OPERATION & INSTALLATION MANUAL

AIS CTRX GRAPHENE

Class B AIS Transponder

TRUE HEADING

Version 1.9E

TABLE OF CONTENTS

ABOUT THIS MANUAL

In accordance with our policy of continuous development and product improvement the AIS CTRX GRAPHENE hardware and/or software may be upgraded from time to time and future versions of the AIS CTRX GRAPHENE may therefore not correspond exactly with this manual.

When necessary, upgrades to the product are made. These will be accompanied by updates or addendum to this manual.

Please take time to read this manual carefully in order to fully understand the functions and preparations necessary for the installation and operation of your AIS transponder.

Information contained in this manual is subject to change without notice.

True Heading AB disclaims any liability for consequences arising from omissions or inaccuracies in this manual and any other documentation provided with this product.

UNDER NO CIRCUMSTANCES SHALL TRUE HEADING AB BE LIABLE FOR INDIRECT OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH OR ARISING OUT OF THE USE OF ANY OF OUR PRODUCTS.

Revision history

Version	Date	Responsible	Approved	Changes
1.0PE	2012-12-14	Anders Bergström	Nils Willart	Preliminary release
1.1PE	2013-03-08	Nils Willart		Update
1.2PE	2013-04-09	Nils Willart		Editorial
1.3PE	-	-	-	Intermediate, not issued
1.4E	2013-05-21	Nils Willart		PGN list added
1.5E	2014-03-03	Nils Willart		USB caution
1.51E	2014-09-11	Nils Willart		Editorial
1.6E	2014-09-11	C. Ander Smith (legal)		Legal comments
1.7E	2014-09-15	Nils Willart		Editorial, WiFi added
1.8E	2014-05-05	Nils Willart		Editorial
1.9E	2015-07-08	Nils Willart		RF exposure added

IMPORTANT INFORMATION

Licensing

In most countries the operation of an AIS unit is included under the vessels marine VHF radio licence provisions. The user/owner of the vessel on to which the AIS unit is to be installed must therefore possess a valid VHF radiotelephone licence which lists the AIS system and the vessel Call Sign and MMSI number.

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

US Customers:

There are specific laws in the USA regarding the configuration of AIS class B transceivers. The entry of static data into a Class B AIS 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. In no event shall the entry of static data into a Class B AIS device be performed by the user of the device or the licensee of a ship station.

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.

FCC notice

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Industry Canada notice

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and

2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie 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, et

2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le Fonctionnement.

RF Exposure

The required compliance boundary for the AIS Graphene is:

Occupational: 0.13 m

General population: 0.27 m

To comply with the requirements set by ICNIRP, FCC, RSS and ARPANSA the VHF antenna shall be installed in such a way that the minimum distance from the antenna to a boundary 0.5 m from where humans can reside is maintained.

The Graphene models equipped with WiFi shall be installed in such a way that the minimum distance to a boundary from the rear towards humans is not less than 20 cm.

EC DECLARATION OF CONFORMITY

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

Standard	Description
IEC 62287-1, Ed2: 2006-03	Maritime navigation and radio communication equipment and systems – Class B ship borne equipment of the automatic identification system (AIS) – Part 1: Carrier-sense time division multiple access (CSTDMA) techniques
IEC 60945, Ed4: 2002-08	Maritime navigation and radio communication equipment and systems – General requirements – Methods of testing and required test results
IEC 61162-1, Ed2:	Maritime navigation and radio communication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners
IEC 61108-1:	GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) – Part 1: Global positioning system (GPS) -Receiver equipment - Performance standards, methods of testing and required test results
EN 301 843-1 v2.1:	Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for marine radio equipment and services; Part 1: Common technical requirements
EN 50383: 2002	Basic standard for calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunications system (110MHz – 40GHz)
EN 60950-1:2002	Information technology equipment – Safety – Part 1: General requirements
NMEA 2000 Edition 2.20	NMEA 2000 Standard for serial-data networking of marine electronic devices

True Heading AB declares that this product is in compliance with the essential requirements and other provisions of the R&TTE directive 1995/5/EC.

The product carries the CE mark, notified body number and alert symbol as required by the R&TTE directive

This True Heading product can be used in the following European Community Countries:

AT	BG	BE	CY	CZ	DK
EE	FI	FR	DE	GR	HU
IE	IT	LV	LT	LU	MT
NL	PL	PT	RO	SK	SL
ES	SE	GB	IS	LI	NO
CH					

INTRODUCTION

We would like to thank you for choosing True Heading AB as supplier of your AIS Class B Transponder. The AIS CTRX GRAPHENE is a high quality AIS Class B Transponder using the latest technology. AIS CTRX GRAPHENE makes it possible to receive information from ships, buoys, lighthouses, SAR helicopters, Coastguard units, Pilot boats, Weather station etc. and to send information about your own ship to others that are equipped with Automatic Identification System (AIS) transponders or receivers. **SEE AND BE SEEN**

It is today, according to the IMO SOLAS regulation a requirement for all ships above 300 GT to carry AIS. This means that a large number of ships and other types of navigational information providers will be seen by your AIS CTRX GRAPHENE and contribute to enhanced safety in your navigation.
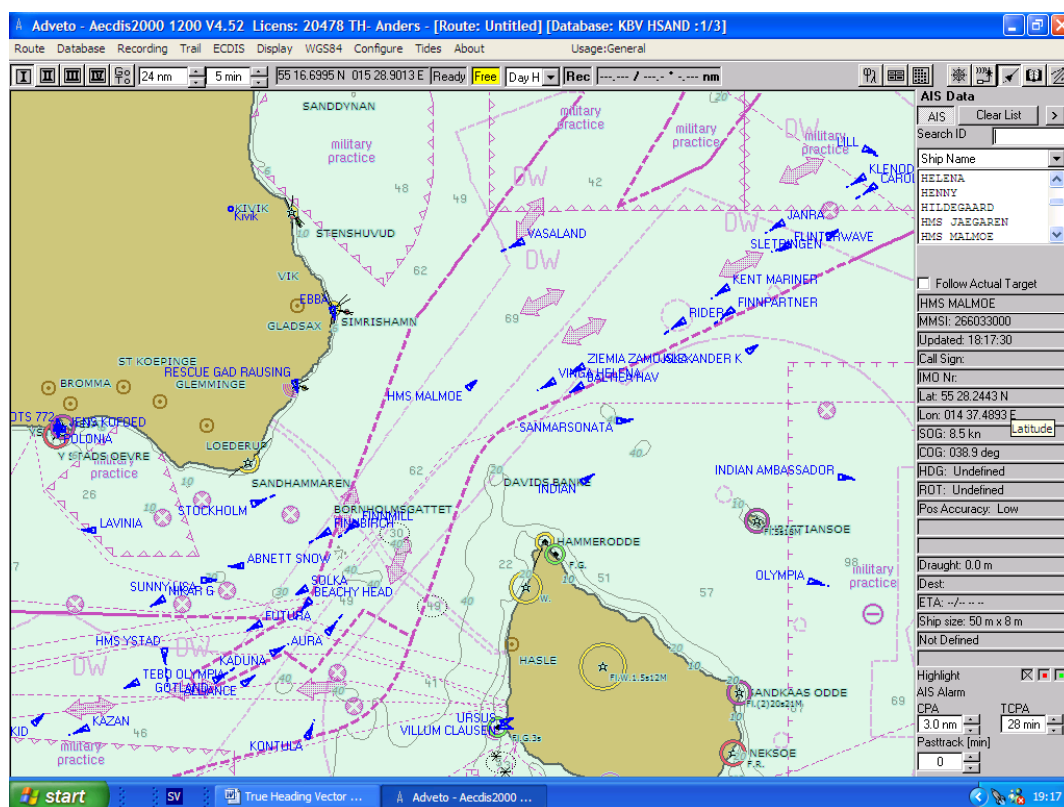
Picture 1 Real traffic scenario between Sweden and Bornholm (Denmark)

It is of utmost importance that you read this manual before you start to install and use your AIS CTRX GRAPHENE.

SAFETY INFORMATION

Before you start using the AIS CTRX GRAPHENE transponder it is important that you read and fully understand the instructions in the installation manual. You should only proceed with the installation if you are confident that you will be able to do so.

True Heading AB cannot be held liable for any injury or damage caused by, during or because of the installation of AIS CTRX GRAPHENE. The AIS CTRX GRAPHENE is used at your own risk and it shall be kept in mind that the validity of the AIS and GPS data depends on the full co-operation of other users and systems.

AIS CTRX GRAPHENE is a navigation aid and is used together with other similar systems like radar, optical lookout etc. to maintain safety at sea. The AIS CTRX GRAPHENE installation should be inspected regularly and frequently checked by the user to maintain proper operation quality. Remember that navigation and safety of lives at sea always requires proper seamanship and that the AIS CTRX GRAPHENE is an aid and not a replacement for such qualities.

NOT ALL VESSELS CARRY AIS. IT IS THEREFORE IMPORTANT TO KEEP A PROPER LOOKOUT AT ALL TIMES AND TO USE ALL AVAILABLE MEANS TO AVOID COLLISIONS AND ACCIDENTS.

GPS MAY FROM TIME TO TIME INCLUDE ERRORS; THEREFORE, USERS MUST ALWAYS VERIFY INDICATED POSITIONS RECEIVED FROM THE GPS BUILT IN TO THE TRANPONDER WITH OTHER AVAILABLE MEANS.

General notice on GNSS reception

The AIS (Automatic Identification System) unit mostly utilise GNSS (Global Navigation Satellite System) as GPS or GLONASS to determine position.

The accuracy of these systems is variable and can be affected by factors such as the positioning of the receiving antenna, the number of satellites available at the time, angle of reception and if satellites are healthy or not.

It is desirable to check and verify both your and other vessels AIS position data as often as possible using visual or if available radar based observations.

Compass safe distance: 0.5m or greater for 0.3° deviation

WARRANTY

General

True Heading AB warrants its AIS CTRX GRAPHENE transponder (the "Product") against defects in design, material and workmanship for a period of two (2) years from the date of purchase (the "Warranty"). The Warranty covers costs for spares, labour, and return shipment; return of the defective Product to True Heading AB shall be at purchaser's risk and expense. Should any failure of the Product to conform with the above Warranty develop during the specified period under normal and proper use and provided the Product has been properly installed and maintained, True Heading AB shall, if given prompt notice of the alleged failure to conform, correct such non-conformity at the option of True Heading AB by repair, replacement, or by refund of the purchase price of the non-conforming Product.

The above Warranty shall terminate and be voided under the following circumstances: (a) the Product serial number is missing, (b) modification, repair or alteration by anyone other than an True Heading authorized service provider; (c) improper operation, maintenance or installation, including but not limited to broken seals; (d) damage during shipment; (e) operation, handling or other dealings with Product in a negligent manner; or (f) abnormal conditions or temperature, moisture, dirt or corrosive matter.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, THE WARRANTIES, RIGHTS AND REMEDIES SET FORTH IN THIS SECTION ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, REPRESENTATIONS, CONDITIONS, RIGHTS AND REMEDIES WITH RESPECT TO ANY PRODUCT, EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, AND WHETHER WRITTEN OR ORAL; ALL OTHER WARRANTIES, REPRESENTATIONS, CONDITIONS, RIGHTS AND REMEDIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY, DURABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY EXPRESSLY DISCLAIMED, EXCLUDED AND WAIVED BY PURCHASER TO THE FULLEST EXTENT PERMITTED BY LAW.

Correction of non-conformities in the manner and for the period of time provided above shall be the exclusive remedy and shall constitute fulfilment of all liabilities of True Heading AB whether in warranty, contract, negligence, tort or otherwise with respect to the quality of the Product.

Warranty procedures

Warranty claims shall be made to the place where you purchased the Product or direct to True Heading AB through mail, fax or e-mail to our support department. Replaced Product shall become the property of True Heading AB.

PLEASE KEEP YOUR PROOF OF PURCHASE as it is required for a Warranty claim.

Replacements pursuant to the Warranty shall not renew or extend the applicable original Warranty period; provided, however, that any such replacement Product shall be warranted for the time remaining under the original Warranty period or for 30 days, whichever is longer.

Other issues

Proper seamanship and common sense must be exercised when using the AIS CTRX GRAPHENE; the Products shall only be seen as a navigational aid.

True Heading AB reserves the right to change the specification of the Product without prior notice.

IF YOU ARE NOT ABLE TO ACCEPT THE TERMS ABOVE, PLEASE RETURN THE AIS CTRX GRAPHENE TO YOUR RETAILER FOR FULL CREDIT BEFORE OPENED AND USED.

SUPPORT

If you need support, please contact the closest reseller or the location where you acquired the product. The manufacturer will only provide support direct if these procedures are followed. The support case has to be registered properly through our webpage at www.trueheading.se.

In order to ensure that you receive important information register the purchase of your product by sending an e-mail to register@trueheading.se where you state the serial number, purchase date, your name, address and where you bought the product.

In accordance with our policy to always offer products with the latest in development and enhancements, future versions of AIS CTRX GRAPHENE may differ somewhat from what is described in this manual. Updated versions of the manual are always available for download at our homepage www.trueheading.se.

PRODUCT SPECIFICATION

Dimensions:	210 x 144 x 50 mm (L x W x H)
Weight:	0.45 kg GRAPHENE 0.5 kg GRAPHENE+
Power:	DC 12-24V (min. 10V, max. 32V) Average power consumption 4W (GRAPHENE) Average power consumption 4.5 W (GRAPHENE+) Nominal current rating: 350 mA @ 12 VDC (receive) Peak current rating: 1.2A @ 12VDC (transmitting)
GPS Receiver (AIS Internal):	IEC 61108-1 compliant 50 channels
Data Interfaces:	USB (mini B), Programming and test interface NMEA 2000 LEN (Load Equivalence Number) = 1 NMEA 0183, RS422, 38400 baud
Connectors:	VHF Antenna connector = BNC (Female) GPS Antenna connector = TNC (Female) USB B serial data (USB mini connector) NMEA 0183/DC power connector NMEA 2000 connector VHF Radio = FME (Male) (GRAPHENE+ only)
VHF Transceiver:	1 Transmitter, 2 Receivers Frequency: 156.025 to 162.025 MHz Receiver sensitivity: <- 110dBm @ 20% PER
RF Output Power:	2 W (50Ω)
Channel Bandwidth:	25 kHz
Data Bit rate:	9600 b/s ± 50 ppm (GMSK) AIS 1200 b/s ± 30 ppm (FSK) DSC
Environmental:	IEC 60945, Operating Temperature: -15ºC to +55ºC IEC 62287-1, Section 5, Cat b: protected from the weather
Compass safe distance:	0.5m or more for 0.3° deviation.
LED indicators:	POWER — **Green** STATUS — **Green** TX STAT — **Yellow** ERROR — **Red** VHF — **Yellow** SILENT — **Blue**

Getting started

Before AIS CTRX GRAPHENE is installed, you should check that you have all the equipment you need for the installation and that nothing is missing from your delivery. The AIS CTRX GRAPHENE comes in two versions the GRAPHENE and the GRAPHENE+ version. The plus version also contains a built in antenna splitter making it possible to use the same VHF antenna for both the AIS and the VHF radio.

AIS CTRX GRAPHENE comes with the following parts:

1	AIS CTRX GRAPHENE Class B Transponder	P/N 0012-001-000
1	Data / DC cable (1 m)	P/N 0012-770-000
1	USB mini cable 1 m	P/N 0012-980-000
1	BNC to UHF adapter	P/N 0012-989-000
1	CD incl. manual, set-up software and AIS information	P/N 0012-972-000

AIS CTRX GRAPHENE + comes with the following parts:

1	AIS CTRX GRAPHENE Class B Transponder	P/N 0012-002-000
1	Data / DC cable (1 m)	P/N 0012-770-000
1	USB mini cable 1 m	P/N 0012-980-000
1	BNC to UHF adapter	P/N 0012-989-000
1	Coaxial cable AIS to VHF with connectors (2 m)	P/N 0010-980-000
1	CD incl. manual, set-up software and AIS information	P/N 0012-972-000

The following may be needed to finish your installation but is *not included*:

1	VHF marine band antenna (0dBd) with cable and UHF or BNC type coaxial connector.	
1	GPS antenna (active antenna, built-in LNA, 20dB gain min., 5VDC) with cable and TNC coaxial connector	
2	3A Fuse with fuse holder	
1	DC cable min. AWG 16, red and black	
4	Mounting screws	
1	Installation materials such as mounts for the antennas, cable ties, screws, connection blocks etc.	

BEFORE YOU BEGIN THE INSTALLATION

Before you begin the installation, you should decide on where you want to place your AIS CTRX GRAPHENE unit.

Place the transponder in in a position where you will be able to see the LED's on the front. This will make it easy to monitor the functions and make sure that the unit is working properly.

The transponder is designed to be installed were it is protected from the weather. The transponder is NOT intended for installation outdoors or anywhere it will be exposed to direct sunlight, moist or risk of water splashing.

The transponder should be installed in a place where the length of the antenna cables can be kept as short as possible, but also where DC power and access to other equipment you would want to connect the AIS to is conveniently available.

The AIS CTRX GRAPHENE has 3 external data ports. 2 of them are preferably used for the connection to a plotter (the NMEA0183/RS422 or the NMEA 2000 port). A USB port (mini type) is available for connection to a PC. This is used for the configuration and maintenance of the unit.

⚠ *Important when using the USB interface:*

The USB port built into this product is not isolated from the vessel power supply, VHF antenna ground or GPS antenna ground. Please observe the following procedures when connecting the USB port to avoid grounding problems;
If the computer is permanently installed on the vessel and/ or electrically connected to any other vessel equipment, including power supplies, it is recommended that connection is made using NMEA0183 or NMEA2000 connections. These benefit from being specifically designed for use in the marine environment and provide isolated and robust data transfer between your devices.
If a battery powered laptop is being used then it is recommended to switch off the computer, connect the USB cable and then switch on the laptop. This will help to ensure that all equipment grounds are correctly referenced before use, minimising any risk of equipment damage.

DC supply connection

If you are installing the AIS CTRX GRAPHENE+ version or using a Class B VHF splitter with the standard CTRX Graphene it is recommended that you connect the DC power leads to the same DC power connection point as your VHF.

Antennas

There are antennas available specifically made for use with AIS equipment but any standard type marine band VHF antenna will work. The antenna gain should not exceed 0 dBd.

Place your VHF antenna as high as possible but at least 2.5-3 m above the water surface. If you are installing a separate AIS antenna you should make sure that it is separated as much as possible from other VHF antennas to avoid interference.

GPS antennas should be installed in such a way that the antenna top surface has a free and unobstructed view of the horizon. Make sure that the antenna is not placed nearby metal objects in order to minimize reflections of the received signal. GPS antennas should not be placed in the vicinity of high power HF or satellite communications equipment.

INSTALLATION

Once you have unpacked the box and checked that your delivery is complete, proceed with the installation as follows:

Figure 5   AIS CTRX GRAPHENE + with its antennas and data/DC connectors

The 12 pole multi-pin connector mounted on the transponder has the following configuration of the pins:

Pin	Signal	Color marking
1	Signal ground	BROWN
2	Power supply Voltage GND (-)	BLUE
3	SILENT LED (Blue)	WHITE
4	Signal ground	GREEN
5	NMEA 0183/RS-422 TX B (-)	YELLOW
6	NMEA 0183/RS-422 TX A (+)	GREY
7	NMEA 0183/RS-422 RX A (+)	PINK
8	Power supply Voltage (+)	RED
9	Power supply Voltage GND (-)	BLACK
10	Power supply Voltage (+)	ORANGE
11	External SILENT switch	PURPLE
12	NMEA 0183/RS-422 RX B (-)	LIGHT GREEN

Table 1.   Data/DC connector pin configuration

The transponder is secured to the bulkhead or deck by means of four screws. A template for the fixing of the screws is supplied in the box in the shape of a cardboard divider sheet. The transponder should be installed so that the six LEDs on the front panel are readily visible for monitoring of the AIS CTRX GRAPHENE functionality. Furthermore, the transponder may also be placed for easy access to the "S" – button, which is used to switch the "silent mode" on and off. Silent mode turns off the transmitter and places the transponder in in receive-

only mode. A remote switch and LED indicator can be connected to the transponder through the DC/DATA cable as shown on page 20. A USB connection (mini B-type) is also provided.

For best performance and an easy installation a suitable place should be found were the installations can provide:

1. Short cable-runs for the VHF and GPS antenna.
2. Easy access to DC power.
3. Access to other equipment to which you may wish to connect the transponder to.

To avoid interference from other equipment on board such as generators, compressors or electrical panels the unit should *not* be installed together or close to such equipment.
The accompanying installation software provides a diagnostic program which can be useful to diagnose a situation where the transponder is experiencing interference. Read more about this in the"*Diagnostics*" section in the chapter on the proAIS software.

To ensure that best performance is obtained it is important to choose good antenna cables. For shorter lengths RG58C/U is sufficient. For cable lengths exceeding 10 m, a low loss cables should be used, such as type RG213, RG214, or LM400, depending on length. It is also important to use proper connectors, where crimp type connectors are preferred over soldered connections. Ready-made 10 m lengths of RG58C/U type cable can conveniently be used. Ready-made lengths with FME type connectors are available where adaptors for the different kind of coaxial connectors used can be fitted. In this way an easy-to-assemble cable/connector kit can be put together for a specific installation without any special tools. True Heading can provide ready-made kits, cables and connectors.

Figure 6.   **CTRX Graphene+:** From L to R: NMEA2000 connector, USB-mini connector, Data/DC circular connector, GPS antenna (TNC), VHF antenna (BNC) and VHF radio (FME).
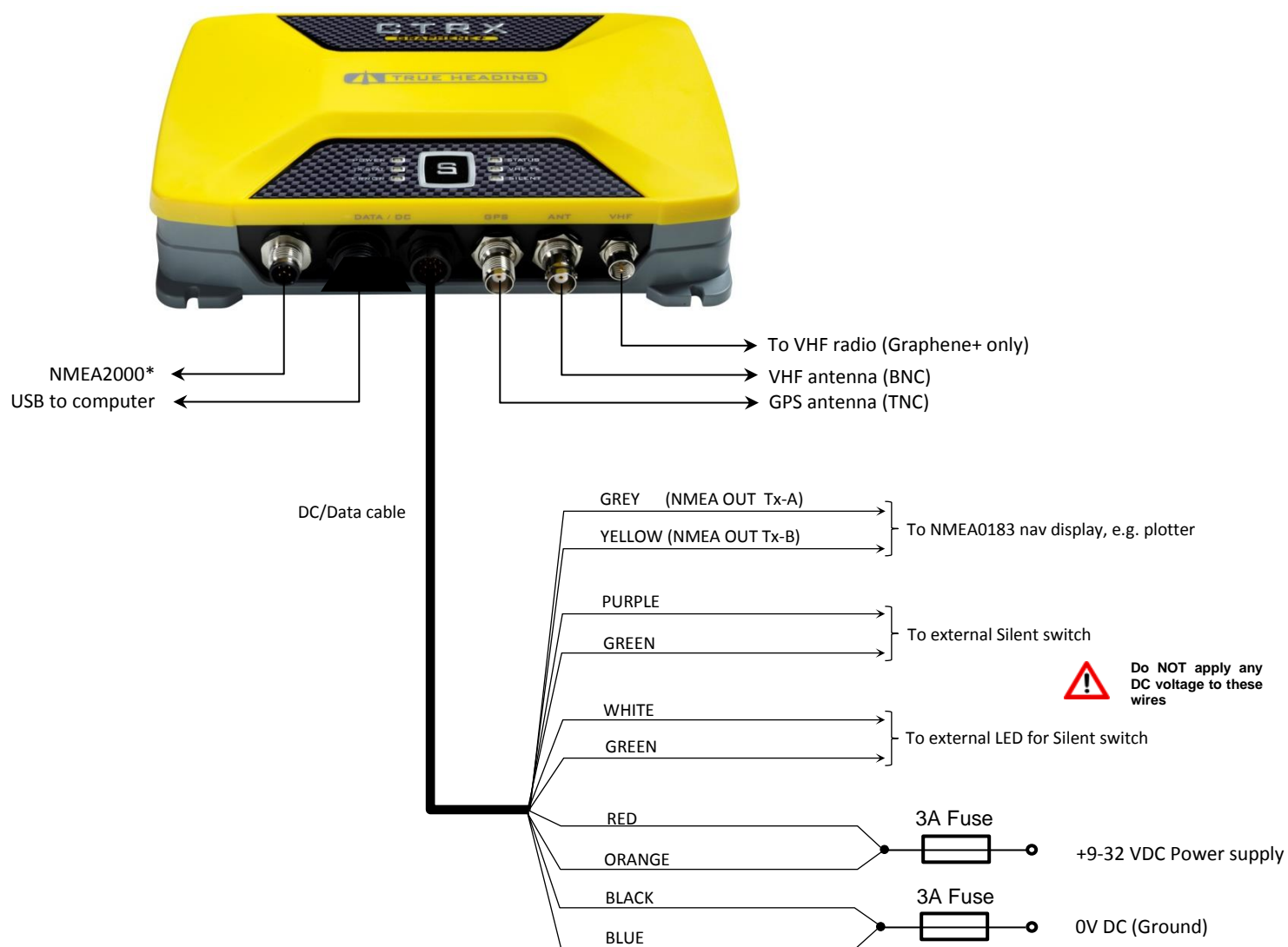

Figure 7.   **CTRX Graphene**: From L to R: NMEA2000 connector, USB-mini connector, Data/DC circular connector, GPS antenna (TNC), VHF antenna (BNC).

After installation of the antennas the AIS CTRX GRAPHENE should be connected to the equipment where the AIS data from the transponder will be used. AIS CTRX GRAPHENE has three data ports to choose from, 1 NMEA2000, 1 USB and 1 NMEA 0183.

CONNECTION, GENERAL OVERVIEW

NMEA2000*

USB to computer

To VHF radio (Graphene+ only)

VHF antenna (BNC)

GPS antenna (TNC)

DC/Data cable

GREY   (NMEA OUT Tx-A)

YELLOW (NMEA OUT Tx-B)

To NMEA0183 nav display, e.g. plotter

PURPLE

GREEN

To external Silent switch

Do NOT apply any DC voltage to these wires

WHITE

GREEN

To external LED for Silent switch

RED

ORANGE

3A Fuse

+9-32 VDC Power supply

BLACK

BLUE

3A Fuse

0V DC (Ground)

ANTENNA CONNECTIONS

VHF-antenna
E.g. AC Marine CX4

GPS-antenna

CTRX Graphene

VHF-antenna

Existing VHF radio

GPS-antenna

2m RG-58 cable w/connectors FME & UHF.

Existing VHF antenna cable in your boat

Cable, 5m, RG-58, attached to the GPS antenna

CTRX Graphene+

CONNECTION TO AN NMEA2000 NETWORK

The picture shows the CTRX Graphene+

NMEA2000*
Connection

RED
ORANGE   9-32 VDC (+)
BLACK
BLUE   0 VDC (-)

NMEA2000 Drop cable
Must not be longer than 6m

NMEA2000
End resistor
120 Ohm

NMEA2000 T-connection

NMEA2000
Power Tap

NMEA2000
End resistor
120 Ohm

NMEA2000 Backbone

9-16 VDC (+)

0 VDC (-)
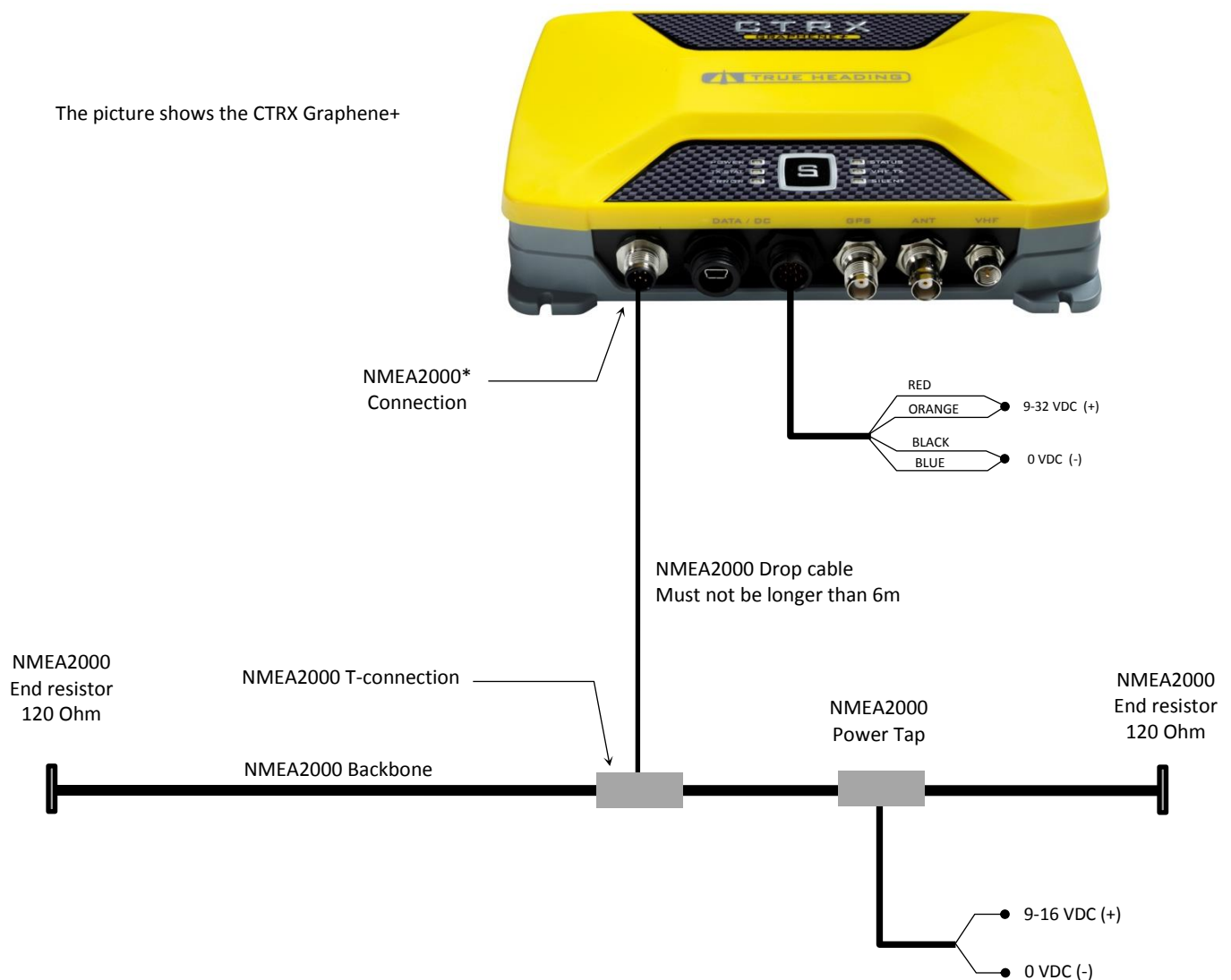
NOTE: The transponder must be connected to an external power source when connected to an NMEA2000 network. Even though some NMEA2000 devices can operate on the bus power, the transponders current consumption is higher than the maximum allowed and subsequently must use external power.

LEN=1 (LEN= Load Equivalence Number**)**

CONNECTION TO THE DC POWER SUPPLY

Now the connection to the DC power supply is all that is left. The AIS CTRX GRAPHENE can be connected to any DC power supply providing between 12V to 24V DC. The lower limit is 10V. Should the supply voltage go below 10V the RED ERROR LED on the front panel will light up and the unit will cease to transmit. The upper limit is 32VDC. This is the maximum allowable voltage. If the upper voltage limit is exceeded severe damage will be made to the transponder.

The DC supply point should be chosen with care. The recommended source should be the same as the VHF radio and/or other navigational equipment.

Even though the source may be protected with a circuit breaker the transponder must have its own fuse protection. The recommendation is to use two *3A fuses* (one on the positive lead and one on the negative lead) to provide protection for the transponder.

⚠ *Note* that the negative lead (-) on the transponder is connected to the same point as the ground on the VHF and GPS antenna connector. This means that if any of the antennas (VHF or GPS) is bolted to a metal structure on board, can result in a connection to the negative pole of the power supply (battery). If the unit is installed in a vessel with a metal hull it is highly recommended that a galvanic isolated DC/DC converter is used between the battery supply and the transponder to prevent galvanic corrosion or damage to the data interface.
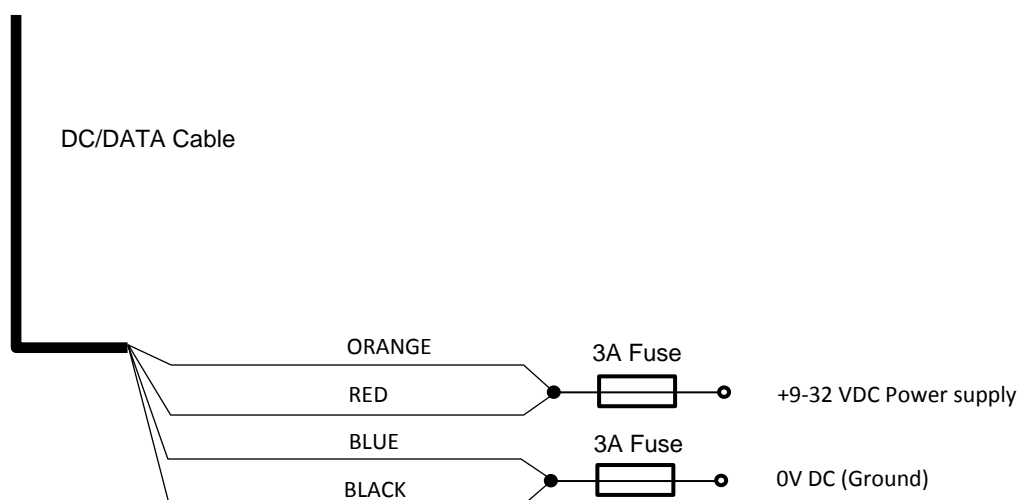
⚠ *Note:* Be careful not to reverse the polarity of the power supply leads, this may cause severe damage to the transponder.

The transponder is supplied with a combined Data/DC power cable. The power supply is connected as follows:
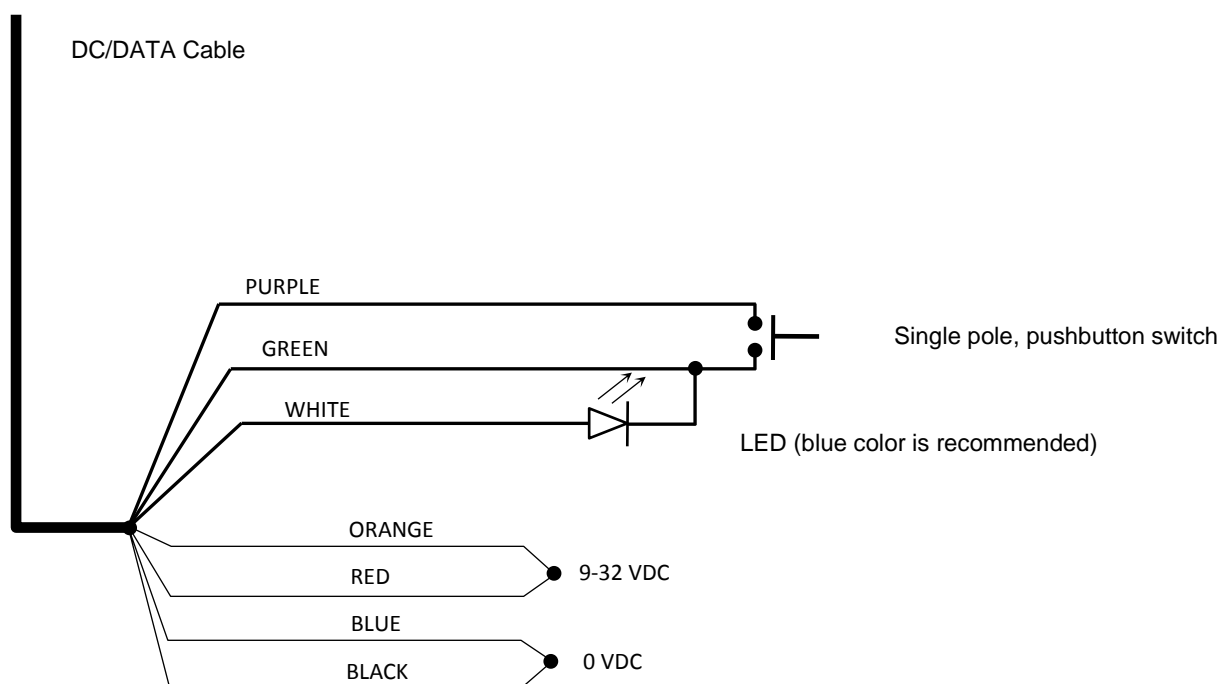
RED and **ORANGE** cable (twisted together) connects to *positive (+)*

BLUE and **BLACK** cable (twisted together) connects to *negative (-)*

⚠ *Do not forget the fuses !*

DC/DATA Cable

```
ORANGE
RED ─────●── 3A Fuse ──○  +9-32 VDC Power supply

BLUE
BLACK ───●── 3A Fuse ──○  0V DC (Ground)
```

CONNECTION OF AN EXTERNAL SILENT SWITCH WITH LED INDICATOR

DC/DATA Cable

PURPLE

GREEN

WHITE

Single pole, pushbutton switch

LED (blue color is recommended)

ORANGE

RED   9-32 VDC

BLUE

BLACK   0 VDC

PROAIS2 CONFIGURATION SOFTWARE

The proAIS2 application allows you to configure and monitor the performance of your CTRX Graphene transponder. proAIS2 is compatible with both Microsoft® Windows® and Intel based Apple® Mac OS operating systems The system requirements are as follows:

- Microsoft® Windows® XP, Windows® Vista, Windows® 7 (32 and 64 bit versions)
- Mac OS X10.5/10.6 (Intel based system only)
- A free USB port for connection to the AIS transponder

Installing the application

The application is installed from the CD provided with your CTRX Graphene transponder. Insert the CD into your PC or Mac and navigate to the Windows or OSX folder

Windows®

Double click on the "setup.exe" icon to start the installer and follow the on screen instructions. When installation of the application is completed, installation of the USB driver will commence automatically.

OS X

Double click on the "proAIS2.dmg" icon to start the installation and follow the on screen instructions

Connecting to your AIS CTRX GRAPHENE

Before launching the proAIS2 application connect your AIS transponder to your PC or Mac using a USB cable. Follow the on screen instructions to complete the USB driver installation if required. You can now launch proAIS2 from the Windows® start menu or the OS X Applications folder.

When using the proAIS2 program with the transponder, the AIS CTRX GRAPHENE should be connected using the supplied USB cable. It will be powered from the USB cable during configuration but cannot transmit or receive AIS messages and the GPS receiver will be disabled unless connected to a 12V or 24V DC power supply.

If the USB driver fails to install automatically, a USB driver is provided on the CD. Run the set-up in the USB driver folder to install the driver.

Select the serial port corresponding to your AIS transponder from the drop down menu at the top left of the proAIS2 window. The port will normally be listed as "*AIS Virtual COM Port*" and click on the **Connect** button.

proAIS2 is now communicating with your AIS transponder and will display any pre-configured vessel data in the **Configuration** page.

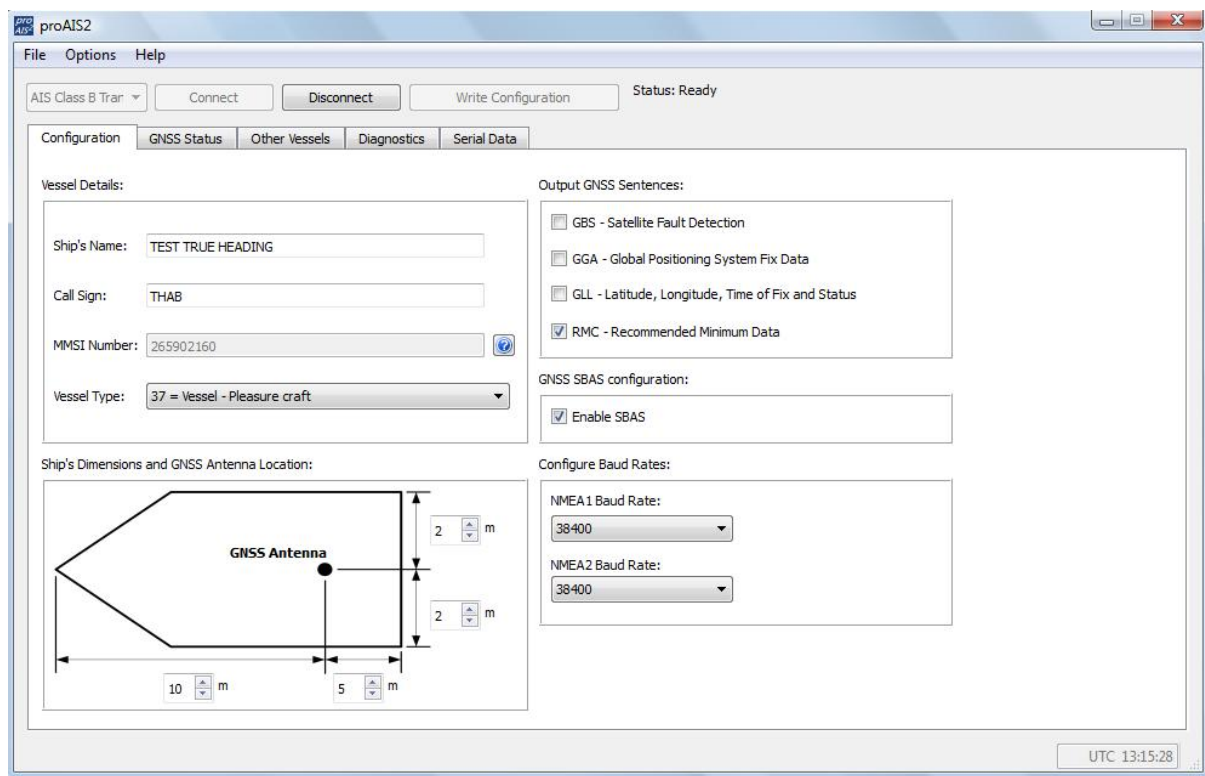If the fields are empty the transponder is un-programmed.

Figure 15   Connection of PC to AIS CTRX GRAPHENE takes place via choice of the correct port. *Normally the correct port will occur as the first choice stating AIS Class B AIS*.

Information on how to configure the unit is given in Appendix A. Restrictions may apply regarding the configuration of your transponder depending on which country you are a resident of. Please consult your retailer or contact your Post and Telecom authority.

The **Configuration** page shows the current vessel information and AIS transponder configuration. Vessel information and configuration can also be edited and saved to the AIS transponder

In the **Output GNSS Sentences** field you can select which type of GPS data you would like to be output on the data port. The default message set is the NMEA sentence **RMC** (Recommended Minimum specific GNSS data) which contains the essential position, course, speed over ground and time data. **GNSS SBAS configuration** allows you to select if DGNSS (EGNOS or WAAS) corrections are to be used or not.

In the **Configure Baud Rates** window, the baud rate of the NMEA data ports can be configured. The default setting is 38400 baud which is the common setting for AIS and should **NOT** be changed on any of the ports. The **NMEA2** port is internal and dedicated to the optional WiFi interface.

The next page is the **GNSS status** page which is a valuable tool for monitoring the built-in GPS receiver. This tool can conveniently be used during installation to check that the GPS antenna has been placed in a proper location for reception and that cables and connections are properly put together and not damaged. When the transponder receives signals from the satellites a vertical bar will appear representing the received satellite. The bar will change colour depending on the status of the satellite. When the receiver is locked to a satellite the bar will change from blue to green indicating that the satellite is used for navigation. If SBAS is used the satellites involved in tracking the SBAS data will show up in yellow.

The reception quality is displayed as a C/N value (carrier to noise), which means that the higher the value, the better the signal quality is. A mean value for a reasonable reception quality should be not less than 30 dBHz.
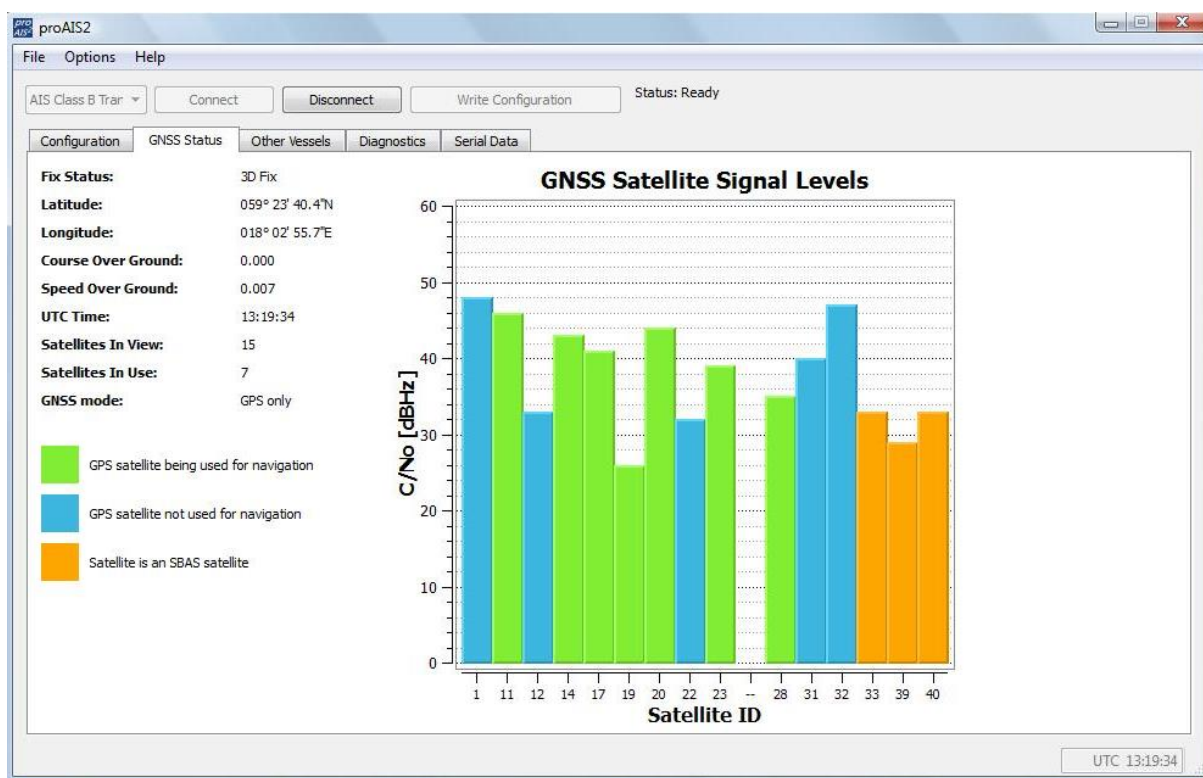

Figure 16   AIS CTRX GRAPHENE GNSS Status field showing satellites being used as well as not being used plus DGNSS satellites using SBAS.

The *Other Vessels* page provides you with an easy way to check that your AIS CTRX GRAPHENE receives data from other AIS transponders. By clicking on the column label the data field can arrange in falling or increasing order depending on the column of interest.

	MMSI	Name	Call Sign	Class	Speed (kn)	Course	Latitude	Longitude	Range (nm)	Bearing (°)	Report Age (s)
2	265549580			A	0	344,8	059° 05' 21.2"N	018° 24' 49.7"E	21,51	148,41	86
3	265617170	HARRY	SGUL	A	0	188,3	059° 18' 17.9"N	017° 26' 23.5"E	19,42	254,16	3
4	265522470			A	10,7	31,8	059° 27' 41.7"N	018° 37' 43.7"E	18,18	76,95	564
5	002655084	Base Station		BASE	0	0	059° 13' 24.4"N	017° 37' 14.5"E	16,68	232,12	1
6	265191000	VESTANVIK	SITA	A	8,9	291,8	059° 16' 15.6"N	017° 42' 1.7"E	13,01	235,33	4
7	265558290			A	7,2	252,4	059° 23' 42.5"N	018° 26' 40.0"E	12,11	89,67	14
8	266314000	BIRKA PARADISE	SIJW	A	9,5	268,3	059° 21' 24.4"N	018° 25' 47.8"E	11,89	100,85	27
9	265565250	POLIS 139 9970	SFC7681	A	8,9	316,1	059° 26' 11.5"N	018° 25' 19.8"E	11,69	77,38	24
10	265607090			B	1,5	51,5	059° 21' 46.8"N	018° 25' 12.1"E	11,52	99,31	482
11	265649360			A	9,8	103	059° 23' 31.0"N	018° 23' 24.0"E	10,44	90,71	36
12	265649350	GALLNO	SKBN	A	10,9	54,8	059° 25' 29.9"N	018° 22' 7.7"E	9,96	79,28	5
13	265568520	SILVERO	SDAK	A	0	13,3	059° 24' 8.7"N	018° 22' 10.2"E	9,82	87,11	5
14	265522690	SJOGULL	SKLJ	A	0	248,5	059° 24' 9.8"N	018° 22' 7.9"E	9,81	87	102
15	265565600	POLIS 139 9950	SFC7700	A	0	252	059° 24' 10.4"N	018° 22' 2.6"E	9,76	86,93	17
16	265577460	GULLI	SFIO	A	8,4	138,7	059° 15' 51.9"N	017° 51' 31.2"E	9,76	216,77	25
17	265546940	VAXHOLMEN	SLEK	A	0	125,1	059° 16' 16.9"N	017° 50' 50.5"E	9,64	219,91	17
18	265614920	SIBYLLA	SC3916	B	13,7	207,9	059° 23' 56.5"N	018° 21' 35.7"E	9,52	88,25	9
19	265546910	FRIDA	SJFV	A	6	59,3	059° 24' 1.7"N	018° 21' 33.5"E	9,51	87,73	6
20	265589970	NINA	SFIC	A	0,1	211,4	059° 24' 0.1"N	018° 21' 2.3"E	9,24	87,84	9
21	265902170	BATINGENJORN	7SA2294	A	0	214	059° 17' 44.0"N	018° 15' 36.0"E	8,79	132,5	42
22	265506960	KBV 311	SHTZ	A	0	0	059° 24' 27.9"N	018° 19' 44.0"E	8,61	84,6	19
23	265585310	JUPITER	SFKL	A	0	176,5	059° 23' 17.2"N	018° 19' 37.5"E	8,53	92,49	26
24	265604470	LINEA	SJEC	A	0	12,9	059° 23' 17.0"N	018° 19' 36.3"E	8,52	92,51	0
25	002655065	Base Station		BASE	0	0	059° 17' 51.4"N	018° 10' 22.9"E	6,96	146,79	2

Figure 17   In the [Other Vessels] field, information is present about all AIS units that can be seen by the connected AIS CTRX GRAPHENE transponder.

The **Diagnostics** page has several functions and tools to check that your AIS transponder works properly. The tools make it easy to monitor and check performance during and after installation.
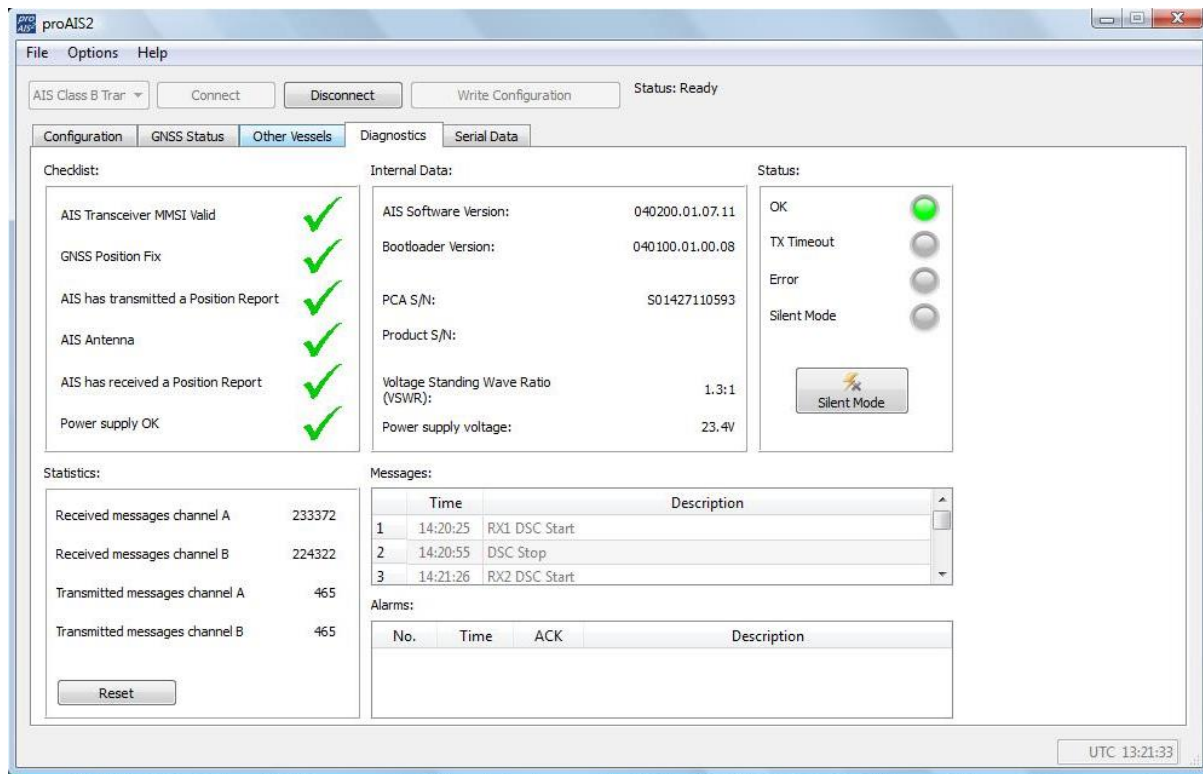

Figure 18   AIS CTRX GRAPHENE Diagnostics field provides good information about the transponder's status and the software version.

In the window **Checklist**, you can get an overall view of the main functions of the transponder such as:

- Programming (***Transponder MMSI valid)***
- GPS functionality (***GPS Position Fix**),*
- Transmission (***AIS has transmitted a position report***)
- Antenna function (***AIS antenna),***
- Reception ***(AIS has received a report)***
- Power supply *(**Power supply OK**).*

Once the items have a green tick the function is checked and validated.

The **Internal data** window shows the version of the firmware and boot loader as well as the product code and internal serial number. The serial number is the same as on the bottom label and should be referred to should it be necessary to contact True Heading for support. Also the VSWR value (antenna matching factor) is shown here as well as the power supply input voltage.

The **Status** window show the status of the LED's on the front panel. Normal operation should have the green LED light. Once in a while, depending on the operational situation (AIS traffic load) the status may change to yellow, which means that the transponder has not been able to transmit during the last transmission period. Once the units have transmitted the LED lights will go back to green.

Before the AIS CTRX GRAPHENE has been programmed, both the yellow and red LED's will light, indicating that the unit is not programmed (no valid MMSI number). This is shown both on the transponder and on the status panel in proAIS2

The green **Power** LED on the transponder panel indicates that the transponder is connected to a DC supply and powered on.

The red **Error** LED indicates the following errors:
*   The transmitter has transmitted longer than 1 s.
*   The GPS has not started to navigate after 30 minutes
*   Excessive VSWR value (> 3:1) (faulty antenna or cable problem).
*   Faulty transmitter (no or low power output).
*   A severe fault which prevents normal operation

The yellow **TX timeout** LED will turn on to indicate a change in the operating status. The situation has called for the transmitter to stop transmitting.

The yellow **TX timeout** LED can indicate the following conditions:
*   The transponder GPS has not received a position fix which means that the transponder cannot transmit as the position data is invalid.
*   The GPS receiver is waiting to acquire a position fix (*LED* is flashing)
*   The transponder has not been able to transmit because free slots are not available. This can be due to disturbance from radio and/or electrical equipment on board or the AIS traffic situation (many transponders in the same area).

When the situation has been resolved the yellow LED will turn off and the green status LED will be turned on (on the front panel of the transponder). This is the normal operating condition.

The blue **Silent Mode** LED will light up when AIS CTRX GRAPHENE is set in silent mode, which turns off the transmitter. This sets the transponder in receive-only mode. This is referred to as "SILENT MODE".

The transponder can be switched to SILENT mode by either pressing the "S" button on the front panel for 3 seconds or by using an external switch (see page 21 for wiring instructions) To switch off the SILENT mode hold the "S" button down for 3 seconds. The blue LED will turn off after approximately 1 second.
A third way to switch the unit to SILENT MODE is to use the software button (marked Silent Mode) in proAIS2 status window were the function can be remotely switched on and off.

NOTE that this is a special function in proAIS2 and that it is separate from the hardware control to set the silent mode with the switch.

In the **Statistics** window received and transmitted messages on the two channels is shown. The values are accumulated from the time the transponder was connected up to the proAIS program. The values will be reset as soon as the connection is disconnected.

The **Serial data** page is for the more experienced installer. The page offers a valuable tool for monitoring the data output from the transponder. Data is output in NMEA0183 format. Received data will appear as !AIVDM strings, transmitted data as !AIVDO and GPS data as $GPRMC (or any of the GPS data sentences selected). The field **Enter commands** below the data window is used for input data *to* the transponder. This field is only used for diagnostics and service functions.

The data shown in the window can be logged and recorded in file format for later recovery and analysis.
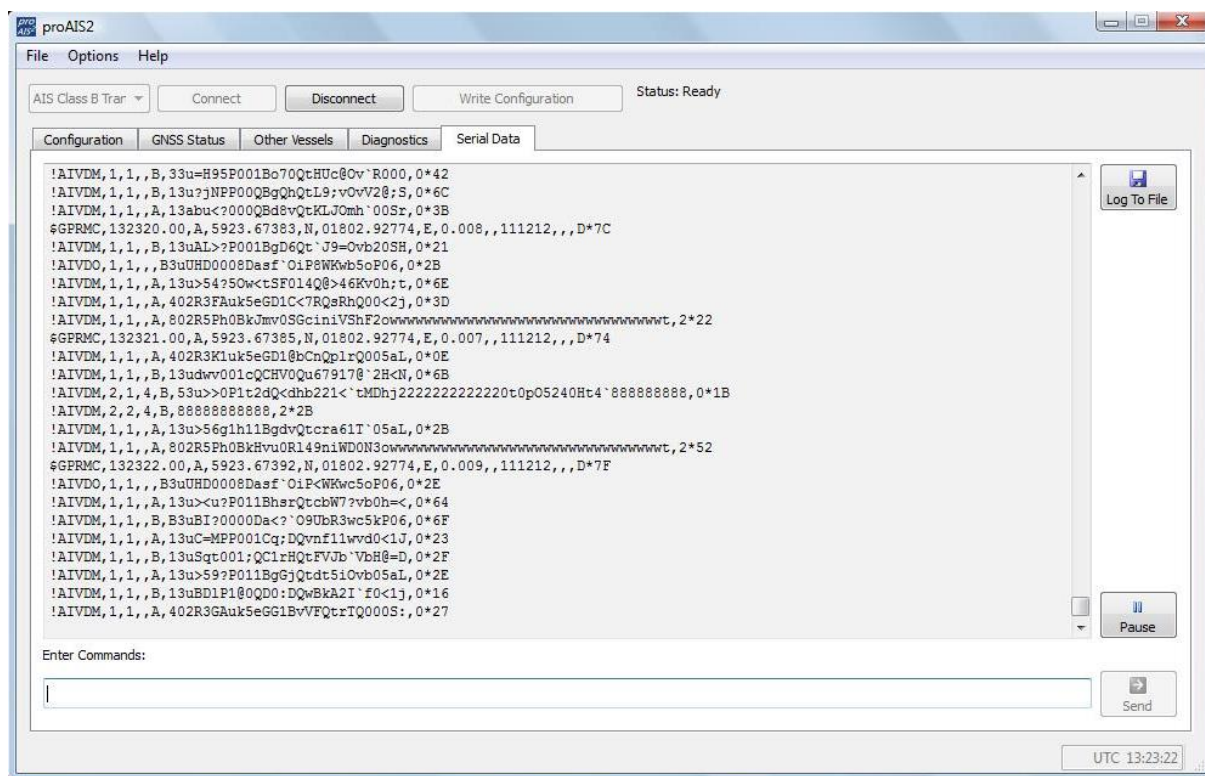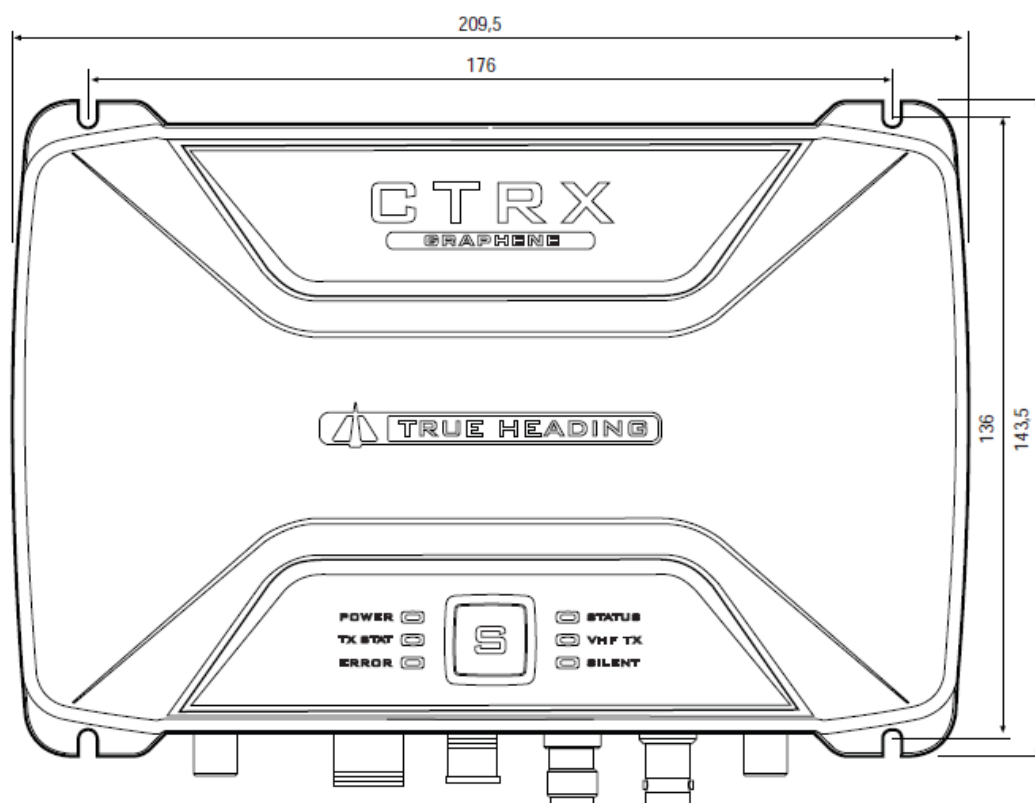

Figure 19   In the field Serial data the data the transponder transmits is displayed on its port and from this data, important information can show that the transponder functions correctly.

NOTES

Mounting Template

NOTE: NOT drawn to scale!

APPENDIX A   CONFIGURING THE AIS CTRX GRAPHENE

AIS CTRX GRAPHENE is configured using the ***proAIS2*** software supplied with the transponder. ***proAIS2*** runs on Windows XP (SP2), Windows Vista and Windows 7 & 8. A version for MacOS is also available on the product CD.

The following information is needed to configure your AIS CTRX GRAPHENE:

1. Assigned MMSI number (9 characters)
2. Call sign (7 characters maximum)
3. Vessel's name: (20 characters maximum)
4. Vessel type (ex. 37 Pleasure craft)
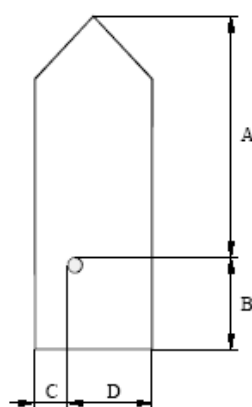5. GPS antenna position

Table 6   Ships dimension (GPS reference position)

⚠ Important information for US Customers:

There are specific laws in the USA regarding the configuration of AIS class B transceivers. If you are a US resident and intend to use your AIS class B transceiver in US waters, you should make sure that your retailer has configured your product prior to supplying it to you. If your AIS transceiver has not been pre-configured please contact your dealer for details of how to have it configured.

⚠ 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.

To configure the transponder proceed as follows:

Start the proAIS2 application and select the serial port corresponding to the AIS transponder from the drop down menu at the top left of the proAIS2 window. Select the Configuration page and enter your vessel's data:

1. Enter vessel's *name* (use **only** A-Z and –, max. 20 characters)
2. Enter vessel's *call sign* (max. 7 characters)
3. Enter the assigned *MMSI* number (max. 9 characters)
4. Select *Vessel type* (the type of vessel on which the transponder is installed on). We recommend that all types of leisure craft is set as *37 = Vessel - Pleasure craft.*
5. Enter the *Ship dimensions* which are determined by the position of the GPS antenna. The length of the vessel is set by the distance measured from fore to the GPS antenna (A) and from aft to GPS antenna (B). The beam is measured as the distance from starboard to the GPS antenna (C) and from port to the GPS antenna (D). The values should be entered in meters, rounded up to the nearest meter.

When finished click on *Write Configuration* and follow the on screen instructions.

Before data is stored you will be prompted to make sure that the data is correct before you can proceed to write the data permanently. This is the last chance to correct any errors, so make absolutely sure that MMSI, name and call sign are correctly entered in their respective fields before you press the button.

⚠ **Once the MMSI number is programmed it cannot be changed!**

Should the transponder been programmed with an incorrect MMSI, please contact True Heading support.

APPENDIX B   ANTENNAS AND ANTENNA MOUNTING

GPS Antenna

The GPS antenna used must be of the active type (i.e. it should incorporate an LNA) and must be suitable for marine shipboard applications (index of protection, ruggedness, means of mounting, etc.). An antenna should be selected with a gain (in dB) depending on the length of cable between the antenna and the AIS unit; after subtraction of cable and connector losses a minimum total gain of 25 dB should be available at the AIS CTRX GRAPHENE unit GPS antenna connector.

The GPS antenna to be used for AIS use must be a dedicated antenna, i.e. not shared with any other GPS receiver.

Installation of the GPS antenna is critical for the performance of the built in GPS receiver which is used for timing of the transmitted time slots and for the supply of navigational information should the main navigational GPS fail. We strongly recommend that:

1.   The GPS antenna is mounted in an elevated position and free of shadow effect from the ship's superstructure

2.   The GPS antenna has a free view through 360 degrees with a vertical angle of 5 to 90 degrees above the horizon.

3.   As the received GPS signal is very sensitive to noise and interference generated by other on board transmitters, ensure that the GNSS antenna is placed as far away as possible from radar, Inmarsat and Iridium transmitters and ensure the GPS antenna is free from direct view of the radar and the Inmarsat antenna beam.

4.   It is also important that the MF/HF and other VHF transmitter antennas are kept as far away as possible from the GNSS antenna. It is good practice never to install a GNSS antenna within a radius of 5 Metres from these antennas.

VHF antenna for AIS use

The VHF antenna employed for AIS use:

- Must be a dedicated antenna, i.e. not shared with any other VHF transmitter/receiver.

- Must be suitable for marine shipboard applications (index of protection, ruggedness, means of mounting, etc.)

- Should be omni-directional and vertically polarised with unity gain (0 dB) and with a bandwidth sufficient to maintain a VSWR less than 1.5 over the frequency range 156 – 163 MHz. As a minimum the 3dB bandwidth must cover the two AIS channels and the DSC Channel 70.

- Should be mounted with at least a two meter vertical separation distance from any other VHF antenna used for speech or DSC communication. See EMI warning below.

- Should be mounted at least 2-3 metres above sea level for good performance.

WARNINGS

VHF Antenna

Connecting a badly mismatched VHF antenna, leaving the VHF antenna port disconnected, or shorting the VHF antenna port will activate the VSWR alarm, causing the unit to stop transmitting to prevent damage to the transponder. The red LED will light up indicating an error preventing normal operation.

EMI (Electro Magnetic Interference) from other equipment on board

To ensure proper functionality it is necessary to install the VHF antenna correctly and operate the AIS equipment according to the instructions.

The table below shows suitable safe distances to other equipment that could cause interference to the AIS Class B Transponder.

Object	Safe distance
Radar antenna, X-band	1, 5 m (5 ft)
High efficiency engines	1 m (3 ft)
HF or VHF antennas	3 m (10 ft)
AC power cables with high currency	1 m (3 ft)
Satellite communication antennas	4 m (13 ft)

APPENDIX C   WIFI OPTION

The CTRX Graphene transponder can be fitted with WiFi connectivity as an option. The WiFi unit is built-in and has an integral antenna.

The WiFi option provides a possibility to connect and share AIS data with a wireless device such as a tablet or a laptop computer. The WiFi is set up as an access point which provides connectivity using the choice of TCP or UDP protocol.

The WiFi antenna is installed on the inside of the bottom part of the enclosure (see arrow). When installing the CTRX Graphene WiFi, please make sure that this area is kept away from any metallic parts such as bulkhead etc. which can attenuate the signal from the WiFi unit.

WiFi antenna position

Technical data

Type:	RN-171-XV
Frequency range:	2,402 – 2,480 MHz
Modulation standard:	802.11 b/g
Channels:	1 – 14
Transmission rate:	1-11 Mbps for 802.11b / 6-54 Mbps for 802-11g
Output level:	Class 1 (up to +12dBm)

Settings

Protocol used:	TCP and UDP
SSID:	Trueheading*xxxx* (*xxxx* is the transponder serial number)

TCP

IP address:	192.169.78.1
Port:	2000

UDP

Broadcast address:	192.168.78.255
Port:	2000

Note: The settings are fixed and cannot be changed by the user.

APPENDIX D   CTRX GRAPHENE NMEA 2000 PGN LIST

PGN description	PGN number	Comments
Class A Position Report	PGN129038	
Class B Position Report	PGN129039	
AIS UTC and Date report	PGN129793 output	From AIS message #4 base station messages
AIS Class A Static and Voyage Related Data	PGN129794	
AIS SAR Aircraft Position Report	PGN 129798	
AIS Broadcast Safety Message	PGN129802	
AIS Class B static data part A	PGN129809	
AIS Class B static data part B	PGN129810	
AtoN position report	PGN129041	
NMEA2000 group function	PGN126208	
NMEA2000 product info	PGN126996	
ISO request	PGN059904	
ISO Acknowledge	PGN059392	
ISO address claim	PGN060928	
ISO Address command	PGN 065240	
GPS position, rapid update	PGN 129025	Added in V1.7
COG and SOG, rapid update	PGN 129026	Added in V1.7