

QK-A027 Manual

Wireless AIS + GPS Receiver

With SeaTalk™ converter + WiFi



Designed in UK



Features

- Two independent receivers monitoring both AIS channels (161.975MHz & 162.025MHz) and decoding both channels simultaneously
- Sensitivity up to -104 dBm@30% PER
- Up to 30 nautical miles receiving range
- Powered by the SeaTalk bus (12V)
- NMEA 0183 message output through WiFi, USB and RS422
- Configurable baud rates: (4800bps, 9600bps, 38400bps input and output)
- Default baud rates set to 38400bps output (Can be changed through Configuration software)
- Simultaneous wireless and USB output
- The internal WiFi access point connects up to 4 devices simultaneously
- Ad-hoc and Station operating modes
- SeaTalk to NMEA 0183 protocol converter
- Built-in GPS to provide positional data
- Combines GPS and AIS messages with NMEA 0183 and outputs as a seamless stream of data
- BNC connector for 50 Ohm VHF antenna
- Powered SMA connector for 50 Ohm GPS antenna
- Plug & Play connectivity with chart plotters and PCs
- Compatible with Windows, Mac, Linux, Android and iOS (Initial Configuration must be completed using Windows software.)
- This device connects to NMEA 0183 and is compatible with RS422 output devices. NMEA 0183-RS232 devices can connect to our device by using the Protocol Bridge (QK-AS03)
- This device does not come pre-loaded with map data. We advise using openCPN for map data. Some iOS apps may charge for map use

* SeaTalk™ is a family of proprietary maritime communications protocols developed by Raymarine

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1. Introduction

1.1. What is AIS?

The marine Automatic Identification System (AIS) is a location and vessel information reporting system. It allows vessels equipped with AIS to automatically and dynamically share and regularly update their position, speed, course and other information such as vessel identity with similarly equipped vessels. Position is derived from the Global Positioning System (GPS) and communication between vessels is by Very High Frequency (VHF) digital transmissions. There are a number of types of AIS device, like Class A transceivers/transponders, Class B transceivers/transponders, AIS base stations, Aids to Navigation (AtoN) and AIS receivers.

1.2. The A027

The A027 is a compact dual channel marine AIS receiver which receives information from both AIS frequencies simultaneously.

QK-A027 is aimed at the small-commercial, leisure, fishing boat and vessel monitoring markets. Connected to an on-board PC running compatible software, or a chart plotter, AIS data transmitted from ships within range will be displayed on the screen enabling the skipper or navigator to visualize the traffic within VHF range. Using A027 can enhance safety at sea by providing proximity, size and directional information from other vessels, improve safety and efficiency in navigation and help protect the marine environment.

The A027 is powered by 12V from the SeaTalk¹ bus. It also reads the SeaTalk¹ data and converts the supported messages to NMEA 0183. A027 combines these converted SeaTalk¹ messages with the AIS and GPS messages. This single NMEA 0183 data stream is then transmitted synchronously via NMEA 0183, USB and WiFi. A027 model includes an integrated GPS module, this provides GPS data to all outputs when it is connected to a GPS antenna (SMA connection type).

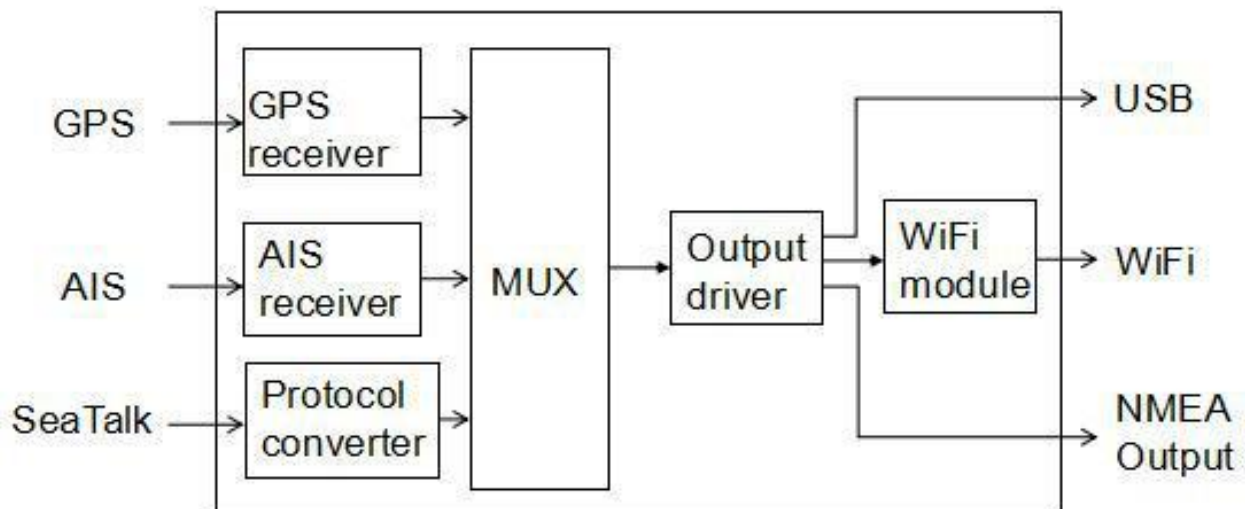


Figure 1: A027 Function diagram

2. Connections

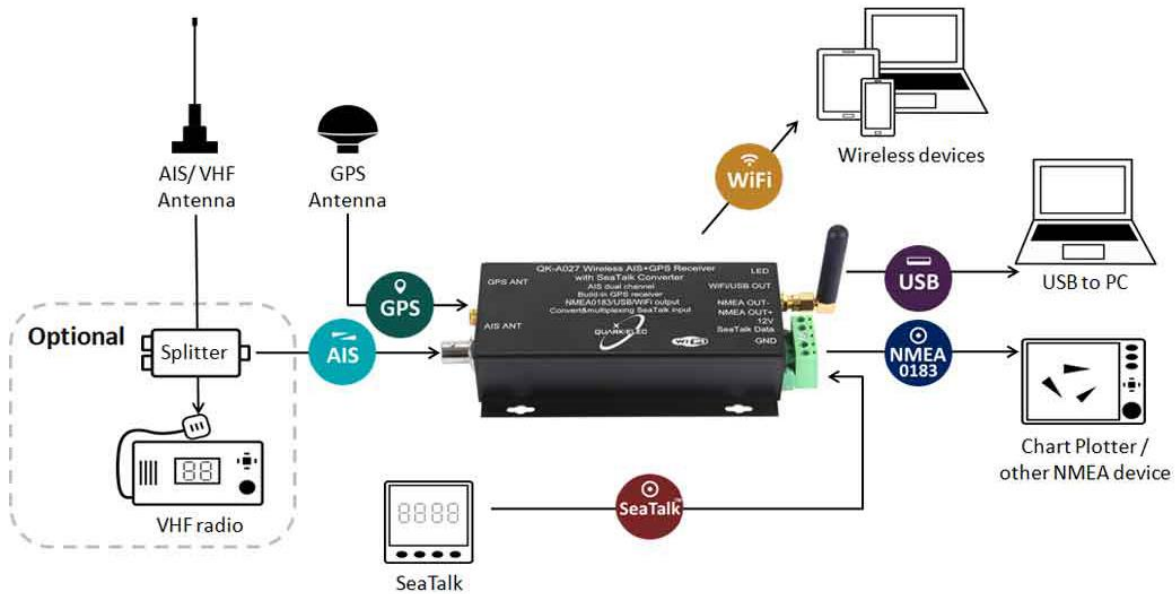


Figure 2: Typical system connection

A027 has the following electrical connections/indicators:

- **AIS antenna connector.** Standard BNC female 50 Ohm connector. An active VHF antenna splitter is required if one VHF antenna is shared by the A027 and a VHF voice radio. (we recommend separate antennas ideally.)
- **GPS connector.** Standard SMA female 50 Ohm connector for GPS antenna. An integrated GPS module supplies positional data provided a GPS antenna is connected. GPS information can be output via WiFi, USB or NMEA.
- **SeaTalk¹ input connection.** The SeaTalk¹ port has a 3-Pin terminal for connection to the SeaTalk¹ bus. As well as being powered by the SeaTalk¹ bus, the A027 also listens on the SeaTalk bus and converts any supported SeaTalk Datagrams to NMEA 0183. In this way, data from SeaTalk¹ equipment, like wind, depth or heading sensors, can be viewed on NMEA chartplotters via the NMEA output. This data is also sent out via USB and WiFi.
- **NMEA 0183 output connector.** The A027 sends out the combined AIS, GPS and SeaTalk (converted to NMEA) messages via the NMEA 0183-RS422 output at a baud rate of 38400bps as default. Baud rates can be configured if required.
- **USB connector.** A micro type C USB connection outputs all NMEA messages. The USB connection is also used to adjust optional settings parameters using the Configuration software.
- **WiFi.** Connectivity in both Ad-hoc and Station Modes on 802.11 b/g/n provides WiFi output of all messages.
- **LED lights.** The A027 features three LEDs which indicate power, AIS and GPS status respectively. Three LEDs turn on and then off after initialization. When operating, these LEDs flash. See [LED section](#) for more LED information.

3. Installation and Operation

3.1. Mounting

Location: Although the A027 comes with an extruded aluminium enclosure to shield it from external RF interference, it should not be fitted close to generators or compressors (e.g. refrigerators) as they can generate substantial RF noise. It is designed to be installed in a protected indoor environment. Generally, a suitable placement of A027 is together with other types of navigation equipment and the PC or chart plotter that will be used to display the output data. The A027 is designed to be securely mounted to a suitable bulkhead or shelf in an indoor environment and needs to be placed where it is well protected from humidity and water.

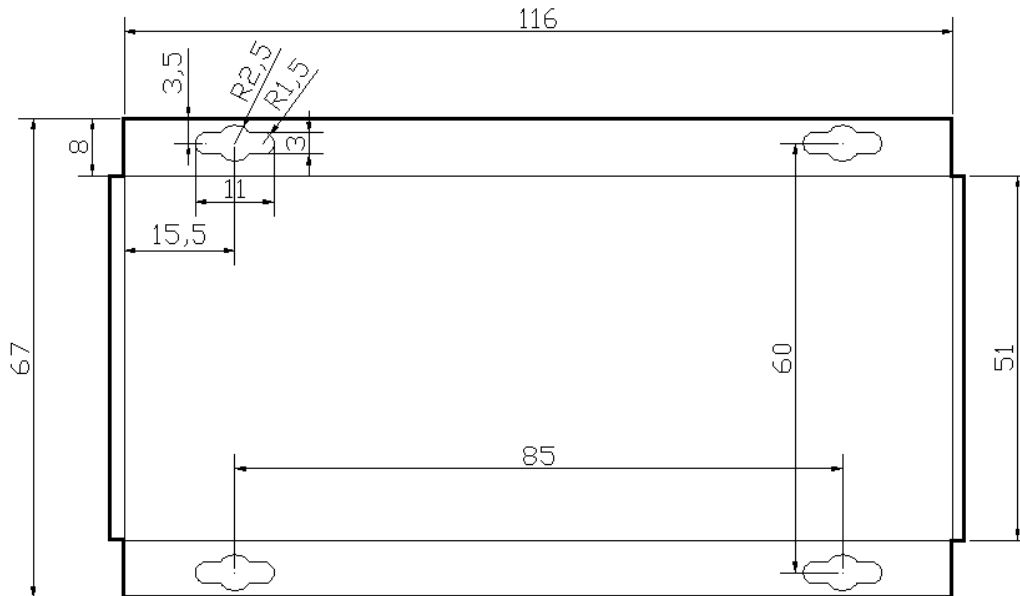


Figure 3:Dimensions

3.2. Power

A027 runs on 12V DC and is powered through the SeaTalk bus. Ensure this is connected correctly to avoid damage.

3.3. VHF/AIS Antenna

The A027 is not supplied with a VHF antenna, as the antenna and cable requirements differ from vessel to vessel. A suitable VHF antenna must be connected before the receiver will operate fully.

AIS communication systems use frequencies in the maritime VHF band, which is considered to be 'line of sight' radio. This means that if an AIS receiver's antenna cannot 'see' the antennas of other vessels, the AIS signals from vessels will not reach that receiver. In practice, this is not a strict requirement, a few buildings and trees between may be fine. Large obstacles such as hills and mountains, on the other hand, will significantly degrade the AIS signal.

To have the best possible receiving range, the AIS antenna should be placed as high as possible with a relatively clear view of the horizon. Large obstructions might shade the AIS radio communication from certain directions, giving uneven coverage.

VHF antennas can be used for AIS messages or Radio communications. One antenna cannot be connected to both AIS and VHF radio equipment unless an active VHF/AIS splitter is used.

There are important considerations when deciding whether to use two separate antennas or a combined antenna:

- 2 VHF antennas: The best reception is achieved by using two separate antennas, one for AIS and one for VHF radio. The antennas must be separated as much space as possible (ideally at least 3.0 meters). A good distance between the AIS VHF antenna and the radio communication VHF antenna is required to avoid interference.
- 1 shared VHF antenna: If using only one antenna, e.g. Using an existing VHF radio antenna to receive AIS signals, proper separation equipment (an active VHF Splitter) must be installed between the antenna and the connected equipment.



Figure 4: GPS (SMA) and AIS (BNC) antenna connections

3.4. GPS input

The A027 uses a standard SMA female 50 Ohm connector for connecting to a GPS antenna (antenna not included).

For best results, the GPS antenna should be located in 'line of sight' of the sky. Once connected to a GPS antenna, the integrated GPS module supplies positional data to the NMEA 0183 output, WiFi and USB, synchronously.

3.5. NMEA output connection

The NMEA 0183 output port allows for connection to NMEA 0183 instruments and chart plotter.

The built-in multiplexer combines the SeaTalk¹ input data (e.g. wind/depth) with the AIS and GPS and sends the combined data stream to the NMEA 0183 output port (and other outputs).

3.5.1. NMEA 0183 Default Baud Rates:

'Baud rates' refer to the data transfer speed. When connecting two NMEA 0183 devices, both devices' baud rates, must be set to the same speed.

The A027 output port's default baud rate is 38400bps. The connected chart plotter should be configured at this rate to receive the proper data as AIS data requires this higher speed.

This is the default baud rate settings and is most likely to be the baud rates required, however, the baud rate is configurable if required. Baud rates can be adjusted using the Configuration software. (See Configuration section)

3.5.2. NMEA 0183 RS422 / RS232:

A027 uses the NMEA 0183-RS422 protocol (differential signal), however some chart plotters or devices may use the older NMEA 0183-RS232 protocol (single-ended signal).

Check which protocol your connecting NMEA devices (e.g. Chart plotter/wind sensor) use. If you are unsure whether your connecting devices use the NMEA 0183 RS422 or RS232, the input/output connections on the device will give you some indication.

Unfortunately, manufacturers who use the older RS232 protocol are not consistent in their product labelling. The following table may help you identify which protocol your product uses, however always check the manual to be certain.

RS422 (Differential)	RS232 (single-ended)
TX+ and TX- / RX+ and RX-	TX+ and TX- (GND) / RX+ and RX- (GND)
	TXa+ and TXa- (GND) / RXa+ and RXa- (GND)
	Output +Ve and -Ve / Input +Ve and -Ve
Occasionally older NMEA 0183 RS232 devices are labelled like RS422 (TX+ and TX- / RX+ and RX-) so check the products' manuals.	

If your connecting device uses the older RS232 protocol, use a QK-AS03 Protocol Bridge for your connection. The QK-AS03 connects and converts RS422 to the older RS232 and visa-versa, through a simple connection, no configuration needed.

3.6. SeaTalk¹ input connection

- The built-in SeaTalk¹ to NMEA converter translates SeaTalk data into NMEA sentences. The SeaTalk port has 3-Pin terminals for connection to the SeaTalk bus. The A027 utilizes the power supply from the SeaTalk¹ bus. Ensure the connection is correct before powering up. Incorrect connection could damage the A027 and other devices on the SeaTalk Bus.

When a SeaTalk message is received, the A027 checks if the message is recognized and should be processed. When the message is recognized by the SeaTalk¹ messages table, the message is extracted, stored and converted to an NMEA sentence. Any unknown datagram is ignored. These converted NMEA messages are then combined with GPS and AIS messages internally. This function allows a SeaTalk¹ instrument to communicate on an NMEA network. Only one SeaTalk¹ input is needed since the SeaTalk¹ bus is a single-cable system that connects all the instruments together through one cable. SeaTalk¹ to NMEA converter in the A027¹ works in one direction only. No NMEA sentences are converted into SeaTalk¹, the multiplexer simply listens on the SeaTalk bus.

Supported SeaTalk Datagram's		
SeaTalk	NMEA	Description
00	DBT	Depth below transducer
10	MWV	Wind angle, (10 and 11 combined)
11	MWV	Wind speed, (10 and 11 combined)
20	VHW	Speed through water, includes heading when present
21	VLW	Trip mileage (21 and 22 combined)
22	VLW	Total mileage (21 and 22 combined)
23	MTW	Water temperature
25	VLW	Total and Trip mileage
26	VHW	Speed through water, includes heading when present
27	MTW	Water temperature
50	---	GPS latitude, value stored
51	---	GPS longitude, value stored
52	---	GPS speed over ground, value stored
53	RMC	Course over ground. RMC sentence is generated from stored values from other GPS related datagrams
54	---	GPS time, value stored
56	---	GPS date, value stored
58	---	GPS lat/long, values stored
89	HDG	Magnetic heading, including variation (99)
99	---	Magnetic variation, value stored

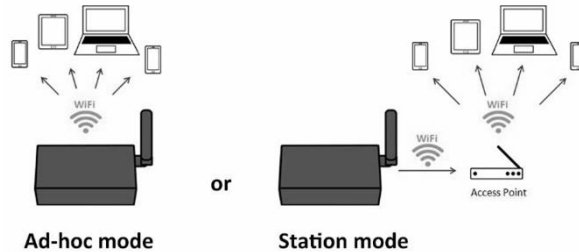
The table shows that not all datagrams result in an NMEA 0183 sentence. Some datagrams are only used to retrieve data, which is combined with data from other datagrams to be able to create one NMEA 0183 sentence.

3.7. WiFi Output

The A027 allows users to view their data through WiFi on a PC, tablet, smartphone or other WiFi enabled device. Users can access marine network data including vessel course, speed, position, wind speed, direction, water depth, AIS etc. These can be viewed in the chart software.

The IEEE 802.11b/g/n wireless standard has two basic modes of operation: Ad-hoc mode (peer to peer) and Station mode (also called infrastructure mode).

The A027 supports 2 working modes.



- In **Ad-hoc mode**, wireless devices connect directly (peer to peer) without a router or access point. For example, your smartphone can connect directly to the A027 to receive marine data.
- In **Station mode**, wireless devices communicate through an access point (AP) such as a router that serves as a bridge to other networks (such as the Internet or LAN). This allows your router to handle the data and traffic from your device. This data can then be picked up through your router anywhere on your local area network. Increasing the WiFi range. Similar to plugging the device directly into the router, but using wireless technology. In this way, the mobile devices receive both your marine data and other AP connections such as Internet.

A027 is set to Ad-hoc mode as a default setting, but can be easily setup to Station mode or standby mode through the configuration tool. (See Configuration section)

3.7.1. WiFi Ad-hoc mode connection

From a Phone, Tablet or PC:

Once the A027 has powered up, scan for a WiFi network with an SSID of 'QK-A027xxxx' or similar.

Connect to 'QK-A027xxxx' with the default password: '88888888'.

A027 SSID	Similar to 'QK-A027xxxx'
WiFi password	88888888

- Note: The SSID and password can be changed if desired. The password must be 8 to 12 characters long. If changing the SSID and password, the A027 should be reset to activate the settings. (The IP address, Gateway, Net Mask and Port can be left blank if no fixed IP address is needed.)

In your chart software (or chart plotter):
Set the protocol to 'TCP', IP address to '192.168.1.100' and the port number to '2000'.

Protocol	TCP
IP address	192.168.1.100
Data Port	2000

- Note: In Ad-hoc mode, the IP address should not be changed.

With the above settings, a wireless connection is established and the user will receive the data through the chart software. (More information in the Chart software section)

The wireless connection and data flow can be checked with TCP/IP port monitoring software.

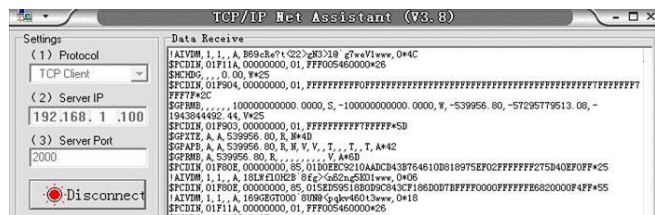


Figure 5: TCP/IP Net Assistant example

- To Configure Station mode WiFi see the Configuration section.

3.8. USB connection

The A027 is supplied with a USB connector. This connector provides the AIS and GPS data output as standard (multiplexed information from SeaTalk instruments will also be sent via these connections). This USB connector can be linked directly to a USB port on a PC.

3.8.1. Will you need a driver to connect via USB?

To enable the USB data connection of A027 to other devices, related hardware drivers may be needed dependent on your system requirements.

Mac:

No driver required. For Mac OS X, the A027 will be recognized and shown as a USB modem. The ID can be checked with the following steps:

1. Plug the A027 into a USB port and launch Terminal.app.
2. Type: `ls /dev/*sub*`
3. The Mac system will return a list of USB devices. A027 will display as - `"/dev/tty.usbmodemXYZ"` where XYZ is a number. Nothing further needs to be done if it is listed.

Windows 7,8,10:

The drivers usually install automatically if your device is running an original Windows 10 version. A new COM port will automatically show up in the device manager once powered and connected via USB.

The A027 registers itself to the computer as a virtual serial com port.

If the driver does not install automatically, it can be found on the included CD and downloaded from www.quark-elec.com.

Linux:

No driver required. When plugged into the computer, A027 will show up as a USB CDC device on `/dev/ttyACM0`.

3.8.2. Checking the USB connection (Windows)

After the driver is installed (if needed), run the Device Manager and check the **COM (port) number**. The port number is the number assigned to an input device. These can be generated randomly by your computer).

Your chart software may require your COM port number in order to access the data.

The port number for the A027 can be found in Windows 'Control Panel>System>Device Manager' under 'Ports (COM & LPT)'. Find something similar to 'STMicroelectronics Virtual Com Port' in the list for the USB port. If the port number need to be changed for some reason, double click the A027 and select the 'Port Settings' tab. Click the 'Advanced' button and change the port number to the one required.

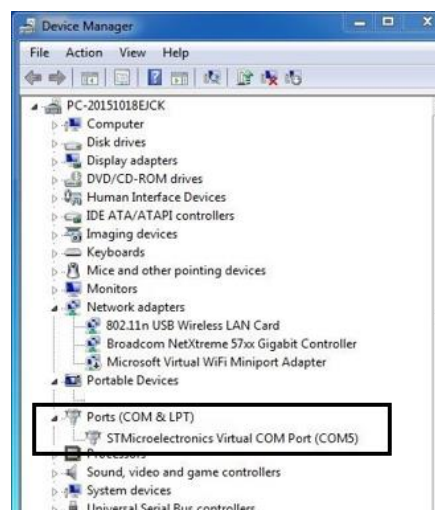


Figure 6: View of COM port in Device Manager

The USB connection status can always be checked with a terminal monitor application like Putty or HyperTerminal. Ensure that the COM port is set at 38400bps, 8, N and 1 as shown below using HyperTerminal on Windows as an example.

To use a terminal monitor application, first connect A027 to the computer, follow the instructions to install the driver if required. After the driver is installed, run the Device Manager and check the COM (Port) number.

HyperTerminal example. Run HyperTerminal, ensure that the COM port is set at 38400bps (if using the default A027 settings), 8, N and 1.

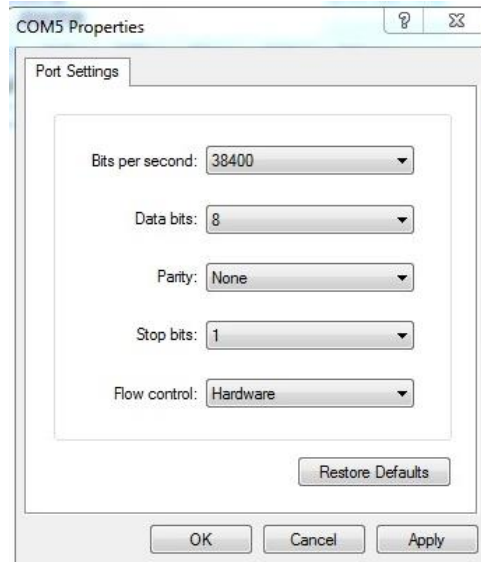


Figure 7: HyperTerminal settings

If all the above is set up correctly, similar AIS messages to the examples below should be shown.

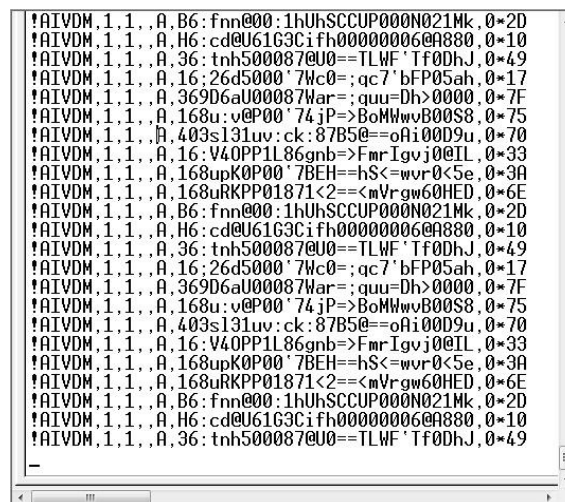


Figure 8: Display on HyperTerminal

4. LEDs

Three LEDs indicate the operation of the A027. When operating, these LEDs flash as below:

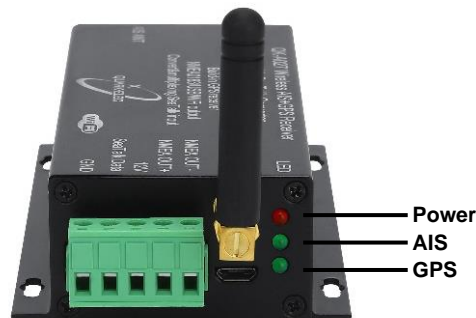


Figure 9:LED indications

Power: Top LED flashes at 3 second intervals.

AIS: Middle LED Flashes for each valid AIS message received.


GPS: Bottom LED Flashes every second while receiving a valid message.

5. Configuration

Quark-Elec Windows configuration tool can be used to setup the NMEA 0183 baud rates and WiFi settings for the A027. The free Configuration software comes with the CD provided or is available to download at https://www.quark-elec.com/doc/QE_MUX_configTool.zip

The configuration tool must be used when plugged into a windows PC via USB cable. The tool cannot be accessed via WiFi.

For extra instructions for using the configuration tool go to https://www.quark-elec.com/doc/QK-A0xx_GUI_application_note.pdf

 The configuration tool must not be opened while other programs are using the A027. Close down all applications using the A027 before using the configuration tool.

5.1. Configuring Baud Rates

1. NMEA 0183 input baud rates can be setup from the dropdown menus.
2. When the A027 is connected to a computer (Windows system) and powered up, 'A027 connected' will be shown at the centre of the bottom and the software version shows at the bottom right. A027 can work with the standard NMEA 0183 devices (4800bps) or the high-speed NMEA 0183 devices (38400bps).
3. Select the desired baud rate.
4. Click '**Config**' save your settings to the A027.
5. Click '**Disconnect**'.
6. Re-power the A027 to activate the new settings to the device.

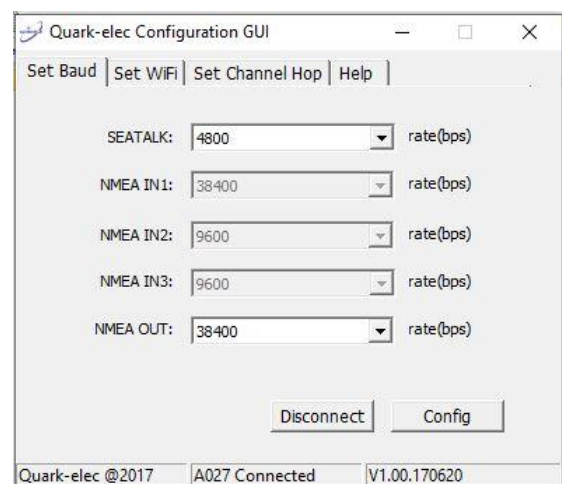


Figure 10: Baud rates

5.2. Configuring Station mode WiFi

WiFi is set to Ad-hoc mode as standard (see “[WiFi Ad-hoc mode connection](#)” chapter). Station mode however, allows your router/access point to handle the data from your device. This data can then be picked up through your router anywhere on your local area network (Similar to plugging the device directly into the router, but using wireless technology). This allows your mobile device to still receive Internet while viewing your marine data.

More and more vessels have a wireless onboard network for access to the internet. In most cases the network is created by using a 3G/4G connection. iOS devices, tablets, mobile phones can all access the internet to obtain weather forecasts, send/receive email and access many other internet services via onboard WiFi.

Although switching between the A027 WiFi network and any onboard wireless network is simple and quick, it can be advantageous to integrate the two networks and allowing operators to receive the A027 multiplexer output through the onboard WiFi network. This way, operators can access the Internet while receiving the NMEA 0183 messages without having to switch between the 2 access points. To work in this way, operators should set up the A027 in Station mode through A027 Configuration software.

To begin setup Station mode the A027 should be connected via USB to a computer running Windows (Mac users can use BootCamp).

1. Connect the A027 to computer via Micro USB B connection.
2. Run the Configuration software (having closed any other programs that would access the A027) and check connection to the A027 at the bottom of configuration tool.
3. Change working mode to ‘**Station mode**’
4. Enter your router’s **SSID**.
5. Enter the **password** for your network.
6. Enter the **IP address** assigned to the A027. This normally start with 192.168. The third group of digits depends on your router’s configuration (commonly 1 or 0). The fourth group must be a unique number between 0 and 255) This number must not be used by any other equipment connected to your router.
7. Enter your **router’s IP address** in the **Gateway** section. This can usually be found under the router. Leave the other settings as they are.
8. Click ‘**Config**’ in the bottom right hand corner and wait 60 seconds. Click ‘**Disconnect**’.
9. Repower the A027 and it will now attempt to connect to the router.

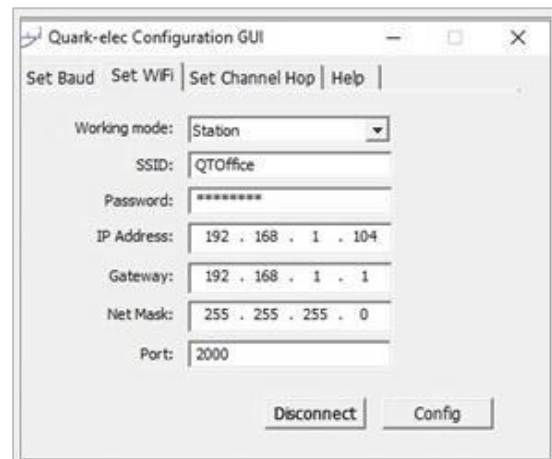


Figure 11: Station mode settings (Example only)

In your chart software, set the protocol as ‘**TCP**’, insert the **IP address** you assigned the A027 and enter the Port number as ‘**2000**’.

You should now see your marine data in your chart software. If not, check your router’s **IP address list** and confirm the **IP address** that your router has assigned the A027. Occasionally, a router assigns a different **IP address** to a device than the one you chose to assign it during configuration. If this is the case, copy the IP address from the router into your chart software.

If the **IP address** in the router’s **IP address list** matched the one inputted into the chart software, everything will work in Station mode.

If you are not able to view your data in Station mode, the likely cause is either the data has been input incorrectly, or the IP address is different in your chart software to that of your router.

6. Chart software

There is a wide range of chart software is available, for example:

- <https://opencpn.org/> OpenCPN (Open Chart Plotter Navigator) is a free software project to create concise chart plotter and navigation software, for use underway or as a planning tool. OpenCPN is developed by a team of active sailors using real world conditions for program testing and refinement.
- <https://www.navionics.com/gbr/apps/navionics-boating>

We will use OpenCPN for our example, other software will require similar setup.

The following is a sample setting for the OpenCPN plotter. COM2 was set as the A027 input and in this case COM1 was used for a standard serial port GPS input (however, A027 doesn't need a separate GPS input).

6.1. Chart Software USB setup (OpenCPN example)

When you open the software, you will be greeted with a page similar to the one below. (This is the main view of openCPN software.) You now need to add data to openCPN via your Quark-elec instruments.



Figure 12: OpenCPN main screen

1. Click on the **'Options'** tab at the top.
2. Select the **'Connections'** from the menu bar
3. Click on **'Add Connection'** button highlighted in the picture below
4. Select **'Serial'**
5. Select the **COM** number assigned to A027 (See connecting via USB to find the COM port in device manager)
6. Adjust the Baud rate accordingly (38400 covers AIS)

Click **'Apply'** and then **'OK'**

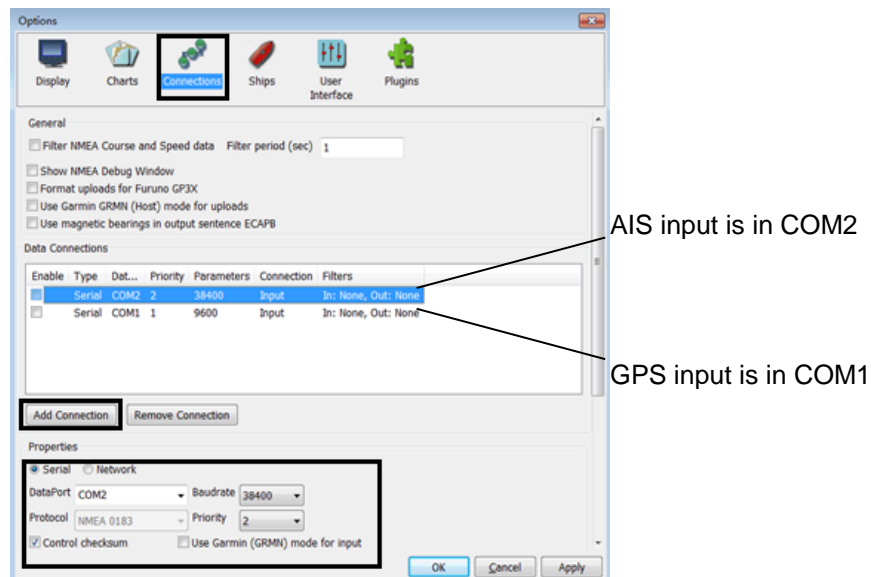


Figure 13: Serial port setting in open CPN (example)

6.2. Chart Software WiFi Network Setup (OpenCPN example)

For WiFi connection, 'Network' rather than 'Serial' needs to be selected in 'Connections->Properties' and the following settings need to be input.

1. Go to the '**Options**' tab as above to set up a wireless network connection
2. Select '**Connections**' tab at the top of the options menu
3. Click the '**Add connection**' button
4. Select '**Network**'
5. Input the Protocol: **TCP**
6. Insert IP address. In Ad-hoc mode (direct WiFi connect) this is **192.168.1.100**. (In Station mode then this will be a different IP address, see [WiFi Station Mode](#) section)
7. Input the 'DataPort': **2000**
8. Click '**Apply**' and then '**OK**'

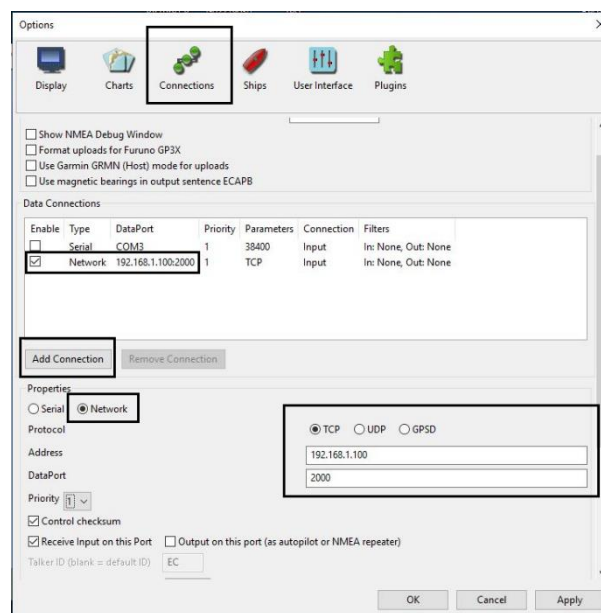


Figure 14: WiFi setting in OpenCPN (example)

6.3. Maps

OpenCPN interface comes with a basic map view. You can easily download more detailed maps.

There are a wide range of free and licensed charts available in different formats via the OpenCPN website at <https://opencpn.org/OpenCPN/info/chartsources.html>.

A worldwide directory of free nautical charts can also be found on openseachart.org. The collection and the updates are community driven.

These links are for your information only. Quark-elec cannot vouch for the accuracy of their information.

7. Specification

Item	Specification
Frequency bands	161.975MHz &162.025MHz
Operating temperature	-5°C to +80°C
Storage temperature	-25°C to +85°C
DC supply	SeaTalk ¹ bus (12V)
Maximum supply current	105mA
AIS receive sensitivity	-104dBm@30%PER
GPS receiver sensitivity	-162dBm
NMEA data format	ITU/ NMEA 0183 format
NMEA output data rate	38400bps
WiFi mode	Ad-hoc and Station mode on 802.11 b/g/n
Security	WPA/WPA2
Network Protocols	TCP

8. Limited Warranty and Notices

Quark-elec warrants this product to be free from defects in materials and manufacture for one year from the date of purchase. Quark-elec will, at its sole discretion, 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 Quark-Elec. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alteration or repairs. A returns number must be given before any unit is sent back for repair.

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

9. Disclaimer

This product is designed to aid navigation and should be used to augment normal navigational procedures and practices. It is the user's responsibility to use this product prudently. Neither Quark-elec, nor their distributors or dealers accept responsibility or liability either to the products user or their estate for any accident, loss, injury or damage whatsoever arising out of the use or of liability to use this product.

Quark- products may be upgraded from time to time and future versions may therefore not correspond exactly with this manual. The manufacturer of this product disclaims any liability for consequences arising from omissions or inaccuracies in this manual and any other documentation provided with this product.

10. Document History

Issue	Date	Changes / Comments
1.0	31-10-2017	Initial release
2.0	24-10-2018	New 2018 format
3.0	12-02-2020	New 2020 format
3.1	08-09-2020	New firmware(V1.20.20629) supports UDP protocol on WiFi
	15-05-2021	

11. Glossary

IP: internet protocol (ipv4, ipv6).

IP Address: is a numerical label assigned to each device connected to a computer network.

NMEA 0183: is a combined electrical and data specification for communication between marine electronics, where data transfer is one-directional. Devices communicate through talker ports being connected to listener ports.

Router: A router is a networking device that forwards data packets between computer networks. Routers perform the traffic directing functions on the Internet.

USB: cable for communication between devices.

WiFi - Ad-hoc mode: devices communicate directly with each other without a router.

WiFi - Station mode: devices communicate by going through an Access Point (AP) or router.

12. For more info...

For more technical information and other enquiries, please go to the Quark-elec forum at:

<https://www.quark-elec.com/forum/>

For sales and purchasing information, please email us: info@quark-elec.com

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