USER MANUAL R450-D SERIES

R450-D – Network AIS Receiver with Ethernet, USB & WiFi – SKU: 001-2510
R450-DG – Network AIS Receiver with GPS, Ethernet, USB & WiFi – SKU: 001-2514

R450-D-Series-MA-v07r00
2025-08-05
ENGLISH

CONTENTS

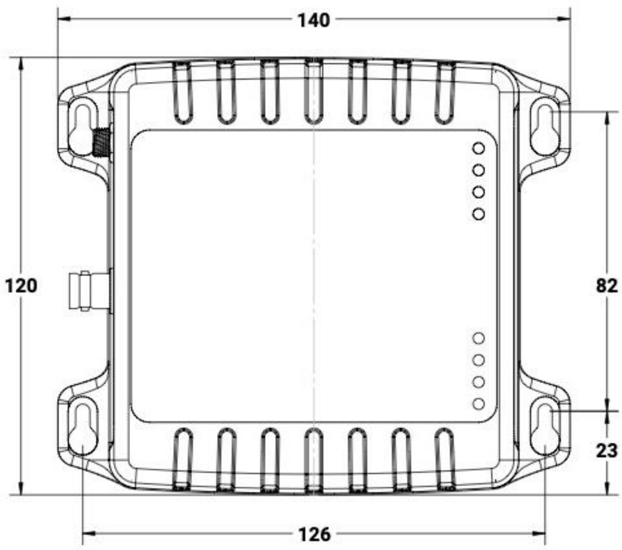
1 R450-D SERIES AIS RECEIVER MODELS

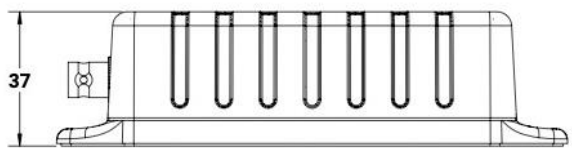
R450-D Network AIS Receiver
With USB, Ethernet & WiFi

R450-DG Network AIS/GPS Receiver
With USB, Ethernet & WiFi

1.1 Major Dimensions

Measured in mm





2 DOCUMENT

2.1 About This Manual

This Manual provides installation, operating Instructions and fault-finding procedures for the equipment to which it relates.

After installation, this manual should remain with the vessel to which it relates.

This manual is made available in electronic Portable Document Format (PDF). In PDF format, the following categories are all enabled as active hyperlink references: (1) The titles of each section; (2) document cross-references; (3) the table of contents.

This document may therefore be navigated quickly and effectively by using a mouse or other pointing device to activate each of these hyperlinks. This is a printer friendly document, designed to be printed 2-sided as a booklet with A5 pages on A4 stock paper.

2.2 Revision History:

Document name:	Date:	Details:	Author:
R450-D-Series-MA-v07r00	2025-08-05	First Issue	TSI

3 NOTICE

3.1 Copyright

Any enquires relating to this document or its contents should be addressed, in writing, in the first instance to Comar Systems Ltd.

COMAR SYSTEMS
Vittlefields Technology Centre
Forest Road
NEWPORT
Isle of Wight
PO30 4LY
UNITED KINGDOM

tel: +44 (0)1983 828900

email: sales@comarsystems.com
web: www.comarsystems.com

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4 GENERAL NOTICES

SAFETY: Make sure the power supply is switched off before you make any electrical connections to the unit.

INSTALLATION: This equipment must be installed in accordance with the instructions provided in this manual. Failure to do so could result in poor performance, personal injury and/or damage to your vessel and/or connected equipment.

CONNECTION: To ensure the performance of the unit, as part of the installation it is recommended that adequate grounding is connected to the unit. Further to this, it is recommended that the power input supply is provided by a clean DC source with filtering if required.

CABLES: The supplied cables should only be cut, shortened or lengthened by an appropriate supplier.

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

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

When necessary, upgrades to the product will be accompanied by updates or addenda to this manual. Information contained in this manual is liable to change without notice.

Comar Systems Ltd. disclaims any liability for consequences arising from omissions or inaccuracies in this manual and any other documentation provided with this product.

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.

5 INTRODUCTION

5.1 Background to AIS

AIS (Automatic Identification System) is a maritime safety system that allows vessels to automatically exchange identification, position, course, and speed information over VHF radio. This data is crucial for improving situational awareness and reducing the risk of collisions at sea.

While AIS transponders are mandatory for most commercial vessels over 300 gross registered tonnes (GRT) on international voyages – as required by IMO regulations, the information they transmit can also be received by AIS receivers. These receivers, including land-based systems, play a vital role in monitoring vessel movements, supporting traffic management, coastal surveillance, port operations, and maritime data services.

This product is an AIS receiver designed to capture AIS transmissions from vessels within VHF range, providing real-time visibility of maritime traffic for shore-based applications.

5.2 The R450 Series

The R450 Series is a range of professional-grade dual-channel AIS receivers designed specifically for coastal and shoreside monitoring of AIS-equipped vessels. These receivers decode all AIS message types—including Class A, Class B, AtoNs, and SARTs—delivering reliable real-time vessel tracking for port authorities, government agencies, and maritime operators.

Within the series, the R450-D and R450-X models provide the same core functionality and form factor, but differ in the embedded network module:

- **D Series models** (e.g. R450-D, R450-DG) use a Digi® network module, offering support for up to 32 simultaneous UDP connections.
- **X Series models** (e.g. R450-X, R450-XG) use a Lantronix® XPort® module, which supports up to 4 TCP and 1 UDP client/server connections.

Users can select a model based on their existing network infrastructure or software compatibility preferences. All R450 units offer the same physical connectivity—USB, Ethernet, and Wi-Fi. However, both models are also available in versions with an integrated GPS receiver, designated by the G suffix (R450-DG and R450-XG).

Information transmitted from vessels fitted with AIS transponders includes:

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

Note: Not all the above information is necessarily transmitted by each vessel.

6 PARTS LIST

Before proceeding with the installation of any R450 Series model, check the contents of the box, which should include:

- The R450-D AIS Receiver Unit, or R450-DG AIS & GPS Receiver Unit
- Universal 100–250 V AC to 12 V DC power supply
- BNC to UHF Antenna Connector Adaptor
- USB Cable
- Network Cable

7 INSTALLATION

7.1 Mounting

The R450 is designed for internal, protected area environments. Mount the unit on a flat surface using #6 (3.5 mm diameter) pan head screws, ensuring it is located close to power, Ethernet, and antenna connections. Maintain a minimum compass safe distance of 0.5m and avoid placing the unit near excessive heat, vibration, or electrical noise sources.

7.2 Power Connection

The unit is supplied with a universal 100–250 V AC to 12 V DC power supply. Fit the appropriate AC plug for your region, then insert the 2.1 mm DC jack into the power socket.

Alternatively, the R450 can be powered from a clean DC power source in the range of 9–30 V DC, capable of supplying at least 1 A. The centre pin of the DC power socket is positive.

7.3 Antenna Installation

The R450 requires connection to a dedicated VHF antenna (not supplied). The antenna should be omnidirectional and tuned for the marine band (around 162 MHz). Use a high-quality 50 Ω coaxial cable and connect it to the BNC connector on the side of the unit.

For optimal reception:

- Mount the antenna as high as possible with a clear line of sight to the horizon.
- Avoid obstructions such as buildings, masts, or metal structures.
- A typical installation at 20 m elevation will provide reception of AIS transmissions at ranges of 25 nautical miles or more.
- Directional antennas, such as Yagis, may be used to improve reception in a specific direction if required.

7.4 GPS Receiver – 'G' Units Only

The R450-DG and R450-XG contains an integral GPS receiver allowing positional data and AIS data to be output together from the receiver.

A standard active 5V DC GPS antenna such as the Comar AG100, with a gain between 10 and 30 dB must be connected to the TNC connector on the side of the unit for the GPS receiver to work.

By default the GPS receiver will output the following NMEA messages:

- GPGGA, GPGSA, GPGSV, GPRMC

7.4.1 GPS Receiver Technical Specification

Channels:	12 Parallel Channels
Frequency:	1575.42 MHz
WAAS:	Yes
Datum:	Default WGS84
Update Rate:	1 sec
Hot Start:	6 sec
Warm Start:	35 sec
Cold Start:	45 sec

8 OPERATION

Operation of R450 Series units are fully automatic and only require Power, VHF and (GPS for ‘G’ Series units):

On powering up the unit:

- The green LED marked ON should illuminate
- The Channel LEDs should come on briefly then go off
- The Channel A and B LEDs should flash momentarily when information from nearby transceivers is received
- Data is then output for visual or textual viewing on compatible electronic charting systems or other systems or devices.

8.1 The range of AIS transmission

The reception range of AIS signals is comparable to that of marine VHF radio, as both operate within the same frequency band. AIS operates in the 162 MHz range, which is line-of-sight and therefore heavily influenced by antenna height, placement, and environmental conditions.

Reception range is primarily determined by the elevation and quality of the receiving antenna. For example:

- An antenna mounted on the rail of a yacht typically achieves up to 15 nautical miles.
- Relocating the antenna to the masthead (approx. 10–15 metres elevation) can extend reception to 20 nautical miles or more.
- A shore-based installation with an unobstructed view of the sea and an antenna height of 20 metres or greater can typically receive AIS transmissions from vessels 25–30 nautical miles away, depending on transmission power and atmospheric conditions.

For best results, the antenna should:

- Be mounted as high as practical, with a clear line of sight to the horizon.
- Be omnidirectional, unless a focused reception zone is desired (in which case a directional antenna like a Yagi can be used).
- Have a gain suited to the application – higher gain antennas on land can significantly increase effective range but may reduce coverage in vertical elevation.

Obstacles such as buildings, hills, or masts can obstruct the signal and reduce performance. Always prioritise height and line-of-sight for optimal AIS reception.

9 NETWORK CONFIGURATION

9.1 Connection to a Network

These models can be connected to a standard PC via USB or Network Router / Switch via Ethernet. Note if connecting directly to a PC you will need a crossover cable.

When connected to a network the yellow LED on the network connection should be on. If no yellow LED is shown then the unit has not detected a link. The green LED will blink when data is transmitted or received.

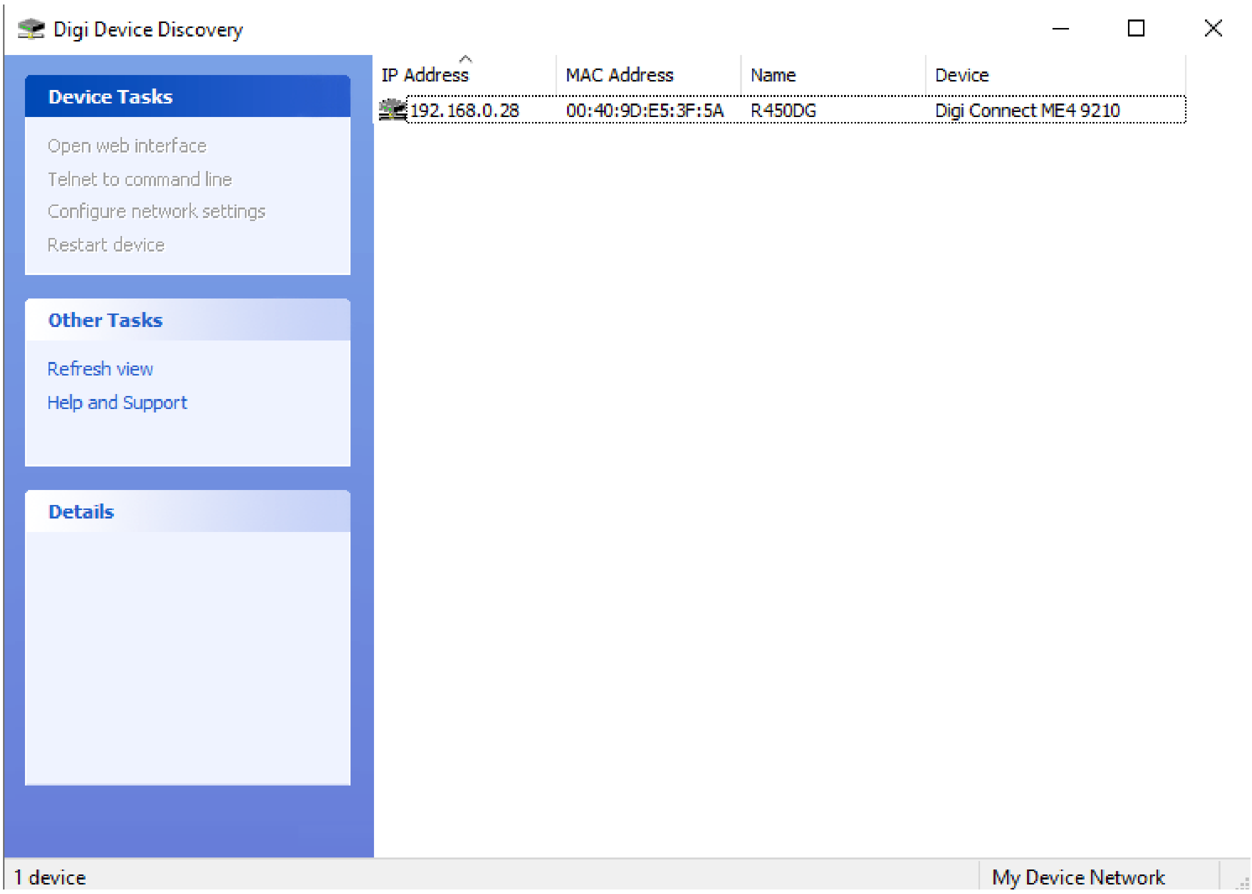
The software download from our website: *comarsystems.com/software-downloads*, contains the program **Digi Device Discovery** utility program for setting up and configuring the unit.

9.2 Configuring the Network

To install the Digi Device Discovery program on your PC run the “Device Discovery” installation executable file in the “Device Discovery” folder from the download and follow the set up wizard.

When the Device Discovery software is installed, select “Device Discovery” from the installed applications.

If you have installed the R450-D or R450-DG on your local network, the device will be displayed as a “Digi Connect ME” device:



9.3 Discovery Troubleshooting Tips

9.3.1 Firewalls

Check to make sure that any software firewalls (common examples are Windows Firewall and most popular Anti-Virus software) are disabled. These can block the discovery process, also any physical firewall will almost certainly block the discovery process as well.

9.3.2 Trouble discovering a Digi device using Windows XP

Trouble discovering a Digi device using Windows XP with Service Pack 2: You will need to make sure that the Windows Firewall is disabled. By default it is enabled and will block the port that the discovery software uses to discover Digi. To disable the firewall go to Start> Settings> Control Panel> Windows Firewall; then click the off button to disable it.

9.3.3 Routers or Switches

Is there a router between the computer running the discovery utility and the Digi device itself? Normally, routers will block the discovery process. If possible remove them and use a hub instead. If there is a switch in between this may or may not be a problem. Occasionally they are configured to block the discovery traffic. If unsure use a hub or a direct Ethernet cable connection, also in case the port on your Router/Switch/Hub is at fault, try an alternative port as well.

9.3.4 Cabling

If nothing else works try using a direct crossover Ethernet cable directly between the computer and the Digi device. Another option is to try another Ethernet cable.

9.3.5 Ethernet LED

Check the Ethernet Link LED on the Digi device. Is it lit solid? If not, there is not a valid network connection and it will not be possible to discover the device.

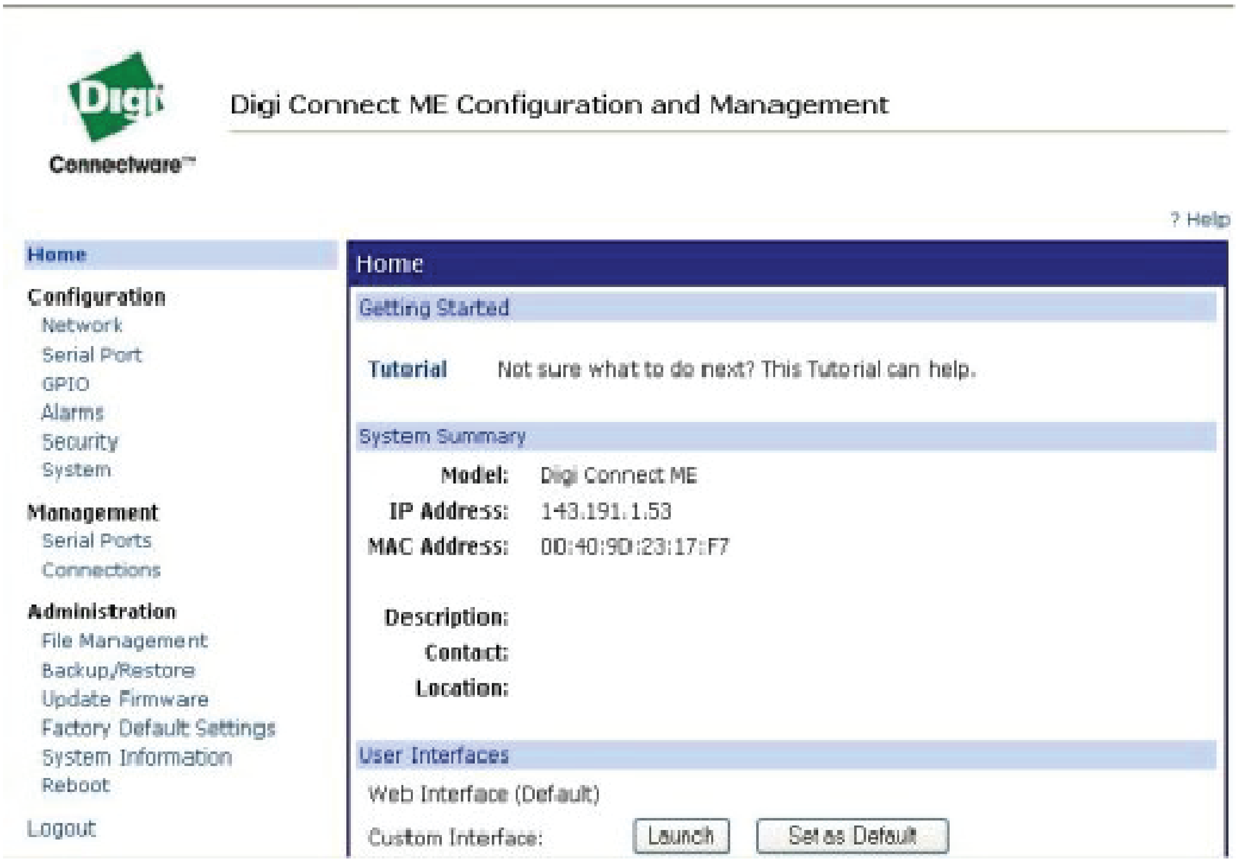
9.3.6 Network Adapters

Make sure the proper network adapter is enabled, also ensure all other network adapters are disabled. If more than one network adapter is enabled, this can cause the discovery process to fail.

9.4 Configuring the Network Settings

Device Discovery has the facility to quickly configure the unit to your own network, select **Configure Network Settings**, this brings up a new window which will give you the choice of letting Windows assign an IP address, or alternatively you can give the unit a fixed IP address.

Alternatively you can select **Open Web Interface**, which will open a login dialog box, the default username is **root** and the default password is **dbps**. Once entered it will connect you directly to the internal web browser, and open it on its home page as below:



However if you wish to use your favourite browser then simply navigate to the IP address that has been assigned to the unit, for example http://192.168.1.200.

Configure the device to your requirements. Use the help function F1, for assistance.

Note: To comply with Schedule 1 of The Product Security and Telecommunications Infrastructure (Security Requirements for Relevant Connectable Products) Regulations 2023 ("Security Requirements") UK, please change the username and password on setup.

10 WIFI CONFIGURATION

This unit uses a USR WIFI232-B2 Module. The WiFi module can be configured to provide an access point (for a WiFi device to connect to) or as a Station (to connect to an Access Point, or WiFi network), or both.

Providing an access point for a mobile device to connect to (enabling AIS data from the Receiver or Transponder to be viewed on the device), it is only necessary to set-up the Application Settings – see 'Application Settings' below.

If the device also needs to connect to the Internet (to receive Map Data etc), it will be necessary to connect both the Mobile device, and the Receiver or Transponder to a WiFi access point / network which has an Internet Connection. On the Comar device, this is done by setting the WiFi module in STA (Station) Mode.

If the WiFi module is set to STA mode, it will no longer be possible to log-on to the Access Point to change / update the settings. Setting the WiFi module to 'AP+STA' operation, will allow it to work as an Access Point as well as a 'Station'. If you need to use STA mode, it is preferable to configure the WiFi module for 'AP+STA' operation.

10.1 Default Setting

By default, the WiFi module is set to AP (Access Point) Mode. The User name and Password for the Web Interface is:

- User Name (Account) = admin
- Password = admin

NOTE: Maintaining the default user & password provides no security for the Wifi connection. It is strongly suggested to change these via the web interface if required.

To restore the WiFi module to its default settings, use the 'WiFi Reset' button located on the underside of the device. This button can be accessed through the top-most hole on the bottom of the enclosure (furthest from the Ethernet port) using a pin or similar tool. Press and hold the button for 5 seconds, then release. The module will reboot with its default settings after approximately 10 seconds.

10.2 Web Configuration Interface

10.2.1 Connection

It is possible to connect to the Web Interface, and perform set-up operations using a mobile phone, however for ease, it is recommended to use a PC. No special software is required for configuration – all necessary settings can be made using a standard web-browser.

On the device, search for the WiFi Access point called 'USR-WIFI232-B2_xxxx, and connect to it.

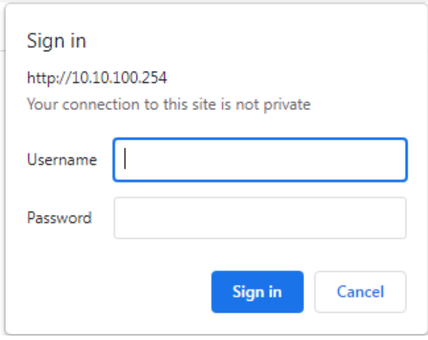
Once connected to the WiFi Access Point, open a web browser, and navigate to the address 10.10.100.254.

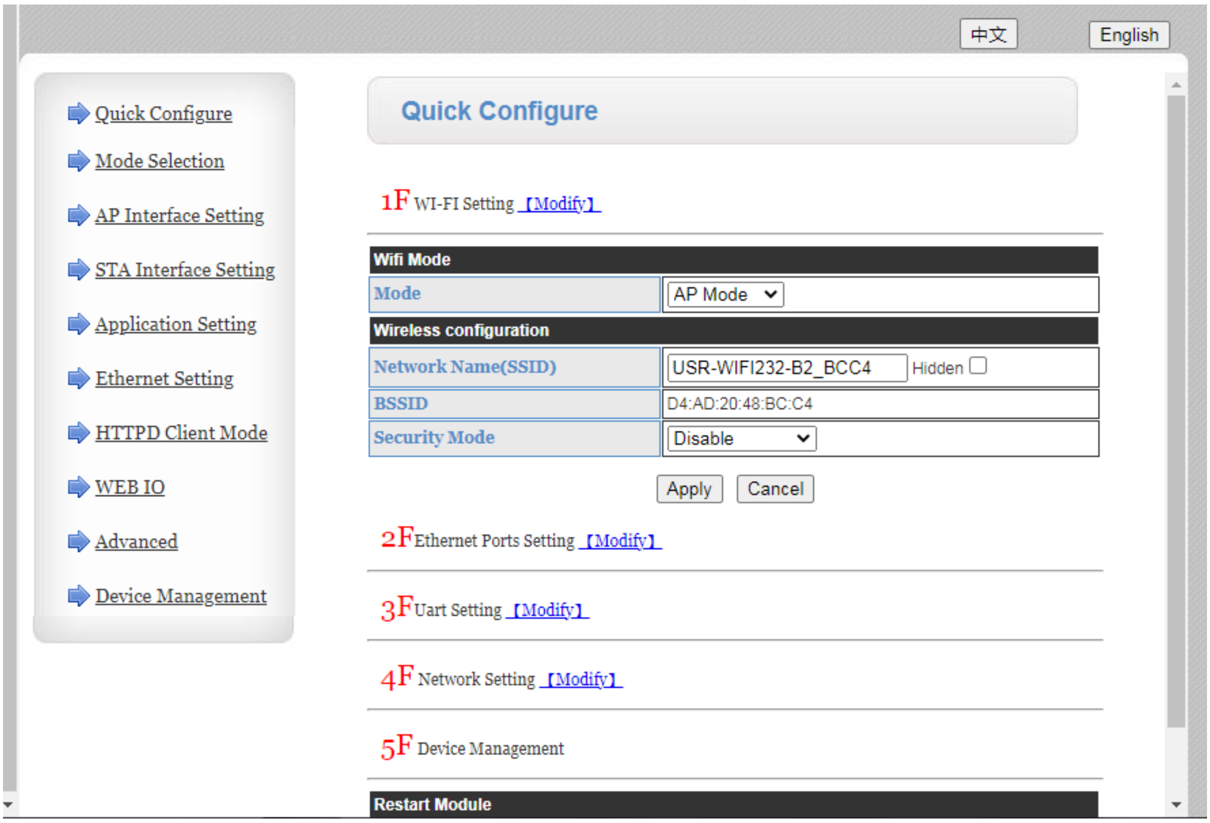
10.2.2 Log-in

When requested, enter the default Username and Password listed on the previous page.

The main page of the Web Interface presents various options which can be used for adjusting the relevant settings.

The Web Interface can display in English or Chinese by clicking the relevant button at the top right of the page.





The Page Links on the left-hand side can be used to access the various settings pages.

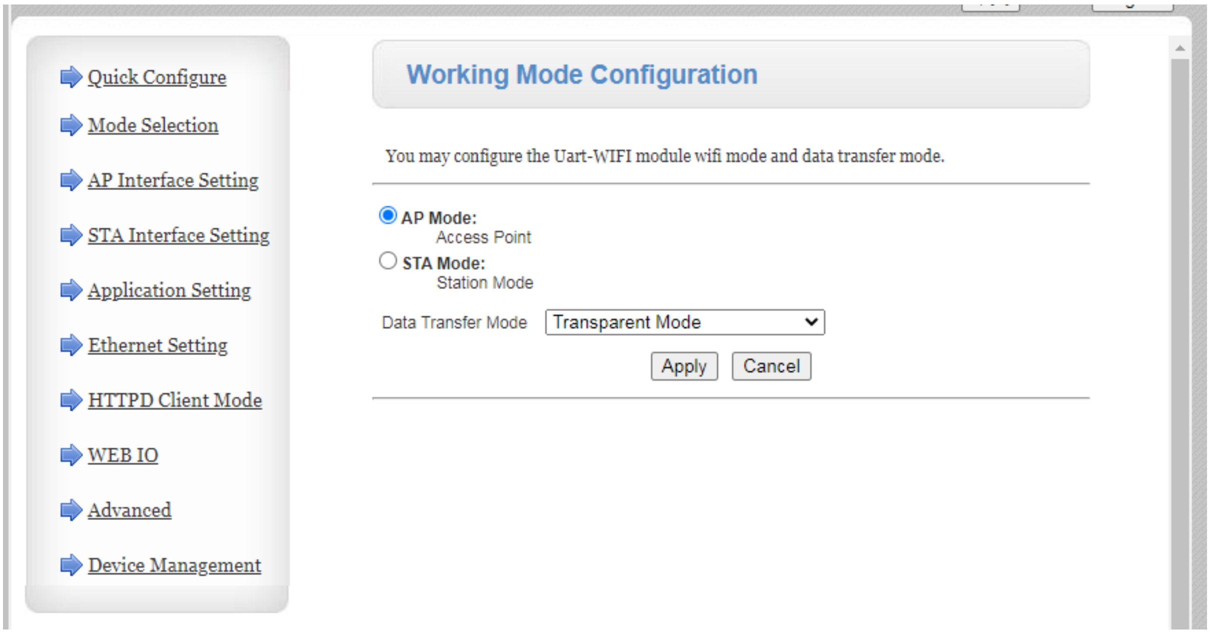
'Ethernet Setting', 'HTTPD Client Mode' and 'WEB IO' settings are not applicable to this application.

10.2.3 Applying Changes

When any changes are made to settings via the Web Configuration Interface, you should click the 'Apply' button underneath the section where the changes have been made. The page will instruct you to 'Restart to use new setting'. It is possible, and advisable to change all required settings before restarting the module.

10.3 Mode Selection

The *Mode Selection* page allows selection of the basic operation as AP or STA Mode, as well as the Data Transfer Mode



For Access Point only (a device can connect to the WiFi module directly, and receive AIS data) the Module needs to be set to AP Mode.

For Station Mode (e.g. to connect the Wifi Module to a Wifi router, so a device also connected to the router can get Internet access and AIS data), or for AP+STA operation (so the WiFi Module can work as a Station AND allow configuration via an Access Point), the Module needs to be set to STA Mode.

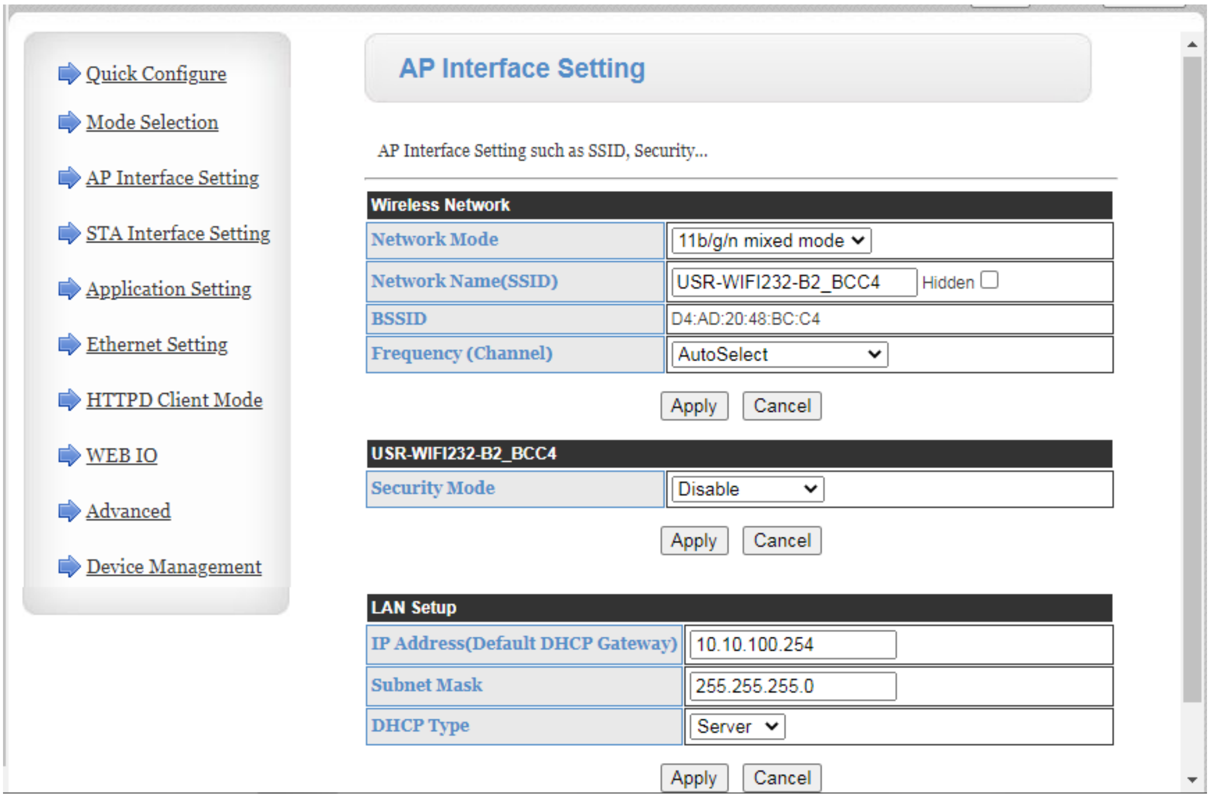
For AP+STA Mode, the Working Mode configuration must be set to STA Mode, and the AP+STA setting in the STA Settings page, must be set to ON.

For transmitting AIS data from the receiver / transceiver the Data Transfer Mode needs to be set to Transparent Mode).

10.4 AP Interface Setting

The *AP Interface setting* page allows configuration of the Access Point settings.

This applies in AP Mode, or in AP+STA Mode.



You can:

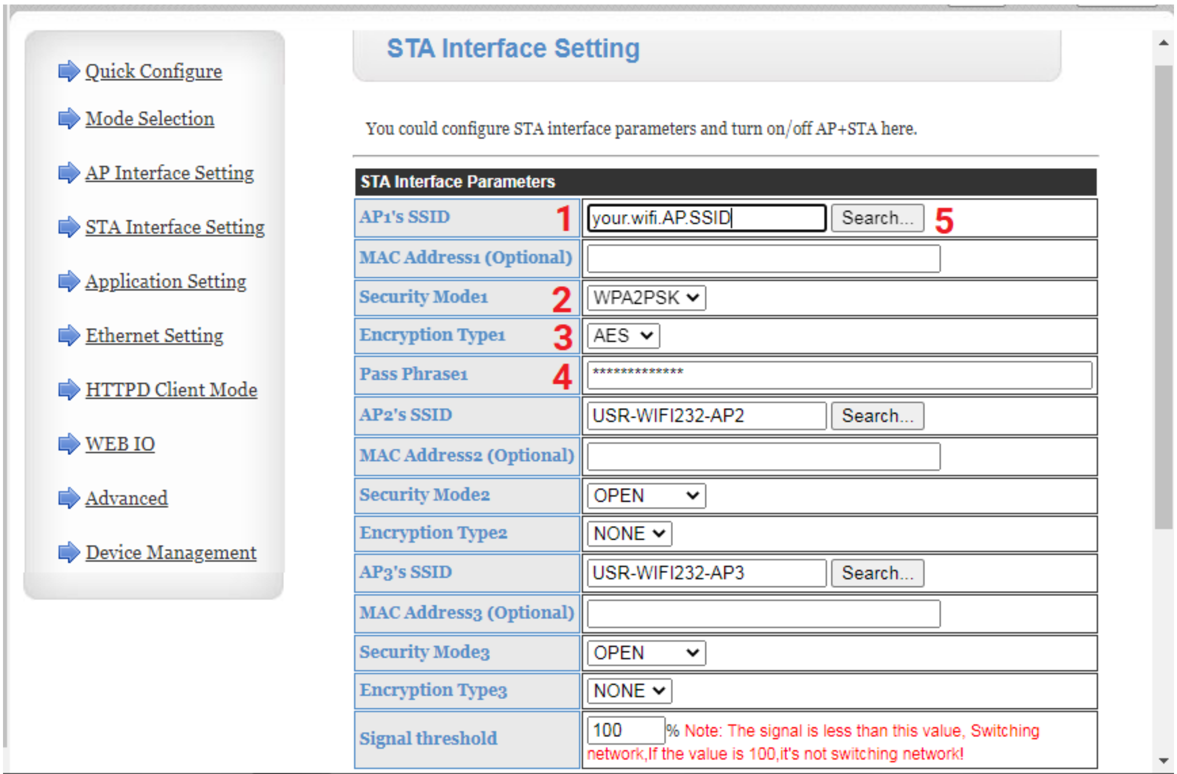
- Set the WiFi communication protocol, (Network Mode)
- Set the SSID (Network ID)
- View the MAC Address (BSSID)
- Set the WiFi Channel (Frequency) used

You can also set the Security Mode, WPA, and set a Password for the Access Point and set-up details of the IP Address, Subnet Mask, and DHCP Server status.

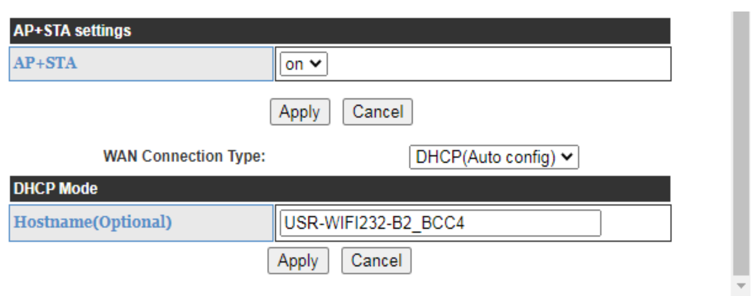
10.5 STA Interface Setting

The *STA Interface setting* page allows configuration of the STA settings. This applies in STA Mode, or in AP+STA Mode.

For STA Mode or AP+STA Mode, the Mode Selection needs to be set to STA Mode, before making the settings for STA Mode.



AP+STA Mode Setting



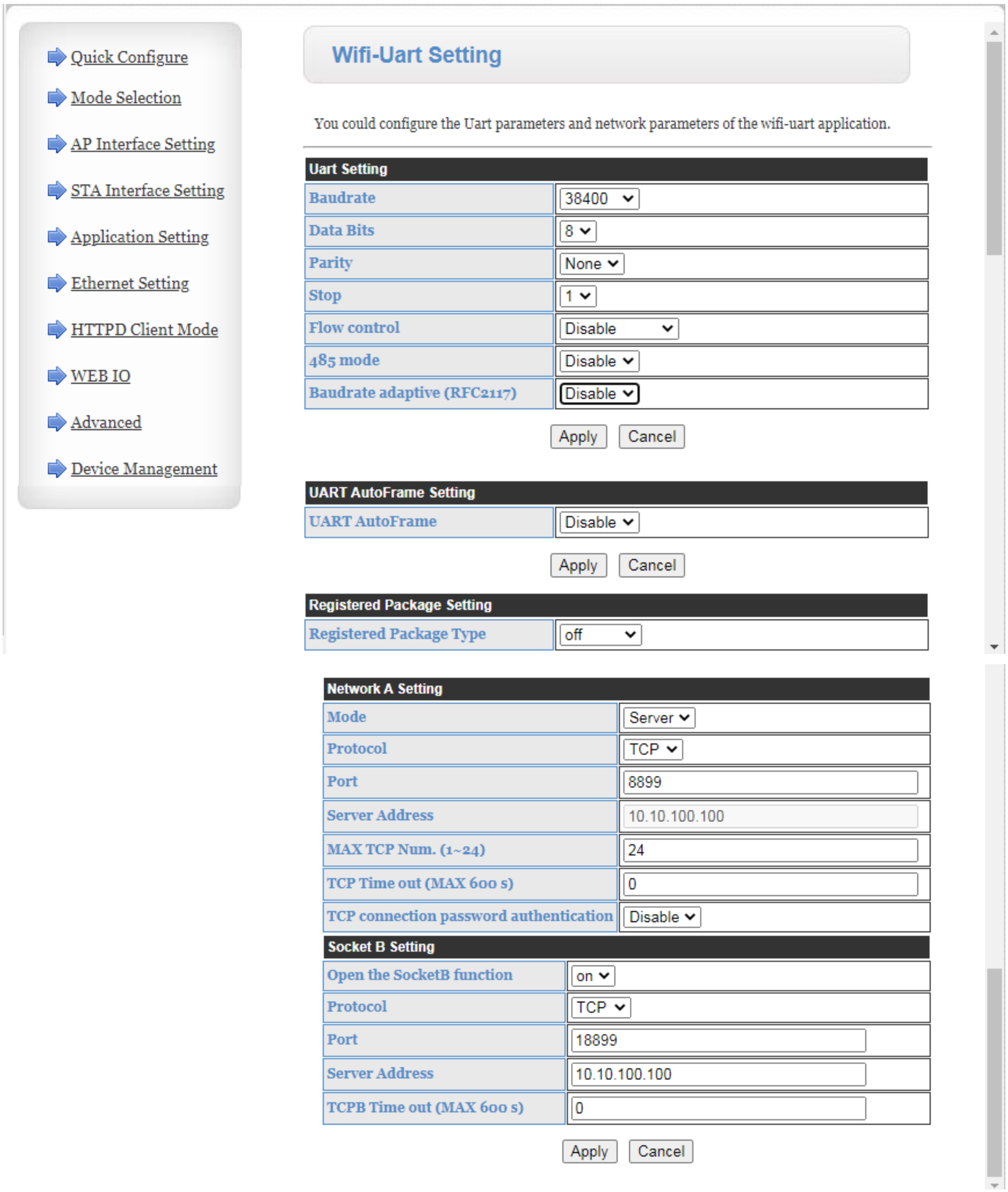
You can enter details (SSID (1), Security Mode (2), Encryption Type (3), and Password (Pass Phrase (4)) for the Access point you wish to connect to, or you can click the 'Search' button (5), to search for, and select an available WiFi Network. You will still need to enter the Password (4) for your chosen network)

The WiFi Module also has the ability to select and choose between up to 3 different Wifi Networks depending on Signal Strength.

Details should be entered for each and a signal level, below which module will look for an alternative network (from those entered).

10.6 Application Settings

The *Application Settings* page allows you to enter the communication parameters for the Ethernet communications, as well as the local serial port (for receiving the AIS data)



The UART Settings are the settings for the serial port input of the WiFi module which connects to the AIS Message data stream within the Comar device. For AIS devices, this should always be set to Baudrate = 38400, Data Bits = 8, Parity = None, Stop =1, Flow Control = Disabled, 485 mode = disabled, and Adaptive Baudrate = Disabled, as shown above.

The Network A setting is the primary method of transmission of AIS data over the WiFi connection. These will largely depend on the requirements of the application using the data.

It can be selected as Client or Server, and can use UDP or TCP protocol.

In TCP Server Mode, it can accept up to 24 simultaneous connections from (and therefore send AIS data to) TCP servers.

- In TCP Client Mode, is can connect to a single TCP server at a remote Address.
- In UDP Client mode, it can sent AUS data as UDP packets to a single IP address, but can also send data to any device on the local network (same sub-net) by using the UDP broadcast address (xxx.xxx.xxx.255).

Socket B Setting can be used as a secondary channel to send AIS data to a second application, but can only operate in Client mode.

10.7 Device Management

The *Device Management* page can be used to change the User Name (Account) and Password for the Web Configuration Interface log-in.

It also has a button for '*Restart Module'* which can be used, once all settings have been made, to restart the module, to the changes take effect.

Restart will take up to 10 seconds.

If the Access Point is still active in the new settings, and the settings for the access point have not been changed, the Device (Laptop) used, should automatically re-connect to the Access Point and refreshing the web page should return to the main page of the Web Interface.

11 TROUBLESHOOTING

11.1 No power LED

Check the power supply and that the unit is connected correctly to a 12 or 24V dc supply

Check the polarity of the supply is correct. The center pin of the 2.1mm jack is positive

11.2 Channel 1 and Channel 2 LEDs do not flash

Check that a VHF antenna is fitted and correctly connected

Check that the antenna is correctly positioned, i.e. at a suitable location to visibly ‘see’ vessels

11.3 Channel 1 and Channel 2 lights flash, but no data is received

If the red channel lights flash then data is being received from nearby vessels.

Check that the correct data cable is connected to the PC or NMEA device

Check on the PC application or device that the correct port is assigned and the correct baud rate is setup. The correct baud rate is 38,400

11.4 I can receive ships on my display, but no names are shown

Remember that the names of ships as well as other static information are only sent every 6 minutes or when requested by another station

12 SPECIFICATIONS

The R450 Series Units are compact dual channel synthesized VHF Receivers designed to receive and decode all transmissions from vessels fitted with Class A or B AIS transceivers, Aids to Navigation, and SARTS.

12.1 Physical	
Weight:	250 g
Dimensions:	L 140 mm × W 120 mm × D 37 mm
Mounting:	To flat surface, #6 (3.5 mm Dia) pan head screws
Connections:	RJ45 Ethernet 10/100 Base-T (Digi®) USB 2.0 Port: Type B BNC coaxial to VHF/AIS antenna R450-DG: TNC Coaxial to GPS antenna*
Construction:	ABS enclosure, PETG-CF connector panels
Finish:	Black fine-texture ABS
12.2 Electrical	
Power Supply:	12 V DC, 3 W nominal (9–30 V DC)
Antenna Impedance:	50 Ω
Data Output:	NMEA 0183 VDM message via USB, Ethernet, and Wi-Fi R450-DG includes GPS messages*
12.3 Operational	
Frequency	Channel A 161.975 MHz Channel B 162.025 MHz
Channel Spacing:	25 kHz
Sensitivity:	AIS: Up to -112 dBm @ 20% MER R450-DG GPS: Up to -163 dBm*
Demodulation:	GMSK
Data Rate:	9600
Antenna Impedance:	50 Ω
Display:	4 Indicator LEDs (On, Ch A, Ch B, WiFi)
Data Types Received:	Name of Vessel; MMSI Number; Position; Speed (SOG); Course (COG); Type of Vessel; Call Sign; Heading; Rate of Turn; Navigational Status; Vessel Dimensions; Destination

12.4 Environmental	
IP Rating:	IP40
Operating temp:	-15°C to +55°C
Compass:	Safe Distance 50 cm
12.5 Network	
WiFi Module:	Built-in, 2.4 GHz
WiFi Modes Supported:	Access Point, Station, AP+STA
WiFi Security:	WPA/WPA2, configurable SSID & password
WiFi Network Protocols:	TCP/IP, UDP/IP
LAN Network Protocols:	TCP/IP, UDP/IP, ARP, ICMP, TFTP, TELNET, DHCP, BOOTP, HTTP, AUTOIP
Data Output:	AIS (and R450-DG GPS*) as NMEA 0183 over TCP/UDP, or USB
LAN Connections:	1 each for TCP Client / Server. Up to 32 for UDP Client
WiFi/LAN Configuration:	Via integrated web interface
12.6 Additional	
Supplied:	R450-D AIS Receiver unit, or R450-DG AIS Receiver with Integrated GPS
Supplied:	Universal 100–250 V AC to 12 V DC Power Supply
Supplied:	BNC to UHF Antenna Connector Adaptor
Supplied:	2m Ethernet cable, 1m USB cable
Download:	Network configuration program
Download:	AIS viewing program
Download:	USB to virtual COM port driver

*Applies to R450-DG Units Only

13 TRANSMISSION SPECIFICATION

13.1 Class A AIS Units

Static information:
Transmitted every 6 minutes, or immediately when amended or upon request.

Dynamic information:
Transmitted based on vessel speed and whether the course is changing.

Class A Shipborne Mobile Equipment Reporting Intervals:

Ship's Dynamic Condition	Reporting Interval
At anchor or moored, speed ≤ 3 knots	3 minutes
At anchor or moored, speed > 3 knots	10 seconds
Underway, 0–14 knots	10 seconds
Underway, 0–14 knots and changing course	3 1/3 seconds
Underway, 14–23 knots	6 seconds
Underway, 14–23 knots and changing course	2 seconds
Underway, >23 knots	2 seconds
Underway, >23 knots and changing course	2 seconds

13.2 Class B AIS Units

Static Information:
Transmitted every 6 minutes

Dynamic Information:
CSTDMA (Carrier Sense Time Division Multiple Access) – less advanced & typical of most leisure Class B units:

- Every 3 minutes if vessel speed is ≤ 2 knots
- Every 30 seconds if vessel speed is > 2 knots

SOTDMA (Self-Organised Time Division Multiple Access) – Used by Class B SOTDMA units like the Comar T350B:

- Every 15 seconds while underway
- Slot reservations and retransmissions follow the same method as Class A
- Offers higher transmission priority, increased reliability, and better performance in busy areas compared to CSTDMA.

> **Note: While the standard interval for SOTDMA Class B is 15 seconds, some units may transmit more frequently (e.g. every 5 seconds) when course changes are detected, depending on manufacturer implementation.**

14 COPYRIGHT

15 LIMITED WARRANTY

Comar Systems Ltd warrants this product to be free from defects in materials and manufacture for one year from the date of purchase. Comar Systems Ltd will, at its sole option, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and labour. The customer is, however, responsible for any transportation costs incurred in returning the unit to Comar Systems Ltd.

This warranty does not cover failures due to abuse, misuse, accident or unauthorised alteration or repairs.

The above does not affect the statutory rights of the consumer.

Changes or modifications not made by Comar Systems or an authorised repairer will: (1) Void the warranty issued by Comar Systems (2) Void the user's authority to operate the equipment.

> **Note: Every effort has been made to ensure that all information contained in this manual is accurate at the time of going to press. We therefore cannot take any responsibility for the content of this manual and advise that you take normal steps to ensure that the information is at its most current when you are reading this manual.**

COMAR SYSTEMS
Vittlefields Technology Centre
Forest Road
NEWPORT
Isle of Wight
PO30 4LY
UNITED KINGDOM

tel: +44 (0)1983 828900

email: sales@comarsystems.com
web: www.comarsystems.com