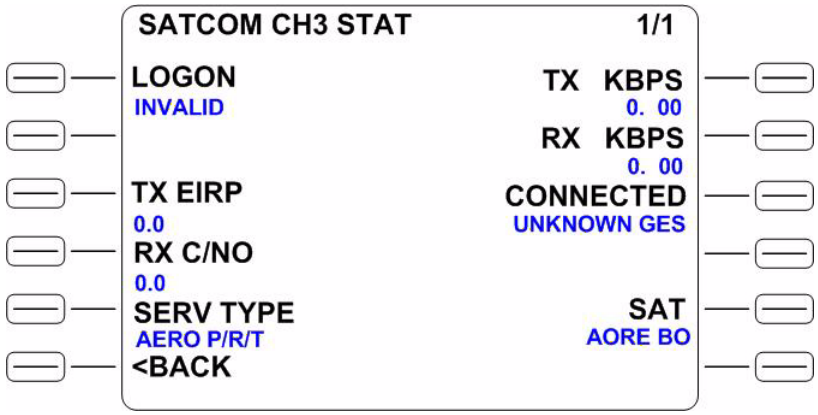

Figure 2-8 SATCOM AERO CARD2 CH1 STAT Menu

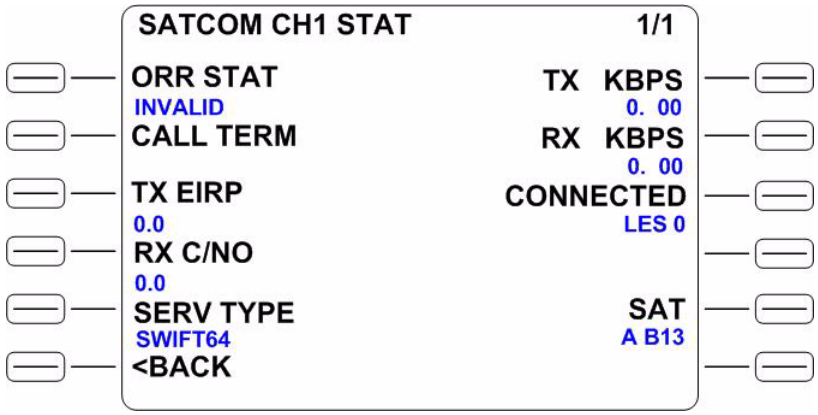

Figure 2-9 SATCOM HSD CARD1 CH1 STAT Menu

On the channel status menu (Figure 2-8 and Figure 2-9), you can view the following detailed information about the operation of a channel:

- Logon status
- Call termination code
- Transmitter Effect Isotropic Radiated Power (EIRP)
- Receiver carrier-to-noise ratio
- Service type
- Number of bits transmitted per second (kbps)
- Number of bits received per second (kbps)
- Service information
- Satellite ID

(a) Viewing the Logon Status

To view the logon status for AERO channels:

- On the SATCOM AERO STAT menu, press the key next to channel for which you wish to view the logon status.

  The MCDU displays the logon status on the line below **LOGON** as either **VALID** or **INVALID**.

To view the logon status for HSD channels:

- On the SATCOM HSD STAT menu, press the key next to channel for which you wish to view the logon status.

  The MCDU displays the logon status on the line below **ORR STAT** as either **VALID** or **INVALID**.

(b) Viewing the Call Termination Code

The call termination code is a two-digit number that corresponds to a call termination reason, such as a line failure.

NOTE: Call Termination Code is not available for Aero channels.

To view the call termination code for HSD channels:

- On the SATCOM HSD STAT menu, press the key next to channel for which you wish to view the call termination code.

  The MCDU displays the call termination code on the line below **CALL TERM**.

(c) Viewing the Transmitter EIRP

To view the transmitter EIRP:

- On the SATCOM AERO STAT menu or SATCOM HSD STAT menu, press the key next to channel for which you wish to view the transmitter EIRP.

  The MCDU displays the transmitter EIRP on the line below **TX EIRP**.

(d) Viewing the Receiver Carrier-to-Noise Ratio

To view the receiver carrier-to-noise ratio:

- On the SATCOM AERO STAT menu or SATCOM HSD STAT menu, press the key next to channel for which you wish to view the receiver carrier-to-noise ratio.

  The MCDU displays the receiver carrier-to-noise ratio on the line below **RX C/NO**.

(e) Viewing the Service Type

The MCDU displays the service type as an acronym.

To view the service type:

- On the SATCOM AERO STAT menu or SATCOM HSD STAT menu, press the key next to channel for which you wish to view the service type.

  The MCDU displays the service type on the line below **SERV TYPE**.

(f) Viewing the Number of Bits Transmitted Per Second

The number of bits being transmitted per second is expressed in kilobits per second (kbps).

To view the number of bits being transmitted per second:

- On the SATCOM AERO STAT menu or SATCOM HSD STAT menu, press the key next to channel for which you wish to view the number of bits being transmitted per second.

  The number of bits being transmitted per second are displayed on the line below **TX KBPS**. When a circuit switched service has been selected or configured, the MCDU screen displays no data.

(g) Viewing the Number of Bits Received Per Second

The number of bits being received per second is expressed in kilobits per second (kbps).

To view the number of bits being received per second:

- On the SATCOM AERO STAT menu or SATCOM HSD STAT menu, press the key next to channel for which you wish to view the number of bits being received per second.

  The number of bits being received per second are displayed on the line below **RX KBPS**. When a circuit switched service has been selected or configured, the MCDU screen displays no data.

(h) Viewing Service Information

If you have Aero service, service information includes the GES number and name description. If you have GAN (Swift64) service, service information includes the service provider number and name description.

To view service information:

- On the SATCOM AERO STAT menu or SATCOM HSD STAT menu, press the key next to channel for which you wish to view service information.

  The MCDU displays the service information on the line below **CONNECTED**.

(i) Viewing Satellite IDs

Satellite IDs include the index number of each satellite, a mnemonic and abbreviated alphanumeric description, and the number of the spot beam that the HSD-440 terminal is currently using.

To view satellite IDs:

- On the SATCOM AERO STAT menu or SATCOM HSD STAT menu, press the key next to channel for which you wish to view satellite IDs.

  The MCDU displays the satellite IDs on the line below **SAT**.

  NOTE: All channels and channel cards must be logged into the same satellite; however, they may be operating through different spot beams.

(9) Performing Maintenance

You can modify headset configuration and initiate self-tests on the HSD-440 terminal from the MCDU.

(a) Modifying Headset Configuration

You can modify some headset configurations using the MCDU, including the cockpit voice levels and noise insertion level.

The cockpit voice level refers to the level at which the cockpit microphone transmits its signal and the level at which the headset/speaker receives its signal.

Noise insertion minimizes the amount of noise modulation you hear when the GES drops its carrier in the forward direction during speech pauses.

To modify headset configuration:

1. On the second page of the MCDU's main menu, as shown in Figure 2-5, press the key next to **HEADSET CFG**.

   The SATCOM HEADSET CONFIG menu appears, as shown in Figure 2-10.

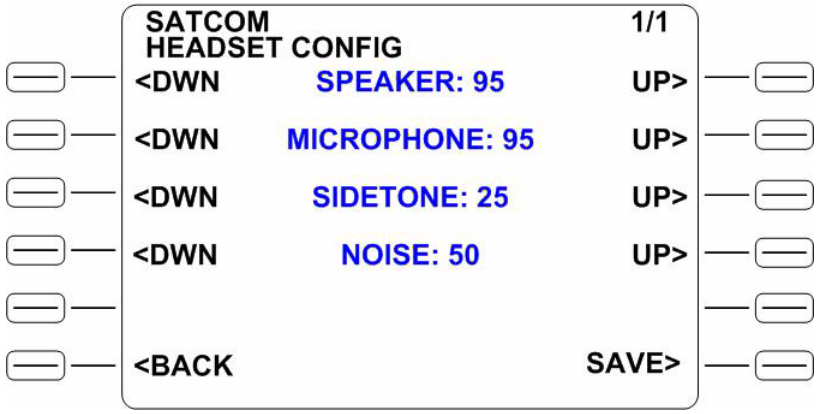

Figure 2-10 SATCOM HEADSET CONFIG Menu

NOTE: The numbers move up and down by increments and decrements of 5.

2. To increase or decrease the speaker, microphone, sidetone, and noise insertion levels, press the keys next to **DWN** and **UP**.
3. Press the key next to **SAVE**.

(b) Initiating a Person Activated Self Test (PAST)

CAUTION: INITIATING A PAST DROPS ANY VOICE OR DATA CALLS THAT ARE IN PROGRESS.

A PAST completely resets the HSD-440 terminal. The HSD-440 terminal drops any telephone calls that are in progress, and the AES drops off the Inmarsat satellite communications system. When the HSD-440 terminal reboots, updated BITE data appears on the appropriate screens in the MCDU. This is equivalent to a POST.

The HSD-440 terminal performs a self-test during the power up sequence. You can initiate a PAST by pressing the TEST button on the front panel of the HSD-440 terminal and holding it down for three seconds or more. You can also initiate a PAST through the MCDU.

NOTE: You can only initiate a PAST when the aircraft is on the ground.

NOTE: You can only access the MAINT menu if the “Allow MCDU PAST” ORT setting is enabled.

To initiate a PAST:

1. On the second page of the MCDU’s main menu, press the key next to **MAINT**.

   The SATCOM DIAG menu appears, as shown in Figure 2-11.

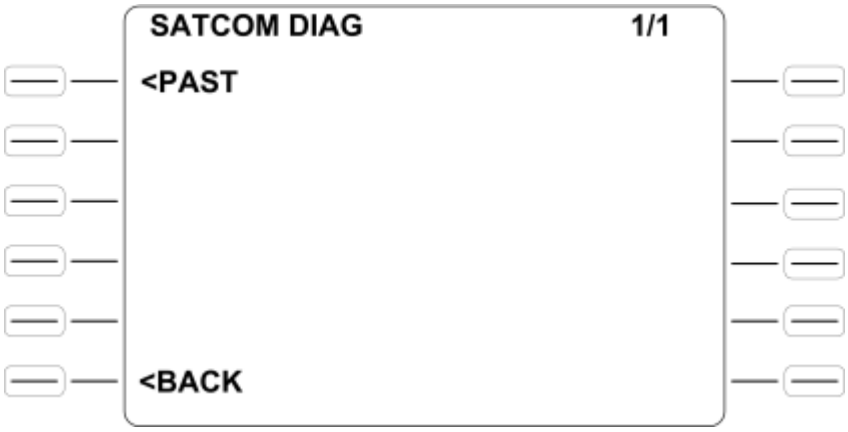

Figure 2-11 SATCOM DIAG Menu

2. To initiate the PAST, press the key next to **PAST**.

D. Cockpit Communications

This section provides instructions for making calls with the MCDU and 4-wire voice services available in the aircraft's cockpit. The cockpit communications system operates with a headset in the aircraft's cockpit.

(1) Modes of Operation

The cockpit communication services are configured in one of two modes of operation before installation: Latched mode and Push-to-Talk (PTT) mode. These configurations are strapped at the terminal and cannot be changed without removing and rewiring the terminal.

In PTT mode, a telephone number can be dialed only using the MCDU keys, not with the switches on the cockpit communication console. In Latched mode, a call to a telephone number loaded into the MCDU can be initiated using the switches on the audio Control Panel (ACP), and calls can be answered and ended with the switches and the MCDU buttons.

(2) Accepting and Making Calls

You can accept and make air-to-ground and air-to-air voice calls using the HSD-440 terminal, the MCDU, the ACP, and a 4-wire cockpit headset.

The way in which you can accept or make calls depends on the mode in which your 4-wire cockpit headset is strapped: PTT mode or Latched mode.

(a) PTT Mode

You can use the MCDU and ACP to accept calls, make air-to-ground calls, and make air-to-air calls in PTT mode. You can make new calls or dial previously saved telephone numbers from the MCDU's telephone directory.

1. Accepting Calls in PTT Mode

   You can use the MCDU and ACP to accept incoming calls, including when another call is in progress. The combination of lights and chimes that alert you to an incoming call depends on the way in which the HSD-440 terminal was strapped during its installation.

   To accept a call in PTT mode:

   1. To accept the call:

      - On the first page of the MCDU's main menu, as shown in Figure 2-12, press the key next to **ANSWER**.

        or

      - On the ACP, assert the **PLACE/END CALL 1** switch or close the **PTT 1** switch.

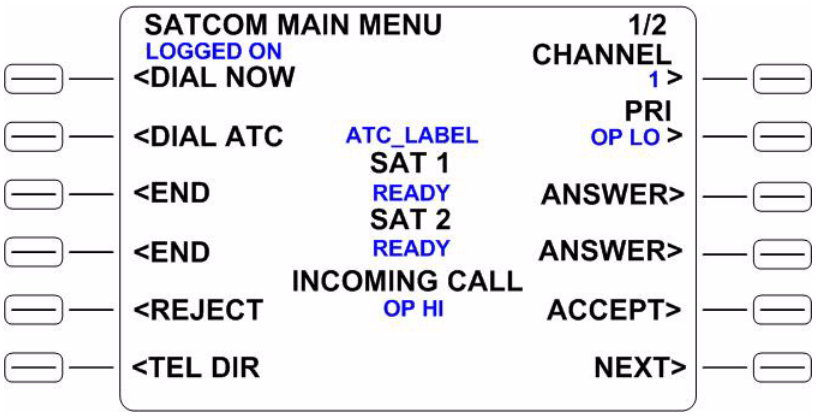

Figure 2-12 SATCOM MAIN MENU (Page 1 of 2)

   2. To end the call:

      - On the MCDU, press the key next to **END**.

        or

      - On the ACP, assert the **PLACE/END CALL 1** switch or open the **PTT 1** switch.

   To accept a call in PTT mode when another call is in progress:

   1. To accept the call, on the first page of the MCDU's main menu, press the key next to **ACCEPT**.

      The original call ends.

2. To end the call:
   - On the MCDU, press the key next to **END**.

     or

   - On the ACP, assert the **PLACE/END CALL 1** switch or open the **PTT 1** switch.

2. Making New Calls in PTT Mode

   Making calls using the HSD-440 terminal is similar to placing an international telephone call. Air-to-ground telephone numbers include an international access code, country code, and area code. Air-to-air telephone numbers include a SNAC or OR and an IMN.

   International access codes and country codes are shown in Appendix G: “International Access and Country Codes” on page G-1.

   OR numbers are shown in Table 2-11.

Table 2-11 OR Numbers

OR	OR number
AOR-E	871
AOR-W	874
POR	872
IOR	873

To make a new call in PTT mode:

1. On the first page of the MCDU’s main menu, type the full telephone number you want to call into the MCDU keyboard.
2. To set the priority for your call using Table 2-12, press the key next to **PRIORITY**.

Table 2-12 Priority Codes

Call priority	Description
EMG	Emergency—used for distress or urgent calls
OP-HI	Operational-High—used for Flight Safety communications
OP-LO	Operational-Lo—used for Regularity of Flight, Meteorological or Administrative communications
NON-OP	Non-Operational—used for Non Safety of Flight or public phone call (cabin) communications

3. To dial the call:
   - On the MCDU, press the key next to **DIAL NOW**.

     or

   - On the ACP, assert the **PLACE/END CALL 1** switch or close the **PTT 1** switch.
4. To end the call:
   - On the MCDU, press the key next to **END**.

     or

   - On the ACP, assert the **PLACE/END CALL 1** switch or open the **PTT 1** switch.

3. Making Calls from the Telephone Directory in PTT Mode

   You can make voice calls from the numbers you have saved in the MCDU's telephone directory.

   To make a call from the telephone directory in PTT mode:

   1. On the first page of the MCDU's main menu, press the key next to **TEL DIR**.

      The SATCOM TEL DIR menu appears, as shown in Figure 2-13.

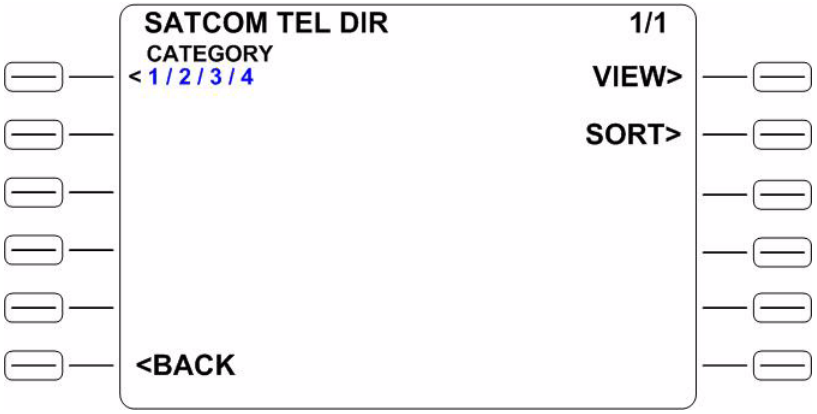

Figure 2-13 SATCOM TEL DIR Menu

   2. Press the key next to **CATEGORY** to select a phone book.

      The SATCOM TEL CAT menu appears, as shown in Figure 2-14.

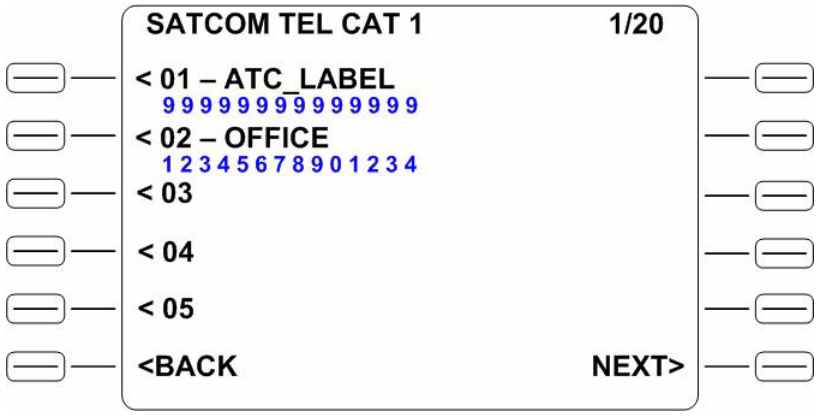

Figure 2-14 SATCOM TEL CAT 1 (Page 1 of 20)

3. Press the key next to the entry you want to dial.

   The SATCOM ENTRY menu appears, as shown in Figure 2-15.

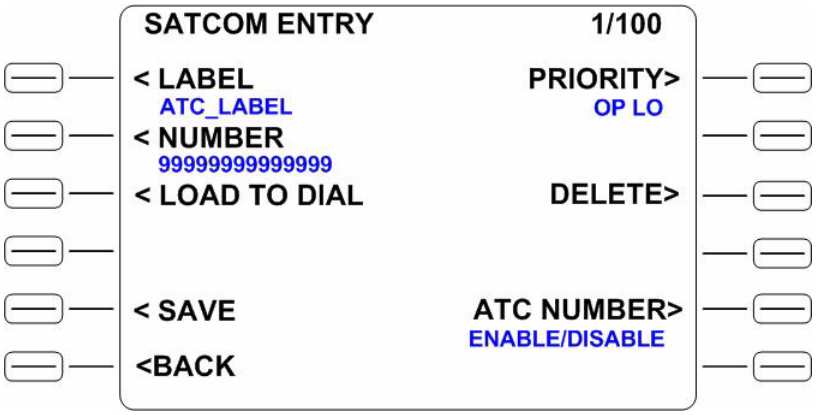

Figure 2-15 SATCOM ENTRY Menu (Page 1 of 100)

4. To load the telephone number, press the key next to **LOAD TO DIAL**.

   The MCDU's main menu appears, as shown in Figure 2-16.

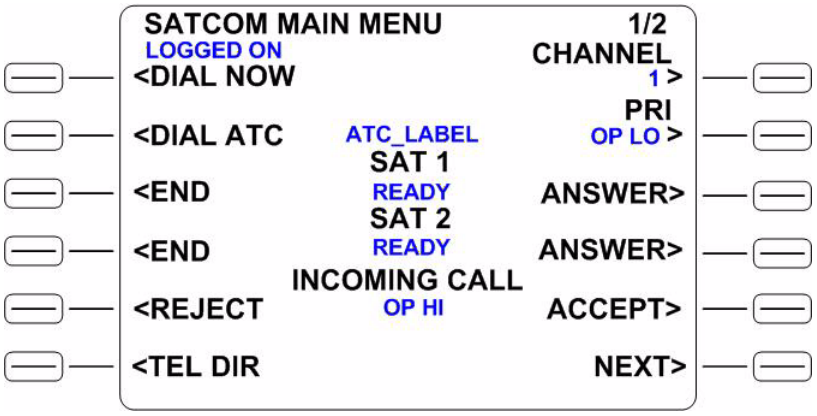

Figure 2-16 SATCOM MAIN MENU (Page 1 of 2)

5. To dial the call:
   - On the MCDU, press the key next to **DIAL NOW**.

     or

   - On the ACP, assert the **PLACE/END CALL 1** switch or close the **PTT 1** switch.
6. To end the call:
   - On the MCDU, press the key next to **END**.

     or

   - On the ACP, assert **PLACE/END CALL 1** switch or open the **PTT 1** switch.

(b) Latched Mode

You can use the MCDU and ACP to accept calls, make air-to-ground calls, and make air-to-air calls in Latched mode. You can make new calls or dial previously saved telephone numbers from the MCDU's telephone directory.

1. Accepting Calls in Latched Mode

   You can use the MCDU and ACP to accept incoming calls, including when another call is in progress. The combination of lights and chimes that alert you to an incoming call depends on the way in which the HSD-440 terminal was strapped during its installation.

   To accept a call in Latched mode:

   1. To accept the call, on the ACP, close the **PTT 1** switch.
   2. To end the call:
      - On the ACP, open the **PTT 1** switch or assert the **PLACE/END CALL 1** switch.

        or

- On the MCDU, press the key next to **END**.

To accept a call in Latched mode when another call is in progress:

1. To accept the call, on the first page of the MCDU's main menu, press the key next to **ACCEPT**.

   The original call ends.

2. To end the call:

   - On the ACP, open the **PTT 1** switch or assert the **PLACE/END CALL 1** switch.

     or

   - On the MCDU's main menu, press the key next to **END**.

2. Making Calls in Latched Mode

   Making calls using the HSD-440 terminal is similar to placing an international telephone call. Air-to-ground telephone numbers include an international access code, country code, and area code. Air-to-air telephone numbers include a SNAC or OR and an IMN.

   To make a new call in Latched mode:

   1. On the first page of the MCDU's main menu, type the full telephone number you want to call into the MCDU keyboard.
   2. To set the priority for your call using Table 2-13, press the key next to **PRIORITY**.

Table 2-13 Priority Codes

Call priority	Description
EMG	Emergency—used for distress or urgent calls
OP-HI	Operational-High—used for Flight Safety communications
OP-LO	Operational-Lo—used for Regularity of Flight, Meteorological or Administrative communications
NON-OP	Non-Operational—used for Non Safety of Flight or public phone call (cabin) communications

   3. Press the key next to **LOAD NUMBER**.

      The full telephone number appears under **DIAL NOW**.

   4. To dial the telephone number, on the ACP, close the **PTT 1** switch.
   5. To end the call:

      - On the ACP, open the **PTT 1** switch or assert the **PLACE/END CALL 1** switch.

        or

      - On the MCDU's main menu, press the key next to **END**.

3. Making Calls from the Telephone Directory in Latched Mode

   You can make voice calls from the numbers you have saved in the MCDU's telephone directory.

   To make a call from the telephone directory in Latched mode:

   1. On the first page of the MCDU's main menu, press the key next to **TEL DIR**.

      The SATCOM TEL DIR menu appears.

   2. Press the key next to **CATEGORY** to select a phone book.

      The SATCOM TEL CAT menu appears.

   3. Press the key next to the entry you want to dial.

      The SATCOM ENTRY menu appears.

   4. To load the telephone number, press the key next to **LOAD TO DIAL**.

      The MCDU's main menu appears.

   5. On the ACP, select CH1 SATCOM.

   6. To dial the telephone number, on the ACP, close the **PTT 1** switch.

   7. To end the call:

      - On the ACP, open the **PTT 1** switch or assert the **PLACE/END CALL 1** switch.

        or

      - On the MCDU's main menu, press the key next to **END**.

(c) Saving Telephone Numbers in the Telephone Directory

You can save telephone numbers to the MCDU's telephone directory to use later, and you can dial telephone numbers from the telephone directory.

1. Saving a New Directory Entry

   To save new telephone numbers to the telephone directory:

   1. On the first page of the MCDU's main menu, press the key next to **TEL DIR**.

      The SATCOM TEL DIR menu appears.

   2. Press the key next to **CATEGORY** to select a phone book.

      The SATCOM TEL CAT menu appears.

   3. Press a key next to an empty entry. If there is no empty entry available on the first page, press the key next to **NEXT** until a free entry appears.

      A SATCOM ENTRY menu appears for this new telephone number.

   4. Type the name you want to give this telephone number into the MCDU's keyboard.

   5. To store the label, press the key next to **LABEL**.

   6. Type the telephone number for this entry into the MCDU's keyboard.

   7. To store the telephone number, press the key next to **NUMBER**.

8. Press the key next to **PRIORITY** repeatedly until the priority you want to associate with this telephone number appears.

   NOTE: When you designate a telephone number as the ATC telephone number, any other telephone number that was designated as ATC loses that designation. Only one telephone number can be designated as the ATC telephone number.

9. To make this telephone number the ATC telephone number, press the key next to **ATC NUMBER**.

10. To save your entry, press the key next to **SAVE**.

    NOTE: The **SAVE** option does not appear until you make a change to the entry.

2. Modifying an Existing Directory Entry

   To modify an existing entry in the directory:

   1. On the first page of the MCDU's main menu, press the key next to **TEL DIR**.

      The SATCOM TEL DIR menu appears.

   2. Press the key next to **CATEGORY** to select a phone book.

      The SATCOM TEL CAT menu appears.

   3. Press the key next to the entry you wish to modify.

      The SATCOM ENTRY menu appears for this entry.

   4. Type the name you want to give this telephone number into the MCDU's keyboard.

   5. To store the label, press the key next to **LABEL**.

   6. Type the telephone number for this entry into the MCDU's keyboard.

   7. To store the telephone number, press the key next to **NUMBER**.

   8. Press the key next to **PRIORITY** repeatedly until the priority you want to associate with this telephone number appears.

      NOTE: When you designate a telephone number as the ATC telephone number, any other telephone number that was designated as ATC loses that designation. Only one telephone number can be designated as the ATC telephone number.

   9. To make this telephone number the ATC telephone number, press the key next to **ATC NUMBER**.

   10. To save your entry, press the key next to **SAVE**.

       NOTE: The **SAVE** option does not appear until you make a change to the entry.

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INSTALLATION

This section describes the procedures required to install HSD-440 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–6 of this manual.

2. Pre-Installation Inspection

Before installing any HSD-440 terminal, conduct a pre-installation inspection of all parts to make sure that no damage occurred during shipping:

- Unpack the HSD-440 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-440 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 to report the problem.

3. ARINC 600 Trays and Connectors

This section provides detailed information on the ARINC 600 trays provided in the HSD-440 Installation Kits.

The HSD-440 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-440 terminals are available from EMS SATCOM. Contact the EMS SATCOM Sales department for more information on how to select and order the appropriate HSD-440 Terminal Installation Kit.

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

Table 3-1 Installation Kits

Installation Kit Name	EMS SATCOM Part Number	Description
HSD-440 Installation Kit AC FAN	1110-F-0120-01	Standard Installation Kit: Bottom AC Fan Tray Assembly and ARINC Connector (Un-pressurized Installation)
HSD-440 Installation Kit DC FAN	1110-F-0120-02	Standard Installation Kit: Bottom DC Fan Tray Assembly and ARINC Connector (Un-pressurized Installation)
8-MCU ARINC 600 Tray with four isolators	H64-BA-15 (Barry Controls)	Vibration-mount installation kit.

B. Cabling Notes

Before proceeding with the installation of the HSD-440 terminal, read all cabling notes provided on the HSD-440 Terminal Interconnection and Contact Assignment drawings (refer to Figure 3-11 and Figure 3-12).

(1) Cabling

When installing the HSD-440 terminal, follow the cabling requirements listed below:

- Maximum recommended cable length is 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-440 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-440 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-440 terminals. The Outline and Installation diagrams are provided at the end of this section, in Figure 3-7 and Figure 3-8.

This section contains the information required to plan the physical placement of the HSD-440 terminals.

The Outline and Installation diagrams, shown in Figure 3-7 and Figure 3-8, illustrate the physical and mechanical specifications of the HSD-440 terminal.

In typical aircraft installations, the HSD-440 terminal assembly fits into standard ARINC, 8-MCU mounting trays. Specialized trays that meet the requirements for installations of the HSD-440 terminals on Helicopters are also available from EMS SATCOM.

All HSD-440 terminal ARINC installation trays are included in the Installation Kits. Table 3-1 describes the HSD-440 terminal Installation Kits available from EMS SATCOM.

A. Physical Placement

When selecting a location for the HSD-440 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. SCM Installation

The SCM holds SIM cards that contain data for the operation of SBB services.

To remove the SCM:

1. Remove the two screws from the front panel of the HSD-440 terminal.
2. Remove the SCM from the HSD-440 terminal, as shown in Figure 3-1.

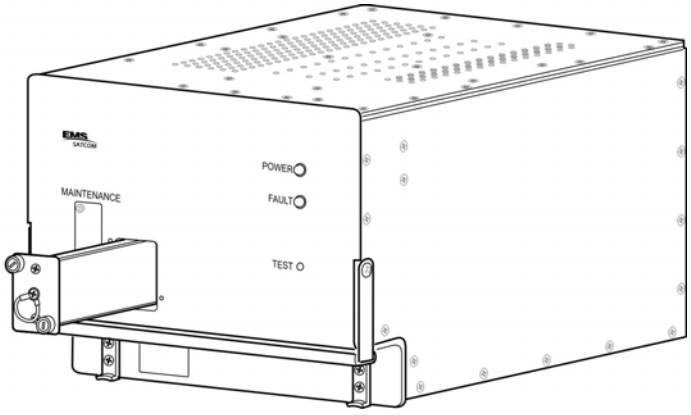

Figure 3-1 HSD-440 Terminal SCM

To install the SCM:

1. Insert the SCM into the slot on the front panel of the HSD-440 terminal.
2. Tighten the two screws on the SCM.

C. Environmental Requirements

The environmental requirements that must be considered during the physical placement of the HSD-440 terminals are based on the RTCA/DO-160E Environmental Specifications detailed in "System Description" on page 1-1.

The standard mounting trays for the HSD-440 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 "System Description" on page 1-1 for a complete listing of the RTCA/DO-160E Environmental Specifications for the HSD-440 terminals.

When selecting an installation location for the HSD-440 terminal, consider the heating and cooling requirements listed below:

- Power Dissipation (AC/DC models): 275 Watts nominal, 400 Watts maximum
- Cooling Air: per ARINC 600
- Recommended Flow rate: 88 kg/hr (185 lbs/hr)
- Pressure drop: 5 ±3 mm (0.07 ±0.025 in.) H_2O

(2) Fan Tray Requirements

WARNING: FAILURE TO INSTALL AND CONFIGURE THE FAN TRAY ASSEMBLY AS INSTRUCTED MAY SERIOUSLY COMPROMISE THE HSD-440 TERMINAL'S EXTREME TEMPERATURE OPERATION.

Fan tray assemblies may be shipped with or without hole-plug-buttons installed. For adequate airflow to the HSD-440 terminal subassemblies, the plugs must be installed or removed in the fan/tray configuration, as illustrated in Figure 3-2.

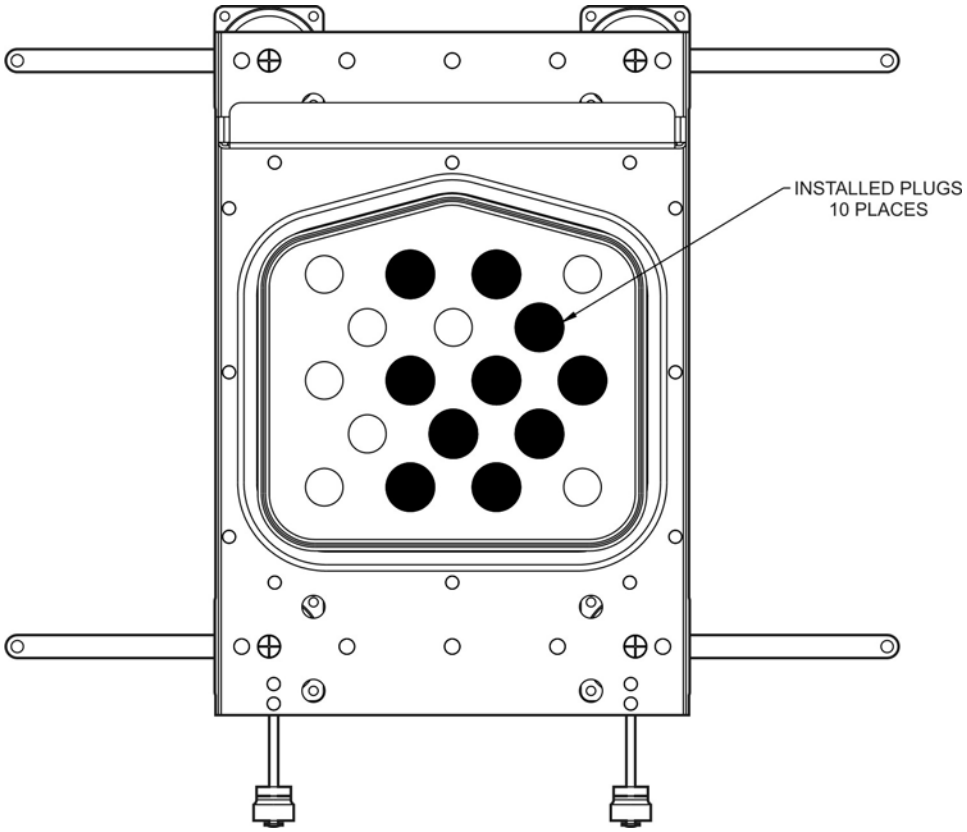

Figure 3-2 Fan Tray Plug Configuration (black = installed, white = removed)

D. Chassis Grounding

The HSD-440 terminal tray-mounted assemblies must be electrically bonded to the airframe. Make sure that 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 6.35 mm (0.25 in.) in width 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-440 terminals. This section is divided into sub-sections that provide the wiring details for the currently supported modes of operation.

A. Stand-Alone Mode Installation

(1) Cabling and Connector Requirements

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

(a) Power Requirements

The HSD-440 terminal can operate from the aircraft's +28 V dc or 115 V ac, 400 Hz (nominal) power supply. If both power sources are connected, the terminal will use the 115 V ac supply.

(b) Ground Requirements

Improper grounding can lead to ground loops and induced Electromagnetic Interference (EMI) or Radio Frequency Interference (RFI). When installing an HSD-440 terminal, follow standard grounding practices for both chassis and cabling shields. Refer to "Chassis Grounding" on page 3-5 for chassis and tray grounding instructions.

(c) 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 of 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

Cable Function	Conductor Type (Typical)	Single Point	Multiple Point	Minimum Conductor Coverage By Shield
Power Lines	Single conductor, stranded	N/A	N/A	N/A
Digital Control	Twisted pair, stranded		Yes	85%

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

Cable Function	Conductor Type (Typical)	Single Point	Multiple Point	Minimum Conductor Coverage By Shield
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
RF TX and RX	Coaxial		Yes	95%

Definitions

Single Point: Cable shield terminated at one end only via a connector or suitable crimp terminal.

Multiple Point: 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.

N/A: Not applicable.

(2) Installation Wiring Notes

(a) SDI

SDI is provided for the 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 HGA 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-440 terminal connectors, FWD ID, System Config, and Data I/O Config, where 0=strapped to common and 1=open.

(b) Maintenance Port Interface

The HSD-440 terminal has an RS-232 maintenance port interface that provides access to the MPU for data loading, system monitoring, and testing purposes.

Access to the HSD-440 terminal MPU is achieved by connecting an RS-232, VT-100 terminal (PC or laptop operating a terminal emulation program) to the RS-232 maintenance port.

The HSD-440 terminal maintenance port is available at the front of the HSD-440 terminal and at the rear ARINC 600 connector. Connection on the front of the HSD-440 terminal is accessible via a DB25S connector for local maintenance of the terminal. Remote access is provided for cases where local access is unavailable. For remote access, install an accessible DB9S connector in the cabin area.

NOTE: The front panel and remote connections to the maintenance port cannot be used simultaneously.

Refer to "Test and Fault Isolation" on page 4-1 for information on how to connect and use the maintenance port, including equipment requirements, connection and cabling requirements, software loading instructions, and configuration details.

(c) 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-440 terminal performance requirements.

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

Table 3-3 RF Parameters Definitions

Parameter	Min. Value (dB)	Max. Value (dB)
Antenna Gain	8	17
Antenna to DLNA Loss		0.3
DLNA Gain	53	60
DLNA Noise Figure		1.8
DLNA to HSD-440 terminal (Rx) Loss	6	25
HSD-440 terminal to Antenna (Tx) Loss	1	2.5 (including DLNA loss)
DLNA Insertion Loss (Tx to Antenna Port)	–	0.8

(d) WOW Pin Wiring

The WOW1 and WOW2 pins are either left open circuit or connected to the airframe DC ground through a ground proximity switch. The WOW Program Select (PGM) pin is either left open circuit or connected to the Forward Address Common. The two ground states for any pin are open and closed circuit.

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.

Table 3-4 WOW Pin Wiring Table

Pin Name and Location			Aircraft Status
WOW1	WOW2	PGM	
TP3G	TP3K	TP3J	
CLOSED	CLOSED	CLOSED	In-air
OPEN	CLOSED	CLOSED	Not valid—Default in-air

Table 3-4 WOW Pin Wiring Table (Continued)

Pin Name and Location			Aircraft Status
CLOSED	OPEN	CLOSED	Not valid—Default in-air
OPEN	OPEN	CLOSED	On-ground
CLOSED	CLOSED	OPEN	On-ground
OPEN	CLOSED	OPEN	Not valid—Default in-air
CLOSED	OPEN	OPEN	Not valid—Default in-air
OPEN	OPEN	OPEN	In-air

Use of the WOW discretes enable the HSD-440 terminal to determine whether the aircraft is airborne. In Stand-Alone Mode installations, this is achieved as the HSD-440 terminal receives speed information for Doppler correction via the INS. This makes the WOW function redundant and optional for most installations.

The function of WOW has been expanded to include the ability to inhibit RF transmission when the aircraft is on the ground. Please note that this function is disabled by default and must be enabled in EEPROM. If the WOW function is disabled, normal maintenance activities should be prohibited when the system is active to avoid RF exposure. Follow normal safety procedures and disable the system before performing antenna maintenance.

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

(e) ICAO IDs

The ICAO ID is strapped and the first FWD ID is entered in the EEPROM. Figure 3-3 provides an example of an ICAO ID address. This number (example: \12345654) must be converted into a binary number for strapping.

NOTE: MSB is the Most Significant Bit and LSB is the Least Significant Bit.

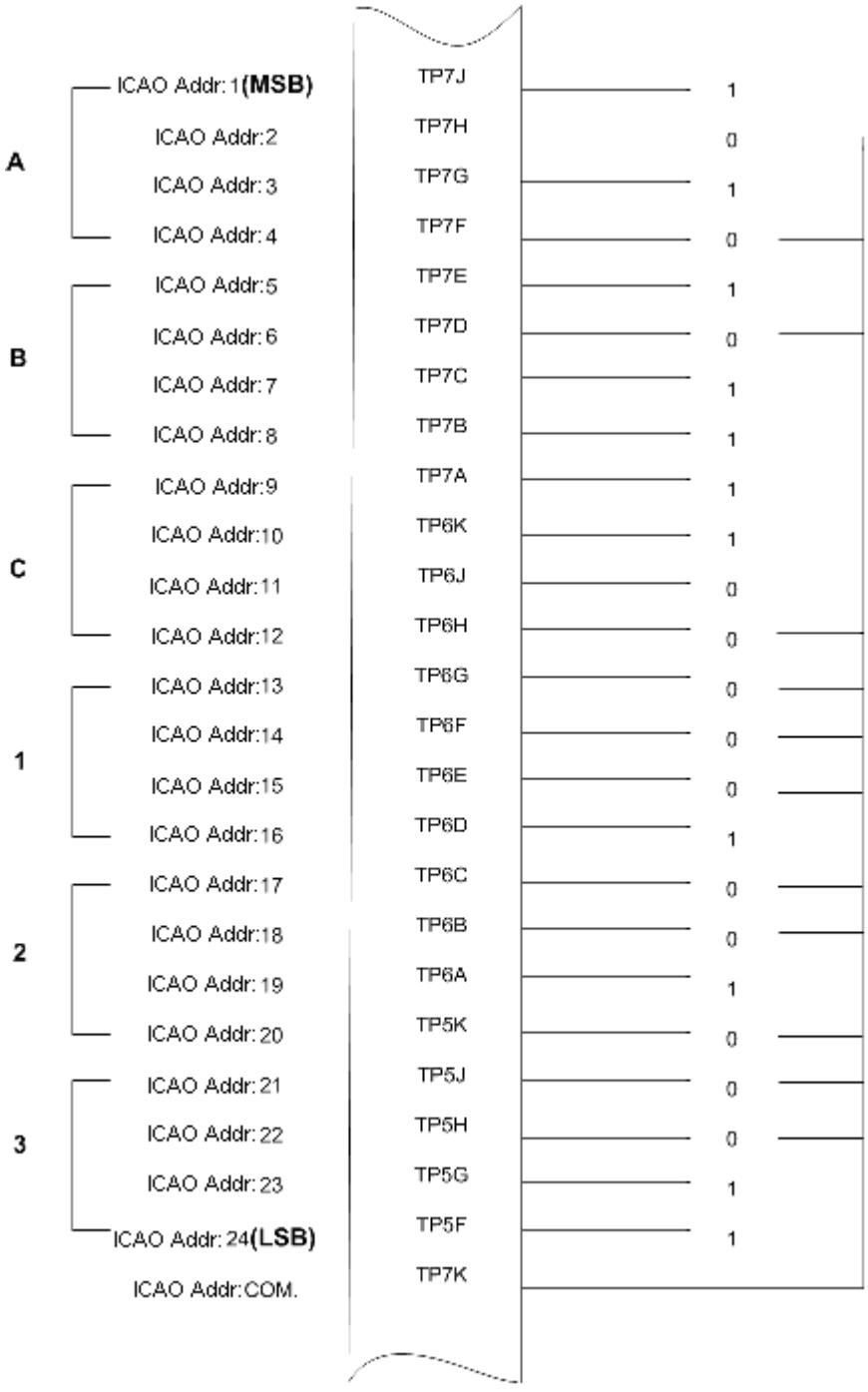

Figure 3-3 ICAO ID, Hex to Binary Conversion

A pin strapped to the same potential as TP7K (ICAO address common) is considered as a logical 0, whereas an open circuit pin is considered as a logical 1.

(f) Remote Status Panel (Optional)

An optional remote status panel may be installed when HSD-440 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-440 terminals can also be installed and located with the remote status panel. Figure 3-4 illustrates a typical wiring diagram for the remote reset circuit.

1. Remote Reset Circuit Switch Requirements

   HSD-440 terminals support the installation of a Remote Reset Switch circuit as shown in Figure 3-4.

   The HSD-440 terminal Remote Reset circuit requires less than 100 ohms between TP1K (RESET) and MP1F(COM) to be asserted and greater than 10 kilohms to be de-asserted (includes all cable and switch contact resistance).

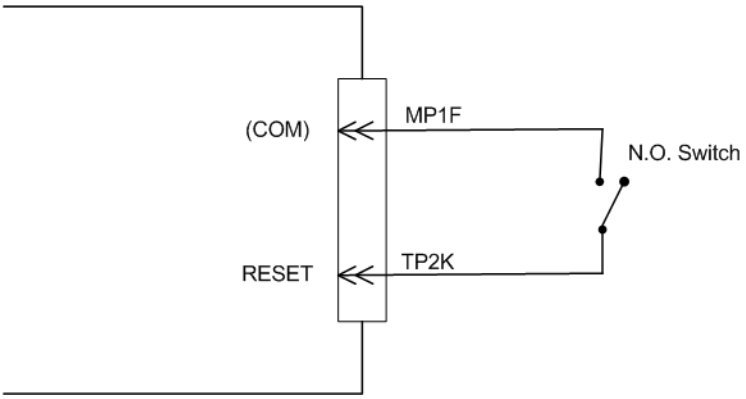

Figure 3-4 Remote Reset Circuit Switch

2. Remote LED Driver Circuit Requirements

   The circuit requirements for the HSD-440 terminal Remote Status LED drivers are shown in Figure 3-5. Each LED driver circuit provides an open-drain Field-Effect Transistor (FET) 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.

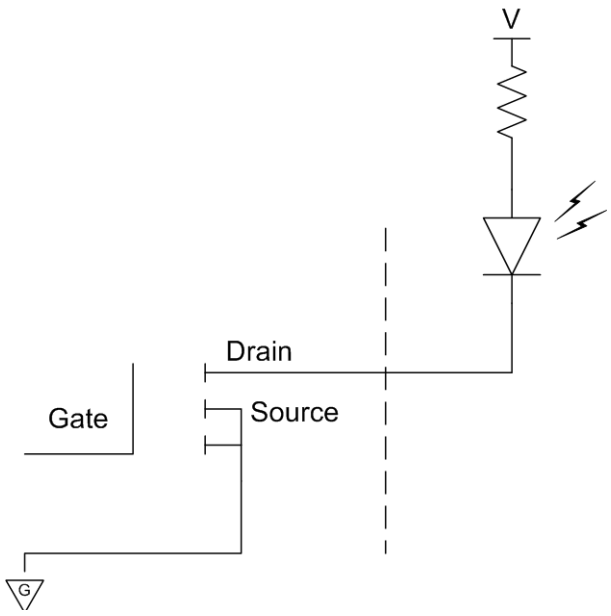

Figure 3-5 Remote LED Panel Circuit

(g) User Interfaces

To facilitate user access to the HSD-440 terminal interfaces, install the following connectors in the appropriate cabin area.

1. ISDN Interface

   Install an RJ45 connector in the cabin area for user connections to the ISDN interface.

2. Ethernet Data Interface

   Install one or two RJ45 interface connectors in the cabin area for user access to the Ethernet interfaces.

3. RJ45 Connector Termination Details

   Details relating to the RJ45 cable terminations required for both the ISDN and/or 10BASE-T services are shown in Table 3-5 and Figure 3-6.

Table 3-5 RJ45 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

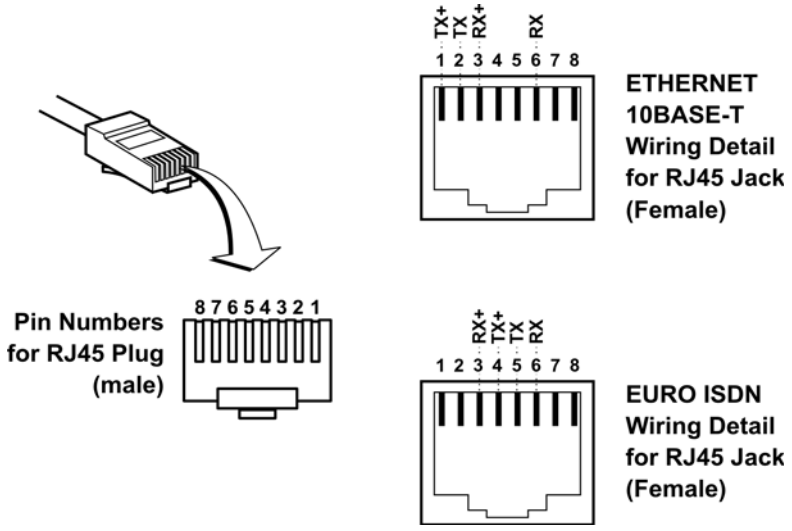

Figure 3-6 RJ45 Connector Terminator Details

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, are acceptable. Equivalent substitutions from other manufacturers may be used.

4. System Configuration Pin Strapping

   The HSD-440 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 requirements, as shown in Table 3-6. Detailed pin assignment is shown in Table 3-7.

Table 3-6 Configuration Pin Summary

Pin Number	Name	Function
TP4A to D	System Config 1 to 4	System mode

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 Address Common (TP7K).
- Pins marked 1 are signaled by an open circuit-no connection.
- Configurations resulting in all ones (1) are invalid.

5. System Mode Strap Pins Coding

   The HSD-440 terminal must be externally strapped according to its intended operational configuration mode. Table 3-7 illustrates the system pin strapping for currently supported HSD-440 terminal operational modes and configurations.

Table 3-7 System Pin Strapping

	Pin Status			
System Mode	TP4A	TP4B	TP4C	TP4D
Invalid	1	1	1	1
Stand-Alone	0	1	0	1

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 Address Common (TP7K).
- Pins marked 1 are signaled by an open circuit—no connection.
- Configurations resulting in all ones (1) are invalid.

(h) ARINC 429 IRS Bus Interface

In Stand-Alone Mode installations, navigational information is provided to the HSD-440 terminal through the high-speed ARINC 429 IRS bus interface. Refer to "System Description" on page 1-1 for more information. The IRS bus connects through the top plug of the ARINC 600 connector to the HSD-440 terminal as follows:

- IRS A to TP4J
- IRS B to TP4K

(i) Antenna Interface

The ARINC 741 antenna subsystem BSU/ACU is connected to the HSD-440 terminal as specified in Table 3-8.

Table 3-8 HSD-440 Terminal to BSU Interconnects

Signal Name	Signal Source			Signal Destination
	HSD-440 Terminal	Mechanical HGA	Phased-Array or Conformal HGA	
HPA MUTE A			Port BSU-G	TP3A
			STBD BSU-G	TP3C
HPA MUTE B			Port BSU-H	TP3B
			STBD BSU-H	TP3D
BSU BITE A		BSU-W(G)*	Port BSU-W	TP2A
			STBD BSU-W	TP2C
BSU BITE B		BSU-X(H)	Port BSU-X	TP2B
			STBD BSU-X	TP2D
Multi-Control A	TP3E			BSU-T(A)
Multi-Control B	TP3F			BSU-U(B)

***Letters in (brackets) represent EMS SATCOM AMT-50 BSU pin designations

Top/Port (T/P): Refers to Mechanical (fin-mount) HGA Subsystem or Top Fuselage mounted Phased Array or Beam Steered antenna

Port: Refers to Port side of Dual (side) Conformal-mount HGA subsystem

Starboard (STBD): Refers to Starboard side of Dual (side) Conformal-mount HGA subsystem

(j) CMU Interface

Data rates, voltage thresholds, and electrical interface specifications are per ARINC Specification 429. (741 p2-7 p4.7.2). The ARINC 600 wiring interconnections for the HSD-440 terminal and each CMU are shown in Table 3-9.

Table 3-9 CMU Interface Wiring

Pin	Name	To
TP1A	CMU 1 Input A	CMU 1 TP1A
TP1B	CMU 1 Input B	CMU 1 TP1B
TP1C	CMU 1/2 Output A	
TP1D	CMU 1/2 Output B	
MP1K	CMU 2 Input B	CMU 2 TP1A
MP2K	CMU 2 Input A	CMU 2 TP1B

The bus speed can be either low or high. Both the transmit and receive ports of the HSD-440 terminal ARINC 429 CMU ports operate together at either low speed or high speed. Both CMUs therefore work at either low speed or high speed, but not one at each speed. The speed is selectable by setting a flag in

the ORT (instead of setting a program pin on the HSD-440 A600 connector as there are none available). If no information is available from the ORT, then the bus speed shall default to low.

(k) MCDU Interface

Table 3-10 shows the strapping for the MCDU.

Table 3-10 MCDU Interface Wiring

Pin	Name	To
TP3E	MCDU input A	MCDU 2 ARINC Output A
TP3F	MCDU input B	MCDU 2 ARINC Output B
MP7G	MCDU 1 input A	MCDU ARINC Output A
MP7H	MCDU 1 input B	MCDU ARINC Output B
MP7J	MCDU 1/2 output A	To both MCDU 1 and 2 ARINC Input A
MP7K	MCDU 1/2 output B	To Both MCDU 1 and 2 ARINC Input B

(l) Call Light Activation Strapping

Table 3-11 shows the configuration strapping for call light activation.

Table 3-11 Call Light Activation Configuration Strapping

Pin Number	Name	Function
TP4E	Call Light Activation	Determines whether the call light illuminates on call activation or initialization. Activation occurs when the GES is responding to the call request, and initialization occurs the moment the call is placed. (1=Activation; 0=Initialization)

(m) Hookswitch Strapping

Table 3-12 shows the configuration strapping for the hookswitch method.

Table 3-12 Hookswitch Configuration Strapping

Pin Number	Name	Function
TP2G	Hookswitch Method	Determines Push To Talk (PTT) or Latched Mode (0=Latched; 1=PTT)

(n) Priority 4 Call Strapping

Table 3-13 shows the configuration strapping for priority 4 calls.

Table 3-13 Priority 4 Call Configuration Strapping

Pin Number	Name	Function
TP4F	Inhibit Priority 4 Calls	Determines whether priority 4 calls are inhibited. When these calls are inhibited, incoming calls at priority 4 are not allowed, and outgoing priority 4 calls are elevated to the next priority and then placed. (1=Uninhibited; 0=Inhibited)

(o) Chime and Light Strapping for Cockpit Voice

Table 3-14 shows the chime and light strapping for cockpit voice.

Table 3-14 Chime and Light Strapping for Cockpit Voice

TP4G	TP4H	Lights	Chime
Strapped	Strapped	Spare	
Strapped	Open	Steady	Multi-stroke (chime sounds every 0.5 to 1 second)
Open	Strapped	Flashing	Single-stroke (chime sounds once)
Open	Open	Steady	Single-stroke

(3) Connection Details

"Stand-Alone Mode Connection Details" on page 3-18 provides all top, middle, and bottom plug connection details for Stand-Alone Mode installations.

6. Installation and Engineering Diagrams

This section contains the Outline and Installation diagrams, and Interconnection and Contact Assignment drawings for HSD-440 terminals.

A. Outline and Installation Diagrams

Figure 3-7, Figure 3-8, Figure 3-9, and Figure 3-10 illustrate the physical characteristics of the HSD-440 terminal and provide installation data for the terminal.

All foldout pages are odd-numbered and not-backed for print production purposes.

B. Interconnection and Contact Assignment Drawings

Figure 3-11 illustrates the interconnection details for HSD-440 terminals.

Figure 3-12 provides the contact assignments for HSD-440 terminals.

All foldout pages are odd-numbered and not-backed for print production purposes.

7. Connection Details

This section includes connection details for the HSD-440 terminal operating in Stand-Alone Mode.

A. Stand-Alone Mode Connection Details

Table 3-15, Table 3-16, and Table 3-17 show the top, middle, and bottom plug connection details for HSD-440 terminals operating in Stand-Alone Mode.

Table 3-15 ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I	1A	CMU 1 Input A	CMU 1 TP1A	CMU 1 RX A
I	1B	CMU 1 Input B	CMU 1 TP1B	CMU 1 RX B
O	1C	CMU 1/2 Output A CMU 1 and 2 Tx A		
O	1D	CMU 1/2 Output BCMU 1 and 2 Tx B		
I	1E	ARINC 615 Input A	ARINC 615 Data Loader	
I	1F	ARINC 615 Input B		
O	1G	ARINC 615 Output A		
O	1H	ARINC 615 Output B		
I	1J	ARINC 615 Link A		
O	1K	ARINC 615 Link B (GND)		
I	2A	BSU Top/Port BITE A (See Note 1)	Mech. Steered Antenna (MA): BSU, Pin G or W or Other Antenna (OA): BSU, PORT-W and Starboard-P	ARINC Tx-HI BITE from BSU
I	2B	BSU Top/Port BITE B	MA: BSU, Pin H or X, or OA: BSU, PORT-X and STBD-R	ARINC Tx-LO BITE from BSU
I	2C	BSU Starboard (STBD) BITE A	MA: Not required OA: BSU, PORT-P and STBD-W	ARINC Tx-HI BITE from BSU
I	2D	BSU STBD BITE B	MA: Not required OA: BSU, PORT-R and STBD-X	ARINC Tx-LO BITE from BSU
O	2E	CMC Output A		CMC
O	2F	CMC Output B		CMC
I	2G	Hookswitch method		
I	2H	CMC Input A		
I	2J	CMC Input B		

Table 3-15 ARINC 600 Top Plug Connection Details (Continued)

I/O	From Top Plug	Signal Name	To	Description
I	3A	Top/Port HPA MUTE A	MA: Not required OA: BSU, PORT-G	HPA Mute-A, Port BSU
I	2K	Remote Reset	Normally open momentary switch-open side. (Closed side to MP1F)	Remote System Reset
I	3A	Top/Port HPA MUTE A	MA: Not required OA: BSU, PORT-H	HPA Mute-A, Port BSU
I	3B	Top/Port HPA MUTE B	MA: Not required OA: BSU, PORT-H	HPA Mute-B, Port BSU
I	3C	STBD HPA MUTE A	MA: Not required OA: BSU, STBD G	HPA Mute-A, STBD BSU
I	3D	STBD HPA MUTE B	MA: Not required OA: BSU, STBD-H	HPA Mute-B, STBD BSU
O	3E	Multi-Control A	MA: BSU, Pin A or T, or OA: BSU, PORT-T and STBD-T	Multi-Control-HI to HSD-440 terminal and antenna subsystem
O	3F	Multi-Control B	MA: BSU, Pin B or U, or OA: BSU, PORT-U and STBD-U	Multi-Control-LO to HSD-440 terminal and antenna subsystem
I	3G	WOW 1	TP3G	Weight On Wheel, as defined in Note 40 of ARINC 741, Part 1. Refer to Section 8.D WOW Pin Wiring
I	3J	WOW Program Select	TP3J	
I	3K	WOW 2	TP3K	
I	4A, 4B, 4C, 4D	System Config 1 to 4	4A and 4C=0 (TP7K common), 4B and 4D=1(Open)	Stand-Alone Mode
I	4E	Call light activation		
I	4F	Priority 4 Calls		Inhibit Priority 4 calls to/from Cockpit. All priority 4 A to G calls will have priority elevated to 3.
I	4G	Chime/light option MS		
I	4H	Chime/light option LS		
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	
I	5B	SDI 2	SDI common (TP5D)	HPA Select Code for HGA
I	5C	Spare 1 Input A		
I	5D	SDI Common	SDI 2 (TP5B)	SDI Common

Table 3-15 ARINC 600 Top Plug Connection Details (Continued)

I/O	From Top Plug	Signal Name	To	Description
I	5E	Spare 1 Input B		
I	5F	ICAO Address, BIT 24	1 = no connection 0 = common (TP7K)	
I	5G	ICAO Address, BIT 23		
I	5H	ICAO Address, BIT 22		
I	5J	ICAO Address, BIT 21		
I	5K	ICAO Address, BIT 20		
I	6A	ICAO Address, BIT 19		
I	6B	ICAO Address, BIT 18		
I	6C	ICAO Address, BIT 17		
I	6D	ICAO Address, BIT 16		
I	6E	ICAO Address, BIT 15		
I	6F	ICAO Address, BIT 14		
I	6G	ICAO Address, BIT 13		
I	6H	ICAO Address, BIT 12		
I	6J	ICAO Address, BIT 11		
I	6K	ICAO Address, BIT 10		
I	7A	ICAO Address, BIT 9		
I	7B	ICAO Address, BIT 8		
I	7C	ICAO Address, BIT 7		
I	7D	ICAO Address, BIT 6		
I	7E	ICAO Address, BIT 5		
I	7F	ICAO Address, BIT 4		
I	7G	ICAO Address, BIT 3		
I	7H	ICAO Address, BIT 2		
I	7J	ICAO Address, BIT 1 (MSB)		
I	7K	ICAO Address, Common		Common GND connection for system and I/O configuration and ICAO ID

Table 3-16 ARINC 600 Middle Plug Connection Details

I/O	From Middle Plug	Signal Name	To	Description
O	1A	Power LED Output 1	Remote status panel	HSD-440 terminal-Power On (Optional)
O	1B	Fault LED Output 2	Remote status panel	HSD-440 terminal-Fault (Optional)
	1C	Channel Available		
	1D	Switch HI current from chime		
	1E	Switch LO current to chime		
O	1F	Discrete Common	Remote status panel	Discrete Common
O	1G	Maint Port Tx	Maint Port serial data, DB9S-2	Maintenance computer (laptop/PC), for Remote access
I	1H	Maint Port Rx	Maint Port serial data, DB9S-3	
I/O	1J	Maint Port Signal Ground	Maint Port serial data, DB9S-5	
I	1K	CMU 2 Input A	CMU 2 TP1A	CMU 2 RX A
O	2A	Data I/O Tx	No connection	
I	2B	Data I/O Rx	No connection	
O	2C	SDU data	SCM A	
O	2D	SDU data	SCM B	
I	2E	SCM data	SDU A	
I	2F	SCM data	SDU B	
O	2G	SCM power +12 V	SCM	
O	2H	SCM power return 0 V	SCM	
	2J	Data I/O Ground	No connection	
I	2K	CMU 2 Input B	CMU 2 TP1B	CMU 2 RX B
O	3A	Call light 1	Audio Control Panel	
I	3B	Mic on 1	Audio Management System	
I	3C	Chime light inhibit	Audio Control Panel	
I	3D	Place/end 1	Audio Management System	
I	3E	MCDU 2 input A	MCDU 2 J4-27	MCDU 2 RX A

Table 3-16 ARINC 600 Middle Plug Connection Details (Continued)

I/O	From Middle Plug	Signal Name	To	Description
I	3F	MCDU 2 input B	MCDU 2 J4-28	MCDU 2 RX B
O	3G	Call light 2		Future
I	3H	Mic on 2		Future
I	3J	Go-ahead / Chime reset	Audio Control Panel	
I	3K	Place/End 2		Future
I/O	4A	POTS 1 TIP	2-wire Analog Phone TIP (RJ-11, Pin 4)	POTS Line 1
I/O	4B	POTS 1 RING	2-wire Analog Phone RING (RJ-11, Pin 3)	
I/O	4C	POTS 2 TIP	2-wire Analog Phone TIP (RJ-11, Pin 4)	POTS Line 2
I/O	4D	POTS 2 RING	2-wire Analog Phone RING (RJ-11, Pin 3)	
I	4E	Input audio 1 HI	Cockpit Headset Microphone HI	Cockpit Voice Microphone
I	4F	Input audio 1 HLO	Cockpit Headset Microphone LO	
I/O	4G to 4K			Reserved
	5A	CEPT-E1 RX+		Future
	5B	CEPT-E1 RX-		
	5C	CEPT-E1 TX+		
	5D	CEPT-E1 TX-		
O	5E	Audio 1 HI	Cockpit Headset Speaker HI	Cockpit Voice Speaker
O	5F	Audio 1 LO	Cockpit Headset Speaker LO	
I/O	5G to 5K			Reserved
I	6A	ISDN Rx+	ISDN, RJ45-3	User data, ISDN-1 Refer to "User Interfaces" on page 3-12
I	6B	ISDN Rx -	ISDN, RJ45-6	
O	6C	ISDN Tx+	ISDN, RJ45-4	
O	6D	ISDN Tx-	ISDN, RJ45-5	
I	6E	Audio 2 HI		Future
I	6F	Audio 2 LO		Future

Table 3-16 ARINC 600 Middle Plug Connection Details (Continued)

I/O	From Middle Plug	Signal Name	To	Description
O	6G	10BASE-T Tx+	Ethernet 10BASE-T RJ45, Pin 1	Port 2 User data Ethernet 10BASE-T
O	6H	10BASE-T Tx-	Ethernet 10BASE-T RJ45, Pin 2	
I	6J	10BASE-T Rx+	Ethernet 10BASE-T RJ45, Pin 3	
I	6K	10BASE-T Rx-	Ethernet 10BASE-T RJ45, Pin 6	
O	7A	10BASE-T Tx+	Ethernet 10BASE-T, RJ45-1	Port 1 User data Ethernet 10BASE-T
O	7B	10BASE-T Tx-	Ethernet 10BASE-T, RJ45-2	
I	7C	10BASE-T Rx+	Ethernet 10BASE-T, RJ45-3	
I	7D	10BASE-T Rx-	Ethernet 10BASE-T, RJ45-6	
I/O	7E to 7K			Reserved
O	C1	RF Tx Output	Antenna subsystem-DLNA or HPR-J	Coaxial cable, RF Transmit

Table 3-17 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
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
I	BP7	115 V ac COLD	Aircraft Power Source, COLD	
I	BP12	RF Rx Input	Antenna subsystem-DLNA	Coaxial cable, RF Receive

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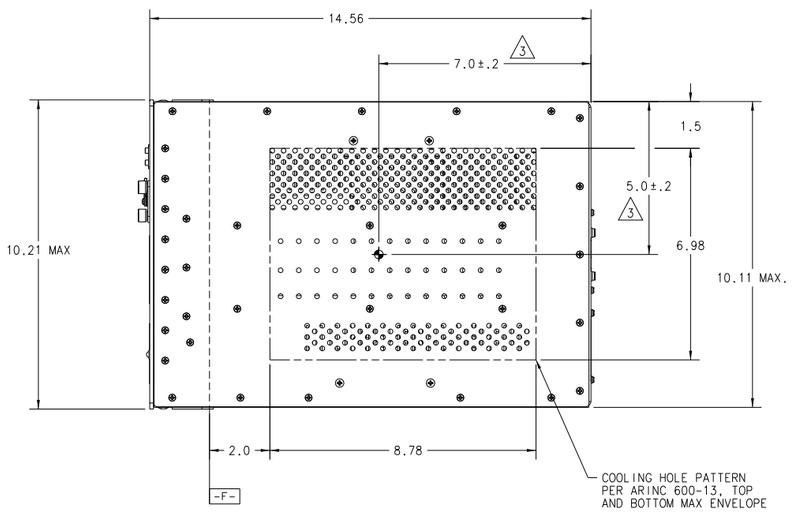
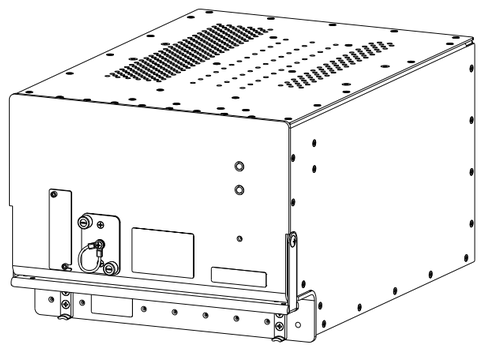
NOTES:

1. THIS UNIT MEETS THE DIMENSIONAL REQUIREMENTS OF ARINC SPECIFICATION 600-13.
2. MAXIMUM WEIGHT IS 15.74 kg (34.7 LBS).
3. APPROXIMATE CENTER OF GRAVITY IS INDICATED BY ⌖.
4. THIS UNIT SHALL BE INSTALLED IN AN 8 MCU TRAY. PER ARINC 600-13 SPEC.
5. COOLING AIR REQUIREMENTS PER ARINC 600:
   -FLOW RATE : 88 Kg/hr
   -PRESSURE DROP: 5 +/-3 mm OF WATER.

TABLE 1. HSD TRANSCEIVER MODEL DESCRIPTION

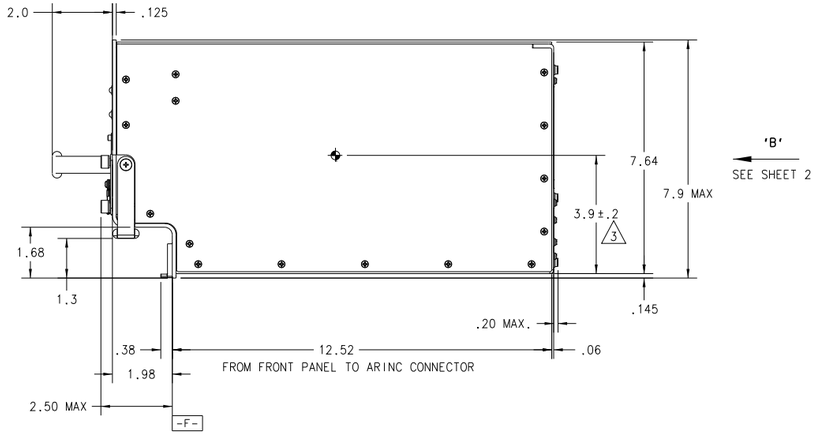
TRANSCEIVER MODEL	CHANNELS	OPERATION MODE	ASSEMBLY PART NO.	INTERCONNECTION DIAGRAM	VOLTAGE (NOMINAL)	MAX POWER DISSIPATION/CONSUMPTION
HSD-440	4	STAND-ALONE	1252-A-3400	1252-B-3110	115VAC/400Hz 28VDC	400/460W
HSD-400i	4	STAND-ALONE	1252-A-3500	1252-B-3500	115VAC/400Hz 28VDC	400/460W





3D VIEW

'A'
SEE SHEET 2



'B'
SEE SHEET 2

Figure 3-7 (Sheet 1). HSD-440 Terminal Outline and Installation Diagram (1252-E-3400, Rev B)

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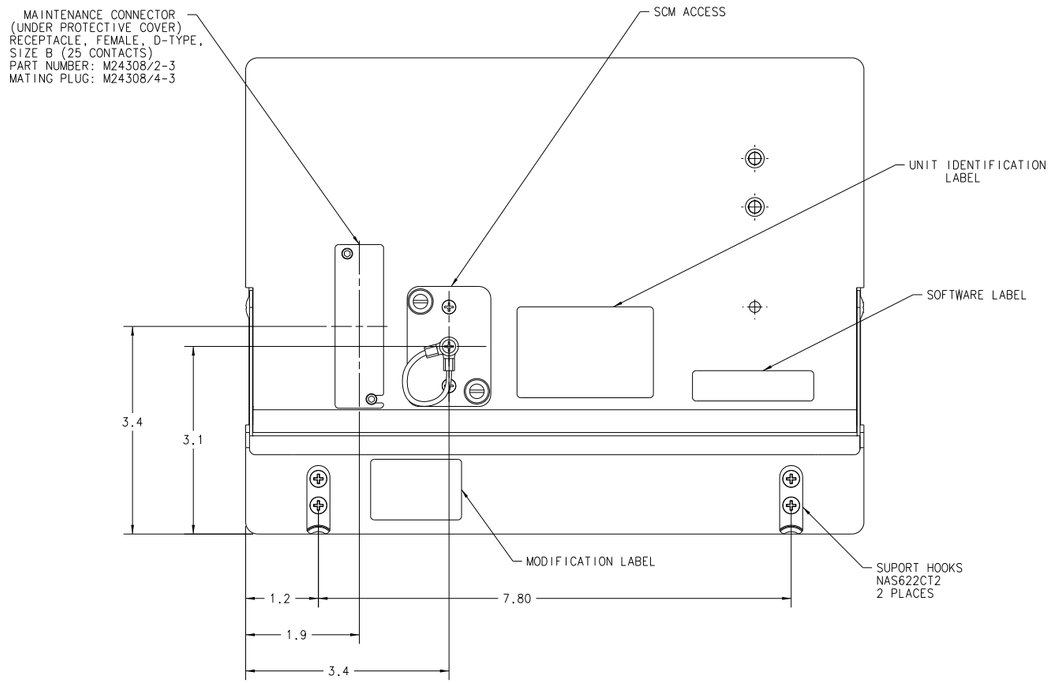
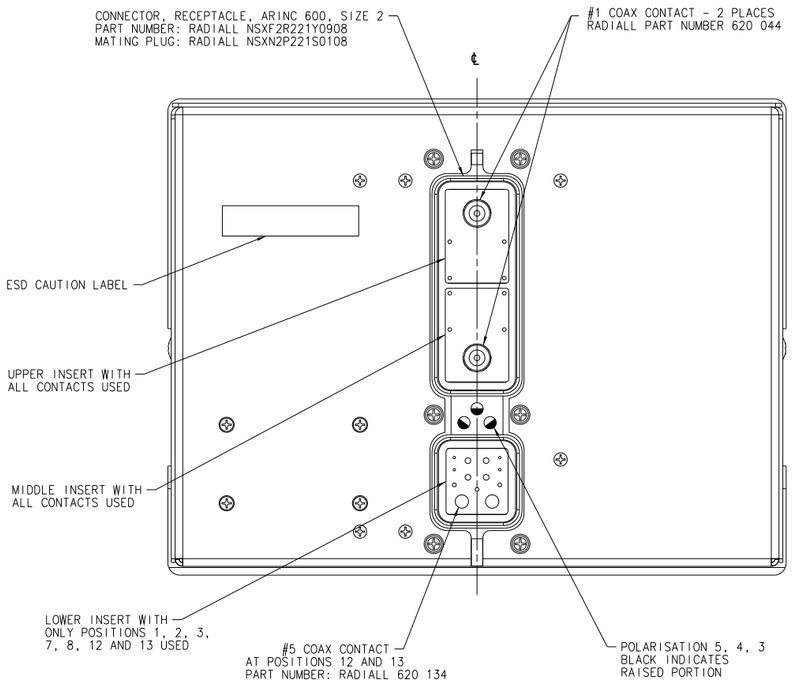


VIEW ON 'A' (FRONT)



VIEW ON 'B' (BACK)

Figure 3-8 (Sheet 2). HSD-440 Terminal Outline and Installation Diagram (1252-E-3400, Rev B)

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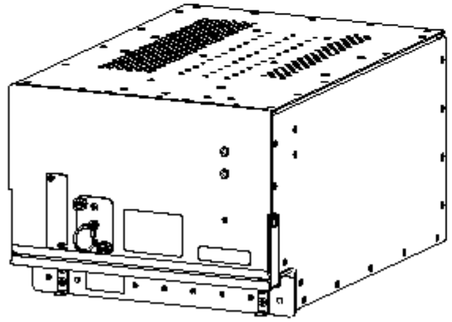
NOTES:

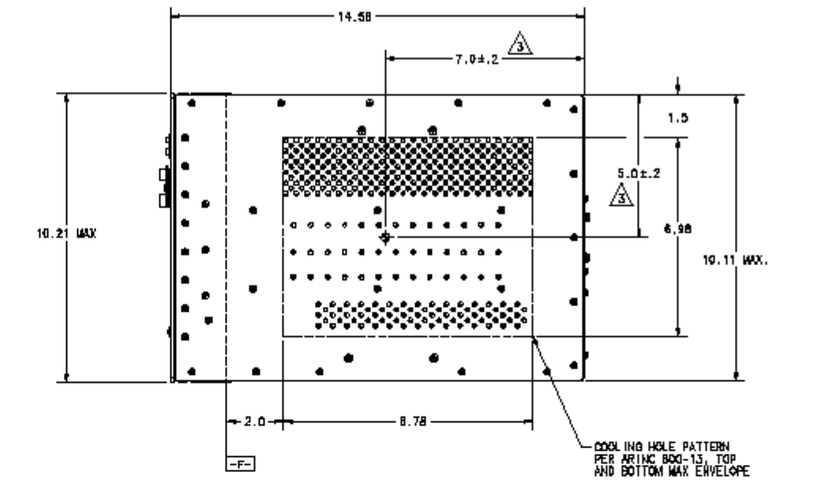
1. THIS UNIT MEETS THE DIMENSIONAL REQUIREMENTS OF ARINC SPECIFICATION 600-15.
2. MAXIMUM WEIGHT IS 15.74 kg (34.7 LBS).
3. APPROXIMATE CENTER OF GRAVITY IS INDICATED BY ⊕.
4. THIS UNIT SHALL BE INSTALLED IN AN 8 MCU TRAY. PER ARINC 600-13 SPEC.
5. COOLING AIR REQUIREMENTS PER ARINC 600:
   -FLOW RATE : 68 Kg/hr
   -PRESSURE DROP: 5 +/-3 mm OF WATER.

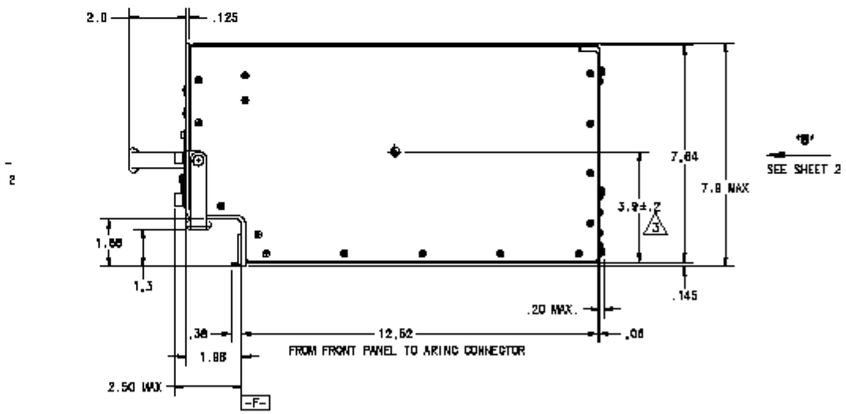
TABLE 1. HSD TRANSCEIVER MODEL DESCRIPTION

TRANSCEIVER MODEL	CHANNELS	OPERATION MODE	ASSEMBLY PART NO.	VOLTAGE (NOMINAL)	MAX POWER DISSIPATION/CONSUMPTION
HSD-440	4	STAND-ALONE SW/CLASSIC	1252-A-3420-01	115VAC/400Hz 28VDC	400/460W
HSD-440	4	STAND-ALONE SBB/SW/CLASSIC	1252-A-3420-02	115VAC/400Hz 28VDC	400/480W
HSD-440	4	STAND-ALONE SBB/SW/CLASSIC/HSDX	1252-A-3420-05	115VAC/400Hz 28VDC	400/460W



3D VIEW





DWG NO 1252-E-3420 REV B SHT 1

Figure 3-9 (Sheet 1). HSD-440 Terminal Outline and Installation Diagram (1252-E-3420, Rev B)

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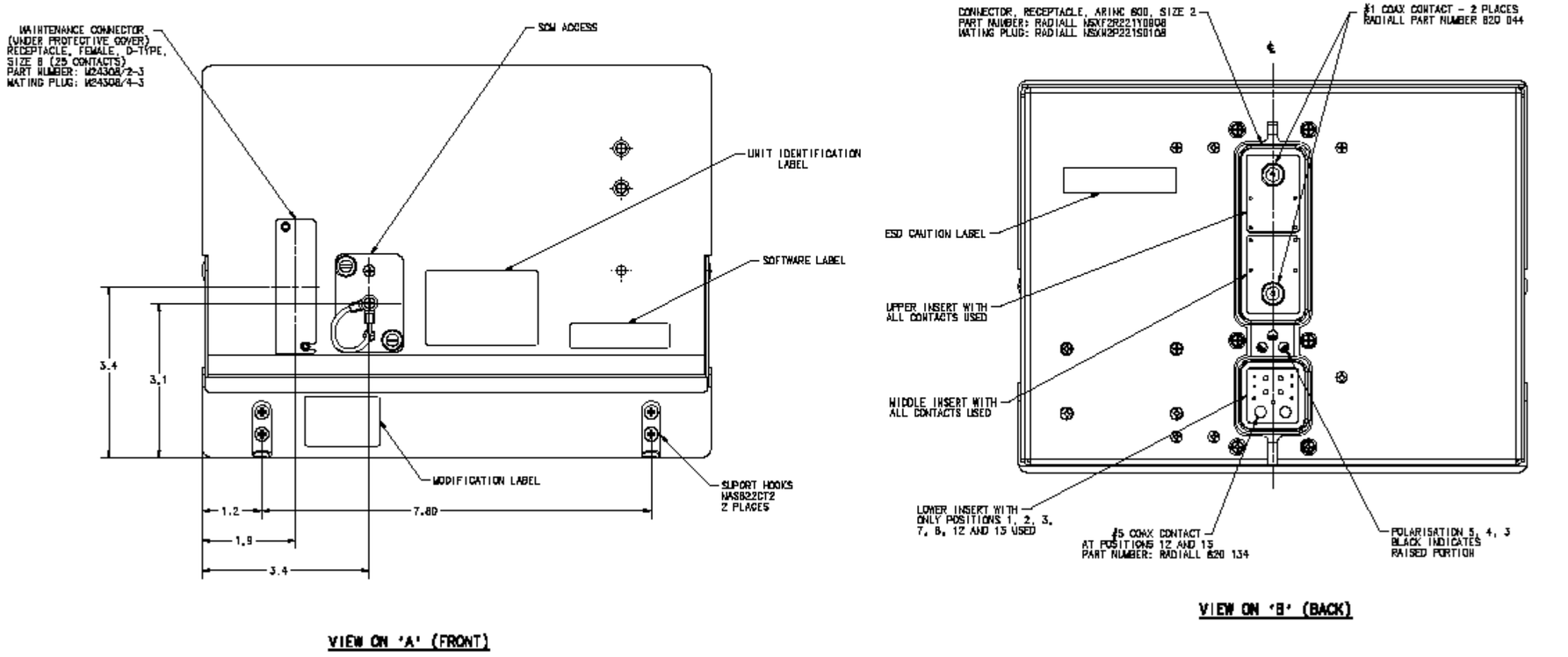

Figure 3-10 (Sheet 2). HSD-440 Terminal Outline and Installation Diagram (1252-E-3420, Rev B)

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NOTES:

1. TRANSMIT CABLE: MAX LOSS: 2.5dB INCLUDING DIPLEXER PER ARINC 741.
2. RECEIVE CABLE: MAX LOSS: 6-25dB PER ARINC 741.
3. THE AIRCRAFT 24-BIT ICAO AIRFRAME ADDRESS SHALL BE WIRED AS FOLLOWS:
   PINS MARKED "0" SHALL BE CONNECTED TO ICAO ADDRESS COMMON PIN TP7K.
   PINS MARKED "1" SHALL BE LEFT OPEN.
4. SYSTEM CONFIG 1 THRU SYSTEM CONFIG 4 DEFINE HSD-440 SYSTEM CONFIGURATION PER TABLE 1.
5. REMOVED.
6. WIRE SIZE RECOMMENDATIONS:
   - +28 VDC HOT (BP2), +28V RTN GND (BP3), 115 VAC COLD (BP7) AND CHASSIS GND (BP8) SHALL BE 12 AWG.
   - 115 VAC HOT (BP1) SHALL BE 20 AWG.
   - UNLESS OTHERWISE SPECIFIED ALL SIGNAL WIRES SHALL BE 22 AWG.
7. ROW (1) NOMENCLATURE, AS PER EMS ANTENNA CONTROL UNIT (ACU). OTHER ACU OR BEAM STEERING UNIT (BSU) MANUFACTURERS MAY USE THOSE OF ROW (2).
8. IN WOW PROGRAM SELECT (TP3J) SHALL BE STRAPPED TO ICAO ADDRESS COMMON (TP7K) IF IN WOW (TP3G AND TP3K) IS OPEN WHEN ON THE GROUND, OTHERWISE DO NOT CONNECT IN WOW PROGRAM SELECT.
9. MAXIMUM SUGGESTED CABLE RUN SHOULD NOT EXCEED 50 FEET.
10. FOR ADDITIONAL CONFIG PIN WIRING DETAILS, REFER TO THE HSD-440 SYSTEM DESCRIPTION AND INSTALLATION MANUAL EMS-MN-1252-33077.
11. LAN CABLES MUST MEET FLAMMABILITY AND TIA/EIA568-A CAT 5 REQUIREMENTS. CABLES 922404, 4 COND. AND 922408, 8 COND., AS SUPPLIED BY ELECTRONIC CABLE SPECIALISTS ARE ACCEPTABLE.
12. TWISTED SHIELDED PAIRS AS PER ARINC 741 WIRING REQUIREMENTS OR EQUIVALENT.

TABLE 1. CONFIGURATION STRAPPING (10)

SYSTEM MODE	PIN STATUS			
	TP4A	TP4B	TP4C	TP4D
	1	2	3	4
INVALID	1	1	1	1
RESERVED	1	1	0	1
RESERVED	1	0	1	1
RESERVED	1	0	0	1
RESERVED	0	1	1	1
STAND-ALONE	0	1	0	1
NOT ASSIGNED	0	0	1	1
RESERVED	0	0	0	1

0=FWD ADDRESS COMMON, 1=NO CONNECTION

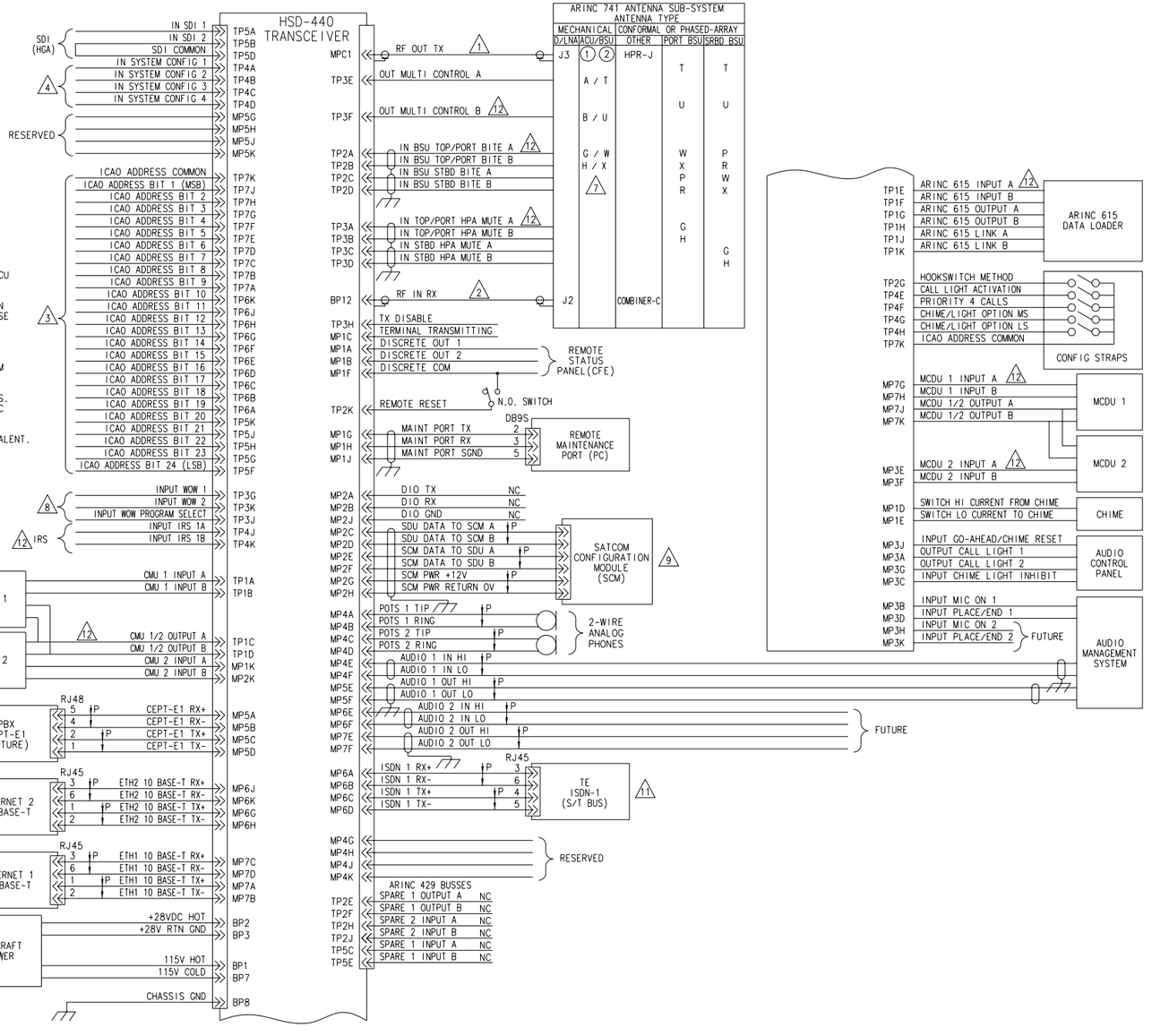

Figure 3-11 (Sheet 1). HSD-440 Terminal Interconnection and Contact Assignment Drawing (1252-B-3110, Rev D)

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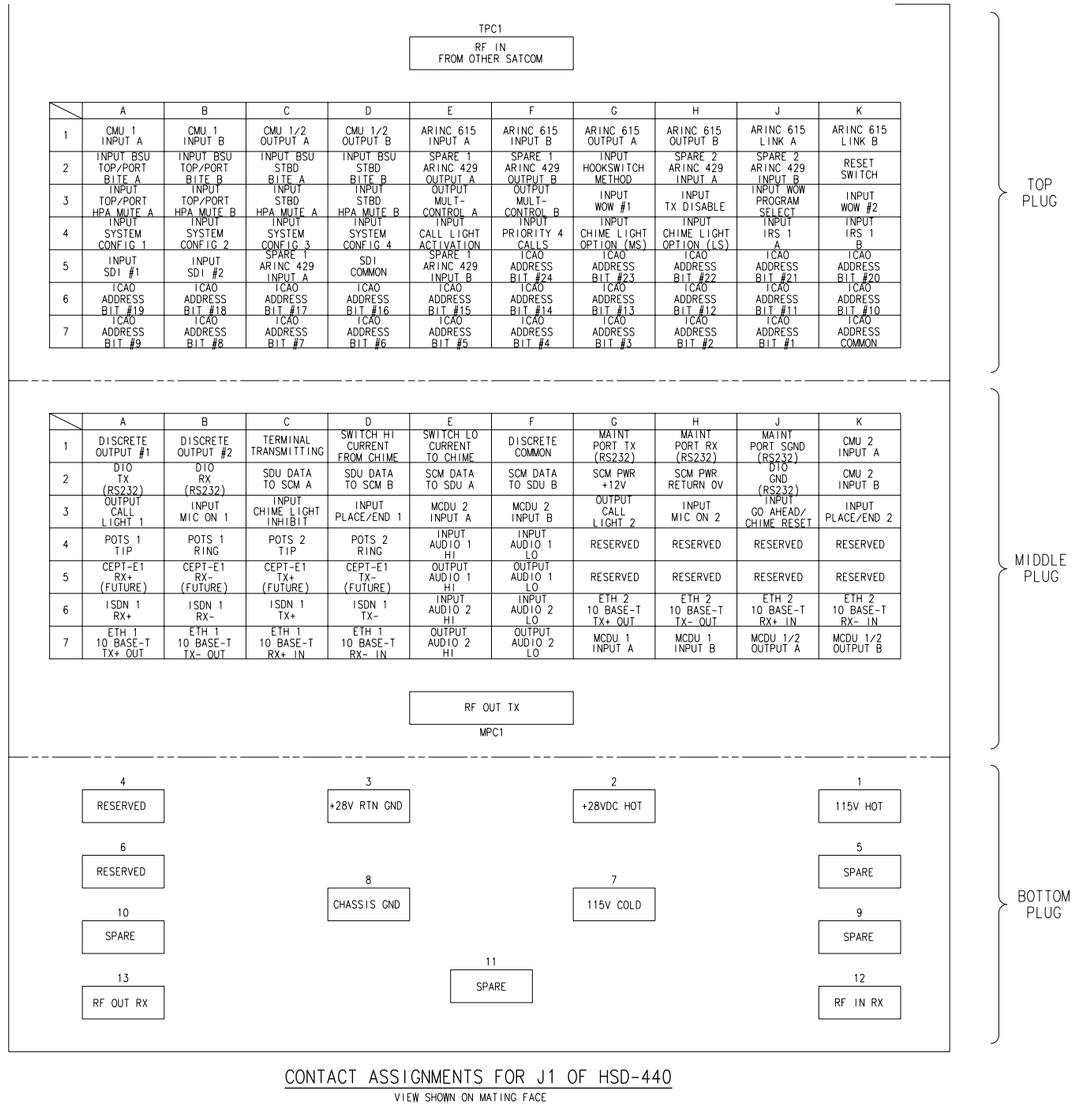

	A	B	C	D	E	F	G	H	J	K
1	CMU 1 INPUT A	CMU 1 INPUT B	CMU 1/2 OUTPUT A	CMU 1/2 OUTPUT B	ARINC 615 INPUT A	ARINC 615 INPUT B	ARINC 615 OUTPUT A	ARINC 615 OUTPUT B	ARINC 615 LINK A	ARINC 615 LINK B
2	INPUT BSU TOP/PORT BITE A	INPUT BSU TOP/PORT BITE B	INPUT BSU STBD BITE A	INPUT BSU STBD BITE B	SPARE 1 ARINC 429 OUTPUT A	SPARE 1 ARINC 429 OUTPUT B	INPUT HOOKSWITCH METHOD	SPARE 2 ARINC 429 INPUT A	SPARE 2 ARINC 429 INPUT B	RESET SWITCH
3	INPUT TOP/PORT HPA MUTE A	INPUT TOP/PORT HPA MUTE B	INPUT STBD HPA MUTE A	INPUT STBD HPA MUTE B	OUTPUT MULT-CONTROL A	OUTPUT MULT-CONTROL B	INPUT WOW #1	INPUT TX DISABLE	INPUT WOW PROGRAM SELECT	INPUT WOW #2
4	INPUT SYSTEM CONFIG 1	INPUT SYSTEM CONFIG 2	INPUT SYSTEM CONFIG 3	INPUT SYSTEM CONFIG 4	INPUT CALL LIGHT ACTIVATION	INPUT PRIORITY 4 CALLS	INPUT CHIME LIGHT OPTION (MS)	INPUT CHIME LIGHT OPTION (LS)	INPUT IRS 1 A	INPUT IRS 1 B
5	INPUT SDI #1	INPUT SDI #2	SPARE 1 ARINC 429 INPUT A	SDI COMMON	SPARE 1 ARINC 429 INPUT B	ICAO ADDRESS BIT #24	ICAO ADDRESS BIT #23	ICAO ADDRESS BIT #22	ICAO ADDRESS BIT #21	ICAO ADDRESS BIT #20
6	ICAO ADDRESS BIT #19	ICAO ADDRESS BIT #18	ICAO ADDRESS BIT #17	ICAO ADDRESS BIT #16	ICAO ADDRESS BIT #15	ICAO ADDRESS BIT #14	ICAO ADDRESS BIT #13	ICAO ADDRESS BIT #12	ICAO ADDRESS BIT #11	ICAO ADDRESS BIT #10
7	ICAO ADDRESS BIT #9	ICAO ADDRESS BIT #8	ICAO ADDRESS BIT #7	ICAO ADDRESS BIT #6	ICAO ADDRESS BIT #5	ICAO ADDRESS BIT #4	ICAO ADDRESS BIT #3	ICAO ADDRESS BIT #2	ICAO ADDRESS BIT #1	ICAO ADDRESS COMMON

	A	B	C	D	E	F	G	H	J	K
1	DISCRETE OUTPUT #1	DISCRETE OUTPUT #2	TERMINAL TRANSMITTING	SWITCH HI CURRENT FROM CHIME	SWITCH LO CURRENT TO CHIME	DISCRETE COMMON	MAINT PORT TX (RS232)	MAINT PORT RX (RS232)	MAINT PORT SGND (RS232)	CMU 2 INPUT A
2	DIO TX (RS232)	DIO RX (RS232)	SDU DATA TO SCM A	SDU DATA TO SCM B	SCM DATA TO SDU A	SCM DATA TO SDU B	SCM PWR +12V	SCM PWR RETURN 0V	DIO GND (RS232)	CMU 2 INPUT B
3	OUTPUT CALL LIGHT 1	INPUT MIC ON 1	INPUT CHIME LIGHT INHIBIT	INPUT PLACE/END 1	MCDU 2 INPUT A	MCDU 2 INPUT B	OUTPUT CALL LIGHT 2	INPUT MIC ON 2	INPUT GO AHEAD/ CHIME RESET	INPUT PLACE/END 2
4	POTS 1 TIP	POTS 1 RING	POTS 2 TIP	POTS 2 RING	INPUT AUDIO 1 HI	INPUT AUDIO 1 LO	RESERVED	RESERVED	RESERVED	RESERVED
5	CEPT-E1 RX+ (FUTURE)	CEPT-E1 RX- (FUTURE)	CEPT-E1 TX+ (FUTURE)	CEPT-E1 TX- (FUTURE)	OUTPUT AUDIO 1 HI	OUTPUT AUDIO 1 LO	RESERVED	RESERVED	RESERVED	RESERVED
6	ISDN 1 RX+	ISDN 1 RX-	ISDN 1 TX+	ISDN 1 TX-	INPUT AUDIO 2 HI	INPUT AUDIO 2 LO	ETH 2 10 BASE-T TX+ OUT	ETH 2 10 BASE-T TX- OUT	ETH 2 10 BASE-T RX+ IN	ETH 2 10 BASE-T RX- IN
7	ETH 1 10 BASE-T TX+ OUT	ETH 1 10 BASE-T TX- OUT	ETH 1 10 BASE-T RX+ IN	ETH 1 10 BASE-T RX- IN	OUTPUT AUDIO 2 HI	OUTPUT AUDIO 2 LO	MCDU 1 INPUT A	MCDU 1 INPUT B	MCDU 1/2 OUTPUT A	MCDU 1/2 OUTPUT B

Figure 3-12. (Sheet 2). HSD-440 Terminal Interconnection and Contact Assignment Drawing (1252-B-3110, Rev D)

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TEST AND FAULT ISOLATION

This section provides the information required to determine the operational readiness of the HSD-440 terminals and 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-440 terminals built-in diagnostic tool referred to as the HSD-440 terminal MPU. This section provides detailed descriptions of the HSD-440 terminal MPU menus, reports, and basic user instructions. See "Cabling Notes" on page 4-3 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

A. General

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 includes test and fault isolation procedures for the HSD-440 terminals. All test and load procedures require the HSD-440 terminal MPU, which is accessed by connecting to the maintenance port of the terminal.

B. Test and Fault Isolation Equipment Requirements

Table 4-1 lists the equipment required to access the HSD-440 terminal MPU and perform operational and diagnostic testing and software loads on the HSD-440 terminal.

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
Cable, maintenance port interface cable	Special See "Connection Requirements" on page 4-3	Remote access maximum cable length 25 ft. (From ARINC 600 connector to DB9 breakout connector) Front Panel access maximum cable length 50 ft.	1
Multimeter	Standard	–	1
General purpose toolset	Standard	–	1

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 4-2 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

C. Terminal MPU

This section describes the HSD-440 terminal MPU and provides the connection and cabling details required to access and use the program.

(1) General Overview

The MPU, built into the HSD-440 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-440 terminal MPU, an RS-232, VT-100 terminal (PC or laptop operating a terminal emulation program) must be connected to the HSD-440 terminal.

The maintenance port on the front panel of HSD-440 terminals provides a direct connection to the HSD-440 terminal MPU using a DB25 connector. Optionally, remote cabin access is possible using a DB9 connector via the ARINC 600 connector.

(2) Connection Requirements

This section describes specific cabling requirements needed to connect to and use the HSD-440 terminal MPU.

(a) Cabling Notes

The HSD-440 terminals provide two options for physical connection to the HSD-440 terminal maintenance port and MPU: direct connection and remote connection.

Table 4-3, Table 4-4, Figure 4-1, and Figure 4-2 provide cabling details for the HSD-440 terminal for both direct and remote connection types. Select one of these connection options to access the HSD-440 terminal MPU.

NOTE: The direct and remote connection points to the HSD-440 terminal maintenance port cannot be used simultaneously.

Table 4-3 Remote Connection Cabling

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

Table 4-4 Direct Connection Cabling

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

(b) Maintenance Port Cable Assembly

HSD-440 terminal maintenance cable connections may vary in length, type of connection used, and connector pin callouts, depending on the access point used.

The cable assembly for HSD-440 terminals assumes that the computer's COM port interface is a 9-Pin, D-Sub connector (DB9). Cable assembly details for HSD-440 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.

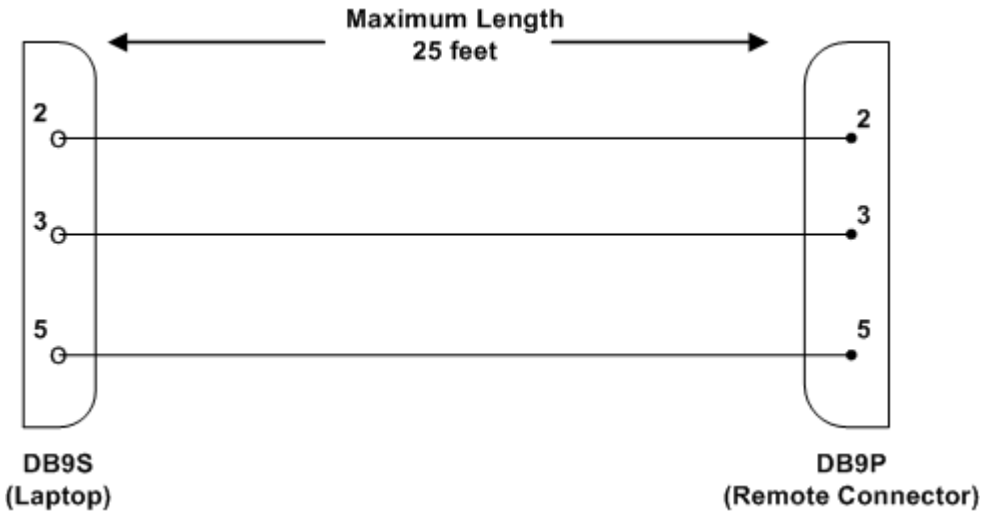

Figure 4-1 Remote Connection, Maintenance Cable

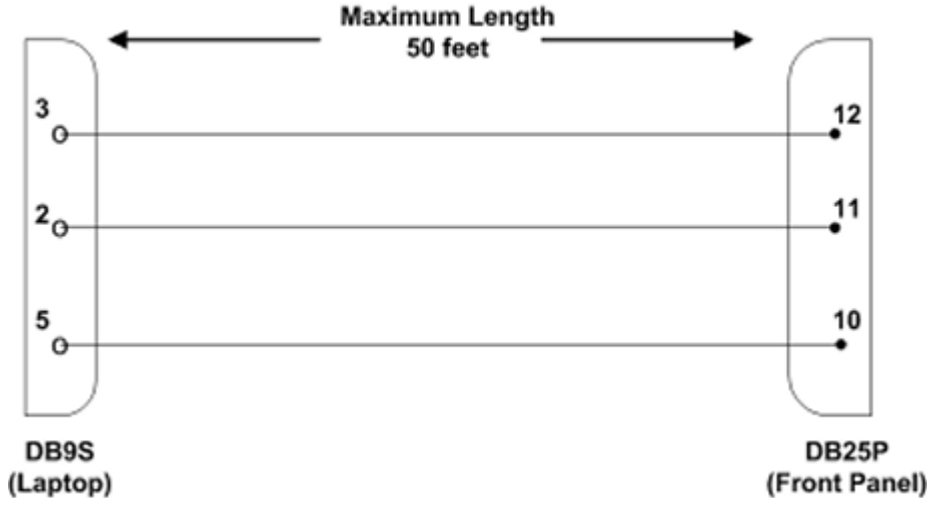

Figure 4-2 Direct Connection, Maintenance Cable

(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-440 terminal MPU. The RS-232 terminal connection settings for HSD-440 terminal maintenance ports are listed in Table 4-5.

Table 4-5 Terminal Connection Settings

Parameter	Setting
Character Format	ASCII
Baud Rate	19200 bps

Table 4-5 Terminal Connection Settings (Continued)

Parameter	Setting
No. of bits	8
Parity	None
Stop bits	1
Flow Control	None

(3) Accessing the MPU

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

This document describes End User and Field Representative access levels for operational testing and verification, software updates, and the basic system monitoring and troubleshooting procedures provided in this manual.

(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.

(4) Using the Terminal MPU

This section describes the basic procedures for using and navigating the HSD-440 terminal MPU.

(a) Entering Passwords

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

NOTE: The password does not appear on the screen when you type it.

(b) Navigating the Terminal MPU

- 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 you for additional inputs or selections.

(d) Selecting Reports

The reports available through the MPU enable users to view information about the configuration and status of the HSD-440 terminal. This information is used to troubleshoot the communication system on the aircraft.

1. To open the list of possible system reports, press EQUAL SIGN.

   A list of reports appears. Active reports show as toggled on. Inactive reports show as toggled off.

2. To activate a report, type the report number, and then press ENTER.

   NOTE: Multiple reports can be activated at the same time; type and enter each report number separately.

3. To turn off individual, active reports, type the report number you want to toggle off, and then press ENTER.

4. To turn off all active reports, press EQUAL SIGN, and then press X.

(5) 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-440 terminals, menu screens display the firmware version.

NOTE: Depending on the version of software installed and the system configuration, the menu and reports available to users may differ slightly from the illustrations shown and described in this document.

(a) Menu 1

Figure 4-3 shows the HSD-440 terminal MPU Menu 1 screen display. Table 4-6 describes the items available in Menu 1.

```
        MENU 1                                        FIRMWARE Vx.x

X     override forward id/ICAO address  L     test LEDs
Y     explain error status              U     list event log (hex)
F     print equipment stats             M     clear equipment stats
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-3 Menu 1 Screen Display

Table 4-6 Menu 1 Item Descriptions

Menu Item	Description
X: override forward id/ICAO address	Used in testing and fault isolation. Enter a test or alternate FWD ID or ICAO ID to use during fault isolation procedures. Resetting the HSD-440 terminal or cycling the power cancels this function.
Y: explain error status	Reports error status when failure LED is illuminated.
F: print equipment stats	Prints a list of the current equipment statistics.
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).
U: list event log	Lists the current event log.
M: clear equipment stats	Resets the equipment statistics. (See Item F.)

(b) Menu 2

Figure 4-4 shows the HSD-440 terminal MPU Menu 2 screen display. Table 4-7 describes the items available in Menu 2.

```
      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                             S     set satellite longitude
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-4 Menu 2 Screen Display

Table 4-7 Menu 2 Item Descriptions

Menu Item	Description
NOTE: 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 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. Offset value entered in degrees from 0 to 180, where a positive entry is clockwise (cw) and a negative entry is counterclockwise (ccw).

Table 4-7 Menu 2 Item Descriptions (Continued)

Menu Item	Description
K: desired az veh-rel velocity	Activates continuous antenna azimuth sweep at a set elevation, as entered with menu item E. Azimuth sweep velocity entered as deg/sec value. 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 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	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. Offset value entered in degrees from 0 to 90.
R: resume automatic steering	Re-activates programmed automatic antenna-steering in both azimuth and elevation.
N: annotate log file	Allows for input of text into a log file. This feature can be used to document information such as test conditions, system or aircraft identification, or any pertinent information 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-440 terminal MPU Menu 3 screen display. Table 4-8 describes the items available in Menu 3. Figure 4-6 shows the Menu 3, Item M: Miscellaneous parameters screen display. Table 4-9 describes the items available in Menu 3, Item M.

```
      MENU 3                                          FIRMWARE Vx.x

L     list EEPROM                       S     list event log
C     clear event log                   M     misc.  EEPROM parameter
F     list call log                     G     clear call log
O     list ORT                          P     ocean region parameter
I     set all LES id's                  H     list SCM/CP ORT
K     set CP ORT parameter              R     copy CP ORT to SCM
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-5 Menu 3 Screen Display

Table 4-8 Menu 3 Item Descriptions

Menu Item	Description
L: list EEPROM	Displays a list of all system EEPROM parameters and their corresponding values (this function is READ only). Certain parameters are set using Menu 3, item M selection.
C: clear event log	Clears all events and system fault codes stored in non-volatile RAM.
F: list call log	Displays call log files for HSD-440 terminal. When selected, three options are available: • To display complete list of all log files, press F. • To list extended EIRP trace data, press X. • To list all remaining entries, press PERIOD.
O: list ORT	Displays all Data I/O parameters and Ocean Region parameters.
I: set all LES id's	Configures all ORs to the same LES access code.
K: set CP ORT parameter	Sets user configurable ORT options in the control processor ORT.
S: list event log	Lists all events stored in non-volatile RAM. When selected, several options are available: • **0** displays the most recent saved entry. • **S** displays next most recent entry saved. • **PERIOD** displays all remaining logged entries. • **1** displays special events (does not include ORR entries).
M: misc. EEPROM parameter	Enables entry or entry changes to some EEPROM parameters.
G: clear call log	Clears call log files for HSD-440 terminal.
P: ocean region parameter	Configures LES access codes for individual ORs.
H: list SCM/CP ORT	Lists the values contained in either the SCM or the CP ORT.
R: copy CP ORT to SCM	Copies values stored in the CP ORT to the SCM.

```
MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS          20  CARD 1 IP ADDRESS
 2  FORWARD ID                         21  CARD 2 IP ADDRESS
 3  GPS PROTECTION ALGORITHMS          22  TRANSMIT IF WEIGHT-ON-WHEELS
10  NUMBER OF CHANNEL CARDS            29  DEFAULT LATITUDE
11  FRONT PANEL LEDS ENABLED           30  DEFAULT LONGITUDE
14  MAINTENANCE PORT INVERSE VIDEO     31  OBEY OXCO STATUS
15  MAINTENANCE PORT DEGREES SYMBOL    42  HCM AERO/M4 PRIORITIZATION
16  TERMINAL CATEGORY                  45  CATEGORY B LOWER FREQUENCY LIMIT

WHICH PARAMETER #   <CTRL> N for next page  ?

46  CATEGORY B UPPER FREQUENCY LIMIT   58  QUAL PA BACKOFF
51  SDU INPUT POWER OFFSET             59  CLASSIC AERO MANUAL BOOT
52  OUTPUT POWER COUPLING CONST        60  CH CARD GATEWAY ADDRESS
53  REFLECTED POWER COUPLING CONST     61  IMEI KEY
54  REFLECTED POWER SLOPE              62  SDU-TO-PA GAIN
55  REFLECTED POWER INTERCEPT          63  CARD 1 SUBNET ADDRESS
56  PSU CURRENT SLOPE                  64  CARD 2 SUBNET ADDRESS
57  PSU CURRENT INTERCEPT              65  AIR/GROUND BEHAVIOUR

WHICH PARAMETER #   <CTRL> N for next page  ?
```

Figure 4-6 Menu 3—Item M: Miscellaneous Parameters

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

Parameter Number	Parameter Name	Description
1	HPA-to-Antenna Total Loss	Defines transmit coaxial cable loss from the HSD-440 terminal at MPC1 to the antenna, including the DLNA loss—maximum is 2.5 dB (includes DLNA loss of 0.8 dB).
2	Forward ID	Entry required as the ICAO address is strapped. Refer to "Installation" on page 3-1 for strapping details.
3	GPS protection algorithms	Disables the GPS algorithms the HSD-440 terminal uses to prevent calls from interfering with the GPS navigational system on the aircraft.
10	Number of channel cards	Selects the number of channel cards for which the system is configured.
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 report to be highlighted in Inverse Video when it is activated—default is 1 (activated).

Table 4-9 Menu 3, Item M EEPROM Parameter Descriptions (Continued)

Parameter Number	Parameter Name	Description
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: • Select 0 to use the letter D; e.g., 180.0 D. • Select 1 to use a degree symbol °; e.g., 180.0°.
16	Terminal category	Offers an LRU configuration choice of the following: • 1 for Stand-Alone • 2 for HW Strapping Default is 2 (where hardware is read on power-up).
20	Card 1 IP Address	IP address of channel card 1.
22	Transmit if Weight-on-Wheels	Allows the system to transmit when it is on the ground.
29	Default Latitude	Allows user to enter a default latitude value. Reset the HSD-440 terminal to activate revised default values.
30	Default Longitude	Allows user to enter a default longitude value. Reset the HSD-440 terminal to activate revised default values.
31	Obey OXCO status	Prevents system operation until OCXO is warmed up (unless overridden). Use parameter setting to override warm-up during testing procedures.
42	HCM Aero/M4 prioritization	Not applicable for HSD-440 terminal Stand-Alone operation
45	Category B lower frequency limit	Not applicable for HSD-440 terminal Stand-Alone operation.
46	Category B upper frequency limit	Not applicable for HSD-440 terminal Stand-Alone operation.
51	SDU input power offset	Not modifiable by the end-user in any mode of operation.
52	Output power coupling const	Not modifiable by the end-user in any mode of operation.
53	Reflected power coupling const	Not modifiable by the end-user in any mode of operation.
54	Reflected power slope	Not modifiable by the end-user in any mode of operation.
55	Reflected power intercept	Not modifiable by the end-user in any mode of operation.
56	PSU current slope	Not modifiable by the end-user in any mode of operation.

Table 4-9 Menu 3, Item M EEPROM Parameter Descriptions (Continued)

Parameter Number	Parameter Name	Description
57	PSU current intercept	Not modifiable by the end-user in any mode of operation.
58	Qual PA backoff	Not modifiable by the end-user in any mode of operation.
59	Classic AERO manual boot	Not modifiable by the end-user in any mode of operation.
60	Ch card gateway address	Not modifiable by the end-user in any mode of operation.
61	IMEI key	Not modifiable by the end-user in any mode of operation.
62	SDU-to-PA gain	Not modifiable by the end-user in any mode of operation.
63	Card 1 subnet address	Subnet address of channel card 1.
65	Air/ground behaviour	Determines the function of WOW strapping.

(d) Menu 4

Figure 4-7 shows the HSD-440 terminal MPU Menu 4 screen display. Table 4-10 describes the items available in Menu 4.

```
      MENU 4                                          FIRMWARE Vx.x

Q     channel card forward ID's         O     set Ocean Region
S     change spot beam                  J     toggle ISDN connection
M     report MUX stats
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-7 Menu 4 Screen Display

Table 4-10 Menu 4 Item Descriptions

Menu Item	Item Description
Q: channel card forward IDs	Enables viewing of channel cards 1 and 2 FWD IDs and ICAO address.
S: change spot beam	Enables manual selection of specific spot beams independently assigned for each channel card.
M: report MUX stats	Not applicable: Used for engineering debugging purposes only.
O: set Ocean Region	Allows for manual selection of satellite ORs: AORW:0 AORE:1 POR:2 IOR:3 To revert to programmed selection, type **-1**, and then press ENTER for AUTO selection.

(e) Menu 10

Menu 10 items are used to manually enter INS parameters to simulate the INS data required for HSD-440 terminal operation when INS data is unavailable. Figure 4-8 shows the HSD-440 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                  Q     simul INS altitude
A     activate INS simul words         C     simul port ACU status
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
```

Figure 4-8 Menu 10 Screen Display

Table 4-11 Menu 10 Item Descriptions

Menu Item	Description
L: simul INS lat	Simulates a latitude by overriding the data received from the aircraft INS.
H: simul INS heading	Simulates 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.
A: activate INS simul words	Activates all input simulate parameters, overriding the INS data received from the aircraft. 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-440 terminal back to using the INS data received from the aircraft.
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.
Q: simul INS altitude	Simulates aircraft altitude 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 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.

(f) Menu 13

Menu 13 items are used to query and debug the data I/O card.

Figure 4-9 shows the HSD-440 terminal MPU Menu 13 screen display. Table 4-12 describes the items available in Menu 13.

```
      MENU 13                                          FIRMWARE Vx.x

T     query DATA IO elapsed time        V     query DATA IO version
S     query DATA IO services            D     DATA IO test
F     DATA IO fault logging level       X     DATA IO console mode
G     print DATA IO call database
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-9 Menu 13 Screen Display

Table 4-12 Menu 13 Item Descriptions

Menu Item	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.
G: print DATA IO call database	Displays the calls made and recorded in the data I/O database.
V: query DATA IO version	Displays the firmware version of the data I/O card.
D: DATA IO test	Tests individual interfaces of the data I/O.
X: DATA IO console mode	Opens a virtual TTY session to the data I/O maintenance port on the HSD-440 terminal.

(g) Menu 14

Menu 14 items are used only by professional installers for debugging and clarifying call routing issues.

Figure 4-10 shows the HSD-440 terminal MPU Menu 14 screen display.

```
      MENU 14                                          FIRMWARE Vx.x

N     num entries in call table         L     list call table
T     get call table
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-10 Menu 14 Screen Display

(h) Menu 15

Figure 4-11 shows the HSD-440 terminal MPU Menu 15 screen display.

Table 4-13 describes the items available in Menu 15.

```
      MENU 15                                          FIRMWARE Vx.x

V     request channel card versions     D     channel card serial number
B     channel card RSSI mode            G     A_TI query
W     request burst counter
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-11 Menu 15 Screen Display

Table 4-13 Menu 15 Item Descriptions

Menu Item	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. As requested, enter the channel number, the OR, 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_TI query	Manually sends an A_TI query to the requested channel card to check on the alive/dead status of the channel card processors. As requested, enter a channel card number and service type to query.

(i) Menu 21

Figure 4-12 shows the HSD-440 terminal MPU Menu 21 screen display.

Table 4-14 describes the items available in Menu 21.

```
       MENU 21                                          FIRMWARE Vx.x

P     get channel card ethernet parms   I     get channel card IMEI key
B     request SBB configuration
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports
```

Figure 4-12 Menu 21 Screen Display

Table 4-14 Menu 21 Item Descriptions

Menu Item	Item Description
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.

(6) Report Descriptions

When testing or troubleshooting the HSD-440 terminal, monitoring real-time system data is sometimes required. Figure 4-13 shows all the reports 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 reports displayed may differ from those shown in Figure 4-13.

```
 1 OFF OFF messages to card #1          13 OFF messages to card #2
 2 OFF OFF hex output to card #1        14 OFF hex output to card #2
 3 OFF OFF responses from card #1       15 OFF responses from card #2
 4 OFF OFF hex input from card #1       16 OFF hex input from card #2
 5 OFF 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


Enter 1 thru 167 to toggle report on/off
X  turn off all reports    <CTRL> N  show next page    S   save to EEPROM
ESC  return to PREVIOUS MENU

25 OFF HPA arinc i/o                    39 OFF combined-mode debugging
27 OFF HPA/channel card backoffs        40 OFF enthusiastic combined-mode debug
28 OFF miscellaneous digital inputs     41 OFF delta combined-mode debugging
29 OFF channel card A_AM msgs           43 OFF sdu path cable calibration
30 OFF multi-control arinc bus          44 OFF hpa calibration (gain droop)
31 OFF ocean region info                45 OFF combined mode ocean region debug
32 OFF hex input from data i/o          46 OFF hpa resets
33 OFF hex output to data i/o           47 OFF channel card temperature
34 OFF input from data i/o              48 OFF hexadecimal INS input
35 OFF changes in multi-control bus     49 OFF main loop latency
36 OFF unit test call setup             50 OFF main loop timing
38 OFF combined-mode power allotment    51 OFF one second tick


Enter 1 thru 167 to toggle report on/off
X  turn off all reports    <CTRL> N  show next page    S   save to EEPROM
ESC  return to PREVIOUS MENU

52 OFF extended call codes              76 OFF HSD-X arinc messages
54 OFF multi-control time and date      77 OFF HSD-X net configuration
60 OFF OFF debug channel card power     78 OFF vt100 eirp/power
61 OFF non-zero channel card power      79 OFF dialtone debugging
62 OFF m4 availability status           86 OFF Channel card rx attenuation
64 OFF channel card frequencies         87 OFF interworking report
65 OFF enthusiastic messages from HPA   89 OFF debug call teardown
66 OFF channel card boot sequence       90 OFF debug cc backoff
67 OFF debug honeywell combined mode    91 OFF HSD frequencies
68 OFF CFDS debugging                   92 OFF intermod debugging
69 OFF vt100 scenario                   93 OFF spot beam debugging
72 OFF DATA I/O events                  94 OFF vt100 channel card info


Enter 1 thru 167 to toggle report on/off
X  turn off all reports    <CTRL> N  show next page    S   save to EEPROM
ESC  return to PREVIOUS MENU
```

```
95 OFF vt100 debugging                  117 OFF output to data i/o (ascii)
96 OFF INS data rate                    118 OFF channel card rf loopback
107 OFF unusual channel card msgs       119 OFF I2C controller i/o
108 OFF channel card rf pwr detect      120 OFF I2C controller hex i/o
109 OFF channel card power SU's         121 OFF I2C slave status
110 OFF underdraft debugging            122 OFF I2C miscellaneous input
111 OFF miscellaneous digital outputs   123 OFF enthusiastic backoff
112 OFF arinc labels                    124 OFF PA mute debugging
113 OFF channel card sw loads           125 OFF PA BITE status
114 OFF all channel card THA codes      126 OFF calibrated power detectors
115 OFF OCXO state toggles              127 OFF power supply dc current
116 OFF DATA I/O passthrough mode       128 OFF VSWR monitoring


Enter 1 thru 167 to toggle report on/off
X  turn off all reports    <CTRL> N  show next page    S   save to EEPROM
ESC  return to PREVIOUS MENU

129 OFF I2C output to PA                142 OFF lo-level W'burg labels from CMU
130 OFF I2C temperature sensors         143 OFF next W'burg LDU
131 OFF duart channel hex input         144 OFF W'burg state changes
133 OFF LES access codes                145 OFF all input from CMU (hex)
134 OFF MCDU #1 arinc input             146 OFF periodic messages from CMU
135 OFF MCDU #2 arinc input             147 OFF arinc hex output to CMU
136 OFF arinc output to MCDU            148 OFF USIM heater control
137 OFF MCDU state machine              149 OFF AERO logging text -- no SU
138 OFF ascii digital inputs            150 OFF ACARS P-channel RX data
139 OFF W'burg messages to CMU          151 OFF all AERO SUs
140 OFF W'burg messages from CMU (hex)  152 OFF AERO msg acks
141 OFF W'burg messages from CMU        154 OFF non-periodic msgs to aero card


Enter 1 thru 167 to toggle report on/off
X  turn off all reports    <CTRL> N  show next page    S   save to EEPROM
ESC  return to PREVIOUS MENU

155 OFF AES status table queries        167 OFF max 615 debugging
156 OFF MCDU driver errors
157 OFF ADC raw values                   1 OFF OFF messages to card #1
158 OFF classic AERO call progress       2 OFF OFF hex output to card #1
159 OFF AES status                       3 OFF OFF responses from card #1
160 OFF AERO SUs for this terminal       4 OFF OFF hex input from card #1
161 OFF 1252-A-3400 status               5 OFF OFF card #1 misc info
162 OFF vt100 mcdu                       6 OFF sb antenna arinc input
163 OFF periodic messages to CMU         7 OFF sb antenna maintenance word
164 OFF enthusiastic digital inputs      8 OFF sb antenna status word
165 OFF 615 data loader upgrades         9 OFF channel card call status
166 OFF 615 data loader debugging       10 OFF channel card THA codes
```

Figure 4-13 HSD-440 Terminal MPU Reports

(7) Activating Maintenance Reports

In Level 1 menu access, report 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 maintenance access provides more flexibility in the use of the reports function. This access level permits the activation or deactivation of any one of the reports (toggle on and off).

(a) Reports General Guidelines

- To open the report menu, press EQUAL SIGN.
- To activate a report, type the number of the report needed, and then press ENTER. This toggles on the report number entered. To toggle the report off, type the report number again, and then press ENTER.
- To disable all reports (toggles all reports off), press X.
- To display the next group of reports, press CTRL+N.
- To save all selected reports 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 reports are used in the testing or troubleshooting of the system. This section describes only the more commonly used reports.

1. Report 23

Report 23 is the most comprehensive report, giving an overall general impression of the HSD-440 terminal health. An example of the contents of report 23 is shown in Figure 4-14. Table 4-15 provides a brief description of the parameters. Each distinct parameter is numbered for description purposes.

```
17:12:40 dop 0 ppb az 112.2 deg el 12.2 deg AORE ant gain 12.0 (sbd)
CHAN #1: C/No=51.5 dB Hz sig=-32.2 dB 41.5 C speech beam=4
CHAN #2: C/No=51.6 dB Hz sig=-32.9 dB 41.5 C no call beam=5
CHAN #3: C/No=49.3 dB Hz sig=-26.2 dB 40.0 C log on beam=4
CHAN #4: C/No= 0.0 dB Hz sig= -0.0 dB 40.5 C no call beam=4
45D0'0.0"N 75D0'0.2"W PT 0.0D RL 0.0D HD 0.0D TK 0.0D 0 knots 0 ft
```

Figure 4-14 Example of Report 23 Output

Table 4-15 Report 23 Item Descriptions

Report 23 Item Number	Description
1	IRS lat/long as interpreted by the HSD-440 terminal
2	Aircraft pitch angle, where UP is positive
3	Aircraft roll angle, where clockwise is positive
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 below)
6	Aircraft velocity
7	Time based on the system real time clock
8	Doppler frequency offset; increases with velocity (see note below)
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	OR to which the system is logged on
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-440 terminal channel card temperature
17	System call status indicates it is logged on or off for channel 3
18	Satellite beam on which the card is registered

NOTE: When the aircraft is stationary, the field may appear as a series of asterisks (*).

2. Reports 5 and 17

   Report 5 displays information for channel card 1, and report 17 displays information for channel card 2.

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

   You are prompted to select the channel(s) for which to generate a report as shown in Figure 4-15:

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

Figure 4-15 Example of Prompt to Generate a Report

Select channel 1, channel 2, Both channels, or X to deselect all channels. For channel card 2, you will 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 reports displayed may differ from those shown in Figure 4-16.

```
CHAN #3: C/No=52.2 dB Hz  sig=-16.2 dB log on  beam=4 AORE bt=OK oc=NA
         tx 1646560000 Hz  burst  0   40.0 C
```

Figure 4-16 Example of Report 17, Channel Card 2, Channel 3

3. Reports 8 and 20

   Report 8 displays the status of the Starboard antenna, and report 20 displays the status of the port antenna.

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

   NOTE: Depending on the version of software installed and the user's selection of reports, the MPU reports displayed may differ from those shown in the example in Figure 4-17.

```
port status $600231  SDI: PRT/TOP  SSM: NORMAL  gain=12.0
OMNIDIRECTIONAL MODE  open loop tracking  starboard active   HGA   LNA=off
```

Figure 4-17 Example of Report 20

Table 4-16 shows descriptions of the items in reports 8 and 20.

Table 4-16 Reports 8 and 20 Descriptions

Reports 8 and 20	Starboard and Port Antenna Status
(Hex code) -	Raw hex code of the 32-bit ARINC word—decoded message follows code. The last 8-bits are not shown (ARINC label).
(SDI) -	Antenna being used (for mechanically and beam steered, only Port data is valid)
(SSM) -	Antenna serviceability
(Gain) -	Reported antenna gain (may vary with increased blockage or keyhole pointing)
(Mode) -	Reports tracking status, antenna selection, and high gain mode
(LNA) -	Power-on status

4. Report 21

   Report 21 displays the call code information for the HSD-440 terminal.

   Figure 4-18 shows an example of report 21. Table 4-17 describes the items in report 21.

```
15:56:23 #2 456DEF E4 start 400110 14.00 dBW  CT SP ocean region registration  4
2.0 C  52 dB Hz
15:56:24 #1 123ABC E5 start 400110 14.00 dBW  CT SP ocean region registration  4
2.0 C  52 dB Hz
15:56:26 #2 456DEF E4 stop 8301  ACSE successful ORR  42.0 C  52 dB Hz
15:56:26 #1 123ABC E5 stop 8301  ACSE successful ORR  42.0 C  51 dB Hz
15:58:30 #3 60104507 E4 stop 400110 aero logon  40.0 C  51 dB Hz
15:59:00 #3 60104507 E0 start 400110 13.50 dBW aero logon  40.0 C  38 dB Hz
15:59:13 #3 60104507 E4 start 400110 20.40 dBW aero logon  40.0 C  50 dB Hz
16:19:23 #3 60104507 E4 stop 400110 aero logon  40.0 C  54 dB Hz
16:19:52 #3 60104507 E0 start 400110 13.50 dBW aero logon  40.0 C  0 dB Hz
16:20:05 #3 60104507 E4 start 400110 20.40 dBW aero logon  40.0 C  49 dB Hz
```

Figure 4-18 Example Report 21

Table 4-17 Report 21 Item Descriptions

Report 21	Call Codes
(Time) -	Time based on the system real time clock
(Fwd Addr) -	Forward address ID/ICAO assigned to the system channel cards
(Alpha/no.) -	OR and beam the card is logged on to
(Call) -	Call real-time status, service type code, and Inmarsat Cause Code (see Appendix H: Inmarsat Cause Codes on page H-1)
(RF power) -	LES commanded HPA power in dBW
(OR status) -	OR registration status
(Call orig)	Call originating from MES or from a fixed location
(Call type)	Call types (for example, speech)

D. Fault Definitions

The fault definitions that appear in the HSD-440 terminal maintenance menu logs are based directly on the cause code definitions provided by Inmarsat. Appendix H: Inmarsat Cause Codes on page H-1 defines the maintenance port menu fault codes of the HSD-440 terminal.

E. Operational and Diagnostic Test Procedures

(1) General

You can perform all test procedures presented in this section to test the total operational status of the HSD-440 terminal. You can 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 (indications). Refer to the detailed operating procedures and descriptions of the HSD-440 terminal MPU included in this section.

CAUTION: ONLY AUTHORIZED TECHNICAL PERSONNEL WHO ARE TRAINED IN GENERAL AVIATION WORKMANSHIP AND HAVE A BASIC UNDERSTANDING OF SATCOM SYSTEMS SHOULD PERFORM THE OPERATIONAL AND DIAGNOSTIC TEST PROCEDURES IN THIS MANUAL.

CAUTION: CHANGES TO DEFAULT VALUES FOR 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 Product Support 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-440 terminal. Maintenance does not imply lubrication or adjustment activities.

Refer to the Outline and Installation diagrams and the Interconnection and Contact Assignment drawings presented in "Installation" on page 3-1 for additional information.

(2) Test Setup Procedure

The test setup procedure is presented in Table 4-18. For detailed connection of test equipment and operating instructions for the HSD-440 terminal MPU, see "Terminal MPU" on page 4-2.

Table 4-18 Test Setup Procedure

Step	Action
1.0	Make sure that the HSD-440 terminal is neither powered up nor connected to a power source.
2.0	Connect a maintenance cable to the HSD-440 terminal front-panel or remote maintenance port connector.
3.0	Connect the other end of the cable to the serial port of the computer.
4.0	Open a log file to capture all test data.

(3) Post Test

When testing is completed, follow the steps in Table 4-19.

Table 4-19 Post Test Procedure

Step	Action
1.0	Save the log file of the test results (or data) for future reference.
2.0	Remove power from the HSD-440 terminal that was tested and from all other test equipment.
3.0	Disconnect test equipment from the HSD-440 terminal.
4.0	Replace the maintenance-port connector cover (if it was removed during the test setup).

(4) 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 "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 4-20 itemizes recommended mechanical checks.

Table 4-20 HSD-440 Terminal Mechanical Verification

STEP	Item Checked	Verification Description
1. 0	Mounting tray	Make sure that service/maintenance are accessible.
	Physical placement	Check that environmental considerations are met, including cooling, air-flow, and pressure
2. 0	Fan tray	Confirm plug configuration is correct.
		Check chassis bonding.
		Make sure that fan rotation is unobstructed and rotates freely.
3. 0	ARINC 600 connector	Check polarized pints.

(c) Electrical Verification

Refer to "Installation" on page 3-1 for detailed electrical information. Table 4-21 itemizes the recommended electrical checks.

When conducting the following tests, do not rack the HSD-440 terminal.

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

Table 4-21 HSD-440 Terminal Electrical Verification Checklist

STEP	Item Checked	Verification Description
1.0	Power connections	28 V dc polarity or 115 V ac polarity
		Chassis ground @ BP8—resistance measurement
2.0	Voltage levels	CAUTION: WHEN POWER IS APPLIED TO THE RACK, THE FAN ENERGIZES. Check voltage levels: 28 V dc: between BP2 (positive) and BP3 (return) or 115 V ac: between BPI (115-H) and BP7 (115-C)
3.0	IRS Input	IRS wiring: Inertial system wired to TP4J (A) and TP4K (B)
		IRS format: ARINC 429 Interface
4.0	Configuration Strap Pins	SDI: Strapped for HGA, Pin TP5B to TP5D
		System configuration: Strapped for Stand-Alone Mode, Pins TP4A and TP4C strapped to TP7K
		ICAO ID: User specific address obtained from the aircraft registration
		WOW: optional
5.0	Ethernet 1 and 2	Wired to RJ45 distribution points Optional—other service may be preferred
6.0	ISDN 1	Wired to RJ45 distribution points Optional—other service may be preferred
7.0	Remotes (optional but recommended)	Remote reset switch
		Maintenance port, remote access
		Power and fault indicators
8.0	RF coaxial	Rx input cable loss from DLNA J2 to HSD-440 terminal at BP12
		Tx output cable loss from HSD-440 terminal at MPC1 to DLNA J3
9.0	Multi-control and BITE from antenna subsystem	Antenna manufacturer and model

(5) Configuration Parameters Verification

You can now verify the system configuration parameters. For additional connection and access information, see "Connection Requirements" on page 4-3. Verify and document using "Installation Checklist" on page E-1.

(a) Parameter Verification Procedure

- From Menu 3, press H (list SCM/CP ORT), and then press 1 (CP EEPROM ORT).

  The ORT listing appears on the screen, as shown in Figure 4-19. Verify that the correct system configuration parameters are listed in the ORT.

```
      MENU 3                            HSD-440   FIRMWARE V11.9  AIR

L     list EEPROM                       S     list event log
E     reset EEPROM                      C     clear event log
M     misc.  EEPROM parameter           J     ignored faults
N     EMS serial number                 F     list call log
G     clear call log                    O     list ORT
P     ocean region parameter            I     set all LES id's
Q     search call log                   H     list SCM/CP ORT
K     set CP ORT parameter              R     copy CP ORT to SCM
<CTRL> N  next menu      <CTRL> O  previous menu      =  select reports

TERMINAL: STAND-ALONE MODE

0 lists SCM ORT -- 1 lists CP EEPROM ORT ?

CP EEPROM ORT: ID 0

MCDU #1 aero voice noise level -50  SET BY CP DEFAULT
MCDU #1 aero voice headset level 50  SET BY CP DEFAULT
MCDU #1 aero voice mic level 50  SET BY CP DEFAULT
MCDU #1 aero voice sidetone level 50  SET BY CP DEFAULT
MCDU #2 aero voice noise level -50  SET BY CP DEFAULT
MCDU #2 aero voice headset level 50  SET BY CP DEFAULT
MCDU #2 aero voice mic level 50  SET BY CP DEFAULT
MCDU #2 aero voice sidetone level 50  SET BY CP DEFAULT
call light flag -1  SET BY CP DEFAULT
chime light flag -1  SET BY CP DEFAULT
hook switch flag -1  SET BY CP DEFAULT
priority 4 flag -1  SET BY CP DEFAULT
MCDU type 1  SET BY CP DEFAULT
Viper antenna gain 16.0  SET BY CP DEFAULT
viper hpa-antenna loss 6.7  SET BY CP DEFAULT
HSD SAL 307  SET BY CP DEFAULT
accept 'auto cts' flag 0  SET BY CP DEFAULT
send 'auto cts' flag 0  SET BY CP DEFAULT
BIT protocol verification flag 1  SET BY CP DEFAULT
Use dest. code in WBURG protocol 1  SET BY CP DEFAULT
HIT 'H' for MORE

RTS conflict resolution flag 1  SET BY CP DEFAULT
WBURG full duplex 0  SET BY CP DEFAULT
use CMU SAL from ALO 0  SET BY CP DEFAULT
allow WBURG solo words 1  SET BY CP DEFAULT
auto aero logon ENABLED  SET BY CP DEFAULT
allow high rate in global beam ENABLED  SET BY CP DEFAULT
aero icao address 000000  SET BY CP DEFAULT
allow interrogation from GES DISABLED  SET BY CP DEFAULT
cabin availability flag 1111  SET BY CP DEFAULT
CMU high-speed baudrate DISABLED  SET BY CP DEFAULT
forward id[7m ABC123[0m  [7mNOT DEFAULT[0m  SET BY MAINT PORT
Viper HSDX #1 cable loss 29.5 dB  SET BY CP DEFAULT
Viper HSDX #2 cable loss 29.5 dB  SET BY CP DEFAULT
air/ground status DISABLED  SET BY CP DEFAULT
position reporting 1  SET BY CP DEFAULT
HPA-antenna loss 2.5 dB  SET BY CP DEFAULT
automatic LEDs ENABLED  SET BY CP DEFAULT
minimum antenna gain 8.0 dB  SET BY CP DEFAULT
restrict maintenance port in air YES  SET BY CP DEFAULT
prevent transmissions on ground YES  SET BY CP DEFAULT
HIT 'H' for MORE

DIO BLOCK:  MISSING
```

```
SATELLITE TABLE:

LES ACCESS CODE TABLE:
     AORW: LES 1    NETWORK ID 0   NO NAME
     AORE: LES 1    NETWORK ID 0   NO NAME
      POR: LES 1    NETWORK ID 0   NO NAME
      IOR: LES 1    NETWORK ID 0   NO NAME
    SAT 4: LES 1    NETWORK ID 0   NO NAME
    SAT 5: LES 1    NETWORK ID 0   NO NAME
    SAT 6: LES 1    NETWORK ID 0   NO NAME
    SAT 7: LES 1    NETWORK ID 0   NO NAME

HIT 'H' for MORE

GES PRIORITY TABLE:
ENTRY #1  AORE   Eik                (GES 104)  PRIORITY 5
ENTRY #2  AORE   Aussaguel          (GES 103)  PRIORITY 5
ENTRY #3  AORE   Goonhilly          (GES 101)  PRIORITY 5
ENTRY #4  AORW   Goonhilly          (GES 1)    PRIORITY 5
ENTRY #5  AORW   Aussaguel          (GES 5)    PRIORITY 5
ENTRY #6  AORW   Southbury          (GES 2)    PRIORITY 5
ENTRY #7  AORW   Eik                (GES 4)    PRIORITY 5
ENTRY #8  IOR    Eik                (GES 301)  PRIORITY 5
ENTRY #9  IOR    Sentosa            (GES 310)  PRIORITY 5
ENTRY #10 IOR    Perth              (GES 305)  PRIORITY 5
ENTRY #11 IOR    Yamaguchi          (GES 306)  PRIORITY 5
ENTRY #12 POR    Santa Paula        (GES 202)  PRIORITY 5
ENTRY #13 POR    Sentosa            (GES 201)  PRIORITY 5
ENTRY #14 POR    Perth              (GES 205)  PRIORITY 5
ENTRY #15 POR    Yamaguchi          (GES 203)  PRIORITY 5

DONE
```

Figure 4-19 HSD-440 Terminal ORT Display Example

(6) System Power-up Checks

NOTE: Before proceeding, make sure that all pre power-up, mechanical, and electrical verifications have been successfully performed and documented using "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 hangar. Make sure 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-440 terminal front panel and on the optional remote panel.

To visually verify LEDs:

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-440 terminal, and verify the initial power-up screen displays, as shown in Figure 4-20.

```
KERNEL V1.4 -- Wed Feb 21 08:58:08 2007
TESTING RAM ......RAM OK.

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1252-A-3400 APPLICATION Vx.x -- Wed Mar 28 10:07:24 2007
VALIDATING DETECTOR CALIBRATION TABLES....  OK
VALIDATING ATTENUATOR CALIBRATION TABLE AT $608000....  OK
ORT OCEAN REGIONS:             SAT LONG   LES ID   TNID
  **W SAT0         (region #0)   52.5W      1       0
  **E AORE         (region #1)   15.0W      1       0
  **P POR          (region #2)  178.5E      1       0
  **I IOR          (region #3)   63.0E      1       0
**  LONGITUDE UPDATED FROM AERO BULLETIN BOARDS

REAL TIME CLOCK PRESENT:  17:02:20 Fri Apr 13, 2007
FORWARD ID TABLE -- VERSION 1
4.1 SECONDS: EEPROM FORCES STAND-ALONE MODE

FIRMWARE VERSIONS:
   KERNEL:           V1.4 -- Wed Feb 21 08:58:08 2007
   APPLICATION:      V11.9 -- Wed Mar 28 10:07:24 2007
   CHANNEL CARD #1:  4.9.8.0 -- 0.3.6.2 -- 2.1.0.0 -- 2.7.0.0
   CHANNEL CARD #2:  1.17.0.1 --  --  -- 2.7.0.0
   DATA I/O CARD:    Version 1.39.0.0 built on Feb  2 2007 13:

CHANNEL CARD STATISTICS
CARD #1  SWIFT64  (SERIAL 4871):
      886.8 hrs powered  3.8 hrs in call since 10:29:31 Dec 11, 2006
CARD #2  CLASSIC AERO  (SERIAL 4422):
      861.3 hrs powered  140.0 hrs in call since 10:29:29 Dec 11, 2006

HARDWARE:
            PART NUMBER        REVISION
     EMS:   1110-A-3400

SOFTWARE:
            PART NUMBER        REVISION
     EMS:   *************      ***
     BOOT CRC:   D96D0D1F
     APP. CRC:   557DFF24

Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.

time 17.0 seconds: powering on channel card #1
time 17.0 seconds: powering on channel card #2
```

Figure 4-20 HSD-440 Terminal Power-up Display Example

(7) System On-Air Checks

Conduct system on-air checks to confirm voice and data call capabilities through the satellite and ground station 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-sight to the satellite.
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-440 terminal maintenance port.

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

(b) On-Air Power up and Logon Procedure

For this test procedure, use the Level 2, **maint** password to access the HSD-440 terminal MPU. For information on how to connect, access, and use the HSD-440 terminal MPU, see "Connection Requirements" on page 4-3.

To perform an on-air power up and logon:

1. With the computer connected, powered up, and ready to accept maintenance port data, power up the HSD-440 terminal.
2. Once the power up messages appear, type the Level 2 password **maint**.
3. To access the reports menu, press EQUAL SIGN, and then activate reports 21 (call codes) and 23 (standard output).

   Remember to save these selected items by pressing S (save to EEPROM).
4. To reset the HSD-440 terminal, in Menu 2, press Z, and then immediately type the password **maint** when the reset messages appear.

   The data from the previously selected reports 21 and 23 appears. This data refreshes on-screen every second. You can capture this information in a log file for later review or pause the display by pressing SCROLL LOCK or highlighting part of the viewed data.
5. Compare the output data to the sample shown in Figure 4-22.

   You can review and document several parameters for operational verification purposes. Refer to "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-440 terminal under test.
   - FWD ID/ICAO ID
   - Installation mode
   - Number of channel cards
   - All channel cards trigger OR registration

The example figure has been edited for clarity. A successful logon is confirmed when channel 3 changes states from Logoff to Logon.

```
CARD #2 LOGGING TEXT [02] 0922 ALO: Received user-initiated log on request (auto-select)
CARD #2 LOGGING TEXT [00] 0923 ALO: User-initiated log on request ACCEPTED
CARD #2 LOGGING TEXT [02] 0924 ALO: State = Entry-11
CARD #2 LOGGING TEXT [02] 0925 ALO: Searching priority group 5
CARD #2 LOGGING TEXT [02] 0926 ALO: Sat ID 1, GES ID 68 not found in blacklist
CARD #2 LOGGING TEXT [02] 0927 ALO: Number of valid satellites found in group = 1
CARD #2 LOGGING TEXT [02] 0928 ALO: Satellite ID in view = 1
CARD #2 LOGGING TEXT [02] 0929 ALO: Longitude difference from present position X100 = 6000
CARD #2 LOGGING TEXT [02] 0930 ALO: Best satellite ID = 1
CARD #2 LOGGING TEXT [02] 0931 ALO: State = Entry-2
CARD #2 LOGGING TEXT [02] 0932 ALO: Pointing antenna: SatId=1 Gen=0 LongX100=-1500 Inc=0, RAsc=100
CARD #2 LOGGING TEXT [02] 0933 ALO: Antenna pointing result = 1
CARD #2 LOGGING TEXT [02] 0934 ALO: State = Entry-10
CARD #2 LOGGING TEXT [02] 0935 ALO: Tuning Psid #0 to 14006
CARD #2 LOGGING TEXT [05] 0936 ALO: Tuning P-channel(0) to 14006, rate=600, CommonTiming = 0
CARD #2 LOGGING TEXT [05] 0937 ALO: Disable Tx Channels. R/T chan: 1
CARD #2 LOGGING TEXT [02] 0938 ALO: State = Await P-Channel Sync-0
CARD #2 LOGGING TEXT [34] 0939 DspMsg: P-status at t = 193 (fr = 0, sf = 0, uw 0)
CARD #2 LOGGING TEXT [34] 0940 DspMsg: P-ch acquisition initiated at t = 193
17:06:20 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:20 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:22 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:22 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:23 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:23 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [34] 0947 DspMsg: P-status at t = 199 (fr = 1, sf = 0, uw 0)
CARD #2 LOGGING TEXT [34] 0948 DspMsg: P-ch sync acquired at t = 199
CARD #2 LOGGING TEXT [02] 0949 ALO: State = Await Revision Number
17:06:25 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:25 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [34] 0950 DspMsg: P-status at t = 200 (fr = 1, sf = 0, uw 1)
CARD #2 LOGGING TEXT [02] 0952 ALO: Detected System Table revision 57
CARD #2 LOGGING TEXT [02] 0953 ALO: No System Table update required
17:06:27 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:27 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [02] 0959 ALO: Spot Beam Map revision 1 - no update required
CARD #2 LOGGING TEXT [02] 0960 ALO: State = Entry-3
CARD #2 LOGGING TEXT [02] 0961 ALO: At entry-3 with null GES ID and satellite chosen from the ORT; check
ORT for corresponding GES
CARD #2 LOGGING TEXT [02] 0962 ALO: Sat ID 1, GES ID 68 not found in blacklist
CARD #2 LOGGING TEXT [02] 0963 ALO: Sat ID 1, GES ID 67 not found in blacklist
CARD #2 LOGGING TEXT [02] 0964 ALO: Sat ID 1, GES ID 65 not found in blacklist
CARD #2 LOGGING TEXT [02] 0965 ALO: Adding to blacklist at index 0, sat ID 1, GES ID 65
CARD #2 LOGGING TEXT [02] 0966 ALO: For sat ID 1 in ORT group 5, number of valid GESs available = 2
CARD #2 LOGGING TEXT [02] 0967 ALO: Selected GES ID = 68
CARD #2 LOGGING TEXT [02] 0968 ALO: AES is in beam 4
CARD #2 LOGGING TEXT [02] 0969 ALO: Tuning Psmc to 14078
CARD #2 LOGGING TEXT [05] 0970 ALO: Tuning P-channel(0) to 14078, rate=600, CommonTiming = 0
CARD #2 LOGGING TEXT [05] 0971 ALO: Disable Tx Channels. R/T chan: 1
CARD #2 LOGGING TEXT [02] 0972 ALO: Requesting Rsmc power for chnl 1: eirp_X100 = 1350, min_slot = 14022,
max slot = 14038
17:06:27 #3 60104507 E0 start 400110 13.50 dBW aero logon  40.0 C  36 dB Hz
CARD #2 LOGGING TEXT [02] 0973 ALO: State = Await P-Channel Sync-1
CARD #2 LOGGING TEXT [34] 0974 DspMsg: P-status at t = 201 (fr = 0, sf = 0, uw 0)
CARD #2 LOGGING TEXT [34] 0975 DspMsg: P-ch acquisition initiated at t = 201
CARD #2 LOGGING TEXT [02] 0976 ALO: Rsmc power allocated: EIRP requested = 1350, allocated = 1350
17:06:29 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:29 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:31 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:31 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [34] 0980 DspMsg: P-status at t = 207 (fr = 1, sf = 0, uw 0)
CARD #2 LOGGING TEXT [34] 0981 DspMsg: P-ch sync acquired at t = 207
CARD #2 LOGGING TEXT [02] 0982 ALO: Tuning Rsmc
CARD #2 LOGGING TEXT [05] 0983 ALO: Tuning R-channel(1) to 14038, rate=600, eirp_X100=1350
CARD #2 LOGGING TEXT [06] 0984 DEA: Msg: Log on
CARD #2 LOGGING TEXT [02] 0985 ALO: State = Entry-5
CARD #2 LOGGING TEXT [02] 0986 ALO: Sending log on request to GES 68 for class 3 AES in beam 4
CARD #2 LOGGING TEXT [02] 0987 ALO: State = Await Log-On Confirm
CARD #2 LOGGING TEXT [0b] 0988 LLUSER: Log-on in progress AMIDU
17:06:33 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:33 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [10] 0995 RTSW: Recovered from missing SYNCHRO
CARD #2 LOGGING TEXT [34] 0997 DspMsg: P-status at t = 208 (fr = 1, sf = 0, uw 1)
```

```
17:06:35 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:35 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [34] 1004 DspMsg: P-status at t = 210 (fr = 1, sf = 1, uw 1)
CARD #2 LOGGING TEXT [34] 1005 DspMsg: P-ch SF lock at t = 210
17:06:36 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:36 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:38 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:38 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [02] 1031 ALO: Required Rd-channel EIRP x100 = 2040
CARD #2 LOGGING TEXT [02] 1032 ALO: Required T-channel [0] EIRP x100 = 910
CARD #2 LOGGING TEXT [02] 1033 ALO: Required T-channel [1] EIRP x100 = 2040
CARD #2 LOGGING TEXT [02] 1034 ALO: Required T-channel [2] EIRP x100 = 910
CARD #2 LOGGING TEXT [02] 1035 ALO: Requesting Rd/T-channel power for chnl 1: eirp_X100 = 2040, min_slot
= 14024, max slot = 14422
17:06:40 #3 60104507 E4 start 400110 20.40 dBW aero logon  40.0 C  49 dB Hz
CARD #2 LOGGING TEXT [02] 1036 ALO: State = Await Rd/T-Channel Power
CARD #2 LOGGING TEXT [02] 1037 ALO: Rd/T-channel power allocated: EIRP X100 requested = 2040, allocated
= 2040
CARD #2 LOGGING TEXT [02] 1038 ALO: Tuning Pd/Rd, Pd = 14434, synchronized = 1
CARD #2 LOGGING TEXT [05] 1039 ALO: Tuning P-channel(0) to 14434, rate=10500, CommonTiming = 0
CARD #2 LOGGING TEXT [05] 1040 ALO: Tuning R-channel(1) to 14422, rate=10500, eirp_X100=2040
CARD #2 LOGGING TEXT [34] 1041 DspMsg: P-status at t = 215 (fr = 0, sf = 0, uw 0)
CARD #2 LOGGING TEXT [34] 1042 DspMsg: P-ch acquisition initiated at t = 215
17:06:40 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:40 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [02] 1043 ALO: State = Await Log-On ACKo
CARD #2 LOGGING TEXT [34] 1044 DspMsg: P-status at t = 215 (fr = 1, sf = 0, uw 1)
CARD #2 LOGGING TEXT [34] 1045 DspMsg: P-ch sync acquired at t = 215
17:06:42 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:43 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [06] 1139 DEA: Msg: Log on
CARD #2 LOGGING TEXT [02] 1143 ALO: State = Logged-On
CARD #2 LOGGING TEXT [02] 1144 ALO: Satellite handover candidate 1: sat ID = 0, pref = 5, long X100 = -5250
CARD #2 LOGGING TEXT [02] 1145 ALO: Satellite handover candidate 2: sat ID = 3, pref = 5, long X100 = 6300
CARD #2 LOGGING TEXT [02] 1146 ALO: Satellite handover candidate 3: sat ID = 4, pref = 0, long X100 = 14250
CARD #2 LOGGING TEXT [02] 1147 ALO: Satellite handover candidate 4: sat ID = 1, pref = 5, long X100 = -1500
CARD #2 LOGGING TEXT [02] 1148 ALO: Satellite handover candidate 5: sat ID = 2, pref = 5, long X100 = 17850
CARD #2 LOGGING TEXT [02] 1149 ALO: Satellite handover evaluation table initialized with 5 satellite(s)
CARD #2 LOGGING TEXT [02] 1150 ALO: Satellite handover thresholds: bad EIRP = 5, bad antenna = 20, general
= 20
CARD #2 LOGGING TEXT [0b] 1163 LLUSER: Log-on AMIDU
CARD #2 LOGGING TEXT [3f] 1164 LLUSER: Resetting link layer traffic statistics
17:06:45 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
17:06:45 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  0 dB Hz
CARD #2 LOGGING TEXT [34] 1275 DspMsg: P-status at t = 220 (fr = 1, sf = 1, uw 1)
CARD #2 LOGGING TEXT [34] 1276 DspMsg: P-ch SF lock at t = 220
17:06:49 #1 ABC123 E4 stop 8306  ACSE failed retry ORR  41.5 C  51 dB Hz
17:06:49 #2 DEF456 E5 stop 8306  ACSE failed retry ORR  41.5 C  51 dB Hz
17:06:52 #1 ABC123 E4 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  51 dB Hz
17:06:53 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  52 dB Hz
17:06:56 #1 ABC123 E4 stop 8301  ACSE successful ORR  41.5 C  52 dB Hz
17:06:58 #2 DEF456 E5 stop 8306  ACSE failed retry ORR  41.5 C  52 dB Hz
17:07:01 #2 DEF456 E5 start 400110 14.00 dBW  CT SP ocean region registration  41.5 C  52 dB Hz
17:07:05 #2 DEF456 E5 stop 8301  ACSE successful ORR  41.5 C  52 dB Hz
CARD #2 LOGGING TEXT [02] 4350 ALO: Evaluating satellite handover for AES lat X100 = 4500, long X100 = -7500
CARD #2 LOGGING TEXT [02] 4351 ALO: Current satellite = 1 has preference = 5, longitude delta X100 =
6000, elevation angle = 12.20 degrees
CARD #2 LOGGING TEXT [02] 4352 ALO: Other candidate satellite = 0 has preference = 5, longitude delta
X100 = 2250, elevation angle = 33.55 degrees
CARD #2 LOGGING TEXT [02] 4353 ALO: Best satellite = 0 (not current), based on longitude delta
CARD #2 LOGGING TEXT [02] 4354 ALO: Satellite handover countdown = 19 minute(s)
CARD #2 LOGGING TEXT [02] 4355 ALO: Evaluating spot beam handover for AES lat X100 = 4500, long X100 = -7500
CARD #2 LOGGING TEXT [02] 4356 ALO: AES is still in beam 4
CARD #2 LOGGING TEXT [02] 7537 ALO: Evaluating satellite handover for AES lat X100 = 4500, long X100 = -7500
CARD #2 LOGGING TEXT [02] 7538 ALO: Current satellite = 1 has preference = 5, longitude delta X100 =
6000, elevation angle = 12.20 degrees
CARD #2 LOGGING TEXT [02] 7539 ALO: Other candidate satellite = 0 has preference = 5, longitude delta
X100 = 2250, elevation angle = 33.55 degrees
CARD #2 LOGGING TEXT [02] 7540 ALO: Best satellite = 0 (not current), based on longitude delta
CARD #2 LOGGING TEXT [02] 7541 ALO: Satellite handover countdown = 18 minute(s)
CARD #2 LOGGING TEXT [02] 7542 ALO: Evaluating spot beam handover for AES lat X100 = 4500, long X100 = -7500
CARD #2 LOGGING TEXT [02] 7543 ALO: AES is still in beam 4
```

Figure 4-21 Logon Initialization Display Example

(c) On-Air Voice/Data Call Verification

Once the system has logged on, place a test voice and/or data call. Refer to "System Operation" on page 2-1 for detailed call procedures. Verification of all aircraft communication functions is recommended. Record the test call result on "Installation Checklist" on page E-1.

NOTE: For the purposes of 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.

(d) On-Air Voice/Data Call Verification Procedure

To place an on-air voice or data call:

1. Make sure that the maintenance port reports 21 and 23 are activated.
2. Place a test call.
3. Observe the maintenance port messages, and verify that they are similar to the sample provided in Figure 4-22.

```
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
17:12:39 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (sbd)
CHAN #1: C/No=51.4 dB Hz  sig=-31.4 dB    41.5 C  no call beam=4
CHAN #2: C/No=51.5 dB Hz  sig=-32.6 dB    41.5 C  no call beam=5
CHAN #3: C/No=48.9 dB Hz  sig=-26.1 dB    40.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    40.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
17:12:40 #1 ABC123 E4 start 800124 14.00 dBW mobile aero 64k speech  41.5 C  52 dB Hz
17:12:40 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (sbd)
CHAN #1: C/No=51.5 dB Hz  sig=-32.2 dB    41.5 C  speech  beam=4
CHAN #2: C/No=51.6 dB Hz  sig=-32.9 dB    41.5 C  no call beam=5
CHAN #3: C/No=49.3 dB Hz  sig=-26.2 dB    40.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    40.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
17:12:42 #1 ABC123 E4 start 800124 22.50 dBW mobile aero 64k speech  41.5 C  52 dB Hz
17:12:42 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (sbd)
CHAN #1: C/No= 0.0 dB Hz  sig=-1000 dB    41.5 C  speech  beam=4
CHAN #2: C/No=51.6 dB Hz  sig=-33.7 dB    41.5 C  no call beam=5
CHAN #3: C/No=49.3 dB Hz  sig=-26.2 dB    40.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    40.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
17:12:44 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (sbd)
CHAN #1: C/No= 0.0 dB Hz  sig=-19.6 dB    41.5 C  speech  beam=4
CHAN #2: C/No=51.6 dB Hz  sig=-32.7 dB    41.5 C  no call beam=5
CHAN #3: C/No=48.9 dB Hz  sig=-25.8 dB    40.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    40.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
17:12:49 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (sbd)
CHAN #1: C/No=62.2 dB Hz  sig=-19.9 dB    41.5 C  speech  beam=4
CHAN #2: C/No=51.8 dB Hz  sig=-32.6 dB    41.5 C  no call beam=5
CHAN #3: C/No=48.9 dB Hz  sig=-25.9 dB    40.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    40.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
17:12:51 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (sbd)
CHAN #1: C/No=61.8 dB Hz  sig=-19.8 dB    41.5 C  speech  beam=4
CHAN #2: C/No=51.7 dB Hz  sig=-32.9 dB    41.5 C  no call beam=5
CHAN #3: C/No=48.9 dB Hz  sig=-25.9 dB    40.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    40.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
17:12:52 #1 ABC123 E4 stop 1001  call cleared by MES terminal  41.5 C  0 dB Hz
17:12:52 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (sbd)
CHAN #1: C/No= 0.0 dB Hz  sig=-1000 dB    41.5 C  no call beam=4
CHAN #2: C/No=51.8 dB Hz  sig=-32.6 dB    41.5 C  no call beam=5
CHAN #3: C/No=48.8 dB Hz  sig=-26.1 dB    40.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    40.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
```

Figure 4-22 HSD-440 Terminal Call Display Example

(8) 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, **maint** password to access the HSD-440 terminal MPU.
- Power up all avionics and align the IRS.
- Taxi or tow the aircraft to an unobstructed, line-of-sight location where a complete 360° rotation is possible.

(b) Antenna Tracking Verification Procedure

To verify antenna tracking:

NOTE: Report 8 (Starboard antenna status word) is only required where conformal antennas are installed.

1. From the reports menu, toggle on reports **8** and **20**, and toggle off report **23**.
2. Position the aircraft at a baseline, start-of-test heading (0 degrees true heading is recommended).
3. Confirm that the baseline heading, as reported by the aircraft IRS, is similar to that reported from the "HD" entry in report 23.
4. Record the following data on the "Installation Checklist" on page E-1:
   - Antenna selected—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°

(9) 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 reports 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.

- Voice/data calls—ground segment:
  Place any combination of voice and/or data calls while the aircraft is taxied in a full circle and/or a figure 8 pattern. Note any voice or data anomalies.

- Voice/data calls—in flight:
  Place any combination of voice and/or data calls during flight. The flight pattern may include "standard rate of turn," figure 8, or circles. Note any voice or data anomalies.

F. Software Load Procedures

EMS SATCOM may occasionally release new software for the HSD-440 terminal.

CAUTION: SOFTWARE MUST NOT BE LOADED TO THE HSD-440 TERMINAL WHEN THE TERMINAL IS FULLY INSTALLED IN THE AIRCRAFT.

CAUTION: ENSURE THAT ALL REPORTS AND MENUS ARE TURNED OFF.

Load new software with a laptop or computer connected to the maintenance port of the HSD-440 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

CAUTION: SOFTWARE MUST NOT BE LOADED TO THE HSD-440 TERMINAL WHEN THE TERMINAL IS FULLY INSTALLED IN THE AIRCRAFT.

This section describes how to load channel card software to HSD-440 terminals using the EMS Loader.

To load channel software:

1. Remove power from the HSD-440 terminal.
2. Connect a computer to the maintenance port of the HSD-440 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.

   It is recommended that you 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-440 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 Load** 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-440 terminal, and then press ENTER.

    The EMS Loader prompts you to type 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).

12. To choose the default, N (No), press ENTER.

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

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

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

14. To terminate the list, press ENTER at the prompt.

    Communication with the HSD-440 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-440 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 4-42.

    NOTE: If the load fails, restart the load from the beginning of the procedure. If, after two attempts, the load still does not complete successfully, contact EMS SATCOM Product Support for assistance.

(2) Loading Control Processor Software

CAUTION: SOFTWARE MUST NOT BE LOADED TO THE HSD-440 TERMINAL WHEN THE TERMINAL IS FULLY INSTALLED IN THE AIRCRAFT.

This section describes how to load control processor software on to HSD-440 terminals.

To load control processor software to the HSD-440 terminal:

1. Remove power from the HSD-440 terminal.
2. Connect a computer to the maintenance port of the HSD-440 terminal.
3. Turn on the computer.

4. Save **ADT_LOAD.exe** to the same folder on your computer that contains the software files.

   It is recommended that you 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-440 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 Load** 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), and then press ENTER.

   The load application prompts you to type a filename.

9. Type the filename for the software being loaded to the HSD-440 terminal control processor, and then press ENTER.

   The EMS Loader prompts you to select a COM port.

10. Type the COM port connected to the HSD-440 terminal, and then press ENTER.
11. To start the load, press ENTER. To abort the software load, press ESC.

    Communication with the HSD-440 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-440 terminal resets.

12. If no other software loads are required, proceed to "Verifying Software Loads" on page 4-42.

    NOTE: If the load fails, restart the load from the beginning of the procedure. If, after two attempts, the load still does not complete successfully, contact EMS SATCOM Product Support for assistance.

(3) Updating Displayed Software Versions

Once you have uploaded the major software to the HSD-440 terminal, you must load a BIN file to display the new versions. Load this file according to the applicable software service bulletin released by EMS SATCOM.

To update displayed software versions:

1. Remove power from the HSD-440 terminal.
2. Connect a computer to the maintenance port of the HSD-440 terminal.
3. Turn on the computer.
4. Save **ADT_LOAD.exe** to the same folder on your computer that contains the software files.

   It is recommended that you 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-440 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 Load** 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 application software, type **24**.
9. Press ENTER.

   The system prompts you for a filename.

   NOTE: The filename follows the format **li_XX.bin**.
10. Type the filename of the software.
11. Press ENTER.

    The program prompts you to select a COM port.
12. Type the COM port connected to the HSD-440 terminal, and then 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 the DOS window closes. This completes the 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 4-42.

In the event that the load fails, restart the load from the beginning of the procedure. If, after two attempts, the load still does not complete successfully, 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 SATCOM, 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.

To verify software loads:

1. Apply power to the HSD-440 terminal.
2. On the computer, open a terminal emulation program, such as HyperTerminal, and start the HSD-440 terminal MPU.
3. Connect the computer to the maintenance port of the HSD-440 terminal.
4. Type **maint**, and then press ENTER.

   Menu 1 appears.
5. To scroll to Menu 2, press CTRL+N.

6. To display the versions of software loaded onto the HSD-440 terminal, press V.

   A list of firmware versions appears similar to the example provided below (actual versions will differ depending on the software installed on the terminal).

```
FIRMWARE VERSIONS:
   KERNEL:           V1.4 -- Wed Feb 21 08:58:08 2007
   APPLICATION:      V11.9 -- Wed Mar 28 10:07:24 2007
   CHANNEL CARD #1:  4.9.8.0 -- 0.3.6.2 -- 2.1.0.0 -- 2.7.0.0
   CHANNEL CARD #2:  1.17.0.1 --  --  -- 2.7.0.0
   DATA I/O CARD:    Version 1.39.0.0 built on Feb  2 2007 13:
```

7. Verify that all software has loaded successfully to both channel cards. Verify that the firmware versions shown match the versions listed on the load disk (or files) and in the software service bulletin (examples shown above).
8. Close the terminal emulation program.
9. Remove power from the HSD-440 terminal.

   This completes the software load verification.

(5) Disconnecting Load Equipment

You must complete all required software loads and load verification before you disconnect the load equipment.

To disconnect load equipment:

1. Remove power from the HSD-440 terminal (if applicable).
2. Turn off the computer (if applicable).
3. Disconnect the serial cable connector from the COM port.
4. Disconnect the serial cable connector from the HSD-440 terminal maintenance port.

2. Troubleshooting and Fault Isolation

This section provides troubleshooting procedures for HSD-440 terminals experiencing faults during the commissioning process or previously operational terminals now considered as not working.

Troubleshooting procedures require data obtained using the MPU of the HSD-440 terminals. For specific instructions on how to access and use the maintenance port and MPU, refer to "Connection Requirements" on page 4-3.

A. Troubleshooting Practices

Troubleshooting practices for the HSD-440 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 4–23. 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 the troubleshooting procedures provided in this section.

(2) Specific Complaints

When troubleshooting terminals with specific complaints, you can proceed directly to the applicable troubleshooting and fault isolation procedure provided in this section.

B. Equipment Required

The equipment required for troubleshooting and fault isolation is the same as the equipment required for test purposes, as listed in "Test and Fault Isolation Equipment Requirements" on page 4-1.

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 illustrative purposes.

(1) Fault Isolation Screen Displays

Figure 4-23 to Figure 4-33 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 22.5 seconds CHAN #1 CONTROL PROCESSOR TRIGGERING ORR IN AORE!!
10:45:14 #1 ABC123 E5 start 400110 14.00 dBW  CT SP ocean region registration
32.0 C  54 dB Hz
10:45:15 #2 ABC456 E5 start 400110 14.00 dBW  CT SP ocean region registration
32.0 C  55 dB Hz
10:45:18 #2 ABC456 E5 stop 8301  ACSE successful ORR  32.0 C  54 dB Hz
10:45:19 #1 ABC123 E5 stop 8306  ACSE successful ORR  32.0 C  54 dB Hz
```

Figure 4-23 Successful OR Registration (report 21 activated)

```
10:45:14 #1 ABC123 E5 start 400110 14.00 dBW  CT SP ocean region registration
32.0 C  54 dB Hz
10:45:15 #2 ABC456 E5 start 400110 14.00 dBW  CT SP ocean region registration
32.0 C  55 dB Hz
10:45:19 #1 ABC123 E5 stop xxxx  ORR FAIL              32.0 C  54 dB Hz
```

Figure 4-24 Failed OR Registration

```
15:14:08 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (p/t)
CHAN #1: C/No=51.8 dB Hz  sig=-32.2 dB    42.5 C  no call beam=4
CHAN #2: C/No=51.5 dB Hz  sig=-32.6 dB    42.5 C  no call beam=4
CHAN #3: C/No=48.9 dB Hz  sig=-24.2 dB    41.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    41.5 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
```

Figure 4-25 No Call (report 23)

```
15:15:04 #1 442BF5 E4 start 800124 14.00 dBW mobile aero 64k speech  42.5 C  52 dB Hz
15:15:03 dop 0 ppb  az 112.2 deg   el 12.2 deg  AORE  ant gain 12.0 (p/t)
CHAN #1: C/No=51.8 dB Hz  sig=-32.6 dB    42.5 C  speech  beam=4
CHAN #2: C/No=51.6 dB Hz  sig=-33.4 dB    42.5 C  no call beam=4
CHAN #3: C/No=48.9 dB Hz  sig=-24.5 dB    41.0 C  log on  beam=4
CHAN #4: C/No= 0.0 dB Hz  sig= -0.0 dB    41.0 C  no call beam=4
45D0'0.0"N  75D0'0.2"W  PT 0.0D  RL 0.0D  HD 0.0D  TK 0.0D  0 knots  0 ft
```

Figure 4-26 In Call—Swift64 Voice Call on Channel 1 (reports 21 and 23)

```
12:43:55 dop****  az 285.4 deg   el 15.3 deg  AOR EAST  ant gain 12 (p/t)
CARD #1: C/No=52.9 dB/Hz  sig=-33.9 dB   27 C  no call beam=4
CARD #2: C/No=52.9 dB/Hz  sig=-34.2 dB   27 C  no call beam=4
************  ***********  *********  ********  *********  *******  *******
CARD #1: C/No=52.4.0 dB/Hz  sig=-33.6 dB   27 C  in call beam=4
CARD #2: C/No=52.4 dB/Hz  sig=-34.5 dB   27 C    no call beam=4
************  ***********  *********  ********  *********  *******  *******
```

Figure 4-27 No IRS Data (report 23 activated)

```
FORWARD ID TABLE -- VERSION 1

**** strapping identifies forward id ffffff -- not in table ****

**** eeprom forward id 000000 not in table *****
7.6 SECONDS: EEPROM FORCES STAND-ALONE MODE

time 18.0 seconds: powering on channel card #1

time 18.0 seconds: powering on channel card #2

** ** ** ** ** ** ** ** ** ** ** ** WARNINGS ** ** ** ** ** ** ** ** ** ** ** * *
CHANNEL CARD FORWARD ID IS ZERO
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
```

Figure 4-28 FWD ID Not in EEPROM (no reports activated)

```
FORWARD ID TABLE -- VERSION 1

**** eeprom forward id 000000 not in table *****
5.5 SECONDS: STAND-ALONE MODE
```

Figure 4-29 ICAO ID Not Strapped

```
      MENU 3                              FIRMWARE Vx.x

L     list EEPROM                         S     list event log
C     clear event log                     M     misc.  EEPROM parameter
F     list call log                       G     clear 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
G     clear call log
<CTRL> N  next menu      <CTRL> 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
```

Figure 4-30 No Strap on SDI Lines, Open (no reports activated)

```
Log-on password entered: "Maint"

      MENU 1                              FIRMWARE Vx.x

X     override forward id                 L     test LEDs
Y     explain error status                U     list event log (hex)
F     print equipment stats               M     clear equipment stats
<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
C     clear event log                     M     misc.  EEPROM parameter
F     list call log                       G     clear 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

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)

```
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 0116135919064#
11:48:10 #1 ABC123 E5 stop 11d2 call failed, insufficient digits in service address
28 C 0
calling 0116135919064#
```

Figure 4-32 Incorrect Dialing Format (report 52 enabled)

```
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 4-33 Top/Port Antenna Status (reports 18, 19, and 20 activated)

(2) Troubleshooting Table

Table 4-22 provides troubleshooting procedures for basic HSD-440 terminal faults. Before starting a troubleshooting procedure, access the HSD-440 terminal MPU using the **maint** password. For detailed connection and user instructions, see "Connection Requirements" on page 4-3.

Table 4-22 Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
Red LED remains on after powering up sequence	• HPA fault	View initial power-up display of the HSD-440 terminal MPU	Verify that: • the terminal is well seated in the ARINC tray • the LES ID Code is programmed (Menu 3, option I).
HPA error status	• reporting invalid SSM • HPA not reporting status word 143 • HPA not reporting maintenance word 350 • HPA maintenance word reporting ARINC error • HPA maintenance word not reporting HGA antenna • HPA maintenance word reporting Voltage Standing Wave Ratio (VSWR) error • HPA maintenance word reporting Random Access Memory (RAM) error • HPA reporting Read-only Memory (ROM) error • HPA maintenance word reporting power supply error • HPA maintenance word reporting temperature error	To obtain an explanation of the HPA error status, in Menu 1, press Y	• Check that the external power source is properly connected and meets installation requirements. • Check that the transmit path from HSD-440 terminal output (MPC1) to the antenna subsystem (e.g., coaxial cables, splitters, and relays). • Check that the installation location meets the RTCA/DO-160E environmental specifications. • Check for proper fan-tray operation and air-cooling. • Verify the fan-tray plug distribution is as per the installation requirements.

Table 4-22 Troubleshooting and Fault Isolation (Continued)

Fault	Description	Maintenance Report	Check
Call failure	IRS information not available	Activate maintenance reports 21 and 23 See Figure 4-27	• Check that the IRS systems are powered on and aligned. • Check that connections to the IRS systems are secured. • Check the polarity of IRS input lines. • 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.
	System does not log onto the broadbeam	Activate maintenance reports 21 and 23 See Figure 4-24	• Check that the IRS data is received and valid. • Make sure that a valid FWD ID is read. • Verify that the antenna is pointing in the correct direction. • Make sure that LES access codes are configured correctly. • Verify all coaxial connections.
	System does not log onto the correct OR	Activate maintenance reports 21 and 23 See Figure 4-24	• Check that the IRS data is received and valid. • Check for antenna line-of-sight interference.
	Terminal is not transmitting	Activate maintenance reports 21 and 23	• Check for a defective or loose RF cables. • Verify that the Rx RF level is acceptable. • Check RF power level displayed in maintenance port menu report 21; the EIRP should be requested at 14.00 dBW, but when in call, power level should increase to 22.5 dBW and then level off to approximately 18.5 dBW, but somewhere between 14.5 - 22.5 is acceptable. Levels at the extremes may indicate a problem, especially if calls are hard to complete or being torn down by the LES for undetermined reasons. Check with your ISP help desk. • Make sure that the HSD-440 terminal is secured properly to the ARINC connector in the tray.

Table 4-22 Troubleshooting and Fault Isolation (Continued)

Fault	Description	Maintenance Report	Check
Call failure (cont'd)	ICAO ID is invalid or strapped incorrectly; FWD ID is invalid or incorrectly entered in EEPROM	Activate maintenance report 21 See Figure 4-28 To check FWD ID/ICAO ID, in Menu 4, press Q	• The account registration process has not been completed. Check your account status with your service provider to make sure that the account registration has been processed into the LES databases and your account is valid. • If the message, **Channel card stuck in boot state** appears in the event log, check that the assigned FWD IDs are entered correctly and ICAO is strapped correctly.
	Terminal is strapped to an incorrect system mode of installation	In Menu 3, press L (List EEPROM)	• Verify the system mode strapping is correct. • Reset the system and observe the initialization display; it shows that the HSD-440 terminal is powering up and displays the terminal's self-test results. The Initialization display lists the installation mode configuration for the terminal. • If the mode displayed is not strapped or is incorrectly strapped, a temporary setting may be used. In Menu 3, press M (misc. EEPROM parameters), then type **16** (channel card category) and configure the HSD-440 terminal to the correct mode. Reset the terminal and try the call again.
	Dialing sequence was incomplete or incorrect	Activate reports 21 and 52 See Figure 4-25	• Verify the number you are calling and try the number again. • Make sure that you end the dialing sequence by pressing POUND KEY. Pressing POUND KEY at the end of the dialing string signals the system to send the call.

Table 4-22 Troubleshooting and Fault Isolation (Continued)

Fault	Description	Maintenance Report	Check
Logon request fails	Terminal is not transmitting	Activate maintenance reports 21 and 23 See Figure 4-24	• Check for defective or loose cables. • Check for antenna line-of-sight interference. • Check for HPA fault. • Make sure that the HSD-440 terminal is secured properly to the ARINC connector in the tray. • Make sure that your account is current and active.
	Terminal is not receiving	Activate maintenance reports 21 and 23	• Check for defective or loose cables. • Make sure that the antenna subsystem DLNA is powered. • Check for antenna line-of-sight interference. • Verify that the ICAO ID is valid, activated, and strapped correctly. • Make sure that your account is current and active. • Make sure that the HSD-440 terminal is secured properly to the ARINC connector in the tray.
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	• Check the connection between the HSD-440 terminal and the external device. • Check configuration of external devices is correct. MSN must be configured correctly for each device connected to the system. • If MSNs are not programmed in the user devices, incoming calls will ring all devices—MSNs cannot be assigned to some devices. NOTE: Zero is an invalid entry.

Table 4-22 Troubleshooting and Fault Isolation (Continued)

Fault	Description	Maintenance Report	Check
Logon successful, but fails to complete call	Authorization error (fault code 12C4)	Activate reports 21 and 23 See Figure 4-24 See Figure 4-27	• Contact your service provider to verify that the FWD ID is activated. • Check that the FWD ID is entered correctly. • Check that IRS data is available and correct. • Check that the Veh Rel Az/EL to Satellite is correct. • Check that all coaxial cable connections are secure. • Check that the Rx C/No value is greater than 50 dB/Hz. • Check that the antenna is functioning. • Check that the LES access codes are valid. • Contact your service provider and verify that they can "see" your Tx signal. To contact the LES operator, dial 33 #. • Contact service provider and request that they place an incoming call to the terminal. • Check the reported HPA back-off in report 21. The signal should initialize at 14 dBW and increase after handshake to approximately 22.5 dBW, then slowly decrease (typically to between 16.5 dBW and 21.5 dBW with a lower limit of 14.5 dBW).
HSD-440 terminal is operating outside the normal environmental specifications	Channel card temperature fault	Activate report 21 or 23	• Check channel card temperature; temperatures over 50° C may cause the HSD-440 terminal to shut down. • Check that the fan tray is operational. • Verify that the tray plug distribution is the same as presented in the installation requirements.

Table 4-22 Troubleshooting and Fault Isolation (Continued)

Fault	Description	Maintenance Report	Check
Calls do not complete and connection is not established	Channel Congestion (fault code 1851)	Activate reports 21 and 23	• Wait five minutes and try the call again. • Contact the LES to verify congestion. To contact the LES operator, dial 33 #.
	No call request sent	Activate report 52	• Verify that the call dial string is correct; pressing the POUND KEY at the end of the dialing string signals the system to send the call. • Check that the HSD-440 terminal is transmitting by ensuring the LED power indicator flashes on and off (1 Hz) during a call request. • Check that the ISDN, Ethernet, or POTS cable is connected correctly and securely.
No dial tone heard in handset	-	Activate report 21	• Confirm that ISDN lines are wired correctly. • Verify that handset connection is secure. • Wait a few minutes for the system to warm up, then log on and try your call again. • Check that IRS data is available. • Verify that the terminal has completed beam registration. • Verify that the ICAO is valid and active. • Ensure system is at a LOG ON state
Call drops after successful connection	If the RF signal fades significantly (during a call), the connection may drop. NOTE: A sudden, severe aircraft banking angle may obstruct the signal long enough (>15 sec.) to drop a call.	Activate reports 21 and 23	• Check signal strength. C/No greater than or equal to 50 dB. • Make sure that there is a clear, unobstructed, line of sight to the satellite. • Select an alternate satellite or beam and try your call again. NOTE: This troubleshooting procedure works if you are located where more than one beam overlaps or satellite is in view.

D. Fault Isolation and Diagnostic Procedures

This section provides basic information required for technical personnel to isolate faults in HSD-440 terminals. Where needed, refer to other sections of this manual (which contain important information to aid in understanding the function of the terminal) for additional information.

(1) General

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

Perform all fault isolation procedures provided in this section. Record and document all test results, including LEDs function and maintenance port data outputs (reports 21 and 23).

Enable reports 18, 19, and 20 (port) or items 6, 7, and 8 (Starboard) to record antenna, ACU, and DLNA related faults. Enable other reports as required.

CAUTION: BEFORE PROCEEDING WITH FAULT ISOLATION PROCEDURES, REFER TO THE "SAFETY ADVISORIES" ON PAGE INTRO-6.

(2) Saving a Diagnostic Reports File

Diagnostic reports are helpful in troubleshooting the HSD-440 terminal. Capturing maintenance port information from the HSD-440 terminal and forwarding the file to EMS SATCOM technical support staff will assist in troubleshooting suspected HSD-440 terminal problems. Instructions on how to activate and save "reports" information is provided in "Saving a Diagnostic Reports File" on page 4-56.

To save a diagnostics reports file:

1. 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.
4. To activate reports 21 and 23 and toggle off all other reports, press EQUAL SIGN.
5. To save these reports as default, press S. This enables the user to view these reports on subsequent HSD-440 terminal power-ups or Reset entries.
6. Reset the system by cycling the power to the terminal; pressing the reset button on the HSD-440 terminal front panel; or, in Menu 2, pressing Z.

   NOTE: The HSD-440 terminal must be logged on to the Aero H+ service.

7. Log on to the maintenance port using the password: **maint**

   The system restarts and ocean registration takes place (approximately two minutes).

8. To display Menu 2, press CTRL+N.

9. To display the software versions of the system, press V.
10. 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 a dial tone? Was the call successful?
11. If applicable, attempt calls from the remaining channel.
12. To display the current reports profile of the system (as noted in step 4), press EQUAL SIGN.
13. To save an alternate reports configuration, activate the required items, and then, to save to EEPROM, press S in the reports menu.
14. To display the ORT List, press CTRL+N until Menu 3 appears, and then press O. (The ORT list displays one terminal screen of information at a time. To display the next screen, press O.)
15. To list the complete event log, in Menu 3:
    - press S (list event log)
    - press 0 (list complete log)
    - press PERIOD (list all remaining entries)
16. To list the complete call log, in Menu 3:
    - press F (list call log)
    - press F again (list complete log)
    - press PERIOD (list all remaining entries)
    - for extended information, press X
17. Close the log file on the terminal program.
18. 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 ID 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 support@emssatcom.com

3. Adjustment/Alignment Procedures

There are no adjustment/alignment procedures required for HSD-440 terminals.

4. Modification History

The HSD-440 terminal currently has no history of modifications.

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MAINTENANCE AND REPAIR

This section provides maintenance and repair information for the HSD-440 terminal, including the following sections:

- Maintenance
- Repair
- Instructions for Continued Airworthiness

1. Maintenance

The HSD-440 terminal does not require routine maintenance.

2. Repair

All repair procedures must be completed by qualified technicians at EMS SATCOM-approved repair facilities.

A. Repair Tools and Supplies

No special supplies are required to repair this equipment.

HSD-440 terminals that require service must be returned to EMS SATCOM or to an EMS SATCOM-approved service center. Refer to "Test and Fault Isolation" on page 4-1 for terminal testing requirements and procedures.

B. Repair Procedures

This equipment does not require any special repair procedures.

C. Removal Procedures

If an HSD-440 terminal must be removed from service for repair, remove power, 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.

(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-440 terminal returned to EMS SATCOM must be returned in its original shipping container. Failure to do so may invalidate the warranty. If an HSD-440 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 (RMA) Procedure

If it is determined that a terminal must be returned to EMS SATCOM for repair or overhaul, please follow the RMA procedure below.

1. Have the following information ready before calling EMS SATCOM Product Support:
   - Model (e.g., HSD-440 terminal)
   - Terminal part number (e.g., 1252-A-3400)
   - 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-440 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, enclose a copy in the box, and send your prepaid shipment to:

   EMS SATCOM (867480857)

   400 Maple Grove Road

   Ottawa, Ontario,

   CANADA K2V 1B8

   RMA #: _____

   ATTN: Repair & Overhaul

   Tel: 613 591-6040 extension 1214

   Fax: 613 591-8951

   Email: rmareturns@emssatcom.com

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 inquires and status requests, please contact the R&O department directly:

   Phone: 613-591-9064, extension 1214 (R&O group)

   Email: 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-440 terminal.

Installation of the HSD-440 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-440 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-440 terminals are considered on-condition units. No additional or routine maintenance is required.
- If an HSD-440 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-440 terminals are not field-repairable. All terminals must be returned to the EMS SATCOM factory or authorized repair centers for repair.
- Repaired terminals 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 "Test and Fault Isolation" on page 4-1. 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.
  - Recommended periodic scheduled preventative maintenance tests (tests to determine system condition and/or latent failures): None required.

APPENDIX A: INMARSAT SATELLITE BEAM COVERAGE

Inmarsat operates strategically placed geostationary satellites called I-3 and I-4. I-3 satellites provide access to services such as Swift64 and Aero H/H+, and I-4 satellites provide access to SBB services.

Each I-3 satellite is located over and named after an OR. The four satellite ORs are:

- Atlantic Ocean Region-East (AOR-E)
- Atlantic Ocean Region-West (AOR-W)
- Indian Ocean Region (IOR)
- Pacific Ocean Region (POR)

Figure A-1 represents the satellite ORs with approximate transfer coordinates for satellite transitions.

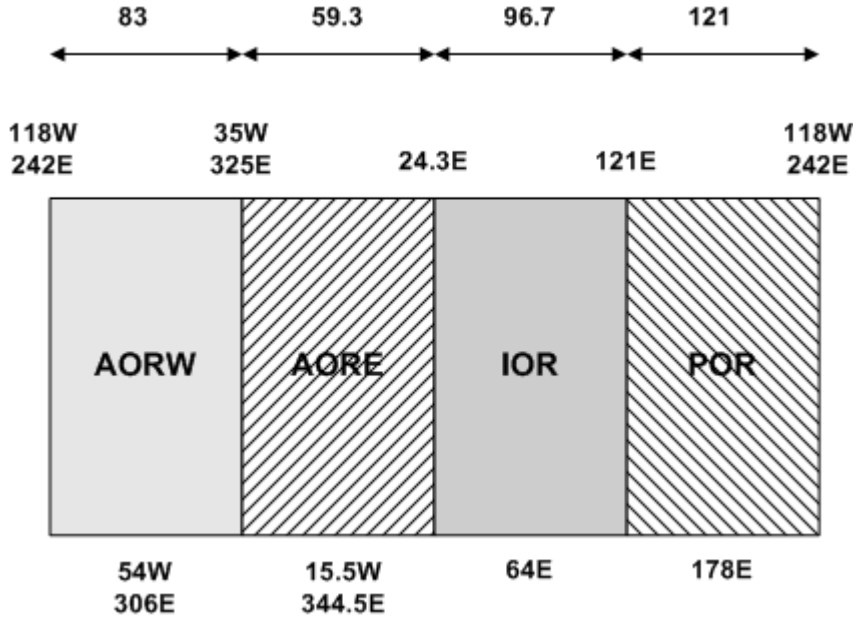

Figure A-1 Satellite ORs

The four satellite ORs are made up of smaller, spot-beam coverage areas. The following maps show the Inmarsat satellite spot-beam coverage for the four ORs, and a composite map of the four regions combined.

NOTE: Figure A-2 and Figure A-3 depict Inmarsat's expectations of coverage but do not represent a guarantee of service and should not be relied upon. The availability of service at the edge of coverage areas fluctuates depending upon a variety of conditions.

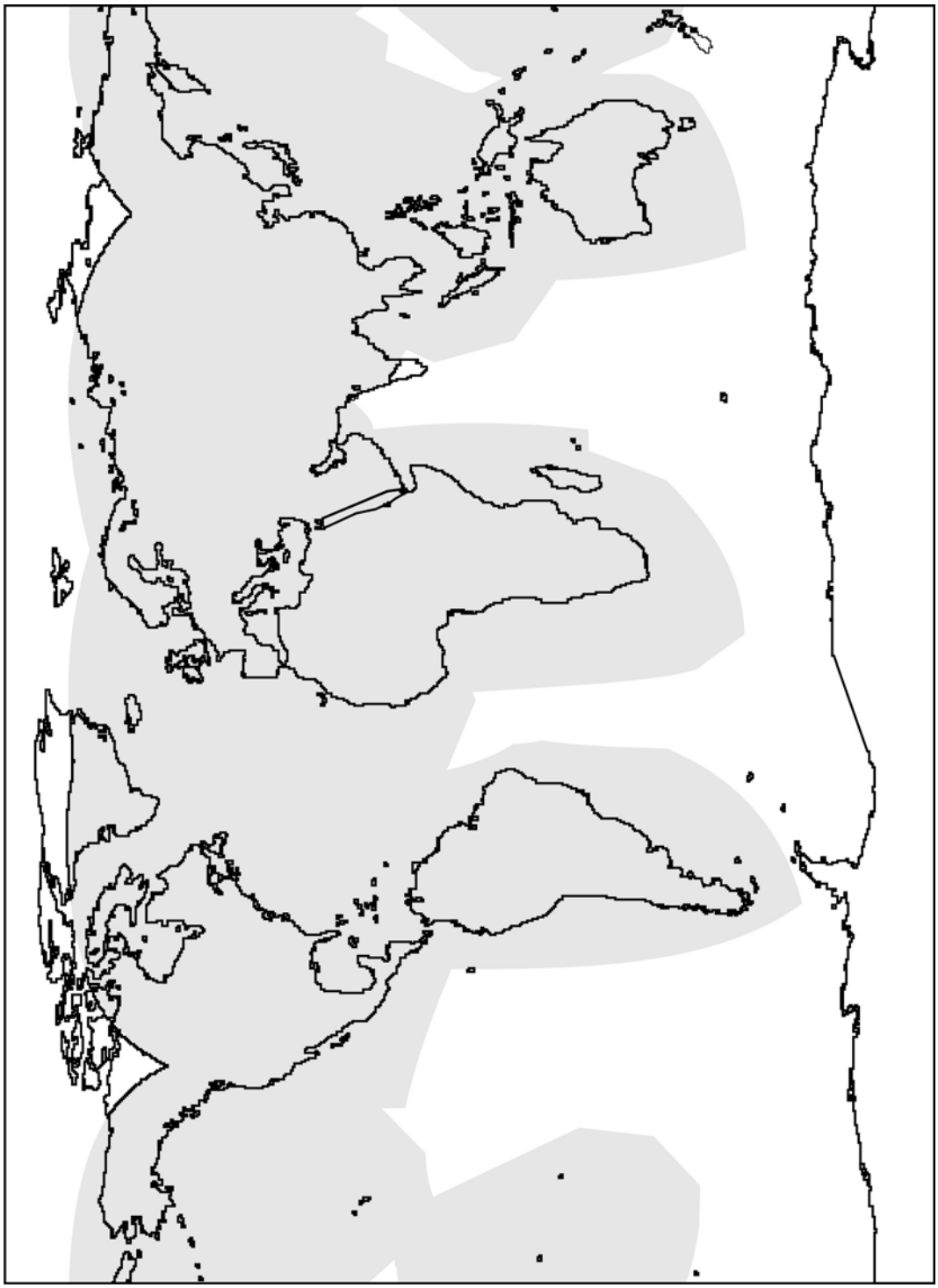

Figure A-2 Inmarsat I3 Satellite Beam Coverage—Composite Map

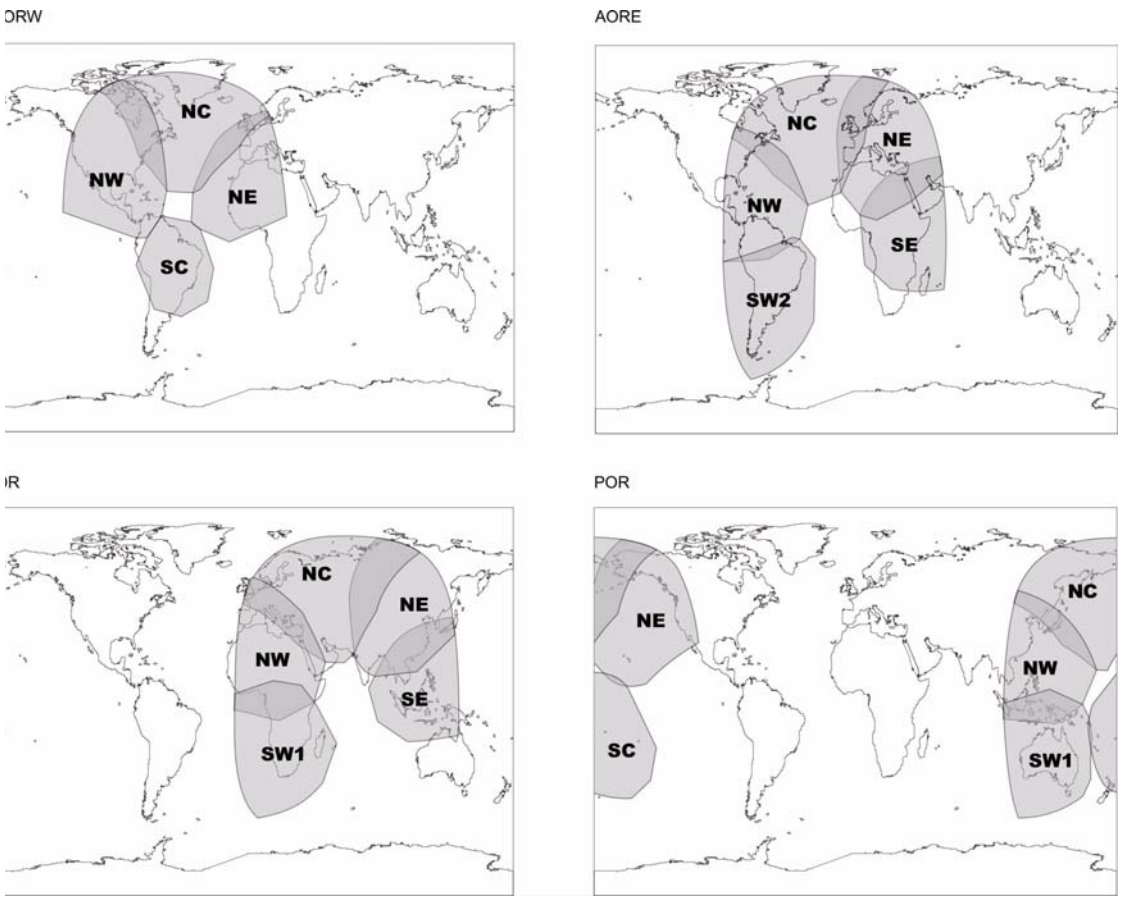

Figure A-3 Inmarsat I-3 Satellite Beam Coverage—OR Maps

At the time of publishing, three I-4 satellites are in service: Americas, EMEA and Asia-Pacific.

Figure A-4 shows the area that is covered by the I-4 satellites.

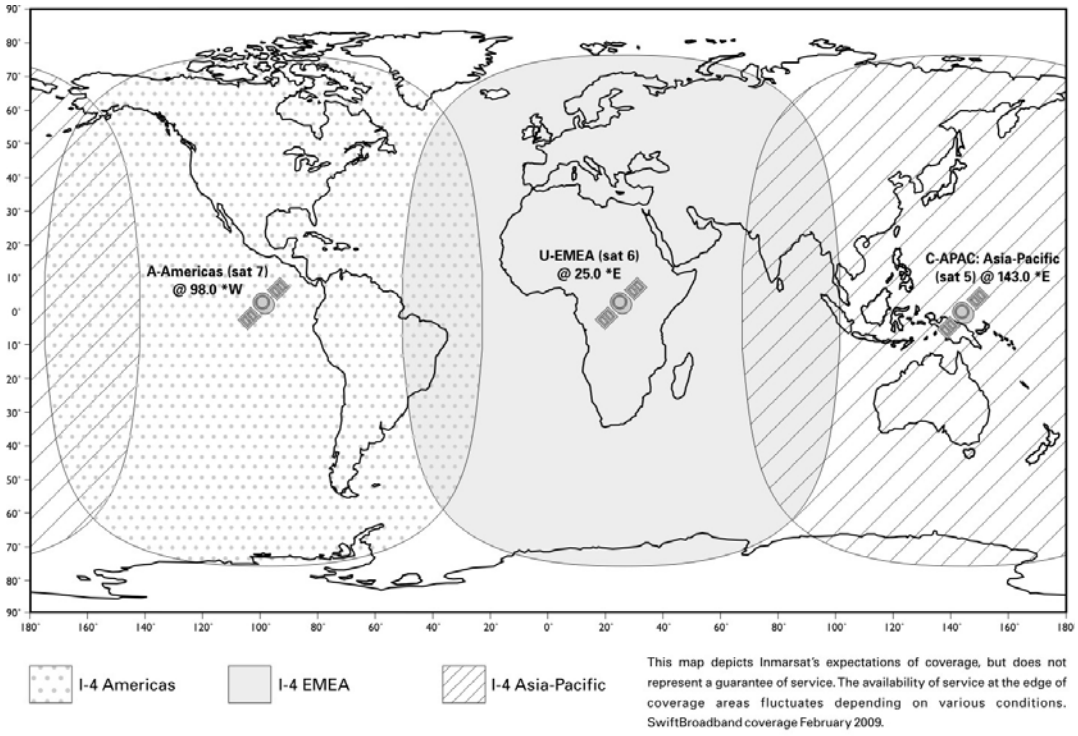

Figure A-4 I-4 Satellite Coverage Map

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 make sure that you have not missed any key steps in the HSD-440 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-440 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

   The ISN (supplied by EMS SATCOM) and ICAO address are required to activate an account.

2. **Has your account been activated?**

   Once registered, your HSD-440 terminal is assigned Inmarsat Serial Numbers which include FWD IDs. The ICAO address of the HSD-440 terminal must be strapped accordingly and FWD ID must be entered. Refer to "Installation" on page 3-1 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 LES level. New terminals 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.

   NOTE: To verify that the service registration information has been validated at the LES, call 33 # for assistance. Confirm with the LES operator that the FWD IDs assigned to your terminal are valid and active.

3. **Is the HSD-440 terminal seated properly?**

   In cases where the HSD-440 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 diagram.
   - Make sure that the HSD-440 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-440 terminal malfunctions. Before proceeding with testing and troubleshooting, complete the following checks:

   - Check that all cables and wiring are routed and connected correctly and securely.

- Make sure that the terminal is installed with the correct power source.
- Verify that all external user and networking devices (for example: TAs, 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 LES Access Codes programmed for all ORs?

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 "System Operation" on page 2-1 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. Only Stand-Alone Mode is currently supported.

APPENDIX C: RJ45 CABLE TERMINATION DETAILS

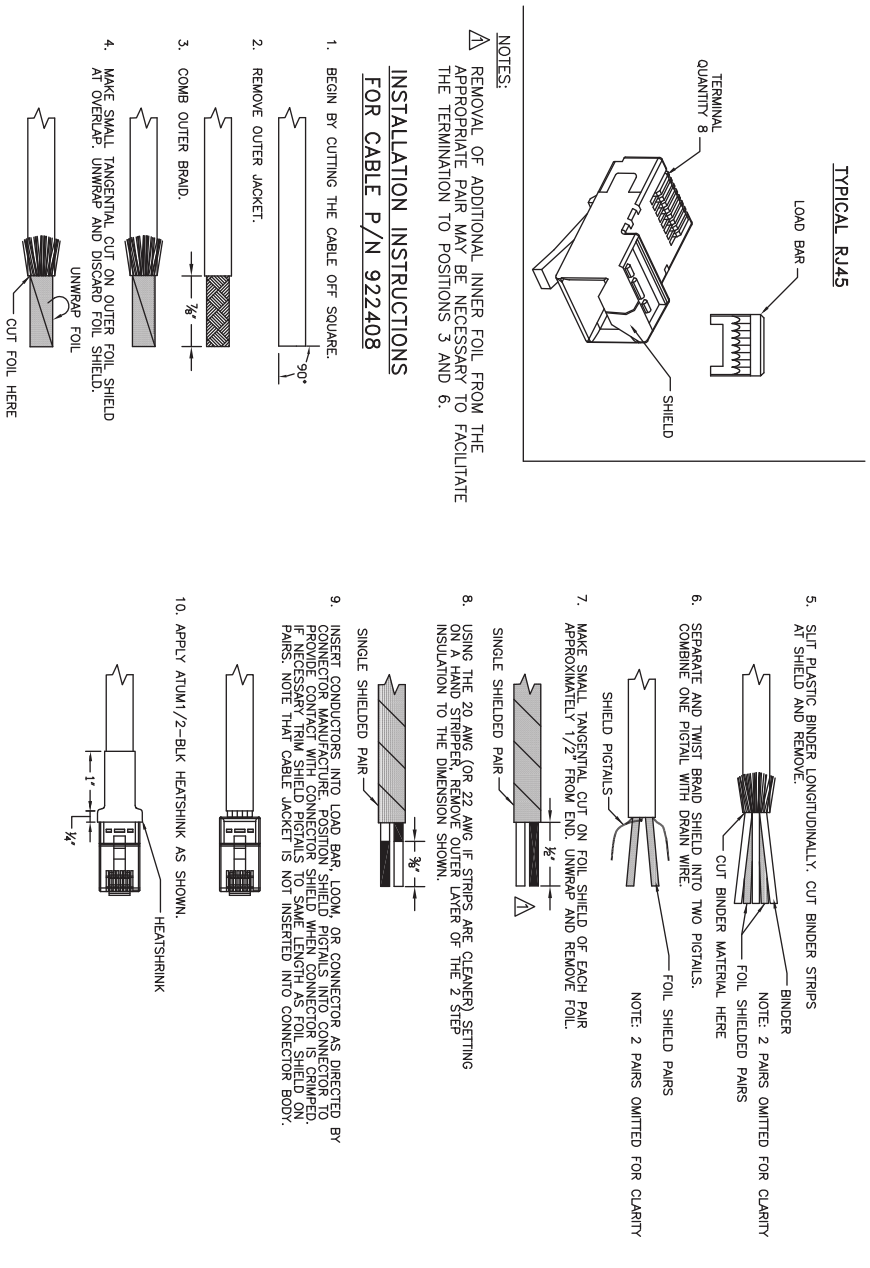

Figure C-1 RJ45 Cable Termination Details

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APPENDIX D: INSTALLATION PLANNING CHECKLIST

Installation Planning Steps			
1. Register the terminal			
Record the following information (provided by EMS SATCOM upon purchase)			
Terminal Category Type—A			☐
Inmarsat Serial Numbers (ISN) x 2	1		☐
	2		
Contact your Service Provider and provide the two 12-digit ISNs from above			
Record the FWD IDs received (part of the ISN) and corresponding Inmarsat Mobile Numbers (IMN)			☐
	1	2	
FWD IDs (last 6 digits of ISN)			
IMNs			
ISDN speech			
ISDN (3.1 kHz audio)			
ISDN 56 kbps			
ISDN 64 kbps			
MPDS			
Service Provider			☐
LES Access Codes (depend on Service Provider)			
AOR-W			
AOR-E			
IOR			
POR			
2. Pin Strapping			
The following strapping is required			
Item	Strapped pins		
System mode	Stand-Alone Mode only		☐
SDI			☐
3. Wiring			

Installation Planning Steps		
Antenna	Multi-Control	☐
	BITE A/B	☐
	HPA Mute A/B	☐
Power		☐
ISDN: Wire one ISDN line to the ISDN port.	ISDN-1	☐
		☐
Ethernet: Wire both Ethernet ports for SBB Wire both Ethernet ports to deploy 2 separate networks	Ethernet-1	☐
	Ethernet-2	☐
Inertial Navigation System (INS)		☐
Analog Tip/Ring (POTS)		☐
CEPT-E1, *Future PBX applications (optional)*		☐
4. Configuration		
Strap the ICAO address and program the FWD ID		☐
Program the Land Earth Station (LES) Access Codes		☐
Configure the CNX Cabin Gateway if required		☐
Set the GES preferences using the EEPROM settings in Menu 3, option K.		

APPENDIX E: INSTALLATION CHECKLIST

Aircraft Identification:		**HSD-440 Terminal Model No.:**	
HSD-440 Terminal Install. Mode:		**HSD-440 Terminal Serial No.:**	
	Name	**Signature**	**Date**
Checks completed by:			
Approved/Witnessed by:			

Section	Parameter	Item	N/A	✓	Value
Installation / Mechanical	Physical	Service/maintenance access			
		Environmental considerations—see "Environmental Requirements" on page 3-4			
	Fan Tray	Plug configuration—see "Fan Tray Requirements" on page 3-4			
		Chassis bonding—see "Chassis Grounding" on page 3-5			
		Fan rotation—unobstructed			
	ARINC 600 Con.	Polarized pins			
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			

Section	Parameter	Item	N/A	✓	Value
	Config. Strap Pins	SDI			
		System configuration			
		ICAO address			
		WOW (optional)			
	Ethernet	Wired to RJ45 distribution points			
	ISDN	Wired to RJ45 distribution points			
	Remotes	Manual reset switch operation			
		Maintenance port (DB9 access)			
		Power and Fault indicators			
	RF Coaxial	Rx i/p cable loss			
		Tx o/p cable loss			
	Antenna	Antenna manufacturer and type			
		Wired as per manufacturer			
	Configuration	LES Access codes			
		Stand-Alone Mode			
		FWD ID			
Test	System Power-Up	Visual LED indications			
		Power-up computer display			
Test On-Air	System Logon	Reset message observed			
		Logon verified			
Test	Optional Checks	Ground segment			
		Flight segment			

Move the aircraft in a circle and check the signal and C/No.

	Heading (Deg)	Antenna Selected	Antenna Azimuth	HSD-440 terminal							
				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: ACARS/CMU MESSAGES

The ACARS/CMU communicates with the HSD-440 terminal using two types of communications: Broadcast messages and Bit Oriented Protocol (BOP) messages. Both types of communication are supported at the same time.

This section includes descriptions of the messages that the ACARS/CMU will transmit to the HSD-440 terminal and receive from the HSD-440 terminal.

(1) Understanding Broadcast Messages

In this communication type, the ACARS/CMU uses an ARINC 429 bus to convey status word exchanges, join/leave words, and other control and command communications to the HSD-440 terminal using conventional ARINC 429 broadcast techniques.

The ACARS/CMU can transmit messages to the HSD-440 terminal and receive messages from the HSD-440 terminal using this communication type.

(a) Understanding Messages Transmitted to the HSD-440 Terminal

The ACARS/CMU transmits broadcast mode messages, including identification and status words, to the HSD-440 terminal.

The rate at which the ACARS/CMU transmits messages to the HSD-440 terminal depends on the device from which the message is coming, as shown in Table F-1.

Table F-1 ACARS/CMU Update Rates for Different Devices

CMU Input Port	Activity Label	Minimum Update Rate (Hz)
Cabin Terminal 1	172	1
Cabin Terminal 2	172	1
CFDIU	125	1
X-Talk Bus	N/A	N/A
ACMS	172	1
FMC 1	270	1
FMC 2	270	1
HFDR 1	270	1
HFDR 2	270	1
MCDU 1	172	1
MCDU 2	172	1
MCDU 3	172	1
OOOI 1	Aircraft specific	1
OOOI 2	Aircraft specific	1
Printer	350	1
SDU 1	270	1

Table F-1 ACARS/CMU Update Rates for Different Devices (Continued)

CMU Input Port	Activity Label	Minimum Update Rate (Hz)
SDU 2	270	1
OOOI 3	Aircraft specific	1
OOOI 4	Aircraft specific	1
OOOI 5	Aircraft specific	1
OOOI 6	Aircraft specific	1
VDR 1	270	1
VDR 2	270	1
VDR 3	270	1
XPDR/ICAO 1	275	1
XPDR/ICAO 2	275	1
FMC HS 1	270	1
FMC HS 2	270	1
EFB-1	172	1
EFB-2	172	1

For all devices connected to the ACARS/CMU, a bus is active when the ACARS/CMU receives three consecutive words at the specified rate. A bus has failed when the ACARS/CMU fails to receive three consecutive words.

1. Understanding System Identification Label 172

   Each ACARS/CMU transmits system identification label 172 (SAL 304) to the HSD-440 terminal. Attachment 6 from ARINC Characteristic 758 describes the word format of this label.

2. Understanding Status Word 1; Label 270

   Each ACARS/CMU transmits status word 1 to the HSD-440 terminal. The standby ACARS/CMU checks to see if its status words are the same as the active ACARS/CMU using its cross-talk connections. In some cases, the status words should be different, as shown in Table F-2.

Table F-2 Status Word 1 Differences

Bit	Label	Meaning
9	270	Determines the position of the ACARS/CMU in the cockpit; see Table F-3
10	276	Determines the position of the ACARS/CMU in the cockpit; see Table F-3
16	270	Determines the health of the ACARS/CMU
20	270	Determines which ACARS/CMU is active and which is on standby

Table F-2 Status Word 1 Differences (Continued)

Bit	Label	Meaning
22-25	276	HF Status (HFDL Installed and HFDL Failed)
26		Determines whether an ACARS or CMU is installed; ACARS = 1, CMU = 0

The ACARS/CMU transmits its position in the cockpit to the HSD-440 terminal using bits 9 and 10, as shown in Table F-3.

Table F-3 Bits 9 and 10 Positions

SDI 1 (bit 9)	SDI 2 (bit 10)	Position
0	0	Single
0	1	Left
1	0	Right
1	1	Not used

Attachment 6 from ARINC Characteristic 758 describes the word format of this label.

3. Understanding Status word 2; Label 276

   Each ACARS/CMU transmits status word 2 to the HSD-440 terminal. The standby ACARS/CMU checks to see if its status words are the same as the active ACARS/CMU using its cross-talk connections. In some cases, the status words should be different, as shown in Table F-3.

   Attachment 6 from ARINC Characteristic 758 describes the word format of this label.

4. Understanding ICAO Address Words One and Two; Labels 214 and 216

   Each ACARS/CMU transmits the same 24 bit ICAO address to the HSD-440 terminal via address words one and two. Table F-4 shows the labels and their bit positions.

Table F-4 ICAO Address Words One and Two Labels

Label	Bits	Bit positions
214	first 16 bits	14–29
216	last 8 bits	13–20

Each ACARS/CMU identifies itself using bits 9 and 10, as shown in Table F-3.

If straps on the HSD-440 terminal ARINC 600 connector are present, they will override the ICAO address content of these words. ORT settings will also override the ICAO address if the override bit is set.

Attachment 6 from ARINC Characteristic 758 describes the word format of these labels.

5. Understanding FWD ID Address Word One and Two; Labels 220 and 221

   Each ACARS/CMU transmits the same 24 bit FWD ID address to the HSD-440 terminal. Table F-5 shows the labels and their bit positions.

Table F-5 FWD ID Address Word One Labels

Label	Bits	Bit positions
220	first 16 bits	14–29
221	last 8 bits	13–20

Since each Swift64 channel requires a FWD ID, additional FWD IDs may be derived from the first FWD ID using an internal lookup table. Each ACARS/CMU can transmit a second FWD ID using address words identical to labels 220 and 221, but using labels 222 and 223, respectively. If the ORT contains a FWD ID, it will override the content of these words.

ARINC 781 Supplement 1 describes the word format of these labels.

6. Understanding Time Clock Time Word; Label 150

   Each ACARS/CMU transmits the time word to the HSD-440 terminal on the A429 bus. The format for the time word is shown in Table F-6.

Table F-6 Time Clock Time Word Format

Bit Position(s)	Label	Description
31–30	SSM	SSM per A429P1
28–24	Hours	5 Bit binary for hours; 0–23
23–18	Minutes	6 Bit binary for minutes; 0–59
17–12	Seconds	6 Bit binary for seconds; 0–59
11	Pad to Zero	Binary 0
10–9	SDI	See Table F-3
8–1	Octal Label	150

7. Understanding Time Clock Date Word; Label 260

   Each ACARS/CMU transmits the date word to the HSD-440 terminal on the A429 bus. The format for the date word is shown in Table F-7.

Table F-7 Time Clock Date Word Format

Bit Position(s)	Label	Description
31–30	SSM	SSM per A429P1
29–28	Tens of Days	2 Bit BCD for tens of days of calendar month; 0–3
27–24	Days	5 Bit BCD for days; 0–9
23	Tens of Months	1 Bit BCD for tens of months; 0–1
22–19	Months	4 bit BCD for months 0–9

Table F-7 Time Clock Date Word Format (Continued)

Bit Position(s)	Label	Description
18–15	Tens of years	4 Bit BCD for tens of years 0–9
14–11	years	3 Bit BCD for years 0–9
10–9	SDI	See Table F-3
8–1	Octal Label	260

(b) Understanding Messages Received from the HSD-440 Terminal

The HSD-440 terminal transmits the following identification and status words to all ACARS/CMUs.

Table F-8 shows Attachment 6 from ARINC Characteristic 758, which describes the rates at which the HSD-440 terminal transmits messages to the ACARS/CMU.

Table F-8 HSD-440 Terminal Transmission Rates

Label	Name	Rate	General Output Buses 1,2	General Output Buses 3,4	DFS/ UTC	Comm Output Bus 4	Comm Output Buses 6,7	General Output Buses 5,9,10
030	DFS Tuning word	5/S			X			
172	Subsystem Identifier	1/S	X	X		X	X	X
377	Equipment Identifier	1/S	X					
350	BITE Word 1 (Binary)	1/S	X					
351	BITE Word 2 (Binary)	1/S	X					
125	UTC BCD	1/S			X			
150	UTC Binary	1/S			X			
260	UTC BCD Date	1/S			X			
270	Status Output 1	1/S	X	X		X	X	X
276	Status Output 2	1/S	X	X		X	X	X
214	ICAO 24-bit aircraft address word 1	1/S	X	X		X	X	X
216	ICAO 24-bit aircraft address word 2	1/S	X	X		X	X	X
047	DFS Autotune Word 8.33 kHz	5/S			X			

1. Understanding System Identification Label 172

   The HSD-440 terminal transmits system identification label 172 (SAL 307) if it is a single HSD-440 terminal that should be identified as SDU 1, as per ARINC 741 and ARINC 758. If the HSD-440 terminal should be identified as SDU 2, it transmits label 172 (SAL 173).

   You can find the SDU identity information in the ORT. If no information is available, the terminal identifies itself as SAL 307 by default.

   ARINC 781 Supplement 1 describes the word format of these labels.

2. Understanding Status Word 1; Label 270

   The HSD-440 terminal transmits status word 1 to the ACARS/CMU. The general format of status word 1 is defined in ARINC 781 Supplement 1; however, the representation of each bit is shown in Table F-9.

Table F-9 Status Word 1 Bits

Bit(s)	Description	If Set
9–10	SDI (per ARINC Specification 429 Section 2.1.4)	• Set to **00**, all call
11	Data Link via CMU Inactive	• Due to equipment failure, no active ARINC 429 input buses from the CMUs (also indicated by bits 12 and/or 19) or no logon
12	CMU 1 Inactive	• CMU 1 transmission of a valid Label 270 is inactive
13	Voice Unavailable	• Terminal is logged off or logged on to the Low Gain System for reasons other than equipment failure; i.e., Low Gain Reversion because of operation in a key hole, very low elevation angles, or blockage • Bit may be used to generate a cockpit advisory message (e.g., >SATCOM VOICE UNAVAILABLE)
14	SELCAL	• Indicates that a new cockpit voice circuit has been established for a ground-initiated call • Depending on the aircraft setting, this bit may result in a visual annunciation of the new call on the EICAS/ECAM/EDU and activation of the cockpit chime • Crew should refer to the EICAS/ECAM/EDU to determine which system is annunciating the call • Bit should remain set until an appropriate acknowledgement is received • Crew should make sure that the bit has been cleared in all transmitted samples for at least two seconds prior to being set, and then set for at least four seconds or until the annunciation is acknowledged, whichever occurs last

Table F-9 Status Word 1 Bits (Continued)

Bit(s)	Description	If Set
15	Message Alert with Chime	• Refer to MCDU messages for timely information • Terminal should clear this bit once positive pilot response has been detected
16	Message Alert without Chime	• Refer to MCDU messages for routine information • Terminal should clear this bit once positive pilot response has been detected
17	Not Logged-On	• Terminal is not logged onto a ground station
18	Master/Slave	• Originating terminal is the slave or the disabled unit in a dual installation
19	CMU 2 Inactive	• CMU 2 transmission of valid Label 270 is detected inactive
20	Cockpit Fault	• No cockpit voice nor CMU data transmissions via terminal are possible (due to equipment failure)
21	Cockpit Voice Fault	• No cockpit voice transmissions via terminal are possible due to equipment failure
22	Voice Call 1	• Terminal has detected a low priority (4) flight deck incoming voice call on channel 1
23	Voice Call 2	• Terminal has detected a low priority (4) flight deck incoming voice call on channel 2
24	Voice Alert 1	• Terminal has detected a high priority (1, 2, or 3) flight deck incoming voice call on channel 1
25	Voice Alert 2	• Terminal has detected a high priority (1, 2, or 3) flight deck incoming voice call on channel 2
26	Cockpit Voice Communication 1	• A cockpit voice communication is connected on channel 1
27	Cockpit Voice Communication 2	• A cockpit voice communication is connected on channel 2
28		• Reserved

Table F-9 Status Word 1 Bits (Continued)

Bit(s)	Description	If Set

29	Data	• No active ACARS/CMU is available at the SDU, or the active ACARS/CMU does not respond with a Loop Word in response to a Test Word
		• This bit being set can be caused by the following:
		  • Bus inactivity on all ACARS/CMU inputs
		  • Bus activity, but no declared active ACARS/CMU
		• Bit may be used to set a cockpit advisory message (e.g., >SATCOM DATA) indicating to the flight crew a loss of data link capability due to a failure in the ACARS/CMU interface.

30–31	SSM (per ARINC Specification 429, Sections 2.1.5 and 2.1.5.3, except that 11 = Not Defined)	

3. Understanding Join/Leave Word; Label 271

   Each of the Aeronautical Telecommunications Network (ATN) subnetworks transmits join and leave words to the ACARS/CMU whenever a path to a specified ground address changes.

   The join event notifies the ACARS/CMU that a new path to a specified ground address is available, triggering ATN air-to-ground communications. The leave event notifies the ACARS/CMU that a path to a specified ground address has been closed, ending ATN air-to-ground communications.

   Table F-10 shows the definitions of the bits in the join/leave word.

Table F-10 Join/Leave Word Bits

Bits	Defines
Bits 8–1	Word Label 271: • Uses the A429 convention • Coded as 10011101
Bits 16–9	GES ID: • 0 is an invalid ID • FF is used for all GESs • ID numbers between 1 and FE are valid GES IDs • GES ID is known to the HSD-440 terminal
Bits 22–17	Satellite ID

Table F-10 Join/Leave Word Bits (Continued)

Bits	Defines
Bits 25–23	Inmarsat Service: • Aero L 000 • Aero I 001 • Aero H 010 • Aero H+ 011
Bits 28–26	Not used; padded with zeros
Bit 29	Data link from the AES to the GES: • Available (a Join message; Bit = 1) • Not Available (a Leave message; Bit = 0) • Identified by the GES ID and Satellite ID fields • CMU uses this information to initiate networklayer virtual circuits with available ground routers by determining the ground routers' DTE addresses from the provided GES identity • Bits 9–16, (GES) and Bits 17–22 (Satellite ID) uniquely identify a GES • Aero Service Type field may be used by the CMU to make routing decisions
Bits 31–30	SSM information (ARINC 429 para 2.1.5)

4. Understanding Fault Summary Word 1; Label 350

   The HSD-440 terminal transmits fault summary word 1 to monitor the function of units that are part of or connected to the HSD-440 terminal. The bits of this word are shown in Table F-11.

Table F-11 Fault Summary Word 1 Bits

Bits	Use
29–11	Report systems as fail or OK
11, 13, 16, 19, and 21	Report a fault

   ARINC Characteristic 741 describes the word format of this label.

5. Understanding Fault Summary Word 2; Label 351

   The HSD-440 terminal transmits fault summary word 2 to monitor the function of the ARINC 429 buses of the units that are part of or connected to the HSD-440 terminal. The bits of this word are shown in Table F-12.

Table F-12 Fault Summary Word 2 Bits

Bits	Use
29–11	Report systems as inactive or OK
13, 14, 15, 16 , 17, 21, and 24	Report that no bus activity is detected by the HSD-440 terminal

ARINC Characteristic 741 describes the word format of this label.

(2) Understanding BOP Messages

In BOP messages, the ACARS/CMU uses Version 1 of the BOP to convey non-broadcast-type messages between the aircraft and ground ends of the HSD-440 terminal, as published in ARINC 429 P3.

Timer values are set to the default definitions in ARINC Specification 429, as shown in Table F-13, Table F-14, and Table F-15.

Table F-13 BOP Events

Event	Description	Standard Value
N_1	Max number of RTS repeats following NCTS	5
N_2	Max number of RTS repeats following Busy	20
N_3	Max number of RTS repeats following No response	5
N_4	Number of NAK words received before declaring failure of communication	3
N_5	Number of SYN words received before declaring failure of communication	3
N_6	Max number of ALO repeats following No response	3

Table F-14 Variables of Low-Speed BOP—Version 1

Time	Description	Min Value	Max Value	Timer or Design Goal for Source or Sink	Notes	Reference
T_1	CTS/NCTS send time	0 ms	100 ms	Goal for Sink	2	2.5.7
T_2	RTS repeat time after receipt of NCTS	500 ms	700 ms	Timer for Source		2.5.7.2
T_3	Busy send time	0 ms	100 ms	Goal for Sink	2	2.5.7.3
T_4	RTS repeat time after receipt of Busy	15 sec	18 sec	Timer for Source		2.5.7.3
T_5	RTS repeat time if no response	500 ms	700 ms	Timer for Source		2.5.7.4

Table F-14 Variables of Low-Speed BOP—Version 1 (Continued)

Time	Description	Min Value	Max Value	Timer or Design Goal for Source or Sink	Notes	Reference
T_6	Time of random timer to resolve RTS conflicts	50 ms	500 ms	Goal for Source	3	2.5.81
T_7	Increment of time T_6	10 ms	100 ms	Goal for Source	3	2.5.81
T_8	ACK/NAK/SYN send time	0 ms	200 ms	Goal for Sink	2	2.5.13
T_9	LDU timeout following CTS	2.5 sec	2.7 sec	Timer for Sink		2.5.13.2 1.5.13.6
T_{10}	ACK/NAK timeout	2.7 sec	3.0 sec	Timer for Source	4	2.5.16
T_{11}	Loop back send time	0 ms	100 ms	Goal for Sink	2	2.5.17.1
T_{12}	ALO repeat time if no response to ALO	200 ms	250 ms	Timer for Source		2.5.19.1
T_{13}	SOT send time after receipt of CTS	0 ms	200 ms	Goal for Source	2	2.5.10
T_{14}	Incomplete file timeout	2 min	2.2 min	Timer for Sink		2.5.14.3
T_{15}	ALR send time	0 ms	180 ms	Goal for Sink	2	2.5.19.1.2
T_{16}	ACK/NAK timeout after EOT	220 ms	330 ms	Timer for Source		2.5.16

Table F-15 Variables of High-Speed BOP—Version 1

Time	Description	Min Value	Max Value	Timer or Design Goal for Source or Sink	Notes	Reference
T_1	CTS/NCTS send time	0 ms	100 ms	Goal for Sink	2	2.5.7
T_2	RTS repeat time after receipt of NCTS	100 ms	140 ms	Timer for Source		2.5.7.2
T_3	Busy send time	0 ms	100 ms	Goal for Sink	2	2.5.7.3
T_4	RTS repeat time after receipt of Busy	1.0 sec	1.2 sec	Timer for Source		2.5.7.3
T_5	RTS repeat time if no response	150 ms	200 ms	Timer for Source		2.5.7.4

Table F-15 Variables of High-Speed BOP—Version 1 (Continued)

Time	Description	Min Value	Max Value	Timer or Design Goal for Source or Sink	Notes	Reference
T_6	Time of random timer to resolve RTS conflicts	50 ms	500 ms	Goal for Source	3	2.5.81
T_7	Increment of time T_6	10 ms	100 ms	Goal for Source	3	2.5.81
T_8	ACK/NAK/SYN send time	0 ms	200 ms	Goal for Sink	2	2.5.13
T_9	LDU timeout following CTS	400 ms	440 ms	Timer for Sink		2.5.13.2 2.5.13.6
T_{10}	ACK/NAK timeout	600 ms	660 ms	Timer for Source	4	2.5.16
T_{11}	Loop back send time	0 ms	100 ms	Goal for Sink	2	2.5.17.1
T_{12}	ALO repeat time if no response to ALO	200 ms	250 ms	Timer for Source		2.5.19.1
T_{13}	SOT send time after receipt of CTS	0 ms	100 ms	Goal for Source	2	2.5.10
T_{14}	Incomplete file timeout	10 sec	11 sec	Timer for Sink		2.5.14.3
T_{15}	ALR send time	0 ms	180 ms	Goal for Sink	2	2.5.19.1.2
T_{16}	ACK/NAK timeout after EOT	220 ms	330 ms	Timer for Source		2.5.16

(a) Understanding BOP Options

The HSD-440 terminal uses the following BOP options for the ACARS/CMU interface. The ORT specifies the values for these options. If no information is available, then the options default to the values shown in Table F-16.

Table F-16 BOP Option Defaults

Option	Value	Notes
O1	Half	Half or Full Duplex Operation
O2	ORT value	High or Low Speed Bus Low speed is default
O3	No	Automatic CTS when ready
O4	No	Accept Automatic CTS
O5	Yes (high-speed data terminal)	System Priority to Resolve RTS Conflict
O6	--	Spare

Table F-16 BOP Option Defaults (Continued)

Option	Value	Notes
O7	--	Spare
O8	Yes	Use of SOLO word
		(TEST/LOOP)
O9	--	Spare
O10	Yes	Destination code in RTS/CTS /NCTS/BUSY Used
O11	Yes	Bit-Protocol verification
O12	No	Use subsystem SAL from ALO word

(b) Understanding LDUs and File Size

BOP messages use Link Data Units (LDUs) encoded in binary octets to transmit data. LDUs conform to the following rules:

- The data is transmitted from a source and is received by a sink.
- LDUs consist of a set of contiguous ARINC 429 32 bit data words.
- The initial data word of each LDU shall be a Start of Transmission (SOT) word.
- The end data word of each LDU shall be an End of Transmission (EOT).
- No data file shall exceed 255 LDUs.

(c) Understanding LDU Size and Word Count

LDUs may vary in size from 3 to 255 ARINC 429 words. The minimum LDU consists of one SOT word, one data word, and one EOT word, and the maximum LDU consists of one SOT, 253 data words, and one EOT.

The HSD-440 terminal calculates word count when it organizes an LDU for transmission. The word count appears in the RTS and CTS data words. See "Understanding Protocol Words" on page F-15.

(d) Understanding Word Format

The general word format of a BOP word is given in ARINC 429 (Attachment 11, Table 11-A). The bit definitions are shown in Table F-17.

Table F-17 BOP Word Format

Bit Position	Description
8-1	SAL
24-9	Data (28-9 for full data words)
28-25	GFI, Control Data or Word Type Extensions
31-29	Word Type
32	Parity Bit

1. Understanding SALs

   The HSD-440 terminal sends LDUs by point to point by using a label field to carry the destination SAL; therefore, each LDU that the HSD-440 terminal sends is prefixed by the SAL for the ACARS/CMU, SAL 304.

   The SAL for the HSD-440 terminal is 307 (if designated SDU 1) or 173 (if designated SDU 2). See ARINC 429, Part 1, attachment 1-1 for a complete list of all SALs.

2. Understanding Data

   Data is sent in 4 or 5 nibble words. See "Understanding Word Types" on page F-14.

3. Understanding General Format Identifier (GFI) Definitions

   Table F-18 defines the GFI definitions.

Table F-18 GFI Definitions

File Type	To				GFI
	CMU		HSD-440 terminal		
	Label	Destination Code	Label	Destination Code	
Data2 Enveloped ACARS Message	304	M	307 (1)	S	1110b (Eh)

A GFI of 1110 b indicates a Data 2 Enveloped ACARS Message. This message indicates to the HSD-440 terminal that this message is to be passed on through the ACARS network. Only one message is transferred per link layer ARINC 429 file. If the HSD-440 terminal is unable to deliver an enveloped message to its destination (ACARS/CMU or GES), the HSD-440 terminal discards the message.

A Data-2 HSD-440 terminal transmits to the GES all messages passed from the avionics network interface during the time that the HSD-440 terminal is logged on. If the HSD-440 terminal is not logged on, any messages passed to the HSD-440 terminal shall be discarded. While the HSD-440 terminal is logged on, any messages received from the GES shall be forwarded to the avionics network interface regardless of the state or availability of the destination avionics equipment.

Any ACARS/CMU message contains a destination code of M if it arrives from the ground to the ACARS/CMU. Similarly, any message originating from the ACARS/CMU that is destined for a GES contains a destination code of S. These codes are embedded in the RTS, CTS, and NCTS protocol words (See "Understanding Protocol Words" on page F-15.)

(e) Understanding Word Types

The word types in Table F-19 are valid. For a full definition, see ARINC 429 P3, attachment 11.

Table F-19 Word Types

31	30	29	WORD TYPE
0	0	0	Full Binary Data Word
0	0	1	Partial Binary Data Word
0	1	0	Start of Frame—Version 3
0	1	1	End of Frame—Version 3
1	0	0	Protocol Word
1	0	1	Solo Word
1	1	0	Start Of Transmission—Version 1
1	1	1	End Of Transmission—Version 1

1. Understanding the Full Binary Data Word

   This word shall transmit 5 nibbles of data. See ARINC 429P3 Attachment 11 for details.

2. Understanding the Partial Binary Data Word

   This word shall transmit 4 or less nibbles of data. See ARINC 429P3 Attachment 11 for details.

3. Understanding Protocol Words

   The protocol words are shown in Table F-20. The protocol identifier occupies bits 28-25 of the protocol word.

Table F-20 Protocol Words and Uses

Protocol word	Uses
RTS (Request to Send)	The HSD-440 terminal issues an RTS to the ACARS/CMU when it is ready to send an LDU. The RTS contains a destination code (bits 24–17) and a word count (bits 16–9).
CTS (Clear to Send)	When the HSD-440 terminal receives an RTS, it issues a CTS to the ACARS/CMU when the ACARS/CMU is ready to send an LDU. The CTS contains the same destination code and word count as the HSD-440 terminal received in the RTS. Bit 11 of the Status Word Label 270 from the HSD-440 terminal indicates when a satellite link is available to proceed if this is a ground destination message.
NCTS (Not Clear to Send)	When the HSD-440 terminal either receives a valid RTS and is not ready to accept data or receives an RTS with an invalid destination or word count, it responds with an NCTS. The NCTS contains a destination code (bits 24–17).
NAK (negative acknowledgement)	If the HSD-440 terminal notes a missing SOT or EOT word, parity error, word count error, CRC error, or time out error, it will respond with a NAK. The NAK contains the same file sequence number in bits 24–17 as the SOT word.

Table F-20 Protocol Words and Uses (Continued)

Protocol word	Uses
ACK (acknowledgement)	If the HSD-440 terminal transfers each word within the designated time and with odd parity, correct word count, and verified CRC. The LDU is either next, first, or a duplicate. Then the HSD-440 terminal sends an ACK. The ACK word contains the file sequence number (bits 24–17) and the LDU sequence number (bits 16–9).
ALO (aloha)	The HSD-440 terminal can initiate BOP V1 communication by sending an ALO word out on the bus. The first ALO word that the HSD-440 terminal transmits contains the highest version number it supports (bits 12–9). This word determines the correct protocol to use for the exchange. The ALO also sends its own SAL (bits 24–17).
ALR (aloha response)	When the HSD-440 terminal receives an ALO word, it leaves its present task and responds with an ALR word. The response contains the protocol version level supported.
SYN	The HSD-440 terminal transmits a SYN word to inform the ACARS/CMU that the construction of the last file that was transmitted is confused. The reception of a SYN word causes the ACARS/CMU to abort any reception or transmission in progress. In addition, if the ACARS/CMU was transmitting, it should re-initiate transmission of the file that was aborted.
Destination code	RTS, CTS, and NTCS words use a destination code. The destination code field (when used, bits 24–17) indicates the final destination of the LDU. If the LDU will be used in the HSD-440 terminal, the destination code can be set to 00h. If the LDU is intended to be passed on to another onboard system, the destination code indicates that system.
Word count	RTS and CTS words use a word count. The word count field (bits 16–9) reflects the number of ARINC 429 words that will be transmitted in a subsequent LDU. The maximum word count value is 255 ARINC 429 words.

4. Understanding the Solo Word

   If the data the HSD-440 terminal is sending consists of only 1 or 2 octets, then the data can be sent blind using the solo word instead of obtaining a CTS. Solo words conform to the following rules:

   - The solo word contains a 16 bit data field in bits 24–9
   - Bits 31–29 are permanently set to 101b
   - Solo words are not acknowledged at the link level
   - Solo words are not interleaved with data file words during a data file transfer, however if the HSD-440 terminal receives a solo word during data transfer, the HSD-440 terminal shall process the solo word normally and resume file transmission or reception.

The solo word also performs test and loop back functions to test the integrity of the ARINC 429 bus interconnection between the HSD-440 terminal and the ACARS/CMU.

The HSD-440 terminal can send a 16 bit loop test pattern word (TEST) on the ARINC 429 TX bus. The ACARS/CMU then responds with the identical loop test pattern word (LOOP) on the ARINC 429 RX bus. If the LOOP does not match the TEST, the HSD-440 terminal indicates a TEST failure.

If the HSD-440 terminal receives a TEST on its ARINC 429 RX bus, it responds by transmitting an identical LOOP on the ARINC 429 TX bus.

A 4 bit identifier (bits 28–25) identifies the nature of the data being sent by the solo word. The three types of data are shown in Table F-21.

Table F-21 Data Types

Purpose	Bits 28-25b	Description
Test	0000b	16 Bit Test Pattern
Loop	0001b	16 Bit Loop Back
Solo Word	ID	16 Bit Data filed

5. Understanding Start of Transmission (SOT)

   When the HSD-440 terminal receives a valid CTS with the destination code and word count of the previous RTS, then it responds by sending an SOT word immediately before the LDU. The SOT contains the file sequence number, the GFI, and the LDU sequence number.

   The file sequence number (bits 24–17) of the SOT word is an 8 bit number assigned to the data file. It is initialized to 00h and increments by 1h for each new file sent over the link. After reaching FFh, the file sequence number returns to 01h and recommences incrementing by 1h for each new file sent. A file consisting of multiple LDUs has the same file sequence number in each SOT word of each LDU. The file sequence number is also used in ACK and NAK words.

   The LDU sequence number (bits 16–9) of the SOT word is an 8 Bit number assigned to the LDU. It is initialized to 00h and increments by 1h for each LDU sent (of the same file). The LDU sequence number resets to 00h at the beginning of each new file. The LDU sequence number is also used in the ACK word.

6. Understanding End of Transmission (EOT)

   Each LDU is terminated by an EOT word. Bit 25 indicates if this LDU is the final LDU of the transfer. If it is, then this bit shall be set to 1; if it is not the final LDU, it shall be set to 0. The EOT also contains the CRC word in bits 24–9. See ARINC 429 P3, paragraph 2.5.12, for details on generating and decoding the CRC word.

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APPENDIX G: INTERNATIONAL ACCESS AND COUNTRY CODES

Table G-1 shows a list of countries with their associated country codes and international access codes.

Table G-1 International Access and Country Codes

Country	Country Code	International Access Code
Afghanistan	93	00
Albania	355	00
Algeria	213	00
Angola	244	00
Anguilla	+1 (264)	011
Antigua	+1 (268)	011
Argentina	54	00
Armenia	374	00
Aruba	297	00
Australia	61	00 11
Austria	43	00
Bahamas	+1 (242)	011
Bahrain	973	00
Bangladesh	880	00
Barbados	+1 (246)	011
Belarus	375	810
Belgium	32	00
Belize	501	00
Benin	229	00
Bermuda	+1 (441)	011
Bolivia	591	00 10
Bosnia and Hercegovina	387	99
Botswana	267	00
Brazil	55	00
British Virgin Islands	+1 (284)	011
Bulgaria	359	00
Burkina Faso	226	00
Burma (Myanmar)	95	00
Burundi	257	90
Cambodia	855	001

Table G-1 International Access and Country Codes (Continued)

Country	Country Code	International Access Code
Cameroon	237	00
Canada	1	011
Cape Verde	238	0
Cayman Islands	+1 (345)	011
Central African Republic	236	19
Chad	235	15
Chile	56	00
China	86	00
Colombia	57	009
Comoros	269	00
Congo (Brazzaville)	242	00
Congo (Kinshasa, formerly Zaire)	243	00
Cook Islands	682	00
Costa Rica	506	00
Cote d'Ivoire (Ivory Coast)	225	00
Croatia	385	99
Cuba	53	119
Cyprus	357	00
Czech Republic	420	00
Denmark	45	00
Diego-Garcia	246	00
Djibouti	253	00
Dominica	+1 (767)	011
Dominican Republic	+1 (809), +1 (829)	011
East Timor	670	00
Ecuador	593	00
Egypt	20	00
El Salvador	503	0
Equatorial Guinea	240	00
Eritrea	291	00
Estonia	372	810
Ethiopia	251	00
Falkland Islands	500	01
Faroe Islands	298	009
Fiji	679	5
Finland	358	00
France	33	00

Table G-1 International Access and Country Codes (Continued)

Country	Country Code	International Access Code
French Antilles	590	00
French Guiana	594	00
French Polynesia	689	00
Gabon	241	00
Gambia	220	00
Germany	49	00
Ghana	233	00
Gibraltar	350	00
Greece	30	00
Greenland	299	009
Grenada	+1 (473)	011
Guam	+1 (671)	011
Guatemala	502	00
Guinea	224	00
Guinea-Bissau	245	00
Guyana	592	001
Haiti	509	00
Honduras	504	00
Hong Kong	852	001
Hungary	36	00
Iceland	354	90
India	91	900
Indonesia	62	001, 008
Iran	98	00
Iraq	964	00
Ireland	353	00
Israel	972	00
Italy	39	00
Ivory Coast (Cote d'Ivoire)	225	00
Jamaica	+1 (876)	011
Japan	81	010
Jordan	962	00
Kazakstan	7	810
Kenya	254	000
Kuwait	965	00
Kyrgyz Republic	996	00
Laos	856	00

Table G-1 International Access and Country Codes (Continued)

Country	Country Code	International Access Code
Latvia	371	810
Lebanon	961	00
Lesotho	266	00
Liberia	231	00
Libya	218	00
Liechtenstein	423	00
Lithuania	370	00
Luxembourg	352	00
Macao	853	00
Macedonia	389	00
Madagascar	261	16
Malawi	265	101
Malaysia	60	00
Maldives	960	00
Mali	223	00
Malta	356	356
Marshall Islands	692	011
Martinique	596	00
Mauritania	222	00
Mauritius	230	00
Mayotte and Reunion	262	10
Mexico	52	98
Micronesia	691	011
Moldova	373	00
Monaco	377	00
Mongolia	976	001
Montenegro	382	00
Montserrat	+1 (664)	011
Morocco	212	00
Mozambique	258	00
Namibia	264	00
Nauru	674	00
Nepal	977	00
Netherlands	31	00
New Caledonia	687	00
New Zealand	64	00
Nicaragua	505	00

Table G-1 International Access and Country Codes (Continued)

Country	Country Code	International Access Code
Niger	227	00
Nigeria	234	009
Niue Island	683	00
North Korea	850	00
Northern Mariana Islands (Commonwealth of)	+1 (670)	011
Norway	47	095
Oman	968	00
Pakistan	92	00
Palau	680	011
Palestine	970	00
Panama	507	00
Papua New Guinea	675	05
Paraguay	595	002
Peru	51	00
Philippines	63	00
Poland	48	00
Portugal	351	00
Puerto Rico	+1 (787)	011
Qatar	974	00
Romania	40	71
Russia	7	810
Rwanda	250	00
Samoa	685	0
San Marino	378	00
Saudi Arabia	966	00
Senegal	221	00
Serbia	381	99
Seychelles	248	00
Sierra Leone	232	00
Singapore	65	001
Slovakia	421	00
Slovenia	386	99
Solomon Islands	677	00
Somalia	252	00
South Africa	27	00
South Korea	82	00

Table G-1 International Access and Country Codes (Continued)

Country	Country Code	International Access Code
Spain	34	00
Sri Lanka	94	00
St Helena and Tristan da Cunha	290	00
St Kitts	+1 (869)	011
St Lucia	+1 (758)	011
St Pierre and Miquelon	508	00
St Vincent	+1 (784)	011
Sudan	249	00
Suriname	597	002
Swaziland	268	00
Sweden	46	00
Switzerland	41	00
Syria	963	00
Taiwan	886	002
Tajikistan	992	810
Tanzania	255	000
Thailand	66	001
Togolese Republic	228	00
Tokelau	690	00
Tonga	676	09
Trinidad and Tobago	+1 (868)	011
Tunisia	216	00
Turkey	90	99
Turkmenistan	993	810
Turks and Caicos	+1 (649)	011
Tuvalu, Ellice Islands	688	00
U.S. Pacific Islands	+1 670, +1 671, +1 684	011
U.S. Virgin Islands	+1 (340)	011
Uganda	256	000
Ukraine	380	810
United Arab Emirates	971	00
United Kingdom	44	00
United States	1	011
Uruguay	598	00
Uzbekistan	998	810
Vanuatu	678	00

Table G-1 International Access and Country Codes (Continued)

Country	Country Code	International Access Code
Vatican City	+39, +379	00
Venezuela	58	00
Vietnam	84	00
Wallis and Futuna	681	19
Yemen	967	00
Yugoslavia	(+38 discontinued)	99
Zambia	260	00
Zimbabwe	263	110

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APPENDIX H: INMARSAT CAUSE CODES

Table H-1 defines the maintenance port menu fault codes of the HSD-440 terminal.

Table H-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

Table H-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

Table H-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

Table H-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

Table H-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

Table H-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

Table H-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

Table H-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
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: • GPS conflict • Insufficient HPA power available to make call • HPA over current
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
12C8	Handover failed, LES not detected

Table H-1 Inmarsat Cause Code Definitions (Continued)

Inmarsat Cause Code	Code Definition
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
1F01	Call cleared by terrestrial circuit (normal call termination from ground source)

Table H-1 Inmarsat Cause Code Definitions (Continued)

Inmarsat Cause Code	Code Definition
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
B022	MOD Su not transmitted
B024	MOD invalid frame no

Table H-1 Inmarsat Cause Code Definitions (Continued)

Inmarsat Cause Code	Code Definition
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
B324	ODU error alarm reverse power
B328	ODU failed due to tx power check

Table H-1 Inmarsat Cause Code Definitions (Continued)

Inmarsat Cause Code	Code Definition
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
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
FFFD	ACSE end marker (MPDS)
FFFE	Status undefined (MPDS)
FFFF	Status OK (MPDS)