

# QK-W016 WiFi Remote Controller

## — WiFi temperature data logger & remote controller

### Features

- Control and store heating/cooling settings for three individual zones via WiFi
- Turn electronic devices ON/OFF from any location via the Internet
- Monitor environmental temperatures using a local PC and a mobile phone
- Output relays can be triggered manually or tied to specific temperature ranges
- Industrial level design
- Standard 802.11b/g/n WiFi, easily connected into an existing wireless Access Point
- Applications on Windows platforms (XP, Windows 7, 8, 10) and Android/iOS APPs
- Rapid installation and setup
- Automotive temperature range ( $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ )
- $\pm 0.5^{\circ}\text{C}$  temperature tolerance
- Supports both ad hoc and station modes on WiFi

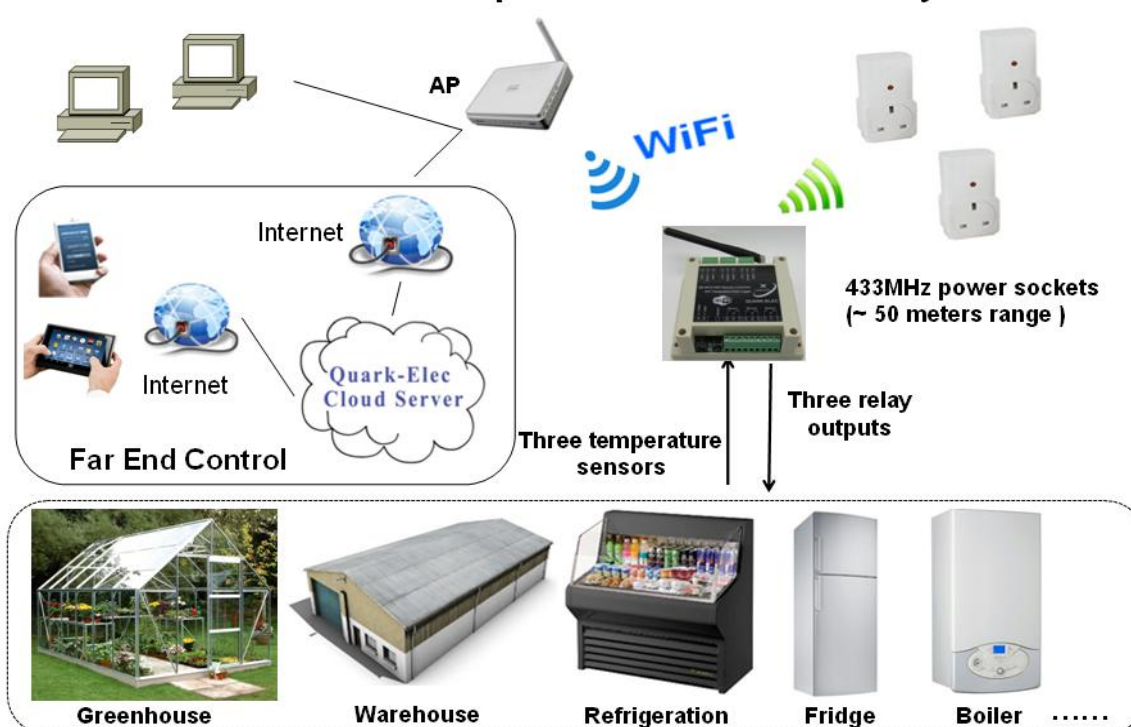




## Applications

- Environmental monitoring systems for industrial and distribution sites
- Greenhouse temperature control
- Home automation
- Boiler and electrical appliance control
- Plant maintenance
- Security systems
- Farm irrigation
- PLC and automation systems

## QK-W016 WiFi Temperature Control System



## Document history

1.0	12-06-2015	Initial release
1.1	16-12-2015	Android/iOS APP version release
1.1	23-06-2016	Minor clarifications



## Order information

Part No	Description
QK-W016	WiFi remote controller (three relay outputs, three temperature sensor inputs)
QK-W016R433	QK-W016 with three RF mains sockets

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## INTRODUCTION

The QK-W016 series WiFi temperature monitoring remote controller is a versatile device which can be attached to appliances such as domestic freezers, water tanks, refrigerators, industrial chillers, boilers, steamers, warehouse controls, greenhouses, industrial equipment and other systems requiring temperature control. Operators can control remote equipment, heaters, lights, machines or power sockets from anywhere in the World via the Internet.

Three wired thermistor sensors measure temperatures in different zones and QK-W016 energises the corresponding relays according to the measured temperatures. QK-W016 can be



## Quark-Elec application note

fitted in any situation where an object needs to be heated, cooled or both in order to maintain the target temperature range (set within the PC application or the Android/iOS APP).

An integrated WiFi module allows the operator to check the temperature log data and manually switch the relays via a WiFi network.

QK-W016 also has an optional RF433 Mhz module which allows the operator to control RF mains sockets within a range of up to 50 metres.

# QK-W016 WiFi Temperature Control System



Figure 1 System diagram (Station mode)

## 1 SETUP

### 1.1 Power up

The QK-W016 remote controller should be powered by a 12V DC 1.0A supply. Connect the power supply to a mains power socket, switch on the power supply and the blue LED should light up and then flash slowly. After about 10 seconds, a red LED will also light up, indicating that the system has finished initialisation.



## 1.2 Accessing QK-W016

Quark-elec have released Windows applications (XP, 7, 8 and later versions) and Android/iOS APPs for QK-W016. The operator can use the following link to download the latest version of the application or APPs:

<http://www.quark-elec.com/download/apps>

For some computers fitted with older type Ethernet network cards (RJ45 cable connected cards), it is recommend that the RJ45 cable is disconnected while the following steps are carried out:

- After QK-W016 has finished initialisation, the operator should be able to scan and find a WiFi network (SSID) called 'WiFi168' using a computer or mobile phone.
- Connect the computer or mobile phone to 'WiFi168' with '88888888' as the default password. A blue LED will remain lit up once the connection is made. Should 'WiFi168' not be found on the computer or the mobile phone, please go to the 'Reset QK-W016' section at 1.5 below and follow the steps to reset the module.

## 1.3 Ad hoc mode

The IEEE 802.11b/g wireless standard has two basic modes of operation, namely ad hoc mode and infrastructure mode (also called station mode). In ad hoc mode, mobile terminals (phones, tablets etc.) transmit directly (peer to peer) to the controller. In infrastructure mode, mobile terminals communicate through an access point (AP) such as a router, that serves as a bridge to other networks (such as the Internet or LAN). The QK-W016 WiFi controller can support both ad hoc and station modes.

Setting QK-W016 to operate in ad hoc mode is quite straightforward. Once the computer or the mobile phone is connected to the 'WiFi168' network, power off QK-W016 and then power it back up (this is important) until both red and blue LEDs light up. QK-W016 will now be working in ad hoc mode.

The operator should also set the IP address via the application interface or APP control panel before using the module. Using the PC application as an example, the main application page is shown below:



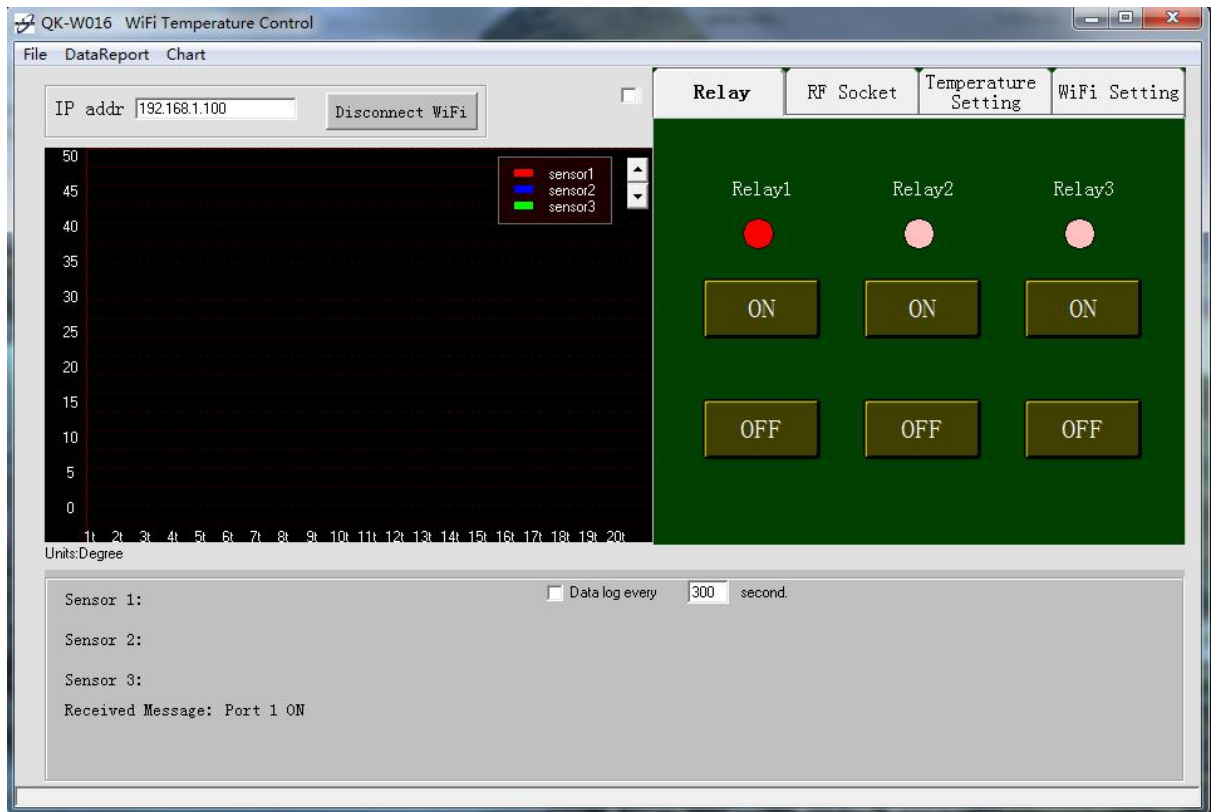


Figure 2 QK-W016 remote control panel

Set the IP address as '192.168.1.100', then click the 'Connect WiFi' button. **It is very important to ensure that there are no additional spaces added when entering this IP address.** Ensure that QK-W016 is re-powered before connecting with the computer or the mobile phone.

The ad hoc mode setting is now complete and the operator will be able to use the module.

### 1.4 Station (infrastructure) mode

When connecting QK-W016 into an existing WiFi network, operators should follow the steps below to set it to operate in station mode:

1. Power off QK-W016.
2. Press and hold the 'Reset' button, then power up QK-W016. The blue LED will light up for few seconds, then the red LED will turn on. After the red LED has been on for 3 seconds, release the 'Reset' button.
3. Wait for 60 seconds, the red LED will turn off and then turn on again. Once the red LED has turned on, the initialisation process is complete. During the initialisation period, the blue LED will flash every second.



### Quark-Elec application note

4. After QK-W016 has finished initialisation, the operator should be able to scan and find a WiFi network (SSID) called 'WiFi168' using a computer or mobile phone. Set the IP address in the top left hand corner of the screen as '192.168.1.100', then click the 'Connect WiFi' button.
5. At this point the setup process is the same as ad hoc mode setting. Make sure that the module is NOT re-started after this step. Otherwise it will set itself to Ad hoc mode.
6. Enter the information below into the application interface. The operator should be patient during these steps as it could take a couple of minutes for QK-W016 to accept each setting (by pressing 'Save') and returning with the reply message. Please do not set the next value until the reply message has been received.

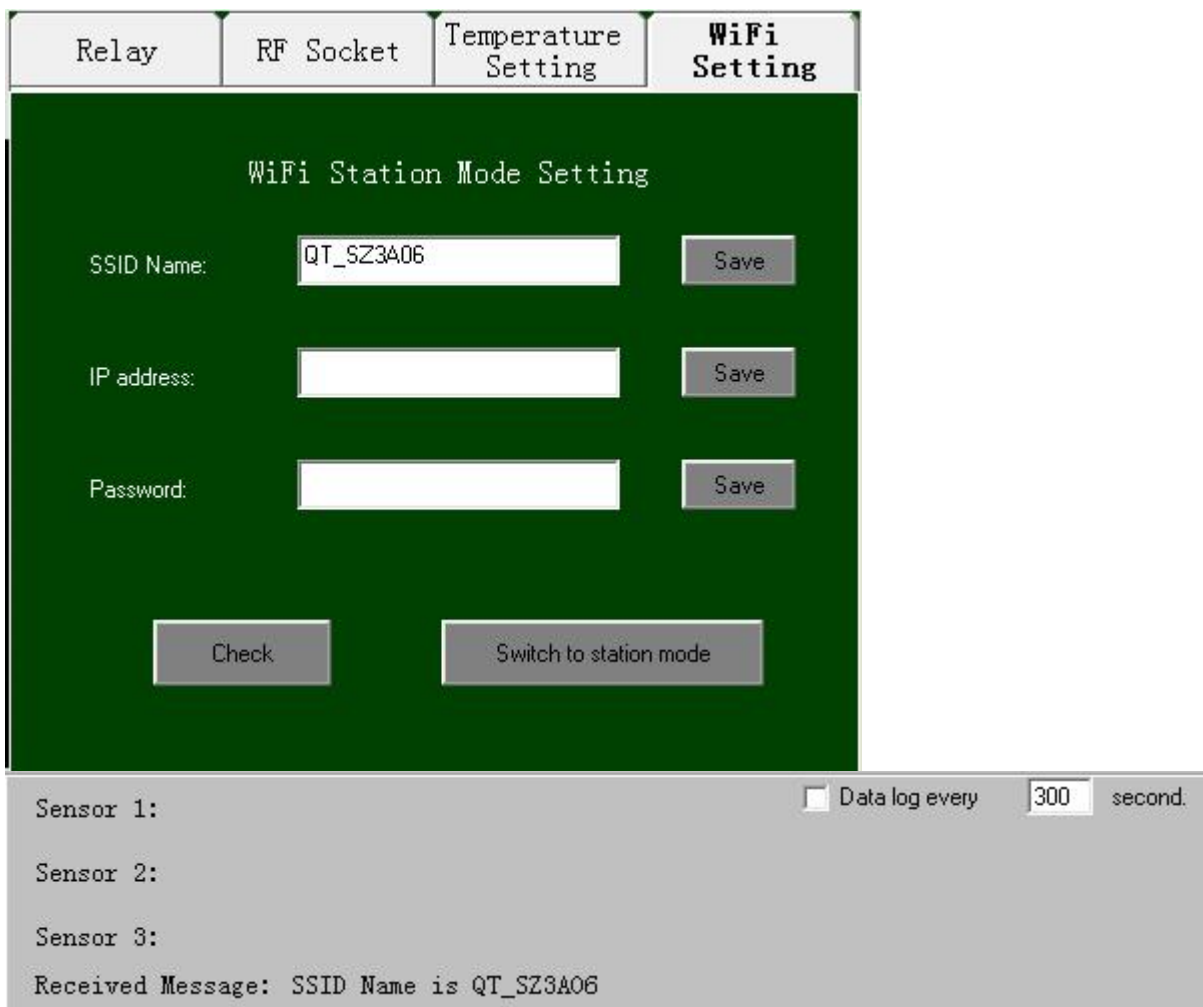


Figure 3 Station mode setting

- SSID name - input the SSID name (sometimes called the AP name) to which QK-W016 will connect. **Again, it is important to ensure that no blank spaces are inadvertently introduced.**



## Quark-Elec application note

- Password - input the password for accessing the AP. Quark-elec has noticed that, for some old type access points, there may be connection problems with QK-W016 if the AP security type is set as 'WEP'. So, if the operator has an access problem, please change the security type to 'WPA' or 'WPA2', and avoid using 'WEP' on the wireless router.
- IP address – set IP address. To allow QK-W016 to connect to the AP, the IP address for QK-W016 must match with the AP's gateway. This means the IP addresses should have the same first three numbers set as the AP's gateway. For example, if the AP gateway IP address is as 192.168.2.1, QK-W016 IP address must be 192.168.2.x (where x could be 2 to 224.). A dynamic IP address will be assigned by the AP if the operator does not set a static IP address in the application.

QK-W016 will be assigned an IP address by the AP automatically so the operator doesn't need to input a IP address in the Android or iOS APPs.

7. Press 'Check' to review that all the above information is correctly set.

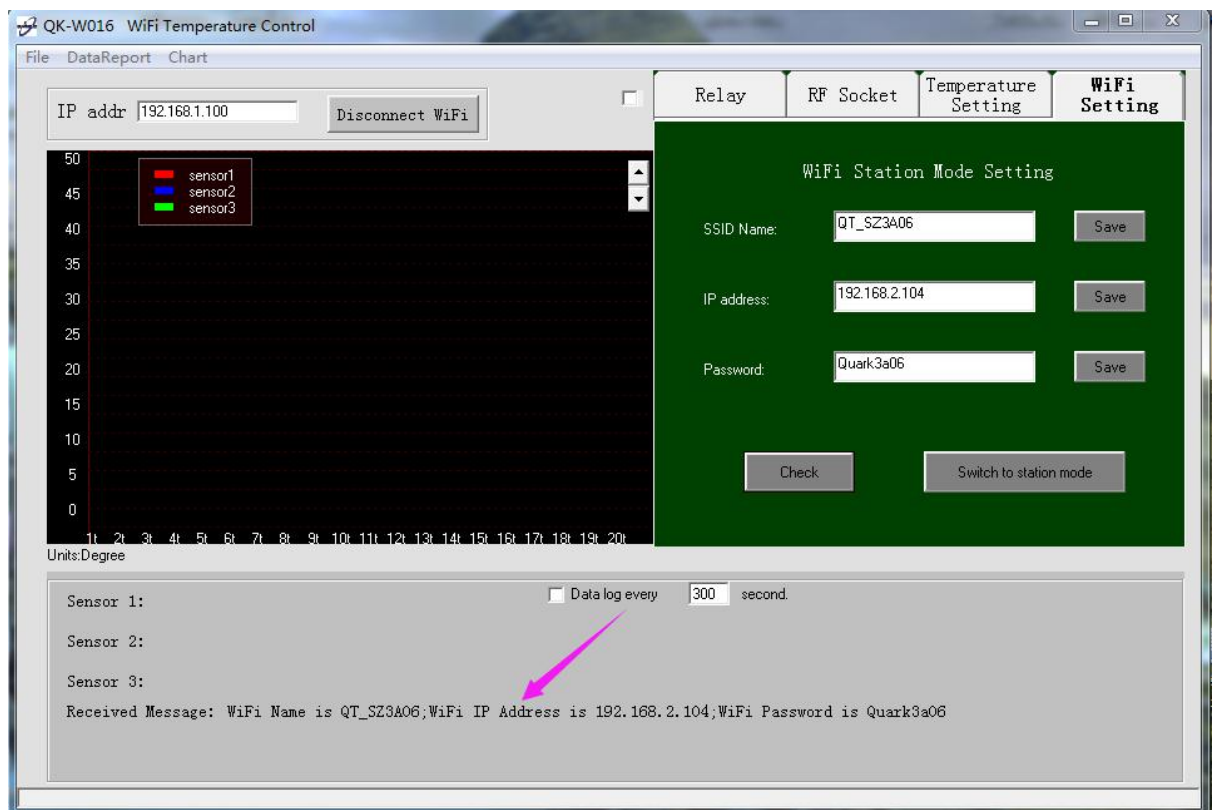


Figure 4 Check station mode setting

8. Press 'Switch to station mode' and wait 2 to 3 minutes (depending on the AP signal condition) until the red LED lights up. Close the application.
9. Re-start the module (this is important). Wait until both red LED and blue LED light up. If the blue LED flashes then this means the wrong SSID name, IP address or password has been input in step 6. Operator should go back to the beginning and repeat the setting up process.



## Quark-Elec application note

- Connect with the AP which has been set up. Run the application and change the IP address to the same address used when QK-W016 was set in step 6 above. Press 'Connect WiFi', all the text on the control buttons (ON/OFF) will change from grey to deep yellow and the blue LED on the module will turn on. The module will now be working in station mode.

The IP address here will now be the same as that entered in the setting field.

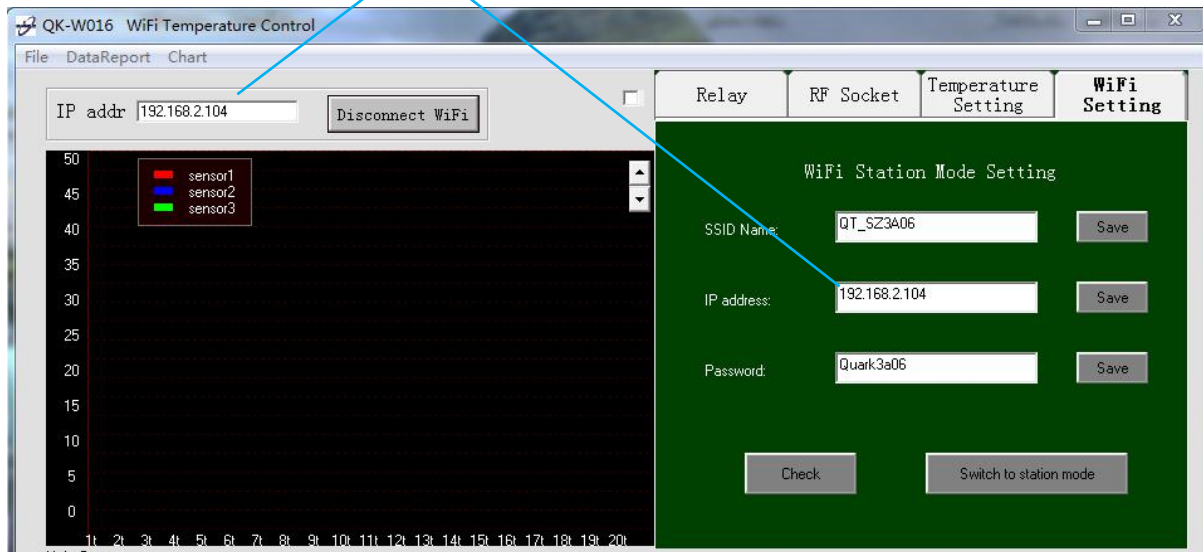


Figure 5 IP address setting in station mode

The Android and iOS APPs share a similar procedure with above, the only difference is QK-W016 doesn't need to be set up with a static IP address in Android/iOS APPs..

### 1.5 Resetting QK-W016

The operator can always reset QK-W016 if the settings are incorrect or if the working mode needs to be changed. Please follow the steps below to restore QK-W016 to the factory settings:

- Power off QK-W016.
- Press and hold the 'Reset' button, then power up QK-W016. A blue LED will light up for few seconds, then the red LED will turn on. After the red LED has been on for at least 3 seconds, release the 'Reset' button.
- Wait for 60 seconds, the red LED will turn off and then turn on again. Once the red LED turns on, the initialisation process is complete. During the initialisation period, the blue LED will flash at one second intervals.

The operator can now scan the available WiFi networks to find and connect to 'WiFi168'.



## 2 APPLICATION INTERFACE

### 2.1 Windows application

Once QK-W016 has been correctly setup (in either ad hoc or station mode), it can be operated with the application interface. The main control panel for the PC application is shown below:

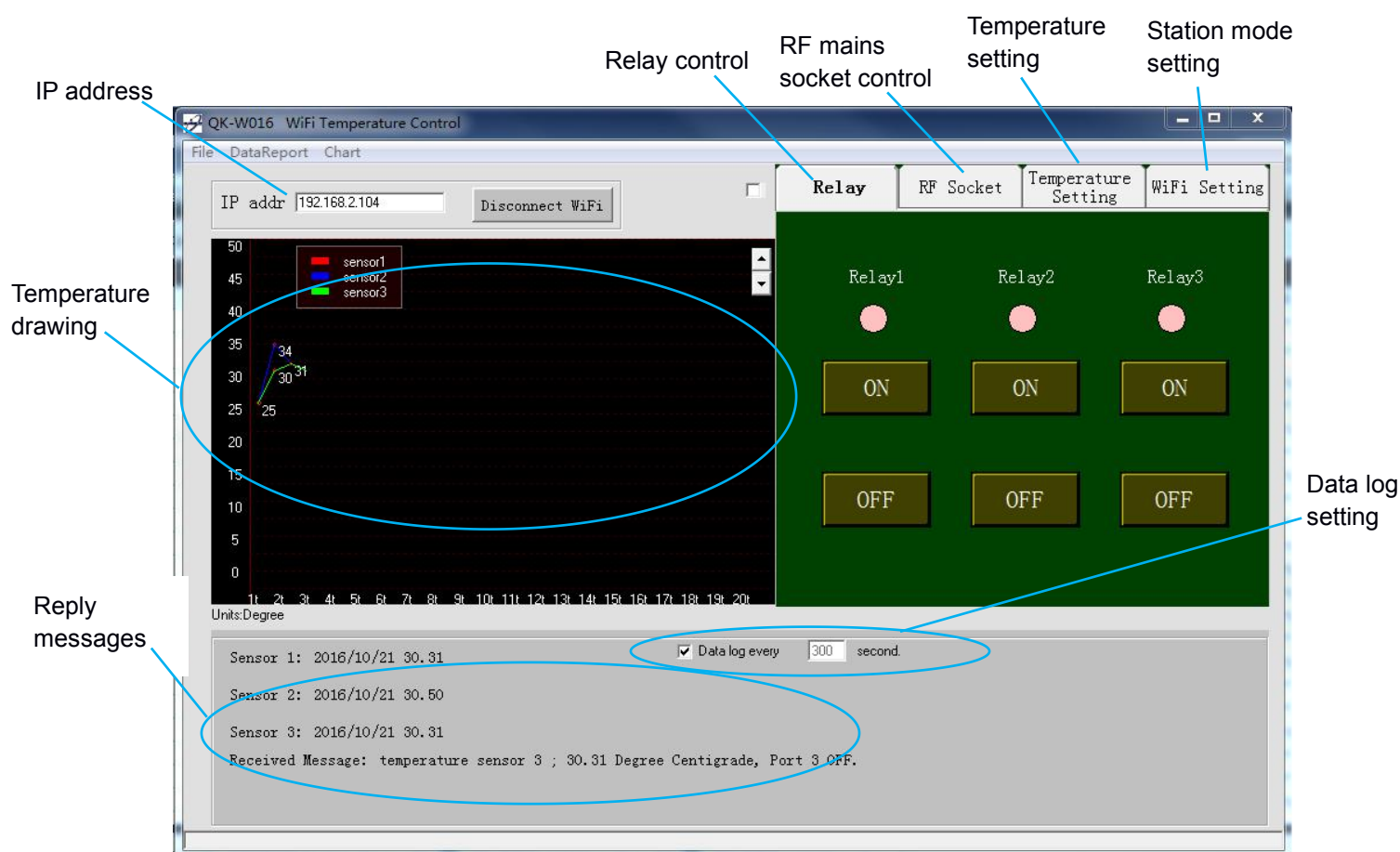


Figure 6 QK-W016 main control panel in the application

There are three icons (the red or pink dots) in the relay control area which indicate the status of the three relays. Unfortunately, due to the fact that there is only one way communication between QK-W016 and the 433MHz RF mains sockets, the status of the mains sockets cannot be indicated and checked.



These icons indicate the status of the relays.

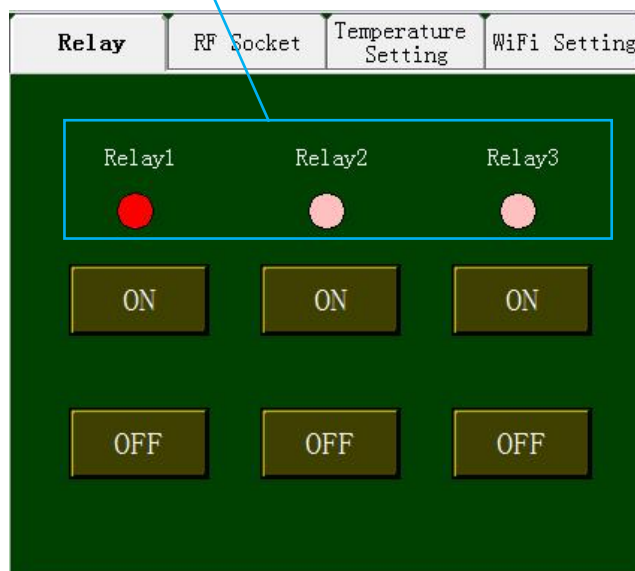


Figure 7 Relay status indicator

## 2.2 Android/iOS APP

The PC application does not support far end control through the Internet. This means that QK-W016 should be connected with the control computer using the same wireless AP (same SSID name).

In order to control QK-W016 from any location, operators can access the Internet using Android/iOS based terminals, such as mobile phones or tablets. The setup process is similar to that for the Windows application. The main control panel on the Android/iOS APP is shown below:



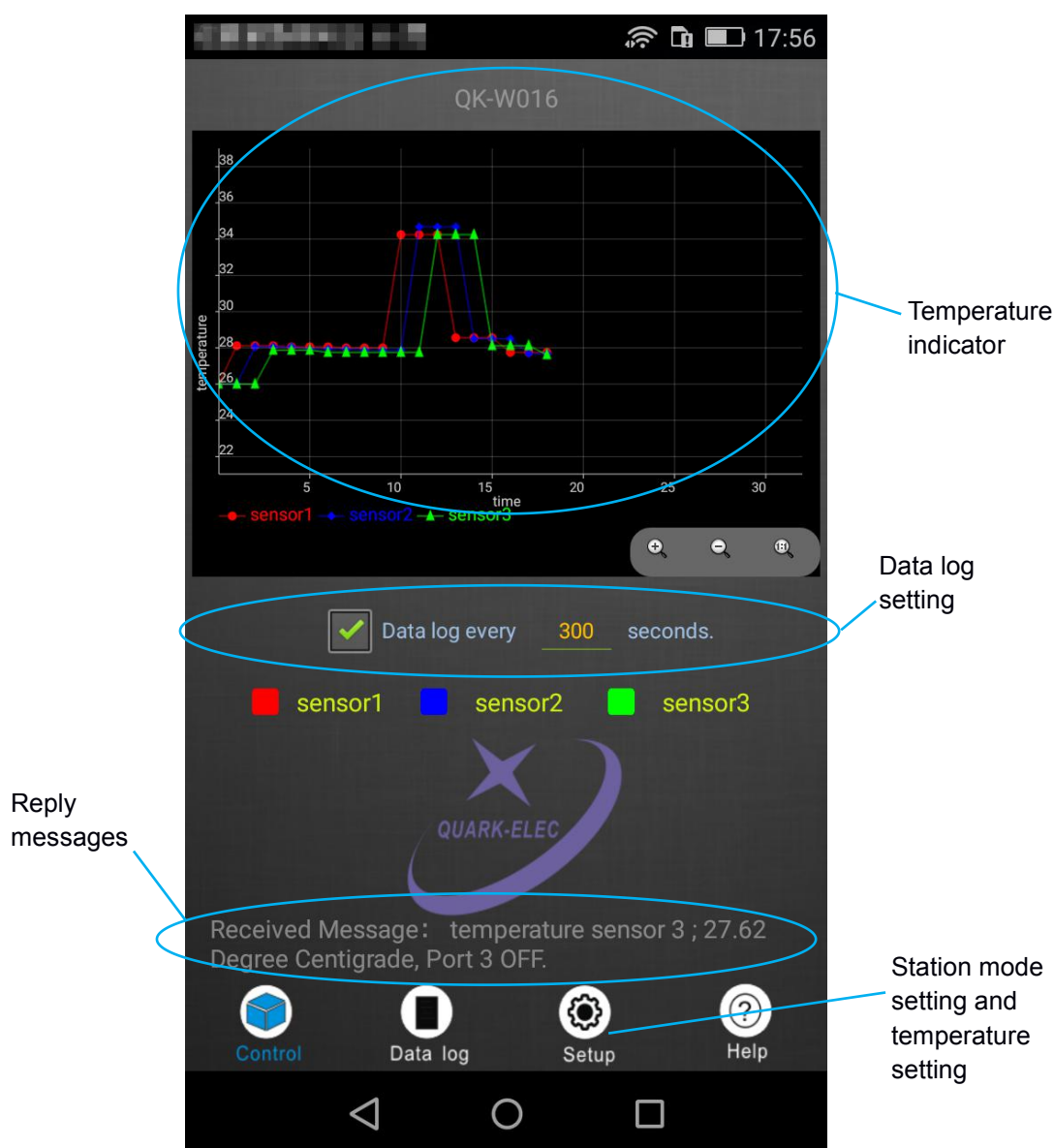


Figure 8 QK-W016 main control panel in APP



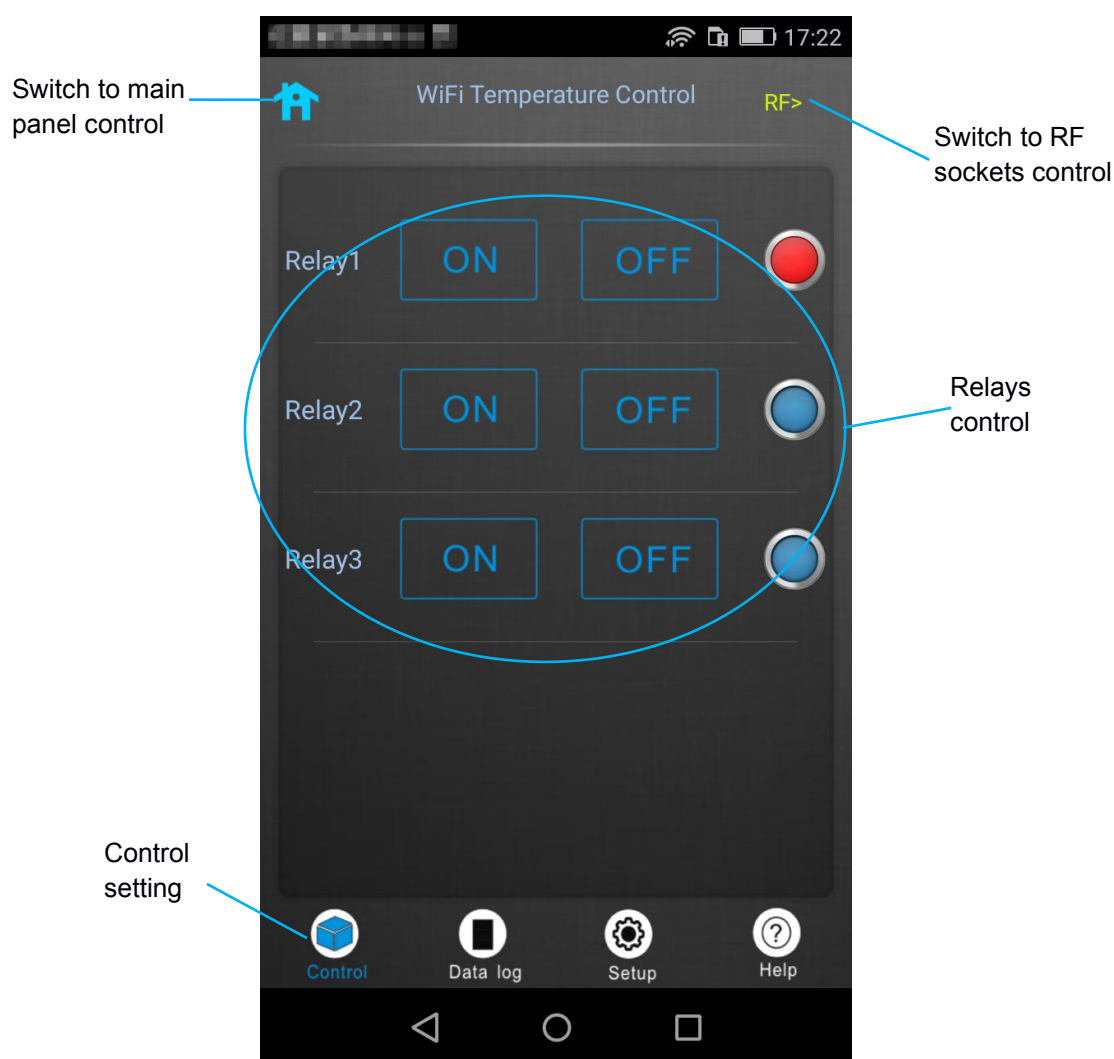


Figure 9 QK-W016 control page in APP

### 3 TEMPERATURE MONITORING & CONTROL

QK-W016 has three attached temperature sensors. Using the related output relays, it can be used to control three individual zones via WiFi. These industrial standard sensors provide typical accuracies of  $\pm 0.5^{\circ}\text{C}$  over the  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  temperature range.



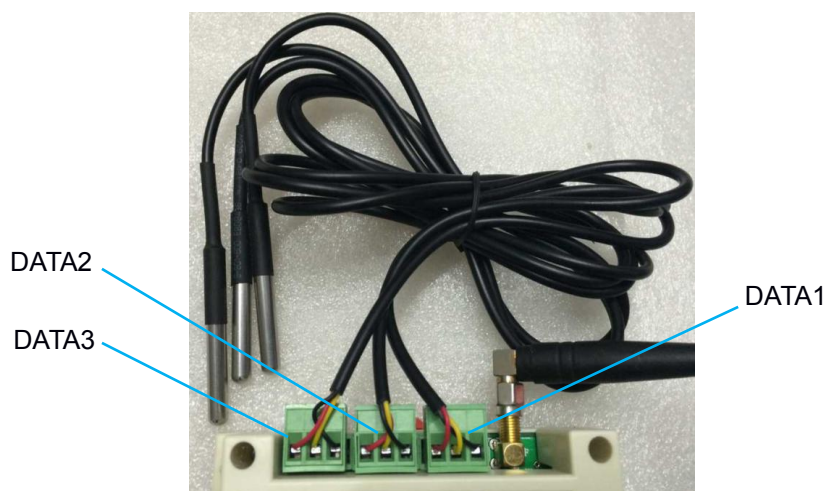


Figure 10 Temperature sensor cable

**Temperature sensor and output relay mapping table**

DATA1	RELAY1
DATA2	RELAY2
DATA3	RELAY3

Details of the sensor cable can be found from:

<http://www.quick-teck.co.uk/ElectronicElement/eeDetail.php?eeld=1567>



### 3.1 Temperature setting within the program

Operators can set the upper limit (maximum temperature) and lower limit (minimum temperature) for the controlled zones via the control panel, so the related relay can be triggered on or off once the measured temperature has reached the set points. The upper temperature needs to be at least 1°C higher than the bottom temperature to avoid hysteresis issues.

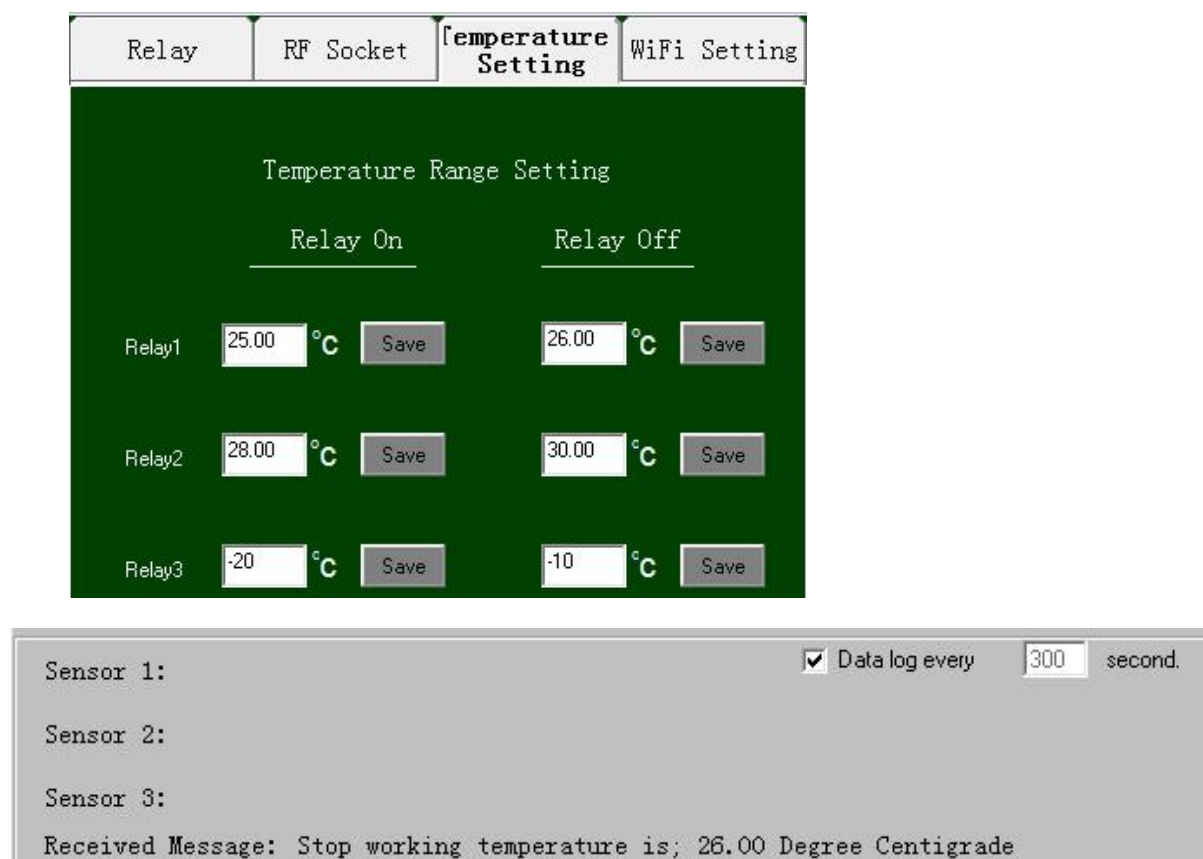


Figure 11 Temperature control setting

### 3.2 Temperature data logger

QK-W016 can monitor and record the temperatures at the sensors regularly by setting the interval times and ticking the boxes at 'Data log every xx seconds.' The minimum sample time intervals are 30 seconds for the PC application and 300 seconds for the mobile Android/iOS application.

The application or the APP will start to collect the temperature information from QK-W016. This information is shown on the received message field:



## Quark-Elec application note

```
Sensor 1: 2016/10/21 30.56
Sensor 2: 2016/10/21 33.87
Sensor 3: 2016/10/21 30.37
Received Message: temperature sensor 3 ; 30.37 Degree Centigrade, Port 3 OFF.
```

☒ Data log every  second.

Figure 12 Temperature information received from sensors

If the following conditions are applied, the application and the APP can store all the collected temperature information in the 'DataReport'.

- Open the application as administrator. This is very important otherwise the application maybe not able to write the data to the data log file;
- Open 'DataReport', input the date and select the sensor you want to check. Then click 'Enter' button, this will retrieve the history data.

You can also check the temperature chart for a specific sensor by opening the 'Chart' file.

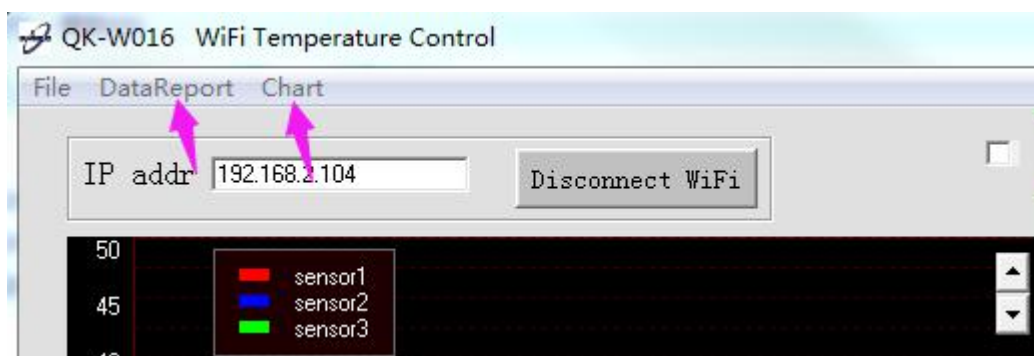


Figure 13 Data report setting



## Quark-Elec application note

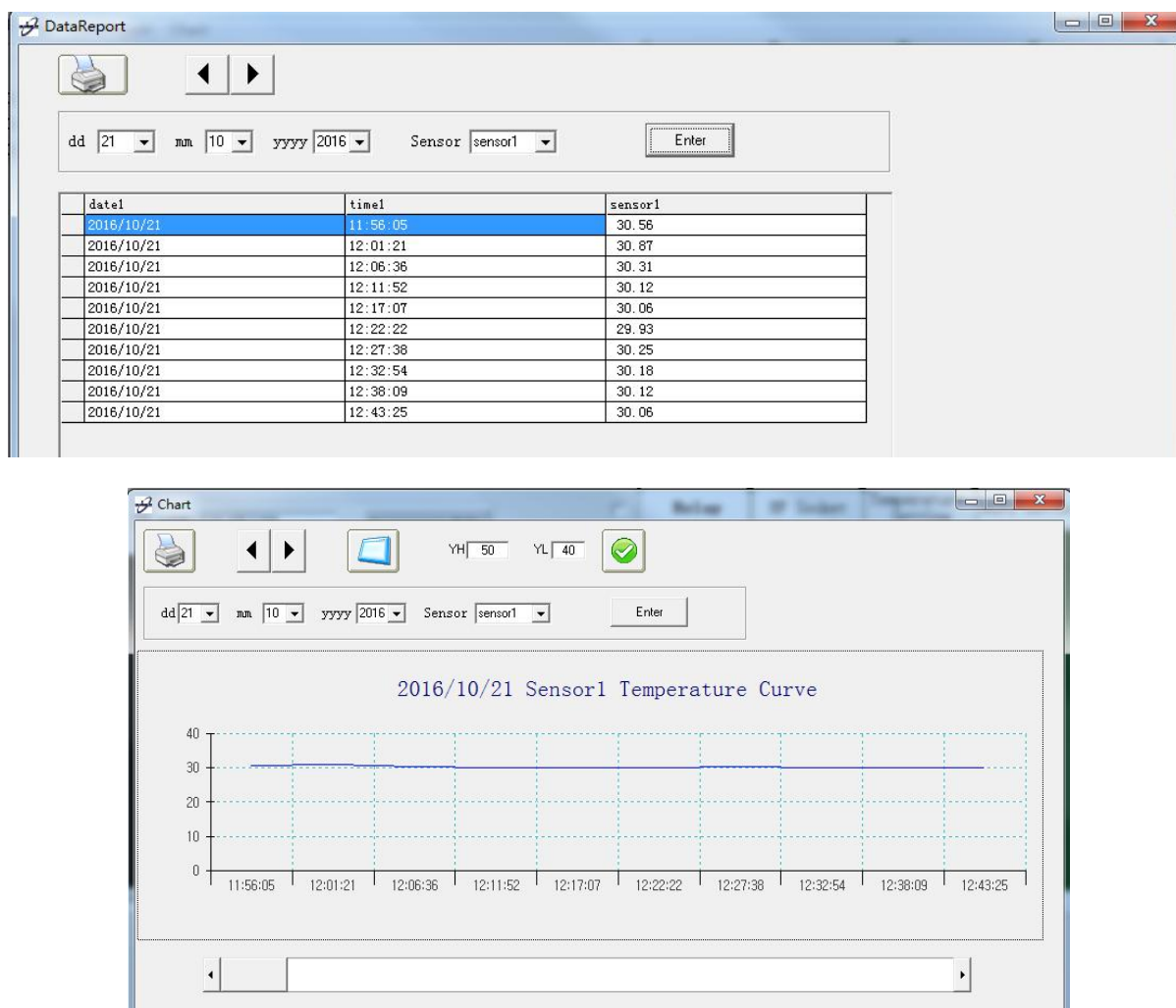


Figure 14 Temperature data logger.

## 4 SWITCHING RELAYS MANUALLY

If required, the operator can always manually switch the output relays. QK-W016 does not allow the disabling of the trigger inputs from the temperature sensors but, in this case, the operator can set the top and bottom temperature limits to be unreachable values.

## 5 PAIRING WITH RF POWER SOCKETS (OPTIONAL FUNCTION)

QK-W016 has a built-in 433 Mhz RF transmitter module that can pair with up to three RF power sockets (customers should contact Quark-elec to apply for this as an optional setting). So operators are able to turn electrical devices ON/OFF by remote control at the power sockets.

The mains power sockets have been pre-paired and ready for use when they are delivered with QK-W016. However, the operator can always re-pair or release the pairing using following steps:



## Quark-Elec application note

- Insert the RF power socket into a powered mains wall socket.
- The LED light on the socket should flash at 1 second intervals, indicating it is ready to pair with QK-W016. If the lights do not flash, press and hold the ON/OFF button for 5 seconds to clear the memory. Cleared memory will be indicated by the LED flashing quickly.
- Open the WiFi remote control panel in the program and press the corresponding RF switch 'ON' button. The pairing command will be sent out via RF signals.

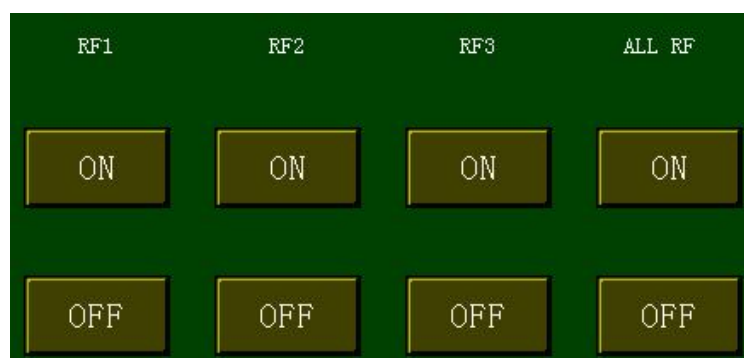


Figure 15 RF switch ON buttons

- Once the mains power socket has received the pairing command, the LED light on the socket will flash briefly more quickly and then flash at 1 second intervals. The RF mains socket should be successfully paired now.
- Repeat the above process for each different RF mains socket.

The RF mains sockets are now ready for remote switching. Due to the nature of the one way communication protocol between QK-W016 and the sockets, there is no RF mains socket indicator icon.

## 6 HARDWARE

### 6.1 Connections

A general view of the module is shown below and details of each connection are also described. QK-W016 uses 12VDC, 1.0A power and the outside and inner diameters of the mains plug are 5.5 mm and 2.1 mm.



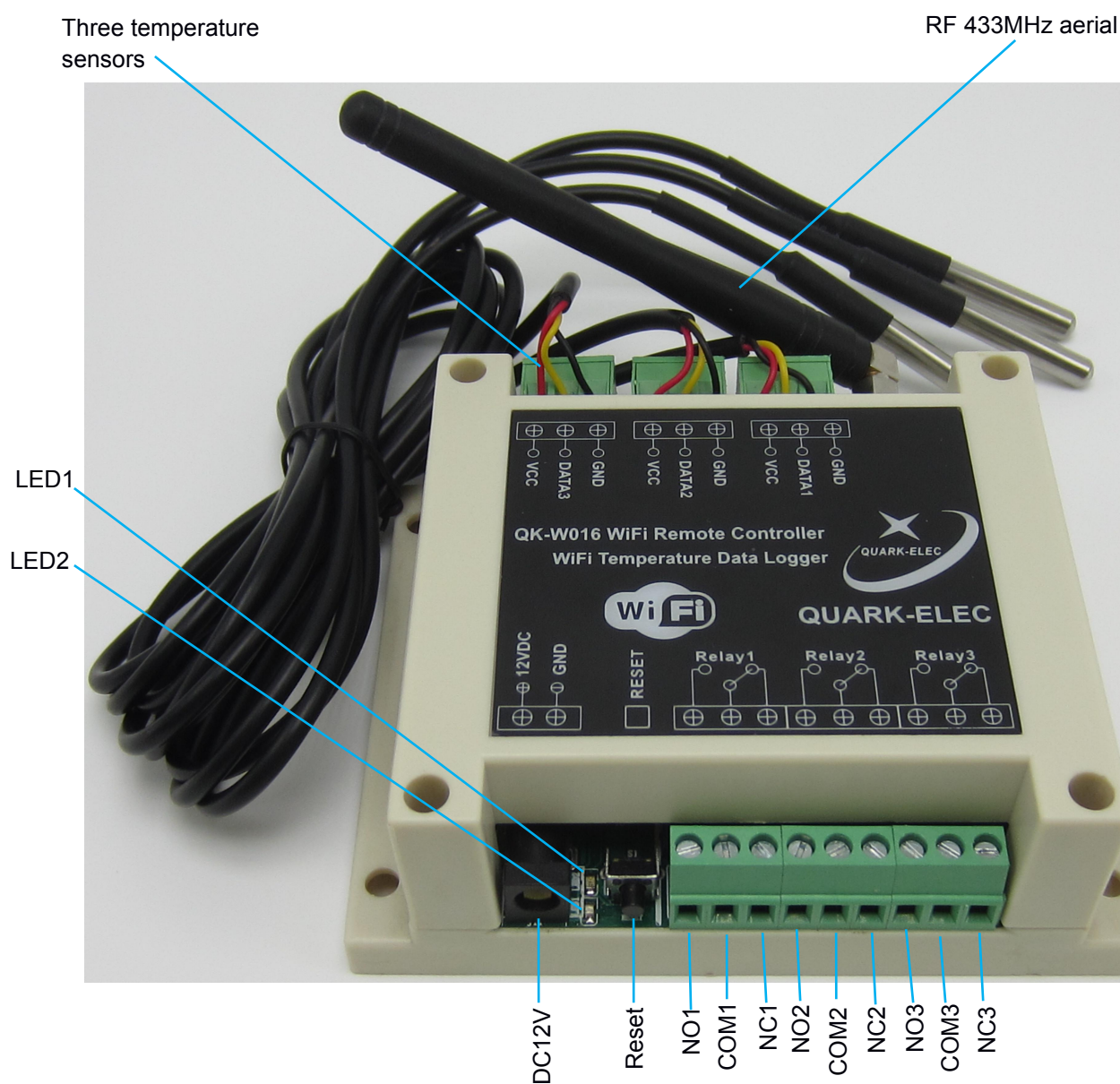


Figure 16 QK-W016 connections



## 6.2 RF mains sockets

Customers can select US, European or UK type RF mains sockets. Quark-elec standard RF mains sockets have a 2000W power rating.

Although QK-W016 runs specific algorithms to increase the RF transmission reliability, Quark-elec cannot guarantee a 100% correct action rate for the RF mains sockets. QK-W016 RF signals could be affected by other nearby RF devices such as wireless doorbells, car keys, cordless phones, mobile phones and RF alarm systems. The following are real test results taken in a house environment in the UK:

Distance between QK-W016 and 433 Mhz RF mains sockets	Proper action rate (RF mains sockets successfully triggered by QK-W016)
2 metres	100.0%
5 metres	100.0%
8 metres	99.2%
10 metres	98.1%
15 metres	95.4%
20 metres	93.7%



### 6.3 Enclosure

QK-W016 has an IP56 Insulation Class 2 plastic enclosure, with 115 x 90 x 40 mm external dimensions.

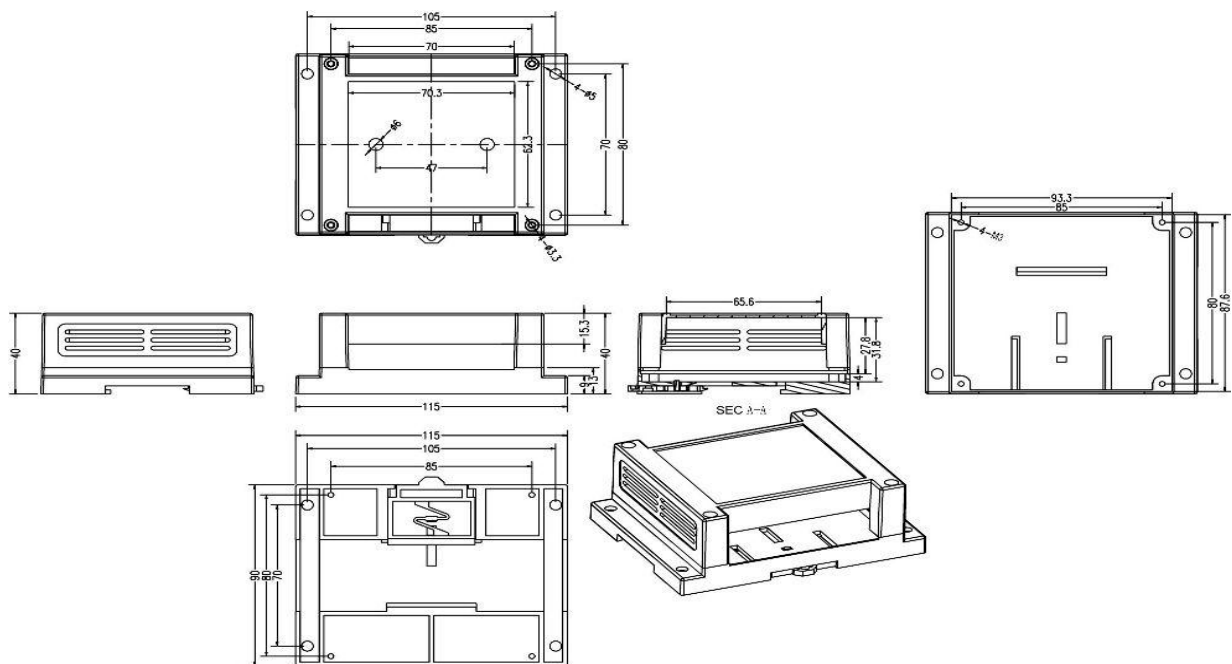


Figure 17 Enclosure drawing



## 7 OPERATING SPECIFICATIONS

Item	Specification
Operating temperature	- 25°C to + 80°C
Storage temperature	- 40°C to + 85°C
DC supply	12.0V ( $\pm 10\%$ )
Average supply current (typical quiescent)	175mA
Supply current in busy period (data transmission)	205mA
Temperature sensor working range	- 40°C to + 105°C
Temperature sensor tolerance	$\pm 0.5^\circ\text{C}$
WLAN standard	IEEE 802.11b/g/n
Operating frequency	2.4000 to 2.4835GHz
Receive sensitivity	-85dBm @ 11Mbps, -70dBm @ 54Mbps
Transmit mean output power	+17dBm for 802.11b, +13dBm for 802.11g, +12dBm for 802.11n
WiFi antenna	Built-in module U.FL antenna connector
Encryption	Support for WEP40/64, WEP104/128, WPA-PSK, WPA2-PSK, AES and TKIP
433Mhz transmitting power	1W
433Mhz modulation mode	ASK (AM)
RF transmission power	<10mW
RF emission distance	25 to 50 metres (open air conditions)
Rated current on relay	7A, 240VAC
Rated voltage on relay	9V - 245V
Power rating on RF mains sockets	< 2000W



## **Quark-Elec application note**

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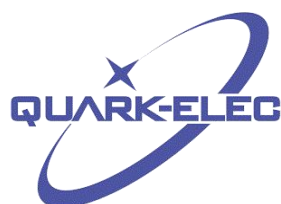
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