



B650

AIS Class B Transponder
(SOTDMA)

USER MANUAL



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Automatic Identification System

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Revision History

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Ed. 1.1	Modify the MPE distance	Jul.18,2025
Ed. 1.2	Modify the Industry Canada Notice	Sep.24,2025
Ed. 1.3	Add Cybersecurity and DATA Protection	Jan.9, 2026

Manual Revision: Version 1.3

WARNING!

WARNING: The transponder must be installed and configured in conformity with the provided instructions in the manual in order to maximize the device's performance.

WARNING: Please bear in mind that not all vessels are equipped with AIS transponders and therefore may not be visible to this transponder. Likewise, certain conditions, such as device malfunction, the environment, improper use, and overcrowded port traffic, may exist whereby the vessel equipped with this AIS transponder is not visible to other AIS transponders.

WARNING: DO NOT DISASSEMBLE OR MODIFY THE EQUIPMENT. Improper disassembly or modification could cause personal injury and will invalidate the guarantee.

WARNING: While most of the installation can be performed by the owner or the crew, final commissioning can be done by your local agent/dealer when needed or required. AMEC and the local agent/dealer will not bear any responsibilities over any damages resulted from improper installation by unauthorized agent/dealer.

FOR USERS IN THE UNITED STATES OF AMERICA ONLY

WARNING: It is a violation of the rules of the Federal Communications Commission to input an MMSI that has not been properly assigned to the end user, or to otherwise input any inaccurate data in this device.

★ The entry of static data into this device shall be performed by the vendor of the device or by an appropriately qualified person in the business of installing marine communications equipment on board vessels.

★ Instructions on how to accurately enter and confirm static data in the device can be found in this user manual.

FOREWORD

AMEC thanks you for the purchase of your new B650 series Automatic Identification System (hereinafter called “AIS”). Wherever you sail now, you can have a better situational awareness of your surrounding sea, and have an enjoyable voyage.

B650 series is strictly tested at the factory to meet the rigorous demands of the marine environment. With proper installation and use, the equipment will serve loyally and reliably at its optimum.

For sales, services, and technical supports, please contact your local AMEC representatives or Alltek Marine Electronics Corp. at sales@alltekmarine.com or service@alltekmarine.com. You are always welcome to visit our website at www.alltekmarine.com for new product status and company update.

Thank you again. Be safe.

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1 System Overview

1.1 Product Description

The AMEC B650 series represents a range of cutting-edge (5W SOTDMA) AIS Class B transponders designed to elevate safety and situational awareness for vessels of all types. Whether you're a professional mariner or a recreational boater, the B650 series offers advanced features that keep you alerted and informed on the water.

The B650 series is designed to provide high performance and great reliability, resulting from our years-long field experience. The latest Software Defined Radio technology it incorporates ensures maximum AIS message processing and an outstanding Rx sensitivity of - 111 dBm.

Chart plotter, PC and Mac can be integrated with ease over its waterproof NMEA 0183, NMEA 2000, or USB port. The built-in high-performance Wi-Fi (B650W/B650WS) makes your favorite smartphone or tablet a real-time AIS position plotter.

The B650 series features multi-GNSS receiver with 72 channels support ensuring solid GNSS positioning. Its ruggedized mechanical design with IP68 waterproof and shock and temperature robustness make it fit for harsh marine environments.

Silent mode activation can be made over wiring with optional external switch box (SB-181).

The B650 series provides 4 different variants with main features detailed below:

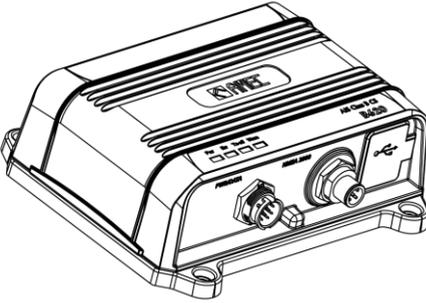
- B650: Standard AIS Class B transponder;

- B650S: AIS Class B transponder with integrated antenna splitter;

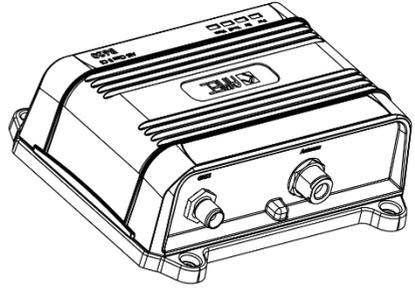
- B650W: AIS Class B transponder with integrated Wi-Fi connection function;

- B650WS: AIS Class B transponder with integrated Wi-Fi and antenna splitter;

B650/B650W

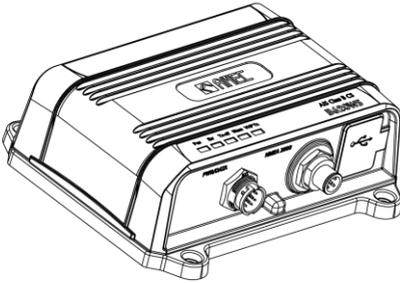


Front

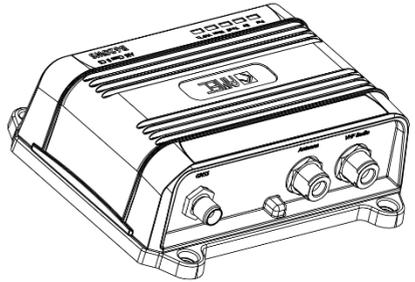


Back

B650S/B650WS



Front



Back

1.2 Equipment in the Box

Upon receiving the product, please verify the items in the box. If any is missing, please contact your local AMEC representative immediately.

(A) Items in B650 / B650W



Class B AIS Transponder



12pin Power and Data cable



USB cable,
1M, type-C to type-A



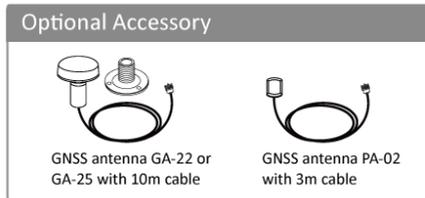
Mounting Template



TP3x3/4 Screws



User Manual



(B) Items in B650S / B650WS



Class B AIS Transponder



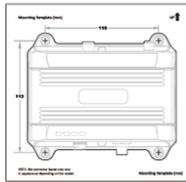
12pin Power and Data cable



USB cable,
1M, type-C to type-A



VHF Radio Cable
(PL259-PL259)



Mounting Template



User Manual



TP3x3/4 Screws

Optional Accessory



GNSS antenna GA-22 or
GA-25 with 10m cable



GNSS antenna PA-02
with 3m cable

1.3 External Connections

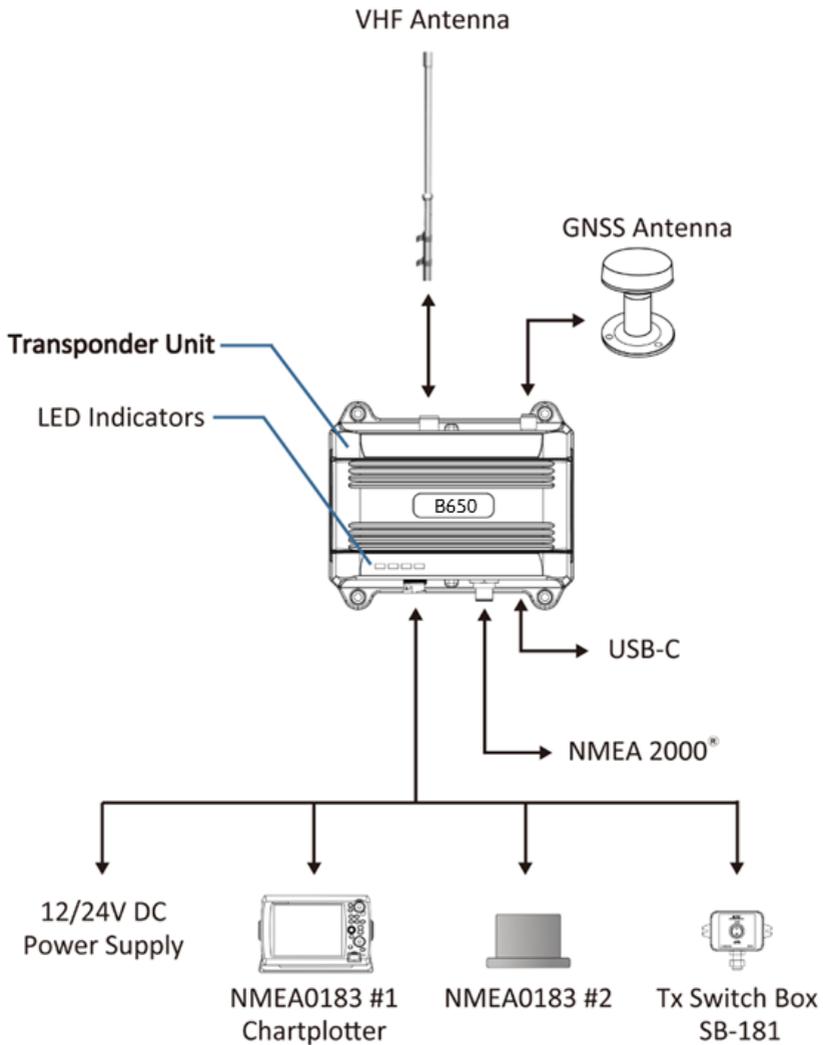


Figure 1 B650/B650W External Connections

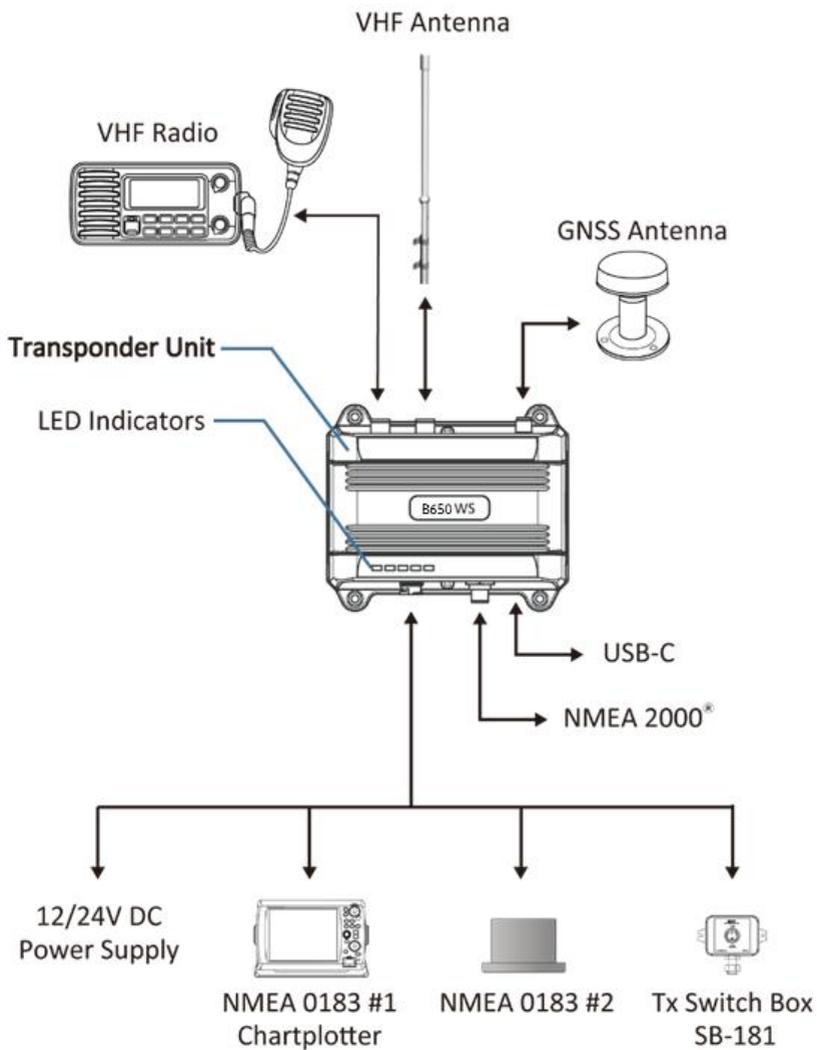


Figure 2 B650S/B650WS External Connections

1.4 What is AIS?

The Automatic Identification System (AIS) is a Very High Frequency (VHF) radio broadcasting system that transfers packets of data over the VHF data link (VDL) and enables AIS equipped vessels and shore-based stations to exchange identification information and navigational data. Ships with AIS transponders continually transmit their ID, position, course, speed and other data to all nearby ships and shore stations. Such information can aid greatly in situational awareness and provide a means to assist in collision avoidance.

AIS equipment is standardized by ITU, IEC, IALA and IMO and is subject to approval by a certification body. The following AIS devices have been developed for variant applications.

- **AIS Class A:**
mandated by the IMO for vessels of 300 gross tonnages and upwards engaged on international voyages, cargo ships of 500 gross tonnages and upwards, as well as passenger ships. It transmits typically on 12.5 watts output power.
- **AIS Class B:**
provides limited functionality and is intended for non-SOLAS commercial vessels and recreational vessels. An AIS Class B typically transmits on 2 or 5 watt output power depending on its TDMA access scheme.
- **AIS Receiver:**
only receives AIS signal and it does not have transmitter to send out AIS signal. Suitable for recreational vessel that does not want to send out its vessel information.
- **AIS Base Station:**
is provided by aids-to-navigation authorities to enable the ship-to-shore / shore-to-ship transmission of information. Networked AIS Base Stations can assist in providing overall maritime domain awareness.
- **AIS AtoN (Aids to Navigation):**
provides the function to transmit position and status of buoys and lights through the same VDL, which can then show up on AIS-ready devices within the range.
- **AIS SART:**
represents the Search and Rescue Transmitter using AIS to assist in determining the location of a vessel in distress. It is typically used on life rafts.
- **AIS on Search and Rescue (SAR) Aircraft:**
is used on airplanes and helicopters to assist search and rescue operation.

1.4.1 Class A vs. Class B AIS

A brief comparison of class A and class B AIS is illustrated in the following table. B650 is a CSTDMA Class B AIS transponder.

Table 1 Comparison of Class A and Class B

Type of AIS	Class A AIS	Class B SOTDMA	Class B CSTDMA
Primary Access Scheme	SOTDMA (Self-organizing)	SOTDMA (Self-organizing)	CSTDMA (Carrier-Sense)
Standard	IEC 61993-2	IEC 62287-2	IEC 62287-1
Transmit Power	12.5W	5W	2W
IMO Mandate	Mandatory for all SOLAS vessels	No mandate	No mandate
Highest reporting rate dynamic data	Every 2 secs when speed is higher than 23nm	Every 5 secs when speed is higher than 23nm	Every 30 secs when speed is higher than 2nm
Lowest reporting rate dynamic data	Every 3 mins when anchored or moored	Every 3 mins when speed is lower than 2nm	Every 3 mins when speed is lower than 2nm
Reporting rate static data	Every 6 mins		
AIS data presented	Static, Dynamic, Voyage	Static and Dynamic data	Static and Dynamic data
Applications	Commercial vessels, fishing boats, working boats, passenger boats with more than 12 passengers	Smaller commercial, fishing and work boats, recreational vessels	Recreational vessels and small fishing boats

The Class B “SO” AIS follows the rules set by ITU-R M.1371-5, and increases the reporting interval to “Increased Reporting Interval” in accordance with Table above when less than 50 % of the slots of each of the last four consecutive frames are free.

When more than 65 % of the slots of each of the last four consecutive frames are free, the Class B “SO” AIS reports at the “Nominal Reporting Interval”. Class B SOTDMA should support " Increased reporting interval " and " Nominal Reporting Interval " in accordance with ITU-R M.1371.

Ship Speed	Nominal Reporting Interval	Increased reporting interval
>23 knots	Every 5 seconds	Every 15 seconds
between 14-23 knots	Every 15 seconds	Every 30 seconds
between 2-14 knots	Every 30 seconds	Every 30 seconds
≤ 2 knots or at anchored or moored	Every 3 minutes	Every 3 minutes

1.4.2 AIS Message Types

Class B AIS broadcasts following message types:

Static Data:

- MMSI
- Vessel name
- Vessel call sign
- Type of ship
- Ship dimensions / GPS antenna location

Dynamic Data:

- Position of the vessel
- Course over ground (COG)
- Speed over ground (SOG)
- True heading

2 Installation

2.1 Installation Procedures

Please familiarize the manual content before beginning installation. Depending on your hardware configuration, use the following recommended steps for installation.

- 1) Program MMSI and vessel information into the device using configuration software before installation (please refer to chapter 3)
- 2) Mount the transponder unit to an appropriate location
- 3) Install VHF antenna
- 4) Install GPS antenna
- 5) Connect to VHF radio (B650S & B650WS only) using the attached VHF radio cable
- 6) Connect to a chart plotter and/or other instruments via NMEA 0183 or NMEA 2000
- 7) Make silent mode connection if applicable (optional external switch needed)
- 8) Connect to an appropriate power source (12 V / 24 V DC, 1.1 A @ 12 V)
- 9) Power On the power source (which turns on the transponder unit)
- 10) Perform LED checking and system functional test

2.2 Mounting Transponder Main Unit

The following guidelines should be noticed when selecting the environment to install your AMEC B650:

- Do not install the AIS transponder in a flammable or hazardous atmosphere such as in an engine or generator room or close to fuel tanks.
- Installation of the transponder should be undertaken in a safe environment without being exposed to any splashing water or rain.
- There should be adequate space around the AIS transponder for routing of cables. See figure below for details of the AIS transponder dimensions.
- The safe distance of the transponder to any magnetic compass is at least 0.3 m.
- The operating temperature is between -25 °C and +55 °C.
- The AIS transponder can be installed and mounted on flat surface, or it can be mounted on wall with the four self-tapping screws supplied.
- The device should be mounted in a location where the indicators can readily be observed as these indicators deliver relevant information on the status of the AIS transponder.

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

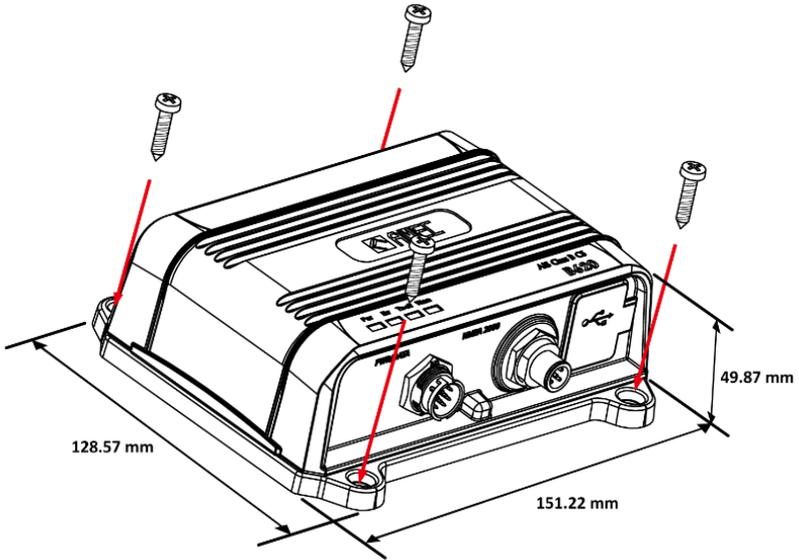


Figure 3 Mounting the Device

2.3 VHF Antenna Installation

The quality and positioning of the antenna are the most important factors dictating AIS performance. It is recommended that a VHF antenna with omnidirectional vertical polarization be specifically tuned for marine band. Since the range of VHF signals is largely decided by line of sight distance, the VHF antenna should be placed as high as possible and at least 5 meters away from any constructions made of conductive materials.

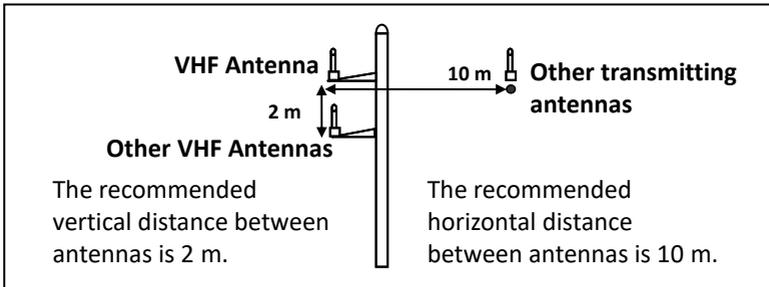


Figure 4 VHF Antenna Locations

2.4 GPS Antenna Installation

Install the GPS antenna where it has a clear view to the sky, so that it may access the horizon freely with 360 degrees.

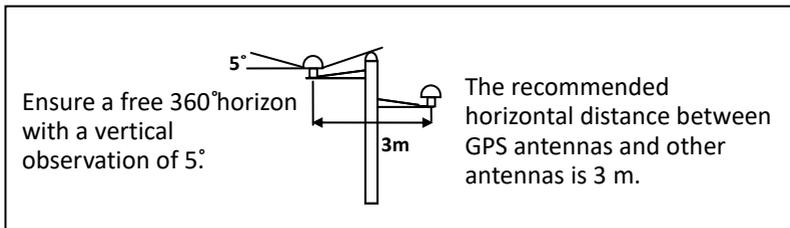


Figure 5 GPS Antenna Locations

It is recommended to keep the GPS antenna out of the transmitting beam of high-power transmitters such as Inmarsat devices and radar.

When connecting the cables, take note of the following precautions.

- Bending cables may cause damage to the inner wires and impair overall the performances.
- Each coaxial cable should be set up separately and can only be set up in a single cable tube.
- Insulation on connector port of the coaxial cable should be considered.

B650 is tested and certified with the GPS antenna GA-25. It's recommended to use GA-25 or GA-22 with B650 series to ensure optimal reliability of your AIS system.

2.5 Connecting Power and Data Cable

Connecting the B650 to external power source and data equipment are illustrated in diagram below.

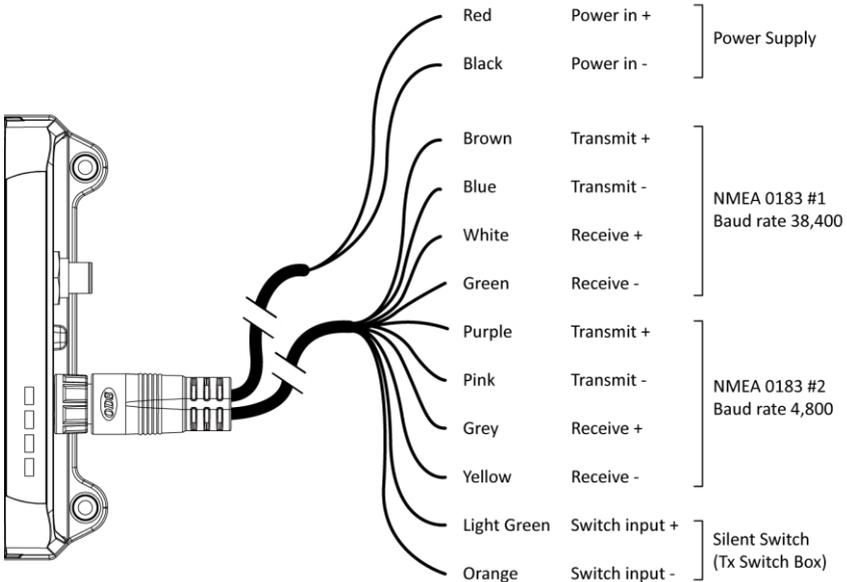


Figure 6 Wiring instructions

When wiring NMEA 0183 to AIS-ready equipment, please refer to your equipment manual first.



During installation, you may have to peel off some wires to make the appropriate connections. After completing the installation, please cover all exposed wires with a rubber-vulcanized tape to prevent the devices from malfunctioning or short-circuited.

2.6 Connecting with NMEA 0183 Devices

B650 supports two NMEA 0183 ports with their default baud rate 38400-bps (high speed) and 4800-bps (low speed). Typically, the high-speed setting is designed for chart plotter connection, while the low-speed setting can be used for NMEA 0183 compatible instruments, e.g. GPS source and/or gyro sensor. Baud rate of the NMEA 0183 ports can be configured depending on different applications using the “AMEC AIS Configuration Tool”.

B650’s NMEA 0183 supports multiplexer function. The received NMEA 0183 data from both ports will be multiplexed and forwarded to both NMEA 0183 output ports, USB and Wi-Fi (B650W/ B650WS).

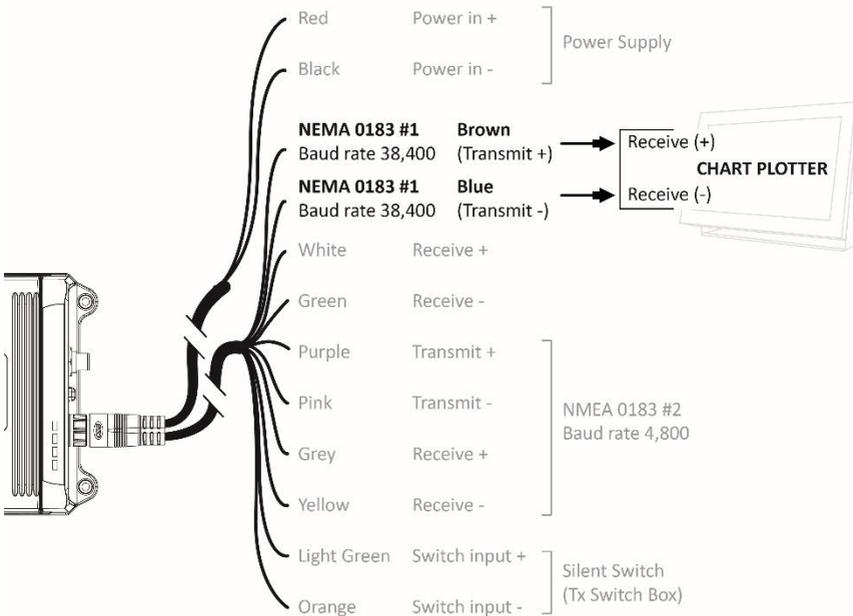


Figure 7 Connecting with Chart Plotter

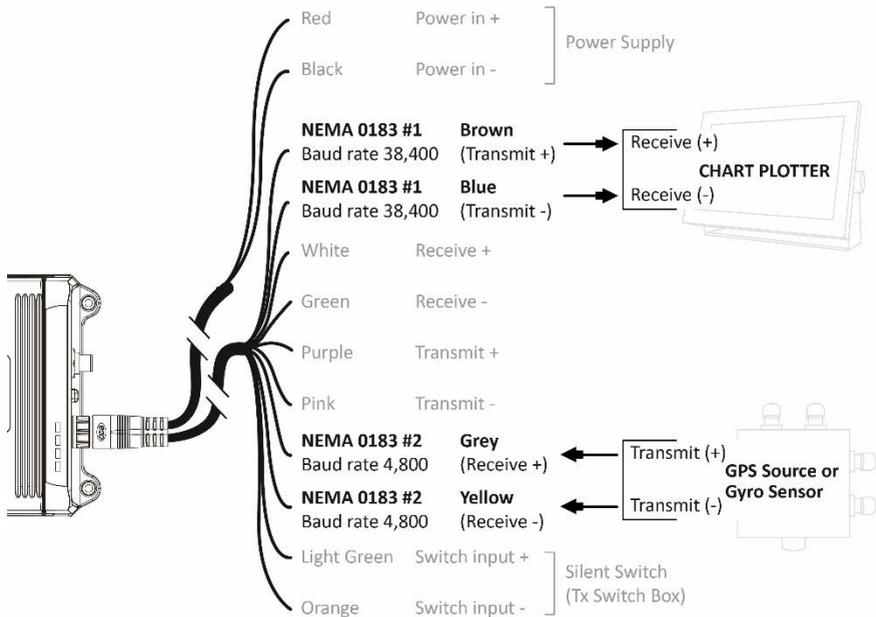


Figure 8 NMEA 0183 Multiplexing Connection

2.7 AIS Silent Mode Connection

If you require Silent Mode feature, it is possible to connect an external toggle switch to B650. Connect the toggle switch between the orange and light green wires to enable Silent Mode function, as depicted in Figure 6. An optional external Tx Switch Box (part number SB-181) is available from AMEC to turn on/off the AIS transmission.

2.8 Connection to NMEA 2000 Network

The B650 is equipped with NMEA 2000 interface with LEN=1. B650 is able to send AIS data and forward received GPS data (from internal GPS antenna) via NMEA 2000 network to other NMEA 2000 devices. Please refer to the chapter “NMEA 2000 PGN Information” in your user manual for updated PGN list.

A compatible T-connector and drop cable available by your local service partner are needed to connect the class B transponder to your chart plotter with NMEA 2000 interface.

When there are multiple GPS sources available on the NMEA 2000 bus, the B650 series will pick the source following the criteria below:

- The source has the lowest device source address
- The source has a valid GPS position fix

Please refer to 5.3 and 5.4 for more info about the related NMEA 2000 and NMEA 0183 sentences for GNSS reception support.

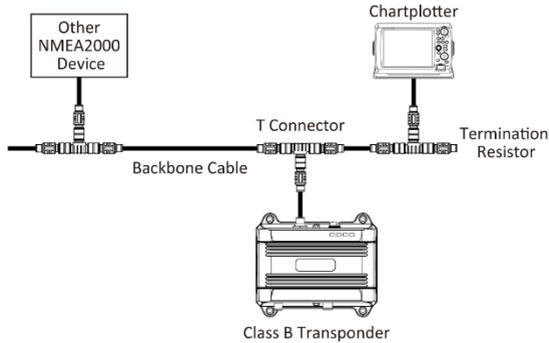


Figure 9 NMEA 2000 Network

2.9 Connecting to Power Supply

The B650 requires a 12 V or 24 V DC power supply (9.6 to 31.2 V) capable of supplying 1.1 A peak current. The red wire and the black wire on the 12-pin cable are used to connect the power supply's positive and negative terminals. Practically, it is suggested to use the fuse panel before connecting directly to the battery/power supply.

3 Configuring Your B650

Your class B transponder comes with a powerful “AIS Configuration Tool” allowing users to set up the transponder and make a real-time diagnosis.

3.1 Connecting to your AIS Transponder

3.1.1 Required Items

Before preceding the configuration procedure, make sure the following items are available:

- AIS Configuration Tool (PC) and USB driver which are available for download from www.alltekmarine.com/support/download
- USB cable (included in the box)
- Microsoft® Windows® (including both 32 and 64-bit versions)
- One available USB port on PC



Note: For configuration and firmware upgrade purpose, B650 series can be powered only by USB. When USB power is in use, the device will not transmit any data. To configure the Wi-Fi of B650W/B650WS, a regular 12/24 V DC power supply is required.

3.1.2 Installing “AIS Configuration Tool”

The “AIS Configuration Tool” is available for download from www.alltekmarine.com/support/download. Unzip the downloaded file and navigate to the folder to execute “AIS_Configuration_Tool.bat” file.

3.1.3 Three steps to connect the AIS transponder

Step 1:

Connect your Class B AIS transponder to your PC using a USB cable. In most cases the USB driver will be installed automatically by Windows system. When it’s not the case, you can find the driver from our website www.alltekmarine.com/support/download and install it manually. Follow the on-screen instructions and assign the correct file path of the USB driver to complete the installation.

Step 2:

Select the “Com Port” corresponding to your AIS transponder from the drop-down menu at the top left of the window, normally listed as “AIS Virtual Com”.

Step 3:

Click the “Connect” button. In a short moment, the button will be displayed as “Disconnect” when the connection is established.

3.1.4 Home page of AIS Configuration Tool

The application is now communicating with your AIS transponder and will display any pre-configured vessel data on the “Home” page depicted as follows.

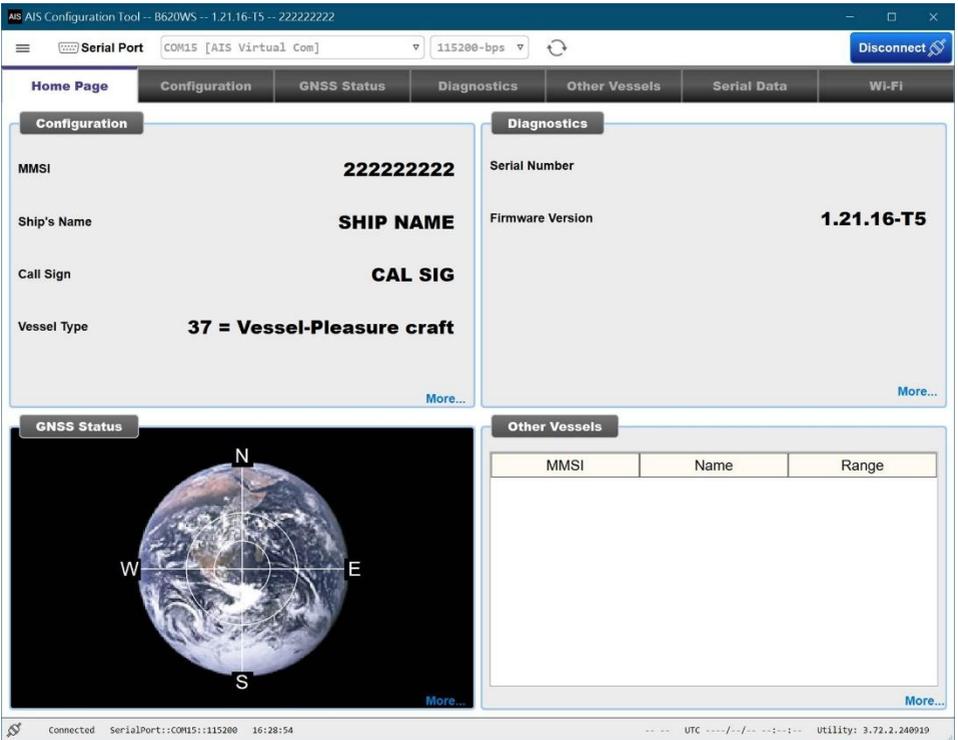


Figure 10 Home page of AIS Configuration Tool

3.2 Programming your vessel data

After the device is successfully connected with the Configuration Tool, click on the “Configuration” tab. You will require the following information in order to configure the device:

- Vessel’s name: limited to 20 characters
- Call sign: limited to 7 characters
- MMSI: Enter your MMSI (Maritime Mobile Service Identity) number
- Vessel type: choose your ship type from the drop-down list
- Ship dimensions: Enter the vessel dimensions by appointing the position of your GPS antenna
- Configure NMEA 0183 Baud Rate: Baud rate of NMEA 0183 # 1 and NMEA 0183 # 2 can be configured here to 38400, 9600 or 4800.
- Click “Program Device” to store the vessel data on your AIS transponder.



WARNING: The MMSI number can only be entered once. Be sure to enter the correct MMSI number, as it cannot be corrected if entered incorrectly.

The screenshot displays the Configuration Tool interface with the following sections:

- Home Page** | **Configuration** | GNSS Status | Diagnostics | Other Vessels | Serial Data | Wi-Fi
- Configure Vessel Details**
 - Ship's Name (0/20):
 - Call Sign (0/7):
 - MMSI Number:
 - Vessel Type:
- Ship's Dimensions and GNSS Antenna Location**
 - Diagram showing vessel dimensions A, B, C, D and antenna location.
 - A: m
 - B: m
 - C: m
 - D: m
- Configure NMEA 0183 Baud Rate**
 - Port 1:
 - Port 2:
- GNSS Setting**
 - GNSS Update Rate:
 - GNSS System: BeiDou GLONASS Galileo GPS
 - GNSS Mode:
- Advanced Configuration**
 - DSC Monitoring:
 - Dummy VDO output:
 - Alarm control:
-

Figure 11 Static Data Setting

4 GETTING STARTED

4.1 LED indicators

The transponder will start up whenever the connected power source is ON. It will operate automatically if the transponder has been properly configured using the Configuration Software and GPS/VHF antennas are also properly installed. Normally the transponder should transmit its own ship positions every 30 seconds or 3 minutes depending on the moving speed. It should also receive other vessels' information in the vicinity.

The operation status of the transponder can be checked from the LED lights on the unit. Description of the LED indications is provided in the following section.

B650 / B650W LED Indicators

Indicator	Color	Steady or Flashing	Description
Power	Green	Steady	The device is powered on and operable.
Error	Red	Steady	A system error is detected as a result of device BIIT self-test or the device is not in GPS position fix.
Tx-off	Blue	Steady	Tx-off (AIS not transmitting): The device is configured as in silent mode, no AIS transmission at all. MMSI is not properly programmed during installation or configuration setting.
Warning	Yellow	Steady	The VHF antenna VSWR is abnormal.
		Flashing	The device is powered by USB power.

B650S / B650WS LED Indicators

Indicator	Color	Steady or Flashing	Description
Power	Green	Steady	The device is powered on and operable.
Error	Red	Steady	A system error is detected as a result of device BIIT self-test or the device is not in GPS position fix.
Tx-off	Blue	Steady	Tx-off (AIS not transmitting):

			<p>The device is configured as in silent mode, no AIS transmission at all.</p> <p>MMSI is not properly programmed during installation or configuration setting.</p>
Warning	Yellow	Steady	The VHF antenna VSWR is abnormal.
		Flashing	The device is powered by USB power.
VHF Tx	White	Flashing	The VHF radio (via antenna splitter) is transmitting.

4.2 Wi-Fi Configuration (B650W/B650WS)

Installation of Wi-Fi antenna is straight forward.

B650W/B650WS can work in Access Point Mode or Client Mode.

The information below details the information required for connecting the B650W/B650WS to another device using Wi-Fi.

4.2.1 Access Point Mode

B650W/B650WS is featuring Wi-Fi module supporting wireless connection with up to 2 mobile devices. After the configuration is done, press “Program Wi-Fi Module” to save the settings to the device.

The screenshot displays the web-based configuration interface for the Wi-Fi module. It is divided into three main sections:

- Wi-Fi Information:** A grey box containing the following details:
 - SSID: AIS-WiFi
 - IP Address: 192.168.2.1 : 3333
 - Wi-Fi Module Firmware Version: "4.0.0-006"
- Wi-Fi Configuration:** A light yellow box with controls for:
 - Wi-Fi Service: A toggle switch currently set to 'On'.
 - Factory Reset: A blue button.
 - Read Config: A blue button.
- Wi-Fi Mode:** A large light blue area with two options:
 - Access Point (Selected):** Indicated by a checked checkbox. It features a diagram of an AIS antenna connected to a router, which is then connected to two mobile devices. Below the diagram are input fields for:
 - SSID: AIS-WiFi
 - Password: (empty) with a 'None' checkbox checked.
 - Channel: 6A blue button labeled 'Program Wi-Fi Module' is at the bottom of this section.
 - Client:** Indicated by an unchecked checkbox. It features a diagram of an AIS antenna connected to a router, which is then connected to a mobile device and a network switch. Below this diagram is a large empty white box. At the bottom of the Client section are 'Refresh' and 'Connect' buttons.

Figure 12 Access Point Mode

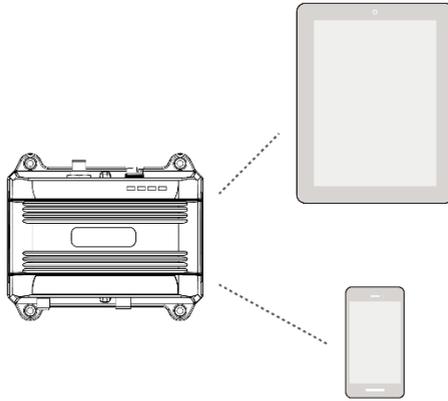


Figure 13 Connect to mobile devices

■ **SSID (Service Set Identifier):**

The SSID for the B650W/B650WS is AIS-Wi-Fi. When another SSID is preferred, just input it in the SSID field and then press “Program Wi-Fi Module”.

■ **Password:**

By default, the Wi-Fi network has no password. Users are allowed to create their own key with an alpha-numeric password between 8 and 63 characters long. The password can include symbols (!?*&_) and spaces.

■ **System IP:**

Default system IP is **192.168.2.1**

■ **Port:**

Default port is 3333.



Note: By default, AMEC B650W/B650WS uses WPA2-Personal wireless security protocol.

4.2.2 Client Mode

B650W/B650WS are also able to join an existing Wi-Fi network. When clicking on “Client”, it can take up to 45 seconds until B650W/B650WS scans all available Wi-Fi networks.

Pick the network you want to join and enter the password and click on “Connect”.

The screenshot shows the web interface for configuring the Wi-Fi module. It is divided into three main sections:

- Wi-Fi Information:** Displays SSID: N/A, IP Address: N/A, and Wi-Fi Module Firmware Version: "4.0.0-006".
- Wi-Fi Configuration:** Contains a "Wi-Fi Service" toggle (set to On), a "Factory Reset" button, and a "Read Config" button.
- Wi-Fi Mode:** Features two radio buttons: "Access Point" (unchecked) and "Client" (checked). The "Client" mode is highlighted with a dashed border. Below the radio buttons are input fields for SSID (AIS-WiFi1), Password (with a "None" checkbox), and Channel (6). A "Program Wi-Fi Module" button is at the bottom left. The "Client" mode panel shows a list of detected networks: "VIC-Office", "AMEC", "VIC-Guest", "MBC-Guest", "Wieson-Guest", and "Wieson". At the bottom of this panel are "Refresh" and "Connect" buttons.

Figure 14 Client Mode

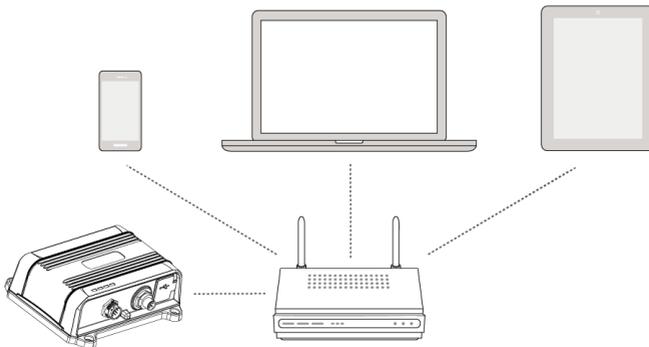


Figure 15 Join an existing Wi-Fi network

4.3 Connecting to a Charting Program

Your transponder can be used as a source of AIS for electronic charting and navigation program under Windows PC such as NaviPro, TimeZero, Coastal Explorer or OpenCPN etc. It's highly suggested that you should use B650W or B650WS model for this purpose under Wi-Fi connection.

In case you want to connect PC via USB for the purpose, follow the steps below to connect the transponder to the software:

- Connect the transponder to your PC using the USB cable that comes with the package. In most cases, the USB driver will be installed automatically. When it's not the case, you can find the driver from our website www.alltekmarine.com/support/download and install it manually.
- Make sure the baud rate is set at 115200. The data port can be confirmed by running the Device Manager on your computer or be detected automatically depending on the software.

4.4 Built-in Integrity Test (BIIT)

With BIIT (Built in Integrity Test) function, the B650 is constantly monitoring and testing the integrity of the AIS transponder. Should an abnormal condition be detected within the device, the Error LED will alert with red light. Abnormal conditions may include situations like the followings:

- RX channel 1 malfunction
- RX channel 2 malfunction
- Tx malfunction
- GPS is unable to gain lock (3D fixed)

5 SPECIFICATIONS

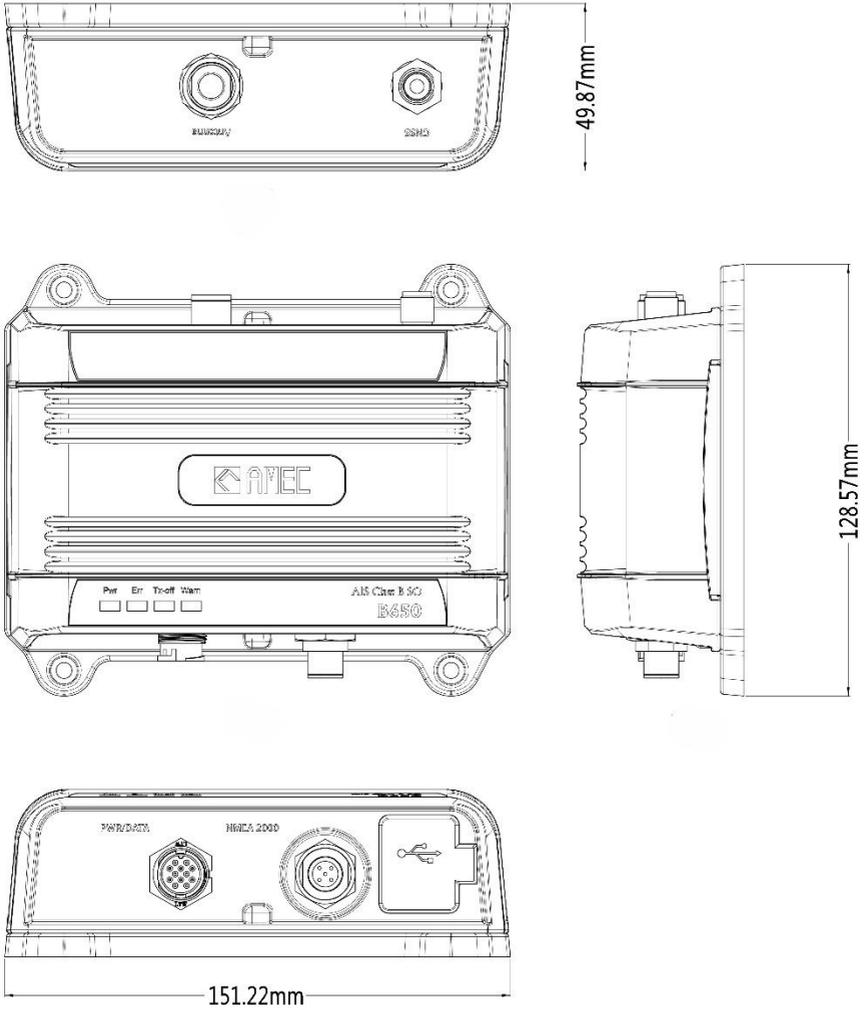
5.1 Product Specifications

Product Model Number	B650	B650S	B650W	B650WS
APPLICABLE STANDARDS				
AIS performance	IEC 62287-1 Ed. 3.0 (2017-04)			
GNSS performance	IEC 61108-1 Ed. 2.0 (2003-07)			
Serial data interface	IEC 61162-1 Ed. 6.0 (2024-04)			
	IEC 61162-2 Ed. 2.0 (2024-04)			
NMEA 2000	NMEA 2000 Version 3.0 (2022-03)			
Environmental	IEC 60945 Ed. 4.0 (2002-08) incl. Cor. 1 (2008-04)			
Product safety	IEC 62368-1 Ed. 4.0 (2023-05) EN 62311 Ed. 2.0 (2020-01)			
GNSS RECEIVER (INTEGRATED)				
Receiving channels	72 channels			
Time to first fix from cold start	30 s			
Horizontal position	2.5 m			
GNSS support	GPS, Galileo, BeiDou, GLONASS			
VHF TRANSCEIVER				
VDL access scheme	SOTDMA			
Frequency range	156.025 MHz ~ 162.025 MHz			
Channel bandwidth	25 KHz			
Receivers / transmitters	2 x receivers, 1 x transmitter			
AIS transmit power	5 Watt (37 dBm ± 1.5 dB)			
	1 Watt (30 dBm ± 1.5 dB)			
AIS receive sensitivity	< -111 dBm @ 20 % PER			
DSC RECEIVER				
Modulation	1,300 Hz / 2,100 Hz FSK			
Data rate	1,200 bps ± 30 ppm			
Spurious response rejection	≥ 70 dB for signal @ -104 dBm; BER ≤ 1 %			
Blocking	≥ 84 dB for signal @ -104 dBm; BER ≤ 1 %			
USER INTERFACE				
Indicators	Power, Error, Tx-off, Warn	Power, Error, Tx-off, Warn, VHF Tx	Power, Error, Tx-off, Warn	Power, Error, Tx-off, Warn, VHF Tx

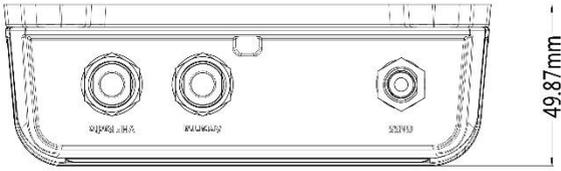
POWER SUPPLY				
Supply voltage	12 V / 24 V DC			
Supply voltage range	9.6 V ~ 31.2 V DC			
Average current (at 12 V)	120 mA	120 mA	160 mA	160 mA
Peak current (at 12 V)	1.7 A	1.7 A	1.8 A	1.8 A
Galvanic isolation	NMEA 0183 inputs only NMEA 2000			
EXTERNAL CONNECTORS				
VHF antenna	SO-239			
VHF radio		SO-239		SO-239
GNSS	TNC			
Power & data connections	12 way circular multipole			
NMEA 2000	5 way Micro-C connector			
USB	USB type-C connector			
CONNECTION INTERFACE				
NMEA 0183	2 x bi-directional ports			
NMEA 2000	NMEA 2000 Version 3.0, LEN=1			
USB	PC virtual com port for NMEA 0183 data			
Wireless (Wi-Fi) connection (2 connections in access point mode)			IEEE 802.11 b/g/n	IEEE 802.11 b/g/n
PHYSICAL & ENVIRONMENTAL				
Size (H x W x D)	151.22 x 128.57 x 49.87 mm			
Weight	400 g			
Operating temperature	-25 °C ~ +55 °C			
Waterproof and dust resistant	IP68			
Wi-Fi CHARACTERISTICS				
Wi-Fi transmit power			≤ 20 dBm (EIRP)	≤ 20 dBm (EIRP)
Frequency range			2,412 MHz ~ 2,472 MHz	2,412 MHz ~ 2,472 MHz
Antenna gain			2.94 dBi	2.94 dBi

5.2 Dimensions

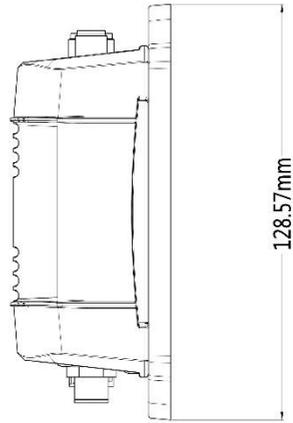
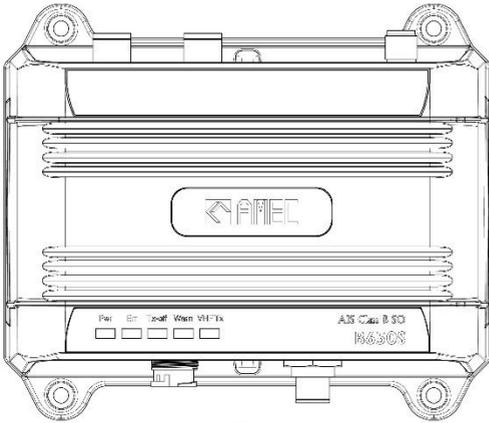
B650/B650W Dimensions



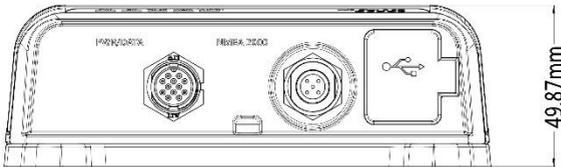
B650S/B650WS Dimensions



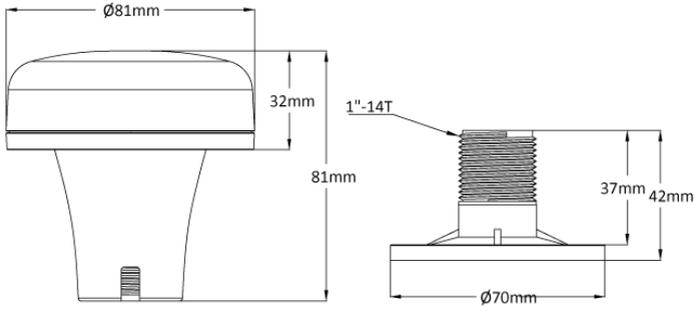
49.87 mm



128.57 mm

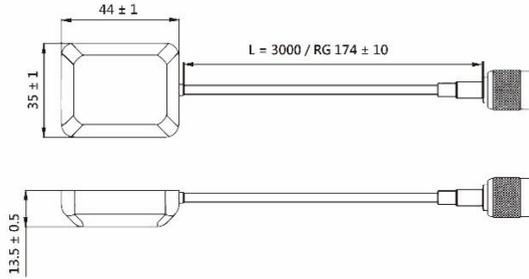


49.87 mm



(GNSS antenna GA-22 is an optional item)

(Unit : mm)



(GNSS antenna PA-02 is an optional item)

5.3 NMEA 2000 PGN Information

Transmit	
PGN	Description
59392	ISO Acknowledgment
59904	ISO Request
60928	ISO Address Claim
126464	PGN List - Transmit PGN's group function
126996	Product Information
129025	Position Rapid Update
129026	COG SOG Rapid Update
129029	GNSS Position Data
129038	AIS Class A Position Report
129039	AIS Class B Position Report
129040	AIS Class B Extended Position Report
129041	AIS Aids to Navigation (AtoN) Report
129539	GNSS DOPs
129540	GNSS Sats in View
129792	AIS DGNSS Broadcast Binary Message
129793	AIS UTC and Date Report
129794	AIS Class A Static and Voyage Related Data
129795	AIS Addressed Binary Message
129796	AIS Acknowledge
129797	AIS Binary Broadcast Message
129798	AIS SAR Aircraft Position Report
129800	AIS UTC/Date Inquiry
129801	AIS Addressed Safety Related Message
129802	AIS Safety Related Broadcast Message
129803	AIS Interrogation
129804	AIS Assignment Mode Command
129805	AIS Data Link Management Message
129806	AIS Channel Management
129807	AIS Group Assignment
129809	AIS Class B "CS" Static Data Report, Part A
129810	AIS Class B "CS" Static Data Report, Part B

Receive	
PGN	Description
59392	ISO Acknowledgment
59904	ISO Request
60928	ISO Address Claim
127250	Vessel Heading
127258	Magnetic Variation
129026	COG & SOG, Rapid Update
129029	GNSS Position Data
129539	GNSS DOPs

5.4 Supported NMEA 0183 Sentences

Transmit	
Sentence	Description
GGA	Global Positioning System Fix Data
GSA	GNSS DOP and Active Satellites
GSV	GNSS Satellites In View
GLL	Geographic Position – Latitude/Longitude
RMC	Recommended Minimum Specific GNSS Data
VDO	AIS VHF Data-Link Own-Vessel Report
VDM	AIS VHF Data-link Message
Receive	
Sentence	Description
DTM	Datum Reference
GBS	GNSS Satellite Fault Detection
GSA	GNSS DOP and Active Satellites
HDT	Heading, True
RMC	Recommended Minimum Specific GNSS Data
ROT	Rate Of Turn

6 TROUBLESHOOTING

B650 receives AIS signals normally, but no one in the surrounding can see me, why?

- AIS Class B transmission range limitation: an AIS Class B transponder transmitting range of 5-7 miles in perfect conditions. The AIS receiver in the transponder will typically see Class A vessels that are 20-30 miles away or even more in excellent conditions. The major reason is that all AIS Class B SOTDMA transponders transmit at 5 watts vs. the 12.5 watts that Class A transponders typically use. This difference in power impacts on the transmission range of each transponder type. For this reason, it is quite possible that Class A vessel can be seen, but Class B vessel might not be seen.
- VHF antennas interference: if you are using a dedicated AIS/VHF antenna for your transponder, be sure that it is placed at least 6 ft (1.83 m) away from other VHF antennas or vertical metal objects and ideally install the antenna on a different vertical plane from other VHF antennas. In several tests, mounting two VHF antennas next to another typically reduces the transmitting range to both antennas by 50-70%.
- GPS is not fixed: If your GPS antenna is not connected or setup correctly, your transponder will see other vessels fine, but you will not be sending out your vessel position. All AIS transponders need a good GPS fix before it can send out any type of transmission. The color and state of the LEDs on the transponder indicate if the unit is in transmission mode or not.
- The location of VHF antenna is directly related to AIS transmitting range. The VHF antenna should be installed at mast as high as possible.

The silent mode (Tx off) on B650 is not working, why?

- Silent mode can be configured on B650 by using the wires at 12-pin connector.

Even though my B650 is transmitting, why do some vessels with AIS take a long time to see my vessel name or not see it at all?

- AIS Class B users should keep in mind that Class B transponders do not broadcast position updates as often as Class A commercial transponders. As with Class B transponders, the full static information, such as vessel's names, the transmission is broadcasted every 6 minutes; however, MMSI and dynamic information, such as position, update will only be sent out every 3 minutes if the vessel is moving slower than 2 knots. To add to this, if the receiving party is using non-standard dual channel receiver (a single channel receiver), then in perfect conditions, the

receiver will get your full static information every 12 minutes and your MMSI and dynamic information every 6 minutes if you are moored.

No data is being received by chart plotter, why?

- Please check that the power supply is connected correctly at B650.
- Please check that the power supply is 12 V or 24 V with sufficient current capacity (no less than 2 A).
- Please make sure that the connections between B650 to the chart plotter are correct.

My MMSI is being received by other vessels but my vessel name is not shown on their chart plotter or PC, why?

- Older software and AIS displays may not be fully compatible with Class B transponders. In some of these cases, older equipment might only have Class B vessel show up on their displays with just MMSI number without the vessel name. This is usually due to the receiving device not knowing how to process the Message 24 static data from Class B transponders. Please contact the chart plotter maker and ask for software upgrades (for these older chart plotters) to resolve this issue.

The LED indication at B650 is illuminated, why?

- The unit may not have a valid MMSI. Please check if the AIS transponder is correctly entered with a valid MMSI.
- Please make sure that both VHF and GPS antennas and their cables are working properly and not damaged.

Why is the Wi-Fi signal weak and how can I improve it?

- The router is too far from the client devices. To improve the Wi-Fi signal strength reallocated your Transponder to a more central location.
- There might be intervening barriers (e.g. a large expanse of metal) that is blocking the Wi-Fi signals. Relocated your Transponder to the center of the area where the client devices are placed, or to a position where the router and the devices are within a visible distance without interfering barrier.

- Nearby devices (e.g. microwaves/wireless phones) using the same frequency band may interfere with the router's 2.4 GHz Wi-Fi transmission. To improve the Wi-Fi signal strength, try to avoid channel overlapping by reassigning their operation channels to channels 1, 6 or 11.

If you still encounter difficulties to set up or operate B650 correctly, please email to service@alltekmarine.com for further instructions.

7 ABBREVIATIONS

AIS	Automatic Identification System
COG	Course Over Ground
CPA	Distance to Closest Point of Approach
CSTDMA	Carrier-Sense Time Division Multiple Access
DSC	Digital Selective Calling
ECS	Electronic Chart System
ETA	Estimated Time of Arrival
GPS	Global Positioning System
IMO	International Maritime Organization
MMSI	Maritime Mobile Service Identity
SOG	Speed Over Ground
TCPA	Time to Closest Point of Approach
TDMA	Time Division Multiple Access
TPI	Thread per Inch
UTC	Coordinated Universal Time
VHF	Very High Frequency
VTS	Vessel Traffic Services

8 FCC INTERFERENCE STATEMENT

NOTE: This equipment has been tested and found to comply with part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) This device may not cause harmful interference, and
- 2) This device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by AMEC for compliance could void of the user's authority to operate the equipment.

9 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 32 cm from VHF antenna, and 32 cm from Wi-Fi antenna (B650W/B650WS). 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 3 dBi and termination impedance of 50 ohms.

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

- The antenna should be mounted at a minimum vertical distance of 5 m above the deck in order to meet international safety directives on Maximum Permissible Exposure (MPE). 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.

DECLARATION OF CONFORMITY

Hereby, Alltek Marine Electronics Corp. (AMEC) declares that this B650/B650S/B650W/B650WS is in compliance with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

A copy of the Declaration of Conformity can be obtained on-line from under “Download”:
<https://www.alltekmarine.com/support/download>

Industry Canada Notice

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada’s licence-exempt RSS(s). Operation is subject to the following two conditions:

- 1) This device may not cause interference.
- 2) This device must accept any interference, including interference that may cause undesired operation of the device.

L’émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d’Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes :

- 1) L’appareil ne doit pas produire de brouillage;
- 2) L’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

CYBERSECURITY AND DATA PROTECTION

Data Minimization Declaration:

Data Privacy & Minimization Policy "This device is designed to process technical machine-to-machine (M2M) telemetry data only. It does not collect, store, or transmit personally identifiable information (PII) such as names, addresses, or biometric data. The only user-related information stored on the device involves network credentials (e.g., Wi-Fi SSID and Password) necessary for connectivity."

Network Security Configuration:

Network Security Recommendations "To ensure the privacy of your network credentials and the integrity of data transmission, please observe the following security practices:

- **Use Strong Encryption:** Always configure the device to connect to networks using **WPA2-AES** security standards. Do not use Open (Unsecured) networks, as these configurations may expose your network traffic and credentials to unauthorized interception.
- **Network Isolation:** For enhanced privacy, it is recommended to connect this device to a dedicated IoT Guest Network or a separate VLAN, isolating it from your primary personal or business data traffic."

Decommissioning & Reset:

Device Disposal & Data Erasure "Before selling, transferring, or disposing of this device, the user is responsible for erasing all stored network credentials. Please perform a **Factory Reset** by Configuration Tool to ensure all private configuration data is permanently removed from the internal memory."

AMEC WORLDWIDE 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.

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 an 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.

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 seal label is removed or defaced.

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.

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.

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.

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Website: www.alltekmarine.com