AIS AtoN
N321/N323

USER MANUAL

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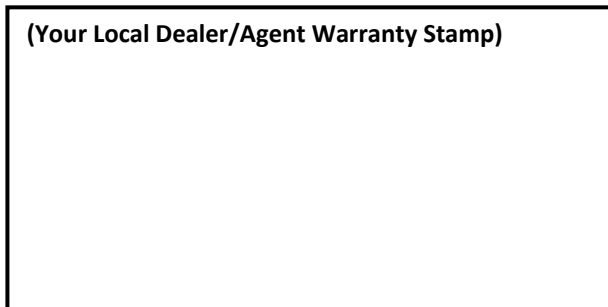
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AMEC

WARNING!

Please carefully read this manual before start using the AIS AtoN device. This product is an auxiliary monitoring device, and it should not be relied upon as the sole monitoring navigation system. Failure to operate this system in accordance with the operating instructions specified in this manual may result in unreliable or reduced system performance. Improper operation or installation may cause damage to the equipment or injury to personnel. AMEC shall in no event be liable for any loss of profit, personal injury, unpredictable damage arising out of incorrect operation or installation or any kind of product misuse or abuse.

SAFETY INSTRUCTIONS

WARNING
ELECTRICAL SHOCK HAZARD. Do not open the case of the equipment. Only qualified personnel should work inside the equipment.
TURN OFF THE POWER IMMEDIATELY IF WATER LEAKS INTO THE EQUIPMENT OR OBJECT DROPS INTO THE EQUIPMENT. Continue operating the equipment could cause electrical shock or fire. Contact your nearest distributor for service.
DO NOT DISASSEMBLE OR MODIFY THE EQUIPMENT. Improper disassemble or modification could cause electrical shocks, fire, or personal injury.
AVOID OPERATING THE EQUIPMENT WITH WET HANDS. Electrical shocks could be resulted if operating with wet hands.
PLEASE USE THE PROPER FUSE. Damage to the equipment or fire could be resulted if using the wrong fuse.

WARNING
TURN OFF THE POWER IMMEDIATELY IF THE EQUIPMENT IS EMMITTING SMOKE OR FIRE. Continue operating the equipment could cause electrical shock or fire. Contact your nearest distributor for service.
EVEN THOUGH THE EQUIPMENT IS WATERPROOF, PLEASE AVOID DIRECT CONTACT WITH RAIN FALLING OR WATER SPLASH. Electrical shock or fire could be resulted if water leaks into the equipment.
DO NOT PLACE ANY LIQUID-FILLED CONTAINER ON TOP OF THE EQUIPMENT. Improper disassemble or modification could cause electrical shocks, fire, or personal injury.

Table of Contents

1 Introduction

1.1 Introduction

Laying out vessel routes, using navigational aids (or aids to navigation, as known as AtoN), in a highly crowded area has always been a huge task for the port authorities. The conventional AtoN solution (buoys, lighthouses, lanterns) is inconvenient for quick deployment needs, inflexible for future expansions, costly for maintenances, and less efficient in bad weather conditions. All these shortcomings can be eliminated with the emergence with the integration of automatic identification system (AIS). Originally AIS was first developed to help vessels avoiding collision and identifying among all boats. Soon people discovered the potential of having AIS in AtoN equipment's.

AIS AtoN transponders are installed in AtoN helping monitoring navigational aids statuses and enabling them transmission of warnings, navigational, and meteorological data to approaching vessels and/or to shore stations. Advanced transponders support remote configuration and AIS message repeating.

1.2 WideLink N321/N323 Series and Comparison

The AMEC WideLink N321/N323 series are AIS AtoN solutions that enable AtoN with powerful AIS capabilities. The series have passed the BSH approval tests. It is noteworthy that AMEC's WideLink N321/N323 series is one of the most power-saving AtoN transceivers with low power consumption in the market.

Currently there are two models in the WideLink product line: WideLink N321 (Type 1) and WideLink N323 (Type 3).

N321 (Type 1)

This N321 model transmits on pre-configured FATDMA slots. The FATDMA slots configuration is normally done by base station authority.
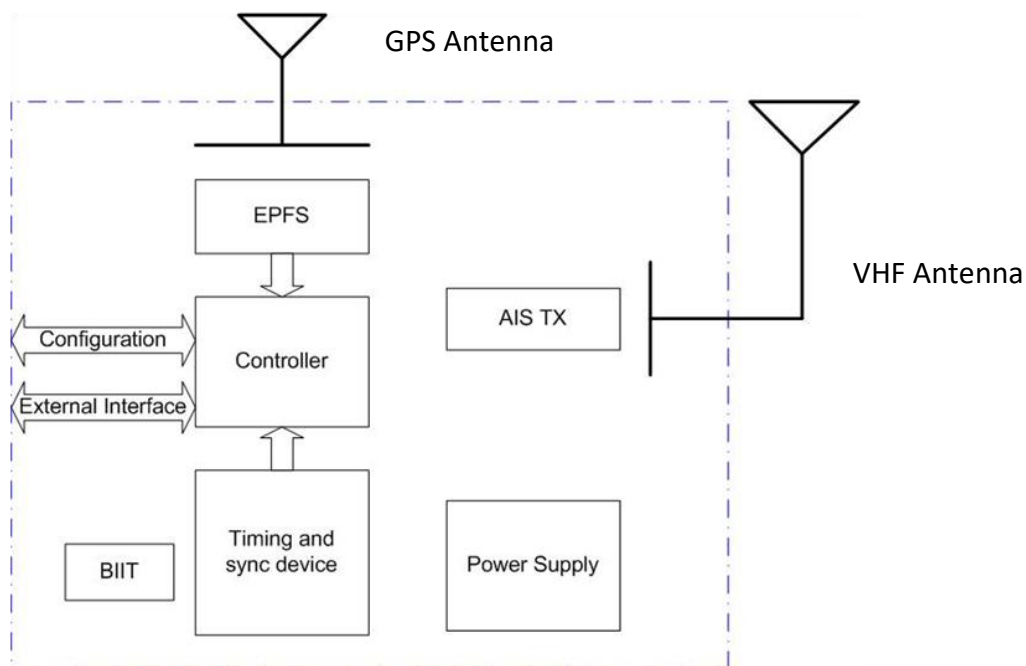
Figure 1-2-1 N321 (Type1)

N323 (Type 3)

This N323 model has everything N321 can offer and in addition, it has the receiving capability in accordance with IEC 62320-2. It supports both FATDMA/RATDMA transmissions. N323 supports multiple digital/analog connection interfaces to connect to other communication devices including hydrological and metrological sensors.
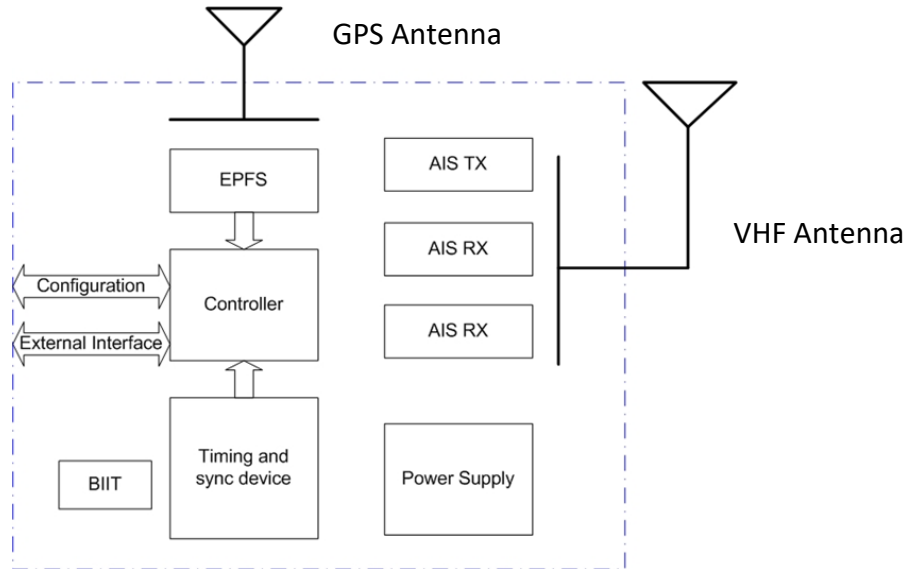
Figure 1-2-2 N323 (Type3)

Comparison between N321 and N323

Below is a brief specification comparison. For more comparison details please refer to Chapter 6.

Table 1-2 Comparison between N321 and N323

Feature	Model N321	Model N323
IEC 62320-2 Type Definition	AIS AtoN Type 1	AIS AtoN Type 3
Standards compliance	IALA, IEC, ITU	
Transmitting Type	FATDMA	FATDMA/RATDMA
Message Support	6, 8, 12, 14, 21, 25	6, 7, 8, 12, 13, 14, 21, 25
Waterproof level	IP 68	
Synthetic Transmissions	Yes	Yes
Virtual Transmissions	Yes	Yes
Meteorological & Hydrological Message	Yes	Yes
Chaining Support	N/A	Yes
Remote Configuration	N/A	Yes
Repeating SART, 6, 8 messages		Yes

1.3   What's in the box

N321/N323 ships with the following items. If any item is missing, please contact AMEC or your local distributor.

Table 1-3 Standard Package of N321/N323

No.	Description		Qty
1	N321/N323 AIS AtoN main unit		1
2	Installation Kit	USB configuration/data cable (waterproof connector, 1 m)	1
		Power cable (waterproof connector, 2 m, AWG 18)	1
		Data cable (waterproof connector, 1 m, AWG 24)	1
		F4 16 mm screw	4
3	Installation Manual (Digital Download)		1

1.3.1   Downloadable Links

To download the latest AMEC AtoN Configuration Utility, please visit the below link.

xxxx.xxxxxx.xxxxx (to be updated)

To download the latest N321/N323 Installation Manual, please visit the below link.

xxxxx.xxxxxxxx.xxxxxx (to be updated)

(An internet connection is required)

2 Installation and Wiring

Before proceeding with installation, please take note of the following safety information and familiarize with the installation instructions. The N321/N323 is IP68 waterproof, yet it is recommended to have N321/N323 installed in a protected environment.

	WARNING!	
⚡	**ELECTRICAL SHOCK HAZARD** Do not open the case of the equipment. Only qualified personnel should work inside the equipment.	
⚡	**MAKE SURE THE POWER SOURCE AND THE POWER INPUT OF THE EQUIPMENT ARE MATCH.** Incorrect power sources will damage the equipment and may even result in fire. Please ensure the correct power input on the adaptor before installation.	

2.1 Mounting Instructions

Locate a suitable place for the unit and use the provided F4 16mm screws to firmly mount the unit.

For safety reason, it's recommended to mount the device not higher than 2m (78.74") above floor-level.
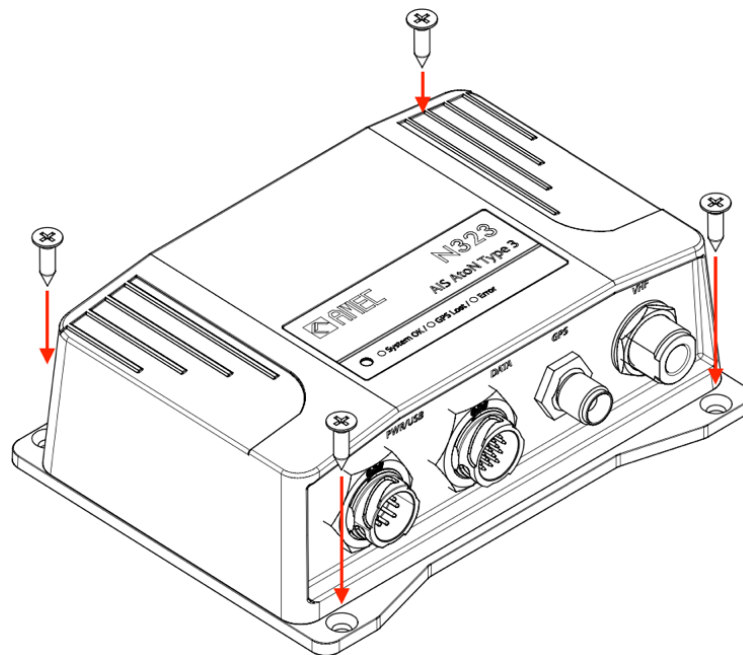
Figure 2-1-1 Mounting the Device

2.2 Connection Interface
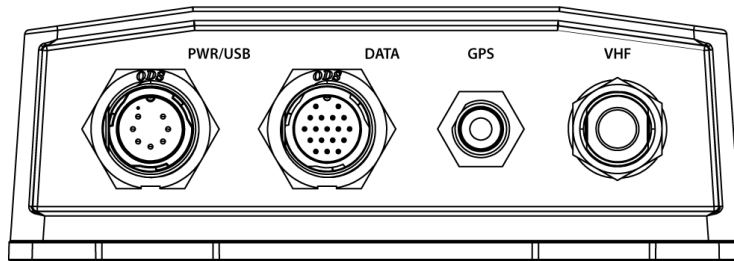
Figure 2-2 Connection Interface

Table 2-2 Connection Interface

Connector Name	Connector Type	Descriptions
Power/USB	ATK-CCM07MKCP01 (by ODS)	Power supply 9.6 V DC ~ 31.2 V DC One USB communication connector for device configuration and firmware upgrade.
Data (18-pin)	ATK-CCM18MLCP01 (by ODS)	NMEA 0183 #1 (Tx/Rx) NMEA 0183 #2 (Rx only) Isolated digital input x 3 Wake up input Wake up output
GPS	TNC Type (Female)	Connect to external GPS antenna
VHF	SO-239 (Female)	Connect to external VHF antenna

Note: Please connect all peripheral devices first, before powering ON the N321/N323. When the Data port is not in use, please lock the waterproof cover.

2.3 External Connections
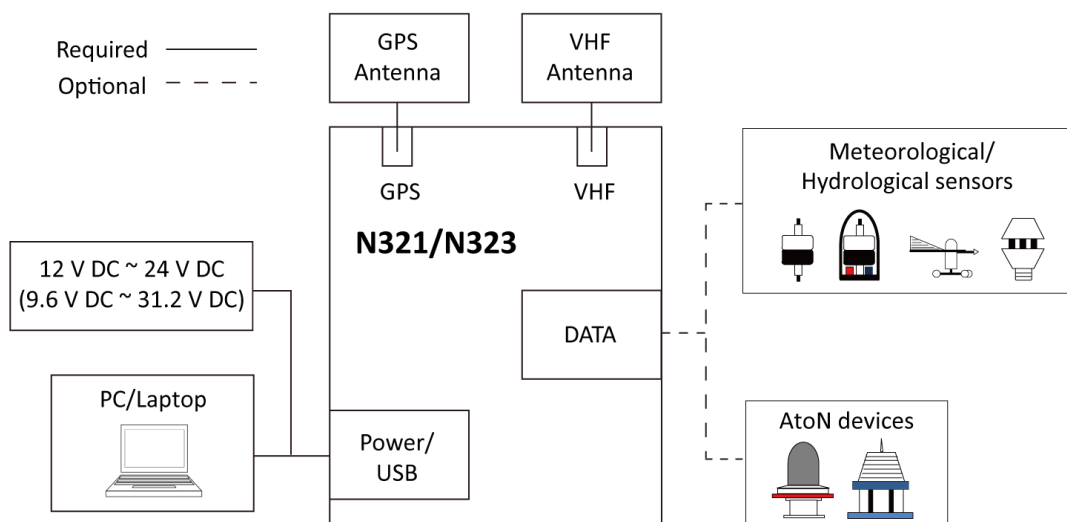
Figure 2-3 External Connections

2.3.1   Antenna and Cables

2.3.1.1   GPS (GNSS) Antenna Installation

All AIS systems communicate accordingly based on the precision time provided by the GPS satellites. Therefore, a correct GPS antenna installation is very important. When installing the GPS antenna, please follow all the manufacturer instructions and pay attention to the cable routing and connection.
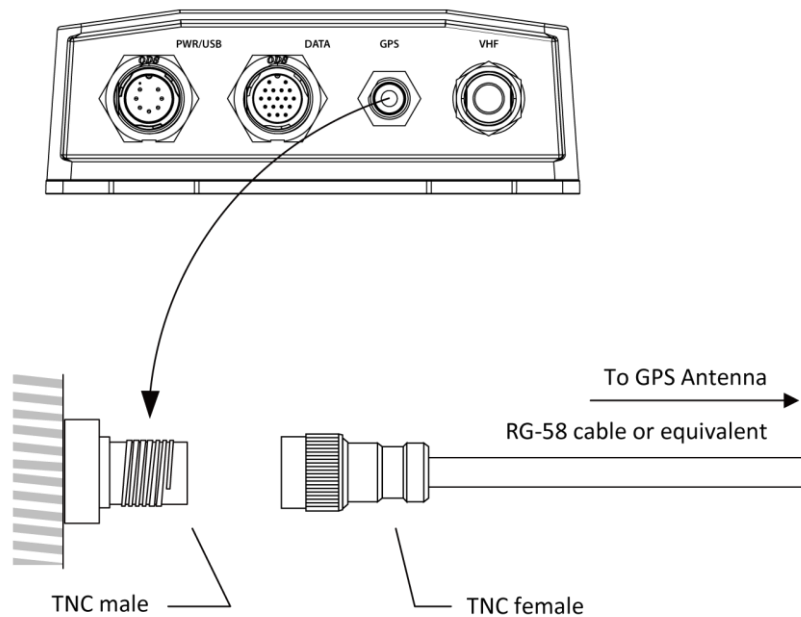
Figure 2-3-1-1 GPS Antenna Installation

During installation of the GPS antenna, please pay attention to the following guidelines.

- Ensure the cable connector is firmly secured.
- Position the antenna as high as possible for better signal reception.
- Be sure the GPS antenna is not blocked to the sky.

Installation Procedure

1) Install the GPS antenna mounting bracket on a rigid surface and then mount the antenna.
2) To reduce signal interference, use only high-quality coaxial cable and keep the cable length as short as possible (for RG-58 cable length max. 10 m).
3) Route and connect the coaxial cable from the antenna to the AtoN device location.
4) Connect the cable to the AtoN device.

2.3.1.2 VHF Antenna Installation

The VHF transmissions rely on good VHF antenna foundation making the installation important. Please use the following descriptions and be cautious during the installation.
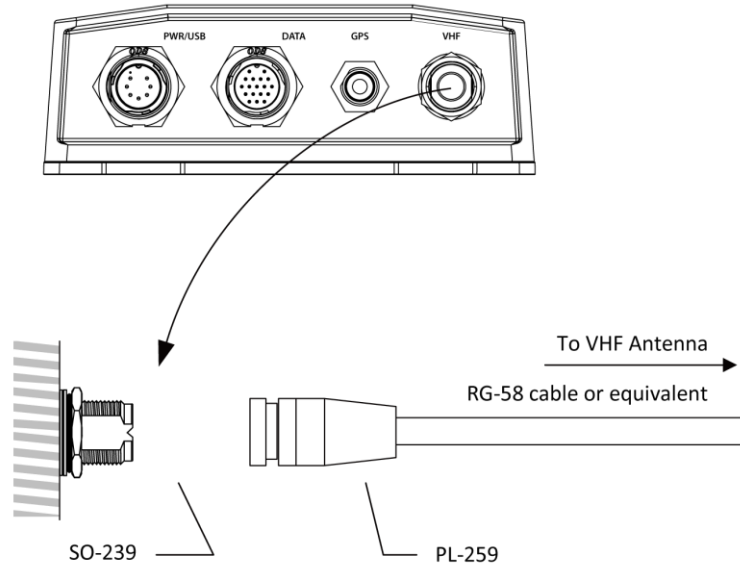
Figure 2-3-1-2 VHF Antenna Installation

When installing the VHF antenna, please follow all the manufacturer instructions and pay attention to the cable routing and connection.

- Ensure the cable connector is firmly secured.

- Place the antenna as high as possible and having no nearby obstructions.

- Ensure the antenna is installed vertically with a minimum of 2 meters of clearance from all conductive material.

- Ensure the antenna has a 360° line of sight to the horizon.

- Avoid the antenna any surrounding obstacles or metal objects to reduce the performance.

- Beware that underneath the VHF antenna is a signal receiving blind zone.

- Keep the antenna cable as short as possible.

- The antenna cable diameter should be 5D/8D (Equivalent or better).

Installation Procedure

1) Install the VHF antenna mounting bracket on a rigid pole and mount the antenna.

2) Route and connect the coaxial cable from the antenna to the AtoN location.

3) Connect the cable to the AtoN device.

2.3.1.3 Lighting Arrestor

Lightning arrestor must be installed on all antenna cables if there is a risk of lighting strike. These coaxial arrestors are available from various suppliers. When buying the arrestors please beware the specified frequency and the maximum output.

2.3.2 Wiring and Pin Assignments

2.3.2.1 Power Connector

Note: The Power/USB is a dual-purpose connector.
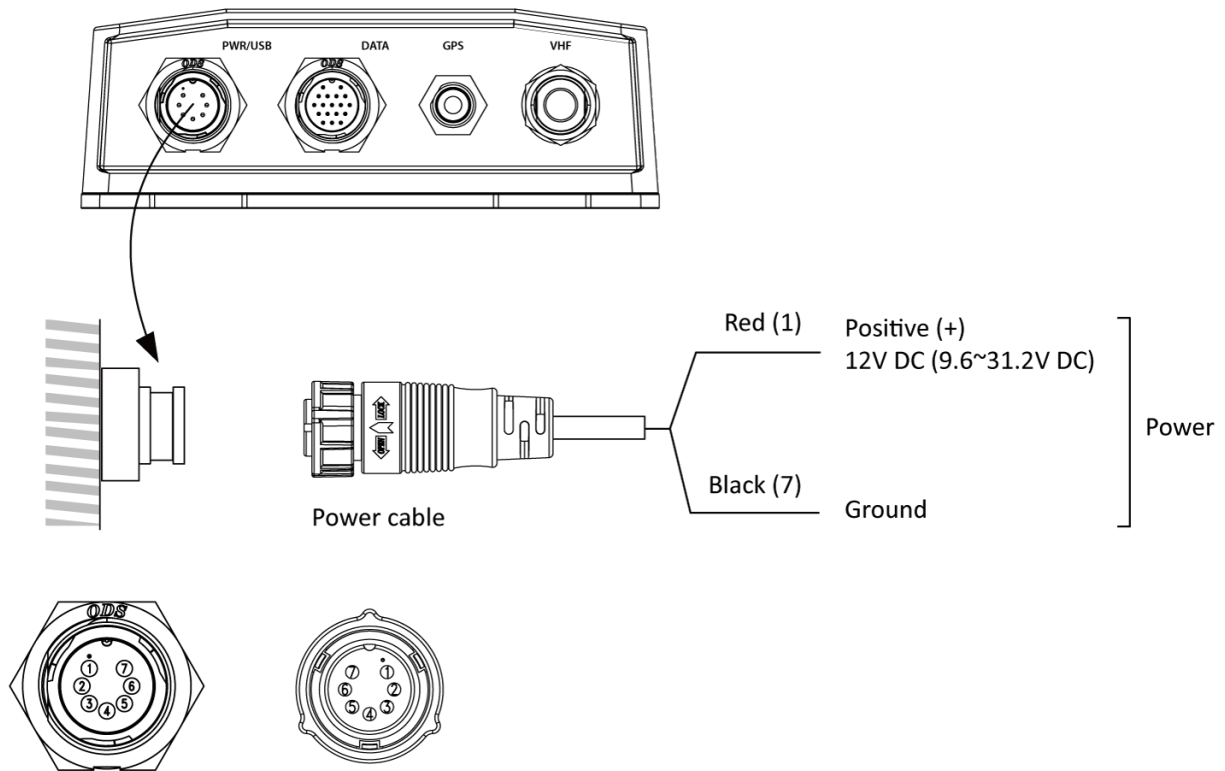
Figure 2-3-2-1 Power Connector

Table 2-3-2-1 Power Cable Wiring Assignments

Pin Number	Cable Color	Pin Definition	Description
1	**Red**	PWR	Power, Positive (+) 9.6~31.2 VDC nominal
7	**Black**	GND	Power ground

2.3.2.2 USB Connector
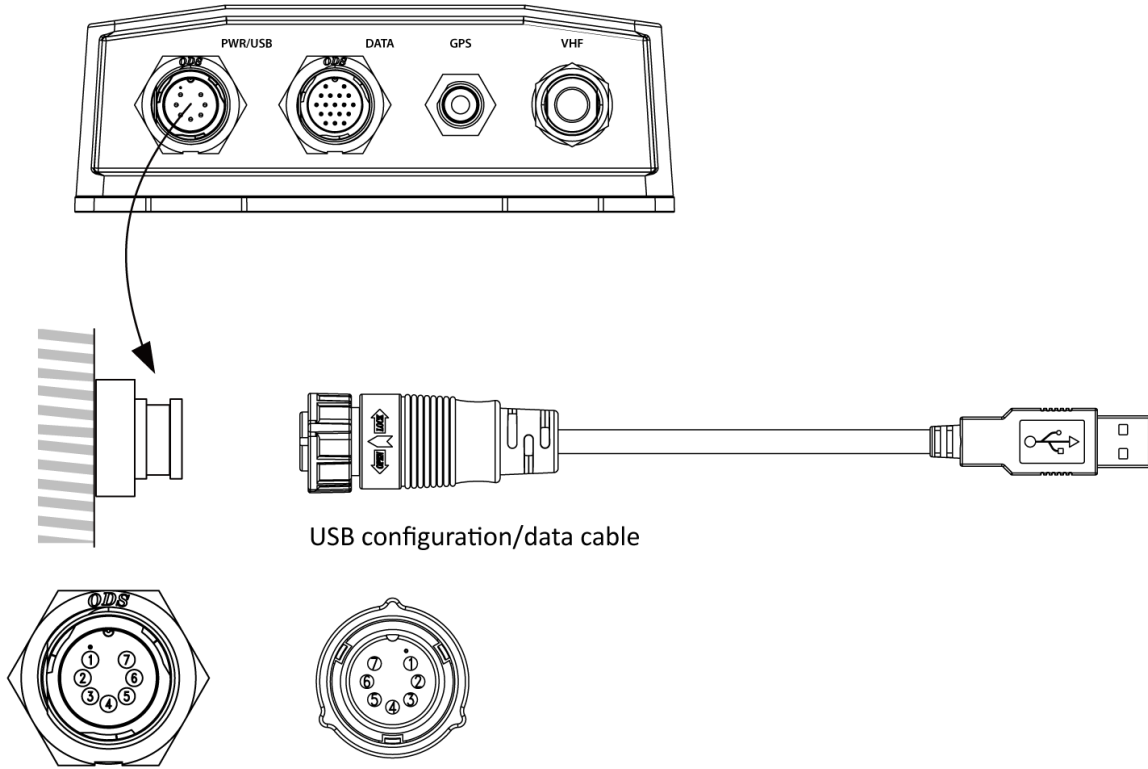
Figure 2-3-2-2 USB Connector

Note: The Power/USB is a dual-purpose connector.
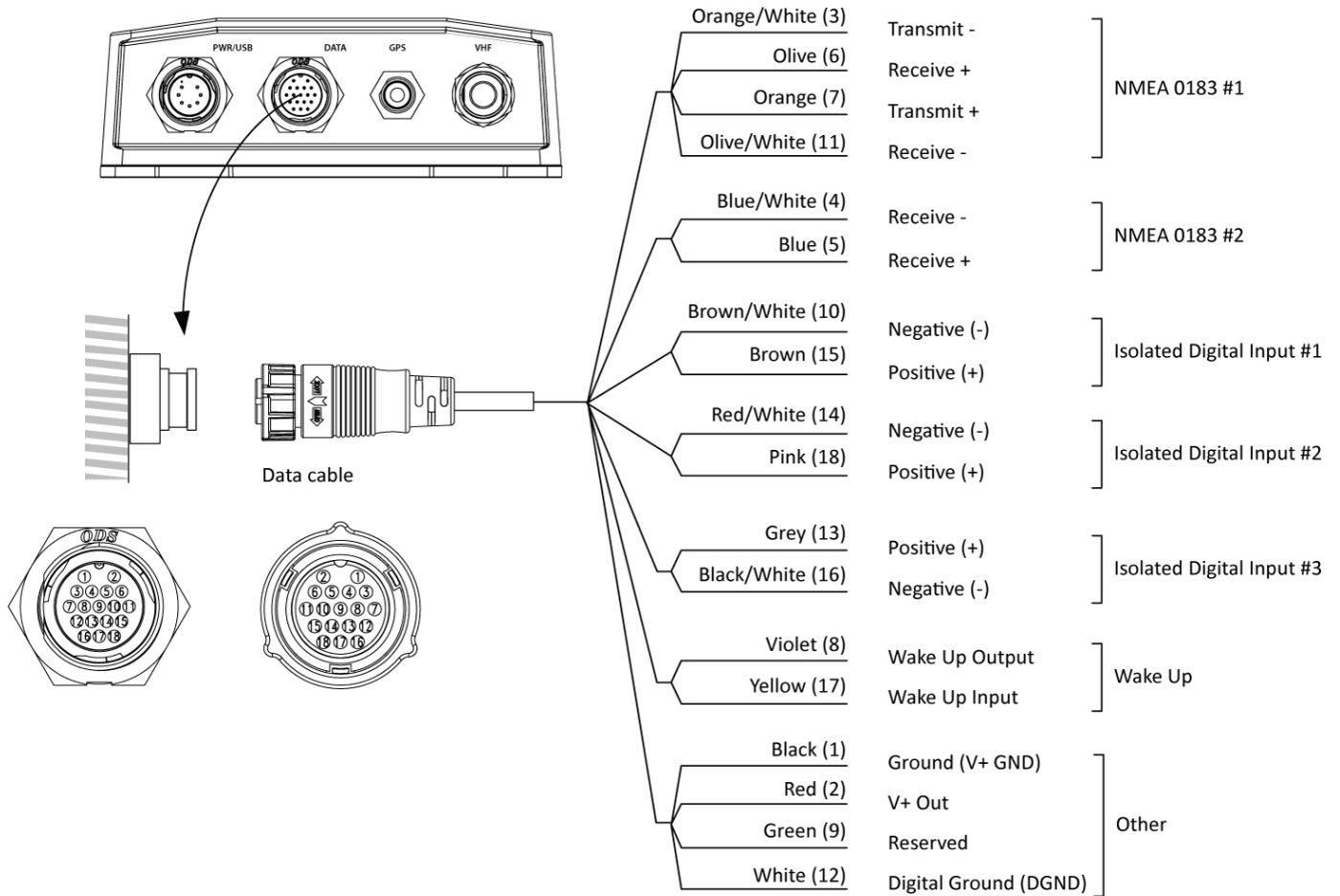
Figure 2-3-2-4 Data Cable Wiring Assignment

NOTE:

The baud rate of NMEA 0183 ports can be configured to 4800, 9600, 38400, or 115200-bps independently. The default baud rate for both ports is 115200-bps.

Table 2-3-2-2 Data Cable Wiring Assignments

Pin Number	Cable Color	Pin Definition	Description
1	Black	GND	Ground (V+ out)
2	Red	V+	V+ out
3	Orange/White	NMEA 0183 #1	NMEA 0183 Transmit - (TXN)
4	Blue/White	NMEA 0183 #2	NMEA 0183 Receive - (RXN)
5	Blue	NMEA 0183 #2	NMEA 0183 Receive + (RXP)
6	Olive	NMEA 0183 #1	NMEA 0183 Receive + (RXP)
7	Orange	NMEA 0183 #1	NMEA 0183 Transmit + (TXP)
8	Violet		Wake up output
9	Green		Reserved
10	Brown/White	Digital Input #1	Isolated Digital Input – (Negative)
11	Olive/White	NMEA 0183 #1	NMEA 0183 Receive - (RXN)
12	White	DGND	Digital Ground
13	Grey	Digital Input #3	Isolated Digital Input + (Positive)
14	Red/White	Digital Input #2	Isolated Digital Input - (Negative)
15	Brown	Digital Input #1	Isolated Digital Input + (Positive)
16	Black/White	Digital Input #3	Isolated Digital Input - (Negative)
17	Yellow		Wake up input
18	Pink	Digital Input #2	Isolated Digital Input + (Positive)

2.4   Sensor Expansion Box (Optional)

Some special project installations may require additional connectivity for added peripherals and devices. The N321/N323 Sensor Expansion Interface is intended to meet the requirements. Please contact AMEC representatives for further information and availabilities.

3 Configuring your AtoN

The default AMEC N3121/N323 configuration method is via standard NMEA 0183 sentences. Please refer to Appendix 7 for a detailed description. We also provide a GUI-based configuration utility. To download the latest AtoN Configuration Utility, please visit section 1.3.1 of this user manual.
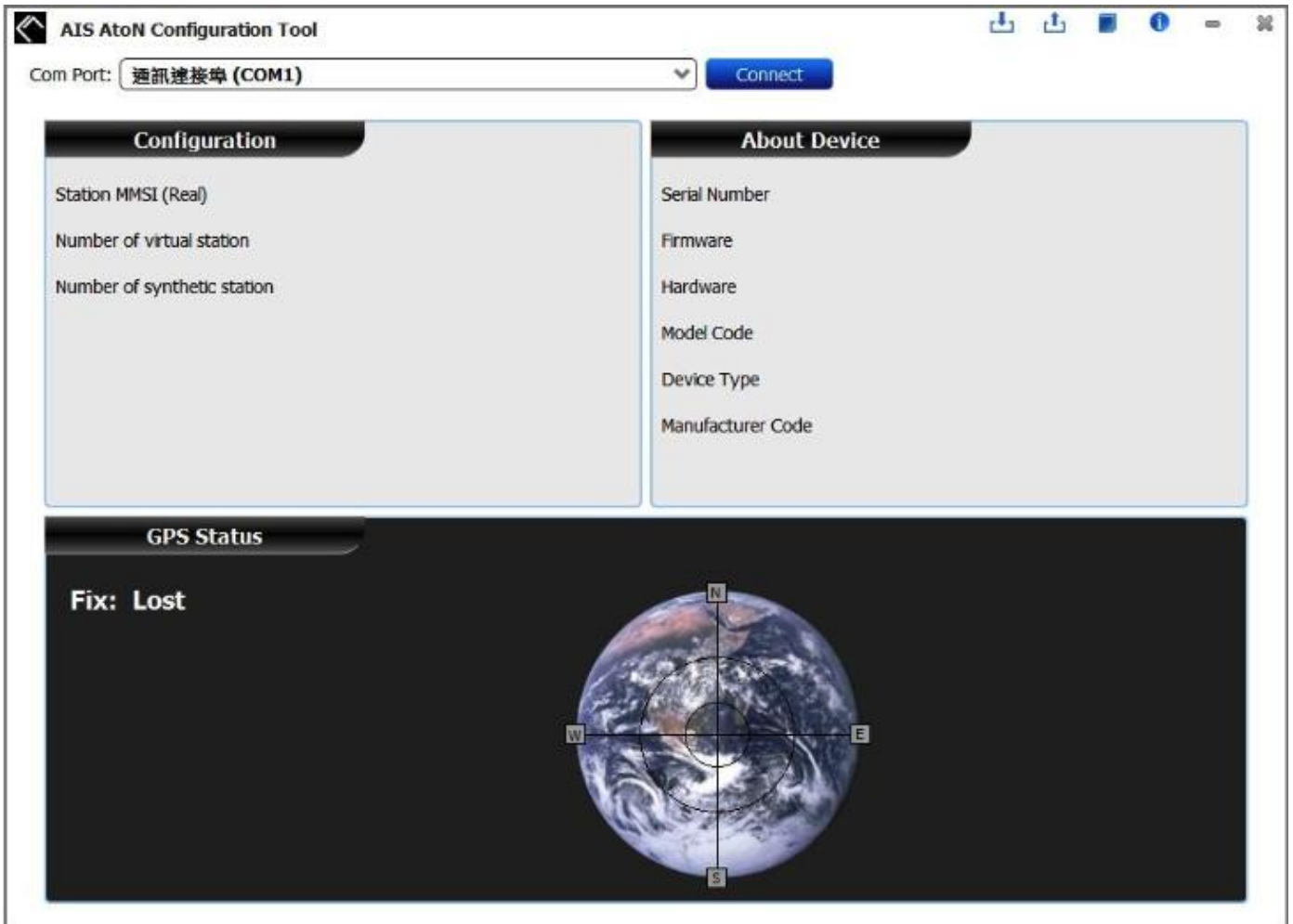
Figure 3 Configuration your AtoN

4 Applications

4.1 Type of AIS AtoN Station

There are three types of AIS AtoN as defined by IEC 62320-2 in below tables.

Table 4-1 Type of AIS AtoN Station

AIS AtoN Station	Physical design	Transmission Scheme	VDL control	Chaining	Repeating	Applicable Message ID
Type 1 (N321)	1 x Transmitter 0 x Receiver	FATDMA	None	None	None	6, 8, 12, 14, 21, 25
Type 2	1 x Transmitter 1 x Receiver	FATDMA	Yes	Yes	None	6, 8, 12, 14, 21, 25
Type 3 (N323)	1 x Transmitter 2 x Receiver	FATDMA RATDMA	Yes	Yes	Yes	6, 7, 8, 12, 13, 14, 21, 25

4.1.1 Transmission Scheme

1) **FATDMA**

An AIS AtoN unit operating in FATDMA mode will transmit in a pair of slots which are reserved by an AIS base station. Ships receive a message from the base station, indicating that certain slots are reserved. The ship AIS transponders store this reserved slot information in their slot maps, and do not transmit in these slots.

The FATDMA is programmed to transmit in slots of those reserved by the base station. So it can only be used in the area where AIS base station exists.

It is also possible to "re-cycle" slots by having a number of AIS AtoN units use the same pair of slots, but use them sequentially. FATDMA allows greatly reduced power drain for an AIS AtoN unit, because no receiving period to build a slot map is needed.

2) **RATDMA**

An AIS AtoN unit operating in RATDMA mode uses its receiver to listen to both AIS frequencies channel for about one minute, and makes and stores a map of all the AIS "slots" [or message spaces] on the VHF data link [VDL]. It then looks for free slots in which to send its message.

This mode is ideal for many applications because such AIS AtoN unit can be placed at any location, and requires no reservation of slots by a base station. It can be used whether base stations exist in the area or not.

Its drawback is that in order to make the "slot map" the unit must turn its receiver on for at least one minute before transmitting, and this is the main power consuming factor with an RATDMA AIS AtoN unit.

4.1.2 VHF Data Link (VDL) Control

AIS AtoN Type 2/Type 3 can be configured not just only through a PC's USB port but also via VHF. When the unit is in a remote location and inconvenient making a physical USB connection, users can configure the AIS AtoN setup remotely through the base station's VHF transmission or relayed through another nearby Type 3 AIS AtoN.

4.1.3 Chaining (subject to software availability)

A chain of AIS AtoN Stations allows for communication from an AIS Base Station to AIS AtoN Stations that are remotely located and unable to communicate directly with the Base Station. Messages are passed from station to station until the intended recipient is reached.

The concept requires an AIS AtoN Station to have knowledge of other AIS AtoN Stations in the chain, namely its parent and all children below it in the chain. A "parent station" is a station that is in the direction of the Base Station. A "child station" is a station that is directed away from a Base Station. In order to prevent unnecessary retransmission of the messages, each AIS AtoN Station in a chain may have only one parent, but may have multiple children (this includes Real, Synthetic and Virtual AIS AtoN).
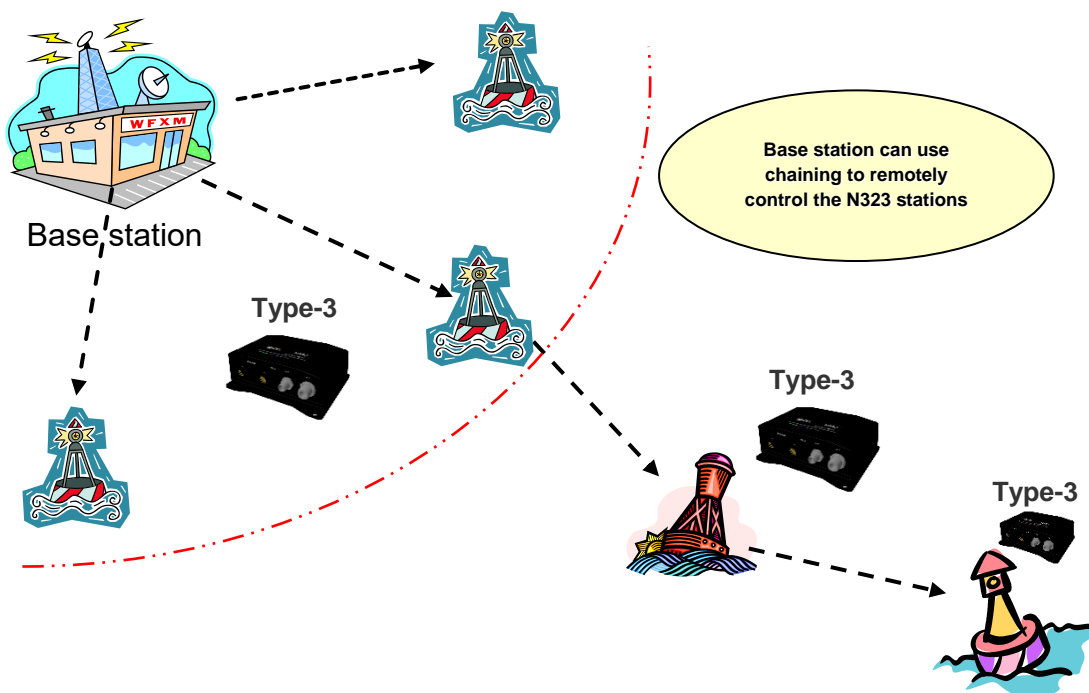
Figure 4-1-3 Chaining

4.1.4 Repeating

N323 can repeat AIS messages 6, 8, 21, and SART messages. By association (implication or connection), N323 can extend the original AIS AtoN coverage.

4.2 AIS AtoN Deployment

4.2.1 Real AIS AtoN

A real AIS AtoN is defined as when an AIS AtoN is installed/powered in an AtoN object like a lighthouse or buoy. In this case, AIS AtoN is defined as a "Real AIS AtoN" in message 21. If the real AIS AtoN is a floating buoy, it can transmit/update its position using a predefined schedule. Also, users can define the nominal/surveyed position and decide an accepted deviation for the radius. As when the actual position is out of the surveyed position's accepted deviation, N321/N323 transmits off-position messages to warn nearby AIS-equipped vessels. In such an event, N321/N323 can also send message 14, the SRM message.

4.2.2 Synthetic AIS AtoN

A synthetic AIS AtoN refers to an AtoN object that has no real AIS AtoN installed, but has been assigned a position/name (via message 21) by another real AIS AtoN.

4.2.3 Virtual AIS AtoN

A virtual AIS AtoN refers to a location where there is no actual existence of AtoN object. The virtual AIS AtoN is assigned a position/name (via message 21) by another real AIS AtoN. In general, virtual AIS AtoN is usually used for emergency/temporary circumstances only.

Basically, IALA does not recommend overusing Synthetic/Virtual due to the overloading of AIS traffic. AMEC N321/N323 provides 4 Synthetic/Virtual stations. Modification is possible to allow more points for some special application.

4.3 Messages of AIS AtoN station

The table below shows all transmission of AIS messages supported by an AtoN station as defined by IEC 62320-2.

Table 4-3 Messages of AIS AtoN Station

Message ID	Message Name	Message description	Application Example
6	Addressed Binary Message	Binary data for addressed communication	Monitoring of AtoN equipment
7	Binary acknowledge message	Acknowledge of addressed binary message	
8	Broadcast Binary Message	Binary data for broadcast communication	Meteorological and hydrological data
12	Addressed Safety Related Message	Safety related data for addressed communication	Warn AtoN malfunctioning Off-position alarm message
13	Safety related acknowledge message	Acknowledge of addressed safety related message	
14	Broadcast Safety Related Message	Safety related data for broadcast communication	Warn AtoN malfunctioning
21	Aids to Navigation Report	Position and status report for aids-to-navigation	AtoN Status report

4.3.1   Message 21

Message 21 describes Aid to Navigation Report which has the highest priority over other message types according to ITU-R M.1371. Based on ITU-R M.1371, message 21 contains the below information:

- Type of AtoN
- Name of the AtoN
- Position of the AtoN
- Position accuracy indicator
- Type of position fixing device
- On/Off position status
- Real and Virtual AtoN identification
- Dimension of the AtoN and reference positions
- Status of the AtoN systems

According to IEC62320-2, the information of message 21 should be able to setup by EUT (equipment under test) program. AMEC N321/N323 has provided program, namely "AMEC configuration software" to define/test the parameters of message 21. For more information, please check AMEC AtoN Configuration Utility.

4.3.2   Message 6

According to IALA-A126, message 6 is the Addressed Binary Message which is for advanced dynamic information such as light status, racon status, battery status and position status from the connected external devices, for example lantern, battery, racon, and so on.

N321/N323 can transmit Message 6 as an addressed binary message carrying AtoN monitoring information. This message would normally be received by an AIS base station or a dedicated AIS transponder, and routed to an AtoN monitoring or management centre, or VTS centre.

N321/N323 utilizes the message 6 format suggested by UK GLA (General Lighthouse Authority). Most charting software systems in the market are now capable parsing and decoding GLA Message 6 data. Besides GLA Message 6 format, N321/N323 also support the proprietary Shanghai Message 6 used by Chinese maritime authority.

For more information of UK GLA parameters, please refer to the AMEC AtoN Configuration Utility.

4.3.3   Message 8

The message 8 is a Broadcast Binary Message. The major applications of message 8 for AtoN are used for transmitting Meteorological and Hydrological information. Meteorological information is collected from external Weather Station devices and the data may include Wind Speed, Wind Direction, Air Temperature, Relative Humidity, Barometric Pressure, and/or etc. As the Hydrological information from external Hydrological Sensors, the data may include Water Temperature, Current Speed, Current Direction, Wave Height, Wave Period, Wave Direction, Salinity (Conductivity), and/or others. N321/N323 implements the format of message 8 which is defined by IMO SN.1/Circ.289.

For more information about IMO message 8 parameters, please refer Appendix 4.

4.3.4   Other messages

- Message 7:
    It is the acknowledgment message when message 6 is received.
- Message 12:
    It is Safety-related text which is addressed to a base station or a dedicated transponder. The message may be sent accordingly with a predefined schedule.
- Message 13:
    It is the acknowledgment message when message 12 is received.
- Message 14:
    It is Safety-related text for broadcast communication; warns any AtoN malfunction.

4.4   The N321/N323 Data Port

N321/N323 can connect to external devices through the N321/N323 DATA port. The DATA port provides the following interfaces:

- NMEA 0183 #1 (Tx/Rx)
- NMEA 0183 #2 (Rx)
- Three (3) Isolated Digital Input
- Wake Up Input
- Wake Up Output
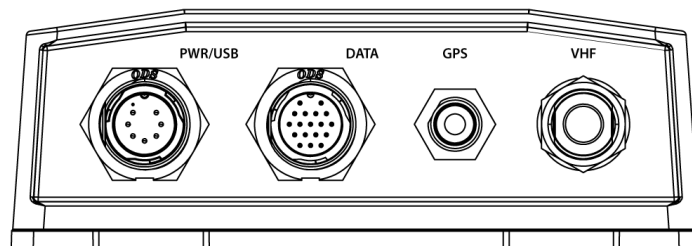
Figure 4-4 N321/N323 Data Port

The N321/N323 NMEA 0183 ports can be configured to 4800, 9600, 38400, or 115200 baud rate independently. The default NMEA 0183 baud rate for both ports is 115200-bps.

4.4.1   N321/N323 Device Configuration

To configure the N321/N323, please connect the N321/N323 to a PC with the provided USB cable.
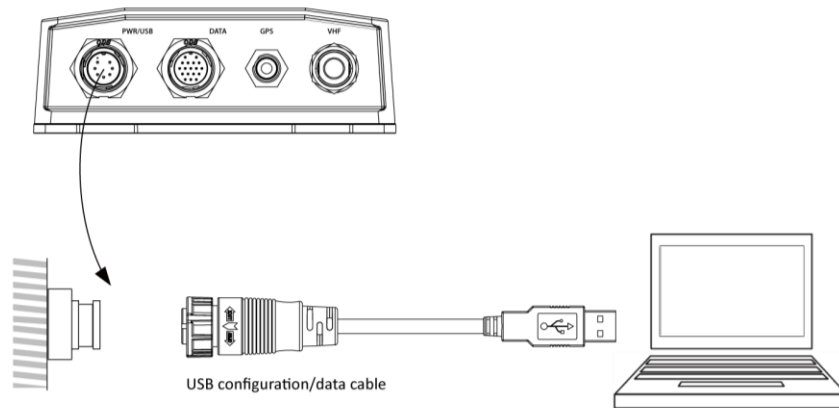
Figure 4-4-1 N321/N323 Device Configuration

4.4.2 Data Communication Interface

N321/N323 is capable of transferring data/sentence from and to external device via its Data communication interface. Please refer the section 2.3.2.4 Wiring and Pin assignments for more Data connection information.

N321/N323 can collect the NMEA 0183 sentences from meteorological and hydrological sensors through Data port and then broadcasts the information using the message 8 format.

Application 1: Meteorological Sensor Monitoring

The meteorological sensors can measure the values for Wind Speed, Wind Direction, Air Temperature, Relative Humidity, Barometric Pressure and Visibility. Unlike some sensors that can only measure one meteorological value, Weather Station can measure two or more meteorological values. In general, the weather station can provide more values using NMEA 0183 output via the Data port.

Authorities or engineers may define their proprietary message 8 format if necessary. AMEC is devoted to assist the implementation of the preferred format under consent agreements. The most convenient way is to use the IMO format for quick implementation.

Application 2: Hydrological Sensor Monitoring

The hydrological sensors are more professional and may have higher cost comparing to other external sensors due to the use in extremely environments, e.g., deep sea. The sensors costs vary by their operating environment conditions.

The Hydrological sensors measure values like Water Temperature, Current Speed, Current Direction, Wave Height, Wave Period, Wave Direction and Salinity (Conductivity). Most of the sensors use RS-232/NMEA 0183 connectivity similar like weather stations.

Users need to provide the technical information of their planned hydrological sensors. Only with the provided information AMEC can then determine possible resources and support for the users. It is highly recommended to use NMEA 0183 string via Data interface connecting to N321/N323. The message 8 format can either be proprietary by user's definition or the standard IMO format.
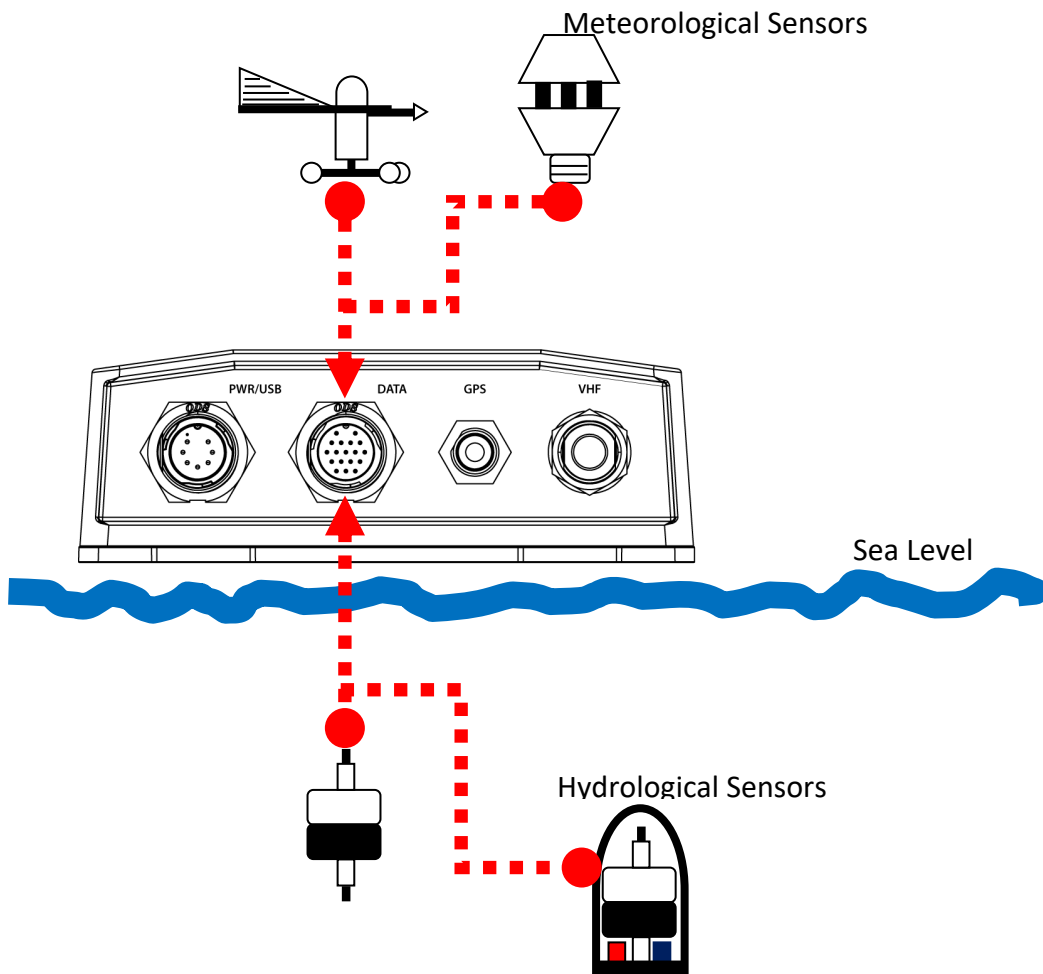
Figure 4-4-2 Data Communication Interface

4.4.3   Digital-Input

The Digital-Input interface at DATA port can be used to detect on/off (or high/low) status of an external hardware device. For more information about Digital-Input wiring of DATA port, please refer the section N321/N323 Data Cable Wiring Assignment.

The status can be transmitting out by local AIS AtoN unit to a remote location via the AIS message 6. Under GLA Message 6 format, this AIS AtoN Digital-Input bit is typically mapped to the parameter of health, Light staus and RACON status.

The input signal voltage of the status HIGH (ON) can range from 5V to 36V DC. Input voltage less than 5V is defined as status LOW (OFF). The Digital-Input interface has opto-isolation-capability as shown in the diagram below
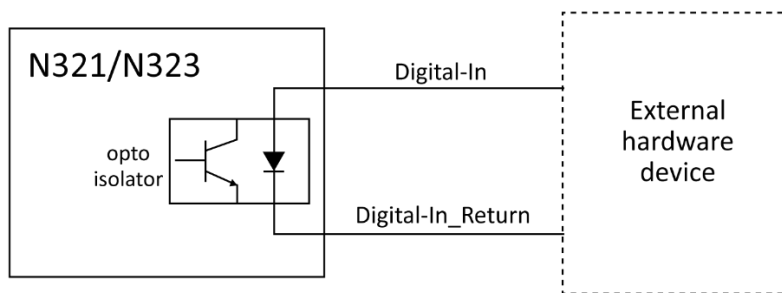
4.4.4   G-Sensor

The AIS AtoN has built-in accelerometer sensor. When detect high G occur, such as hit by ship/vessel, the AIS AtoN can transmit the AIS message with predefined text content.

(To be revised later)

4.5   Summary of AIS AtoN Applications

To summarize what a typical AIS AtoN can do, some of the descriptions below are taken from IALA Guideline No. 1062.

(1) The use of AIS as an AtoN can provide the following services to AIS equipped vessels: (this is not a priority list)
- Provide identification of the AtoN in all weather conditions;
- Complement existing signals from AtoN (e.g. Racon);
- Transmit accurate positions of floating AtoN;
- Indicate if a floating AtoN is off position;
- Mark or delineate tracks, routes, areas, and limits (for example, areas to be avoided and Traffic Separation Schemes (TSS));
- Mark offshore structures (for example, wind turbines, wave and tidal energy devices, oil and gas platforms);
- Provide weather, tidal, and sea state data.
- Provide additional AtoN capability through use of virtual AIS AtoN where installation of physical AtoN is technically or economically difficult;
- Indicate AtoN status; and
- Provide an accurate position for fixed AtoN which acts as reference targets for verifying radar.

(2) In addition, the use of AIS as an AtoN can provide a number of benefits to the AtoN authority or the port authority:
- Monitor the status of an AtoN;
- Track AtoNs that are off position;
- Assist in the identification of ships involved in collisions with AtoN through provision of exact AtoN position data;
- Gather real-time (or near real-time) information on the 'state of health' of an AtoN;
- Remotely control changes in AtoN parameters (if so equipped);
- Provide statistics on reliability of AtoN;

5 Operation, Maintenance, and Trouble Shooting

5.1 Operation

Once N321/N323 is fully configured, the unit will report meteorological/hydrological statuses and AIS AtoN messages automatically making operation minimized.

5.2 Maintenance

Deployed sites are usually located out at sea, making maintenances inconveniently and costly. N321/N323 is designed to keep maintenances minimized. Plan and deploy Type1 or Type3 AIS AtoN based on the requirements. If the site requires frequent configuration and maintenance, the Type3, N323, would be the choice for the deployment as it supports remote configuration.

5.3 Trouble Shooting

AIS AtoN can apply to a wide range of applications making compiling a full list of trouble shooting quite difficult. All most used operations are described in this manual, but there might be topics out there where this manual might not cover. If encountering any problems, please do not hesitate to contact us or our local agent.

6 Product Specifications

6.1 Specifications

Product Model Number	N321	N323
General		
IEC 62320-2 type definition	AIS AtoN Type 1	AIS AtoN Type 3
Support synthetic and virtual AtoN	Yes	Yes
Support chaining function	No	Yes
Configuration method	NMEA 0183 sentences	NMEA 0183 sentences, AIS standard VDL messages, AES encryption of VDL message
Positioning device	EPFS and surveyed position	
AIS Transmitter		
Access scheme	FATDMA	FATDMA or RATDMA configurable
Tx frequency	AIS1: 161.975 MHz AIS2: 162.025 MHz	
Tx frequency range	156.025 MHz ~ 162.025 MHz	
Frequency accuracy	+/- 500 Hz	
Tx power	2 or 5 or 12.5 watt selectable	
Tx schedule interval	1~1440 minute	
Tx message	Message 6, 8, 12, 14, 21, 25	Message 6, 7, 8, 12, 13, 14, 21, 25
AIS Receivers		
Receivers	No	Yes, 2 receivers
Rx frequency range	n.a.	156.025 MHz ~ 162.025 MHz
Rx sensitivity	n.a.	PER 20% at -112 dBm
VHF		
VHF antenna	External	
Impedance	50 ohms	
Connector type	SO-239 (Female)	
GNSS		
GNSS antenna	Active externa antenna (3.3 V) with gain >20dB	
Impedance	50 ohms	
Connector type	TNC type (Female)	
Receiving channels	72 channels	
GNSS receiver type	GPS/QZSS L1C/A, GLONASS L1OF, BeiDou B1l, Galileo E1B/C, SBAS L1C/A: WAAS, EGNOS, MSAS, GAGAN	
Horizontal position	< 2.5 m (CEP, 50%, 24 hours static, -130 dBm, > 6 SVs)	
Power Supply		
Supply voltage	12 V DC ~ 24 V DC nominal (at power connector)	
Supply voltage range	9.6 V DC ~ 31.2 V DC	
Peak Current Draw	3A at 12 V DC	

	1.5A at 24 V DC	
* Must apply power output with < 100W Switching adapter or DC power equipment.		
Power Consumption (measured under 12Vdc, at 12.5 watt Tx power, reporting interval 3 minutes)		
Under FATDMA mode	< 0.037 Ah/day	n.a
Under RATDMA mode	n.a.	< 0.764 Ah/day
Configuration / Communication Interface		
External communication port	Data Port (NMEA 0183 x 2)	
External configuration port	USB (Configuration and Firmware upgrade)	
Configuration by VDL	No	Yes
Physical Connectors		
Power/USB	Proprietary 7-pin connector for external power supply (2 pins), and USB for configuration/firmware upgrade.	
VHF	SO-239 (Female)	
GPS	TNC Type	
DATA (18-pin)	Proprietary 18-pin connector for: • NMEA 0183 #1 (Tx/Rx); (Default baud rate 115200) • NMEA 0183 #2 (Rx only); (Default baud rate 115200) • Isolated digital input x 3 • Wake up input • Wake up output	
Accelerometer (G-Sensor); Optional		
6-Axis 3D Accelerometer	Linear acceleration range: ±2/±4/±8/±16 g Angular rate range: ±125/±250/±500/±1000/±2000/±4000 dps	
Software Tool		
Windows-based PC configuration utility (Digital Download)		
Environmental		
Product category	IEC 60945 "Protected"	
Operating temperature	-25°C ~ +55°C	
Storage temperature	-30°C ~ +70°C	
Humidity	93% relative humidity at 40°C	
Mechanical		
Length	156.6 mm (6.14 inch)	
Width	120.1 mm (4.72 inch)	
Height	54 mm (2.13 inch)	
Weight	<= 800 g (28 oz); main unit only	
Case material	Aluminum alloy (ADC12)	
Waterproof	IP 68	
Applicable Standards		
ITU-R M.1371-5 (2014)	EN 301 843-1 V2.2.1: 2017	
IALA A-126 Ed.1.5 (2011)	EN 301 843-2 V2.2.1: 2017	
IEC 60945 Ed.4.0 (2002)	EN 62311: 2020	
IEC 62320-2 Ed. 2.0 (2016)	EN 301 489-1 V2.2.3: 2019	
IEC 61108-1 (2003)	EN 301 489-19 V2.1.1: 2019	
IEC 61162-1 Ed.5.0 (2016)	EN 303 413 V1.2.1: 2021	
IEC 61162-2 Ed. 1.0: 1998	EN 62368-1: 2020/A11: 2020	

Note: the specifications of N321/N323 are subject to change without notice.

6.2 Mechanical Diagrams

N321/N323 Main Unit
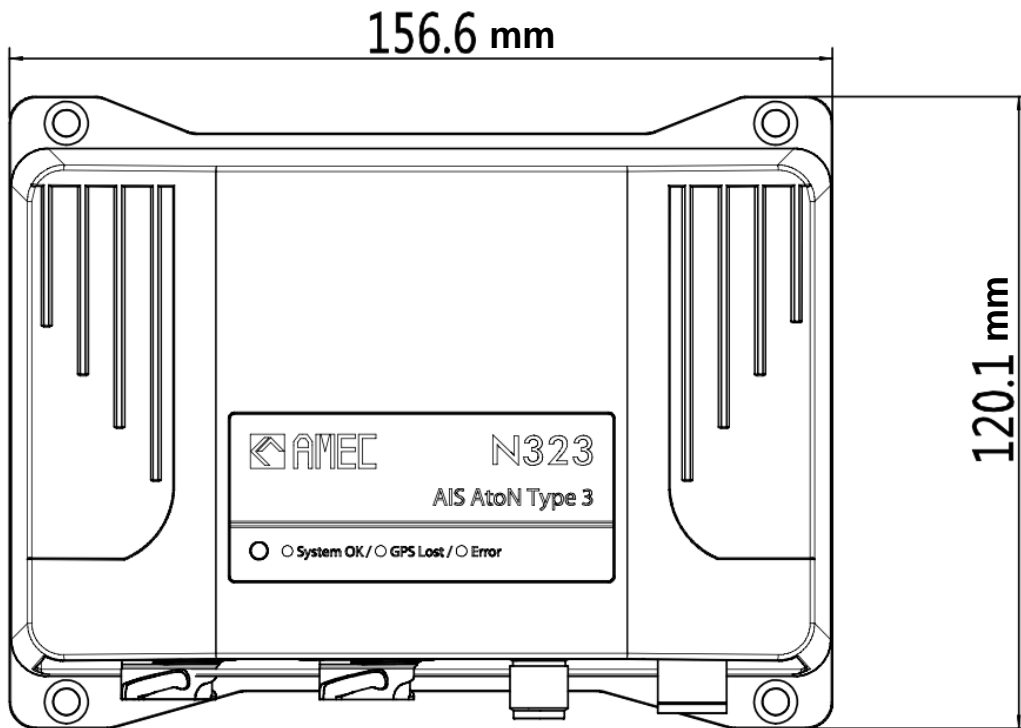
Figure 6-2-1 Top View
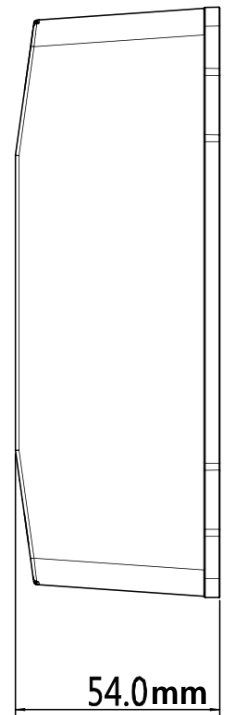
Figure 6-2-2 Side View
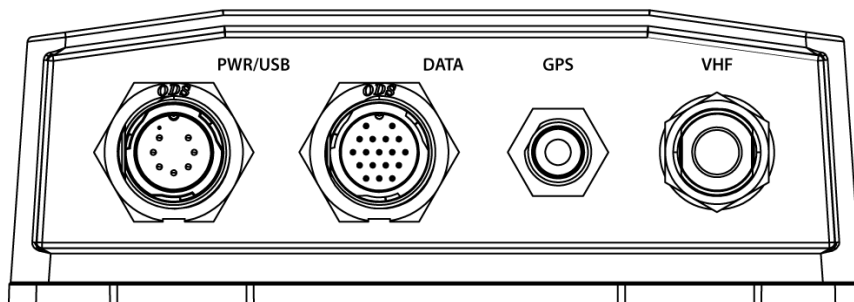
Figure 6-2-3 Front View

PCB
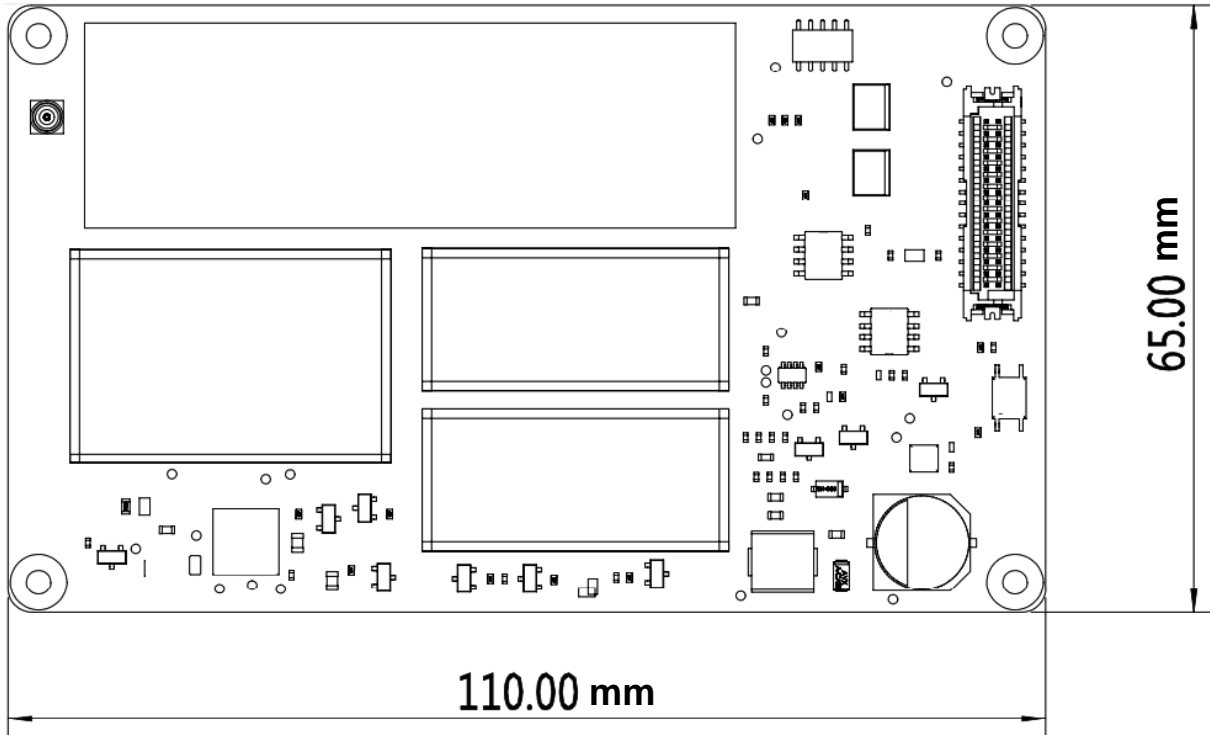
Figure 6-2-4 Top View
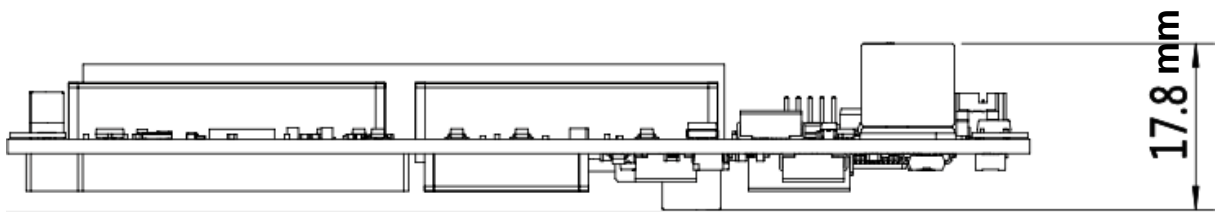
Figure 6-2-5 Side View

APPENDIX A1: ATON CODES

Table below lists all the codes for type of AtoN defined by IALA.
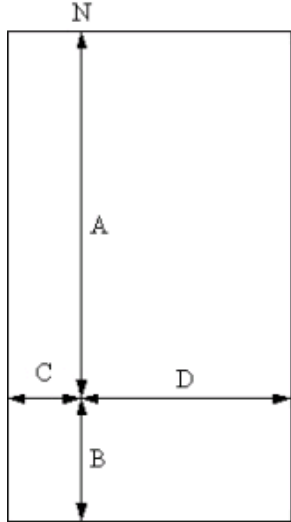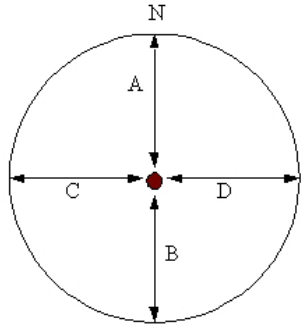
	Code	Definition	Dimension/ reference for position
	0	Default, Type of AtoN not specified	
	1	Reference point	
	2	RACON	
	3	Fixed structure off shore, such as oil platforms, wind farms. (Note: This code should identify an obstruction that is fitted with an Aid-to-Navigation AIS station.)	
	4	Spare, Reserved for future use.	
Fixed AtoN	5	Light, without sectors	
	6	Light, with sectors	
	7	Leading Light Front	
	8	Leading Light Rear	
	9	Beacon, Cardinal N	
	10	Beacon, Cardinal E	
	11	Beacon, Cardinal S	
	12	Beacon, Cardinal W	
	13	Beacon, Port hand	Figure 1. Dimensions of a fixed AtoN related to the given reference point.
	14	Beacon, Starboard hand	
	15	Beacon, Preferred Channel port hand	
	16	Beacon, Preferred Channel starboard hand	
	17	Beacon, Safe water	
	18	Beacon, Safe water	
	19	Beacon, Special mark	
Floating AtoN	20	Cardinal Mark N	
	21	Cardinal Mark E	
	22	Cardinal Mark S	
	23	Cardinal Mark W	
	24	Port hand Mark	
	25	Starboard hand Mark	
	26	Preferred Channel Port hand	
	27	Preferred Channel Starboard hand	
	28	Isolated danger	Figure 2. Dimensions for a floating AtoN and fixed floating off-shore structures
	29	Safe Water	
	30	Special Mark	
	31	Light Vessel / LANBY / Rigs	

Note that Code 3 type in the table above uses Figure 2 as its "Dimensions/reference for position".

APPENDIX A2: ITU-R AIS MESSAGES

The descriptions below are taken directly from ITU-R M.1371, "Technical characteristics for an automated identification system using time division multiple access in the VHF maritime mobile band". This Appendix summarizes all the defined messages in the table below.

Message ID	Name	Description
1	Position report	Scheduled position report; (Class A shipborne mobile equipment)
2	Position report	Assigned schedule position report; (Class A shipborne mobile equipment)
3	Position report	Special position report, response to interrogation; (Class A shipborne mobile equipment)
4	Base station report	Position, UTC, date and current slot number of base station
5	Static and voyage related data	Scheduled static and voyage related vessel data report; (Class A shipborne mobile equipment)
6	Binary addressed message	Binary data or addressed communication
7	Binary acknowledgement	Acknowledgement of received addressed binary data
8	Binary Broadcast message	Binary data for broadcast communication
9	Standard SAR aircraft position report	Position report for airborne stations involved in SAR operations, only
10	UTC/date inquiry	Request UTC and date
11	UTC/date response	Current UTC and date if available
12	Addressed safety related message	Safety related data for addressed communication
13	Safety related acknowledgement	Acknowledgement of received addressed safety related message
14	Safety related broadcast message	Safety related data for broadcast communication
15	Interrogation	Request for a specific message type(can result in multiple responses from one or several stations)
16	Assignment mode command	Assignment of a specific report behavior by competent authority using a Base station
17	DGNSS broadcast binary message	DGNSS corrections provided by a base station
18	Standard Class B equipment position report	Standard position report for Class B shipborne mobile equipment to be used instead of Messages 1, 2, 3
19	Extended Class B equipment position report	Extended position report for class B shipborne mobile equipment; contains additional static information

20	Data link management message	Reserve slots for Base station(s)
21	Aids-to-navigation report	Position and status report for aids-to-navigation
22	Channel management	Management of channels and transceiver modes by a Base station
23	Group assignment command	Assignment of a specific report behavior by competent authority using a Base station to a specific group of mobiles
24	Static data report	Additional data assigned to an MMSI Part A: Name Part B: Static Data
25	Single slot binary message	Short unscheduled binary data transmission (Broadcast or addressed)
26	Multiple slot binary message with Communications state	Scheduled binary data transmission (Broadcast or addressed)

APPENDIX A3: ITU-R AIS MESSAGES 21

The descriptions below are taken directly from ITU-R M.1371, "Technical characteristics for an automated identification system using time division multiple access in the VHF maritime mobile band".

This message should be used by an AtoN AIS station. This station may be mounted on an aid-to-navigation or this message may be transmitted by a fixed station when the functionality of an AtoN station is integrated into the fixed station. This message should be transmitted autonomously at a Rr of once every three (3) min or it may be assigned by an assigned mode command (Message 16) via the VHF data link, or by an external command. This message should not occupy more than two slots.

Parameter	Number of bits	Description
Message ID	6	Identifier for Message 21
Repeat indicator	2	Used by the repeater to indicate how many times a message has been repeated. See § 4.6.1, Annex 2; 0-3; 0 = default; 3 = do not repeat any more
Type of aids-to-navigation	5	0 = not available = default; refer to appropriate definition set up by IALA; see Table 71
Name of Aids-to-Navigation	120	Maximum 20 characters 6-bit ASCII, as defined in Table 44 "@@@@@@@@@@@@@@@@@@@@" = not available = default. The name of the AtoN may be extended by the parameter "Name of Aid-to-Navigation Extension" below
Position accuracy	1	1 = high (> 10 m) 0 = low (< 10 m) 0 = default. The PA flag should be determined in accordance with Table 47
Longitude	28	Longitude in 1/10 000 min of position of an AtoN (±180º, East = positive, West = negative 181 = (6791AC0$_h$) = not available = default)
Latitude	27	Latitude in 1/10 000 min of an AtoN (±90º, North = positive, South = negative 91 = (3412140$_h$) = not available = default)
Dimension/ reference for position	30	Reference point for reported position; also indicates the dimension of an AtoN (m) (see Fig. 42 and § 4.1), if relevant[1]
Type of electronic position fixing Device	4	0 = Undefined (default) 1 = GPS 2 = GLONASS 3 = Combined GPS/GLONASS 4 = Loran-C 5 = Chayka 6 = Integrated Navigation System

		7 = surveyed. For fixed AtoN and virtual AtoN, the charted position should be used. The accurate position enhances its function as a radar reference target 8 = Galileo 9-15 = not used
Time stamp	6	UTC second when the report was generated by the EPFS (0-59 or 60) if time stamp is not available, which should also be the default value or 61 if positioning system is in manual input mode or 62 if electronic position fixing system operates in estimated (dead reckoning) mode or 63 if the positioning system is inoperative)
Off-position indicator	1	For floating AtoN, only: 0 = on position; 1 = off position. NOTE 1 – This flag should only be considered valid by receiving station, if the AtoN is a floating aid, and if time stamp is equal to or below 59. For floating AtoN the guard zone parameters should be set on installation
AtoN status	8	Reserved for the indication of the AtoN status 00000000 = default
RAIM-flag	1	RAIM (Receiver autonomous integrity monitoring) flag of electronic position fixing device; 0 = RAIM not in use = default; 1 = RAIM in use see Table 47
Virtual AtoN flag	1	0 = default = real AtoN at indicated position; 1 = virtual AtoN, does not physically exist[2].
Assigned mode Flag	1	0 = Station operating in autonomous and continuous mode = default 1 = Station operating in assigned mode
Spare	1	Spare. Not used. Should be set to zero. Reserved for future use
Name of Aid-to-Navigation Extension	0, 6, 12, 18, 24, 30, 36, ... 84	This parameter of up to 14 additional 6-bit-ASCII characters for a 2-slot message may be combined with the parameter "Name of Aid-to-Navigation" at the end of that parameter, when more than 20 characters are needed for the name of the AtoN. This parameter should be omitted when no more than 20 characters for the name of the A-to-N are needed in total. Only the required number of characters should be transmitted, i.e. no @-character should be used
Spare	0, 2, 4, or 6	Spare. Used only when parameter "Name of Aid-to-Navigation Extension" is used. Should be set to zero. The number of spare bits should be adjusted in order to observe byte boundaries
Number of bits	272-360	Occupies two slots

APPENDIX A4: METEOROLOGICAL AND HYDROGRAPHIC DATA MESSAGE 8

The suggested message 8 format is taken from IMO SN.1/Circ.289.

Meteorological and Hydrographic data

1. This message allows the distribution of meteorological and hydrographic information.
2. This message should not be transmitted when positional information or time of measurement are not available. If there is no data available for that particular data field, it should be displayed as "not available".
3. Not all the information specified in the table 1.1 will be available at all stations.

Parameter	Number of bits	Description
Message ID	6	Identifier for Message 8; always 8.
Repeat Indicator	2	Used by the repeater to indicate how many times a message has been repeated. 0 - 3 0 = default 3 = do not repeat anymore
Source ID	30	MMSI number of source station.
Spare	2	Not used. Set to zero.
IAI	16	DAC = 001; **FI = 31**
Longitude	25	Longitude in 1/1,000 min, ±180 degrees as per 2's complement (East = positive, West = negative). 181 = not available = default
Latitude	24	Latitude in 1/1,000 min, ±90 degrees as per 2's complement (North = positive, South = negative). 91 = not available = default
Position Accuracy	1	1 = high (<10 m; Differential Mode of, e.g., DGNSS receiver) 0 = low (>10 m; Autonomous Mode of, e.g., GNSS receiver or of other electronic position fixing device) default = 0
Time Stamp		UTC date and time of the data.
UTC Day	5	1 - 31 0 = not available = default
UTC Hour	5	0 - 23 24 = not available = default
UTC Minute	6	0 - 59 60 = not available = default

Parameter	Number of bits	Description
Average Wind Speed	7	Average of wind speed values for the last 10 minutes, in 1 knot steps. 0 - 125 knots 126 = wind 126 knots or greater 127 = not available = default
Wind Gust	7	Maximum wind speed reading during the last 10 minutes, in 1 knot steps. 0 - 125 knots 126 = wind 126 knots or greater 127 = not available = default
Wind Direction	9	Direction of the average wind during the last 10 minutes, in 1 degree steps. 0 - 359 degrees 360 = not available = default 361 - 511 (reserved for future use)
Wind Gust Direction	9	Direction of the maximum wind during the last 10 minutes, in 1 degree steps. 0 - 359 degrees 360 = not available = default 361 - 511 (not for use)
Air Temperature	11	Dry bulb temperature in degrees Celsius (as per 2's complement), in 0.1 degree steps. -60 to +60 degrees Celsius 601 - 1,023 (reserved for future use) -1,024 = data not available = default -1,023 to -601 (reserved for future use)
Relative Humidity	7	Relative Humidity, in 1% steps. 0 - 100% 101 = not available = default 102 -127 (reserved for future use)
Dew Point	10	Dew point temperature in degrees Celsius (as per 2's complement), in 0.1 degree steps. -20.0 to +50.0 degrees 501 = not available = default 502 - 511 (reserved for future use) -511 to -201 (reserved for future use)
Air Pressure	9	Air pressure, defined as pressure reduced to sea level, in 1 hPa steps. 0 = pressure 799 hPa or less 1 - 401 = 800 - 1200 hPa 402 = pressure 1201 hPa or greater 403 - 510 (reserved for future use) 511 = not available = default

Parameter	Number of bits	Description
Air Pressure Tendency	2	0 = steady 1 = decreasing 2 = increasing 3 = not available = default
Horizontal Visibility	8	Horizontal visibility, in 0.1 Nautical Miles steps (00000000 to 01111111). 0.0 - 12.6 Nautical Miles The most significant bit (MSB) indicates that the maximum range of the visibility equipment was reached and the reading shall be regarded as > x.x NM. (e.g., if 10110010,then visibility is 5.0 NM or greater) 127 = data not available = default
Water level (incl. tide)	12	Deviation from local chart datum, in 0.01 metre steps. -10.0 to +30.0 metres A value representing 0 - 4,000 is sent by the 12 binary bits. The water level is achieved by adding -10.0 to the sent value. Water level = (Integer value /100) – 10 for Integer = 0-4,000 4,001 = not available = default 4,002 – 4,095 (reserved for future use)
Water Level Trend	2	0 = steady 1 = decreasing 2 = increasing 3 = not available = default
Surface Current Speed (incl. tide)	8	Speed of Current measured at the sea surface, in 0.1 knot steps. 0.0 - 25.0 knots 251 = speed 25.1 knots or greater 255 = not available = default 252-254 (reserved for future use)
Surface Current Direction	9	Direction of Current at the sea surface, in 1 degree steps. 0 - 359 degrees 360 = not available = default 361 - 511 (reserved for future use)
Current Speed, #2	8	Speed of Current 2 measured at a chosen level below the sea surface, in 0.1 knot steps. (Same as Surface Current Speed)
Current Direction, #2	9	Direction of Current 2, in 1 degree steps. (Same as Surface Current Direction)
Current Measuring level, #2	5	Measuring level below sea surface, in 1 metre increment. 0 - 30 metres 31 = not available = default

Parameter	Number of bits	Description
Current Speed, #3	8	Speed of Current 3 measured at a chosen level below the sea surface, in 0.1 knot steps. (Same as Surface Current Speed)
Current Direction, #3	9	Direction of Current 3, in 1 degree steps. (Same as Surface Current Direction)
Current Measuring level, #3	5	Measuring level below sea surface, in 1 metre steps. 0 - 30 metres 31 = data not available = default
Significant Wave Height	8	Height of the waves, in 0.1 metre steps. 0.0 - 25.0 metres 251 = height 25.1 metres or greater 255 = data not available = default 252 - 254 (reserved for future use)
Wave Period	6	Wave period, in 1 second steps. 0 - 60 seconds 61 - 62 (reserved for future use) 63 = not available = default
Wave Direction	9	Direction of waves, in 1 degree steps. 0 - 359 degrees 360 = data not available = default 361 - 511 (reserved for future use)
Swell Height	8	Height of the swell, in 0.1 metre steps. 0.0 - 25.0 metres 251 = height 25.1 metres or greater 255 = data not available = default 252 - 254 (reserved for future use)
Swell Period	6	Swell period, in 1 second steps. 0 - 60 seconds 61 - 62 (reserved for future use) 63 = not available = default
Swell Direction	9	Direction of swells, in 1 degree steps. 0 - 359 degrees 360 = not available = default 361 - 511 (reserved for future use)
Sea State	4	Beaufort Scale, as defined in the Beaufort scale table next page.

Parameter	Number of bits	Description
Water Temperature	10	Temperature of the water in degrees Celsius (as per 2's complement), in 0.1 degree steps. -10.0 to +50.0 degrees Celsius 501 = data not available = default 502 - 511 (reserved for future use) -511 to -101 (reserved for future use)
Precipitation (type)	3	According to WMO 306 Code table 4.201: 0 = reserved 1 = rain 2 = thunderstorm 3 = freezing rain 4 = mixed/ice 5 = snow 6 = reserved 7 = not available = default
Salinity	9	Salinity, in 0.1‰ (ppt) steps. 0.0 - 50.0 ‰ 50.1 = salinity 50.1 ‰ or greater 510 = not available = default 511 = sensor not available 502 - 509 (reserved for future use)
Ice	2	0 = No 1 = Yes 2 = (reserved for future use) 3 = not available = default
Spare	10	Not used. Set to zero
Total	**360**	**Occupies 2 slots**

Beaufort scale

Scale	Sea Conditions
0	Flat.
1	Ripples without crests.
2	Small wavelets. Crests of glassy appearance, not breaking.
3	Large wavelets. Crests begin to break; scattered whitecaps.
4	Small waves.
5	Moderate (1.2m) longer waves. Some foam and spray.
6	Large waves with foam crests and some spray.
7	Sea heaps up and foam begins to streak.
8	Moderately high waves with breaking crests forming spindrift. Streaks of foam.
9	High waves (6-7m) with dense foam. Wave crests start to roll over. Considerable spray.
10	Very high waves. The sea surface is white and there is considerable spray.
11	Exceptionally high waves.
12	Huge waves. Air filled with foam and spray. Sea completely white with driving spray. Visibility greatly reduced.
13	Not available = default
14-15	(Reserved for future use)

APPENDIX A5: ADDRESSED BINARY MESSAGES 6 (GLA)

Message 6 example format Information in this appendix is taken from IALA A-126 Ed 1.5.

AIS Aids to Navigation monitoring can provide a significant benefit to the AtoN authority. Message type 6 is used for this purposed, and different approaches can be taken to address this process.

The interval between the transmissions of these messages will be synchronized with message 21, although not necessarily at the same reporting rate. If Message 21 is not used at a particular site, then the reporting interval should be selected to minimize the power requirement of the transponder, whilst still providing enough data to enable meaningful diagnostic analysis.

Parameter	Number of bits	Description
Message ID	6	Identifier for this message 6; always 6.
Repeat Indicator	2	Used by the repeater to indicate how many times a message has been repeated. 0 – 3; default = 0; 3 = do not repeat any more.
Source ID	30	MMSI number of source Unit
Sequence Number	2	0 – 3
Destination ID	30	MMSI number of destination Unit.
Retransmit Flag	1	Retransmit Flag should be set upon retransmission: 0 = no retransmission = default 1 = retransmitted.
Spare	1	Not used. Should be zero.
DAC	10	Destination Area Code. Default: 235 (UK & NI) or 250 (ROI)
FI	6	Function Identifier Default: 10 for this GLA standard message
Analogue (internal)	10	0.05 – 36V 0.05V step Supply voltage to AIS Unit 0 – Not Used
Analogue (external - from hardware analogue input No 1	10	0.05 – 36V 0.05V step 0 – Not Used
Analogue (external - from hardware analogue input No 2	10	0.05 – 36V 0.05V step 0 – Not Used
Status Bits 0 / 1 (internal – same as the 5 LSBs of status bits from Message type 21)	5	4 \ / 00 – no RACON installed; 01 – RACON not monitored 3 / \ 10 – RACON operational; 11 – RACON ERROR 2 \ / 00 – no light or no monitoring; 01 – Light ON 1 / \ 10 – Light OFF; 11 – Light ERROR 0 0 - Good Health, 1 - Alarm
Status Bits 0 / 1 (external - derived from hardware digital inputs)	8	7 Digital Input Off / On 0 Digital Input Off / On
Off Position Status	1	Off position or On position 0: On position 1: Off position
Spare	4	For future use. Should be zero.
TOTAL OF BITS.	**136**	**Occupies 1 slot.**

APPENDIX A6: N321/N323 INSTALLATION AND OPERATION CHECK SHEET

During the installation and setting, installers are recommended to use the following Installation check sheet to verify all procedures are well followed.

	Items	Check
Prior to installations	Ensure that the package has all the necessary parts.	
	Check that items are not damaged.	
	Ensure the GNSS antenna has a suitable installation location and itself has clear view of the sky.	
	Ensure the VHF antenna has a suitable installation location and it has no metal substances around to interfere its VHF radio transmitting.	
	Check that the battery is fully charged. (If using other types of power source, ensure the power is 12V 10A.)	
Verifications during N321/N323 unit installation	Ensure that GNSS antenna is properly installed.	
	Ensure that VHF antenna is properly installed.	
	Ensure that N321/N323 is secured firmly.	
	Ensure that cables and arrestors are well installed.	
	Ensure that cable connectors firmly secured. (Note: overly secured may damage the connectors.)	
	Ensure that no water will reach the connector area.	
Verifications during N321/N323 software configuration	Ensure that the data is input correctly to N321/N323	
	Ensure that all settings are well documented for future reference	
Final Installation inspection	Check that N321/N323 AIS signal can be received by an AIS Receiver or AIS Base Station	
	Check AIS signal is transmitting according to the configuration setting	

APPENDIX A7: BIIT

With BIIT (Built-in Integrity Test), the N321/N323 is constantly monitoring and testing the integrity itself.

BIIT Function for Antenna Disconnect

There is a built-in RF output power detector, which is used to monitor the VSWR of the VHF antenna port. If there is any abnormal condition (open or short) at the VHF port of N321/N323, N321/N323 will cease transmission at the next transmission phase. The ADS and ALR sentences will output. The MANOD will continue transmission.

BIIT Function for Tx malfunction

BIIT Function for Receiver Channel 1 and/or Channel 2 Failure

The receiver at N321/N323 has a built-in receiver signal strength indication (RSSI), which is designed under a pre-defined threshold to judge receiver operating status. If the RSSI level is over the pre-defined threshold, N321/N323 will reflect receiver failure and cease transmission during the next transmission phase. The ADS and ALR sentences will output. The N321/N323 will stop transmission on the channel(s) which detect a fault.

The N321/N323 is not equipped with any additional augmentation system.

APPENDIX A8: SUPPORTED NMEA 0183/IEC 61162 SENTENCE

The standard NMEA 0183/IEC 61162 sentences supported by AMEC AIS AtoN are listed in the table below. Please refer to the document of NMEA 0183/IEC 61162-1 for details.

Table A.1 Standard sentences support by N321/N323

Formatter	Description	Output	Input	Query
	Query sentences		V	
ABK	AIS Addressed and Binary Broadcast Acknowledgement	V		
ABM	AIS Addressed Binary and Safety Related Message		V	
ACF	General AtoN Station Configuration Command	V	V	V
ACG	Extended General AtoN Station Configuration Command	V	V	V
ADS	Automatic Device Status	V		
AID	AtoN Identification Configuration Command	V	V	V
BBM	AIS Broadcast Binary Message		V	
CBR	Configure Broadcast Rates for AIS AtoN Station Message	V	V	V
CEK	Configure Encryption Key Command	V	V	V
MEB	Message Input for Broadcast, Command	V	V	V
NAK	Negative Acknowledgement	V		
VDM	AIS VHF Data-link Message	V		
VDO	AIS VHF Data-Link Own-Vessel Report	V		
VER	Version	V		V
VSI	VDL Signal Information	V		
RMC	Recommended Minimum Specific GNSS Data	V		
GGA	Global Positioning System Fix Data	V		
GSA	GNSS DOP and Active Satellites	V		
GSV	GNSS Satellites In View	V		

Please contact AMEC sales for detail information when necessary.

WARRANTY

Limited warranty

Subject to the terms, conditions and limitations set forth in this Worldwide Limited Warranty (hereinafter the "Warranty"), AMEC warrants that its products, when properly installed and used, will be free from defects in material and workmanship for a period of twelve (12) months, from the date of first purchase (the 'Warranty Period')

For the purposes of this warranty, 'date of first purchase' means the date that the product was purchased by the first retail customer, or by the institutional customer, or in the case of a product installed on a new vessel or any other marine related platform by a certified AMEC original equipment manufacturer (a 'AMEC OEM'), the date that such vessel was purchased by the first retail customer.

AMEC will, at its sole option, repair or replace any defective products or components returned during the Warranty Period in accordance with the terms, conditions and limitations set forth below. **Such repairs or replacement will be the sole remedy of the customer under this Warranty.**

Limited to Original Purchaser

This Warranty is for the sole benefit of the original purchaser of the covered product and shall not extend to any subsequent purchaser of the product.

Miscellaneous

Apart from the specific warranties provided under this warranty, all other express or implied warranties relating to the above product is hereby excluded to the fullest extent allowable under law. The warranty does not extend to any lost profits, loss of good will or any indirect, incidental or consequential costs or damages or losses incurred by the purchaser as a result of any defect with the covered product.

Standard Warranty Service

To qualify for standard warranty service the product must be returned to a AMEC-certified service agent (i) within the Warranty Period, and (ii) within thirty (30) days of the alleged product failure. Any products returned must be securely packaged and sent pre-paid and insured to AMEC or to a AMEC-certified service agent. All products returned must be accompanied by a copy of the original sales receipt to be eligible for standard warranty service.

Obtaining Warranty Service

A list of AMEC-certified service agents is available from AMEC Technical Support at www.alltekmarine.com

Other conditions

This Warranty is fully transferable provided that you furnish the original proof of purchase to the AMEC - certified service agent. This Warranty is void if the label bearing the serial number has been removed or defaced.

Limitation and Exclusions

In addition to any other limitations and exclusions set forth herein, AMEC is not responsible for, and this Warranty does not cover:

- Failure due to abuse, misuse, accident, unauthorized alteration, modification or repair, improper installation or operation (whether or not by a AMEC-certified service agent) or improper storage, shipping damage or corrosion;

- Costs associated with routine system checkouts, alignment/calibration, sea trials or commissioning;

- Defects or damage that result from the use of non-AMEC branded or certified products, accessories or other peripheral equipment, including without limitation housings, parts, or software;

- Aftermarket software (i.e. all software other than the original operating software sold with the products);

- Products that have been refurbished, reconditioned, or remanufactured (The foregoing does not apply to products repaired or replaced pursuant to the terms of this Warranty).

- Products that have been dismantled resulting in the broken label on the Products;

- costs associated with overtime or premium labor costs;

- differences in material, coloring or size that may exist between actual products and the pictures or descriptions of such products in our advertising, advertising literature or on the Internet;

TO THE EXTENT PERMITTED BY APPLICABLE LAW, THE FOREGOING WARRANTY IS AMEC'S SOLE WARRANTY AND IS APPLICABLE ONLY TO NEW PRODUCTS PURCHASED WORLDWIDE. THE PROVISIONS OF THIS WARRANTY ARE IN LIEU OF ANY OTHER WRITTEN WARRANTY, WHETHER EXPRESSED OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

THE LIABILITY OF AMEC TO A CUSTOMER UNDER THIS WARRANTY, WHETHER FOR BREACH OF CONTRACT, TORT, BREACH OF STATUTORY DUTY OR OTHERWISE SHALL IN NO EVENT EXCEED AN AMOUNT EQUAL TO THE TOTAL PURCHASE PRICE OF THE PRODUCT GIVING RISE TO SUCH LIABILITY AND IN NO EVENT SHALL AMEC BE LIABLE FOR SPECIAL, INCIDENTAL, CONSEQUENTIAL OR INDIRECT DAMAGES OR LOST OF GOODWILL, REPUTATION, LOSS OF OPPORTUNITY OR INFORMATION, DATA, SOFTWARE OR APPLICATIONS.

SOME JURISDICTIONS DO NOT ALLOW EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS AND YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM JURISDICTION TO JURISDICTION.

This Warranty supersedes and replaces all previous Warranties.
In the event that any term or provision contained in this Warranty is found to be invalid, illegal or unenforceable by a court of competent jurisdiction, then such provision shall be deemed modified to the extent necessary to make such provision enforceable by such court, taking into account the intent of the parties.

No oral or written representations made by AMEC or any seller, reseller or distributor of the products, including employees and agents thereof, shall create any additional warranty obligations, increase the scope, or otherwise modify in any manner the terms of this Warranty.

All AMEC products sold or provided hereunder are merely aids to navigation. It is the responsibility of the user to exercise discretion and proper navigational skill independent of any AMEC product.

CONFORMITY

(To be updated when new model is certified.)

ACRONYMS

Acronyms	Description	Acronyms	Description
ABM	AIS addressed binary and safety related Message	NMEA	National Marine Electronics Association
ACK	Acknowledgment Message	RATDMA	Random Access Time Division Multiple Access
AIS	Automatic Identification System	RF	Radio Frequency
AtoN	Aids to Navigation	SART	Search and Rescue Transponder
BBM	AIS broadcast binary message	SOG	Speed Over Ground
COG	Course Over Ground	SRM	Safety Related Message
DGNSS	Differential Global Navigation Satellite System	TDMA	Time Division Multiple Access
DGPS	Differential Global Positioning System	TNC	Threaded Neill-Concelman Connector
DSP	Digital Signal Processor	TX	Transmitter
ECS	Electronic Chart System	VDL	VHF Data-link Other Vessel Message
EPFS	Electronic Position Fix System	VDM	AIS VHF data-link message
FATDMA	Fixed Access Time Division Multiple Access	VDO	AIS VHF data-link own-vessel report
GNSS	Global Navigation Satellite System	VHF	Very High Frequency
GPS	Global Positioning System	VSD	Voyage Static Data
IEC	International Electrotechnical Commission	VSWR	Vertical Standing Wave Ratio
IMO	International Maritime Organization	VTS	Vessel Traffic Services
MMSI	Maritime Mobile Service ID		

RF EXPOSURE WARNING

WARNING: This device generates and radiates RF electromagnetic energy and must be installed and operated according to the instructions contained in this manual. Failure to do so may result in product malfunction and/or exposure to potentially harmful levels of radio frequency radiation.

WARNING: Never operate this device unless it is properly connected to a VHF antenna. To maximize performance and minimize human exposure to RF energy, always mount the antenna at least 3 m from the device.

The system has a Maximum Permissible Exposure (MPE) radius of 1.1 m from VHF antenna. This has been determined assuming the maximum power of the transmitter and using a standard half-wave monopole VHF antenna with a maximum gain of 2.86 dBi and termination impedance of 50 ohms.

When installing the antenna and operating the equipment consider the following:

- Failure to adhere to these limits could expose persons within the radius to RF radiation in excess of the recommended MPE limits.
- Higher gain VHF antennas will require a larger MPE radius.
- Do not operate the unit when anyone is within the MPE radius of the antenna.
- The antenna should not be co-located or operated in conjunction with any other transmitting antenna.

NOTE:

NOTE: