QUARK-ELEC

QK-A031 Manual

NMEA 0183 Multiplexer

With SeaTalk1[1*] Converter + WiFi

Features

- Multiplex up to three NMEA 0183 input devices
- Galvanically isolated NMEA and SeaTalk[1] input ports
- SeaTalk1[1] to NMEA 0183 protocol converter
- NMEA 0183 Differential NMEA output with galvanically isolated protection Configurable baud rates: (4800bps / 9600bps / 38400bps)
- Default baud rates set to 4800bps input and 38400bps output (adjustable through Configuration software)
- Wide range of power supply voltage tolerance (12V - 35V)
- Simultaneous wireless and USB output
- WiFi - the internal access point connects can connect to 4 devices simultaneously
- WiFi - Compatible with Windows, Mac, Linux, Android and iOS (Initial Configuration must be completed using Windows software)
- USB - Compatible with Windows
- This device connects to NMEA 0183 and is compatible with RS422 input/output devices. Older NMEA 0183-RS232 devices can be connected by using the Protocol Bridge (QK-AS03)

* SeaTalk[1TM] is a family of proprietary maritime communications protocols developed by Raymarine

Contents

1. Introduction

The A031 NMEA 0183 multiplexer enables the connection of multiple NMEA 0183 devices and a SeaTalk1[1] input, to NMEA chartplotters and wireless devices such as PCs, laptops and tablets. The A031 multiplexer has three NMEA 0183 inputs (listener-ports), one SeaTalk1[1] input, one NMEA 0813 output (talker-port), a WiFi output and a USB output.

The internal SeaTalk[1] converter converts verified SeaTalk1[1] datagrams into NMEA and combines this with the NMEA data received on the three NMEA input (listener) ports. This combined data is sent to a NMEA output (talker) port and the WiFi output and the USB port simultaneously. The USB port is also used for configuration of optional WiFi and NMEA ports settings.

The built-in SeaTalk[1] to NMEA converter allows a SeaTalk[1] instrument to communicate on the NMEA network. Only one SeaTalk[1] input is provided since the SeaTalk[1] bus is a single-cable system where all instruments are connected through one cable. The SeaTalk[1] to NMEA converter in the A031 works in one direction. NMEA sentences are not converted into SeaTalk[1], the multiplexer simply listens on the SeaTalk[1] bus.

Every input on the A031 is galvanically isolated (also called opto-isolation). A galvanically isolated input prevents unwanted currents flowing between the instruments and the multiplexer, this protects equipment from damage and interference from radio signals.

Data from all instruments are transmitted wirelessly though the A031's WiFi transmission, giving the user freedom to navigate and monitor from anywhere on board. It acts as a wireless access point for iPad, iPhone, Android tablets, laptops and other WiFi enabled devices.
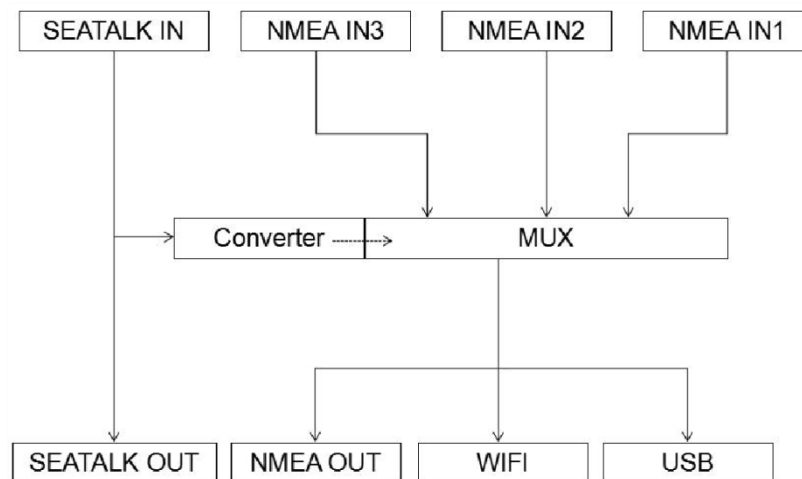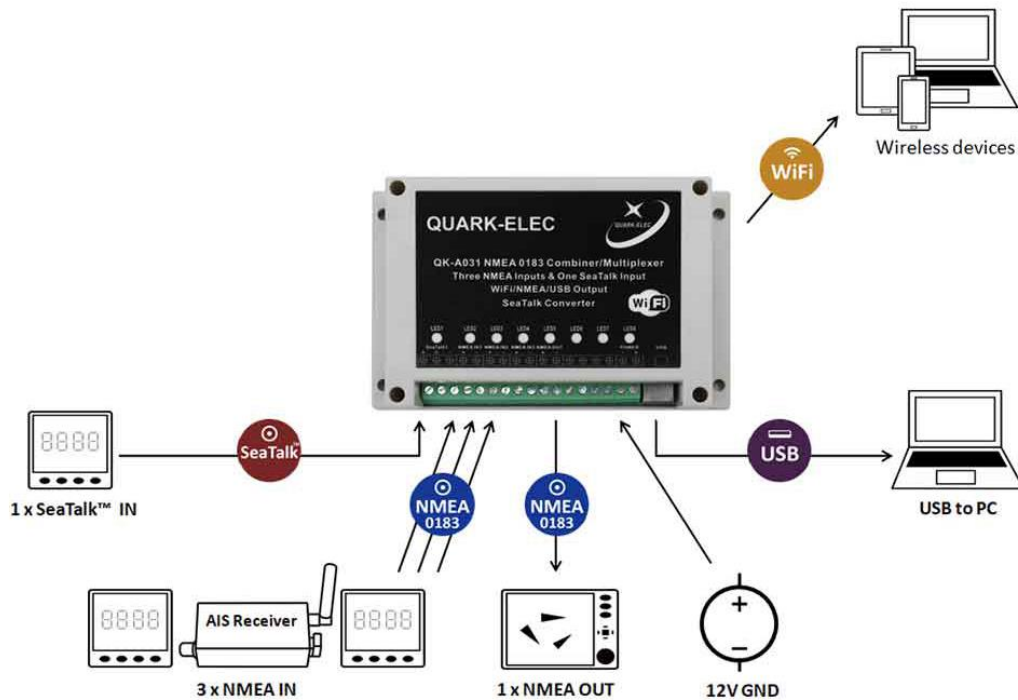

Figure 1: A031 Function diagram

2. Connections

Figure 2: Typical system connection

A031 has the following electrical connections/indicators:

- **SeaTalk[1] input connection:** The SeaTalk[1] port has a 3-Pin terminal for connection to the SeaTalk[1] bus. As well as being powered by the SeaTalk[1] bus, the A031 also listens on the SeaTalk[1] bus and converts any supported SeaTalk[1] datagrams to NMEA 0183. In this way, data from SeaTalk[1] equipment, like wind/depth or heading sensors, can be viewed on NMEA chartplotters via the NMEA output. This data is also accessible via USB and WiFi.

- **NMEA 0183 input/output connectors:** The A031 uses the NMEA 0183-RS422 protocol. It provides connection of NMEA 0183 equipment, like wind, depth or heading sensors, via the NMEA inputs. The NMEA output provides the combined data to a chartplotter or other NMEA device/s of your choice. The default baud rates are set to 4800bps (input) and 38400bps (output). These can be changed via the Configuration software.

- **USB:** A type B USB connector outputs all messages. It can also be used for adjusting parameters using the Configuration software.

- **WiFi:** WiFi Connectivity in both Ad-hoc and Station mode on 802.11 b/g/n provides WiFi output of all messages.

- **LEDs:** provide feedback and status to the user.

3. Installation and Operation

3.1. Mounting

The A031 is aimed at the small commercial, leisure and fishing boat and vessel monitoring markets. The A031 uses an IP56 Insulation Class 2 plastic enclosure with 115 x 90 x 40 mm external dimensions. It is not waterproof so should be mounted in a dry place such as behind the instrument panel on a flat surface.

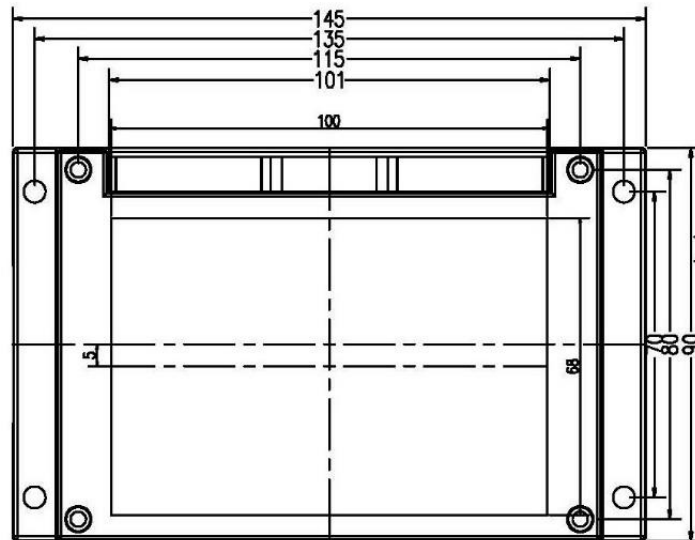Figure 3: Dimensions

3.2. Power

The A031 runs on 12V – 35V DC. Power and GND are clearly indicated. Ensure these are connected correctly. The A031 benefits from reverse polarity protection to protect the device in case of faulty installation.

3.3. NMEA input and output connection

Although the NMEA 0183 standard specifies the signal names, voltage levels and connection methods very clearly, in reality, this standard has been interpreted with a level of variation between manufacturers. So, to ensure A031 is not damaged please double-check the specifications of the devices before connecting them.

The A031 has three NMEA inputs called IN1, IN2 and IN3. Each input should be connected to one device only. These inputs are galvanically isolated from each other and the A031 multiplexer, as specified by the NMEA 0183 standard. The A031 performs serial combining of these three NMEA 0183 serial inputs into one NMEA 0183 serial output.

The NMEA 0183 output is capable of driving the combined data from the inputs. Connect the + and - terminals of the NMEA output on the A031 to the + and - terminals of the input on the instrument (e.g., chart plotter). These terminals may also be labelled as A/B, RX+/RX-, In+/In– etc (see more information regarding RS422/232 section below).

3.3.1. 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 inputs ports' default baud rates are set to 4800bps but they can be adjusted using the Configuration software if required.

- The A031 output port's default baud rate is set to 38400bps. If your data includes AIS data, the output and the connected chart plotter should be configured at this rate to receive the proper data as AIS data requires this higher speed.

See Configuration chapter for more information.

3.3.2. NMEA 0183 RS422 / RS232:

This product 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.

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

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 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.

3.4. SeaTalk1[1] input connection

The built-in SeaTalk1[1] to NMEA converter translates SeaTalk[1] data into NMEA sentences. The SeaTalk[1] port has 3-Pin terminals for connection to the SeaTalk[1] bus. Ensure the connection is correct before powering up. A wrong connection could damage the A031 and other devices on the SeaTalk[1] Bus.

When a SeaTalk[1] message is received, the A031 checks if the message is recognized and should be processed. When the message is recognized by the SeaTalk[1] messages table, the message is extracted, stored and converted to an NMEA 0183 sentence. Any unknown datagram is ignored. These converted NMEA messages are then combined with NMEA data received on the other inputs. This function allows a SeaTalk[1] instrument to communicate on an NMEA network. Only one SeaTalk[1] input is needed since the SeaTalk[1] bus is a single-cable system that connects all the instruments together through one cable. SeaTalk[1] to NMEA converter in the A031 works in one direction only. No NMEA sentences are converted into SeaTalk[1], the multiplexer just listens on the SeaTalk[1] bus.

| Supported SeaTalk[1] Datagram's		
SeaTalk[1]	**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 then combined with data from other datagrams to be able to create one NMEA 0183 sentence.

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3.5. WiFi Output

The A031 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 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 A031 supports 2 working modes.
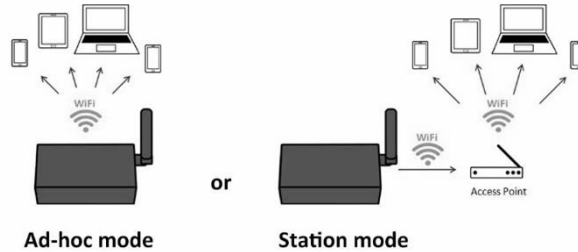
- In **Ad-hoc mode,** wireless devices connect directly (peer to peer) without a router or access point. For example, your smartphone can connect directly to the A031 to receive marine data.

- 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, mobile devices receive both your marine data and other AP connections such as Internet.

The A031 is set to Ad-hoc mode as a default setting, but can be easily configured to Station mode or standby mode through the configuration tool. (See Configuration section)

3.5.1. WiFi Ad-hoc mode connection

From a Phone, Tablet or PC:
Once the A031 has powered up, scan for a WiFi network with an SSID of 'QK-A031xxxx' or similar.

Connect to '**QK-A031xxxx**' with the default password: '**88888888**'.

A031 SSID	Similar to 'QK-A031xxxx'
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 A031 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 4: TCP/IP Net Assistant example

● **To Configure Station mode WiFi see the Configuration section.**

3.6. USB connection

The A031 is supplied with a USB connector. This connector provides the NMEA 0183 data output and the configuration input. This USB connector can be linked directly to a USB port on the PC or other mobile devices via the supplied cable.

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

To enable the USB data connection of A031 to other devices, a related hardware driver may be needed, dependent on your system requirements.

Windows 7,8,10:
If your device is running an original Windows 10 version, the driver usually installs automatically. The A031 registers itself to the computer as a virtual serial COM Port. A new COM Port should automatically appear in the device manager once powered and connected via USB.

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

The A031 does not support Mac OS and Linux via USB at this moment.

3.6.2. 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 A031 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, double click the A031 and select the 'Port Settings' tab. Click the 'Advanced' button and change the port number to the one required.
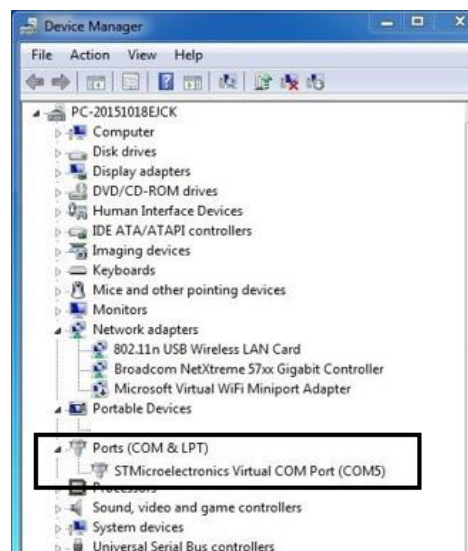

Figure 5: View of COM port in Device Manager

The USB connection status can always be checked with a terminal monitor application like Putty or HyperTerminal. Ensure that the COM port is set correctly (38400bps if using the default A031 settings), 8, N and 1 as shown below using HyperTerminal on Windows as an example.

To use a terminal monitor application, first connect A031 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 interface number.

HyperTerminal example. Run HyperTerminal, set COM Port settings to 38400bps (if using the default A031 settings), 8, N and 1.
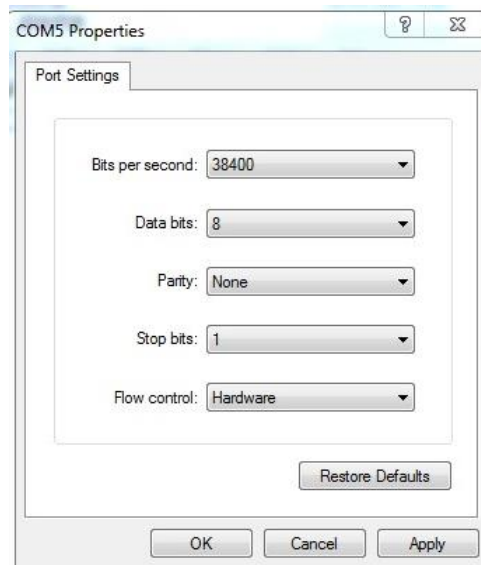

Figure 6: HyperTerminal settings

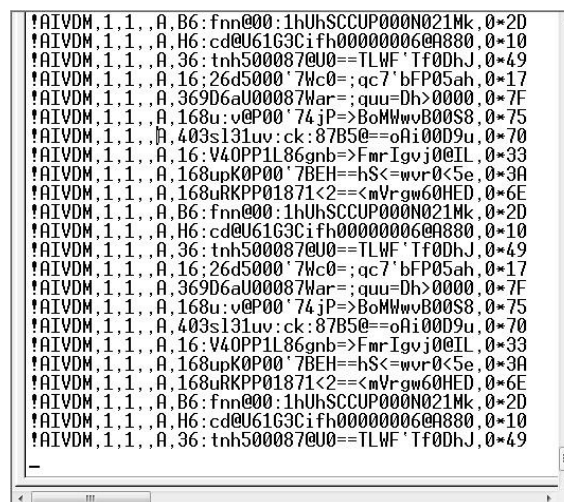If all the above is set up correctly, NMEA 0183 messages similar to the example below will be shown.

Figure 7: Display on HyperTerminal

4. LEDs

LEDs indicate the A031 operational status. The A031 features eight LEDs to confirm power and data transfer, and for troubleshooting.
The status LEDs on the panel show each input port activity and system status.
When in operation, the LEDs will flash as below:

Figure 8: LED indications

LED1 (SeaTalk[1]) flashes when valid SeaTalk[1] data are received.
LED2 (IN1), **LED3 (IN2)**, and **LED4 (IN3)** flash when valid NMEA sentences are received.
LED5 (OUT) flashes when valid NMEA sentences are send out through the NMEA output.
LED6 (USB) flashes when valid NMEA sentences are send out through USB. Also reserved for firmware updating.
LED7 (WiFi) flashes when valid NMEA sentences are send out through WiFi.
LED8 (PWR) will be constantly lit when powered up.

5. Configuration

Quark-Elec Windows configuration tool can be used to setup the NMEA 0183 baud rates and WiFi settings for A031. 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 A031. Close all applications using the A031 before using the configuration tool. Once configured, configuration settings are stored in the internal flash memory and are retained even without a power supply.

5.1. Configuring Baud Rates

The default baud rates are 4800bps (inputs) and 38400 (output). NMEA 0183 input baud rates can be adjusted through the dropdown menus.

1. To adjust baud rates, the A031 should be connected via USB to a computer running Windows (or Mac users can use BootCamp).

2. When the A031 is connected and powered up, 'A031 connected' will be shown at the bottom centre of the window and the software version shows at the bottom right.

3. Select the desired baud rate.

4. Click '**Config**' to save your settings to the A031.

5. Click '**Disconnect'**.

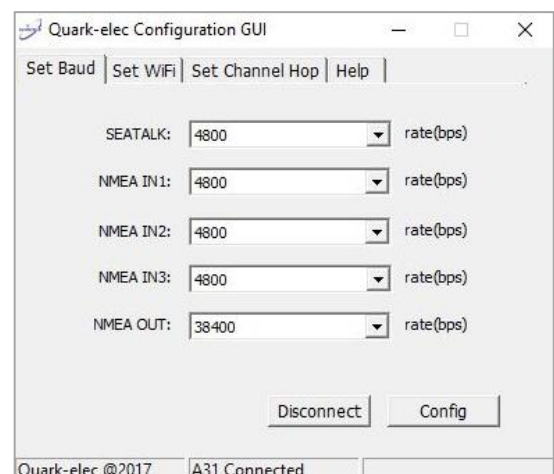6. Re-power the A031 to activate the new settings to the device.

Figure 9: Baud rates

5.2. Configuring Station mode WiFi

WiFi is set to Ad-hoc mode as standard (see WiFi section). 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 network onboard for access to the internet. In most cases the network is created by using a 3G/4G wireless 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 A031 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 A031 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 A031 in Station mode through the A031 Configuration software.

To setup Station mode the A031 should be connected via USB to a computer running Windows (Mac users can use BootCamp).

1. Connect A031 to computer via Micro USB B connection.

2. Run the Configuration software (having closed any other programs that would access the A031) and check connection to the A031 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 A031. This normally starts 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'.**

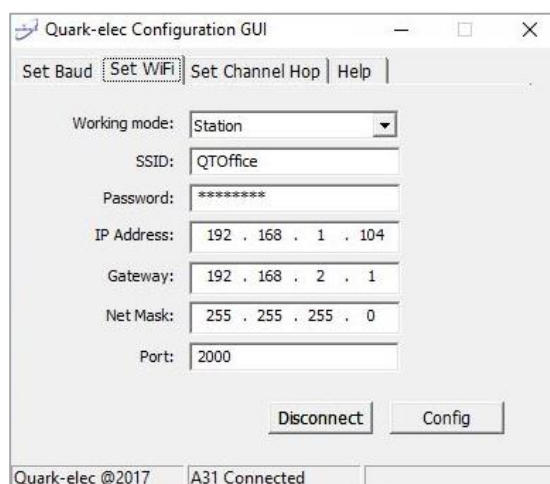9. Repower the A031 and it will now attempt to connect to the router.

Figure 10: Station mode settings (example only)

In your chart software, set the protocol as '**TCP'**, insert the **IP address** you assigned the A031 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 A031. 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. Specification

Item	Specification
DC supply	12V - 35V
Average supply current	80mA
NMEA data format	ITU/ NMEA 0183 format
NMEA input data rate	4800bps, RS422 galvanically isolated
NMEA output data rate	38400bps, RS422 galvanically isolated
WiFi mode	Ad-hoc and Station mode on 802.11 b/g/n
Security	WPA/WPA2
Operating temperature	-5°C to +80°C
Storage temperature	-25°C to +85°C

7. 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.

8. 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.

9. Document History

Issue	Date	Changes / Comments
1.0	02-10-2016	Initial release
2.0	12-12-2016	Support WiFi station mode, add LED indications in 2.2.
3.0	24-10-2018	New 2018 format
4.0	12-02-2020	New 2020 format
	10/05/2021	

10. 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.
SeaTalk[1]: A proprietary language of Raymarine devices.
USB: port/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.

11. 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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