



Product Support Manual

Nauticast-B Class B AIS Transponder Product No. 2680 AIS-300

Y1-03-0222

Rev. B

Automatic Identification System

ACR Electronics, Inc.
5757 Ravenswood Road
Fort Lauderdale, FL 33312
Tel : +1 (954) 981-3333
Fax: +1 (954) 983-5087
www.acrelectronics.com
Email: info@acrelectronics.com

GENERAL WARNINGS

All marine Automatic Identification System (AIS) units utilize a satellite based system such as the Global Positioning Satellite (GPS) network or the Global Navigation Satellite System (GLONASS) network to determine position.

The accuracy of these networks is variable and is affected by factors such as the antenna positioning, how many satellites are used to determine a position and how long satellite information has been received for.

It is desirable wherever possible therefore to verify both your vessel's AIS derived position data and other vessels' AIS derived position data with visual or radar based observations.

The compass safe distance of this unit is 0.5m or greater for 0.3° deviation.

IMPORTANT: In most countries the operation of an AIS unit is included under the vessel's marine VHF license provisions. The vessel onto which the AIS unit is to be installed must therefore possess a current VHF radiotelephone license which lists the AIS system and the vessel Call Sign and MMSI number.

Please contact the relevant authority in your country for more information.

In accordance with a policy of continual development and product improvement the NAUTICAST-B hardware and software may be upgraded from time to time and future versions of the NAUTICAST-B may therefore not correspond exactly with this manual.

When necessary, upgrades to the product will be accompanied by updates or addendums to this manual.

Please take time to read this manual carefully and to understand its contents fully so that you can install and operate your AIS system correctly.

Information contained in this manual is liable to change without notice. Please visit our website for the latest manual revision at www.acrelectronics.com.

ACR Electronics, Inc. disclaims any liability for consequences arising from omissions or inaccuracies in this manual and any other documentation provided with this product.

© 2007 ACR Electronics, Inc.

LIMITED WARRANTY

THIS PRODUCT IS WARRANTED AGAINST FACTORY DEFECT IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF FIVE YEARS FROM DATE OF PURCHASE OR RECEIPT AS A GIFT. DURING THE WARRANTY PERIOD ACR ELECTRONICS, INC. WILL REPAIR OR, AT ITS OPTION, REPLACE AT NO COST TO YOU FOR LABOR, MATERIALS OR RETURN TRANSPORTATION, PROVIDED YOU OBTAIN A RETURN AUTHORIZATION FROM ACR ELECTRONICS, INC., 5757 RAVENSWOOD ROAD, FT. LAUDERDALE, FL. 33312-6645. TO OBTAIN A RETURN AUTHORIZATION, CALL OUR CUSTOMER SERVICE DEPARTMENT AT (800) 432-0227. THIS WARRANTY DOES NOT APPLY IF THE PRODUCT HAS BEEN DAMAGED BY ACCIDENT OR MISUSE, OR AS A RESULT OF SERVICE OR MODIFICATION BY OTHER THAN THE FACTORY. EXCEPT AS OTHERWISE EXPRESSLY STATED IN THE PREVIOUS PARAGRAPH, THE COMPANY MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO THIS PRODUCT. THE COMPANY SHALL NOT BE LIABLE FOR, CONSEQUENTIAL OR SPECIAL DAMAGES. IN ORDER TO PLACE THE WARRANTY IN EFFECT, THE ACCOMPANYING REGISTRATION CARD MUST BE RETURNED TO US WITHIN TEN DAYS OF PURCHASE.

Manual Revision Status	3
SECTION 1 - WHAT IS AIS?	4
1.1 AIS Classes	5
1.2 Position Information Source	6
SECTION 2 - INSTALLATION	6
2.1 The contents of this box	6
2.2 Software Installation	7
2.3 Programming	7
2.4 Help	8
2.5 Software Configuration	9
2.6 Hardware Installation	10
2.7 Antenna Installation	11
SECTION 3 – USING THE TRANSPONDER	12
3.1 Switching On	12
3.2 Warning And Fault States	12
3.3 Data Port Messages	13
3.4 Information Transmitted And Received	13
3.5 Built In Test	14
3.6 Led Indicators	14
3.7 Antennas	15
SECTION 4 – MAINTENANCE	15
SECTION 5 – SERIAL DATA INTERFACE	15
5.1 Power Connection / Data Connection	15
5.2 Serial Port Input/Output	15
5.3 Power up messages	16
5.4 VHF data link messages (NMEA 0183 VDM)	16
5.5 VHF data link own vessel messages (NMEA 0183 VDO)	17
5.6 Regional Assignment Channel Assignment Message (NMEA 0183 ACA)	18
5.7 Channel management information source messages (NMEA 0183 ACS)	19
5.8 AIS Alarm Messages (NMEA 0183 ALR, Text)	19
5.9 ACK messages	20
SECTION 6 – STANDARDS	20
6.1 Product Specification	21
6.2 Information Reporting Intervals	22
6.3 Warnings	22
SECTION 7 – CONTACT & SUPPORT INFORMATION	22

Manual Revision Status

Date	Rev.	Status	Comments	Responsible
2007-5-23	A			T. Martin
2007-6-7	B			C. Wahler

SECTION 1 - WHAT IS AIS?

AIS stands for **A**utomatic **I**dentification **S**ystem. AIS increases navigational safety and collision avoidance by transmitting vessel identification, helping to reduce the difficulty of identifying ships when not in sight (e.g. at night, in radar blind arcs or shadows or at distance) by broadcasting navigational intentions to other vessels by providing ID, position, course, speed and other ship data with all other nearby ships and land based stations.

According to IALA regulations, AIS is defined as follows:

AIS is a broadcast Transponder system, operating in the VHF maritime mobile band. It is capable of sending ship information such as identification, position course, speed and more, to other ships and to shore. It can handle multiple reports at rapid update rates and uses Carrier Sense Time Division Multiple Access (CSTDMA) technology to meet these high broadcast rates and ensure reliable and robust ship to ship operation.

The IMO defines the performance standards as follows:

Ship to ship working, ship to shore working, including long range application, automatic and continuous operation, provision of information messaging via PC and utilization of maritime VHF channels

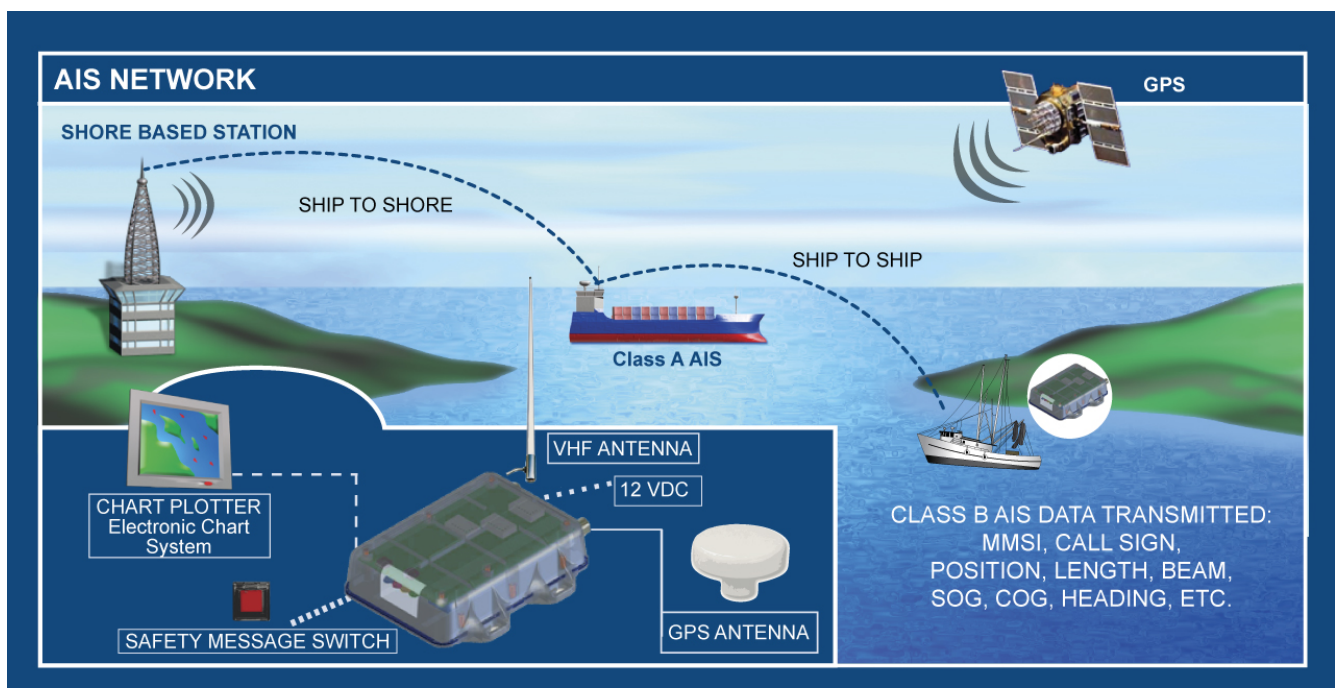
The Modules: GPS system, AIS Transponder, VHF Antenna, and the Data Power Cable (appropriate application software connects the individual modules).

AIS are required to function flawlessly in a variety of modes. The relevant regulations requirements:

The system shall be capable of

- An **"autonomous and continuous"** mode for operation in all areas. This mode shall be capable of being switched to/from one of the following alternate modes by a competent authority;
- An **"assigned"** mode for operation in an area subject to a competent authority responsible for traffic monitoring such that the data transmission interval and/or time slots may be set remotely by that authority;
- A **"polling or controlled"** mode, where the data transfer occurs in response to interrogation from a ship or competent authority.

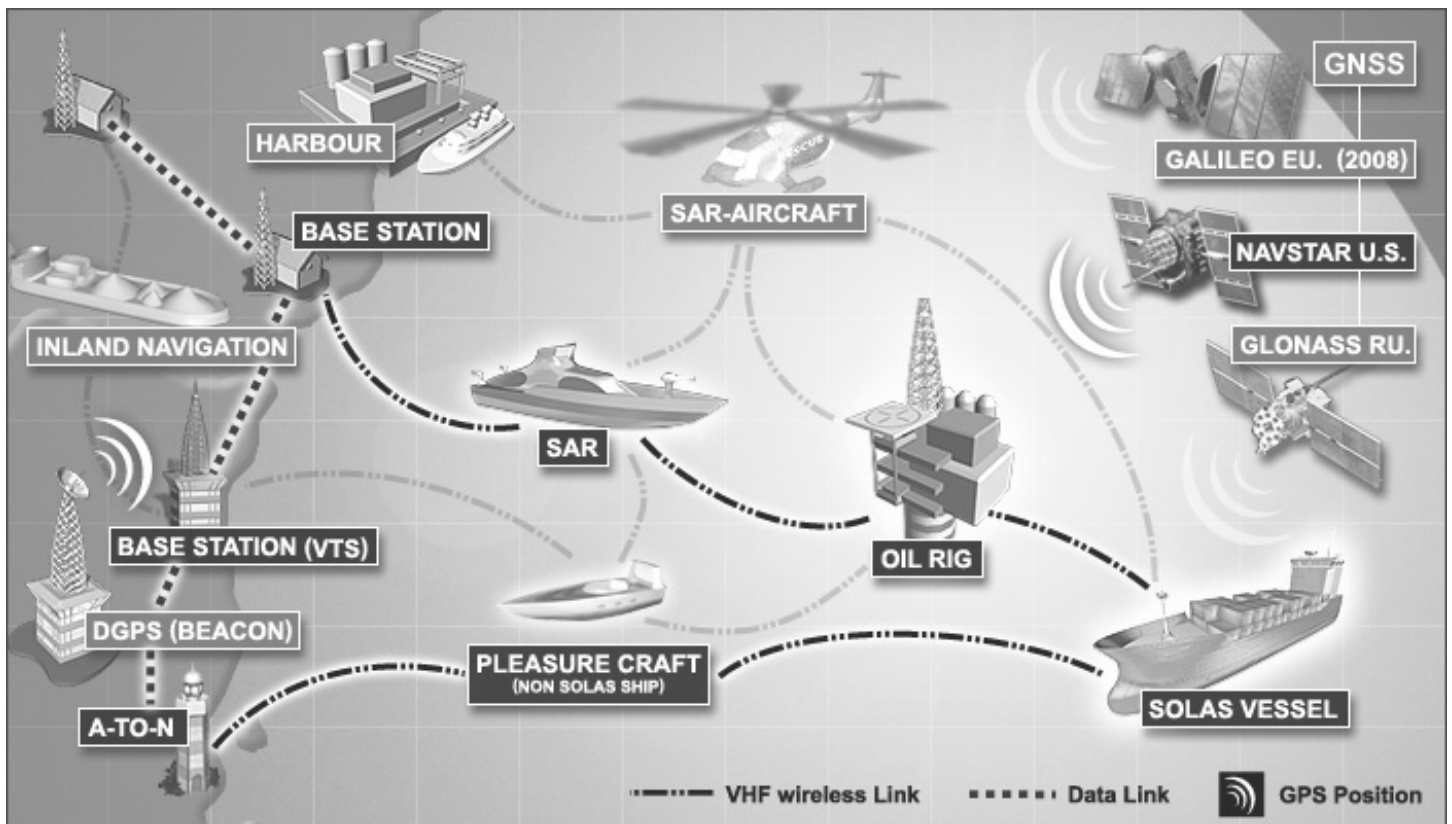
This illustration depicts a typical AIS System, where two or more AIS equipped vessels (and shore based systems) are automatically communicating with each other.



On the bottom, a typical NAUTICAST-B installation in a common environment is shown. The NAUTICAST-B is connected to the vessels power supply, and in connection with the VHF, and GPS-Antennas, the minimal requirements for Transponder operation are fulfilled.

Both vessels in the above illustration are equipped with an AIS transceiver. Due to “Time – Synchronization” they use the same organization of free and allocated windows (Slots) in the shared VHF Data Link (this method is called “Carrier Sense Time Division Multiple Access”) to send and receive messages. Without the necessity of any operating interaction, both vessels know exactly who or what is cruising nearby and where the individual object is heading.

The scenario below shows a full AIS coverage area (including all applications and complete shore infrastructure).



1.1 AIS Classes

There are two classes of AIS units fitted to vessels, Class A and Class B. In addition AIS base stations may be employed by the Coastguard, port authorities and other authorized bodies. AIS units acting as Aids to Navigation (A to N) can also be fitted to fixed and floating navigation markers such as channel markers and buoys.

Class A units are a mandatory fit under the safety of life at sea (SOLAS) convention to vessels above 300 gross tons or which carry more than 11 passengers in International waters. Many other commercial vessels and some leisure craft also maybe fitted Class A units.

Class B units are designed for fitting in vessels which do not fall into the mandatory Class A fit category. **The ACR NAUTICAST-B is a Class B AIS unit.**

Information transmitted from vessels that have a CLASS A AIS transponders on-board include:

- | | | | |
|------------------|-----------------------|------------------|---------------------|
| • Name of Vessel | • Destination | • Size of Vessel | • Vessel Dimensions |
| • Speed (SOG) | • Call Sign | • ETA | • Draft |
| • Position | • Course (COG) | • Type of Vessel | • Status |
| • MMSI Number | • Navigational Status | • Heading | • Cargo |
| • Rate of Turn | • IMO Number | | |

Information transmitted from vessels that have a CLASS B AIS transponders on-board include:

- | | |
|------------------|---------------------|
| • Name of Vessel | • Vessel Dimensions |
| • Speed (SOG) | • Type of Vessel |
| • Position | • Heading |
| • MMSI Number | • Course (COG) |
| • Call Sign | |

1.2 Position Information Source

The marine AIS system uses position information derived from networks such as the Global Positioning Satellite (GPS) or the Global Navigation Satellite System (GLONASS) in order to determine the location of the AIS unit and thus the vessel to which it is fitted. The NAUTICAST-B utilizes the GPS satellite network.

SECTION 2 - INSTALLATION

2.1 The contents of this box

Before proceeding with the installation of the Nauticast-B, please check the contents of the box, which should include:

- The Nauticast-B AIS transponder
- Data/Power Cable
- Mounting hardware (4 self tapping screws)
- Strain relief cable straps (3)
- VHF Antenna (dedicated for AIS use only) with connection cable
- GPS Antenna (dedicated for AIS use only) with connection cable
- Nauticast-B Product Support Manual
- Link2AIS Software CD
- Link2AIS User Guide

Installation should be completed in 4 separate steps. Complete each step before proceeding to the next.

- Installing the Link2AIS software onto your PC.
- Enter your Ships data into the Link2AIS software (MMSI, Vessel Name, Call sign, Length, Beam ect.)
- Program your ships data into the AIS hardware.
- Installing your AIS hardware to your vessel.

2.2 Software Installation

The Link2AIS application is designed to operate with Microsoft Windows 2000, XP and above. Recommended minimum system requirements are:

- Microsoft Windows 2000 SP 3 or Microsoft Windows XP SP2
- Display resolution of at least 1024 x 768
- At least one RS232 serial port (or USB to serial converter already installed*)

***If you are using a USB to serial converter please ensure this is fully installed before proceeding.**

This software uses the Microsoft .Net Framework V2.0. The framework will be automatically installed during setup if not already present on the system.

Insert the installation CD and locate the Setup.exe file.

Double click the Setup.exe file to begin the installation.

Follow on screen prompts to install the .Net framework if required.

Follow the screen prompts to install Link2AIS software.

Refer to Software User Guide for detail install instructions.

The application will install and launch automatically.

A Start Menu folder and shortcut will be created with the name 'Link2AIS'. This short cut should be used to re-launch the application as required

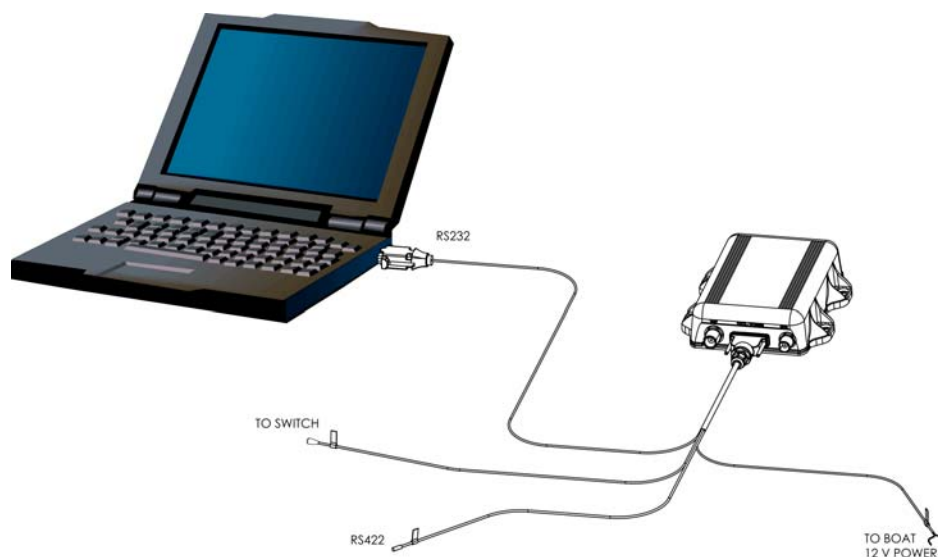
2.3 Programming

NOTE: To program your NAUTICAST-B you will need to connect the AIS to a personal computer and supply the NAUTICAST-B with 12V of power.

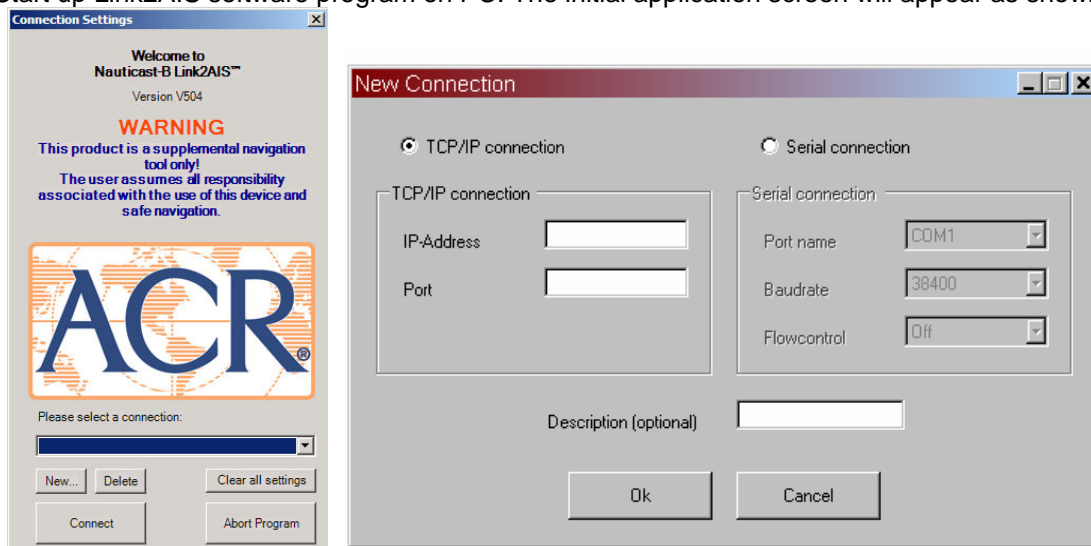
ACR recommends you connect the AIS to your boat's power and connect it to a laptop in order to easily program your AIS before physically mounting the transceiver.

Connect the RS232 (9-Pin Connector) to your laptop. This connects between the supplied data lead and the PC. If the PC being used for programming does not have a 9-pin serial port then a commercially available USB to serial adaptor (RS 232) may be required.

Connect the AIS to your boat's interior power supply (12 V).



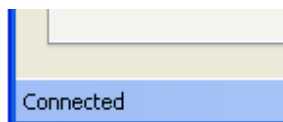
Start up Link2AIS software program on PC. The initial application screen will appear as shown:



The application requires a serial connection to an NAUTICAST-B transponder. Connect the transponder to an available serial port. If your serial port is not located in the drop down box, select 'New...' and create a new connection.

Select the serial port from the drop down menu, then click 'Connect':

Once a connection is established the application is ready to use. Connection status is indicated at the bottom left of the application window:



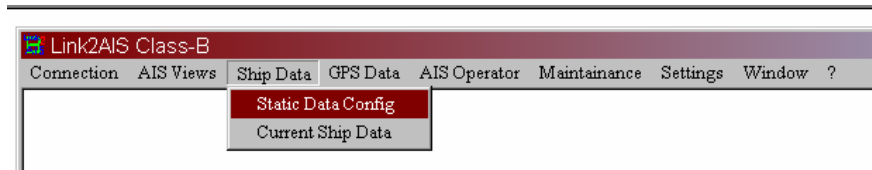
2.4 Help

There is a context based Help file which explains what each data entry field means and what sort of data is expected.

2.5 Software Configuration

The functions of Link2AIS are arranged in a series of tabs. Each tab contains information relating to a particular aspect of the connected AIS transponder. Depending on the version of Link2AIS installed not all tabs shown below may be visible.

Select the Monitoring tab and open the Static Data tab. This will display the 'Static Data' for the connected AIS transponder. This includes the vessel's name, call sign, MMSI number and other fixed information.

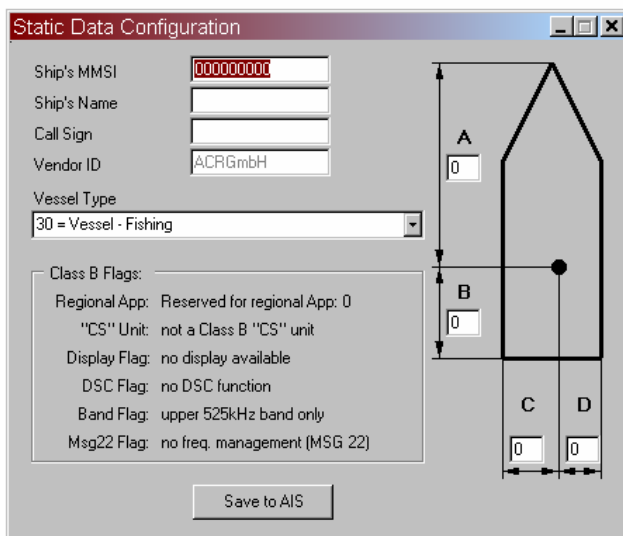


To configure the transponder all of the data fields must be completed and saved to the AIS.



CAUTION:

For security reasons the MMSI of the vessel cannot be changed once programmed. Do not program the MMSI unless you are certain you have the correct information. Please check the number entered carefully. If the MMSI programmed is incorrect the AIS transponder will need to be returned to the supplier for factory reset.



Enter the vessels information in the appropriate box:

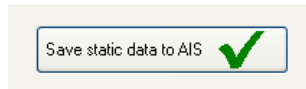
- Ship's name - enter the name of the vessel (20 characters maximum)
- Call Sign - enter the vessel's radio call sign (7 characters maximum)
- MMSI number - enter the vessel's Maritime Mobile Service Identity number
- Enter the vessels dimensions as follows rounded to the nearest meter
 - Dimension A - distance from bow to GPS antenna location to the nearest meter
 - Dimension B - distance from the GPS antenna location to the stern to the nearest meter
 - Dimension C - distance from the port side to the GPS antenna location to the nearest meter
 - Dimension D - distance from the GPS antenna to the starboard side to the nearest meter
- Select the most appropriate vessel type from the drop down menu.



CAUTION:

If no MMSI is entered (MMSI is set to 000000000) then the AIS transponder will operate in receive only mode and the red LED will remain on. The vessels own position will not be transmitted. An MMSI must be entered to allow the AIS transponder to transmit its own position to other vessels.

When you have entered all of the vessel's data click the 'Save static data to AIS' button to program this configuration into the AIS transponder:



A warning will be displayed asking you to verify the MMSI number. The MMSI can only be changed by your dealer once programmed into the transponder. You can change all data (except the MMSI) at any time, should the need arise. Please check that the number displayed is correct before proceeding. If the number is incorrect click the 'No' button to cancel programming of the MMSI:



Click the 'Yes' button if the MMSI is correct

The static data tab will be updated to show the newly programmed vessel information. The MMSI number will be displayed with a grey background to indicate that it has been programmed and cannot be changed.

For additional Software applications unrelated to the installation, please refer to the Link2AIS manual for technical support.

2.6 Hardware Installation



WARNING: Do not connect the NAUTICAST-B unit to a main (line) AC electrical supply, as an electric shock or fire hazard could result. Length of Data/Power Cable connection must not exceed 3 meters.

CAUTION: Do not connect the NAUTICAST-B unit to a DC supply exceeding 15.6 V or reverse the supply polarity. Damage to the unit may result. Ensure the power supply is limited in accordance with EN 60950-1:2006 and protected with fuse or breakers not to exceed the specifications listed in this manual.

CAUTION: The NAUTICAST-B unit is designed for operation in the temperature range -25 °C to +55 °C. Do not install (or use) the NAUTICAST-B unit in environments which exceed this range.

CAUTION: Do not install the NAUTICAST-B unit in an environment where it can be subject to excessive exposure to water.

Electrical connections

Warning: Only the data and power cables provided with the NAUTICAST-B unit should be used to connect antennas, power and display devices so as to maintain the integrity of the enclosure.

Please see the drawings section of this manual for details of the power, data and RF cables supplied.

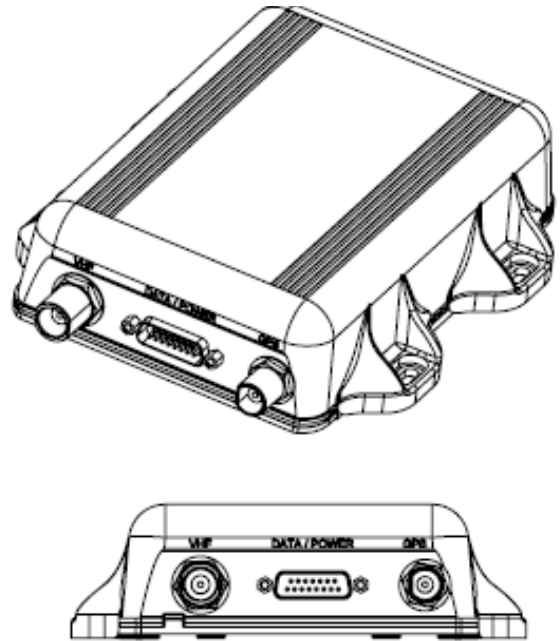
Using the two co-axial leads supplied connect the down-lead from a VHF antenna to the VHF antenna port and connect the down-lead of a GPS antenna to the GPS antenna port. Please see Appendix A for a block diagram of the antenna installation.

If an external display unit (chart plotter, PC etc) is to be used connect the supplied power and data interface cable to the Power / NMEA port.

If an external display unit is not to be used connect the supplied power only interface cable to the Power / NMEA port. See page 23 for wiring details.

PC serial terminal or other display device) connect the user end of the data interface cable to the display device. Note that the software in the display device must be configured for AIS operation AND to accept standard Class B operation NMEA sentences. This external display unit software is not part of the NAUTICAST-B transponder package.

Connect a 12V DC supply (9.6-15.6V) capable of supplying 2A peak to the DC power lead (brown/red = positive, black/blue=negative).



Physical Mounting

The unit shall be mounted on a vertical bulkhead with the cables in the down position. The mounting location should be protected from the weather and direct water spray. Typically this would be under the helm station or in the cabin.

It is recommended that the unit is attached to a solid surface with #10-32 x 1.2 self tapping head Phillips screw (provided in kit). A template for drilling pilot holes is shown on page 24.

CAUTION: Avoid excess stress on connectors during installation.

2.7 Antenna Installation

Antenna connections

GPS Antenna

This is a TNC female bulkhead connector that mounts to the back of the case. This port provides the 5V DC feed for the active GPS antenna required by the NAUTICAST-B unit.

VHF Antenna

This is a UHF female bulkhead connector that mounts to the back of the case.

CAUTION: The GPS, VHF and power/data cables need to be secured to the bulkhead within 6" to 12" from the connectors.

Antenna Mounting

GPS Antenna

The GPS antenna used must be of the active type (i.e. it should incorporate an LNA) and must be suitable for marine shipboard applications (index of protection, ruggedness, means of mounting, etc.). An antenna should be selected with a gain (in dB) depending on the length of cable between the antenna and the AIS unit; after subtraction of cable and connector losses a minimum total gain of 20 dB should be available at the NAUTICAST-B unit GPS antenna connector. The GPS antenna to be used for AIS use must be a dedicated antenna, i.e. not shared with any other GPS receiver. Installation of the GPS antenna is critical for the performance of the built in GPS receiver which is used for timing of the transmitted time slots and for the supply of navigational information should the main navigational GPS fail.

We strongly recommend that:

- The GPS antenna is mounted in an elevated position and free of shadow effect from the ship's superstructure.
- The GPS antenna has a free view through 360 degrees with a vertical angle of 5 to 90 degrees above the horizon.
- As the received GPS signal is very sensitive to noise and interference generated by other onboard transmitters, ensure that the GNSS antenna is placed as far away as possible from radar, Inmarsat and Iridium transmitters and ensure the GPS antenna is free from direct view of the radar and the Inmarsat beam.
- It is also important that the MF/HF and other VHF transmitter antennas are kept as far away as possible from the GNSS antenna. It is good practice never to install a GNSS antenna within a radius of 2 meters from these antennas.

VHF antenna for AIS use

The VHF antenna employed for AIS use:

- Must be a dedicated antenna, i.e. not shared with any other VHF transmitter/receiver.
- Must be suitable for marine shipboard applications (index of protection, ruggedness, means of mounting, etc.).
- Should be omni-directional and vertically polarized with unity gain (0 dB) with a bandwidth sufficient to maintain VSWR <1.5 over the frequency range 156 – 163 MHz. As a minimum the 3dB bandwidth must cover the two AIS channels and the DSC Channel.
- Should be mounted with at least a two meter vertical separation distance from any other VHF antenna used for speech or DCS communication but see also the section "Radio Frequency Exposure Warning" below.

SECTION 3 – USING THE TRANSPONDER

3.1 Switching On

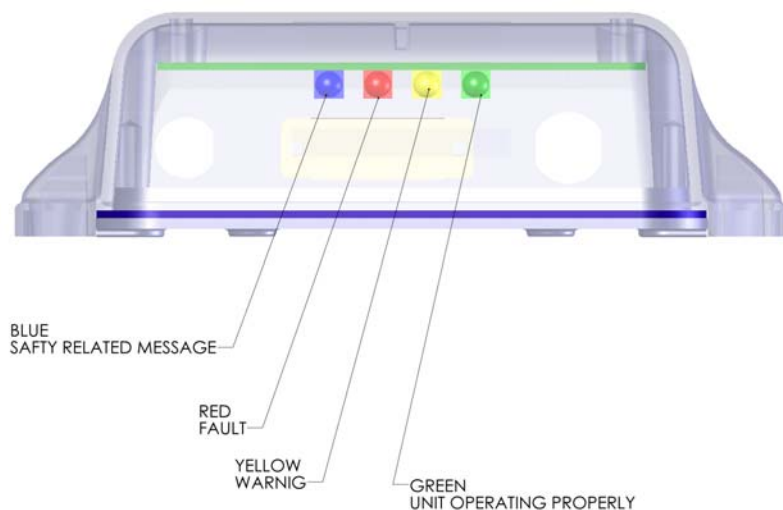
When the 12V supply is switched on all four LEDs visible on the front panel of the unit will illuminate twice for a period of one second on each illumination. The blue LED will then go out, when the internal GPS starts outputting valid position information the red LED will go out and the NAUTICAST-B unit transmits its first position report (message 18) and the yellow LED will go out; note that this process may take up to 30 minutes depending on the switch-on state of the GPS receiver. When the yellow LED goes out the green LED will illuminate indicating that the unit is now operating correctly.

3.2 Warning and Fault States

If the unit has not been able to transmit a position report during the last expected two reporting intervals (i.e. the nominal reporting interval cannot be maintained for operational reasons such as a Message 23 quiet period, high channel load conditions, etc) the yellow LED will illuminate. This is a warning condition only and indicates that your vessels position is not currently being reported to other vessels. Reception of other vessel AIS information by the NAUTICAST-B is not affected. When the unit is able to commence reporting the yellow LED goes out.

If a fault occurs the red LED will illuminate. This may illuminate briefly if the power supply is interrupted or if the

VHF or GPS antenna characteristics are briefly affected.



If the Red LED illuminates continuously the unit should be assumed to be faulty and should either be switched off (power removed) or if this is not practical any other vessel position information derived from the unit should not be used and it should also be assumed that the unit is not transmitting valid position information for your vessel.

The unit should be examined by a competent equipment maintainer at the earliest opportunity.

More details on LED indications can be found in section 3.6.

3.3 Data Port Messages

The data port will output the following:

(At power-up) boot-loader and main application splash text screens including version numbers, and memory status

- Details of relevant AIS transmissions received
- Details of AIS transmissions sent
- Details of channel management messages received
- Alarm messages generated by the BIIT function
- The data port will accept the following inputs:
- Programming information
- Alarm acknowledgements

Please see the 'Data Interface' section of this manual for more details of the data port messages.

When in operation an AIS unit:

- Uses one of two VHF channels within the international marine band allocation (channel 87B; 161.975MHz, or channel 88B; 162.025MHz) to regularly transmit information such as the vessel position, Maritime Mobile Service Identity (MMSI), name, speed, course, etc.
- Receives similar information from other AIS equipped vessels within VHF range and outputs that information for use by an external display medium (AIS enabled chart plotter, PC using AIS enabled chart plotter software etc.)

3.4 Information Transmitted And Received

A Class A unit will transmit its IMO number (if known), MMSI, Call sign and Name, length and beam, ship type, time, course over ground (COG), speed over ground (SOG), heading, navigational status, rate of turn, draught, cargo type, destination and safety related messages via a short message service (SMS) facility. Message lengths are variable with static and voyage related information being transmitted less often.

A Class B unit will transmit its MMSI, Call Sign and Name, length and beam, ship type, time, course over ground (COG), speed over ground (SOG) and heading.

3.5 Built In Test

The NAUTICAST-B unit is equipped with Built in Integrity Testing (BIIT). BIIT tests run continuously or at appropriate intervals simultaneously with the standard functions of the equipment. The BIIT detects any failure or malfunction that will significantly reduce integrity or stop operation of the NAUTICAST-B unit.

The tests include:

- AIS TX malfunction (synthesizer not locked and TX time-out not exceeded)
- Antenna VSWR exceeds limit
- Rx channel 1 malfunction (synthesizer not locked)
- Rx channel 2 malfunction (synthesizer not locked)
- Internal GNSS not in use
- No valid SOG information
- No valid COG information
- Background noise > -77dBm
- GPS failure
- VSWR exceeding the maximum allowed level
- The input voltage is out of the specified range

3.6 Led Indicators

Power

This is a green LED which indicates, when lit, that power has been connected correctly to the transponder, that the transponder hardware has been configured, that the operating software is present, that the CPU has booted up and the application software is running.

TX Timeout

This is a yellow LED which indicates when lit that the CSTDMA transmitter is prevented from transmitting. Reasons for this include the following:

- The transponder's internal GPS receiver is not operating or is not yet ready. [1] requires that a class B CSTDMA transponder shall not transmit if its internal position sensor is not operating
- The transponder was unable to transmit an AIS message due to the channel being already occupied, e.g. by transmissions from other AIS transponders

Error

This is a red LED which indicates, when lit, one of the following status conditions is possible:

- Transmitter lockout timer (1 second maximum) has operated
- GPS is unable to gain lock after 30 minutes
- VHF antenna VSWR is out of range
- Power Supply is out of range
- Background noise level is above the threshold level (-77dBm)

Safety Related Message (SRM) Status

This is a blue LED which indicates when lit that the Safety Related Message (SRM) button (not included, recommend momentary contact switch rated for $\geq 25\text{mA}$) has been depressed for more than 2 seconds and the pre-set SRM has been sent. If the SRM LED is illuminated it is not possible to send another SRM. An SRM can be sent once a minute. The payload within the message 14 transmission is the text string "MAYDAY MAYDAY". This function can be activated thru the Link2AIS software when a switch is not installed.

Silent Mode Function (if user configures SRM switch to act as Silent Mode switch)

This is a blue LED which indicates when lit that the Silent Mode button has been depressed for more than 2 seconds and the pre-set Silent Mode has been activated. If the blue LED is illuminated you are not transmitting your AIS data to other vessels, your AIS is acting as a receive-only device. Depress the Silent Mode button a second time transmit your position data. This function can be activated thru the Link2AIS software when switch

is not installed.

3.7 Antennas

The NAUTICAST-B unit requires VHF and GPS antennas independent from those in use for other purposes. Please see [Appendix A](#) for details of the antennae required.

SECTION 4 – MAINTENANCE

WARNING: Unauthorized opening of the NAUTICAST-B system will invalidate the warranty.

CAUTION: Avoid using chemical solvents to clean the NAUTICAST-B as some solvents can damage the case material. To clean, wipe down with a damp cloth.

NOTE: The NAUTICAST-B contains no user serviceable parts. Contact your Service Agent for repair for replacing the fuse fails to make the equipment serviceable.

SECTION 5 – SERIAL DATA INTERFACE

5.1 Power Connection / Data Connection

There is a 15-pin D-Sub female connector mounted on the back of the transponder cover. The standard data or power and data cable assembly provided mates with this connector.

NOTE: Both thumb screws on the power/data cable shall be tightened securely.

Power

12V DC (9.6-15.6V) is connected to the transponder power supply input via the data/power cable.

Data

- A minimum keypad and display (MKD) unit, chart plotter or other display device may be connected to the NAUTICAST-B unit via the appropriate cable assembly. The default baud rate of the data link is 38.4kBaud with 8 data bits, one stop bit and no parity.
- The data interface conforms to IEC 61162-1.
- VDM, VDO, ACA, ACS, ALR, TXT and ACK messages conform to NMEA 0183. Please refer to NMEA 0183 for full details of these AIS messages.

5.2 Serial Port Input/Output

There is one 9-pin serial port for data in RS232 format. There is one set of flying leads for data in RS422 format. Duplex capability is available from either or both ports.

The serial port interface(s) output:

- At power-up boot-loader and main application splash text screens including version numbers and memory status.
- As a VHF Data Link Message (VDM) all incoming VHF Data Link (VDL) data received by the NAUTICAST-B.
- The VHF data link own vessel (VDO) messages sent by the NAUTICAST-B over the VHF Data Link.
- AIS regional channel assignment messages (ACA) received. These are derived from an incoming VHF Data Link message (message 22) or a DSC message.
- AIS channel management information source (ACS) messages.
- Alarm messages (ALR, TXT).

The data interface will accept:

- Personality programming messages
- Alarm acknowledgement messages (ACK)

5.3 Power up messages

On power up the unit will report details of the firmware versions residing in the unit.

5.4 VHF data link messages (NMEA 0183 VDM)

This sentence is used to transfer the receipt of a VHF Data Link (VDL) message on either AIS radio channel, as defined in ITU-R M.1371, using the "Six-bit" field type. The structure provides for the transfer of long binary messages by using multiple sentences. Data messages should be transmitted in as few sentences as possible. When a data message can be accommodated in a single sentence, then it shall not be split.

VDM Message Format

!-VDM,x1,x2,x3,a,s--s,x*hh<CR><LF>
field 1 2 3 4 5 6

Field	Format	Description
1	x	Total number of sentences needed to transfer the message ¹ , 1 to 9
2	x	Sentence number ¹ , 1 to 9
3	x	Sequential message identifier ² , 0 to 9
4	a	AIS Channel, "A" or "B" ³
5	s---s	Encapsulated ITU-R M.1371 radio message ⁴
6	x	Number of fill-bits ⁵ , 0 to 5

NOTE 1 The length of an ITU-R M.1371 message may require the transmission of multiple sentences. The first field specifies the total number of sentences used for a message, minimum value 1. The second field identifies the order of this sentence in the message, minimum value 1. These cannot be null fields.

NOTE 2 The sequential message identifier provides a message identification number from 0 to 9 that is sequentially assigned and is incremented for each new multi-sentence message. The count resets to 0 after 9 is used. For a message requiring multiple sentences, each sentence of the message contains the same sequential message identification number. It is used to identify the sentences containing portions of the same message. This allows for the possibility that other sentences might be interleaved with the message sentences that, taken collectively, contain a single message. This shall be a null field for messages that fit into one sentence.

NOTE 3 The AIS channel is indicated as either "A" or "B". This channel indication is relative to the operating conditions of the AIS unit when the packet is received. This shall be a null field when the channel identification is not provided. The VHF channel numbers for channels "A" and "B" are obtained by using a "query" (See IEC 61162-1, clause 5.3.2) of the AIS unit for an ACA sentence.

NOTE 4 This field supports a maximum of 62 valid characters for messages transferred using multiple sentences, and 63 valid characters for messages using a single sentence.

NOTE 5 This cannot be a null field. See "x4" in 5.3.3.

VDM Message Types

For example, the information contained in the s - s portion of the VDM = Encapsulated ITU-R M.1371 radio message. Note that messages 5 and 19 may be sent as multi part messages using the x1, x2 and x3 parameters for message sequence control.

VDL Message number	VDM Message description
AIS Target Display Information	
1, 2, 3, 9, 18, 21	position report
4	base station report
5*	voyage related data
19*	Class B – extended data
Safety message handling	
12	addressed safety related
14	broadcast safety related
External Application handling	
6	binary addressed
8	binary broadcast
System control	
7	binary acknowledge (INFO)
10	UTC and data inquiry (INFO)
11	UTC and data response (INFO)
13	safety related ack (INFO)
15	interrogation (INFO)
16	assignment mode command (INFO)
17	DGNSS corrections (INFO)
20	data link management (INFO)
22	channel management (INFO)

*Note that messages 5 and 19 may be sent as multi part messages.

5.5 VHF data link own vessel messages (NMEA 0183 VDO)

This message describes your own vessel message being sent.

VDO Message Format

!-VDO,x1,x2,x3,a,s--s,x*hh<CR><LF>
field 1 2 3 4 5 6

Field	Format	Description
1	x	Total number of sentences needed to transfer the message ¹ , 1 to 9
2	x	Sentence number ¹ , 1 to 9
3	x	Sequential message identifier ² , 0 to 9
4	a	AIS Channel, "A" or "B" ³
5	s---s	Encapsulated ITU-R M.1371 radio message ⁴
6	x	Number of fill-bits ⁵ , 0 to 5

NOTE 1 The length of an ITU-R M.1371 message may require the transmission of multiple sentences. The first field specifies the total number of sentences used for a message, minimum value 1. The second field identifies the order of this sentence in the message, minimum value 1. These cannot be null fields.

NOTE 2 The Sequential message identifier provides a message identification number from 0 to 9 that is sequentially assigned and is incremented for each new multi-sentence message. The count resets to 0 after 9 is used. For a message requiring multiple sentences, each sentence of the message contains the same sequential message identification number. It is used to identify the sentences containing portions of the same message. This allows for the possibility that other sentences might be interleaved with the message sentences that, taken collectively, contain a single message. This shall be a null field for messages that fit into one sentence.

NOTE 3 The AIS channel is indicated as either “A” or “B”. This channel indication is relative to the operating conditions of the AIS unit when the packet is received. This shall be a null field when the channel identification is not provided. The VHF channel numbers for channels “A” and “B” are obtained by using a “query” (See IEC 61162-1, clause 5.3.2) of the AIS unit for an ACA sentence.

NOTE 4 This field supports a maximum of 62 valid characters for messages transferred using multiple sentences, and 63 valid characters for messages using a single sentence.

NOTE 5 This cannot be a null field. See “x4” in 5.3.3.

VDO Message number	VDO Message description
AIS Target Display Information	
13	Safety Related Acknowledgement
18	Standard Class B position report (Includes MMSI, SOG, position accuracy, lat, long, COG, true heading,)
24a	Class B “CS” Static data Part A (Includes MMSI and vessel name)
24b	Class B “CS” Static data Part B (MMSI, ship type, cargo type, call sign, ship dimensions)

5.6 Regional Assignment Channel Assignment Message (NMEA 0183 ACA)

An NAUTICAST-B unit can receive regional channel management information in two ways: ITU-R M.1371 message 22 or a DSC telecommand received on channel 70. Channel management information is applied based upon the actual location of the AIS device. An AIS unit is “using” channel management information when the information is being used to manage the operation of the VHF receiver and/or transmitter inside the AIS unit. This sentence is used both to enter and obtain channel management information. When sent to an AIS unit, the ACA sentence provides regional information that the unit stores and uses to manage the internal VHF radio. When sent from an AIS unit, the ACA sentence provides the current channel management information retained by the AIS unit. The information contained in this sentence is similar to the information contained in an ITU-R M.1371-1 message 22. The information contained in this sentence directly relates to the Initialization Phase and Dual Channel Operation and Channel Management functions of the AIS unit as described in ITU-R M. 1371.

ACA Message Format

\$--ACA,x,IIII.II,a,yyyyy.yy,a,IIII.II,a,yyyyy.yy,a,x,xxxx,x,xxxx,x,x,x,a,x,hhmmss.ss
 field 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Field	Format	Description
1	x	Sequence Number , 0 to 9
2	llll, ll, a	Region Northeast corner latitude – N/S
3	yyyyy.yy,a	Region Northeast corner longitude – E/W
4	llll, ll, a	Region Southwest corner latitude – N/S
5	yyyyy.yy,a	Region Southwest corner longitude – E/W
6	x	Transition Zone Size
7	xxxx	Channel A
8	x	Channel A bandwidth
9	xxxx	Channel B
10	x	Channel B bandwidth
11	x	Tx/Rx mode contro
12	x	Power level control
13	a	Information source
14	x	In-Use Flag
15	hhmmss.ss	Time of "in-use" change

5.7 Channel management information source messages (NMEA 0183 ACS)

This sentence is used in conjunction with the ACA sentence. This sentence identifies the originator of the information contained in the ACA sentence and the date and time the AIS unit received that information.

ACS Message Format

```
!-- ACS,x,xxxxxxxx, hhmmss.ss,xx,xx,xxxx*hh<CR><LF>
field 1  2  3 4 5 6
```

Field	Format	Description
1	x	Sequence Number , 0 to 9
2	xxxxxxxx	MMSI of originator
3	hhmmss.ss	UTC of receipt of channel management information
4	xx	UTC Day, 01 -31
5	xx	UTC Month, 01 -12
6	xxxx	UTC Year

5.8 AIS Alarm Messages (NMEA 0183 ALR, Text)

Local alarm condition and status. This sentence is used to report an alarm condition on a device and its current state of acknowledgement.

ALR message format

```
!-- ALR,hhmmss.ss,xxx,A,A,c--c*hh<CR><LF>
field  1 2 3 4 5
```

Field	Format	Description
1	x	hhmmss.ss = Time of alarm (UTC)
2		Unique alarm number
3		Alarm condition
4		Alarm acknowledge state
5		alarm description, text Alarms descriptions presented are: AIS: TX malfunction AIS: Antenna VSWR exceeds limit AIS: Rx channel 1 malfunction AIS: Rx channel 2 malfunction AIS: general failure AIS: no sensor position in use AIS: no valid SOG information AIS: no valid COG information AIS: 12V alarm AIS: 5V alarm AIS: Loss of serial interface integrity AIS: Background noise above -77dBm

5.9 ACK messages

An Acknowledge Message (ACK) can be generated by a minimum keypad and display (MKD) unit, chart plotter or other display device connected to the NAUTICAST-B to acknowledge an alarm condition reported by the NAUTICAST-B.

ACK message format

```
!-- ACK,xxx*hh <CR><LF>
field 1
```

Field	Format	Description
1	x	unique alarm number

SECTION 6 – STANDARDS

This product complies to all the necessary standards under the European R&TTE directive for Article 3.1(a), 3.1(b), 3.2 and 3.3(e). The following standards have been followed in pursuance of this:

- IEC62287-1: 2006-03 Maritime navigation and radio communication equipment and systems – Class B ship borne equipment of the automatic identification system (AIS) – Part 1: Carrier-sense time division multiple access (CSTDMA) techniques
- IEC60945: 2002-08 Maritime navigation and radio communication equipment and systems – General requirements – Methods of testing and required test results
- IEC61162-1: Maritime navigation and radio communication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners
- IEC61108-1: GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) – Part 1: Global positioning system (GPS) -Receiver equipment - Performance standards, methods of testing and required test results
- EN 301 843-1 v2.1: Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for marine radio equipment and services; Part 1: Common technical requirements
- EN 50383: 2002 Basic standard for calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunications system (110MHz – 40GHz)
- EN60950-1:2006 Information technology equipment – Safety – Part 1: General requirements

6.1 Product Specification

Parameter	Value
Dimensions	7.8 x 6.22 x 1.84 in. (198 x 158 x 46.7 mm)
Weight	13.2 oz (375g)
Power	DC (9.6-15.6V)
	Average power consumption 4W
	Peak current rating 2A
GPS Receiver (AIS Internal)	IEC 61108-1 compliant
Electrical Interfaces	RS232 38.4kBaud bi-directional
	RS422 NMEA 38.4kBaud bi-directional
Connectors	VHF Antenna connector (UHF female bulkhead connector)
	GPS Antenna connector (TNC female bulkhead connector)
Cable – Data/Power	RS232 / RS422 / Data / Power (15-pin Connector) Typically, 1.5 meter DSUB
VHF Transceiver	Transmitter x 1
	Receiver x 2 (One receiver time shared between AIS and DSC)
AIS1: 161.975 MHz AIS2: 162.025 MHz	Frequency: 156.025 to 162.025 MHz in 25 kHz steps
Output Power	33dBm \pm 1.5 dB
Channel Bandwidth	25kHz
Channel Step	25kHz
Modulation Modes	25kHz GMSK (AIS, TX and RX)
	25kHz AFSK (DSC, RX only)
Bit rate	9600 b/s \pm 50 ppm (GMSK)
	1200 b/s \pm 30 ppm (FSK)
RX Sensitivity	Sensitivity – 107dBm 25kHz (Message Error Rate 20%)
	Co-Channel 10dB
	Adjacent Channel 70dB
	IMD 65dB
	Blocking 84dB
Environmental	IEC 60945
	Operating Temperature: -25°C to +55°C
	IEC 62287, IP67 (with cables installed)
Indicators	Power, TX timeout, status, pre-set SRM sent or Silent Mode
Operator Controls	Optional pre-set safety related message (SRM) transmit button or Silent Mode -No Transmit (user Configured).

6.2 Information Reporting Intervals

The Nauticast Class B AIS will transmit position reports (Message 18) in reporting intervals of

- Every 30 seconds if SOG is > 2 kn;
- Every 3 Minutes if SOG is ≤ 2 kn

Provided that the transmission time periods are available. A command received by Message 23 shall override the reporting interval.

Static Data sub messages 24A and 24B will be transmitted every 6 minutes in addition to and independent of the position report.

6.3 Warnings

VHF Antenna Connection

Connecting a badly mismatched VHF antenna, leaving the VHF antenna port disconnected, or shorting the VHF antenna port will activate the VSWR alarm, cause the unit to stop sending position reports or cause damage to the transponder and activating the red LED.

Radio Frequency Exposure

To meet the requirements for Radio Frequency Exposure it is necessary to install the VHF antenna correctly and operate the AIS equipment according to the instructions.

SECTION 7 – CONTACT & SUPPORT INFORMATION

Although ACR strives for accuracy in all its publications; this material may contain errors or omissions, and is subject to change without prior notice. ACR shall not be made liable for any specific, indirect, incidental or consequential damages as a result of its use. ACR components may only be used in safety of life devices or systems, with the express written approval of ACR, as the failure of such components could cause the failure of the ACR device or system. If these fail, it is reasonable to assume that the safety of the user or other persons may be endangered.

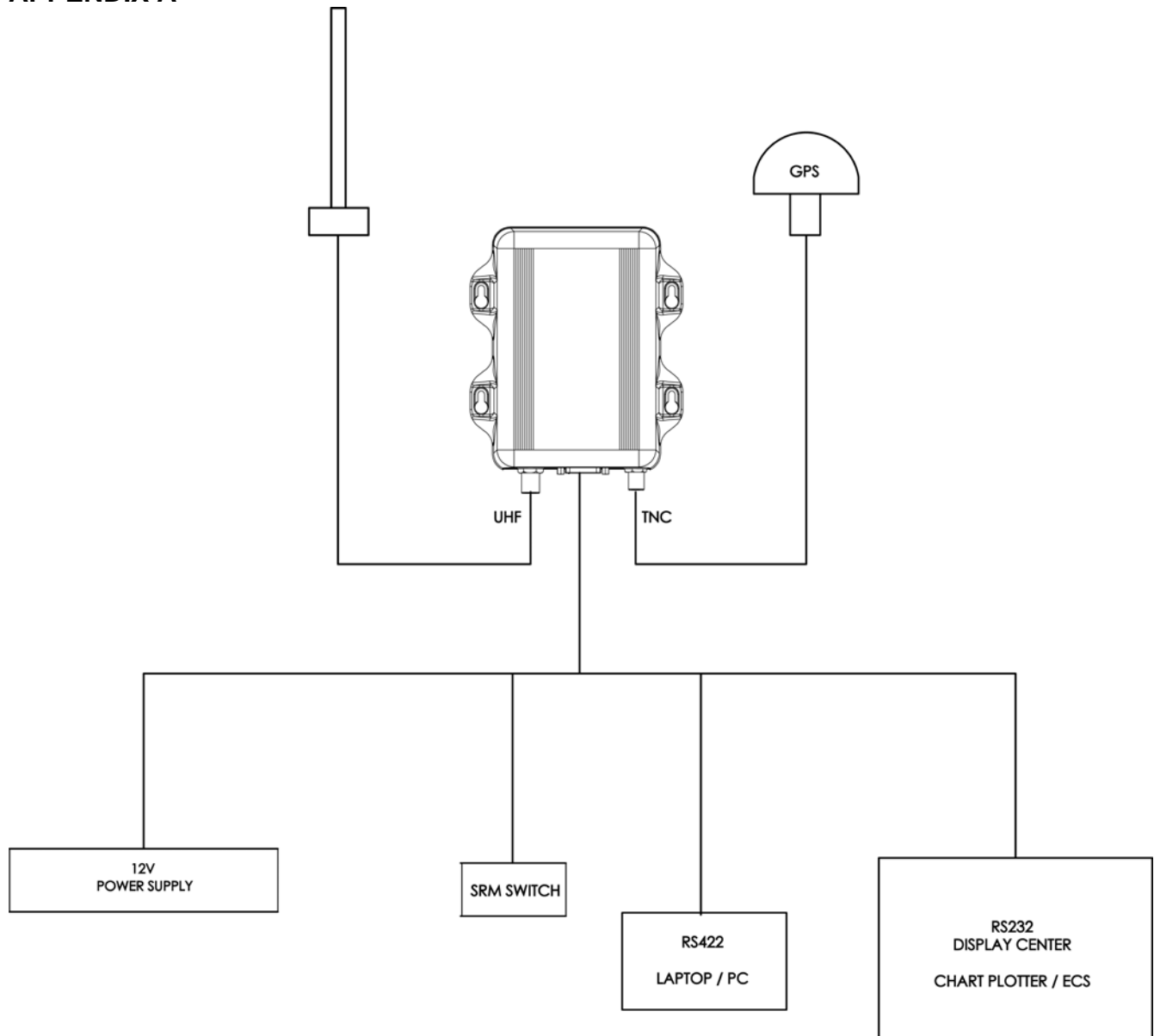
Contact your local dealer for NAUTICAST AIS support.

Please see our ACR Website for Service Listing.

ACR Electronics Europe GmbH
Handelskai 388 / Top 632
A-1020 Vienna, Austria
Tel: +43 (1) 5 237 237 - 0
Fax: +43 (1) 5 237 237 - 150
Email: Technical.Support@acr-europe.com
Web: www.acr-europe.com

ACR Electronics Inc.
Customer Service
5757 Ravenswood Road
Fort Lauderdale, FL 33312, U.S.A.
Tel.: +1 (954) 981-3333
Fax: +1 (954) 983-5087
Email: info@acrelectronics.com
Web: www.acrelectronics.com

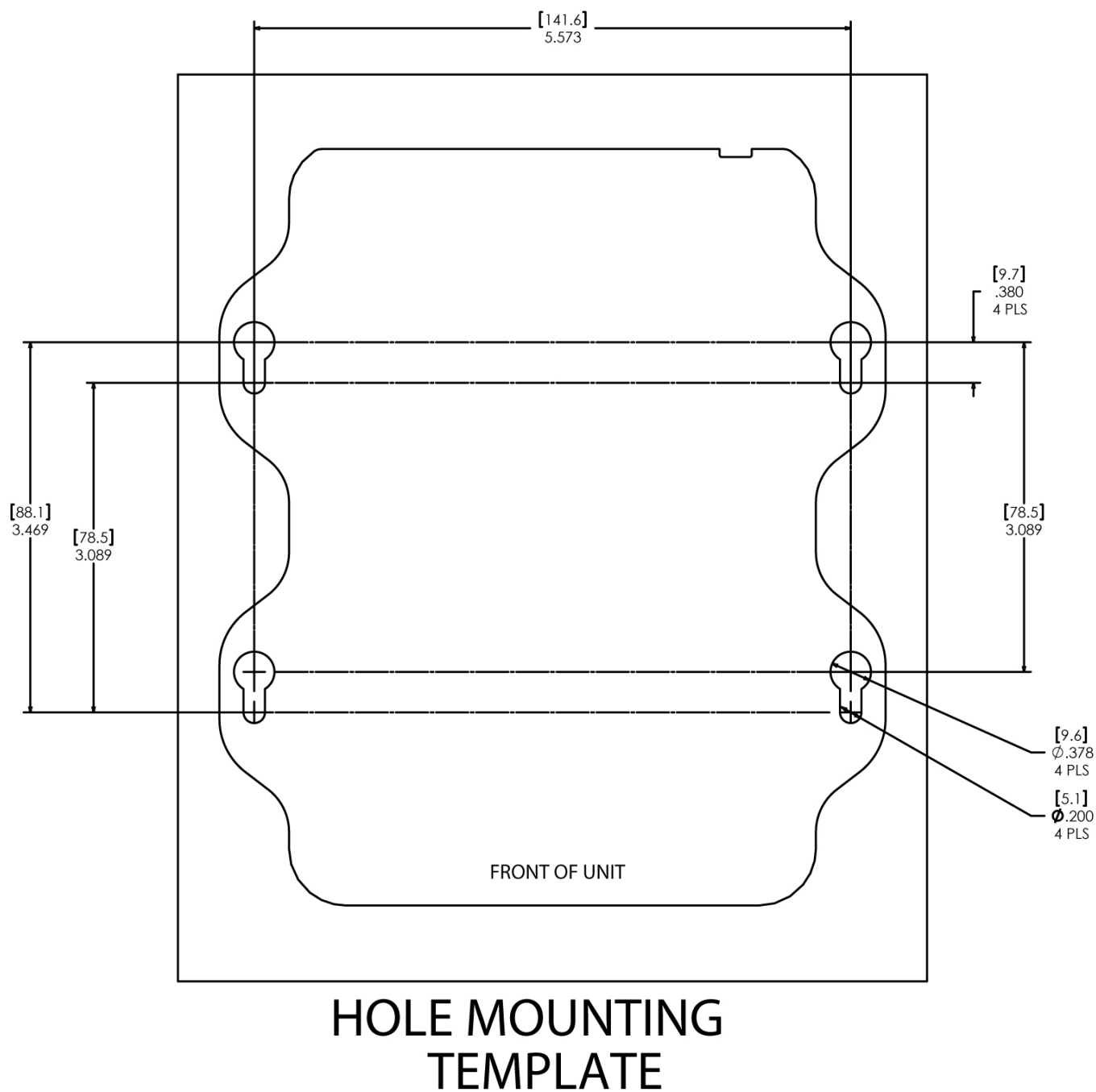
APPENDIX A



System Block Diagram

Power supply, SRM Switch, PC, Chart Plotter not included
(Mount unit with cable side down)

APPENDIX B



Note: Template not to scale.

APPENDIX C

Class B

A2-07-0196-1
DATA POWER CABLE

Description	J1		J2		Wire Type	Color	AWG	CABLE #
	PCB	DB15	DB9					
12V +	1	1			Tinned Copper	RED	18	CABLE1
12V -	2	9			Tinned Copper	BLACK	18	CABLE1
RS422 TX A	3	2			Tinned Copper	ORANGE	22-24	CABLE 2
RS422 RX A	5	3			Tinned Copper	YELLOW	22-24	CABLE 2
RS422 TX B	4	10			Tinned Copper	BLACK	22-24	CABLE 2
RS422 RX B	6	11			Tinned Copper	WHITE	22-24	CABLE 2
SW1GND	14	15			Tinned Copper	BLACK	22-24	CABLE 3
SW1 Switch	15	8			Tinned Copper	PURPLE	22-24	CABLE 3
RS232 TX	8	12	2		Tinned Copper	RED	22-24	CABLE 4
RS232 RX	10	13	3		Tinned Copper	BLUE	22-24	CABLE 4
GND	12	14	5		Tinned Copper	BLACK	22-24	CABLE 4

Note: Connectors J1 and J2 have shielded Jackets with ground connection to metal shell of connector.

Cable 2 and Cable 3 have staggered length Clipped conductors to prevent shorting and are capped with heat shrink.