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PROTEC
AUTOMATIC IDENTIFICATION SYSTEM
INSTALLATION AND OPERATION MANUAL

AIS PART NUMBER
AISA6-000-10

Record of Revisions

Rev	Description	Date	Approved By
-	Initial Release	4/2017	T. Meloche
A	Added antenna warning page 25	9/2017	T. Meloche

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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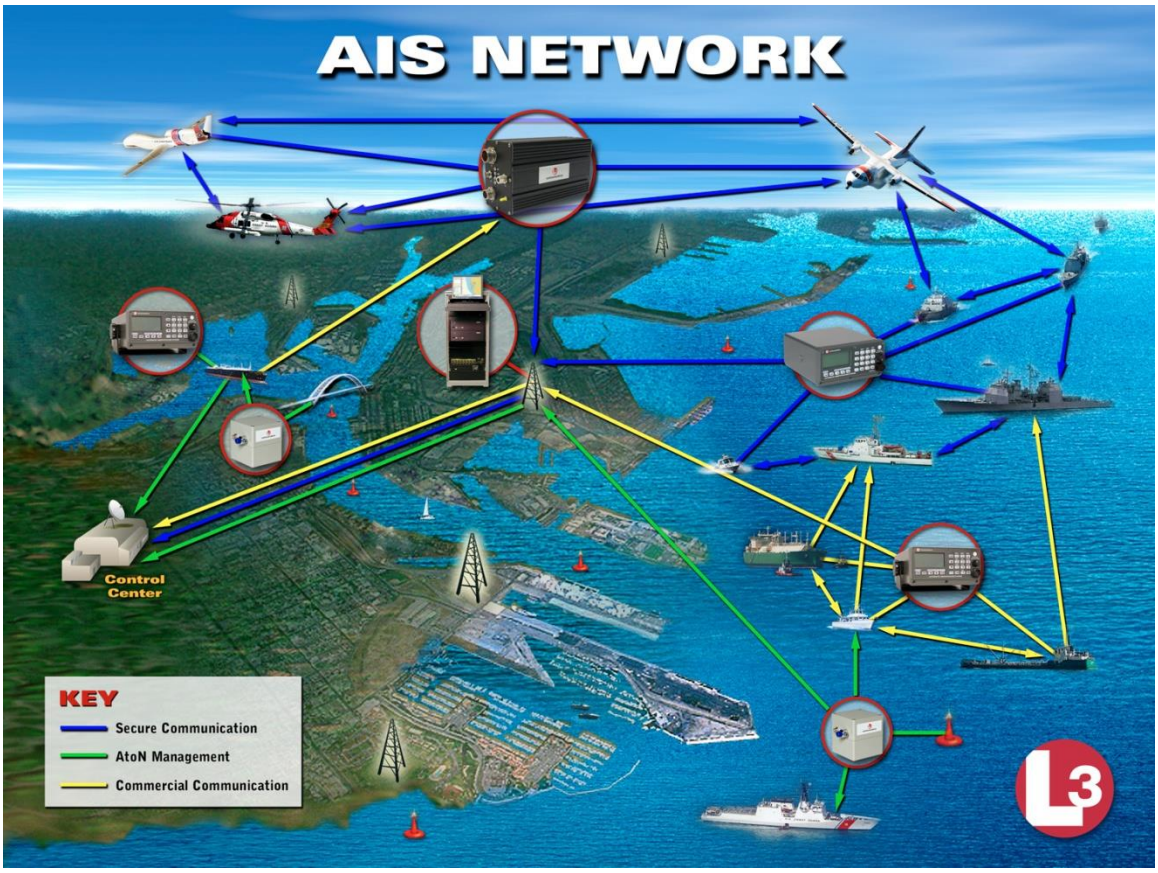


Figure 1- AIS Network

1.1 Introduction

An Automatic Identification System (AIS) is an automatic tracking system used on ships for identifying and locating vessels in a geographical area by electronically exchanging data with other nearby ships and AIS base stations that are located on the shore. AIS information enhances marine radar, which is the primary method of collision avoidance for marine transport.

An AIS-equipped system on board a ship presents the bearing and distance of nearby vessels in a radar-like display format. Information provided by AIS equipment, such as unique identification, position, course, and speed is displayed on a screen such as an Electronic Chart Display (ECDIS).

AIS is intended to assist a vessel's navigation officers and allow maritime authorities to track and monitor vessel movements. AIS integrates a standardized VHF transceiver with a positioning system such as a GPS receiver, with other electronic navigation sensors, such as a gyrocompass or rate of turn

(ROT) indicator. Vessels fitted with AIS transceivers can be tracked by AIS base stations located along coast lines or, when out of range of terrestrial networks, through satellites that are fitted with special AIS receivers.

The International Maritime Organization's International Convention for the Safety of Life at Sea (SOLAS) requires AIS to be fitted aboard international voyaging ships with a gross tonnage of 300 or more, and all passenger ships regardless of size.

1.2 Types of AIS

There are several types of AIS devices:

- **Class A transceivers** - These are designed to be fitted to commercial vessels such as cargo ships and large passenger vessels. Class A transceivers transmit at a higher VHF signal power than class B transceivers and therefore can be received by more distant vessels. They also transmit more frequently. Class A transceivers are mandatory on all vessels over 300 gross tons on international voyages and certain types of passenger vessels under the SOLAS mandate.
- **Class B transceivers** - Similar to Class A transceivers in many ways, but are normally lower cost due to the less stringent performance requirements. Class B transceivers transmit at a lower power and at a lower reporting rate than Class A transceivers.
- **AIS base stations** - AIS base stations are usually land based and used by Vessel Traffic Systems to monitor and control the transmissions of AIS transceivers. They may be installed stand alone or integrated into a network for data gathering and analysis.
- **Aids to Navigation (AtoN) transceivers** - AtoN's are transceivers mounted on buoys or other hazards to shipping which transmit details of their location to the surrounding vessels.
- **AIS receivers** - AIS receivers receive transmissions from Class A transceivers, Class B transceivers, AtoN's and AIS base stations but do not transmit any information about the vessel on which they are installed.
- **Airborne AIS** - These transceivers are installed in Search and Rescue (SAR) fixed wing and rotary wing aircraft and can receive AIS messages at much longer distances while at altitude.

1.3 System Overview

The L-3 **PROTEC** is an Automatic Identification System fully compliant with the IMO specifications. The Transceiver has been developed using the latest Software Defined Radio (SDR) technology and employs Self Organized Time Division Multiple Access (SOTDMA) and DSC controller schemes to provide a high performance, automated and reliable identification system for commercial mariners.

The Transceiver 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 Transceiver 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 Transceiver is to change the ship's Vessel/Voyage data as required.

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.

1.4 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.1371-5, Technical Characteristics for a Universal Shipborne Automatic Identification System Using Time Division Multiple Access in the Maritime Mobile Band.

IEC 61993-2 Edition 2, 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.

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.

1.5 Acronyms and Abbreviations

1PPS	One Pulse Per Second
ABK	Acknowledgement Message
ABM	Addressed Binary Message
ACA	AIS Channel Assignment
ACK	Acknowledgment Message
ASCII	American Standard Code for Information Interchange Operating Mode
ARPA	Automatic Radar Plotting Aid
BBM	Broadcast Binary Message
COG	Course Over Ground
DGLONASS	Differential Global Navigation Satellite System
DGPS	Differential Global Positioning System
DoD	Department of Defense
DTM	Datum Reference
ECDIS	Electronic Chart Display
GGA	Global Positioning Fix Data
GLL	Geographic Position, Latitude/Longitude
GND	Ground
GNS	Global Navigation Satellite
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GUI	Graphical User Interface
HDT	Heading, True
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
LED	Light Emitting Diode
LRF	Long Range Function
LRI	Long Range Interrogation
MFD	Multi Function Display
MMSI	Maritime Mobile Service Identifier
NMEA	National Marine Electronics Association
PI	Presentation Interface
RF	Radio Frequency
RAIM	Receiver Autonomous Integrity Monitoring
RMC	Recommended Minimum Specific Data for GPS
ROT	Rate Of Turn
RX	Receive
SDR	Software Defined Radio
SOG	Speed Over Ground
SOLAS	Safety Of Life At Sea
SOTDMA	Self Organized Time Division Multiple Access
SSD	Station Static Data
TDS	Target Display Software
TNC	Threaded Neill-Concelman

TX	Transmit
TXT	Text Transmission
UAIS	Universal Automatic Identification System
UTC	Coordinated Universal Time
VBW	Dual Ground/Water Speed
VDC	Volts Direct Current
VDL	VHF Data-link Message
VDM	VHF Data-link Other Vessel Message
VDO	VHF Data-link Own-vessel Message
VHF	Very High Frequency
VSD	Voyage Static Data
VSWR	Voltage Standing Wave Ratio
VTG	Course Over Ground and Ground Speed
VTS	Vessel Traffic Services
ZDA	Date and Time

Figure 2 - AIS System with Flush Mount

1.6 Technical Specifications

1.6.1 Physical

Transceiver dimensions	6.4” W (162mm.) x 3.2” H (81mm.) x 7.0” D (178mm.).
Keyboard dimensions	7.47" W (190mm) x 4.72" H (120mm) x 1.0" D (25.4mm).
Weight	8.4 lbs. (3.8kg)
Compass safe distance	200 millimeters

1.6.2 Environmental

Operating temperature range	-40°C to +55°C
Relative humidity	0% to 95%
Shock	10g peak at 50 mSec half sine
Vibration	2 Hz – 100 Hz at 7 m/s^2

1.6.3 Electrical

Input	12 to 24 VDC (absolute min 10V, absolute max 31V)
Watts	24 W average, 60 W peak

1.6.4 Data I/0 connections

Front panel Pilot Port	(1) Bi-directional RS422 PI port
IEC port (*backward compatible)	(3) Receive only RS422 sensor ports (3) Bi-directional RS422 PI ports
Accessory port	(2) General purpose RS232 ports (1) EMCON external control
CAN Bus	(1) NMEA 2000 compatible PI port (IEC 61162-3)
Ethernet	(1) IEC 61162-450 compatible PI port
GPS 1 pulse per second	(1) 1PPS programmable input/output BNC
VHF Antenna (*backward compatible)	(1) SO-259, 50 Ohms, with grounding lug
GPS Antenna (*backward compatible)	(1) TNC, 5 V active, 50 Ohms
Power and BIIT (*backward compatible)	(1) 12 - 24 VDC in and alarm relay

* Backward compatible to previous **PROTEC** models, allows use of existing cables.

1.6.5 Display and user interface

Display	480 (H) x 272 (W) color TFT with adjustable backlight. Anti-glare, anti-reflective and EMI coated
Keypad	Translucent silicon with independent adjustable backlighting

1.6.6 Internal GPS

Receiver type	50 channels, L1 band, Galileo capable, SBAS: WAAS, EGNOS, MSAS
Time-to-first-fix	Cold start - 32 sec Warm start - 32 sec Hot start - 1 sec
Sensitivity	-160 dBm
Position accuracy	2.5 meter
Antenna requirement	5 V active, 50 Ohms

1.6.7 TDMA transmitter

Tx frequency range	156.025 MHz to 162.025 MHz
Tuning resolution	25 kHz
Modulation	GMSK/FSK (π/4 QPSK capable)
Tx power control	1 to 12.5 W
Tx power accuracy	± 0.7 dB
Tx frequency drift	± 500 Hz
Nominal impedance	50 Ohm
Data rate	9600 bits/s

1.6.8 TDMA receivers

Number of receivers	Up to 8: (2) AIS, (1) DSC. ASM and VDE waveform supported (π/4 QPSK)
Rx frequency range	156.025 MHz to 162.025 MHz
Sensitivity	PER = 20% @ -115 dBm
Co-channel rejection	-10 dB (IEC or better) TBD
Adjacent channel selectivity	70 dB (IEC or better) TBD
Blocking	86 dB (IEC or better) TBD
Large signal PER	1% or better (IEC or better) TBD
Image rejection	70 dB (IEC or better) TBD
Spurious rejection	70 dB (IEC or better) TBD
Minimum sensitivity	≤ -107 dBm TBD
Nominal impedance	50 Ohm

1.6.9 DSC receiver

Number of receivers	1
Frequency	156.525 MHz (Channel 70)
Channel bandwidth	25 kHz
Sensitivity	-107 dBm
Adjacent channel selectivity	70 dB
Spurious response rejection	70 dB

1.6.10 Interface sentences

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

2 Basic PROTEC Installation

The transceiver is designed for easy installation into any existing bridge layout. It may be installed in several configurations including flush or trunnion mount as a "one box" system or the transceiver may be connected by a cable to a remote MKD in either a flush or trunnion mount. A typical system and connection diagram is shown in Figure 5.

2.1 Installing the PROTEC

The main elements of the installation are:

- Mount the Transceiver and MKD
- Mount the terminal block or junction box (optional)
- Connect all ships sensors and data interfaces
- Connect the power cable
- Install the VHF antenna to manufacturer's instructions
- Install the GPS antenna to manufacturer's instructions
- Install the Pilot Port cable (optional)
- Apply power and configure the transceiver

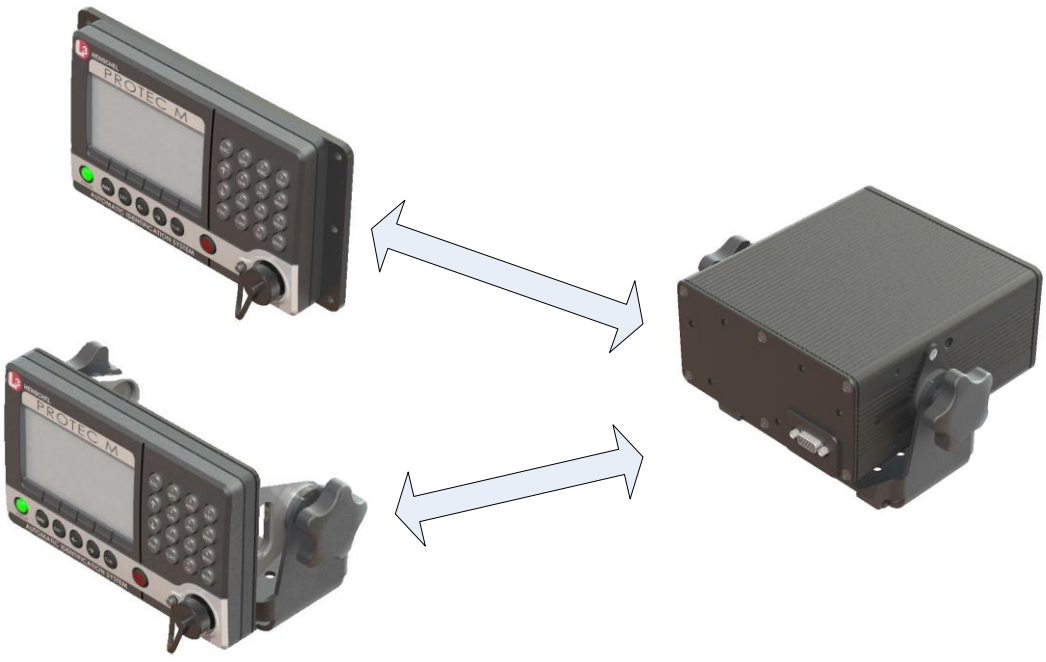


Figure 3 - Remote MKD Shown With Flush and Trunnion Mounting

Figure 4 - Integrated MKD Shown With Flush and Trunnion Mounting

2.1.1 Mount the Transceiver and MKD

- The **PROTEC** can be installed in a trunnion bracket or in a flush mount bracket. Ensure that the unit is installed with adequate clearance to all connectors on the rear of the unit.
- If a trunnion bracket is used, the mount itself can be used as a template to mark the screw holes on the mounting surface.

Note: Consideration must be given to the location of the PROTEC relative to any nearby compass. The PROTEC is certified for a "compass safe distance" of one meter. Install the unit at least one meter away from any compass used for navigation.

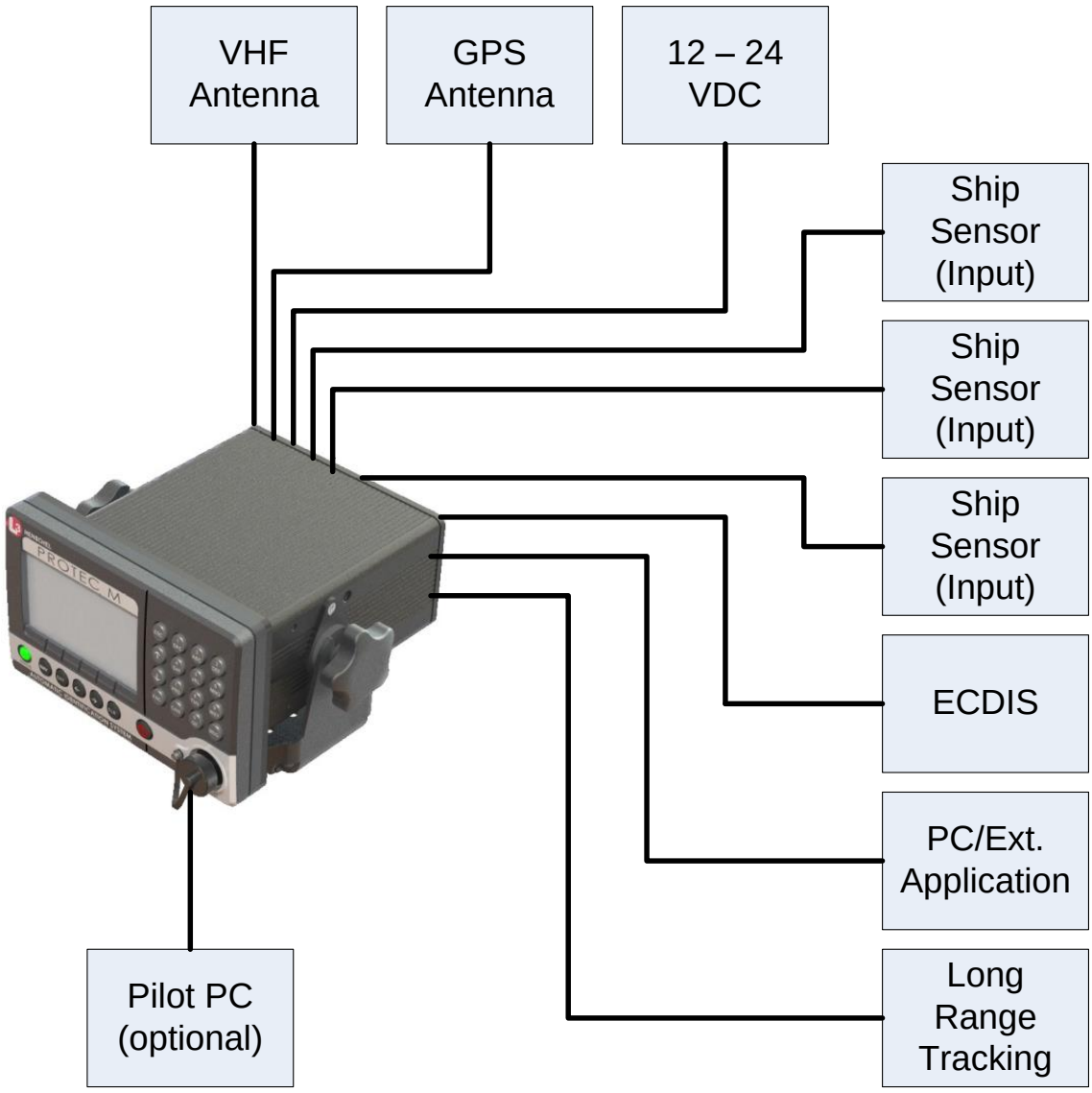


Figure 5 - AIS Interconnection Diagram (Optional interfaces not shown)

2.1.2 Mount the Junction Box or Terminal Strip

A junction box or terminal strip is one method to connect the NMEA data output from a ship sensor (DGPS, ROT, SOG, Heading, and Gyro). They allow flexibility in completing the connection to the ship's sensors which may not have compatible pin-outs.

Position the terminal block or junction box with the following considerations:

- Locate within 2.5 meters (100 inches) of the transceiver, which is mandated by IEC
- Can be easily accessed in order to make connections for the input and output feeds
- Protected from weather and high heat
- Protected from accidental contact with conductive material
- Provides grounding of the terminal block to the ship's structure

2.1.3 Connect Ships Sensors and Data Interfaces

The **PROTEC** transceiver has seven NMEA0183 (IEC61162-1 / IEC61162-2) data ports for connection of ship's sensors and display equipment. There are three input ports for ship's sensor data and four bidirectional ports for connection of display equipment such as Radar, ECDIS, PC or multifunction displays.

It is recommended that an AIS compatible display as mentioned above is connected to the transceiver for the display of AIS targets.

To comply with IMO regulations the AIS must be connected to speed over ground (SOG), course over ground (COG), heading (HDG), rate of turn (ROT) and position information sources.

All data input connections are optically isolated. BAUD rates are configurable for all channels through the front panel menus. BAUD rates are: 4800, 9600, 19200, 38400, 57600 and 115200.

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

Table 1 - Serial Data Ports Default Settings

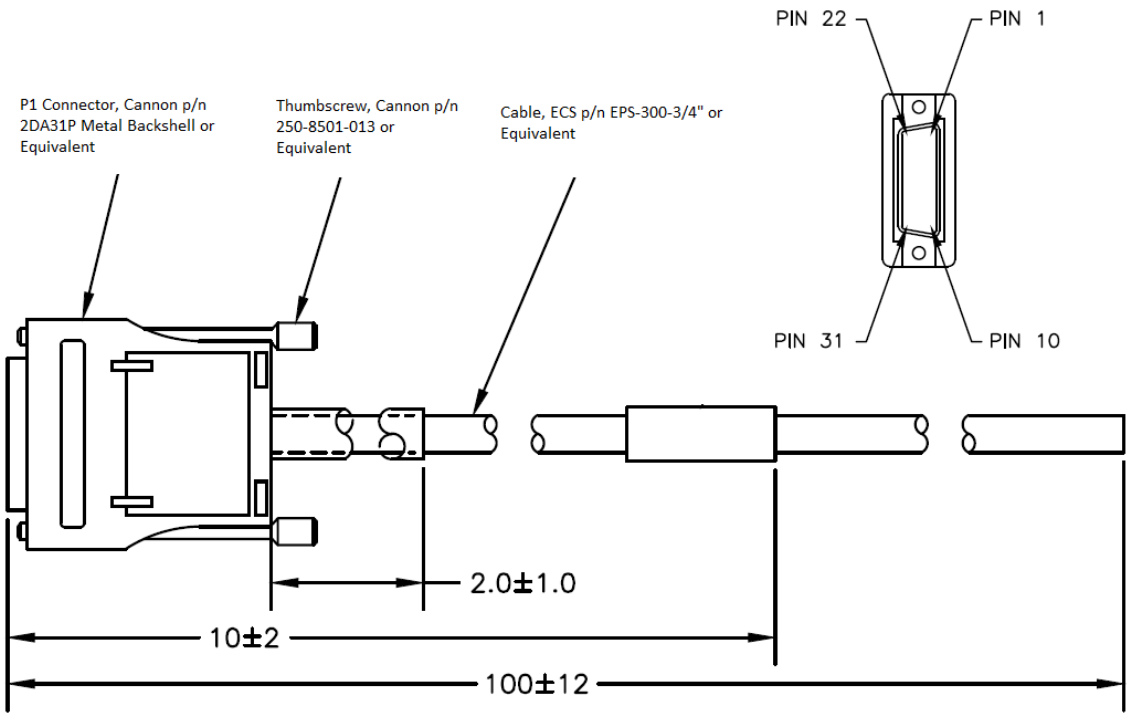


Figure 6 - IEC Data Cable

2.1.4 IEC Input / Output Electrical Characteristics

- The A, B, and C leads are defined in IEC 61162 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 A lead to C lead and from B lead to C lead. Low-level output voltage is 0.4V maximum.
- The 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.
- The differential input voltage threshold is 250mV maximum.
- Inputs meet the requirement of withstanding +/-15V between any two leads among A, B, or C.

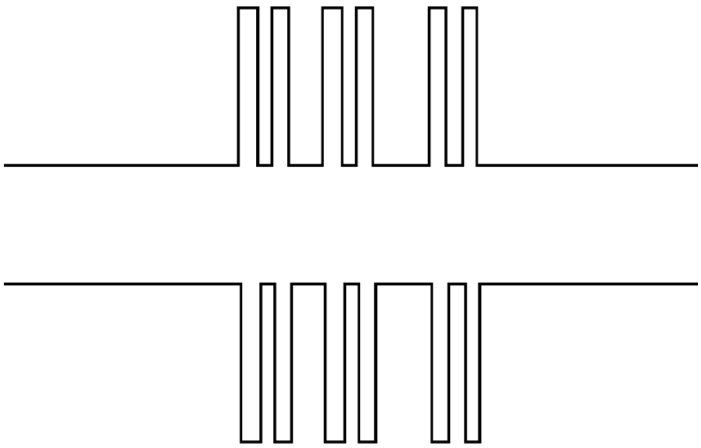


Figure 7 – A and B RS422 Signals

B Signal (top) – normally low going high
A Signal (bottom) – normally high going low

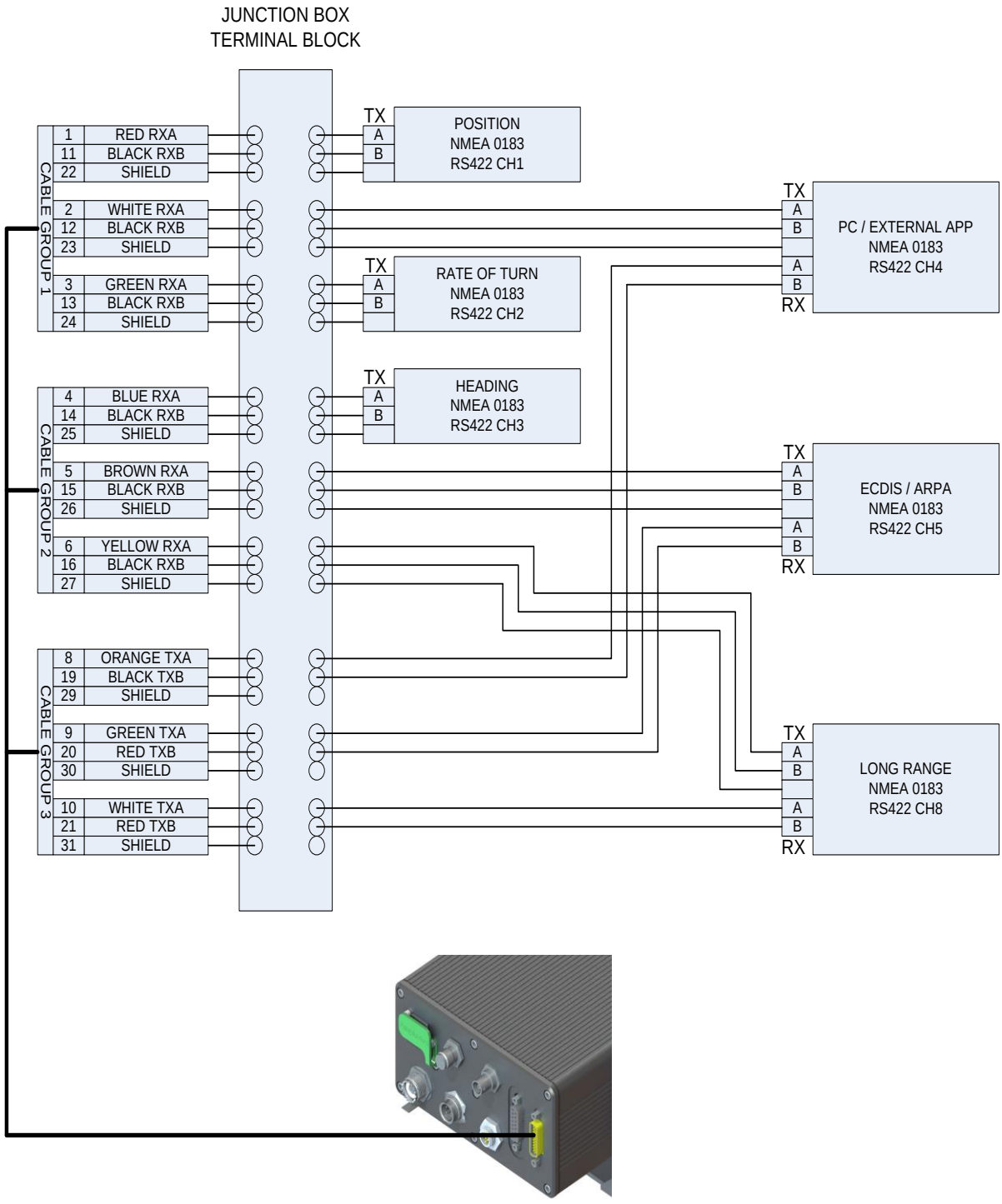


Figure 8 - IEC Data Cable External Wiring Diagram

2.1.5 Connect Power and Alarm Relay

Connect the power cable of the transceiver to the ship's power supply.

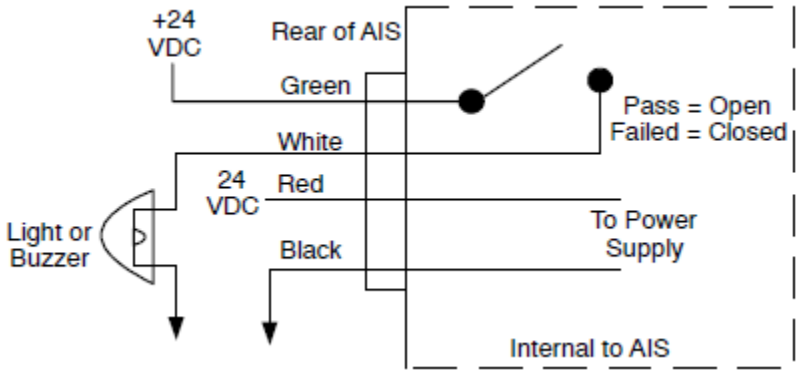


Figure 9 - Sample Alarm Setup

2.1.6 Install the VHF Antenna

When installing the VHF Antenna, consider the following:

- 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' of clearance from anything that is made with conductive material.
- The antenna should have a 360 degree line of sight to the horizon, free of all large, vertical obstructions.
- 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. The antenna must be out of the transmitting beam.
- Ideally, there should not be more than one antenna on the same horizontal level.
- The VHF antenna should be mounted directly above or below the ship's primary VHF radio/telephone antenna, with a minimum of 2 meters of 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.
- The VHF antenna cable should be kept as short as possible to minimize signal loss. High quality, low loss coaxial cable should be used.

Note: Use only high quality RG213/RG214 coaxial cable to reduce signal attenuation.

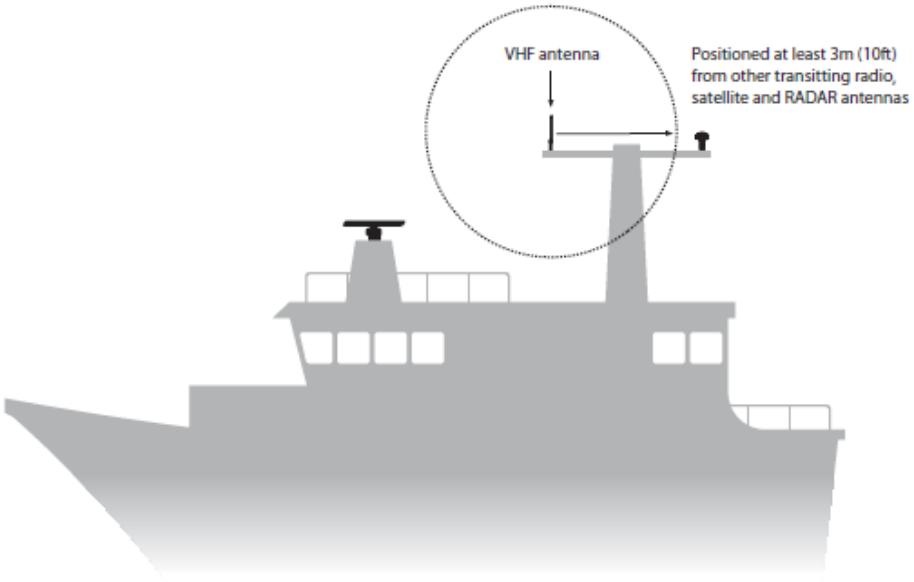


Figure 10 - VHF Antenna Installation

To install the VHF antenna:

- Follow the antenna manufacturers' installation instructions.
- Position the antenna mounting bracket on a rigid and structurally sound surface.
- Install the antenna on the antenna mount.
- Run the coaxial cable from the antenna to the transceiver.
- Trim the cable to the proper length leaving a few extra inches at the transceiver.
- Terminate both ends of the cable with the proper connectors. A PL-259 coaxial connector should be used for connection to the transceiver.

WARNING

Do not approach the antenna closer than listed below when it is transmitting.
The antenna emits radio waves that can be harmful to the human body.

RF power density on antenna aperture	Distance
100 W/m^2	N/A
10 W/m^2	0.04 m
2 W/m^2	0.09 m

2.1.7 Connect the GPS Antenna

The internal GPS receiver provides timing data required to synchronize transmissions. The ship's position information is fed to the Transceiver in NMEA format from the ship's External Electronic Position Indicating System through the IEC data cable.

The internal GPS requires that a dedicated GPS antenna be mounted on the superstructure and the appropriate connections are made to the back panel of the Transceiver.

The correct installation of a GPS antenna is crucial to the operation of the Transceiver, because the synchronization of transmissions relies on the accuracy of the time signal obtained from the GPS.

When installing the GPS Antenna, consider the following issues.

- The GPS antenna should have a clear, unobstructed view of the sky.
- Since GPS signals can be affected by RADAR and SATCOM transmissions, the GPS antenna should be positioned at least 5 meters away from RADAR and SATCOM antennas. It should be placed outside of the beam path.
- GPS signals can be affected negatively by radio transmissions, so the GPS antenna should be positioned at least 3 meters from them.
- To prevent ice or spray from negatively affecting signal reception, the GPS antenna can be mounted flat onto any surface, but it is recommended that it be elevated from the deck surface by 20 to 30 centimeters.
- Certain makes and models of TV antennas can drastically interfere with GPS reception. Be careful to place the GPS antenna as far away from shipboard TV antennas as possible, and make sure that antennas used on board do not exhibit GPS interference problems.

Note: Use only high quality RG213/RG214 coaxial cable to reduce signal attenuation.

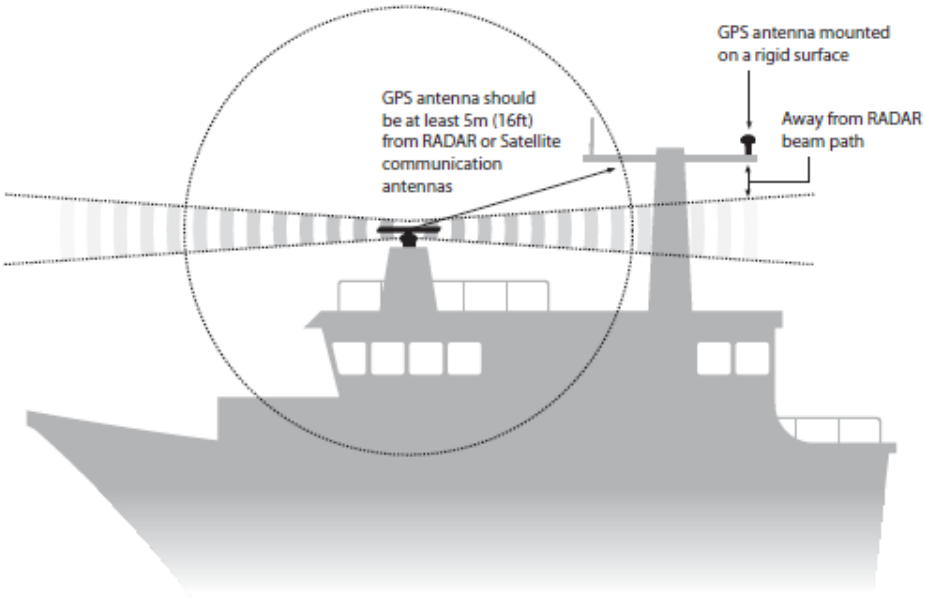


Figure 11 - GPS Antenna Installation

To install the GPS antenna:

- Follow the antenna manufacturers' installation instructions.
- Position the antenna mounting bracket on a rigid and structurally sound surface.
- Install the antenna on the antenna mount.
- Run the coaxial cable from the antenna to the transceiver.
- Trim the cable to the proper length leaving a few extra inches at the transceiver.
- Terminate both ends of the cable with the proper connectors. A male TNC coaxial connector should be used for connection to the transceiver.

2.1.8 Install the Pilot Port Cable (Optional)

The Pilot port is an optional part of the **PROTEC** that allows the MKD to be connected to a PC, so the data can be viewed on a computer screen. The Pilot Port and cable are shown below. The L-3 Part Number is 024M0099-03.

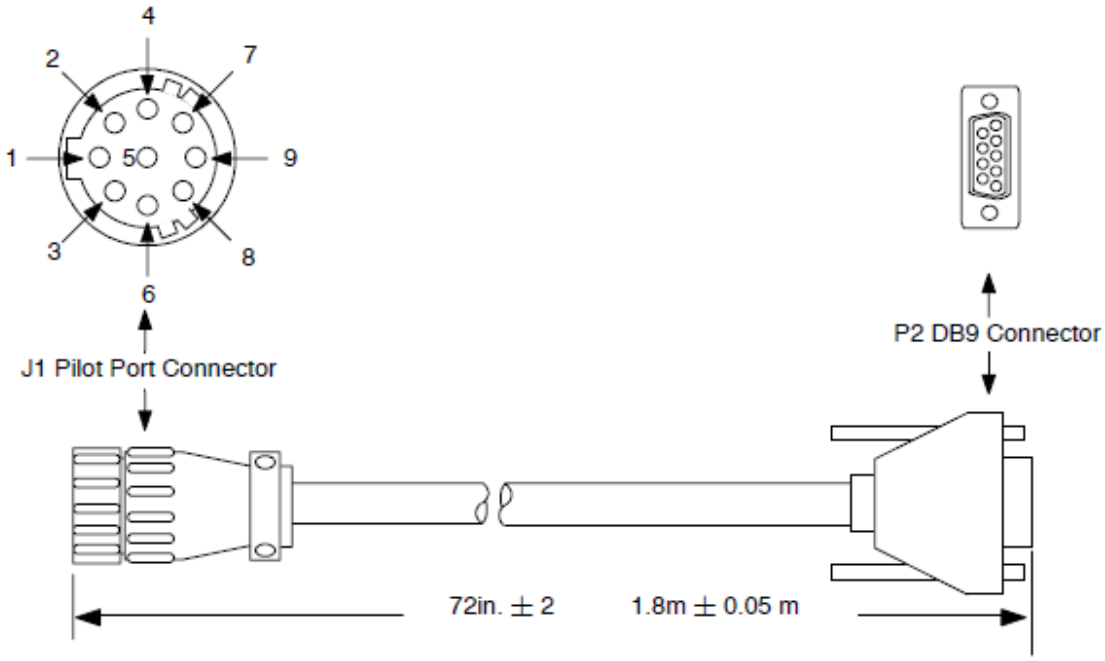


Figure 12 - Pilot Port Cable

NOTE: **Front Panel Mating Connectors**
Pilot Port - L3 PN: 063-98-02113

2.1.9 Apply Power and Configure the Transceiver

At this stage you should have the following steps complete:

- The PROTEC transceiver and display are installed and 24Vdc power is connected.
- The VHF antenna installed and connected to the transceiver.
- The GPS antenna installed and connected to the transceiver.
- The IEC data cable is installed and connected to the transceiver and to a terminal block or junction box.

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

- Push the Power button to turn on the transceiver.
- Check the Status indicator to ensure it has a steady light, which indicates that power is supplied to the unit.
- Press ENT to acknowledge the alarms for features that your system does not use.
- Verify the transceiver connection to the DGPS & GYRO Compass
- Press the NAV button until the Own Ship Information screen opens.
- Make sure all data the system is set up to receive is correct. This may include positional data, heading, and SOG/COG/ROT data.
- Confirm that there are no alarms after one minute (alarms will be present if sensors such as ROT are not connected).
- Press ESC to return to the NAV Display screen.

The transceiver must be configured with information about the vessel on which it is installed prior to operation. Refer to section 4 - **PROTEC** Operation for details.

The following information is required:

- MMSI - Vessel MMSI number (Maritime Mobile Service Identity), this can usually be found on the ships VHF radio license and should be the same MMSI as used for the VHF / DSC radio.
- Name - Vessel Name (limited to 20 characters)
- Call sign - Vessel radio call sign (limited to 7 characters)
- IMO No. - Vessels IMO identification number (if applicable)
- Dimensions giving the location of the GNSS antenna connected to the AIS transceiver (Internal GPS)

The **PROTEC** is now in service. It is to remain in service at all times when the vessel is operating, unless given specific authorization to discontinue operation. The only interaction with the interface should be to view surrounding ship traffic information and to enter voyage data at the start of each voyage.

3 Input / Output Connections

3.1 Connector Part Numbers

Nomenclature	AIS connector	Mating connector
Pilot port	TE Conn 206486-2	TE Conn 206485-1
IEC data port	ITT Cannon 2DA-31SF171	ITT Cannon 2DA-31P
VHF	UHF female SO-239	Amphenol PL-259
Grounding lug	L-3 029 0007 001	L-3 024M0043-00
GPS	Amphenol 122160	Amphenol 122108
Power/ BIIT	Conxall 7381-4PG-300	Conxall 6382-4SG-522
Ethernet	Amphenol MRJ5C80-01	RJ-45 plug
1 PPS GPS	Applied Eng 6501-7551-219	Amphenol 112957
NMEA 2000	Phoenix 1436437	Phoenix 1662298
Discreet (factory only)	NorComp 772-E15-203R011	Amphenol DA15P064TXLF

Table 2- IEC Rear Panel Part Numbers

Note: Specified mating connectors are for reference only, similar connectors may be used.

3.2 Rear Panel Connector Location

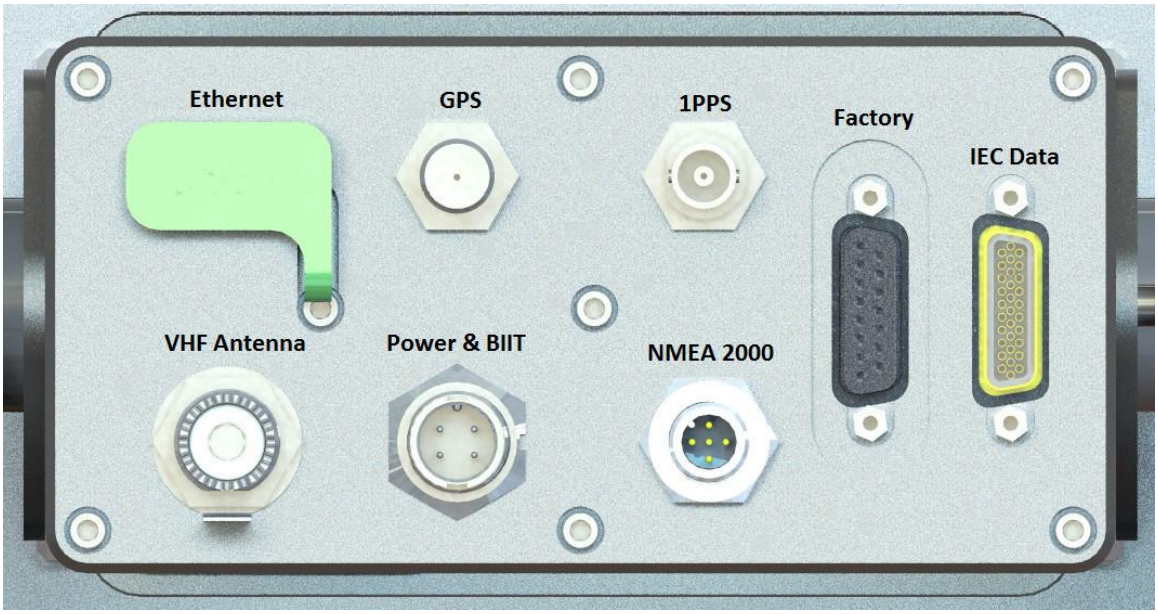


Figure 13 - Rear Panel Connector Location

Note: All graphical connector drawings are viewed looking at the rear of the unit.

3.2.1 IEC Data

Pin	Twisted Pair and Color	Signal		Pin	Twisted Pair and Color	Signal
11	Pair 1 BLK	CH1 RX-		15	Pair 6 BLK	CH5 RX-
1	Pair 1 RED	CH1 RX+		5	Pair 6 BRN	CH5 RX+
22	Pair 1 Drain	CH1 Shield		26	Pair 6 Drain	CH5 RX Shield
13	Pair 2 BLK	CH2 RX-		20	Pair 7 RED	CH5 TX-
3	Pair 2 GRN	CH2 RX+		9	Pair 7 GRN	CH5 TX+
24	Pair 2 Drain	CH2 Shield		30	Pair 7 Drain	CH5 TX Shield
14	Pair 3 BLK	CH1 RX-		6	Pair 8 YEL	CH8 RX-
4	Pair 3 BLU	CH1 RX+		16	Pair 8 BLK	CH8 RX+
25	Pair 3 Drain	CH1 Shield		27	Pair 8 Drain	CH8 RX Shield
12	Pair 4 BLK	CH4 RX-		10	Pair 9 WHI	CH8 TX-
2	Pair 4 WHT	CH4 RX+		21	Pair 9 RED	CH8 TX+
23	Pair 4 Drain	CH4 RX Shield		31	Pair 9 Drain	CH8 TX Shield
19	Pair 5 BLK	CH4 TX-		7	Not Connected	
8	Pair 5 ORN	CH4 TX+		17	Not Connected	
29	Pair 5 Drain	CH4 TX Shield		28	Not Connected	
				18	Not Connected	

Table 3- IEC Data Connector Pin-out

Note: A = (+) Positive, B = (-) Negative

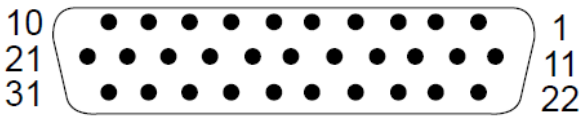


Figure 14 - IEC Data Connector Pin Configuration

3.2.2 Power and BIIT

Line	Color	Name	Description	Power
1	Black	Batt (-)	Battery negative	Ground
2	Red	Batt (+)	Battery positive	Nominal voltage: 12 to 24 Vdc Operating voltage: 10 to 31 Vdc
3	Green	BIIT 1	BIIT relay, terminal 1	Contact closure 220 Vdc, 2A, 60 Watt maximum
4	White	BIIT 2	BIIT relay, terminal 2	Contact closure 220 Vdc, 2A, 60 Watt maximum

Table 4 - Power and BITT Connector Pin-out

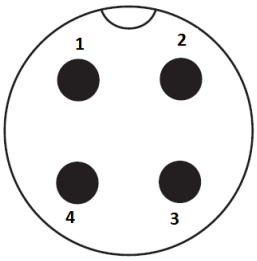


Figure 15 - Power and BIIT Connector Pin Configuration

3.2.3 VHF Antenna

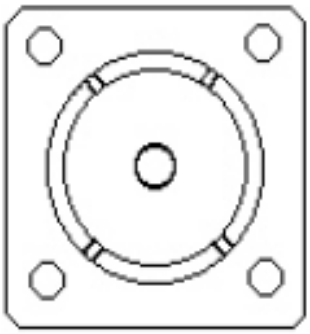


Figure 16 - VHF SO239 Female Connector

3.2.4 GPS Antenna

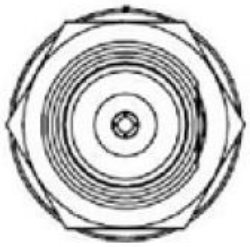


Figure 17 - TNC Female Connector

3.2.5 NMEA 2000 (IEC 61162-3) CAN Bus

Pin Number	Signal Name	Description
1	Shield	Shield
2	CAN PWR	+12 VDC
3	CAN GND	GND
4	CAN_H	High level CAN Bus line
5	CAN_L	Low level CAN Bus line

Table 5 - NMEA 2000 CAN Bus Connector Pin-out

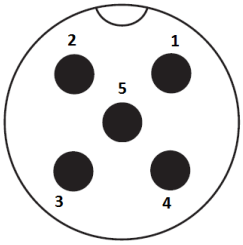


Figure 18 - NMEA2000 CAN Bus M12 male A-coded Connector Pin-out

3.2.6 Ethernet Lite (IEC 61162-450) data port

RJ-45 Pin Number	Wire Color	Name
1	White/Orange	TX_HI
2	Orange	TX_LO
3	White/Green	RX_HI
6	Green	RX_LO
4, 5, 7, 8	N/A	Not Used

Table 6 - Ethernet Connector Pin-out

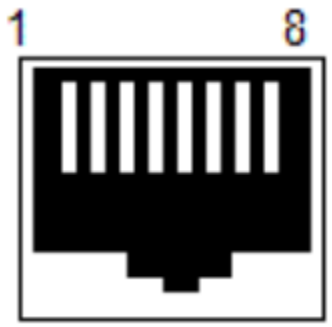


Figure 19 - Ethernet RJ-45 Connector Pin Configuration

3.2.7 One Pulse Per Second (1PPS)

Figure 20 - BNC Female Connector

3.2.8 Discreet data and factory test connector

Pin Number	Name	Description
1	EM_CON_A	Emissions control A
2	GND	Ground
3	TEST_IO1	Factory test (no connect)
4	RS232_RX_2	Factory test (no connect)
5	SHARC_TRACE_DATA	Factory test (no connect)
6	RS232_RX_1	Factory test (no connect)
7	BF_TRACE_DATA	Factory test (no connect)
8	GND	Ground
9	EM_CON_B	Emissions control B
10	TEST_IO2	Factory test (no connect)
11	RS232_TX_2	Factory test (no connect)
12	GND	Ground
13	RS232_TX_1	Factory test (no connect)
14	GND	Ground
15	GPS_RAW	Factory test (no connect)

Table 7 - Discreet data and factory test Pin-out

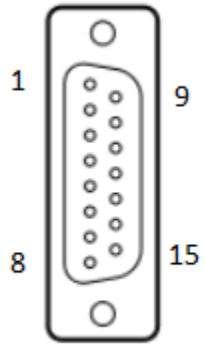


Figure 21 - 15 Pin DSUB Female Configuration

3.3 Front Panel Connector Location

3.3.1 Pilot Port

Figure 22 - Front Panel Pilot Port

J1 Pin	Name	Description	Pair Color	P2 Pin
1	Pilot_TXA	RS422 compliant output A	Blue	2
2	GND	Signal/Power ground	Black	5
3	+ 5.5 Vdc	Voltage out used to power external test equipment. 300 mA maximum		N/C
4	Pilot_TXB	RS422 compliant output B	Black	7
5	Pilot_RXA	RS422 compliant input A	Green	8
6	Pilot_RXB	RS422 compliant input B	Black	3
7	Trace/Boot _TX	TTL-Level RS232 serial output for trace message and bootload output		N/C
8	RX_Sinad	TDMA/DSC FM discriminator output used for factory test		N/C

9	No Connect	Not used		N/C

Table 8 - Pilot Port Pin-outs

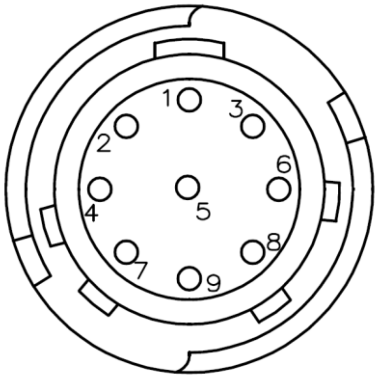


Figure 23 - Pilot Port Plug Configuration

4 PROTEC Operation

The **PROTEC** is designed to require minimal user interaction during normal operation. The interface consists of a Minimum Keyboard and Display (MKD) that includes an alphanumeric keypad for data entry and an LCD screen to display the data. This section assumes that the **PROTEC** has been installed in accordance with Section 2.

Figure 24 - PROTEC Transceiver Front Panel

Note: Due to the compact design of the PROTEC, it is normal for the external housing to be warm to the touch while in operation.

4.1 Front Panel Display and Controls

4.1.1 Power On/Off

Push to turn power on and off to the transceiver.

4.1.2 Status Indictor Light

Shows power has been applied. Red indicates that there is an unacknowledged alarm. Green indicates all alarms have been acknowledged and the system is running normally.

4.1.3 Pilot Port

The Pilot Port is an IEC high speed (default 38,400bps), RS422 data port that can be used to connect an external PC or multifunction display.

4.1.4 Display

The display shows essential AIS operating information and allows for configuration of the transceiver. It is recommended that the transceiver is connected to a compatible Radar or Electronic Chart Display System (ECDIS) for monitoring of AIS vessels during navigation.

4.1.5 Key Pad

The keypad allows the user to access the menu system built into the transceiver interface. To navigate between screens and within specific fields in the screens do the following:

- Use the Left ←, Right→, Up↑, and Down ↓ arrows to navigate among 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 key to save the data entered into the field and exit.

The keys are defined below.

NAV AIS target 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. This key also cycles through the NAV display, Target display and Own Ship Information screens.

ENT Enter Key

This key opens the highlighted menu item so it can be edited, and it saves data after edits are made.

CLR Clear Key

Pressing CLR key once removes all data from a data entry field.

Arrows Arrow Keys

The arrow keys are used to navigate among menu items, move through fields in the data entry forms, and scroll the options within display fields. When a screen has a second page, the Right and Left arrows can be used to move between the pages.

CAN Cancel Key

The CAN key is used to clear all edits made in a data entry field and to revert to the pre-existing data.

MSG Message Key

The MSG key is used to access the text messaging screen in order to send Safety Text Messages.

ESC Escape Key

The ESC key has two functions. When changing data in a field, it cancels all edits. When not editing, it moves the screen up one level in the menu system.

FNC Function Key

These functions are activated by first pressing the FNC key, and then one of the following buttons within two seconds.

FNC → SETUP Opens the Main System Menu

FNC → ENT	Opens the Vessel/Voyage setup screen
FNC → HOME	Returns the cursor to the start position in a
FNC → END	Moves the cursor to the last position in a data
FNC → CLR	Opens the System Information and Configuration Menu
FNC → 4	Turns the internal GPS position on and off
FNC → 9	Displays a screen test

The alphanumeric keypad is used to enter both numbers and letters. When the software is programmed to expect text, instead of a number, the non-numerical options appear first. For example, the number [2] key provides for entry of [2], [A], [B], and [C]. When the cursor is positioned in a field that expects text, the first press of the [2] key displays an A. Another press in less than one second causes a B to be displayed. The next press displays a C, and the fourth a [2].

Repeated key presses result in cycling through the character options. When the operator stops pressing keys for longer than the timeout, the last value is retained, and the cursor moves to the next location in the field.

4.2 Power-Up and Configuration

After installing the **PROTEC** the following steps should be complete:

- The transceiver has been mounted to a sturdy surface on the vessel and power has been connected.
- High quality VHF and GPS antennas have been installed and connected.
- The IEC data cable has been connected to the ships sensors using a terminal block or junction box.

4.2.1 Power-Up the Transceiver

- Press the Power button  on the front panel. The keypads should immediately light up. The transceiver takes approximately 10 seconds to boot up. The main NAV menu should be displayed as the default.
- The Status indicator light  should be steady green indicating power is applied and operation is normal. If the status indicator light turns red, acknowledge the alarms using the ENT button and refer to section 2.1.8.

4.2.2 Configure the Vessel Information into the PROTEC.

The transceiver must be configured with the proper vessel information on which it is installed prior to operation. The following information is required.

- MMSI - Vessel Maritime Mobile Service Identity number. This can usually be found on the vessels VHF radio license and should be the same number as the VHF/DSC radio. See section XXX.
- Name - Vessel name. See section XXX
- Call Sign - Vessel radio call sign. See section XXX.
- IMO number - Vessel IMO identification number if applicable. See section XXX
- GPS antenna location on the vessel. See section XXX

4.3 Viewing the Menus

4.3.1 Main Menu

When power is applied, the **PROTEC** boots up and displays the Main Navigation Menu as the default screen. As targets are received, they are displayed on the screen. The display shows the name (or MMSI) of other AIS equipped vessels. The nearest vessel is shown at the top of the list followed by more distant vessels. Up to 200 targets can be displayed.

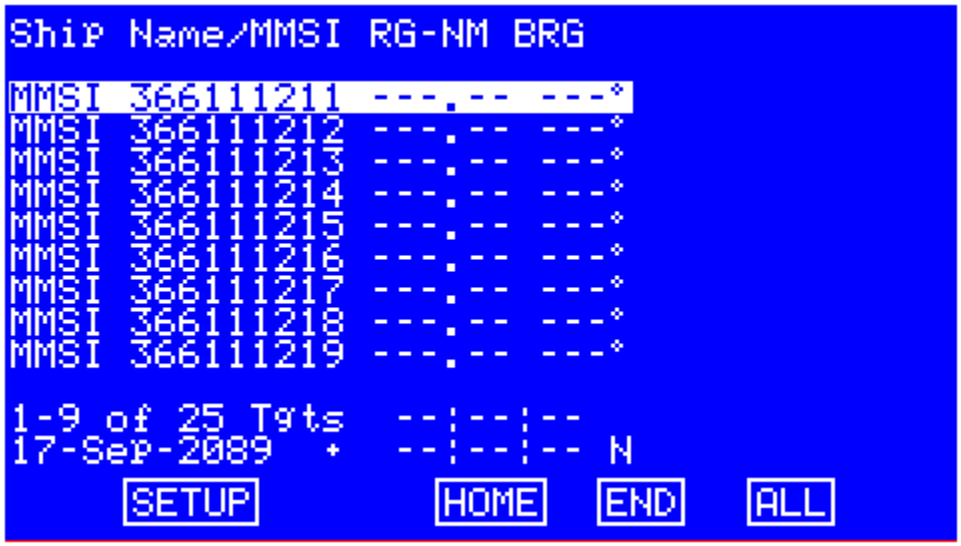


Figure 25 - Main Menu (Default Screen)

Pressing the NAV button from the Main Menu cycles between the main navigation screen, the target screen and the own ship information screen.

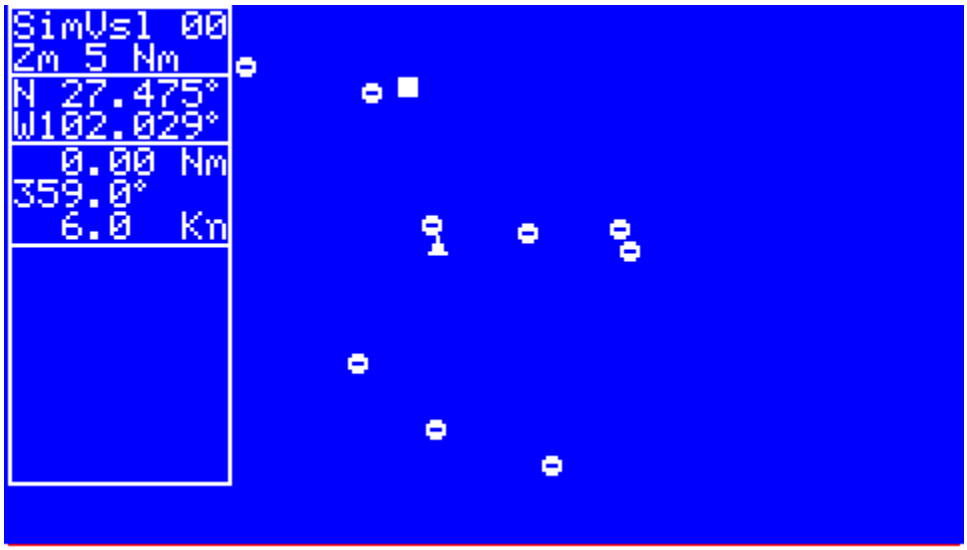


Figure 26 - Secondary Navigation Menu Showing Moving Targets

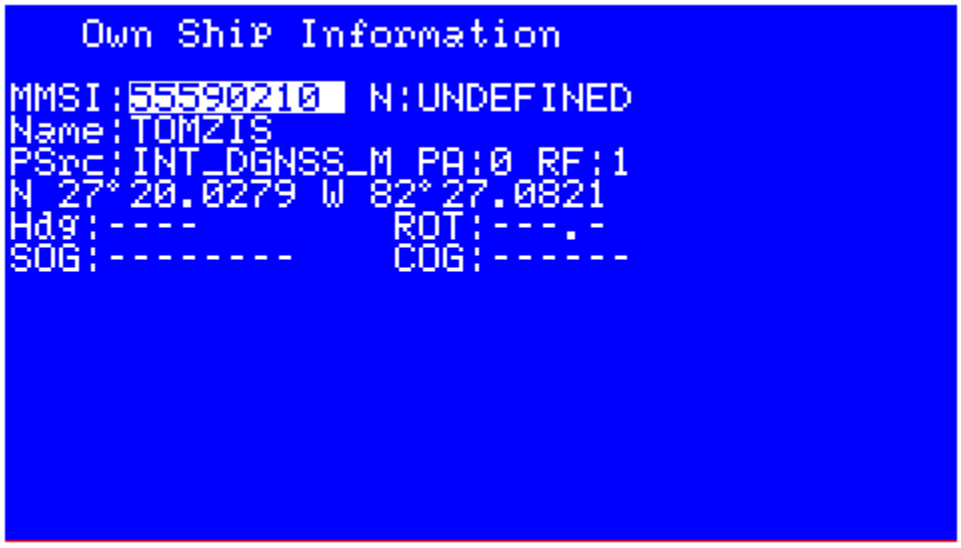


Figure 27 - Own Ship Information Menu

4.3.2 Vessel Information

From the main navigation menu press the up ↑ and down ↓ arrow keys to highlight a vessel of interest. Press ENT to display the vessel information. Use the left ← and right → arrows to navigate between the two Vessel Information screens.

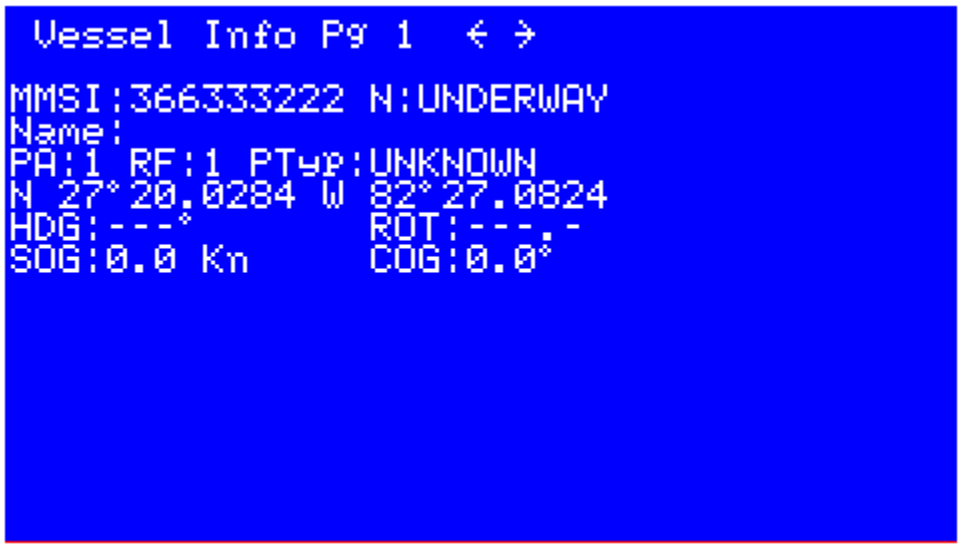


Figure 28 - Vessel Information Page 1

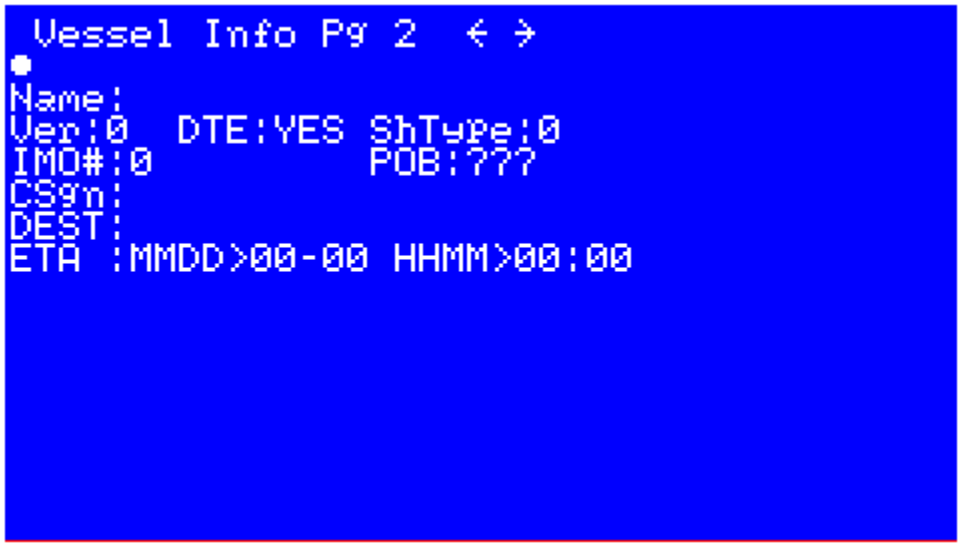


Figure 29 - Vessel Information Page 2

4.3.3 Main System Menu

From any screen you may press FNC then NAV to bring up the Main System Menu. Press the up ↑ and down ↓ arrow keys to navigate to the different menus. Press ENT to enter.

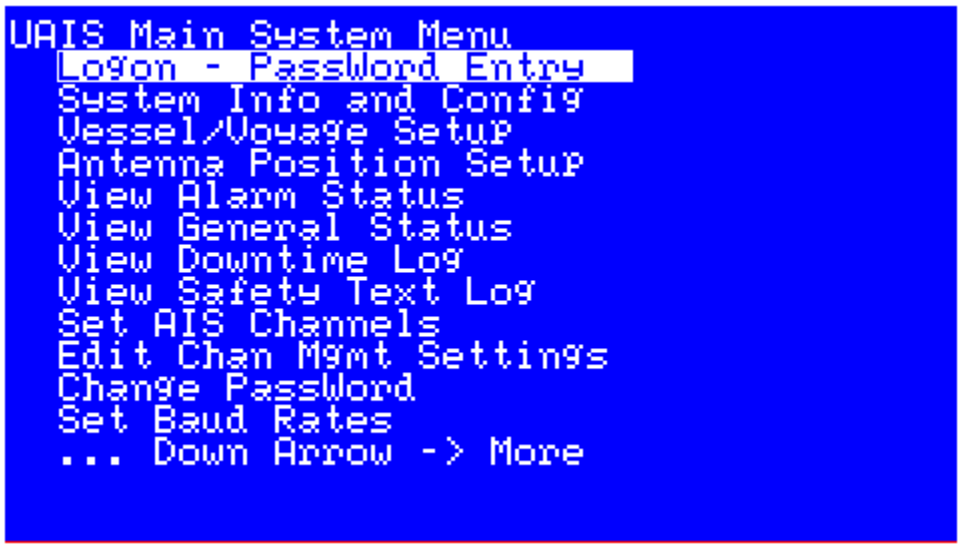


Figure 30 - Main System Menu

4.3.4 Logon and Password Entry

The **PROTEC** is shipped from the factory so it can be used without logging on with a password. However, when there is a need to prevent the vessel information and configuration parameters from being changed, a password protected logon is provided.

Different passwords give users different levels of privileges to change the information contained in the transceiver. Users with an Administrative password can change all of the information. 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.

To logon:

- Press ENT then NAV.
- Use the up ↑ and down ↓ arrow keys to highlight the logon menu and press ENT to enter the menu.
- Press ENT to activate the field and enter the password. Press ENT again to save and exit the field.

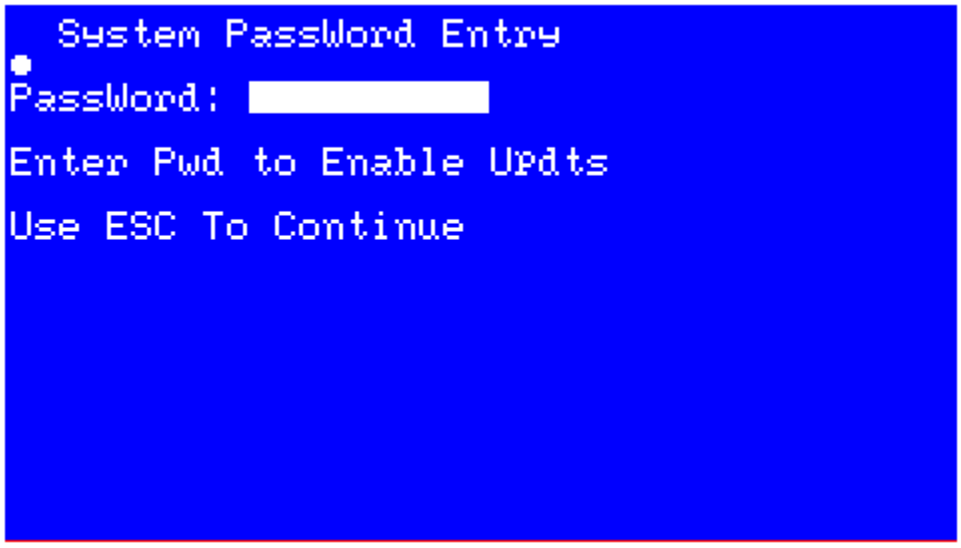


Figure 31 - System Password Entry Menu

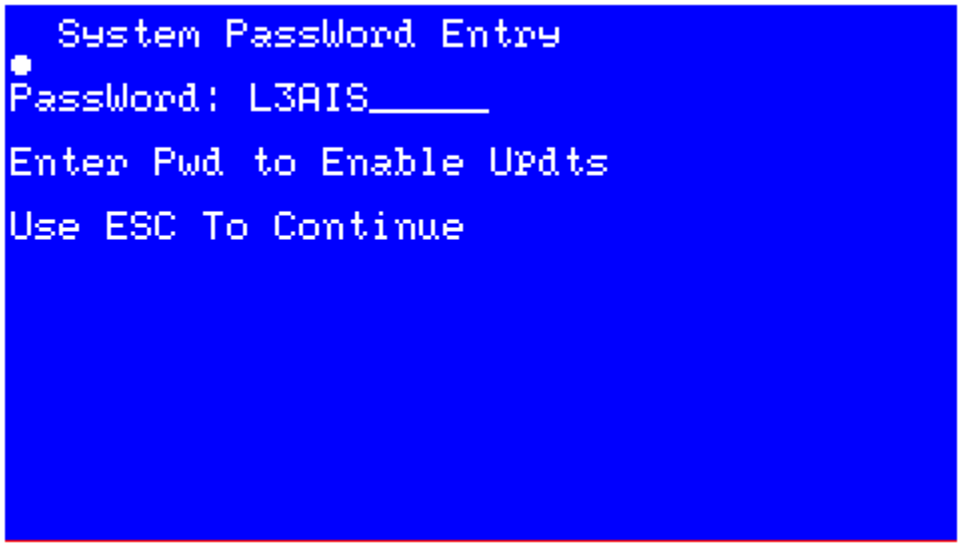


Figure 32 - Password Entered

Default Passwords	
Administrative	L3AIS
User	L3USR

Table 9 - PROTEC Default Passwords

NOTE: **If your password is lost, the unit must be returned to the factory for service**.

In the Read Access and Write Access columns of Table 10, the following abbreviations are used.

G = General Access
U = User Access
A = Admin 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	
Adjust LCD Brightness	G, U, A	A	

Table 10 - Password Privileges According to Specific Menus

4.3.5 Entering System Information and Configuration Data

The System Information and Configuration screen is shown in Figures 32 and 33. This screen displays the type, serial number and software revision among other parameters. A complete description is described below.

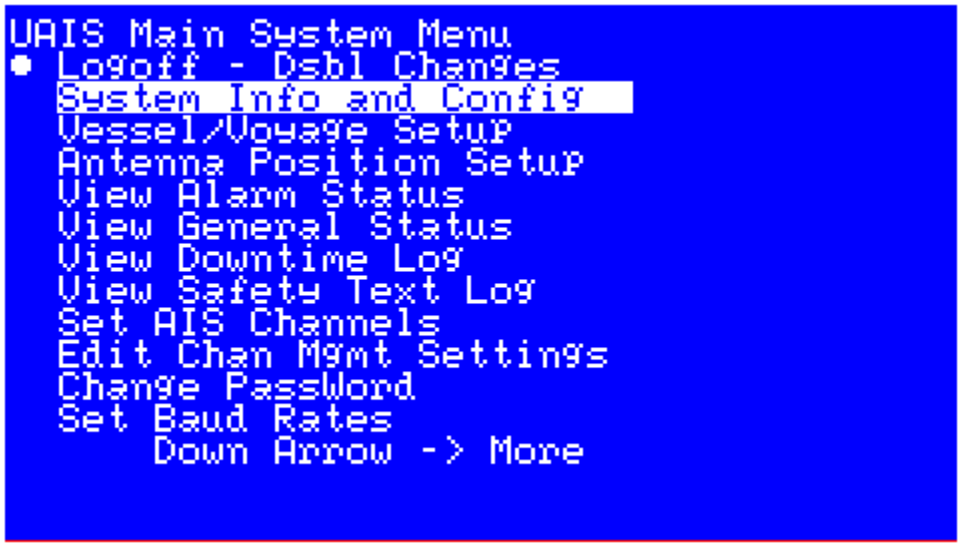


Figure 33 - System Information and Configuration Menu

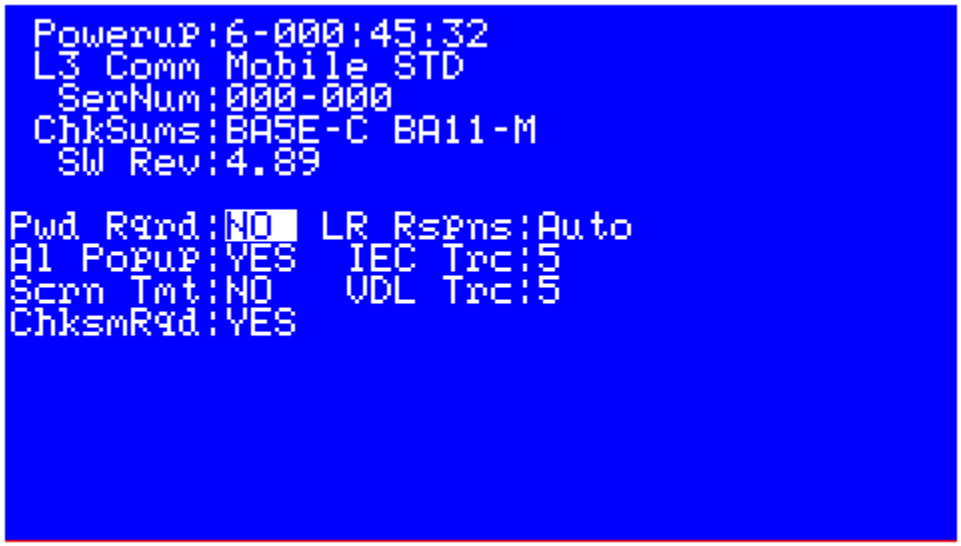


Figure 34 - System Information and Configuration Screen

NOTE: **Figure 33 shows a typical screen. The software revision level and checksums may be different.**

Powerup: Displays the number of Power-Ups and length of the current power up.

L3 Comm: Software version type.

SerNum: Internal serial number.

ChkSums: Shows the Checksums of the internal processors, used for information and troubleshooting.

SW Rev: Displays the Software Revision of the transponder.

Pwd Rqrd: Toggles between requiring and not requiring a password at power up.

A1 Popup: Toggles between Alarm Popups: Yes = popups enabled, No = disabled.

Scrn Tmt: Sets the Screen Timeout. Yes = default to NAV screen after 30 seconds, No = disable

LR RsPns: Sets the Long Range Response that causes an alarm to be displayed (Manual or Auto); This should be used only if it is directed by service personnel for troubleshooting.

IEC Trc: Sets the IEC Trace for up to five levels (0 to 5) of troubleshooting messages: 0 = off. (Must be 0 for proper operation).

VDL Trc: Turns on the VDL Trace for up to five levels (0 to 5) of troubleshooting messages: 0 = off. (Must be 0 for proper operation).

ChksmRqd: 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.

4.3.6 Vessel / Voyage Information Setup

The Vessel / Voyage screen is shown in Figures 34 and 35, and its fields are described below.

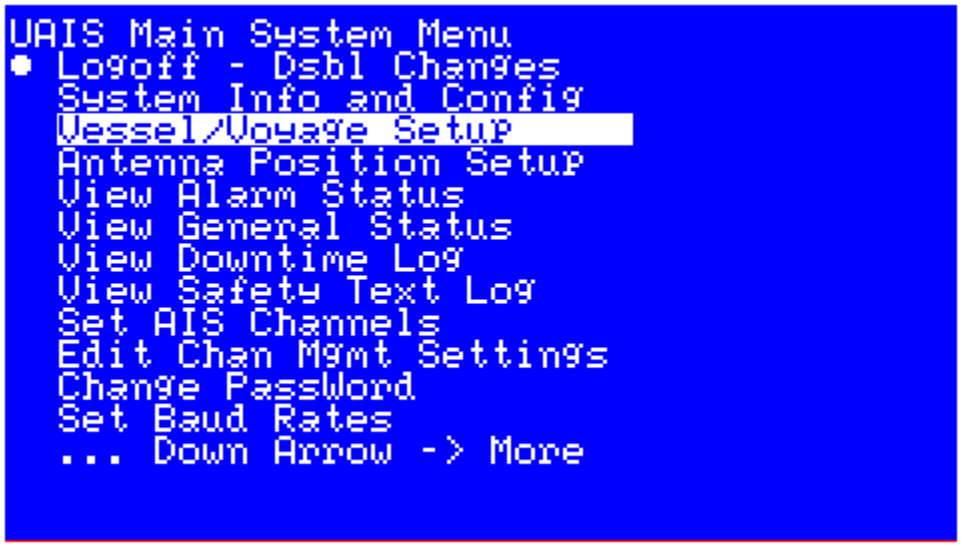


Figure 35 - Vessel / Voyage Menu

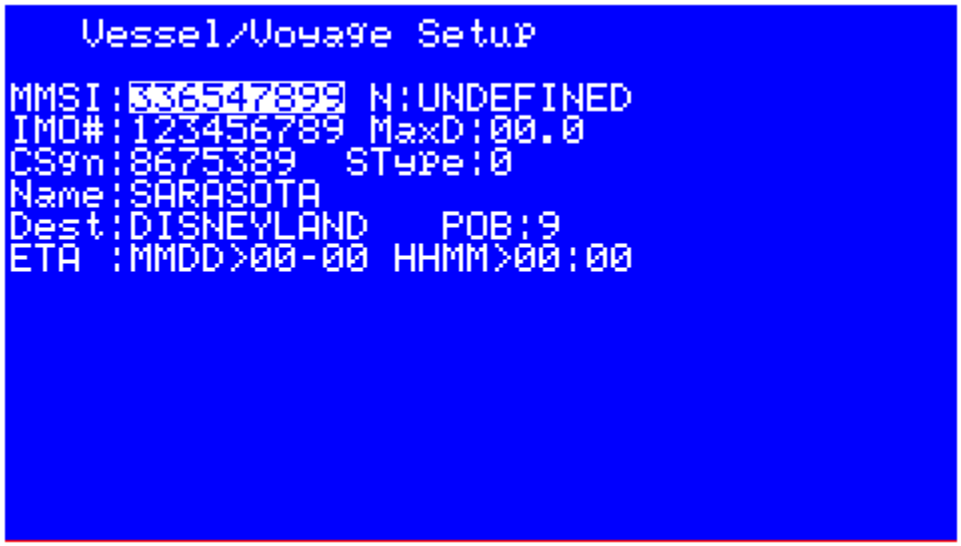


Figure 36 - Vessel / Voyage Screen

MMSI: Maritime Mobile Service Identity is a series of nine numbers that uniquely identify a vessel. (if fewer than nine numbers are entered, this field will automatically be padded with leading zeroes).

N: Navigational Status: Note that “UNDEFINED” can’t be selected as a navigational status, but it may automatically be generated if the unit’s firmware is upgraded and a specific selection has not been made for this field.)

IMO#: IMO Number.

MaxD: Maximum Draft is the maximum draft in meters from 0.1 to 25.5m.

CSgn: Radio Call Sign: Unique, international designation for transmission often used on voice radio with a maximum of seven characters.

ShType: Vessel Type.

Name: Vessel Name consisting of alphanumeric characters.

AsT: Asset Type.

Dest: Destination for the current voyage.

POB: People on Board. This is the total number of crew and passengers.

ETA: Estimated Date of Arrival.

HHMM: Estimated Time of Arrival in hours and minutes.

Identifiers to be used by ships to report their type	
Identifier	Special craft
50	Pilot vessel
51	Search and rescue vessels
52	Tugs
53	Port tenders
54	Vessels with anti-pollution facilities or equipment
55	Law enforcement vessels
56	Spare - for assignments to local vessels
57	Spare - for assignments to local vessels
58	Medical transports as defined in the 1949 Geneva Convention
59	Ships and aircraft of States not parties to an armed conflict

Table 11 - Type of Ship

Other ships			
First digit	Second digit(1)	First digit(1)	Second digit(1)
1 - Reserved for future use	0 - all ships of this type	-	0 - Fishing

2 - WIG	1 - Carrying DG, HS, or MP, IMO hazard or pollutant category X(2)	-	1 - Towing
3 - See right column	2 - Carrying DG, HS, or MP, IMO hazard or pollutant category Y(2)		2 - Towing and length of the tow exceeds 200 m or breadth exceeds 25 m
4 - HSC	3 - Carrying DG, HS, or MP, IMO hazard or pollutant category Z(2)	3 - Vessel	3 - Engaged in dredging or underwater operations
5 - See above	4 - Carrying DG, HS, or MP, IMO hazard or pollutant category OS(2)	-	4 - Engaged in diving operations
	5 - reserved for future use	-	5 - engaged in military operations
6 - Passenger ships	6 - reserved for future use	-	6 - Sailing
7 - Cargo ships	7 - reserved for future use	-	7 - Pleasure craft
8 - Tanker(s)	8 - reserved for future use	-	8 - reserved for future use
9 - Other types of ships	9 - No additional information	-	9 - reserved for future use
DG: dangerous goods HS: harmful substances MP: marine pollutants (1) The identifier should be constructed by selecting the appropriate first and second digits. (2) Note 2 - The digits 1, 2, 3 and 4 reflecting categories X, Y, Z and OS formerly were categories A, B, C and D. ITU-R M. 1371 - 5			

Table 12 - Type of Ship (Continued)

4.3.7 Antenna Position Setup

The Antenna Position screen is shown in Figures 36 and 37. Enter the internal (if installed) and external GPS antenna positions. Refer to Figure 38 and the description below.

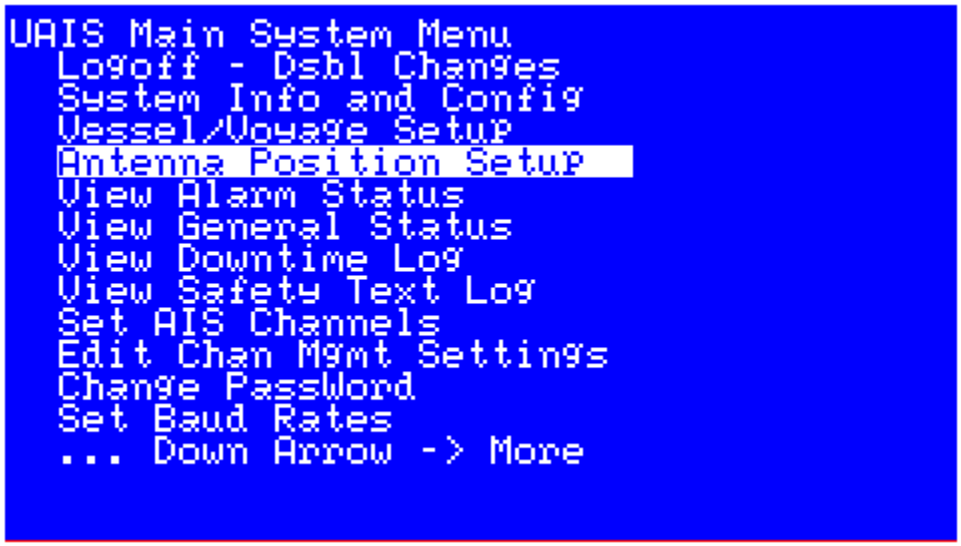


Figure 37 - Antenna Position Menu

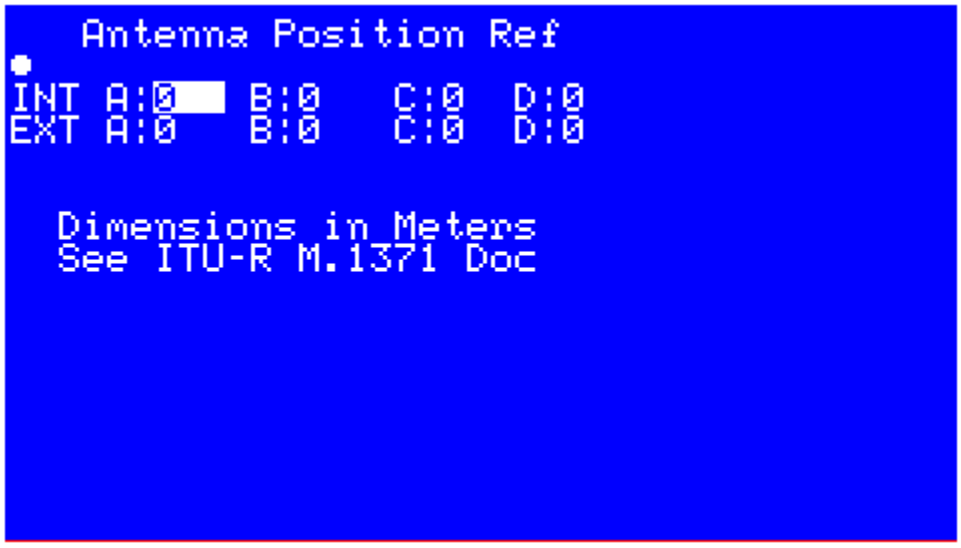


Figure 38 - Antenna Position Screen

A: Distance in meters from the bow to the GPS antenna.

B: Distance in meters from the stern to the GPS antenna.

C: Distance in meters from the port side to the GPS antenna.

D: Distance in meters from the starboard side to the GPS antenna.

Per ITU-R M. 1371-5

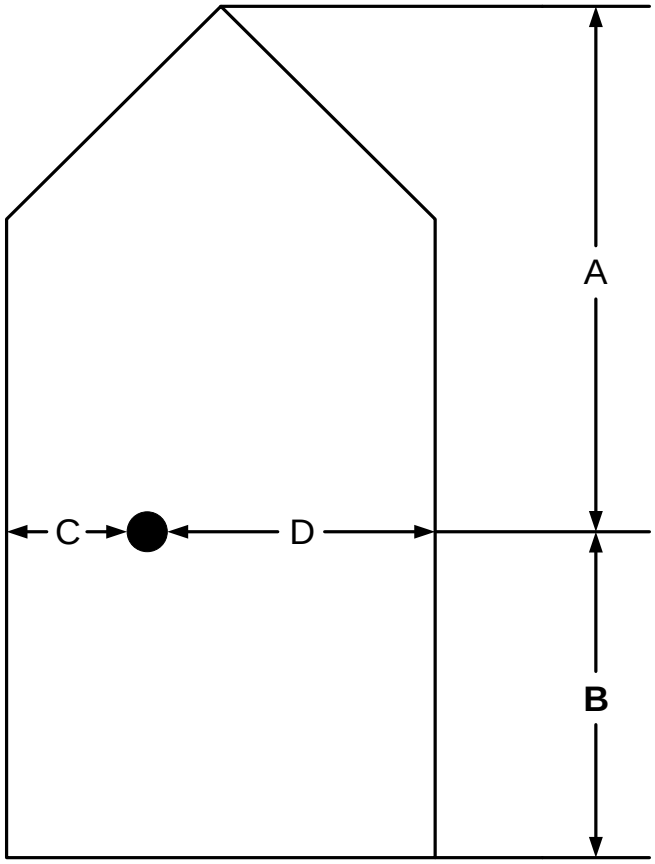


Figure 39 - Antenna Position Measurements

4.3.8 View Alarm Status

The **PROTEC** displays discreet alarm messages.

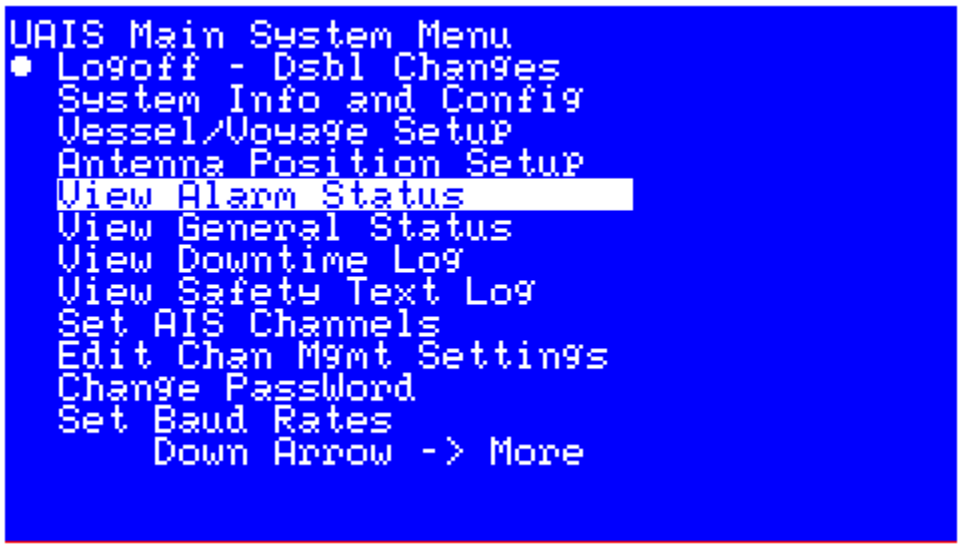


Figure 40 - Alarm Status Menu

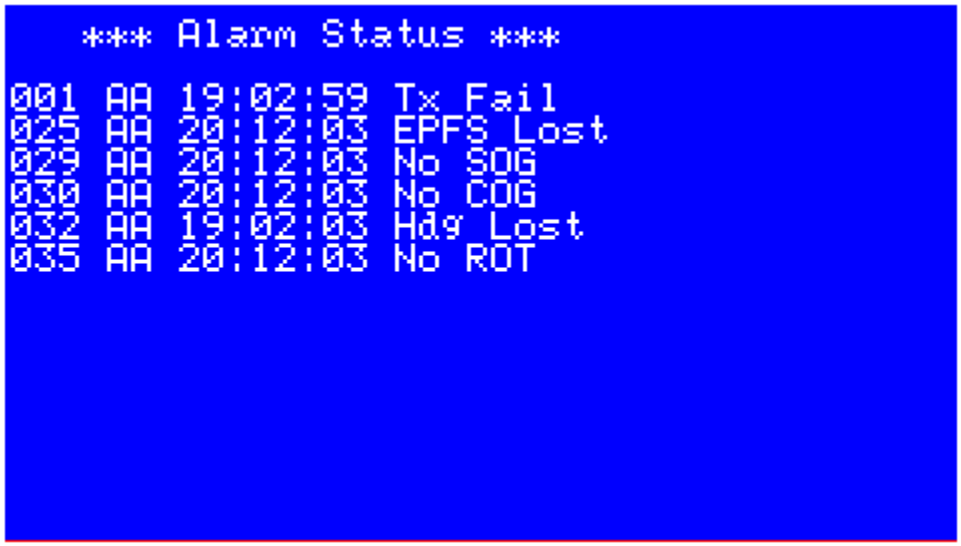


Figure 41 - Alarm Status Screen

Alarm ID	Alarm Ack*	Alarm Text	System Reaction to Alarm

001	AA or AV	Tx malfunction	Stop transmission
002	AA or AV	Antenna VSWR exceeds limit	Continue operation
003	AA or AV	Rx channel 1 malfunction	Stop transmission on affected channel; unit needs service
004	AA or AV	Rx channel 2 malfunction	Stop transmission on affected channel; unit needs service
005	AA or AV	Rx channel 70 malfunction	Stop transmission on affected channel; unit needs service
006	AA or AV	General failure	Stop transmission
007	AA or AV	UTC sync invalid	Continue operation using indirect or semaphore synchronization
008	AA or AV	MKD connection lost	Continue operation with "DTE" set to [1] (if applicable); unit needs service
009	AA or AV	Internal/external GNSS position mismatch	Continue operation
010	AA or AV	NavStatus incorrect	Continue operation
011	AA or AV	Heading sensor offset	Continue operation
014	AA or AV	Active AIS-SART	Continue operation
025	AA or AV	External EPFS lost	Continue operation
026	AA or AV	No sensor position in use	Continue operation
029	AA or AV	No valid SOG	Continue operation using default data(1)
030	AA or AV	No valid COG	Continue operation using default data(1)
032	AA or AV	Heading lost/invalid	Continue operation using default data(1)
035	AA or AV	No valid ROT	Continue operation using default data(1)
051	AA or AV	IEC Com error	Indicates miswired NMEA port, continue operation
052	AA or AV	Encryption failed self-test	Indicates encryption failed; unit needs service

Table 13 - Integrity Alarm Conditions Using ALR Sentence Formatter

*AA: Alarm is active and has been acknowledged.
AV: Alarm is active and has not been acknowledged.

(1) When so configured.

4.3.9 View General Status

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.

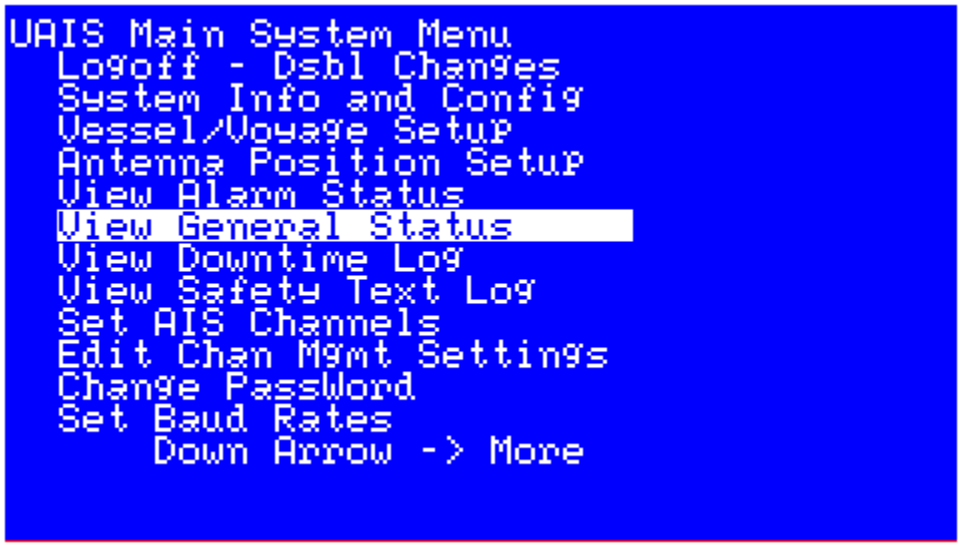


Figure 42 - General Status Menu

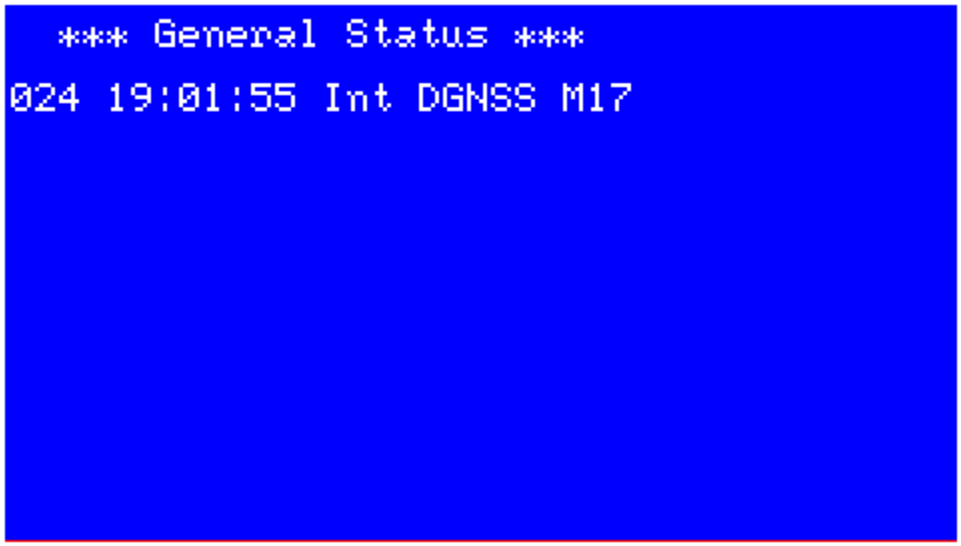


Figure 43 - General Status Screen

Per IEC 61993-2 ed. 2

Text Message	Text Identifier	Reaction of the System
External DGNSS in use	021	Continue operation
External GNSS in use	022	Continue operation
Internal DGNSS in use (beacon)	023	Continue operation
Internal DGNSS in use (Message 17)	024	Continue operation
Internal GNSS in use	025	Continue operation
External SOG/COG in use	027	Continue operation
Internal SOG/COG in use	028	Continue operation
Heading valid	031	Continue operation
Rate of Turn indicator in use	033	Continue operation
Other ROT source in use	034	Continue operation
Channel management parameters changed	036	Continue operation

Table 14 – Sensor status indications signaled using TXT sentence formatter

4.3.10 Down Time Log

This screen show the date, time and duration that the transponder was powered off. The unit must be off for at least 20 minutes for a log entry to occur.

Use the up ↑ and down ↓ arrow keys to scroll through the list. The display shows the day, month, year, 24 hour time, and the amount of time the unit was powered down.

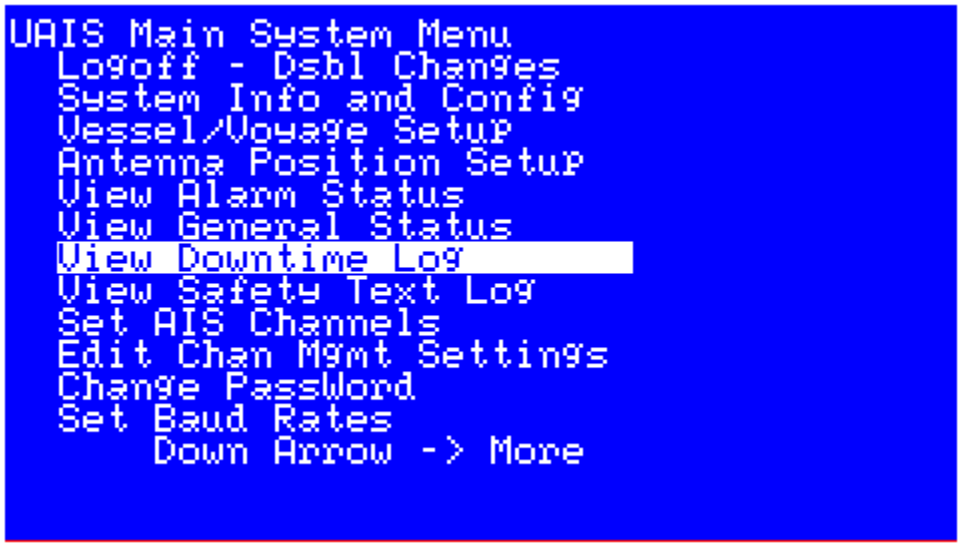


Figure 44 - Down Time Log Menu

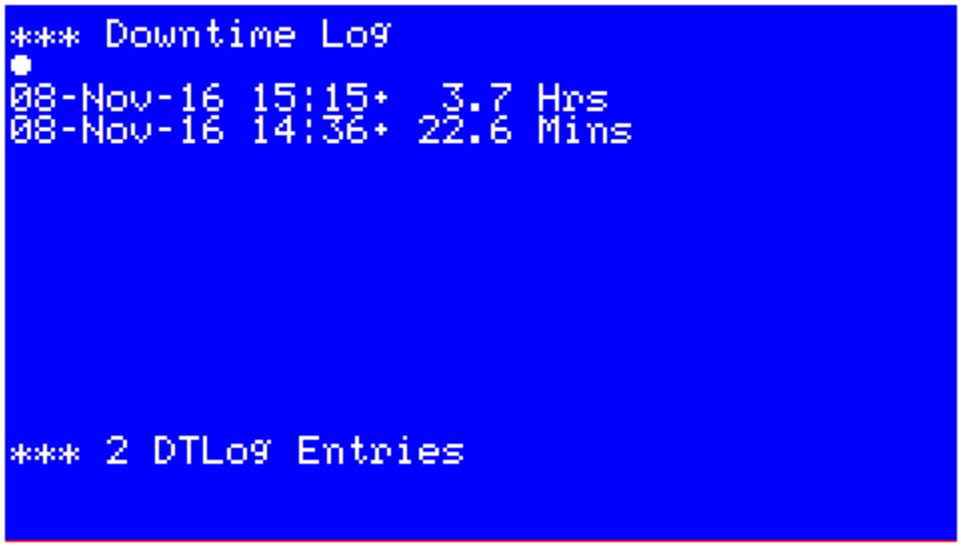


Figure 45 - Down Time Log Screen

4.3.11 Safety Text Log

This log shows all safety text messages that were received during the current power up.

The first column indicates the type of message as "Br" for "broadcast" or "Ad" for "addressed". The second column shows the time the message was received. The third column shows the originating MMSI.

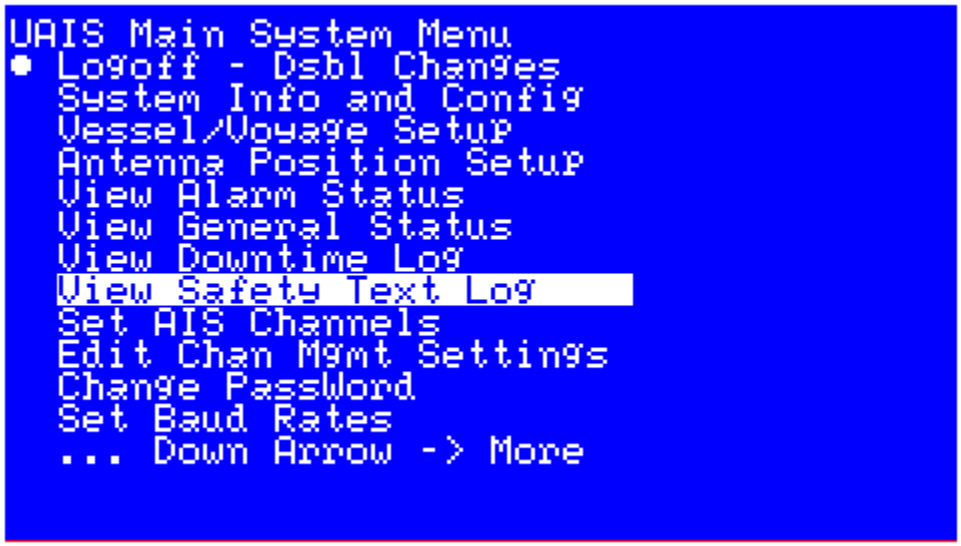


Figure 46 - Safety Text Log Menu

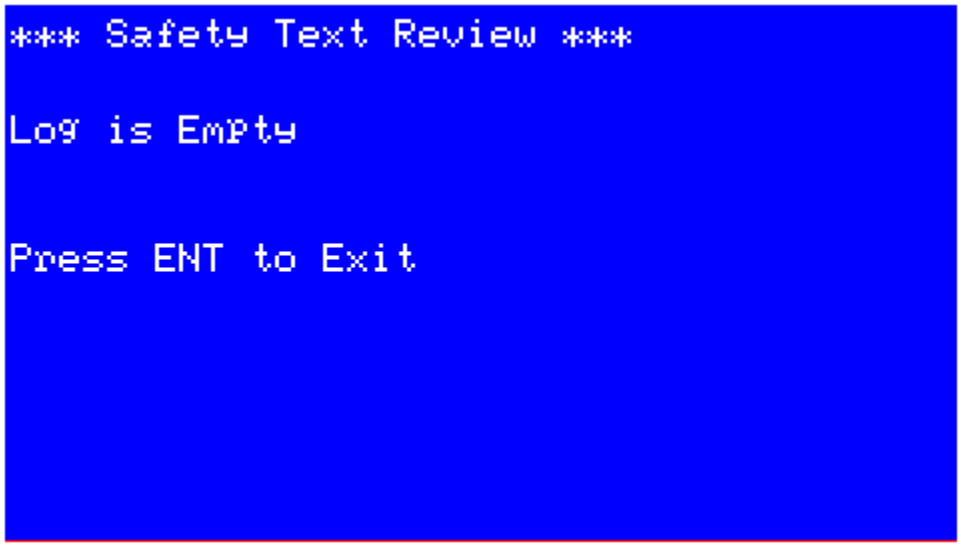


Figure 47 - Safety Text Log Screen

4.3.12 Set AIS Channels

The Set AIS Channels menu allows a person with Administrator privileges to set the default frequencies for channels A and B and the Power Level.

Figure 48 - Set AIS Channels Menu

REMOVE this

Figure 49 - Set AIS Channels Screen

Defaults:

AIS Channel A:	2087 Channel 87B (161.975MHz)
AIS Channel B:	2088 Channel 88B (162.025MHz)
Power Level:	Hi = high power (12.5Watt), LOW = low power (2Watt)

4.3.13 Channel Management

Regional authorities may approve operating frequencies for their coverage areas. Regions can be created by a governing authority's VTS, another Universal AIS, or by manual entry. The High Seas Region Actv page, displays relevant information pertaining to these regions. Though this configuration information can be set up manually, the **PROTEC** transceiver automatically acquires the data for a new region once it enters the area.

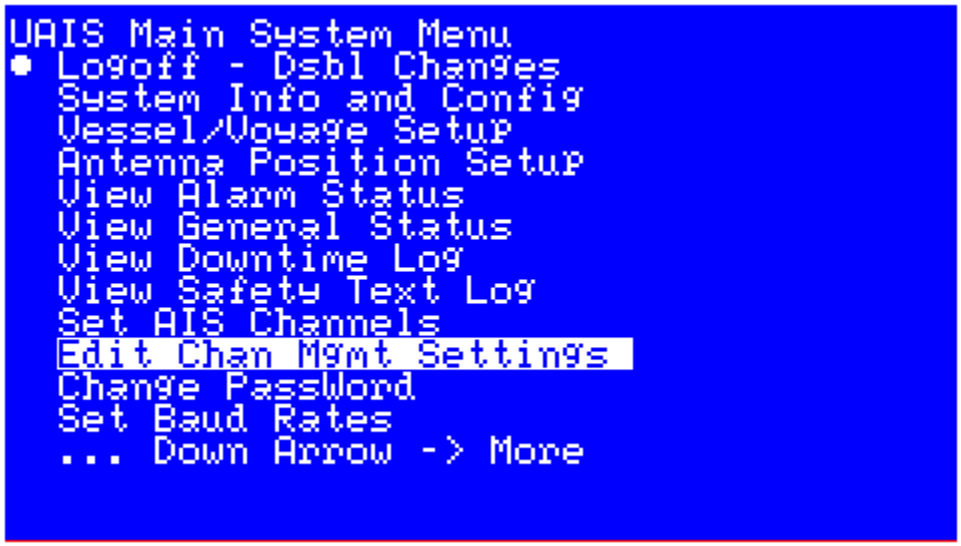


Figure 50 - Channel Management Menu

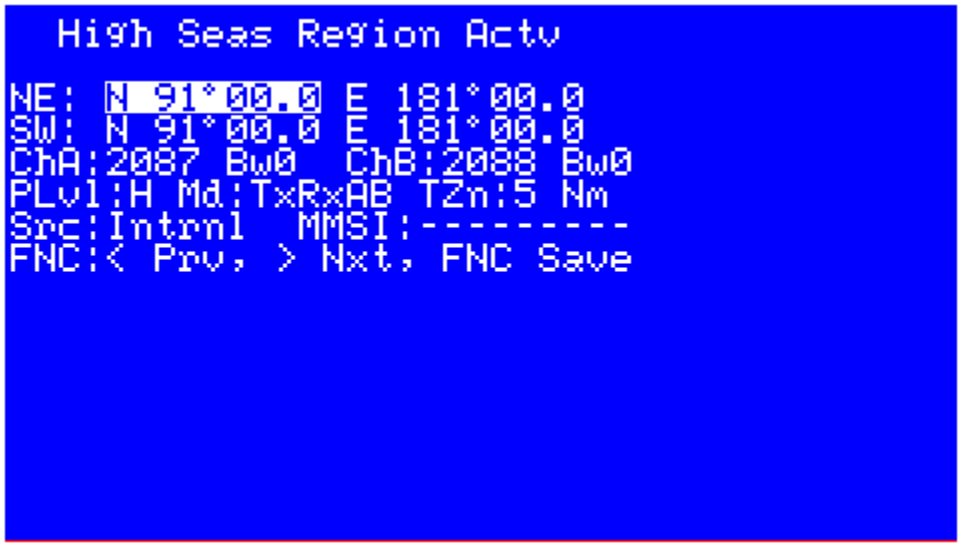


Figure 51 - Channel Management Screen

NOTE: **If the transponder is not receiving a governing authority's region definitions, or if the northeast and southwest corners have not been set manually as described below, "N 91°0.00" and "E 181°00.0" are displayed.**

After entering the High Seas Region Actv screen, several fields are displayed. They are described below.

NE: Indicates the northeast corner of the region (see note, above)

SW: Indicates the southwest corner of the region (see note, above)

ChA: Displays the Channel Frequency for Channel A

Bw: Toggles the Bandwidth between 0 = 25kHz, 1 = 12.5kHz

ChB: Shows the Channel Frequency for Channel B

Bw: Toggles the Bandwidth between either 0 = 25kHz, 1 = 12.5kHz

Plv1: Toggles the Power Level between H = high power (12.5W) and L = low power (2W)

Md: Mode can be TxRxAB, TARxAB, TBRxAB, RxAB, RAOnly, and RBOnly

TZn: Displays Transition Zone size defined in nautical miles (Nm)

Src: Toggles between Source GPS that is either Intrnl = Internal command or Extrnl = External (governing authority) (Read Only)

MMSI: Shows the MMSI of the authority that has issued the command (blank if internal) (Read Only)

Use the arrow keys to highlight a field, and press the ENT key. Enter the data, and press the ENT key to exit the field. The top of the screen changes to display Edit Mode Active.

Move to the next field to enter data. When all the data is entered into the page, press the FNC key twice. A message appears, stating that the transponder is about to save the channel management settings, asking the user to press ENT to save the data.

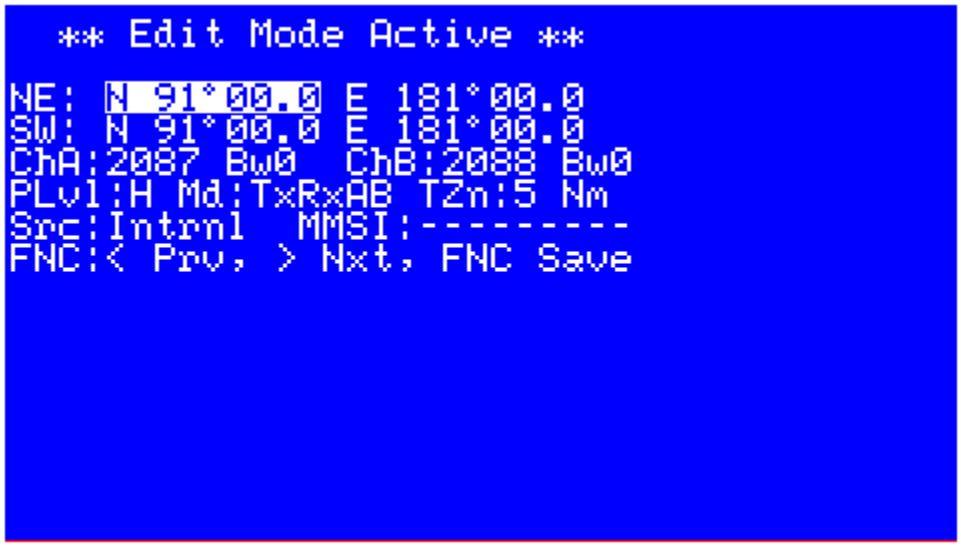


Figure 52 - Edit Mode Active Screen

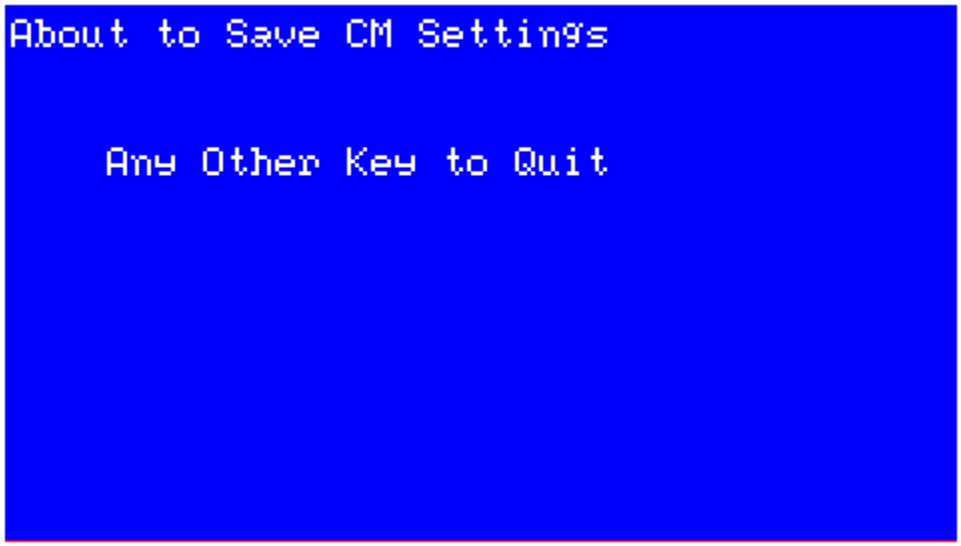


Figure 53 - Save Settings Screen

Press ENT to save the information or any other key to exit the screen. In the Edit Mode Active screen, press the ESC key to return to the UAIS Main System Menu screen.

NOTE: **Users should take extreme caution when defining channel management settings and should coordinate the settings with local VTS authorities.**

4.3.14 Changing the Password

The System Password Change screen allows users to enter new passwords. Use the arrow keys to navigate to the fields and press ENT to enter the field. Enter the new password and press ENT to exit the field.

Refer to Section 4.3.4 for more information on passwords.

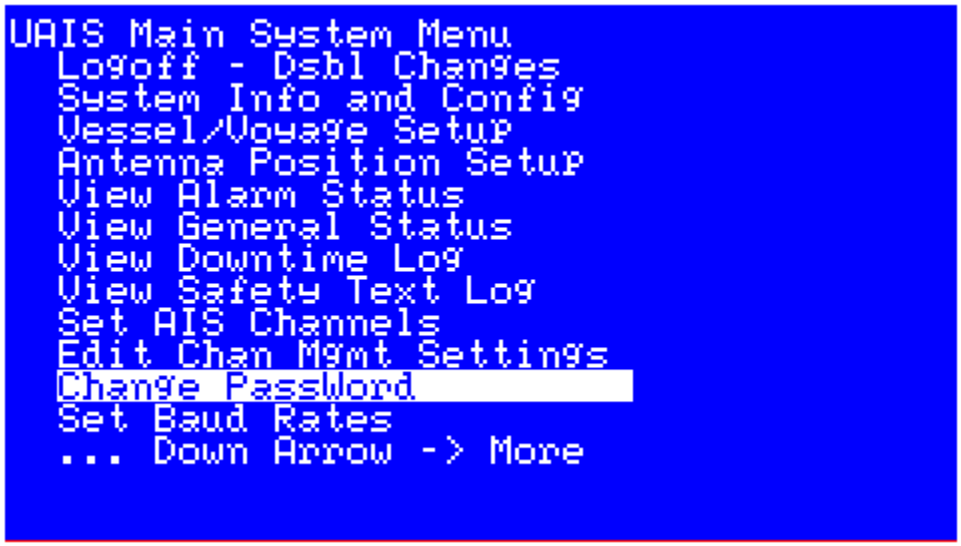


Figure 54 - Change Password Menu

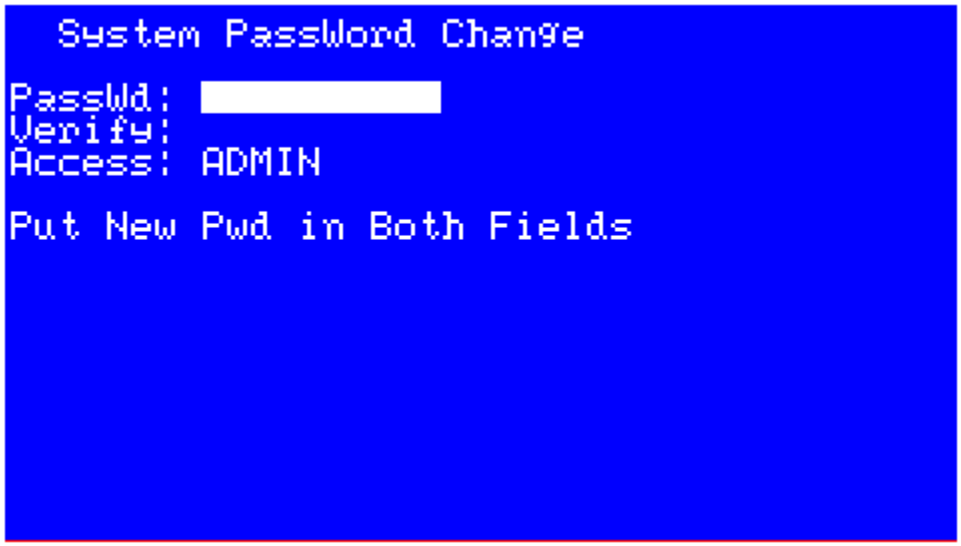


Figure 55 - Change Password Screen

4.3.15 Setting BAUD Rates

The **PROTEC** transceiver has seven RS422, NMEA0183 (IEC 61162-1/2) compatible data ports for connection to ship's sensors and display equipment. The BAUD rates for any of these channels may be changed.

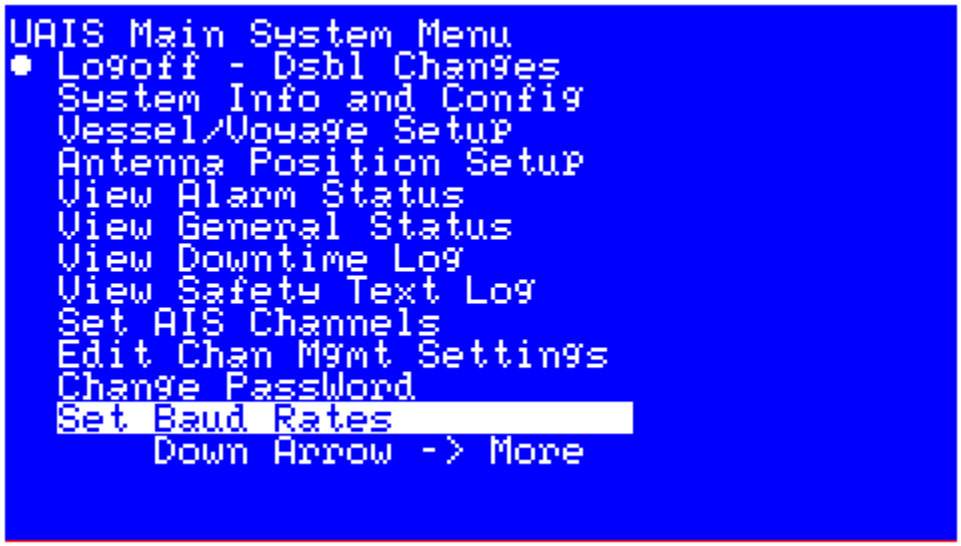


Figure 56 - Set BAUD Rate Menu

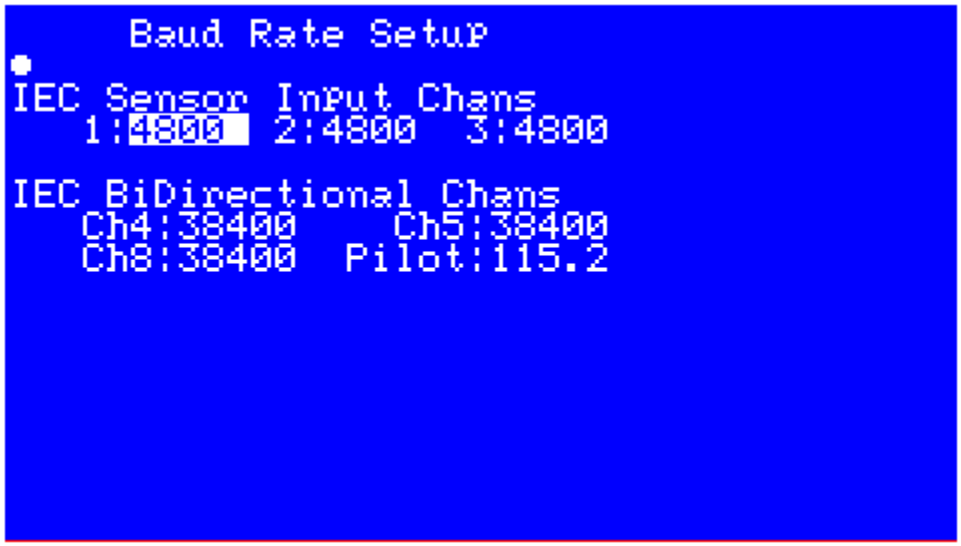


Figure 57 - Set BAUD Rate Screen

Use the arrow keys to navigate to the desired port, press ENT to enter the field and press the arrow keys to cycle through the available BAUD rates. Press ENT again to exit and save the setting.

The fields and their rates are described below.

IEC Sensor Input Channels:	Valid baud rates for CH1, CH2, and CH3 (Default = 4,800)
IEC Bidirectional Channels:	Valid baud rates for CH4, CH5, CH8, and Pilot (front panel) (Default = 38,400)

Available Baud Rates for all channels are:

4,800
9,600
19,200
38,400
57,600
115,200

4.3.16 Set RS422 Termination Controls

Proper cable termination is very important for signal fidelity particularly over long cable runs. If the cable is not terminated with its characteristic impedance, reflections will distort the signal waveforms.

A switchable termination resistor is integrated at the receiver input to provide proper termination to the data bus. This is ideal for use in networks where grounds can take on different voltages. Isolation in the circuitry blocks high voltage differences and eliminates ground loops and is extremely tolerant of common mode transients between ground potentials. The circuitry also mitigates the adverse effects of imperfect transmission line termination caused by stubs or mismatched cables.

For normal installations where cable runs are relatively short and the cable networks are simple this termination is not needed and should be left at the default (disabled) setting.

To enable the termination, arrow over to the desired IEC channel. Press ENT to activate the field and press any arrow toggle through the two settings.

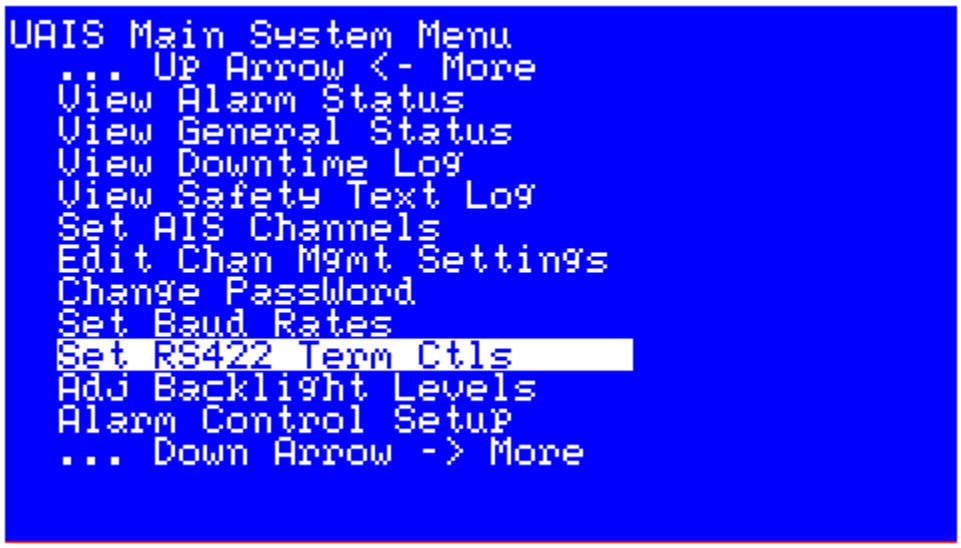


Figure 58 - Set RS422 Termination Menu

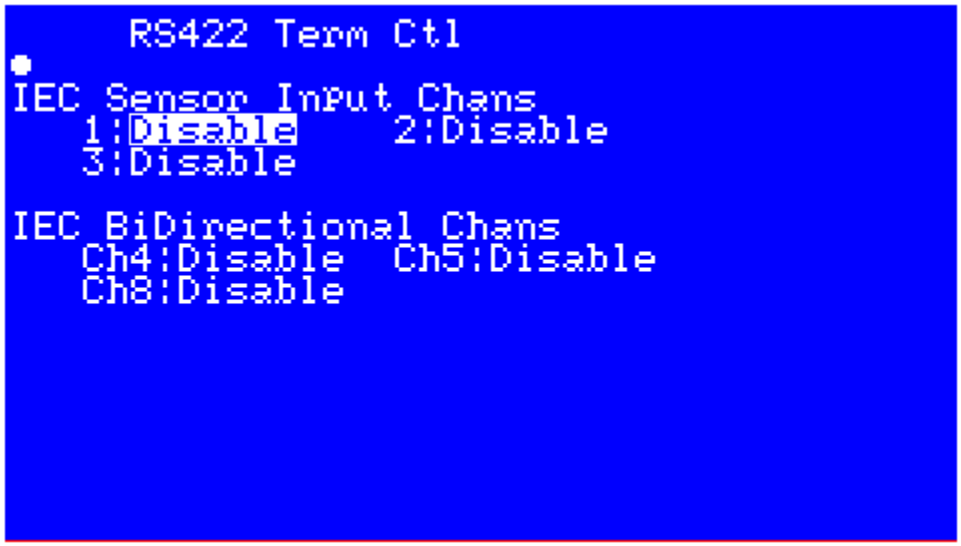


Figure 59 - Set RS422 Termination Screen

4.3.17 Adjust Backlight Levels

The backlight to the LCD display and the keypads on the front panel may be independently set. Enter the menu and press the left ← and right → arrows to adjust the LCD. Use the up ↑ and down ↓ arrows to adjust the keypads. Press CLR to restore the default setting.

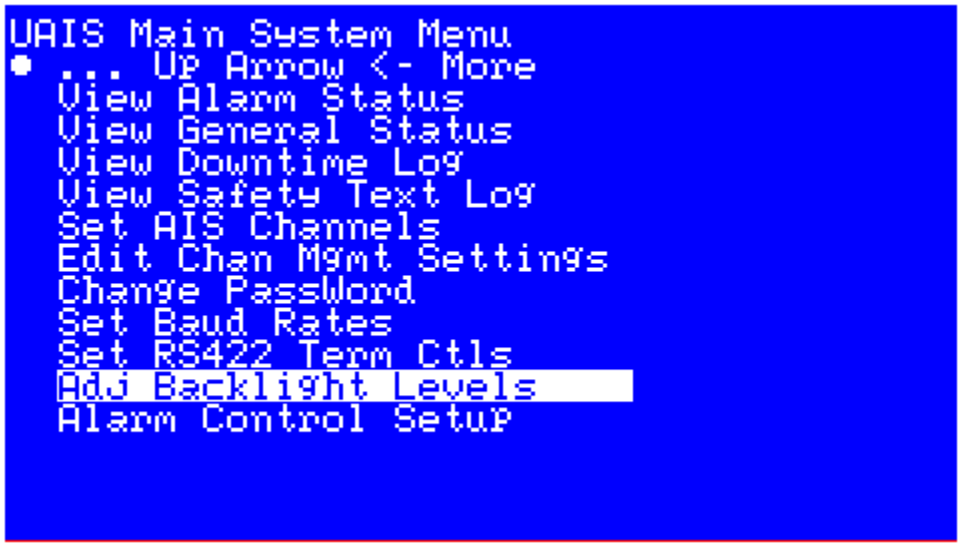


Figure 60 - Adjust Backlight Level Menu

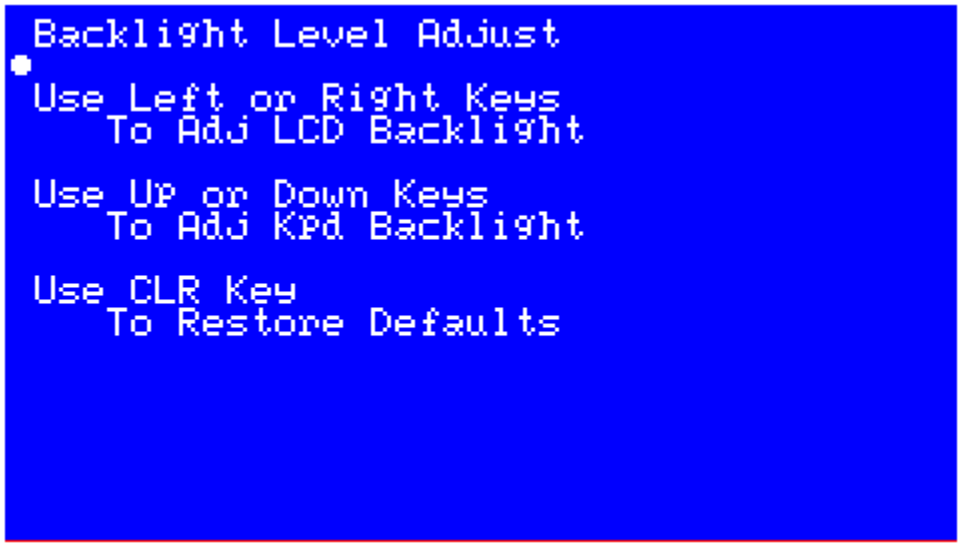


Figure 61 - Adjust Backlight Level Screen

4.3.18 Alarm Control Setup

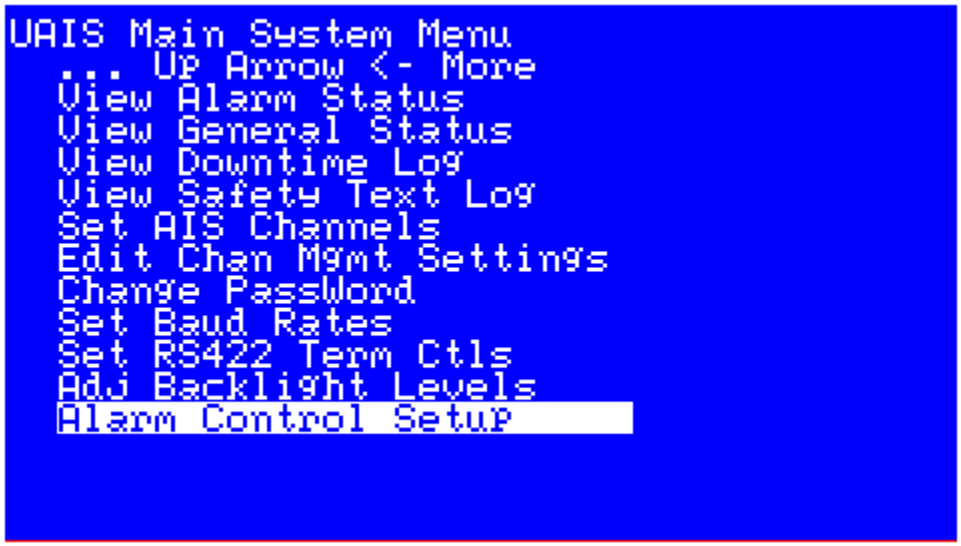


Figure 62 - Alarm Control Menu

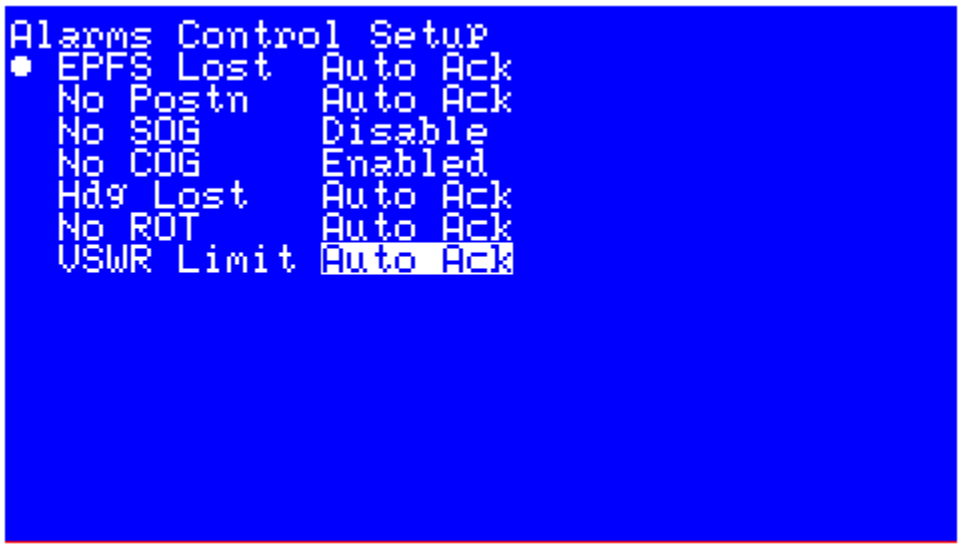


Figure 63 - Alarm Control Screen

This menu page allows a user with Administrator privileges to let the transceiver to automatically acknowledge alarms or to enable and disable alarms. The alarms can be set to appear on the MKD when the following conditions occur.

- EPFS Lost
- No Postn
- No SOG
- No COG
- Hdg Lost
- No ROT
- VSWR Limit

To control the alarms, arrow over to the desired field and press ENT to enter the field. Use the arrow keys to cycle through the three settings:

- Enable: The alarm will be displayed and generate a message in the alarm log
- Disable: No alarm is displayed, and no message is generated in the alarm log
- Auto Ack: The alarm will be auto--acknowledged, and generate a message in the alarm log

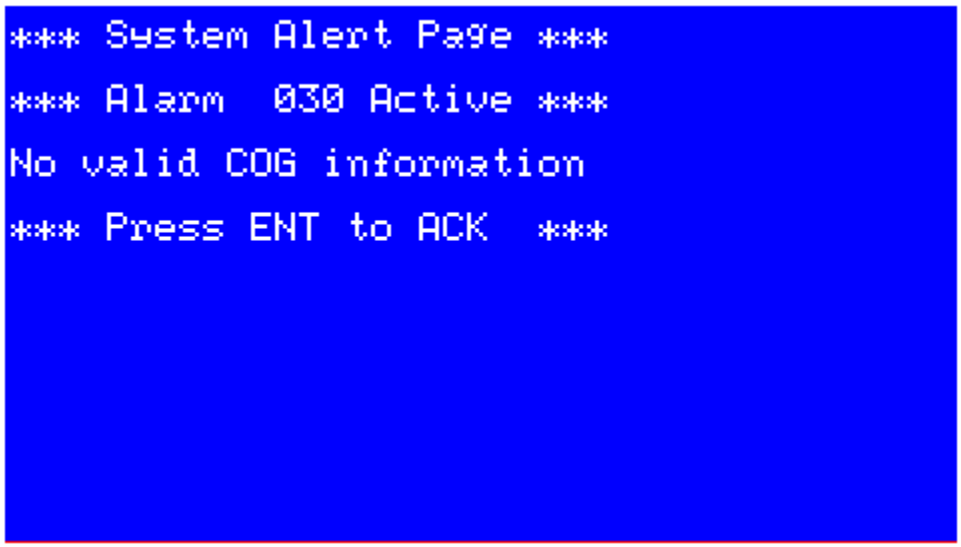


Figure 64 - Alarm Acknowledged

4.3.19 Text Messaging

Text messages can be sent through the Safety Text Entry Form.

Figure 65 - Safety Text Menu

MMSI: A Maritime Mobile Service ID is a nine digit unique identifier:
Addressed = enter MMSI, and Broadcast = must enter 0

Mode: Toggles between Addressed and Broadcast

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: Enter message with up to 156 alphanumeric characters

To send an addressed message:

- Press MSG key from any menu.
- Highlight the MMSI field and press ENT.
- Enter the MMSI number for the ship designated to receive the message, and press the ENT key.
- Press the Down ↓ arrow key to highlight the Mode field and press the ENT key.
- Using the Down ↓ arrow key, highlight Addressed, and press the ENT key.
- Using the Down ↓ arrow key, highlight the text portion of the screen, press the ENT key, and type in the message.
- Press the MSG key to broadcast the message. A message, stating Successful Transmission appears at the bottom of the screen.

To send a broadcast message:

- Press MSG key.
- Verify that the MMSI number is a zero. If it is not, press the Down ↓ arrow key until the MMSI is highlighted.
- Press the ENT key, and press the CLR key. Press ENT.
- Press the Down arrow key to highlight the Mode field, and press the ENT key.
- Use the arrow keys to select Broadcast, and press the ENT key.
- Press the Down arrow key to highlight the TxCh field. Select Auto Select, and press ENT.
- Using the Down arrow key, highlight the text portion of the screen, press the ENT key, and type in the message.
- Press the MSG key to broadcast the message.

5 Antennas

Data sheets on the recommended external antennas are included here.

5.1 VHF

MODEL VHF-159 HD ANTENNA

The Morad Heavy Duty (HD) Marine VHF Antenna is designed to give years of optimum performance under the most severe weather and vibration conditions. Due to its excellent propagation pattern and low angle of radiation, clipping and fading are minimized.

The design of this antenna enables it to consistently outperform its competitors. Use of a larger diameter rod, instead of a small wire, decreases resistive losses and provides an increased radiating surface.

The Model VHF-159 HD is base fed through a PL-259 UHF connector and a 50 OHM coaxial cable and can be mounted on any Morad 1" diameter stanchion for extra height.

The antenna body is 1.5" o.d. painted aluminum tube and has a high tensile strength stainless steel tip.

SPECIFICATIONS

Electrical

Power Rating	100 Watts
Input Impedance	50 OHMS
Standing Wave Ratio (SWR)	1.15 to 1
Transmitting Frequency Range	156 - 161 MHz
Radiation Pattern	Omnidirectional
Relative Gain	6 dB

Mechanical

Overall Height	54"
Maximum Diameter	1.5"
Wind Survival	100 MPH
Shipping Weight	3 lbs.
Actual Weight	2 1/2 lbs.

5.2 GPS

Bullet™ III GPS Antenna

KEY FEATURES

- Weatherproof housing
- Extended temperature range (-40°C / +90°C)
- Proven extra rugged, reliable
- Available in 3.3V (TNC) or 5V (TNC or F)
- RoHS-II Compliant

Bullet™ III GPS L1 Band Antenna
Whatever the environment—the Trimble® Bullet™ III GPS antenna will perform, year after year. The Bullet III antenna provides a perfect solution for manufacturers who need a fixed-site, rooftop GPS antenna.

This antenna is also a high-quality solution for adding GPS RF signals for marine GPS navigation systems.

Put it anywhere
The antenna is housed in weatherproof packaging designed to withstand exposure to shock, vibration, extreme temperatures, rain, snow and sunlight

The dome is all plastic, and the threaded socket in the base of the antenna. The socket accepts either a 1"-14" straight threat (typical marine antenna mount) or a 3/4" pipe thread.

The F-type or TNC antenna connector is located inside the threaded socket, which allows the antenna cable to be routed inside a mounting pole and protects the cable connection.

Strong Performance
The Bullet III antenna is an active GPS L1 band antenna with 5V DC and 3.3V DC options. The high gain preamp allows the Bullet III antenna to be used with up to 75 feet of RG-59 cable

Proven Reliability
For over 25 years, Trimble has sold GNSS antennas renowned for their survivability in tough environments. The Bullet III GPS antenna is the fourth generation of the proven Bullet antenna family and offers all the reliability and performance benefits that are required for mission critical installations.

In unforgiving environments, an antenna failure could be disastrous. Don't risk it. Select a proven GNSS antenna – the Trimble Bullet III GPS antenna.

Trimble

Bullet™ III GPS Antenna

ENVIRONMENTAL SPECIFIATIONS

Operating Temperature.....-40°C to +90°C
Storage Temperature.....-40°C to +90°C
Vibration..... 10 – 200 Hz Log sweep
3g (Sweep time 30 minutes) 3 axes
Shock.....50g vertical, 30g all axes
Humidity Soak.....+60°C @ 95% RH, 96 hours
Corrosion Salt Resistant.....5% Salt spray tested, 96 hours

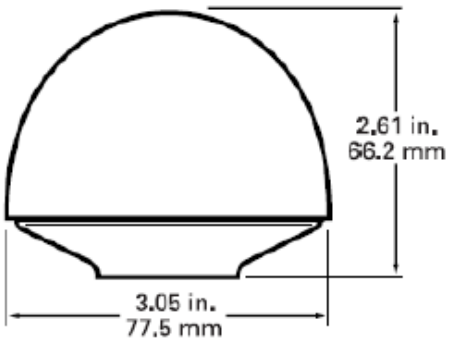
PHYISCAL CHARCTERISTICS – 3.3V & 5V DC ANTENNAS

Dimensions.....3.05"D x 2.61" H (77.5mm x 66.2mm)
Weight.....7.0oz (200grams)
Enclosure.....Off-white plastic
Connector.....F-type & TNC (5V) – TNC (3.3V only)
Mounting.....1" – 14" thread or ¾" pipe thread

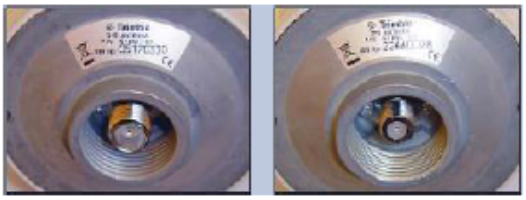
TECHNICAL / PERFORMANCE SPECIFICATIONS

Feature	3.3V	5.0V
Prime Power	3.3V DV (±10%)	5.0V DV (±10%)
Power Consumption	<20mA	<30mA
Gain	28dB ± 3dB	30dB ± 3dB
Output Impedance	50Ω	
Frequency	GPS L1 1575.42 ±1.023MHz	
VSWR	2.0 maximum	
Axial ratio	90°: 4 dB maximum; 10°: 6 dB maximum	
Noise	3.0dB (typical)	
Bandwidth (10dB RL)	50 MHz (min)	
Out of Band rejection	fo= 1575.42MHz fo ±20 MHz: 7 dB min fo ±30 MHz: 12 dB min fo ±50 MHz: 20 dB min fo ±100MHz: 30dB min	
Azimuth coverage	360° (omni-directional)	
Elevation coverage	0°-90° elevation (hemispherical)	0°-90° elevation (hemispherical)
ESD	IEC 61000-4-2	

MECHANICAL



CONNECTORS



GENERAL INFORMATION & ACCESSORIES

Please go to www.trimble.com/timing for the latest documentation and tools, part numbers and ordering information.

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