

QK-R041 Manual

WIRELESS 4G LTE ROUTER



Designed in UK



Features

Stable and Reliable

- Industrial design, metal enclosure, with waterproof IP30 rating
- Wide input voltage range: DC 9-36V, with reverse polarity protection
- ESD, Surge, EFT/Burst protection
- Multi-types of VPN and firewall against network attacks

Flexible Networking

- Automatic detection of cellular networks and 4G/3G/2G mode automatic switching
- Supports most EMEA & APC countries (US and Australia will be supported soon)
- Failover between 4G and WAN, ensures automatic switching to alternative backup connection, effectively ensuring uninterrupted data transmission
- Supports both wired(WLAN) and wireless(4G) Internet connection

Powerful Functions

- Supports Email/SMS/DO alarm, monitoring the devices on the vessel

- Multi-interfaced, including 4 Ethernet ports, serial port R232/RS485(alternative) , 2*DI , 2*DO, Wi-Fi, and GPS(optional)
- Serial port supports multiple protocols, including NMEA 0183 and transparent TCP/UDP protocol.

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1. Introduction

The QK-R041 is a marine wireless router designed for permanent installation on boats and yachts. It provides Internet connection for devices connected to it through WiFi and Ethernet cables via 4G/3G

network with just a SIM card. It offers the option to surf the Internet at high speed, ensuring stable and fast connection for up to 22 miles away from the coast.

The R041 features two MIMO 4G diversity antennas which ensure excellent mobile network reception and two omni-WiFi antennas which offer great WiFi signal strength onboard. The QK-R041's WiFi network is secure, and password protected and allows for up to 32 devices to be connected to the router at the same time. On larger yachts, where a single WiFi access point is not enough to cover all areas, a second R041 or an additional WiFi extender can be connected to the router through the LAN (RJ45) connection.

The R041 is a Plug & play device with its default settings, only requires a 12VDC power supply and a SIM card with an active data package to offer access to the Internet. All this makes the system particularly easy to install.

2. Mounting

The R041 is aimed at the commercial, leisure, fishing boat and vessel monitoring markets.

It is not fully waterproof, so it needs to be mounted in a dry place such as behind the instrument panel on a flat surface or a rack. When choosing the right place for it, the most important factor is the quality of the 3G/4G reception. A mobile phone with a signal strength measuring application (e.g., Signal Strength on Google Play store) to test various places inside the boat to see where strong and reliable mobile signal can be received, usually close to a port hole, hatch, or window. The suggested signal strength is at least 3 bars (-90dBm) shown on the phone. On vessels with a fiberglass hull, it should be easy to find a place with good mobile network reception, but if this is not achievable or the vessel has a wooden, carbon fibre or steel hull, then the installation of external fiberglass antennas are recommended. This will allow the R041 to have the best possible receiver range.

Apart from the mobile signal strength, Wi-Fi reception and cable runs also need to be considered to find the best possible place for the router. **Please allow a minimum of 0.5m between the R041 and other WiFi devices.** This will help avoid interference problems.

The R041 can be mounted in any orientation, as the antennas can be rotated and bent for best reception, although we recommend mounting the R041 on a flat surface with the antennas pointing upwards, to avoid stress on the cables and to ensure condensation doesn't get into the connectors.

Antenna connector dust covers should be applied at all times if the antennas are not connected to the router.



The default settings of the R041 have been chosen for optimum performance. We do not recommend users to make any changes to them, except for changing the default wireless network name (SSID), password and APNs.

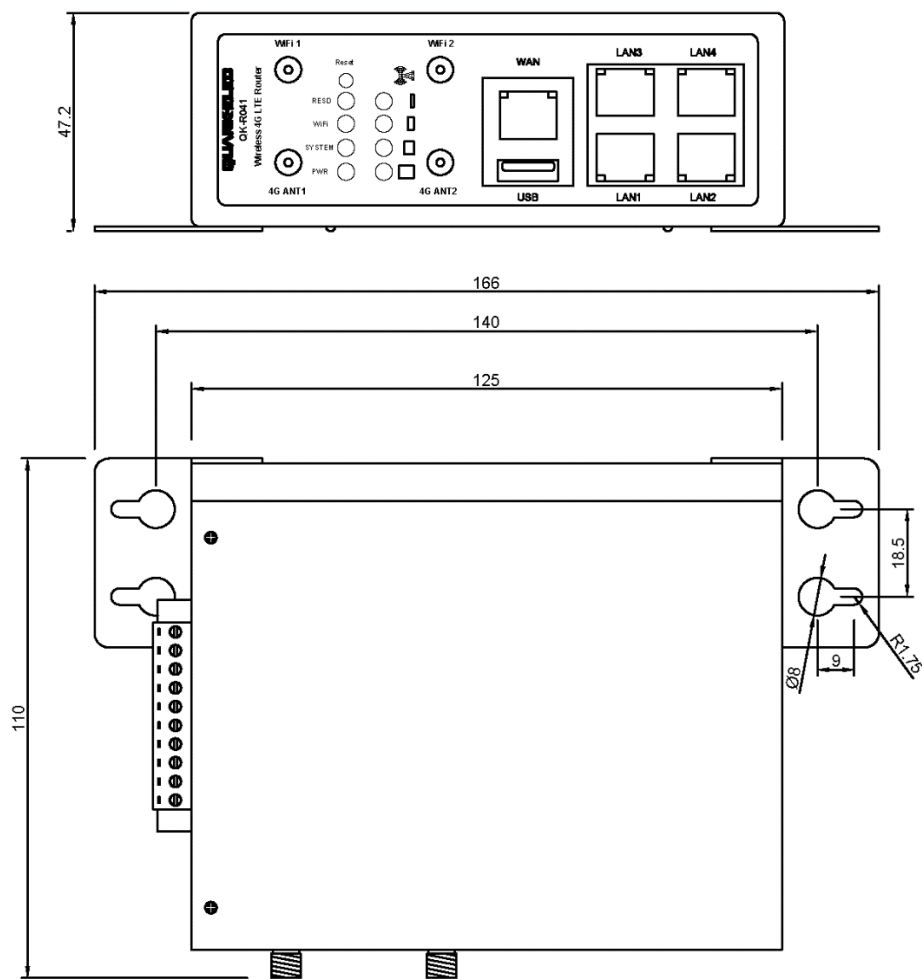
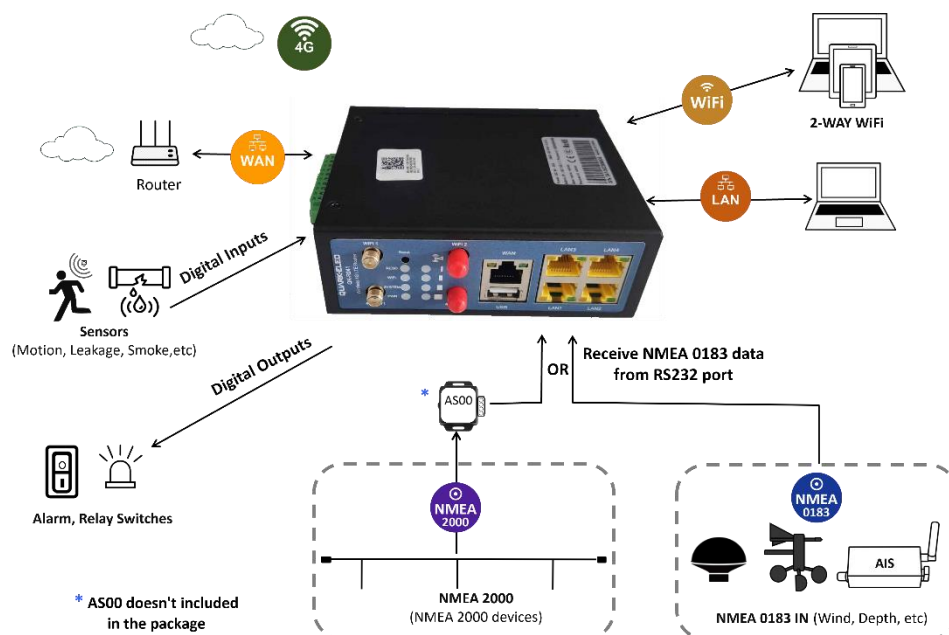


Figure 1: R041 Dimension in mm

3. Connections



The R041 wireless marine 4G router multiplexer has the following options for inputs, outputs and host devices.

- Power supply
- 1x 4G SIM card slot
- 2x digital inputs and 2x digital outputs
- 1x RS232 interface, supports NMEA 0183 protocol
- 4x LAN interfaces
- 1x WAN interface
- 2x SMA WiFi antennas
- 2x SMA 4G/UMTS/GSM antennas
- 1x USB port(reserved) and 1x SD card slot(reserved)



Power off all devices and the router before connecting them to or disconnecting them from the router!

3.1. Power supply

The R041 can be powered from a 12V to 35V DC power supply. Power(V+) and GND(V-) are clearly indicated on the side terminal block. Ensure these are connected correctly. The R041 is equipped with reverse polarity protection to protect the device in case of improper installation.

3.2. Reset

The R041 can be restored to factory settings in the following way:

Ensure the R041 is in normal working mode: the power LED is steady on; the system LED flashes every one second.

Use a pin to press and hold the Reset button for 5 to 10 seconds and then release it.

After releasing the button, all the LEDs will turn on and then off.

Wait for another 1 to 2 minutes until the System LED starts flashing every 1 second. This indicates that the reset process has been successfully completed.

3.3. 4G SIM card

To get Internet connection via a 3G/4G mobile network, the R041 should have a 3G/4G data SIM inserted, which is registered to a valid mobile operator account.

To insert a SIM card into the router, unscrew the two screws and remove the small cover as shown on the image below and insert the SIM card into the SIM card slot. For nano and micro-SIM cards a card adaptor is required (not included with the router, normally comes with the SIM card).



When inserting a SIM card, ensure the SIM card has the correct orientation. Do NOT insert the SIM card at an angle or use force. There is also an SD card slot next to the SIM card slot, the use of this is not currently supported by the firmware.

After inserting the SIM card, power on the R041 to ensure the SIM card works well before replacing the cover. The router will automatically connect to the mobile network, the first 4G indicator will stay on showing that the router is connected to the Internet. The other three signal strength indicators will turn on if the signal strength arrive relative level. If the 4G indicator doesn't show on, login to the configuration interface to check if the Access Point Name (APN) need to be modified.

Please switch off the router before inserting or removing the SIM card. Inserting the SIM card with the router on, it might affect the performance or might cause SIM card data loss.

3.4. Network connections

The R041 has five RJ45 Ethernet connectors: four LANs and one WAN.

3.4.1. WAN

The WAN port on the R041 can be used to connect the router to a wired Internet connection. For example, if your boat has a second Internet connection (via Satellite, or long-range WiFi router), the R041 can be connected to it using a network cable and your R041 will have two independent Internet connections. The priority of internet connections can be set using the configuration interface. Once the R041 is connected to an external Internet device, it will start working as soon as it receives a dynamic IP address.

3.4.2. LANs

The R041 features four local Ethernet ports for connecting the devices on the boat. Devices like Smart TVs, desktops, VOIP phones can be connected to the LAN ports to get a reliable Internet connection. The R041 assigns IP addresses automatically to all devices connected to the LAN ports.

3.5. Digital inputs / outputs

The R041 provides two digital inputs and two digital outputs. The two digital outputs can be used for switching external digital levels (DO1 and DO2) from the Router, the two digital inputs can accept external digital level (DI1 and DI2) to the Router. Both digital outputs are dry contact and can only be

used for switching, rather than driving other inputs.

3.5.1. Digital inputs

DI1 and DI2 are two digital inputs. Digital Inputs allow the R041 to detect logic states (low or high) when GND is connected to or disconnected from the DI1/2 terminals of the router. Using the R041's configuration interface, the operator can set up the input parameters and specify what actions should be executed when the digital input is triggered.

The digital inputs are non-isolated and set as dry connect by default. The following is the typical connection example. The R041 also supports wet connection, but please ensure the maximum input voltage is 5.0V, voltage higher than 5.0V could permanently damage your device.

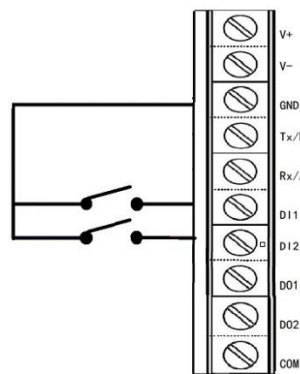


Figure 2 Digital input connections

3.5.2. Digital outputs

Digital Outputs allow the R041 to output logic states. It can be used to turn on other devices such as sensors, alarms. The DO function can be accessed and configured on the router by using the configuration interface.

Not like the Digital inputs, the outputs are wet connections. The follow is a typical connection to external devices. Make sure the GND of the external devices is connect to the R041's COM terminal. Improper connection to other devices could damage the router. The DO port can stand up to 36VDC and 300mA as the maximum current.

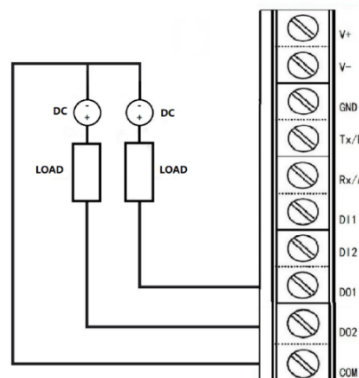


Figure 3 Digital output connections

3.6. RS232 serial interface (NMEA 0183)

The R041 features an industrial RS232 serial interface with up to 230.4kbps baud rate.

Since the most marine NMEA 0183 devices support the RS232 or RS485 communication protocols, the R041 can communicate with these devices through its RS232 interface.

To connect the router to a NMEA 0183 device (e.g., sensor, multiplexer, etc.), the wires or terminals need to be connected as shown below.

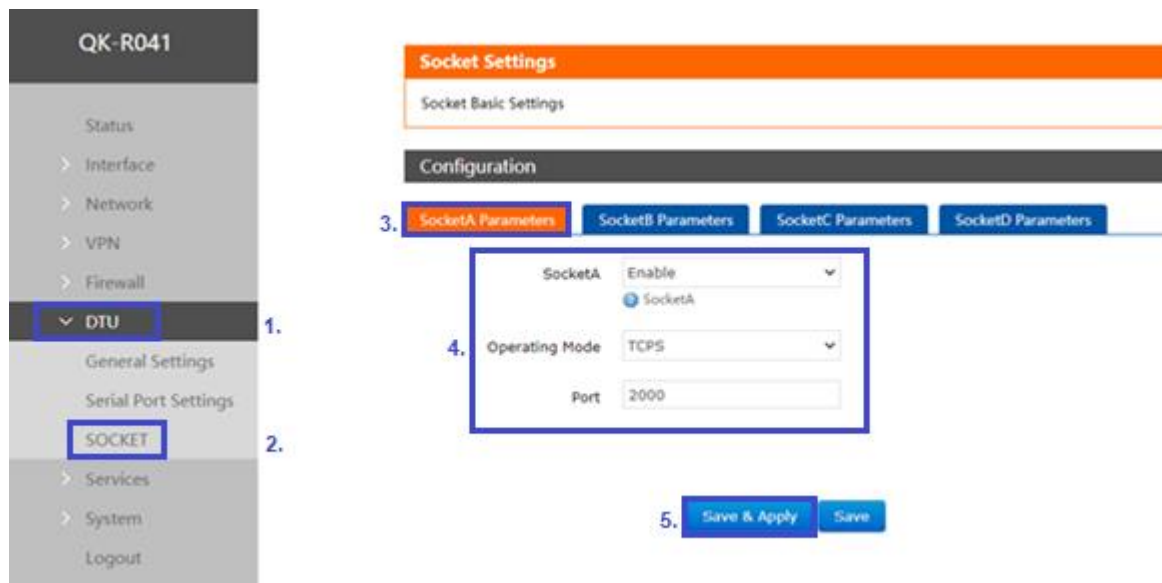
R041 interface		Connection needed on RS232 device	Connection needed on RS422 device
Transmit	TX/B	NMEA RX	*[1] NMEA input-
	GND	GND	NMEA input+
Receive	RX/A	NMEA TX	*[1] NMEA output-
	GND	GND	NMEA output+

*[1] Swap the differential NMEA data wires if there is no communication between your R041 router and the NMEA0183 device.

To setup NMEA 0183 input data (e.g. GPS receiver, wind sensor) transfer, the socket configuration needs to be set.

Please connect your computer or mobile device to the R041 router and launch the configuration web interface (more details can be found in chapter **5. Configuration**). On successful login, the router's main status page will be displayed on your computer screen.

Please click **DTU** in the main menu bar (on the left) and **SOCKET**. The R041 supports up to 4 sockets to be handled. Click the **SocketA Parameters** tab as an example, set SocketA to Enable, Operating mode to TCPS and port to 2000 (as shown on the figure below, this port number must be the same as the receiver's port setting) and click **Save&Apply**.



Launch the chart application on your laptop or mobile device. In the application's connection setup menu, please set the IP address to the router's IP (default IP address is 192.168.1.1) and the port to 2000. The chart application should now receive and display the marine navigation data from the NMEA 0183 talker device through the router's WiFi and/or Ethernet connections.

3.7. WiFi connections

The R041 can be used out-of-the-box, no initial setup is required. The default SSID is similar to 'QK-R041-xxx' and the default password is 'QE88888888', however we strongly suggest changing these to your preferred network name (SSID) and wireless password via the configuration interface. This ensures that only the users who know the login details will be able to connect to your router.

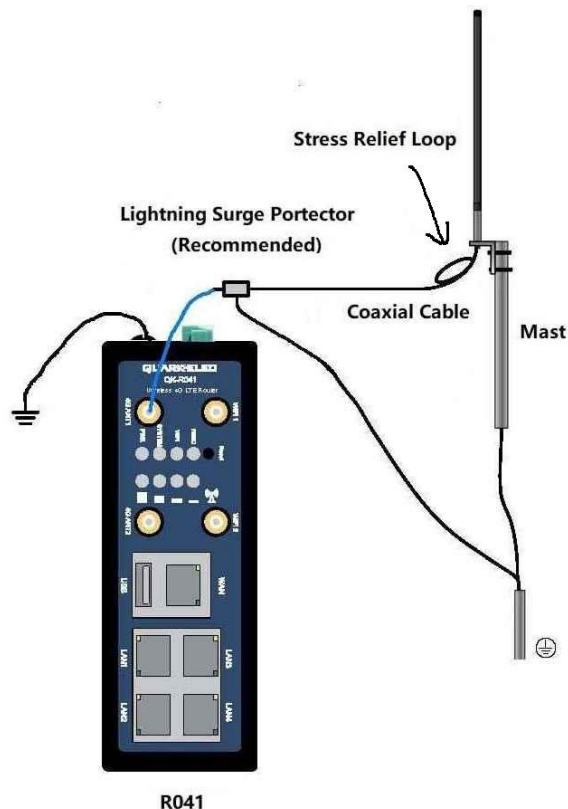
3.8. 4G antennas

The R041 comes with two SMA 5 dBi external indoor 4G/3G antennas. Both antennas have a magnetic base so they can be attached to various ferrous surfaces. The two 4G antennas should be placed at a minimum distance of 20 inches (50cm) from each other to maximise the positive effect of the MIMO technology. There is no need to place the two antennas further apart, since the field tests show that the signal quality cannot be significantly improved by increasing the distance.

The 4G antennas should not be mounted near metal objects or close to other high-power transmitting antennas like VHF, HF and SSB antennas. It is recommended to place the 4G antennas at a minimum distance of 40 inches (1.0 meter) away from these high-power transmitting antennas ~~on the boat~~.

For low power antennas or not near frequency band antennas (e.g. WiFi, GPS, TV), it is recommend to keep a minimum distance of 20 inches (50cm) between antennas.

To have better 4G network reception external 4G fiberglass antennas can be used. The following image shows a wiring example. If longer cables are used to connect the antenna to the router, it must be a high-quality, low loss cable. The cable and any connectors used should have 50 Ohms impedance.



Only one 4G antenna is shown on the diagram. Use this example as a reference for wiring the second antenna.

Figure 4 The antenna connections

4. Indication LEDs

The R041 features indicator LEDs which show power, system, WiFi and 4G/3G network strength status. There is also another LED on the front panel, which can be customized as required by the operator.

- * Power: LED light is constantly lit in red when the device is powered on.
- * System: LED light flashes once every second, when the router is working properly.
- * WiFi: LED will flash for each data transaction via WiFi. It will keep steady on when idle.
- * Reserved: This LED can be assigned to a specific status or event by using the configuration interface.
- * 4G/3G signal strength: There are four LED lights: the left LED shows the current network type. Red indicates 2G, green indicates 3G(UMTS) and the orange (mixed green and red) indicates 4G(LTE). The other three LEDs represent the current signal strength. More lit up LEDs mean stronger signal.

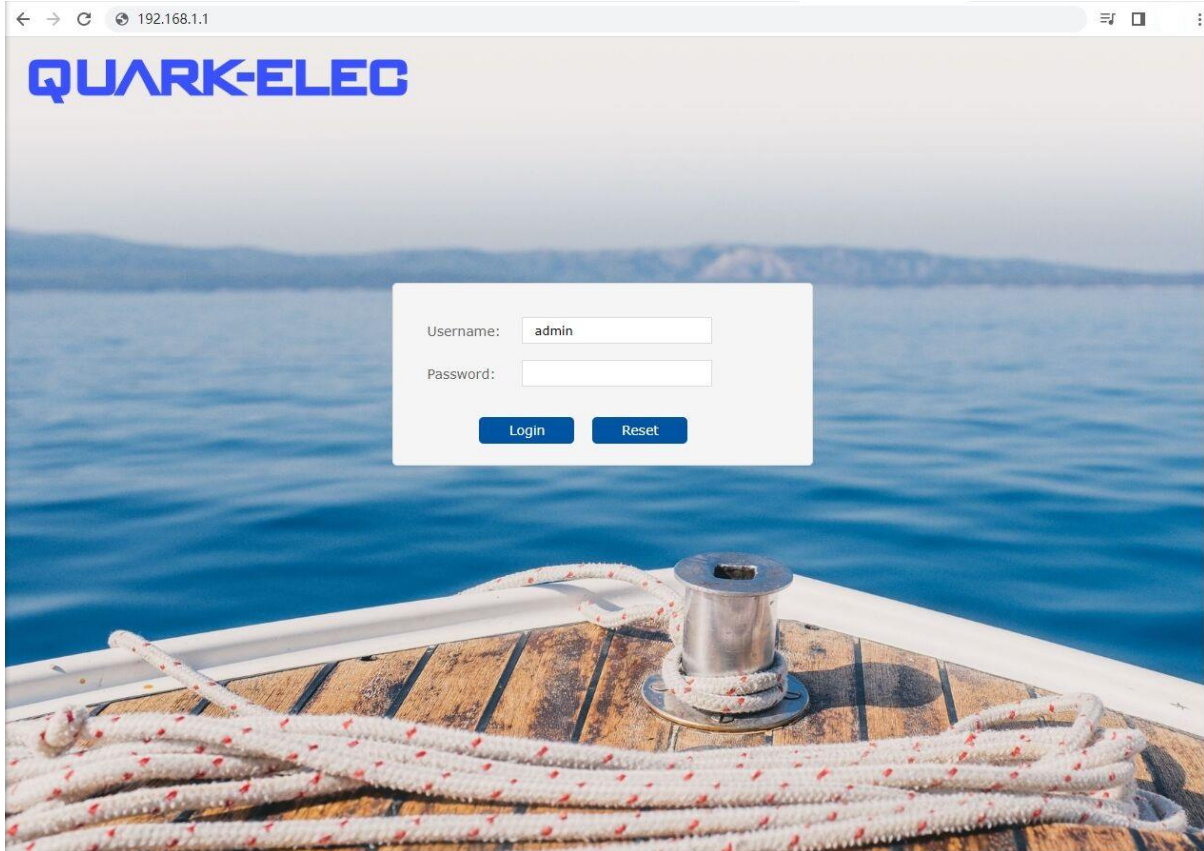


5. Configuration

After you completed the installation as described in the section above, you can log in and start configuring your router.

1. Connect your tablet, iPad, Mac or desktop to the router's WiFi network using the default password, which is 'QE88888888'.

2. Launch a web browser on the device connected to the router, and input 192.168.1.1 into the address bar and click enter.
3. You will be asked the login in ID and password, both of which are 'admin'.



4. Click 'Login' after entering the username and password.

QUARK-ELEC
Simply Connected

QK-R041

Status

> Interface

> Network

> VPN

> Firewall

> DTU

> Services

> System

Logout

Status

System

Device name	QK-R041
Firmware Version	V1.0.09.C159304.03-EN
S/N	01600121060700002984
Local Time	Mon Jun 20 15:17:17 2022
Running Time	0h 24m 4s

Memory

Total Available	97416 kB / 126548 kB (76%)
Free	72948 kB / 126548 kB (57%)
Cached	17324 kB / 126548 kB (13%)
Buffered	7144 kB / 126548 kB (5%)

Network

IPv4 WAN Status	Type: dhcp eth0.2 IP Address: 192.168.1.13 Netmask: 255.255.255.0 Gateway: 192.168.1.1 DNS 1: 79.79.79.77
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Quark-elec(UK), Marine Electronics

The above image shows the main status page of the router. On the left side of the page, it's the main menu bar, which will take you to various status, configuration, tools, and service menus.

The default R041 settings have been carefully selected to work well in most situations/installations, commonly found on pleasure boats. We strongly suggest you not to change any settings except those specifically mentioned in this manual.

The key settings that the user should check and set if needed are as below:

- 1) The APN settings. Access Point Name (APN) is a configurable network identifier used by a mobile terminal when connecting to a 4G/3G/GSM network. For some of the mobile operator's SIM, the R041 needs to be manually set up the APN. Please use the left side menu bar, and go to Interface -> Mobile, to access the Mobile (WAN_4G) settings.

The most common APN parameters which need to be set are: APN, username, and password. For most cases, the rest of the settings can be kept as default.

WAN_4G Settings
Ping Detection Settings
Mobile Information

APN
everywhere
Input your APN Name, 0-62 characters

Username
everywhere
User name for apn, 0-62 characters

Password
everywhere
User password for apn, 0-62 characters

Auth Method
None
Authentication type for apn

Network Type
AUTO

Priority Of Network Search
AUTO
The priority of network search

PIN Enable
☐
If SIM card enable PIN, enable this function to enter the PIN code

EHRPD Enable
Disable

Data Traffic Control
0
If you want to configure traffic alarm, you need to fill in your data traffic.(MB)

Save & Apply
Save

Once the setup has been completed, click 'Save & Apply' and wait for a couple of minutes to see the network LED turn on. For some SIM cards, you probably need to re-power the R041 to activate the new settings. Please contact your data SIM provider if more information or further details needed.

- The WiFi Network settings (SSID and Password). From the left side menu bar, go to Interface - > WLAN, then you should be able to access the WLAN(WiFi) interface as below.

WLAN Overview

Generic 802.11b/g/n Wireless Controller
Channel: 13 (2.472 GHz) | Bitrate: 144 Mbit/s

SSID: QK-R041-CB56 | **Mode:** Master
BSSID: 9C:A5:25:EF:CB:57 | **Encryption:** -

General Settings
Advanced Settings

Client Information

SSID	MAC	Host	Signal Strength	RX Rate	TX Rate
QK-R041-CB56	3C:F0:11:00:53:7A	192.168.1.182	-56 dBm	54.0 MBit/s	58.0 MBit/s
QK-R041-CB56	60:F8:1D:1C:60:94	192.168.1.150	-52 dBm	6.0 MBit/s	54.0 MBit/s

The SSID name and the password can be changed in 'General Settings'. Please, don't change any settings in 'Advanced Settings' unless you know exactly how the changes will affect the functionality of the router.

The image displays two sequential screenshots of the QK-R041 router's web interface, specifically the 'Wireless Network: Master "QK-R041-CB56" (ra0)' configuration page. The top screenshot shows the 'Basic settings' tab selected, with fields for 'ESSID' (set to 'QK-R041-CB56'), 'Mode' (set to 'Access Point'), and 'Hide ESSID' (unchecked). The bottom screenshot shows the 'Wireless Security' tab selected, with fields for 'Encryption' (set to 'WPA2-PSK'), 'Cipher' (set to 'Force CCMP (AES)'), and 'Key' (masked with dots). Both screenshots include 'Save & Apply' and 'Save' buttons at the bottom.

6. Upgrading software



Before updating the router's firmware, please switch off all the devices connected via the digital input / output and the RS232 ports.

The current software version is displayed on the main status page. To update the firmware please go to System -> Backup/Upgrade -> Upload new firmware.

Export/Import

Export or import the current system configuration file

Download Configuration file: Export configuration file

Restore to Default: Restore

Import configuration file from backup.

Restore Backup: Please select file Browse Upload

Upload new firmware

Upload a proper firmware here to replace the current version. Check 'Keep settings' to keep the current settings.

Keep Settings: ☐

Firmware Image: Please select file Browse Flash

Flash Firmware

The flash image was uploaded. Below is the checksum and file size listed, compare them with the original file to ensure data integrity. Click "Upgrade" below to start the flash procedure.

Verify

Checksum: 7bac0e627e076d853d724bd610b536a5

Size: 9.00 MB (15.69 MB available)

Note: Configuration files will be erased.

Cancel Upgrade

Wait for about 5 minutes until the status LED starts flashing once every second
Firmware update is done, you can start using your device now.

7. Specification

Item	Specification
DC supply	9V-35V
Average supply current	525mA @ 12V
Maximum supply current	820mA @ 12V
SIM card type	Standard 3&1.8 V SIM, drawer-type sim card slot
Support frequency	TDD-LTE: B38/B40/B41 FDD-LTE: B1/B3/B5/B7/B8/B20 WCDMA: B1/B5/B8

	GSM/GPRS/EDGE: B3/B8 Covers EMEA & APAC main countries.
WAN port (Ethernet)	10/100 Mbps, IEEE 802.3, 1.5KV transformer isolation protected. Supports PPP, PPPoE, DHCP client.
LAN port (Ethernet)	10/100 Mbps, IEEE 802.3 and IEEE 802.3U, 1.5KV transformer isolation protected. Support PPP, PPPoE, DHCP client.
WiFi mode	Station modes on 802.11 b/g/n
Security	WPA/WPA2
Network protocols	TCP
Cable Length NMEA 2000	1.0m
Operating temperature	-20°C to +55°C
Storage temperature	-30°C to +75°C
Operating humidity	5%~95%RH (non-condensing)
EMC	Static IEC61000-4-2, level 3 Pulsed Electric Field IEC61000-4-4, level 3 Surge IEC61000-4-5, level 3
Recommended humidity	0 - 93% RH
Grounding protection	Screw

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 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 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.

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-, 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.

Document history

Issue	Date	Changes / Comments
1.0	03-06-2022	Initial release
1.1	01-06-2022	Add DTU settings

9. Glossary

- **Ad-hoc WiFi, also known as 'peer-to-peer':** devices communicate directly with each other without a router.
- **IP:** internet protocol (ipv4, ipv6)- explains which version
- **IP Address:** is a numerical label assigned to each device connected to a computer network.
- **NMEA 0183:** is a serial data interface operating at 4.8 Kbit/second utilizing standard asynchronous communications. It is an electrical and data standard for communication between marine electronics.
- **NMEA2000 / N2K:** is a serial data network operating at 250 Kbit/second utilizing the Controller Area Network (CAN). The CAN bus was originally developed for the automotive industry but is now used in numerous industrial applications. It is a communications standard used for connecting marine sensors and display units within ships and boats and is generally plug-and-play.
- **NMEA2000 / N2K backbone:** Used with NMEA 2000, the backbone is the main BUS supplying data and power to all the devices on the boat.
- **PGN:** Packet group number – used in the NMEA 2000 protocol instead of sentences
- **Router:** A router [https://en.wikipedia.org/wiki/Router_\(computing\)](https://en.wikipedia.org/wiki/Router_(computing)) - cite_note-2 is a networking device that forwards data packets between computer networks. Routers perform the traffic directing functions on the Internet.
- **Sentences:** Used in NMEA 0183 protocol to transfer data between marine equipment.
- **Station mode WiFi:** devices communicate by going through an Access Point (AP) or router. This allows the user to view data while accessing other router functions such as other devices or internet.
- **USB:** cable for communication and power supply between devices.

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