



communications

ProTec AUTOMATIC IDENTIFICATION SYSTEM HARDWARE INSTALLATION AND OPERATION MANUAL



AIS PART NUMBER
AISD1000-00



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AIS Hardware I&O Manual 165M0601-00

Initial Issue

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L-3 Communications

Aviation Recorders Publications

Vendor Code: 06141

P. O. Box 3041

Sarasota, Florida 34230

Phone: (941) 371-0811

FAX: (941) 377-5591



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GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This board was constructed in an ESD (electro-static discharge) protected environment. This is because most of the semiconductor devices used in this board are susceptible to damage by static discharge.

Depending on the magnitude of the charge, device substrates can be punctured or destroyed by contact or mere proximity of a static charge. The results can cause degradation of device performance, early failure, or immediate destruction.

These charges are generated in numerous ways such as simple contact, separation of materials, and normal motions of persons working with static sensitive devices.

When handling or servicing equipment containing static sensitive devices, adequate precautions must be taken to prevent device damage or destruction.

Only those who are thoroughly familiar with industry accepted techniques for handling static sensitive devices should attempt to service circuitry with these devices.

In all instances, measures must be taken to prevent static charge build-up on work surfaces and persons handling the devices.



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RETURN MATERIAL POLICY

Components and spare parts purchased from L-3 that are discrepant for any of the following reasons may be returned immediately provided the extended value of the parts are in excess of \$100.00.

1. Overshipments

Quantity of parts received in excess of quantity specified on purchase order.

2. Wrong Part Numbers

Receipt of parts numbered other than those identified on a customer order where L-3 has not advised the customer by purchase order acknowledgment, by telex, or by notification on the shipping document that the received part is a replacement for the ordered part.

3. Parts Nonconforming to Specifications

If the extended value of the items is less than \$100.00, the items are to be scrapped instead of returned. When this occurs, notification must be sent to L-3 advising: (1) the reason for the rejection; (2) the items are less than \$100.00 in extended value and have been scrapped, and; (3) whether credit or replacement is desired.

If you wish to return material to L-3 for reasons other than warranty returns or those specified above, please contact an L-3 Account Administrator for authorization before proceeding. A Return Authorization Number will be assigned at this time. Your request should specify the relevant Return Authorization Number, purchase order number, part number, quantity and the reason you wish the part returned.

To assist us in processing these items more efficiently, we ask that all returned goods be accompanied by paperwork that clearly indicates the following:

1. Reason for return.
2. Purchase Order Numbers.
3. Correspondence Reference Number.
4. Return Authorization Number.

4. Copies of returned goods paperwork should be mailed to:

L-3 COMMUNICATIONS CORPORATION
AVIATION RECORDERS DIVISION
P. O. Box 3041
Sarasota, FL 34230-3041
Attn: Tom Meloche / Marine Systems Product Support Department

5. Parts returned under the above conditions should be addressed to:

L-3 COMMUNICATIONS CORPORATION
AVIATION RECORDERS DIVISION
6000 E. Fruitville Road
Sarasota, FL 34232
Attn: SERVICE DEPARTMENT

Component and spare parts purchased from L-3 that have been on the customer's shelf for more than 10 weeks from date of receipt; have been installed in a component or on a vessel, are not covered by this procedure. Such parts may be covered by warranty in which case they should be returned through normal warranty channels.



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RETURN OF MATERIAL UNDER WARRANTY

1. Material should be returned to the following address:

L-3 COMMUNICATIONS CORPORATION
AVIATION RECORDERS DIVISION
6000 E. Fruitville Road
Sarasota, FL 34232
Attn: WARRANTY RETURNS

2. For returning overseas shipments, the following customs broker must be used:

L-3 COMMUNICATIONS CORPORATION
AVIATION RECORDERS DIVISION
c/o A.J. Arango
Air Cargo Bldg.
Hoover Blvd.
Tampa Int'l Airport
Tampa, Florida 33634
Tel: (813) 248-9220
Fax: (813) 248-6013

To ensure prompt handling of material returned under warranty, your return order and shipment should clearly identify the item as a warranty return, and a copy of such return order should accompany the shipment. Status of warranty in process will be provided by the Warranty Administrator.

3. Warranty claims and warranty return orders pertaining to components and spare parts returned should be mailed to the following address:

L-3 COMMUNICATIONS CORPORATION
AVIATION RECORDERS DIVISION
P. O. Box 3041
Sarasota, FL 34230-3041

Attn: Marine Systems Warranty Administrator
Tel: (941) 377-5574
Fax: (941) 377-5591

RETURNED GOODS

Goods returned to stock for credit at the request of the Buyer and authorized by the Seller, will be subject to a restocking charge of 10% of the purchase price if notified within 30 days of the order, and 25% of the purchase price if notified after 30 days of the order.

CANCELLATION CHARGE

Any order wishing to be canceled must be approved by the pertinent Account Administrator and may be accountable for a cancellation fee of 15%. This cancellation fee shall take into account expenses already incurred and commitments made by L-3.



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SECTION 1

ProTec

AUTOMATIC IDENTIFICATION SYSTEM (AIS)

INTRODUCTION



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ProTec AIS Introduction

1.1. General

The L-3 ProTec is an Automatic Identification System transponder which is fully compliant to the technical specifications defined by the IMO and outlined in ITU.R.M 1371-1. The transponder employs the latest radio frequency and SOTDMA and DSC controller technology to provide a high performance, automated, and reliable identification system for commercial mariners. The Transponder is a fully automated system which ties into ship's navigational instruments to provide automatic transmission of ships identity, status, and maneuvering intentions via standard marine VHF communication techniques. Sequencing of transmission between all vessels within VHF range is provided through SOTDMA controlling software to handle high traffic volume situations.

The Transponder is a fully automated system. This means that once it is installed and turned on, no maintenance is required to keep it operational. The only time the user needs to perform any function on the transponder is to change the ship's Vessel/Voyage data as required.

1.1.1. System Overview

The L-3 ProTec is an Automatic Identification System fully compliant with the IMO specifications defined in IMO MSC.74(69) Annex 3, IEC 61993-2, and ITU.R M.1371-1. This AIS transponder has been developed using technology applied in the design of our VHF DSC Class A radio, a design which has been field tested for over a decade with over 10000 units operational in the field. With the addition of the SOTDMA controllers, the L-3 ProTec provides a cost-effective AIS solution which will meet the needs of any vessel required to carry AIS. The compact, single-box design allows the L-3 ProTec to be easily incorporated into any bridge layout thus simplifying installation and cabling requirements.

The L-3 ProTec has been designed as maintenance-free unit which makes extensive use of surface mount technology (SMT). The repair of printed wiring assemblies (PWAs) containing SMT components requires specialized factory equipment, training, and techniques, therefore, such PWAs are not field-repairable.

As a result, maintenance philosophy for the L-3 ProTec is replacement of failed assemblies. In the case of the L-3 ProTec, the replaceable assemblies are the Faceplate Assembly (192M0093-00), the RF PWA (205M0597-00), the CPU PWA (205M0596-00), and the PS PWA (205M0598-00).



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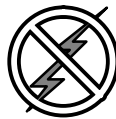
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When it has been determined that one or more of these assemblies is faulty, the faulty assembly(ies) should be removed and returned to the Aviation Recorders factory for repair or replacement. Attempts to repair any of these assemblies will void the warranty. Extreme care should be used when handling these assemblies.

For repair service, ship units to:

L-3 Communications, Aviation Recorders
6000 East Fruitville Road
Sarasota, FL 34232 USA
Attn: Repair Department
Tel: (941) 377-5558
Fax #: (941) 377-5585

CAUTION: THE L-3 ProTec CIRCUIT BOARDS ARE SUSCEPTIBLE TO ELECTROSTATIC DESTRUCTION (ESD). PRIOR TO HANDLING PWAs, ENSURE PROPER PERSONNEL GROUNDING TECHNIQUES ARE USED. ENSURE THAT CARDS ARE PLACED INTO STATIC SHIELDING CONDUCTIVE BAGS WHEN HANDLING OR STORING.



1.1.2. References

IMO Resolution MSC.74(69), Annex 3, Recommendation on Performance Standards for an Universal Shipborne Automatic Identification Systems (AIS)

IMO SN/Circ. 227, Guidelines for the INstallation of a Shipborne Automatic Identification System (AIS)

International Telecommunications Union Sector for Radio Communications (ITU-R) Recommendation M.1371-1, Technical Characteristics for a Universal Shipborne Automatic Identification System Using Time Division Multiple Access in the Maritime Mobile Band.

IEC 61993-2 Edition1, Maritime Navigation and Radiocommunication Requirements - Automatic Identification Systems (AIS) - Part 2: Class A shipborne Equipment of the Universal Automatic Identification System (AIS) - Operational and Performance Requirements, Methods of Test and Required Test Results

IEC 60945 Edition 4, Maritime Navigation and Radiocommunication Equipment and Systems - General Requirements - Methods of Testing and Required Test Results.

IALA Recommendation on AIS Shore Stations and Networking Aspects Relating to the AIS Service, Edition 1.0, September 5, 2002



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IEC 61162-1 Edition 1.0, Maritime Navigation and Radiocommunication Equipment and Systems - Digital Interfaces - Part 100: Single Talker and Multiple Listeners

IEC 61162-2 Edition 1.0, Maritime Navigation and Radiocommunication Equipment and Systems - Digital Interfaces - Part 100: Single Talker and Multiple Listeners, High-Speed Transmissions

1.1.3. Acronyms

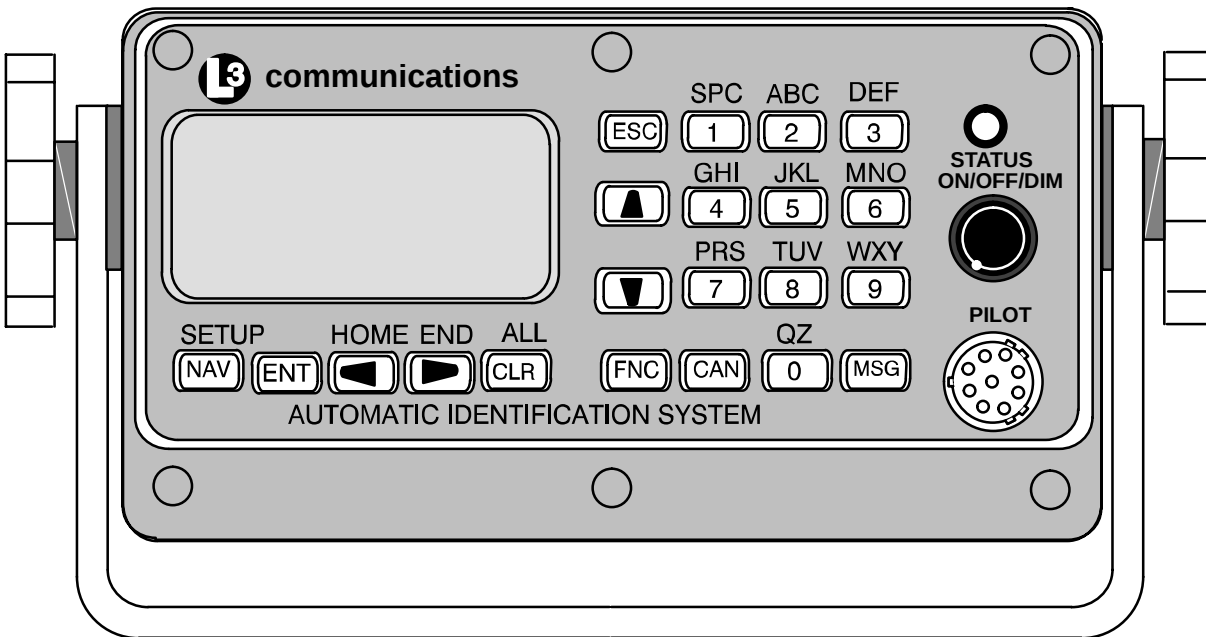
ABM	Addressed Binary Message
ABK	Acknowledgement Message
ACA	AIS Channel Assignment
ACK	Acknowledgement Message
ASPA	Automatic Radar Plotting Aid
BBM	Broadcast Binary Message
COG	Course Over Ground
DGPS	Differential Global Positioning System
GGA	Global Positioning Fix Data
GLL	Geographic Position, Latitude/Longitude
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GSA	GPS DOP and Active Satellites
GSV	GPS Satellites in View
HDG	Heading, Deviation & Variation
HDT	Heading, True
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
LRF	Long Range Function
LFI	Long Range Interrogation
MMSI	Maritime Mobile Service ID
NMEA	National Marine Electronics Association
RAIM	Receiver Autonomous Integrity Monitoring
RMC	Recommended Minimum Data for GPS
ROT	Rate of Turn
SOG	Speed Over Ground
SOTDMA	Self Organized Time Division Multiple Access
SSD	Station Static Data
TDS	Target Display Software
TXT	Status/Indication Message
VBW	Dual Ground/Water Speed
VDL	VHF Data-link Other Vessel Message
VDM	VHF Data-link Message
VDO	VHF Data-link Own-vessel Message
VSD	Voyage Static Data
VTG	Track Made Good and Ground Speed
ZDA	Date and Time



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NOTE: 1. **Front Panel Mating Connectors**

Pilot Port - L3 PN: 063-98-02113

TYCO PN: 206485-1

Figure 1–1. AIS Transponder

1.2. Technical Specifications

Standards IMO MSC.74(69) Annex 3, IEC 61993-2 Ed. 1, ITU.R.M.1371-1

Ship reporting capacity

2250 reports per minute, 4500 reports per minute on two channels

TDMA Transmitter

TX Frequency: 156.025 MHz - 162.025 MHz, manual/automatic setting

Transmitter Power: 2 W, 12.5 W manual/automatic selection

TDMA Receiver

RX Frequency: 156.025 MHz - 162.025 MHz, 2 channels

RX1: Default CH87B (161.975 MHz), manual/automatic setting

RX2: Default CH88B (162.025 MHz), manual/automatic setting

Channel Spacing: 25 kHz and 12.5 kHz

DSC Receiver

RX Frequency: CH70 (156.525 MHz)



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Internal GPS Receiver

12 Channel, UTC Synchronization Jitter: $\pm 100 \mu\text{s}$
[Time between slot start and transmitter on.]

Navigational data

COG/SOG, ROT, POS, Heading from external sources

Display

Integral MKD with 160 x 64 Dots backlit LCD

INTERFACE

Input ABM, ACA, ACK, AIR, BBM, DTM, GBS, GGA, GLL, GNS, HDT, OSD, SSD, RMC, ROT, VBW, VSD, VTG

Output ABK, VDO, VDM, ACA, ACS, ALR, LRF, LR1, LR2, LR3, TXT

Power Supply

24 VDC nominal, complies with IEC 60945 Ed. 4

NOTE: Due to the stringent transmit attack and release times specified in ITU 1371, a robust power source is required for proper operation. Recommended current ratings for power sources are:

24 VDC - 10 Amps

The transponder may operate improperly if the power source does not have the recommended minimum current ratings.

Environment

IEC 60945 Ed. 4 for Protected Environment

Frequency

VHF Marine Band



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1.3. AIS Description

1.3.1. Compact Design

The completely self-contained L-3 ProTec is the most compact AIS unit available on the market today with outside dimensions of 6.5" W (16.5 cm.) x 3.4" H (8.6 cm.) x 7.4" D (18.8 cm.). It is easily mounted on any surface using either a trunion bracket or flush-mount bracket. The data port on the faceplate provides for easy connection to any external display in either mounting configuration.

1.3.2. Integral Minimum Keyboard Display (MKD)

In line with the compact design, the L-3 ProTec is a single-box design incorporating an integral MKD which is fully IMO compliant. The interface includes a 2.58" L (6.5 cm.) x 1.16" H (2.9 cm.) (160 x 64 Dots) backlit LCD screen for displaying alphanumeric text and a multifunction keypad. The closest three vessels within AIS range will be displayed with each vessel identified by MMSI and ship name and will display both range and bearing to each vessel.

The interface has been designed to facilitate data entry and retrieval with a minimum of keystrokes. It also includes a Pilot port designed to allow any user to quickly and easily attach a portable AIS-compatible display system directly to the AIS transponder for display of the AIS data. This display system can consist of any system which recognizes the NMEA AIS string whether it's installed on a handheld PC, laptop PC, or dedicated display.

1.3.3. Integral GPS

The L-3 ProTec includes an internal GPS receiver card. The internal GPS provides timing data required for synchronization of transmission. By specifications, ship positional information in NMEA format is to be fed to the transponder from the ship's external electronic position indicating system through the supplied data cable. The internal GPS requires a dedicated GPS antenna to be mounted on the superstructure and the appropriate connections are supplied on the transponder unit back panel.

1.3.4. Data Interface

Each transponder will be delivered with an IEC-specified NMEA standard data cable required to interface to ship's sensors and external display. The description of this interface cable is given in the Installation Section of this manual. The standard kit includes an eight (8) ft. (2.9 meters) cable and a terminal block to facilitate the final hookup to the ship's navigational instruments.



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1.3.5. **Equipment List**

The Standard AIS Installation Kit includes the following equipment:

- Transponder Unit
- Flush Mount Kit
- Trunion Mount Kit
- IEC NMEA Data Cable
- Terminal Strips (Qty: 3)
- Power Cable
- Ground Cable
- Installation Manuals

In order to complete the installation, the following items will be required.

- GPS Antenna with coaxial cable
- VHF Antenna with coaxial cable
- Gyro Interface (if gyro output is not NMEA)
- DGPS Interface (if ships dGPS output is not NMEA)

Table 1–1. AIS Parts List

Component	Part Number
Transponder	AISD1000-00
Flush Mount Kit	147M0092-01
Trunion Mount	147M0092-02
IEC Cable	024M0599-00
Terminal Strip	2469800177
422 to 232 Adapter	415-98-00079
Power Cable	024M0600-00
Ground Cable	024M0043-00
Installation Manual	165M0601-00



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1.3.6. Operational Modes

The ProTec AIS is designed to operate in each of three modes: Autonomous and Continuous, Assigned and Polled which are defined below.

1.3.6.1 Autonomous and Continuous

This is the default mode. The ProTec AIS will determine its own schedule for transmission of position and identification and will automatically resolve scheduling conflicts with other stations using the Self Organized Time Division Multiple Access (SOTDMA) methodology.

1.3.6.2 Assigned

The ProTec will automatically switch to assigned mode when it is commanded by a competent authority, such as a base or repeater station, to transmit on a specific transmission schedule. In this mode, the ProTec allocates the defined slots and begins transmitting on these slots. It will continue to transmit in these slots with a zero slot time-out and a zero slot offset, until those slots have been removed from the transmission schedule. The assigned slots use the SOTDMA access scheme, with the time-out value set to the assigned slot time-out. The assignment terminates when the slot time-out reaches zero of any assigned slot, and the ProTec returns to autonomous and continuous mode.

1.3.6.3 Polled

The ProTec AIS will transmit a response to DSC interrogation messages from a ship or competent authority and respond back on the same channel without interfering with either of the other two modes. When an automatic response is required, transmitted responses will be made on channel 70 unless the unit is instructed to transmit on another channel. The ProTec is inhibited from transmitting on the AIS 1 and AIS 2 channels. If and when frequency channels other than channel 70 are used for DSC transmissions, the receive capability of TDMA operations should not be impaired more than it would be if all DSC messages were transmitted on channel 70.

1.3.6.4 Initialization

The ProTec AIS will enter into an Initialization mode at Power-Up during which it will monitor the TDMA channels for one minute. During this initialization period, a dynamic directory of all users in the system will be created which includes user IDs, slot assignments, positions, and other transmitted data. After this initialization period of 1 minute, the ProTec will enter the required operational mode and begin transmission of the AIS data on the required schedule.



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1.3.7. DSC Functionality

The Assigned and Polled operational modes are activated through a DSC message transmitted by the competent authority. In order to provide for this, the ProTec AIS contains a dedicated DSC receiver that is tuned to channel 70. DSC messages originating from shore stations of competent authorities will define regional AIS frequencies, regions of coverage, required transmission schedule and/or interrogation request. The ProTec AIS will respond back to such DSC interrogations on the frequency specified in a manner such that it does not interfere with the TDMA transmissions by interleaving the transmission between TDMA transmissions. The DSC response will be made after a random delay of 0 - 20 secs provided the signaling channel is clear and the TDMA transmissions are not interrupted.

1.3.8. AIS Broadcast Parameters

A Class A AIS unit broadcasts the following information every 2 to 10 seconds while underway, and every 3 minutes while at anchor at a power level of 12.5 watts. The information broadcast includes:

- MMSI number - unique referenceable identification.
- Navigation status
- Speed over ground - 1/10 knot resolution.
- Position accuracy - differential GPS.
- Longitude - to 1/10000 minute and Latitude - to 1/10000 minute.
- Course over ground - relative to true north to 1/10th degree.
- True Heading - 0 to 359 degrees derived from heading sensor.
- Time stamp - The universal time to nearest second that this information was generated.

In addition, the Class A AIS unit broadcasts the following information every 6 minutes:

- MMSI number - same unique identification used above, links the data above to described vessel.
- IMO number - unique referenceable identification (related to ship's construction).
- Radio call sign - international call sign assigned to vessel, often used on voice radio.
- Name - Name of ship, 20 characters are provided.
- Type of ship/cargo - there is a table of possibilities that are available.



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- Dimensions of ship - to nearest meter.
- Location on ship where reference point for position reports is located.
- Type of position fixing device - various options from differential GPS to undefined.
- Draught of ship - 1/10 meter to 25.5 meters [note "air-draught" is not provided].
- Destination - 20 characters are provided.

1.3.9. **AIS Frequencies**

The International Telecommunications Union World Radio Conference in 1997 designated two VHF radio frequencies: 161.975 MHz (AIS1, or channel 87B) and 162.025 MHz (AIS2, or channel 88B) for AIS. In the US, the first channel is owned by MariTEL, a public coast station operator, and the second by the federal government. The USCG signed a Memorandum of Agreement with MariTEL for use of AIS 1, and has authority from the National Telecommunications and Information Administration to use both AIS1 and AIS 2 US-wide for AIS operation. The USCG has asked the Federal Communications Commission to authorize any US vessel to operate AIS on these two channels under its existing ship station license. The FCC released a Notice authorizing operation of AIS under a ship's existing station license.

1.3.10. **AIS Input Sentences**

This section lists the input sentences received by the L-3 ProTec AIS Transponder. The input sentences are categorized as Pilot, Long Range, and Sensor, which are listed as follows:

Pilot

ABM, BBM, AIR, VSD, SSD, ACK, ACA, AIQ

Long Range

LRI, LRF

Sensor

RMC, VTG, ROT, HDT, GNS, GLL, GGA, GRS, GSA, GST, GSV, ZDA, GBS, DTM, VBW



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1.4. Interface Description

1.4.1. Pilot Systems Input Data and Formats

The input data and formats are shown in Table 1–2, and the details of the sentences can be found in IEC 61162-1.

Table 1–2. Pilot System High-Speed Input Data Formats

Data	IEC 61162-1 Sentences
Normal Access - Parameter Entry	
Static station information - (Vessel name) - (Call sign) - Antenna location - Length and beam	SSD - Station Static Data - (not used, field sets to null by MKD) - (not used, field sets to null by MKD) - used to set the antenna location for the MKD external GPS only (saved in MKD memory)
Voyage Information - Vessel type and cargo category - Navigational status - Draught, max. actual static - Destination - ETA date and time - Regional application flags	VSD - Voyage Static Data
Long Range Acknowledgement	
External manual LR acknowledgement	LRF - Long Range Function
Initiate VHF Data Link Broadcasts	
Safety messages	ABM - Addressed Binary Message BBM - Broadcast Binary Message
Binary messages	ABM - Addressed Binary Message BBM - Broadcast Binary Message
Interrogation message	AIR - AIS Interrogation Information
Channel Setting	
Channel assignment message (set frequency)	ACA - AIS Channel Assignment Message
BIIT Input	
Alarm / indication acknowledgement	ACK - Acknowledgement Message
Own Station Settings Queries	
Query messages	AIQ, ACA - Query AIS Channel Assignment



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1.4.2. Pilot Systems Output Data and Formats

The output data and formats are shown in Table 1–3, and the details of the sentences can be found in IEC 61162-1.

Table 1–3. Pilot System High-Speed Output Data Formats

Data	IEC 61162-1 Sentences
Prepared by AIS Transponder	
Notification that a session initiated by messages ABM, BBM, ACA, AIR is terminated	ABK - Acknowledgement Message
AIS Own-ship broadcast data (all transmissions available)	VDO - VHF Data-link Own-vessel Message
Query response messages	ACA - AIS Channel Assignment SSD - Station Static Data VSD - Voyage Static Data
BIIT Results	
AIS equipment status	ALR - Alarm Message TXT - Status / Indication Message
Received from Long Range Equipment	
LR Interrogation	LRI - Long Range Interrogation
LR Function identification	LRF - Long Range Function
Received on VHF Data Link by AIS Transponder	
All VDL AIS messages received - Broadcast or - Addressed to own station	VDM - VHF Data Link Message

1.4.3. Pilot Input / Output Port

The Pilot input/output port is a part of the AIS Class A stations. If the installation of the AIS equipment is such that a pilot cannot connect his Personal Pilot Unit (PPU) with a reasonable length of cable, an extension cable must be installed with a connector located on the bridge such that the PPU can be connected on the normal working position of the port.



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The Pilot input/output port defined by IEC 61193-2 for connections of ship's pilot equipment shall, if fitted, be connected using the pilot port cable, p/n: 024M0099-03. The Pilot input/output port meets the requirement of IEC 61162-2 and is terminated as shown in Table 1–4.

Table 1–4. Pilot Port Pinout

J1 Pin	Name	Description	Pair Color	P2 Pin
1	PILOT_TXA	RS4–22 Compliant Output A	Blue	2
2	GND	Signal/Power 0 Volt Reference	Black	5
3	+ 8V	+ 8.0 Volt ($\pm$ 5%) Output Used to Power External Test Equipment. External Equipment should be Current Limited to 300mA		
4	PILOT_TXB	RS–422 Compliant Output B	Black	7
5	PILOT_RXA	RS–422 Compliant Input A	Green	8
6	PILOT_RXB	RS–422 Compliant Input B	Black	3
7	TRACE/BOOT_TX	TTL–Level RS–232 Serial Output (Trace Message/ Bootload Output)		
8	RX_SINAD	TDMA / DSC FM Discriminator Output used to Test Receiver Performance during Special Test Modes.		
9	NO CONNECT	Not Used		

NOTE: Some early transponders had incorrect Pilot Port wiring.
See factory for more details.

1.4.4. Long Range Equipment Interface

The range of operation of standard AIS is limited to the range of VHF transmissions which is around 30 miles. The Long Range mode is intended to allow the exchange of ships position information from ship to a competent authority via a satellite interface such as Inmarsat-C which is already onboard many ships. This port is intended to interface with the Long Range equipment.

The Long Range reply can be set in either:

- automatic mode (AUTO)
- manual mode L-3 ProTec (MANUAL)
- manual mode external application (EXT APPL).

The Long Range reply, when in AUTO mode, is made as soon as a request is received on the Long Range communication port.



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The Officer of the Watch must approve the Long Range reply when in MANUAL mode, by a means of pressing a keyboard button on the L-3 ProTec before the reply is performed.

The Long Range reply, when in EXT APPL mode, is made by the L-3 ProTec upon reception of confirmation / acknowledgement from the external application via the high-speed ports. The external application acknowledges the interrogation by returning the LRF sentence (updated with reply information).

1.4.5. Long Range Input Data and Formats

The input data and formats are in the form of two Long Range interrogation sentences, LRI and LRF, refer to Table 1–5.

- The LRI -sentence contains the information needed to determine if a reply needs to be constructed.
- The LRF-sentence identifies the information items that are being requested. Details of each sentence can be found in IEC 61162-1.

Table 1–5. Long Range Input Data and Formats

Data	IEC 61162-1 Sentences
Long Range Interrogation Type of request: - Geographic area request - AIS transponder request	LRI - Long Range Interrogation
Long Range Function identification Requestor MMSI and Name Request for: - Ship's name, call sign and IMO number (A) - Date and time of message composition (B) - Position (C) - Course over ground (E) - Speed over ground (F) - Destination and ETA (I) - Draught (O) - Ship / Cargo (P) - Ship's length, breadth and type (U) - Number of persons on board (W)	LRF - Long Range Function



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1.4.6. Long Range Output Data and Formats

The output data and formats are in the form of four Long Range reply sentences, LRF, LR1, LR2, and LR3, refer to Table 1–6.

- The LRF sentence provides the “Function Reply Status” for the requested information. Following is a list of “Function Reply Status” characters with the status:
 - 2 = Information available and provided in the following LR1, LR2, and LR3 sentences.
 - 3 = Information not available from the AIS system.
 - 4 = Information is available but not provided (i.e. restricted access determined by ship's master).
- The LR1 sentence identifies the destination for the reply and contains the information items requested by the “A” function identification character in the LRF sentence.
- The LR2 sentence contains the information items requested by the “B, C, E, and F” function identification characters in the LRF sentence.
- The LR3 sentence contains the information items requested by the “I, O, P, U, and W” function identification characters in the LRF sentence.



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Table 1–6. Long Range Output Data and Formats

Data	IEC 61162-1 Sentences
Long Range Function identification Requestor MMSI and Name Request for: - Ship's name, call sign and IMO number (A) - Date and time of message composition (B) - Position (C) - Course over ground (E) - Speed over ground (F) - Destination and ETA (I) - Draught (O) - Ship / Cargo (P) - Ship's length, breadth and type (U) - Number of persons on board (W)	LRF - Long Range Function
MMSI of Responder MMSI or Requestor Ship's name Ship's call sign IMO number	LR1 - Long Range Response, Line 1
MMSI of Responder Date and time of message composition Position Course over ground Speed over ground	LR2 - Long Range Response, Line 2
MMSI of Responder Destination and ETA Draught Ship / Cargo Ship's length, breadth and type Number of persons on board	LR3 - Long Range Response, Line 3



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1.4.7. Sensor Input Data and Formats

The L-3 ProTec Shipborne Class A Transponder supports input data sentences from various ship sensors, refer to Table 1–7.

Table 1–7. Sensor Input Data and Formats

Sensor	Data	IEC 61162-1 Sentences
GNSS	Positions system: - Time of position - Latitude /Longitude - Accuracy (and integrity status) Course Over Ground (COG) Speed Over Ground (SOG) RAIM Indicator	DTM, GBS, GGA, GLL, GNS, GRS, GSA, GST, GSV, HDT, RMC, ROT, VBW, VTG, ZDA
Log	Course Over Ground (COG) Speed Over Ground (SOG)	VBW
Gyro	Heading Rate of Turn (ROT)	HDT, ROT

1.5. Data Field Assignments

1.5.1. GPS and Sensor Input Sentences

1.5.1.1 DTM - Datum Reference

If Local and Reverence Datum codes are not WGS84, then the positions report from that sensor is discarded.

Field	Notes
Local Datum Code	Check for WGS84
Local Datum Subdivision Code	Ignored
Lat Offset (2 fields)	Ignored
Long Offset (2 fields)	Ignored
Altitude Offset	Ignored
Reference Datum Code	Check for WGS84



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1.5.1.2 GBS - GNSS Satellite Fault Detection

If this sentence is received from the position source, with Latitude error or Longitude error specified, the RAIM flag will be set to TRUE. If both are Null or 60 seconds goes by without a GBS sentence, RAIM flag goes to False

Field	Notes
UTC Time of GGA or GNS	Ignored
Expected Error in Latitude	Check for Null
Expected Error in Longitude	Check for Null
Expected Error in Altitude	Ignored
ID Number of Most Likely Failed Satellite	Ignored
Probability of Missed Detection	Ignored
Estimate of Bias in Meters	Ignored
Standard Deviation of Bias Estimate	Ignored

1.5.1.3 GGA - Global Positioning System Fix Data

Field	Notes
UTC of Position	UTC Second is used to indicate Time Stamp
Latitude (2 fields)	Used
Longitude (2 fields)	Used
GPS Quality Indicator	Used
Number of Satellites in Use	Ignored
Horizontal Dilution of Precision (HDOP)	Ignored
Altitude RE: Main Sea Level (2 fields)	Ignored
Geoidal Separation (2 fields)	Ignored
Age of Diff Data	Ignored
Diff Reference Station	Ignored

1.5.1.4 GLL - Geographic Position - Latitude / Longitude

Field	Notes
Latitude (2 fields)	Used
Longitude (2 fields)	Used
UTC of Position	UTC Second is used to indicate Time Stamp
Status	Used
Mode Indicator	Used



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1.5.1.5 GNS - GNSS Fix Data

If the Mode Indicator is a NULL field, the sentence is ignored.

Field	Notes
UTC of Position	UTC Second is used to indicate Time Stamp
Latitude (2 fields)	Used
Longitude (2 fields)	Used
Mode Indicator	Used
Total Number of Satellites in Use	Ignored
HDOP	Ignored
Antenna Altitude	Ignored
Geoidal Separation	Ignored
Age of Diff Data	Ignored
Diff Reference Station ID	Ignored

1.5.1.6 HDT - Heading True

Message is ignored if Talker is "HC".

Field	Notes
Heading	Used if Valid indicator is "T"
Valid Indicator	Used

1.5.1.7 RMC - Recommended Minimum Specific GNSS Data

Field	Notes
UTC of Position Fix	UTC Second is used to indicate Time Stamp
Status	Must be "A"
Latitude (2 fields)	Used
Longitude (2 fields)	Used
SOG, knots	Used
COG, degrees	Used
Date	Ignored
Magnetic Variation (2 fields)	Ignored
Mode Indicator	Used



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1.5.1.8 ROT - Rate of Turn

The rate of turn value is only used if the talker identifier is "TI". Otherwise the value will only be used to determine if the vessel is "Moving Right" or "Moving Left".

Field	Notes
Rate of Turn	Used when status is "A". If Talker is "TI", value is converted ascending to 1371 msg 1, 2, 3 spec. If talker is not "TI", value is set to - 127, 0, or + 127, based on ROT value.
Status	Must be "A"

1.5.1.9 VBW - Dual Ground / Water Speed

The current position source must be external GPS, and heading must be available for the transponder to accept this sentence.

Field	Notes
Longitudinal Water Speed	Ignored
Transverse Water Speed	Ignored
Status: Water Speed	Ignored
Longitudinal Ground Speed	Used if Status is set to "A"
Transverse Ground Speed	Used if Status is set to "A"
Status: Ground Speed	Used
Stern Transverse Water Speed	Ignored
Status Stern Water Speed	Ignored
Stern Transverse Ground Speed	Ignored
Status Stern Ground Speed	Ignored

1.5.1.10 VTG - Course Over Ground and Ground Speed

Field	Notes
GOG, degrees True (2 fields)	Used
COG, degrees Magnetic (2 fields)	Ignored
SOG, knots (2 fields)	Used
SOG, km/h (2 fields)	Ignored
Mode Indicator	Used



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1.5.1.11 ZDA - Time and Date

This message is only processed if it is received from the internal GPS (the time synchronization source).

Field	Notes
UTC	Used
Day	Used
Month	Used
Year	Used
Local Zone Hours	Ignored
Local Zone Minutes	Ignored

1.5.2. AIS Specific Input Sentences

1.5.2.1 ABM - Addressed Binary and Safety-Related Message

Field	Notes
Total Number of Sentences	Used if in interval 1..9, otherwise the sentence is ignored.
Sentence Number	Used if in interval 1..total sentence, otherwise the sentence is ignored.
Sequential Message Identifier	Used if in interval 0..3, otherwise the sentence is ignored.
MMSI of Destination	Used
AIS Channel	Used
Message ID	Used if in 6 or 12, otherwise the sentence is ignored.
Encapsulated Data	Used
Number of Filled Bits	Used



1.5.2.2 ACA - AIS Regional Channel Assignment Message

The zone created of this sentence must be accepted by the channel management rules (size of zone, distance to own position, etc.) If the zone isn't accepted, the zone will be ignored.

Field	Notes
Sequence Number	Ignored
NE Latitude (2 fields)	Used
NE Longitude (2 fields)	Used
SW Latitude (2 fields)	Used
SW Longitude (2 fields)	Used
Transitional Zone Size	Used
Channel A	Used
Channel A Bandwidth	Used
Channel B	Used
Channel B Bandwidth	Used
Tx/Rx Mode	Used
Power Level	Used
In Use Flag	Ignored
Time of In Use Change	Ignored

1.5.2.3 ACK - Acknowledge Alarm

Field	Notes
ID of the Alarm Source	Used

1.5.2.4 AIQ - Query Sentence

Field	Notes
Approved Sentence Formatter of Data being Requested	It is possible to query the ACA Sentence



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1.5.2.5 AIR - AIS Interrogation Request

Field	Notes
MMSI 1	Used
Message ID 1.1	Used
Message Subsection	Ignored
Message ID 1.2	Used, may be NULL
Message Subsection	Ignored
MMSI 2	Used, may be NULL
Message ID 2.1	Used, may be NULL
Message Sub Section	Ignored

1.5.2.6 BBM - Broadcast Binary Message

Field	Notes
Total Number of Sentences	Used if in interval 1..9, otherwise rejected.
Sentence Number	Used if in interval 1..total number of sentences, otherwise rejected.
Sequential Message Identifier	Used if in interval 0..9, otherwise rejected.
AIS Channel	Used
Message ID	Used if 8 or 14
Encapsulated Data	Used
Number of Filled Bits	Used

1.5.2.7 SSD - Ship Static Data

Field	Notes
Call Sign	Ignored, use the proprietary password protected sentence instead (used by the MKD)
Name	<i>Same as Call Sign</i>
Pos Ref A	This is the EXTERNAL Position reference, use proprietary sentence for the internal Position reference. May be NULL
Pos Ref B	<i>Same as Pos Ref A</i>
Pos Ref C	<i>Same as Pos Ref A</i>
Pos Ref D	<i>Same as Pos Ref A</i>
DTE	Used
Source Identifier	Ignored



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1.5.2.8 VSD - Voyage Static Data

Field	Notes
Type of Ship and Cargo	Used
Maximum Present Draught	Used
Persons On-Board	Used
Destination	Used
Estimated UTC of Arrival	Used
Estimated Day of Arrival	Used
Estimated Month of Arrival	Used
Navigational Status	Used
Regional Application Flags	Used



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SECTION 2

ProTec

AUTOMATIC IDENTIFICATION SYSTEM (AIS)

OPERATION



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ProTec AIS Operation

2.1. Operation

The L-3 ProTec has been designed to require minimal user interaction during normal operation. The interface consists of an integral alphanumeric display with alphanumeric keypad providing for data entry, retrieval and display.

2.1.1. Minimum Keyboard Display

The L-3 ProTec includes an integral MKD which is fully IMO compliant. The MKD is designed to be used for configuration of the hardware, entry of vessel and voyage specific data, and be used to monitor the AIS system. The MKD provides numerous functions, which can be accessed via the controls located on the front face of the ProTec AIS system. The MKD provides a fully functional menu structure that allows the user to Logon / Logoff, configure System Information, Vessel / Voyage data, and the Antenna Position. The user may also view Alarm Status, General Status, Down-Time Log, and the Safety Text Log. In addition, the AIS Channels can be configured, along with changing user passwords, setting Baud rate, adjust the LCD viewing angle, and managing the Change Management Settings. The front face of the L-3 ProTec contains the following controls.

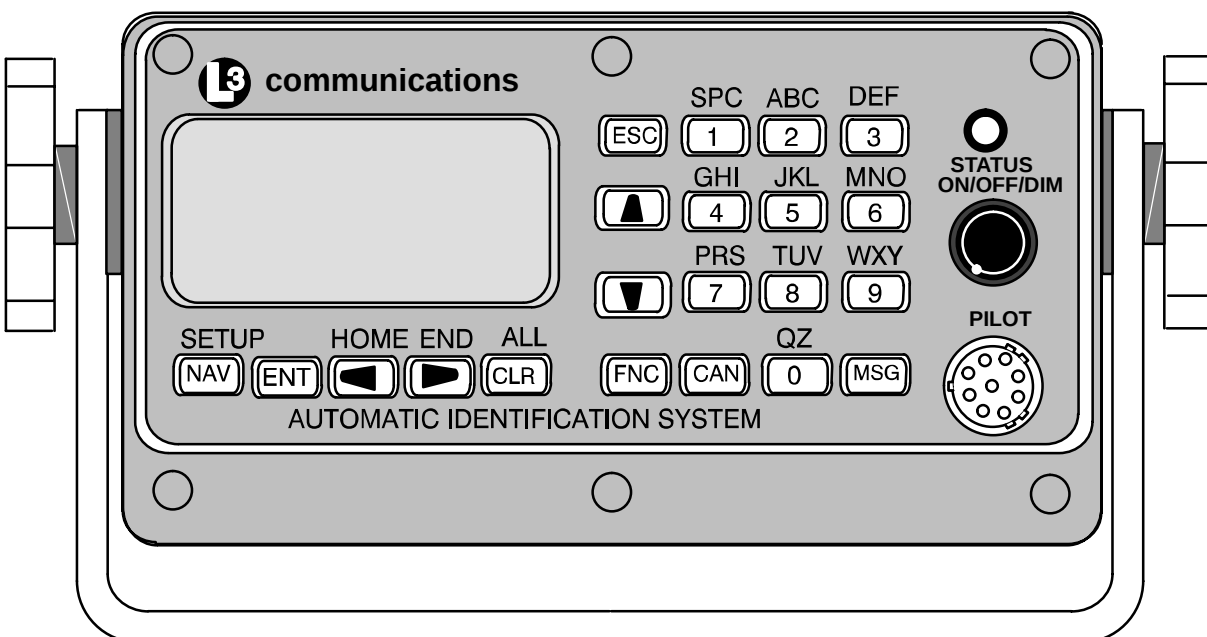


Figure 2–1. AIS Transponder



2.1.1.1 Power/Dim Control

A single control knob controls both the on/off function and backlighting level for the LCD. To turn the unit 'On', rotate the knob clockwise. To turn unit 'Off' rotate counter-clockwise fully. The degree of rotation determines the brightness of the LCD backlight and rotation to the right will dim the backlighting.

2.1.1.2 Liquid Crystal Display

The display is an alphanumeric LCD with backlighting which will display data entry forms and AIS target data for the nearest three vessels.

2.1.1.3 Key Pad

The keypad contains dedicated function buttons and alphanumeric buttons which allow for data entry and retrieval.

2.1.1.4 Pilot Port

The Pilot Port is an IEC high speed (38400 Kbs), RS422, data port which can be used to connect any external display such as an ECS, or other PC-based software package.

2.1.2. Keypad Description

The keypad allows the user to access the menu system built into the transponder interface. The keys are defined below:

NAV	AIS Target Data Display Pressing this button will bring the user to the main default screen which will display the AIS target data for the nearest three vessels, or allows the user to switch back to the "Own Ship" display if the nearest three vessels are already displayed.
ENT	Enter Key Allows user to enter Edit mode, or to save data if already performing an Edit operation.
CLR	Clear Key Used to clear data from a data entry field before entering new data . Pressing once will clear the entire field.



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Directional ARROW Keys

Used to navigate between data entry fields on a data entry form and scroll right/left and up/down in an alphanumeric display field. When in Closest Vessel (default) screen, the Left or Right Arrow Keys will allow the user to toggle between the Ship Name display and the MMSI screen. (The MMSI screen will always be displayed for a vessel if the ship name is not known.

FNC Function Key

Used as the initial key in a key sequence to access the various secondary functions of the interface.

CAN Cancel Key

Used to cancel any edit made in a data entry field and revert data back to preexisting data.

MSG Message Key

Used to access the text messaging window, in order to send Safety Text Messages.

ESC Escape Key

Will bring user up one level on the menu system.

The blue text above some of the keys identify the secondary definitions for each button. These secondary definitions are activated by pressing of the FNC button in a key sequence.

SETUP Enters the AIS Main System Menu menu system.

HOME Returns cursor to start position in a data entry field

END Moves cursor to last position in a data entry field

ALL System Information Menu

The alphanumeric keypad is used to enter both numbers and letters. When alphanumeric text entry is expected, the nonnumerical options are presented before the numeric value of the key. For example, the number “2” key provides for entry of “A”, “B”, and “C”. When the cursor is positioned in a display field location that expects an alphanumeric character, the first press of the “2” key will result in the display of an “A”. Another press (in less than one second) will cause a “B” to be displayed. The next press shows a “C”, while the forth press shows a “2”.



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Repeated key presses will result in cycling through the character options repeatedly. When the operator stops pressing keys for longer than the preset timeout, the last value is retained and the cursor moves to the next location in the field. Pressing a different key forces acceptance of the last character for the field and moves the cursor along.

FNC-ENT Own Ship display
(NAV Key will also bring up this screen if already showing the Closest Vessel display.)

2.1.3. Data Display Screens

The AIS interface consists of the following display screens each of which is accessed using the defined key sequence.

2.1.3.1 NAV Display Screen (Default Screen)

Ship Name/MMSI	RG-NM	BRG
MMSI 0123456789	0.35	265°
MMSI 1234567890	1.64	173°
Targets: 002		
27-June-2004	+ 01:43:30	I

Figure 2-2. NAV Display Screen

MKD will default to this screen after 30 seconds when the unit is idle.

This display shows closest three (3) targets by MMSI number or ship name, the range in nautical miles, and bearing of each target. Using the up (↑) or down (↓) arrow keys you may scroll through every target that is detected.

Targets xxx: Number of targets detected by the transponder.
Date: Current date.
Time: Current time derived by the internal GPS receiver.

GPS status can be found in lower right corner of display.

I = Internal Time: Valid time from the internal GPS (normal operating condition).

S = Slot Time: Lost internal GPS time but is deriving timing information from the slot timing on the VHF Data Link (VDL).

F= Flywheel: Transponder is depending on the internal CPU clock for timing, after losing internal and slot timing. It will



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run for approximately one minute and then go to "N".

N= No time available

Text messaging can be disabled by pressing the FNC → 1 button. When text messaging is disabled a "Tx Disabled" message will appear in the upper right hand area of the display window.

The AIS can be set to use it's internal GPS by pressing the FNC → 4 button. When using the internal GPS a "+" symbol will appear in the lower center area of the display window (as shown in Figure 2–2).

Own Ship Information	
MMSI:0123456789	Navs:UNDFND
Name:L3 Example	
PSrc:Ext DGNSS	PA:1 RF:1
N 29°54.0000	W 80°00.0000
Hdg:0°	ROT:0°
SOG:30.0 Kn	COG:0.0°

Figure 2–3. Own Ship Data Display

2.1.3.2 Own Ship Information

Press the NAV button repeatedly from any menu to cycle the displays until the Own Ship Information menu appears. The data that is displayed is as follows:

MMSI: Maritime Mobile Service ID: Nine digit unique identification number that registers the boat information in the U.S. Coast Guard's national distress database for use in emergency situations

NavS: Navigational Status:

UNDFND	Undefined
UW-ENG	Underway Using Engine
AANCHR	At Anchor
NOCMD	Not Under Command
RMANUV	Restricted Maneuverability
CBDRFT	Constrained by Draught
MOORED	Moored
AGRND	Aground
FISHNG	Engaged in Fishing
SAILNG	Underway sailing

Name: Vessel Name: Any alphanumeric characters up to 20 in length.



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- PSrc: Positional Data Source: The following options may be seen in the order of their priority:
Ext DGNSS - External GPS in use (corrected).
Int M17Corr - Internal GPS in use (corrected, message 17).
Int Bcncorr - Internal GPS in use (corrected, beacon).
Ext Uncorr - External GPS in use (uncorrected).
Int Uncorr - Internal GPS in use (uncorrected).
No Pos Src - No sensor position in use.
- PA: Positional Accuracy: 0 = uncorrected, 1 = corrected.
- RF: RAIM Flag: (Receiver Autonomous Integrity Monitoring)
0 = normal operation, 1 = in use.
- Lat: Latitude: North or South in degrees.
- Lon: Longitude: East or West in degrees.
- Hdg: Heading: in degrees true from Gyrocompass.
- ROT: Rate of turn: in degrees/sec (- denotes port, + denotes starboard).
- COG: Course Over Ground: in degrees true from dGPS.
- SOG: Speed Over Ground: in knots from dGPS.

2.1.4. Data Entry Screens

The AIS interface provides the following three data entry screens for completing input of required vessel and voyage data and for modifying the administrator password. The required data entry screen can be accessed from the main AIS Main System Menu menu. This menu is accessed by the key sequence FNC SETUP. The required screen can be selected by using the DOWN / UP arrow keys to scroll through the list and pressing ENT to select the highlighted screen name. This will open and display the screen and free all fields for editing.

Use the LEFT, RIGHT, UP, DOWN arrows to navigate between fields. Use the ENT key to select a field to edit. Use the alphanumeric keypad to enter the required data into the field. Use ENT to save the data entered into the field. Use CAN to cancel any changes made to edited fields and revert to preexisting data. Once the data entry is completed, pressing ESC will exit the user to the AIS Main System Menu screen, allowing the user to go to another menu selection.

2.1.4.1 AIS Main System Menu

Press FNC → NAV button from any menu to access this screen.



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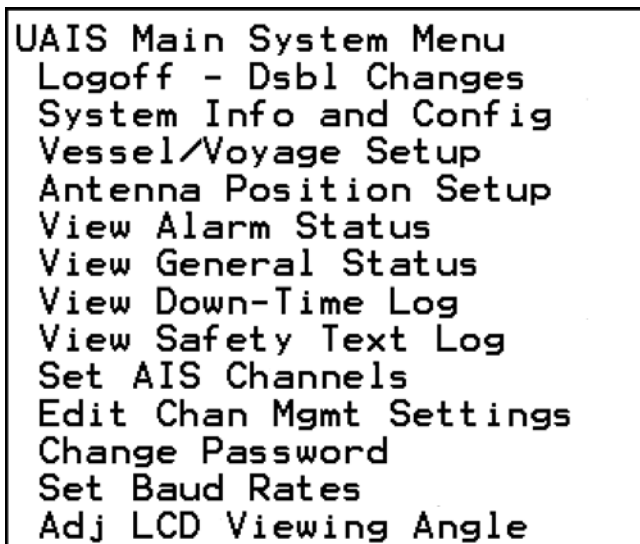
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The AIS Main System Menu contains the following options:

- Logon / Logoff
- System Information and Config
- Vessel / Voyage Setup
- Antenna Position Setup
- View Alarm Status
- View General Status
- View Down-Time Log
- View Safety Text Log
- Set AIS Channels
- Edit Channel Mgmt Settings
- Change Password
- Set Baud Rates
- LCD Viewing Angle

NOTE: Figure 2-4 shows the AIS Main System Menu screen as it appears as the user initially enters this menu. Not shown is the Logon option.



```
UAIS Main System Menu
Logoff - Dsbl Changes
System Info and Config
Vessel/Voyage Setup
Antenna Position Setup
View Alarm Status
View General Status
View Down-Time Log
View Safety Text Log
Set AIS Channels
Edit Chan Mgmt Settings
Change Password
Set Baud Rates
Adj LCD Viewing Angle
```

Figure 2-4. AIS Main System Menu

2.1.4.2 Logon / Logoff Screen

Passwords allow the user to change the information contained within the AIS Transponder. Users with an Administrative password can change any of the information



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contained within the AIS Transponder; however, users with a User password, cannot change the MMSI number, IMO number, Name of the ship, Call Sign, passwords, or anything contained in the Channel management screen.

Press FNC → NAV button from any menu and use the up (↑) or down (↓) arrow keys.

This screen will appear prior to entry of any menu besides the NAV menu. After entering the proper password, press ESC to continue.

Table 2–1. ProTec AIS Default Passwords

Default Passwords	
Administrative	L3AIS
User	L3USR

Table 2–2. Password Type Menu Screen Access

Menu Item	Read Access	Write Access	Comments
Logon - Password Entry	G, U, A	G, U, A	
System Info and Config	G, U, A	A	
Vessel/Voyage Setup	G, U, A	U, A	Update of MMSI, IMO No, Call Sign, and Name of Ship Limited to A
Antenna Position Setup	G, U, A	A	
View Alarm Status	G, U, A	Not Applicable	
View General Status	G, U, A	Not Applicable	
View Down-Time Log	G, U, A	Not Applicable	
View Safety Text Log	G, U, A	Not Applicable	
Set AIS Channels	G, U, A	A	
Edit Chan Mgmt Settings	G, U, A	U, A	
Change Password	G, U, A	A	
Set Baud Rates	G, U, A	A	
Adj LCD Viewing Angle	G, U, A	A	

(G)eneral Access, (U)ser Access, (A)dmin Access



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To log on perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Select Logon, and press the ENT key. The System Password Entry screen will appear.
- (4) Press the ENT key, and enter the password, and press the ENT again.
- (5) Press the ESC key to return to the AIS Main System Menu screen.

To log off from any menu other than the UAIS Main System menu perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Select Logoff, and press the ENT key. The user is now logged off of the AIS Transponder.

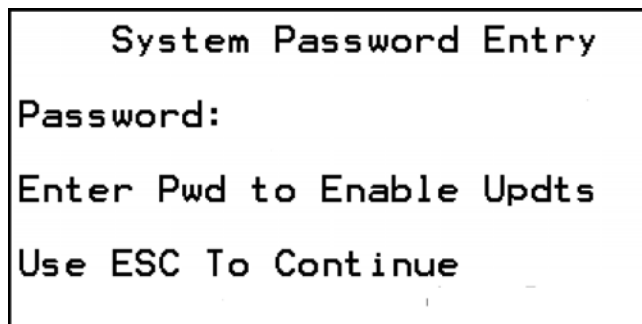


Figure 2–5. Password Entry Screen

2.1.4.3 System Information and Configuration

Press FNC → CLR button from any menu.

Powerup: Number of power ups and length of current power up.
ChkSums: Checksums of internal processors. Used for information and troubleshooting.

NOTE: To be compatible with older versions of NMEA 0183 (version 1.X and lower) the checksum requirement must be disabled. This can be done by setting the ChksmRqd (Checksum Required) field to “NO” by using the up and down arrows.



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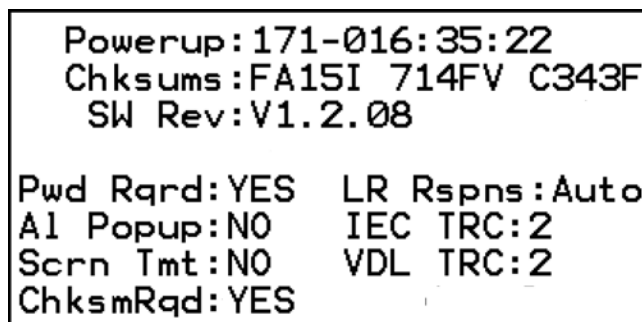
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SW Rev: Software Revision of transponder.
Pwd Rqrd: Password required. Determines whether or not a password is required at power up.
Al Popup: Alarm Popups. Yes = popups enabled, No = disabled.
Scrn Tmt: Screen Timeout. Yes = default to NAV screen after 30 seconds, No = disable
LR RsPns: Long Range Response. All long range requests cause an alarm to be displayed.
IEC Trc: IEC Trace. Turns on up to five levels of troubleshooting messages, 0 = off.
VDL Trc: VDL Trace. Turns on up to five levels of troubleshooting messages, 0 = off.

To enter System Information and Configuration information, perform the following:

- (1) Press the FNC key, press the NAV key. The AIS Main System Menu screen will appear.
- (2) Using the down Arrow key, select System Info and Config, and press the ENT key. (Refer to Figure 2–6.)
- (3) Using the arrow keys, highlight an entry point, and press the ENT key.
- (4) Enter the data by using the arrow keys, press the ENT key, and move to the next data entry point.
- (5) Press the ESC key to return to the AIS Main System Menu screen.



```
Powerup:171-016:35:22
Chksums:FA15I 714FV C343F
SW Rev:V1.2.08

Pwd Rqrd:YES    LR Rspns:Auto
Al Popup:NO     IEC TRC:2
Scrn Tmt:NO     VDL TRC:2
ChksmRqd:YES
```

Figure 2–6. System Information and Configuration Screen



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2.1.4.4 Vessel/Voyage Setup

The Vessel/Voyage Setup screen allows the user to enter the following information, which is required to be completed during the installation of the AIS.

MMSI:	Maritime Mobile Service ID: Maximum nine (9) numbers.
NavS:	Navigational Status:
	UNDFND Undefined
	UW-ENG Underway Using Engine
	AANCHR At Anchor
	NOCMD Not Under Command
	RMANUV Restricted Maneuverability
	CBDRFT Constrained by Draught
	MOORED Moored
	AGRND Aground
	FISHNG Engaged in Fishing
	SAILNG Underway sailing
IMO#:	IMO Number: Official IMO designation ID for Vessel. 0 = default = not available.
MaxD:	Maximum Draft: Maximum draft in meters from 0.1 to 25.5 meters.
CSgn:	Radio Call Sign: Maximum seven (7) characters.
Type:	Vessel Type: (Refer to Table 2–3.)
Name:	Vessel Name: Any alphanumeric characters up to 20 in length.
Dest:	Destination. The current destination of this voyage.
POB:	People on Board. The number of persons currently on board the vessel.
ETA:	Estimated Time of Arrival.

To enter vessel and voyage information, perform the following:

- (1) Press FNC and then NAV to get to the AIS Main System Menu screen. (Refer to Figure 2–4.)
- (2) Use DOWN ARROW key to scroll down to Vessel Voyage Setup. Press ENT.

Use the following instructions to enter data for Steps (3) through (9). (Refer to Figure 2–7.)

- Use the LEFT, RIGHT, UP, DOWN arrows to navigate between fields.
- Use the ENT key to select a field to enter.
- Use the alphanumeric keypad to enter the required data into the field.
- Use ENT to save the data entered into the field.



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- (3) Enter Data in MMSI Field (MMSI).
- (4) Enter Data in Navigational Status Field (NavS).
- (5) Enter Data in IMO Number Field (IMO#).
- (6) Enter Data in Maximum Sailing Draft Field (MaxD).
- (7) Enter Data in Radio Callsign Field (CSgn).
- (8) Enter Data in Vessel Type Field (Type). (Refer to Table 2–3.)
- (9) Enter Data in Vessel Name Field (Name).

NOTE: Destination (Dest), ETA, and POB are optional fields and can be entered at this time if known.

- (10) Press ESC to return to the AIS Main System Menu screen.

Vessel/Voyage Setup	
MMSI:0123456789	NavS:UNDFND
IMO#:1234567890	MaxD:10.0
CSgn:CLIPPER	Type:34
Name:L-3 CLIPPER	
Dest:Home	POB:0
ETA :MMDD>09-01	HHMM>00-00

Figure 2–7. Vessel Data Setup



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Table 2–3. Vessel Type Codes

Special Crafts		Other Ships	
		First Digit	Second Digit
50	Pilot Boats	1 reserved for future use	0 All ships of this type
51	Search and Rescue Vessels	2 WIG	1 Carrying DG HS or MP IMO hazard or pollutant category A
52	Tugs	3 See Below	2 Carrying DG HS or MP IMO hazard or pollutant category B
53	Port Tenders	4 HSC	3 Carrying DG HS or MP IMO hazard or pollutant category C
54	Vessels with anti-pollution facilities or equipment	5 See Special Crafts	4 Carrying DG HS or MP IMO hazard or pollutant category D
55	Law Enforcement Vessel	6 Passenger Ships	5 Reserved for future use
56	Spare - for assignment to local vessels	7 Cargo Ships	6 Reserved for future use
57	Spare - for assignment to local vessels	8 Tankers	7 Reserved for future use
58	Medical Transport (as defined in the 1949 Geneva Conventions)	9 Other types of ships	8 Reserved for future use
59	Spare - Ships according to RR Resolution No. 18 (Mob-83)		9 No additional information
		First Digit	Second Digit
			0 Fishing
			1 Towing
			2 Towing and length of the tow exceeds 200 m or breadth exceeds 25 m
			3 Engaged in dredging or underwater operations
			4 Engaged in diving operations
			5 Engaged in military operations
			6 Sailing
			7 Pleasure craft
			8 Reserved for future use
			9 Reserved for future use
DG: Dangerous Goods			
HS: Harmful Substances			
MP: Marine Pollutants			



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2.1.4.5 Channel Management

This page displays all of the relevant information regarding the regions established either by manual entry, a governing authority's VTS station broadcasting region information, or another Universal AIS broadcasting the data. These regions determine the authorized operating frequencies for the coverage area. The user can set these different configurations at the initial setup; however, the L-3 ProTec Transponder will acquire the data for a new region once it has entered the region.

Edit Chan Mgmt Settings
NE: N 91'00.0 E 181'00.0
SW: N 91'00.0 E 181'00.0
ChA: 2087 Bw0 ChB:2088 Bw0
PLvl:H Md:TxRxAB TZn: Nm
Src:Intrnl MMSI:-----
FNC: ← Prv. → Nxt. FNC Save

Press FNC → NAV button from any menu and use the up (↑) or down (↓) arrow keys.

NE: Indicates the North East corner of the region.
SW: Indicates the South West corner of the region.
ChA: Channel Frequency for Channel A.
Bw: Bandwidth 0 = 25 kHz, 1 = 12.5 kHz.
ChB: Channel Frequency for Channel B.
Bw: Bandwidth 0 = 25 kHz, 1 = 12.5 kHz.
Plvl: Power Level H = high power (12.5 Watts), L = low power (2 Watts)
Md: TxRxAB, TARxAB, TBRxAB, RxAB, RAOnly, and RBOnly.
TZn: Transition zone size, defined in nautical miles.
Src: Intrnl = Internal command, Extrnl = External command
(governing authority).
MMSI: MMSI of the authority that has issued the command (blank if internal).

For the initial setup perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Using the down Arrow key, select "Edit Chan Mgmt Settings", and press the ENT key. The Channel Management Table Entry screen will appear. (Refer to Figure 2–8.)



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- (4) Use the up and down arrow keys and the left and right arrow keys to highlight an entry point, and press the ENT key.
- (5) Enter the data, press the ENT key, and move to the next data entry point.
- (6) After all of the data is entered for that region, press the FNC key twice and then press the ENT key to save the data.
- (7) Press the ESC key to return to the AIS Main System Menu screen.

```
High Seas Region Actv
NE: N 91°00.0 E 181°00.0
SW: N 91°00.0 E 181°00.0
ChA:2087 Bw0 ChB:2088 Bw0
PLvl:H Md:TxRxAB TZn:5 Nm
Src:Intrnl MMSI:0123456789
Fnc:< Prv. > Nxt. Fnc Save
```

Figure 2–8. Channel Management Settings Screen

2.1.4.6 Antenna Position

This setup provides for data entry of location of the antenna for each of the GPS antennas required for the system. The 'Int' refers to the antenna dedicated to the AIS' internal GPS and the 'Ext' refers to the antenna dedicated to the ship's external GPS. The screen layout is as follows:

```
Antenna Position Ref
INT A:47 B:14 C:3 D:5
EXT A:250 B:250 C:50 D:50

Dimensions in Meters
See ITU-R M.1371 Doc
```

Figure 2–9. Antenna Position Screen



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To enter the antenna position, perform the following:

(Refer to Figure 2–9 and Figure 2–10)

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Using the down Arrow key, select “Antenna Position Setup”, and press the ENT key. The Antenna Position Reference screen will appear.
- (4) Use the up and down arrow keys and the left and right arrow keys to highlight an entry point, and press the ENT key.
- (5) Enter the data, press the ENT key, and move to the next data entry point.
- (6) Press the ESC key to return to the AIS Main System Menu screen.

NOTE: The INT antenna is the antenna dedicated to the GPS receiver internal to the AIS. The EXT antenna is the antenna dedicated to the ship’s dGPS. The dimensions are to be entered in Meters and are defined as follows: (Refer to Figure 2–10.)

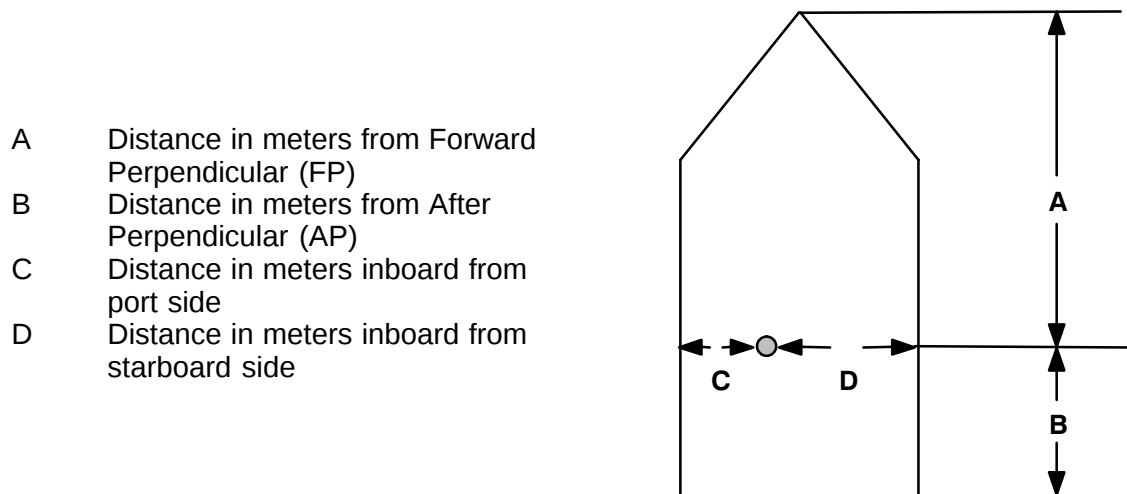


Figure 2–10. Antenna Position Measurements



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2.1.4.7 Text Messaging

Text messages include specific addressed messages, broadcast messages, and safety messages. To send a particular type of message perform the steps as described below:

MMSI:	Maritime Mobile Service ID: Nine digit unique identification number
Mode:	Mode: Broadcast: 0 = Default Addressed: Enter MMSI
TXch:	Transmit Channel: Auto Select: Default ChanA: Send on channel A ChanB: Send on channel B Chan A and B: Send on both channels
Text:	Safety Message Text to be Sent: Up to 156 alphanumeric characters

To send an addressed message, perform the following:

- (1) Press MSG key (From any menu).
- (2) Ensure the MMSI is highlighted.
- (3) Press the ENT key, and enter the MMSI number of the ship to be addressed, press the ENT key.
- (4) Press the down arrow key to highlight "Mode" and press the ENT key.
- (5) Using the down arrow key, highlight "Addressed", and press the ENT key.
- (6) Using the down arrow key, highlight the text portion of the screen, press the ENT key, and type in the message.
- (7) Press the MSG key to broadcast the message.

To broadcast a message, perform the following:

- (1) Press MSG key.
- (2) Verify that the MMSI number is a zero.
- (3) If the MMSI is not a zero, press the down arrow key until the MMSI is highlighted.
- (4) Press the ENT key, and press the CLR key.
- (5) Press the down arrow key to highlight "Mode" and press the ENT key.



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- (6) Using the down arrow key, highlight “Broadcast”, and press the ENT key.

NOTE: Unless instructed, leave TxCh to Auto Select.

- (7) Using the down arrow key, highlight the text portion of the screen, press the ENT key, and type in the message.
- (8) Press the MSG key to broadcast the message.

NOTE: “Successful Transmission” should be displayed at the bottom of the screen.

```
Safety Text Entry Form
MMSI:0123456789
MODE:ADDRESSED
TxCh:Auto Select
TEXT:Msg from 0123456789
Use Msg Key to Send Text
```

Figure 2–11. Safety Text Message

2.1.4.8 View Safety Text Log

This log shows any safety text messages that have been received during the present power up.

To review Safety Text Messages that have been received, perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Using the down Arrow key, select “View Safety Text Log”, and press the ENT key. The Safety Text Review screen will appear.
- (4) Use the left and right arrows to view previous or next messages respectively.
- (5) Press the ESC key to return to the AIS Main System Menu screen.



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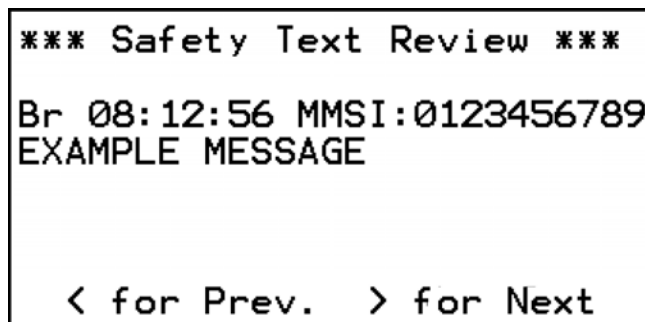


Figure 2–12. Safety Text Review Screen

2.1.4.9 Change Password

NOTE: Only users with an administrative password can change passwords

To change the transponder's access password, perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Using the down Arrow key, select Change Password, and press the ENT key. The System Password Change screen will appear.
- (4) Enter the new password, and press the ENT key.
- (5) Enter the new password in the Verify field, and press the ENT key. This will save the new password.
- (6) Use the Up (↑) and Down (↓) keys too select type of Access, and press the ENT key.

PassWd:	New password.
Verify:	Confirmation of new password
Access:	ADMIN = administrator, USER = user.

- (7) Press the ESC key to go back to the AIS Main System Menu screen.



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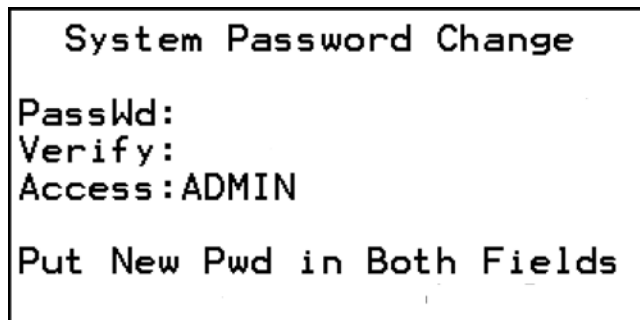


Figure 2–13. Password Change Screen

2.1.4.10 System Alert Screen

This screen will appear when a system alert is received. Press the ENT key to acknowledge the alert.

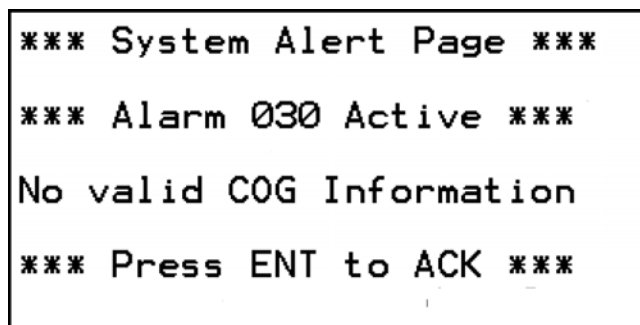


Figure 2–14. System Alert Screen

2.1.4.11 Alarm Status

The ProTec AIS unit does not support a "General Failure" alarm since all detected failures are reported with an explicit discrete alarm message. Refer to Table 2–4 for an explanation of the alarm codes. Table 2–4 explains the codes that are referenced on this page.



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To review Safety Text Messages that have been received, perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Using the down Arrow key, select "View Alarm Status", and press the ENT key.
- (4) Use the up (↑) or down (↓) arrow keys to view previous or next messages respectively.
- (5) Press the ESC key to return to the AIS Main System Menu screen.

*** Alarm Status ***				
025	AA	18:32:43	EPFS Lost	
026	AA	18:32:43	No Postn	
029	AA	18:32:43	No SOG	
030	AA	18:32:43	No COG	
032	AA	18:32:43	Hdg Lost	
035	AA	18:47:58	No ROT	

AA: Alarm is active and has been acknowledged.

AV: Alarm is active and has not been acknowledged.

Figure 2-15. Alarm Status Screen



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Table 2–4. Integrity Alarm Conditions Signalled Using ALR Sentence Formatter

As per IEC 61193–2

Alarm's description text	Alarm condition threshold exceeded	Alarm condition exceeded	Alarm ID Text Identifier	Reaction of the system to the alarm condition threshold exceeded
AIS: Tx malfunction	A	V	001	Stop transmission
AIS: Antenna VSWR exceeds limit	A	V	002	Continue operation
AIS: Rx channel 1 malfunction	A	V	003	Stop transmission on affected channel
AIS: Rx channel 2 malfunction	A	V	004	Stop transmission on affected channel
AIS: Rx channel 70 malfunction	A	V	005	Stop transmission on affected channel
AIS: general failure	A	V	006	Stop transmission
AIS: MKD connection lost	A	V	008	continue operation with "DTE" set to "1" ¹
AIS: external EPFS lost	A	V	025	continue operation
AIS: no sensor position in use	A	V	026	continue operation
AIS: no valid SOG information	A	V	029	continue operation using default data ²
AIS: no valid COG information	A	V	030	continue operation using default data ²
AIS: Heading lost/invalid	A	V	032	continue operation using default data ²
AIS: no valid ROT information	A	V	035	continue operation using default data ²
AIS: IEC Com Error	A	V	051	indicates miswired NMEA port, continue operation

¹ If applicable

² When so configured



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2.1.4.12 General Status Screen

This menu page displays a table of events describing the general status of the operating unit along with a time stamp of when each automatic entry was made.

Table 2–5 explains the codes that are referenced on this page. Refer to Table 2–5 for an explanation of the General Status codes.

To review the ProTec General status, perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Using the down Arrow key, select “View General Status”, and press the ENT key. The General Status screen will appear. (Refer to Figure 2–16.)
- (4) Press the ESC key to return to the AIS Main System Menu screen.

*** General Status ***			
025	14:01:52	Int	GNSS
028	14:01:52	Int	SOG/COG

Figure 2–16. General Status Screen



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Table 2–5. Sensor Status Indications Signalled Using TXT Sentence Formatter

As per IEC 61193–2

Text Message	Text Identifier	Reaction of the system
AIS: UTC clock lost	007	Continue operation using indirect or semaphore synchronization
AIS: external DGNSS in use	021	Continue operation
AIS: external GNSS in use	022	Continue operation
AIS: internal DGNSS in use (beacon)	023	Continue operation
AIS: internal GNSS in use (message 17)	024	Continue operation
AIS: internal GNSS in use	025	Continue operation
AIS: external SOG/COG in use	027	Continue operation
AIS: internal SOG/COG in use	028	Continue operation
AIS: Heading valid	031	Continue operation
AIS: Rate of Turn Indicator in use	033	Continue operation
AIS: Other ROT source in use	034	Continue operation
AIS: Channel management parameters changed	036	Continue operation



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2.1.4.13 Down-Time Log

This screen shows the date, time and duration that the transponder has been powered off.

To review Down-Time Log, perform the following:

- (1) Press the FNC key.
- (2) Press the NAV key. The AIS Main System Menu screen will appear.
- (3) Using the down Arrow key, select "View Down-Time Log", and press the ENT key.
- (4) Use the down arrow to view the down times that are further down the list.
- (5) Press the ESC key to return to the AIS Main System Menu screen.

*** Down-Time Log ***		
23-Aug-04	14:29	30.5 Mins
19-Aug-04	09:13	3.8 Days
17-Aug-04	12:54	1.7 Days

Figure 2-17. Down-Time Log Screen

2.1.4.14 LCD Viewing Angle Adjustment

This menu page allows the user to adjust the contrast of the LCD display on all pages and screens.

Use the up (↑) or left (←) arrow keys to decrease the viewing angle.

Use the down (↓) or right (→) arrow keys to increase the viewing angle.

To enter adjust the LCD viewing angle, perform the following:

- (1) Press the FNC key, press the NAV key. The AIS Main System Menu screen will appear.
- (2) Using the down Arrow key, select Adj LCD Viewing Angle, and press the ENT key. The LCD Viewing Angle Adjust screen will appear. (Refer to Figure 2-18.)
- (3) Use the Left or Up arrows to decrease the viewing angle, or use the Right or Down arrows to increase the viewing angle.



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- (4) Press the ESC key to return to the AIS Main System Menu screen.

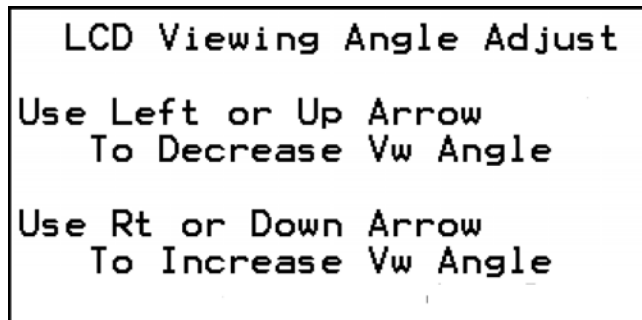


Figure 2–18. LCD Viewing Angle Adjust Screen

2.1.4.15 Baud Rate Setup

IEC Sensor Input Channels: Valid baud rates for CH1, CH2, and CH3 - 4800, 9600, 19200, and 38400. (Default = 4800)

IEC Bidirectional Channels: Valid baud rates for CH4, CH5, CH8, and Pilot (front panel) are 4800, 9600, 19200, 38400. (Default = 38400)

To setup the Baud Rate, perform the following:

- (1) Press the FNC key, press the NAV key. The AIS Main System Menu screen will appear.
- (2) Using the down Arrow key, select Set Baud Rate, and press the ENT key. The Baud Rate Setup screen will appear. (Refer to Figure 2–19.)
- (3) Using all of the arrow keys, highlight an entry point, and press the ENT key.
- (4) Enter the data, press the ENT key, and move to the next data entry point.
- (5) Press the ESC key to return to the AIS Main System Menu screen.

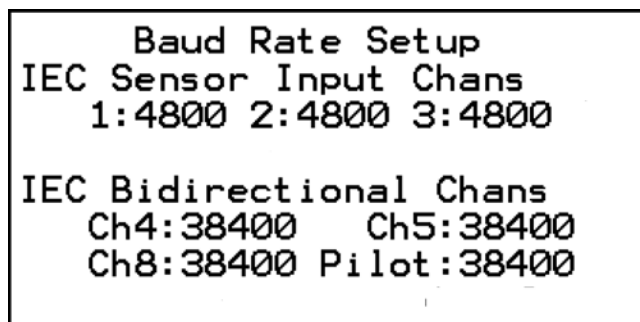


Figure 2–19. Baud Rate Setup Screen



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2.1.4.16 Set AIS Channels

This menu page allows the administrator to set the default, Open Seas, transmit and receive frequencies as well as the operating power level.

AIS Channel A: 2087 should be default (Channel 87B, 161.975 MHz)

AIS Channel B: 2088 should be default (Channel 88B, 162.025 MHz)

Power Level: Hi = high power, Lo = low power

To enter System Information and Configuration information, perform the following:

- (1) Press the FNC key, press the NAV key. The AIS Main System Menu screen will appear.
- (2) Using the down Arrow key, select Set AIS Channels, and press the ENT key. The AIS Channel Setup screen will appear. (Refer to Figure 2–20.)
- (3) Using all of the arrow keys, highlight an entry point, and press the ENT key.
- (4) Enter the data, press the ENT key, and move to the next data entry point.
- (5) Press the ESC key to return to the AIS Main System Menu screen.

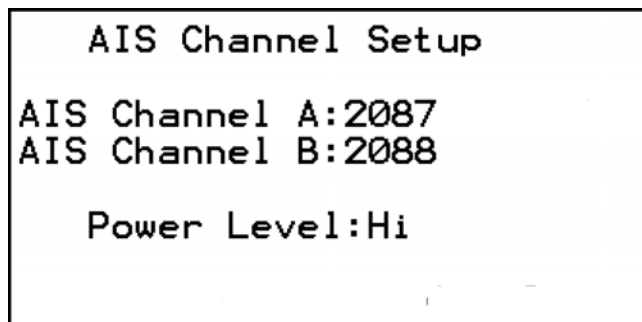


Figure 2–20. AIS Channel Setup Screen



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SECTION 3

ProTec

AUTOMATIC IDENTIFICATION SYSTEM (AIS)

INSTALLATION



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ProTec AIS Installation

3.1. Installation

The L-3 ProTec Transponder has been designed for easy installation into any existing bridge layout. Figure 3–1 gives a general representation of the system layout. Installation can be broken down into 5 distinct operations as follows:

- Transponder
- VHF Antenna
- GPS Antenna
- Data Interface
- Powerup and Configuration

Each operation will be discussed in detail below. In regards to 3rd part components such as VHF and GPS antennas and Gyro interfaces, it is suggested that the installation procedures suggested by the manufacturer be followed in lieu of these procedures.

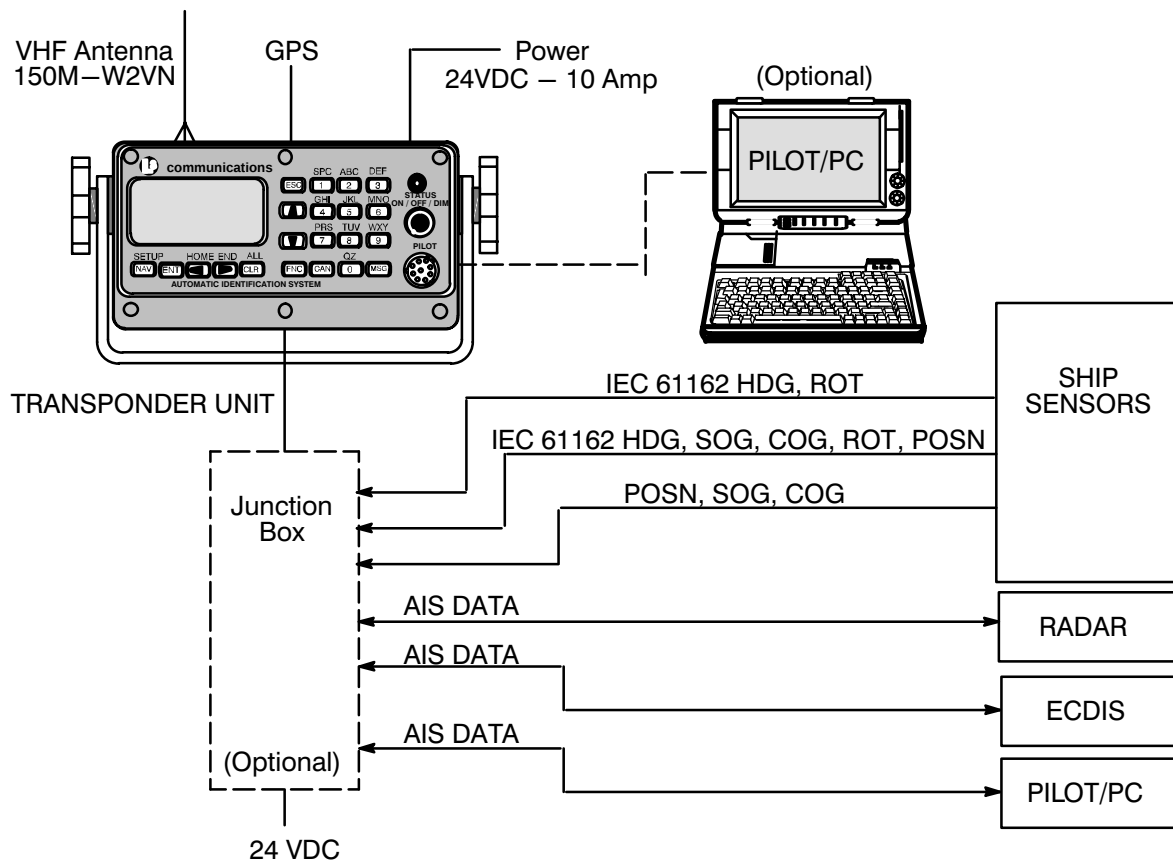


Figure 3–1. AIS Transponder Interconnection Diagram



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3.1.1. Transponder

The L-3 ProTec is a single box design which is easily installed into any existing bridge layout. The compact design requires minimal clearance (refer to Section 4 Figure 4–1 and Figure 4–2) and can be mounted in a trunion bracket or mounted flush using the available flush–mount bracket.

- Mount the transponder in a position which provides easy access to the keyboard and display.
- If using the trunion bracket, the mount itself may be used to mark the screw holes on the mounting surface. When locating the transponder, consider that the IMO mandates that the AIS keyboard and display be easily accessed from a navigable position on the bridge.
- If used, Mount the transponder in the trunion utilizing the trunion knobs provided, otherwise mount transponder in flush mount bracket.
- Locate and mount the terminal block or junction box in a position near the transponder. The IEC cable provided with the unit is 100 inches (2.54 m) long. Locate the terminal block in a fashion which allows for easy access to the terminals for making the connections to required input/output feeds.
- When connecting the power cable, the “Red” lead goes to positive and “Black” to negative. Ensure proper ground wire attachment to ships structure. The other two leads can be used to connect to an external alarm system. This alarm system can provide an audio and/or visual alarm in the event of an internal system malfunction, or if the AIS loses power or is turned off.

Install the transponder, and complete the AIS Installation Checklist found in Appendix A, as follows:

- (1) Mount the transponder. (In trunion, if used.)

NOTE: A junction box may be used in place of the terminal block.

- (2) Locate an ideal position for the terminal block.
 - Protected from weather.
 - Protected from high heat.
 - Protected from accidental contact with conductive material.
 - Within 100 inches (2.5 m) of the transponder due to IEC data cable length.
 - Grounding of terminal block to ship's structure.
 - Need to feed cables from navigational sensors.
- (3) Mount terminal block or junction box with self tapping screws.
- (4) Ground terminal block to ship's structure using grounding cable provided.



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For steps (5) through (9) refer to Paragraph 3.1.2.

(5) Connect the IEC cable to data port on back of Transponder.

NOTE: If an interface adapter must be used to convert either Gyro output and/or dGPS output to IEC (NMEA 0183) standard, the output from the interfaces should be located as near as possible to the sending unit (Gyro or dGPS) and the output cables led to the IEC terminal block.

(6) Lead data cables from Gyrocompass data output port to terminal block.

(7) Lead data cables from ship's DGPS data output port to terminal block.

(8) Feed the IEC data cable to the terminal block.

NOTE: The metallic shielding of each of the three shielded cables containing the twisted pairs must be connected to the terminal block using the shield drain wire connected to the shield. The shields from Cables 1 and 2 do not have to be connected. The shield from Cable 3 must be connected to TB pin ID 30, which is grounded to the ship's hull.

(9) Connect each wire in the IEC data cable to the terminal block. (Refer to Table 3-2 and Figure 3-2.)

(10) Connect power cable to transponder. (Refer to Figure 3-3.)

NOTE: Due to the stringent transmit attack and release times specified in ITU 1371, a robust power source is required for proper operation. Recommended current ratings for power sources are:

24 VDC – 10 Amp

The transponder may operate improperly if the power source does not have the recommended minimum current ratings.

(11) Connect power cable to ships 24 Vdc, 10 Amp minimum power supply is recommended. (Red + , Black –)

(12) Connect the other two leads to external alarm system if desired.

(13) If an external display system is to be connected, lead the pilot port cable from the display unit to the terminal block. (Refer to Figure 3-4.)

CAUTION: Do not power up the unit at this time.

(14) Go to Paragraph 3.1.3. for VHF antenna installation steps.



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3.1.2. **Connecting the IEC Data Interface Cable**

The AIS Transponder receives data from the ship's sensors through a data interface cable which is connected to the back of the transponder through a data port. IMO regulations require that the ship heading, speed-over-ground (SOG), course-over-ground (COG), rate-of-turn (ROT) and position be transmitted from the AIS. In order to meet these requirements, the L-3 ProTec provides six (6) data channels to allow the AIS to be connected to the ships Gyrocompass and DGPS system in accordance with NMEA 0183.

The L3 AIS is shipped with one IEC interface cable P/N 024M0599-00. All IEC/Pilot communications with the AIS is referenced with the L-3 ProTec considered the "MASTER" in that transmit data is OUTPUT from the L-3 ProTec, and receive data is INPUT to the L-3 ProTec. All channels are isolated with individual shielded twisted pair cables. For more information, refer to Figure 4-3. The IEC connector (J4) is located on the back of the L-3 ProTec. (Refer to IEC 61993-2 annex D. and NMEA 0183) IEC channels 1, 2, and 3 are RECEIVE ONLY sensor inputs. Differential data (RS422) is received on each of these channels and internally converted to TTL for input to a standard UART. Channels 4, 5, and 8 are all RS422 interfaces. IEC channels 4 and 5 are TRANSMIT/RECEIVE channels for AIS data. IEC channel 8 is the AIS long range port.

3.1.2.1 **Data Channels**

Data enters the Transponder through six (6) available data channels. Three data channels are low speed unidirectional (4800 baud) channels suitable for data input to the transponder. The other three data channels are high speed bidirectional (38400 baud) which support both input and output to/from the transponder.

The channels are described below by channel number and type. Suggested uses of each channel are provided but it is not required that a user define the channels in this fashion. The internal software in the transponder is able to distinguish the type of data feeding from each channel provided all data streams subscribe to the IEC 61162 format (NMEA 0183).

Table 3-1. Data Channels

Channel	BAUD	Type	Suggested Use
1	4800	Receive	dGPS (COG, SOG, LAT, LON)
2	4800	Receive	Rate of Turn
3	4800	Receive	Heading (Gyro)
4	38400	Transmit / Receive	PC Application
5	38400	Transmit / Receive	ARPA/ECDIS
8	38400	Transmit / Receive	Long Range Tracking (Dedicated)



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The IEC I/O electrical characteristics are as follows:

The “A”, “B” and “C” leads are as defined in IEC 61162–1, 61162–2 and V.11.

“A” and “B” are both signal leads with “C” being the effective return for both the “A” and “B” leads.

“A” and “B” operate differentially to each other.

High–level output voltage is 4V minimum from the “A” lead to the “C” lead and from the “B” lead to the “C” lead. Low–level output voltage is 0.4V maximum.

Recommended maximum output current capability is 110mA.

Input is differential from “A” to “B”. Effective input resistance is 4.9k ohm across “A” and “B” and 96k from “A” or “B” to “C”.

Differential input voltage threshold is 250mV maximum.

Inputs will meet the requirement of withstanding +/-15V between any two leads, “A”, “B” or “C”.

3.1.2.2 Data Cable

Each transponder will come shipped with an 100 inches long IEC data cable (P/N 024M0599-00) terminated at one end by a J4 connector. (Refer to NO TAG, Figure 4–3 and Figure 3–2.) The IEC data cable is shielded and contains three smaller diameter cables, each of which is also shielded. Each of these smaller cables contains three shielded twisted pairs (STP) each and each STP includes a drain wire. A low speed unidirectional (input only) data channel (4800 Kbs) is carried through one STP, and a high speed bidirectional (input/output) data channel (38400 Kbs) will require two pairs.

3.1.2.3 Terminal Block

A terminal block is the preferred installation method for completing the data interface (NMEA) because data output from a ship sensor (dGPS, ROT, Gyro) may not subscribe to a standard pinout definition. As such, each installation may require that the installer identify and cross reference the sensor pinouts with the IEC pinouts, which is a well defined standard pinout description. The terminal block allows for greater flexibility in completing the connection to the ship's sensors.



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A junction box may be made available which terminates the data cable on the terminal block and provides serial connectors to allow for easy connection to ship sensors. However, the installer will need to confirm the pinout definitions for the sensor outputs before completing the connection correctly.

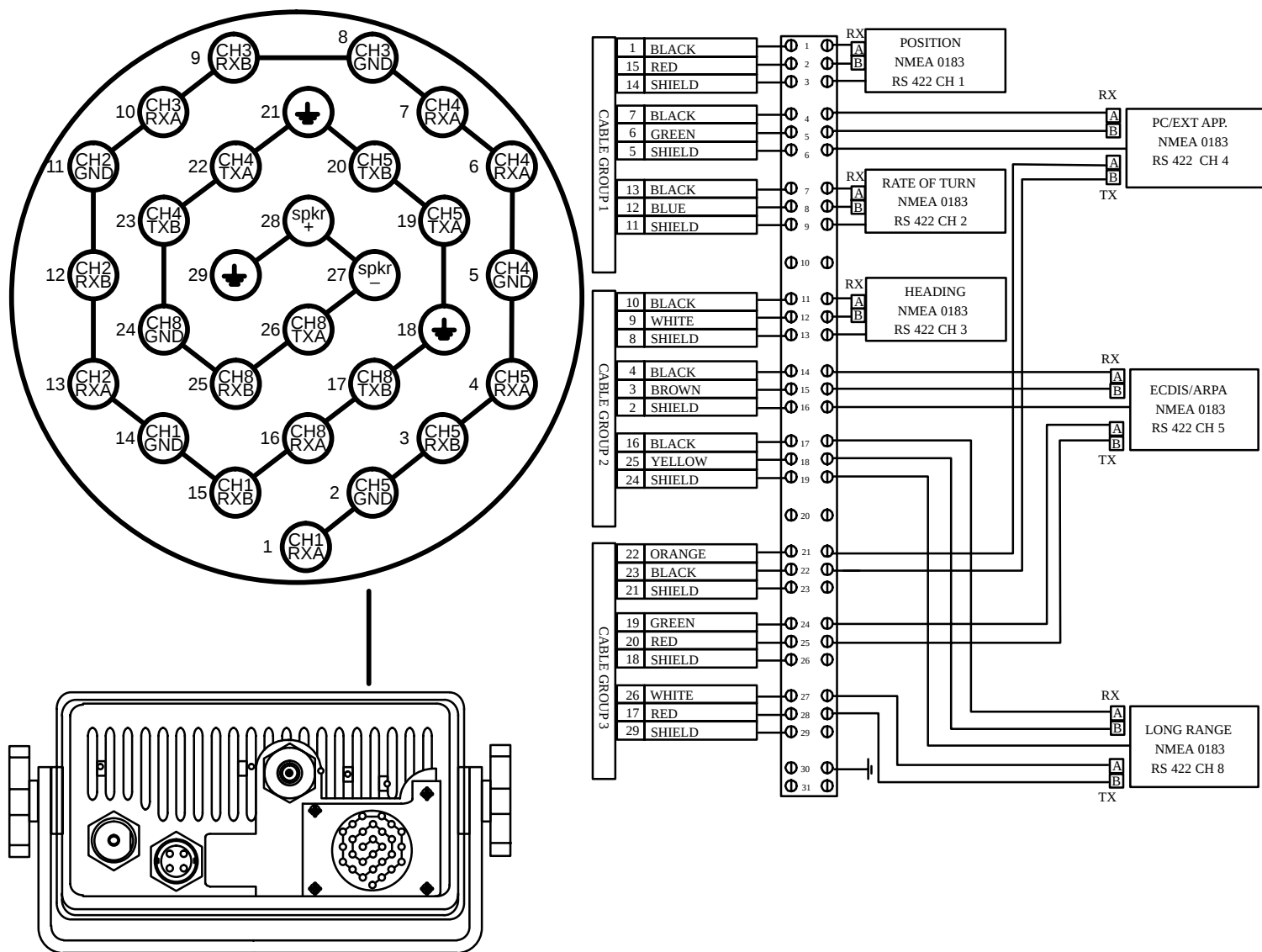


Figure 3-2. IEC Data Cable External Wiring Diagram

NOTE: Each shielded twisted pair of wires is shielded as well by metallic shielding and a drain wire connected to this shielding is to be connected in accordance with Table 3-2.



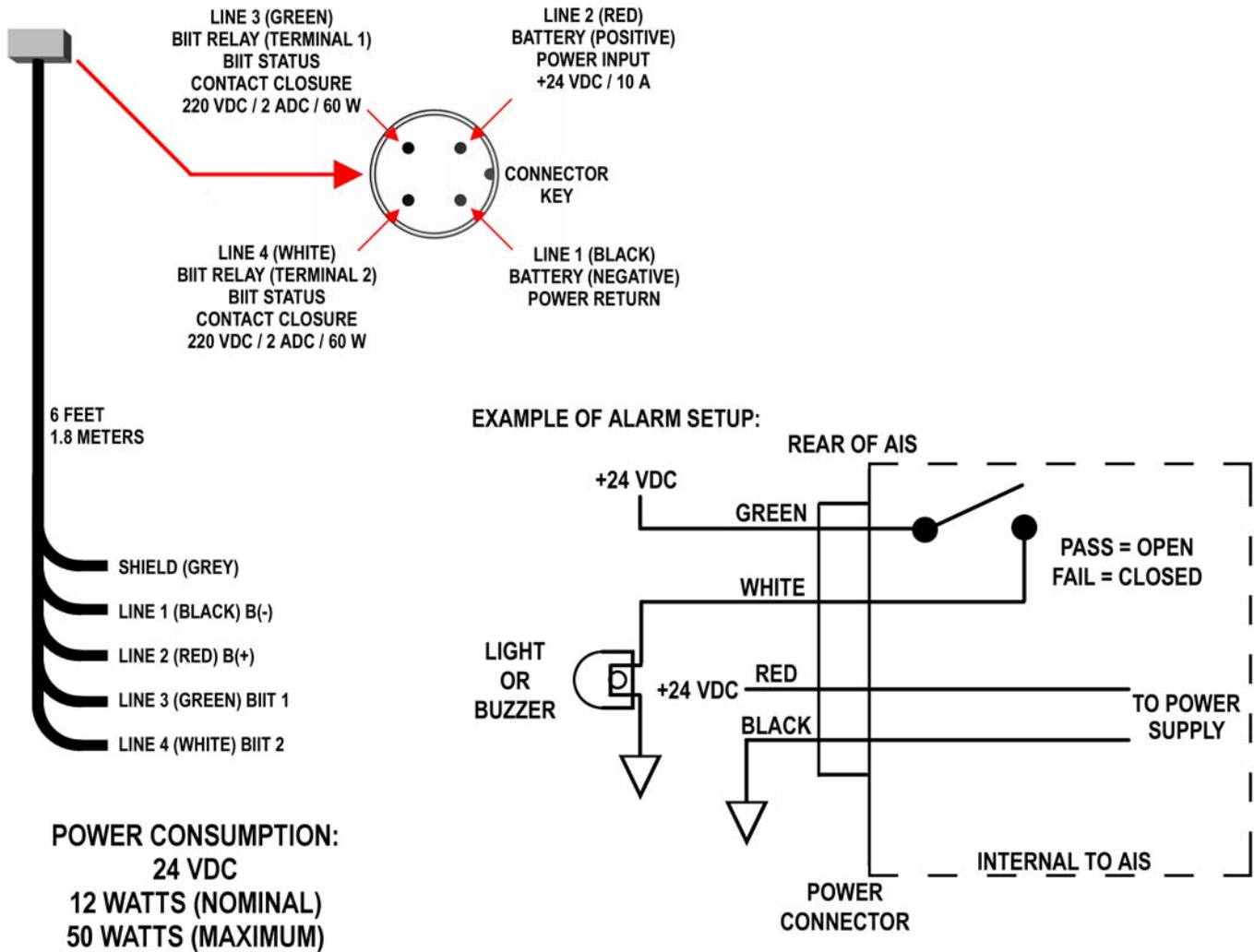
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Table 3–2. IEC Cable and Junction Box Pinouts

Cable	STP	Wire Color	IEC Pin	TB Pin
Cable Group1	1	Black	1	1
		Red	15	2
		Shield	14	3
	2	Black	7	4
		Green	6	5
		Shield	5	6
	3	Black	13	7
		Blue	12	8
		Shield	11	9
		Shield Drain	NC	10
Cable Group 2	4	Black	10	11
		White	9	12
		Shield	8	13
	5	Black	4	14
		Brown	3	15
		Shield	2	16
	6	Black	16	17
		Yellow	25	18
		Shield	24	19
		Shield Drain	NC	20
Cable Group 3	7	Orange	22	21
		Black	23	22
		Shield	21	23
	8	Green	19	24
		Red	20	25
		Shield	18	26
	9	White	26	27
		Red	17	28
		Shield	29	29
		Shield	NC	30



Signal Table for "Cable Assembly, Power/BIIT, External"					
Line	Color	Name	Description	Function	Power
1	Black	B(-)	Battery, negative	Power return	—
2	Red	B(+)	Battery, positive	Power input	+24VDC/10A (nominal voltages)
3	Green	BIIT 1	BIIT relay, terminal 1	BIIT Status	Contact closure 220VDC/ 2ADC/ 60W maximum
4	White	BIIT 2	BIIT relay, terminal 2		

Figure 3-3. AIS Transponder Power Cable



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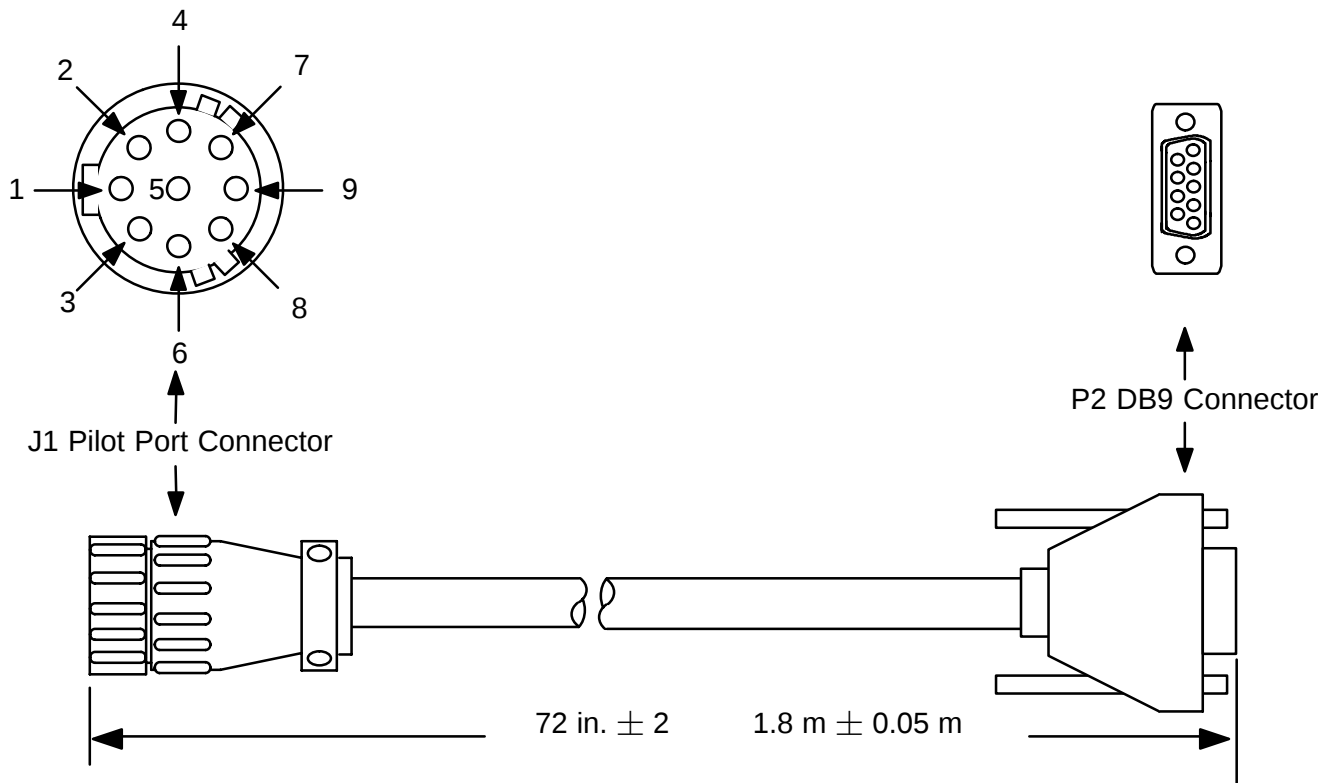


Figure 3-4. Pilot Port Cable

NOTE: A Digital Volt Meter may be used to determine the “A” and “B” polarities. A negative voltage when referenced to ground would indicate “A”, while a positive voltage when referenced to ground would indicate “B”.

Table 3-3. Pilot Port Pinout

J1 Pin	Name	Description	Pair Color	P2 Pin
1	PILOT_TXA	RS4-22 Compliant Output A	Blue	2
2	GND	Signal/Power 0 Volt Reference	Black	5
3	+ 8V	+ 8.0 Volt ($\pm 5\%$) Output Used to Power External Test Equipment. External Equipment should be Current Limited to 300mA		
4	PILOT_TXB	RS-422 Compliant Output B	Black	7
5	PILOT_RXA	RS-422 Compliant Input A	Green	8
6	PILOT_RXB	RS-422 Compliant Input B	Black	3
7	TRACE/BOOT_TX	TTL-Level RS-232 Serial Output (Trace Message/ Bootload Output)		
8	RX_SINAD	TDMA / DSC FM Discriminator Output used to Test Receiver Performance during Special Test Modes.		
9	NO CONNECT	Not Used		



3.1.3. Installing the VHF Antenna

Installation of a VHF antenna is as important to reliable communications as the transceiver itself. It is recommended that a high quality antenna be purchased from an established source and that all manufactures instructions be followed with particular attention to cable routing and connector installation. Some important considerations in antenna installation are:

- In general, antennas should be located as high as practical on the vessel and separated as much as possible from each other.
- The VHF antenna should be placed in an elevated position with a minimum of 2 meters clearance from any construction that is made with conductive material. In addition, it should not be installed close to any large vertical obstruction, and the VHF antenna should have a 360° line of sight to the horizon.
- It is preferable that the VHF antenna is installed at least 3 meters away from high power energy sources such as radar and other transmitting radio antennas, and out of the transmitting beam.
- There should not be more than one antenna on the same level. The AIS VHF antenna should be mounted directly above or below the ship's primary VHF radiotelephone antenna, with no separation and with a minimum of 2 meters vertical separation. If the VHF antenna is located on the same level as other antennas, the distance between them should be at least 10 meters.

To install the VHF antenna, perform the following:

(Refer to Figure 3–5 and Figure 3–6.)

- (1) Position the antenna mounting bracket on a rigid and structurally sound surface.
- (2) Install the antenna on the antenna mount.

NOTE: Use only high quality RG213/RG214 coaxial cable and keep cable length as short as possible to reduce signal attenuation.

- (3) Run the coaxial cable from the antenna to the transponder location.
- (4) Trim cable to length leaving a few inches slack at the transponder.
- (5) Attach the connectors to the end of the coaxial cable.
- (6) Connect the cables to the transponder. Soldering the connection is recommended.



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3.1.4. Installing the GPS Antenna

The correct installation of a GPS antenna is crucial to the operation of the transponder because the internal transmission synchronization relies on the accuracy of the time signal obtained from the GPS. It is recommended that a high quality GPS antenna be purchased from an established source and that all manufactures instructions be followed with particular attention to cable routing and connector installation. Some important considerations in GPS antenna installation are:

- GPS antennas should be located to provide a clear, unobstructed view of the sky.
- GPS signals can be affected by RADAR and SATCOM transmissions. As such, GPS antennas should be positioned below and at least 5 meters away from RADAR and SATCOM antennas and outside of the beam path.
- GPS signals can also be affected negatively by VHF and HF transmissions, and the GPS antenna should be positioned at least 3 meters from these types of antennas.
- The GPS antennas can be flat mounted onto any surface but it is recommended that it be elevated from the deck surface (20–30 cm.) to prevent ice or spray from negatively impacting the signal reception.
- Recently, it has been identified that certain makes/models of TV antennas can drastically interfere with GPS reception. As such, the installer should place the GPS antenna as far away from any shipboard TV antennas as possible and confirm that any antennas used on board are not ones which have been exhibited GPS interference problems.

To install the GPS antenna, perform the following:

(Refer to Figure 3–5 and Figure 3–6.)

- (1) Position the antenna mounting bracket and/or antenna mast on a rigid and structurally sound surface.
- (2) Install the antenna on the antenna mount.

NOTE: Use only high quality RG213/RG214 coaxial cable and keep cable length as short as possible to reduce signal attenuation.

- (3) Run the coaxial cable from the antenna to the transponder location through an existing throughhull.
- (4) Trim cable to length leaving a few inches slack at the transponder.
- (5) Attach the connectors to the end of the coaxial cable.
- (6) Connect the cable to the transponder. Soldering the connection is recommended.



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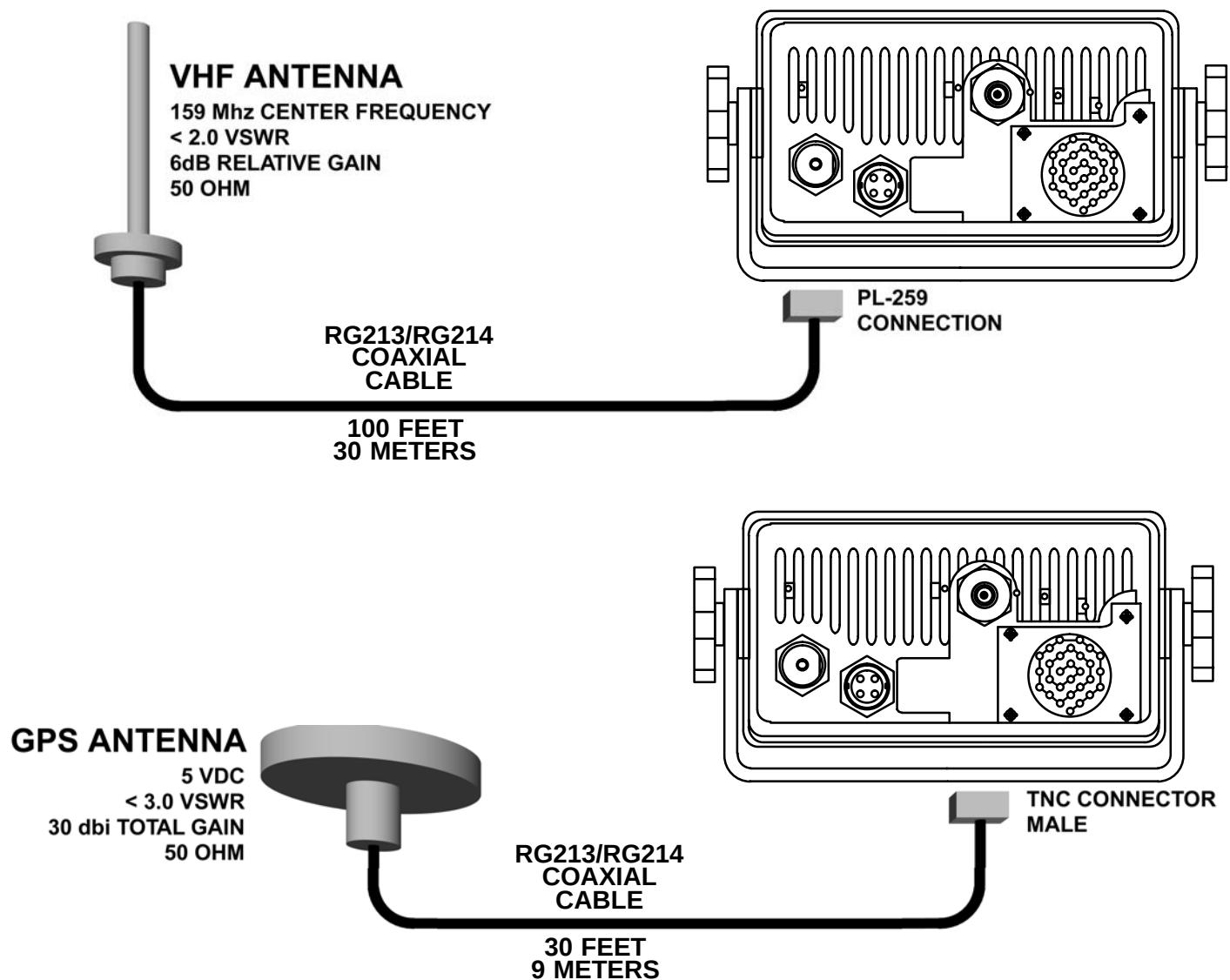


Figure 3-5. AIS Transponder Antenna Diagram



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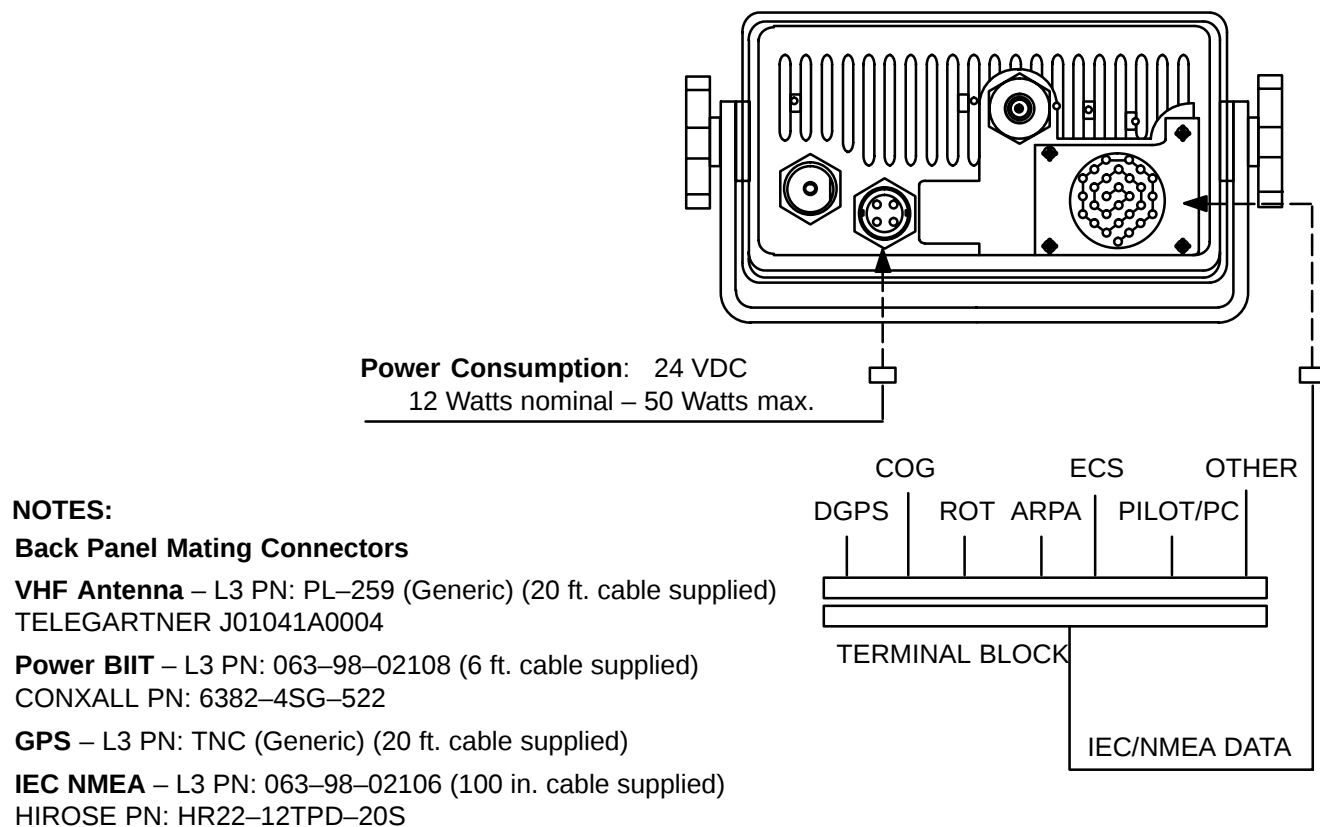


Figure 3-6. AIS Transponder Rear View



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3.1.5. **PowerUp and Configuration**

At this stage you should have the following steps completed:

- Transponder installed and 10–28 Vdc power connected.
- VHF antenna installed and connected to transponder.
- GPS antenna installed and connected to transponder.
- IEC data cable installed and connected to transponder and terminal block.

The next step in the installation of the AIS transponder involves setup and configuration. A complete description of the interface and menu system is previously given in Section 2. Figure 3–7 presents a view of the layout of the integral Minimum Keyboard Display. This display includes a backlit LCD screen and keypad which allows the user to enter the required static and voyage related vessel data. A complete description of the user interface and menu system is presented in Section 2. The configuration process is summarized below.

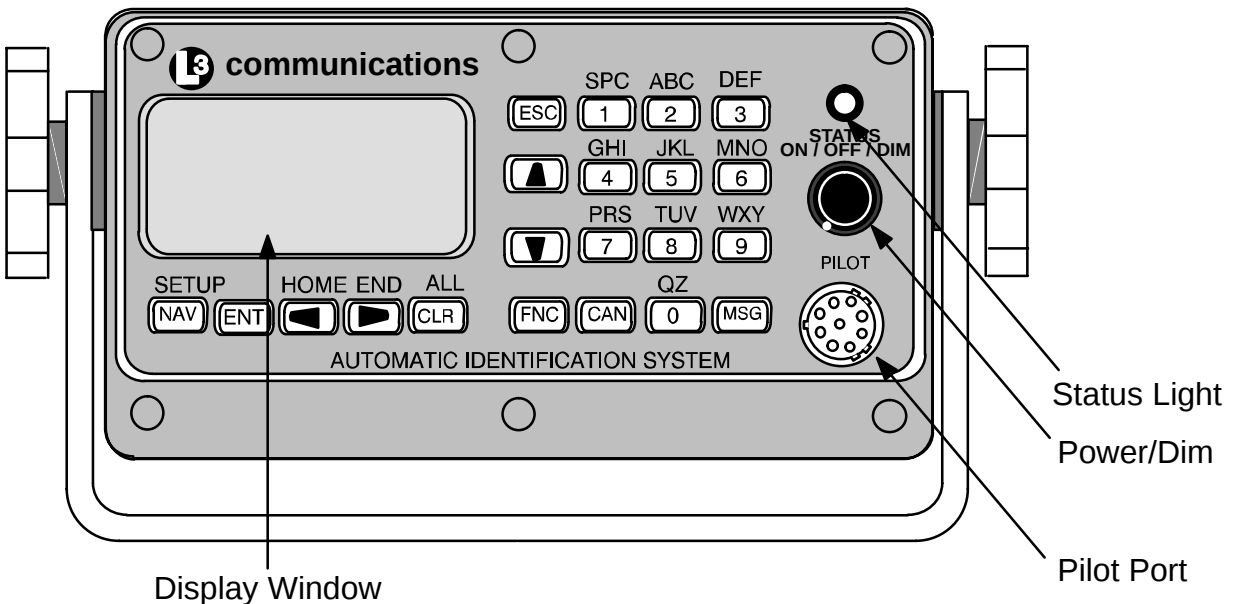


Figure 3–7. AIS Transponder MKD

3.1.5.1 **PowerUp the Transponder**

The following procedure should be followed to carry out final setup and testing of the AIS Transponder.

- (1) Rotate the POWER button clockwise to turn on the transponder.
- (2) Check the STATUS light for a steady light to ensure power is supplied to unit.



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Table 3–4. ProTec AIS Default Passwords

Default Passwords	
Administrative	L3AIS
User	L3USR

- (3) Press FNC and then the NAV button.
- (4) Enter Password. Press ENT.
- (5) Verify password entry confirmation message is present.
- (6) Press ESC to continue.

3.1.5.2 Vessel / Voyage Setup

The Vessel Data Setup screen allows the user to enter the following information which is required to be completed during the installation of the AIS.

MMSI: Maritime Mobile Service ID: Maximum nine (9) numbers.

NavS: Navigational Status:

UNDFND	Undefined
UW-ENG	Underway Using Engine
AANCHR	At Anchor
NOCMD	Not Under Command
RMANUV	Restricted Maneuverability
CBDRFT	Constrained by Draught
MOORED	Moored
AGRND	Aground
FISHNG	Engaged in Fishing
SAILNG	Underway sailing

IMO#: IMO Number: Official IMO designation ID for Vessel. 0 = default = not available.

MaxD: Maximum Draft: Maximum draft in meters from 0.1 to 25.5 meters.

CSgn: Radio Call Sign: Maximum seven (7) characters.

Type: Vessel Type: (Refer to Table 3–5.)

Name: Vessel Name: Any alphanumeric characters up to 20 in length.

Dest: Destination. The current destination of this voyage.

POB: People on Board. The number of persons currently on board the vessel.

ETA: Estimated Time of Arrival.

NOTE: Destination, ETA, and POB are optional fields.



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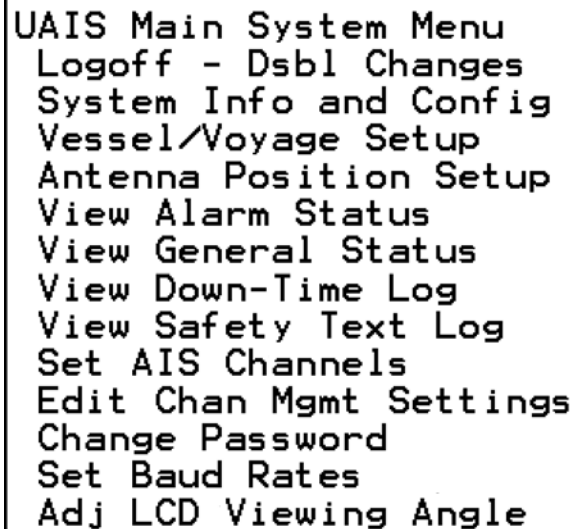
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Perform the following to setup the Vessel/Voyage data:

- (1) If already on the UAIS Main System Menu screen, go to Step (2).

Otherwise, press FNC and then NAV to get to the UAIS Main System Menu screen. (Refer to Figure 3–8.)

NOTE: Figure 3–8 shows the UAIS Main System Menu screen as it appears as the user initially enters this menu. Not shown is the Logon option.



```
UAIS Main System Menu
Logoff - Dsbl Changes
System Info and Config
Vessel/Voyage Setup
Antenna Position Setup
View Alarm Status
View General Status
View Down-Time Log
View Safety Text Log
Set AIS Channels
Edit Chan Mgmt Settings
Change Password
Set Baud Rates
Adj LCD Viewing Angle
```

Figure 3–8. UAIS Main System Menu



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- (2) Use DOWN ARROW key to scroll down to Vessel/Voyage Setup. Press ENT.

Vessel/Voyage Setup	
MMSI:0123456789	NavS:UNDFND
IMO#:1234567890	MaxD:10.0
CSgn:CLIPPER	Type:34
Name:L-3 CLIPPER	
Dest:Home	POB:0
ETA :MMDD>09-01	HHMM>00-00

Figure 3–9. Vessel/Voyage Setup

Use the following instructions to enter data for Steps (3) through (9). (Refer to Figure 3–9.)

- Use the LEFT, RIGHT, UP, DOWN arrows to navigate between fields.
- Use the ENT key to select a field to enter.
- Use the alphanumeric keypad to enter the required data into the field.
- Use ENT to save the data entered into the field.

- (3) Enter Data in MMSI Field (MMSI).
- (4) Enter Data in Navigational Status Field (NavS).
- (5) Enter Data in IMO Number Field (IMO#).
- (6) Enter Data in Maximum Sailing Draft Field (MaxD).
- (7) Enter Data in Radio Callsign Field (CSgn).
- (8) Enter Data in Vessel Type Field (Type). (Refer to Table 3–5.)
- (9) Enter Data in Vessel Name Field (Name).

NOTE: Destination (Dest), ETA, and POB are optional fields and can be entered at this time if known.

- (10) Press ESC to return to the UAIS Main System Menu screen.



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Table 3–5. Vessel Type Codes

Special Crafts		Other Ships			
		First Digit		Second Digit	
50	Pilot Boats	1	reserved for future use	0	All ships of this type
51	Search and Rescue Vessels			1	Carrying DG HS or MP IMO hazard or pollutant category A
52	Tugs	2	WIG		
53	Port Tenders	3	See Below		
54	Vessels with anti-pollution facilities or equipment	4	HSC	2	Carrying DG HS or MP IMO hazard or pollutant category B
55	Law Enforcement Vessel	5	See Special Crafts		
56	Spare – for assignment to local vessels	6	Passenger Ships	3	Carrying DG HS or MP IMO hazard or pollutant category C
57	Spare – for assignment to local vessels	7	Cargo Ships		
58	Medical Transport (as defined in the 1949 Geneva Conventions)	8	Tankers	4	Carrying DG HS or MP IMO hazard or pollutant category D
59	Spare – Ships according to RR Resolution No. 18 (Mob-83)	9	Other types of ships		
				5	Reserved for future use
				6	Reserved for future use
				7	Reserved for future use
				8	Reserved for future use
				9	No additional information
		First Digit		Second Digit	
				0	Fishing
				1	Towing
				2	Towing and length of the tow exceeds 200 m or breadth exceeds 25 m
				3	Engaged in dredging or underwater operations
				4	Engaged in diving operations
				5	Engaged in military operations
				6	Sailing
				7	Pleasure craft
				8	Reserved for future use
				9	Reserved for future use
DG: Dangerous Goods					
HS: Harmful Substances					
MP: Marine Pollutants					



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3.1.5.3 Antenna Position Configuration

- (1) On the UAIS Main System Menu screen, use DOWN ARROW key to scroll down to Antenna Position. Press ENT to select. (Refer to Figure 3–10.)

Antenna Position Ref				
INT	A:47	B:14	C:3	D:5
EXT	A:250	B:250	C:50	D:50
Dimensions in Meters				
See ITU-R M.1371 Doc				

Figure 3–10. Antenna Position

NOTE: The INT antenna is the antenna dedicated to the GPS receiver internal to the AIS. The EXT antenna is the antenna dedicated to the ship's dGPS. The dimensions are to be entered in Meters and are defined as follows: (Refer to Figure 3–11.)

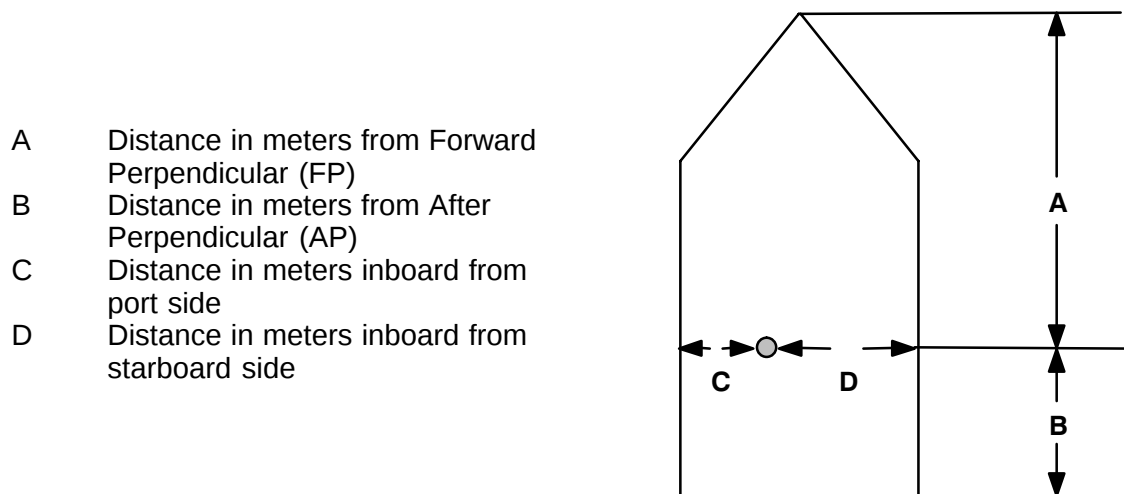


Figure 3–11. Calculating Antenna Position

- (2) Enter AIS Internal GPS Position. (Refer to Figure 3–11.)
 - Enter AIS Internal GPS “A” Position
 - Enter AIS Internal GPS “B” Position
 - Enter AIS Internal GPS “C” Position



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- Enter AIS Internal GPS “D” Position
- (3) Press ENT to save data.
 - (4) Enter External GPS Antenna Position. (Refer to Figure 3–11.)
 - Enter External GPS Antenna “A” Position
 - Enter External GPS Antenna “B” Position
 - Enter External GPS Antenna “C” Position
 - Enter External GPS Antenna “D” Position
 - (5) Press ENT to save data.
 - (6) Press ESC to return to the UAIS Main System Menu screen.
 - (7) Press ESC again to return to the Navigational Display Screen.

3.1.5.4 Verify Transponder Linkup to Ship’s dGPS & GYRO

- (1) Press NAV to go to the Own Ship Information Screen.
- (2) Confirm ship positional data, heading and SOG/COG/ROT data is correct by referencing the equipment repeater display.
- (3) Confirm that there are no alarms after one minute.
- (4) Press ESC to return to the Navigational Display Screen.

The AIS is now placed in service. It is to remain operational at all times when the vessel is operating unless given specific authorization to discontinue operation by local maritime authorities. The only interaction with the interface will be to view surrounding ship traffic identification information and to enter voyage specific data at the start of each voyage.



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SECTION 4

ProTec

AUTOMATIC IDENTIFICATION SYSTEM (AIS)

DRAWINGS



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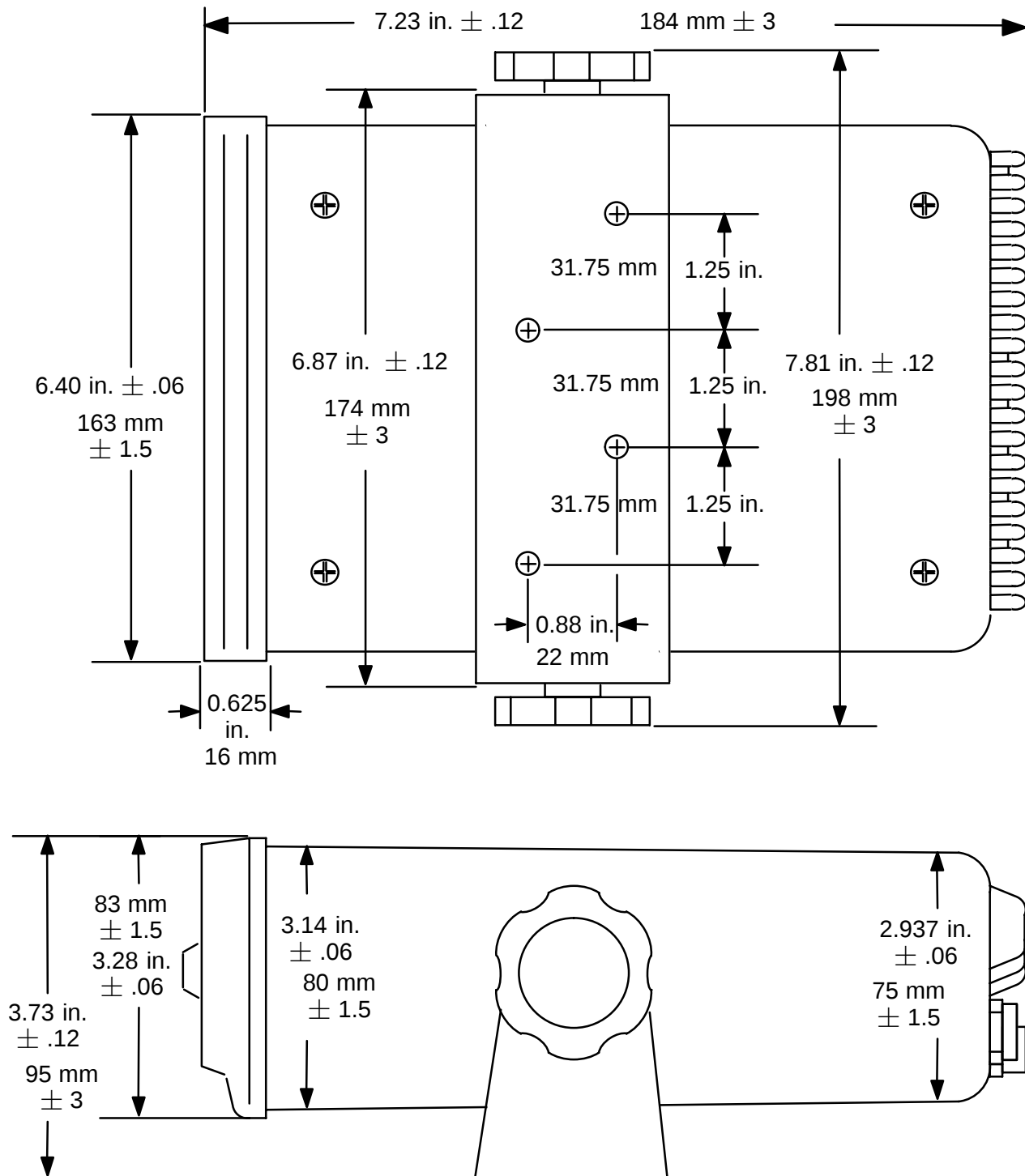


Figure 4-1. AIS Transponder O&D Drawing with Trunion Bracket



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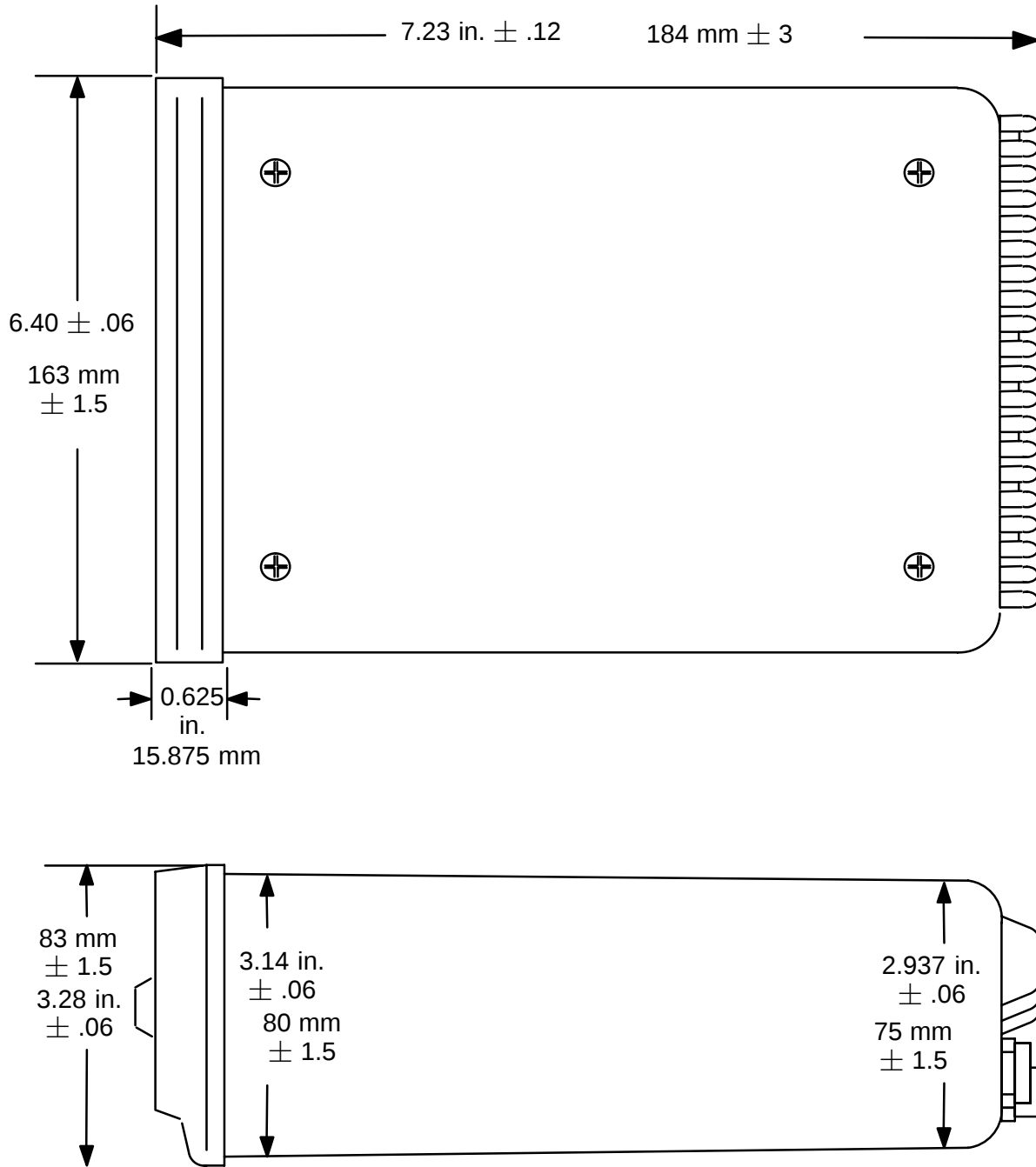


Figure 4-2. AIS Transponder O&D Drawing



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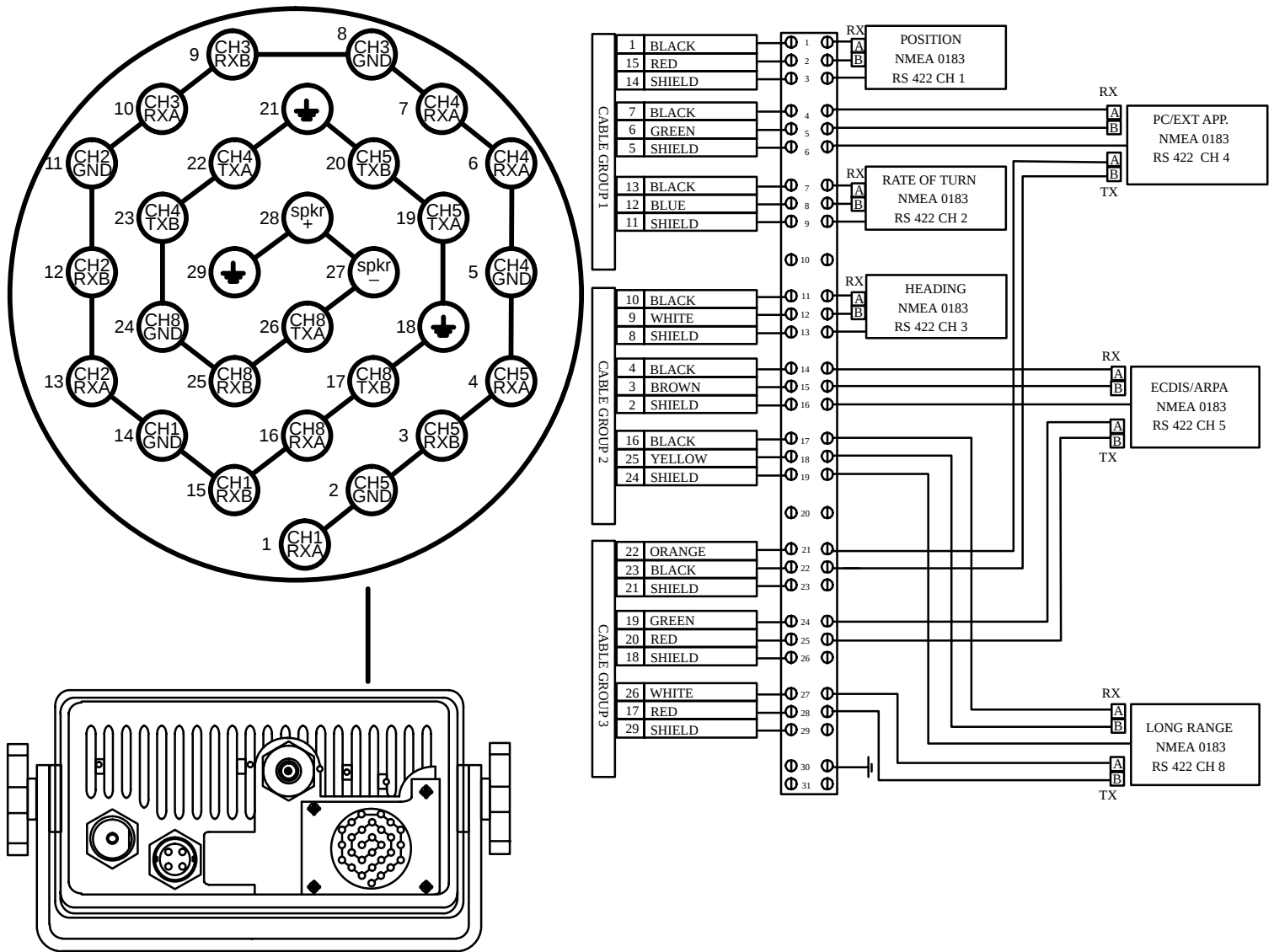


Figure 4-3. IEC Data Cable Interconnect Diagram



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APPENDIX A

ProTec

AUTOMATIC IDENTIFICATION SYSTEM (AIS)

INSTALLATION CHECKLIST



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ProTec AIS INSTALLATION CHECKLIST

Installation Tasks	Completed (Yes / No)	Date
1. Transponder Installed	_____	_____
2. IEC Cable Connected	_____	_____
3. VHF Antenna Installed and Connected	_____	_____
4. GPS Antenna Installed and Connected	_____	_____
Power Up and Configuration Tasks		
1. Transponder Powered Up	_____	_____
2. MMSI Number Entered	_____	_____
3. Navigational Status Entered	_____	_____
4. IMO Number Entered	_____	_____
5. Maximum Sailing Draft Entered	_____	_____
6. Radio Callsign Entered	_____	_____
7. Vessel Type Entered	_____	_____
8. Vessel Name Entered	_____	_____
9. Destination Entered (Optional)	_____	_____
10. POB Entered (Optional)	_____	_____
11. ETA Entered (Optional)	_____	_____
Antenna Configuration Tasks		
1. AIS Internal GPS Position Entered	_____	_____
2. External GPS Antenna Position Entered	_____	_____
3. Transponder Linkup to Ship's dGPS & GYRO Verified	_____	_____
4. No Alarms Verified	_____	_____



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