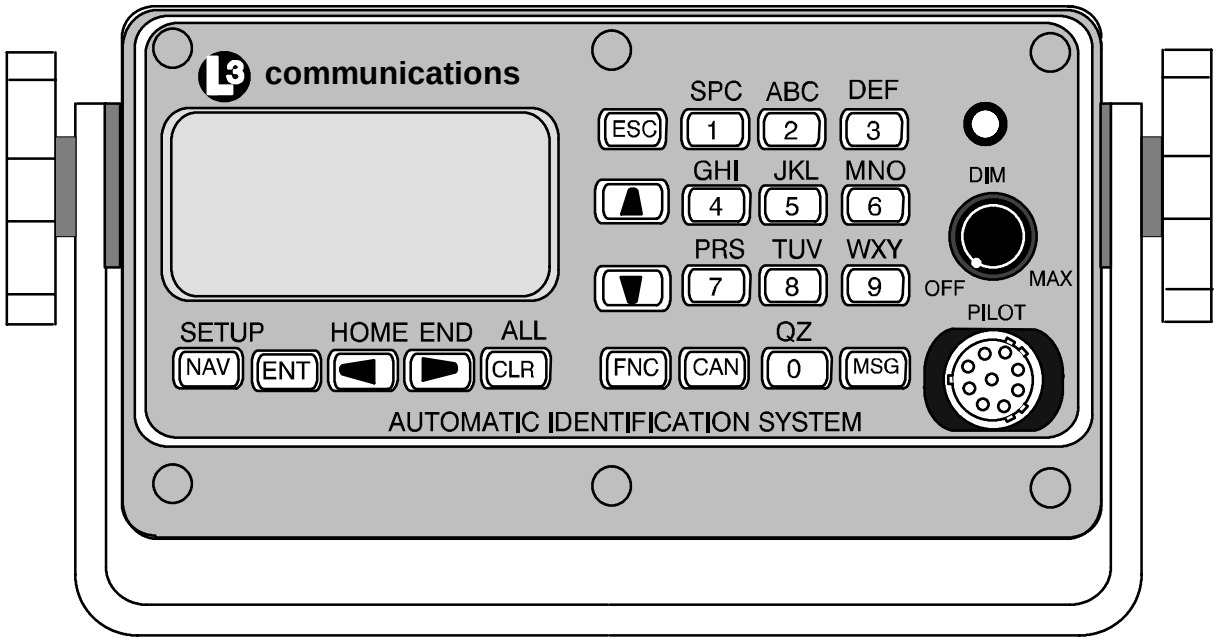
communications

ProTec
AUTOMATIC IDENTIFICATION SYSTEM
HARDWARE
INSTALLATION AND OPERATION MANUAL



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Rev. 02
July 29/03

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communications

Aviation Recorders
Marine Systems

AIS Hardware I&O Manual 165M0014-00
Rev. 02
July 29/03

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Aviation Recorders Publications
Vendor Code: 06141
P. O. Box 3041
Sarasota, Florida 34230
Phone: (941) 371–0811
FAX: (941) 377–5591

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.

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.

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 RF Main PWA (205M0023–00), the Channel 70 PWA (205M0003–01), the Computer PWA (p/n: 205M0272–00), the Display PWA (205M0051–00), the IEC PWA (205M0274–00), and the Controller PWA (205M0008–00).

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.

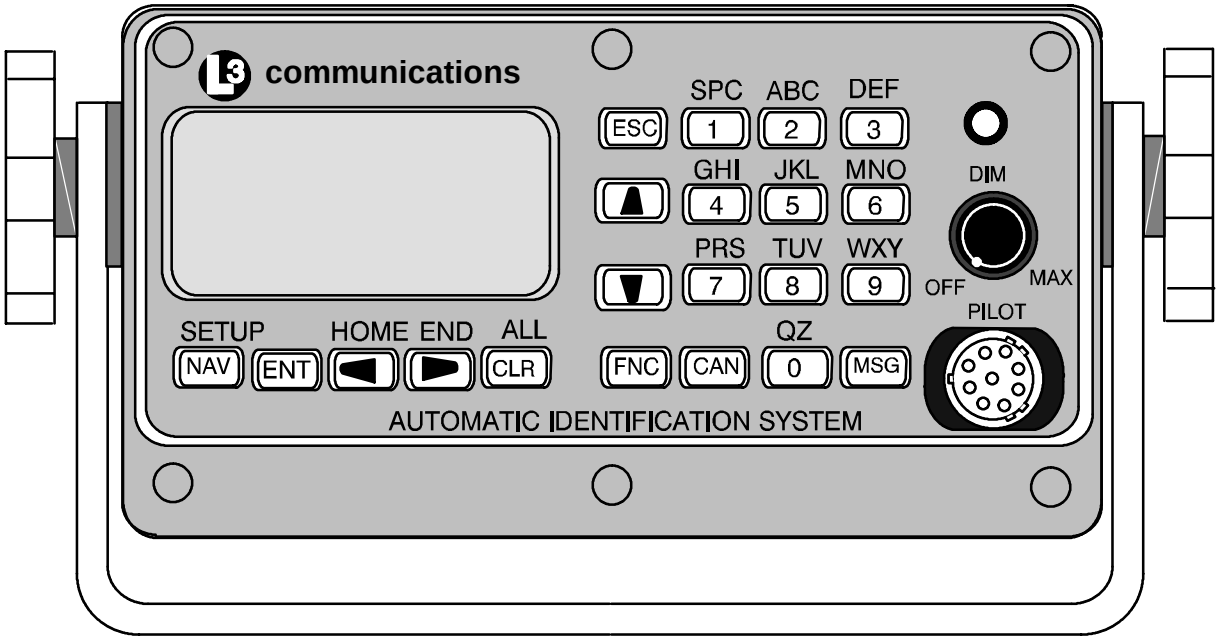
IEC 61993–2 Ed.1, Maritime Navigation and Radiocommunication Requirements – Automatic Identification Systems (AIS) – Part 2: Class A shipborne Equipment of the Universal Automatic Identification System (AIS) – Operational and Performance Requirements, Methods of Test and Required Test Results

IEC 60945 Ed. 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

1.1.3. Acronyms

ABM	Addressed Binary Message
ABK	Ackowledgement Message
ACA	AIS Channel Assigment
ACK	Ackowledgement Message
BBM	Broadcast Binary Message
COG	Course Over Ground
DGPS	Differential Global Positiioning System
GGA	Global Positioning Fix Data
GLL	Geographic Position, Latitude/Longitude
GPS	Global Positiioning 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
VDO	VHF Data–link Own–vessel Message
VSD	Voyage Static Data
VTG	Track Made Good and Ground Speed
ZDA	Date and Time



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, 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)

Internal GPS Receiver

12 Channel, UTC Synchronization Jitter (time between slot start and transmitter on): ± 100 μs

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

12–24 VDC nominal, complies with IEC 60945
Power Supply requirements, 2.5–5 A, 115/230 VAC with Converter

Environment

IEC 60945 for Protected Environment

Frequency

VHF Marine Band

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 of 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 ships 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. (2.5 meters) cable and a terminal block to facilitate the final linkup to the ship’s navigational instruments.

1.3.5. Equipment List

The Standard AIS Installation Kit includes the following equipment:

- Transponder Unit with Trunion OR Flush Mount
- IEC NMEA Data Cable
- Terminal Block (for data interface)
- Power Cable
- Installation Manual and parts kit

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	AISA1000-00
Trunion Mount	0780019011
Flush Mount	0010019002
IEC Cable	024M0088-00
Power Cable	024M0086-00
Pilot Port Cable	024M0099-00
12V DC Power Supply (AC/DC Power Converter)	0810006015

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 ID's, 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.

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.

- 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.

1.4. 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 AIQ, SSD – Query Station Static Data AIQ, VSD – Query Voyage Static Data

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.

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: 024M0099–00. The Pilot input/output port meets the requirement of IEC 61162–2 and is terminated as follows:

- TX A is connected to Pin 1
- TX B is connected to Pin 4
- RX A is connected to Pin 5
- RX B is connected to Pin 6
- Shield is connected to Pin 9

1.4.4. Long Range equipment interface

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.

The Officer of the Watch must approve the Long Range replay 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 1–4.

- 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 1-4. 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

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 1-5.

- 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.

Table 1-5. 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

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 1–6.

Table 1–6. 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

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 and integral MKD which is fully IMO compliant. It is recommended that the MKD **should not act as the primary display** due to limitations in data presentation options. It should be used for configuration of the hardware and entry of vessel and voyage specific data, which is required infrequently. It may also serve as a backup display if the external display were to malfunction. L–3 strongly recommends that the AIS Target Display Software (TDS) be used as the primary AIS display system and this software is available from the hardware supplier. TDS is a basic yet powerful graphic display software compatible with Windows™ which provides numerous display options for the AIS data. Contact L–3 Communications for further information and acquisition. The front face of the L–3 ProTec contains the following controls.

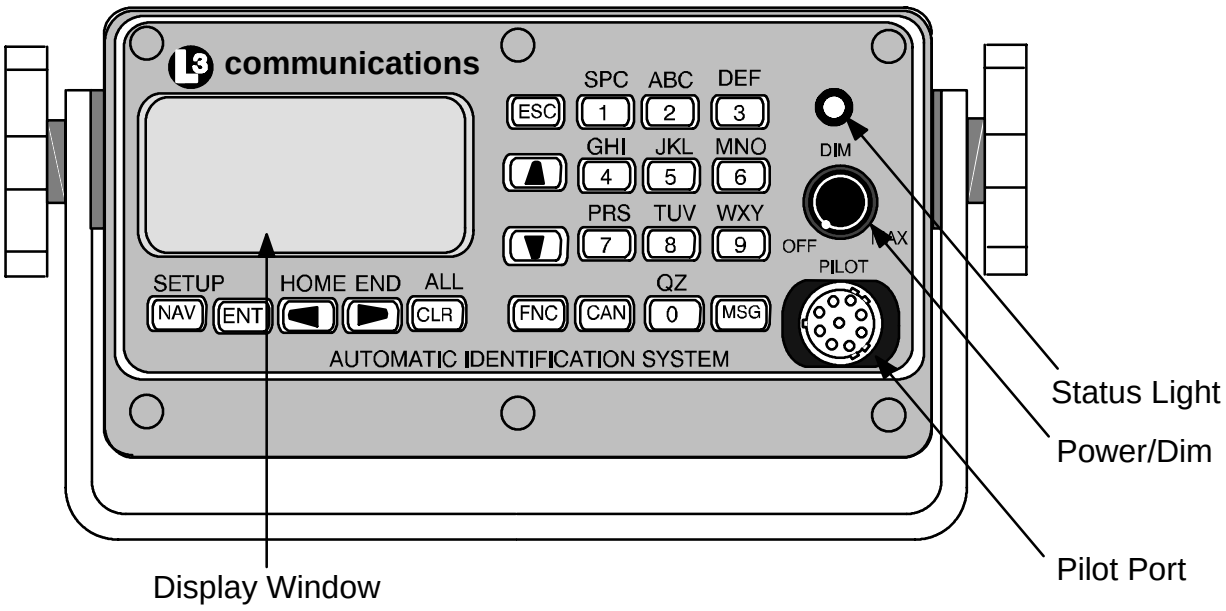


Figure 2–1. AIS Transponder

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 back-light 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) 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.

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 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 system configuration menu system.

HOME Returns cursor to start position in a data entry field

END Returns cursor to end position in a data entry field

ALL Will clear all contents of a data entry field when preceded by the FNC key.

The alphanumeric keypad is used to enter both numbers and letters. When alphanumeric text entry is expected, the nonnumeric 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 a fairly short time) will cause a “B” to be displayed. The next press shows a “C”, while the forth press shows a “2”.

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.

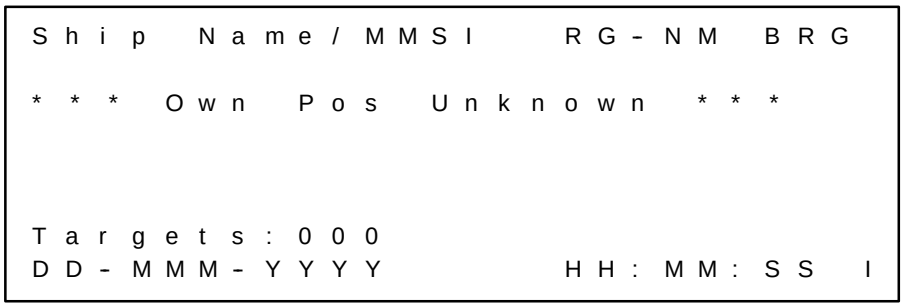
FNC–ENT Own Ship display

(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.

NOTE: The letter in the lower right hand corner of the screen depicts the type of time that is being indicated. S = slot time, I = Internal GPS, F = Flywheel, N = Time not available.



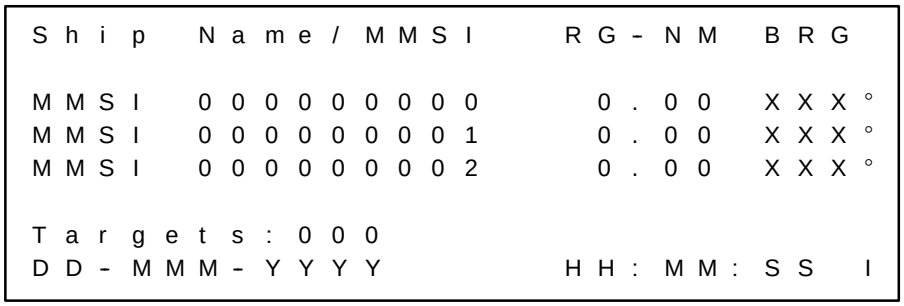


Figure 2–2. NAV Display Screens

Displays ID, Range, and Bearing of nearest three (3) vessels sorted by range, closest first. This is the default display screen and accessed from anywhere within the menu system by pressing the NAV key. As the default screen, it will display automatically after 10 seconds of inactivity on any other screen. Each vessel will be displayed using their MMSI if the ship name is not know, and the user can toggle between MMSI and Shipname using LEFT or RIGHT arrow keys.

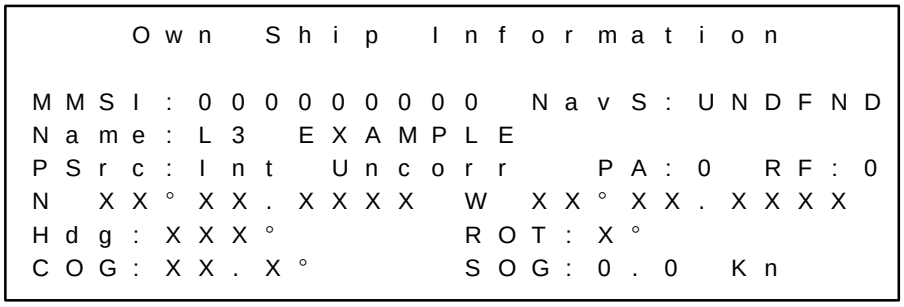


Figure 2–3. Own Ship Data Display

Display navigational information for own–ship and configuration details. This is accessed by the sequence FNC ENT. The data that is displayed is as follows:

MMSI Maritime Mobile Service ID

NavS Navigational Status
Options:

Underway
At Anchor

Name Shipname

Psrc Positional Data Source

PA Positional Accuracy
Options:

0 = External DGNSS in use (corrected)
1 = Internal DGNSS in use (corrected, message 17)
2 = Internal DGNSS in use (corrected, beacon)
3 = External EPFS in use (uncorrected)
4 = Internal GNSS in use (uncorrected)
5 = No sensor position in use

RF RAIM Flag (receiver autonomous integrity monitoring, check GPS status)

Lat	Latitude
Lon	Longitude
Hdg	Vessel Heading in degrees true from Gyrocompass
ROT	Rate of turn in degrees/sec (– denotes port, + denotes stbd)
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 System Configuration 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 main System Configuration screen, allowing the user to go to another menu selection.

The System Configuration and Status menu contains the following options:

- Logon / Logoff
- Vessel / Voyage Setup
- Antenna Position Setup
- View Safety Text Log
- View Alarm Status
- View Down–Time Log
- Edit Change Management Settings
- Change Password

NOTE: Figure 2-4 shows the System Configuration and Status menu screen as it appears as the user initially enters this menu. Not shown is the Change Password option.

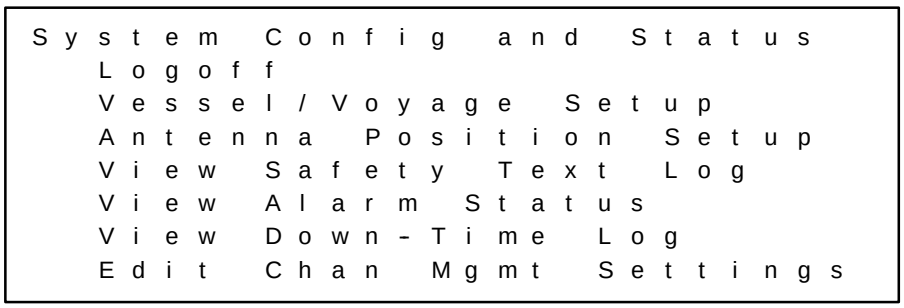


Figure 2-4. System Configuration Screen

2.1.4.1 Vessel Data 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 9 characters)

NavS: Navigational Status. When in field, use down arrows to scroll through available option and click ENT to select.

IMD#: Official IMO designation ID for vessel
(0 = not available= default)

MaxD: Maximum sailing draft in Meters
(0.1 to 25.5 meters)

Csgn: Radio Callsign
(maximum 7 characters)

Type: Vessel Type
(refer to Table 2-1)

Name: Vessel Name
(maximum 20 characters)

Dest: Name of next Destination
(maximum 20 characters)

ETA: Estimated Time of Arrival
(MMDDHHMM UTC)

Table 2-1. Vessel Type Codes

Special Crafts	Other Ships	
	First Digit	Second Digit
50 Pilot Boats 51 Search and Rescue Vessels 52 Tugs 53 Port Tenders 54 Vessels with anti-pollution facilities or equipment 55 Law Enforcement Vessel 56 Spare for assignment to local vessels 57 Spare for assignment to local vessels 58 Medical Transport 59 Spare for assignment to other special vessels	6 Passenger Ships 7 Cargo Ships 8 Tankers 9 Other types of ships DG Dangerous Goods HS Harmful Substances MP Marine Pollunants	0 All ships of this type 1 Carrying DG HS or MP IMO hazard or polluant category A 2 Carrying DG HS or MP IMO hazard or polluant category B 3 Carrying DG HS or MP IMO hazard or polluant category C 4 Carrying DG HS or MP IMO hazard or polluant category D 5 Not under command 6 Restricted by her ability to manuever 7 Constrained by her draught 8 Spare 9 No additional information

To enter vessel and voyage information, perform the following:

(1) Press the FNC key, press the Setup key. The System Configuration screen will appear.

(2) Using the down Arrow key, select Vessel / Voyage Setup, and press the ENT key.

(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 System Configuration screen.

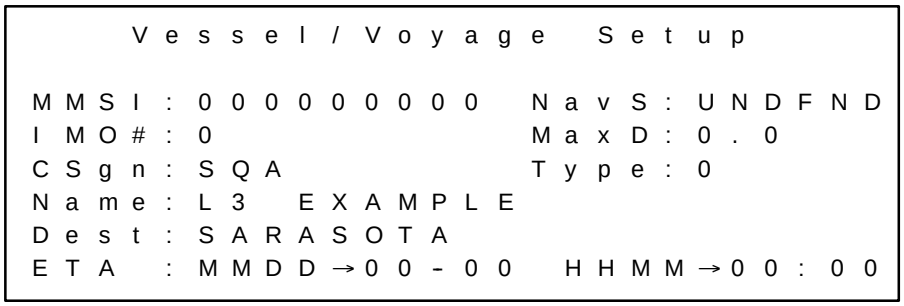


Figure 2-5. Vessel Data Setup

2.1.4.2 Channel Management

This screen is designed for the initial setup for the AIS Transponder channel operation. The L-3 ProTec Transponder will hold up to eight different channel configurations. 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.

For the initial setup perform the following:

(1) Press the FNC key.

(2) Press the Setup key. The System Configuration 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 2-6.)

(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 to save the data.

(7) If another region is required, press the right arrow key to move to the next screen and repeat steps (4) through (6).

(8) Press the ESC key to return to the System Configuration screen.

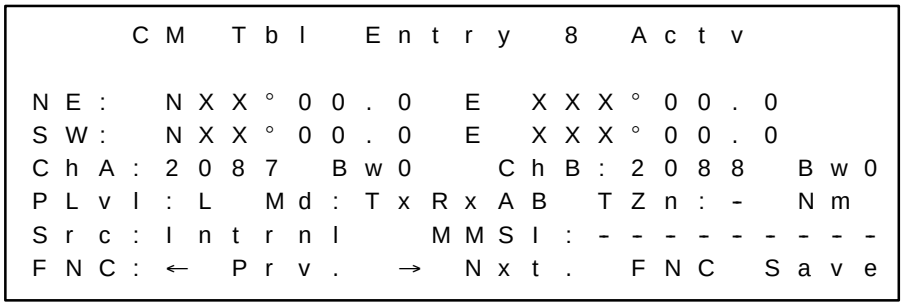


Figure 2-6. Channel Management Settings Screen

2.1.4.3 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:

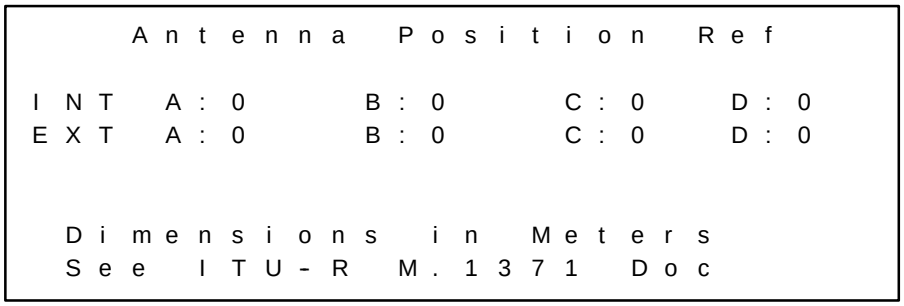


Figure 2-7. Antenna Position Screen

To enter the antenna position, perform the following:
(Refer to Figure 2-7 and Figure 2-8)

(1) Press the FNC key.

(2) Press the Setup key. The System Configuration 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 System Configuration screen.

All dimensions defined below are entered in meters.

A Distance in meters from Forward Perpendicular (FP)

B Distance in meters from After Perpendicular (AP)

C Distance in meters inboard from port side

D Distance in meters inboard from starboard side

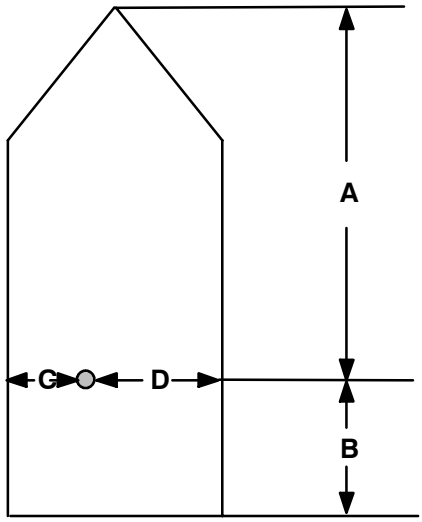


Figure 2-8. Antenna Position Measurements

2.1.4.4 Text Messaging

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

To send a addressed message, perform the following:

(1) Press MSG key.

(2) Press the down arrow key until the MMSI is highlighted.

(3) Press the ENT key, and enter the MMSI number of the ship to be addressed.

(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 message portion of the screen, 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 they MMSI number is all zeros.

(3) If the MMSI is not all zeros, press the down arrow key until the MMSI is highlighted.

(4) Press the ENT key, and enter all zeros for the MMSI number.

(5) Press the down arrow key to highlight “Mode” and press the ENT key.

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

(7) Using the down arrow key, highlight the message portion of the screen, type in the message.

(8) Press the MSG key to broadcast the message.

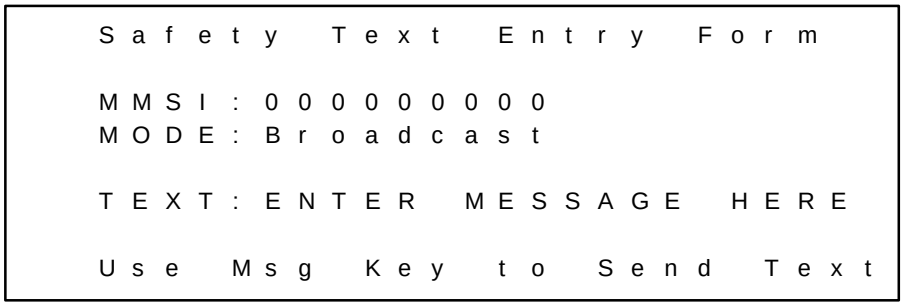


Figure 2-9. Safety Text Message

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

(1) Press the FNC key.

(2) Press the Setup key. The System Configuration 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 down left and right arrows to view previous or next messages respectively.

(5) Press the ESC key to return to the System Configuration screen.

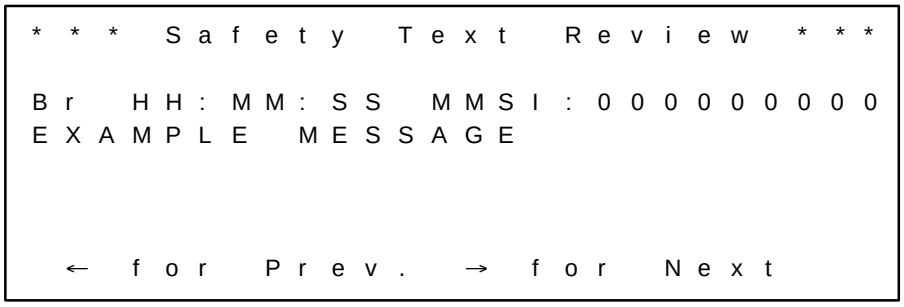


Figure 2-10. Safety Text Review Screen

2.1.4.5 Password Entry

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

NOTE: The default administrative password is L3AIS, and the default user password is L3USR.

Table 2-2. Password Type Menu Screen Access

Menu Screen	Administrative Password	User Password
System Configuration	Edit All Fields	Edit All Fields
Vessel Data Setup	Edit All Fields	Edit All Fields except MMSI Number, IMO Number, Call Sign, Name of Ship
Channel Management Settings	Edit All Fields	Read Only
Antenna Position	Edit All Fields	Edit All Fields
Safety Text Message	Edit All Fields	Edit All Fields
Safety Text Review	Access Allowed	Access Allowed
Password Entry	Data Entry Allowed	Data Entry Allowed
Password Edit	Edit All Fields	Read Only
System Alert	Access Allowed	Access Allowed
Alarm Status	Access Allowed	Access Allowed
Down-Time Log	Access Allowed	Access Allowed

NOTE: Access denotes the abilitly to view the menu and take appropriate actions for the screen.

To log on perform the following:

(1) Press the FNC key.

(2) Press the Setup key. The System Configuration screen will appear.

(3) Using the down Arrow key, 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 System Configuration screen.

To log off perform the following:

(1) Press the FNC key.

(2) Press the Setup key. The System Configuration screen will appear.

(3) Using the down Arrow key, select Logon, and press the ENT key. The user is now logged off of the AIS Transponder.

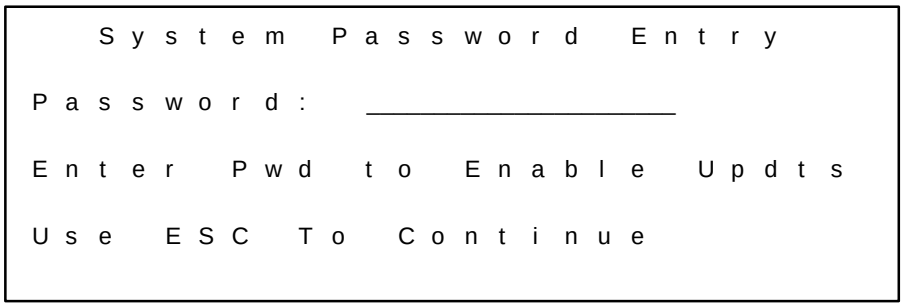


Figure 2-11. Password Entry Screen

2.1.4.6 Change Password

<u>NOTE</u>: 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 Setup key. The System Configuration 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 in both fields, and press the ENT key. This will save the new password.

(5) Press the ESC key to go back to the System Configuration screen.

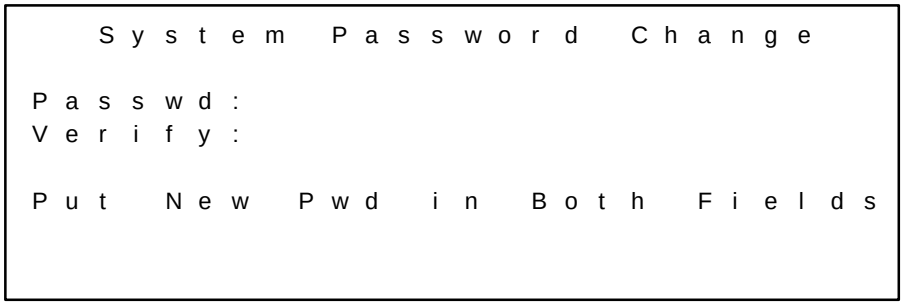


Figure 2-12. Password Change Screen

2.1.4.7 System Alert Screen

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

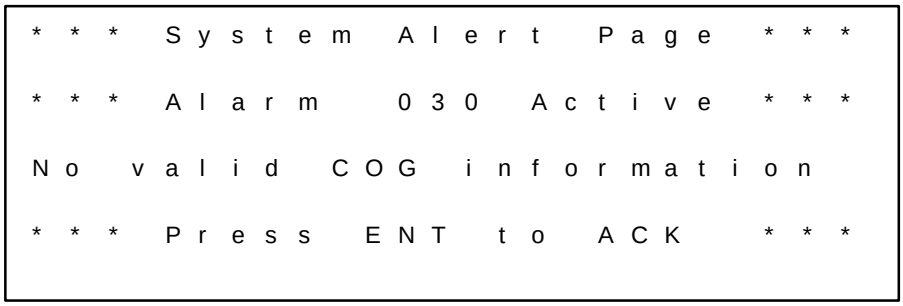


Figure 2-13. System Alert Screen

2.1.4.8 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.

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

(1) Press the FNC key.

(2) Press the Setup key. The System Configuration screen will appear.

(3) Using the down Arrow key, select “View Alarm Status”, and press the ENT key.

(4) Use the down left and right arrows to view previous or next messages respectively.

(5) Press the ESC key to return to the System Configuration screen.

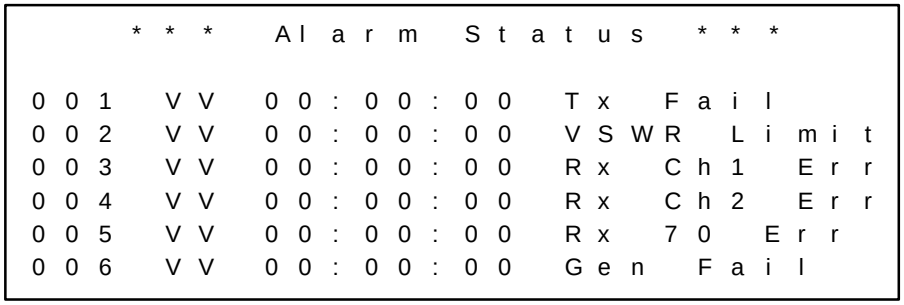


Figure 2-14. Alarm Status Screen

2.1.4.9 Down-Time Log

To review Down-Time Log, perform the following:

(1) Press the FNC key.

(2) Press the Setup key. The System Configuration 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 System Configuration screen.

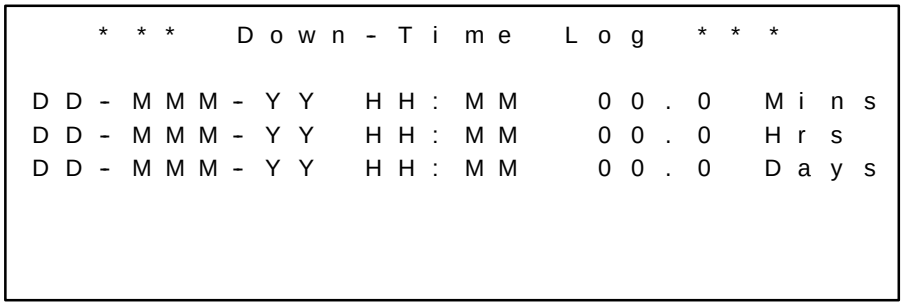


Figure 2-15. Down-Time Log Screen

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.

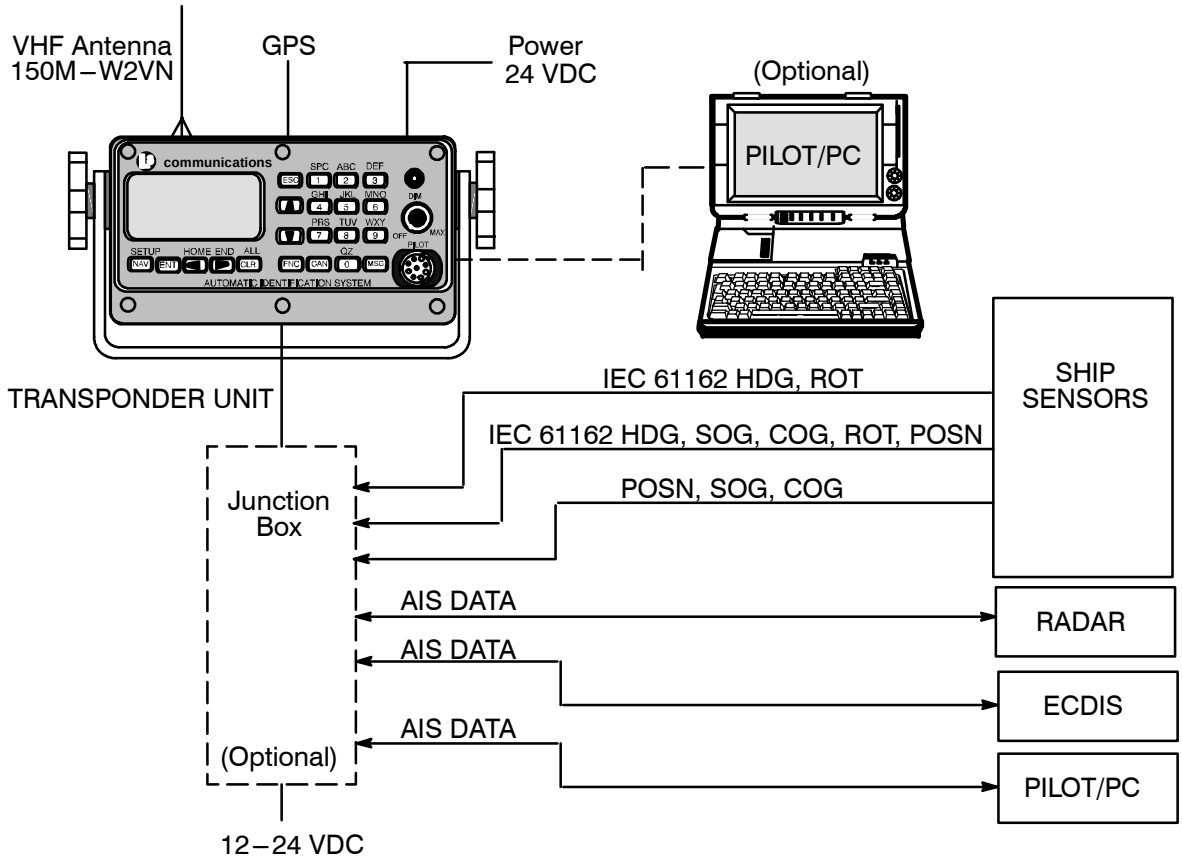


Figure 3-1. AIS Transponder Interconnection Diagram

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 Figure 3–2 and Figure 3–3) and can be mounted in a trunion bracket or mounted flush using the available flush–mount bracket. Install the transponder is as follows:

(1) 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.

(2) If used, Mount the transponder in the trunion utilizing the trunion knobs provided, otherwise mount transponder in flush mount bracket.

(3) 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 (2.5 m) long and the terminal block should be located to take this into account. Locate the terminal block in a fashion which allows for easy access to the terminals for making the connections to required input/output feeds.

(4) Refer to Figure 3–4. Connect the transponder power cable to the power connection on the Transponder and connect to the ships 12–24 Vdc power supply. 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.

For steps (5) through (7) refer to Paragraph 3.1.2.

(5) Connect the IEC cable to data port on back of Transponder using J4 connector provided.

(6) Lead data cables from Gyrocompass data output port and ship’s DGPS data output port. To terminal block. 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.

(7) Feed the IEC data cable pigtail to the terminal block.

(8) Do not power up the unit at this time. The transponder should not be powered up without the VHF antenna connected.

(9) If an external display system is to be connected for display of the AIS target data, lead the cable from the display unit to the terminal block. (Refer to Figure 3–5.)

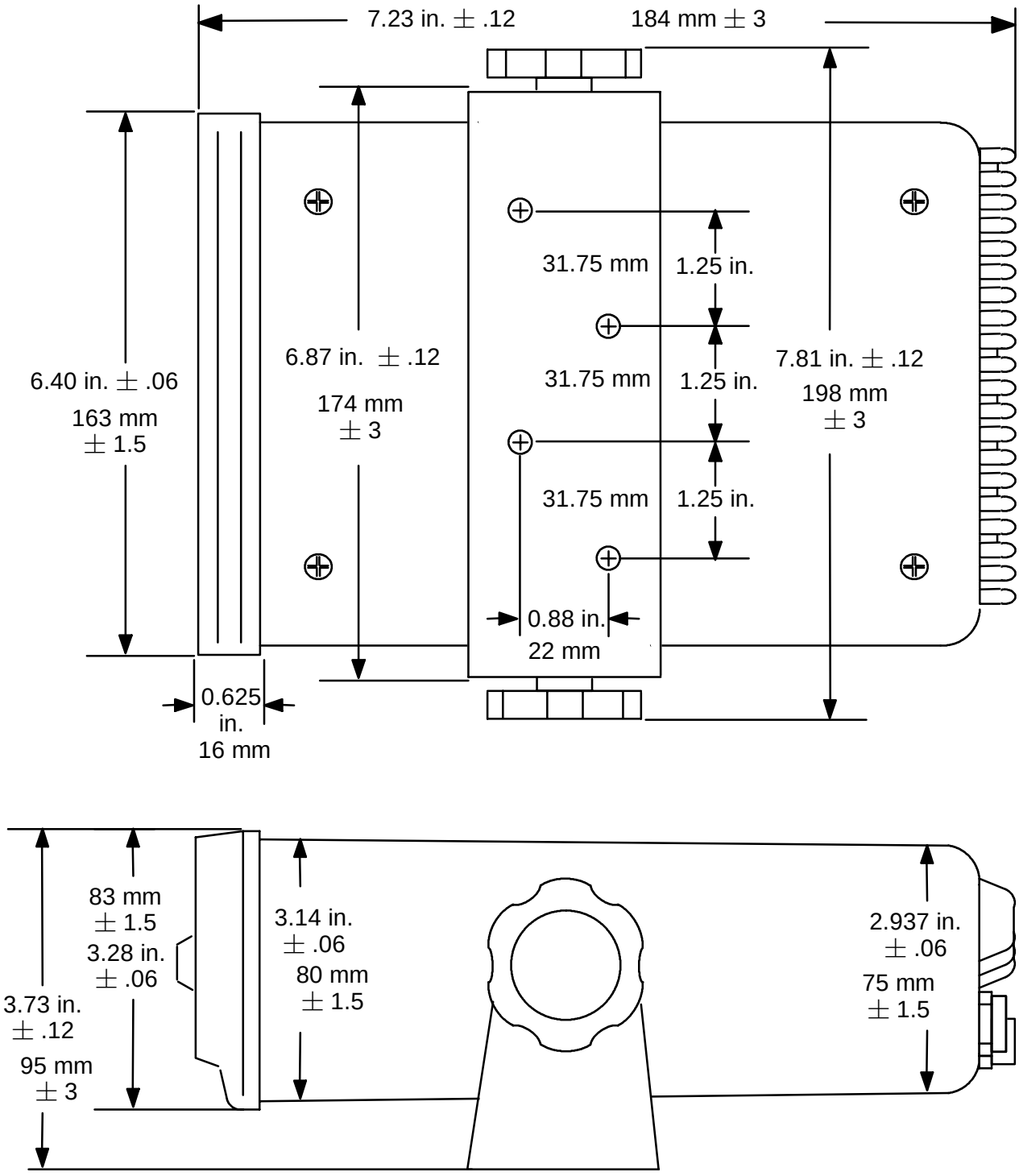


Figure 3-2. AIS Transponder O&D Drawing with Trunion Bracket

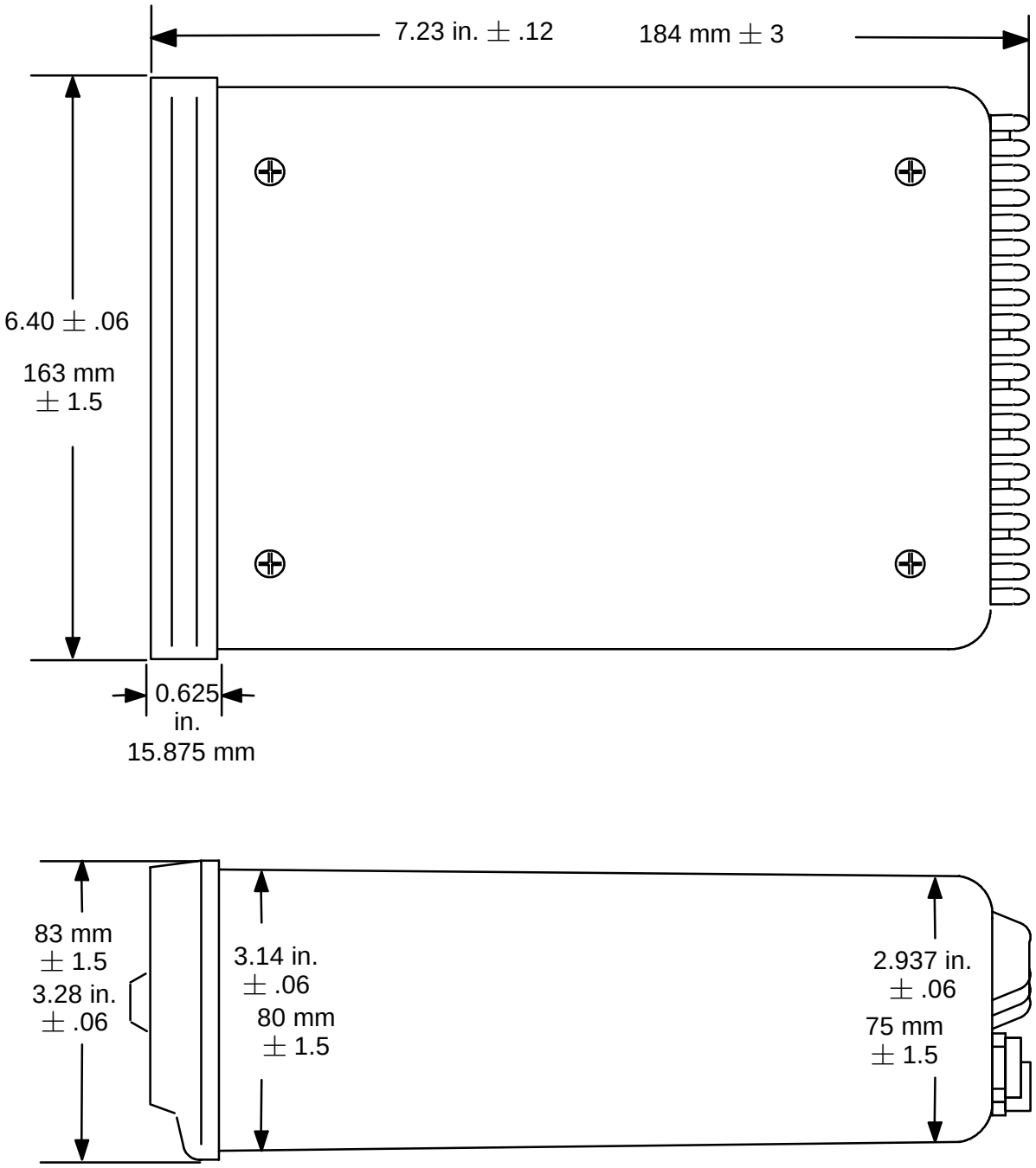
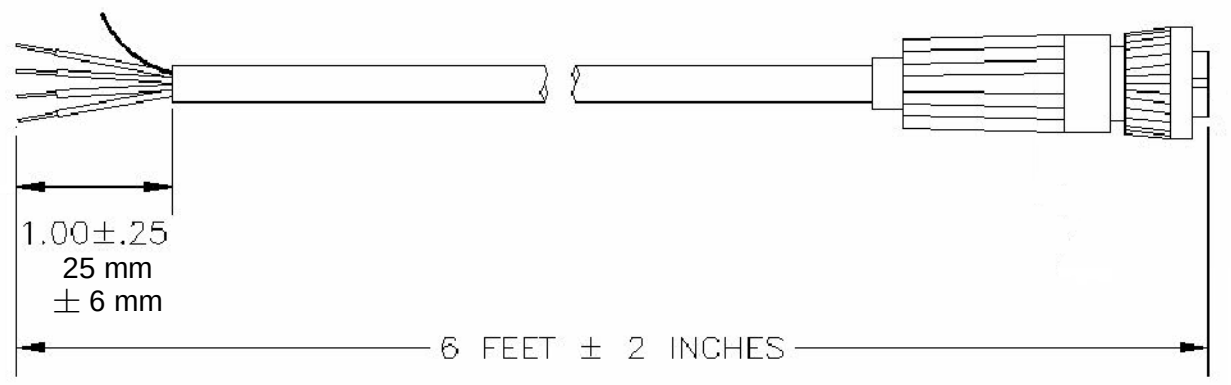
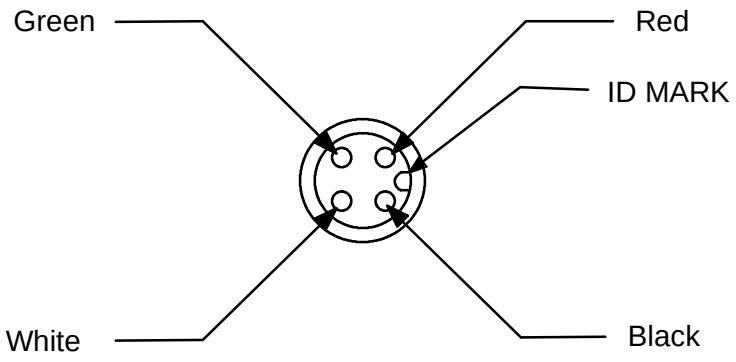


Figure 3-3. AIS Transponder O&D Drawing





Cable End

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	+12VDC/5A to +24VDC/2.5A (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 3–4. AIS Transponder Power Cable

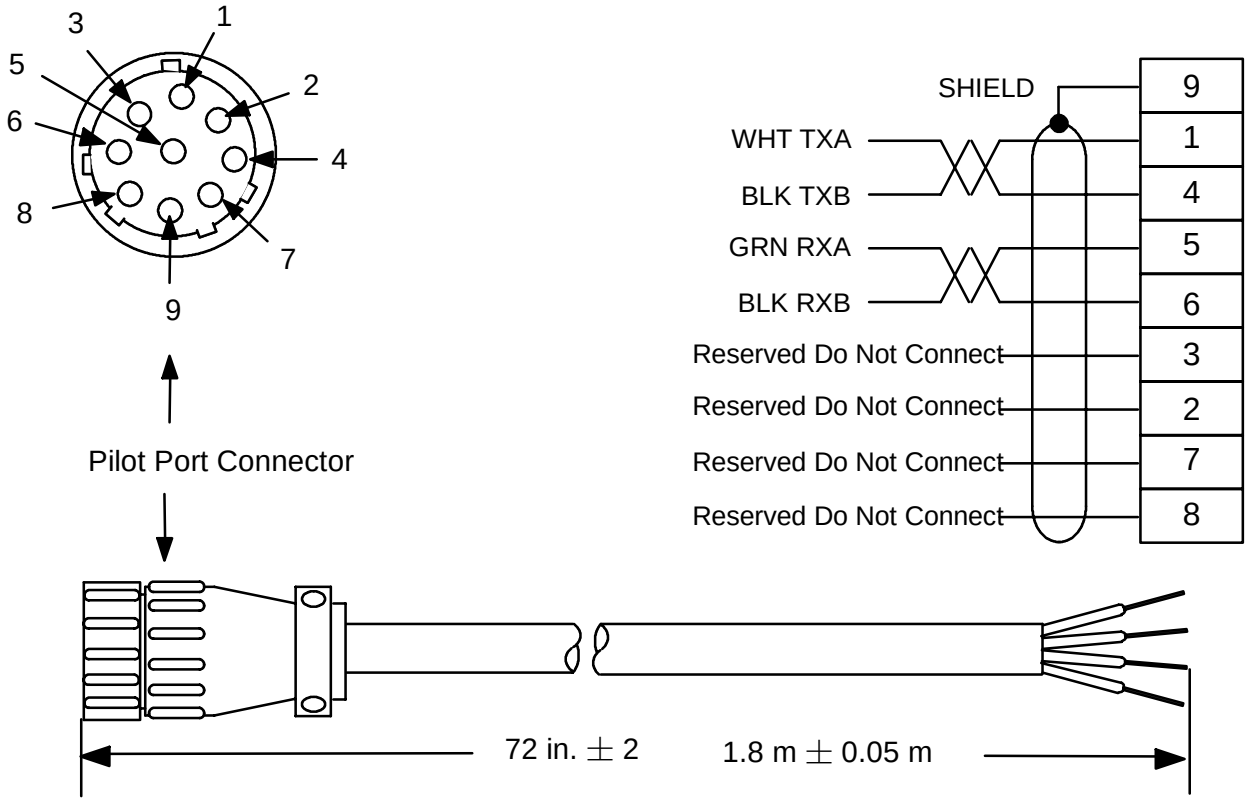


Figure 3-5. Pilot Port Cable

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 postive voltage when referenced to ground would indicate "B".

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 024–M0088–01. 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. Refer to Figure 3–7. 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 channels (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)

3.1.2.2 Data Cable

Each transponder will come shipped with an 100 inches long IEC data cable (P/N 024–M0088–01) terminated at one end by a J4 connector. (Refer to Figure 3–6, Figure 3–7 and Figure 3–8.) 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.

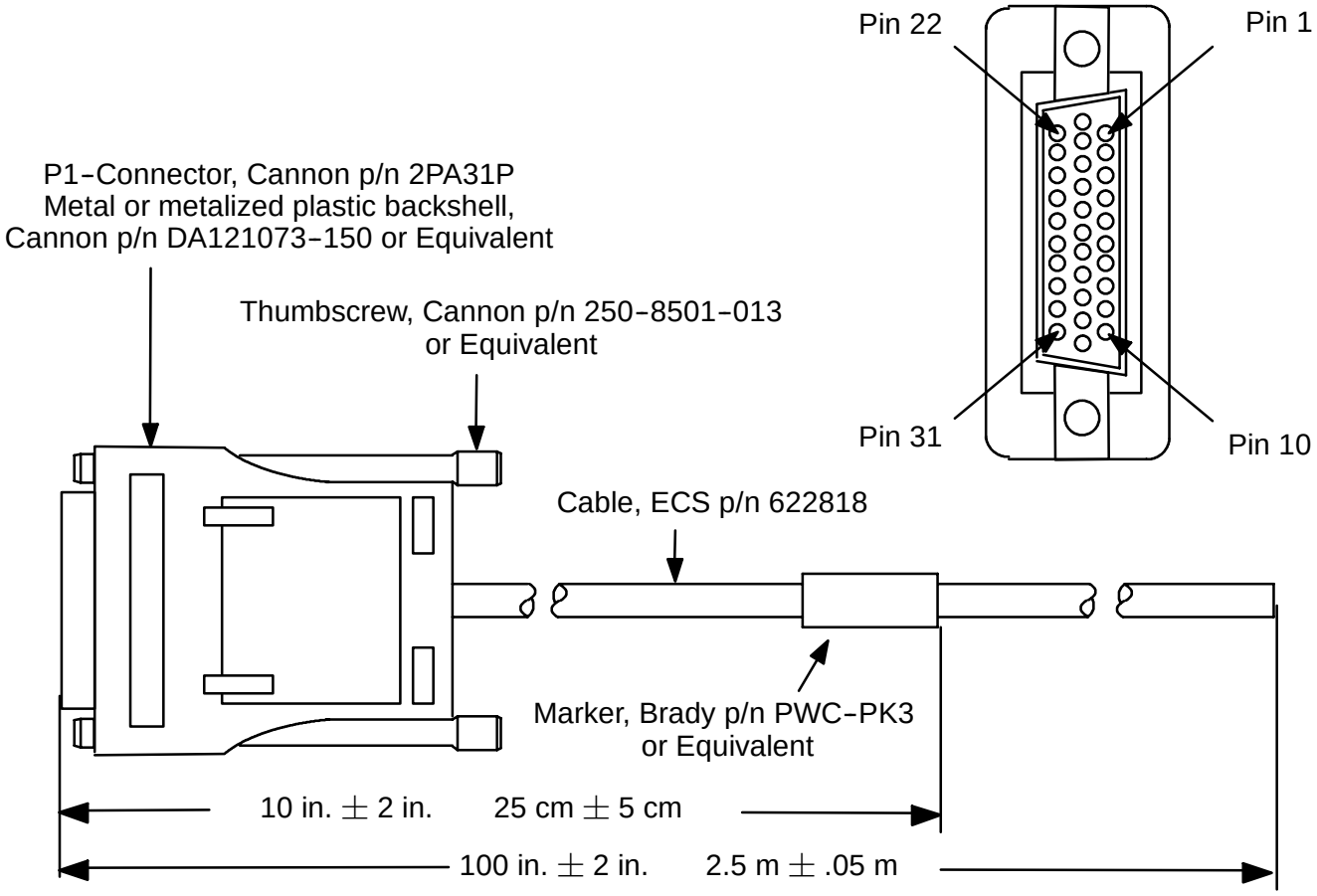


Figure 3–6. AIS Transponder IEC Data Cable

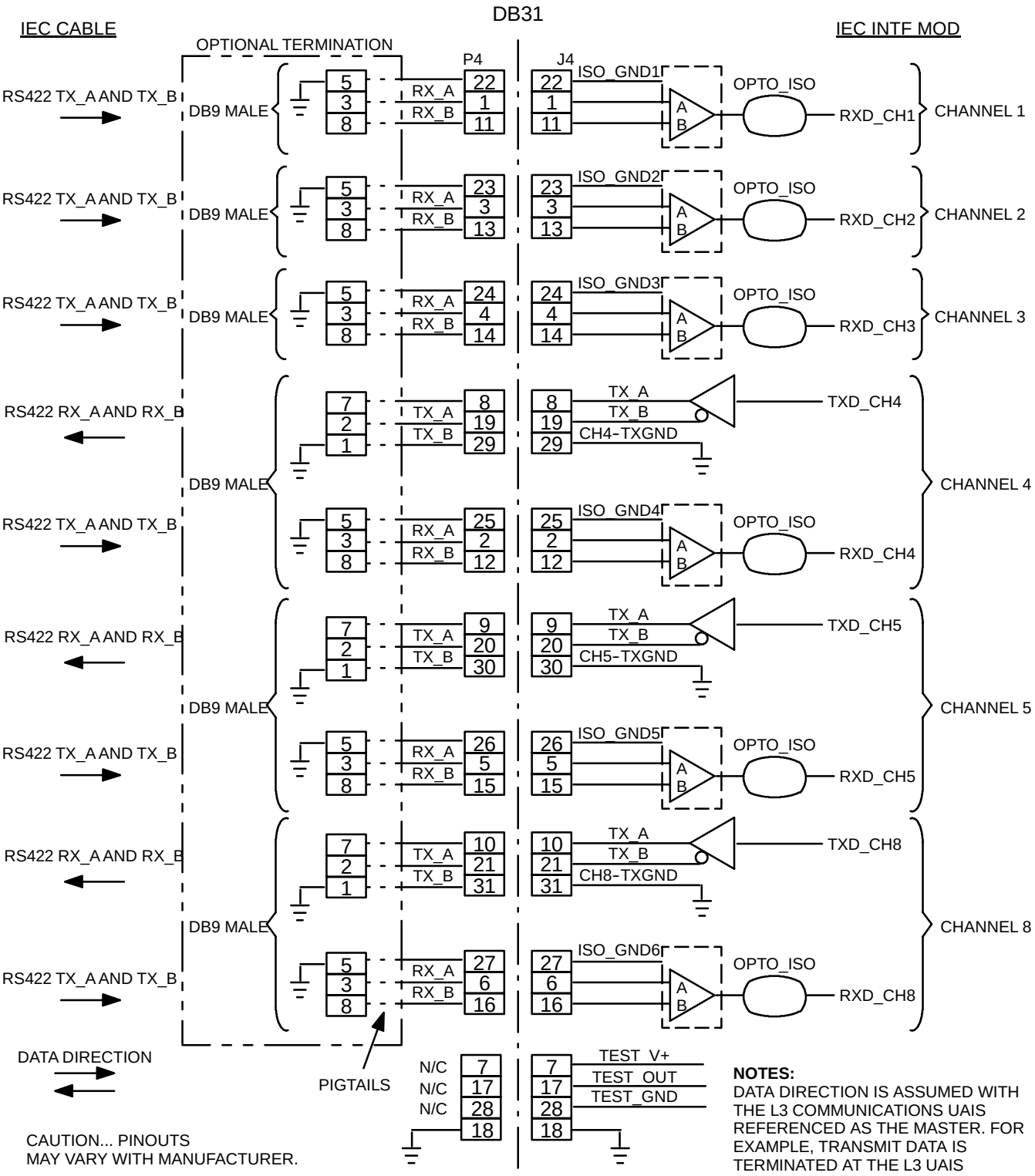


Figure 3-7. IEC Data Cable Interconnect Diagram

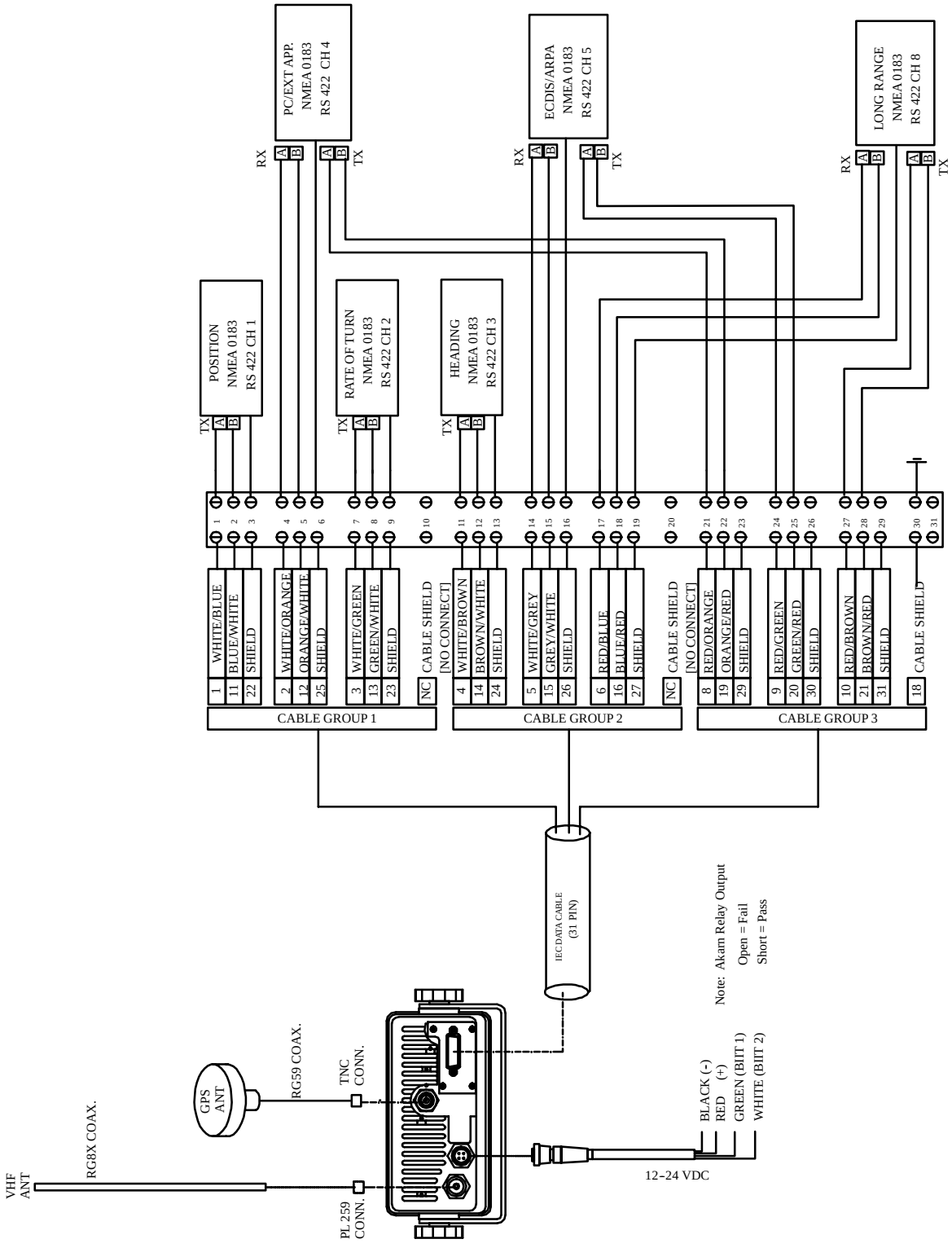


Figure 3–8. IEC Data Cable External Wiring Diagram

3.1.2.3 Terminal Block

Each Transponder will come shipped with a 31 pin 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.

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.

To complete the data connection to the ship's sensors, perform the following:

(1) Connect the data cable to the back of the transponder unit.

(2) Feed the data cable into the console to the position in which the terminal block will be placed.

(3) 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.

(4) Mount the terminal block to the ships structure with self tapping screws

(5) Ground terminal block to ship's structure using grounding cable provided.

(6) Connect each wire to the correct terminal block position. Use the table below which gives the IEC pin ID (and color code) and identifies the correct terminal block position ID.

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.

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.

Table 3-2. IEC Cable and Junction Box Pinouts

Cable	STP	Wire Color	IEC Pin	TB Pin
Cable 1	1	White / Blue	1	1
		Blue / White	11	2
		Drain	22	3
	2	White / Orange	2	4
		Orange / White	12	5
		Drain	25	6
	3	White / Green	3	7
		Green / White	13	8
		Drain	23	9
		Shield Drain	NC	10
Cable 2	4	White / Brown	4	11
		Brown / White	14	12
		Drain	24	13
	5	White / Gray	5	14
		Gray / White	15	15
		Drain	26	16
	6	Red / Blue	6	17
		Blue / Red	16	18
		Drain	27	19
		Shield Drain	NC	20
Cable 3	7	Red / Orange	8	21
		Orange / Red	19	22
		Drain	29	23
	8	Red / Green	9	24
		Green / Red	20	25
		Drain	30	26
	9	Red / Brown	10	27
		Brown / Red	21	28
		Drain	31	29
		Shield Drain	18	30

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 3–9 and Figure 3–10.)

(1) Position the antenna mounting bracket on a rigid and structurally sound surface. In general, two bracket types are available, a rail mount and a flat (padeye) mount. Some mounts have a ratchet mechanism which allows them to be mounted on an inclined surface. Whichever mount is used; ensure the quality of the mount. L–3 recommends a heavy gage stainless steel mount be used in the mounting of the antenna.

(2) Install the antenna on the antenna mount.

(3) Run the coaxial cable from the antenna to the transponder location. Use only high quality RG8X or RG214 coaxial cable and keep cable length as short as possible to reduce signal attenuation.

(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 not required.

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 3–9 and Figure 3–10.)

(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.

(3) Run the coaxial cable from the antenna to the transponder location through an existing throughhull. Use only high quality RG59 coaxial cable and keep cable length as short as possible to reduce signal attenuation.

(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 not required.

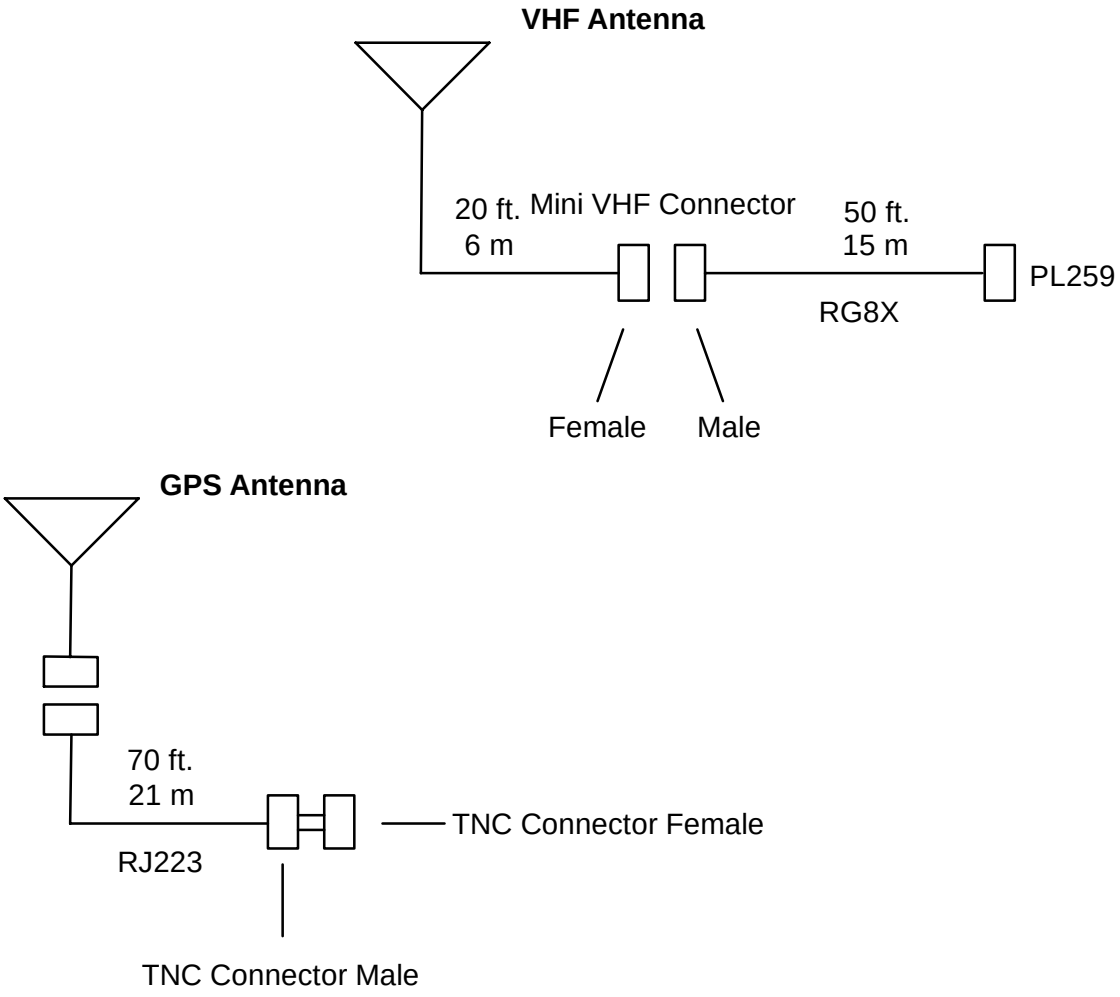
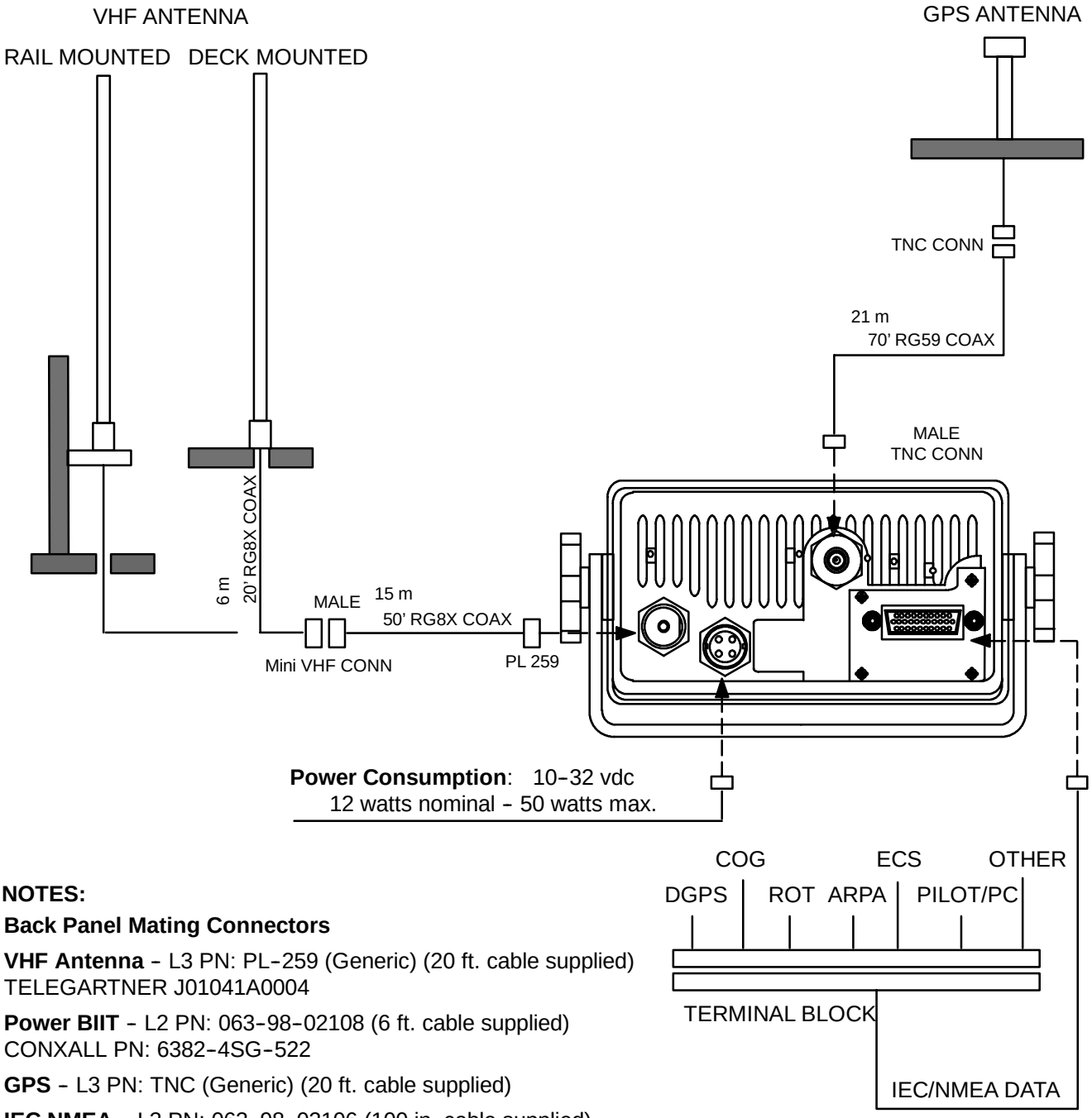


Figure 3-9. AIS Transponder Antenna Diagram



NOTES:

Back Panel Mating Connectors

VHF Antenna – L3 PN: PL–259 (Generic) (20 ft. cable supplied)
TELEGARTNER J01041A0004

Power BIIT – L2 PN: 063–98–02108 (6 ft. cable supplied)
CONXALL PN: 6382–4SG–522

GPS – L3 PN: TNC (Generic) (20 ft. cable supplied)

IEC NMEA – L3 PN: 063–98–02106 (100 in. cable supplied)
HIROSE PN: HR22–12TPD–20S

Figure 3–10. AIS Transponder Rear View

3.1.5. PowerUp and Configuration

At this stage you should have the following steps completed:

- Transponder installed and 10–32 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 3–11 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. The following procedure should be followed to carry out final setup and testing of the AIS Transponder.

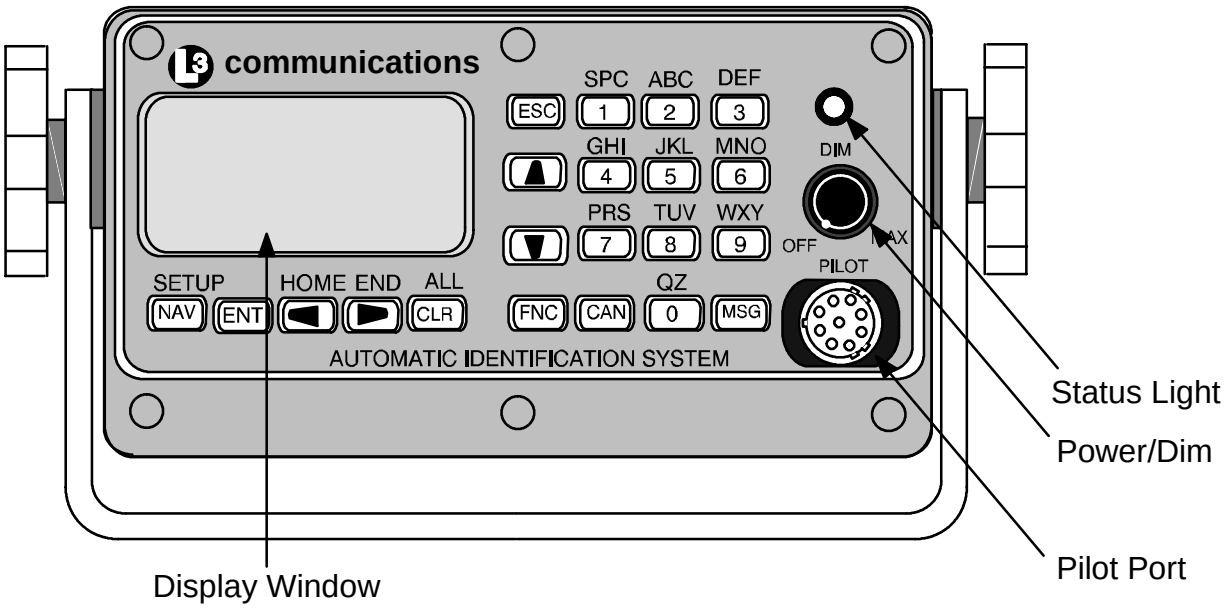


Figure 3-11. AIS Transponder MKD

(1) Turn on the Transponder. Rotate the POWER button clockwise. This knob also controls the brightness of the backlighting such that rotation of the knob clockwise dims the backlight level.

(2) Check the STATUS light to ensure power is supplied to unit. Steady light indicates normal operation.

(3) Enter Vessel Static Information and Voyage Information. Press FNC and then NAV to get to the System Configuration screen.

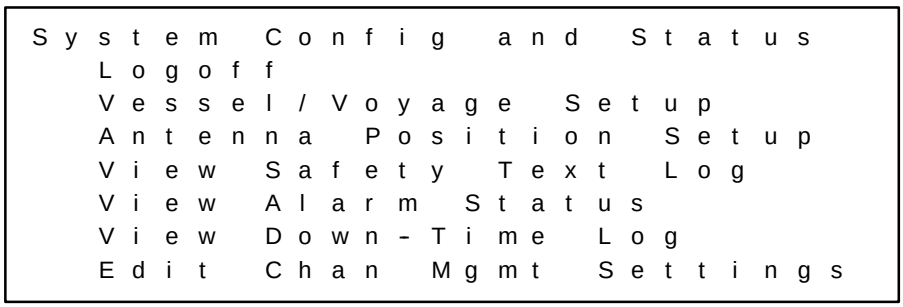


Figure 3-12. System Configuration Screen

(4) Use DOWN ARROW key to scroll down to Vessel Data Setup. Click ENT.

(5) This will bring you to a screen which allows you to enter the vessel's data. The destination and ETA fields may be entered once the ship deploys. The layout of the screen is shown below.

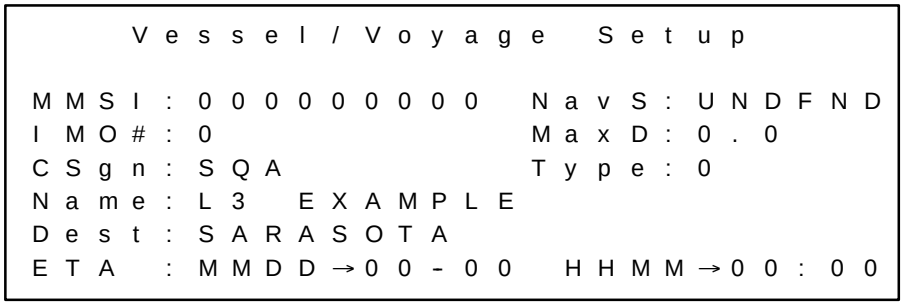


Figure 3-13. Vessel Data Setup

The fields are described as follows:

MMSI: Maritime Mobile Service ID (Maximum 9 characters)

NavS: Navigational Status. When in field, use down arrows to scroll through available option and click ENT to select.

IMD#: Official IMO designation ID for vessel
(0 = not available= default)

MaxD: Maximum sailing draft in Meters
(0.1 to 25.5 meters)

Csgn: Radio Callsign
(maximum 7 characters)

Type: Vessel Type
(see codes listed in Table 3–3 below)

Name: Vessel Name
(maximum 20 characters)

Dest: Name of next Destination
(maximum 20 characters)

ETA: Estimated Time of Arrival
(MMDDHHMM UTC)

Table 3–3. Vessel Type Codes

Special Crafts	Other Ships	
	First Digit	Second Digit
50 Pilot Boats	6 Passenger Ships	0 All ships of this type
51 Search and Rescue Vessels	7 Cargo Ships	1 Carrying DG HS or MP IMO hazard or polluant category A
52 Tugs	8 Tankers	2 Carrying DG HS or MP IMO hazard or polluant category B
53 Port Tenders	9 Other types of ships	3 Carrying DG HS or MP IMO hazard or polluant category C
54 Vessels with anti–pollution facilities or equipment		4 Carrying DG HS or MP IMO hazard or polluant category D
55 Law Enforcement Vessel		5 Not under command
56 Spare – for assignment to local vessels		6 Restricted by her ability to manuever
57 Spare – for assignment to local vessels		7 Constrained by her draught
58 Medical Transport		8 Spare
59 Spare – for assignment to other special vessels		9 No additional information
	DG: Dangerous Goods	
	HS: Harmful Substances	
	MP: Marine Pollunants	

The following keyboard commands will allow you to navigate and complete the data entry requirements for this screen.

- 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.
- Use CAN to cancel any changes made to a field

(6) After entering the required data, Click ENT and ENT again to return to System Configuration.

(7) Use DOWN ARROW key to scroll down to Antenna Position. Click ENT to select.

(8) In this screen you will be asked to enter the relative position of the location of the antennas for both the ship's (external) dGPS systems and the AIS' (internal) GPS system.

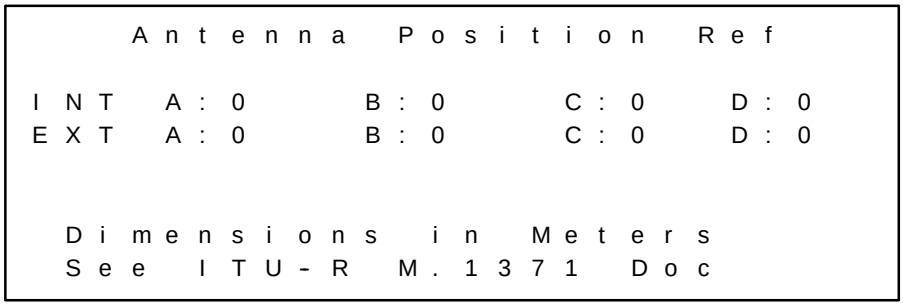


Figure 3-14. Antenna Position

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 3–15.)

A Distance in meters from Forward Perpendicular (FP)

B Distance in meters from After Perpendicular (AP)

C Distance in meters inboard from port side

D Distance in meters inboard from starboard side

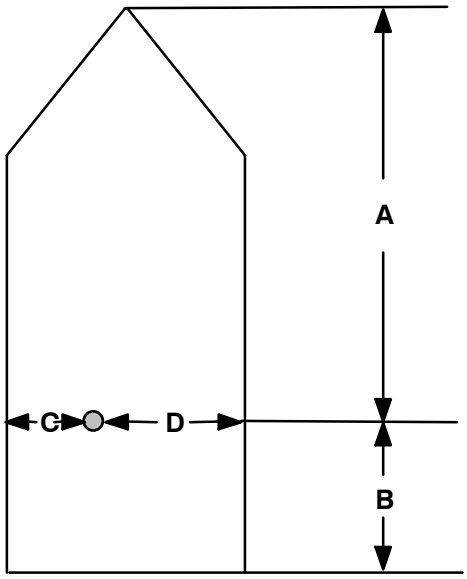


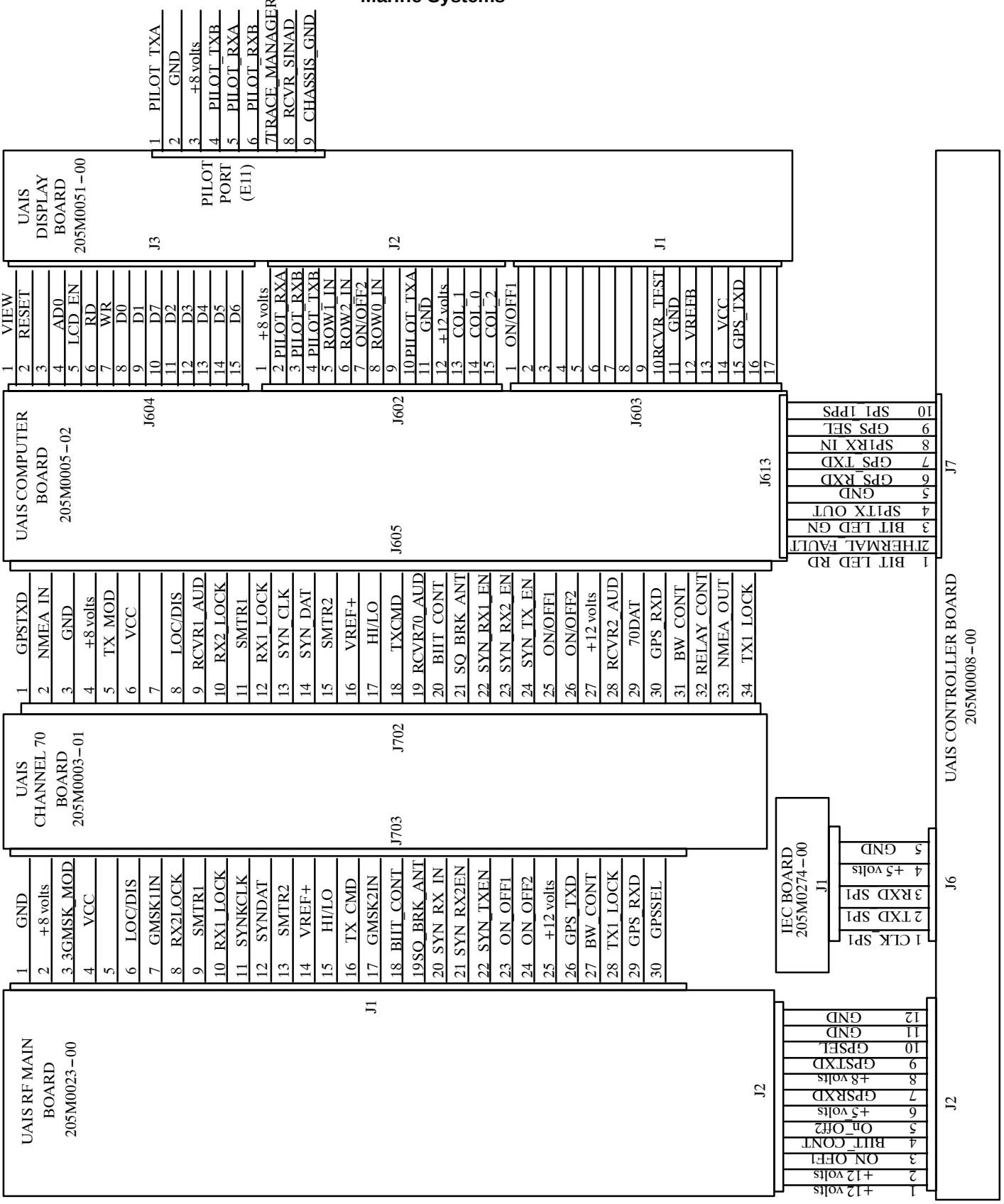
Figure 3-15. Calculating Antenna Position

(9) This completes the configuration requirements of the AIS. The next step involves checking the system linkup to ship's dGPS and Gyro. To check these links you must enter the Own Ship Data screen of the interface.

(10) Enter FNC and then ENT. This will get you to Own Ship Data screen. The screen will display ship positional and heading information.

(11) Confirm ship positional data, heading and SOG/COG/ROT data is correct by referencing the equipment repeater display.

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.


UAIS RF MAIN BOARD 205M0023-00
J1
1 GND
2 +8 volts
3 3GMSK_MOD
4 VCC
5
6 LOC/DIS
7 GMSK1IN
8 RX2LOCK
9 SMTR1
10 RX1_LOCK
11 SYNKCLK
12 SYNDAT
13 SMTR2
14 VREF+
15 HI/LO
16 TX_CMD
17 GMSK2IN
18 BIIT_CONT
19 SQ_BRK_ANT
20 SYN_RX_IN
21 SYN_RX2EN
22 SYN_TXEN
23 ON_OFF1
24 ON_OFF2
25 +12 volts
26 GPS_TXD
27 BW_CONT
28 TX1_LOCK
29 GPS_RXD
30 GPSSEL
J2
1 +12 volts
2 +12 volts
3 ON_OFF1
4 BIIT_CONT
5 On_Off2
6 +5 volts
7 GPSRXD
8 +8 volts
9 GPSTXD
10 GPSEL
11 GND
12 GND
UAIS CHANNEL 70 BOARD 205M0003-01
J702
J703
1 GPSTXD
2 NMEA_IN
3 GND
4 +8 volts
5 TX_MOD
6 VCC
7
8 LOC/DIS
9 RCVR1_AUD
10 RX2_LOCK
11 SMTR1
12 RX1_LOCK
13 SYN_CLK
14 SYN_DAT
15 SMTR2
16 VREF+
17 HI/LO
18 TXCMD
19 RCVR70_AUD
20 BIIT_CONT
21 SQ_BRK_ANT
22 SYN_RX1_EN
23 SYN_RX2_EN
24 SYN_TX_EN
25 ON/OFF1
26 ON/OFF2
27 +12 volts
28 RCVR2_AUD
29 70DAT
30 GPS_RXD
31 BW_CONT
32 RELAY_CONT
33 NMEA_OUT
34 TX1_LOCK
UAIS COMPUTER BOARD 205M0005-02
J604
J602
J603
J605
J613
1 VIEW
2 RESET
3
4 AD0
5 LCD_EN
6 RD
7 WR
8 D0
9 D1
10 D7
11 D2
12 D3
13 D4
14 D5
15 D6
1 +8 volts
2 PILOT_RXA
3 PILOT_RXB
4 PILOT_TXB
5 ROW1_IN
6 ROW2_IN
7 ON/OFF2
8 ROW0_IN
9
10 PILOT_TXA
11 GND
12 +12 volts
13 COL_1
14 COL_0
15 COL_2
1 ON/OFF1
2
3
4
5
6
7
8
9
10 RCVR_TEST
11 GND
12 VREFB
13
14 VCC
15 GPS_TXD
16
17
1 BIT LED RD
2THERMAL FAULT
3 BIT LED GN
4 SP1TX OUT
5 GND
6 GPS RXD
7 GPS TXD
8 SP1RX IN
9 GPS SEL
10 SP1 1PPS
J7
UAIS DISPLAY BOARD 205M0051-00
J3
J2
J1
PILOT PORT (E11)
1 PILOT_TXA
2 GND
3 +8 volts
4 PILOT_TXB
5 PILOT_RXA
6 PILOT_RXB
7TRACE_MANAGER
8 RCVR_SINAD
9 CHASSIS_GND
IEC BOARD 205M0274-00
J1
1 CLK SP1
2 TXD SP1
3 RXD SP1
4 +5 volts
5 GND
J6
UAIS CONTROLLER BOARD 205M0008-00
J2
1 +12 volts