eNfusion™ HSD-128 High-speed Data Terminal
System Description, Installation, and Maintenance Manual

This manual supercedes MN-1110-10023 and MN-1110-10057 and provides documentation for the equipment listed below.

Model	PN
eNfusion™ HSD-128 High-speed Data Terminal	1110-A-0001
	1110-A-0060
	1110-A-0070
	1110-A-0080
	1110-A-0150
	1110-A-0160

eNfusion™ HSD-128 High-speed Data Terminal SYSTEM DESCRIPTION, INSTALLATION, AND MAINTENANCE MANUAL

Document Number: MN-1110-10113, Revision E

Revision Table		
Revision	**ECR**	**Description**
A	N/A	First release
B	030758	Updated to include new installation modes
C	040711	Updated Service Bulletin Matrix
	040673	Added AMBE copyright statement
	050060	Updated middle plug connections on table and drawings
	061189	Updated terminology
D	070552	Removed section cover pages
		Updated frequency bands, service bulletins, and added LED label section
E	070111	Updated address and telephone numbers

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SERVICE BULLETIN LIST

Service Bulletin Number	Subject	Manual Rev. Number	Manual Rev. Date
1110-SB-0001	Channel card software upgrade (C30) to accommodate Inmarsat system change	A	10-Feb-03
1110-SB-0002	Backplane modification to HPA wiring harness and power supply circuits of the control processor card	A	10-Feb-03
1110-SB-0003	Upgrade to HSD HPA software to improve power management by the HSD to the SAT-906 SDU	A	08-Apr-03
1110-SB-0004	Upgrade hardware to include an Data I/O Type 2 Card to support the Ethernet (10BASE-T) interface for data input and output	A	06-Aug-03
1110-SB-0005	Upgrade the hardware for Combined Mode operation	B	06-Aug-03
1110-SB-0006	Channel Card Software MPDS upgrade	A	05-Nov-03
1110-SB-0007	Software upgrade for Multi-Channel operation	A	20-Nov-03
1110-SB-0008	Not applicable	N/A	N/A
1110-SB-0009	Not applicable	N/A	N/A
1110-SB-0010	Hardware upgrade for dual channel	A	05-Aug-03
1110-SB-0011	HSD Software Upgrade	B	19-Nov-03
1110-SB-0012	HSD Software Enhancement	A	19-Nov-03
1110-SB-0013	Addition of Software Identification Label	A	09-Dec-03
1110-SB-0014	Data I/O Type 2 Software Upgrade	A	12-Mar-04
1110-SB-0015	HSD Control Processor Software Enhancement	B	15-Jun-04
1110-SB-0016	HSD Transceiver Upgrade to HSD-400	C	13-Oct-06

Service Bulletin Number	Subject	Manual Rev. Number	Manual Rev. Date
1110-SB-0017	HSD Transceiver Control Processor Software Enhancement	A	24-Feb-05
1110-SB-0018	HSD Transceiver Channel Card Hardware Modification	C	10-Aug-05
1110-SB-0020	HSD Transceiver HPA DC Software Upgrade	A	31-May-05
1110-SB-0021	2-Channel Cooperative Mode HSD Transceiver Control Processor Software Enhancement	A	01-Feb-06
1110-SB-0022	GPS Protection Software Upgrade	B	03-Jan-07
1110-SB-0023	HSD Transceiver Motherboard Hardware Replacement	A	25-Aug-06
1110-SB-0401	HSD-X Software Upgrade	A	19-Nov-03
1110-SB-0402	Addition of Software Identification Label	A	09-Dec-03

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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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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Cover	*ALL	Nov. 3, 2006
Front Matter	*ALL	Nov. 3, 2006
Customer Comment Form	*ALL	Nov. 3, 2006
List of Effective Pages	*ALL	Nov. 3, 2006
Record of Revisions	*ALL	Nov. 3, 2006
Service Bulletin List	*ALL	Nov. 3, 2006
Table of Contents	*ALL	Nov. 3, 2006
Introduction	*ALL	Nov. 3, 2006
System Description	*ALL	Nov. 3, 2006
System Operation	*ALL	Nov. 3, 2006
Installation	*ALL	Nov. 3, 2006
Test and Fault Isolation	*ALL	Nov. 3, 2006
Maintenance and Repair	*ALL	Nov. 3, 2006
Appendix A	*ALL	Nov. 3, 2006
Appendix B	*ALL	Nov. 3, 2006
Appendix C	*ALL	Nov. 3, 2006
Appendix D	*ALL	Nov. 3, 2006
Appendix E	*ALL	Nov. 3, 2006
Appendix F	*ALL	Nov. 3, 2006
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INTRODUCTION

1. General

This manual provides all the specifications, principles of operation, and information necessary to install an HSD High-Speed-Data SATCOM Transceiver made by EMS Technologies in all supported operational modes and configurations.

The information needed to install HSD-X High-Speed-Data SATCOM Transceiver Extensions in Multi-Channel configurations with Stand-Alone HSD-128 units is also provided in this document.

The information provided is presented in the following sections: "System Description" on page 1-1, "System Operation" on page 2-1, "Installation" on page 3-1, "Test and Fault Isolation" on page 4-1, and "Maintenance and Repair" on page 5-1. The Appendices provide additional reference information. 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 may 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.

Depending on the version of software and configuration mode of installation of the HSD transceiver, the "actual" or "live" system messages such as dialog boxes and screen displays, may differ slightly from the example illustrations presented and described in this manual.

2. Abbreviations and Acronyms

ACSE Access Control and Signalling Equipment

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

AERO Aeronautical

AMBE® Advanced Multiband Excited Coding

AWG American Wire Gauge

BRI Basic Rate ISDN

b/s Bits per second

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

CCW Counter Clockwise

CMT Commissioning Maintenance Terminal (Honeywell)

CW Clockwise

DLNA Diplexer/Low-Noise Amplifier

EMI Electromagnetic Interference

GND Ground

HGA High Gain Antenna

HPA High Power Amplifier

HSD High-speed Data Terminal

HSD-X High-Speed-Data SATCOM Transceiver Extension

Hz Hertz

ICAO International Civil Aviation Organization

ICD Interconnect Drawing

INS Inertial Navigational System

I/O Input/Output

IRS Inertial Reference System

ISDN Integrated Services Digital Network

kbps Kilobits per Second

LES Land Earth Station

LRU Line Replaceable Unit

LSV Low Speed Voice

Mbps Megabit per second

MCDU Multifunction Control Display Unit

MCU Modular Concept Unit

MES Mobile Earth Station

MPDS Mobile Packet Data Services

ms	Millisecond
MSN	Multiple Subscriber Number
NAT	Network Address Translation
OCXO	Oven Controlled Crystal Oscillator
OEM	Original Equipment Manufacturer
O&I	Outline and Installation Drawing
PC	Personal Computer (or Laptop)
PN	Part Number
PPPoE	Point-to-Point Protocol over Ethernet
REA	Responsible Engineering Authority
RF	Radio Frequency
RFI	Radio Frequency Interference
RFU	Radio Frequency Unit
rms	root mean square
Rtn	Return
Rx	Receive
satcom	Satellite Communications
SCPC	Single Channel per Carrier
SDI	Source/Destination Identification
SDU	Satellite Data Unit
SPID	Service Profile Identifier (ISDN)
STBD	Starboard
STE	Secure Terminal Equipment
STU	Secure Telephone Unit
T/A	Terminal Adapter
Tx	Transmit
WOW	Weight on Wheels

3. Advisories

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

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

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

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

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

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.

4.   Illustration of Equipment Covered
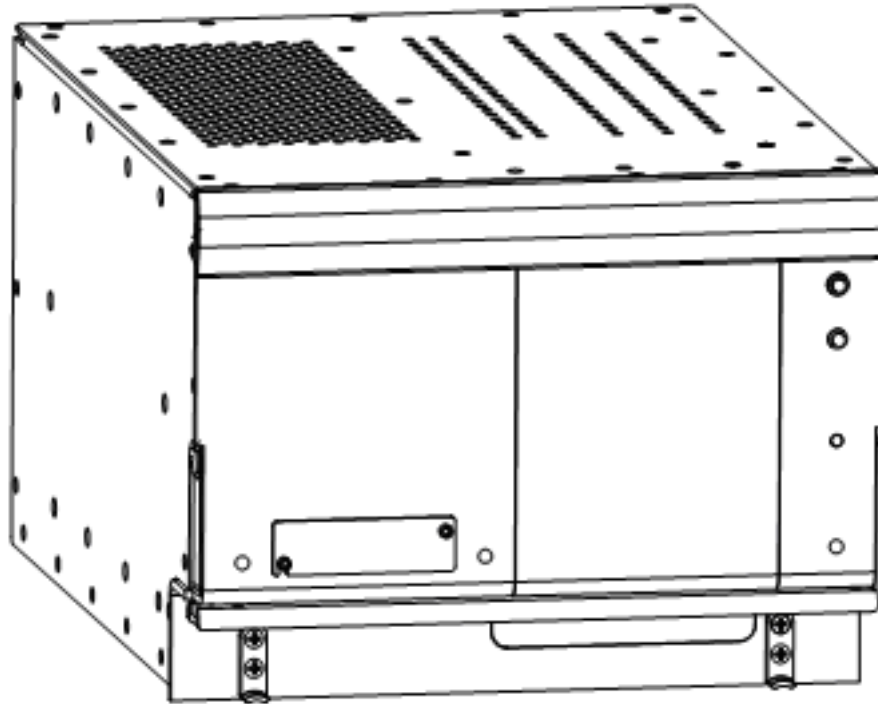
Figure TC–1. HSD-128 Terminal
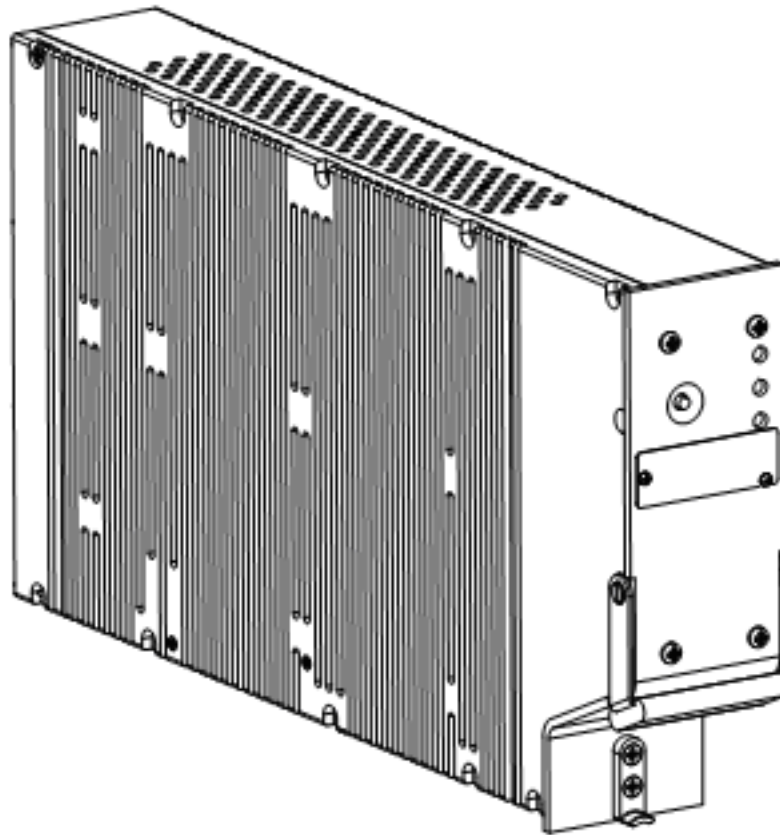
Figure TC–2. HSD-X SATCOM High-Speed-Data Transceiver Extension

SYSTEM DESCRIPTION

1. Purpose of Equipment

The HSD is a scalable, high-speed-data, satellite communications terminal, which interfaces with an ARINC 741-compatible antenna subsystem to provide a high-speed data communication link with the Inmarsat satellite communication network. HSD transceivers are available in single and dual channel models which can be installed in the following modes of operation: Stand-Alone Mode, Combined/Selective Mode, and Cooperative Mode.

In Stand-Alone Mode HSD installations, the addition of HSD-X extension transceivers expands the channel capacity by providing one additional voice or 64 kbps data channel—per HSD-X to provide a Multi-Channel, high-speed data communication link with the Inmarsat satellite communication network.

Table 1–1 shows the services that are supported by each HSD terminal.

Table 1–1. Supported Services Matrix for HSD-128, HSD-64, and HSD-X

Supported Services and Functionality		HSD-128 (Stand-Alone, Multi-Channel)	HSD-64/HSD-128 (Combined/Selective, Cooperative)	HSD-X (Multi-Channel HSD)
Inmarsat Swift64 ISDN (64 kbps UDI, 64 kbps Speech, 56 kbps Data, and 3.1 kHz audio)		YES	YES	YES
MPDS	Over RS-232	YES (with service bulletin 1110-SB-0006)	YES (with service bulletin 1110-SB-0006)	YES
	Over Ethernet	YES (PNs 1110-A-0150, 1110-A-0160, and HSD transceivers with service bulletin 1110-SB-0006, 1110-SB-0004)	YES (PNs 1110-A-0150, 1110-A-0160, and HSD transceivers with service bulletin 1110-SB-0006, 1110-SB-0004)	YES
AMBE® Mini-M Voice (4.8 kbps)		YES	NO	YES
STU III (Encryption)		YES (Full ISDN)	YES (Full ISDN)	YES (Full ISDN)
AMBE® STU		YES (with channel card software version 6.0 (C41) or later)	NO (Selective – YES)	YES (with channel card software version 6.0 (C41) or later)

Table 1–1. Supported Services Matrix for HSD-128, HSD-64, and HSD-X

Supported Services and Functionality	HSD-128 (Stand-Alone, Multi-Channel)	HSD-64/HSD-128 (Combined/Selective, Cooperative)	HSD-X (Multi-Channel HSD)
Ethernet Interface (1110-A-0150 and 1110-A-0160 support the Ethernet interface)	YES (with service bulletin 1110-SB-0006 and 1110-SB-0004)	YES (with service bulletin 1110-SB-0006 and 1110-SB-0004)	YES
Bonding Functionality	YES	NO - Not supported in single-channel units and Cooperative Mode	NO - Not supported in single-channel units

2. Equipment Covered

A. Hardware Description

Table 1–2 provides a comparison of the Hardware variants of HSD and HSD-X transceivers. Table 1–3 lists and describes all models of HSD transceivers covered in this manual.

Table 1–2. HSD Transceiver Variants

Model	Assembly PN	Channel Card(s)	Operational Modes/ Configurations	Interconnection Diagram	Voltage (nominal)	Power (nom/ max)
HSD-128	1110-A-0001	2	Stand-Alone	1110-B-0019	28 V dc	275/370 W
			Multi-Channel Configuration (with Service Bulletin 1110-SB-0012 accomplished)	1110-B-0419		
HSD-128	1110-A-0060	2	Stand-Alone	1110-B-0019	115 V ac/ 400 Hz	275/385 W
			Multi-Channel Configuration (with Service Bulletin 1110-SB-0012 accomplished)	1110-B-0419		
HSD-128	1110-A-0001	2	Selective/Honeywell Combined (with Service Bulletin 1110-SB-0005 accomplished)	1110-B-0081	28 V dc	325/370 W
			Collins Co-operative	1110-B-0156		
HSD-128	1110-A-0060	2	Selective/Honeywell Combined (with Service Bulletin 1110-SB-0005 accomplished)	1110-B-0081	115 V ac/ 400 Hz	325/385 W
			Collins Co-operative	1110-B-0156		
HSD-128	1110-A-0150	2	Stand-Alone	1110-B-0019	115 V ac/ 400 Hz	325/385 W
			Collins Co-operative	1110-B-0156		
			Selective/Honeywell Combined	1110-B-0081		
			Multi-Channel Configuration	1110-B-0419		

Table 1–2. HSD Transceiver Variants

Model	Assembly PN	Channel Card(s)	Operational Modes/ Configurations	Interconnection Diagram	Voltage (nominal)	Power (nom/ max)
HSD-128	1110-A-0160	2	Stand Alone	1110-B-0081	28 V dc	275/370 W
			Collins Co-operative	1110-B-0156		
			Selective/Honeywell Combined	1110-B-0081		
			Multi-Channel Configuration	1110-B-0419		
HSD-64	1110-A-0080	1	Selective/Honeywell Combined (with Service Bulletin 1110-SB-0005 accomplished)	1110-B-0081	28 V dc	275/370 W
			Collins Co-operative	1110-B-0156		
HSD-64	1110-A-0070	1	Selective/Honeywell Combined (with Service Bulletin 1110-SB-0005 accomplished)	1110-B-0081	115 V ac/ 400 Hz	275/385 W
			Collins Co-operative	1110-B-0156		
HSD-X	1110-A-0401	1	Multi-Channel Extension Configuration with HSD-128 Transceiver	1110-B-0419	115 V ac/ 400 Hz	30/40 W

Table 1–3. Equipment Covered

Model	Description
HSD-128	PN 1110-A-0001 HSD High-speed Data SATCOM Transceiver: High-speed data terminal containing two channel cards, a control processor, a high power amplifier, and a +28 V dc power supply. Operates with an Aero H/H+ (ARINC 741 compatible) antenna subsystem to provide circuit (Swift64 Mobile ISDN), packet-switched HSD (Swift64 MPDS), and Mini-M AMBE services over the Inmarsat satellite communications network.
HSD-128	PN 1110-A-0060 HSD High-speed Data SATCOM Transceiver: High-speed data terminal containing two channel cards, a control processor, a high power amplifier, and a 115 V ac, 400 hertz (Hz) power supply. Operates with an Aero H/H+ (ARINC 741 compatible) antenna subsystem to provide circuit (Swift64 Mobile ISDN), packet-switched HSD (Swift64 MPDS), and Mini-M AMBE services over the Inmarsat satellite communications network.

Table 1–3. Equipment Covered

Model	Description
HSD-128	PN 1110-A-0150 HSD High-speed Data SATCOM Transceiver: High-speed data terminal containing two channel cards, a control processor, a Data I/O Type 2 card, a high power amplifier, and a 115 V ac, 400 hertz (Hz) power supply. Operates with an Aero H/H+ (ARINC 741 compatible) antenna subsystem to provide circuit (Swift64 Mobile ISDN), packet-switched HSD (Swift64 MPDS), and Mini-M AMBE services over the Inmarsat satellite communications network. Supports Ethernet connections.
HSD-128	PN 1110-A-0160 HSD High-speed Data SATCOM Transceiver: High-speed data terminal containing two channel cards, a control processor, a Data I/O Type 2 card, a high power amplifier, and a a +28 V dc power supply. Operates with an Aero H/H+ (ARINC 741 compatible) antenna subsystem to provide circuit (Swift64 Mobile ISDN), packet-switched HSD (Swift64 MPDS), and Mini-M AMBE services over the Inmarsat satellite communications network. Supports Ethernet connections.
HSD-64	PN 1110-A-0070 HSD High-speed Data SATCOM Transceiver: High-speed data terminal containing one channel card, a control processor, a high power amplifier, and a 115 V ac, 400 hertz (Hz) power supply. Operates with an Aero H/H+ (ARINC 741 compatible) antenna subsystem to provide circuit (Swift64 Mobile ISDN), packet-switched HSD (Swift64 MPDS), and Mini-M AMBE services over the Inmarsat satellite communications network.
HSD-64	PN 1110-A-0080 HSD High-speed Data SATCOM Transceiver: High-speed data terminal containing one channel card, a control processor, a high power amplifier, and a +28 V dc power supply. Operates with an Aero H/H+ (ARINC 741 compatible) antenna subsystem to provide circuit (Swift64 Mobile ISDN), packet-switched HSD (Swift64 MPDS), and Mini-M AMBE services over the Inmarsat satellite communications network.
HSD-X	PN 1110-A-0401 The HSD-X High-speed Data SATCOM Transceiver Extension contains a single channel card, a High Stability Reference, an Output Amplifier, a Data Processor module, and a 115 V ac 400 hertz (Hz) power supply. It operates in conjunction with an HSD-128 transceiver to provide Inmarsat Swift64 services and Mini-M AMBE voice services. This transceiver supports Multi-Channel HSD configurations by adding additional channels to HSD-128 systems.

B. Software Description

This section describes the software specifications and operational software components of the HSD and HSD-X transceivers. It also describes the software requirements and compatibility issues for each mode of operation.

(1) Software Specifications

The operating software of the HSD and HSD-X transceivers meets with RTCA/DO-178B Level E requirements.

(2) Operational Software Part Numbers

Table 1–4 provides a list of software part numbers for the HSD transceiver. Table 1–5 provides a list of software part numbers for the HSD-X transceiver.

Table 1–4. HSD Operational Software

EMS SATCOM Part Number	Description
LI-1110-10136	HSD-64/128 Software Configuration
1110-A-0082	Aero Channel Card Software
1110-A-0048	Assembly Firmware Control Processor
1110-A-0109	Firmware HPA 28 V dc
1110-A-0110	Firmware HPA 115 V ac
1110-A-0129	Firmware HPA 28 V dc Revised Board
1110-A 0141	Firmware HPA 115 V ac Revised Board
1110-A-0100	HSD Data I/O Firmware Assembly (Only applies to units with Data I/O Card Type 2 installed)

Table 1–5. HSD-X Operational Software

EMS SATCOM Part Number	Description
LI-1110-10181	HSD-X Software Configuration
1110-A-0082	Aero Channel Card Software
1110-A-0420	Assembly Firmware Control Processor
1110-A-0115	HSD-X Data I/O Firmware
1110-A-0085	M4 Combined Pic and Bootloader

(3) Operational Mode Software Requirements

This section describes the software requirements and compatibility issues for each mode of operation, including Multi-Channel configurations.

(a) Stand-Alone Mode

For Stand-Alone Mode installations, the minimum and recommended requirements for software are shown in Table 1–6.

Table 1–6. Stand-Alone Mode Minimum Software Requirements

Unit	Part Number	Software PN	Software Type	Minimum Software Req't	Recommended Software
HSD-128	1110-A-0001 1110-A-0060 1110-A-0150 1110-A-0160	1110-A-0048	Control Processor	4.1	7.5 (or later)
		1110-A-0082	Channel Card	C24	C41 (or later)

(b)   Combined Mode

For Combined Mode installations, the minimum requirement for HSD Control-Processor software is version 5.4 (or later) to use ARINC 429 data from the Honeywell SDU. Version 5.4, Control-Card software is available via HSD Service Bulletin, 1110-SB-0012. The minimum requirements and recommendations for software are shown in Table 1–7.

Table 1–7. Combined Mode Recommended Software Requirements

Unit	Part Number	Software PN	Software Type	Minimum Software Req't	Recommended Software
HSD-128	1110-A-0001 1110-A-0060	1110-A-0048	Control Processor	5.7	7.5 (or later)
	1110-A-0150 1110-A-0160	1110-A-0082	Channel Card	C35	C41 (or later)

(c)   Cooperative Mode

For Cooperative Mode installations, the minimum requirements and recommendations for software are shown in Table 1–8.

Table 1–8. Cooperative Mode Recommended Software Requirements

Unit	Part Number	Software PN	Software Type	Minimum Software Req't	Recommended Software
HSD-128	1110-A-0001 1110-A-0060	1110-A-0048	Control Processor	5.7	7.5 (or later)
	1110-A-0150 1110-A-0160	1110-A-0082	Channel Card	C35	C41 (or later)

(d)   Selective Mode

Selective Mode is a non-standard installation and it is not a recommended mode of operation. Selective Mode has been superseded by Combined Mode operation for MCS series SATCOM and with Cooperative Mode operation for SAT-906 series SATCOM. It is recommended that all systems operating in Selective Mode are upgraded to support Combined or Cooperative Mode as applicable.

For Selective Mode installations, the minimum requirements and recommendations for software are shown in Table 1–9.

Table 1–9. Selective Mode Minimum Software Requirements

Unit	Part Number	Software PN	Software Type	Minimum Software Req't	Recommended Software
HSD-128	1110-A-0001 1110-A-0060	1110-A-0048	Control Processor	5.7	7.5 (or later)
	1110-A-0150 1110-A-0160	1110-A-0082	Channel Card	C35	C41 (or later)

(e) Multi-Channel Configurations

In a Multi-Channel configuration, the minimum requirement for HSD-128 Control Processor software is version 7.0. Version 7.0, Control Processor software is available via HSD Service Bulletin 1110-SB-0012. HSD-X Transceiver Extensions require Control Processor software version 6.0.

In Multi-Channel configurations, both the HSD-128 and the HSD-X units must have the same Channel Card and Data I/O software versions installed. When upgrading software in either the HSD-128 or HSD-X, verify that the software version is compatible for operation in Multi-Channel systems as indicated in the applicable service bulletin.

The minimum requirements and recommendations for software are shown in Table 1–10.

Table 1–10. Multi-Channel Configuration Recommended Software Requirements

Unit	Part Number	Software PN	Software Type	Minimum Software Req't	Recommended Software
HSD-128	1110-A-0001 1110-A-0060	1110-A-0048	Control Processor	7.0	7.5 (or later)
	1110-A-0150 1110-A-0160	1110-A-0082	Channel Card	6.0 (C41)	6.0 (C41) (or later)
HSD-X	1110-A-0401	1110-A-0420	Control Processor	6.0	6.0 (or later)
		1110-A-0082	Channel Card	6.0 (C41)	6.0 (C41) (or later)
		1110-A-0240	Data I/O Software	115	Superceded by 1110-A-0115
		1110-A-0115	Data I/O HSD-X	117	117

(4) Software Version Description

This section provides a brief description of the deltas between versions of operational software. Table 1–11 provides a matrix of software versions, applicable service bulletins, compliance requirements, and a brief description of the software deltas.

Table 1–12 provides a service bulletin matrix to list the applicability of all service bulletins released against the HSD and HSD-X units as of the release date of this manual.

Table 1–11. Description of Control Processor Software Changes

Control Processor Software Version	Applicable Service Bulletin	Compliance Requirements	Description of Change
4.4	1110-SB-0001	Control card release with mandatory channel card change from C24 to C30	Ensures channel card is powered down for 5 seconds after a fatal error. Channel card software change from C24 to C30
4.5	1110-SB-0003	Mandatory for all units operating in Cooperative Mode installs with Collins SAT-906 systems.	Resolves the problem occurring during the power up sequence, the SAT-906 system reports error 0100, 1000, and 0800, which results in the deactivation of the HSD channel cards.
4.6	N/A	N/A	Adds menu command to specify manual satellite longitude. Ensures that manually specified ocean regions are maintained. This version does not support Cooperative Mode (with SAT-906).
5.4	1110-SB-0005	Mandatory for units installed in Combined Mode with Honeywell Aero H Satcom systems. Optional for all other units.	Upgrades the hardware for Honeywell Combined Mode (HCM) to include a RF detector and a variable attenuator on the Aero H path of the pre-HPA combiner and allows the reading and control of this attenuator through a serial connection to the combiner. This version does not support Cooperative Mode (with SAT-906).

Table 1–11. Description of Control Processor Software Changes

Control Processor Software Version	Applicable Service Bulletin	Compliance Requirements	Description of Change
5.7	1110-SB-0011	Recommended for all units operating in Cooperative Mode with Collins Sat-906 systems, optional for all other units.	Upgrades the Channel Card software to version C35 to fix Cooperative Mode bug in Channel Card software version C30. Upgrades software to recognize Cooperative Mode System Config hardware strapping.
6.5	1110-SB-0007	Generic release suitable for all modes of HSD operation Compatible with HSD-X version 6.0 firmware.	Upgrades the HSD-128 Control Processor software to version 6.5. This version adds the Multi-Channel capability to the HSD-128 software to support HSD-128 units integration with external HSD-X channels (PN 1110-A-0401).

Table 1–11. Description of Control Processor Software Changes

Control Processor Software Version	Applicable Service Bulletin	Compliance Requirements	Description of Change
7.0	1110-SB-0012	Recommended for units operating in multi-channel configurations with HSD transceivers. Optional for all other units and system modes.	Upgrades the channel card software to version C41 (6.0) which supports enhanced HSD functionality in all modes of operation, (including Multi-Channel configurations and AMBE STU capability). In Cooperative Mode systems, MPDS is not supported with this version of software. Upgrades the control processor software to version 7.0, which enhances all modes of operation. Selective Mode units operating Category A Inmarsat terminals may experience GPS faults when operating this version of software. Contact EMS SATCOM Product Support for details.
7.5	1110-SB-0015	Highly recommended for units operation in Cooperative Mode with Rockwell Collins SAT-906 systems. Optional for Stand-Alone units and all other operational modes.	HSD Control Processor software version 7.5 includes fixes specific to Cooperative Mode operation problems and enhances unit operation.

Table 1–12. Service Bulletin Matrix

Service Bulletin	PN 1110-A-0001	PN 1110-A-0060	PN 1110-A-0070	PN 1110-A-0080	PN 1110-A-0150	PN 1110-A-0160	PN 1110-A-0401	Description
1110-SB-0001	X	X	X	X				Software upgrade to accommodate Inmarsat system changes
1110-SB-0002	X	X	X	X				HPA Mute and ARINC 429 Driver Modifications
1110-SB-0003		X						Upgrade to HPA software and Control Processor software to fix Cooperative Mode SAT-906 system reporting errors (Version 4.5)
1110-SB-0004	X	X	X	X				Data I/O Type 2 upgrade option
1110-SB-0005	X	X	X	X				Hardware modification and software upgrade for Combined Mode operation
1110-SB-0006	X	X	X	X				Software upgrade to support MPDS service (Version C35)
1110-SB-0007	X	X						Software upgrade for Multi-Channel (Version 6.5)
1110-SB-0008								N/A
1110-SB-0009								N/A
1110-SB-0010			X	X				Optional hardware upgrade to dual channel transceiver and support for STU III and Mini-M Voice (Version C41)
1110-SB-0011	X	X	X	X				Software upgrade for Cooperative Mode
1110-SB-0012	X	X	X	X				Software upgrade to add AMBE STU support and enhances performance of all modes of operation (Version 7.0)
1110-SB-0013	X	X	X	X	X	X		Addition of a software identification label to all units

Table 1–12. Service Bulletin Matrix

Service Bulletin	PN 1110-A-0001	PN 1110-A-0060	PN 1110-A-0070	PN 1110-A-0080	PN 1110-A-0150	PN 1110-A-0160	PN 1110-A-0401	Description
1110-SB-0014	X	X	X	X	X	X		Upgrades Data I/O Type 2 software to fix susceptibility to certain malformed traffic, which caused PPPoE sessions to "hang-up" leaving the call connected
1110-SB-0015	X	X	X	X	X	X		Upgrades control processor software to enhance Cooperative Mode operation (Version 7.5)
1110-SB-0401							X	Software upgrade to add AMBE STU capability, enhance system operation, including with MPDS
1110-SB-0402							X	Addition of a software identification label to all units
1110-SB-0403							X	Upgrades Data I/O Type software to fix susceptibility to certain malformed traffic, which caused PPPoE sessions to "hang-up" leaving the call connected

3. Equipment Description

This section describes the physical and environmental specifications of the equipment.

A. Applicable Documents

- High speed data terminal Setup Guide, EMS SATCOM PN MN-1110-10048

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

B. Reference Documents

- HSD-64/128 Software Control Document, EMS SATCOM PN LI-1110-10136

- HSD-X Software Control Document, EMS SATCOM PN LI-1110-10181

C. Equipment Specifications

This section provides the equipment specifications for the HSD and HSD-X transceivers.

Table 1–13 lists the physical and equipment specifications for the HSD transceiver. Table 1–14 lists the RTCA/DO-160D environmental characteristics and specifications for the HSD transceiver.

Table 1–15 lists the physical and equipment specifications for the HSD-X transceiver. Table 1–16 lists the RTCA/DO-160D environmental characteristics and specifications for the HSD-X transceiver.

Table 1–13. HSD Equipment 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-160D, *Environmental Conditions and Test Procedures for Airborne Equipment*, July 29, 1997
HSD Software	RTCA/DO-178B Level E
Physical Size	
Height	19.93 cm (7.85 in)
Width	25.91 cm (10.20 in)
Length	36.45 cm (14.58 in)
Weight	13 Kg (28.7 lbs)
Mounting information	8 MCU Tray (per ARINC 600, 8 MCU LRU)
Maintenance requirements	No scheduled maintenance is required
Electrical specifications	

Table 1–13. HSD Equipment Characteristics and Specifications

CHARACTERISTIC	SPECIFICATION
HSD-128 dc input power 1110-A-0001, 1110-A-0160	
Voltage	Minimum: 22 V dc Typical: 27.5 V dc Maximum: 30.3 V dc
Power dissipation (Stand-Alone)	Minimum: 275 W Maximum: 370 W
Power dissipation (Selective, Combined, and Cooperative)	Minimum: 325 W Maximum: 370 W
HSD-128 ac input power 1110-A-0060, 1110-A-0150	
Voltage	Minimum: 100 V rms Typical: 115 V rms Maximum: 122 V rms
Power dissipation (Stand-Alone)	Minimum: 275 W Maximum: 385 W
Power dissipation (Selective, Combined, and Cooperative)	Minimum: 325 W Maximum: 385 W
Frequency	Minimum: 360 Hz (Typical: 400 Hz) Maximum: 440 Hz
HSD-64 dc input power 1110-A-0080	
Voltage	Minimum 22 V dc (Typical 27.5 V dc) Maximum 30.3 V dc
Power dissipation	Minimum: 275 W Maximum: 370 W
HSD-64 ac input power 1110-A-0070	
Voltage	Minimum 100 V rms (Typical 115 V rms) Maximum 122 V rms
Power dissipation	Minimum: 275 W Maximum: 385 W
Frequency	Minimum: 360 Hz (Typical: 400 Hz) Maximum: 440 Hz
Frequency band	Tx: 1626.5 to 1660.5 MHz Rx: 1525.0 to 1559.0 MHz
Power requirements HSD	
PN 1110-A-0001, 1110-A-0080, 1110-A-0160	+ 28 V dc nominal @ 13.5A

Table 1–13. HSD Equipment Characteristics and Specifications

CHARACTERISTIC	SPECIFICATION
PN 1110-A-0060, 1110-A-0070, 1110-A-0150	115 V ac, 400 Hz (nominal) @5A
Wire gage	dc power: 12 American Wire Gauge (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
Heating and cooling requirements	
Cooling air	ARINC 600
Flow rate	175 lbs/hr
Pressure drop	0.05", ± 0.025" H_2O
Output frequency range (Transmit)	Minimum: 1626.5 MHz Maximum: 1660.5 MHz
Input frequency range (Receive)	Minimum: 1530 MHz Maximum: 1559 MHz
Receive input impedance	50 ohms
Transmit output impedance	50 ohms
VSWR	2:1 maximum
Maximum Output Power	18 dBW

Table 1–14. HSD RTCA/DO-160D Environmental Characteristics

CHARACTERISTIC	SPECIFICATION
Environmental	
Temp and altitude	115 V ac units: Category A1, F2 V
In-flight loss of cooling	28 V dc units: Category A1 F2 W
Temperature variation	Category B (± 5°C/minimum)
Humidity	Category A (95%, 48 hours)
Shock	Category B (6g/20g, 11ms)
Vibration	Category SB (1.48grms)
Explosion proofness	Category E
Waterproofness	Category X (not applicable)
Fluids susceptibility	Category X (not applicable)
Sand and dust	Category X (not applicable)
Fungus resistance	Category F
Salt spray	Category X (not applicable)
Magnetic effect	115 V ac units: Category Z (< 1.0m) 28 V dc units: Category A (<1.0m)
Power input	Categoriy A

Table 1–14. HSD RTCA/DO-160D Environmental Characteristics

CHARACTERISTIC	SPECIFICATION
Voltage spike	115 V ac units: Category A 28 V dc units: Category A
Audio frequency susceptibility	115 V ac units: Category A 28 V dc units: not tested
Induced signal susceptibility	115 V ac units: Category Z 28 V dc units: not tested
RF susceptibility	115 V ac units: Category RR 28 V dc units: not tested
Emission of RF Energy	115 V ac units: Category B 28 V dc units: Category B
Lightning Direct Effects	Category X (not applicable)
Icing	Category X (not applicable)

Table 1–15. HSD-X Transceiver 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-160D, Environmental Conditions and Test Procedures for Airborne Equipment, July 29, 1997
HSD-X Software	RTCA/DO-178B Level E
Physical	
Size	2 MCU ARINC 600-10 Form Factor
Weight	8.8 lbs maximum
Cooling air	Unit capable of continuous duty cycle operation, with or without forced air-cooling provided, as per ARINC 600 specifications. Refer to 1110-E-0401. (See "Installation" on page 3-1.)
Mounting Information	As per ARINC 600 specifications. Refer to 1110-E-0401. (See "Installation" on page 3-1.)
Maintenance Requirements	No maintenance requirements
Electrical	
Power Dissipation	34 Watts
Input Power	115 V ac, 400 Hz, 75 va
Input frequency range	1530.0 to 1559.0 MHz
Output frequency range	1626.5 to 1660.5 MHz
Receiver input impedance	50 ohms

Table 1–15. HSD-X Transceiver Specifications

CHARACTERISTIC	SPECIFICATION
Transceiver output impedance	50 ohms
VSWR	2:1 maximum
Input level operational Input level no damage	-107 dBm to -47 dBm +10 dBm
External (Digital) Interfaces	
Crosstalk Bus	ARINC 429 high-speed (100 kbps) data bus
Maintenance Port RS-232 Data loader Front and Rear Connector	RS-232 serial bus supporting 57.6 kbps data load capacity
ISDN User Interface	64 kbps ISDN Euro input and output

Table 1–16. HSD-X RTCA/DO-160D Environmental Specifications

CHARACTERISTIC	SPECIFICATION
Temperature and Altitude	Categories: A4 (without cooling air)/ C4 (with cooling air)
Low operating temperature	-40 °C (A4), -40 °C (C4)
High operating temperature	+55 °C (A4), +70 °C (C4)
Altitude	Maximum operating altitude: 15,000 ft (A4)/55,000 ft (C4)
Loss of cooling	Category Y
Temperature Variation	Category B
Humidity	Category A
Shock	Category B
Vibration	Category SB
Explosion Proofness	Category E
Waterproofness	Category X
Fluids Susceptibility	Category X
Sand and Dust	Category X
Fungus Resistance	Category F
Salt Spray	Category X
Magnetic Effect	Category Z
Power Input	Category A
Voltage Spike	Category A
Audio Frequency	Category A
Induced Signal	Category C
RF Susceptibility	Category RR

Table 1–16. HSD-X RTCA/DO-160D Environmental Specifications

CHARACTERISTIC	SPECIFICATION
Emission of RF Energy	Category M
Lightning Induced Transient Susceptibility	Category A3E3
Lightning Direct Effects	Category X
Icing	Category X
Electrostatic Discharge	Category A

D. Mechanical Description

This section describes the mechanical characteristics of the HSD and HSD-X transceivers.

(1) HSD Transceiver

The HSD transceiver 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 unit. Two front-panel LEDs indicate unit status.

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

For detailed wiring information, refer to the interconnection diagrams and contact assignments for each installation mode presented in "Installation" on page 3-1 as noted below:

Table 1–17. HSD Installation Mode Drawing Reference Matrix

Installation Mode	Installation Section Figure	Figure Description
Stand-Alone	Figure 3–29	System Interconnect
	Figure 3–30	Contact Assignments
Combined/Selective	Figure 3–31	System Interconnect
	Figure 3–32	Contact Assignments
Cooperative	Figure 3–33	System Interconnect
	Figure 3–34	Contact Assignments
Stand-Alone HSD in Multi-Channel Configuration	Figure 3–35 and Figure 3–36	System Interconnect
	Figure 3–37 and Figure 3–38	Contact Assignments

(2) HSD-X Transceiver

The HSD-X is a 2-MCU sized unit with mounting requirements according to the ARINC 600 specification. The front panel has one, female, micro-D type connector for data loading and monitoring of the unit. Three front panel LEDs illuminate to indicate unit functionality as described in detail in "Test and Fault Isolation" on page 4-1.

The rear connector complies with ARINC 600, shell size 1. The connector top and middle cavities have 60 number 22 interconnects, while the bottom cavity has two number 16 interconnects, one number 12 interconnect, and two RF interconnects.

E. Electrical Description

This section describes the external electrical interfaces of the HSD and HSD-X transceivers. General system block diagrams of the avionics and antenna subsystem are presented in Figure 1–10, Figure 1–11, Figure 1–12, and Figure 1–13.

"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 installation modes, including Stand-Alone Mode, Multi-Channel configurations with HSD-X transceivers, 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 as well as provide installation connection details.

(1) General

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

The HSD-X contains a communications switch (SW) that supports Inmarsat Swift64 Mobile ISDN and MPDS service within a 2-MCU assembly built in accordance to ARINC 600 specifications.

(a) Stand-Alone Mode

The HSD L-Band Rx/Tx input and outputs interface directly with the DLNA. The HSD uses the ARINC 429 multi-control bus to interface with the ACU/BSU to control the RF antenna and obtain antenna-subsystem status information. The HSD receives the required navigational data, provided by the aircraft Inertial Navigational System (INS), from the ARINC 429 IRS bus. The aircraft supplies either 28 V dc or 115 V 400 Hz power to the HSD.

(b) Non-Stand-Alone Modes (Cooperative, Combined, Selective)

The HSD L-band Rx/Tx interface combiners are shared with those of the SATCOM H/H+ system via splitters after the DLNA and before the high power amplifier (HPA). The Aero H/H+ system, that the HSD is installed with, controls the antenna subsystem and the RF transmit signal attenuation in the High-Gain Antenna HPA of the HSD through the SDU multi-control ARINC 429 bus. The aircraft supplies either 28 V dc or 115 V 400 Hz power to the HSD.

(c) Multi-Channel Configurations with HSD-X Transceivers

The HSD Multi-Channel configuration combines a dual-channel, Stand-Alone Mode, HSD-128 Transceiver with one or more single-channel HSD-X Transceivers to add additional channels to the system.

Each channel provides an ISDN 64 kbps connection that can be used for voice or data services. The two channels in the HSD-128 can be internally bonded to provide a 128 kbps ISDN data connection. Externally, all four channels shown in Multi-Channel System Block Diagram on page 40 can be combined to provide a single 256 kbps capability with the help of a router, Ethernet hub, or Terminal Adapter.

The HSD-128 is the master of the system; it controls the overall operation of the Multi-Channel HSD configuration. It keeps track of time and allocated power and may command the HSD-X units to terminate calls under certain conditions, such as an ocean region change. The HSD-X units are wired to the HSD-128 HPA and therefore compete equally for HPA power allocation.

The transmit signal of each channel is fed through combiners/attenuators combinations to the HPA located in the HSD and ultimately to the antenna. Conversely, the receive signal from the antenna goes through a series of splitters on its way to each channel.

On power-up, HSD-X channels go through an initialization process that identifies and communicates the number of HSD-X channels and their position in the system chain back to the HSD-128 master.

The block diagram in Figure 1–10 illustrates the system function of the HSD-128, two HSD-Xs, and the antenna system.

(2) Pin and Connector Descriptions

Detailed pin and connector descriptions for both HSD and HSD-X transceivers are provided for all installation modes and configurations in "Installation" on page 3-1.

F. System Interface Descriptions

This section briefly describes the external HSD and HSD-X system interfaces. The system interfaces are those required to control, monitor, maintain, and supplement the unit's functionality. "Installation" on page 3-1 provides a detailed description of interface connections.

(1) HSD System Interfaces

This section describes the system interfaces of HSD transceivers. Detailed information on the splitter and combiner specifications and losses, as well as cabling notes and system interconnections for all operational modes for HSD transceivers are provided in "Installation" on page 3-1.

(a) HSD Source Destination Identification (SDI)

1. Stand-Alone Mode and Multi-Channel Configuration

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

2. Non-Stand-Alone Mode

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

(b) HSD Forward and Return Address IDs

The HSD uses two 24-bit IDs called "Forward Link Pairs" (FRLPs): a Forward ID (Fwd ID) and a Return (Rtn) ID per pair. The HSD reads the Fwd ID and performs a look-up for the Rtn ID. For security reasons, each assembly contains an encrypted look-up table with the whole addressing space assigned to the product by Inmarsat. To minimize the risk of unauthorized use of its contents, the table is not accessible to the user.

The 24-bit Fwd ID strap pins, available on the ARINC 600 connector, form part of the Inmarsat serial number (ISN). The ISN consists of the type approval number and the Fwd ID address. Each FRLP is associated with Inmarsat Mobile Numbers (IMN), which are the numbers that a user dials from the ground to reach the terminal on an aircraft. There is a unique IMN for each of the service types (e.g. data, voice, Fax).

(c) HSD WOW Pin Wiring

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

(d) HSD IRS ARINC 429 Interface

Table 1–18 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 1–18. ARINC 429 IRS Navigational Requirements

Label (octal)	Name	Interval Rate (ms)	
		Min.	Max.
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

1. Stand-Alone Mode and Multi-Channel Configuration

In Stand-Alone Mode installations, the HSD requires high-speed ARINC 429, IRS Navigational information (as shown in 17) to compute the azimuth, elevation, and Doppler correction information required for antenna pointing.

2. Non-Stand-Alone Modes

In Combined and Selective Mode installations, the HSD uses aircraft IRS information to determine which satellite to use, as selected by the Aero H/H+ SDU.

In Cooperative Mode installations, the HSD uses aircraft IRS information received from the ARINC 741 SATCOM SDU via the SDU crosstalk ARINC 429 bus.

(e)   HSD Antenna Interface

1.   Stand-Alone Mode and Multi-Channel Configuration

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

2.   Non-Stand-Alone Modes

In Non-Stand-Alone installations (Combined, Cooperative, and Selective Modes), the ARINC 741 SATCOM SDU controls the satellite selection and antenna pointing. The HSD monitors traffic on the Multi-Control, BSU, and HPA mute busses to determine which satellite is used for the HSD's channel card(s) communication links. In Cooperative Mode, the HPA command and status messages are communicated over the crosstalk lines.

(f)   Antenna Subsystem RF Interface

In all installation modes, several external system RF parameters (such as cable losses and antenna gain) are delimited to ensure that the HSD performance requirements are met. Refer to "Installation" on page 3-1 for a definition of these parameters and their expected values.

(g)   RF Splitter: Non-Stand-Alone Mode Installations

In Non-Stand-Alone installations, an RF splitter must be installed to split the RF Receive signal from the antenna subsystem's DLNA between the Aero H Radio Frequency Unit (RFU) and the HSD. (Refer the applicable section of "Installation" on page 3-1 for specifications.)

(h)   HSD Remote Status Panel (Optional)

The outputs to the optional "Remote Status Panel" provide a visual indication of the operational status of the HSD; they "mirror" the LRU's front panel LEDs labeled as Power (LED1) and Fault (LED2) as defined in Table 1–19. Refer to "Installation" on page 3-1 for detailed installation and circuit requirements.

Table 1–19. HSD LED Output Designations

LED Signal	Label	LED Color	Indication Description
LED1	Power	Green	Power On: HSD supply voltage is active. Flashes at 1 Hz when the HPA is transmitting
LED2	Fault	Red	Fault: Fault condition as described in "HSD Fault Conditions" on page 1-23

(i)   HSD Fault Conditions

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

•   Channel Card fault

- • HPA fault

- • External Reference Fault

- • Internal ROM Fault

- • Internal RAM Fault

- • Over Temperature Fault

(j) HSD Remote Reset

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

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

CAUTION: Cooperative and Combined/Selective Mode installations and HSD-X transceivers *DO NOT* support the use of the reset function. If the HSD transceiver is reset in Cooperative or Combined Mode installations, the communications between the HSD HPA and the SDU of the Aero H/H+ system can be disrupted—potentially causing the SATCOM system faults that may require the complete reset of both systems.

(2) HSD-X Multi-Channel System Interfaces

This section describes the external interfaces unique to Stand-Alone Mode, HSD-128 Transceivers installed in a Multi-Channel configuration with HSD-X transceivers.

The following additional wiring is required for the installation of Multi-Channel HSD systems.

- • Splitter for the Rx path (See "Installation" on page 3-1)

- • Combiner for the Tx path (See "Installation" on page 3-1)

- • TPC1 must be installed on any HSD-128 ARINC 600 Trays that do not have TPC1 installed

- • Forward ID Address as per HSD wiring

Detailed information on the splitter and combiner specifications and losses, as well as cabling notes and system interconnections for Multi-Channel Configurations of HSD and HSD-X transceivers are provided in "Installation" on page 3-1.

(a) Multi-Channel HSD-X Antenna Interface

Refer to "HSD Antenna Interface" on page 1-23.

(b) Weight-on-Wheels (WOW) (Optional)

Refer to "HSD WOW Pin Wiring" on page 1-22.

(c) HSD-X Forward ID

Like the HSD transceivers, the HSD-X units use Forward IDs (Fwd ID) to identify the terminal to the Inmarsat communication network.

The 24-bit Forward ID strap pins, available on the ARINC 600 connector, form part of the Inmarsat serial number (ISN). The ISN consists of the type approval number and the Fwd ID address. Each Forward ID is associated with Inmarsat Mobile Numbers (IMN), which are the numbers that a user would dial from the ground to reach the terminal on an aircraft. There is a unique IMN for each of the service types (e.g. Swift64 ISDN 64 kbps data).

When strapping the Forward ID on the HSD-128, the first number in the Forward ID pair is used. The HSD-128 internally identifies the second Forward ID by looking up a table in its memory. It is important to strap the first number; otherwise, the HSD-128 will not be able to correctly look up the second number.

For strapping the Forward ID on the HSD-X in a four-channel configuration, although each HSD-X can use either number in the second pair, typically the first number of the second pair is assigned to the first HSD-X and the second number of the second pair to the second HSD-X. Figure 1–1 illustrates the assignment of Forward IDs in a 3-channel system. Figure 1–2 illustrates the assignment of Forward IDs in a 4-channel system.

Note: The placeholder for the Forward ID in the following illustrations uses "xxxxxx" to represent the six-digit hex number of a valid Forward ID. Uppercase "X's" indicate a strapped Forward ID address.

First Forward ID pair
(one for each channel card) **XXXXXX**
xxxxxx → HSD-128

Second Forward ID pair
(Second Forward ID of pair is not used) **XXXXXX**
xxxxxx → HSD-X 1
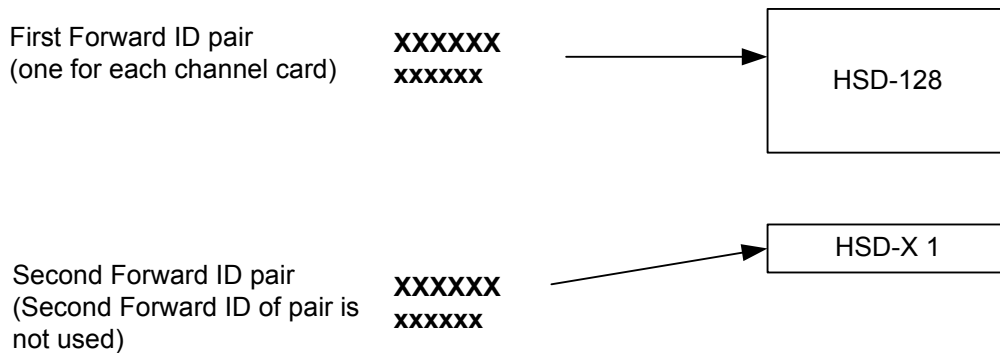
Figure 1–1. Forward ID Assignment (3-channel system)

First Forward ID pair
(one for each channel card) **XXXXXX**
xxxxxx → HSD-128

Second Forward ID pair
(one for each HSD-X) **XXXXXX**
XXXXXX → HSD-X 1
→ HSD-X 2
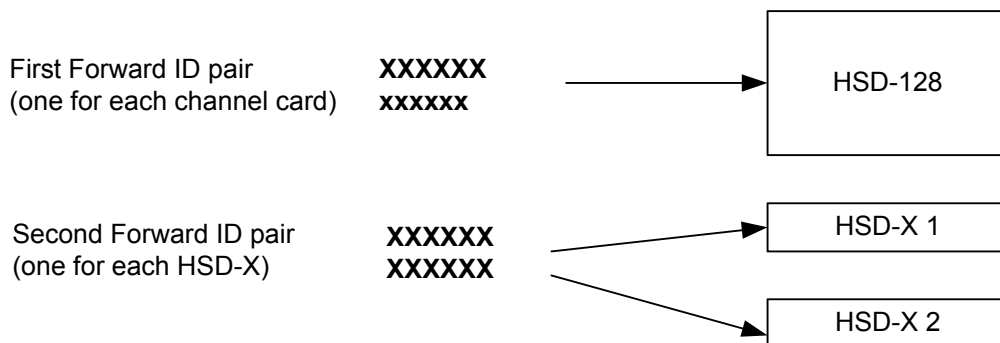
Figure 1–2. Forward ID Assignment (4-channel system)

(d) RS-232 Maintenance Port

Like the HSD-128, HSD-X units have an RS-232 Maintenance Port interface that provides access to a maintenance utility program for system monitoring and testing purposes.

Access to the maintenance port and the HSD Maintenance Utility Program is possible using an RS-232, VT-100 terminal (PC or Laptop operating a terminal emulation program such as HyperTerminal).

For testing and monitoring of all components of the Multi-Channel HSD configuration, access to all units in the system is achieved using a single terminal (PC or Laptop) connected to the Maintenance Port of the HSD-128 Transceiver. Communication with any installed HSD-Xs installed in the system is possible by either passing through the HSD's Maintenance Facility when operating in "console-mode" or through a direct connection to individual HSD-X units. Figure 1–3 illustrates the Maintenance Port Facility in a Multi-Channel configuration.

Note: For information on the operation of the HSD Maintenance Utility Program in "Console-Mode" refer to "Test and Fault Isolation" on page 4-1.

Although system monitoring is possible using the "console-mode" feature, software updates, if required, must be loaded directly to the HSD-128 and each HSD-X via their respective maintenance port.

Direct connection to the front-panel of the HSD-X maintenance port requires an HSD-X maintenance port cable. The front connector, maintenance port supports trace and data load functions and is a female, micro-D-type, M83513/04-B11N, or equivalent. As well, a permanent connector wired to the rear, middle-plug, maintenance port connector can be installed for remote access. A detailed description of the HSD-X maintenance port pins is provided in "Test and Fault Isolation" on page 4-1. The RS-232 connection settings for the HSD-X maintenance port are the same as for the HSD-128 as listed below:

• Baud rate – 19.2 kbps

• Data bits – 8

• Stop bits – 1

• Parity – none

• Flow control – none
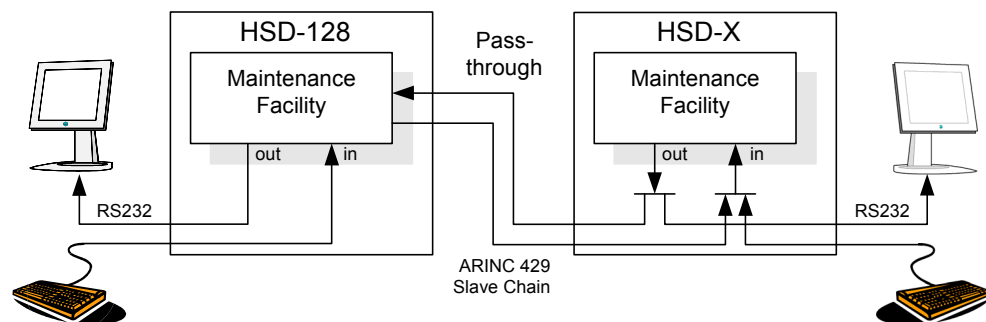
Figure 1–3. Maintenance Port Access

(e) HSD-X Remote Status Panel (Optional)

The outputs to the optional "Remote Status Panel" provide a visual indication of the operational status of the HSD-X. They "mirror" the unit's front panel LEDs labeled as Power (LED1), Fault (LED2), and Channel Available (LED3). Table 1–20 defines the interpretation for each LED. Refer to "Installation" on page 3-1 for detailed installation and circuit requirements.

Table 1–20. HSD-X Front Panel LEDs Output Designations

LED	Name	LED Color	Indication Description
Top (LED1)	Power	GREEN	Power (ac); Flashes at 1 Hz rate while "in call"
Middle (LED2)	HSD-X Fail	RED	Fault (Illuminates upon HSD-X failure)
Bottom (LED3)	Channel Available	GREEN	Channel Available

(f) HSD-X Fault Conditions

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

- HSD/HSD-X communications link fault

- Channel Card fault

- Data I/O fault

- Internal ROM fault

- Internal RAM fault

- Over Temperature fault

G. User Interfaces

The HSD can support multiple voice and data communication configurations depending on the number of channel cards the unit contains and the mode of installation.

The most likely user configurations include a networking device (such as a router or a file server) that allows multiple users to share the channel capability offered by the HSD (single, dual, or multiple channels depending on model, mode, and configuration of the HSD or HSD-X transceivers installed).

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

A different way to achieve this functionality is to use the 10BASE-T port to carry a PPP over Ethernet virtual connection between the networking device (typically a file server) and the HSD. Support for PPP over Ethernet is also required on the user's side.

Note: HSD transceivers PN 1110-A-0150 and 1110-A-0160 have Data I/O Type 2 Cards installed and support the Ethernet interface. All other HSD transceivers must have service bulletin, 1110-SB-0004 accomplished to support the Ethernet interface. All HSD-X transceivers support an Ethernet interface.

Figure 1–4 and Figure 1–5 illustrate the user interfaces for single-channel HSD transceiversFigure 1–6 and Figure 1–7 illustrate the user interfaces for dual-channel HSD transceivers. For clarity, these figures only display Data Services. Voice devices are supported by direct connection to the HSD using EURO ISDN telephones or by indirect connection to a router or terminal adapter using two-wire telephone handsets.

(1) Stand-Alone Mode User Interfaces

Dual-channel HSD transceivers support a maximum of two simultaneous instances of Swift64 Mobile ISDN and/or Mobile Packet Data Services (MPDS) services.

(2) Collins Cooperative Mode User Interfaces

In Cooperative Mode installations, the HSD system provides one channel of Swift64 data service and Aero H/H+ call capability. Swift64 and Aero H/H+ calls are simultaneously possible providing the following system conditions are met:

- If a Swift64 call is in process and an Aero H/H+ call is attempted, either incoming or outgoing, the Aero H/H+ call is allowed to proceed providing that there is sufficient HPA power available to process all calls.

- If any Aero H/H+ calls are in process, a Swift64 call is allowed providing that there is sufficient HPA power available to process both the Swift64 and Aero H/H+ calls.

(3) Honeywell Combined Mode User Interfaces

In single-channel transceivers in Combined Mode installations, the HSD system provides one channel of Swift64 data service and Aero H/H+ call capability. In dual-channel transceivers in Combined Mode installations, the HSD system provides two channels of Swift64 data service and Aero H/H+ call capability. Swift64 and Aero H/H+ calls are simultaneously possible providing the following system conditions are met:

- If a Swift64 call is in process and an Aero H/H+ call is attempted, either incoming or outgoing, the Aero H/H+ call is allowed to proceed providing that there is sufficient HPA power available to process all calls.

- If any Aero H/H+ calls are in process, a Swift64 call is allowed providing that there is sufficient HPA power available to process both the Swift64 and Aero H/H+ calls.

- If both call types are in process, and system resources become limited due to dropping antenna gain, then Aero H/H+ calls will maintain priority.

(4) Selective Mode User Interfaces

In Selective Mode operation, dual-channel HSD transceivers support a maximum of two simultaneous instances of Swift64 Mobile ISDN and/or MPDS services.

(5) Multi-Channel Configurations

The HSD Multi-Channel configuration combines a dual-channel, Stand-Alone Mode HSD-128 Transceiver with one or more single-channel HSD-X Transceivers to add additional channels to the system.

MPDS connections demand more power and may reduce channel availability. AMBE connections demand less power and may increase channel availability.

Each channel provides an ISDN 64 kbps connection that can be used for voice or data services. The two channels in the HSD can be internally bonded to provide a 128 kbps ISDN data connection. Externally, all four channels shown in Figure 1–10 can be combined to provide a single 256 kbps capability with the help of a router, Ethernet hub, or Terminal Adapter.

Although the Multi-Channel HSD configuration is designed to accommodate one HSD-128 and multiple HSD-Xs, the number of channels that can be active at one time is dependent on the number of channels available at the Land Earth Station (LES), the available HPA power, and the available antenna gain—which can vary over the course of a flight.

At the time of printing, Multi-Channel HSD systems support four, simultaneous, high-speed data connections—with software automated, staggered initiation of calls (approximately 20 seconds apart).

HSD Transceiver

NOTE: Only HSD transceivers PN 1110-A-0150 and 1110-A-0160 or HSD transceivers with Service Bulletin 1110-SB-0004 accomplished and HSD-X transceiver extensions support the Ethernet (10BaseT) interface.
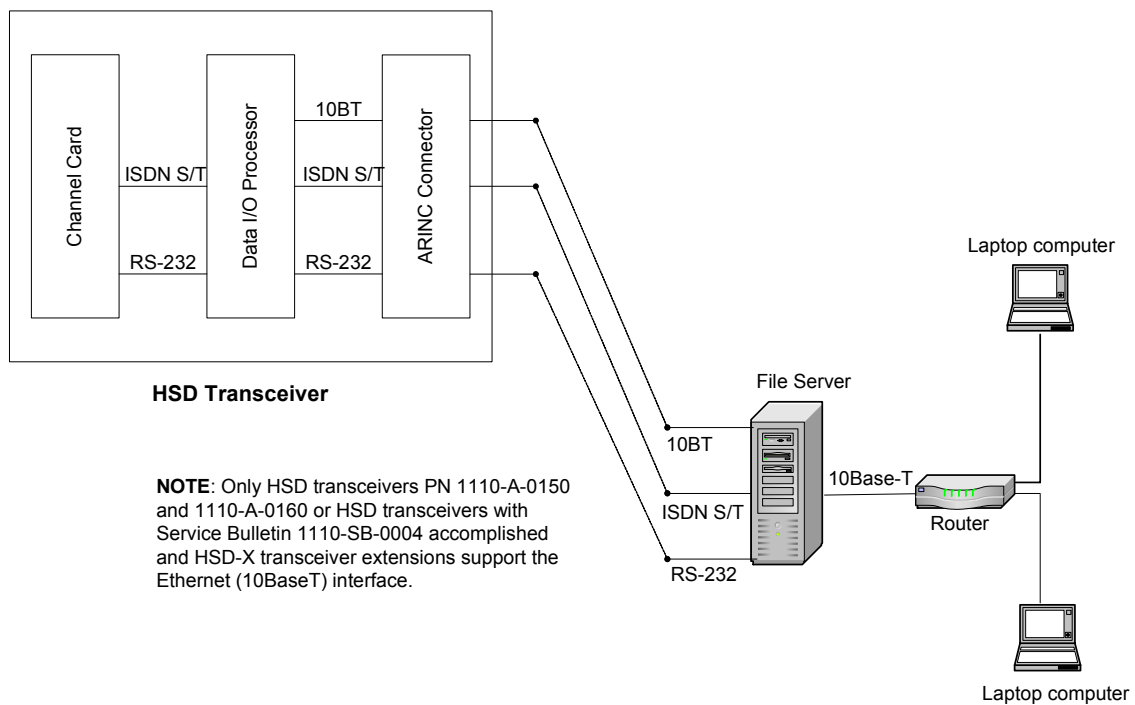
Figure 1–4. System Interface Block Diagram Single Channel System
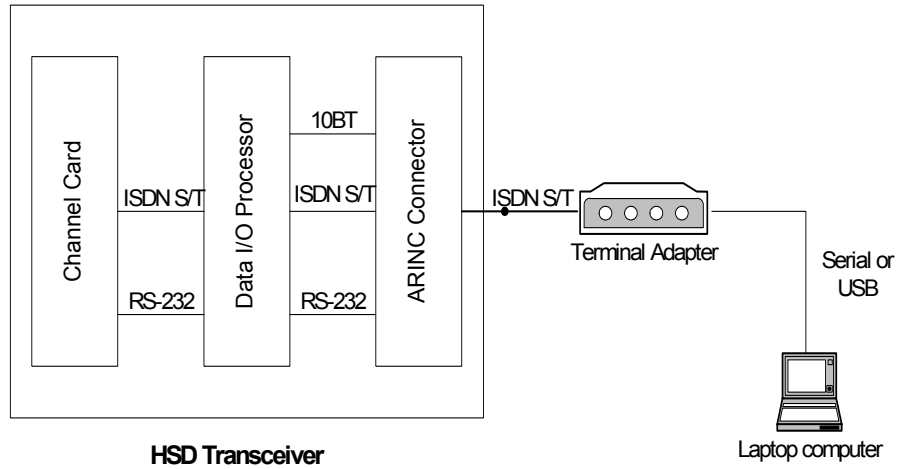
Figure 1–5. Reduced Functionality Single-Channel System

NOTE: Only HSD transceivers PN 1110-A-0150 and 1110-A-0160 or HSD transceivers with Service Bulletin 1110-SB-0004 accomplished and HSD-X transceiver extensions support the Ethernet (10BaseT) interface.
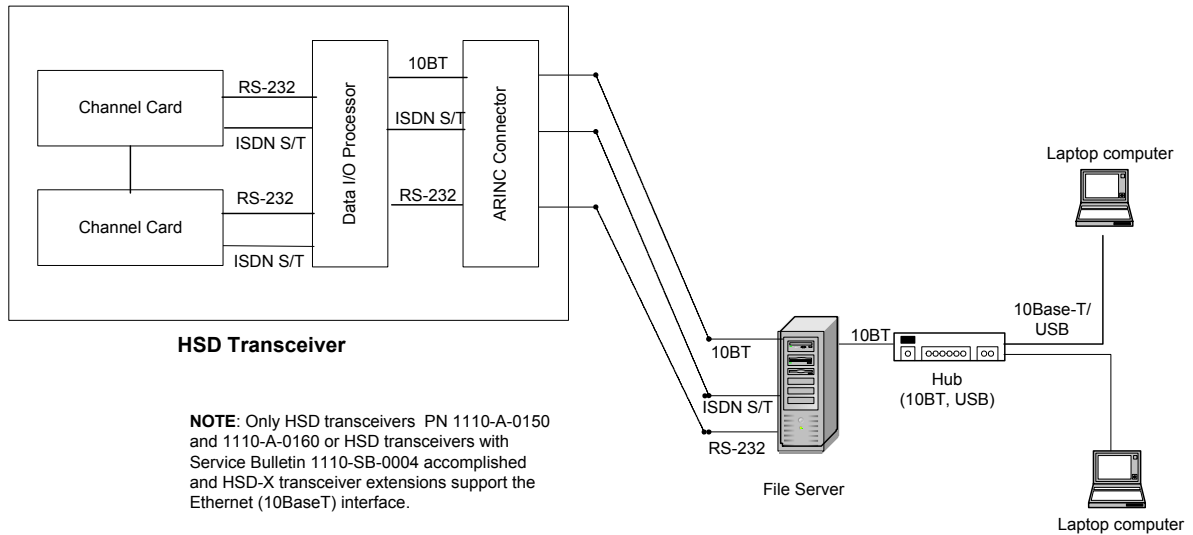
Figure 1–6. System Interface Block Diagram Dual-Channel System
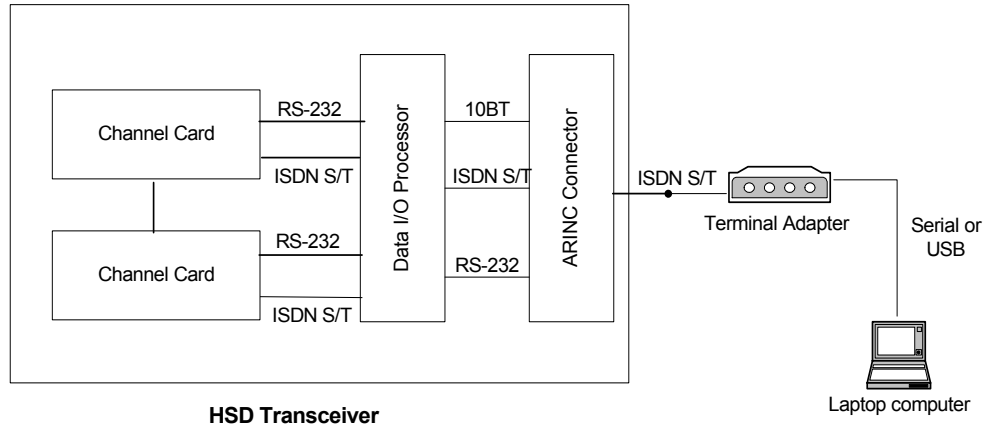
Figure 1–7. Reduced Functionality Dual-Channel System

(6) ISDN Circuit-Switched Data Interface

HSD and HSD-X transceivers 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 and HSD-X transceivers provide either one or two ISDN S/T bus interfaces (depending on the number of channel cards and mode of installation of the unit).

Each bus is capable of hosting up to eight, EURO ISDN physical devices—which means a one-channel system supports up to eight physical connections to EURO ISDN devices; a two-channel system supports up to sixteen physical connections to EURO ISDN devices.

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

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

For incoming calls, each channel card (ISDN BUS) is assigned a Forward ID. The Forward ID is assigned Inmarsat Mobile Numbers (IMNs) for each service type. Each service type has an associated Multiple Subscriber Number (MSN). The MSNs are configured in the ISDN devices to direct incoming calls of different service types to the appropriate device.

For a two-channel HSD transceiver, two IMNs are assigned for each service type. "System Operation" on page 2-1 provides examples and a detailed description of the routing assignments for the HSD transceiver.

Several ISDN interface options are shown in Figure 1–8. The physical interface is EURO S/T, which can support up to eight simultaneous connections to user equipment. In the illustrated example, the ISDN port is only used for circuit-switched services (Swift64 Mobile ISDN).

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

For connection to Inmarsat Mobile ISDN services, install an RJ-45 interface connector in the cabin area. "Installation" on page 3-1 describes the RJ45 connector and cable termination.
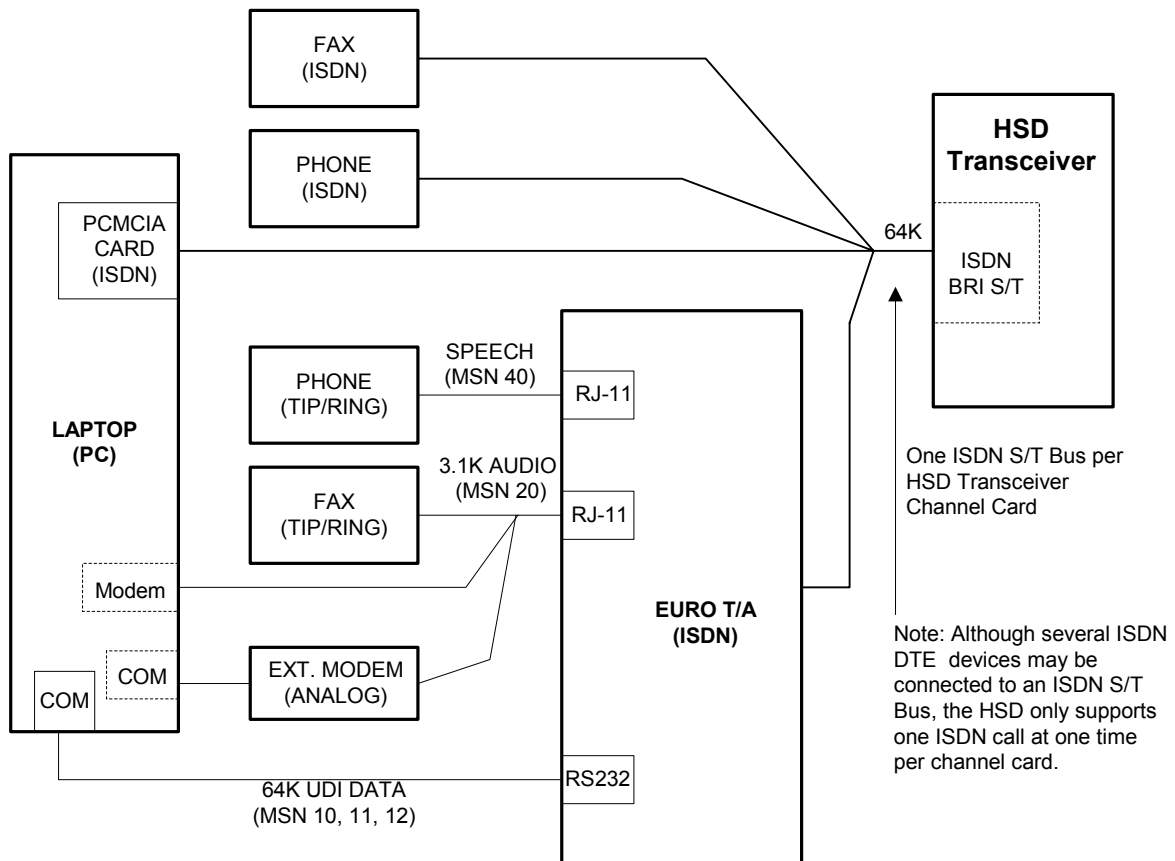
Figure 1–8. ISDN Connection Options

(7) RS-232 Interface

The simplest configuration, using the RS-232 interface, allows users to connect directly to the HSD without any kind of networking device (i.e. router or file server). The port identified as DTE-MPDS, on the Interconnect Drawings (refer to "Installation" on page 3-1), is a serial data port capable of operating up to 115 kbps line speed with a maximum throughput of 64 kbps. This RS-232 port only supports Mobile Packet Data Service (MPDS).

Install a 9-pin, socket D-Sub interface connector in the cabin area for connection to this service. Configure the connection as:

• Bits per second – 115200

• Data bits – 8

- Parity – none

- Stop bits – 1

- Flow control – Hardware

Refer to the applicable Interconnect Diagrams provided in "Installation" on page 3-1 for complete pinout designations.

(8) Ethernet Data Interface

HSD transceivers PN 1110-A-0150 and 1110-A-0160 support the Ethernet interface. All other HSD transceivers require the accomplishment of service bulletin, 1110-SB-0004 to upgrade to a Data I/O Card Type 2 that supports the Ethernet interface.

The Ethernet port provides a 10 Mb/s access, with a 10BASE-T physical interface. The HSD 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. PPP over Ethernet protocol (PPPoE) is required on the user equipment to allow the establishment of virtual connections to either service. Use the Ethernet port for either Swift64 Mobile ISDN or MPDS service.

(9) ISDN S/T Interface

Transceivers with a Data I/O Type 1 card installed support eight simultaneous connections to user equipment in single-channel card system and sixteen simultaneous connections in two-channel systems.

HSD models 1110-A-0150 and 1110-A-0160 and HSD Transceivers with service bulletin 1110-SB-0004 accomplished have a Data I/O Type 2 card installed. Data I/O Type 2 cards support seven simultaneous connections to user equipment in single-channel card system and fifteen simultaneous connections in two-channel systems.

Note: An HSD transceiver with a Data I/O Card Type 2 uses one S/T Bus "device connection" for system use.

Install an RJ-45 interface connector in the cabin area to facilitate connection to the Ethernet interface. Refer to "Installation" on page 3-1 for a description of the RJ-45 connector and cable termination.

(10) Maintenance Port Interface

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

The maintenance port provides the physical connection to a password-protected, HSD maintenance utility program 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 (DB25S) connector on the front panel of the HSD, or through a remote 9-pin socket D-Sub (DB9S) connector via the ARINC 600 connector, as described in "Test and Fault Isolation" on page 4-1.

A standard VT100 compatible terminal or computer (PC/laptop) running an emulator program such as HyperTerminal©, ProComm (PCPLUS)©, or another serial communication package provides the user interface to the HSD maintenance utility program. Configure the connection as follows:

- Bits per second – 19200

- Data bits – 8

- Parity – none

- Stop bits – 1

- Flow control – none

The HSD supports two different end user access levels within the Maintenance Port architecture: End User or Field Representative.

(a) End User Access: **Level 1**

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) Field Representative Access: **Level 2**

Password: *maint*

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

"Test and Fault Isolation" on page 4-1 provides a detailed description of the two levels of user access and of the menus, report selections, functionality, and system diagnostic procedures of the HSD Maintenance Utility Program.

H. Initiated-Self-Test

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

I. Owner Requirements Table

An Owner Requirements Table Tool (ORT Tool) is a Windows-based program that is used to create and change system configuration disks for HSD transceivers. The configuration data files created using the ORT Tool are loaded into the HSD transceiver via the RS-232 Maintenance Port interface.

Detailed information on how to use the ORT Tool is provided in "Test and Fault Isolation" on page 4-1.

4. Inmarsat System Overview

A. General

This section provides an overview of the Inmarsat satellite communications system and networks.

B. Satellite Network Overview

The satellite communication system (SATCOM) comprises global satellite networks, Land Earth Stations (LES), and Mobile Earth Stations (MES).

Satellite communication systems provide users with long-range voice and data communication by accessing global satellite and ground communications networks.

Inmarsat is an international organization that operates and maintains the satellites and satellite networks. Inmarsat operates multiple geostationary satellites. Each satellite is located over an oceanic region; the current ocean region names are:

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

These satellites provide worldwide telecommunication services for aviation, shipping, and land-mobile terminal users. The satellites connect to ground telecommunication systems through the LES.

The HSD transceiver, in conjunction with an ARINC 741 Aero H/H+ antenna subsystem, acts as an MES. The combined system provides users with a data and voice communications link to the satellite network and global telecommunications system.

Figure 1–9 illustrates a simplified satellite communications system.

L-Band
(1.5/1.6 GHz)

Inmarsat
Satellite

Aircraft equipped with an MES/AES
(HSD Terminal)

C-Band
(4/6 GHz)

Space
Segment

Air-Ground-Air
Communications

Terrestrial Link

International
Telecommunications Network

LES/GES
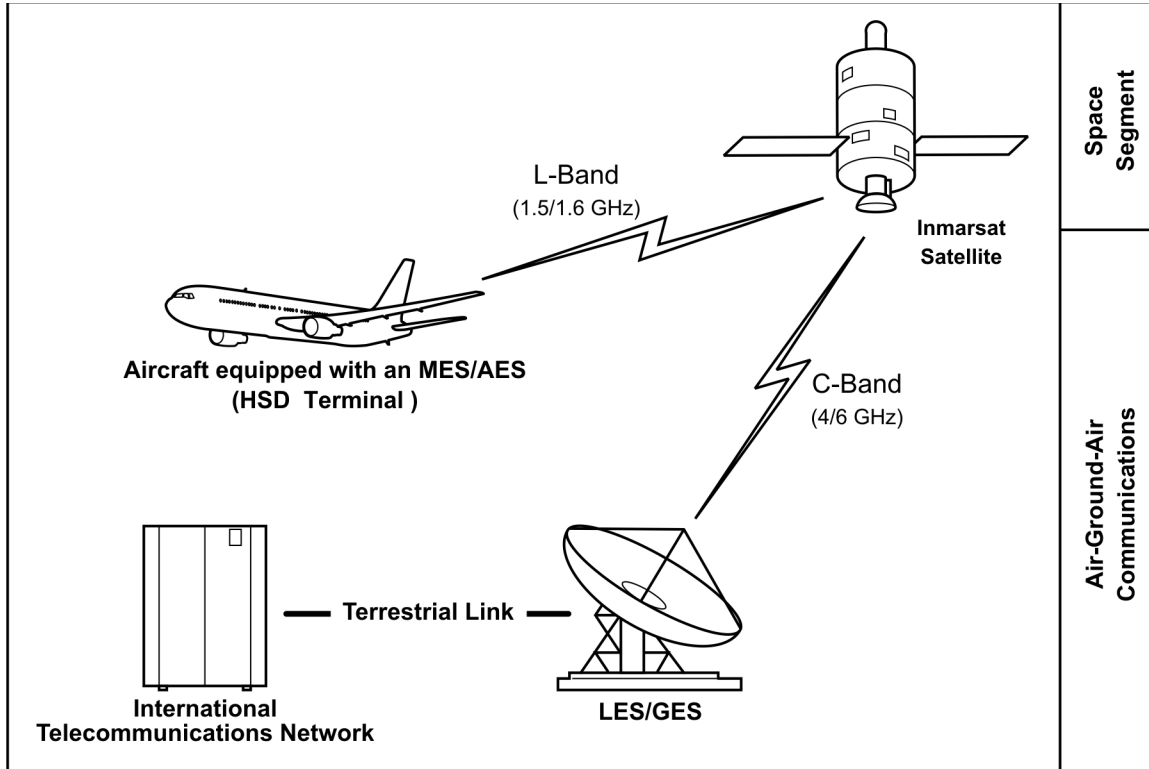
Figure 1–9. Simplified Aeronautical Satellite Communications System

5.   HSD Modes and Configuration Descriptions

A.   General

This section describes the system mode and configuration variations for the HSD High-Speed-Data SATCOM Transceiver installations.

B.   Overview

HSD transceivers install in a variety of customized configuration modes. HSD transceivers may be installed as Stand-Alone systems or as Non-Stand-Alone units installed within existing SATCOM systems. Four different system configuration modes are possible:

- Stand-Alone Mode—single or dual channel transceiver

- Cooperative Mode—single channel transceiver (with Collins SAT-906 systems)

- Combined Mode—single or dual channel transceiver (with Honeywell MCS systems)

- Selective Mode—single or dual channel transceiver (with Collins SAT-906 or Honeywell MCS systems)

- Multi-Channel configurations—dual-channel HSD transceiver integrated with additional HSD-X extension transceiver(s) to support multi-channel operation (more than two 64 kbps channels).

(1)   Channel Card Configurations

This section describes the types of channel card configurations supported by HSD transceivers.

(a)   Dual-Channel Card HSD Transceivers

In dual-channel card HSD transceivers, both 64 kbps channels work either independently or as a bonded 128 kbps data-link to the Inmarsat Communications Network.

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

(b)   Single-Channel Card HSD Transceivers

Single-channel-card HSD transceivers provide one 64 kbps channel that supports a bi-directional, 64 kbps data-link to the Inmarsat Communications Network.

The user has the option to select the service type needed—either Swift64 Mobile ISDN or MPDS. The HSD also supports one voice or 14.4 kbps fax call when not being used in data mode.

(c)   Multi-Channel Configurations

Stand-Alone HSD-128 transceivers in Multi-Channel installations support two 64 kbps channels that work either independently or as a bonded 128 kbps data-link to the Inmarsat Communications Network as well as an additional 64 kbps channel per HSD-X installed in the system.

The user has the option to select the service type needed—either circuit-switched data (Swift64 Mobile ISDN) or MPDS. The HSD also supports three or more simultaneous voice or 14.4 kbps fax calls when not being used in data mode—depending on the number of additional HSD-X transceivers installed.

(2) Installation Modes and Configurations

    (a) Stand-Alone Mode Systems

    In Stand-Alone Mode, the HSD transceiver controls both the HPA and antenna. The system supports one channel of Swift64 Mobile ISDN and one channel of Swift64 MPDS or two channels of Swift64 Mobile ISDN or two channels of MPDS.

    For details, refer to the system block diagram.

    (b) Non-Stand-Alone Mode Systems

    In Non-Stand-Alone configuration modes, the HSD hardware acts as the High Gain Antenna HPA for Aero H/H+ calls and provides one or two channels of Swift64 communications. In these configurations, the Aero H/H+ system provides the system interface to the aircraft antenna subsystem. The radio frequency (RF) from the HSD transceiver and the Aero H/H+ system is combined in the HSD. The receive RF from the antenna sub-system is split before being presented to the Aero H/H+ and HSD transceivers.

        1. Cooperative Mode Systems

        HSD transceivers installed in Cooperative Mode configurations operate with a SAT-906 SATCOM system. The HSD hardware is installed in the SAT-906 HPA equipment position. A communications link between the SAT-906 system and the HSD transceiver coordinates the use of the HPA.

        An external splitter "splits" the antenna RF receive (Rx) signal path to both the HSD and the SAT-906 SATCOM systems. The antenna is controlled by the SAT-906 system's SDU.

        This system configuration provides one channel of Swift64 Mobile ISDN, MPDS high-speed data, or Aero H/H+ communications. Simultaneous Swift64 and Aero H/H+ calls are possible. Swift64 HSD calls proceed even if an Aero H/H+ incoming or outgoing call is in progress providing there is sufficient HPA power available to process all of the calls.

        To use ARINC 429 data from the Collins SAT-906 SDU, the minimum requirement for HSD control-card software is version 4.5 (or later). Version 4.5 control-card software is available via HSD service bulletins: 1110-SB-0001 and 1110-SB-0003. The recommended software version for optimum system performance is version 7.5 or later. Version 7.5 is available via service bulletin, 1110-SB-0015.

        The SAT-906 SDU must have core software –068, including service bulletins 31 and 501, which change the unit to a –150 designation and include wiring SDU pin TP12E grounded to indicate that the SDU is operating with an HSD.

        To achieve the current "best system" operation performance, incorporate EMS SATCOM service bulletin 1110-SB-0015. At the time of writing, Cooperative Mode installations only support single-channel card configurations. If installing a dual-channel HSD-128 transceiver in a Cooperative Mode environment, the HSD EEPROM parameters must be

configured as a single-channel system. Use the HSD maintenance utility program to configure the EEPROM settings for a single channel card. (Menu 3, press M, select miscellaneous parameter number 10.)

Refer to the system block diagram in Figure 1–12 for Cooperative Mode system details.

2. Honeywell Combined Mode (HCM) Systems

HSD transceivers installed in Combined Mode configurations operate with the Honeywell Aero H/H+ MCS 3000/6000 and MCS 4000/7000 Multi-Channel Satellite Communication Systems. The HSD hardware is installed in the SATCOM HPA equipment position, replacing the Honeywell HPA.

An external splitter "splits" the antenna RF receive (Rx) path signal to the HSD and the Aero H/H+ systems. The antenna is controlled by the Aero H/H+ system's SDU.

This system configuration provides up to two channels of access to high-speed Swift64 Mobile ISDN or MPDS services as well as the existing Aero H/H+ communications simultaneously. Swift64 HSD calls proceed even if an Aero H/H+ incoming or outgoing call is in progress—providing there is sufficient HPA power available to process all of the calls.

In Combined Mode (HCM) installations, the HSD system provides two channels of Swift64 data service and Aero H/H+ call capability. Swift64 and Aero H/H+ calls are possible simultaneously under the following conditions:

- If a Swift64 call is in process and an Aero H/H+ call is initiated, either incoming or outgoing, the Aero H/H+ call is allowed to proceed;

- If any Aero H/H+ calls are in process, a Swift64 call is allowed to proceed providing that there is sufficient HPA power available to process both the Swift64 and Aero H/H+ calls; and,

- If both call types are in process, and system resources become limited due to dropping antenna gain, Aero H/H+ calls will maintain priority.

Refer to the system block diagram in Figure 1–13 for details.

3. Selective Mode Systems

HSD transceivers installed in Selective Mode configurations operate with an Aero H/H+ system. The HSD transceiver is installed in the Aero H/H+ HPA equipment position.

This system configuration provides either one or two channels of Swift64 Mobile ISDN and MPDS high-speed-data communications **OR** Aero H/H+ communications. Simultaneous Swift64 and Aero H/H+ calls are not possible. Swift64 HSD calls are terminated if an Aero H/H+ incoming or outgoing call is detected by the HSD transceiver allowing the Aero H/H+ call to proceed. While Aero H/H+ calls are in process, Swift64 HSD calls cannot be initiated.

Refer to the system block diagram in Figure 1–13 for details.

(c)   Multi-Channel Configurations

The HSD Multi-Channel configuration combines a dual-channel, Stand-Alone Mode HSD-128 Transceiver with one or more single-channel HSD-X transceivers to add additional channels to the system.

Each channel provides an ISDN 64 kbps connection that can be used for voice or data services. The two channels in the HSD can be internally bonded to provide a 128 kbps ISDN data connection. Externally, all four channels shown in Figure 1–10 can be combined to provide a single 256 kbps capability with the help of a router, Ethernet hub, or Terminal Adapter.

The HSD-128 is the master of the system, and as its name suggests, it controls the overall operation of the Multi-Channel HSD configuration. It keeps track of time and allocated power and may command the HSD-X "slaves" to terminate calls under certain conditions, such as an ocean region change. The HSD-X transceivers are wired to the HSD-128 HPA and therefore compete equally for HPA power allocation.

The transmit signal of each channel is fed through a combiners/attenuator combination to the HPA located in the HSD and ultimately to the antenna. Conversely, the receive signal from the antenna goes through a series of splitters on its way to each channel.

On power-up, HSD-X transceivers go through an initialization process that identifies and communicates the number of extension channels and their position in the system chain back to the HSD-128 controller.

The block diagram in Figure 1–10 illustrates the system function of the HSD-128, two HSD-Xs, and the antenna system.
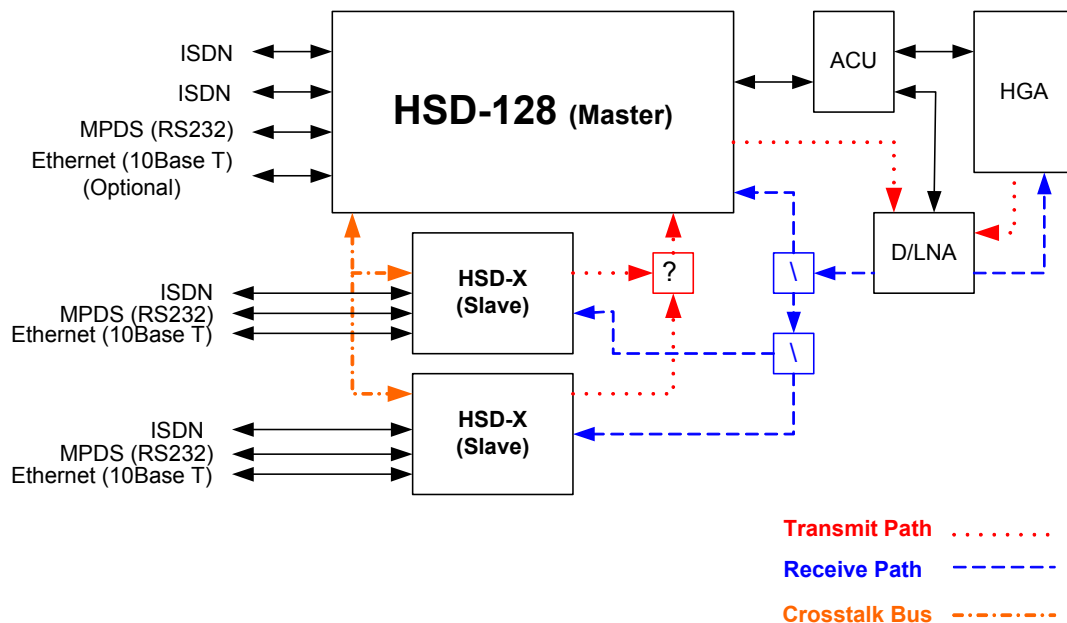
Figure 1–10. Multi-Channel System Block Diagram
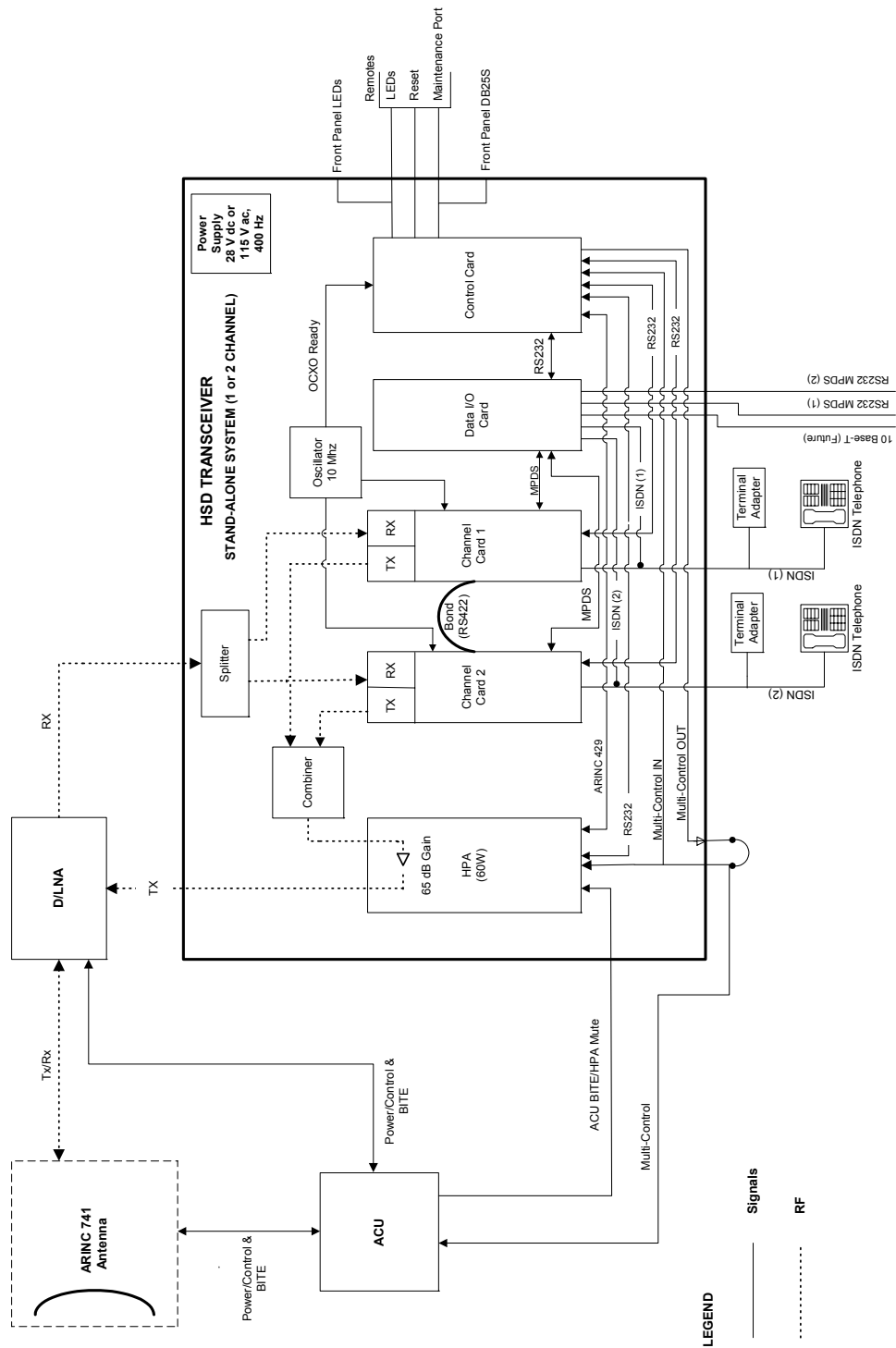
Figure 1–11. Stand-Alone Mode System Block Diagram
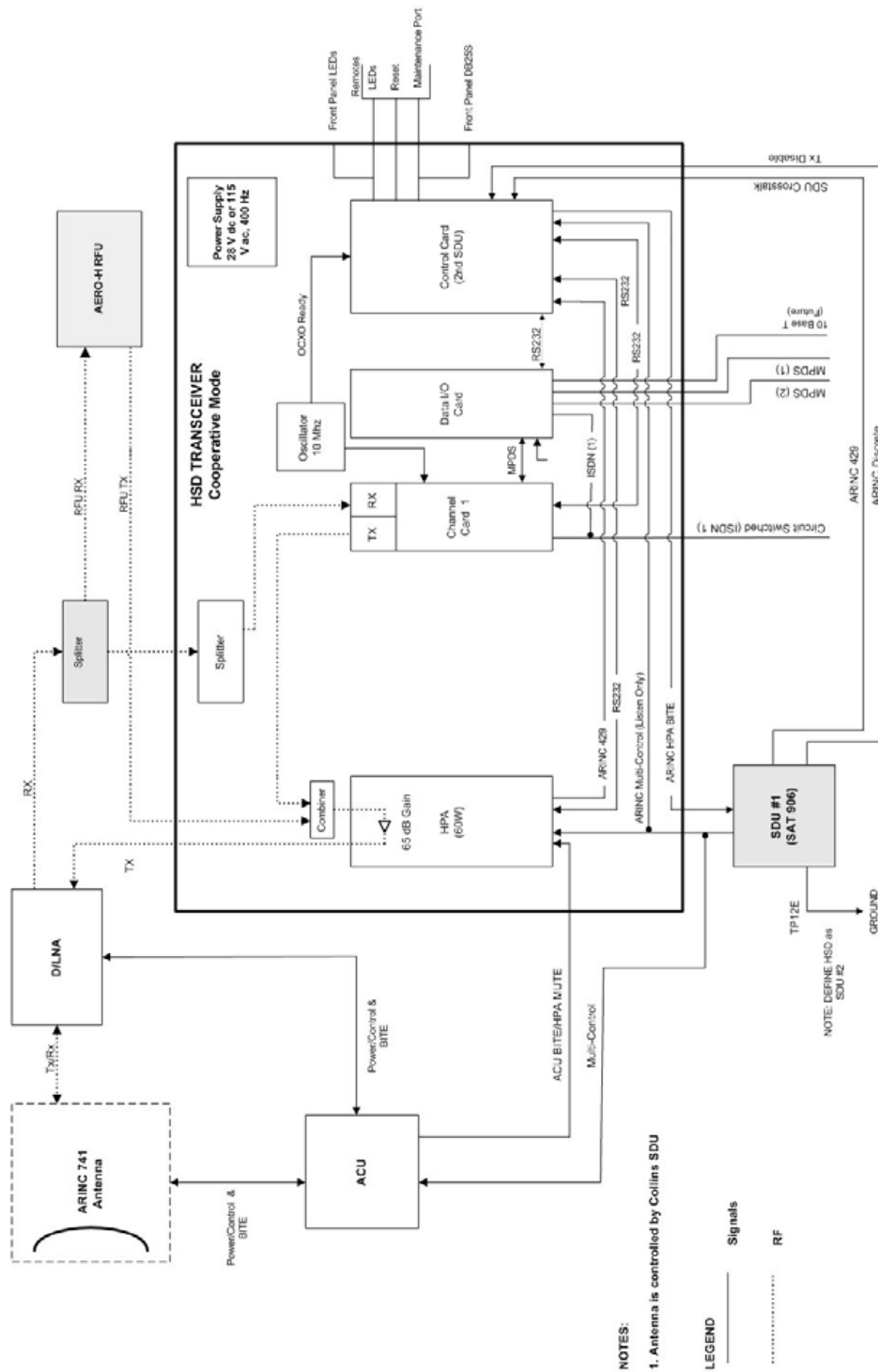
Figure 1–12. Cooperative Mode System Block Diagram
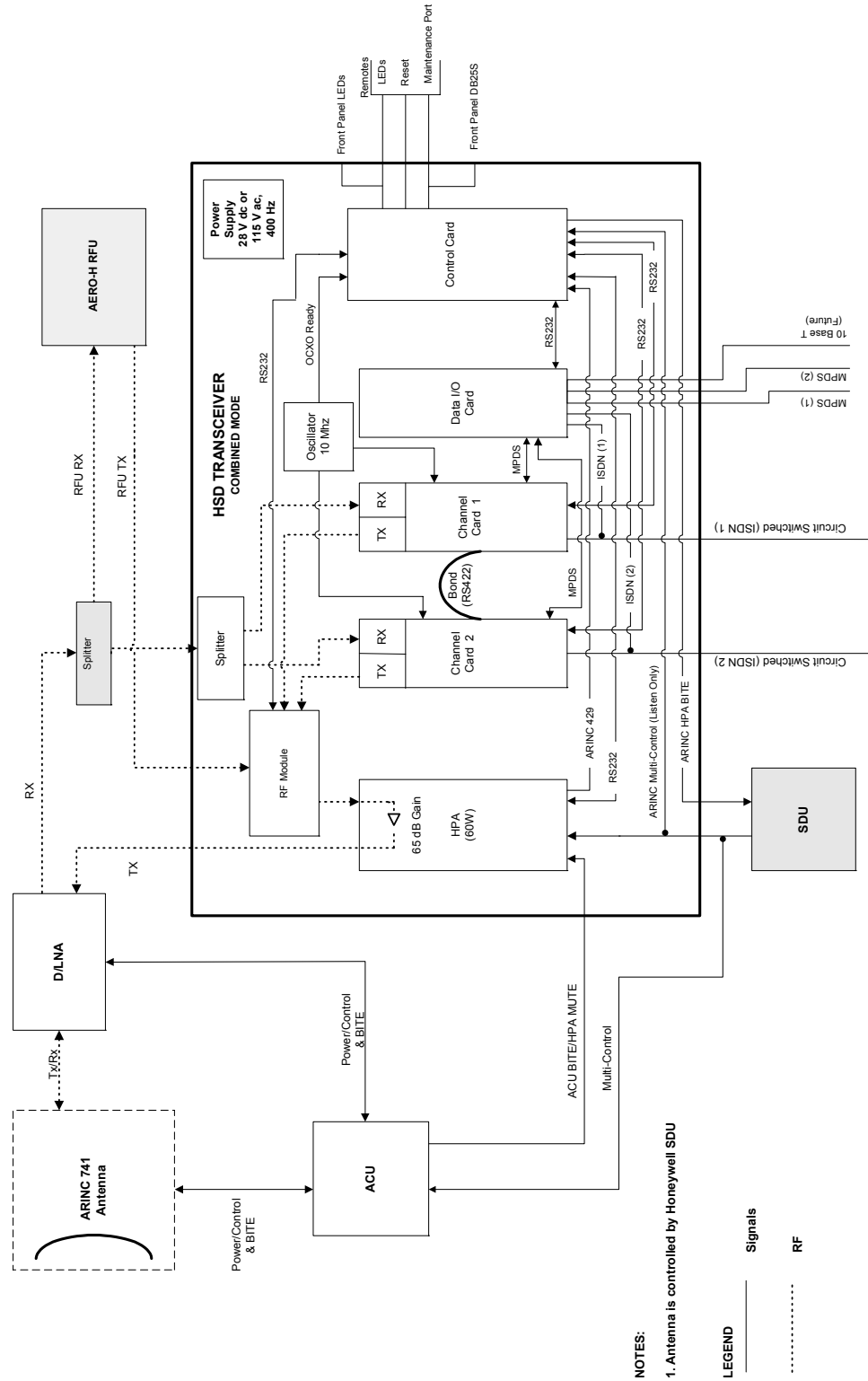
Figure 1–13. Combined/Selective Mode System Block Diagram

C. Functional System Theory

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

When integrated with the SAT-906 Aero H/H+ as a Cooperative Mode system (refer to Figure 1–12), the HSD L-band Rx/Tx interfaces are shared with those of the SAT-906 via combiners/splitters between the DLNA and the HPA. The SDU of the SAT-906 maintains control over the HSD component via the crosstalk bus and associated discretes.

HSD transceivers installed in Combined Mode configurations operate with the Honeywell Aero H/H+ MCS 3000/6000 and MCS 4000/7000 Multi-Channel Satellite Communication Systems. The HSD hardware is installed in the SATCOM HPA equipment position, replacing the existing HPA. An external splitter "splits" the antenna receive (Rx) path to send the RF signal to the HSD and the Aero H/H+ systems. The antenna is controlled by the Aero H/H+ system's SDU.

The HSD supports one or more channels (depending on the model, mode, and configuration installed) of Inmarsat Swift64 MPDS and Mobile ISDN 64 kbps data links. The HSD and HSD-X both have three different ports that support the following interfaces: EURO ISDN S/T, serial (RS-232), and Ethernet (10BASE-T). Although able to support multiple configurations depending on user needs, the following constraints apply:

- EURO ISDN S/T port supports Swift64 Mobile ISDN (circuit-switched services - SCPC) only

- RS-232 port supports MPDS only

- 10BASE-T port supports Swift64 Mobile ISDN or MPDS (Available on HSD transceivers PN 1110-A-0150 and 1110-A-0160 or HSD transceivers that have accomplished Service Bulletin, 1110-SB-0004 to upgrade to a Data I/O Type 2 Card)

Note: Only one service type can be used at one time—per HSD or HSD-X transceiver channel card.

The most likely configurations (as illustrated in Figure 1–14) 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.

The simplest configurations, using the RS-232 interface, allow users to connect directly to the HSD without any kind of networking device (e.g. router or server). The RS-232 port allows a single user for MPDS only, while the ISDN S/T port will allow up to eight users on a first come first serve basis.
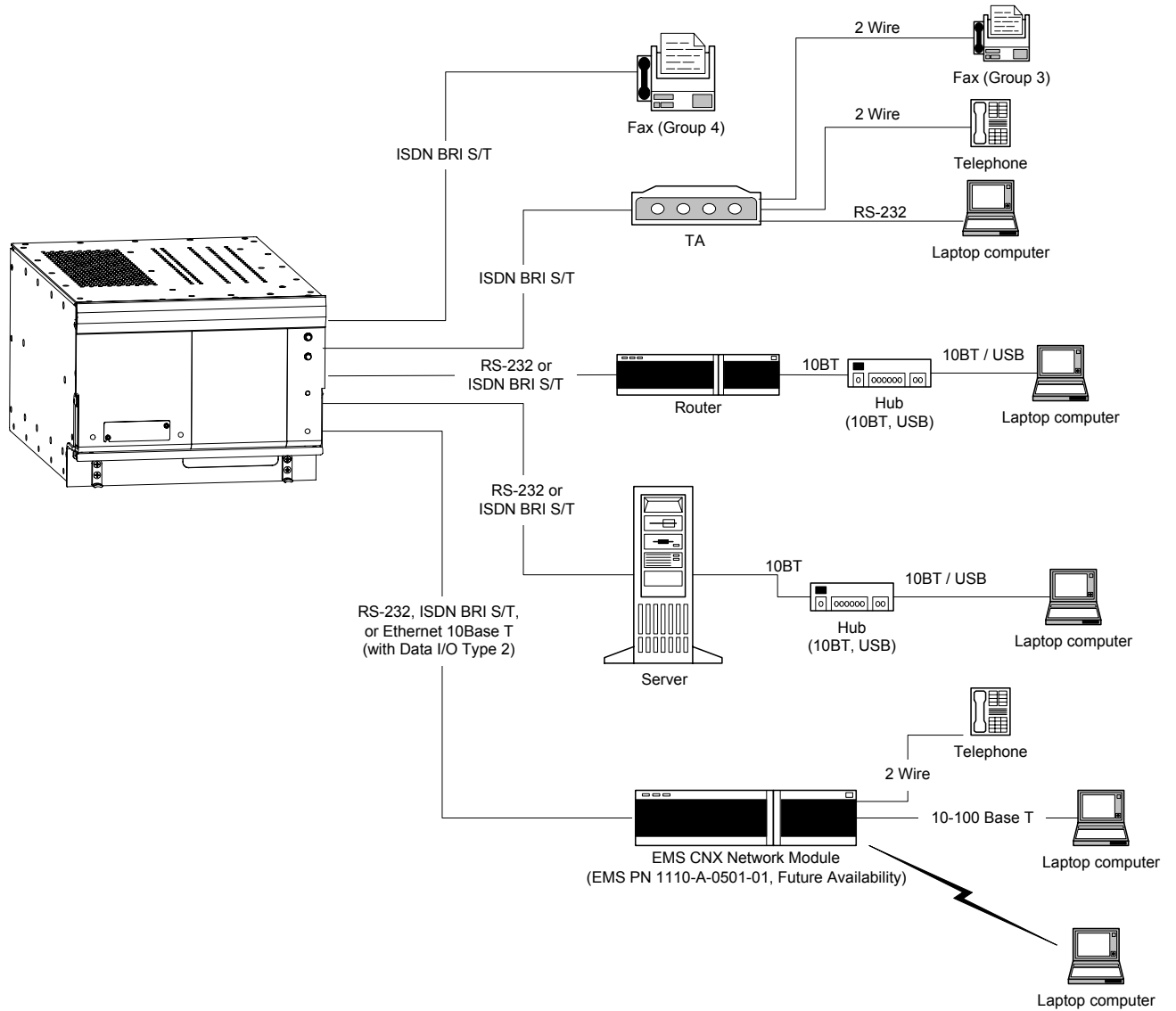
Figure 1–14. HSD User Configurations

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SYSTEM OPERATION

1. Introduction

This section provides basic information on registering, commissioning, and operating the HSD High-Speed Data SATCOM transceiver and HSD-X High-Speed SATCOM Extension transceiver. For more information on Swift64 service providers and the activation of HSD and HSD-X transceivers, visit the EMS Technologies HSD Web page at www.emssatcom.com/hsd/team.asp.

2.   Activating HSD Transceivers

To activate an HSD or HSD-X transceiver:

1. Obtain terminal information (Forward Identification Numbers and Terminal Type and Category information) from EMS Technologies.

2. Register the terminal with an Inmarsat approved service provider and activate an account.

A. Obtaining Terminal Information

Before installing the HSD or HSD-X transceiver, contact EMS Technologies to obtain terminal information needed to register and activate the unit with Inmarsat.

EMS SATCOM Customer Care assigns an appropriate Terminal Type number and valid Forward IDs for the HSD transceiver based on the intended installation configuration (Stand-Alone or Non-Stand-Alone Mode).

Note: Cooperative, Combined, and Selective Mode installations are Non-Stand-Alone Mode installations that operate with an Aero H/H+ system. Cooperative and Combined installations are assigned a Category B terminal type. Please note that Inmarsat does not support Mini-M Voice (4.8 kbps) service for Category B terminals. For more information on available services for Category B systems, contact your Inmarsat Service Provider.

Note: If you are replacing or upgrading a Stand-Alone or Selective Mode system with a Combined Mode system, you need to de-activate the "old" system's Forward IDs and service accounts and "activate" new Forward IDs and service accounts to Category B frequency allocations. This process may take 24 to 48 hours to complete. Contact your service provider for more information.

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

*   End customer name, including contact information

*   Purchase order number

*   Tail registration number, aircraft type, and serial number of the aircraft the unit is being installed on

*   Serial Number of HSD or HSD-X transceiver(s)

*   Intended installation configuration mode (Stand-Alone, Cooperative, Combined (HCM), Selective, or Stand-Alone in a Multi-Channel Configuration)

Contact EMS SATCOM Aeronautical Sales and Customer Service at:

Toll-free from Canada and U.S.A.	1.800.600.9759
Outside Canada and U.S.A.	1.613.591.9064
Fax:	1 613.591.8703
Web sites:	www.emssatcom.com

(1) Swift64 Service Categories

Inmarsat has restricted the frequencies assigned to the HSD system eliminating the possibility of intermodulation signals occurring, thus avoiding any resulting interference problems with the GPS band signals.

Inmarsat split the band of frequencies assigned to Swift64 High-Speed Data into two separate categories: Category A and Category B. Category B frequencies are restricted to those frequencies that do not overlap with AERO-H frequency allocations. HSD transceivers in Cooperative and Combined Mode installations must be registered as Category B systems. HSD transceivers in Stand-Alone and Selective installations do not require restricted frequency allocations. Register Stand-Alone HSD transceivers, Multi-Channel, and Selective Mode systems as Category A systems.

The frequencies assigned to 4.8 kbps Low-Speed Voice (LSV) are not within the managed Category B frequency range. Therefore, LSV is not a service supported by Inmarsat in Cooperative and Combined Mode HSD transceivers.

Secure communications in Category B, HSD systems do not have access to Mini-M service. However, HSD transceivers have both c8400 or c21000 M4 circuit-switched mode channels, which support secure communication operations.

To ensure the correct Category frequency assignments for HSD systems, different terminal type numbers are assigned to HSD transceivers based on their intended installation configuration.

Table 2–1 lists the terminal type, frequency category, and supported service types for all types of HSD transceivers installations.

Table 2–1. Swift64 Category and Service Matrix

HSD Installation Mode	Inmarsat Frequency Category	Terminal Type	64 kbps speech	3.1 KHz audio	56 kbps data	64 kbps UDI	Mini-M Voice	MPDS
Stand-Alone and Multi-Channel (HSD and HSD-X)	Category A	76ES03	X	X	X	X	X	X
Collins Cooperative	Category B	76ES04	X	X	X	X	N/A	X
Honeywell Combined	Category B	76ES05	X	X	X	X	N/A	X
Selective Mode (Not Rec'd)	Category A	76ES03	X	X	X	X	X	X

Note: Category B, Inmarsat terminals do not support Mini-M Voice (4.8 kbps LSV). Selective Mode is a non-standard installation and it is not a recommended mode of operation. Selective Mode has been superseded by Combined Mode operation for MCS series SATCOM and with Cooperative Mode operation for

SAT-906 series SATCOM. It is recommended that all systems operating in Selective Mode be upgraded to support Combined or Cooperative Mode as applicable.

B. Selecting a Service Provider

Register the HSD transceiver with an Inmarsat service provider. Contact Inmarsat for an up-to-date list of Inmarsat Swift64 service providers as follows:

Inmarsat
99 City Road, London
EC1Y 1AX
Tel: +44 20 7728 1000
Fax: +44 20 728 1044

Customer Care
Tel: +44 20 7728 1777
Fax: +44 20 7728 1142
Email: customer_care@inmarsat.com

Web addresses: www.inmarsat.com and www.inmarsat.com/swift64/supp_ser.htm

Note: Although the HSD and HSD-X are Mobile Earth Stations (MES), they are referred to as Aircraft Earth Stations (AES) on the service-provider registration form.

C. Registering and Activating the HSD and HSD-X Transceivers

Contact your Inmarsat service provider and ask for a "*Registration for service activation of Aircraft Earth Station* " form.

To complete the registration form the following information is needed:

- Customer information (address and contact information)

- Service provider details (obtain from your Inmarsat service provider)

- System and terminal information (system terminal type, manufacturer, model number, serial number of unit and Inmarsat Serial Number)

- Aircraft information (tail number, fuselage/airframe number, manufacturer and model, and country of registration

- List of services required (e.g. Swift64 Mobile ISDN)

3. Configuring HSD Systems

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

A. Setting up Networks

This section provides basic information on how to configure user connections and networks for operation with the HSD and HSD-X transceivers and satellite communications network.

(1) Network Types

The samples in Figure 2–1 have been simplified to illustrate different types of networks (including a basic, single-user connection). In the illustration, SATCOM refers to HSD transceivers (including any HSD-X transceivers installed in Multi-Channel configurations), as well as any associated SATCOM systems in Non-Stand Alone installations (Cooperative, Honeywell Combined, and Selective Modes).
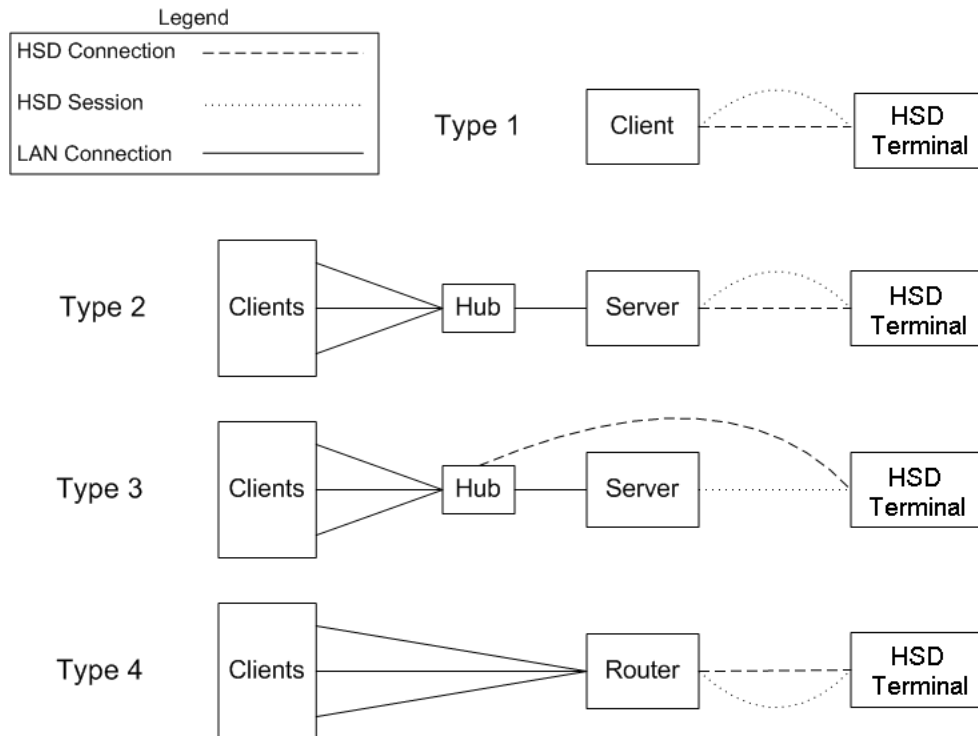
Figure 2–1. Network Configuration Types

Note: A single client is a server that does not need to share the connection. A server connecting to a SATCOM through a hub still has the same logical session link. A router is equivalent to a server and a hub bundled into a single device.

(2) Networking Components

The network configurations illustrated in Figure 2–1 have common components that integrate and operate with HSD transceivers.

- An interface connection to the HSD equipment:
The HSD equipment supports the following interface connections: an RS-232 serial port (MPDS only), a 10BASE-T Ethernet interface on HSD models, 1110-A-0150 and 1110-A-0160 and available as an option on other models with HSD service bulletin, 1110-SB-0004 accomplished, (MPDS or Swift64 Mobile ISDN), and an ISDN interface (Swift64 Mobile ISDN only). The Ethernet interface is accessed through a direct connection (dedicated network card or crossover cable) or through a hub.

- A session over the HSD equipment:
This is the logical link between the server and the ground segment.

- A connection to other local computers:
Connection to other local computers is usually achieved using a hub or router; however, the system supports any method computers use to communicate between each other (for example: wireless, dial-up).

- A method of sharing the session with other computers:
Session sharing is accomplished using Network Address Translation (NAT)—the method behind Internet Connection Sharing, although various proxies may also be used.

(3) HSD Interface Options

The HSD has three interface options ("Installation" on page 3-1 provides connection details):

(a) ISDN

The ISDN interface supports connections to Swift64 Mobile ISDN services only. Computers connect to the ISDN interface through a EURO ISDN S/T BRI terminal adapter or router. (Euro ISDN S/T modem and drivers are required.)

(b) Serial Port (RS-232)

The RS-232 port interface supports MPDS services only, and to a single channel per physical cable connection.

Connect to the serial port RS-232 interface using a serial cable. (Hardware handshaking lines are required: CTS/RTS and DTR/DSR.) On the server computer, install a generic external modem with the port set to 115200 bps.

(c) Ethernet

The Ethernet interface is supported in HSD transceivers, PN 1110-A-0150 and 1110-A-0160—and HSD transceivers with service bulletin 1110-SB-0004 accomplished (with Data I/O Type 2 Card installed). HSD-X transceiver extensions also support Ethernet.

The Ethernet interface supports both MPDS and M4 circuit-switched data (Swift64 Mobile ISDN) services for either single or dual channel systems. It supports longer cable lengths to accommodate extension through hubs and other networking devices.

Connect to the HSD transceiver's Ethernet interface either directly from a dedicated Ethernet card using an Ethernet crossover cable or from a hub using a regular Ethernet cable.

B. Mapping User Devices for ISDN Services

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

(1) Overview

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

The physical interface for ISDN service is EURO S/T, which supports several types of connections to user equipment. HSD transceivers provide either one or two ISDN S/T (BRI) Bus interfaces (depending on the number of channel cards and mode of installation of the unit).

Each bus is capable of hosting up to eight, EURO ISDN physical devices—which means a one-channel system supports up to eight physical connections to EURO ISDN devices; whereas, a two-channel system supports up to sixteen physical connections to EURO ISDN devices.

Note: An HSD transceiver with a DATA I/O Card Type 2 (models 1110-A-0150 and 1110-A-0160 or units with service bulletin 1110-SB-0004 accomplished) also supports eight devices per channel card, but uses one "device connection" on the first channel card for system use, therefore providing up to *fifteen* possible device connections in two-channel systems.

Each channel card provides one, 64 kbps ISDN B channel that is available to either ISDN Bus. If the channel(s) is "busy" or "in-call", the request for service is denied (the system is busy).

For ISDN data devices that support bonding (with a two-channel card, HSD transceiver), the device will attempt to use both ISDN B channels to increase data throughput (as long as no other devices are "in call").

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

Note: Sixteen MSNs for 4.8 kbps LSV were implemented in Version 4.1 Control Card Software. Systems shipped from the factory after November 15, 2002 have Version 4.1 software or later.

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

For a one-channel HSD transceiver: one IMN is assigned to 64 kbps Speech, 56 kbps Data, and 3.1 kHz Audio; three IMNs are assigned to 64 kbps Data; and sixteen IMNs are assigned to 4.8 kbps LSV.

For a two-channel HSD transceiver: two IMNs are assigned to 64 kbps Speech, 56 kbps Data, and 3.1 kHz Audio; six IMNs are assigned to 64 kbps Data; and in Stand-Alone systems thirty-two IMNs are assigned to 4.8 kbps LSV.

For a three-channel HSD Multi-Channel configuration (one HSD-128 and one HSD-X extension channel), three IMNs are assigned to 64 kbps Speech, 56 kbps Data, and 3.1 kHz Audio; nine IMNs are assigned to 64 kbps Data; and in Stand-Alone systems forty-eight IMNs are assigned to 4.8 kbps LSV.

For a four-channel HSD Multi-Channel configuration (one HSD-128 and two HSD-X extension channels), four IMNs are assigned to 64 kbps Speech, 56 kbps Data, and 3.1 kHz Audio; 12 IMNs are assigned to 64 kbps Data; and in Stand-Alone systems sixty-four IMNs are assigned to 4.8 kbps LSV.

Figure 2–2 illustrates the routing assignments for a two-channel HSD transceiver with the following attached to the bus: two voice lines, one FAX line, and one data line device.

Figure 2–2 and Table 2–2 and Table 2–3 illustrate the system setup routing or configuration possibilities for ISDN devices using a two-channel HSD transceiver in Stand-Alone Mode as an example.

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

- To call ISDN Phone #1: Dial IMN of 60xxxxxx1 or 76xxxxxx7

- To call ISDN Phone #2: Dial IMN of 60xxxxxx6 or 76xxxxx29

- To call ISDN FAX: Dial IMN 60xxxxxx2

- To call ISDN FAX: Dial IMN 60xxxxx24
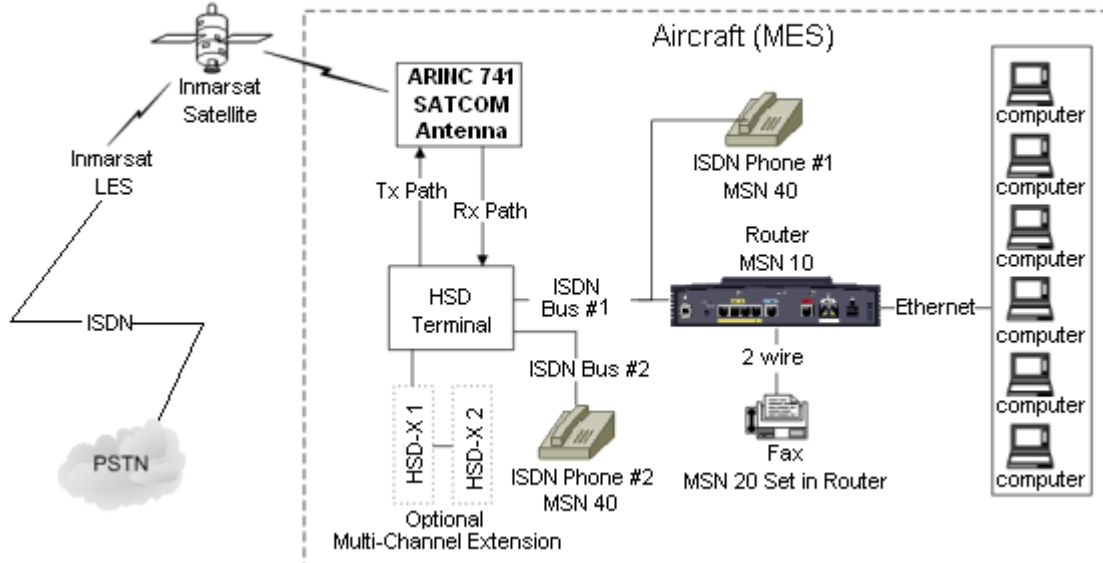
Figure 2–2. System Setup and Mapping for Incoming Calls (Fixed-to-Mobile)

Note: Refer to Table 2–2, Table 2–3, and Table 2–4 for the default MSNs assigned within the HSD system.

Table 2–2. IMN and MSN Assignments for ISDN Bus #1

Channel Card # 1 Forward ID XAXXXX		
Service Type	IMN	MSN
64 kbps Speech	60xxxxxx1 (*See Note below*)	MSN 40
3.1 kHz Audio	60xxxxxx2	MSN 20
56 kbps Data	60xxxxxx3	MSN 30
64 kbps Data	60xxxxxx4	MSN 10
	60xxxxxx5	MSN 11
	60xxxxxx6	MSN 12
4.8 kbps LSV	76xxxxxx7 through to 760xxxx22	MSN 80 through to 95

Table 2–3. IMN and MSN Assignments for ISDN Bus #2

Channel Card # 2 (if installed) Forward ID XBXXXX		
Service Type	IMN	MSN
64 kbps Speech	60xxxxx23	MSN 40
3.1 kHz Audio	60xxxxx24	MSN 20
56 kbps Data	60xxxxx25	MSN 30

Table 2–3. IMN and MSN Assignments for ISDN Bus #2

Channel Card # 2 (if installed) Forward ID XBXXXX		
64 kbps Data	60xxxxx26	MSN 10
	60xxxxx27	MSN 11
	60xxxxx28	MSN 12
4.8 kbps LSV	76xxxxx29 through to 760xxxx44	MSN 80 through to 95

Note: IMNs shown are examples only. Actual IMNs may not be assigned in numerical sequence. HSD-X extension channels are assigned IMNs using the same logic.

(a) Inmarsat Mobile Numbers

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

When registering your system, request IMNs for each service-type device attached to the HSD transceiver 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 IMN per service type, you must request them from your service provider when filling out your service registration and application form.

The maximum a one-channel HSD transceiver supports is eight physical connections to EURO ISDN devices. A two-channel HSD transceiver supports up to sixteen physical connections to EURO ISDN devices. The maximum an HSD-X transceiver supports is seven physical connections to EURO ISDN devices.

Note: An HSD transceiver with a DATA I/O Card Type 2 installed (models 1110-A-1050 and 1110-A-0160 or other models with service bulletin, 1110-SB-0004 accomplished) only supports seven EURO-ISDN devices on a one-channel card system. DATA I/O Card Type 2 systems can only connect to one channel card in a two-channel-card, split-bus configuration providing connectivity to fifteen devices in total.

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

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

Numerical Example:

- 760011819 (for 4.8 kbps AMBE LSV)
- 600221989 (for 64 kbps Data)

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

(b) Multiple Subscriber Numbers

Multiple Subscriber Numbers (MSNs) act as identification and routing codes for user devices attached to the HSD system. 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).

1. Configuring MSNs

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

- One MSN for the service types 64 kbps Speech, 3.1 kHz Audio, and 56 kbps Data

- Three MSNs for 64 kbps Data

- Sixteen MSNs for Mini-M Voice (4.8 kbps LSV AMBE)
  (On control card software 4.1 or later—systems shipped from the factory after November 15, 2002 have Version 4.1 software or later installed.)

The three MSNs assigned to 64 kbps ISDN support connection to three separate devices mapped to the same IMN. Therefore, in dual-channel systems, three ISDN devices can be connected to each channel provided six separate mapping extensions; in three-channel systems, three ISDN devices can be connected to each channel provided nine separate mapping extensions; and, in four-channel systems, three ISDN devices can be connected to each channel providing twelve separate mapping extensions.

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

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

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

Table 2–4. HSD Transceiver MSN Configuration Table

Forward ID	Service Type	IMN	MSN
Channel Card #1 (XAXXXX)	64 kbps Speech	60xxxxxxx	40
Channel Card #2 (XBXXXX) - Dual Channel Units	64 kbps Speech	60xxxxxxx	40
Channel Card #3 (XCXXXX) - Multi-Channel HSD-X 1	64 kbps Speech	60xxxxxxx	40
Channel Card #4 (XDXXXX) - Multi-Channel HSD-X 2	64 kbps Speech	60xxxxxxx	40
Channel Card #1 (XAXXXX)	3.1 kHz Audio	60xxxxxxx	20
Channel Card #2 (XBXXXX) - Dual Channel Units	3.1 kHz Audio	60xxxxxxx	20
Channel Card #3 (XCXXXX) - Multi-Channel HSD-X 1	3.1 kHz Audio	60xxxxxxx	20
Channel Card #4 (XDXXXX) - Multi-Channel HSD-X 2	3.1 kHz Audio	60xxxxxxx	20
Channel Card # 1 (XAXXXX)	56 kbps Data	60xxxxxxx	30
Channel Card # 2 (XBXXXX) - Dual Channel Units	56 kbps Data	60xxxxxxx	30
Channel Card #3 (XCXXXX) - Multi-Channel HSD-X 1	56 kbps Data	60xxxxxxx	30
Channel Card #4 (XDXXXX) - Multi-Channel HSD-X 2	56 kbps Data	60xxxxxxx	30
Channel Card # 1 (XAXXXX)	64 kbps Data	60xxxxxxx	10, 11, 12
Channel Card # 2 (XBXXXX) - Dual Channel Units	64 kbps Data	60xxxxxxx	10, 11, 12
Channel Card #3 (XCXXXX) - Multi-Channel HSD-X 1	64 kbps Data	60xxxxxxx	10, 11, 12
Channel Card #4 (XDXXXX) - Multi-Channel HSD-X 2	56 kbps Data	60xxxxxxx	30
Channel Card #1 (XAXXXX)	4.8 kbps LSV (Not supported in Non-Stand-Alone systems)	76xxxxxxx	80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95
Channel Card #2 (XBXXXX) - Dual Channel Units	4.8 kbps LSV (Not supported in Non-Stand-Alone systems)	76xxxxxxx	80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95

Table 2–4. HSD Transceiver MSN Configuration Table

Forward ID	Service Type	IMN	MSN
Channel Card #3 (XCXXXX) - Multi-Channel HSD-X 1	4.8 kbps LSV (Not supported in Non-Stand-Alone systems)	76xxxxxxx	80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95
Channel Card #4 (XDXXXX) - Multi-Channel HSD-X 2	4.8 kbps LSV (Not supported in Non-Stand-Alone systems)	76xxxxxxx	80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95

Table 2–5. System Assignments for Incoming Calls (Fixed-to-Mobile)

Entry	PERIPH	MSN	TID	Call Type	REDIR
0	ISDN	NO_ID\	1	800103	Mobile AMBE
1	Bonded	NO_ID\	1	800103	Mobile AMBE
2	ISDN	NO_ID\	91	800124	Mobile aero 64k speech
3	ISDN	10\	51	800622	Mobile aero 64k UDI
4	ISDN	11\	52	800622	Mobile aero 64k UDI
5	ISDN	12\	53	800622	Mobile aero 64k UDI
6	ISDN	NO_ID\	51	800622	Mobile aero 64k UDI
7	Bonded	NO_ID\	51	800622	Mobile aero 64k UDI
8	ISDN	20\	61	800625	Mobile aero 64k audio 3.1
9	ISDN	NO_ID\	61	800625	Mobile aero 64k audio 3.1
10	Bonded	NO_ID\	61	800625	Mobile aero 64k audio 3.1
11	ISDN	30\	71	800623	Mobile aero 56k UDI
12	ISDN	NO_ID\	71	800623	Mobile aero 56k UDI
13	Bonded	NO_ID\	71	800623	Mobile aero 56k UDI
14	ISDN	40\	91	800124	Mobile aero 64k speech
15	Bonded	NO_ID\	91	800124	Mobile aero 64k speech
16	ISDN	80	1	800103	Mobile AMBE (4.8 kbps LSV)
17	ISDN	81	2	800103	Mobile AMBE (4.8 kbps LSV)
18	ISDN	82	3	800103	Mobile AMBE (4.8 kbps LSV)
19	ISDN	83	4	800103	Mobile AMBE (4.8 kbps LSV)

Table 2–5. System Assignments for Incoming Calls (Fixed-to-Mobile)

Entry	PERIPH	MSN	TID	Call Type	REDIR
20	ISDN	84	5	800103	Mobile AMBE (4.8 kbps LSV)
21	ISDN	85	6	800103	Mobile AMBE (4.8 kbps LSV)
22	ISDN	86	7	800103	Mobile AMBE (4.8 kbps LSV)
23	ISDN	87	8	800103	Mobile AMBE (4.8 kbps LSV)
24	ISDN	88	9	800103	Mobile AMBE (4.8 kbps LSV)
25	ISDN	89	A	800103	Mobile AMBE (4.8 kbps LSV)
26	ISDN	90	B	800103	Mobile AMBE (4.8 kbps LSV)
27	ISDN	91	C	800103	Mobile AMBE (4.8 kbps LSV)
28	ISDN	92	D	800103	Mobile AMBE (4.8 kbps LSV)
29	ISDN	93	E	800103	Mobile AMBE (4.8 kbps LSV)
30	ISDN	94	F	800103	Mobile AMBE (4.8 kbps LSV)
31	ISDN	95	10	800103	Mobile AMBE (4.8 kbps LSV)

C. Configuring System Parameters using the Maintenance Port Utility

This section describes how to configure the system parameters for all modes and configurations of HSD operation, including: Stand-Alone Mode, Cooperative Mode, Honeywell Combined Mode, Selective Mode, and Multi-Channel Configurations.

(1) Configuring System Parameters for Stand-Alone Mode

This section describes how to use the HSD Maintenance Port Utility to configure the HSD system parameters for operation in Stand-Alone Mode.

Refer to "Test and Fault Isolation" on page 4-1 for detailed instructions on how to connect to and use the HSD Maintenance Port Utility Program.

When all the required system parameters have been configured, "reset" or cycle the power on the HSD to activate the new configuration.

To configure the required system parameters first establish a connection to the HSD Maintenance Port Utility program:

•   Connect a computer to the maintenance port of the HSD transceiver as described in "Test and Fault Isolation" on page 4-1, and then power up the system.

•   Using a terminal emulation program, open the HSD maintenance utility program.

- Type the password *maint*. (The password does not appear on the screen.)

The HSD Maintenance Port Utility Program Menu 1 appears. You are now ready to begin configuring the system parameters for Stand-Alone operation as described in the following sections.

(a) Configuring the Terminal Category for Stand-Alone Mode

The factory default for the Terminal Category is configured to "2=HW Strapping." If the HSD transceiver does not have the recommended hardware strapping for system configuration installed, the terminal category must be configured using the HSD Maintenance Port EEPROM parameters.

To configure the Terminal Category:

1. In **Menu 3**, to select misc. EEPROM parameters press **M**.

The Miscellaneous Parameters list appears. The available parameters may differ depending on the version of control processor software installed.

```
MENU 3                              FIRMWARE Vx.x
L    list EEPROM                     S     list event log
M    misc.  EEPROM parameter         F     list call log
O    list ORT                        P     ocean region parameter
I    set all LES id's
<CTRL> N  next menu      <CTRL> O  previous menu     =  select reports


MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS        11  FRONT PANEL LEDS ENABLED
 2  FORWARD ID                       14  MAINTENANCE PORT INVERSE VIDEO
 3  GPS PROTECTION ALGORITHMS        15  MAINTENANCE PORT DEGREES SYMBOL
 4  REGISTRATION REQ'D BEFORE CALLS  16  TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS          17  VIPER ANTENNA GAIN
TERMINAL CATEGORY
WHICH PARAMETER # ? 16
```

2. To select the Terminal Category, type **16** and then press **Enter**.

The Terminal Category Menu appears.

```
TERMINAL CATEGORY  HW STRAPPED VALUE
0=SAT906  1=STANDALONE  2=HW STRAPPING  3=MCS3000  4=MCS6000  5=MCS7000
6=MCS COMB  7=STANDALONE W/O ANTENNA  8=HCM COMBINED
9=COOPERATIVE ROCKWELL-COLLINS SAT906  10=OLD COMBINED MODE DEVELOP
11=HSD-X NETWORK 12=HSD-X NETWORK W/O ANTENNA 13=VIPER

NEW TERMINAL CATEGORY = ? 1
```

3. Type **1** for Stand-Alone and then press **Enter**.

A system message appears stating that the EEPROM has been updated. This completes the configuration of the terminal category.

You now need to configure the LES Access Codes.

(2) Configuring System Parameters for Cooperative Mode

This section describes how to use the HSD Maintenance Port Utility to configure the HSD system parameters for operation in Cooperative Mode.

Refer to "Test and Fault Isolation" on page 4-1 for detailed instructions on how to connect to and use the HSD Maintenance Port Utility Program.

When all the required system parameters have been configured, "reset" or cycle the power on the HSD to activate the new configuration.

To configure the required system parameters first establish a connection to the HSD Maintenance Port Utility program:

- Connect a computer to the maintenance port of the HSD transceiver as described in "Test and Fault Isolation" on page 4-1, and then power up the system.

- Using a terminal emulation program, open the HSD maintenance utility program.

- Type the password MAINT. (The password does not appear on the screen.)

The HSD Maintenance Port Utility Program menus appear. You are now ready to begin configuring the system parameters for Cooperative Mode operation as described in the following sections.

(a) Configuring the Terminal Category for Cooperative Mode

If the HSD transceiver does not have the recommended hardware strapping for system configuration installed, the terminal category must be configured using the HSD Maintenance Port EEPROM parameters.

To configure the Terminal Category:

1. In **Menu 3**, to select misc. EEPROM parameters press **M**.

The Miscellaneous Parameters list appears. The available parameters may differ depending on the version of control processor software installed.

```
MENU 3                           FIRMWARE Vx.x
L    list EEPROM                      S    list event log
M    misc.  EEPROM parameter          F    list call log
O    list ORT                         P    ocean region parameter
I    set all LES id's
<CTRL> N   next menu     <CTRL> O  previous menu    =  select reports


MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS       11  FRONT PANEL LEDS ENABLED
 2  FORWARD ID                      14  MAINTENANCE PORT INVERSE VIDEO
 3  GPS PROTECTION ALGORITHMS       15  MAINTENANCE PORT DEGREES SYMBOL
 4  REGISTRATION REQ'D BEFORE CALLS 16  TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS         17  VIPER ANTENNA GAIN

WHICH PARAMETER #  <CTRL> N for next page  ? 16
```

2. To select the Terminal Category, type **16** and then press **Enter**.

The Terminal Category Menu appears.

```
TERMINAL CATEGORY   HW STRAPPED VALUE
0=SAT906  1=STANDALONE  2=HW STRAPPING  3=MCS3000  4=MCS6000  5=MCS7000
6=MCS COMB  7=STANDALONE W/O ANTENNA  8=HCM COMBINED
9=COOPERATIVE ROCKWELL-COLLINS SAT906  10=OLD COMBINED MODE DEVELOP
11=HSD-X NETWORK 12=HSD-X NETWORK W/O ANTENNA 13=VIPER

NEW TERMINAL CATEGORY = ? 9
```

    3.   Type **9** for Cooperative Rockwell-Collins SAT-906 and then press **Enter**.

        A system message appears stating that the EEPROM has been updated.

(b)   Configuring the Number of Channel Cards

    HSD transceivers operating in Cooperative Mode must be configured as single-channel units—even if the unit is a dual-channel transceiver.

    To configure the transceiver as a Single Channel system:

    1.   In **Menu 3**, press **M**.

    2.   Type **10** to select the "Number of Channel Cards" parameter and then press **Enter**.

    3.   Type **1** for the number of channel cards and then press **Enter**.

        A system message appears stating that the EEPROM has been updated. This completes the configuration of the system's number of channel cards.

        You now need to configure the LES Access Codes as described in "Configuring LES Access Codes (All Modes)" on page 2-24.

(3) Configuring System Parameters for Honeywell Combined Mode

To operate the HSD transceiver in Honeywell Combined Mode, you need to configure the following system parameters using the Honeywell SATCOM Direct Commissioning and Maintenance Terminal (CMT) and the HSD Maintenance Port Utility.

To configure the Honeywell System Parameters:

  1. First, use the Honeywell CMT to:

    •   Obtain the HPA to antenna loss from the Honeywell SDU

    •   Configure High Rate Data Support settings (recommended—but not mandatory)

  2. Then use the HSD Maintenance Port Utility to:

    •   Configure the Terminal Category (only required when the recommended hardware strapping is not used)

    •   Set Swift64 (M4) and Aero service priorities

    •   Change the LES Access Codes

    •   Reset the system to activate the new configuration.

(a) Step One: Honeywell System Configuration

Using the Honeywell SATCOM Direct CMT, obtain the antenna loss parameter and configure the High Rate Data Support settings.

The connection to the Honeywell SATCOM Direct CMT Port uses an RS-232 interface with any "VT-100" terminal emulator program. Configure your VT-100 terminal settings as follows: 9600 bps, no parity, 8 data bits, and 1 stop bit. Refer to Honeywell provided documentation for more information.

To configure the Honeywell System:

1. Obtain the HPA to Antenna Loss Parameter Value

    To maximize system performance, adjust the HPA-to-Antenna Loss parameter within the HSD system to accommodate the HPA to antenna loss from the Honeywell SDU.

    •   Using the Honeywell CMT, obtain the value of the HPA to antenna loss from the Honeywell SDU.

    •   Record the HPA to antenna loss value for future reference. Typically, the value is between 1.5 dB and 2.5 dB. Enter this antenna-loss value into the HSD system configuration using the HSD transceiver's Maintenance Port Utility Program.

2. Configure the High Rate Data Support Settings

    Usually, the High Rate Data Support parameters of the Honeywell SDU (Global Beam, High Rate Data and Spot Beam, High Rate Data) are configured to "DIS/EN" (disabled/enabled). Although not mandatory, setting both parameters to "disabled" is recommended.

(b) Step Two: Configuring the HSD Transceiver for HCM Mode

This section describes how to use the HSD Maintenance Port Utility to configure the HSD system parameters for operation in HCM Mode.

Refer to "Test and Fault Isolation" on page 4-1 for detailed instructions on how to connect to and use the HSD Maintenance Port Utility Program.

When all the required system parameters have been configured, the HSD must be "reset" to activate the new configuration. To configure the required system parameters first establish a connection to the HSD Maintenance Port Utility program:

•   Connect a computer to the maintenance port of the HSD transceiver as described in "Test and Fault Isolation" on page 4-1, and then power up the system.

•   Using a terminal emulation program, open the HSD maintenance utility program.

•   Type the password MAINT. (The password does not appear on the screen.)

The HSD Maintenance Port Utility Program menus appear. You are now ready to begin configuring the system parameters for HCM operation as described in the following sections.

1. Configuring the Terminal Category for Combined Mode

   If the HSD transceiver does not have the recommended hardware strapping for system configuration installed, configure the terminal category using the HSD Maintenance Port EEPROM parameters as described in the following procedure.

   To configure the Terminal Category:

   1. In **Menu 3**, to select misc. EEPROM parameters press **M**.

   The Miscellaneous Parameters list appears. The available parameters may differ depending on the version of control processor software installed.

```
MENU 3                            FIRMWARE Vx.x
L    list EEPROM                       S     list event log
M    misc.  EEPROM parameter           F     list call log
O    list ORT                          P     ocean region parameter
I    set all LES id's
<CTRL> N  next menu     <CTRL> O  previous menu    =  select reports

MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS      11  FRONT PANEL LEDS ENABLED
 2  FORWARD ID                     14  MAINTENANCE PORT INVERSE VIDEO
 3  GPS PROTECTION ALGORITHMS      15  MAINTENANCE PORT DEGREES SYMBOL
 4  REGISTRATION REQ'D BEFORE CALLS 16  TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS        17  VIPER ANTENNA GAIN

WHICH PARAMETER #  <CTRL> N for next page  ? 16
```

   2. To select the Terminal Category, type **16** and then press **Enter**.

   The Terminal Category Menu appears.

```
TERMINAL CATEGORY  HW STRAPPED VALUE
0=SAT906  1=STANDALONE  2=HW STRAPPING  3=MCS3000  4=MCS6000  5=MCS7000
6=MCS COMB  7=STANDALONE W/O ANTENNA  8=HCM COMBINED
9=COOPERATIVE ROCKWELL-COLLINS SAT906  10=OLD COMBINED MODE DEVELOP
11=HSD-X NETWORK 12=HSD-X NETWORK W/O ANTENNA 13=VIPER

NEW TERMINAL CATEGORY = ? 8
```

   3. Type **8** for HCM Combined and then press **Enter**.

   A system message appears stating that the EEPROM has been updated. This completes the configuration of the terminal category.

2. Configuring Antenna Loss

   To configure the Antenna Loss:

   1. In **Menu 3**, to select misc. EEPROM parameters, press **M**.

   The Miscellaneous Parameters list appears.

```
MENU 3                              FIRMWARE Vx.x
L    list EEPROM                    S     list event log
M    misc.  EEPROM parameter        F     list call log
O    list ORT                       P     ocean region parameter
I    set all LES id's
<CTRL> N  next menu     <CTRL> O  previous menu    =  select reports


MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS       11  FRONT PANEL LEDS ENABLED
 2  FORWARD ID                      14  MAINTENANCE PORT INVERSE VIDEO
 3  GPS PROTECTION ALGORITHMS       15  MAINTENANCE PORT DEGREES SYMBOL
 4  REGISTRATION REQ'D BEFORE CALLS 16  TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS         17  VIPER ANTENNA GAIN

WHICH PARAMETER #  <CTRL> N for next page  ? 1
```

2. To select the HPA Antenna Cable Loss parameter, type **1**

3. Press **Enter**.

The current value for HPA to antenna cable loss appears.

```
HPA-ANTENNA CABLE LOSS 2.5 dB = ?
```

4. Enter the "HPA to Antenna Cable Loss" value recorded from the Honeywell SDU, and then press **Enter**.

Note: The loss refers to the total loss from the HPA to the antenna, including the coax cable and the DLNA insertion loss (typically 0.8 dB maximum).

A system message appears stating that the EEPROM has been updated. This completes the configuration of the HPA to Antenna Cable Loss parameter.

3. Configuring Service Priority

The HSD system can be configured to give priority to either Aero H or M4 (HCM HSD Swif64) communications. The system default gives priority to Aero H communications.

If the HSD parameter is set to Aero priority, the SATCOM Aero H calls are given the priority for power consumption when HPA resources become limited. If the HSD parameter is set to M4 priority, M4 calls have priority when HPA resources become limited.

To configure the Service Priority:

1. In Menu 3, press **M** for misc. EEPROM parameters.

The Miscellaneous Parameters List appears.

```
MISCELLANEOUS PARAMETERS
1  HPA-TO-ANTENNA TOTAL LOSS        11   FRONT PANEL LEDS ENABLED
2  FORWARD ID                       14   MAINTENANCE PORT INVERSE VIDEO
3  GPS PROTECTION ALGORITHMS        15   MAINTENANCE PORT DEGREES SYMBOL
4  REGISTRATION REQ'D BEFORE CALLS  16   TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS         17   VIPER ANTENNA GAIN


WHICH PARAMETER #   <CTRL> N for next page  ?


18  VIPER HPA/ANT LOSS          31   OBEY OXCO STATUS
24  RECEIVER CALIBRATION        42   HCM AERO/M4 PRIORITIZATION
28  RX32 ACTIVE                 45   CATEGORY B LOWER FREQUENCY LIMIT
29  DEFAULT LATITUDE            46   CATEGORY B UPPER FREQUENCY LIMIT
30  DEFAULT LONGITUDE…….
WHICH PARAMETER #.? 42
```

> **2.** To select HCM Aero/M4 Prioritization, type **42** and then press **Enter**.
>
> The system prompts you to select a service priority.

```
HCM AERO/M4 PRIORITIZATION AERO  (1=M4  0=AERO)  = ? 0
 EEPROM UPDATED
```

> **3.** Set the service priority for the system as follows:
>
> - To select M4 services as the system priority, type **1** then press **Enter**.
>
> - To select Aero services as the system priority, type **0** (the number zero) then press **Enter** (as displayed in the example provided above).
>
> A system message appears stating that the EEPROM has been updated. This completes the configuration of service priority. You now need to configure the LES Access Codes.

(4) Configuring System Parameters for Selective Mode

This section describes how to use the HSD Maintenance Port Utility to configure the HSD system parameters for operation in Selective Mode.

Refer to "Test and Fault Isolation" on page 4-1 for detailed instructions on how to connect to and use the HSD Maintenance Port Utility Program.

When all the required system parameters have been configured, "reset" or cycle the power on the HSD to activate the new configuration.

To configure the required system parameters first establish a connection to the HSD Maintenance Port Utility program:

- Connect a computer to the maintenance port of the HSD transceiver as described in "Test and Fault Isolation" on page 4-1, and then power up the system.

- Using a terminal emulation program, open the HSD maintenance utility program.

- Type the password MAINT. (The password does not appear on the screen.)

The HSD Maintenance Port Utility Program menus appear. You are now ready to begin configuring the system parameters for Selective Mode operation as described in the following procedure.

(a) Configuring the Terminal Category for Selective Mode

If the HSD transceiver does not have the recommended hardware strapping for system configuration installed, the terminal category must be configured using the HSD Maintenance Port EEPROM parameters.

To configure the Terminal Category:

1. In **Menu 3**, to select misc. EEPROM parameters press **M**.

The Miscellaneous Parameters list appears. The available parameters may differ depending on the version of control processor software installed.

```
MENU 3                              FIRMWARE Vx.x
L    list EEPROM                        S    list event log
M    misc.  EEPROM parameter            F    list call log
O    list ORT                           P    ocean region parameter
I    set all LES id's
<CTRL> N  next menu     <CTRL> O  previous menu     =  select reports


MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS         11  FRONT PANEL LEDS ENABLED
 2  FORWARD ID                        14  MAINTENANCE PORT INVERSE VIDEO
 3  GPS PROTECTION ALGORITHMS         15  MAINTENANCE PORT DEGREES SYMBOL
 4  REGISTRATION REQ'D BEFORE CALLS   16  TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS           17  VIPER ANTENNA GAIN

WHICH PARAMETER #  <CTRL> N for next page  ? 16
```

2. To select the Terminal Category, type **16** and then press **Enter**.

The Terminal Category Menu appears.

```
TERMINAL CATEGORY  HW STRAPPED VALUE
0=SAT906  1=STANDALONE  2=HW STRAPPING  3=MCS3000  4=MCS6000  5=MCS7000
6=MCS COMB  7=STANDALONE W/O ANTENNA  8=HCM COMBINED
9=COOPERATIVE ROCKWELL-COLLINS SAT906  10=OLD COMBINED MODE DEVELOP
11=HSD-X NETWORK 12=HSD-X NETWORK W/O ANTENNA 13=VIPER

NEW TERMINAL CATEGORY = ? 3
```

3. Type the appropriate terminal category number required Selective Mode (0, 3, 4, 5, or 6), and then press **Enter**.

A system message appears stating that the EEPROM has been updated. This completes the configuration of the terminal category. You now need to configure the LES Access Codes as described on page 24.

(5) Configuring System Parameters for Multi-Channel Configurations

This section describes how to use the HSD Maintenance Port Utility to configure the HSD system parameters for operation in Multi-Channel Configurations.

Refer to "Test and Fault Isolation" on page 4-1 for detailed instructions on how to connect to and use the HSD Maintenance Port Utility Program.

When all the required system parameters have been configured, "reset" or cycle the power on the HSD to activate the new configuration.

To configure the required system parameters first establish a connection to the HSD Maintenance Port Utility program:

- Connect a computer to the maintenance port of the HSD transceiver as described in "Test and Fault Isolation" on page 4-1, and then power up the system.

- Using a terminal emulation program, open the HSD maintenance utility program.

- Type the password MAINT. (The password does not appear on the screen.)

The HSD Maintenance Port Utility Program Menu 1 appears. You are now ready to begin configuring the system parameters for Multi-Channel operation as described in the following sections.

(a) Configuring the Terminal Category for Multi-Channel

If the HSD transceiver does not have the recommended hardware strapping for system configuration installed, the terminal category must be configured using the HSD Maintenance Port EEPROM parameters.

To configure the Terminal Category:

1. In **Menu 3**, to select misc. EEPROM parameters press **M**.

   The Miscellaneous Parameters list appears. The available parameters may differ depending on the version of control processor software installed.

```
MENU 3                              FIRMWARE Vx.x
L    list EEPROM                         S    list event log
M    misc.  EEPROM parameter             F    list call log
O    list ORT                            P    ocean region parameter
I    set all LES id's
<CTRL> N  next menu     <CTRL> O  previous menu    =  select reports


MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS        11  FRONT PANEL LEDS ENABLED
 2  FORWARD ID                       14  MAINTENANCE  PORT  INVERSE VIDEO
 3  GPS PROTECTION ALGORITHMS        15  MAINTENANCE PORT DEGREES SYMBOL
 4  REGISTRATION REQ'D BEFORE CALLS  16  TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS          17  VIPER ANTENNA GAIN

WHICH PARAMETER #  <CTRL> N for next page  ? 16
```

2. To select the Terminal Category, type **16** and then press **Enter**.

   The Terminal Category Menu appears.

```
TERMINAL CATEGORY   HW STRAPPED VALUE
0=SAT906  1=STANDALONE  2=HW STRAPPING  3=MCS3000  4=MCS6000  5=MCS7000
6=MCS COMB  7=STANDALONE W/O ANTENNA  8=HCM COMBINED
9=COOPERATIVE ROCKWELL-COLLINS SAT906  10=OLD COMBINED MODE DEVELOP
11=HSD-X NETWORK 12=HSD-X NETWORK W/O ANTENNA 13=VIPER

NEW TERMINAL CATEGORY = ? 11
```

3. Type the appropriate terminal category number appropriate Multi-Channel Configuration (**11, 12, or 13**), and then press **Enter**.

A system message appears stating that the EEPROM has been updated. This completes the configuration of the terminal category. You now need to configure the LES Access Codes.

D. Configuring LES Access Codes (All Modes)

This section describes how to configure the LES access codes provided by your Inmarsat service provider in HSD and HSD-X transceivers.

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

(1) General Overview

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

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

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

New and upgraded HSD units, with Control Processor software version 5.7 or later, are shipped with the factory default LES Access Codes set to '0' (zero). All HSD units (including HSD-X units in Multi-Channel configurations) must be configured with the valid LES Access Codes provided by your Inmarsat Service Provider.

(a) Changing Default LES using the HSD Maintenance Port Utility Program

The LES access codes can be configured using the HSD Maintenance Port Utility Program accessed by connecting a computer running a VT100 terminal emulation program to the RS-232 Maintenance Port on the HSD (or HSD-X) transceivers (refer to "Test and Fault Isolation" on page 4-1 for connection settings and cabling information).

The LES access codes for HSD-X transceivers can either be configured directly, through the HSD-X RS-232 Maintenance Port, or by "passing through" the HSD-128 by activating the console mode feature. (To activate console mode, in menu 18, press X).

When configuring the LES access codes using the HSD Maintenance Port Utility, the application requests the input of a Secondary LES Access Code. At the time of writing, the Inmarsat LES have not implemented the recognition of the

secondary LES value in their systems. However, a valid Secondary LES Access Code must be entered in the HSD system. The Secondary LES Access Code must be the same as the Primary LES Access Code.

When operating HSD software version 5.7, **DO NOT** select the "Send line ends with line feeds" option in the terminal emulation program's ASCII Setup. (See example dialog box presented in Figure 2–3.) If this ASCII Sending option is selected, the LES Access Code entered in Menu 3 using the "P" command codes will not be updated or saved to EEPROM.
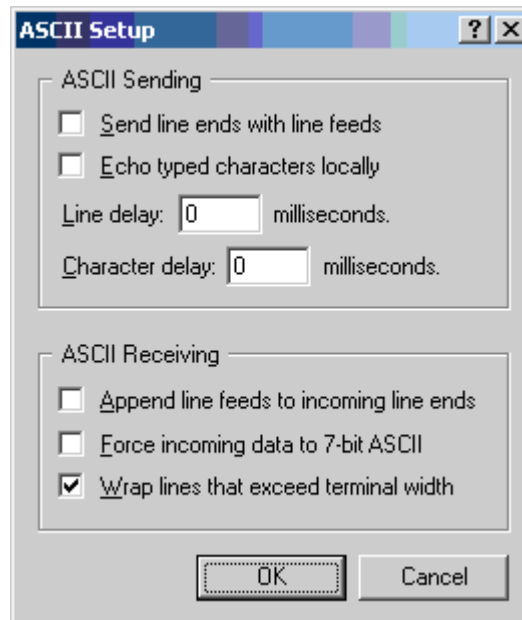
Figure 2–3. Terminal Emulation Program, ASCII Setup

HSD transceivers with earlier versions of control processor software (5.4 or earlier) are set with a factory default LES access code of 001. When installing and commissioning the HSD transceiver, change the factory-set default LES for each Ocean Region to the LES access codes provided by your Inmarsat Service Provider.

Table 2–6 provides LES access codes for the service providers providing Swift64 services at the time of publication. Contact Inmarsat directly for an up-to-date list of LES and Swift64 service providers.

For more information visit Inmarsat's Web site at www.inmarsat.com/swift64 or contact their Customer Care Service at:

Telephone: +44 20 7728 1777
Fax: +44 20 7728 1142
E-mail: customer_care@inmarsat.com

Table 2–6. Inmarsat Swift64 LES Status (As of January, 2004)

Ocean Region	Service Provider (LES)	Global LES Access Code	Service Status
AORE	Stratos Mobile Networks (Satcom Direct)	002	Swift64 – Low Speed Voice (LSV)/HSD (Secure LSV– future availability)
AORE	Xantic (Station 12)	012	Swift64 LSV/HSD
AORE	Telenor USA	001*	Swift64 LSV
AORW	Stratos Mobile Networks (Satcom Direct)	002	Swift64 – Low Speed Voice (LSV)/HSD (Secure LSV– future availability)
AORW	Xantic (Station 12)	012	Swift64 LSV/HSD
AORW	Telenor USA	001*	Swift64 LSV
IOR	Stratos Mobile Networks (Satcom Direct)	002	Swift64 – Low Speed Voice (LSV)/HSD (Secure LSV– future availability)
IOR	Xantic (Telstra)	022	Swift64 LSV/HSD
IOR	Telenor USA	001*	Swift64 LSV/HSD
POR	Stratos New Zealand (Satcom Direct)	002	Swift64 – Low Speed Voice (LSV)/HSD (Secure LSV– future availability)
POR	Xantic (Telstra)	022	Swift64 LSV/HSD
POR	Telenor USA	001*	Swift64 LSV

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

(b) Equipment Required

The following equipment is required to change the default LES access code in an HSD system (HSD or HSD-X transceivers):

* Computer (Laptop or PC)

* Windows 95® or later (Window 2000® recommended)

* HSD control processor software 4.1 or later

* Terminal emulation program (e.g. HyperTerminal)

(c) Connecting to the HSD Maintenance Port

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

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

The following procedure provides detailed instructions in how to change the LES default access code for HSD and HSD-X transceivers.

Note: This procedure provides instructions on how to change the HSD system default for LES selection. 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.

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 (022) used as an example only):

901 + LES CODE + International Code + Country Code + Area Code + Telephone Number + #
Example: 901 + 022 + 00 + 1+ 613+5551212 + #

(e) Changing LES access codes using control processor software version 5.4 (and earlier)

To change the HSD or HSD-X default LES access code in systems operating control processor software version 5.4 or earlier:

1. Connect a computer to the maintenance port of the HSD transceiver, and then power up system.

2. Using a terminal emulation program, open the HSD maintenance utility program.

3. Type the password MAINT. (The password will not appear on the screen.)

4. Press **Ctrl+N** (repeatedly) to scroll down to **Menu 3**.

Menu 3 appears.

```
MENU 3                              FIRMWARE Vx.x

L    list EEPROM                    S     list event log
E    reset EEPROM                   C     clear event log
M    misc.  EEPROM parameter        J     ignored faults
N    system serial number          F     list call log
G    clear call log
<CTRL> N  next menu      <CTRL> O  previous menu    =  select reports
```

5. For miscellaneous EEPROM parameters, press **M**.

The Miscellaneous Parameters list appears.

```
MISCELLANEOUS PARAMETERS
 1  HPA-ANTENNA CABLE LOSS              18  AOR E VALID BEAMS
 2  FORWARD ID                         19  POR VALID BEAMS
 3  AORW LES ACCESS CODE               20  IOR VALID BEAMS
 4  TERRESTRIAL NETWORK ID             21  AORE LES ACCESS CODE
 5  HPA-CHANNEL CARD CABLE LOSS        22  POR LES ACCESS CODE
 6  MAX HPA GAIN                       23  IOR LES ACCESS CODE
 7  MIN ANTENNA GAIN                   24  RECEIVER CALIBRATION (AERO)
 8  MAX EIRP                           25  MAX HPA POWER
 9  MAX CHANNEL_CARD POWER             26  HPA RESERVED POWER (AERO)
10  NUMBER OF CHANNEL CARDS            27  CHANNEL CARD STARTUP DELAY
11  FRONT PANEL LEDS ENABLED           28  RX32 ACTIVE
12  RX ATTENUATION (LAND-ON-WINGS)     29  DEFAULT LATITUDE
13  MIN SECS BETWEEN CHAN CARD RESETS  30  DEFAULT LONGITUDE
14  MAINTENANCE PORT INVERSE VIDEO     31  OBEY OXCO STATUS
15  MAINTENANCE PORT DEGREES SYMBOL    32  CC DEBUG PORT
16  TERMINAL CATEGORY               33  COMBINED MODE BACKOFF ADJUSTMENT
17  AOR W VALID BEAMS
WHICH PARAMETER # ?
```

6. Type in the parameter number for the Ocean Region LES access code you want to change (i.e. 3, 21, 22, or 23), and then press **Enter**.

The program prompts you to type in the LES access code.

7. Type in the Ocean Region LES access code, and then press **Enter**.

Note: You may change one or all of the LES defaults. Each must be entered separately. Refer to Table 2–6 for access codes of the LES service providers available at the time of publication. Contact Inmarsat directly for the most up-to-date service provider and LES access code information.

8. In each parameter, enter a valid LES access code as needed.

CAUTION: Do not change the Satellite Longitude parameter—press Enter to continue.

9. Reset the system. (In menu 2, press Z to reset the system, cycle the power to the HSD transceiver, or press the front panel "Test" button or the remote reset switch.)

Note: To activate the new default LES code(s) reset the system. If you change the default LES code(s), but do not reset the system, the system uses the "original" or previous default LES code(s)—even though the "new" LES codes appear in the MENU 3 EEPROM Listing—the new codes are activated (or loaded) when the system is reset or the power is cycled.

To confirm the activation of new LES access code after resetting the system:

1. In **Menu 3**, press **L**.

2. The EEPROM Listing appears. Confirm that the new LES access codes are displayed correctly. (*See* bolded parameters below.)

```
EEPROM LISTING:
    MAGIC NUMBER :OK
    EEPROM VERSION NUMBER 2001
    FIRMWARE VERSION 1018
SERIAL NUMBER: 114
IGNORED FAULTS: 0
HARDWARE CONFIG: 0
    NUMBER OF POWERUPS (index 0) 13
    HOURS OF OPERATION (index 0) 49
MISCELLANEOUS PARAMETERS
HIT 'L' for MORE
MISCELLANEOUS PARAMETERS
HIT 'L' for MORE
  HPA-ANTENNA CABLE LOSS:   2.5 dB
  FORWARD ID:   000000
  AORW LES ACCESS CODE:   1
  TERRESTRIAL NETWORK ID:   0
  HPA-CHANNEL CARD CABLE LOSS:   10.0 dB
  MAX HPA GAIN:   65.0 dB
  MIN ANTENNA GAIN:   11.0 dB
  MAX EIRP:   53.5 dBm
  MAX CHANNEL_CARD POWER:   0.0 dBm
  NUMBER OF CHANNEL CARDS :   2
  FRONT PANEL LEDS ENABLED:   1
  RX ATTENUATION (LAND-ON-WINGS):   0.0 dB
  MIN SECS BETWEEN CHAN CARD RESETS:   300
HIT 'L' for MORE
 MAINTENANCE PORT INVERSE VIDEO:   0
  MAINTENANCE PORT DEGREES SYMBOL:   0
  TERMINAL CATEGORY:    HW STRAPPED VALUE
  AOR W VALID BEAMS:   4 5 6
  AOR E VALID BEAMS:   5 6
  POR VALID BEAMS:   4 5 6
  IOR VALID BEAMS:   5 6
  AORE LES ACCESS CODE:    1
  POR LES ACCESS CODE:   1
  IOR LES ACCESS CODE:   1
  RECEIVER CALIBRATION (AERO):   11.0 dB
  MAX HPA POWER:   18.0 dBw
  HPA RESERVED POWER (AERO):   16.0 dBw
HIT 'L' for MORE
CHANNEL CARD STARTUP DELAY:   30 sec
  RX32 ACTIVE:    1
  DEFAULT LATITUDE:   45 D 0' 0.0" N
  DEFAULT LONGITUDE:   75 D 0' 0.0" W
  OBEY OXCO STATUS:   YES
  CC DEBUG PORT:  NONE
  COMBINED MODE BACKOFF ADJUSTMENT:   10.0 dB
CHECKSUM (stored at offset 462) 9695  OK
longest write cycle took 0 MSEC
```

(f)   Changing LES access codes using control processor software version 5.7 (or later)

To change individual LES access codes in systems operating software version 5.7 up to version 7.0:

1. Connect to the HSD-128 Maintenance Port.

2. Type the password *maint*

3. In **Menu 3**, press **P**.

4. Follow the application prompts and enter the LES access codes for each Ocean Region as provided by your service provider. A valid LES ID (LES Access Code) must be entered for all Ocean Regions. A valid LES ID number must also be entered for the Secondary LES parameter; the same LES Access Code as the Primary LES Access Code must be used.

   Note: Although at the time of writing the Inmarsat LES have not yet implemented the recognition the Secondary LES Access Code parameter in their systems, the HSD requires that a valid LES Access Code for the Secondary LES is entered in the configuration.

5. Using the "Console Mode" function in Menu 18, access each HSD-X installed on the system and configure the LES access codes as described above.

   CAUTION: Do not change the Satellite Longitude parameter—press Enter to continue.

(g) Changing LES access codes using control processor software version 7.0 (or later)

To change all of the LES Access Codes *simultaneously* to the same LES Access Code—available in systems operating software version 7.0 or later:

1. Connect to the HSD-128 Maintenance Port.

2. Type the password *maint*.

3. In **Menu 3**, press **I**.

4. Follow the application prompts and enter the LES access code. The Menu 3, I command configures the Primary and Secondary LES Access Codes for all of the Ocean Regions to the same LES Access Code.

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

5. Using the "Console Mode" function in Menu 18, access each HSD-X installed on the system and configure the LES access codes as described above.

E. 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.

F. Activating Configurations

After configuring the HSD system parameters, the HSD and HSD-X transceivers must be reset using one of the following methods:

• In **Menu 2**, press **Z** to reset the system;

• Cycle the power to the HSD, and if applicable, HSD-X transceiver(s); or,

- Press the reset or remote reset button on all HSD and HSD-X units installed in the system. (Not supported in Cooperative or Combined Mode systems.)

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

Note: In Multi-Channel configurations, the application prompts the user to select the specific units to reset as shown in the example screen below.

```
  MENU 2                            FIRMWARE Vx.x

A     set veh-relative azimuth        E     set veh-relative elevation
K     desired az veh-rel velocity     R     resume automatic steering
T     enter time of day               N     annotate log file
L     re-enter logon password         V     get firmware versions
Z     reset HSD-128                   S     set satellite longitude
<CTRL> N  next menu      <CTRL> O  previous menu    =  select reports
TERMINAL: HSD-X NETWORK MODE
HSD-X   (y/n) [n] ?
HSD   (y/n) [n] ?
```

- Press **Y** (for yes) to reset the HSD-X.
- Press **Y** (for yes) to reset the HSD.

The configuration values and parameters are now activated.

(1) Verifying Configurations

This section describes how to verify or refer to the HSD system configuration parameters.

To view the HSD ORT system configuration:

1. In Menu 3, press **O**.

    The List ORT appears.

2. Press **O** to scroll through the listing.

    To view the new system configurations select "List EEPROM" from Menu 3

1. In **Menu 3**, press **L**.

2. The List EEPROM appears. Press **L** to scroll through the listing.

G. Configuring System Parameters using the HSD Owner Requirement Tool

HSD transceivers operating version 7.0 (or later) control processor software and HSD-X transceivers operating control processor software 6.0, (or later) both support system configuration using the HSD ORT Tool (PN 1110-SW-1047). The HSD Owner Requirements Table (ORT) Tool application is available from EMS Technologies. Contact EMS SATCOM Product Support for more information.

The ORT Tool is a Windows-based program that is used to create and change system configuration disks or files for the HSD system. The configuration data files, created using the ORT Tool, are either loaded into the HSD and HSD-X transceivers via the RS-232 maintenance port interface using an HSD load program or loaded using the self-extracting option of the HSD ORT application.

The ORT Tool allows users to customize certain user-defined parameters in the HSD system such as:

- Satellite Data

- Service Provider Information

- LES Access Code selection

- Ethernet Configuration parameters (including IP Address information)

- Cable loss

The HSD ORT Tool has built-in help files that describe in detail the functionality of the tool. To access the help file, open the ORT Tool and click on **Help**.

(1) Creating an ORT using the HSD ORT Tool

This section describes how to create an HSD ORT file that can be loaded on to an HSD/HSD-X transceiver for configuration purposes.

Note: The ORT Tool and ORT procedures described in this document may differ from later versions of the ORT Tool. Click the ORT Tool **Help** button for up-to-date instructions.

Note: The HSD ORT Tool is a Windows-based program. Save the program file to either your desktop or in the program files directory of your computer before beginning.

To create an HSD ORT configuration file:

1. Double-click on the HSD ORT Tool Icon on your desktop or its filename in the appropriate directory on your computer.

   The HSD ORT Tool window appears.
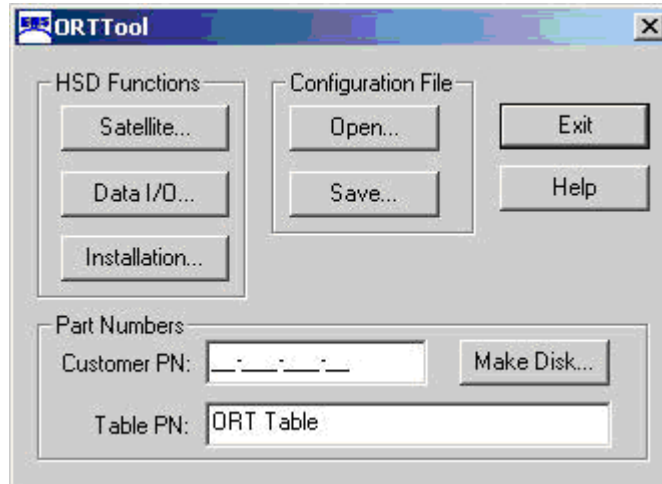
2. In the **Part Numbers** text boxes, type in a Customer PN (required) and Table PN (optional – default is ORT Table).

   Note: The Part Numbers are used to identify the ORT configuration file. The Customer PN is a required field because of ARINC Data Loader file requirements. If your organization does not require this information, fill in the field the Customer PN fields with any combination of numbers or letters.

   Note: The optional Table PN is a customer comment field displayed from within the equipment's maintenance menu; it is not a required field.

3. Click **Satellite**.

   The **Satellite Information** dialog box appears with system defaults showing in the satellite names and positions data fields.

4. In the satellite-location-information text boxes (Ocean Region, Index, Location, and Mnemonic), modify the data for a satellite (AORE, AORW, IOR, and POR) as required.

> **Note:** In the **Index** text box, type in a unique number from 0 to 7. This index value references the selected satellite entry's position with the unit's tables.

5. In the **Service Provider Information** text boxes:

- Leave the Terrestrial Network ID as the default value.

  > **Note:** Terrestrial Network ID specifies which telephone network to use; at the time of printing, the Terrestrial Network ID is not required and must be left as the default value.

- In the Primary HSD Service Provider text box type the valid LES access code of your primary Inmarsat Swift64 Service Provider.

- In the Secondary HSD Service Provider text box, enter the same LES access code of your secondary Inmarsat Swift64 service provider. The Primary and Secondary HSD Service Provider ID codes must be identical.

  > **Note:** In both the Primary and Secondary HSD Service Provider text box, enter a valid LES access code. Both the Primary and Secondary Service Provider fields may contain the same ID or LES access code as at the time of printing, the Inmarsat Network does not support Secondary Service Providers.

6. Modify the Satellite Information configuration by doing one of the following:

- Click **Add** to create a new entry in the satellite list field.

- Click **Remove** to delete selected satellite entries from the satellite list field.

- Click **Update** to change the data values of a satellite selected from the existing list (the selected satellite appears highlighted).

    Note: If the required data fields are not completed correctly, an error message appears indicating incomplete or incorrect field entries. Follow the instructions provided in the system error messages and re-try the step.

7. Repeat steps for each satellite that requires new or revised data.

8. Click **OK**.

    You return to the main dialog box of the HSD ORT Tool.

9. Click **Data I/O**.

    The **Data I/O Configuration** dialog box appears. The Data I/O dialog box has two, tabbed property sheets: **IP** and **PPPoE**.
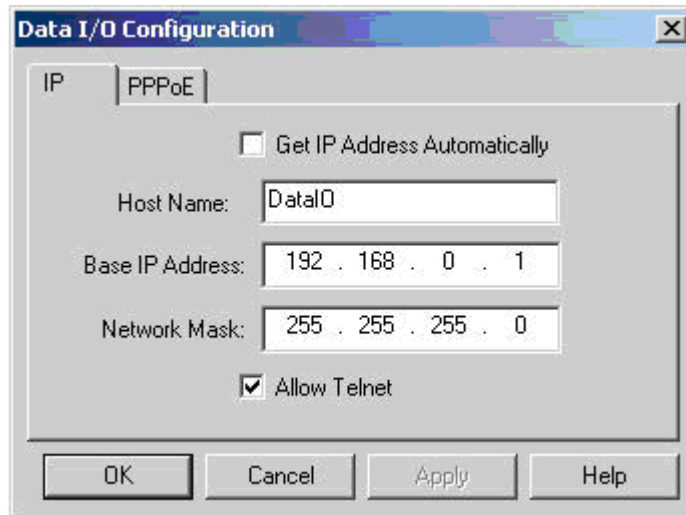
10. If applicable, select the **Get IP Address Automatically** check box.

    Note: If **Get IP Address Automatically** is selected, **BASE IP Address** and **Network Mask** data is not required.

11. If required, in the **IP** property sheet text boxes, enter the **IP** addressing information (**Host Name**, **Base IP Address**, and **Network Mask**) that applies to your system configuration.

12. If applicable, select the **Allow Telnet** check box.

    Note: Telnet provides remote monitoring and maintenance of devices using a password-protected, terminal-emulation-program session over TCP port 23 (the Telnet Port). Selecting the **Allow Telnet** check box enables remote access to the HSD using Telnet over the Ethernet port. Clearing the **Allow Telnet** check box disables this remote functionality.

13. Click the **PPPoE** tab.

The **PPPoE** property sheet appears.
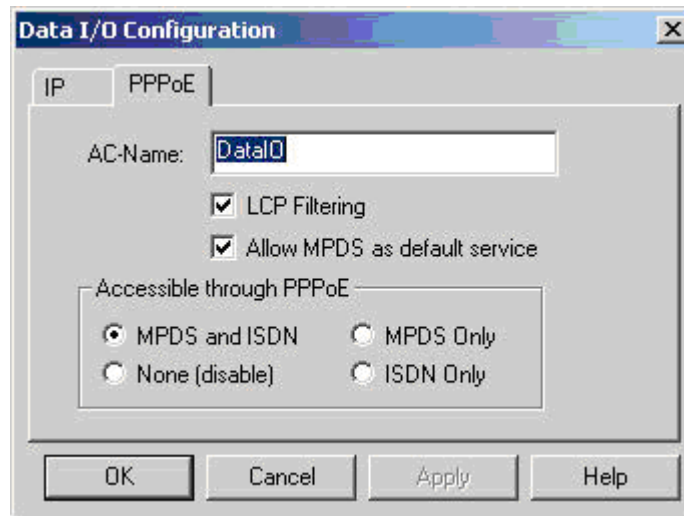
14. In the **AC-Name** text box (Access Concentrator Name), type the name of the Access Concentrator used by the PPPoE client to differentiate between multiple PPPoE devices.

> **Note:** The "**AC-Name**" is the "name of the HSD unit's Data I/O card" that is used to direct PPPoE communications to a specific Data I/O card of an HSD installed on a Local Area Network. When configuring Multi-Channel HSD systems, use the naming convention described in Table 2–7.
>
> The **AC-Name** is used to identify the Data I/O cards of HSD and HSD-X units installed on a Local Area Network. If the **AC-Name** text box is left blank, all of the installed HSD/HSD-X units will respond to a PC's request for a connection. With each unit specifically identified by a unique **AC-Name**, connections are managed through the controlled distribution of connection requests.
>
> Using the **AC-Name** to identify each unit's Data I/O card is particularly useful in the following reasons:
>
> • To direct communication traffic to a specific unit to leave the other units installed on the network free to handle different service types. For example, direct all MPDS traffic to a specific HSD-X unit so that the HSD transceiver channels are available for ISDN data or voice calls.
>
> • To specify the distribution of connections using the **AC-Name**, so that the connection requests are managed effectively to ensure faster and more efficient connection start ups.
>
> • In Multi-Channel HSD networks, to direct connection requests using the **AC-Name** identifier manages call requests so that multiple connection requests (from different computers on the network) are not sent simultaneously to the same unit, which could lead to call failure.

Table 2–7. DATA I/O Naming Convention for AC-Name

	HSD	HSD-X #1	HSD-X #2
AC-Name	DataIO (default)	DataIO-1	DataIO-2

15. Select or clear the **LCP Filtering** and **Allow MPDS** as default service check boxes as required.

16. In the **Accessible through PPPoE** field, select the appropriate service option (MPDS and ISDN, MPDS Only, None-disable, or ISDN Only).

17. Click **OK**.

    You return to the main screen of the HSD ORT Tool.

18. Click **Installation**.

    The Installation dialog box, **Signal Loss** tab sheet appears.
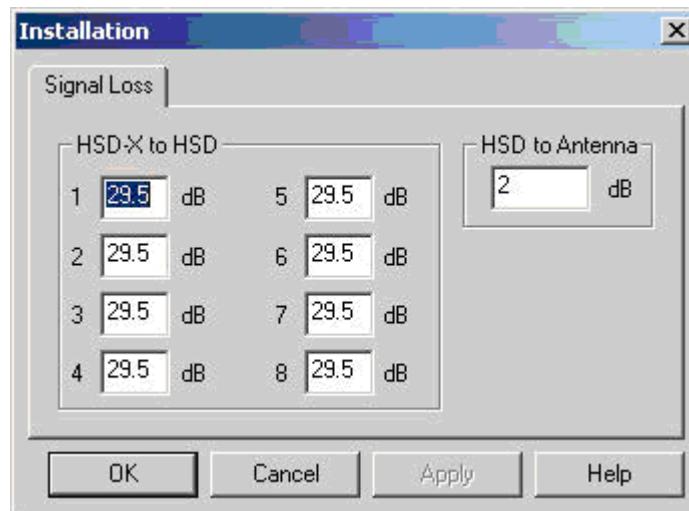
19. In the **HSD-X to HSD** text boxes, enter the **Signal Loss** values for each HSD-X unit installed in the HSD system.

    Note: The installer determines this value. Refer to "Installation" on page 3-1 for more information.

20. In the **HSD-to Antenna Loss** text box, enter the installation-specific HSD to Antenna Loss value.

    Note: The installer determines this value (minimum of 1 dB and maximum of 2.5 dB).

21. To exit the **Installation** dialog box and return to the main **ORT Tool** menu, click **OK**. Clicking **OK** applies the all changed or left as default values in the **Installation** dialog box, **Signal Loss** tab fields.

(2) Saving the ORT file

To save the ORT file:

1. Click **Save**.

A **Save as** dialog box appears.

> **Note:** Save a copy of the configuration file for back up and future reference.

2. In the File name text box, type the name of the configuration file.

3. Click **Save**.

You return to the main screen of the HSD ORT Tool.

(3) Loading the ORT

To create a disk to load the ORT:

1. Click **Make Disk**.

> **Note:** If the configuration file is incomplete or contains invalid data, an error message appears.

If an error message appears:

- Ensure that all required fields have valid data entered
- Save the configuration file
- Click **Make Disk** again

The Select contents dialog box appears.
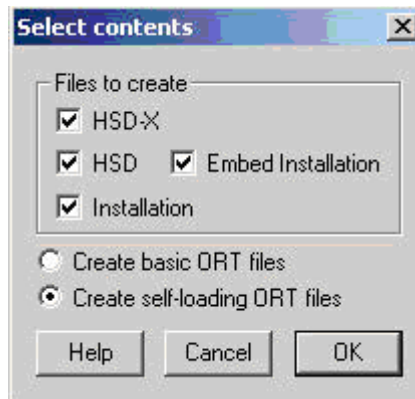
The **Files to create** area of the **Select contents** dialog box contains four file creation options. The Select contents dialog box also provides two options for creating files: basic ORT files and self-loading ORT files. All of the **Select content** options are described in Table 2–8.

Table 2–8. Description of *Select Contents* Dialog Box Options

Option	Description
☑ HSD-X	Selecting the **HSD-X** option creates an ORT file for HSD-X transceivers. The format of the basic file is HSDX.ORT. The format for a self-loading file is HSDXORT.exe.
☑ HSD	Selecting the **HSD** option creates an ORT file for HSD transceivers. The format of basic file is HSD.ORT. The format of a self-loading file is HSDORT.exe.
☑ Installation	Selecting the **Installation** option creates an ORT files containing the installation configuration information. This file is loading into the HSD transceiver only. The format of a basic installation file is INST.ORT. The format for a self-loading file is INSTORT.exe.
☑ Embed Installation	Selecting the **Embed Installation** option includes the Installation configuration data in the HSD ORT file. Use this option to create a single, HSD ORT file that contains both the HSD ORT and **Installation** configuration files so that they do not have to be loaded separately.
⦿ Create basic ORT files	Selecting the **Create basic ORT files** option generates ORT files that are loading using the HSD Software Load Application, ADT_LOAD.exe (PN 1110-SW-1021).
⦿ Create self-loading ORT files	Selecting the **Create self-loading ORT files** option generates ORT files that are self-loading, executable files that contain the ORT configuration data.

The system prompts you to select a destination.

2. Select the appropriate destination to create the disk, and then click **OK**.

   The HSD ORT Tool creates the disk copy of the configuration file. A message appears confirming that the disk has been created successfully.

3. After completion of making the disk, click **Exit** to close the ORT Tool.

   After completing the configuration of the ORT, load the ORT disks to each HSD or HSD-X unit as described in the next section.

(4) Loading ORT Files

This section describes how to load both basic and self-loading ORT files.

(a) Loading Self-loading ORT Files

Self-loading ORT files have the HSD software load application embedded in the file. Self-loading ORT files are executable. Opening the file executes the software load application.

To load self-loading ORT configuration files onto an HSD or HSD-X unit:

1. Remove power from the system.

2. Connect a computer to the maintenance port of the HSD or HSD-X (Refer to "Test and Fault Isolation" on page 4-1 for cabling and connection details.)

3. Turn on the computer.

4. Apply power to the unit.

5. Close all other applications running on the computer (especially programs that use the serial COM port, e.g. HyperTerminal). The ORT load program may not execute successfully if other programs are running.

6. Open the self-loading ORT configuration file.

The ORT Loader application window appears.
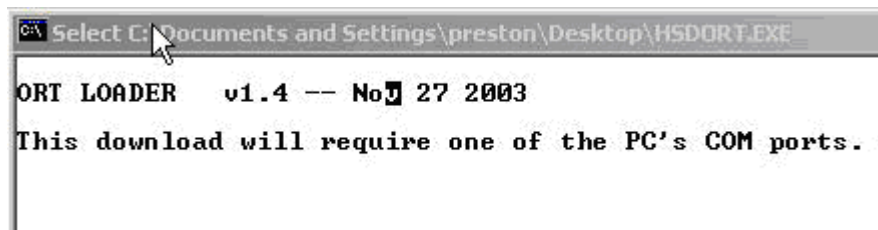
7. To load the self-loading, ORT configuration files, follow the directions as indicated by the ORT Loader application.

The ORT Loader application loads the software to the unit connected to the computer via the selected COM port. When the software load is complete, the window closes.

(b) Loading Basic ORT Files

When loading a basic ORT file that does not have the self-loading application embedded, load the file using the HSD serial loader, ADT_LOAD.exe (PN 1110-SW-1021).

Note: HSD ORT configuration files must be loaded into the HSD transceiver. HSD-X ORT configuration files must be loaded into each of the Multi-Channel HSD-X units installed on the system. The IP addresses are automatically incremented.

To load basic ORT configuration files onto an HSD or HSD-X unit:

1. Remove power from the system.

2. Connect a computer to the maintenance port of the HSD or HSD-X (Refer to "Test and Fault Isolation" on page 4-1 for cabling and connection details.)

3. Turn on the computer.

4. Apply power to the unit.

5. Close all other applications running on the computer (especially programs that use the serial COM port, e.g. HyperTerminal). The load program may not execute successfully if other programs are running.

6. Start the HSD Software Load program (ADT_LOAD.exe) to launch the load program.

   A DOS window opens displaying the "Load Target" menu; it shows a number of load selection options.

```
HSD/HST LOADER   Vx.x -- Mon Mar 24 12:12:17 2003
which target ?
  0 = control processor
  1 = channel card #1
  2 = channel card #2
  3 = HPA application
  4 = data i/o card
  5 = HPA application with manual setup
  6 = HPA application plus boot with manual setup
  7 = HPA application plus boot
  8 = channel card #1 boot code
  9 = channel card #2 boot code
 11 = channel card #1 pic code
 12 = channel card #2 pic code
 13 = HCM application
 14 = HST ORT
 15 - HSD ORT
 16 - HSD-X ORT
?
```

7. From the "Which Target" menu:

   • Type "**15**" to load the ORT file to an HSD unit.

   • Type "**16**" to load the ORT file to an HSD-X unit.

8. Press **Enter**.

   The load application prompts you to type in a filename.

9. Type the appropriate filename for the software being loaded to the unit, and then press **Enter**.

   The application prompts you to select a COM port.

10. Select the COM port on your computer connected to the HSD.

11. Type the appropriate COM port (1 or 2—typically 1), and then press **Enter**.

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

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

```
HSD/HST LOADER   Vx.x – [Date]
which target ?
   0 = control processor
   1 = channel card #1
   2 = channel card #2
   3 = HPA application
   4 = data i/o card
   5 = HPA application with manual setup
   6 = HPA application plus boot with manual setup
   7 = HPA application plus boot
   8 = channel card #1 boot code
   9 = channel card #2 boot code
   11 = channel card #1 pic code
   12 = channel card #2 pic code
   13 = HCM application
   14 = HST ORT
   15 = HSD ORT
   16 = HSD-X ORT
?  File name which contains the firmware image? This download will require
one of the PC's COM ports. (1, 2, etc) [1] ?
Connect COM1 of this PC to the maintenance port of the data terminal.
Hit <ESC> to abort, or <ENTER> to proceed
Establishing communication to the data terminal -- DO NOT CYCLE THE POWER!!
Hit ESC to abort.
DATA TERMINAL APPARENTLY READY TO ACCEPT PROGRAM
switching to 57.6 kbaud
loading c:\ort\hsd.ort
 67% 100%
DATA TRANSFER COMPLETE -- 0 SECONDS
dio state 1DATA TRANSMITTED: 1506 BYTES  CHECKSUM = 13D9FHSD/HST LOADER
Vx.x – [Date]
```

4. Using the HSD System

This section describes how to place voice and fax calls using the ISDN interface of the HSD SATCOM system.

A. Placing Voice and Fax Calls

Placing voice and fax calls using the HSD system are similar to placing an international telephone call or entering a telephone number for dial-up networking data calls. Like international telephone numbers, the HSD "dialing-number-sequence" includes different "routing" components or codes. Figure 2–4 illustrates the required order of the dialing components.
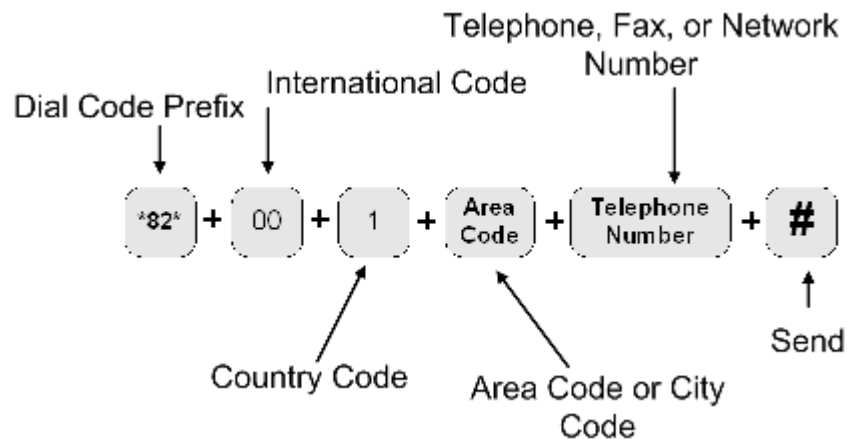
Figure 2–4. HSD Dialing-Sequence Components

Each dialing sequence component serves a different routing function:

- Dial Code Prefix:

  Use service-specific dial code prefixes when sending fax or using analogue modems, or for overriding system defaults to force the system to request a specific service type. The illustration uses the dial code prefix for 3.1 KHz audio service type (*82*). (See Table 2–9.)

- International Access Code:

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

- Country Code:

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

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

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

- **#** (SEND):

    Pressing # (or entering # at the phone number field on data devices) signals the system to "send" the call. Certain devices using the HSD system may not have the functionality to insert the # symbol at the end of the dialing sequence. For those devices, additional Dial Code Prefixes are required to override the "send" command requirement. Refer to Table 2–10 for more information.

Note: For more information on using the HSD transceiver for voice and fax, refer to the HSD User Guide (MN-1110-10048).

(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 fax, identify an analogue modem, or force the system to override the system defaults to select a specific service type. (See Table 2–9.)

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

   Other Dial Code Prefixes provide system overrides required if you are using either devices that cannot add a # symbol to the dialing string or devices that are slow dialing. Table 2–10 provides a description of the additional Dial Code Prefixes used for system overrides. Table 2–6 provides a list of the LES and their associated codes available.

Table 2–9. 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*
3.1 kHz audio	Fax, Analogue Modem, STU-III	*82*
56 kbps data	High-Speed Data	*83*
64 kbps data	High-Speed Data	*84*
4.8 kbps speech	Mini-M Voice (Swift64 Low Speed Voice)	*80*

Table 2–10. 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 *Table 2–6*.)	901 + LES CODE	901 + LES CODE + International Code + Country Code + Area Code + Telephone Number + # 901 + 002 + 00 + 1+ 613 +5551212 + #
Use with devices that cannot produce or add a "# "character to end the dialing sequence. This Dial Code Prefix signals the system to send the call after a specified delay in user input when the # symbol 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 "# "character to end the dialing sequence. This Dial Code Prefix signals the system to send the call after a specified delay in user input.	903	903 + International Code + Country Code + Area Code + Telephone Number 903 + 00 + 1+ 613 + 5551212

Note: When using the System Override Dial-Code-Prefixes **do not** press "✱" before or after the Dial Code Prefix as with other dial code prefixes.

(2) Mobile-to-Mobile Communication

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

Using mobile-to-mobile calling requires additional information. You need to know the IMN of the device or service on the aircraft you are calling. If your service provider does not support Inmarsat's Single Network Access Code (SNAC) 870, you also need to know which Satellite Ocean Region that the aircraft you are calling is logged on to. Table 2–11 lists the SNAC code and the Satellite Ocean Regions Region Numbers.

Table 2–11. Satellite Ocean Region Codes

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

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

Figure 2–5 illustrates the Mobile-to-Mobile dialing sequence.
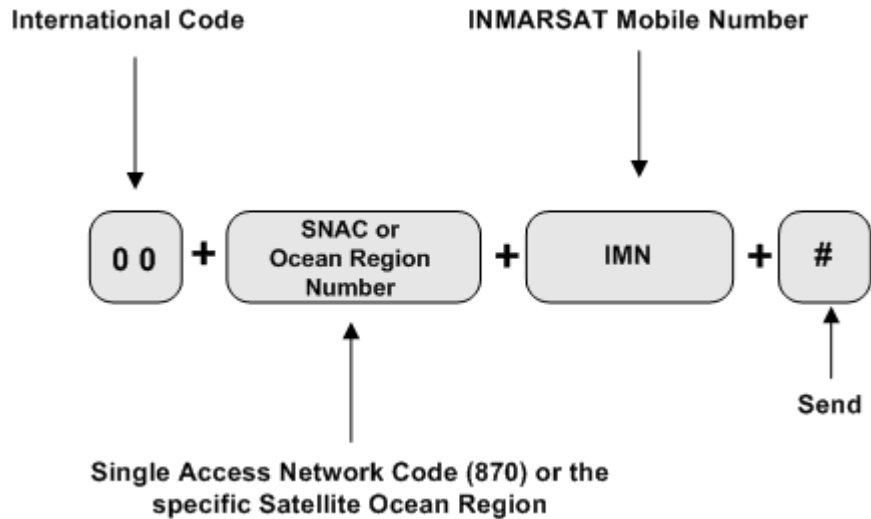
Figure 2–5. Mobile-to-Mobile Dialing Sequence

B. Using Data Connections

This section provides a basic overview of the requirements for making data connections using the HSD transceiver. Refer to the HSD Transceiver User's Guide (MN-1110-10048) for detailed instructions on creating and configuring HSD dial-up networking connections.

(1) Mobile ISDN versus MPDS

Deciding which service type to use depends how you intend on using your data connections.

For surfing the Web (with high turnover of pages and graphics), video conferencing, video streaming, and large file transfers, Mobile ISDN is faster and more efficient. However, service charges for Mobile ISDN are time-based (based on the length of your total connection time).

MPDS provides a cost-effective solution for user applications that involve intermittent interaction or transmission of data, such as e-mail, database queries, and connectivity to IP/LAN and intranets.

MPDS also has an "always on" advantage over Mobile ISDN. Service charges for MPDS are based on the number of data bits transmitted over the system—not on the length of your connection time.

(2) Connecting to Inmarsat Mobile ISDN Service

The transmission of data over satellite networks differs from land-based ISDN applications. Factors inherent in satellite communications (signal fading, latency, and transmission blockages) can cause data transit delays and bit errors.

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

ISDN protocols are not designed specifically for use over satellite communication networks. To improve data transfer rates most ISDN protocols require minor adjustments. For best results, consider how the ISDN protocol you intend to use sends data over the network. Adjust the configuration taking into account the unique operating environment of satellite network communication.

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

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

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

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

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

When choosing an ISDN protocol for satellite ISDN networks, consider a flexible solution that allows for modifications to the operating parameters to suit the unique environment of satellite communications.

Both the HSD ISDN and Ethernet interfaces support connections to Inmarsat's Mobile ISDN service. Ethernet is available for HSD transceivers, PNs 1110-A-0150 and 1110-A-0160 and HSD transceivers with Service Bulletin 1110-SB-0004 accomplished. All HSD-X transceivers support the Ethernet interface.

(a)   Using the ISDN Interface

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

- A EURO ISDN terminal adapter or router

- An account with an Inmarsat Service Provider

- A computer

- Dial-up Networking capabilities

The following sections describe the three main components required for Swift64 Mobile ISDN service using the ISDN interface (terminal adapters – ISDN modems, ISDN protocols, and ISDN line).

1. Terminal Adapters—ISDN Modem

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

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

2. ISDN Protocols

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

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

3. ISDN Line

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

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

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

(b) Using the Ethernet Interface for Inmarsat Mobile ISDN

   HSD transceivers with a Data I/O Type 2 Card (PNs 1110-A-0150, 1110-A-0160 and HSD transceivers with service bulletin 1110-SB-0004 accomplished) and all HSD-X transceiver extensions support the Ethernet interface.

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

   • A PPPoE compatible router—optional devices (e.g. routers) must be PPPoE compatible

   • An account with an Inmarsat Service Provider

   • A computer with PPPoE driver installed—a PPPoE driver is the protocol most commonly used by Digital Subscriber Line (DSL) devices; it establishes the connection of the session and the exchanges of PPP frames over Ethernet.

   • Dial-up Networking capabilities

(3) Connecting to Inmarsat MPDS

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

   (a) Using the RS-232 Interface

   To make an MPDS connection using the HSD RS-232 port requires the following:

- An RS-232 cable (Asynchronous Serial)

- An activated account with an Inmarsat Service Provider that supports MPDS services

- A computer with an available COM port

- Dial-up Networking capabilities

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

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

(b) Using the Ethernet Interface

HSD transceivers with a Data I/O Type 2 Card (PNs 1110-A-0150, 1110-A-0160 and HSD transceivers with service bulletin 1110-SB-0004 accomplished) and all HSD-X transceiver extensions support the Ethernet interface.

Connections using MPDS over the HSD Ethernet port require the following:

- A Point-to-Point Protocol over Ethernet (PPPoE) driver installed—a PPPoE driver is the protocol most commonly used by Digital Subscriber Line (DSL) devices; it establishes the connection of the session and the exchanges of PPP frames over Ethernet.

- An activated account with an Inmarsat Service Provider that supports MPDS services

- A computer with an Ethernet port

- Dial-up Networking capabilities/Web browser

- Optional devices (e.g. router) must be PPPoE compatible

(c) Optimizing the System for MPDS

To optimize your system for MPDS:

- Reduce the amount of unnecessary traffic. Ensure that the router configuration disables unnecessary Local Area Network (LAN) messages.

- Increase the window size in TCP/IP.

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

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

To optimize your e-mail client when using MPDS:

- Compress attachments (zip files)

- Under Tools, in the Options of your e-mail client (e.g. Outlook®, Eudora®) customize the settings for MPDS based on the recommendations below:

  • Disable the read receipt option

  • Send messages in text format not in HTML format and disable signatures to reduce message size

  • Disable the "automatic download of message when in viewing panel" feature

  • Increase the time period for automatic mail checks to reduce traffic

  • Use IMAP4 mail protocol to allow for header retrieval only

  Note: Disable the "Save copy of send messages in the 'Sent Items' folder" option.

(4) Bonding Channel Cards in Two-Channel Card Systems

This section provides, as an example, detailed instructions on how to make bonded calls with a two-channel card HSD transceiver using a DIVA T/A ISDN modem.

Bonded calls are possible with HSD transceivers that have two channel cards installed. Bonded calls utilize both 64 kbps channels to provide a single 128 kbps data channel. The terminal adapter or router places two separate calls to combine the data transfer over both channels.

Although bonded calls provide a single 128 kbps channel, the actual link capacity is application and protocol dependant. Throughput on a Multilink PPP TCP/IP connection is typically 80 to 90 % of the link capacity (running Windows 2000®).

The system can only make internally bonded calls if both channels are available. If another device is using one of the B Channels, then the data call proceeds—but as a single channel call.

If a bonded call is in progress, (using both B channels) the system is busy and denies all other calls until a channel is free.

In Multi-Channel configurations, the HSD transceiver channel cards cannot be internally bonded together with the HSD-X channel cards installed on the system; however, a Multi-Channel configuration, that includes an HSD-128 and two HSD-X extensions, is capable of up to 256 kbps data throughput—with the help of an external device such as a router or Ethernet hub.

(a) Bonding HSD Channel Cards using the ISDN Interface

If the HSD Transceiver has two channel cards, bonded calls provide the potential for higher throughput. For bonded calls, configure the terminal adapter and connections to use Multilink PPP as the protocol.

Note: Not all Internet service providers support Multi-link PPP. Contact your service provider for more information.

If a bonded call is in progress, (using both B channels) the system is busy and denies all other calls until a channel is free.

The following is an example of a configuration for bonded calls using a DIVA T/A for illustration purposes only. Other manufacturers' terminal adapters may require different or more complex configurations to configure the system for bonded calls.

1. Using HyperTerminal, connect to the Terminal Adapter EURO ISDN modem.

2. Type AT@MENU.

   The following screen appears.
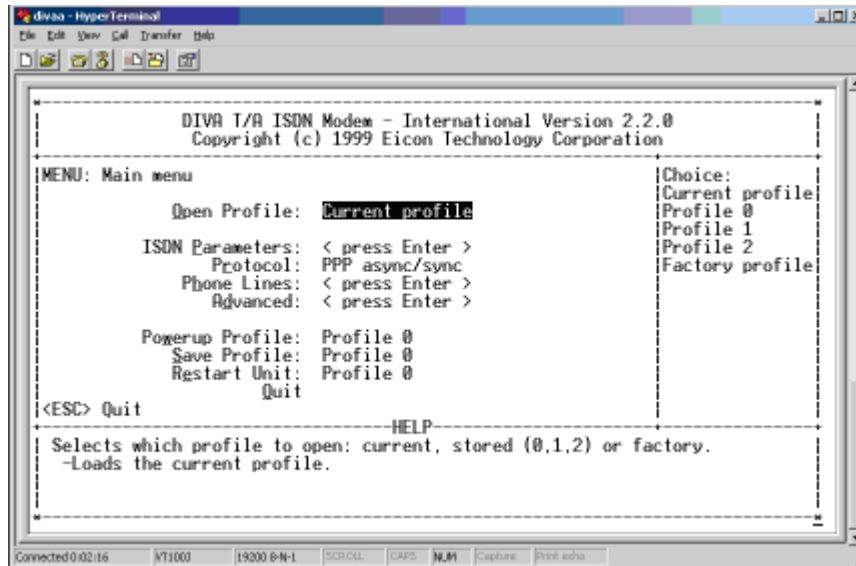
3. In the protocol field, select **Multilink PPP**.

   The protocol field now shows Multilink PPP as the selected protocol.

```
divaa - HyperTerminal                                                    _|□|×|
File  Edit  View  Call  Transfer  Help

 +------------------------------------------------------------------------+
 | --------------------------------------------------------------------   |
 | | DIVA T/A ISDN Modem - International Version 2.2.0             |     |
 | | Copyright (c) 1999 Eicon Technology Corporation              |     |
 | +-------------------------------------------------------+-----------+  |
 | |MENU: Main menu                                        |Choice:    | |
 | |                                                       |PPP async/sync| |
 | |        Open Profile:  Current profile                 |Multilink PPP | |
 | |                                                       |V.120      | |
 | |      ISDN Parameters: < press Enter >                 |V.110      | |
 | |            Protocol:  Multilink PPP                    |Trans. HDLC| |
 | |         Phone Lines:  < press Enter >                 |           | |
 | |            Advanced:  < press Enter >                 |           | |
 | |                                                       |           | |
 | |      Powerup Profile: Profile 0                       |           | |
 | |        Save Profile:  Profile 0                       |           | |
 | |        Restart Unit:  Profile 0                       |           | |
 | |                 Quit                                  |           | |
 | |<ESC> Quit                                             |           | |
 | +--------------------------------HELP-------------------+-----------+  |
 | | Sets the protocol to use for the ISDN connection.                 |  |
 | |  -Multilink PPP asynchronous to synchronous.                      |  |
 | |     Don't forget to configure the number for both channels        |  |
 | |     in ISDN parameters.                                           |  |
 | --------------------------------------------------------------------   |
 +------------------------------------------------------------------------+
Connected 0:03:39   VT100J   19200 8-N-1   SCROLL  CAPS  NUM  Capture  Print echo
```

4. When prompted, select "yes" to save the profile and then reboot your computer.

5. Using the AT@ MENU command, confirm the settings are correct.

    The Terminal Adapter is now configured to place bonded Multilink calls.

    Note: If you are dialing a EURO ISDN phone number or a North American ISDN number that has a "HUNT" group assigned, then no changes are required to the Dial-up networking setup of the user's computer.

The following screen illustrates a dial-up networking connection with a "HUNT" group assigned. If a "HUNT" group number is not available, other phone numbers may be used.

Connect Dial-up Connection

User name: user

Password: ✱✱✱✱✱✱✱✱✱

☐ Save password

Dial: 0016135551212# & 0016135551213#

| Dial | Cancel | Properties | Help |
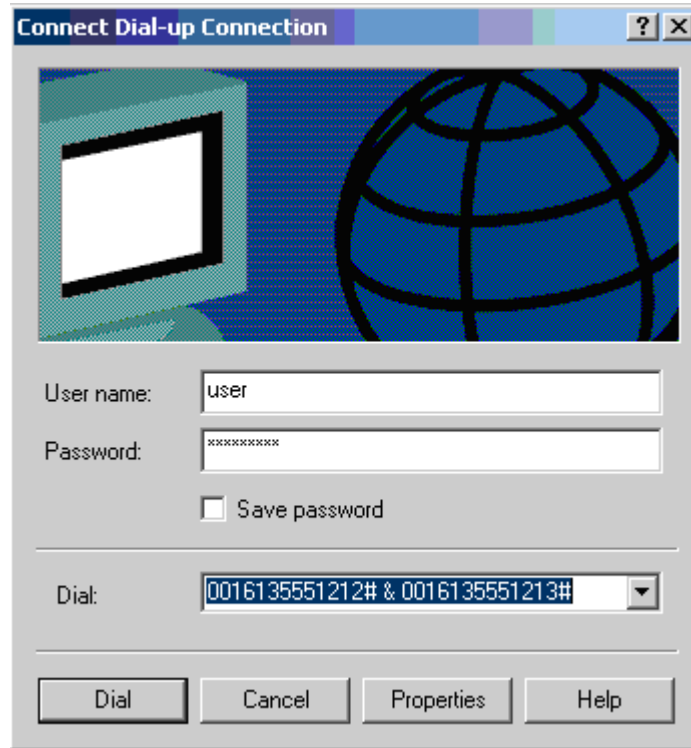
Note: If you are dialing a North American ISDN number, both Service Profile Identifier ISDN (SPID) numbers must be included in the dial-up networking connection to place Multilink calls.

To configure the dial-up connection to include both SPID numbers, type in both numbers separated by the "&" symbol.

The following screen illustrates the configuration of a Multilink connection to a North American number.
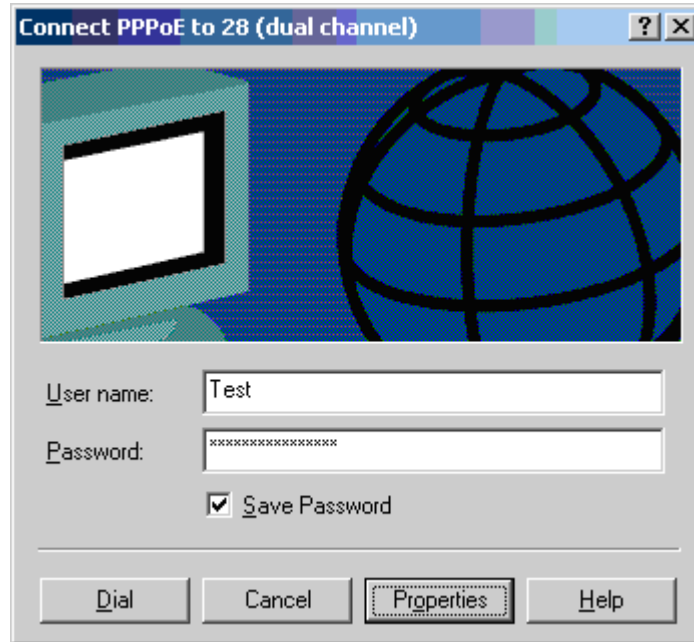
(b) Bonding Channel Cards using the Ethernet Interface for Mobile
      ISDN Service

HSD transceivers with a Data I/O Type 2 Card (PNs 1110-A-0150, 1110-A-0160
and HSD transceivers with service bulletin 1110-SB-0004 accomplished) support
the bonding of two channel cards using the HSD Ethernet interface to access
Swift64 Mobile ISDN.

To access Swift64 Mobile ISDN services over the Ethernet interface using a bonded two-channel-card connection

1. Create a new dial-up networking connection for two-channel Ethernet ISDN.
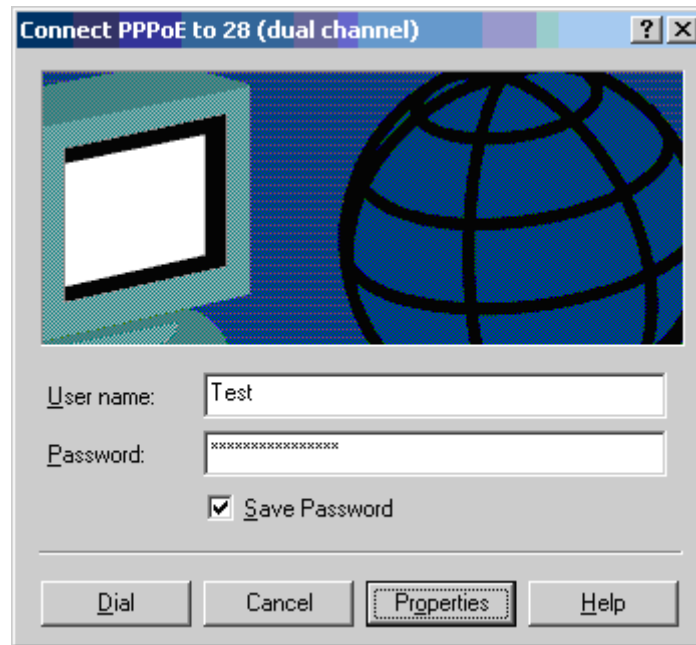
2. Double-click on the connection and select properties.

The **PPPoE Properties** Dialog box appears.
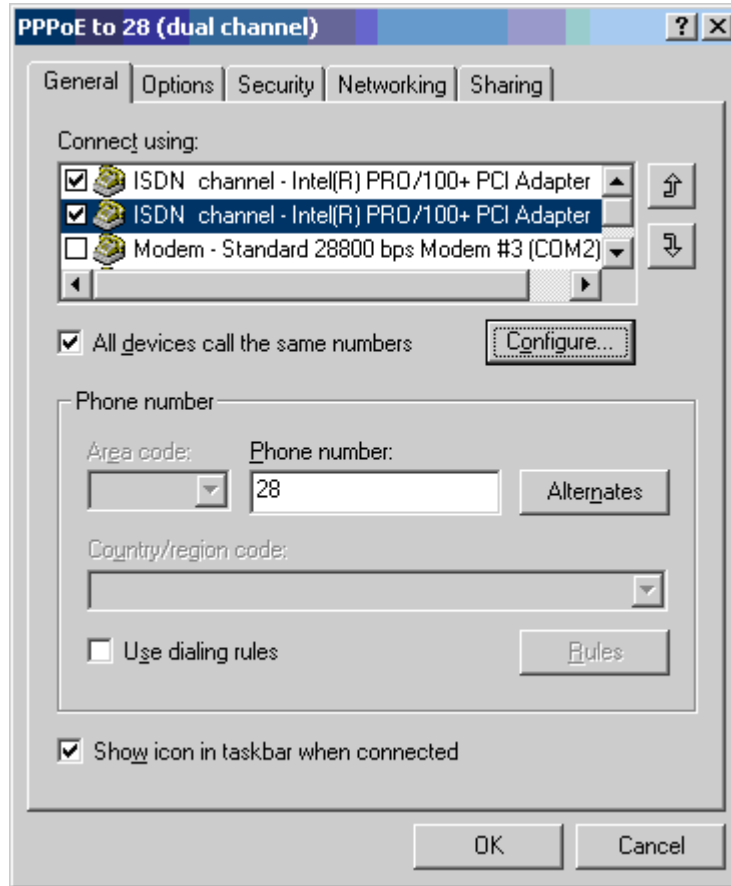
3. From the **Connect using** list, select both available ISDN channels.

4. Select **All devices call the same number**.

5. Click **Configure**.

    The **ISDN Configure** dialog box appears.
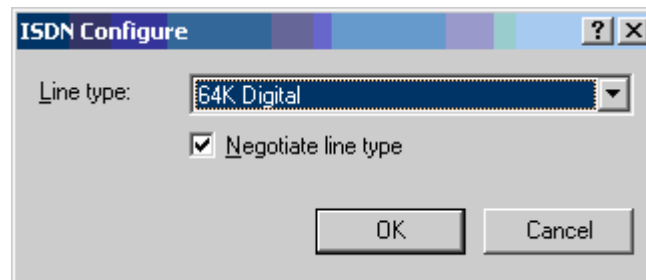
6. Select **64K Digital** as the **Line type**.

7. Select **Negotiate line type**.

8. Click **OK**.

9. Click on the **Options** tab.

   The Options tab sheet appears.

10. From the **Multiple Devices** list select **Dial all devices** and then click **OK**. (**Display progress while connecting** and **Prompt for name and password, certificate, etc**, and **Redialing options** are optional.)

11. Click the **Security** tab.

12. In **Security options**, select **Typical recommended settings and Allow unsecured password**.

13. Click **OK**.
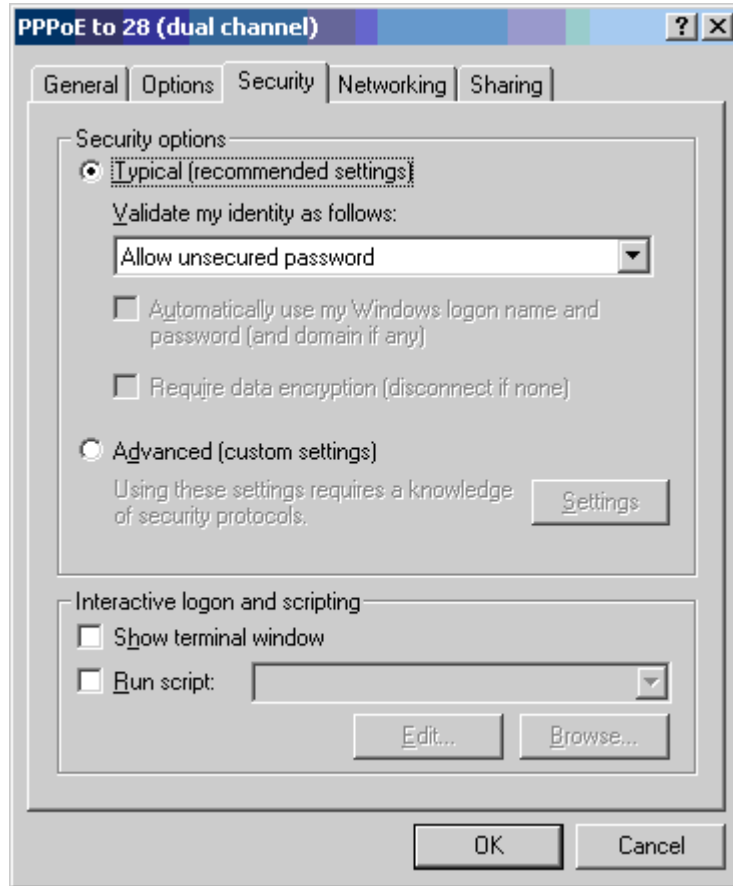
14. Click the **Networking** tab.

The Networking tab sheet appears.
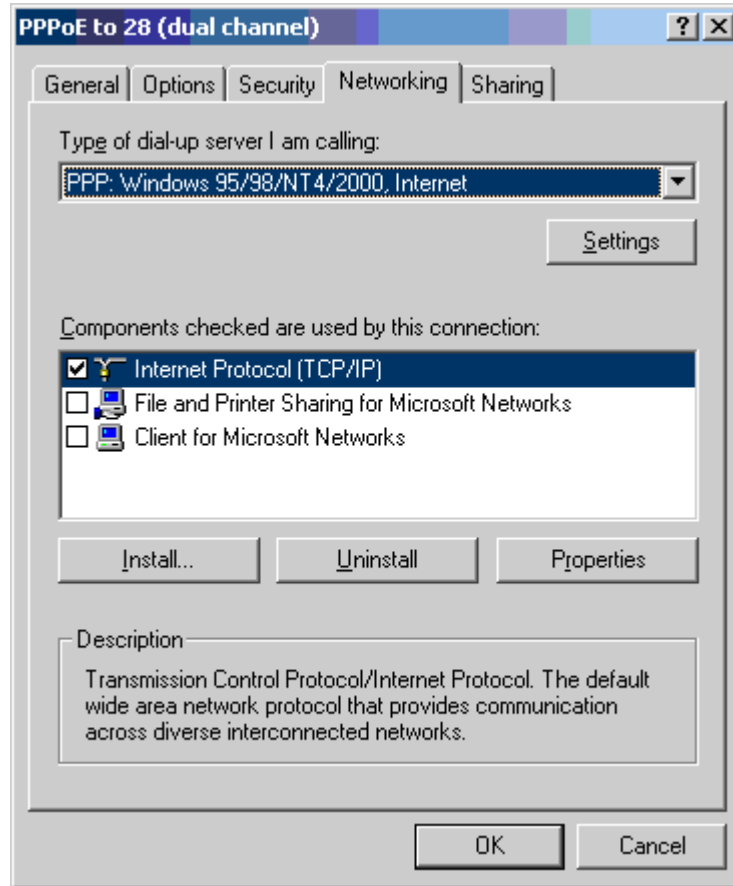
15. Select the **Internet Protocol TCP/IP**.

16. Click **Properties**.

The **Internet Protocol** dialog box appears.
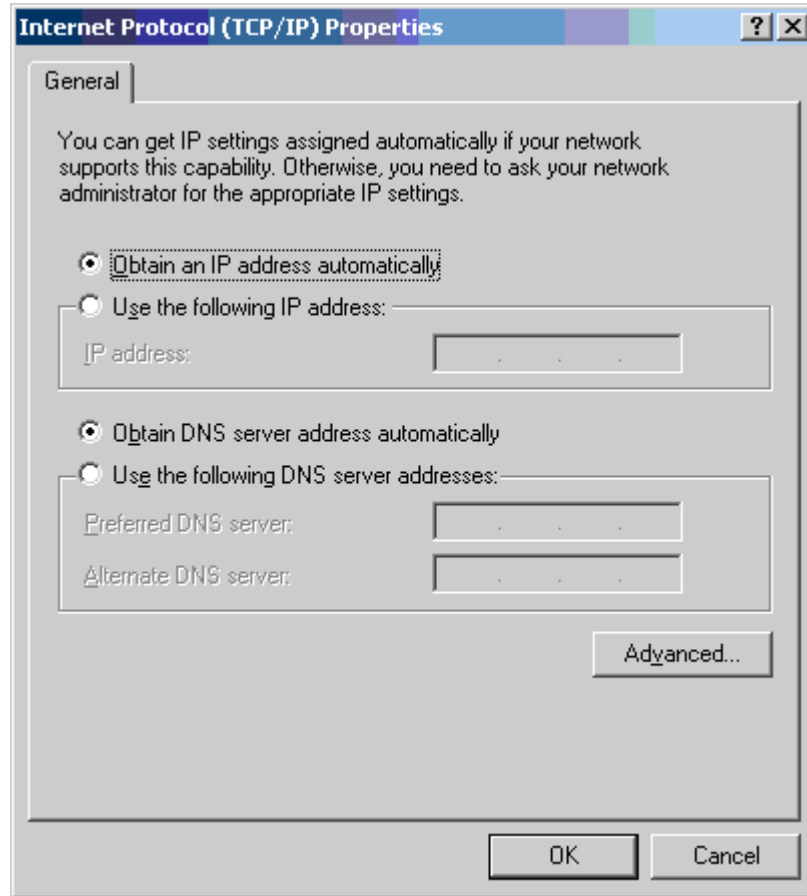
17. Select "**Obtain an IP address automatically**" and "**Obtain DNS address automatically"**, and then click **OK**.

This completes the creation of the new bonded connection for Mobile ISDN using the Ethernet interface. Before using the connection, you need to configure the Local Area Connection properties.

To Configure the Local Area Connection Properties for Bonding (PPPoE):

1. In Network and Dial-up Connections, double-click on **Local Area Connection**.
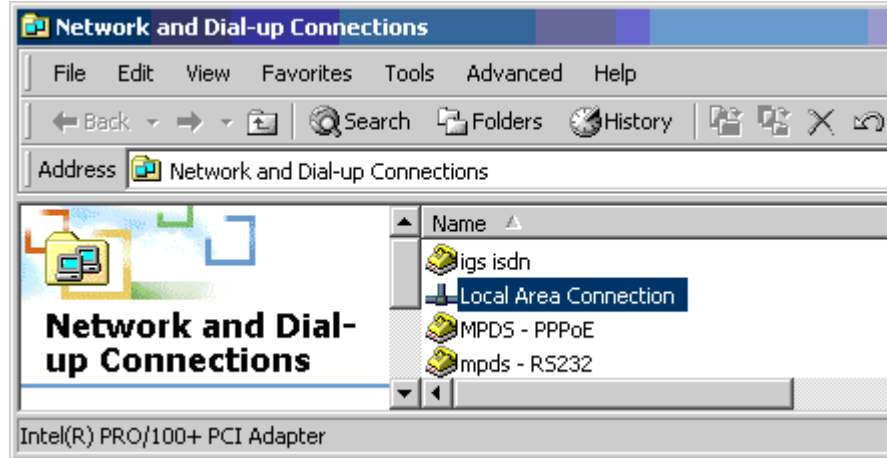
The **Local Area Connection Status** dialog box appears.
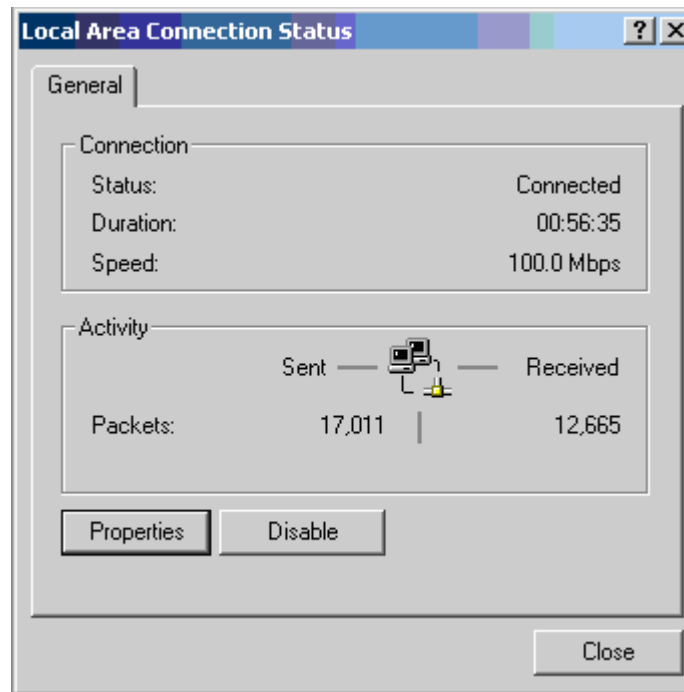
2. Click **Properties**.

The **Local Area Connection Properties** dialog box appears.
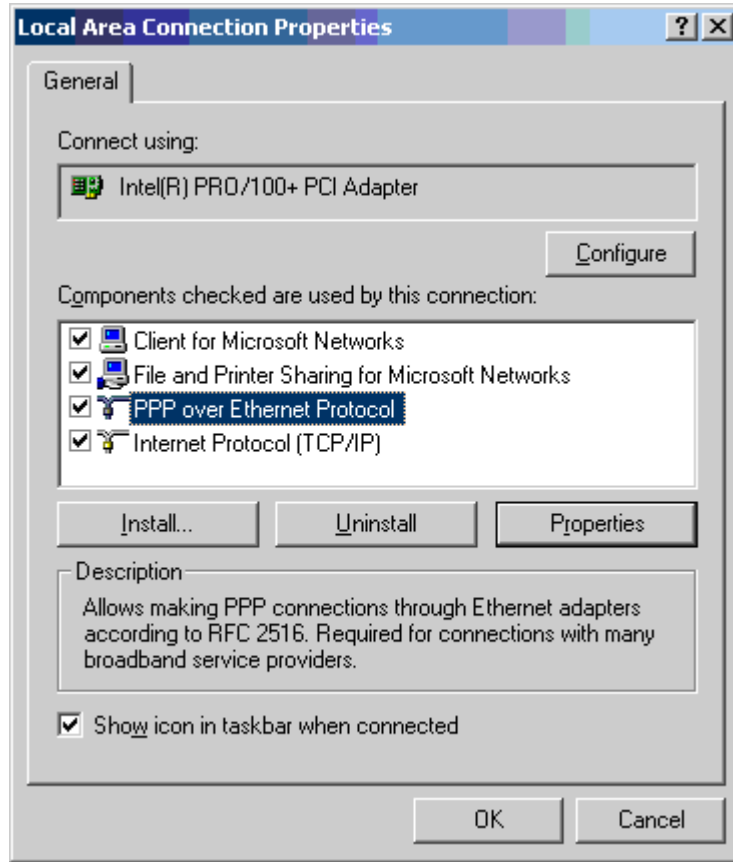
3. **Select PPP over Ethernet Protocol** and then click **Properties**.

   The **PPP over Ethernet Protocol Properties** dialog box appears.
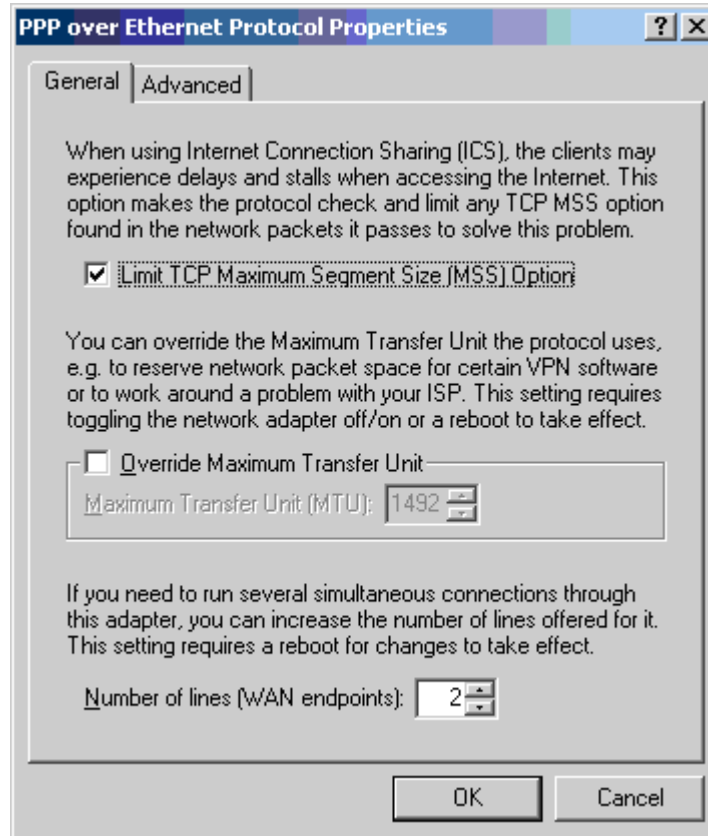
4. On the **General** tab sheet, select "2" for **the Number of lines** (WAN endpoints).

This completes the connection configuration for the two-channel Swift64 Mobile ISDN over Ethernet connection. The connection is ready to use.

INSTALLATION

1. Introduction

This section provides general information and procedures required to install HSD transceivers and HSD-X transceivers in Multi-Channel configurations on an aircraft. Mode-specific installation instructions are provided in separate installation sections.

The organization of the installation information provided in this section is described below:

- **General Installation**

  This section provides general installation information that applies to all modes and configurations of HSD and HSD-X systems, including pre-installation instructions, general cabling and connector requirements, information on installation kits, and physical placement considerations.

- **Section I: Stand-Alone Mode Installation**

  This section provides installation information specific to Stand-Alone Mode HSD transceiver system configurations.

- **Section II: Combined Mode (HCM)/Selective Mode Installation**

  This section provides installation information specific to Combined Mode and Selective Mode HSD transceiver system configurations.

- **Section III: Cooperative Mode Installation**

  This section provides installation information specific to Cooperative Mode HSD transceiver system configurations.

- **Section IV: Multi-Channel Configuration Installation**

  This section provides installation information specific to Multi-Channel HSD transceiver system configurations that includes the installation of HSD-X transceiver extension units.

If installation assistance is required, contact EMS SATCOM Product Support at the telephone or fax numbers listed in the front matter of this manual.

2.   Advisories

Before performing any installation procedures, read the safety advisories listed in "Introduction" on page TC-1.

3.   Pre-Installation Inspection

Before installing any HSD equipment, conduct a pre-installation inspection of all parts to ensure that no damage occurred during transit.

4. Unpacking and Inspecting Equipment

- Unpack the HSD/HSD-X transceiver(s) from their shipping containers.

- 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 EMS Technologies immediately and report the problem.

- Visually inspect the unit for any shipping damage. If any shipping damage has occurred, contact the shipping carrier immediately and report the problem.

- Check the HSD/HSD-X transceiver connectors for corrosion and damage. If damage is noted, do not apply power to the unit. Report any damage to EMS SATCOM immediately.

5.   Cabling and Connector Requirements

This section provides general electrical installation information on power, ground, shielding requirements, and cabling that applies to all installation modes for HSD and HSD-X transceivers.

A. Power Requirements

The aircraft power supply provides power to the HSD transceiver. This power supply must be +28 V dc nominal for models PN 1110-A-0001, 1110-A-0160, and 1110-A-0080. For HSD models, PN 1110-A-0060, 1110-A-0150, and PN 1110-A-0070, and HSD-X model PN 1110-A-0401, the power supply must be at 115 V ac, 400 Hz (nominal).

The breaker rating for the HSD assembly is based on power consumption details provided in Table 1 Variants of Outline and Installation Diagram (1110-E-0001) presented in 225.

The power requirements for the HSD-X transceiver are listed in the notes on the HSD-X Outline and Installation Diagram.

B. Ground Requirements

Improper grounding can potentially lead to ground loops and induced Electromagnetic Interference (EMI) or Radio Frequency Interference (RFI). When installing an HSD or HSD-X transceiver, follow standard grounding practices for both chassis and cabling shields.

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 as well as on both sides on any production break in the cable. Where applicable, terminate shields with connectors via the backshell or via a pigtail with a suitable termination to the closest aircraft ground.

General aviation cable-routing guidelines apply. Refer to Table 3–1 for detailed information.

Note: Typically, Ethernet and ISDN cable has multiple shields; terminate each shield separately.

Table 3–1. 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%
Serial Data	Twisted pair, stranded		Yes	85%
Ethernet Data	Twisted pair, stranded		Yes	85%

Table 3–1. Cable Shielding and Termination Specifications

Cable Function	Conductor Type (Typical)	Single Point	Multiple Point	Minimum Conductor Coverage by Shield
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:				

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 side of any production break.

N/A: Not applicable.

6.   ARINC 600 Trays and Connectors

This section provides detailed information on the ARINC 600 trays provided in the HSD Installation Kits that are used in the installation of the HSD and HSD-X transceivers.

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

The HSD-X LRU is typically installed in a standard, 2-MCU tray. Ruggedized trays designed specifically for installations on Helicopter aircraft are also available.

A.   Installation Kits

Installation kits for HSD and HSD-X transceivers are available from EMS Technologies Ltd. Contact EMS Technologies Sales department for more information on how to select and order the appropriate HSD Installation Kit.

Table 3–2 lists the recommended installation kits for typical installations.

Table 3–2. HSD and HSD-X Installation Kits

Installation Kit Name	EMS SATCOM Part Number	Description
HSD Installation Kit AC FAN	1110-F-0120-01	Standard Installation Kit: Bottom AC Fan Tray Assembly and ARINC Connector (Un-pressurized Installation)
HSD Installation Kit DC FAN	1110-F-0120-02	Standard Installation Kit: Bottom DC Fan Tray Assembly and ARINC Connector (Un-pressurized Installation)
HSD Installation Kit HELICOPTER AC FAN	1110-F-0120-03	Helicopter Installation Kit: Side AC Fan Tray Assembly and ARINC Connector
HSD-X Installation Kit AC FAN	1110-F-0121-01	Standard Installation Kit: Fan Tray Assembly with Bottom AC Fan and ARINC Connectors
HSD-X Installation Kit NO FAN	1110-F-0121-02	Standard Installation Kit: Tray Assembly and ARINC Connectors (No Fan)
HSD-X Installation Kit HELICOPTER NO FAN	1110-F-0121-03	Helicopter Installation Kit: Tray Assembly with Isolators and ARINC Connectors (No Fan)
HSD/HSD-X COAX Cable Kit	1110-K-0122	Multi-Channel RF COAX Kit: Tx and Rx Cables (33ft), Combiners, Splitters, Isolators, and HSD-X Cables

B. Cabling Notes

Before proceeding with the installation of the HSD transceiver, read all cabling notes provided on the HSD System Interconnection Diagram for the applicable HSD system operational mode.

(1) HSD Transceiver Cabling

When installing the HSD transceiver, follow the cabling requirements listed below:

- Maximum recommended cable length should not exceed 50 feet.

- LAN cables must meet flammability, TIA/EIA568-A CAT 5 requirements, and conform to ARINC 628 specifications.

- Wire size recommendations:

  - For +28 V dc HOT (BP2), +28 V dc RTN GND (BP3), 115 V ac COLD (BP7), and Chassis GND (BP8), use 12 AWG

  - For 115 V ac HOT (BP1), use 20 AWG

  - Unless otherwise specified, for signaling use 22 AWG wire.

(2) HSD-X Transceiver Cabling

When installing the HSD-X transceiver in Multi-Channel Configurations, follow the cabling requirements listed below:

- For 115 V ac HOT (BP2), use 20 AWG

- For 115 V ac COLD (BP4), use 20 AWG

- Chassis GND (BP3), use 14 AWG

(3) HSD Transceiver Coaxial Cable Loss Considerations

When installing HSD transceivers, 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 transceivers operating in Stand-Alone, Cooperative, and Combined Mode installations, the minimum loss is 6 – 25 dB (including any in-line attenuator) as per ARINC 74. For HSD-128 and HSD-X transceivers installed in Multi-Channel Configurations, the minimum loss is 0 – 19 dB (including cables and splitters).

7. Mechanical Installation

This section describes the mechanical installation requirements for the HSD and HSD-X units. The outline and installation drawings for both transceivers are provided at the end of this section.

A. General

This section contains the information required to plan the physical placement of the HSD and HSD-X (Multi-Channel configurations only) transceivers.

The HSD Transceiver Outline and Illustration Drawing (Sheet 1 and 2) illustrates the physical and mechanical specifications of the HSD transceiver. The HSD-X Transceiver Outline and Illustration Drawing (Sheet 1 and 2) illustrates the physical and mechanical specifications of the HSD-X transceiver.

In typical aircraft installations, the HSD assembly fits into standard ARINC, 8-MCU mounting trays. HSD-X units fit into standard, 2-MCU mounting trays. Specialized trays, that meet the requirements for installations of both the HSD and HSD-X units on Helicopters, are also available from EMS SATCOM.

All HSD ARINC installation trays are included in the HSD and HSD-X Installation Kits that are available from EMS Technologies Ltd. Section Installation Kits describes the HSD and HSD-X Installation Kits available from EMS SATCOM.

B. Physical Placement

When selecting a placement location for the HSD, and if applicable, HSD-X mounting trays, allow for adequate spacing for the installation of the HSD assembly while providing reasonable access for servicing. Leave a minimum gap of 0.5 inches between LRUs.

In Multi-Channel configurations, after wiring the tray(s) for HSD-X units, populate the trays in order, starting from the first-in-line tray that is directly connected to the HSD-128 transceiver. The second HSD-X tray is connected to the first HSD-X tray as shown in Figure 3–1. HSD-X trays are strapped to index the HSD-X units to read the appropriate ARINC messages on the crosstalk bus (communications bus).

If an HSD-X must be removed for service, the Multi-Channel HSD system will still function, but the remaining HSD-X units must be moved so that no empty trays are in the middle of the series or chain. Refer to "Maintenance and Repair" on page 5-1 for more information.
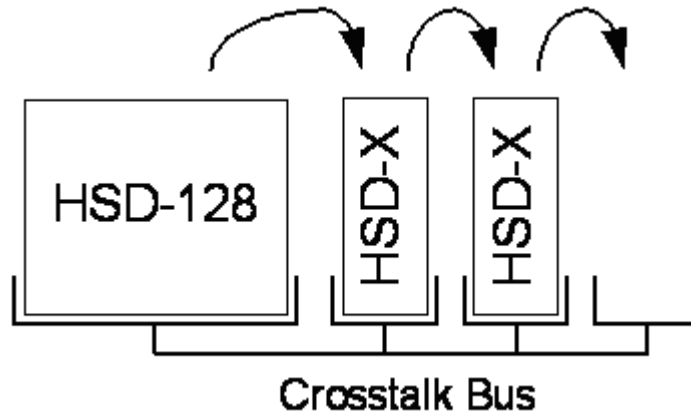
Figure 3–1. HSD-X Physical Placement Requirements

C. Environmental Requirements

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

The standard mounting trays for the HSD and HSD-X 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-160D Environmental Specifications for the HSD and HSD-X transceivers.

(a) HSD Transceivers

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

- Power Dissipation (DC models): 275 Watts nominal, 370 Watts maximum

- Power Dissipation (AC models): 275 Watts nominal, 385 Watts maximum

- Cooling Air: per ARINC 600

- Recommended Flow rate: 175 lbs/hr

- Pressure drop: 0.05", ± 0.025" H_2O

(b) HSD-X Transceivers

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

- Power Dissipation: 34 Watts

- Cooling Air: per ARINC 600

- Recommended Flow rate: 15.5 lbs/hr

- Pressure drop: 0.044", ± 0.025" H_2O

(c)   HSD Fan Tray Requirements

> **WARNING:** Failure to install and configure the fan tray assembly as instructed may seriously compromise the HSD's extreme temperature operation.

Fan tray assemblies may be shipped with or without hole-plug-buttons installed. For adequate airflow to the HSD subassemblies, the plugs must be installed or removed in the fan/tray configuration as illustrated in Figure 3–2. Installed plugs are shown in black, and removed plugs are shown in white.
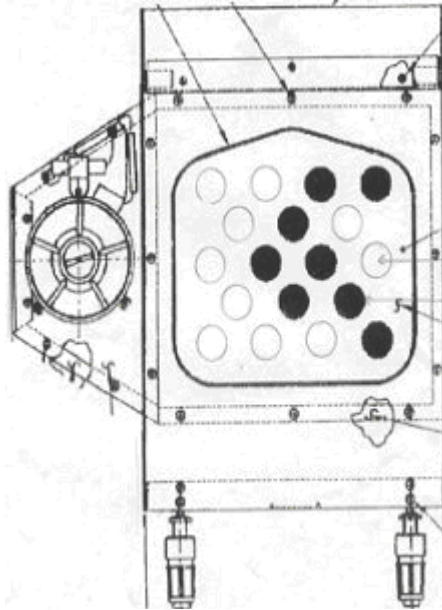
Figure 3–2. Fan Tray Plug Configuration

D. Chassis Grounding

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

8.   Electrical Installation

This section provides mode-specific installation details for HSD and HSD-X transceivers. This section is divided into sub-sections that provide the electrical installation requirements for the different modes of operation. The sub-sections are presented as follows:

- **Section I: Stand-Alone Mode Installation**

   This section provides installation requirements for HSD transceivers operating in Stand-Alone Mode.

- **Section II: Combined Mode (HCM)/Selective Mode Installation**

   This section provides installation requirements for HSD transceivers operating in Combined Mode (Honeywell Combined Mode) and Selective Mode.

   Selective Mode is a non-standard installation and it is not a recommended mode of operation. Selective Mode has been superseded by Combined Mode operation for MCS series SATCOM and with Cooperative Mode operation for SAT-906 series SATCOM. It is recommended that all systems operating in Selective Mode be upgraded to support Combined or Cooperative Mode as applicable.

- **Section III: Cooperative Mode Installation**

   This section provides installation requirements for HSD transceivers operating in Cooperative Mode.

- **Section IV: Multi-Channel Configuration Installation**

   This section provides installation requirements for HSD transceivers operating in Multi-Channel Configurations with HSD-X transceiver extension units.

A.   Section I: Stand-Alone Mode Installation

(1)   Stand-Alone Mode Installations Wiring Notes

This section provides detailed information on the external interface and system connections involved in the installation of an HSD transceiver for Stand-Alone Mode operation.

(a)   Source/Destination Identification (SDI) – Stand-Alone

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

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

(b)   Maintenance Port Interface – Stand-Alone

The HSD transceiver has an RS-232 Maintenance Port interface that provides access to a maintenance utility program for data loading, system monitoring and testing purposes.

Access to the HSD Maintenance Utility Program 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 Maintenance port is available at the front of the HSD and at the rear ARINC 600 connector. Connection on the front of the HSD is accessible via a DB25S connector for local maintenance of the unit. 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 – Stand-Alone

Several external RF parameters (such as cable losses and antenna gain), that must be delimited to ensure proper operation, dictate the HSD performance requirements. Table 3–3 defines these parameters and their expected values.

Table 3–3. RF Parameters Definition

Parameter	Min. Value (dB)	Max. Value (dB)
Antenna Gain	8	17
Antenna—DLNA Loss	0.1	0.3
DLNA Gain	53	60
DLNA Noise Figure	1.5	1.8
DLNA—HSD (Rx) Loss	6	25
HSD—Antenna (Tx) Loss	1	2.5
DLNA Insertion Loss (Tx to Antenna Port)	–	0.8

(d) WOW Pin Wiring – Stand-Alone

These Weight-On-Wheel (WOW) discretes are wired only if equivalent information is not strapped as being available to the SDU on an ARINC 429 input [for example, IRS or the Centralized Fault Display System (CFDS)].

WOW wiring, for the HSD, is optional for system operation as the HSD already receives speed information for Doppler correction. However, if WOW wiring is not wired, normal maintenance must be disabled when speed or Doppler readings are greater than zero.

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

• OPN: Open circuit

- AFG: Airframe DC Ground

- FAC: Fwd Address Common (TP7K)

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

1. Stand-Alone Mode Installations

   Labeled as WOW1, WOW2, and WOW Program Select, these discretes are wired only if equivalent information is not strapped as being available to the SDU on an ARINC 429 input [for example, IRS or the Centralized Fault Display System (CFDS)].

   WOW wiring is optional for system operation in Stand-Alone Mode installations as the HSD already receives speed information for Doppler correction. However, if WOW wiring is not wired, normal maintenance must be disabled when speed or Doppler readings are greater than zero.

Table 3–4. WOW Pin Wiring Table

Pin Name and Location			
WOW1	WOW2	PGM	**Aircraft Status**
TP3G	TP3H	TP3J	
AFG	AFG	FAC	In-air
OPN	AFG	FAC	Not valid – Default in-air
AFG	OPN	FAC	Not valid – Default in-air
OPN	OPN	FAC	On-ground
AFG	AFG	OPN	On-ground
OPN	AFG	OPN	Not valid – Default in-air
AFG	OPN	OPN	Not valid – Default in-air
OPN	OPN	OPN	In-air

(e) Forward and Return Address IDs – Stand-Alone

   Figure 3–3 provides an example of a Forward ID address. The Forward ID is a Hex number (example: $ABC123) that must be converted into a binary number for strapping.
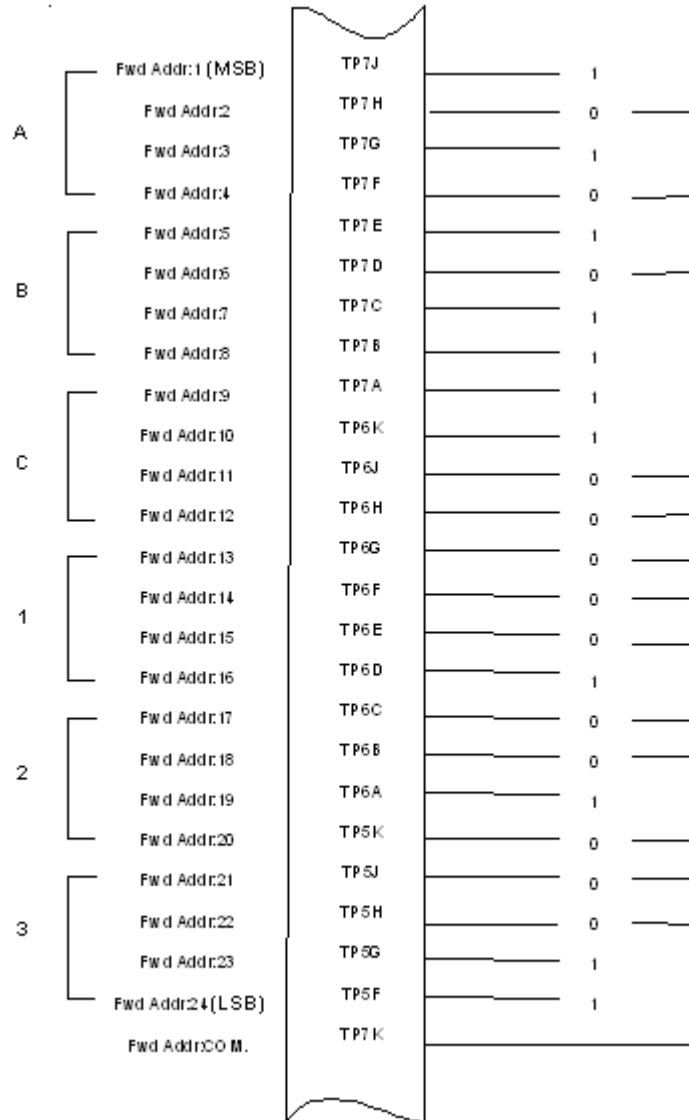
Figure 3–3. Forward ID, Hex to Binary Conversion

> **Note:** A pin strapped to the same potential as T7K (Forward address common)
> is considered as a logical "0", whereas an open circuit pin is considered
> as a logical "1".
> MSB is the Most Significant Bit and LSB is the Least Significant Bit.

(f) Remote Status Panel – Stand-Alone (Optional)

An optional "remote status panel" may be installed in installations where the HSD
and/or any HSD-X units are located in inaccessible or remote locations. The
installation of a "remote status panel" is recommended as it provides visual
indications of each of the power, fault, and call status of each of the units.

A "remote reset switch" for HSD transceivers can also be installed and located with the Remote Status Panel. Figure 3–4 illustrates a typical wiring diagram for the remote reset circuit.

Note: Cooperative and Combined Mode installations and HSD-X transceivers *DO NOT* support the use of the reset function.

1. HSD Remote Reset Switch Circuit Requirements – Stand-Alone

   HSD transceivers support the installation of a Remote Reset Switch circuit as shown in Figure 3–4.

   The HSD 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 (include all cable and switch contact resistance).

2. HSD Remote LED Driver Circuit Requirements – Stand-Alone

   The circuit requirements for the HSD Remote Status LED drivers are shown in Figure 3–5. Each LED driver circuit has a 200-ohm current limit resistor. The maximum cable resistance (including the forward and return paths) must not exceed 100 ohms to provide adequate current to the 5 volt LEDs (i.e. 10 mA minimum) at the remote status panel.

   It is recommended that the installer use shielded cables to provide a level of noise immunity.
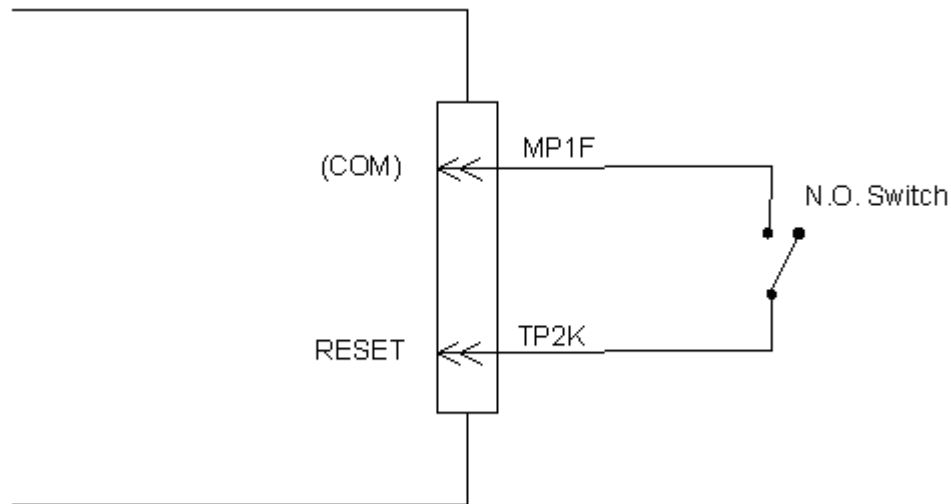
Figure 3–4. HSD Remote Reset Circuit – Stand-Alone
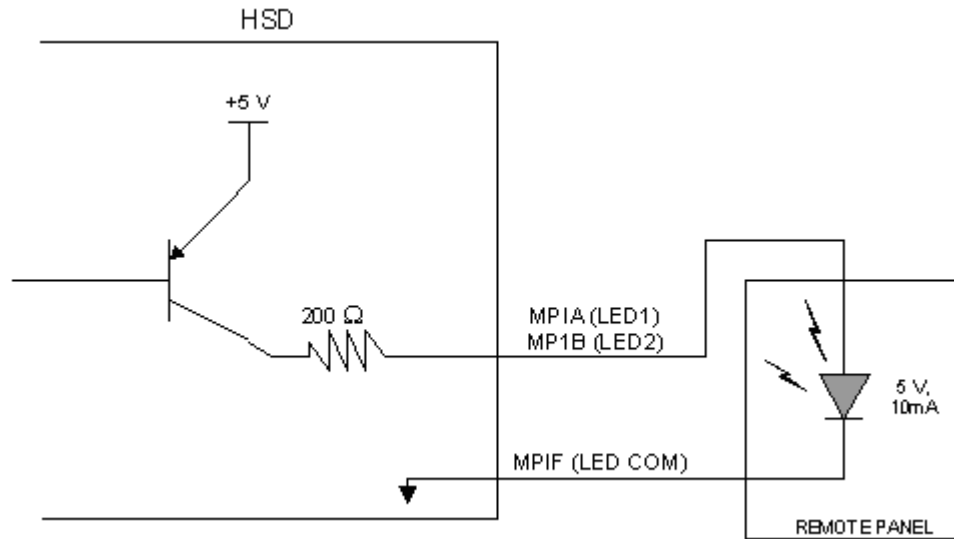
Figure 3–5. HSD Remote LED Panel Circuit – Stand-Alone

(g) User Interfaces – Stand-Alone

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

Note: Although the Ethernet interface is only supported by HSD-X transceivers, HSD transceiver models, PN 1110-A-0150 and 1110-A-0160, and other models of HSD transceivers with service bulletin 1110-SB-0004 accomplished, consider pre-wiring the cabin for all interfaces—even when installing an HSD transceiver that currently does not support the Ethernet interface.

1. ISDN Interface

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

2. RS-232 Interface (MPDS)

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

3. Ethernet Data Interface

HSD transceiver models, part numbers 1110-A-0150 and 1110-A-0160 support the Ethernet interface. All other models of HSD transceivers must have service bulletin 1110-SB-0004 (Data I/O Type 2) accomplished to support the Ethernet interface.

Install an RJ-45 interface connector in the cabin area for user access to the Ethernet interface. The next section describes the RJ-45 connector and cable termination.

4. RJ-45 Connector Termination Details

Details relating to the RJ-45 cable terminations, required for both the ISDN and/or 10BASE-T services, are shown in Table 3–5 and Figure 3–6.

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.

Table 3–5. RJ45 Wiring Details – Stand-Alone

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. RJ-45 Connector Terminator Details – Stand-Alone

5. System Configuration Pin Strapping – Stand-Alone

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

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

Table 3–6. Configuration Pin Summary – Stand-Alone

Pin #	Name	Function
TP4A to D	System Config #1 to #4	System Mode (coded)
TP4E to H	System Config #5 to #8	Not assigned (set to"1")
MP5G to K	Data I/O Config #1 to #4	NOTE: Data I/O Mode (coded)
MP6G to K	Data I/O Config #5 to #8	Not assigned (set to"1")

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

- Pins marked "0" are signaled by strapping to "Fwd Address Common" (T7K).

- Pins marked "1" are signaled by an open circuit—no connection.

- Configurations resulting in all "1's" are invalid.

6. System Mode Strap Pins Coding – Stand-Alone

    The HSD must be externally strapped according to its intended operational configuration mode. Table 3–7 illustrates the system pin strapping for all HSD operational modes and configurations. The system pin strapping for Stand-Alone Mode is highlighted.

Table 3–7. Stand-Alone System Mode Pin Strapping – Stand-Alone

System Modes	Pin Status			
	TP4A	TP4B	TP4C	TP4D
	1	2	3	4
INVALID	1	1	1	1
Stand Alone	0	1	0	1
Selective, SAT-906	1	1	0	1
Selective, MCS-3000	1	0	1	1
Selective, MCS-6000	1	0	0	1
Selective, MCS-7000	0	1	1	1
Honeywell Combined	1	1	1	0
Reserved	1	1	0	0
Collins Cooperative	0	0	1	1
Multi-Channel	0	0	0	1

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

- Pins marked "0" are signaled by strapping to "Fwd Address Common" (TP7K).

- Pins marked "1" are signaled by an open circuit—no connection.

- Configuration resulting in all "1's" is Invalid.

7. User Data I/O Mode Pin Strapping – Stand-Alone

Data I/O Mode Pin strapping is only required for HSD transceivers models with Data I/O Type 2 installed (PN 1110-A-0150 and 1110-A-0160) or other HSD models that have Data I/O Type 2 cards installed via Service Bulletin, 1110-SB-0004.

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

In HSD transceivers with two channel cards, both channels are accessible for Swift64 Mobile ISDN via the ISDN port on a first come-first served basis. All modes, as detailed in Table 3–8, are also described in Figure 3–7.

In units where all Data I/O services are available (including Ethernet), the following statements are valid:

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

- If one channel card becomes inoperative, and there is a conflicting configuration (for example, 1 Reserved, 1 SCPC – for Swift64 Mobile ISDN), then the remaining card operates in "Unrestricted" mode.

- A "restricted" channel is not handled by the Data I/O Controller, which results in the channel not being accessible for SCPC via Ethernet or for MPDS via RS232 or Ethernet.

- An SCPC channel is accessible for SCPC via Ethernet.

- An MPDS channel is accessible for MPDS via RS232 and Ethernet.

- An "unrestricted" channel is accessible for SCPC via Ethernet and MPDS via RS232 and Ethernet.

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

Table 3–8. Data I/O Mode Pin Strapping – Stand-Alone

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

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

Figure 3–7. User Data I/O Mode Configurations – Stand-Alone

(h)   ARINC 429 IRS Bus Interface – Stand-Alone

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

- IRS A to TP4J

- IRS B to TP4K

(i)   Antenna Interface – Stand-Alone

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

Table 3–9. Stand-Alone Mode HSD to BSU Interconnects

Signal Name	Signal Source			Signal Destination
	HSD Transceiver	Mechanical HGA	Phased-Array or Conformal HGA	
HPA MUTE A			Port BSU-G	HSD TP3A
			STBD BSU-G	HSD TP3C
HPA MUTE B			Port BSU-H	HSD TP3B
			STBD BSU-H	HSD TP3D

Table 3–9. Stand-Alone Mode HSD to BSU Interconnects

Signal Name	Signal Source			Signal Destination
	HSD Transceiver	Mechanical HGA	Phased-Array or Conformal HGA	
BSU BITE A		BSU-W(G)[1]	Port BSU-W	HSD TP2A
			STBD BSU-W	HSD TP2C
BSU BITE B		BSU-X(H)	Port BSU-X	HSD TP2B
			STBD BSU-X	HSD TP2D
MULTI-CONTROL A	TP3E			BSU-T(A) & HSD TP1A
MULTI-CONTROL B	TP3F			BSU-U(B) & HSD TP1B

NOTE [1]:	Letters in (brackets) represent EMS SATCOM AMT-50 BSU pin designations
Top/Port (T/P):	Refers to Mechanical (fin-mount) High Gain Antenna (HGA) Subsystem
Port:	Refers to Phased Array (Fuselage-mount) or Port side of Dual (side) Conformal-mount, HGA subsystem
Starboard (STBD):	Refers to Starboard side of Dual (side) Conformal-mount HGA subsystem

(j)   Stand-Alone Mode Connection Details

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

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

I/O	From Top Plug	Signal Name	To	Description
I	1A	Multi-control A	TP3E	Multi-control from control card
I	1B	Multi-control B	TP3F	Multi-control from control card
I	2A	BSU Top/Port BITE A (See Note 1)	*Mech. Steered Antenna (MA):* BSU, Pin G[1] or W or *Other Antenna[2] (OA):* BSU, PORT-W & Starboard-P	ARINC Tx-HI BITE from Top/Port BSU
I	2B	BSU Top/Port BITE B	*MA:* BSU, Pin H or X, or *OA:* BSU, PORT-X & STBD-R	ARINC Tx-LO BITE from Top/Port BSU
I	2C	BSU Starboard (STBD) BITE A	*MA:* Not required *OA:* BSU, PORT-P & STBD-W	ARINC Tx-HI BITE from STBD BSU

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

I/O	From Top Plug	Signal Name	To	Description
I	2D	BSU STBD BITE B	*MA*: Not required *OA*: BSU, PORT-R & STBD-X	ARINC Tx-LO BITE from STBD BSU
I	3A	Top/Port HPA MUTE A	*MA*: Not required *OA*: BSU, PORT-G	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	OUT Multi-Control A	IN Multi Ctrl A (TP1A), and *MA*: BSU, Pin A or T, or *OA*: BSU, PORT-T & STBD-T	Multi-Control-HI to HSD & Antenna Subsystem
O	3F	OUT Multi-Control B	IN Multi Ctrl B (TP1B), and *MA*: BSU, Pin B or U, or *OA*: BSU, PORT-U & STBD-U	Multi-Control-LO to HSD & Antenna Subsystem
I	2K	Remote Reset	Normally open momentary switch—open side. (Closed side to MP1F)	Remote System Reset
I	3G	WOW 1	TP3G	Weight On Wheel, as defined in Note 40 of ARINC 741, Part 1. Refer to "WOW Pin Wiring – Stand-Alone" on page 3-13
I	3H	WOW 2	TP3H	
I	3J	WOW Program Select	TP3J	
I	4A, 4B, 4C, 4D	System Config 1 to 4	4A & 4C=0 (TP7K common), 4B & 4D=1(Open)	Stand-Alone Mode
I	4E to 4H	System Config 5 to 8	Open (1)	System Configuration - not assigned
I	4J	IRS-A	Aircraft main IRS	IRS 429 Data, Rx HI
I	4K	IRS-B	Aircraft main IRS	IRS 429 Data, Rx LO
I	5A	SDI 1	Not connected	HPA Select Code for
I	5B	SDI 2	SDI common (TP5D)	HPA Select Code for
I	5D	SDI Common	SDI 2 (TP5B)	SDI Common for HPA select codes

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

I/O	From Top Plug	Signal Name	To	Description
I	5F	FWD Address, BIT 24 (LSB)	1=no connection,	Six digit Hex ID assigned by Inmarsat /EMS
I	5G	FWD Address, BIT		
I	5H	FWD Address, BIT		
I	5J	FWD Address, BIT		
I	5K	FWD Address, BIT 20		
I	6A	FWD Address, BIT		
I	6B	FWD Address, BIT		
I	6C	FWD Address, BIT		
I	6D	FWD Address, BIT		
I	6E	FWD Address, BIT		
I	6F	FWD Address, BIT		
I	6G	FWD Address, BIT		
I	6H	FWD Address, BIT		
I	6J	FWD Address, BIT		
I	6K	FWD Address, BIT		
I	7A	FWD Address, BIT		
I	7B	FWD Address, BIT		
I	7C	FWD Address, BIT		
I	7D	FWD Address, BIT		
I	7E	FWD Address, BIT		
I	7F	FWD Address, BIT		
I	7G	FWD Address, BIT		
I	7H	FWD Address, BIT		
I	7J	FWD Address, BIT 1 (MSB)		
I	7K	FWD Address, Common		Common GND connection for system and I/O configuration and

1. BSU Pin nomenclature for Mechanically-Steered Antennae (*MA*) is manufacturer dependent.
2. "Other antenna types" (*OA*) represent either conformal or phased array antennae.

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

I/O	From Middle Plug	Signal Name	To	Description
O	1A	LED 1	Remote Status Panel—Green	HSD—Power On (Optional)
O	1B	LED 2	Remote Status Panel—Red	HSD—Fault (Optional)
O	1F	LED Common	Remote Status LED Panel, and closed side of N.O. Remote Reset Switch	LED Common
O	1G	Maint Port Tx (OUT)	Maint Port serial data, DB9S-2	Maintenance computer (laptop/PC), for "Remote" access
I	1H	Maint Port Rx (IN)	Maint Port serial data, DB9S-3	
I/O	1J	Maint Port Signal Ground.	Maint Port serial data, DB9S-5	
O	2A	CC (channel card) #1 Rx	DTE-1A, DB9S-2 or DB25P-3	User Mobile Packet Data (MPDS), RS-232, DTE-1A
I	2B	CC #1 Tx	DTE-1A, DB9S-3 or DB25P-2	
I	2C	CC #1 RTS	DTE-1A, DB9S-7 or DB25P-4	
O	2D	CC #1 CTS	DTE-1A, DB9S-8 or DB25P-5	
I	2E	CC #1 DTR	DTE-1A, DB9S-4 or DB25P-20	
O	2F	CC #1 DSR	DTE-1A, DB9S-6 or DB25P-6	
O	2G	CC #1 CD	DTE-1A, DB9S-1 or DB25P-8	
O	2H	CC #1 RI	DTE-1A, DB9S-9 or DB25P-22	
I/O	2J	CC #1 SGND	DTE-1A, DB9S-5 or DB25P-7	

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

I/O	From Middle Plug	Signal Name	To	Description
O	3A	CC (channel card)#2 Rx	DTE-1B, DB9S-2 or DB25P-3	User Mobile Packet Data (MPDS), RS-232, DTE-1B
I	3B	CC #2 Tx	DTE-1B, DB9S-3 or DB25P-2	
I	3C	CC #2 RTS	DTE-1B, DB9S-7 or DB25P-4	
O	3D	CC #2 CTS	DTE-1B, DB9S-8 or DB25P-5	
I	3E	CC #2 DTR	DTE-1B, DB9S-4 or DB25P-20	
O	3F	CC #2 DSR	DTE-1B, DB9S-6 or DB25P-6	
O	3G	CC #2 CD	DTE-1B, DB9S-1 or DB25P-8	
O	3H	CC #2 RI	DTE-1B, DB9S-9 or DB25P-22	
I/ O	3J	CC #2 SGND	DTE-1B, DB9S-5 or DB25P-7	
I	4G	BRI Rx+	ISDN, RJ45-3	User Data, ISDN–2 Refer to "User Interfaces – Stand-Alone" on page 3-17
I	4H	BRI Rx-	ISDN, RJ45-6	
O	4J	BRI Tx+	ISDN, RJ45-4	
O	4K	BRI Tx-	ISDN, RJ45-5	
I	5G to 5K	I/O CONFIG Pins 1 to 4	See Table 3–8	System Data I/O Mode Configurations
I	6G to 6K	I/O CONFIG 5 to 8	Open (1)	System Data I/O Configurations – not assigned
I	6A	BRI Rx+	ISDN, RJ45-3	User Data, ISDN–1 Refer to "User Interfaces – Stand-Alone" on page 3-17
I	6B	BRI Rx –	ISDN, RJ45-6	
O	6C	BRI Tx+	ISDN, RJ45-4	
O	6D	BRI Tx-	ISDN, RJ45-5	

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

I/O	From Middle Plug	Signal Name	To	Description
I	7A	10BASE-T Rx+	Ethernet 10BASE-T, RJ45-3	User Data, Ethernet 10BASE-T
I	7B	10BASE-T Rx–	Ethernet 10BASE-T, RJ45-6	(Available in models 1110-A-0150, 1110-A-0160, and in units with Service Bulletin, 1110-SB-0004 accomplished)
O	7C	10BASE-T Tx+	Ethernet 10BASE-T, RJ45-1	
O	7D	10BASE-T Tx–	Ethernet 10BASE-T, RJ45-2	
O	C1	RF Tx Output	Antenna Subsystem-DLNA	Coax Cable, RF Transmit

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

I/O	From Bottom Plug	Signal Name	To	Description
I	BP2	+28 V dc HOT	Aircraft Power Source, HOT	+28 V dc supply
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	Coax Cable, RF Receive

B. Section II: Combined (HCM)/Selective Mode Installation

(1) Combined Mode (HCM)/Selective Mode Installations Wiring Notes

This section provides detailed information on the external interface and system connections involved in the installation of an HSD transceiver for Combined and Selective Mode operation.

Note: Selective Mode is a non-standard installation and it is not a recommended mode of operation. Selective Mode has been superseded by Combined Mode operation for MCS series SATCOM and with Cooperative Mode operation for SAT-906 series SATCOM. It is recommended that all systems operating in Selective Mode be upgraded to support Combined or Cooperative Mode as applicable.

Note: All connections, except power and RF, are HSD specific. Refer to "other SATCOM" and antenna manufacturers' installation documentation for interconnection wiring details.

(a)   Maintenance Port Interface – Combined/Selective

The HSD transceiver has an RS-232 Maintenance Port interface that provides access to a maintenance utility program for data loading, system monitoring, and testing purposes.

Access to the HSD Maintenance Utility Program 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 Maintenance port is available at the front of the HSD and at the rear ARINC 600 connector. Connection on the front of the HSD is accessible via a DB25S connector for local maintenance of the unit. 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.

(b)   Antenna Subsystem RF Interface – Combined/Selective

Several external RF parameters (such as cable losses and antenna gain), that must be delimited to ensure proper operation, dictate the HSD performance requirements. Table 3–13 defines these parameters and their expected values.

Table 3–13. RF Parameters Definition – Combined/Selective

Parameter	Min. Value (dB)	Max. Value (dB)
Antenna Gain	8	17
Antenna—DLNA Loss	0.1	0.3
DLNA Gain	53	60
DLNA Noise Figure	1.5	1.8
DLNA—HSD (Rx) Loss	6	25
HSD—Antenna (Tx) Loss	1	2.5
DLNA Insertion Loss (Tx to Antenna Port)	–	0.8

(c)   WOW Pin Wiring – Combined/Selective

This section describes the requirements for WOW pin wiring.

•   Combined Mode Installations

In Combined Mode installations, WOW1, WOW2, and WOW Program Select are reserved for future use.

- Selective Mode Installations

Labeled as WOW1, WOW2, and WOW Program Select, these discretes are wired only if equivalent information is not strapped as being available to the SDU on an ARINC 429 input [for example, IRS or the Centralized Fault Display System (CFDS)].

WOW wiring is optional for system operation in Selective Mode installations as the HSD already receives speed information for Doppler correction. However, if WOW wiring is not wired, normal maintenance must be disabled when speed or Doppler readings are greater than zero.

Table 3–14. WOW Pin Wiring Table – Combined/Selective

Pin Name and Location			
WOW1	WOW2	PGM	Aircraft Status
TP3G	TP3H	TP3J	
AFG	AFG	FAC	In-air
OPN	AFG	FAC	Not valid – Default in-air
AFG	OPN	FAC	Not valid – Default in-air
OPN	OPN	FAC	On-ground
AFG	AFG	OPN	On-ground
OPN	AFG	OPN	Not valid – Default in-air
AFG	OPN	OPN	Not valid – Default in-air
OPN	OPN	OPN	In-air

(d) Forward and Return Address IDs – Combined/Selective

Figure 3–8 provides an example of a Forward ID address. The Forward ID is a Hex number (example: $ABC123) that must be converted into a binary number for strapping.
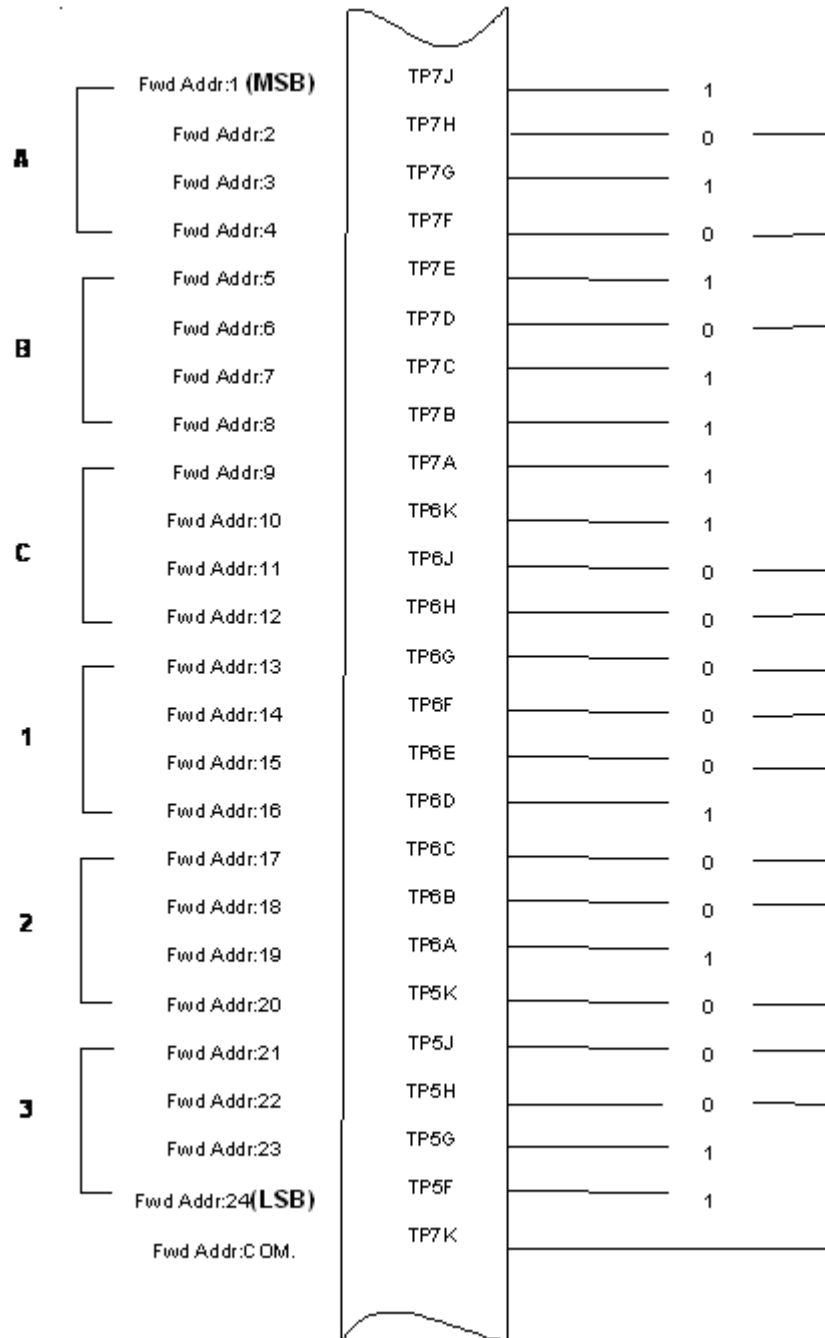
Figure 3–8. Forward ID, Hex to Binary Conversion – Combined/Selective

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

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

(e) Remote Status Panel – Combined/Selective (Optional)

An optional "remote status panel" may be installed in installations where the HSD units are located in inaccessible or remote locations. The installation of a "remote status panel" is recommended as it provides visual indications of each of the power, fault, and call status of each of the units.

A "remote reset switch" for HSD transceivers can also be installed and located with the Remote Status Panel. Figure 3–10 illustrates a typical wiring diagram for the remote reset circuit.

1. HSD Remote Reset Switch Circuit Requirements

   Note: Combined Mode installations *DO NOT* support the use of the reset function. In Selective Mode installations, the use of the reset function is optional.

   HSD transceivers support the installation of a Remote Reset Switch circuit as shown in Figure 3–9.

   The HSD 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 (include all cable and switch contact resistance).

2. HSD Remote LED Driver Circuit Requirements

   The circuit requirements for the HSD Remote Status LED drivers are shown in Figure 3–10. Each LED driver circuit has a 200-ohm current limit resistor. The maximum cable resistance (including the forward and return paths) must not exceed 100 ohms to provide adequate current to the 5 volt LEDs (i.e. 10 mA minimum) at the remote status panel.

   It is recommended that the installer use shielded cables to provide a level of noise immunity.
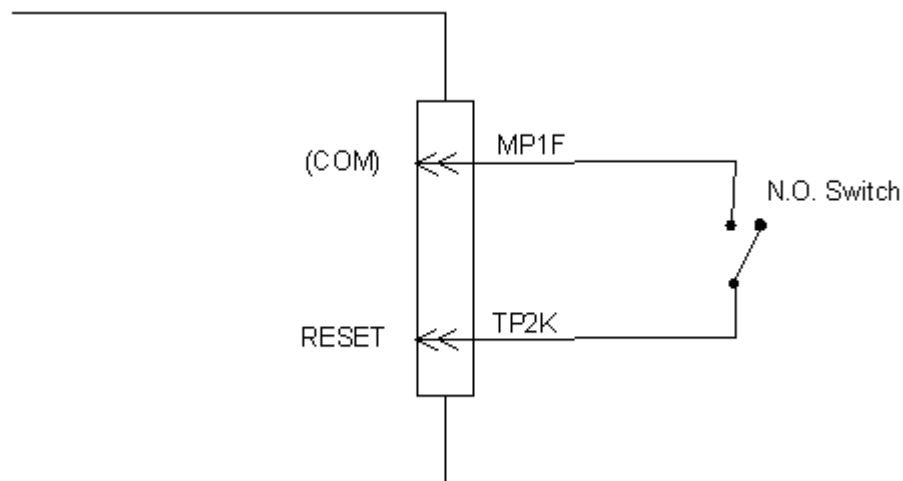

Figure 3–9. HSD Remote Reset Circuit – Combined/Selective

Figure 3–10. HSD Remote LED Panel Circuit – Combined/Selective

(f)   User Interfaces – Combined/Selective

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

Note: Although the Ethernet interface is only supported by HSD-X transceivers, HSD transceiver models, PN 1110-A-0150 and 1110-A-0160, and other models of HSD transceivers with service bulletin 1110-SB-0004 accomplished, consider pre-wiring the cabin for all interfaces—even when installing an HSD transceiver that currently does not support the Ethernet interface.

1. ISDN Interface

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

2. RS-232 Interface (MPDS)

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

3. Ethernet Data Interface

HSD transceiver models, part numbers 1110-A-0150 and 1110-A-0160 support the Ethernet interface. All other models of HSD transceivers must have service bulletin 1110-SB-0004 accomplished to support the Ethernet interface.

Install an RJ-45 interface connector in the cabin area for user access to the Ethernet interface. The next paragraph, describes the RJ-45 connector and cable termination.

4. RJ-45 Connector Termination Details

Details relating to the RJ45 cable terminations, required for both the ISDN and/or 10BASE-T services, are shown in Table 3–15 and Figure 3–11.

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.

Table 3–15. RJ45 Wiring Details – Combined/Selective

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 3–11. RJ-45 Connector Terminator Details – Combined/Selective

5. System Configuration Pin Strapping – Combined/Selective

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

Configuration pins are assigned based on system-mode-configuration selection and data input/output (I/O) requirements as shown in Table 3–16. Detailed pin assignment is shown in Table 3–17 and Table 3–18.

Table 3–16. Configuration Pin Summary – Combined/Selective

Pin #	Name	Function
TP4A to D	System Config #1 to #4	System Mode (See Table 3–17)
TP4E to H	System Config #5 to #8	Not assigned (set to"1")
MP5G to K	Data I/O Config #1 to #4	NOTE: Data I/O Mode (See Table 3–18)
MP6G to K	Data I/O Config #5 to #8	Not assigned (set to"1")

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

- Pins marked "0" are signaled by strapping to "Fwd Address Common" (T7K).
- Pins marked "1" are signaled by an open circuit—no connection.
- Configurations resulting in all "1's" are invalid.

6. System Mode Strap Pins Coding – Combined/Selective

The HSD must be externally strapped according to its intended operational configuration mode. Table 3–17 illustrates the system pin strapping for all HSD operational modes and configurations. The HCM Mode is highlighted as an example.

Table 3–17. Combined Mode System Mode Pin Strapping

System Modes	Pin Status			
	TP4A	TP4B	TP4C	TP4D
	1	2	3	4
INVALID	1	1	1	1
Stand-Alone	0	1	0	1
Selective, SAT-906	1	1	0	1
Selective, MCS-3000	1	0	1	1
Selective, MCS-6000	1	0	0	1
Selective, MCS-7000	0	1	1	1
Honeywell Combined	1	1	1	0
Reserved	1	1	0	0

Table 3–17. Combined Mode System Mode Pin Strapping

System Modes	Pin Status			
	TP4A	TP4B	TP4C	TP4D
	1	2	3	4
Collins Cooperative	0	0	1	1
Multi-Channel	0	0	0	1

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

- Pins marked "0" are signaled by strapping to "Fwd Address Common" (TP7K).

- Pins marked "1" are signaled by an open circuit—no connection.

- Configuration resulting in all "1's" is Invalid.

7. User Data I/O Mode Pin Strapping – Combined/Selective

Data I/O Mode Pin strapping is only required for HSD transceivers models, PN 1110-A-0150 and 1110-A-0160 or other HSD models that have Data I/O Type 2 cards installed via Service Bulletin 1110-SB-0004.

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

In HSD transceivers with two channel cards, both channels are accessible for Swift64 Mobile ISDN via the ISDN port on a first come-first served basis. All four modes, as detailed in Table 3–18, are also described in Figure 3–12.

In units where all Data I/O services are available (including Ethernet), the following statements are valid:

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

- If one channel card becomes inoperative, and there is a conflicting configuration (for example, 1 Reserved, 1 SCPC – for Swift64 Mobile ISDN), then the remaining card operates in "Unrestricted" mode.

- A "restricted" channel is not handled by the Data I/O Controller, which results in the channel not being accessible for SCPC via Ethernet or for MPDS via RS232 or Ethernet.

- An SCPC channel is accessible for SCPC via Ethernet.

- An MPDS channel is accessible for MPDS via RS232 and Ethernet.

- An "unrestricted" channel is accessible for SCPC via Ethernet and MPDS via RS232 and Ethernet.

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

Table 3–18. Data I/O Mode Pin Strapping – Combined/Selective

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

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

Figure 3–12. User Data I/O Mode Configurations – Combined/Selective

(g) ARINC 429 IRS Bus Interface – Combined/Selective

In HCM Combined Mode and Selective Mode installations, navigational information (refer to "System Description" on page 1-1 for details) is provided to the HSD through the high-speed ARINC 429 IRS bus interface. The IRS bus connects through the top plug of the ARINC 600 connector to the HSD as follows:

• IRS A to TP4J

• IRS B to TP4K

(h) Antenna Interface – Combined/Selective

The SATCOM Aero H/H+ system provides the interface to the antenna. Refer to Honeywell documentation for specific details.

(i) RF Splitter Installation – Combined/Selective

Refer to the Interconnection Diagrams for cabling details. Refer to Table 3–19 for a list of the required cable assembly parts. Substitutions using different parts of equivalent functionality are acceptable.

Note: Before installing the RF splitter, **read all of the steps** included in the following splitter installation procedure.

Note: Actual splitter mounting location may vary depending on the placement of the existing RFU and HPA assemblies.

To install the RF Splitter:

1. Determine a suitable location near the RFU to secure the splitter.

2. Cut the receive coax cable at the splitter mounting location.

3. Re-terminate the cut ends with TNC coax connectors

4. Connect the end coming from the antenna subsystem to the splitter input (S) connector.

5. Connect the end going to TPC1 of the RFU to one of the output ports of the splitter, one or two.

6. Run a new coax cable (length is installation specific) from the unused splitter output port to BP-12 of the ARINC 600 connector of the HSD tray assembly.

Table 3–19. Receive Path Parts Requirements – Combined/Selective

Item	Manufacturer PN	EMS SATCOM PN	Description
RF Splitter	ZAPD-2-TNC	32800004	Mini-Circuit, 2-way 0°, TNC, Splitter
Receive Coax	432101	–	ECS, Coax Cable, 0.130 O.D., 50Ω, 17.5 dB/100 ft @ 1.5 GHz
Connector (@ Splitter)	CTS522	–	ECS, TNC, Straight Plug
Connector (@ BP12)	P522	–	ECS, ARINC 600, Size 5, Socket

(j) Combined/Selective Mode Connection Details

The tables in this section provide all top, middle, and bottom plug connection details for Combined and Selective Mode installations.

Table 3–20. Combined/Selective Mode ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I/O	1A to 1D	Multi-Control IN and BITE OUT	As per avionics manufacturer's documentation	Multi-Control and BITE
I	2A	BSU Top/Port BITE A	SDU, MP7G	ARINC Tx-HI BITE From Top/Port BSU
I	2B	BSU Top/Port BITE B	SDU, MP7H	ARINC Tx-LO BITE From Top/Port BSU
I	2C	BSU STBD BITE A	*Mechanically Steered Antenna*[1] *(MA):* Not required *Other Antenna*[2] *(OA):* SDU, MP7J	ARINC Tx-HI BITE From STBD BSU

Table 3–20. Combined/Selective Mode ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I	2D	BSU STBD BITE B	*MA*: Not required *OA*: SDU, MP7K	ARINC Tx-LO BITE From STBD BSU
I	3A to 3D	HPA MUTE	MA: Not required As per avionics manufacturer's documentation	HPA Mute-A & B to BSU
I	2K	Remote Reset	Normally Open momentary switch—open side (Closed side to MP1F)	Remote System Reset (Optional; not recommended for Combined Mode)
I	3G	WOW 1	TP3G	Weight On Wheel, as defined in Note 40 of ARINC 741
I	3H	WOW2	TP3H	
I	3J	WOW Program Select	TP3J	
I	4A to 4D	System Config 1 to 4		System Mode Configurations
I	4E to 4H	System Config 5 to 8	Open (1)	System Mode configuration-not assigned
I	4J	IRS-A	Aircraft main IRS	IRS 429 Data, Rx HI
I	4K	IRS-B	Aircraft main IRS	IRS 429 Data, Rx LO
I	5A, 5B, & 5D	SDI 1, SDI 2, & SDI Common	As per avionics manufacturer's documentation	HPA Select Code for HGA
I	5F	FWD Address, BIT 24 (LSB)	1=no connection, 0=Common (TP7K)	Six digit Hex ID assigned by Inmarsat /EMS SATCOM

Table 3–20. Combined/Selective Mode ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I	5G	FWD Address, BIT 23		
I	5H	FWD Address, BIT 22		
I	5J	FWD Address, BIT 21		
I	5K	FWD Address, BIT 20		
I	6A	FWD Address, BIT 19		
I	6B	FWD Address, BIT 18		
I	6C	FWD Address, BIT 17		
I	6D	FWD Address, BIT 16		
I	6E	FWD Address, BIT 15		
I	6F	FWD Address, BIT 14		
I	6G	FWD Address, BIT 13		
I	6H	FWD Address, BIT 12		
I	6J	FWD Address, BIT 11		
I	6K	FWD Address, BIT 10		
I	7A	FWD Address, BIT 9		
I	7B	FWD Address, BIT 8		
I	7C	FWD Address, BIT 7		
I	7D	FWD Address, BIT 6		
I	7E	FWD Address, BIT 5		
I	7F	FWD Address, BIT 4		
I	7G	FWD Address, BIT 3		
I	7H	FWD Address, BIT 2		
I	7J	FWD Address, BIT 1 (MSB)		
I	7K	FWD Address, Common		Common GND connection for system and I/O configuration and FWD ID

1. BSU Pin nomenclature for Mechanically-Steered Antennae (*MA*) is manufacturer dependent.

2. "Other antenna types" (*OA*) represent either conformal or phased array antennae.

Table 3–21. Combined/Selective Mode ARINC 600 Middle Plug Connection Details

I/O	From Middle Plug	Signal Name	To	Description
O	1A	LED 1	Remote Status Panel—Green	HSD-64—Power On (Optional)
O	1B	LED 2	Remote Status Panel—Red	HSD-64—Fault (Optional)
O	1F	LED Common	Remote Status LED Panel <u>and</u> closed side of N.O. Remote Reset switch (if used)	LED Common
O	1G	Maint Port Tx (Out)	Maint Port serial data, DB9S-2	Maintenance Laptop/PC, for "Remote" access
I	1H	Maint Port Rx (In)	Maint Port serial data, DB9S-3	
	1J	Maint Port Signal GND	Maint Port serial data, DB9S-5	
O	2A	Channel Card (CC) #1 Rx	DTE-1A, DB9S-2	User Mobile Packet Data (MPDS), RS-232, DTE-1A
I	2B	CC #1 Tx	DTE-1A, DB9S-3	
I	2C	CC #1 RTS	DTE-1A, DB9S-7	
O	2D	CC #1 CTS	DTE-1A, DB9S-8	
I	2E	CC #1 DTR	DTE-1A, DB9S-4	
O	2F	CC #1 DSR	DTE-1A, DB9S-6	
O	2G	CC #1 DCD	DTE-1A, DB9S-1	
O	2H	CC #1 RI	DTE-1A, DB9S-9	
I/O	2J	CC #1 SGND	DTE-1A, DB9S-5	
I	6A	BRI RX+	RJ45-3	User Data, ISDN–1 Refer to "User Interfaces – Combined/Selective" on page 3-33
I	6B	BRI RX-	RJ45-6	
O	6C	BRI TX+	RJ45-4	
O	6D	BRI TX-	RJ45-5	

Table 3–21. Combined/Selective Mode ARINC 600 Middle Plug Connection Details

I/O	From Middle Plug	Signal Name	To	Description
I	5G to 5K	I/O CONFIG Pins 1 to 4	See Table 3–8	System Data I/O Mode Configurations
I	6G to 6K	I/O CONFIG Pins 5 to 8	Open (1)	Data I/O Config – not assigned
I	4G	BRI Rx+	ISDN, RJ45-3	User Data, ISDN–2 (Provisional)
I	4H	BRI Rx-	ISDN RJ45-6	
O	4J	BRI Tx+	ISDN, RJ45-4	
O	4K	BRI Tx-	ISDN, RJ45-5	
I	7A	10BASE-T Rx+	Ethernet 10BASE-T, RJ45-3	User Data, Ethernet 10BASE-T (Available in models 1110-A-0150, 1110-A-0160, and in units with Service Bulletin, 1110-SB-0004 accomplished)
I	7B	10BASE-T Rx-	Ethernet 10BASE-T, RJ45-6	
O	7C	10BASE-T Tx$^+$	Ethernet 10BASE-T, RJ45-1	
O	7D	10BASE-T Tx-	Ethernet 10BASE-T, RJ45-2	
O	C1	RF Tx Output	Antenna Subsystem-DLNA	Coax Cable, RF Transmit

Table 3–22. Combined/Selective Mode ARINC 600 Bottom Plug Connection Details

I/O	From Bottom Plug	Signal Name	To	Description
I	2	+28 V dc HOT	Aircraft Power Source, HOT	+28 V dc supply
I	3	+28 V dc Rtn GND	Aircraft Power Source, Rtn	
I	8	Chassis GND	Aircraft Ground	Aircraft Chassis Ground
I	1	115 V ac HOT	Aircraft Power Source, HOT	115 V ac 400 Hz supply
I	7	115 V ac COLD	Aircraft Power Source, COLD	
I	12	RF Rx Input	RF Rx Splitter output port	RF Receive from Antenna Subsystem

C. **Section III: Cooperative Mode Installation**

(1) Cooperative Mode Installations Wiring Notes

This section provides detailed information on the external interface and system connections involved in the installation of an HSD transceiver in Cooperative Mode operation.

(a) General Overview – Cooperative Mode

This section describes external interfaces unique to HSD Transceivers operating in Collins SAT-906 Cooperative-Mode. For detailed interface descriptions, refer to the Cooperative Mode, Interconnection Diagram, (1110-B-0156).

Note: All connections, except power and RF, are HSD specific. Refer to "other SATCOM" and antenna manufacturers' installation documentation for interconnection wiring details.

To achieve the current "best system" operation performance, the HSD should have EMS SATCOM service bulletin 1110-SB-0015 incorporated (service bulletin 1110-SB-0015 supercedes 1110-SB-0003). Cooperative Mode installations that use an HSD *without* a minimum of service bulletin 1110-SB-0003 (control processor software version 4.5) incorporated will occasionally generate Disable 0100, Disable 0800, and Disable 1000 SAT-906 system errors.

Cooperative Mode system installations that use an HSD with service bulletin 1110-SB-0003 incorporated operate with improved system performance and should only generate Disable 1000 SAT-906 system errors (Disable 1000 errors occur on approximately 1% of M4 call terminations). This error occurs due to the HSD reporting a lower than expected actual power out value in the HPA Status Word on the ARINC 429 HPA BITE bus.

Currently, Cooperative Mode installations only support single channel card configurations. If installing a dual-channel HSD transceiver in a Cooperative Mode environment, use the maintenance port utility to configure the EEPROM setting, in Menu 3, for a single channel card.

The following general wiring notes must be considered before installing an HSD transceiver for Cooperative Mode operation with the Collins SAT-906 system.

- Splitter for the RX path
- System Configuration strapping is set to "Cooperative Rockwell-Collins SAT-906" in the EEPROM parameter for software versions 4.5. External system strapping to "Collins Cooperative" Mode is used for installations operating software versions 5.7 or later (1110-SB-0011). Software versions 5.7 or later "read" the hardware strapping to automatically identify the system configuration.

Add the following HSD-specific wiring:

- Forward ID Address (Category B)
- Antenna to BSU BITE information from SDU
- A "Tx Disable" line from the SDU to the HSD
- ARINC 429 SDU to/from HSD, Crosstalk BUS lines

Other HSD-specific wiring includes:

- • ISDN, Ethernet (if supported with an installed Data I/O Type 2 Card), and/or MPDS (RS-232) interface wiring

- • System and Data I/O Configuration lines

- • Optional maintenance and LED remote interfaces

(b) Rockwell Collins Requirements for Cooperative Operation with SAT-906

At the time of printing, the SAT-906 SDU needs, at a minimum, core software – 068, that includes service bulletins 31 and 501, which changes the unit to a – 150 designation with wiring SDU pin TP12E grounded to indicate that the SDU is operating with an HSD.

The Collins Owner Requirements Table (ORT) must updated with the latest version, ORT generation tool.

(c) Maintenance Port Interface – Cooperative Mode

The HSD transceiver has an RS-232 Maintenance Port interface that provides access to a maintenance utility program for data loading, system monitoring and testing purposes.

Access to the HSD Maintenance Utility Program 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 Maintenance port is available at the front of the HSD and at the rear ARINC 600 connector. Connection on the front of the HSD is accessible via a DB25S connector for local maintenance of the unit. 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.

(d) Antenna Subsystem RF Interface – Cooperative Mode

Several external RF parameters (such as cable losses and antenna gain), that must be delimited to ensure proper operation, dictate the HSD performance requirements. Table 3–23 defines these parameters and their expected values.

Table 3–23. RF Parameters Definition – Cooperative Mode

Parameter	Min. Value (dB)	Max. Value (dB)
Antenna Gain	8	17
Antenna—DLNA Loss	0.1	0.3
DLNA Gain	53	60
DLNA Noise Figure	1.5	1.8
DLNA—HSD (Rx) Loss	6	25

Table 3–23. RF Parameters Definition – Cooperative Mode

Parameter	Min. Value (dB)	Max. Value (dB)
HSD—Antenna (Tx) Loss	1	2.5
DLNA Insertion Loss (Tx to Antenna Port)	–	0.8

(e)   WOW Pin Wiring – Cooperative Mode

In Cooperative Mode installations, WOW 2 discrete is re-assigned as Tx- Disable and is therefore not used.

(f)   Forward and Return Address IDs – Cooperative Mode

Figure 3–13 provides an example of a Forward ID address. The Forward ID is a Hex number (example: $ABC123) that must be converted into a binary number for strapping.

	Signal	Test Point	Value
A	Fwd Addr:1 **(MSB)**	TP7J	1
	Fwd Addr:2	TP7H	0
	Fwd Addr:3	TP7G	1
	Fwd Addr:4	TP7F	0
B	Fwd Addr:5	TP7E	1
	Fwd Addr:6	TP7D	0
	Fwd Addr:7	TP7C	1
	Fwd Addr:8	TP7B	1
C	Fwd Addr:9	TP7A	1
	Fwd Addr:10	TP6K	1
	Fwd Addr:11	TP6J	0
	Fwd Addr:12	TP6H	0
1	Fwd Addr:13	TP6G	0
	Fwd Addr:14	TP6F	0
	Fwd Addr:15	TP6E	0
	Fwd Addr:16	TP6D	1
2	Fwd Addr:17	TP6C	0
	Fwd Addr:18	TP6B	0
	Fwd Addr:19	TP6A	1
	Fwd Addr:20	TP5K	0
3	Fwd Addr:21	TP5J	0
	Fwd Addr:22	TP5H	0
	Fwd Addr:23	TP5G	1
	Fwd Addr:24 **(LSB)**	TP5F	1
	Fwd Addr:COM.	TP7K	
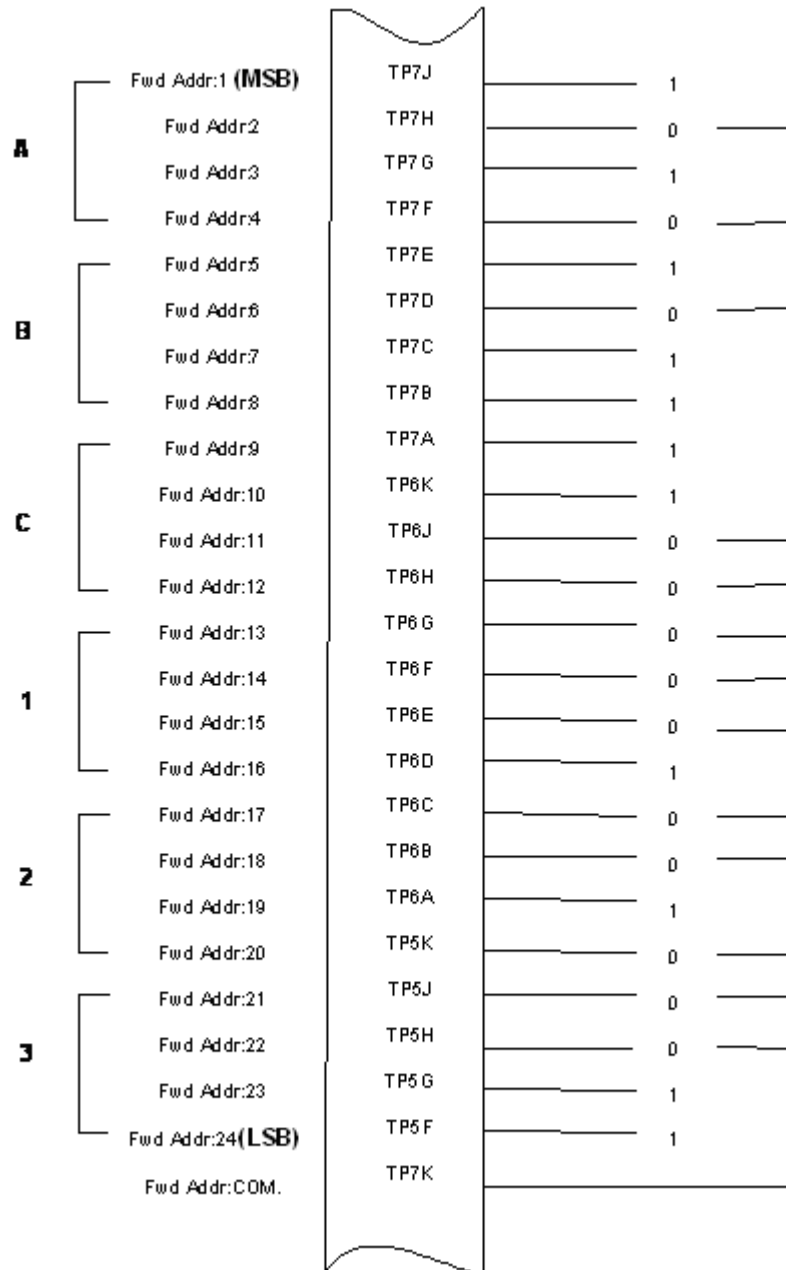
Figure 3–13. Forward ID, Hex to Binary Conversion – Cooperative Mode

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

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

(g) Remote Status Panel – Cooperative Mode (Optional)

An optional "remote status panel" may be installed in installations where the HSD is located in inaccessible or remote locations. The installation of a "remote status panel" is recommended as it provides visual indications of each of the power, fault, and call status of the HSD.

Note: Cooperative Mode installations *DO NOT* support the use of the reset function.

1. HSD Remote LED Driver Circuit Requirements – Cooperative Mode

The circuit requirements for the HSD Remote Status LED drivers are shown in Figure 3–14. Each LED driver circuit has a 200-ohm current limit resistor. The maximum cable resistance (including the forward and return paths) must not exceed 100 ohms to provide adequate current to the 5 volt LEDs (i.e. 10 mA minimum) at the remote status panel.

It is recommended that the installer use shielded cables to provide a level of noise immunity.
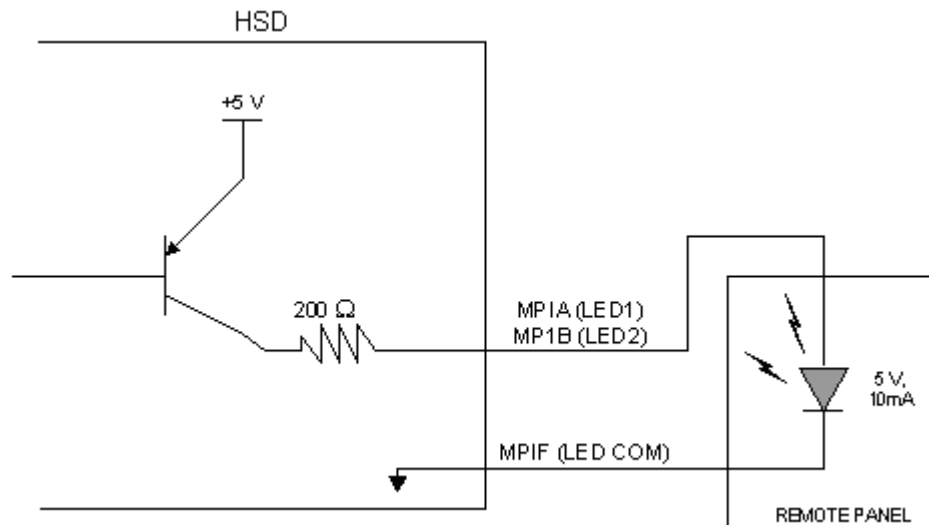
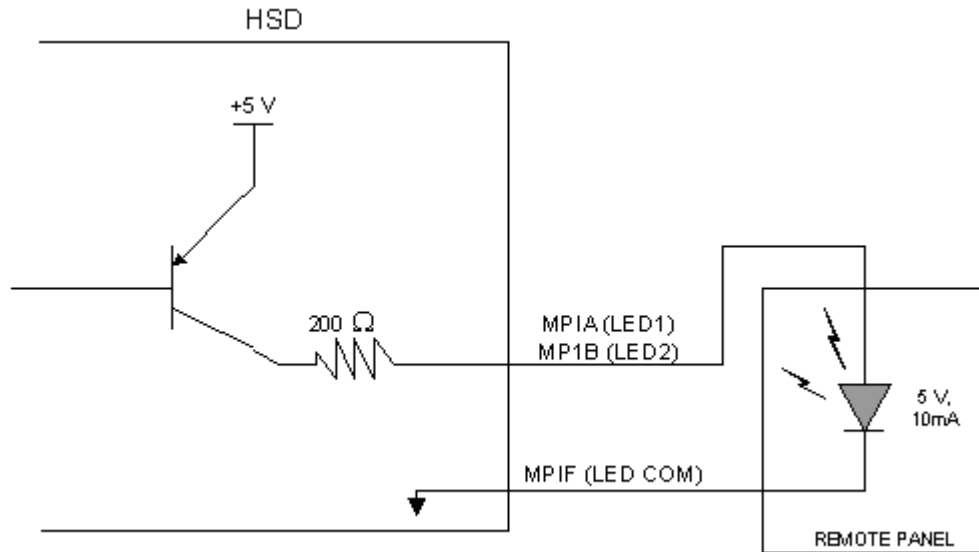**Figure 3–14. HSD Remote LED Panel Circuit – Cooperative Mode**

(h) User Interfaces – Cooperative Mode

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

Note: Although the Ethernet interface is only supported by HSD-X transceivers, HSD transceiver models, PN 1110-A-0150 and 1110-A-0160, and other models of HSD transceivers with service bulletin 1110-SB-0004 accomplished, consider pre-wiring the cabin for all interfaces—even when installing an HSD transceiver that currently does not support the Ethernet interface.

1. ISDN Interface

   Install an RJ-45 interface connector in the cabin area for user connections to the ISDN interface. "RJ-45 Connector Termination Details" on page 3-49 describes the RJ-45 connector and cable termination.

2. RS-232 Interface (MPDS)

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

3. Ethernet Data Interface

   HSD transceiver models, part numbers 1110-A-0150 and 1110-A-0160 support the Ethernet interface. All other models of HSD transceivers must have service bulletin 1110-SB-0004 accomplished to support the Ethernet interface.

   Install an RJ-45 interface connector in the cabin area for user access to the Ethernet interface. "RJ-45 Connector Termination Details" on page 3-49 describes the RJ-45 connector and cable termination.

4. RJ-45 Connector Termination Details

   Details relating to the RJ-45 cable terminations, required for both the ISDN and/or 10BASE-T services, are shown in Table 3–24 and Figure 3–15.

   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.

Table 3–24. RJ-45 Wiring Details – Cooperative Mode

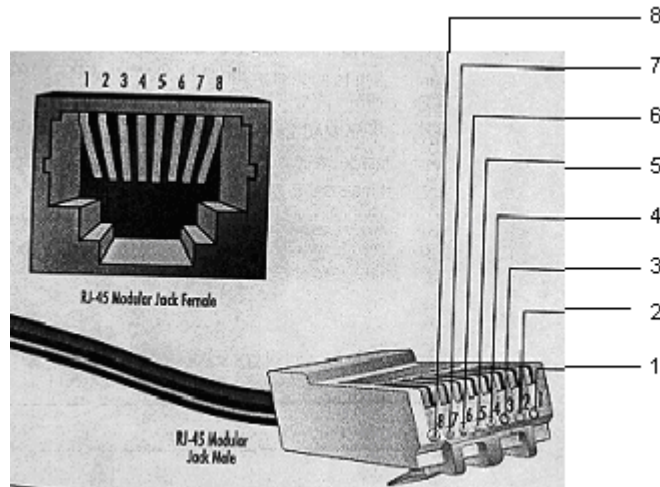| Signal	SERVICE					
	EURO ISDN			Ethernet 10BASE-T		
	Pin	Cable		Pin	Cable	
		ECS	Other		ECS	Other
RX +	3	White	White/Green	3	White	White/Orange stripe
RX−	6	Blue	Green	6	Green	Orange/White stripe or solid Orange
TX+	4	White	Blue	1	White	White/Green stripe
TX−	5	Orange	White/Blue	2	Brown	Green/White stripe or solid Green

Figure 3–15. RJ-45 Connector Terminator Details – Cooperative Mode

5. System Configuration Pin Strapping – Cooperative Mode

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

Configuration pins are assigned based on system-mode-configuration selection, and data input/output (I/O) requirements as shown in Table 3–25. Detailed pin assignment is shown in Table 3–26 and Table 3–27.

Table 3–25. Configuration Pin Summary – Cooperative Mode

Pin #	Name	Function
TP4A to D	System Config #1 to #4	System Mode (See Table 3–26)
TP4E to H	System Config #5 to #8	Not assigned (set to"1")
MP5G to K	Data I/O Config #1 to #4	NOTE: Data I/O Mode (See Table 3–27)
MP6G to K	Data I/O Config #5 to #8	Not assigned (set to"1")

> **Note:** The logic for the System Configuration pins is reverse to the logic explained in ARINC 741 Characteristic Attachment 1-4, Note 19. For System Configuration pins, 0=strapped to common and 1=open.
>
> • Pins marked "0" are signaled by strapping to "Fwd Address Common" (T7K).
>
> • Pins marked "1" are signaled by an open circuit—no connection.
>
> • Configurations resulting in all "1's" are invalid.

6. System Mode Strap Pins Coding – Cooperative Mode

The HSD must be externally strapped as highlighted in Table 3–26; it illustrates the system pin strapping for operation in Cooperative Mode (with Collins SAT-906).

Table 3–26. System Mode Pin Strapping – Cooperative Mode

System Modes	Pin Status			
	TP4A	TP4B	TP4C	TP4D
	1	2	3	4
INVALID	1	1	1	1
Stand Alone	0	1	0	1
Selective, SAT-906	1	1	0	1
Selective, MCS-3000	1	0	1	1
Selective, MCS-6000	1	0	0	1
Selective, MCS-7000	0	1	1	1
Honeywell Combined	1	1	1	0
Reserved	1	1	0	0
Collins Cooperative	0	0	1	1
Multi-Channel	0	0	0	1

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

- Pins marked "0" are signaled by strapping to "Fwd Address Common" (TP7K).

- Pins marked "1" are signaled by an open circuit—no connection.

- Configuration resulting in all "1's" is Invalid.

7. User Data I/O Mode Pin Strapping – Cooperative Mode

Data I/O Mode Pin strapping is only required for HSD transceivers models, PN 1110-A-0150 and 1110-A-0160 or other HSD models that have Data I/O Type 2 cards installed via Service Bulletin 1110-SB-0004.

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

In HSD transceivers with two channel cards, both channels are accessible for Swift64 Mobile ISDN via the ISDN port on a first come-first served basis. All four modes, as detailed in Table 3–27, are also described in Figure 3–16.

In units where all Data I/O services are available (including Ethernet), the following statements are valid:

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

- If one channel card becomes inoperative, and there is a conflicting configuration (for example, 1 Reserved, 1 SCPC – for Swift64 Mobile ISDN), then the remaining card operates in "Unrestricted" mode.

- A "restricted" channel is not handled by the Data I/O Controller, which results in the channel not being accessible for SCPC via Ethernet or for MPDS via RS232 or Ethernet.

- An SCPC channel is accessible for SCPC via Ethernet.

- An MPDS channel is accessible for MPDS via RS232 and Ethernet.

- An "unrestricted" channel is accessible for SCPC via Ethernet and MPDS via RS232 and Ethernet.

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

Table 3–27. Data I/O Mode Pin Strapping – Cooperative Mode

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

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

Figure 3–16. User Data I/O Mode Configurations – Cooperative Mode

(i)   ARINC 429 IRS Bus Interface – Cooperative Mode

Although the IRS bus connections are not required, the installation of provisional wiring for these connections is recommended.

(j)   Antenna Interface – Cooperative Mode

The SAT-906 Aero H/H+ system provides the interface to the antenna. Refer to Rockwell Collins SAT-906 documentation for specific details.

(k)   RF Splitter Installation – Cooperative Mode

Refer to Table 3–28 for a list of the required cable assembly parts. Substitutions using different parts of equivalent functionality are acceptable.

Note: Before installing the RF splitter, **read all of the steps** included in the following splitter installation procedure.

Note: Actual splitter mounting location may vary depending on the placement of the existing RFU and HPA assemblies.

To install the RF Splitter:

1.   Determine a suitable location near the RFU to secure the splitter.

2.   Cut the receive coax cable at the splitter mounting location.

3.   Re-terminate the cut ends with TNC coax connectors.

4. Connect the end coming from the antenna subsystem to the splitter input (S) connector.

5. Connect the end going to TPC1 of the RFU to one of the output ports of the splitter, one or two.

6. Run a new coax cable (length is installation specific) from the unused splitter output port to BP-12 of the ARINC 600 connector of the HSD tray assembly.

Table 3–28. Receive Path Parts Requirements – Cooperative Mode

Item	Manufacturer PN	EMS SATCOM PN	Description
RF Splitter	ZAPD-2-TNC	32800004	Mini-Circuit, 2-way 0°, TNC, Splitter
Receive Coax	432101	–	ECS, Coax Cable, 0.130 O.D., 50Ω, 17.5 dB/100 ft @ 1.5 GHz
Connector (@ Splitter)	CTS522	–	ECS, TNC, Straight Plug
Connector (@ BP12)	P522	–	ECS, ARINC 600, Size 5, Socket

(I) Cooperative Mode Connection Details

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

Table 3–29. Cooperative Mode ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I/O	1A to 1D	Multi-Control IN and BITE OUT	As per Collins documentation	Multi-Control and BITE
I	2A	BSU Top/Port BITE A	SDU, MP7G	ARINC Tx-HI BITE From Top/Port BSU
I	2B	BSU Top/Port BITE B	SDU, MP7H	ARINC Tx-LO BITE From Top/Port BSU
I	2C	BSU STBD BITE A	*Mechanically Steered*[1] *Antenna (MA):* Not required *Other Antenna*[2] *(OA):* SDU, MP7J	ARINC Tx-HI BITE From STBD BSU
I	2D	BSU STBD BITE B	*MA*: Not required *OA*: SDU, MP7K	ARINC Tx-LO BITE From STBD BSU
O	2E	OUT SDU Crosstalk A	SDU, MP12A	ARINC 429
O	2F	OUT SDU Crosstalk B	SDU, MP12B	ARINC 429

Table 3–29. Cooperative Mode ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I	2H	IN SDU Crosstalk A	SDU, MP12C	ARINC 429
I	2J	IN SDU Crosstalk B	SDU, MP12D	ARINC 429
I	3H	Tx– disable	SDU, MP5J	ARINC Discrete, Tx disable
I	3A to 3D	HPA MUTE	MA: Not required As per Collins documentation	HPA Mute-A &B to BSU
I	2K	Remote Reset	Normally Open momentary switch— open side (Closed side to MP1F)	Remote System Reset (Not supported in Cooperative Model)
I	4A to 4D	System Config 1 to 4	4A & 4B=0 (TP7K COM) 4C & 4D=1 (OPEN)	System Mode – Collins Cooperative
I	4E to 4H	System Config 5 to 8	Open (1)	System Mode configuration – not assigned
I	4J	IRS-A	Aircraft main IRS	IRS Data, Rx HI (Provisional)
I	4K	IRS-B	Aircraft main IRS	IRS Data, Rx LO (Provisional)
I	5A, 5B, & 5D	SDI 1, SDI 2, & SDI Common	As per Collins documentation	HPA Select Code for HGA

Table 3–29. Cooperative Mode ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I	5F	FWD Address, BIT 24 (LSB)	1=no connection, 0=Common (TP7K)	Six digit Hex ID assigned by Inmarsat /EMS SATCOM
I	5G	FWD Address, BIT 23		
I	5H	FWD Address, BIT 22		
I	5J	FWD Address, BIT 21		
I	5K	FWD Address, BIT 20		
I	6A	FWD Address, BIT 19		
I	6B	FWD Address, BIT 18		
I	6C	FWD Address, BIT 17		
I	6D	FWD Address, BIT 16		
I	6E	FWD Address, BIT 15		
I	6F	FWD Address, BIT 14		
I	6G	FWD Address, BIT 13		
I	6H	FWD Address, BIT 12		
I	6J	FWD Address, BIT 11		
I	6K	FWD Address, BIT 10		
I	7A	FWD Address, BIT 9		

Table 3–29. Cooperative Mode ARINC 600 Top Plug Connection Details

I/O	From Top Plug	Signal Name	To	Description
I	7B	FWD Address, BIT 8		
I	7C	FWD Address, BIT 7		
I	7D	FWD Address, BIT 6		
I	7E	FWD Address, BIT 5		
I	7F	FWD Address, BIT 4		
I	7G	FWD Address, BIT 3		
I	7H	FWD Address, BIT 2		
I	7J	FWD Address, BIT 1 (MSB)		
I	7K	FWD Address, Common		Common GND connection for system and I/O configuration and FWD ID

1. BSU Pin nomenclature for Mechanically-Steered Antennae (*MA*) is manufacturer dependent.
2. "Other antenna types" (*OA*) represent either conformal or phased array antennae.

Table 3–30. Cooperative Mode ARINC 600 Middle Plug Connection Details

I/O	From Middle Plug	Signal Name	To	Description
O	1A	LED 1	Remote Status Panel—Green	HSD—Power On (Optional)
O	1B	LED 2	Remote Status Panel—Red	HSD—Fault (Optional)
I/O	1F	LED Common	Remote Status LED Panel <u>and</u> closed side of N.O. Remote Reset switch (if used)	LED Common
O	1G	Maint Port Tx (Out)	Maint Port serial data, DB9S-2	Maintenance Laptop/PC, for Remote access
I	1H	Maint Port Rx (In)	Maint Port serial data, DB9S-3	
I/O	1J	Maint Port Signal GND	Maint Port serial data, DB9S-5	

Table 3–30. Cooperative Mode ARINC 600 Middle Plug Connection Details

I/O	From Middle Plug	Signal Name	To	Description
O	2A	Channel Card (CC) #1 Rx	DTE-1A, DB9S-2	User Mobile Packet Data (MPDS), RS-232, DTE-1A
I	2B	CC #1 Tx	DTE-1A, DB9S-3	
I	2C	CC #1 RTS	DTE-1A, DB9S-7	
O	2D	CC #1 CTS	DTE-1A, DB9S-8	
I	2E	CC #1 DTR	DTE-1A, DB9S-4	
O	2F	CC #1 DSR	DTE-1A, DB9S-6	
O	2G	CC #1 DCD	DTE-1A, DB9S-1	
O	2H	CC #1 RI	DTE-1A, DB9S-9	
I/O	2J	CC #1 SGND	DTE-1A, DB9S-5	
I	4G	BRI RX+	RJ45-3	User Data, ISDN–2 (Provisional) Refer to "User Interfaces – Cooperative Mode" on page 3-48
I	4H	BRI RX-	RJ45-6	
O	4J	BRI TX+	RJ45-4	
O	4K	BRI TX-	RJ45-5	
I	6A	BRI RX+	RJ45-3	User Data, ISDN–1 Refer to "User Interfaces – Cooperative Mode" on page 3-48
I	6B	BRI RX-	RJ45-6	
O	6C	BRI TX+	RJ45-4	
O	6D	BRI TX-	RJ45-5	
I	5G to 5K	I/O CONFIG Pins 1 to 4	See Table 3–26	System Data I/O Mode Configurations
I	6G to 6K	I/O CONFIG Pins 5 to 8	Open (1)	Data I/O Config – not assigned

Table 3–30. Cooperative Mode ARINC 600 Middle Plug Connection Details

I/O	From Middle Plug	Signal Name	To	Description
I	7A	10BASE-T Rx+	Ethernet 10BASE-T, RJ45-3	User Data, Ethernet 10BASE-T
I	7B	10BASE-T Rx-	Ethernet 10BASE-T, RJ45-6	(Available in models 1110-A-0150,
O	7C	10BASE-T Tx+	Ethernet 10BASE-T, RJ45-1	1110-A-0160, and in units with Service
O	7D	10BASE-T Tx-	Ethernet 10BASE-T, RJ45-2	Bulletin, 1110-SB-0004 accomplished)
O	C1	RF Tx Output	Antenna Subsystem-DLNA	Coax Cable, RF Transmit

Table 3–31. Cooperative Mode ARINC 600 Bottom Plug Connection Details

I/O	From Bottom Plug	Signal Name	To	Description
I	2	+28 V dc HOT	Aircraft Power Source, HOT	+28 V dc supply
I	3	+28 V dc Rtn GND	Aircraft Power Source, Rtn	
I	8	Chassis GND	Aircraft Ground	Aircraft Chassis Ground
I	1	115 V ac HOT	Aircraft Power Source, HOT	115 V ac 400 Hz supply
I	7	115 V ac COLD	Aircraft Power Source, COLD	
I	12	RF Rx Input	RF Rx Splitter output port	RF Receive from Antenna Subsystem

Note: At SDU#1, connect TP12E to GND

D. Section IV: Multi-Channel Configuration Installation

(1) Multi-Channel Configuration Installation Wiring Notes

This section provides detailed information on the external interface and system connections involved in the installation of an HSD-128 and HSD-X transceivers for Multi-Channel configuration operation.

Table 3–33, Table 3–34, Table 3–35, and Figure 3–38 illustrate the interconnection and contact assignment details of a Multi-Channel HSD configuration.

This section provides detailed information on cable loss considerations, the splitter for the receive path, and the combiner for the transmit path.

(a)   Multi-Channel Coaxial Cable Loss Considerations – Multi-Channel

When installing a Multi-Channel HSD configuration, the transmit loss between the HSD-X slaves and the HSD-128 master must be considered. This loss, taking into consideration the cables, the combiner, and the attenuator, should come as close as possible to 29.5 dB (as shown in Table 3–32). For an illustrated example, refer to Figure 3–17.

Table 3–32. Coax Cable Losses – *Multi-Channel*

Item	Loss (dB)
Cable, HSD-X to combiner	3
Combiner	3.5
Cable, combiner to attenuator	2
Attenuator	20
Cable, attenuator to HSD-128	1
Total:	29.5

Note: The installer should try to achieve 29.5 dB loss; ± 3 dB for all HSD-X slaves. (See Figure 3–17.) The loss is generally referred to as "HSD-X cable loss", even though it includes the combiner and attenuator.
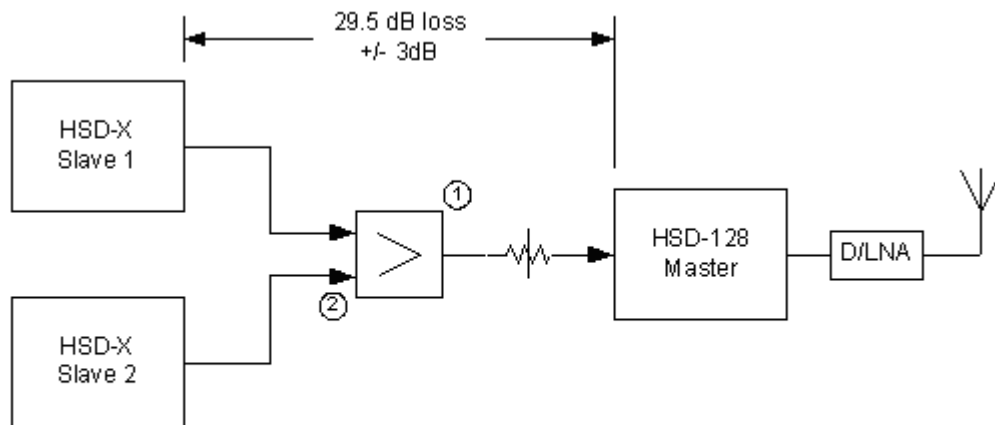
Figure 3–17. HSD-X Coax Cable Loss

After installation, the actual calculated (or measured) loss between each HSD-X and the HSD should be included in the HSD-128 ORT or EEPROM configuration.

(b)   HSD-128 Transceiver Multi-Channel Configuration Installations

The tables in this section provide all top, middle, and bottom plug, connection details for Stand-Alone Mode installations for the HSD-128 transceiver—specific to Multi-Channel HSD configurations.

This section describes the general installation details and external interface connections that are the same for all operational modes and configurations of HSD and HSD-X transceivers.

(c)   Source/Destination Identification (SDI) – Multi-Channel

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

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

(d)   Maintenance Port Interface – Multi-Channel

Both HSD and HSD-X transceivers have an RS-232 Maintenance Port interface that provides access to a maintenance utility program for data loading, system monitoring and testing purposes.

Access to the HSD Maintenance Utility Program 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 Maintenance port is available at the front of the HSD and at the rear ARINC 600 connector. Connection on the front of the HSD is accessible via a DB25S connector for local maintenance of the unit. Remote access is provided for cases where local access is unavailable. For remote access, install an accessible DB9S connector in the cabin area.

Direct connection to the HSD-X's front panel, maintenance port requires an HSD-X maintenance port cable. The front connector, maintenance port supports trace and data load functions and is a female, micro-D-type, M83513/04-B11N, or equivalent. As well, a permanent connector wired to the rear, middle-plug, of the ARINC-600 connector can be installed for remote access. Specifications and pinouts for this cable are provided in "Test and Fault Isolation" on page 4-1.

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.

(e) Antenna Subsystem RF Interface – Multi-Channel

Several external RF parameters (such as cable losses and antenna gain), that must be delimited to ensure proper operation, dictate the HSD performance requirements. Table 3–33 defines these parameters and their expected values.

Table 3–33. RF Parameters Definition – Multi-Channel

Parameter	Min. Value (dB)	Max. Value (dB)
Antenna Gain	8	17
Antenna—DLNA Loss	0.1	0.3
DLNA Gain	53	60
DLNA Noise Figure	1.5	1.8
DLNA—HSD-128 (BP12), including cables and splitter (Rx) Total Loss	0	19
DLNA—HSD-X (BP5), including cables and splitter (Rx) Total Loss	5	24
HSD-128—Antenna (Tx) Loss	1	2.5
DLNA Insertion Loss (Tx to Antenna Port)	–	0.8

(f) WOW Pin Wiring – Multi-Channel

These Weight-On-Wheel (WOW) discretes are wired only if equivalent information is not strapped as being available to the SDU on an ARINC 429 input [for example, IRS or the Centralized Fault Display System (CFDS)].

WOW wiring, for the HSD, is optional for system operation as the HSD already receives speed information for Doppler correction. However, if WOW wiring is not wired, normal maintenance must be disabled when speed or Doppler readings are greater than zero.

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

•   OPN: Open circuit

•   AFG: Airframe DC Ground

•   FAC: Fwd Address Common (TP7K)

Resolve any conflict between WOW1 and WOW2 by assuming the aircraft is "in-air." The interpretation of the state of the WOW1 and WOW2 pins is defined by the state of the WOW program select pin. Refer to Table 3–34 for details.

1. Multi-Channel Configurations

Labeled as WOW1, WOW2, and WOW Program Select, these discretes are wired only if equivalent information is not strapped as being available to the SDU on an ARINC 429 input [for example, IRS or the Centralized Fault Display System (CFDS)].

WOW wiring is optional for system operation in Stand-Alone Mode installations as the HSD already receives speed information for Doppler correction. However, if WOW wiring is not wired, normal maintenance must be disabled when speed or Doppler readings are greater than zero.

Table 3–34. WOW Pin Wiring Table – Multi-Channel

Pin Name and Location			
WOW1	WOW2	PGM	Aircraft Status
TP3G	TP3H	TP3J	
AFG	AFG	FAC	In-air
OPN	AFG	FAC	Not valid – Default in-air
AFG	OPN	FAC	Not valid – Default in-air
OPN	OPN	FAC	On-ground
AFG	AFG	OPN	On-ground
OPN	AFG	OPN	Not valid – Default in-air
AFG	OPN	OPN	Not valid – Default in-air
OPN	OPN	OPN	In-air

(g)   Forward and Return Address IDs – Multi-Channel

Figure 3–18 provides an example of a Forward ID address. The Forward ID is a Hex number (example: $ABC123) that must be converted into a binary number for strapping.

	Fwd Addr	Test Point	Binary
A	Fwd Addr:1 **(MSB)**	TP7J	1
	Fwd Addr:2	TP7H	0
	Fwd Addr:3	TP7G	1
	Fwd Addr:4	TP7F	0
B	Fwd Addr:5	TP7E	1
	Fwd Addr:6	TP7D	0
	Fwd Addr:7	TP7C	1
	Fwd Addr:8	TP7B	1
C	Fwd Addr:9	TP7A	1
	Fwd Addr:10	TP6K	1
	Fwd Addr:11	TP6J	0
	Fwd Addr:12	TP6H	0
1	Fwd Addr:13	TP6G	0
	Fwd Addr:14	TP6F	0
	Fwd Addr:15	TP6E	0
	Fwd Addr:16	TP6D	1
2	Fwd Addr:17	TP6C	0
	Fwd Addr:18	TP6B	0
	Fwd Addr:19	TP6A	1
	Fwd Addr:20	TP5K	0
3	Fwd Addr:21	TP5J	0
	Fwd Addr:22	TP5H	0
	Fwd Addr:23	TP5G	1
	Fwd Addr:24 **(LSB)**	TP5F	1
	Fwd Addr:COM.	TP7K	
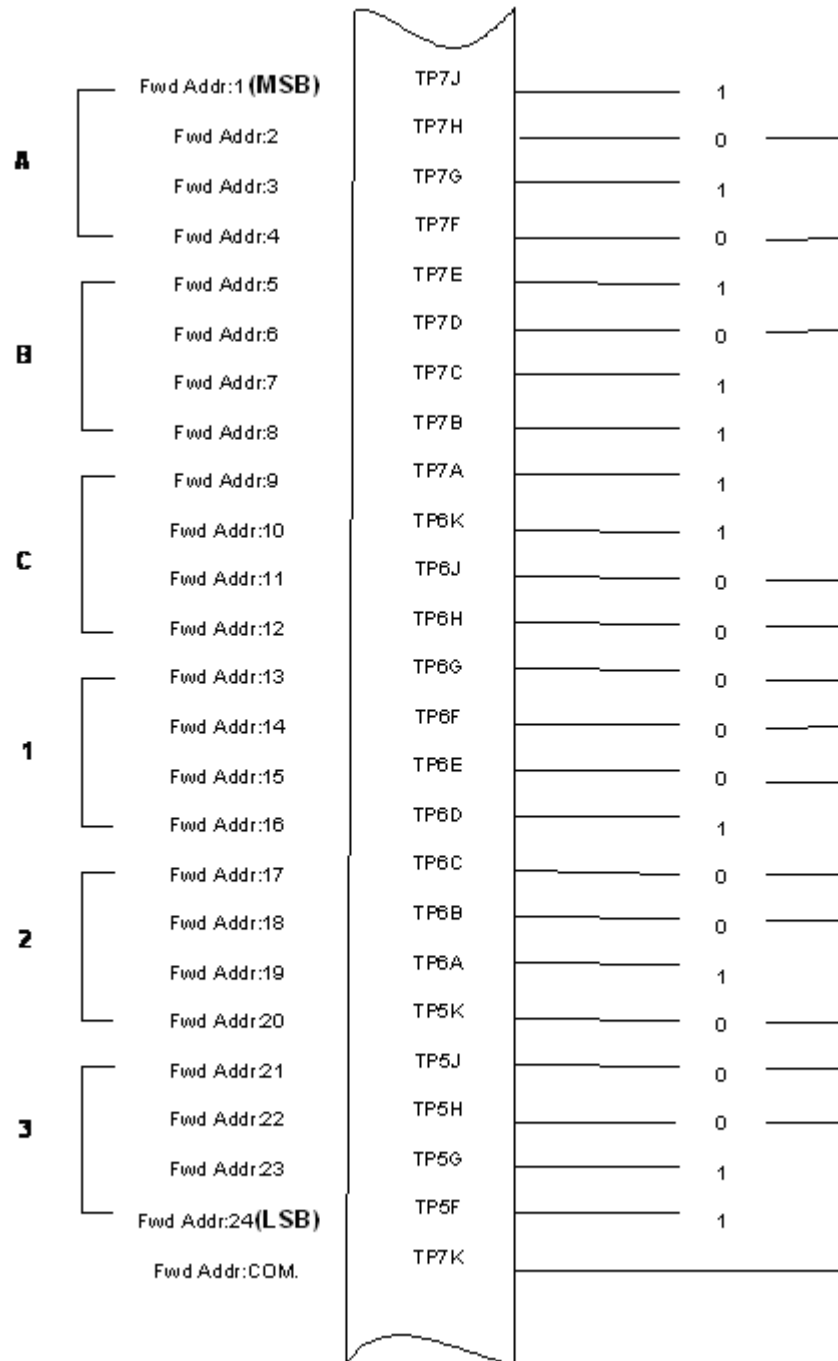
Figure 3–18. Forward ID, Hex to Binary Conversion – Multi-Channel

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

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

(h) Remote Status Panel – Multi-Channel (Optional)

An optional "remote status panel" may be installed in installations where the HSD and/or any HSD-X units are located in inaccessible or remote locations. The installation of a "remote status panel" is recommended as it provides visual indications of each of the power, fault, and call status of each of the units.

A "remote reset switch" for HSD transceivers can also be installed and located with the Remote Status Panel. Figure 3–19 illustrates a typical wiring diagram for the remote reset circuit.

Note: HSD-X transceivers *DO NOT* support the use of the reset function.

1. HSD Remote Reset Switch Circuit Requirements

HSD transceivers support the installation of a Remote Reset Switch circuit as shown in Figure 3–19.

The HSD 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 (include all cable and switch contact resistance).

2. HSD Remote LED Driver Circuit Requirements

The circuit requirements for the HSD Remote Status LED drivers are shown in Figure 3–20. Each LED driver circuit has a 200-ohm current limit resistor. The maximum cable resistance (including the forward and return paths) must not exceed 100 ohms to provide adequate current to the 5 volt LEDs (i.e. 10 mA minimum) at the remote status panel.

It is recommended that the installer use shielded cables to provide a level of noise immunity.

3. HSD-X Remote LED Driver Circuit Requirements

The HSD-X unit's Remote LED drivers are shown in Figure 3–21. The open collector transistors located in the HSD-X are capable of driving up to 500 mA of current—so either incandescent lamps or LED circuits with the appropriate current limits can be used. The example shown in Figure 3–21 shows an LED powered with a 28-volt source.
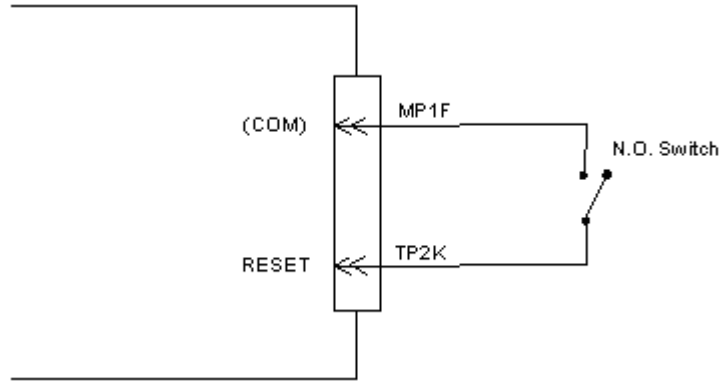
Figure 3–19. HSD Remote Reset Circuit – Multi-Channel
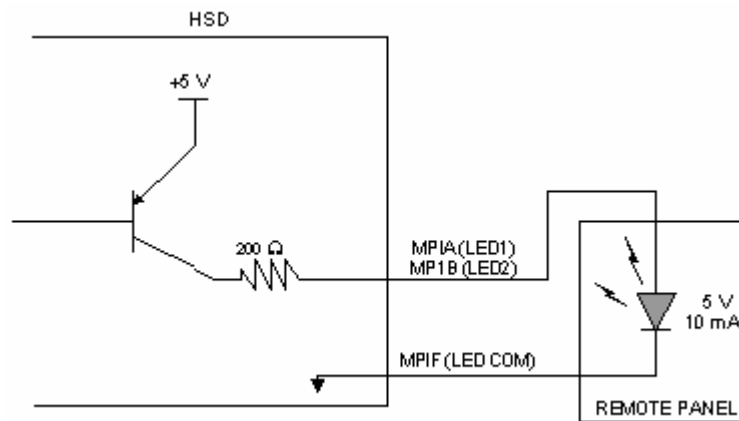
Figure 3–20. HSD Remote LED Panel Circuit – Multi-Channel
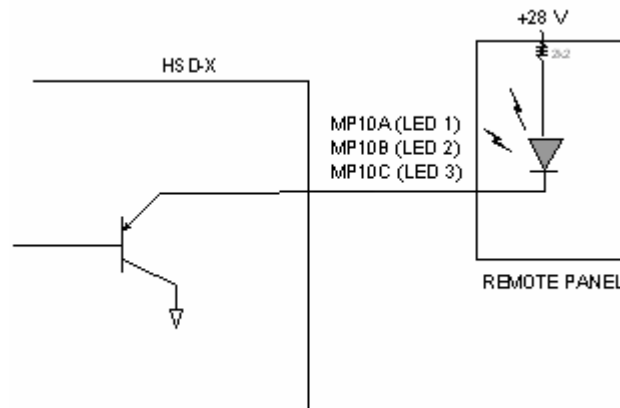
Figure 3–21. HSD-X Remote Status LED Driver Circuits – Multi-Channel

(i)   User Interfaces – Multi-Channel

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

Note: Although the Ethernet interface is only supported by HSD-X transceivers, HSD transceiver models, PN 1110-A-0150 and 1110-A-0160, and other models of HSD transceivers with service bulletin 1110-SB-0004 accomplished, consider pre-wiring the cabin for all interfaces—even when installing an HSD transceiver that currently does not support the Ethernet interface.

1. ISDN Interface

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

2. RS-232 Interface (MPDS)

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

3. Ethernet Data Interface

HSD transceiver models, part numbers 1110-A-0150 and 1110-A-0160 support the Ethernet interface. All other models of HSD transceivers must have service bulletin 1110-SB-0004 accomplished to support the Ethernet interface.

All HSD-X transceivers support the Ethernet Data Interface.

Install an RJ-45 interface connector in the cabin area for user access to the Ethernet interface. RJ-45 Connector Termination Details below describes the RJ-45 connector and cable termination.

4. RJ-45 Connector Termination Details

Details relating to the RJ-45 cable terminations, required for both the ISDN and/or 10BASE-T services, are shown in Table 3–35 and Figure 3–22.

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.

Table 3–35. RJ-45 Wiring Details – Multi-Channel

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 3–22. RJ-45 Connector Terminator Details – Multi-Channel

5. System Configuration Pin Strapping – Multi-Channel

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

Configuration pins are assigned based on system-mode-configuration selection and data input/output (I/O) requirements as shown in Table 3–36. Detailed pin assignment is shown in Table 3–37 and Table 3–38.

Table 3–36. Configuration Pin Summary – Multi-Channel

Pin #	Name	Function
TP4A to D	System Config #1 to #4	System Mode (See Table 3–27)
TP4E to H	System Config #5 to #8	Not assigned (set to"1")
MP5G to K	Data I/O Config #1 to #4	NOTE: Data I/O Mode (See Table 3–28)
MP6G to K	Data I/O Config #5 to #8	Not assigned (set to"1")

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

- Pins marked "0" are signaled by strapping to "Fwd Address Common" (T7K).

- Pins marked "1" are signaled by an open circuit—no connection.

- Configurations resulting in all "1's" are invalid.

6. System Mode Strap Pins Coding – Multi-Channel

The HSD transceiver must be externally strapped according to its intended operational configuration mode. Table 3–37 illustrates the system pin strapping for all HSD operational modes and configurations.

Table 3–37. System Mode Pin Strapping – Multi-Channel

System Modes	Pin Status			
	TP4A	TP4B	TP4C	TP4D
	1	2	3	4
INVALID	1	1	1	1
Stand Alone	0	1	0	1
Selective, SAT-906	1	1	0	1
Selective, MCS-3000	1	0	1	1
Selective, MCS-6000	1	0	0	1
Selective, MCS-7000	0	1	1	1
Honeywell Combined	1	1	1	0
Reserved	1	1	0	0
Collins Cooperative	0	0	1	1
Multi-Channel	0	0	0	1

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

- Pins marked "0" are signaled by strapping to "Fwd Address Common" (TP7K).

- Pins marked "1" are signaled by an open circuit—no connection.

- Configuration resulting in all "1's" is Invalid.

7. User Data I/O Mode Pin Strapping – Multi-Channel

Data I/O Mode Pin strapping is only required for HSD transceivers models, PN 1110-A-0150 and 1110-A-0160 or other HSD models that have Data I/O Type 2 cards installed via Service Bulletin 1110-SB-0004.

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

In HSD transceivers with two channel cards, both channels are accessible for Swift64 Mobile ISDN via the ISDN port on a first come-first served basis. All four modes, as detailed in Table 3–38, are also described in Figure 3–23.

In units where all Data I/O services are available (including Ethernet), the following statements are valid:

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

- If one channel card becomes inoperative, and there is a conflicting configuration (for example, 1 Reserved, 1 SCPC – for Swift64 Mobile ISDN), then the remaining card operates in "Unrestricted" mode.

- A "restricted" channel is not handled by the Data I/O Controller, which results in the channel not being accessible for SCPC via Ethernet or for MPDS via RS232 or Ethernet.

- An SCPC channel is accessible for SCPC via Ethernet.

- An MPDS channel is accessible for MPDS via RS232 and Ethernet.

- An "unrestricted" channel is accessible for SCPC via Ethernet and MPDS via RS232 and Ethernet.

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

Table 3–38. Data I/O Mode Pin Strapping – Multi-Channel

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

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

Figure 3–23. User Data I/O Mode Configurations – Multi-Channel

(j)   Multi-Channel Configuration Connection Details

The tables in this section provide all top, middle, and bottom plug connection details for Multi-Channel Configuration installations of HSD-128 transceivers and HSD-X transceiver extensions.

Table 3–39. HSD-128 Multi-Channel Configuration ARINC 600 Top Plug Connections

I/O	From Top Plug	Signal Name	To	Description
I	1A	Multi-control A	TP3E	Multi-control from control card
I	1B	Multi-control B	TP3F	Multi-control from control card
I	2A	BSU Top/Port BITE A (See Note 1)	*Mech. Steered Antenna (MA):* BSU, Pin G[1] or W or *Other Antenna[2] (OA):* BSU, PORT-W & Starboard-P	ARINC Tx-HI BITE from Top/Port BSU
I	2B	BSU Top/Port BITE B	*MA*: BSU, Pin H or X, or *OA*: BSU, PORT-X & STBD-R	ARINC Tx-LO BITE from Top/Port BSU
I	2C	BSU Starboard (STBD) BITE A	*MA*: Not required *OA*: BSU, PORT-P & STBD-W	ARINC Tx-HI BITE from STBD BSU
I	2D	BSU STBD BITE B	*MA*: Not required *OA*: BSU, PORT-R & STBD-X	ARINC Tx-LO BITE from STBD BSU
I	3A	Top/Port HPA MUTE A	*MA*: Not required *OA*: BSU, PORT-G	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	OUT Multi-Control A	IN Multi Ctrl A (TP1A), and *MA*: BSU, Pin A or T, or *OA*: BSU, PORT-T & STBD-T	Multi-Control-HI to HSD & Antenna Subsystem
O	2E	A OUT	All slave HSD-Xs TP6A	ARINC 429 Tx-HI HSD-X crosstalk broadcast
O	2F	B OUT	All slave HSD-Xs TP6B	ARINC 429 Tx-Lo HSD-X crosstalk broadcast
I	2H	A IN	HSD-X slave 1 TP6C	ARINC 429 Tx-HI HSD-X crosstalk chain
I	2J	B IN	HSD-X slave 1 TP6D	ARINC 429 Tx-Lo HSD-X crosstalk chain

Table 3–39. HSD-128 Multi-Channel Configuration ARINC 600 Top Plug Connections

I/O	From Top Plug	Signal Name	To	Description
O	3F	OUT Multi-Control B	IN Multi Ctrl B (TP1B), and *MA*: BSU, Pin B or U, or *OA*: BSU, PORT-U & STBD-U	Multi-Control-LO to HSD & Antenna Subsystem
I	2K	Remote Reset	Normally open momentary switch—open side. (Closed side to MP1F)	Remote System Reset
I	3G	WOW 1	TP3G	Weight On Wheel, as defined in Note 40 of ARINC 741, Part 1.
I	3H	WOW 2	TP3H	
I	3J	WOW Program Select	TP3J	
I	4A, 4B, 4C, 4D	System Config 1 to 4	4A, 4B, & 4C=0 (TP7K common) 4D=1(Open)	Multi-Channel Mode Configurations
I	4E to 4H	System Config 5 to 8	Open (1)	System Configuration - not assigned
I	4J	IRS-A	Aircraft main IRS	IRS 429 Data, Rx HI
I	4K	IRS-B	Aircraft main IRS	IRS 429 Data, Rx LO
I	5A	SDI 1	Not connected	HPA Select Code for HGA
I	5B	SDI 2	SDI common (TP5D)	HPA Select Code for HGA
I	5D	SDI Common	SDI 2 (TP5B)	SDI Common for HPA select codes
I	5F	FWD Address, BIT 24 (LSB)	1=no connection, 0=Common (TP7K)	Six digit Hex ID assigned by Inmarsat /EMS SATCOM
I	5G	FWD Address,		
I	5H	FWD Address,		
I	5J	FWD Address,		
I	5K	FWD Address, BIT 20		
I	6A	FWD Address,		
I	6B	FWD Address,		
I	6C	FWD Address,		
I	6D	FWD Address,		
I	6E	FWD Address,		

Table 3–39. HSD-128 Multi-Channel Configuration ARINC 600 Top Plug Connections

I/O	From Top Plug	Signal Name	To	Description
I	6F	FWD Address,		
I	6G	FWD Address,		
I	6H	FWD Address,		
I	6J	FWD Address,		
I	6K	FWD Address,		
I	7A	FWD Address,		
I	7B	FWD Address,		
I	7C	FWD Address,		
I	7D	FWD Address,		
I	7E	FWD Address,		
I	7F	FWD Address,		
I	7G	FWD Address,		
I	7H	FWD Address,		
I	7J	FWD Address, BIT 1 (MSB)		
I	7K	FWD Address, Common		Common GND connection for system and I/O configuration and
I	C1	RF in Tx	Attenuator, from HSD-X slaves	Coax Cable, RF Transmit

[1]BSU Pin nomenclature for Mechanically-Steered Antennae (*MA*) is manufacturer dependent.

[2]"Other antenna types" (*OA*) represent either conformal or phased array antennae.

Table 3–40. HSD-128 Multi-Channel Configuration, ARINC 600 Middle Plug Connections

I/O	From Middle Plug	Signal Name	To	Description
O	1A	LED 1	Remote Status Panel—Green	HSD—Power On
O	1B	LED 2	Remote Status Panel—Red	HSD—Fault

Table 3–40. HSD-128 Multi-Channel Configuration, ARINC 600 Middle Plug Connections

I/O	From Middle Plug	Signal Name	To	Description
O	1F	LED Common	Remote Status LED Panel, and closed side of N.O. Remote Reset Switch	LED Common
O	1G	Maint Port Tx (OUT)	Maint Port serial data, DB9S-2	Maintenance computer, for "Remote" access
I	1H	Maint Port Rx (IN)	Maint Port serial data, DB9S-3	
I/O	1J	Maint Port Signal Ground.	Maint Port serial data, DB9S-5	
O	3A	CC (channel card)#2 Rx	DTE-1B, DB9S-2 or DB25P-3	User Mobile Packet Data (MPDS), RS-232, DTE-1B
I	3B	CC #2 Tx	DTE-1B, DB9S-3 or DB25P-2	
I	3C	CC #2 RTS	DTE-1B, DB9S-7 or DB25P-4	
O	3D	CC #2 CTS	DTE-1B, DB9S-8 or DB25P-5	
I	3E	CC #2 DTR	DTE-1B, DB9S-4 or DB25P-20	
O	3F	CC #2 DSR	DTE-1B, DB9S-6 or DB25P-6	
O	3G	CC #2 CD	DTE-1B, DB9S-1 or DB25P-8	
O	3H	CC #2 RI	DTE-1B, DB9S-9 or DB25P-22	
I/O	3J	CC #2 SGND	DTE-1B, DB9S-5 or DB25P-7	
I	4G	BRI Rx+	ISDN, RJ45-3	User Data, ISDN–2 Refer to "User Interfaces – Multi-Channel" on page 3-67
I	4H	BRI Rx–	ISDN, RJ45-6	
O	4J	BRI Tx+	ISDN, RJ45-4	
O	4K	BRI Tx–	ISDN, RJ45-5	
I	5G to 5K	I/O CONFIG Pins 1 to 4	See Figure 3–8	System Data I/O Mode Configurations

Table 3–40. HSD-128 Multi-Channel Configuration, ARINC 600 Middle Plug Connections

I/O	From Middle Plug	Signal Name	To	Description
I	6G to 6K	I/O CONFIG 5 to 8	Open (1)	System Data I/O Configurations – not assigned
I	6A	BRI Rx+	ISDN, RJ45-3	User Data, ISDN–1
I	6B	BRI Rx –	ISDN, RJ45-6	Refer to "User Interfaces – Multi-Channel" on page 3-67
O	6C	BRI Tx+	ISDN, RJ45-4	
O	6D	BRI Tx-	ISDN, RJ45-5	
I	7A	10BASE-T Rx+	Ethernet 10BASE-T, RJ45-3	User Data, Ethernet 10BASE-T
I	7B	10BASE-T Rx-	Ethernet 10BASE-T, RJ45-6	
O	7C	10BASE-T Tx+	Ethernet 10BASE-T, RJ45-1	
O	7D	10BASE-T Tx-	Ethernet 10BASE-T, RJ45-2	
O	C1	RF, Tx Output	Antenna Subsystem-DLNA-J3	Coax Cable, RF Transmit

Table 3–41. HSD-128 Multi-Channel Configuration ARINC 600 Bottom Plug Connections

I/O	From Bottom Plug	Signal Name	To	Description
I	2	+28 V dc HOT	Aircraft Power Source, HOT	+28 V dc supply
I	3	+28 V dc return GND	Aircraft Power Source, return	
I	8	Chassis GND	Aircraft Ground	Aircraft Chassis Ground
I	1	115 V ac HOT	Aircraft Power Source, HOT	115 V ac 400 Hz supply
I	7	115 V ac COLD	Aircraft Power Source, COLD	
I	12	RF Rx Input	Splitter output from Antenna Subsystem –DLNA	Coax Cable, RF Receive

(k) HSD-X Installations – Multi-Channel

The tables in this section provide all top, middle, and bottom plug, connection details for of HSD-Xs integrated with the HSD-128 transceiver in Multi-Channel configurations.

Table 3–42. HSD-X Top Plug Connections

I/O	From Top Plug	Signal Name	To	Description
I	4A, 4B, 4C, 4D	System Configuration 1 to 4	4A, 4B, 4C, 4D = 1 (Open)	System Configuration Reserved
I	6A	HSD-X/HSD I/F Bus A In	HSD-128 Master TP2E	ARINC 429 Rx-HI Master Crosstalk Broadcast
I	6B	HSD-X/HSD I/F Bus B In	HSD-128 Master TP2F	ARINC 429 Rx-LO Master Crosstalk Broadcast
O	6C	HSD-X/HSD I/F Bus A Out	Refer to the interconnection diagram 1110-B-0419	ARINC 429 Tx-HI HSD-X Crosstalk Ring
O	6D	HSD-X/HSD I/F Bus B Out	Refer to the interconnection diagram 1110-B-0419	ARINC 429 Tx-LO HSD-X Crosstalk Ring
I	8A	Input Bus A In	Refer to the interconnection diagram 1110-B-0419	ARINC 429 Rx-HI HSD-X Crosstalk Ring
I	8B	Input Bus B In	Refer to the interconnection diagram 1110-B-0419	ARINC 429 Rx-LO HSD-X Crosstalk Ring
I	9D	Fwd ID Common		Common GND connection for system, I/O configuration, and FWD ID
I	10A	Fwd ID #1 (MSB)	1 = no connection, 0 = common (TP9D)	Six digit Hex ID assigned by Inmarsat / EMS SATCOM
I	10B	Fwd ID #2		
I	10C	Fwd ID #3		
I	10D	Fwd ID #4		
I	11A	Fwd ID #5		
I	11B	Fwd ID #6		
I	11C	Fwd ID #7		
I	11D	Fwd ID #8		
I	12A	Fwd ID #9		
I	12B	Fwd ID #10		
I	12C	Fwd ID #11		

Table 3–42. HSD-X Top Plug Connections

I/O	From Top Plug	Signal Name	To	Description
I	12D	Fwd ID #12		
I	13A	Fwd ID #13		
I	13B	Fwd ID #14		
I	13C	Fwd ID #15		
I	13D	Fwd ID #16		
I	14A	Fwd ID #17		
I	14B	Fwd ID #18		
I	14C	Fwd ID #19		
I	14D	Fwd ID #20		
I	15A	Fwd ID #21		
I	15B	Fwd ID #22		
I	15C	Fwd ID #23		
I	15D	Fwd ID #24 (LSB)		
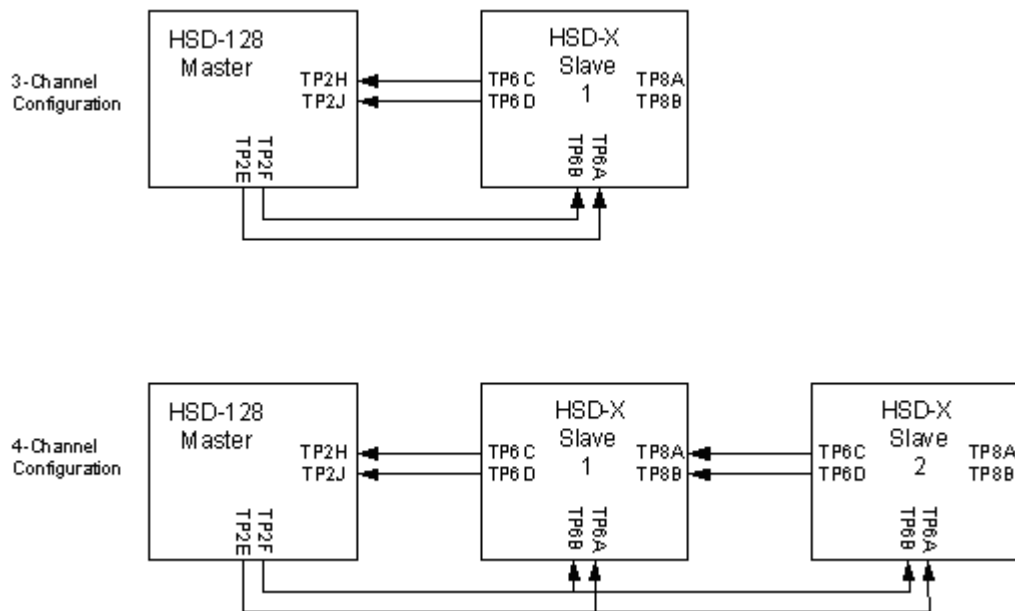
Figure 3–24. HSD-X Top Plug Connections (Illustrated)

Table 3–43. HSD-X Middle Plug Connections– Multi-Channel

I/O	From Middle Plug	Signal Name	To	Description
O	1A	Maint Port Tx	Maint Port serial data, DB9S-2	Maintenance Computer, for "Remote" access, RS-232
I	1B	Maint Port Rx	Maint Port serial data, DB9S-3	
I	1C	Maint Port GND	Maint Port serial data, DB9S-5	
I	1D	MPDS SGND	DTE-1, DB9S-5 or DB25P-7	User Mobile Packet Data (MPDS), RS-232, DTE-1A
O	2A	MPDS Rx	DTE-1, DB9S-2 or DB25P-3	
I	2B	MPDS Tx	DTE-1, DB9S-3 or DB25P-2	
I	2C	MPDS RTS	DTE-1, DB9S-7 or DB25P-4	
O	2D	MPDS CTS	DTE-1, DB9S-8 or DB25P-5	
I	3C	MPDS DTR	DTE-1, DB9S-4 or DB25P-20	
O	3D	MPDS DSR	DTE-1, DB9S-6 or DB25P-6	
O	4C	MPDS CD	DTE-1, DB9S-1 or DB25P-8	
O	4D	MPDS RI	DTE-1, DB9S-9 or DB25P-22	
O	10A	Channel Available	Discrete	Channel Available
O	10B	Service Ready	Discrete	System ready
O	10C	HSD-X Fail	Discrete	An "ON" state indicates that the HSD-X LRU has failed
I	10D	Transmit Disable	Discrete	An "ON" state commands the HSD-X LRU to turn off its transmit carrier.
I	11A to 11C	I/O Config 1 to 3	As per 245	System Data I/O Mode Configurations
I	13A	ISDN BRI RX+	ISDN, RJ45-3	User Data, ISDN-1 Refer to "User Interfaces – Multi-Channel" on page 3-67
I	13B	ISDN BRI RX-	ISDN, RJ45-6	
O	13C	ISDN BRI TX+	ISDN, RJ45-4	
O	13D	ISDN BRI TX-	ISDN, RJ45-5	

Table 3–43. HSD-X Middle Plug Connections– Multi-Channel

I/O	From Middle Plug	Signal Name	To	Description
I	15A	10BASE-T RX+	Ethernet 10BASE-T, RJ45-3	User Data, Ethernet 10BASE-T
I	15B	10BASE-T RX-	Ethernet 10BASE-T, RJ45-6	
O	15C	10BASE-T TX+	Ethernet 10BASE-T, RJ45-1	
O	15D	10BASE-T TX-	Ethernet 10BASE-T, RJ45-2	

Table 3–44. HSD-X Bottom Plug – Multi-Channel

I/O	From Bottom Plug	Signal Name	To	Description
O	1	RF, Tx Output	Combiner to HSD-128	Coax Cable, RF Transmit
I	2	115 V ac HOT	Aircraft Power Source, HOT	115 V ac 400 Hz supply
I	3	Chassis GND	Aircraft Ground	Aircraft Chassis Ground
I	4	115 V ac COLD	Aircraft Power Source, COLD	115 V ac 400 Hz supply
I	5	RF Rx Input	Splitter from Antenna Subsystem-DLNA	Coax Cable, RF Receive

Table 3–45. HSD-X I/O Data Strapping– Multi-Channel

MP11A	MP11B	MP11C	I/O Config
1	1	1	Invalid
1	1	0	Restricted (disable Data I/O)
1	0	1	MPDS (Future)
1	0	0	SCPC (M4) only
0	1	1	Unrestricted (recommended if there are no specific user requirements)
0	1	0	Not Assigned
0	0	1	Not Assigned
0	0	0	Reserved

Note: MP11D: Reserved, 0 = FWD Address Comm

Table 3–46. Inter-LRU RF Connection Considerations for Attenuators–
Multi-Channel

Function	From	To	Frequency (MHz) Loss	VSWR
HSD-X1 Tx	HSD-X1 BP1	HSD-128 TPC1	1626.5-1660.5 29.5dB ± 3.0dB	1.5:1, max
HSD-X2 Tx	HSD-X2 BP1	HSD-128 TPC1	1626.5-1660.5 29.5dB ± 3.0dB	1.5:1, max
HSD-X1 Rx	DLNA	HSD-X1 BP5	1525.0-1559.0 5.0dB to 24.0dB	1.5:1, max
HSD-X2 Rx	DLNA	HSD-X2 BP5	1525.0-1559.0 5.0dB to 24.0 dB	1.5:1, max
HSD-128 Rx	DLNA	HSD-128 BP12	1525.0-1559.0 0.0dB to 19.0dB	1.5:1, max

9. Outline/Installation and Interconnection/Contact Assignment Diagrams

This section contains the outline and installation drawings and interconnection and contact assignment diagrams for all installation modes and configurations of HSD and HSD-X transceivers.

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

A. Outline/Installation Diagrams

Figure 3–25 and Figure 3–26 illustrate the physical characteristics of the HSD transceiver and provides installation data for the unit.

Figure 3–27 and Figure 3–28 illustrate the physical characteristics of the HSD-X transceiver and provides installation data for the unit.

B. Interconnection/Contact Assignment Drawings

Figure 3–29 illustrates the interconnection details for Stand-Alone Mode HSD Transceivers.

Figure 3–30 provides the contact assignments for Stand-Alone Mode HSD Transceivers.

Figure 3–31 illustrates the interconnection details for Combined/Selective Mode HSD Transceivers.

Figure 3–32 provides the contact assignments for Combined/Selective Mode HSD Transceivers.

Figure 3–33 illustrates the interconnection details for Cooperative Mode HSD Transceivers.

Figure 3–34 provides the contact assignments for Cooperative Mode HSD Transceivers.

Figure 3–35 and Figure 3–36 illustrate the interconnection details for Multi-Channel HSD configurations.

Figure 3–37 and Figure 3–38 provide the contact assignments for Multi-Channel HSD configurations.

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REVISIONS

LTR	DESCRIPTION	DATE	BY	APPD	APPD
B	REVISED PER ECR 020181	25MAR02	MRM	DN	JS
C	REVISED PER ECR 020211	10APR02	MRM	MG	JS
D	REVISED PER ECR 020679, 030215	30MAY03	MRM		

NOTES:

1. USE THIS DRAWING IN CONJUNCTION WITH ALL HSD ASSEMBLIES LISTED IN TABLE 1.

2. THIS UNIT MEETS THE DIMENSIONAL REQUIREMENTS OF ARINC SPECIFICATION 600-12.

3. MAXIMUM WEIGHT IS 13 kg.

4. APPROXIMATE CENTRE OF GRAVITY IS INDICATED BY ⊕

5. REMOVED.

6. THIS UNIT SHALL BE INSTALLED IN AN 8MCU TRAY. ECS PART NUMBER: 120-89585 WITH POLARIZATION -08 (PRESSURIZED) OR 120-89584 WITH POLARIZATION -08 (UN-PRESSURIZED).

7. COOLING AIR REQUIREMENTS PER ARINC 600:
   – FLOW RATE: 175 lbs/hr.
   – PRESSURE DROP: 0.050 INCHES ± 0.025 INCHES H$_2$O.

TABLE 1. HSD TRANSCEIVER VARIANTS

TRANSCEIVER MODEL	CHANNEL CARDS	OPERATION MODE(S)	ASSEMBLY PART No.	INTERCONNECTION DIAGRAM	VOLTAGE (NOMINAL)	POWER NOM/MAX
HSD-128	2	STAND-ALONE	1110-A-0001	1110-B-0019	28VDC	275/370W
HSD-128	2	STAND-ALONE	1110-A-0060	1110-B-0019	115VAC/400Hz	275/385W
HSD-128	2	SELECTIVE/COMBINED	1110-A-0001	1110-B-0081	28VDC	325/370W
		COLLINS CO-OPERATIVE		1110-B-0156		
HSD-128	2	SELECTIVE/COMBINED	1110-A-0060	1110-B-0081	115VAC/400Hz	325/385W
		COLLINS CO-OPERATIVE		1110-B-0156		
HSD-64	1	SELECTIVE/COMBINED	1110-A-0080	1110-B-0081	28VDC	275/370W
		COLLINS CO-OPERATIVE		1110-B-0156		
HSD-64	1	SELECTIVE/COMBINED	1110-A-0070	1110-B-0081	115VAC/400Hz	275/385W
		COLLINS CO-OPERATIVE		1110-B-0156		

7.10 .06
4.40
10.20 MAX
10.11 MAX
.06

COOLING HOLE PATTERN, TOP AND BOTTOM PER ARINC 600-12

A → SEE SHEET 2
B ← SEE SHEET 2

7.64
3.84
1.67 1.32
.12
12.52
.20 MAX .145
2.00 TO FRONT FLANGE OF ARINC CONNECTOR .06
3.76 WITH HANDLE ROTATED

ISOMETRIC VIEW

APPLICATION
USED ON USED ON
ADDITIONAL APPROVALS
SIGN DATE
REA M.GOODMAN 29NOV01
MASS M.GOODMAN 29NOV01
ANTENNA
THERMAL M.GOODMAN 29NOV01

DWG. LEVEL 2
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
DECIMALS ANGLES SURFACES
.X ±.020
.XX ±.010 0 30'
.XXX ±.005
DO NOT SCALE DRAWING
MATERIAL

CONTRACT/PROJECT ADT-1000
APPROVALS
SIGN DATE
DRAWN M.MARTIN 14JUN01
CHECKED D.SOKOLOSKI 29NOV01
MECH. M.GOODMAN 29NOV01
ELECT. K.DELMAGE 29NOV01
MFG ENG

EMS Technologies 1725 WOODWARD DRIVE OTTAWA, ONTARIO K2C 0P9

TITLE
OUTLINE & INSTALLATION DRAWING, HSD-64/128 TRANSCEIVER

DWG No 1110-E-0001 REV D SHT 1

Figure 3–25 (Sheet 1). HSD Outline and Installation Drawing - 1110-E-0001, Rev D

MAINTENANCE CONNECTOR,
(UNDER PROTECTIVE COVER)
RECEPTACLE, FEMALE, D-TYPE,
SIZE B (25 CONTACTS).
PART NUMBER:M24308/2-3
MATING PLUG:M24308/4-3

CONNECTOR, RECEPTACLE, ARINC 600, SIZE 2.
PART NUMBER: RADIALL NSXF2R221Y0908.
MATING PLUG: RADIALL NSXN2P221S0108.

#1 COAX CONTACT - 2 PLACES
RADIALL PART NUMBER: 620 044

UPPER INSERT WITH
ALL CONTACTS USED

MIDDLE INSERT WITH
ALL CONTACTS USED

LOWER INSERT WITH
ONLY POSITIONS 1, 2,
3, 7, 8, & 12 USED

#5 COAX CONTACT AT POSITION 12
RADIALL PART NUMBER: 620 134

POLARIZATION
5, 4, 3

2.5

1.2

2.5

7.80

VIEW ON 'A' (FRONT)

VIEW ON 'B' (REAR)

DWG No 1110-E-0001

REV D

SHT 2

Figure 3–26 (Sheet 2). HSD Outline and Installation Drawing - 1110-E-0001, Rev D

Figure 3–27 (Sheet 1). HSD-X Outline and Installation Drawing - 1110-E-0401, Rev 1

NOTES:

1. THIS UNIT MEETS THE APPLICABLE REQUIREMENTS OF ARINC 600 FOR A SIZE 2 MODULAR CONCEPT UNIT (2MCU).

2. WEIGHT: 8.8 LBS MAX.

3. APPROXIMATE CENTRE OF GRAVITY IS SHOWN BY ⬤

4. FINISH: ALL SURFACES EXCEPT BOTTOM, PAINTED USING PRISM POWDER-COAT PB134LT (POLYESTER POWDER, SATIN SANDTEX, BLACK. BOTTOM SURFACE, CHEMICAL FILM PER MIL-C-5541.

5. INPUT POWER: 115VAC, 400Hz, SINGLE-PHASE.

6. POWER DISSIPATION: 34 WATTS.

7. UNIT IS DESIGNED TO OPERATE WITH, OR WITHOUT, FORCED-AIR COOLING PER ARINC 600. COOLING AIR IS REQUIRED ONLY WHEN UNIT IS MOUNTED IN AN UN-PRESSURIZED LOCATION.

8. COOLING AIR REQUIREMENTS ARE:
   - FLOW RATE: 15.5 LBS/HR.
   - PRESSURE DROP: .044 ± .025 INCHES WATER.

9. THIS UNIT SHALL BE MOUNTED IN A 2 MCU TRAY.

10. ENVIRONMENTAL TESTING PER DO-160D:
    [(A4)(C4)Y]BAB[SB]EXXXFXZAAAC[RR]M[(A3)(E3)]XXA.

ISOMETRIC VIEW
NTS

VIEW ON 'A'

CONNECTOR, RECEPTACLE, ARINC 600, SIZE 1. RADIALL P/N NSXF1R101Y0008

INSERT ARRANGEMENT 01 60 x #22 SOCKETS 2 PLACES

INDEX PIN CODING 08

INSERT ARRANGEMENT 03 2 x #5 COAX 2 x #16 PIN 1 x #12 PIN

.000-.012 PROTRUSION OF CONNECTOR BOSS BELOW CHASSIS

SIZE D | FSCM NO. 38473 | DWG NO. 1110-E-0401 | REV 1
SCALE 2:1 | LIBRARY: ADT ASSEMBLIES | SHEET 2 OF 2

Figure 3–28 (Sheet 2). HSD-X Outline and Installation Drawing - 1110-E-0401, Rev 1
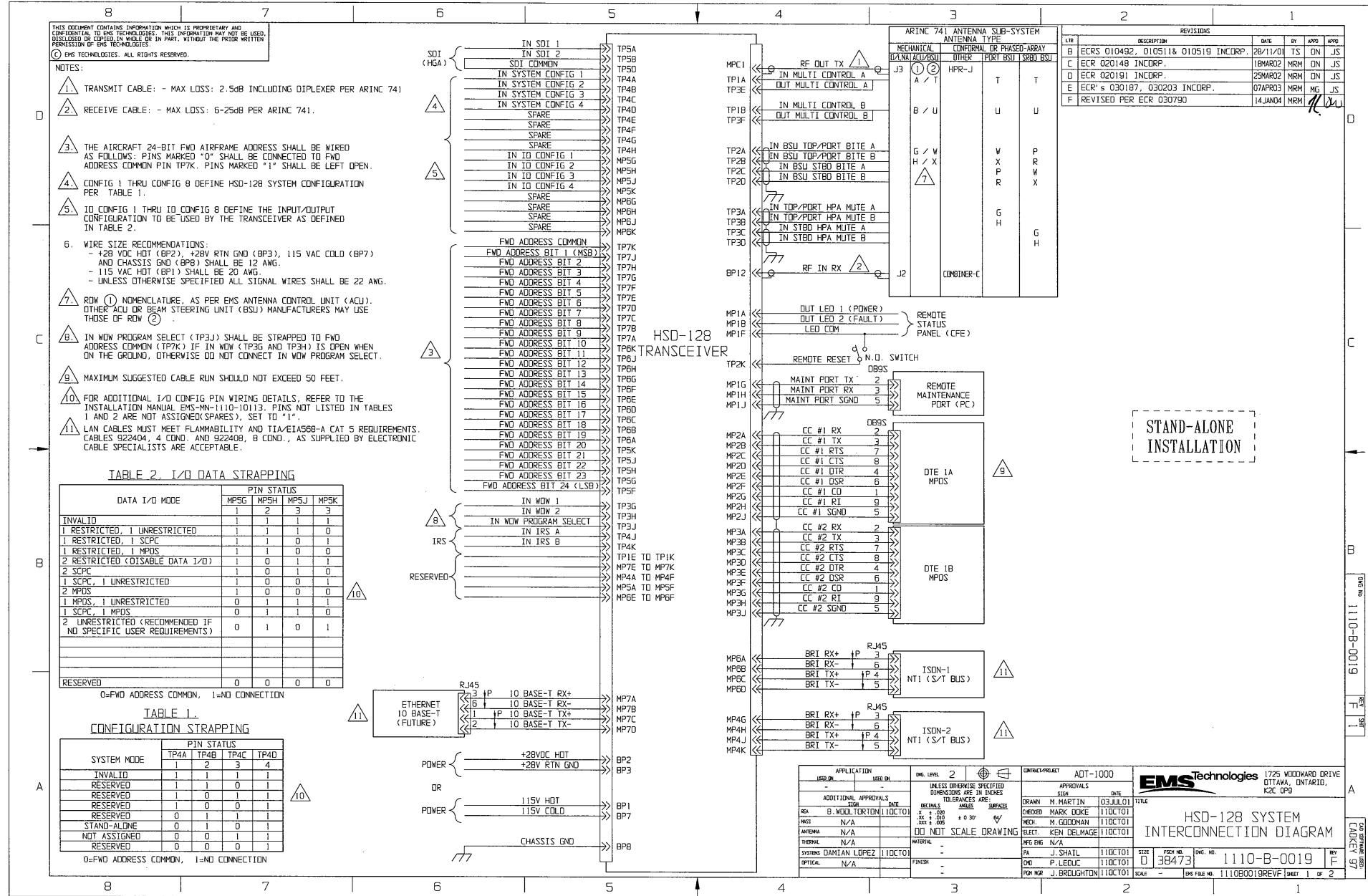
Figure 3–29 (Sheet 1). Stand-Alone Mode HSD System Interconnection Diagram - 1110-B-0019, Rev F

TPC1

UPPER INSERT

	A	B	C	D	E	F	G	H	J	K
1	INPUT MULTI-CONTROL A	INPUT MULTI-CONTROL B			RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
2	INPUT BSU TOP/PORT BITE A	INPUT BSU TOP/PORT BITE B	INPUT BSU STBD BITE A	INPUT BSU STBD BITE B			FUTURE SPARE			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 MULTI-CONTROL A	OUTPUT MULTI-CONTROL B	INPUT WOW #1	INPUT WOW #2	INPUT WOW PROGRAM SELECT	FUTURE SPARE
4	INPUT SYSTEM CONFIG 1	INPUT SYSTEM CONFIG 2	INPUT SYSTEM CONFIG 3	INPUT SYSTEM CONFIG 4	SPARE	SPARE	SPARE	SPARE	INPUT IRS A	INPUT IRS B
5	INPUT SOI #1	INPUT SOI #2	FUTURE SPARE	SOI COMMON	FUTURE SPARE	FWD ADDRESS BIT #24	FWD ADDRESS BIT #23	FWD ADDRESS BIT #22	FWD ADDRESS BIT #21	FWD ADDRESS BIT #20
6	FWD ADDRESS BIT #19	FWD ADDRESS BIT #18	FWD ADDRESS BIT #17	FWD ADDRESS BIT #16	FWD ADDRESS BIT #15	FWD ADDRESS BIT #14	FWD ADDRESS BIT #13	FWD ADDRESS BIT #12	FWD ADDRESS BIT #11	FWD ADDRESS BIT #10
7	FWD ADDRESS BIT #9	FWD ADDRESS BIT #8	FWD ADDRESS BIT #7	FWD ADDRESS BIT #6	FWD ADDRESS BIT #5	FWD ADDRESS BIT #4	FWD ADDRESS BIT #3	FWD ADDRESS BIT #2	FWD ADDRESS BIT #1	FWD ADDRESS COMMON

MIDDLE INSERT

	A	B	C	D	E	F	G	H	J	K
1	OUTPUT LED #1	OUTPUT LED #2				LED COMMON	MAINT PORT TX (RS232)	MAINT PORT RX (RS232)	MAINT PORT SGND (RS232)	FUTURE SPARE
2	CC #1 RX (RS232)	CC #1 TX (RS232)	CC #1 RTS (RS232)	CC #1 CTS (RS232)	CC #1 DTR (RS232)	CC #1 DSR (RS232)	CC #1 CD (RS232)	CC #1 RI (RS232)	CC #1 SGND (RS232)	FUTURE SPARE
3	CC #2 RX (RS232)	CC #2 TX (RS232)	CC #2 RTS (RS232)	CC #2 CTS (RS232)	CC #2 DTR (RS232)	CC #2 DSR (RS232)	CC #2 CD (RS232)	CC #2 RI (RS232)	CC #2 SGND (RS232)	FUTURE SPARE
4	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	ISDN-2 RX+	ISDN-2 RX-	ISDN-2 TX+	ISDN-2 TX-
5	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	INPUT IO_CONFIG 1	INPUT IO_CONFIG 2	INPUT IO_CONFIG 3	INPUT IO_CONFIG 4
6	ISDN-1 RX+	ISDN-1 RX-	ISDN-1 TX+	ISDN-1 TX-	RESERVED	RESERVED	SPARE	SPARE	SPARE	SPARE
7	10BASE-T RX+	10BASE-T RX-	10BASE-T TX+	10BASE-T TX-	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

RF OUT TX

MPC1

LOWER INSERT

4 RESERVED	3 +28V RTN GND	2 +28VDC HOT	1 115V HOT
6 RESERVED	8 CHASSIS GND	7 115V COLD	5 SPARE
10 SPARE			9 SPARE
13 SPARE	11 SPARE		12 RF IN RX

CONTACT ASSIGNMENTS FOR J1 OF HSD-128
VIEW SHOWN ON MATING FACE

SIZE D	FSCM NO. 38473	DWG. NO. 1110-B-0019	REV F
SCALE -		EMS FILE NO. 1110B0019REVF	SHEET 2 OF 2

Figure 3–30 (Sheet 2). Stand-Alone Mode HSD System Interconnection Diagram - 1110-B-0019, Rev F

Figure 3–31 (Sheet 1). HSD Selective/Combined Mode Interconnection Diagram - 1110-B-0081, Rev D

Figure 3–32 (Sheet 2). HSD Selective/Combined Mode Interconnection Diagram - 1110-B-0081, Rev D
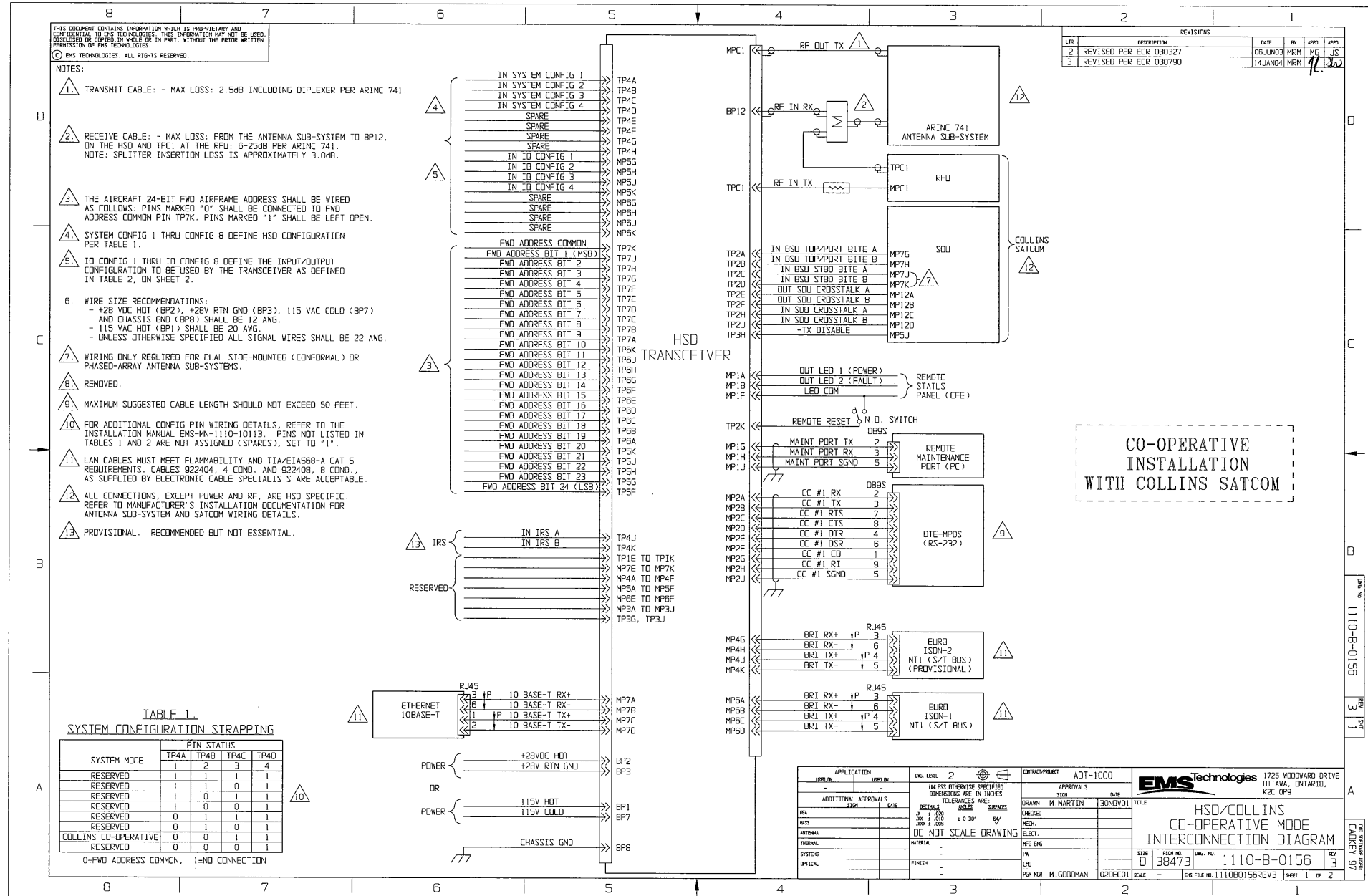
Figure 3–33 (Sheet 1). HSD Cooperative Mode Interconnection Diagram - 1110-B-0156, Rev 3

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TABLE 2.
I/O DATA CONFIGURATION STRAPPING

DATA I/O MODE	PIN STATUS			
	MP5G 1	MP5H 2	MP5J 3	MP5K 3
INVALID	1	1	1	1
1 RESTRICTED, 1 UNRESTRICTED	1	1	1	0
1 RESTRICTED, 1 SCPC	1	1	0	1
1 RESTRICTED, 1 MPDS	1	1	0	0
2 RESTRICTED (DISABLE DATA I/O)	1	0	1	1
2 SCPC	1	0	1	0
1 SCPC, 1 UNRESTRICTED	1	0	0	1
2 MPDS	1	0	0	0
1 MPDS, 1 UNRESTRICTED	0	1	1	1
1 SCPC, 1 MPDS	0	1	1	0
2 UNRESTRICTED (RECOMMENDED IF NO SPECIFIC USER REQUIREMENTS)	0	1	0	1
RESERVED	0	0	0	0

0=FWD ADDRESS COMMON, 1=NO CONNECTION

TPC1

TX FROM OTHER SATCOM

	A	B	C	D	E	F	G	H	J	K
1	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
2	INPUT BSU TOP/PORT BITE A	INPUT BSU TOP/PORT BITE B	INPUT BSU STBD BITE A	INPUT BSU STBD BITE B	OUT SDU CROSSTALK A	OUT SDU CROSSTALK B	FUTURE SPARE	IN SDU CROSSTALK A	IN SDU CROSSTALK B	
3	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	-TX DISABLE	RESERVED	FUTURE SPARE
4	INPUT SYSTEM CONFIG 1	INPUT SYSTEM CONFIG 2	INPUT SYSTEM CONFIG 3	INPUT SYSTEM CONFIG 4	SPARE	SPARE	SPARE	SPARE	INPUT IRS A	INPUT IRS B
5	RESERVED	RESERVED	FUTURE SPARE	RESERVED	FUTURE SPARE	FWD ADDRESS BIT #24	FWD ADDRESS BIT #23	FWD ADDRESS BIT #22	FWD ADDRESS BIT #21	FWD ADDRESS BIT #20
6	FWD ADDRESS BIT #19	FWD ADDRESS BIT #18	FWD ADDRESS BIT #17	FWD ADDRESS BIT #16	FWD ADDRESS BIT #15	FWD ADDRESS BIT #14	FWD ADDRESS BIT #13	FWD ADDRESS BIT #12	FWD ADDRESS BIT #11	FWD ADDRESS BIT #10
7	FWD ADDRESS BIT #9	FWD ADDRESS BIT #8	FWD ADDRESS BIT #7	FWD ADDRESS BIT #6	FWD ADDRESS BIT #5	FWD ADDRESS BIT #4	FWD ADDRESS BIT #3	FWD ADDRESS BIT #2	FWD ADDRESS BIT #1	FWD ADDRESS COMMON

UPPER INSERT

	A	B	C	D	E	F	G	H	J	K
1	OUTPUT LED #1	OUTPUT LED #2	RESERVED	RESERVED	LED COMMON	RESERVED	MAIN PORT TX (RS232)	MAIN PORT RX (RS232)	MAIN PORT SGND (RS232)	FUTURE SPARE
2	CC #1 RX (RS232)	CC #1 TX (RS232)	CC #1 RTS (RS232)	CC #1 CTS (RS232)	CC #1 DTR (RS232)	CC #1 DSR (RS232)	CC #1 CD (RS232)	CC #1 RI (RS232)	CC #1 SGND (RS232)	FUTURE SPARE
3	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	FUTURE SPARE
4	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	ISDN-2 RX+	ISDN-2 RX-	ISDN-2 TX+	ISDN-2 TX-
5	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	INPUT IO_CONFIG 1	INPUT IO_CONFIG 2	INPUT IO_CONFIG 3	INPUT IO_CONFIG 4
6	ISDN-1 RX+	ISDN-1 RX-	ISDN-1 TX+	ISDN-1 TX-	RESERVED	RESERVED	SPARE	SPARE	SPARE	SPARE
7	10BASE-T RX+	10BASE-T RX-	10BASE-T TX+	10BASE-T TX-	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

MIDDLE INSERT

RF OUT TX
MPC1

4 RESERVED	3 +28V RTN GND	2 +28VDC HOT	1 115V HOT
6 RESERVED	8 CHASSIS GND	7 115V COLD	5 SPARE
10 SPARE			9 SPARE
13 SPARE	11 SPARE		12 RF IN RX

LOWER INSERT

1110-B-0156

CONTACT ASSIGNMENTS FOR J1 OF HSD
VIEW SHOWN ON MATING FACE

SIZE	FSCM NO.	DWG. NO.	REV
D	38473	1110-B-0156	3
SCALE	-	DWG FILE NO. 1110B0156REV3	SHEET 2 OF 2

Figure 3–34 (Sheet 2). HSD Cooperative Mode Interconnection Diagram - 1110-B-0156, Rev 3

Figure 3–35 (Sheet 1). HSD-128 Multi-Channel Interconnection Diagram - 1110-B-0419, Rev C

Figure 3–36. (Sheet 2). HSD-128 Multi-Channel Interconnection Diagram - 1110-B-0419, Rev C

TPC1 — RF IN TX (UPPER INSERT)

	A	B	C	D	E	F	G	H	J	K
1	INPUT MULTI-CONTROL A	INPUT MULTI-CONTROL B			RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED
2	INPUT BSU TOP/PORT BITE A	INPUT BSU TOP/PORT BITE B	INPUT BSU STBD BITE A	INPUT BSU STBD BITE B	A IN	B IN	FUTURE SPARE	A OUT	B OUT	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 MULTI-CONTROL A	OUTPUT MULTI-CONTROL B	INPUT WOW #1	INPUT WOW #2	INPUT WOW PROGRAM SELECT	FUTURE SPARE
4	INPUT SYSTEM CONFIG 1	INPUT SYSTEM CONFIG 2	INPUT SYSTEM CONFIG 3	INPUT SYSTEM CONFIG 4	SPARE	SPARE	SPARE	SPARE	INPUT IRS A	INPUT IRS B
5	INPUT SDI #1	INPUT SDI #2	FUTURE SPARE	SDI COMMON	FUTURE SPARE	FWD ADDRESS BIT #24	FWD ADDRESS BIT #23	FWD ADDRESS BIT #22	FWD ADDRESS BIT #21	FWD ADDRESS BIT #20
6	FWD ADDRESS BIT #19	FWD ADDRESS BIT #18	FWD ADDRESS BIT #17	FWD ADDRESS BIT #16	FWD ADDRESS BIT #15	FWD ADDRESS BIT #14	FWD ADDRESS BIT #13	FWD ADDRESS BIT #12	FWD ADDRESS BIT #11	FWD ADDRESS BIT #10
7	FWD ADDRESS BIT #9	FWD ADDRESS BIT #8	FWD ADDRESS BIT #7	FWD ADDRESS BIT #6	FWD ADDRESS BIT #5	FWD ADDRESS BIT #4	FWD ADDRESS BIT #3	FWD ADDRESS BIT #2	FWD ADDRESS BIT #1	FWD ADDRESS COMMON

MPC1 — RF OUT TX (MIDDLE INSERT)

	A	B	C	D	E	F	G	H	J	K
1	OUTPUT LED #1	OUTPUT LED #2				LED COMMON	MAINT PORT TX (RS232)	MAINT PORT RX (RS232)	MAINT PORT SGND (RS232)	FUTURE SPARE
2	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	FUTURE SPARE
3	CC #2 RX (RS232)	CC #2 TX (RS232)	CC #2 RTS (RS232)	CC #2 CTS (RS232)	CC #2 DSR (RS232)	CC #2 DTR (RS232)	CC #2 CD (RS232)	CC #2 RI (RS232)	CC #2 SGND (RS232)	FUTURE SPARE
4	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	ISDN-2 RX+	ISDN-2 RX-	ISDN-2 TX+	ISDN-2 TX-
5	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	INPUT IO_CONFIG 1	INPUT IO_CONFIG 2	INPUT IO_CONFIG 3	INPUT IO_CONFIG 4
6	ISDN-1 RX+	ISDN-1 RX-	ISDN-1 TX+	ISDN-1 TX-	RESERVED	RESERVED	SPARE	SPARE	SPARE	SPARE
7	10BASE-T RX+	10BASE-T RX-	10BASE-T TX+	10BASE-T TX-	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED	RESERVED

LOWER INSERT

4 RESERVED	3 +28V RTN GND	2 +28VDC HOT	1 115V HOT
6 RESERVED	8 CHASSIS GND	7 115V COLD	5 SPARE
10 SPARE			9 SPARE
13 SPARE	11 SPARE		12 RF IN RX

CONTACT ASSIGNMENTS FOR J1 OF HSD-128
VIEW SHOWN ON MATING FACE

SIZE D — FSCM NO. 38473 — DWG. NO. 1110-B-0419 — REV C
SCALE — DWG FILE NO. 1110B0419REVC — SHEET 3 OF 4

TABLE 3.
HSD-128 FRONT PANEL MAINTENANCE CONNECTOR DESCRIPTIONS

FUNCTION	PIN	HSD IN/OUT	SIGNAL TYPE
CHASSIS GND	J2-1	GND	
RESERVED	J2-2	IN	–
RESERVED	J2-3	IN	–
CHASSIS GND	J2-4	GND	
RESERVED	J2-5	OUT	–
RESERVED	J2-6	OUT	–
CHASSIS GND	J2-7	GND	
RESERVED	J2-8		–
RESERVED	J2-9		–
UNIT MAINT SGND	J2-10		RS 232
UNIT MAINT TX	J2-11		RS 232
UNIT MAINT RX	J2-12		RS 232
	J2-13		
HPA MAINT SGND	J2-14		RS 232
HPA MAINT TX	J2-15		RS 232
HPA MAINT RX	J2-16		RS 232
CC1 MAINT SGND	J2-17		
EXT CC1 TX	J2-18		–
EXT CC1 RX	J2-19		–
EXT CC1 MON	J2-20		–
CC2 MAINT SGND	J2-21		–
EXT CC2 TX	J2-22		–
EXT CC2 RX	J2-23		–
EXT CC2 MON	J2-24		–
–	J2-25		–

Figure 3–37 (Sheet 3). HSD-128 Multi-Channel Interconnection Diagram - 1110-B-0419, Rev C

UPPER INSERT (TP)

	A	B	C	D
1	INPUT DATA LOADER A	INPUT DATA LOADER B	OUTPUT DATA LOADER A	OUTPUT DATA LOADER B
2	INPUT DATA LOADER LINK A	GND DATALOADER LINK B	INPUT RESERVED DISCRETE	INPUT RESERVED DISCRETE
3	OUTPUT RESERVED DISCRETE	OUTPUT RESERVED DISCRETE	OUTPUT RESERVED DISCRETE	INPUT RESERVED DISCRETE
4	INPUT SYSTEM CONFIG 1	INPUT SYSTEM CONFIG 2	INPUT SYSTEM CONFIG 3	INPUT SYSTEM CONFIG 4
5	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
6	INPUT HSD-X/HSD I/F BUS A	INPUT HSD-X/HSD I/F BUS B	OUTPUT HSD-X/HSD I/F BUS A	OUTPUT HSD-X/HSD I/F BUS B
7	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
8	A IN	B IN	FUTURE SPARE	FUTURE SPARE
9	SPARE INPUT BUS A	SPARE INPUT BUS B	FUTURE SPARE	GND FWD ID COMMON
10	INPUT FWD ID #1	INPUT FWD ID #2	INPUT FWD ID #3	INPUT FWD ID #4
11	INPUT FWD ID #5	INPUT FWD ID #6	INPUT FWD ID #7	INPUT FWD ID #8
12	INPUT FWD ID #9	INPUT FWD ID #10	INPUT FWD ID #11	INPUT FWD ID #12
13	INPUT FWD ID #13	INPUT FWD ID #14	INPUT FWD ID #15	INPUT FWD ID #16
14	INPUT FWD ID #17	INPUT FWD ID #18	INPUT FWD ID #19	INPUT FWD ID #20
15	INPUT FWD ID #21	INPUT FWD ID #22	INPUT FWD ID #23	INPUT FWD ID #24

MIDDLE INSERT (MP)

	A	B	C	D
1	OUTPUT MAINTENANCE PORT TX	INPUT MAINTENANCE PORT RX	GND MAINTENANCE PORT SGND	GND MPDS SGND
2	INPUT MPDS RX	OUTPUT MPDS TX	MPDS RTS	MPDS CTS
3	FUTURE SPARE	FUTURE SPARE	MPDS DTR	MPDS DSR
4	FUTURE SPARE	FUTURE SPARE	MPDS CD	MPDS RI
5	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
6	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
7	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
8	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
9	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
10	OUTPUT CHANNEL AVAILABLE	OUTPUT SERVICE READY	OUTPUT HSD-X FAIL	INPUT TRANSMIT DISABLE
11	INPUT I/O CONFIG 1	INPUT I/O CONFIG 2	INPUT I/O CONFIG 3	INPUT I/O CONFIG 4
12	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
13	INPUT ISDN BRI RX+	INPUT ISDN BRI RX-	OUTPUT ISDN BRI TX+	OUTPUT ISDN BRI TX-
14	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE	FUTURE SPARE
15	INPUT 10 BASE-T RX+	INPUT 10 BASE-T RX-	OUTPUT 10 BASE-T TX+	OUTPUT 10 BASE-T TX-

LOWER INSERT (BP)

- BP1 OUTPUT RF TX
- BP2 INPUT 115VAC/400Hz HOT
- BP3 CHASSIS GROUND
- BP4 INPUT 115VAC/400Hz COLD
- BP5 INPUT RF RX

CONTACT ASSIGNMENTS FOR J1 OF HSD-X
VIEW SHOWN ON MATING FACE

TABLE 4.
HSD-X FRONT PANEL MAINTENANCE CONNECTOR DESCRIPTIONS

FUNCTION	PIN	HSD-X IN/OUT	SIGNAL TYPE
DATA LOADER IN A	J2-1		RESERVED
DATA LOADER IN B	J2-2		RESERVED
SPARE	J2-3		
DATA LOADER OUT A	J2-4		RESERVED
DATA LOADER OUT B	J2-5		RESERVED
SPARE	J2-6		
DATA LOADER CONTINUITY LINK (A)	J2-7		RESERVED
MAINT PORT TD	J2-8	OUT	RS232
MAINT PORT GND	J2-9	GND	RS232
MAINT PORT RD	J2-10	IN	RS232
DATA LOADER CONTINUITY LINK (B)	J2-11		RESERVED
ATE RESERVED	J2-12		ATE
ATE RESERVED	J2-13	GND	ATE
ATE RESERVED	J2-14		ATE
ATE RESERVED	J2-15		ATE

TABLE 5.
HSD-X CONFIGURATION STRAPPING

TP4A	TP4B	TP4C	TP4D	SYSTEM CONFIG
1	1	1	1	RESERVED
1	1	1	0	RESERVED
1	1	0	1	RESERVED
1	1	0	0	RESERVED
1	0	1	1	RESERVED
1	0	1	0	RESERVED
1	0	0	1	RESERVED
1	0	0	0	RESERVED
0	1	1	1	RESERVED
0	1	1	0	RESERVED
0	1	0	1	RESERVED
0	1	0	0	RESERVED
0	0	1	1	RESERVED
0	0	1	0	RESERVED
0	0	0	1	RESERVED
0	0	0	0	RESERVED

0=FWD ADDRESS COMMON, 1=NO CONNECTION

TABLE 6.
HSD-X I/O DATA STRAPPING

MP11A	MP11B	MP11C	I/O CONFIG
1	1	1	INVALID
1	1	0	RESTRICTED (DISABLE DATA I/O)
1	0	1	MPDS
1	0	0	SCPC (M4) ONLY
0	1	1	UNRESTRICTED (RECOMMENDED IF NO SPECIFIC USER REQUIREMENTS)
0	1	0	NOT ASSIGNED
0	0	1	NOT ASSIGNED
0	0	0	RESERVED

0=FWD ADDRESS COMMON, 1=NO CONNECTION

SIZE D | FSCM NO. 38473 | DWG. NO. 1110-B-0419 | REV C
SCALE | DWG FILE NO. 1110B0419REVC | SHEET 4 OF 4

Figure 3–38 (Sheet 4). HSD-128 Multi-Channel Interconnection Diagram - 1110-B-0419, Rev C

TEST AND FAULT ISOLATION

1. Introduction

This section provides the information required to determine the operational readiness of the HSD and HSD-X transceivers and to aid service personnel in diagnosing system faults.

The operational and diagnostic tests described in this section require using the HSD and HSD-X transceivers built-in diagnostic tool referred to as the HSD maintenance utility program. This section provides detailed descriptions of the HSD maintenance utility program menus, reports, and basic user instructions. Refer to page "HSD Maintenance Utility Program" on page 4-3 for maintenance port cabling details.

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

2. Operational and Diagnostic Testing

A. General

Usually, units require testing for one of the reasons listed below:

- To verify the operational readiness of the unit during and after installation on an aircraft.

- To verify that a fault exists and produce system reports for troubleshooting purposes.

- To verify the operational readiness of repaired LRUs during re-installation on an aircraft.

This section presents software loading and test and fault isolation procedures for the HSD and HSD-X transceivers. All test and load procedures require using the HSD maintenance utility program, which is accessed by connecting to the maintenance port of the unit.

B. Test and Fault Isolation Equipment Requirements

Table 4–1 lists the equipment required to access the HSD maintenance utility program and perform operational and diagnostic testing and software loads on the HSD and HSD-X transceivers.

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

Table 4–1. List of Required Test Equipment

Item	Equipment	Specification	Quantity
Computer	Standard	VT-100 386 CPU, 20-MHz or higher	1
VT-100 terminal emulation program	HyperTerminal©, ProComm Plus©, or equivalent	Serial communication program using an RS-232 port	1
Cable, maintenance port interface cable	Special HSD units (See Figure 4–3) HSD-X units (See Figure 4–4)	Remote access: maximum length 25 ft (Measured from the ARINC 600 connector to the DB9 breakout connector) Front Panel access: maximum length 50 ft	1
Multimeter	Standard	–	1
General purpose toolset	Standard	–	1
Software load program	Special	PN 1110-SW-1021	1
HSD/HSD-X software files	Special	As specified in applicable service bulletins	As required

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
High speed data terminal Setup Guide	Special	MN-1110-10048	1
Time Domain Refectometer	Standard	–	1

C. HSD Maintenance Utility Program

This section describes the HSD maintenance port utility program and provides the connection and cabling details required to access and use the program.

(1) General Overview

A maintenance utility program, built into the HSD and HSD-X transceiver'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 Maintenance Utility Program, an RS-232, VT-100 terminal (PC or Laptop operating a terminal emulation program) must be connected to the HSD or HSD-X transceiver.

The maintenance port on the front panel of HSD transceivers provides a direct connection to the HSD maintenance utility program using a DB25S connector. Optionally, remote cabin access is possible using a DB9S connector via the ARINC 600 connector.

Direct connection to the HSD-X's front panel, maintenance port requires an HSD-X maintenance port cable. The front connector, maintenance port supports trace and data load functions and is a female, micro-D-type, M83513/04-B11N, or equivalent. As well, a permanent connector wired to the rear, middle-plug, maintenance port connector can be installed for remote access. A description of the HSD-X maintenance port pins is provided in 305.

For testing and monitoring of all components of a Multi-Channel HSD configuration, access to all units in the system is achieved by using a single terminal (PC or Laptop) connected to the Maintenance Port of the HSD-128 Transceiver. Communication with any installed HSD-Xs installed in the system is possible by passing through the HSD's Maintenance Facility when operating in "console-mode." Figure 4–1 illustrates the Maintenance Port Facility in a Multi-Channel configuration.

Although system monitoring is possible using the "console-mode" feature, software updates, if required, must be loaded directly to the HSD-128 and each HSD-X via their respective maintenance port.
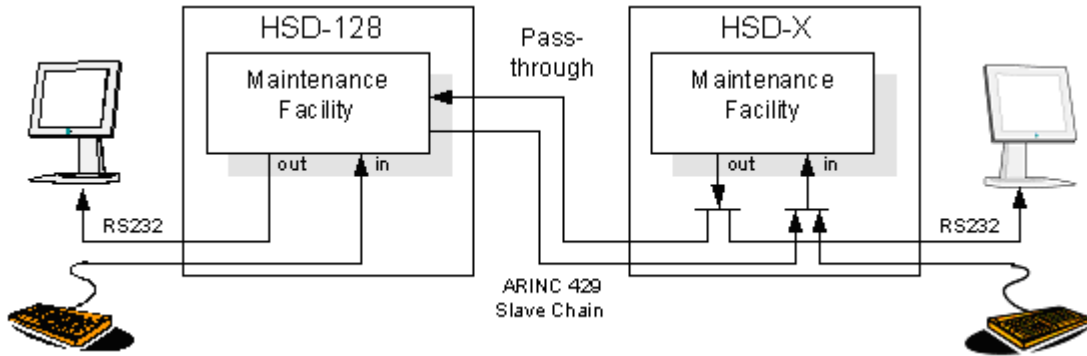
Figure 4–1. Multi-Channel Maintenance Port Access

(2) Connection Requirements

This section describes specific cabling requirement needed to connect to and use the HSD Maintenance Port Utility program.

(a) Cabling Notes

The HSD and HSD-X transceivers provide two options for physical connection to the HSD maintenance port and utility program: direct connection and remote connection.

Table 4–3, Table 4–4, Figure 4–2, and Figure 4–3 provide cabling details for the HSD transceiver for both direct and remote connection types. Select one of the connection options below to access the HSD maintenance utility program.

Table 4–5 and Figure 4–4 provide cabling details for the HSD-X transceiver for both direct and remote connection types. Select one of the connection options below to access the HSD maintenance utility program.

Note: The direct and remote connection points to the HSD maintenance port cannot be used simultaneously.

Table 4–3. Remote Maintenance Port Access Cabling (HSD)

Remote Access				
Pin Definition	**ARINC Connector (Rear)**	**Remote (DB9S)**	**Cable (See Figure 4–2)**	**Computer (DB9P)**
Maint Port SGND	(MP1J)	5		5
Maint Port Rx	(MP1H)	3		3
Maint Port Tx	(MP1G)	2		2

Table 4–4. Front-Panel Maintenance Port Access Cabling (HSD)

Front Panel Access				
Pin Definition	Front Panel DB25S	HSD Maintenance Cable Connector DB25P	Cable (See Figure 4–3)	Computer DB9P
Maint Port SGND	10	10		5
Maint Port Rx	12	12		3
	1	1		2

Table 4–5. HSD-X Maintenance Port Pin Descriptions

Function	Pin	HDS-X In/Out	Signal Type
Data Loader in A	1	–	Reserved
Data Loader in B	2	–	Reserved
Spare	3	–	–
Data Loader out A	4	–	Reserved
Data Loader out B	5	–	Reserved
Spare	6	–	–
Data Loader Continuity Link (A)	7	–	Reserved
Maint Port TD	8	Out	RS-232
Maint Port GND	9	GND	RS-232
Maint Port RD	10	In	RS-232
Data Loader Continuity Link (B)	11	–	Reserved
ATE Reserved	12	–	ATE
ATE Reserved	13	GND	ATE
ATE Reserved	14	–	ATE
ATE Reserved	15	–	ATE

(b)   Maintenance Port Cable Assembly

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

The cable assembly for HSD transceivers assumes that the computer's COM Port interface is a 9-Pin, D-Sub connector (DB9S). Cable assembly details for HSD transceivers are presented in Figure 4–2 and Figure 4–3. The cable assembly required for HSD-X transceivers is presented in Figure 4–4.

Note: The maximum cable length, shown in Figure 4–2 and Figure 4–3, assumes that the length is measured from the ARINC 600 connector to the DB9 breakout connector.
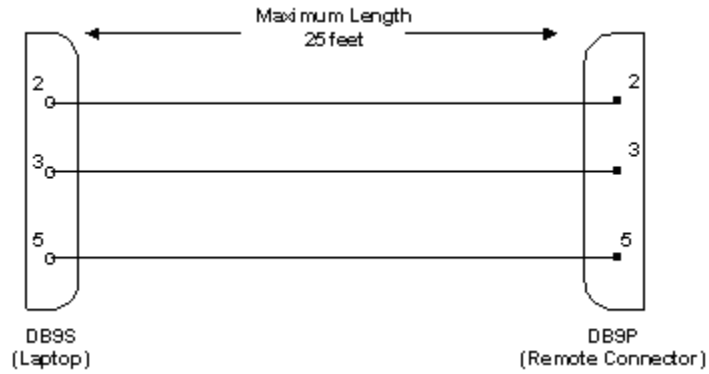
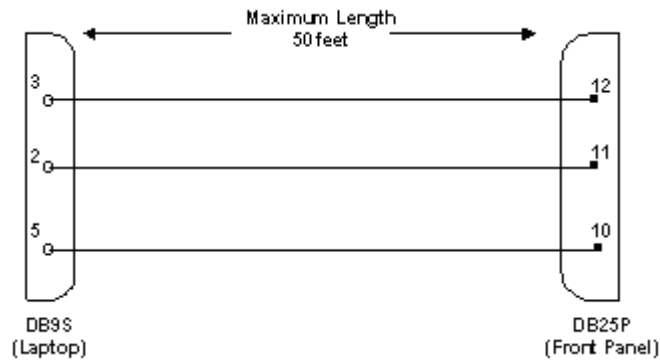**Figure 4–2. Remote Access, Maintenance Cable (HSD)**

Figure 4–3. Front Panel Access, Maintenance Cable (HSD)
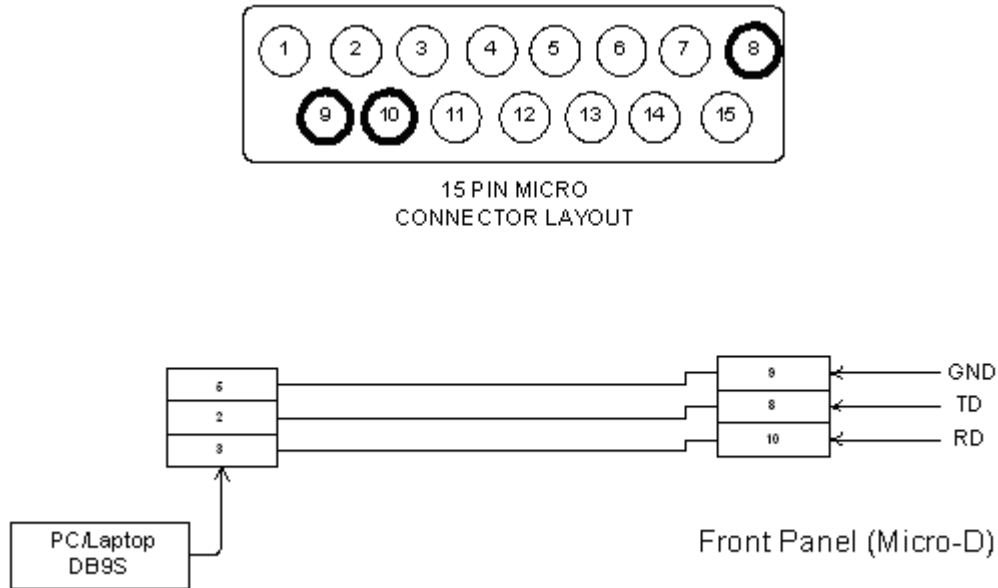
Figure 4–4. HSD-X Front-Panel, Maintenance Port Cable

(c)   Interface Requirements

A standard VT100 compatible terminal running an emulator program (such as HyperTerminal, ProComm Plus, or another similar serial communication package) provides the user interface to the HSD maintenance utility program. The RS-232 connection settings for HSD and HSD-X maintenance ports are the same. Refer to Table 4–6 for the recommended terminal connection settings.

Table 4–6. Terminal Connection Settings

Parameter	Setting
Character Format	ASCII
Baud Rate	19200 bps
No. of bits	8
Parity	None
Stop bits	1
Flow Control	None

(3) Accessing the Maintenance Utility Program

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

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

(a) End User Access: Level 1 – 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) Field Representative Access: Level 2 – Password: MAINT

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

(4) Using the HSD Maintenance Utility Program

This section describes the basic operating instructions for using and navigating the HSD maintenance utility program.

(a) Entering Passwords

- For untrained users use Level 1 access: Type *menu*, and then press **Enter**.

- For trained technicians and product support personnel use Level 2 access: Type *maint*, and then press **Enter**.

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

(b) Navigating the HSD Maintenance Utility Program

- To scroll through the available menus press **Ctrl+N**.

- To go to the previous menu, press **Ctrl+O**.

- To refresh the menu screen or exit from a Reports Menu press ESC.

(c) Selecting MENU Items

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

(d) Selecting Report Items

- To open the list of possible system reports, press the equals sign (**=**).

  A list of report items appears. Active reports show as toggled "**ON**." Inactive reports show as toggled "**OFF**."

- To activate a report item, type the report item number and then press **Enter**.

Note: Multiple report items can be activated at the same time; however, you must type and enter each report item number separately.

- To turn "**OFF**" individual, active report items, type the report item number you want to toggle off, and then press **Enter**.

- To turn "**OFF**" all active report items, press the equals sign (**=**) to display the report item list, and then press **X**.

(5) Menu Descriptions

This section describes the menus and menu items available in the HSD maintenance utility program in Level 1 access (using the MENU password) and Level 2 access (using the MAINT password) based on control processor software version 4.5 and 7.0. The differences between version 4.5 and 7.0 are noted within the examples. All menus and items that appear in Level 1 also appear in Level 2.

No additional menus or menu items were added with the release of Version 7.5, Control Processor software.

Note: Depending on the version of software and configuration mode installed, the actual menus and screen displays in "live" systems may differ slightly from the illustrations provided in this manual.

(a) Level 1 Menu Selections (Password: MENU)

Figure 4–5 shows all menus available to Level 1 users for control-processor software version 4.5 to 7.0. Menu items added or changed in version 7.0, control processor software are highlighted in bold text. No additional menus or menu items were added with the release of Version 7.5, Control Processor software.

```
     MENU1                              FIRMWARE V7.0


Y     explain hpa error status
<CTRL> N   next menu      <CTRL> O   previous menu  = select reports



      MENU2                             FIRMWARE V7.0


N     annotate log file               L     re-enter logon password
V     get firmware versions           Z     reset HSD-128
<CTRL> N   next menu      <CTRL> O   previous menu  = select reports


      MENU 3                            FIRMWARE V7.0

L     list EEPROM                      S     list event log
F     list call log                    O     list ORT
<CTRL> N   next menu      <CTRL> O   previous menu  = select reports



      MENU 4                            FIRMWARE V7.0

Q     channel card forward ID's
<CTRL> N   next menu      <CTRL> O   previous menu  = select reports
```

Figure 4–5. Level 1 MENU Selections

Note: Menu 3, item **O 'list ORT'** was added in control processor software version 7.0.

(b) Level 2 Menu Selections (Password: MAINT)

Figure 4–6 through Figure 4–12 show all menus and menu items available in Level 2, menu options in control processor software, version 7.0. Menu items added in version 7.0, control processor software are highlighted in bold. Where applicable, any items that were deleted in version 7.0 are described and noted below each menu. No additional menus or menu items were added with the release of Version 7.5, Control Processor software.

```
     MENU1                            FIRMWARE V7.0

X  override forward id              L  test LEDs
Y  explain hpa error status         S  set hcm attenuator
R  hcm RF threshold

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–6. Level 2: Menu 1

```
     MENU2                            FIRMWARE V7.0

A  set veh-relative azimuth         E  set veh-relative elevation
K  desired az veh-rel velocity      R  resume automatic steering
T  enter time of day                N  annotate log file
L  re-enter logon password          V  get firmware versions
Z  reset HSD-128                     S  set satellite longitude

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–7. Level 2: Menu 2

```
     MENU 3                           FIRMWARE V7.0
L  list EEPROM                       S  list event log
M  misc.  EEPROM parameter           F  list call log
O  list ORT                          P  ocean region parameter
I  set all LES id's

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–8. Level 2: Menu 3

Note: In control processor software, version 7.0, menu 3, item **N 'serial number'** was removed.

```
     MENU 4                             FIRMWARE V7.0

Q  channel card forward ID's      F  force spot beam selection
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
Level 2: Menu 4
        MENU10                            FIRMWARE V7.0

L  simul INS lat                 G  simul INS long
H  simul INS heading             T  simul INS true track
P  simul INS pitch               R  simul INS roll
S  simul INS speed               A  activate all simul words
X  deactivate all simul words    C  simul port ACU status
B  simul sb ACU status           M  activate antenna status words
N  deactivate antenna status words

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–9. Level 2: Menu10

```
     MENU 13                            FIRMWARE V7.0

T  query DATA IO elapsed time     V  query DATA IO version
S  query DATA IO services         C  query DATA IO config pins
F  DATA IO fault logging level    X  DATA IO console mode

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–10. Level 2: Menu 13

```
     MENU 14                            FIRMWARE V7.0

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 4–11. Level 2: Menu 14

```
  MENU 15                          FIRMWARE V7.0

V  request channel card versions    D  channel card serial number

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–12. Level 2, Menu 15

```
  MENU 18                          FIRMWARE V7.0

X  HSD-X slave console mode         B  HSD-X slave cable loss
L  list HSD-X slave cable loss      V  get HSD-X firmware version

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–13. Level 2, Menu 18

> **Note:** In control processor software, version 7.0, Menu 18 is available when the terminal category is set to HSD-X Network, HSD-X Antenna, or Viper configurations.

(6) Menu Item Descriptions

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

Although this section only provides illustrations and descriptions for Level 2 access, descriptions of all Level 1 access menu items shown in Figure 4–5 are covered. (All Level 1 menus are included in Level 2 Menus.)

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

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

(a) Menu 1

Figure 4–14 shows the HSD maintenance utility program Menu 1 screen display. Table 4–7 describes the items available in Menu 1.

In control processor software, version 7.0, the following changes were made to menu 3 selections (delta between version 4.5 and 7.0). No additional menu items were added with the release of Version 7.5, Control Processor software.

• Added menu items, S 'set hcm attenuator' and R ' hcm RF threshold'

```
      MENU1                              FIRMWARE V7.0

X  override forward id                L   test LEDs
Y  explain hpa error status           S   set hcm attenuator
R  hcm RF threshold


<CTRL> N   next menu        <CTRL> O   previous menu   = select reports
```

Figure 4–14. Menu 1 Screen Display

Table 4–7. Menu 1 Item Descriptions

Menu Item	Description
X: override forward id	• Used in testing and fault isolation • Enter a "test or alternate" Forward ID to use during fault isolation procedures. Resetting the HSD or cycling the power cancels this function.
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).

Y: explain hpa error status	• Reports HPA status:
	
	    • Displays HPA OK when no error codes are reported from the system's power up test
	
	    • Displays HPA error code message if system's power up test fails

S	• Used to set the preferred attenuation for Honeywell Combined Mode (HCM) operation to reduce the output signal level of the HCM module.
R	• Displays the HCM module threshold parameters for the RF: • If the measured RF level is below this threshold, the "RF low" bit is set in the HPA maintenance word, which is then sent by the HSD control processor to the Honeywell SDU.

(b) Menu 2

Figure 4–15 shows the HSD maintenance utility program Menu 2 screen display. Table 4–8 describes the items available in Menu 2.

In control-processor software version 7.0, no changes were made to menu 3 selections. No additional menu items were added with the release of Version 7.5, Control Processor software.

```
    MENU2                                    FIRMWARE Vx.x

A  set veh-relative azimuth          E  set veh-relative elevation
K  desired az veh-rel velocity       R  resume automatic steering
T  enter time of day                 N  annotate log file
L  re-enter logon password           V  get firmware versions
Z  reset HSD-128                      S  set sat long
<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–15. Menu 2 Screen Display

Table 4–8. Menu 2 Item Descriptions

Menu Items	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 a maximum signal reception. These commands are typically used where no IRS data is available.	
A: set veh-relative azimuth	• Antenna azimuth pointing offset with reference to the front centerline of the aircraft • Offset value entered in degrees from 0° to ± 180 °, where a positive entry is clockwise (cw) and a negative entry is counterclockwise (ccw)
K: desired az veh-rel velocity	• Activates continuous antenna azimuth sweep at a set elevation, as entered with menu item "E" • 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 on-board entry of date and time for initial one-time setting of the "Real Time Clock" • Where no clock is available (on some early models) the time may be set to time stamp a log file of a "reports" item
L: re-enter logon password	• Permits a user to enter a new access level password: *menu* or *maint*
Z: reset HSD	• 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

Table 4–8. Menu 2 Item Descriptions

Menu Items	Item Description
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 needed for later review
V: get firmware versions	• Displays the system Kernel and Application software versions as well as the channel card(s) and HPA firmware revisions
S: set satellite longitude	• Sets the satellite longitude

(c) Menu 3

In control processor software version 7.0, the following changes were made to menu 3 selections (delta between version 4.5 and 7.0). No additional menu items were added with the release of Version 7.5, Control Processor software.

• Deleted item N, 'serial number' as it was no longer required.

• The new item O, 'list ORT', displays all available ocean regions along with the satellite longitude.

• The new item P, 'ocean region parameter', displays the ocean region number along with the ocean region e.g. REGION 0: AOR WEST. This command item configures both the Primary and Secondary LES access codes in the unit.

• The new item I, 'set all LES id's', sets the LES IDs in all the ocean regions to the same LES access code and service provider.

• Removed several miscellaneous parameters from the Menu 3, item M selections.

In menu 3, the following changes were made to item M 'misc. EEPROM parameter':

• Removed extraneous parameters, 12, 19 to 24 and 28 to 31, which were neither required for system configuration nor operation

• Added parameter 3, 'GPS protection algorithm' — used to disable the GPS algorithms the HSD uses to prevent calls from interfering with the GPS navigational system on the aircraft.

• Added parameter 4, 'Registration Req'd before calls' — used to require successful ocean region registration before HSD calls are permitted (by default ocean region registration is not required).

• Added parameter 17, 'Viper Antenna Gain' — used to configure the nominal antenna gain used by the HSD when operating in Viper Mode—presuming that the HSD is connected to an antenna that does not provide antenna status words.

• Added parameter 18, 'Viper HPA/ANT Loss' — this is the RF loss between the HPA and the antenna, when the system is operating in Viper Mode.

- Added parameter 45, 'Category B Lower Frequency Limit' and Parameter 46, "Category B Upper Frequency Limit" — these two parameters specify the "CAT B" terminal frequency range. Calls, which involve transmitting outside of this range, may interfere with the GPS navigational system if an Aero H call occurs at the same time. Usually the GPS protection algorithm tears down these calls.

Figure 4–16 shows the HSD maintenance utility program Menu 3 screen display for version 7.0, control processor software. Table 4–9 describes the items available in Menu 3.

```
    MENU 3                              FIRMWARE V7.0

L  list EEPROM                     S  list event log
M  misc.  EEPROM parameter         F  list call log
O  list ORT                        P  ocean region parameter
I  set all LES id's

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–16. Menu 3 Screen Display

Table 4–9. Menu 3 Item Descriptions

Menu Item	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. Figure 4–17 shows an example of the EEPROM listing

S: list event log	• A list of system fault codes stored in non-volatile RAM
	
	• When selected, several options are available:
	
	    0 = Most recent saved entry is displayed
	
	    S = Displays next most recent entry saved
	
	    • = Displays all remaining logged entries
	
	    1 = Special events (Does not include Ocean Region Registration entries)

M: misc. EEPROM parameter	• Enables entry or entry changes to some of the EEPROM parameters listed in function 'L' **Note:** Parameters 5,6,7,8, 9, 13, 25, 26, 27, and 28 are not accessible using Level 1 or Level 2 passwords

F: list call log	• Displays call log files for HSD or HSD-X. When selected, two options are available:
	
	    Press "F" to display complete list of all log files
	
	    Press "X" to list extended EIRP trace data

Table 4–9. Menu 3 Item Descriptions

Menu Item	Item Description
O: list ORT	• Displays all EEPROM parameters, including all cable losses and LES configurations
P: ocean region parameter	• Used to configure LES access codes (primary and secondary service providers) for individual ocean regions
I: set all LES id's	• Used to configure the LES access codes to configure all ocean regions to the same LES access code and service provider (including primary and secondary service providers)

```
EEPROM LISTING:
MAGIC NUMBER :OK
EEPROM VERSION NUMBER 2001
FIRMWARE VERSION 1018
SERIAL NUMBER: xxx
IGNORED FAULTS: 0
HARDWARE CONFIG: 0
NUMBER OF POWERUPS (index 0) 570
HOURS OF OPERATION (index 0) 117


MISCELLANEOUS PARAMETERS
HIT 'L' for MORE


HPA-ANTENNA CABLE LOSS:   2.5 dB
FORWARD ID:  xxxxxx
AORW LES ACCESS CODE:   1
TERRESTRIAL NETWORK ID:   0
HPA-CHANNEL CARD CABLE LOSS:   10.0 dB
MAX HPA GAIN:   66.3 dB
MIN ANTENNA GAIN:   11.0 dB
MAX EIRP:   53.5 dB
MAX CHANNEL_CARD POWER:   0.0 dB
NUMBER OF CHANNEL CARDS :   2
FRONT PANEL LEDS ENABLED:   1
RX Attenuation (LAND-ON-WINGS):   0.0 dB
MIN SECS BETWEEN CHAN CARD RESETS:   300
HIT 'L' for MORE


MAINTENANCE PORT INVERSE VIDEO:   0
MAINTENANCE PORT DEGREES SYMBOL:   0
TERMINAL CATEGORY:    HW STRAPPED VALUE
AOR W VALID BEAMS:   4 5 6
AOR E VALID BEAMS:   5 6
POR VALID BEAMS:   4 5 6
IOR VALID BEAMS       5 6
AORE LES ACCESS CODE:   1
POR LES ACCESS CODE:   1
IOR LES ACCESS CODE:   1
RECEIVER CALIBRATION (AREO):   11 dB
MAX HPA POWER:   18.0  dBw
HPA RESERVED POWER:   16.0 dBw
HIT 'L' for MORE


CHANNEL CARD STARTUP DELAY:   30 sec
RX32 ACTIVE:    1
DEFAULT LATITUDE: 45 DO' 0.0"N
DEFAULT LONGITUDE: 75 DO' 0.0"W
OBEY OXCO STATUS: YES
CCDEBUG PORT: NONE
COMBINED MODE BACKOFF ADJUSTMENT: 10.0 dB


CHECKSUM (stored at offset 462) 9656 OK
Longest write cycle took 0 MSEC
```

Figure 4–17. Menu 3 – L: EEPROM Listing (Version 4.5)

> **Note:** Depending on the version of software installed and the Terminal Category, the EEPROM Listing shown may differ from those shown and described here.

```
<CTRL> N  next menu     <CTRL> O  previous menu  = select reports


MISCELLANEOUS PARAMETERS
 1  HPA-ANTENNA CABLE LOSS           18  AOR E VALID BEAMS
 2  FORWARD ID                       19  POR VALID BEAMS
 3  AORW LES ACCESS CODE             20  IOR VALID BEAMS
 4  TERRESTRIAL NETWORK ID           21  AORE LES ACCESS CODE
10  NUMBER OF CHANNEL CARDS          22  POR LES ACCESS CODE
11  FRONT PANEL LEDS ENABLED         23  IOR LES ACCESS CODE
12  RX ATTENUATION (LAND-ON-WINGS)   24  RECEIVER CALIBRATION (AERO)
14  MAINTENANCE PORT INVERSE VIDEO   28  RX32 ACTIVE
15  MAINTENANCE PORT DEGREES SYMBOL  29  DEFAULT LATITUDE
16  TERMINAL CATEGORY                30  DEFAULT LONGITUDE
17  AOR W VALID BEAMS                31  OBEY OXCO STATUS
WHICH PARAMETER # ?
```

Figure 4–18. Menu 3 – Item M: Miscellaneous Parameters (Version 4.5)

```
MISCELLANEOUS PARAMETERS
 1  HPA-TO-ANTENNA TOTAL LOSS         11  FRONT PANEL LEDS ENABLED
 2  FORWARD ID                        14  MAINTENANCE PORT INVERSE VIDEO
 3  GPS PROTECTION ALGORITHMS         15  MAINTENANCE PORT DEGREES SYMBOL
 4  REGISTRATION REQ'D BEFORE CALLS   16  TERMINAL CATEGORY
10  NUMBER OF CHANNEL CARDS           17  VIPER ANTENNA GAIN


WHICH PARAMETER #   <CTRL> N for next page  ?

18  VIPER HPA/ANT LOSS                31  OBEY OXCO STATUS
24  RECEIVER CALIBRATION              42  HCM AERO/M4 PRIORITIZATION
28  RX32 ACTIVE                       45  CATEGORY B LOWER FREQUENCY LIMIT
29  DEFAULT LATITUDE                  46  CATEGORY B UPPER FREQUENCY LIMIT
30  DEFAULT LONGITUDE
```

Figure 4–19. Menu 3 – Item M: Miscellaneous Parameters (Version 7.0)

Table 4–10. Menu 3, Item 'M' EEPROM Parameter Descriptions (Version 4.5)

Parameter #	Parameter Title	Description
1	HPA Cable loss	• Measured transmit coax cable loss from the HSD at MPC1 to the antenna including the DLNA loss (0.8 dB) • Maximum is 2.5 dB – 0.8 dB = 1.7 dB
2	Forward ID	• Entry required ONLY if the ID is not strapped, refer to "Installation" on page 3-1 for strapping details
3, 21, 22, and 23	AORW, AORE, POR, and IOR 'LES' Access Codes	• Inmarsat Service Provider LES access code entry; default is "1"
4	Terrestrial Network ID	• Used to change Terrestrial Network ID (where applicable)
10	Number of Channel Cards	• Entry selects the number of channel cards the system is configured for. • Default for Stand-Alone Mode installations is "2"
11	Front Panel LEDs Enabled	• Future consideration is provided for additional LEDs, beyond the two currently activated • Default is "2"
14	Maintenance Port Inverse Video	• Enables a selected "reports" item to be highlighted in Inverse Video when it is activated • Default is "1" (activated)

15	Maintenance Port Degrees Symbol	• Offers a choice of displaying the letter "D" or the degree symbol "°" when viewing the lat/long information displayed in the 'Reports' output:
		
		  • Select "0" to use the letter "D", e.g. 180.0 D
		
		  • Select "1" to use a degree symbol "°", e.g. 180.0°

Table 4–10. Menu 3, Item 'M' EEPROM Parameter Descriptions (Version 4.5)

Parameter #	Parameter Title	Description

16	Channel Card Category	• Offers an LRU configuration choice of:
		
		   • 0 for SAT-906
		
		   • 1 for Stand-Alone
		
		   • 2 for HW Strapping
		
		   • 3 for MCS3000
		
		   • 4 for MCS6000
		
		   • 5 for MCS7000
		
		   • 6 for MCS Combined
		
		   • 7 for Stand-Alone without antenna
		
		   • 8 for Honeywell Collaborative
		
		   • 9 for Cooperative Rockwell Collins SAT-906
		
		• Default is "2" (where hardware is read on power-up)

17, 18, 19, and 20	AORW, AORE, POR, and IOR Valid Beams	• Not applicable (applied to prototype channel card software)
24	Receiver Calibration (AERO)	• Enables attenuation of receive RF input level to the channel cards • Entered as an absolute number, e.g., 10, means 10 dB of input RF attenuation is added • ***Not applicable to HSD systems with version C30 (or later) channel card software*** (Version C30 and later channel card software automatically adjusts RF input) • Default is "0"
28	RX32 Active	• Not applicable (applied to prototype HPA systems)
29	Default Latitude	• Allows user to enter a default latitude value • Reset the HSD to activate revised default values
30	Default Longitude	• Allows user to enter a default longitude value • Reset the HSD 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

Table 4–11. Menu 3, Item 'M' EEPROM Parameter Descriptions (Version 7.0)

Parameter #	Parameter Title	Description
1	HPA cable loss	• Measured transmit coax cable loss from the HSD at MPC1 to the antenna including the DLNA loss—maximum is 2.5 dB
2	Forward ID	• Entry required ONLY if the ID is not strapped, refer to "Installation" on page 3-1 for strapping details
3	GPS protection algorithms	• Used to disable the GPS algorithms the HSD uses to prevent calls from interfering with the GPS navigational system on the aircraft.
4	Registration req'd before calls	• Used to change Terrestrial Network ID (where applicable)
10	Number of channel cards	• Entry selects the number of channel cards the system is configured for—default for Stand-Alone Mode installations is "2"
11	Front panel LEDs enabled	• Future consideration is provided for additional LEDs, beyond the two currently activated—default is "2"'
14	Maintenance port inverse video	• Enables a selected "reports" item to be highlighted in Inverse Video when it is activated—default is "1" (activated)

15	Maintenance port degrees symbol	• Offers a choice of displaying the letter "D" or the degree symbol "°" when viewing the lat/long information displayed in the 'Reports' output:
		
		  • Select "0" to use the letter "D", e.g. 180.0 D
		
		  • Select "1" to use a degree symbol "°", e.g. 180.0°

Table 4–11. Menu 3, Item 'M' EEPROM Parameter Descriptions (Version 7.0)

Parameter #	Parameter Title	Description

16	Channel card category	• Offers an LRU configuration choice of:
		
		    • 0 for SAT-906
		
		    • 1 for Stand-Alone
		
		    • 2 for HW Strapping
		
		    • 3 for MCS3000
		
		    • 4 for MCS6000
		
		    • 5 for MCS7000
		
		    • 6 for MCS Combined
		
		    • 7 for Stand-Alone without antenna
		
		    • 8 for HCM Combined (Honeywell Combined Mode)
		
		    • 9 for Cooperative Rockwell Collins SAT-906
		
		    • 10 not used
		
		    • 11 for HSD-X Network (Multi-Channel AERO)
		
		    • 12 for HSD-X Network without antenna (Multi-Channel Non AERO)
		
		    • 13 for VIPER
		
		• Default is "2" (where hardware is read on power-up)

17	Viper antenna gain	• Used to configure the nominal antenna gain used by the HSD when operating in Viper Mode—presuming that the HSD is connected to an antenna that does not provide antenna status words
18	Viper HPA/ANT loss	• Used to configure the nominal antenna gain used by the HSD when operating in Viper Mode—presuming that the HSD is connected to an antenna that does not provide antenna status words

Table 4–11. Menu 3, Item 'M' EEPROM Parameter Descriptions (Version 7.0)

Parameter #	Parameter Title	Description
24	Receiver Calibration (AERO)	• Enables attenuation of receive RF input level to the channel cards • Entered as an absolute number, e.g., 10, means 10 dB of input RF attenuation is added • ***Not applicable to HSD systems with version C30 (or later) channel card software*** (Version C30 and later channel card software automatically adjusts RF input) • Default is "0"
28	RX32 Active	• Not applicable (applied to prototype HPA systems)
29	Default Latitude	• Allows user to enter a default latitude value • Reset the HSD to activate revised default values
30	Default Longitude	• Allows user to enter a default longitude value • Reset the HSD 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	• Sets HPA power allocation to Aero H/H+ or Swift64 call priority (1=M4, 0=AERO-H) • Default set to AERO priority
45	Category B lower frequency limit	• Used to specify category B terminal lower frequency range. Calls transmitting outside of this specified range may interfere with the GPS navigational system if an Aero H call occurs simultaneously; however, in this event, the GPS protection algorithm usually tears down the call
46	Category B upper frequency limit	• Used to specify category B terminal upper frequency range. Calls transmitting outside of this specified range may interfere with the GPS navigational system if an Aero H call occurs simultaneously; however, in this event, the GPS protection algorithm usually tears down the call

(d) Menu 4

In control-processor software version 7.0, the following changes were made to Menu 4 selections (delta between version 4.5 and 7.0). No additional menu items were added with the release of Version 7.5, Control Processor software.

• Removed Menu 4, item F, 'force spot beam' selection.

Figure 4–20 shows the HSD maintenance utility program Menu 4 screen display. Table 4–12 describes the items available in Menu 4.

```
    MENU 4                              FIRMWARE V7.0

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 4–20. Menu 4 Screen Display

Table 4–12. Menu 4 Item Descriptions

Menu Item	Item Description	
Q: channel card forward IDs	• Enables viewing of channel cards, # 1 and # 2 Forward IDs	
O: set Ocean Region	• Allows for manual selection of satellite Ocean Regions:	
	AORW:	"0"
	AORE:	"1"
	POR:	"2"
	IOR:	"3"
	• To revert to programmed selection, type **–1** and press Enter for AUTO selection	
J: toggle ISDN connection	• Used for testing and fault isolation purposes	
	• Connects ISDN 1 lines to Channel Card 2 (Does not work in reverse—ISDN 2 to ISDN 1)	
	• Redirection only applies until the system is reset	
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	

(e)   Menu 10

Menu 10 items are used to manually enter INS parameters to simulate the INS data required for HSD operation when INS data is unavailable. Figure 4–21 shows the HSD maintenance utility program Menu 10 screen display. Table 4–13 describes the items available in Menu 10. No additional menu items were added with the release of Version 7.5, Control Processor software.

In control-processor software version 7.0, the following changes were made to Menu 10 selections (delta between version 4.5 and 7.0).

- Added item C, 'simul port ACU status', which prompts the user to enter both the port antenna gain in dB and the message rate in Hz.

- Added item M, 'activate antenna status words', which activates all set antenna status words.

- Added item N, 'deactivate antenna status words', which deactivates all set antenna status words.

- Added item B, 'simul sb ACU status', which prompts the user to enter the Starboard antenna gain in dB and the message rate in Hz.

```
     MENU10                            FIRMWARE Vx.x

L  simul INS lat                  G  simul INS long
H  simul INS heading              T  simul INS true track
P  simul INS pitch                R  simul INS roll
S  simul INS speed                A  activate all simul words
X  deactivate all simul words     C  simul port ACU status
B  simul sb ACU status            M  activate antenna status words
N  deactivate antenna status words

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–21. Menu 10 Screen Display

Table 4–13. Menu 10 Item Descriptions

Menu Item	Item Description
L: simul INS lat	• Allows user to simulate a latitude by overriding the data received from the aircraft INS
H: simul INS heading	• Allows user to simulate a aircraft heading by overriding the data received from the aircraft INS
P: simul INS pitch	• Allows user to simulate aircraft pitch by overriding the data received from the aircraft INS
S: simul INS speed	• Allows user to simulate aircraft speed by overriding the data received from the aircraft INS
X: deactivate all simul words	• De-activates all simulated parameters reverting the HSD system back to using the INS data received from the aircraft

Table 4–13. Menu 10 Item Descriptions

Menu Item	Item Description
B: simul sb ACU status	• Used to enter the starboard antenna gain in dB and the message rate in Hz
N: deactivate antenna status words	• Used to deactivate all set antenna status words
G: simul INS long	• Allows user to simulate aircraft longitude by overriding the data received from the aircraft INS
T: simul ins true track	• Allows user to simulate true track by overriding the data received from the aircraft INS
R: simul INS roll	• Allows user to simulate aircraft roll by overriding the data received from the aircraft INS
A: activate all 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
C: simul port ACU status	• Used to enter both the port antenna gain in dB and the message rate in Hz
M: activate antenna status words	• Used to activate all set antenna status words

(f)   Menu 13

Menu 13 items are used to query and debug systems with Data I/O Card 2 (available on HSD models 1110-A-0150 and 1110-A-0160 or other HSD models via service bulletin 1110-SB-0004). Menu 13 is the same in all control processor software versions 4.5 and later.

Figure 4–22 shows the HSD maintenance utility program Menu 13 screen display. Table 4–14 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            C  query DATA IO config pins
F  DATA IO fault logging level       X  DATA IO console mode
<CTRL> N  next menu        <CTRL> O  previous menu  = select reports
```

Figure 4–22. Menu 13 Screen Display

Table 4–14. Menu 13 Item Descriptions

Menu Item	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
V: query Data IO version	• Displays the firmware version of the Data I/O card
C: query Data I/O config pins	• Displays the Data I/O configuration pin summary
X: Data IO console mode	• Opens a virtual TTY session to the Data I/O maintenance port on the HSD

(g) Menu 14

Menu 14 items are used for debugging and clarifying call routing issues. Menu 14 is the same in all control processor software versions 4.5 and later.

Figure 4–23 shows the HSD maintenance utility program Menu 14 screen display. Table 4–15 describes the items available in Menu 14.

```
    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 4–23. Menu 14 Screen Display

Table 4–15. Menu 14 Item Descriptions

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

(h) Menu 15

Menu 15 was added in control processor software version 7.0 to allow the user to query the system for channel-card, software versions and serial number information.

Figure 4–24 shows the HSD maintenance utility program Menu 15 screen display. Table 4–16 describes the items available in Menu 15.

```
    MENU 15                          FIRMWARE V7.0

V  request channel card versions    D  channel card serial number

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–24. Menu 15 Screen Display

Table 4–16. Menu 15 Item Descriptions

Menu Item	Item Description
V: request channel card versions	• Displays software versions for a selected channel card
D: channel card serial number	• Displays the serial number of the selected channel card

(i) Menu 18

Menu 18 was added in control processor software version 7.0 to support Multi-Channel configurations. No additional menu items were added with the release of Version 7.5, Control Processor software. Menu 18 is only available if the HSD system is configured to either HSD-X Network, HSD-X without Antenna, or Viper terminal categories.

Figure 4–25 shows the HSD maintenance utility program Menu 18 screen display. Table 4–17 describes the items available in Menu 18.

```
    MENU 18                          FIRMWARE V7.0

X  HSD-X slave console mode        B  HSD-X slave cable loss
L  list HSD-X slave cable loss     V  get HSD-X firmware version

<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

Figure 4–25. Menu 18 Screen Display

Table 4–17. Menu 15 Item Descriptions

Menu Item	Item Description
X: HSD-X slave console mode	• Activates a system control connection to a selected HSD-X unit installed on the system
L: list HSD-X slave cable loss	• Select this item to display the HSD to HSD-X cable loss for a selected HSD-X unit installed on the system
B: HSD-X slave cable loss	• Used to enter the measured HSD to HSD-X cable loss for selected HSD-X unit
V: get HSD-X firmware version	• Select this item to display the software version of a selected HSD-X unit installed on the system

(7) Report Item Descriptions

When testing or troubleshooting the HSD system, monitoring real-time system data is sometimes required. Figure 4–26 shows all the report items potentially available to 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 maintenance utility program report items displayed may differ from those shown in Figure 4–26 and Figure 4–27.

```
 1 OFF messages to channel card #1    13 OFF messages to channel card #2
 2 OFF hex output to channel card #1  14 OFF hex output to channel card #2
 3 OFF responses from channel card #1 15 OFF responses from channel card #2
 4 OFF hex input from channel card #1 16 OFF hex input from channel card #2
 5 OFF channel #1 misc info           17 OFF channel #2 misc info
 6 OFF sb antenna arinc input         18 OFF port antenna arinc input
 7 OFF sb antenna maintenance word    19 OFF port antenna maintenance word
 8 OFF sb antenna status word         20 OFF port antenna status word
 9 OFF channel card call status       21 OFF call codes
10 OFF channel card THA codes         22 OFF spot beam selection
11 OFF channel card errors            23 OFF standard output
12 OFF INS input                      24 OFF doppler, antenna az/el


25 OFF HPA arinc i/o                  37 OFF combined-mode spoofed output
26 OFF HPA error status               38 OFF combined-mode power allotment
27 OFF HPA/channel card backoffs      39 OFF combined-mode debugging
28 OFF miscellaneous digital inputs   40 OFF enthusiastic combined-mode
debug
29 OFF channel card A_AM msgs         41 OFF delta combined-mode debugging
30 OFF multi-control arinc bus        42 OFF raw arinc data from ITS
31 OFF ocean region info              43 OFF high-precision hpa power
32 OFF hex input from data i/o        44 OFF hpa calibration (gain droop)
33 OFF hex output to data i/o         45 OFF combined mode ocean region debug
34 OFF input from data i/o            46 OFF hpa resets
35 OFF changes in multi-control bus   47 OFF channel card temperature
36 OFF unit test call setup           48 OFF hexadecimal INS input


49 OFF main loop latency             59 OFF RC Satellite Position
50 OFF main loop timing              60 OFF debug channel card power
51 OFF one second tick               61 OFF non-zero channel card power
52 OFF extended call codes           62 OFF m4 availability status
53 OFF standalone w/o ant data       63 OFF enthusiastic output to RC SDU
54 OFF RC SDU time and date          64 OFF channel card frequencies
55 OFF RC arinc i/o (hex)            65 OFF enthusiastic messages from HPA
56 OFF RC misc arinc i/o (ascii)     66 OFF channel card boot sequence
57 OFF RC EIRP                       67 OFF HPV power meter/attenuator
58 OFF RC SAT-906 Status
```

Figure 4–26. HSD Maintenance Utility Program: Report Items (Version 4.5)

```
 1 OFF messages to channel card #1    13 OFF messages to channel card #2
 2 OFF hex output to channel card #1  14 OFF hex output to channel card #2
 3 OFF responses from channel card #1 15 OFF responses from channel card #2
 4 OFF hex input from channel card #1 16 OFF hex input from channel card #2
 5 OFF channel #1 misc info            17 OFF channel #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 ON call codes
10 OFF channel card THA codes          22 OFF spot beam selection
11 OFF channel card errors             23 OFF standard output
12 OFF INS input                       24 OFF doppler, antenna az/el

25 OFF HPA arinc i/o                 37 OFF combined-mode spoofed output
26 OFF HPA error status              38 OFF combined-mode power allotment
27 OFF HPA/channel card backoffs      39 OFF combined-mode debugging
28 OFF miscellaneous digital inputs   40 OFF enthusiastic combined-mode
debug
29 OFF channel card A_AM msgs         41 OFF delta combined-mode debugging
30 OFF multi-control arinc bus        42 OFF raw arinc data from ITS
31 OFF ocean region info              43 OFF high-precision hpa power
32 OFF hex input from data i/o        44 OFF hpa calibration (gain droop)
33 OFF hex output to data i/o       45 OFF combined mode ocean region debug
34 OFF input from data i/o            46 OFF hpa resets
35 OFF changes in multi-control bus   47 OFF channel card temperature
36 OFF unit test call setup           48 OFF hexadecimal INS input

49 OFF main loop latency             61 OFF non-zero channel card power
50 OFF main loop timing              62 OFF m4 availability status
51 OFF one second tick               63 OFF enthusiastic output to RC SDU
52 OFF extended call codes            64 OFF channel card frequencies
53 OFF standalone w/o ant data      65 OFF enthusiastic messages from HPA
54 OFF RC SDU time and date           66 OFF channel card boot sequence
55 OFF RC arinc i/o (hex)           67 OFF debug honeywell combined mode
56 OFF RC misc arinc i/o (ascii)     68 OFF CFDS debugging
57 OFF RC EIRP                        69 OFF vt100 scenario
58 OFF RC SAT-906 Status              70 OFF HCM input
59 OFF RC Satellite Position          71 OFF HCM power level
60 OFF debug channel card power       72 OFF DATA I/O events

73 OFF HCM power control           85 OFF debug CC#2 channel card power
74 OFF TIM HCM power debugging       86 OFF Channel card rx attenuation
75 OFF HCM BITE                       87 OFF interworking report
76 OFF HSD-X arinc messages           88 OFF all words to SDU
77 OFF HSD-X net configuration        89 OFF debug call teardown
78 OFF vt100 eirp/power               90 OFF debug cc backoff
79 OFF dialtone debugging             91 OFF HSD frequencies
80 OFF RC CC#2 SDU time and date      92 OFF intermod debugging
81 OFF RC CC#2 arinc i/o (hex)        93 OFF spot beam debugging
82 OFF RC CC#2 misc arinc i/o (ascii) 94 OFF vt100 channel card info
83 OFF RC CC#2 EIRP                   95 OFF vt100 debugging
84 OFF RC CC#2 SAT-906 Status
```

Figure 4–27. HSD Maintenance Utility Program: Report Items (Version 7.0)

(8) Activating Maintenance Reports

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

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

(a) Report Items: General Guidelines

1. Press the equal sign on the keyboard (**=**) to open the Report Item menu.

2. To activate a report, type the number of the report item needed, and then press **Enter**. This toggles ON the report number entered. To toggle the report OFF, type in the report number again, and press **Enter**.

3. Press **X** to disable all report items (toggles reports OFF).

4. Press **Ctrl+N** to display the next group of report items.

5. Press **S** to save all selected report items to EEPROM. If the items selected are not saved, they are "de-activated" when the system is reset or power is cycled to the unit.

6. Press **Esc** (in Level 2 access only) to start the scrolling report display. Press **Esc** again to return to the MENU selection screen.

(b) Report Items: Descriptions

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

1. Report Item: 23

Use report item #23 (the most comprehensive report) to get an overall general impression of the HSD system health. An example of the contents of report item 23 is shown in Figure 4–28. Table 4–18 provides a brief description of the parameters. Each distinct parameter is numbered for description purposes.

```
[1]45D38'52.9"N  74D59'29.3"W  [2]PT 0.2D  [3]RL -0.4D  [4]HD 349.9D  [5]TK 0.2D  [6]0
knots
[7]10:26:07 [8]dop 0 ppb  [9]az 161.6 deg   [10]el 33.6 deg  [11]AOR WEST  [12]ant gain
13 (sbd)
[13]CARD #1: [14]C/No=51.5 dB/Hz [15]sig=-16.8 [16]27 C [17]no call [18]beam=4
[13]CARD #2: [14]C/No=51.5 dB/Hz [15]sig=-15.4 [16]27 C [17]no call [18]beam=4
```

Figure 4–28. Example of Report Item 23

Table 4–18. Report 23 Item Descriptions

Report 23 Item Number	Description
1	IRS lat/long as interpreted by the HSD
2	Aircraft pitch angle, where "UP" is +ve
3	Aircraft roll angle, where clockwise (cw) is +ve
4	Aircraft heading; where the nose of the aircraft is pointing, based on yaw offset
5	Aircraft true track; direction the aircraft is flying—not necessarily the direction it is pointing (See NOTE)
6	Aircraft velocity
7	Time, based on the system real time clock
8	Doppler frequency offset; increases with velocity (See NOTE)
9	Antenna azimuth pointing to the satellite, with respect to the nose of the aircraft
10	Antenna elevation angle to the satellite, with respect to the horizontal position of the aircraft
11	Ocean Region the system is logged-on to
12	Reported antenna gain and the selected antenna, port or starboard
13	Indicates the channel card for which results 14) to 17) relate to
14	RF input Carrier-to-Noise (C/No) level; typically 50.0 to 55.0
15	RF input signal level; typically –12.0 to –18.0 when not "in call": *not to exceed 0 when "in-call"
16	HSD internal LRU temperature
17	System call status
18	Satellite beam the card is registered on

Note: When the aircraft is stationary the field may appear as ✳'s.

2. Report Items: 5 & 17, 8 & 20, and 21

Some other commonly used report items, used in the testing or troubleshooting of the system, are shown in Figure 4–29. These report items shown 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 maintenance utility program report items displayed may differ from those shown in the example illustrated Figure 4–29.

Note: Signal strength values (C/no=) in early versions of software do not show the decimal point. If operating HSD transceivers with earlier software, divide the C/no value by ten.

```
Report 5;        Channel card #1 & #2 miscellaneous information:


CARD #1: C/No=51.8  sig=-16.6  no call beam=4 AOR WEST bt=OK oc=OK int=8080
CARD #1: C/No=51.6  sig=-16.8  no call beam=4 AOR WEST bt=OK oc=OK int=8080

CARD #2: C/No=52.0  sig=-16.1  no call beam=4 AOR WEST bt=OK oc=OK int=8080
CARD #2: C/No=51.7  sig=-16.3  no call beam=4 AOR WEST bt=OK oc=OK int=8080


Report 8 & 20;    Starboard and Port Antenna Status:
starboard status: 0x608236 SDI: STARBOARD SSM: NORMAL OPERATION gain: 13
OMNIDIRECTIONAL MODE  open loop tracking  starboard active   HGA   LNA on
starboard status: 0x608236 SDI: STARBOARD SSM: NORMAL OPERATION gain: 13
OMNIDIRECTIONAL MODE  open loop tracking  starboard active   HGA   LNA on
starboard status: 0x608236 SDI: STARBOARD SSM: NORMAL OPERATION gain: 13

port status:  0x600201  SDI: PORT/TOP  SSM: NORMAL OPERATION  gain: 0
OMNIDIRECTIONAL MODE  open loop tracking  starboard active   HGA   LNA off
port status:  0x600201  SDI: PORT/TOP  SSM: NORMAL OPERATION  gain: 0
OMNIDIRECTIONAL MODE  open loop tracking  starboard active   HGA   LNA off


Report 21;       Call Codes:

13:39:00 #1 ABC123 E4 start 800124 21.50 dBW mobile aero 64k speech 28 C
54 dB/Hz
13:39:00 #2 ABC456 E4 start 800622 19.50 dBW mobile aero 64k UDI 30 C 0 dB/Hz
13:39:06 #1 ABC123 E4 start 800124 21.50 dBW mobile aero 64k speech 28 C
0 dB/Hz
13:39:06 #2 ABC456 E4 start 800622 19.50 dBW mobile aero 64k UDI 30 C 0 dB/Hz
13:39:12 #1 ABC123 E4 start 800124 21.50 dBW mobile aero 64k speech 28 C
55 dB/Hz
13:39:12 #2 ABC456 E4 start 800622 19.50 dBW mobile aero 64k UDI 30 C 0 dB/Hz
13:39:18 #1 ABC123 E4 start 800124 21.50 dBW mobile aero 64k speech 28 C
0 dB/Hz
13:39:19 #2 ABC456 E4 stop 1001  call cleared by MES terminal 30 C  0 dB/Hz
13:39:20 #1 ABC123 E4 stop 1001  call cleared by MES terminal 28 C  0 dB/Hz
13:39:19 #2 ABC456 E4 stop 1001  call cleared by MES terminal 30 C  0 dB/Hz
13:39:20 #1 ABC123 E4 stop 1001  call cleared by MES terminal 28 C  0 dB/Hz
```

Figure 4–29. Maintenance Port, Report Items

Table 4–19. Report information

Report(s)	Information
Report 5 & 17	**Channel card #1 & #2 miscellaneous information:**
(C/No) -	RF input carrier to noise level (value displayed is typically 50 to 55 when not "in-call" and 55 to 65 when "in-call"-may also show as "0's")
(sig) -	RF input signal level (typically –12 to –18 when not "in-call")
(beam) -	Satellite Beam the card is registered on
(oc) -	Ocean region the card is logged-on to
(bt) -	Card boot-up status

Table 4–19. Report information

Report(s)	Information
(oc) -	Ocean region registration status
(int) -	Interface status (=8080 means the card is ready for dialing)
Report 8 & 20	**Starboard and Port Antenna Status:**
(Hex code) -	Raw hex code of the 32-bit ARINC word—decoded message follows code
(SDI) -	Antenna being used (for mechanically 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
Report 21	**Call Codes:**
(Time) -	Time based on the system real time clock
(Fwd Addr) -	Forward Address ID assigned to the system channel cards
(Alpha/no.) -	Ocean region and beam the card is logged-on to
(Call) -	Call real-time status, service type code, and Inmarsat Cause Code (See Table 4–20)
(RF power) -	LES requested HPA power in dBW
(OR status) -	Ocean region registration status
(Call orig)	Call originating from MES (Mobile) or from a fixed location.
(Call type)	Call types (for example, speech)

D. Fault Definitions

(1) Cause Indication (Fault Codes)

The four fields listed below are used to signal the cause indication result:

- Coding Standard   (1 bit)
- Cause Location   (4 bits)
- Cause Class   (4 bits)
- Cause Value   (4 bits)

The Table 4–20 shows the hexadecimal coding for these fields and briefly describes the events relating to each code.

(2) Inmarsat Cause Codes

The fault definitions that appear in the HSD Maintenance Menu logs are based directly on the cause code definitions provided by Inmarsat. Table 4–20 defines the Maintenance Port Menu fault codes of the HSD.

Table 4–20. Fault 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
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
1202	Handover, MES ready
1281	Call failed, MES cannot accept
1291	Call failed, MES cannot accept at present
12B1	Call cleared by MES for unspecified reason
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 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
12D1	Call failed, Spot-beam data invalid
12D2	Call failed, invalid scrambling vector
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
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)

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
15D2	LES MES already busy
15E1	Call cleared but MES still transmitting (FAULT)
1651	Call failed, LES congested (no channel unit)
1661	Call failed, long interruption in reception at LES
1662	LES long term blockage of SCPC MES
16C2	LES missing MES SCPC
16C3	Handover failed, MES not detected
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
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)
1F11	Call failed, terrestrial party busy
1F21	Call failed, LES time-out (no answer)

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
1F61	Call failed, terrestrial circuit failure
1F62	Call failed, early clear by terrestrial circuit
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
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

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
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
2F00	LES int reject lack of MES RESP response
2F01	LES int reject lack of MES ARN response
2F02	LES int reject incorrect SVECSCPC
8000	ACSE Recycling
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

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
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
8306	ACSE failed retry ORR
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

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
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
8800	ACSE cable call begin
8801	ACSE cable call successful
8900	ACSE Logoff Begin
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

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
9081	ACSE InMRSII
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
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
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

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
9124	Peripheral bonding auto
9125	Peripheral bonding slave
9126	Peripheral bonding none
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
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
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

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
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 unit 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
B329	ODU error alarm timeout
B330	ODU error alarm timeout no trip
B400	Internal temperature of unit 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

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
FFFD	ACSE end marker
FFFE	Status undefined
FFFF	Status OK
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
4000A0	CT SP any
4000F0	CT Terminal ID
4000F1	CT Options
4000F2	CT config names
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
400902	CT SP ODU status DDS
400910	CT SP prod test
400911	CT SP prod test ODU
401000	CT SP clear spot beam

Table 4–20. Fault Code Definitions

Inmarsat Cause Code	Code Definition
800103	Mobile AMBE
80010F	Mobile 64k speech
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
8D0FFF	Mobile MiniM
8E0FFF	Mobile HSD
8F0FFF	Mobile
C00103	Fixed AMBE
C0010F	Fixed 64k speech
C00124	Fixed aero 64k speech
C00404	Fixed data
C00504	Fixed facsimile
C00606	Fixed 64k UDI
C00607	Fixed 56k UDI
C00610	Fixed 64k audio 3k1
C00622	Fixed aero 64k UDI
C00623	Fixed aero 56k UDI
C00625	Fixed aero 64k audio 3k1
CD0FFF	Fixed miniM
CE0FFF	Fixed HSD
CF0FFF	Fixed

E.   Operational and Diagnostic Test Procedures

(1)   General

Perform all test procedures presented in this section in their entirety to test the total operational status of the HSD or HSD-X transceiver. If the unit fails any test, refer to the troubleshooting procedures to determine the faulty circuit. Conduct operational tests for all units 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 Maintenance Utility Program included in this section.

CAUTION: Only Authorized Technical Personnel, trained in general aviation workmanship, that have a basic understanding of SATCOM systems, should proceed with the Operational and Diagnostic test procedures presented in this manual.

CAUTION: Changes to some Menu functions may seriously degrade system operation.

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

Note: Using a terminal emulation program, open a log file and save all test results for future reference and test records. This section includes detailed user instructions on opening and saving log files using the HSD maintenance utility program.

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

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

(2) Test Setup Procedure

The test setup procedure is presented in Table 4–21. Refer to "Connection Requirements" on page 4-4 for detailed connection of test equipment and operating instructions for the HSD maintenance utility program.

Table 4–21. Test Setup Procedure

STEP	ACTION
0	Ensure that the HSD or HSD-X transceiver is neither powered up nor connected to a power source before proceeding.
0	If a remote access has not been installed: on the front panel of the HSD or HSD-X transceiver, remove the maintenance-port-connector cover.
0	Connect a cable to the HSD or HSD-X front-panel or remote maintenance port connector.
0	Connect the other end of the cable to a computer's serial port.
0	Open a log file to capture all test data.

(3) Post Test

When testing is completed:

1. Save the log file of the test results (or data) for future reference.

2. Remove power from the unit under test and all other test equipment.

3. Disconnect test equipment from the HSD or HSD-X unit.

4. Replace the maintenance-port connector cover (if previously 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 D-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 4–22 itemizes recommended mechanical checks.

Table 4–22. HSD Mechanical Verification

STEP	Item Checked	Verification Description
0	Mounting Tray Physical Placement	Ensure service/maintenance accessibility
		Check environmental considerations are met Cooling, air-flow, and pressure
0	Fan Tray	Confirm plug configuration is correct
		Check chassis bonding
		Ensure fan rotation is unobstructed and rotates freely
0	ARINC 600 Connector	Check polarized pints

(c) Electrical Verification

Refer to "Installation" on page 3-1 for detailed electrical information. Table 4–23 itemizes the recommended electrical checks.

Note: When conducting the following tests, do not rack the HSD or HSD-X.

WARNING: To avoid personal injury and/or equipment damage, use extreme caution during the Voltage Levels measurements.

Table 4–23. HSD Electrical Verification

STEP	Item Checked	Verification Description
1.0	Power connections	Model 1110-A-0001/1110-A-0080/1110-A-0160: 28 V dc polarity
		Model 1110-A-0060/1110-A-0070/1110-A-0150: 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:
		Model 1110-A-0001/1110-A-0080/1110-A-0160 (28 V dc): between BP2 ($^+$ve) and BP3 (return)
		Model 1110-A-0060/1110-A-0070/1110-A-0150 (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

Table 4–24. HSD Electrical Verification

STEP	Item Checked	Verification Description
1.0	Configuration Strap Pins	SDI: Strapped for HGA, Pin TP5B to TP5D
		System Configuration: Strapped for System Mode, Pins TP4A, TP4B, TP4C, and/or TP4D strapped to TP7K
		Data I/O: User specific, default to unrestricted (ISDN only): Pins MP5H to TP7K
		Forward Address: User specific
		WOW: (Optional)
2.0	Ethernet	Strapped to RJ45 distribution points
		Note: Optional—other service may be preferred.
3.0	ISDN	Strapped to RJ45 distribution points
		Note: Optional—other service may be preferred.
4.0	DTE - MPDS (RS232)	Strapped to DB9S distribution connector
		Note: Optional—other service may be preferred.

Table 4–24. HSD Electrical Verification

STEP	Item Checked	Verification Description
5.0	Remotes (Optional—but recommended)	Remote Reset switch operation
		Maintenance Port, remote access
		Power and Fault LED indicators
6.0	RF Coax	Rx input cable loss from DLNA to HSD at BP12 and to the RFU at TPC1 (including splitter)
		Tx output cable loss from HSD at MPC1 to DLNA
7.0	Antenna Connection	Antenna manufacturer and model
		Multi-Control loopbacks installed from TP3E to TP1A and TP3F to TP1B (Stand-Alone Mode)
8.0	SDU	HSD to SDU interconnect wiring confirmed (Non-Stand-Alone modes)

(5) Configuration Parameters Verification

The system configuration parameters can now be verified. Verify and document using "Installation Checklist" on page D-1.

(a) Parameter Verification Procedure

For units operating control processor software versions 5.7 or earlier:

1. From Menu 3, select item 'L' (list EEPROM). The EEPROM listing appears on the screen. The EEPROM listing appears as shown in Figure 4–30.

2. From Menu 4, select item 'Q' (channel card forward IDs). Ensure the displayed Forward ID(s), for all channel cards, are correct.

For units operating control processor software versions 5.7 or later:

• From Menu 3, select item 'O' (list ORT). The ORT listing appears on the screen, as shown in Figure 4–31. Verify that the correct system configuration parameters are listed in the ORT.

```
EEPROM LISTING:
MAGIC NUMBER :OK
MAGIC NUMBER :OK
EEPROM VERSION NUMBER 2001
FIRMWARE VERSION 1018
SERIAL NUMBER: xxx
IGNORED FAULTS: 0
HARDWARE CONFIG: 0
NUMBER OF POWERUPS (index 0) 5
HOURS OF OPERATION (index 0) 11


MISCELLANEOUS PARAMETERS
HIT 'L' for MORE



HPA-ANTENNA CABLE LOSS:   2.5 dB
FORWARD ID: xxxxxx
AORW LES ACCESS CODE:   1
TERRESTRIAL NETWORK ID:   0
HPA-CHANNEL CARD CABLE LOSS:   10.0 dB
MAX HPA GAIN:   66.3 dB
MIN ANTENNA GAIN:   11.0 dB

HPA-ANTENNA CABLE LOSS:   2.5 dB
FORWARD ID: xxxxxx
AORW LES ACCESS CODE:

1
TERR
ESTRIAL NETWORK ID:   0
HPA-CH
ANNEL CARD CABLE LOSS:   10.0 dB
MAX HPA
GAIN:   66.3 dB
MIN ANTENNA GAIN:   11.0
dB
MAX EIRP:
5
3.5 dB
MAX CHANNEL_CARD POWER:   0.0
```

Figure 4–30. Sample EEPROM Listing (Control Processor Software, Version 4.5)

```
HSD SERIAL NUMBER S/N ???
MISCELLANEOUS PARAMETERS
  HPA TO ANTENNA LOSS:   3.5 dB   MANUALLY SET
  FORWARD ID:   000000   MANUALLY SET
  GPS PROTECTION ALGORITHMS:   DISABLED   MANUALLY SET
  REGISTRATION REQ'D BEFORE CALLS:   DISABLED   MANUALLY SET
  CHANNEL CARD TO HPA LOSS:   10.0 dB   MANUALLY SET
  MAX HPA GAIN:   65.00 dB   MANUALLY SET
  MIN ANTENNA GAIN:   8.0 dB   MANUALLY SET
  MAX EIRP:   52.5 dBm   MANUALLY SET
  MAX CHANNEL_CARD POWER:   0.0 dBm   MANUALLY SET
  NUMBER OF CHANNEL CARDS :   2   MANUALLY SET
HIT 'O' for MORE

  FRONT PANEL LEDS ENABLED:   1   MANUALLY SET
  MIN SECS BETWEEN CHAN CARD RESETS:   300   MANUALLY SET
  MAINTENANCE PORT INVERSE VIDEO:   1   MANUALLY SET
  MAINTENANCE PORT DEGREES SYMBOL:   0   MANUALLY SET
  TERMINAL CATEGORY:    HW STRAPPED VALUE   MANUALLY SET
  VIPER ANTENNA GAIN :   12 dB   MANUALLY SET
  VIPER HPA/ANT LOSS :   2.5 dB   MANUALLY SET
  RECEIVER CALIBRATION:   11.0 dB   MANUALLY SET
  MAX HPA POWER:   18.0 dBw   MANUALLY SET
  AERO POWER ALLOCATION:   16.0 dBw   MANUALLY SET
  CHANNEL CARD STARTUP DELAY:   30 sec   MANUALLY SET
  RX32 ACTIVE:   1   MANUALLY SET
  DEFAULT LATITUDE:   45 D 26' 60.0" N   MANUALLY SET
HIT 'O' for MORE

  DEFAULT LONGITUDE:   75 D 42' 0.0" W   MANUALLY SET
  OBEY OXCO STATUS:   YES   MANUALLY SET
  CC DEBUG PORT:  NONE   MANUALLY SET
  MAX CHANNEL CARD BACKOFF:   28.5 dB   MANUALLY SET
  CO-OP MODE BACKOFF ADJUSTMENT:   10.0 dB   MANUALLY SET
 ALLOW CALLS DESPITE HPA ERRORS:   NO (DON'T TRANSMIT IF ERRORS)  MANUALLY
SET
  CO-OP MODE DUAL CHANNEL:   DISABLED   MANUALLY SET
  MOBILE BURST TIMEOUT:   4000 msec   MANUALLY SET
  MPDS SPOTBEAM HANDOVER:   DISABLED   MANUALLY SET
  MAX SIMULATED HPA BACKOFF:   31 dB   MANUALLY SET
  HCM AERO/M4 PRIORITIZATION:   AERO   MANUALLY SET
  AERO 'C-CHANNEL' ALLOCATION:   19.5   MANUALLY SET
  HPA GAIN DROOP SLOPE:   0.10 dB/dB   MANUALLY SET
HIT 'O' for MORE

  CATEGORY B LOWER FREQUENCY LIMIT:   1644.50 MHz   MANUALLY SET
  CATEGORY B UPPER FREQUENCY LIMIT:   1660.50 MHz   MANUALLY SET
HIT 'O' for MORE

ORT OCEAN REGIONS:             SAT LONG   LES ID   SECONDARY LES ID   TNID
    W AOR WEST     (region #0)   54.0W     1         1                 0
    E AOR EAST     (region #1)   15.5W     1         1                 0
    P POR          (region #2)   178.0E    1         1                 0
    I IOR          (region #3)   64.0E     1         1                 0

ORT TOOL VERSION:
```

```
ORT TOOL NAME:
ORT TOOL PART NUMBER:
ORT TOOL OEM VERSION:
ORT PART NUMBER:

CHECKSUM (stored at offset 464) 12133  OK
longest write cycle took 0 MSEC
```

Figure 4–31. HSD ORT Sample Display (software version 5.7 or later)

(6) System Power-up Checks

Note: Before proceeding, ensure that all pre power-up, mechanical, and electrical verifications have been successfully performed and documented using the Installation Checklist provided in "Installation Checklist" on page D-1.

(a) Preparation

The following tests serve primarily to confirm proper system power-up; therefore, they can be performed while the aircraft is still in the hanger. Ensure that a computer, configured as instructed on page 7, 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 and HSD-X front panel and on the optional remote panel.

1. Verify that the LEDs (at both locations) repeatedly cycle ON/OFF when power is applied.

2. Once the cycle has completed (~5 seconds), verify that the power LED remains illuminated.

(c) Initial Computer Power up Display

With the computer connected and configured to accept Maintenance Port data, power-up the HSD, and verify the initial power-up screen displays as shown in the example, Figure 4–32. The example provides a display using a Stand-Alone Mode installation.

```
KERNEL Vx.x -- Mon Oct 07 13:36:26 2002
TESTING RAM ......RAM OK.

HSD APPLICATION Vx.x -- Thu Apr 24 08:02:39 2003
Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.
HSD reset --  watchdog may have fired 77 seconds after powerup
fault log sector 15 contains 114 entries
REAL TIME CLOCK PRESENT:  9:42:53 Tue Jun 10, 2003

channel card forward id ABC123
STAND-ALONE MODE
!!ensure that arinc test data doesn't bother sat906
powering up channel card #1
powering up channel card #2
KERNEL Vx.x -- Mon Oct 07 13:36:26 2002
TESTING RAM ......RAM OK.
```

Figure 4–32. HSD Power-up Display

(7) System On-Air Checks

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

(a) Preparation

Before attempting on-air testing procedures:

1. Complete and confirm all service provider registration and activation.

2. Complete and document all pre power-up and power-up checks.

3. Position the aircraft outside, away from all obstructions in the line-of-site to the satellite used.

4. Apply the aircraft power source.

5. Power on and wait for the IRS to align.

6. Connect a computer (with a terminal emulation program) to the HSD transceiver maintenance port.

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

(b) On-Air Power up and Logon Procedure

For this test procedure, use the Level 2, *maint* password to access the HSD Maintenance Utility Program.

1. With the computer connected, powered-up, and ready to accept maintenances port data:

• Power up the HSD

2. Once the power up messages appear:

   • Enter the Level 2, password: *maint*

3. Press the equal sign on the keyboard (=) to access the "reports" menu, then activate report items 21 (call codes) and 23 (standard output). Remember to save these selected items by using the "S" (save to EEPROM) command.

4. In Menu 2, press **Z** to reset the HSD.

   • The system resets and displays the power up equivalent reset messages (as previously shown in Figure 4–32).

5. After the reset messages appear, immediately type the password maint.

   • The data from the previously selected report items 21 and 23 appears.

This data refreshes on-screen every second. For easier reading of the data, capture this information in a log file for later review.

6. Compare the output data to the sample shown in Figure 4–33.

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

7. Verify that the following system information, as shown on the "System Initialization Display" during the test, is accurate for the HSD unit under test.

   • Correct forward ID displayed

   • Correct installation mode displayed

   • Correct number of channel cards listed

   • All channel cards trigger ocean region registration

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

```
KERNEL V1.6 -- Mon Oct 07 13:36:26 2002
TESTING RAM ......RAM OK.


HSD APPLICATION Vx.x -- Thu Oct 10 08:36:29 2002
Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.
fault log sector 15 contains 116 entries
REAL TIME CLOCK NOT DETECTED

channel card forward id ABC123
STAND-ALONE MODE
powering up channel card #1
powering up channel card #2
dop 0 ppb  az 0.0 deg   el 45.0 deg  ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz  sig=****    ?? C  call=??
CARD #2: C/No=0.0 dB/Hz  sig=****    ?? C  call=??
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
CARD #1: C/No=***  sig=****    ?? C  call=??
CARD #2: C/No=***  sig=****    ?? C  call=??
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
powering up channel card #2
powering up channel card #1
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
CARD #1: C/No=***  sig=****    26 C  call=??
CARD #2: C/No=***  sig=****    24 C  call=??
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
CARD #1: C/No=***  sig=****    26 C  call=??
CARD #2: C/No=***  sig=****    24 C  call=??
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
SENDING FIRST OC_RESTART COMMAND
!!CARD #2 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR WEST!!
SENDING FIRST OC_RESTART COMMAND
!!CARD #1 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR WEST!!
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz  sig=****    26 C  call=?? beam=255
CARD #2: C/No=0.0 dB/Hz  sig=-999.9 dB   24 C  call=?? beam=255
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz  sig=-999.9 dB   26 C  call=?? beam=4
CARD #2: C/No=0.0 dB/Hz  sig=-999.9 dB   24 C  call=?? beam=4
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
CARD #1: C/No=51.3 dB/Hz  sig=-15.9 dB   26 C  call=?? beam=4
CARD #2: C/No=51.1 dB/Hz  sig=-8.0 dB   24 C  call=?? beam=4
45D10'30.3"N  75D6'20.9"W  PT 1.8D  RL 1.6D  HD 25.5D  TK 1.8D  23 knots
dop -28 ppb  az 125.6 deg   el 36.3 deg  AOR WEST  ant gain 11 (p/t)
```

Figure 4–33. Log-on Sample Initialization Display

(c)   On-Air Voice/Data Call Verification

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

Note: For the purposes of providing a sample display, an ISDN voice call is documented. Reference the HSD User's Guide for specific instructions on how to place voice and data calls.

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

1.   Ensure the maintenance port report items 21 and 23 are activated.

2.   Place a test call. Observe and verify the maintenance port messages are similar to the sample provided in Figure 4–34.

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

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

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

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

Figure 4–34. HSD Call Sample Display

(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 items before proceeding.

- As directed in previous tests, connect a computer to the maintenance port and use Level 2, *maint* password to access the HSD maintenance utility program.

- Power up all avionics and align the IRS.

- Taxi or tow the aircraft to an unobstructed, line-of-site location where a complete 360° rotation is possible.

(b) Antenna Tracking Verification Procedure

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

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

2. Position the aircraft at a baseline, start-of-test heading (0° recommended).

3. Confirm that the baseline heading, as reported by the aircraft IRS is similar to that reported from the "HD" entry in reports item 23.

4. Record the following data in "Installation Checklist" on page D-1:

- Antenna selected—port or starboard (conformal only)

- Antenna gain and azimuth angle

- Heading

- Channel Card number "1" and "2" C/No and signal level

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 report items 21 and 23 for the following checks.

(b) Optional Voice/Data Calls Procedure

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

1. 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 and figure 8 pattern. Note any voice or data anomalies.

2. Voice/data calls – in flight:

- Place any combination of voice and/or data calls during any of the segments listed above. The flight pattern may include "standard rate of turn", figure 8s, or circles. Note any voice or data anomalies.

F. Operational Mode and Configuration System Checks

This section describes system checks designed for specific HSD modes of operation.

(1) Verifying Cooperative Mode System Operation

This section provides system operational verification procedures that are specific to Cooperative Mode installations.

The following system verification procedures use the HSD Maintenance Port Utility Program to access system information.

Note: Record all test results in "Installation Checklist" on page D-1.

Note: Depending on the version of software and the system configuration installed, the actual menus and screen displays appearing in "live" systems may differ slightly from the illustrations provided in this document. The illustrations also use "x.x" as a substitute for the actual firmware version.

(2) Verifying Honeywell Combined Mode System Operation

This section provides system operational verification procedures that are specific to Honeywell Combined Mode installations.

The following system verification procedures use the HSD Maintenance Port Utility Program to access system information.

Note: Record all test results in "Installation Checklist" on page D-1.

(a) Checking HPA Status

To check the HPA Status:

1. With the Maintenance Port Utility program activated (MAINT password access), press the equals sign (**=**) to activate the "Reports".

2. Press **Ctrl+N** to scroll to report 25.

3. To toggle on the HPA ARINC I/O report, type *25*.

Report 25 toggles ON.

4. Press **Esc**.

The "Reports" for HPA Status appears on screen. The screen refreshes every few seconds.

```
HPA maintenance word 600002: SSM: NORMAL OPERATION  SDI: HGA HPA
HPA status word 64137a: SSM: NORMAL OPERATION  SDI: HGA HPA
OUTPUT POWER: 28.0 dB LESS THAN 40W
MAX. AVAILABLE RMS POWER: 2.0 dB GREATER THAN 40W
HELD POWER    LINEAR    CARRIER OFF    BACKOFF RANGE= 31 dB
```

5. Confirm that the report shows SSM as "normal operation" and that SDI appears configured as HGA HPA. (See example provided above.)

6. Toggle OFF report 25. (Press **=** , then type *25*. Report 25 appears as "OFF").

(b)   Checking EIRP power

Check EIRP power values during system operation using the HSD Maintenance Port Utility program. Place a number of call types and combinations while using the "reports" function of the HSD Maintenance Port Utility program and record the reported values in "Installation Checklist" on page D-1.

(c)   Test Set-up Procedure

1.   With the Maintenance Port Utility program activated (MAINT password access), press the equals sign (=) to activate the "Reports".

2.   Press **Ctrl+N** to scroll to report 78.

3.   To toggle on the vt100 EIRP/power report, type **78**.

Report 78 toggles ON.

4.   Press **Esc**. The "Reports" for vt100 EIRP/power appears on screen. The "Reports" screen refreshes every few seconds.

(d)   EIRP Test Procedures

1.   Place an HSD ISDN voice call using channel card one (repeat procedure placing a call using the second channel card), and then place a multi-link PPP ISDN data call (128 kbps ISDN) to confirm bonding is operational.

•   Confirm that the EIRP/Watts value begins at approximately 20 to 22.5 W until it stabilizes to a lower power usage value of approximately 17.0 W until the end of the call.

•   Confirm that the HPA value is in the range of 11 W to 16 W during the call.

2.   Place two simultaneous HSD Swift64 ISDN voice calls (one call from each channel card) and while both calls are connected, confirm that the EIRP/Watts value is reported similar to the values presented in Figure 4–36 and Figure 4–37.

3.   Place one Aero H/H+ call.

The Aero Watts value should initially increase to a value of 8 to 10 W and then stabilize to lower watt value of 1.5 to 2.5 W when the call has stabilized. Refer to Figure 4–38 and Figure 4–39.

4.   Place two simultaneous Aero H/H+ calls.

The Aero H/H+ Watts value should initially increase to a value of 8 to 10 W and then stabilize to lower watt value of 1.5 to 2.5 W when the call has stabilized. Refer to Figure 4–40. Keeping the two Aero H/H+ calls up, place one HSD Swift64 ISDN call. Refer to Figure 4–41.

5.   Place two HSD Swift64 ISDN voice calls (one call from each channel card) and while both calls are connected, place an Aero H/H+ voice call.

The Aero Watts value should initially increase to a value of 8 to 10 W and then stabilize to lower watt value of 1.5 to 2.5 W when the call has stabilized. Refer to Figure 4–42.

6. Place two HSD Swift64 ISDN voice calls (one call from each channel card) and while both calls are connected, place two Aero H/H+ voice calls.

The Aero Watts value should initially increase to a value of 8 to 10 W and then stabilize to lower watt value of 1.5 to 2.5 W when the call has stabilized. Refer to Figure 4–43 and Figure 4–44.

7. Toggle OFF report 78. (Press = , then type 78. Report 78 appears as "OFF").

(e) Verifying System Operation when "In-Call" (Report 78)

The values shown in the following examples of the HSD Maintenance Port Utility, Report 78, are derived from an HCM system operating with a 12 dBW gain and 2.5 dBW HPA-to-antenna-loss and assumes good beam coverage.

```
CHANNEL CARD    #1              #2
EIRP/WATTS    0.0/0       17.5/6

HPA (ITS): 11.3 WATTS A   CHANNEL CARDS:  6.3 WATTS  ANT GAIN: 12
15:05:55 PERMITTED UNDERDRAFT: 5.0 dB  ADD M4 CALL: 06 WATTS
AERO WATTS:  USED=00  RESERVED=13  HPA=36 WATTS  HPA GAIN=62.0 dB
```

Figure 4–35. Stable Connection with one M4 (Swift64) call

```
CHANNEL CARD    #1              #2
EIRP/WATTS   18.5/8       22.5/20

HPA (ITS): 35.7 WATTS A   CHANNEL CARDS: 27.9 WATTS  ANT GAIN: 12
12:05:31 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 20 WATTS
AERO WATTS:  USED=00  RESERVED=13  HPA=36 WATTS  HPA GAIN=62.8 dB
```

Figure 4–36. Initial Connection with two M4 (Swift64) calls

```
CHANNEL CARD    #1              #2
EIRP/WATTS   17.5/6       17.5/6

HPA (ITS): 15.9 WATTS A   CHANNEL CARDS: 12.5 WATTS  ANT GAIN: 12
12:07:33 PERMITTED UNDERDRAFT: 4.0 dB  ADD M4 CALL: 08 WATTS
AERO WATTS:  USED=00  RESERVED=13  HPA=36 WATTS  HPA GAIN=62.4 dB
```

Figure 4–37. Stable Connection with two M4 (Swift64) calls

```
CHANNEL CARD    #1            #2
EIRP/WATTS    0.0/0         0.0/0

HPA (ITS):  9.0 WATTS A   CHANNEL CARDS:  0.0 WATTS  ANT GAIN: 12
15:10:02 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 20 WATTS
AERO WATTS:  USED=10   RESERVED=23   HPA=36 WATTS   HPA GAIN=62.2 dB
```

Figure 4–38. Call Initialization (Aero H/H+ call)

```
CHANNEL CARD    #1            #2
EIRP/WATTS    0.0/0         0.0/0

HPA (ITS):  2.2 WATTS H   CHANNEL CARDS:  0.0 WATTS  ANT GAIN: 12
15:11:24 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 20 WATTS
AERO WATTS:  USED=02   RESERVED=14   HPA=36 WATTS   HPA GAIN=61.2 dB
```

Figure 4–39. Stable Connection with one Aero H/H+ call

```
CHANNEL CARD    #1            #2
EIRP/WATTS    0.0/0         0.0/0

HPA (ITS):  4.0 WATTS A   CHANNEL CARDS:  0.0 WATTS  ANT GAIN: 12
15:14:09 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 20 WATTS
AERO WATTS:  USED=04   RESERVED=16   HPA=36 WATTS   HPA GAIN=61.7 dB
```

Figure 4–40. Connection with two Aero H/H+ calls

```
CHANNEL CARD    #1            #2
EIRP/WATTS    17.5/6        0.0/0

HPA (ITS): 15.9 WATTS A   CHANNEL CARDS:  6.2 WATTS  ANT GAIN: 12
15:15:48 PERMITTED UNDERDRAFT: 3.0 dB  ADD M4 CALL: 10 WATTS
AERO WATTS:  USED=04   RESERVED=17   HPA=36 WATTS   HPA GAIN=62.3 dB
```

Figure 4–41. Connection with two Aero H/H+ calls and one M4 (Swift64) call

```
CHANNEL CARD    #1            #2
EIRP/WATTS    18.5/8        18.5/8

HPA (ITS): 17.9 WATTS A   CHANNEL CARDS: 15.7 WATTS  ANT GAIN: 12 =04
RESERVED=17   HPA=36 WATTS   HPA GAIN=62.6 dB
12:16:10 PERMITTED UNDERDRAFT: 4.0 dB  ADD M4 CALL: 08 WATTS
AERO WATTS:  USED=02   RESERVED=15   HPA=36 WATTS   HPA GAIN=62.6 dB
```

Figure 4–42. Connection with two M4 (Swift64) calls and one Aero H call

```
CHANNEL CARD    #1              #2
EIRP/WATTS   18.5/8         17.5/6


HPA (ITS): 22.5 WATTS A   CHANNEL CARDS: 14.2 WATTS  ANT GAIN: 12
12:10:22 PERMITTED UNDERDRAFT: 5.0 dB  ADD M4 CALL: 06 WATTS
AERO WATTS:  USED=11  RESERVED=24  HPA=36 WATTS  HPA GAIN=62.8 dB
```

Figure 4–43. Initial Connection with two Aero H/H+ calls and two M4 (Swift64) calls

```
CHANNEL CARD    #1              #2
EIRP/WATTS   18.5/8         17.5/6


HPA (ITS): 17.9 WATTS A   CHANNEL CARDS: 14.3 WATTS  ANT GAIN: 12
12:12:01 PERMITTED UNDERDRAFT: 5.0 dB  ADD M4 CALL: 06 WATTS
AERO WATTS:  USED=02  RESERVED=15  HPA=36 WATTS  HPA GAIN=62.5 dB
```

Figure 4–44. Stable Connection with two Aero H/H+ calls and two M4 (Swift64) calls

If the HSD Honeywell Combined Mode system does not pass the system operational verification procedure, or if the system fails, refer to the test and fault isolation checks presented in the following table.

Table 4–25. Honeywell Combined Mode Basic Fault Checks

SYMPTOM	CHECK
System "not working"	Strapping and SDI – HPA Status
No communication with avionics	Check multi-control wiring
Unable to place an HSD Swift64 call	Activate Report 38 and check for power request value.
	Check RF connections between the Transmit cable and the HSD DLNA
	Check the connection of the receive cable between the HSD and the splitter
Unable to place an Aero H/H+ call	Check transmit cable between the Aero H RFU and the HSD HPA
	If a low receive value is indicated on either the HSD or Honeywell SDU, check splitter connections (receive cable from DLNA to the splitter)
	Check the connection on the Aero H RFU receive cable connector
Calls dropping when placing multiple calls	HPA to antenna, cable loss value may not be accurate.
	Re-measure the HPA to antenna cable loss and re-configure the HSD system to match the revised value.

(3) Verifying Multi-Channel Configuration System Operation

This section provides system operational verification procedures that are specific to Multi-Channel configuration installations.

The following system verification procedures use the HSD Maintenance Port Utility Program to access system information.

Note: Record all test results in "Installation Checklist" on page D-1.

The following system verification procedures use the HSD Maintenance Port Utility's "console-mode" functionality to access system information from all of the HSD-X units in a Multi-Channel installation.

(a) Activating "Console-Mode"

The HSD-Xs are monitored using the "console-mode" function of the HSD Maintenance Port Utility Program.

To remotely access an HSD-X for monitoring purposes using the "console-mode" feature of the HSD-128 transceiver's Maintenance Port Utility Program:

1. Connect to the HSD-128 Maintenance Port (using either the front panel or remote access connector).

2. Open a session of the HSD Maintenance Port Utility Program using the password MAINT.

3. In **Menu 18**, press **X**.

The application prompts you to enter the number of the HSD-X you want to monitor.

4. Type the number of the HSD-X you want to monitor, and then press Enter.

5. Enter the password: maint

The reports screen appears for the selected HSD-X.

```
     MENU 18                          FIRMWARE Vx.x

X   HSD-X slave console mode     B   HSD-X slave cable loss
L   list HSD-X slave cable loss  V   get HSD-X firmware version
<CTRL> N  next menu   <CTRL> O  previous menu   =  select reports


TERMINAL: HSD-X NETWORK MODE


which slave (1 thru 2 -- 0=none) ? 1
Slave #1 console mode. Press ~ to exit.

      MENU 1                           FIRMWARE Vx.x

X     override forward id          L     test LEDs
Y     explain hpa error status     S     set hcm attenuator
R     hcm RF threshold
<CTRL> N  next menu      <CTRL> O  previous menu  = select reports

TERMINAL: HSD-X NETWORK MODE
```

(b) Installation Check – Multi-Channel

Conduct the following installation check to confirm proper Multi-Channel installation and configuration before performing the operational verification tests.

Before beginning the system checks, connect to the HSD-128 Maintenance Port and open the HSD Maintenance Utility Program using the password MAINT.

1. Check the Forward ID in all units.

    • In **Menu 4**, press **Q**.

2. Check the System Config and I/O strapping is correctly installed for all units.

    • Activate **Report 28***: Press the equal sign "=", type 28, press Enter, and then press Esc to activate the report.*

```
ID=XXXXXX config=11111000 DUART1=11101111 DUART2=10001111 DUART3=11111111
DATA I/O CONFIG=00001010
```

3. Check the cable loss values are in the required range.

4. Check that LES Access Codes are configured correctly in all units.

    • In **Menu 3**, press **O** (until the LES access codes are displayed).

5. Check that the HSD-X "slaves" are recognized by the system.

    • Activate **Report 78***: Press the equal sign "=", type 78, press Enter, and then press Esc to activate the report.* All installed HSD-X units should be listed on screen as shown in the 4-channel system example below.

```
CHANNEL CARD    #1              #2              S1              S2
EIRP/WATTS    0.0/0           0.0/0           0.0/0           0.0/0


HPA (ITS):  4.0 WATTS H   CHANNEL CARDS:  0.0 WATTS  ANT GAIN: 14
11:33:28 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 14 WATTS
AERO WATTS:   USED=00                   HPA=60 WATTS      HPA GAIN=59.9 dB
```

    (c)   Operational Verification Tests – Multi-Channel

        The operational verification test procedures provided in this section are specific to Multi-Channel HSD systems and confirm basic system operation.

        All verification tests require using the HSD Maintenance Port Utility Program.

        1.   Verify valid receive (Rx) signals:

            •   With the system powered up, activate **Report 23**. Confirm that the receive C/No signal value is greater than 50 dB/Hz as shown in the example below.

```
45D21'16.1"N  75D45'0.2"W  PT 0.0D  RL 0.0D  HD 180.0D  TK 0.0D  0 knots
11:35:55 dop 0 ppb  az 330.7 deg  el 33.5 deg  AOR WEST  ant gain 14 (p/t)
CARD #1: C/No=55.5 dB/Hz  sig=-15.9 dB   26.0 C  no call beam=5
CARD #2: C/No=55.9 dB/Hz  sig=-15.9 dB   26.0 C  no call beam=5
CARD S1: C/No=56.1 dB/Hz  sig=-17.1 dB   30.0 C  no call beam=5
CARD S2: C/No=55.4 dB/Hz  sig=-16.6 dB   30.5 C  no call beam=5
```

        2.   Verify valid transmit (Tx) signals:

            •   Activate **Report 78**.

            •   Place a call on the first channel of the Multi-Channel HSD system.

            •   Confirm that the EIRP/Watts values are similar to the examples provided in Figure 4–45 and Figure 4–46.

            •   Repeat step b. and c. for each channel installed on the system.

        3.   Verify Multi-Channel Operation:

            •   Activate **Report 78**.

            •   Place calls on each channel of the Multi-Channel HSD system.

            •   Confirm that the EIRP values are similar to the examples provided in Figure 4–47.

```
CHANNEL CARD    #1              #2              S1              S2
EIRP/WATTS   22.5/25          0.0/0           0.0/0           0.0/0


HPA (ITS): 31.8 WATTS A   CHANNEL CARDS: 25.1 WATTS  ANT GAIN: 12
11:38:03 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 25 WATTS
```

Figure 4–45. Initial Call, Channel #1

```
CHANNEL CARD    #1              #2          S1          S2
EIRP/WATTS   18.5/10        0.0/0       0.0/0       0.0/0


HPA (ITS): 14.2 WATTS A   CHANNEL CARDS: 10.1 WATTS  ANT GAIN: 12
11:39:36 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 25 WATTS
AERO WATTS:  USED=00                HPA=60 WATTS  HPA GAIN=62.6 dB
```

Figure 4–46. Stable Call, Channel #1

```
CHANNEL CARD    #1              #2          S1          S2
EIRP/WATTS   17.5/8        18.5/10      19.5/10     20.5/16
HPA (ITS): 50.4 WATTS A   CHANNEL CARDS: 43.8 WATTS  ANT GAIN: 14
14:43:43 PERMITTED UNDERDRAFT: 0.0 dB  ADD M4 CALL: 25 WATTS
AERO WATTS:  USED=00                HPA=60 WATTS  HPA GAIN=62.6 dB
```

Figure 4–47. Confirmed Operation of Multi-Channel (4 calls up)

If the Multi-Channel HSD configuration does not pass the system operational verification procedure, or if the system fails, refer to the test and fault isolation checks presented in Table 4–26.

Table 4–26. Multi-Channel Basic Fault Checks

SYMPTOM	CHECK
Ocean Region Registration Fails	Make sure all HSD LRUs are configured with the same default LES Access Codes (Primary and Secondary)
Unable to place calls using the HSD-Xs	Check System Config and I/O Config strapping
System "not working" (Fault LED – ON)	Check HPA Status and FWD ID, SDI strapping
No communication with avionics	Check multi-control wiring
Unable to place an HSD Swift64 call	Activate Report 38 and check for power request value. Check RF coax connections in the Transmit path to the DLNA
Calls dropping when placing multiple calls	HPA to antenna, cable loss value may not be accurate. Re-measure the HPA to antenna and HSD-X to HSD-128 cable losses and re-configure the HSD system to match the revised value.

G. Software Load Procedures

EMS SATCOM may occasionally release new software. Newly released software is loaded via a laptop or computer connected by cable to the maintenance port of the HSD system using an HSD Firmware Upgrade application (PN 1110-SW-1021 – ADT_LOAD.exe).

When loading software to HSD units in installation environments that include an SDU, disable the SDU (Power off or remove the sdu from the arinc tray) before beginning the software load procedure.

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. The file formats of the software presented in this manual are examples only; refer to the applicable service bulletin for the actual files required for each specific software load.

Note: When loading channel card software to HSD transceivers in installation environments where the SDU has been disabled or removed, the channel card (or cards) must be manually powered up using the HSD Maintenance Utility Program.

(1) Loading Channel Card Software

This section describes how to load channel card software on to HSD and HSD-X transceivers.

Note: Software cannot be loaded onto an HSD-X unit using the pass-through mode function via the HSD transceiver. Software must be loaded to an HSD-X via the front connector or ARINC connections of the HSD-X unit.

To load channel card software

1. Connect a computer to the Maintenance Port of the HSD transceiver.

2. Turn on the computer.

3. Save the HSD Load Program file (PN 1110-SW-1021) to a folder on your PC. (Recommended: Create a folder named HSD Load in the PC's root directory and save the load application file to this folder.)

4. Apply power to the HSD or HSD-X transceiver.

5. If loading software in installation environments where the SDU is disabled during software loading, the channel cards must be manually powered up before proceeding with the software load. Refer to "Forcing Channel Card Power Up Procedure" on page 4-76 for detailed instructions.

6. Close all other applications running on the computer (especially programs that use the serial COM port, e.g. HyperTerminal). The load program may not execute successfully if other programs are running.

7. In the HSD folder, double-click on the ADT_LOAD.exe to launch the load application.

The ADT_LOAD application opens in a DOS window and displays the "Load Target" menu.

```
HSD/HST LOADER   Vx.x -- Mon Mar 24 12:12:17 2003

which target ?
  0 = control processor
  1 = channel card #1
  2 = channel card #2
  3 = HPA application
  4 = data i/o card
  5 = HPA application with manual setup
  6 = HPA application plus boot with manual setup
  7 = HPA application plus boot
  8 = channel card #1 boot code
  9 = channel card #2 boot code
 11 = channel card #1 pic code
 12 = channel card #2 pic code
 13 = HCM application
 14 = HST ORT
 15 = HSD ORT
?
```

The ADT_LOAD application prompts the user to select a "Target".

8. From the "Which Target" menu:

- To load channel card application software (for example: appl41.hex, cfig41.hex) to channel card #1, press **1**

- To load channel card application software (for example: appl41.hex, cfig41.hex) to channel card #2, press **2**

9. Press **Enter**.

The load application prompts you to type in a filename.

10. Type the appropriate filename for the software being loaded to the HSD Channel Card (for example appl41.hex or cfig41.hex), and then press **Enter**.

The application prompts you to select a COM port.

11. Select the COM port on your computer connected to the HSD.

12. Type the appropriate COM port (1 or 2—typically 1), and then press **Enter**.

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

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

```
HSD/HST LOADER   Vx.x -- Mon Mar 24 12:12:17 2003

which target ?
  0 = control processor
  1 = channel card #1
  2 = channel card #2
  3 = HPA application
  4 = data i/o card
  5 = HPA application with manual setup
  6 = HPA application plus boot with manual setup
  7 = HPA application plus boot
  8 = channel card #1 boot code
  9 = channel card #2 boot code
  11 = channel card #1 pic code
  12 = channel card #2 pic code
  13 = HCM application
  14 = HST ORT
  15 = HSD ORT
  16 = HSD-X ORT
?1
File name, which contains the firmware image? applxx.hex
This download will require one of the PC's COM ports. (1, 2, etc) [1] ?
1
Connect COM1 of this PC to the maintenance port of the data terminal.
Hit <ESC> to abort, or <Enter> to proceed
Establishing communication to the data terminal -- DO NOT CYCLE THE POWER !!
Hit ESC to abort.
DATA TERMINAL APPARENTLY READY TO ACCEPT PROGRAM
switching to 57.6 kbaud
loading applxx.hex
1% 5% 10%
```

This completes the first load of the Channel Card software selected in step 10.

14. For HSD transceivers with two channel cards, repeat all required software loads to both channel cards.

15. Repeat steps 7 through 13 for all other required software loads of Channel Card Software files as specified in the applicable software service bulletin.

16. When all Channel Card Software is loaded, reset or cycle the power on the HSD transceiver.

17. If no other software loads are required, proceed to "Verifying Software Loads" on page 4-78.

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

(2) Loading Control Processor Software

CAUTION: When loading software to the units in installation environments that include an SDU, disable the SDU (Power off or remove the sdu from the arinc tray) before beginning the software load procedure.

To load control processor software:

1. Connect a computer to the Maintenance Port of the HSD transceiver.

2. Turn on the computer.

3. Save the HSD Load Program file (PN 1110-SW-1021) to a folder on your PC. (Recommended: Create a folder named HSD Load in the PC's root directory and save the load application file to this folder.)

4. Apply power to the HSD or HSD-X transceiver.

5. Close all other applications running on the computer (especially programs that use the serial COM port, e.g. HyperTerminal). The load program may not execute successfully if other programs are running.

6. In the HSD Load folder, double-click on the ADT_LOAD.exe file to launch the load application.

   The ADT_LOAD application opens in a DOS window and displays the "Load Target" menu, as displayed in the example below.

   The ADT_LOAD application prompts the user to select a "Target."

```
HSD/HST LOADER   Vx.x -- Mon Mar 24 12:12:17 2003
which target ?
  0 = control processor
  1 = channel card #1
  2 = channel card #2
  3 = HPA application
  4 = data i/o card
  5 = HPA application with manual setup
  6 = HPA application plus boot with manual setup
  7 = HPA application plus boot
  8 = channel card #1 boot code
  9 = channel card #2 boot code
 11 = channel card #1 pic code
 12 = channel card #2 pic code
 13 = HCM application
 14 = HST ORT
 15 = HSD ORT
 16 = HSD-X ORT
?
```

7. From the "Which Target" menu:

   • To load control processor software (for example, adt70.bin) to the control processor, press **0**

8. Press **Enter**.

   The load application prompts you to type in a filename.

9. Type the appropriate filename for the software being loaded to the HSD Control Processor (for example adt70.bin), and then press **Enter**.

   The application prompts you to select the COM port that is connected to the HSD or HSD-X.

10. Type the appropriate COM port (1 or 2—typically 1), and then press **Enter**.

11. To proceed with the load, press **Enter**.

> **Note:** If you press **Esc**, the application aborts the software load. Only press **Esc** if you want to discontinue the software load procedure.

Communication with the HSD or HSD-X transceiver is established. The following screen appears. As shown in the example screen, a percentage (%) progress indicator appears on the screen showing load status. Once the load is complete, a confirmation message briefly appears on the screen indicating that the file has been successfully loaded. The DOS window then closes and the HSD resets.

```
HSD/HST LOADER   V3.0 -- Mon Mar 24 12:12:17 2003
which target ?
  0 = control processor
  1 = channel card #1
  2 = channel card #2
  3 = HPA application
  4 = data i/o card
  5 = HPA application with manual setup
  6 = HPA application plus boot with manual setup
  7 = HPA application plus boot
  8 = channel card #1 boot code
  9 = channel card #2 boot code
  11 = channel card #1 pic code
  12 = channel card #2 pic code
  13 = HCM application
  14 = HST ORT
  15 = HSD ORT
  16 = HSD-X ORT
?) 0
File name, which contains the firmware image? Adt70.bin
This download will require one of the PC's COM ports. (1, 2, etc) [1] ?
1
Connect COM1 of this PC to the maintenance port of the data terminal.
Hit <ESC> to abort, or <ENTER> to proceed
Establishing communication to the data terminal -- DO NOT CYCLE THE POWER !!
Hit ESC to abort.
DATA TERMINAL APPARENTLY READY TO ACCEPT PROGRAM
switching to 57.6 kbaud
loading adt70.bin
1% 5% 10%
```

This completes the load of the Control Processor software selected in step 9.

12. When software load is finished, reset or cycle the power on the HSD of HSD-X transceiver.

13. If no other software loads are required, proceed to Verifying the Software Load.

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

(3) Forcing Channel Card Power Up Procedure

In installation environments that include an SDU, the SDU must be disabled before loading software to the HSD transceiver. With the SDU disabled (removed from the ARINC tray or powered off), the channel card(s) must be manually powered on using the HSD Maintenance Utility Program.

Note: If the channel card is already powered up, the "force channel card power up" item "U" in Menu 4 is not available and will not appear as a selection option.

To force channel card power up:

1. Click **Start**, then point to:
   Programs ⇨ Accessories ⇨ Communications ⇨ HyperTerminal, and then click on the connection to the HSD Maintenance Utility Program.

2. At the password prompt, type **MAINT** and then press **Enter**.

   The Maintenance Utility Program **Menu 1** appears.

3. Press **Ctrl+N** to scroll to **Menu 4**.

4. To force channel card power up, press **U**.

5. Wait 30 seconds for the channel card to power up before continuing with the load procedure.

6. Close HyperTerminal and all other applications running on the PC (especially programs that use the serial COM port) before continuing with the software load. The load program may not execute successfully if other programs are running.

(4) Loading HPA Software

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

WARNING: BEFORE loading NEW hpa software, Contact EMS SATCOM product suppport to verify the unit's hpa version is compatible with field-loading of hpa software. if the HPA version is not compatible with field-loading, you must send it back to EMS Technologies for upgrading.

There are four different versions of HPA—two variants for 28 V dc units and Two variants for 115 V ac units. hpa software is variant-specific—**loading the wrong software version may lock the unit**; therefore, Contact EMS SATCOM for assistance when loading any Hpa software to ensure that the correct hpa software and revision is loaded.

To load HPA software

1. Remove power from the HSD transceiver.

2. Connect a computer to the Maintenance Port of the HSD transceiver.

3. Turn on the computer.

4. Apply power to the HSD transceiver.

5. Close all other applications running on the computer (especially programs that use the serial COM port, e.g. HyperTerminal). The load program may not execute successfully if other programs are running.

   In the HSD folder, double-click on the ADT_LOAD.exe to launch the load program.

   The ADT_LOAD application opens in a DOS window and displays the "Load Target" menu.

```
HSD/HST LOADER   Vx.x -- Mon Mar 24 12:12:17 2003

which target ?
  0 = control processor
  1 = channel card #1
  2 = channel card #2
  3 = HPA application
  4 = data i/o card
  5 = HPA application with manual setup
  6 = HPA application plus boot with manual setup
  7 = HPA application plus boot
  8 = channel card #1 boot code
  9 = channel card #2 boot code
 11 = channel card #1 pic code
 12 = channel card #2 pic code
 13 = HCM application
 14 = HST ORT
 15 = HSD ORT
 16 = HSD-X ORT
  ?
```

6. Select Menu item **7**, HPA application plus boot, and then press **Enter**.

7. The system prompts you for a filename. (i.e. "Filename which contains the firmware image?")

   Note: Use care to ensure that the correct file name is entered for the HSD transceiver's power type.

8. Enter **A1703006-V9A6.SX** for a 28 V dc unit

9. Enter **C0300106-V4A2.SX** for a 115 V ac unit

10. Press **Enter**.

    The program prompts you to select a COM port.

11. Select the COM port on your computer connected to the HSD.

12. Type the appropriate COM port (1 or 2—typically 1), 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 then the DOS window closes. This completes HPA software load.

If all software loads are finished, verify the success of the software load by following the instructions provided in "Verifying Software Loads" on page 4-78.

14. In the event that the load fails, restart the load from the beginning of "Loading HPA Software" on page 4-76. If after two attempts, the load still does not complete successfully, assume that the software disks may have been corrupted or the software is incompatible with the hardware configuration. Contact EMS SATCOM product support for assistance.

(5) Verifying Software Loads

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

WARNING: In systems with disabled or removed SDU, the channel card or cards must be manually powered on to enable the verification of the software load.

To verify that software loaded successfully

1. Apply power to the HSD.

2. On the computer, open HyperTerminal and start the HSD Maintenance Utility Program.

3. Connect a computer to the Maintenance Port of the HSD transceiver.

4. Enter the Maintenance Utility Program password: Type maint and then press **Enter**.

The Maintenance Utility Program, Menu 1 appears.

```
        MENU1                           FIRMWARE Vx.x


X      override forward id          L      test LEDs
Y      explain hpa error status     S      set hcm attenuator
R      hcm RF threshold

<CTRL> N   next menu      <CTRL> O  previous menu  = select reports

```

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

Menu 2 appears.

```
     MENU2                              FIRMWARE Vx.x

A     set veh-relative azimuth         E     set veh-relative elevation
K     desired az veh-rel velocity      R     resume automatic steering
T     enter time of day                N     annotate log file
L     re-enter logon password          V     get firmware versions
Z     reset HSD-128
<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
```

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

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

```
FIRMWARE VERSIONS:
  KERNEL:          V1.6 -- Mon Oct 07 13:36:26 2002
  APPLICATION:     V4.1 -- Thu Oct 10 08:36:29 2002
  CHANNEL CARD #1: 0.5.4.0 9040 -- 0.0.0.30 -- 1.8.0.A
  CHANNEL CARD #2: 0.5.4.0 9040 -- 0.0.0.30 -- 1.8.0.A
  HPA:             S/W P/N: A1703706 Ver: V1B1-Unit #00043 F/W Ver: V5
  DATA I/O CARD:      -- MAY BE TYPE 1
```

> **Note:** HSD units with two channel cards also list the firmware versions for Channel Card #2.

7. Verify that all software has successfully loaded. In two-channel card units verify that the software has loaded successfully to both channel cards. Verify that the software versions (Firmware Versions) shown, match the versions listed on the load disk (or files) and in the software service bulletin.

8. Close the HyperTerminal session.

9. Remove power from the HSD.

10. Turn off the computer.

This completes the software load verification. The next section explains how to disconnect the software load equipment.

(6) Disconnecting Load Equipment

After completing all required software loads and load verification:

1. Remove power from the HSD (if applicable).

2. Turn off the computer (if applicable).

3. Disconnect the serial cable connector from the computer COM port.

4. Disconnect the serial cable connector from the HSD Maintenance Port.

(7) Completing Record of Accomplishment

After completing all required software loads and the load verification, fill out the Record of Accomplishment form provided in "Record of Accomplishment" on page E-1. (Retain a copy for future reference.)

3. Troubleshooting and Fault Isolation

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

Troubleshooting procedures require data obtained using the Maintenance Utility Program feature of the HSD units. Refer to "HSD Maintenance Utility Program" on page 4-3 for specific instructions on how to access and use the Maintenance Port and Maintenance Utility Program of the unit.

A. Troubleshooting Principles

(1) Non-specific Complaints

When troubleshooting units with non-specific complaints, complete all system verification and functional tests in "Operational and Diagnostic Test Procedures" on page 4-48. Document whether the unit passes or fails each test.

If the unit passes all tests and no fault is discovered, all associated equipment and aircraft wiring should be tested.

If the unit fails a specific test, isolate the actual fault or faults by performing troubleshooting procedures provided in this section.

(2) Specific Complaints

When troubleshooting units with specific complaints, service personnel may choose not to complete some or all of the diagnostic tests and proceed directly to the applicable troubleshooting and fault isolation procedure provided in this section.

B. Equipment Required

Equipment required for troubleshooting and fault isolation is the same as the equipment required for test purposes as listed in page 2.

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 unit's operational software and installation configuration mode.

Note: The screens used in the figures presented in this section may have been edited for clarity and for illustrative purposes.

(1) Fault Isolation Screen Displays

Figure 4–48 to Figure 4–54 provide example maintenance screens for reference and illustration purposes.

```
KERNEL Vx.x -- Mon Oct 07 13:36:26 2002
TESTING RAM ......RAM OK.

HSD APPLICATION Vx.x -- Thu Apr 24 13:28:58 2003
Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.
fault log sector 15 contains 1372 entries
REAL TIME CLOCK PRESENT:  9:52:57 Tue Jun 3, 2003

channel card forward id ABC123
EEPROM forces STAND-ALONE MODE
!!ensure that arinc test data doesn't bother sat906
powering up channel card #1
powering up channel card #2
SENDING FIRST OC_RESTART COMMAND
!!CARD #2 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!
SENDING FIRST OC_RESTART COMMAND
!!CARD #1 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!
9:53:20 #1 ABC123 E5 start 400110 14.00 dBW CT SP ocean region registration
28 C   54 dB/Hz
9:53:20 #2 ABC456 E5 start 400110 14.00 dBW CT SP ocean region registration
30 C   54 dB/Hz
9:53:24 #2 ABC456 E5 stop 8301  ACSE successful ORR 30 C  53 dB/Hz
9:53:24 #1 ABC123 E5 stop 8306  ACSE failed retry ORR 28 C  53 dB/Hz
9:53:28 #1 ABC123 E5 start 400110 14.00 dBW CT SP ocean region registration
28 C  54 dB/Hz
9:53:33 #1 ABC123 E5 stop 8301  ACSE successful ORR 28 C  53 dB/Hz
```

Figure 4–48. Successful Ocean Region Registration: Report 21 activated

```
CARD #1: C/No=52.9 dB/Hz  sig=-16.9 dB   27 C   no call beam=4
CARD #2: C/No=52.9 dB/Hz  sig=-18.2 dB   27 C   no call beam=4
45D21'29.1"N  75D1'54.6"W  PT -10.0D  RL 0.0D  HD 185.0D  TK 0.2D  0 knots
CARD #1: C/No=52.4.0 dB/Hz  sig=-17.6 dB   27 C   in call beam=4
CARD #2: C/No=52.4 dB/Hz  sig=-18.5 dB   27 C    no call beam=4
45D21'16.1"N  75D0'0.2"W  PT -10.0D  RL 0.0D  HD 185.0D  TK 0.2D  0 knots
```

Figure 4–49. No call: Report 23 activated

```
CARD #1: C/No=52.5 dB/Hz  sig=-17.2 dB   28 C   no call beam=4
CARD #2: C/No=0.0 dB/Hz  sig=-999.9 dB   28 C   in call beam=4
45D21'16.1"N  75D0'0.2"W  PT -10.0D  RL 0.0D  HD 185.0D  TK 0.2D  0 knots
12:43:55 dop 0 ppb az 285.4 deg  el 15.3 deg  AOR EAST  ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz  sig=-999.9 dB   28 C   in call beam=4
CARD #2: C/No=47.1 dB/Hz  sig=-15.5 dB   30 C   no call beam=4
45D21'16.1"N  75D0'0.2"W  PT -10.0D  RL 0.0D  HD 185.0D  TK 0.2D  0 knots
12:43:55 #1 ABC123 E4 start 800124 18.50 dBW  mobile aero 64k speech 28 C
```

Figure 4–50. In Call: Reports 21 and 23 activated

```
12:43:55 dop**** az 285.4 deg  el 15.3 deg AOR EAST ant gain 11 (p/t)
CARD #1: C/No=52.9 dB/Hz  sig=-16.9 dB   27 C  no call beam=4
CARD #2: C/No=52.9 dB/Hz  sig=-18.2 dB   27 C  no call beam=4
************ *********** ********* ******* ********* ******* *******
CARD #1: C/No=52.4.0 dB/Hz  sig=-17.6 dB   27 C  in call beam=4
CARD #2: C/No=52.4 dB/Hz  sig=-18.5 dB   27 C   no call beam=4
************ *********** ********* ******* ********* ******* *******
```

Figure 4–51. No IRS Data: Report 23 activated

```
15:02:29 dop 0 ppb  az 135.1 deg   el 33.8 deg  AOR WEST  ant gain 11 (p/t)
CARD #1: C/No=0.0 dB/Hz  sig=****   27.0 C  no call beam=5
CARD #2: C/No=0.0 dB/Hz  sig=****   26.5 C  no call beam=5
45D9'29.2"N  75D1'54.6"W  PT 0.2D  RL -0.4D  HD 16.2D  TK 0.2D  0 knots
```

Figure 4–52. No Signal: Report 23 activated

```
15:01:27  #2 ABC123  W5 call term 8306 26.0 C
15:01:29  #1 DEF456  W5 call init  4000110 14.00 dbw  SP Ocean Region
Registration 2 7.0 C
15:01:30  #2 ABC123  W5 call init  4000110 14.00 dbw  SP Ocean Region
Registration 2 6.0 C
15:01:35  #1 DEF456  W5 call term 8306 27.0 C
15:01:36  #2 ABC123  W5 call term 8306 26.5 C
15:01:37  #1 DEF456  W5 call init  4000110 14.00 dbw  SP Ocean Region
Registration 2 7.0 C
15:01:39  #2 ABC123  W5 call init  4000110 14.00 dbw  SP Ocean Region
Registration 2 6.5 C
15:01:43  #1 DEF456  W5 call term 8302  ACSE **Failed ORR**  27.0 C
15:01:45  #2 ABC123  W5 call term 8302  ACSE **Failed ORR**  26.5 C
```

Figure 4–53. Failed Ocean Region Registration: Report 21 activated

```
10:00:35 Tue Jun 3, 2003
KERNEL Vx.x -- Mon Oct 07 13:36:26 2002
TESTING RAM ......RAM OK.

HSD APPLICATION Vx.x -- Thu Apr 24 13:28:58 2003
Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.
fault log sector 15 contains 1384 entries
REAL TIME CLOCK PRESENT:  10:00:55 Tue Jun 3, 2003

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

**** eeprom forward id 0 not in table *****
EEPROM forces STAND-ALONE MODE
!!ensure that arinc test data doesn't bother sat906
powering up channel card #1
powering up channel card #2
SENDING FIRST OC_RESTART COMMAND
!!CARD #2 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!
SENDING FIRST OC_RESTART COMMAND
!!CARD #1 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!
```

Figure 4–54. Forward ID Not Strapped: No reports activated

```
KERNEL Vx.x -- Mon Oct 07 13:36:26 2002
TESTING RAM ......RAM OK.

HSD APPLICATION V4.6 -- Thu Apr 24 13:28:58 2003
Type "menu" to activate the maintenance port menus.
Other passwords provide different levels of authorization.
fault log sector 15 contains 1396 entries
REAL TIME CLOCK PRESENT:  10:09:51 Tue Jun 3, 2003

channel card forward id ABC123
EEPROM forces STAND-ALONE MODE
!!ensure that arinc test data doesn't bother sat906
powering up channel card #1
powering up channel card #2
SENDING FIRST OC_RESTART COMMAND
!!CARD #2 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!
SENDING FIRST OC_RESTART COMMAND
!!CARD #1 -- CONTROL PROCESSOR TRIGGERING OCEAN REGION REG IN AOR EAST!!


Log-on password entered: "Maint"


        MENU1                           FIRMWARE Vx.x
X  override forward id            L   test LEDs
Y  explain hpa error status
<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
HPA ERROR CODE 1800


Y command entered:

HPA MAINTENANCE WORD NOT REPORTING HGA ANTENNA
HPA STATUS WORD NOT REPORTING HGA ANTENNA


Event log messages:

  MENU 3                              FIRMWARE Vx.x

L  list EEPROM                        S  list event log
E  reset EEPROM                       C  clear event log
M  misc.  EEPROM parameter            J  ignored faults
N  system serial number              F  list call log
G  clear call log
<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
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  Jun 03 11:19:39 2003
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 4–55. No Strap on SDI Lines (open): No reports activated

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


       MENU1                              FIRMWARE Vx.x

X   override forward id              L   test LEDs
Y   explain hpa error status
<CTRL> N   next menu      <CTRL> O   previous menu   = select reports
HPA UNCONTROLLED


Y command entered:

HPA MAINTENANCE WORD REPORTING ARINC ERROR
HPA MAINTENANCE WORD NOT REPORTING HGA ANTENNA
HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTED DATA)
HPA STATUS WORD NOT REPORTING HGA ANTENNA



Event log messages:

  MENU 3                              FIRMWARE Vx.x

L   list EEPROM                      S   list event log
E   reset EEPROM                     C   clear event log
M   misc.  EEPROM parameter          J   ignored faults
N   system serial number            F   list call log
G   clear call log
<CTRL> N   next menu      <CTRL> O   previous menu   = select reports

FAULT (ENTRY #1422):  address ABC123: 30 seconds after powerup
  powerup #203  389 hours operation  Jun 03 11:15:07 2003
  ERROR CODE 40
   HPA FAULT -- 0x1c80
   HPA MAINTENANCE WORD REPORTING ARINC ERROR
   HPA MAINTENANCE WORD NOT REPORTING HGA ANTENNA
   HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTED DATA)
   HPA STATUS WORD NOT REPORTING HGA ANTENNA
```

Figure 4–56. Wrong Strap on SDI Lines (TP5A to GND)

```
MENU1                          FIRMWARE Vx.x

X  override forward id              L  test LEDs
Y  explain hpa error status
<CTRL> N  next menu      <CTRL> O  previous menu  = select reports
HPA UNCONTROLLED


Y command entered:


HPA MAINTENANCE WORD REPORTING ARINC ERROR
HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTED DATA)


Event log messages:

  MENU 3                          FIRMWARE Vx.x

L  list EEPROM                          S  list event log
E  reset EEPROM                         C  clear event log
M  misc.  EEPROM parameter              J  ignored faults
N  system serial number                F  list call log
G  clear call log
<CTRL> N  next menu      <CTRL> O  previous menu  = select reports

FAULT (ENTRY #1442):  address 4ff7d4: 30 seconds after powerup
  powerup #207  389 hours operation  Jun 03 11:33:02 2003
  ERROR CODE 40
HPA FAULT -- 0x480
    HPA MAINTENANCE WORD REPORTING ARINC ERROR
    HPA STATUS WORD REPORTING INVALID SSM 1 (NO COMPUTE
```

Figure 4–57. Stand-Alone Mode Multi-Control Loopback (TP1A-3E & TP1B-3F) Not Wired: HSD Fault LED "ON"

```
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 4–58. Incorrect Dialing Format: Reports 21 and 52 Enabled

```
Enter 1 thru 67 to toggle report on/off
X  turn off all reports    <CTRL> N  show next page    S   save to EEPROM
ESC  return to PREVIOUS MENU

 1 OFF messages to channel card #1    13 OFF messages to channel card #2
 2 OFF hex output to channel card #1  14 OFF hex output to channel card #2
 3 OFF responses from channel card #1 15 OFF responses from channel card #2
 4 OFF hex input from channel card #1 16 OFF hex input from channel card #2
 5 OFF channel #1 misc info           17 OFF channel #2 misc info
 6 OFF sb antenna arinc input         18 ON port antenna arinc input
 7 OFF sb antenna maintenance word    19 ON port antenna maintenance word
 8 OFF sb antenna status word         20 ON 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


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 4–59. Top/Port Antenna Status: Reports 18,19, and 20 activated

```
12:31:25 #1 ABC123 E4 start 800103 14.00 dBW  mobile AMBE 28 C  47 dB/Hz
12:31:27 #1 ABC123 E4 start 800103 14.00 dBW  mobile AMBE 28 C  47 dB/Hz
12:31:38 #1 ABC123 E4 start 800103 14.00 dBW  mobile AMBE 28 C  44 dB/Hz
12:31:55 #1 ABC123 E4 stop 1001  call cleared by MES terminal 28 C  44 dB/Hz
```

Figure 4–60. AMBE Call (Mobile-to-Fixed) MES Terminated: Report 21 activated

```
12:34:27 #1 ABC123 E4 start 800103 14.00 dBW  mobile AMBE 28 C  48 dB/Hz
12:34:29 #1 ABC123 E4 start 800103 14.00 dBW  mobile AMBE 28 C  48 dB/Hz
12:34:39 #1 ABC123 E4 start 800103 14.00 dBW  mobile AMBE 28 C  0 dB/Hz
12:35:31 #1 ABC123 E4 stop 1f01  call cleared by terrestrial circuit 28
C  43 dB/Hz
```

**Figure 4–61. AMBE Call (Mobile-to-Fixed) Terrestrial Terminated: Report 21
activated**

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

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

12:43:55 dop 0 ppb  az 285.4 deg  el 15.3 deg  AOR EAST  ant gain 12 (p/t)
CARD #1: C/No=0.0 dB/Hz  sig=-10.7 dB   28 C  in call beam=4
CARD #2: C/No=46.6 dB/Hz  sig=-15.3 dB   30 C  no call beam=4
45D21'16.1"N  75D0'0.2"W  PT -10.0D  RL 0.0D  HD 185.0D  TK 0.2D  0 knots
12:43:55 #1 ABC123 E4 start 800124 21.50 dBW  mobile aero 64k speech 28 C
12:43:56 dop 0 ppb  az 285.4 deg  el 15.3 deg  AOR EAST  ant gain 12 (p/t)
CARD #1: C/No=0.0 dB/Hz  sig=-999.9 dB   28 C  in call beam=4
CARD #2: C/No=47.1 dB/Hz  sig=-15.5 dB   30 C  no call beam=4
45D21'16.1"N  75D0'0.2"W  PT -10.0D  RL 0.0D  HD 185.0D  TK 0.2D  0 knots

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

**Figure 4–62. 64 K Speech call (Mobile to Fixed) Terrestrial Termination: Reports 21
and 23 activated**

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

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

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

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

Figure 4–63. 64 K Speech Call (Mobile-to-Fixed) Terrestrial Termination: Reports 21 and 23 activated

```
13:40:53 Tue Jun 3, 2003
13:41:22 #1 ABC123 E4 start c00124 14.00 dBW  fixed aero 64k speech 28 C
47 dB/Hz
13:41:25 #1 ABC123 E4 start c00124 22.50 dBW  fixed aero 64k speech 28 C
48 dB/Hz
13:41:35 #1 ABC123 E4 start c00124 18.50 dBW  fixed aero 64k speech 28 C
53 dB/Hz
13:41:41 #1 ABC123 E4 start c00124 19.50 dBW  fixed aero 64k speech 28 C
52 dB/Hz
13:41:45 #1 ABC123 E4 stop 1f01  call cleared by terrestrial circuit 28
C  52 dB/Hz
```

Figure 4–64. Speech Call (Fixed-to-Mobile) Terrestrial Terminated: Report 21 activated

```
13:31:06 #2 ABC456 E4 start 800625 14.00 dBW  mobile aero 64k audio 3k1
30 C  48 dB/Hz
13:31:17 #2 ABC456 E4 start 800625 22.50 dBW  mobile aero 64k audio 3k1
30 C  48 dB/Hz
13:31:28 #2 ABC456 E4 start 800625 22.50 dBW  mobile aero 64k audio 3k1
30 C  55 dB/Hz
13:31:40 #2 ABC456 E4 start 800625 21.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:31:46 #2 ABC456 E4 start 800625 20.50 dBW  mobile aero 64k audio 3k1
30 C  55 dB/Hz
13:31:52 #2 ABC456 E4 start 800625 19.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:31:58 #2 ABC456 E4 start 800625 20.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:32:04 #2 ABC456 E4 start 800625 20.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:32:10 #2 ABC456 E4 start 800625 20.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:32:17 #2 ABC456 E4 start 800625 19.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:32:23 #2 ABC456 E4 start 800625 20.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:32:29 #2 ABC456 E4 start 800625 19.50 dBW  mobile aero 64k audio 3k1
30 C  0 dB/Hz
13:32:32 #2 ABC456 E4 stop 1f01  call cleared by terrestrial circuit 30
C  0 dB/Hz
```

Figure 4–65. FAX Call (Mobile-to-Fixed) Terrestrial Terminated: Report 21 activated

```
13:33:27 Tue Jun 3, 2003
13:38:22 #2 ABC456 E4 start 800622 14.00 dBW  mobile aero 64k UDI 30 C
47 dB/Hz
13:38:25 #2 ABC456 E4 start 800622 22.50 dBW  mobile aero 64k UDI 30 C
47 dB/Hz
13:38:35 #1 ABC123 E4 start 800124 14.00 dBW  mobile aero 64k speech 28
C  47 dB/Hz
13:38:36 #2 ABC456 E4 start 800622 22.50 dBW  mobile aero 64k UDI 30 C
55 dB/Hz
13:38:37 #1 ABC123 E4 start 800124 22.50 dBW  mobile aero 64k speech 28
C  47 dB/Hz
13:38:42 #2 ABC456 E4 start 800622 21.50 dBW  mobile aero 64k UDI 30 C  0
dB/Hz
13:38:48 #1 ABC123 E4 start 800124 22.50 dBW  mobile aero 64k speech 28
C  54 dB/Hz
13:38:48 #2 ABC456 E4 start 800622 20.50 dBW  mobile aero 64k UDI 30 C  0
dB/Hz
13:38:54 #1 ABC123 E4 start 800124 21.50 dBW  mobile aero 64k speech 28
C  0 dB/Hz
13:38:54 #2 ABC456 E4 start 800622 19.50 dBW  mobile aero 64k UDI 30 C  0
dB/Hz
13:38:53 Tue Jun 3, 2003
13:39:00 #1 ABC123 E4 start 800124 21.50 dBW  mobile aero 64k speech 28
C  54 dB/Hz
13:39:00 #2 ABC456 E4 start 800622 19.50 dBW  mobile aero 64k UDI 30 C  0
dB/Hz
13:39:06 #1 ABC123 E4 start 800124 21.50 dBW  mobile aero 64k speech 28
C  0 dB/Hz
13:39:06 #2 ABC456 E4 start 800622 19.50 dBW  mobile aero 64k UDI 30 C  0
dB/Hz
13:39:12 #1 ABC123 E4 start 800124 21.50 dBW  mobile aero 64k speech 28
C  55 dB/Hz
13:39:12 #2 ABC456 E4 start 800622 19.50 dBW  mobile aero 64k UDI 30 C  0
dB/Hz
13:39:18 #1 ABC123 E4 start 800124 21.50 dBW  mobile aero 64k speech 28
C  0 dB/Hz
13:39:19 #2 ABC456 E4 stop 1001  call cleared by MES terminal 30 C  0 dB/Hz
13:39:20 #1 ABC123 E4 stop 1001  call cleared by MES terminal 28 C  0 dB/Hz
```

Figure 4–66. 64 K Speech and Data Call (Mobile-to-Fixed) MES Terminated: Report 21 activated

(2) Troubleshooting Table

Table 4–27 provides fixes for basic HSD system faults. Before completing any fix, activate the HSD Maintenance Utility Program using the "*maint*" password. For detailed connection and user instructions, refer to "HSD Maintenance Utility Program" on page 4-3.

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
RED LED remains on after powering up sequence	• HPA Uncontrolled • HPA Fault	View initial power-up display of the HSD Maintenance Utility Program	• In Stand-Alone installations, verify that the multicontrol, looped back is wired (out to in) • In Stand-Alone installations, check transmit path between RFU and HSD
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 VSWR error • HPA maintenance word reporting RAM error • HPA reporting ROM error • HPA maintenance word reporting power supply error • HPA maintenance word reporting temperature error	In menu 1, press **Y** to obtain an explanation of the HPA error status	• Check continuity on ARINC buses between HSD and antenna subsystem • Check continuity on ARINC buses between HSD and SDU • Verify SDI is strapped correctly (TP5B to TP5D) • Check the external power source is properly connected and meets installation requirements • Check transmit path from HSD output (MPC1) to the antenna subsystem (coax cables, splitters, relays, etc…) • Check the RFU TX output (MPC1) connection to the HSD input (TPC1) • Check installation location meets the RTCA/DO-160D environmental specifications • Check for proper fan-tray operation and air-cooling. • Verify the fan-tray plug distribution is as per the installation requirements

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
Call failure	IRS information not available	Activate maintenance reports 21 and 23 (See Figure 4–51)	• 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.
Call failure	System does not log onto the broadbeam	Activate maintenance reports 21 and 23 (See Figure 4–53)	• Check that the IRS data is received and valid. • Ensure that a valid FWD ID is read • Verify correct antenna pointing. • Ensure LES Access codes are configured correctly. • Verify all coax connections.
Call failure	System does not log onto the correct Ocean Region	Activate maintenance report 21 and 23 (See Figure 4–53)	• Check that the IRS data is received and valid. • Check for antenna line-of-sight interference.
Call failure	Unit is not transmitting	Activate maintenance reports 21 and 23 Figure 4–52 – No Signal	• Check for a defective or loose RF cable. • Verify the Rx RF level is acceptable. • Check RF power level displayed in Maintenance Port Menu Report Item 21; signal strength should be requested at 14.00 dBW but in call should increase to 22.5 dBW. • Ensure the HSD is secured properly to the ARINC connector in the tray.

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
Call failure	Forward ID is invalid or strapped incorrectly	Activate maintenance report 21 (See Figure 4–54) To check FWD ID, in Menu 4, press **Q**	• The account registration process has not been completed. Check your account status with your service provider to ensure that the account registration has been processed into the LES databases and that your account is valid. • If in the event log, the message, "Channel card stuck in boot state" appears, check that the assigned FWD IDs are strapped correctly. • If fault code 12B1 appears in the even log, ensure FWD ID is valid for the Inmarsat Terminal Category (If you replace a Stand-Alone unit (CAT. A) with a Non-Stand-Alone unit (CAT. B), you need to get new FWD IDs assigned).

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
Call failure	Unit is strapped to an incorrect system mode of installation	In menu 3, select Item **L** (List EEPROM)	• Verify the system mode strapping is correct. • Reset the system and observe the initialization display; it shows the HSD unit's powering up, self-test results. The Initialization display lists the installation mode configuration for the unit. • If the mode displayed is not strapped or is incorrectly strapped, a temporary setting may be used—in Menu 3, select M (misc. EEPROM parameters), then select parameter 16 (Channel Card Category) and configure the HSD to the correct mode (e.g. '0' for SAT-906 ,'1' for Stand-Alone…). Reset the unit and try the call again.
Call failure	Dialing sequence was incomplete or incorrect	Activate report 21 and 23 Figure 4–48 – No call	• Verify the number you are calling and try the number again. • Refer to the HSD User's Guide for detailed operating instructions. • Ensure that you end the dialing sequence by pressing # (pound key)—pressing # at the end of the dialing string signals the system to "send" the call.
Log-on request fails	Unit is not transmitting	Activate maintenance reports 21 and 23 (See Figure 4–53)	• Check for a defective or loose cable. • Check for HPA fault. • Ensure the HSD is secured properly to the ARINC connector in the tray.

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
Log-on request fails	Unit is not receiving	Activate maintenance reports 21 and 23 (See Figure 4–52)	• Check for a defective or loose cable. • Verify that the Forward ID is valid, activated, and strapped correctly. • Ensure your account is current and active. • Check for antenna line-of-sight interference. • Ensure the HSD 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 report 21 and 23	• Check the connection between the HSD 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. NOTE: Zero "0" is an invalid MSN entry.

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
Log-on successful, but fails to complete call	Authorization error (fault code 12C4)	Activate maintenance reports 21 and 23 (See Figure 4–53 and Figure 4–51)	• Contact your service provider to verify that the forward ID is activated. • Check that the Forward ID is strapped correctly. • Check that IRS data is available and correct. • Check that the Veh Rel Az/EL to Satellite is correct. • Check that all coax cable connections are secure. • Check that the Rx C/No value is ≥50dB. • Check antenna status is okay. • Check that the primary and secondary 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 unit. • Check the reported HPA back-off in report 21; Signal should initialize at 14 dBW and increase after handshake to approximately 22.5 dBW – then slowly decrease (Range typically between 18.5 dBW to 21.5 dBW with a lower limit of 14.5 dBW).

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
HSD is operating outside the normal environmental specifications	Channel card temperature fault	Activate report 21 or 23	• Check channel card temperature; temperatures of over 50° C to 60° C may cause the HSD or HSD-X 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.
Calls do not complete and connection is not established	Channel Congestion (fault code 2024)	Activate report 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 21 and 23	• Verify that the call dial string is correct; Pressing # at the end of the dialing string signals the system to "send" the call. • Check that the HSD or HSD-X power LED flashes on and off (1 Hz) during a call request. • Check that the ISDN cable is connected correctly and securely.

Table 4–27. Troubleshooting and Fault Isolation

Fault	Description	Maintenance Report	Check
No dial tone heard in handset	–	–	• Confirm ISDN lines are wired correctly. • Verify 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 unit has completed beam registration.
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	Activate report 21 and 23	• Check signal strength (C/No $\geq$ 50 dB). • Ensure there is a clear, un-obstructed, line-of-sight to the satellite. • Select an alternate satellite or beam and try your call again (Note: works if you are located where more than one beam overlaps or satellite is in-view).

D. Fault Isolation and Diagnostic Procedures

This section provides basic information required for technical personnel to isolate faults in HSD and HSD-X transceivers. Where needed, refer to other sections of this manual (which contain important information to aid in understanding the functionality of the unit) for additional information.

Fault isolation procedures are usually conducted on equipment that falls within one of the following categories:

• Units that have failed to pass operational and installation verification procedures

• Units that have failed during service

• Units repaired and returned to service

Maintenance reports are helpful in troubleshooting the HSD system. Capturing maintenance port information from the HSD or HSD-X transceiver and forwarding the file to EMS SATCOM technical support staff will assist in troubleshooting suspected HSD system problems. Instructions on how to activate and save "reports" information is provided in the next section.

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

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

Conduct the fault isolation procedures provided in this section and record the resulting system information. Then send the system information collected to EMS SATCOM HSD product support for analysis.

CAUTION: Before proceeding with fault isolation procedures, refer to the advisories paragraphs in the introduction section of this manual.

(1) Activating and Saving a Diagnostic 'Reports' File

Use the following procedure to save or "capture" a troubleshooting report for the HSD transceiver. Remember to date and save the file. Annotate the file with any system anomalies or unique operating environments that may in anyway affect system functionality (e.g., physical location of aircraft or transceiver, Land Earth Station being used, list of connected devices).

In Multi-Channel systems, activate console mode and select the applicable HSD-X unit you want to monitor before proceeding with this procedure. (To activate console mode, in Menu 18, press X.)

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. (Access level can be changed using **menu 1**, **L** command if the system is running and the password level is menu.)

4. Press the equals sign (**=**) key to activate reports **21** and **23** (toggle off all other report items).

5. Press **S** to "SAVE" these reports as default. This enables the user to view these reports on subsequent HSD power-ups or "Reset" entries.

6. Reset the system by: cycling the power to the unit; pressing the reset button on the HSD front panel; or in **menu 2,** press **Z** to reset the system.

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

The system should restart and ocean registration will take place (approximately two minutes).

8. After the Beam Registration process completes, press **Ctrl+N** to display **menu 2**.

9. Press **V** to display the software versions of the system.

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 dial tone? Was the call successful?

11. If applicable, attempt a call from the second channel.

12. Press **=** to display the current "reports" profile of the system (as noted in step 4).

13. To save an alternate "reports" configuration, activate the required items and then press **S** (in the "reports" menu) to save to EEPROM.

14. Using Ctrl+N, go to **menu 3**, and then do one of the following:

- For units operating control processor software earlier than version 5.7, press **L** to display EEPROM parameters. (The EEPROM list displays one terminal screen of information at a time. Press **L** to display subsequent screens.)

- For units operating control processor software later than version 5.7, press **O** to display the ORT List. (The ORT list displays one terminal screen of information at a time. Press **O** to display the next screen.)

15. In **menu 3**, press **S** (list event log) and then press zero "**0**" and then press the period key "**.**" to list the complete event log.

16. In **menu 3**, press **F** (list call log), then press **F** again (complete log) and then press the period key "**.**" to the complete event log." 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 unit)

- Aircraft and customer name

- Any notes about the problems encountered

- Contact name, telephone number, and e-mail address

- E-mail the log file to EMS Technologies technical support at: **hsd.help@emstechnologies.ca**

4. Adjustment/Alignment Procedures

A. General

There are no adjustment/alignment procedures required for HSD or HSD-X transceivers.

5.   Modification History

Table 4–28 lists the modification history for the HSD transceiver. This history is provided to aid the technician in understanding the reason for issuing a service bulletin and to describe the changes to the equipment.

Table 4–28. Modification History

Service Bulletin	Description of Modification
1110-SB-0001/A	Upgrades channel card software to version 3.0. Upgrades the control processor software to version 4.4. Upgrades accommodate Inmarsat system change and fix software bugs.
1110-SB-0002/A	HPA Mute and ARINC 429 driver repair hardware modification. Backplane modification to the HPA wiring harness corrected the reverse biasing of the Mute lines affecting all units installed with a Ball dual-conformal-array antenna.
1110-SB-0003/A	Resolves problems with Cooperative Mode operation
1110-SB-0004/A	Hardware upgrade to install Data I/O Type 2 card
1110-SB-0005/B	Upgrades the hardware for Honeywell Combined Mode (HCM) to include a RF detector and a variable attenuator on the Aero H path of the pre-HPA combiner and allows the reading and control of this attenuator through a serial connection to the combiner. The control processor code is upgraded to include processing of the attenuator settings in the power control algorithm and to allow setting of the attenuator as part of the combined operation.

This version does not support Cooperative Mode (with SAT-906). |
1110-SB-0006/A	Channel card software upgrade to support MPDS
1110-SB-0007/A	Upgrades the HSD-128 Control Processor software to version 6.5. This version adds the Multi-Channel capability to the HSD-128 software to support HSD-128 units integration with external HSD-X channels (PN 1110-A-0401).
1110-SB-0010/A	Hardware upgrade to dual-channel for single channel card transceivers
1110-SB-0011/B	Upgrades the Channel Card software to version C35 to fix Cooperative Mode bug in Channel Card software version C30. Upgrades software to recognize Cooperative Mode System Config hardware strapping.
1110-SB-0012/A	Upgrades the channel card software to version C41 (6.0) which supports enhanced HSD functionality in all modes of operation, (including multi-channel configurations) and the use of Inmarsat services—including AMBE STU capability. In Cooperative Mode systems, MPDS is not supported with this version of software.

Upgrades the control processor software to version 7.0, which enhances all modes of operation. Selective Mode units operating Category A Inmarsat terminals may experience GPS faults when operating this version of software (workaround: deactivate GPS protection). |
| 1110-SB-0013/A | Adds software identification label to HSD units |

Table 4–28. Modification History

Service Bulletin	Description of Modification
1110-SB-0014/A	Data I/O Type 2 Software Upgrade for units with a Data I/O Type 2 card installed
1110-SB-0015/B	HSD Control Process Software Enhancement
1110-SB-0401/A	Upgrades software to support AMBE STU and improve system and MPDS operation
1110-SB-0402/A	Adds software identification label to HSD units

MAINTENANCE AND REPAIR

1.   General

This section provides the maintenance and repair information applicable for all HSD transceiver models.

2.   Maintenance

The HSD Transceiver does not require routine maintenance.

3.   Repair

All repair procedures must be completed by EMS SATCOM approved repair facilities.

A. Repair Tools and Supplies

No special supplies are required to repair this equipment.

HSD units that require servicing must be returned to EMS Technologies, Canada or to an EMS SATCOM approved service center. Refer to "Test and Fault Isolation" on page 4-1 for unit testing requirements and procedures.

B. Repair Procedures

This equipment does not require any special repair procedures.

C. Removal Procedures

If an HSD or HSD-X unit must be removed from service for repair, with power removed, disconnect all equipment from the unit and then remove it from the ARINC tray.

If an HSD-X unit is removed for servicing, the Multi-Channel HSD system will still operate (with reduced channel capacity) as long as the HSD-X trays are populated as shown in Figure 5–1.

With an HSD-X unit removed from the series, the remaining HSD-X units must be moved so that the empty tray is always the last tray in the installation series. If the RF path is not equipped with isolators (either separate or built into the combiner), cap all unused splitter outputs and combiner inputs with 50-ohm terminations.
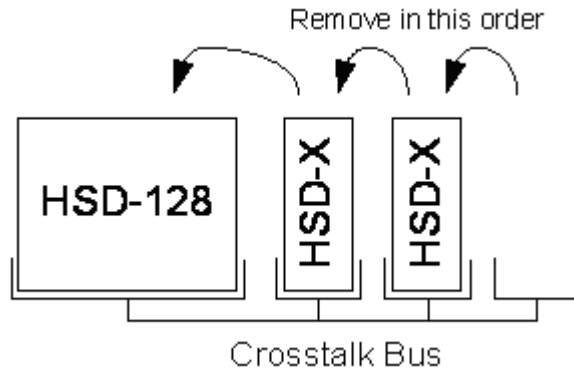
Figure 5–1. HSD-X Order of Removal

D. Repair Facility Approvals

The EMS Technologies SATCOM Division, 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 Technologies 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 unit 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 unit prior to invoicing for the repair or replacement. The customer shall pay for the shipping costs to and from EMS Technologies.

(3) Repackaging Requirements

An HSD returned to EMS Technologies must be returned in its original shipping container. Failure to do so may invalidate the warranty. If an HSD 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 unit must be returned to EMS SATCOM for repair or overhaul, please follow the Return Materials Authorization procedure as follows:

1. Have the following information ready before calling the SATCOM Product's Customer Service Center:

   - Model number (e.g. HSD);

   - Unit part number (e.g. 1110-A-0001);

   - Serial number;

   - Description of failure;

   - Federal ID no. (if applicable); and,

   - Purchase Order number (if available).

2. Call EMS Technologies Customer Service at (1-888) 300-7415 or (613) 591-3086.

3. Request an RMA number.

4. Pack the HSD in an EMS SATCOM-approved shipping-container.

5. Write the RMA number on the outside of the shipping container and ship to:

   <RMA Number>

   EMS Technologies

   400 Maple Grove Road

   Ottawa, Ontario, CANADA

   K2V 1B8

6. Fax shipping details with Way Bill # to the attention of the EMS SATCOM R&O Coordinator at (613) 591-8951.

Note: The processing of LRU returns is limited to standard business hours from 8:00 am to 4:00 pm EST.

4. Instructions for Continued Airworthiness, FAR 25.1529

This section presents the special instructions and maintenance requirements for continued airworthiness of the HSD High-Speed Data Transceiver.

Installation of the HSD 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.

A. Instructions for Continued Airworthiness Procedures

The following paragraphs describe all maintenance requirements and instructions for continued airworthiness of the HSD or HSD-X transceiver.

a. This manual contains maintenance information for the HSD and HSD-X units (including system description, system operation, removal, installation, test and fault isolation, and maintenance and repair).

b. 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).

c. Add all wiring diagram information contained in this manual to the aircraft operator's appropriate aircraft Wiring Diagram Manuals.

d. HSD and HSD-X transceivers are considered on-condition units. No additional or routine maintenance is required.

e. If an HSD or HSD-X transceiver is inoperative, remove the unit, 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 unit in the log book [refer to section 91.213 of the FAR or the aircraft's minimum equipment list (MEL)].

f. HSD and HSD-X transceivers are not field-repairable. All units must be returned to the EMS SATCOM factory or authorized repair centers for repair. Instructions for the removal of the unit for repair are provided in this section.

g. Repaired units must be re-installed on the aircraft in accordance with the instructions provided in this manual. The operation of all repaired units 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 unit 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.

h. 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 four, strategically placed geostationary satellites. Each satellite is located over and named after an oceanic region. The four satellite ocean regions are:

- Atlantic Ocean Region-East (AOR-E)

- Atlantic Ocean Region-West (AOR-W)

- Indian Ocean Region (IOR)

- Pacific Ocean Region (POR)

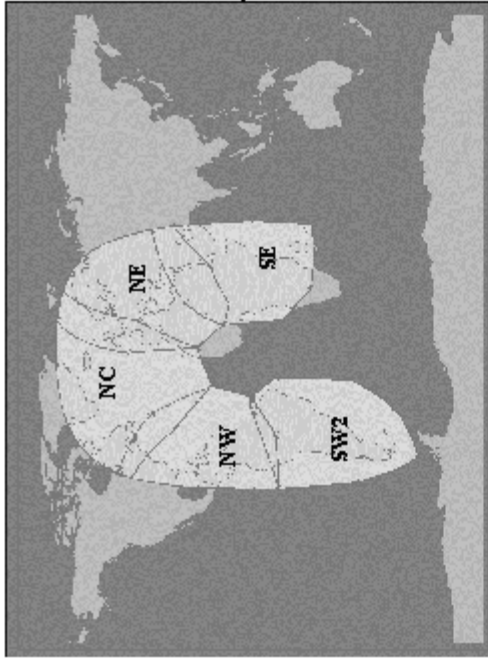The diagram below represents the satellite ocean regions with approximate transfer coordinates for satellite transitions.
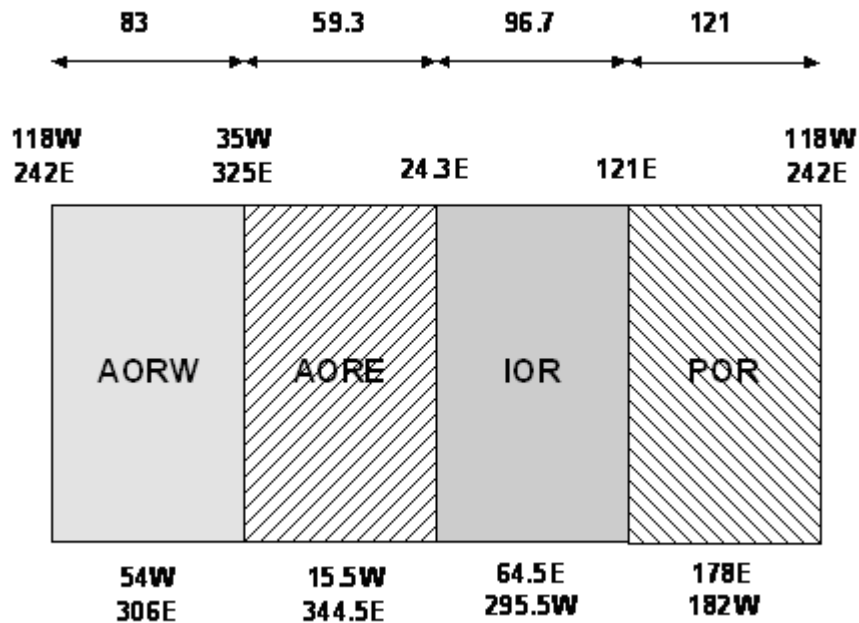
The four satellite ocean regions are made up of smaller, spot-beam coverage areas. The following maps show the Inmarsat satellite spot-beam coverage for the four ocean regions—as well as a composite map of the four regions combined.
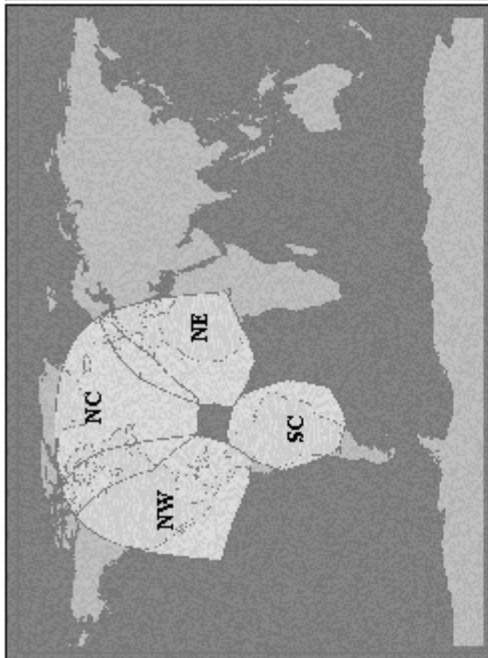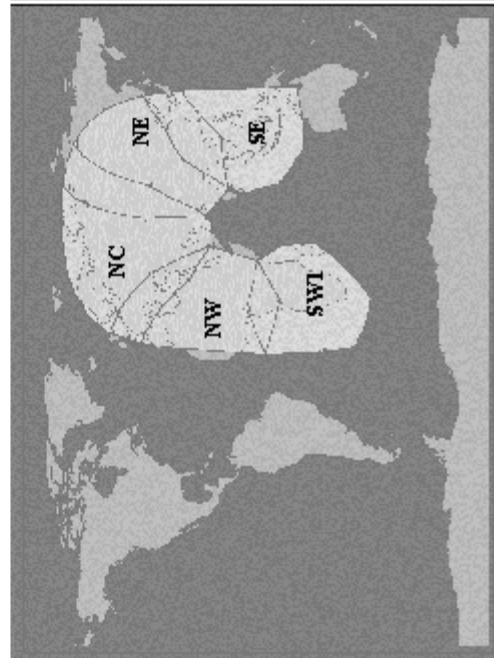
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APPENDIX B: TROUBLESHOOTING CHECKLIST

Before proceeding to the detailed testing and troubleshooting procedures provided in this manual, read the following *QuickStart* Troubleshooting Checklist. The *QuickStart* Troubleshooting Checklist provides answers to common HSD system activation questions.

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 Aeronautical Transceiver. 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

2 Has your account been activated?

Once registered, your HSD Transceiver is assigned terminal identification numbers called Forward IDs (FWD ID). The HSD transceiver must be strapped accordingly. 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 Land Earth Station (LES) level. New units being commissioned are not validated by the LES until their customer database has been updated by Inmarsat to reflect the registration and activation of your unit.

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

3 Is the HSD/HSD-X transceiver seated properly?

In cases where the HSD or HSD-X is not fully seated into the ARINC 600 connector (to the rear of the Fan Tray), the user may experience intermittent system operation. If intermittent system operation occurs:

Check that the polarization pins are installed correctly as indicated on the applicable Outline and Installation drawing.

Ensure the HSD/HSD-X is fully inserted into the tray and that the front, hold-down screws are properly tightened to secure the unit.

4 Is all cabling attached correctly and securely?

Broken connections and improper cabling are the most common causes of HSD units "not working." Before proceeding with testing and troubleshooting, complete the following checks:

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

- Ensure the unit is installed with correct power source.

- Verify that all external user and networking devices (for example: terminal adapters, routers, fax, telephones, computers) are connected and configured properly.

5 Have any changes to the system been made?

For previously installed and functional units, make note of any changes made to the system since the last time the unit functioned without problems.

- Were any new devices or systems connected to the unit?

- Have any connecting devices or equipment been removed or replaced? If so, check that all new or replaced connections are attached and configured correctly.

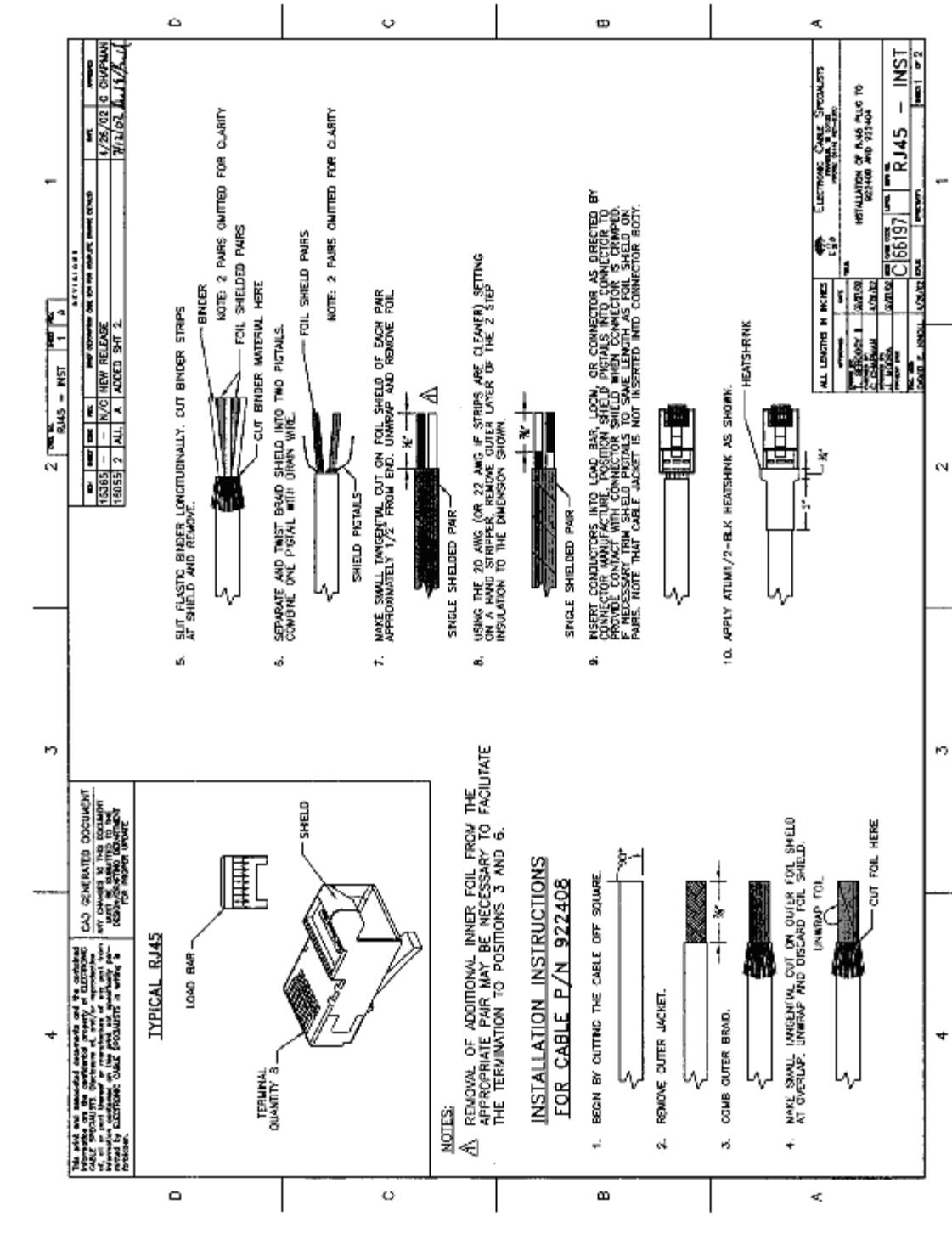- Have you changed service providers or re-configured the system in any way?

6 Are your Primary and Secondary LES Access Codes programmed for all Ocean Regions?

In Control Card software versions later than 5.7, the system default for LES access codes is set to "0" (zero), which must be configured to a valid LES access codes before operation. Refer to "System Operation" on page 2-1 for details.
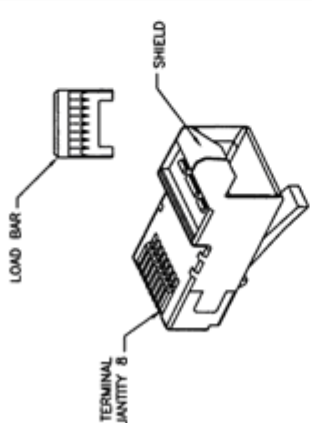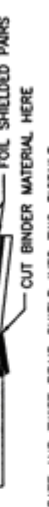
7 Was the operational mode of the system strapped or configured correctly?

Verify that the System Mode wiring straps match the installation configuration mode, for example Stand-Alone Mode, Honeywell Combined Mode (HCM), Cooperative Mode, Multi-Channel or Selective Mode.

APPENDIX C: RJ-45 CABLE TERMINATION DETAILS

APPENDIX D: INSTALLATION CHECKLIST

Aircraft Identification:		HSD Model Number:	
HSD Installation Mode:		HSD Serial Number:	
	Name:	Signature:	Date:
Checks completed by:			
Approved/witnessed by:			

Section	Parameter	Item	N/A	R	Value
Installation/ Mechanical	Physical	Service/maintenance access			
		Environmental considerations			
	Fan Tray	Plug configuration			
		Chassis bonding			
		Fan rotation			
	ARINC 600 Connector	Polarized pins			

Section	Parameter	Item	N/A	R	Value
Installation/Electrical	Power Connections	$^+$ 28 V dc polarity			
		115 V ac polarity			
		Chassis grounding			
	Voltage Measurements	$^+$ 28 V dc level			
		115 V ac level			
	IRS Input	IRS wiring			
		IRS format			
	Configuration Strap Pins	SDI			
		System configuration			
		Data I/O			
		Forward Address			
		WOW (optional)			
	Ethernet	Strapped to RJ45 distribution points			
	ISDN	Strapped to RJ45 distribution points			
	MPDS	Strapped to DB9S distribution connectors			
	Remotes	Manual Reset switch operation			
	Remotes	Maintenance port (DB9S access)			
		Power and Fault LED indicators			
	RF Coax	Rx i/p cable loss			
		Tx o/p cable loss			
	Antenna Connection	Antenna manufacturer and type			
		Wired as per manufacturer			
		Multi-control loopbacks installed			
	Configuration	Access codes			
		Channel cards			
		Stand-Alone mode			
		Valid beams			
		Forward ID			
		RF i/p attenuation			
TEST	System Power-up	Visual LED indications			
		Power-up computer display			
TEST On-air	System Log-on	Reset messages observed			
		Log-on verified			
	Voice/Data Call	Voice/data aircraft all placed			

Section	Parameter		Item								N/A	R	Value
			Tracking results checklist completed										
	Antenna Tracking Results												
	Heading (Deg)	**Antenna selected**	**Antenna Azimuth**	**HSD**				**HSDX**					
				Ch 1		**Ch 2**		**#1**		**#2**			
				C/NO	sig	C/NO	sig	C/NO	sig	C/NO	sig		
	15												
	30												
	45												
	60												
	75												
	90												
	105												
	120												
	135												
	150												
	165												
	180												
	195												
	210												
	225												
	240												
	255												
	270												
	285												
	300												
	315												
	330												
	345												
	360												
TEST	Optional Checks		Ground segment										
			Flight segment										

(Section label for tracking rows: **Operational Test**)

Section	Parameter	Item					N/A	R	Value
Operational Test									
		Tracking results checklist completed							
	Antenna Tracking Results								
	Heading (Degrees)	Antenna selected	Antenna Azimuth	Card # 1		Card # 2			
				C/No	Signal	C/No	Signal		
	15								
	30								
	45								
	60								
	75								
	90								
	105								
	120								
	135								
	150								
	165								
	180								
	195								
	210								
	225								
	240								
	255								
	270								
	285								
	300								
	315								
	330								
	345								
	360								
TEST	Optional Checks	Ground segment							
		Flight segment							

APPENDIX E: RECORD OF ACCOMPLISHMENT

To record the accomplishment of a software service bulletin, complete a copy of this form for each unit (serial number) that has been upgraded.

Fax or e-mail all Record of Accomplishments (one for each unit) to EMS Technologies. If you require assistance, contact EMS SATCOM Product Support.

EMS SATCOM Product Support: 1.888.300.7415 (routed to a mobile after regular business hours)
E-mail: hsd.help@emstechnologies.ca
FAX:1.613.591.0797

HSD IDENTIFICATION			
Part No		Serial No	
Hardware Revision		Software Revision No. (LI revision)	
AIRCRAFT IDENTIFICATION			
Type		Serial No	
Registration (Tail) No			
CUSTOMER INFORMATION			
Company		Phone No	
Contact Name		Signature	
DEALER			
Company		Phone No	
Contact Name		Signature	

SOFTWARE STATUS AFTER ACCOMPLISHMENT OF SERVICE BULLETIN:

	Application		Channel Cards		HPA		Data I/O	
	HSD	HSD-X	HSD	HSD-X	HSD	HSD-X	HSD	HSD-X
Example	4.3		C30		V9A4		DIOMain 1.17.elf	
Original Software								
New Software Installed								

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APPENDIX F: RF SPLITTER
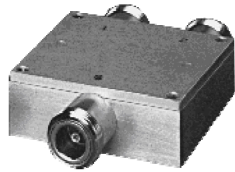
Notes:

- Internal load dissipation: 0.125 Watt.

- Matched power rating: 10 Watt.

- When only specification for M range given, specification applies to entire frequency range.

ZAPD-2-TNC (EMS p/n 32800004)   2 Way-0°

Frequency MHz	Isolation, dB						Insertion Loss, dB Above 3.0dB						Phase Unbalance Degrees			Amplitude Unbalance, dB		
$f_L - f_U$	L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	L Typ.	Max.	M Typ.	Max.	U Typ.	Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.
1000-2000			25	19					0.25	0.60				2.00			0.20	

L=low range(f_L to $10f_L$) M=mid range($10f_L$ to $f_U/2$) U=upper range($f_U/2$ to f_U)

Pin Connections

Port	Sum Port	Port 1	Port 2
as	S	1	2
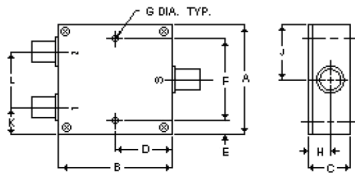
Case Style - F14 (inch,mm) weight: 170 grams.

A	B	C	D	E	F	G	H	J
2.00	2.00	.75	1.00	.25	1.500	.125	.39	1.00
50.800	50.800	19.050	25.400	6.350	38.100	3.175	9.906	25.400
K	L	M	N	P	Q	R	S	T
.50	1.00							
12.700	25.400							

Tolerance: .x ± .1 .xx ± .03 .xxx ± .015 inch.

Material and Finish:

Case material: aluminum alloy. Finish: grey paint or yellow iridite.

Marking:

For port markings 1, 2, and 3 see specification data sheet.

FREQ (MHz)	Insertion Loss (dB) S-1	(dB) S-2	Amplitude Unbalance (dB)	Isolation (dB)	Phase Unbalance (Degrees)	FREQ (MHz)	VSWR S	VSWR 1	VSWR 2
1300.00	3.18	3.15	0.020	32.66	0.25	1300.00	1.09	1.02	1.02
1325.00	3.22	3.20	0.020	34.41	0.15	1325.00	1.08	1.02	1.02
1350.00	3.19	3.18	0.010	36.26	0.18	1350.00	1.07	1.02	1.02
1375.00	3.21	3.18	0.040	38.36	0.17	1375.00	1.07	1.02	1.02
1400.00	3.22	3.20	0.020	40.79	0.23	1400.00	1.06	1.03	1.02
1425.00	3.19	3.18	0.010	43.43	0.14	1425.00	1.06	1.03	1.02
1450.00	3.21	3.19	0.010	46.58	0.22	1450.00	1.06	1.03	1.02
1475.00	3.21	3.17	0.040	48.01	0.27	1475.00	1.06	1.03	1.02
1500.00	3.22	3.20	0.020	47.39	0.25	1500.00	1.06	1.03	1.03
1525.00	3.20	3.18	0.030	45.89	0.23	1525.00	1.06	1.04	1.03
1550.00	3.22	3.18	0.040	44.16	0.23	1550.00	1.06	1.04	1.03
1575.00	3.23	3.20	0.030	43.02	0.28	1575.00	1.06	1.04	1.04
1600.00	3.22	3.19	0.040	41.97	0.19	1600.00	1.06	1.04	1.04
1625.00	3.21	3.18	0.030	41.28	0.21	1625.00	1.07	1.04	1.04
1650.00	3.25	3.21	0.040	40.64	0.23	1650.00	1.07	1.05	1.04
1675.00	3.23	3.18	0.060	39.99	0.30	1675.00	1.08	1.05	1.05
1700.00	3.25	3.20	0.040	39.27	0.28	1700.00	1.08	1.05	1.05
1725.00	3.23	3.19	0.030	38.59	0.24	1725.00	1.08	1.05	1.05
1750.00	3.27	3.21	0.050	37.67	0.17	1750.00	1.09	1.06	1.05
1775.00	3.23	3.20	0.030	36.60	0.22	1775.00	1.10	1.06	1.06

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Notes

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