BRK Series User Manual

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BRK-2800 Series

IIoT MQTT Communication Server

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Revision History

Content of Table

1. BRK Introduction

1.1 Introduction

BRK Series is an Communication Server that specially provides Broker function of MQTT protocol for MQTT message distribution and concentrator in M2M and Industrial Internet of Things environments. The BRK Series is compatible with the MQTT version V.3.1, V.3.1.1 and V.5.0 protocol. It supports many functions such as QoS message quality mechanism, retains mechanism, identity authentication, communication encryption, last message (Last Will), and bridge. The method of Web UI settings can quickly set up BRK functions. This reduce the burden of setting up the broker by user oneself and the maintenance cost. Besides, BRK Series provides Bridge, Cluster, Load Balancer, and High Availability functions. By forming multiple BRK Series a group to a better Redundancy system can prevent field systems from stopping services due to hardware or network failures.

1.2 Features

- **Provide Bridge and Cluster functions, which allows excellent scalability**
  The Bridge and Cluster functions can expand the limits of service and data sources for MQTT Broker applications:

  - **Bridge function**
    Allows BRK series to forward/subscribe the messages to other BRK series or third-party MQTT Brokers. By forwarding messages, it can direct the message to other BRK series service side. By subscribing to the remote brokers, it can increase the data sources.

  - **Cluster function**
    Allows BRK series in the same group to share data to others with lower resources. When the number of connections and messages exceeds the limit of a BRK, using the cluster function can increase the number of connections to meet the needs.

- **Support High Availability architecture**
  When there are more than two BRK devices in the same site, they can be set as backup between each other. When the BRK device that is providing services fails or goes offline, other BRK device can detect and take over in a short time to ensure that the service will not be interrupted for a long time.

- **Support Load Balancing Function, which can effectively configure tasks and optimize MQTT communication**
  The BRK load balancing function can be used in conjunction with the MQTT bridging or clustering function. A BRK device in this group provides a single fixed IP and communication port to connect other BRK clients in the group, which can be effectively allocated to the BRK devices in the group for MQTT communication services. This function simplifies user configuration and maximizes the overall system service capacity: when a single or a small number of devices in the group fail, the connection can be redistributed to other BRK devices to continue to provide communication services.

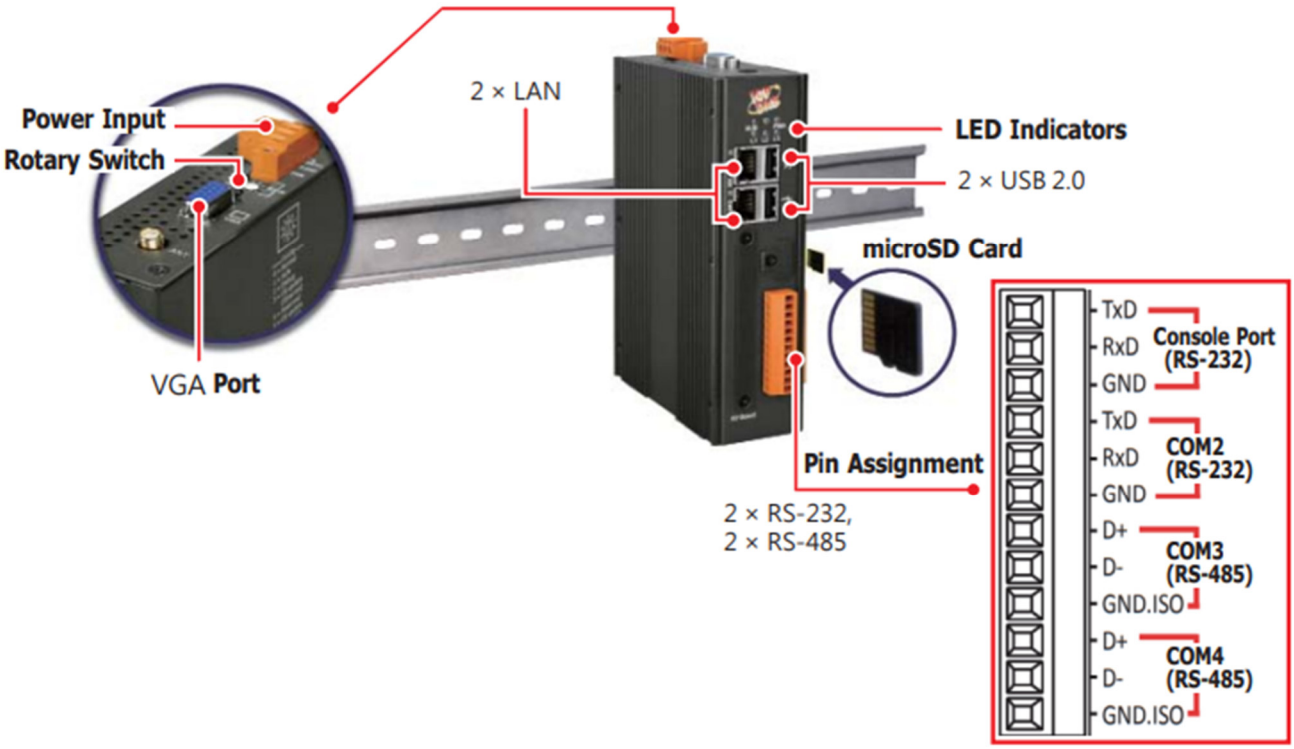
- **Support Redundancy System**
  Based on the High Availability architecture and Load Balancing function. This redundancy is hardware backup. In the entire MQTT Broker group, if one of the BRKs fails or disconnects, the other BRKs with normal functions will take over to provide MQTT services, and users do not need to perform other related settings.

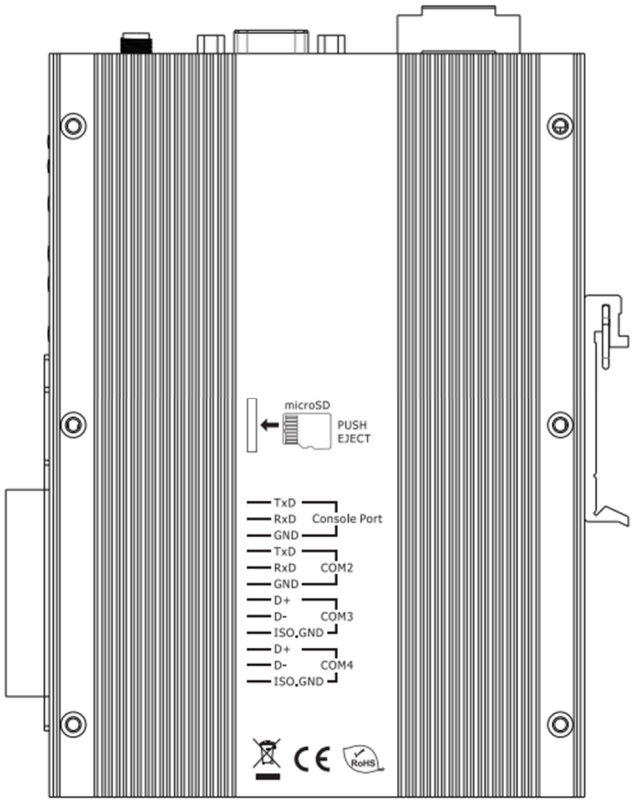
1.3 Specifications

Model		BRK-2841M
Main Unit		
CPU		Quad-core ARM CPU, 1.6 GHz/Core
System Memory		DDR3 SDRAM 1 GB
Storage		Flash 8 GB
Non-Volatile Memory		FRAM 64 KB, MRAM 128 KB
Ethernet		
Ports		RJ-45 x 2, 10/100/1000 Base-TX (Auto-negotiating, Auto MDI/MDI-X)
Power		
Input Range		+12～+48 VDC
Consumption		4.8 W
Environmental		
Operating Temperature		-25～+75° C
Storage Temperature		-40～+80° C
Humidity		10～90% RH,Non-condensing
Software		
MQTT Client Connection Numbers		Max. 100000
MQTT Broker	**Basic Features**	
	Bridge Function	Support
	Cluster Function	Support
	QoS (Quality of Service)	Support QoS0, QoS1, QoS2
	MQTT Protocol	Support V3.1 / V3.1.1 / V5.0
	Retained Message	Support
	Last Will Message	Support
	System Topic($SYS/#)	Support
	Delay Publish	Available Soon
	Topic Alias	Available Soon
	Supported Protocol	
	TCP/SSL	Support
	Websocket (SSL)	Available Soon
	STOMP	Available Soon
	MQTT-SN	Available Soon
	CoAP	Available Soon
	LwM2M	Available Soon
	Identity Authentication	
	Client ID	Support
	User Account & Password	Support
	IP Address	Support

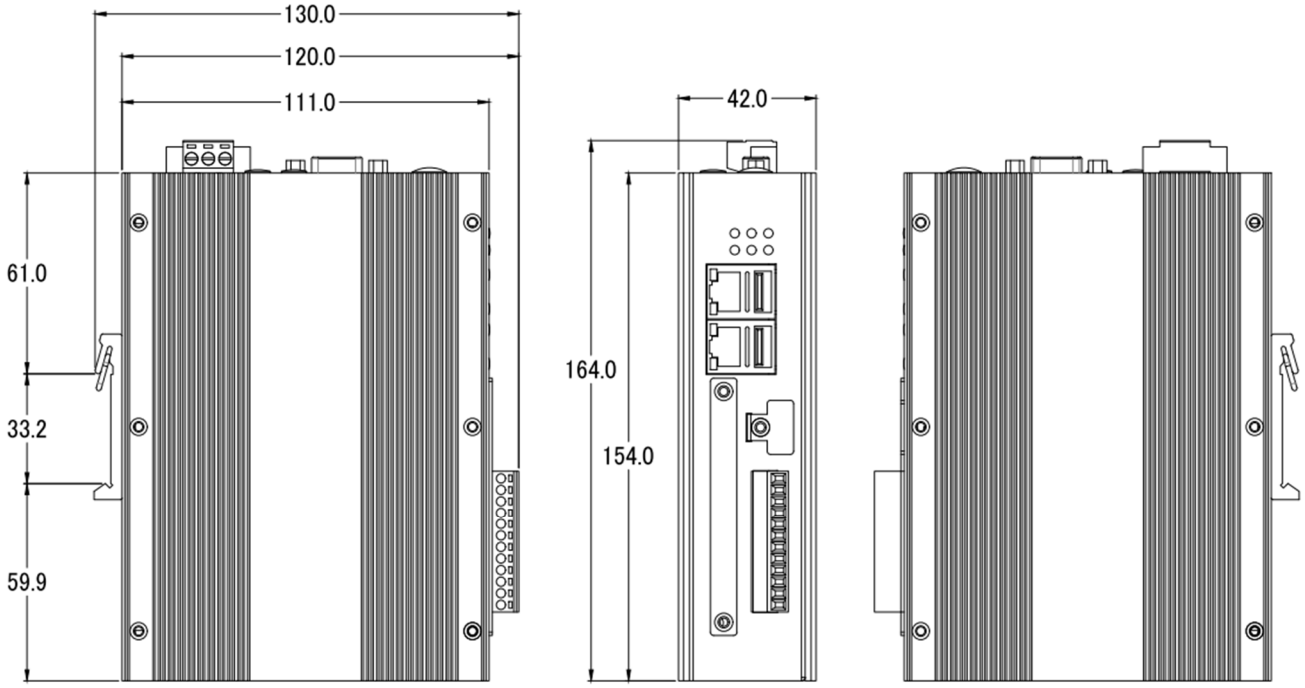
Load Balancing Function	Support
High Availability Architechture	Support

1.4 Appearance





1.5 Dimensions



2. Quick Start: Hardware/Network Connection

This chapter describes the devices hardware connection, network connection and quick setting for the BRK Controller, and how to connect to the BRK controller web-based UI via a browser. Next chapter will set up web functions, and complete a demo project. (Please refer to Chapter 3).

2.1 Hardware Connection

This section describes the hardware wiring and connection for the BRK Series.

2.1.1 Preparations for Devices

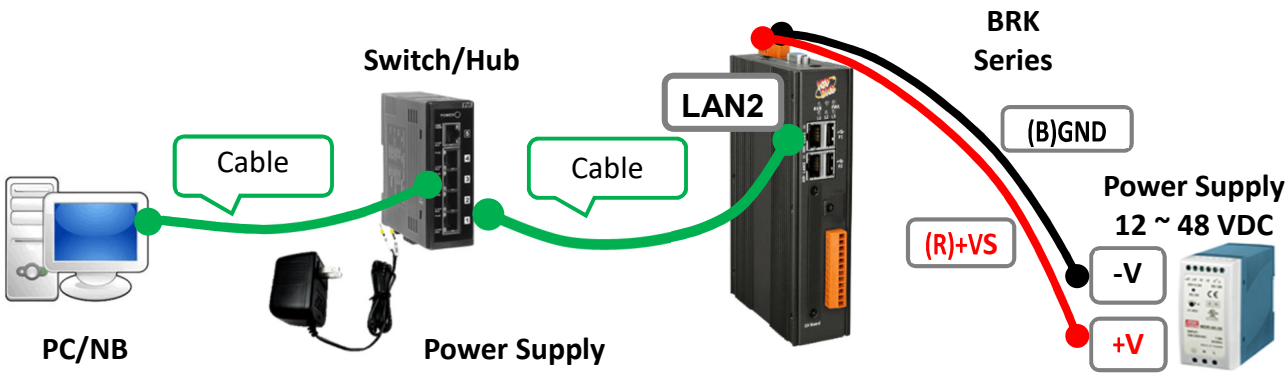
In addition to the BRK controller (Ex: BRK-2841M) , please prepare the following:

1. **Computer: PC/NB** Connect to the local network and can set up the network
2. **Ethernet Hub or Switch**: e.g. NS-205
3. **Power Supply: +12 ~ +48**, e.g. MDR-60-24

2.1.2 Hardware Wiring

Use LAN2 of BRK-2800 to connect to the PC through a network hub/switch, or directly connect to the PC's network interface.

After power is connected, please [**wait for 1 minute**] for BRK boot procedure. When the "RUN" and "PWR" lights of the BRK start to flash green and red, it means the boot is completed, and the connection and setting can be performed.



2.2 Network Connection

There are three ways to log in to the **BRK Web UI** (User Interface) through BRK network connection. The following is a brief description, and then the steps are described in subsections:

- If the device has just arrived from the factory or is used for the first time (A), it is recommended to use the connection method in **Section 2.2.1** (same as the "Quick Start" included with the shipment).
- If the device has been set up to connect but does not know the IP (B), it is recommended to use the connection method in **Section 2.2.2** (use Utility to search for the devices).
- If the device has been set up and the connection IP (C) is known, you can directly enter the IP connection in the browser website to log in.

The methods to login the BRK Web UI:

A. Using Factory Default Setting:

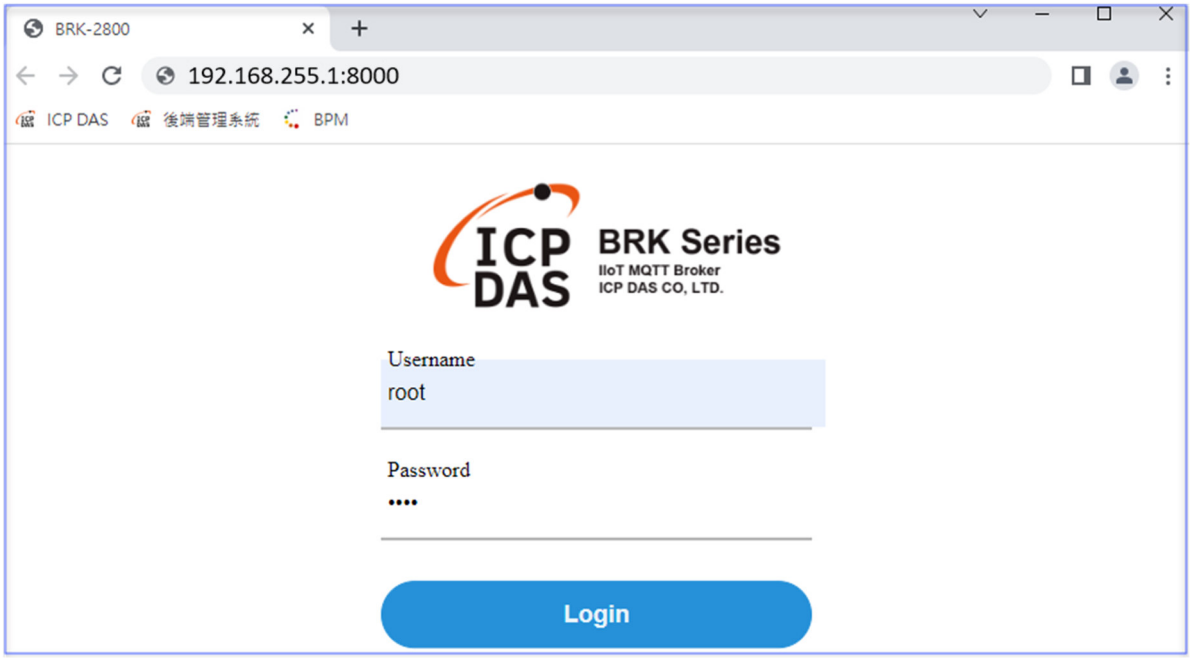
This way is suitable for those who is setting a new BRK or the PC network IP is not in the same domain with BRK. This method changes the PC network IP to match the BRK factory default settings to connect and login the Web UI. (Refer to **Chapter 2.2.1**)

B. Using Software Utility:

Suitable for quick setting when multiple BRKs are connected in the same network but each IP address is unknown. BRK products provide a free software utility to automatically search and connect to BRKs on the internet and can Log into BRK Web UI.(Refer to **Chapter 2.2.2)**

C. Using IP Address:

Suitable for the situation while BRK has a fixed IP and in the same domain network with the PC. If the BRK has a fixed IP and in the same domain with the PC, users can directly enter the IP in the address bar of a web browser and log in to the Web UI of the BRK.



2.2.1. Connection by Factory Default Settings (For New BRK)

The factory default settings of the BRK series are as the following table:

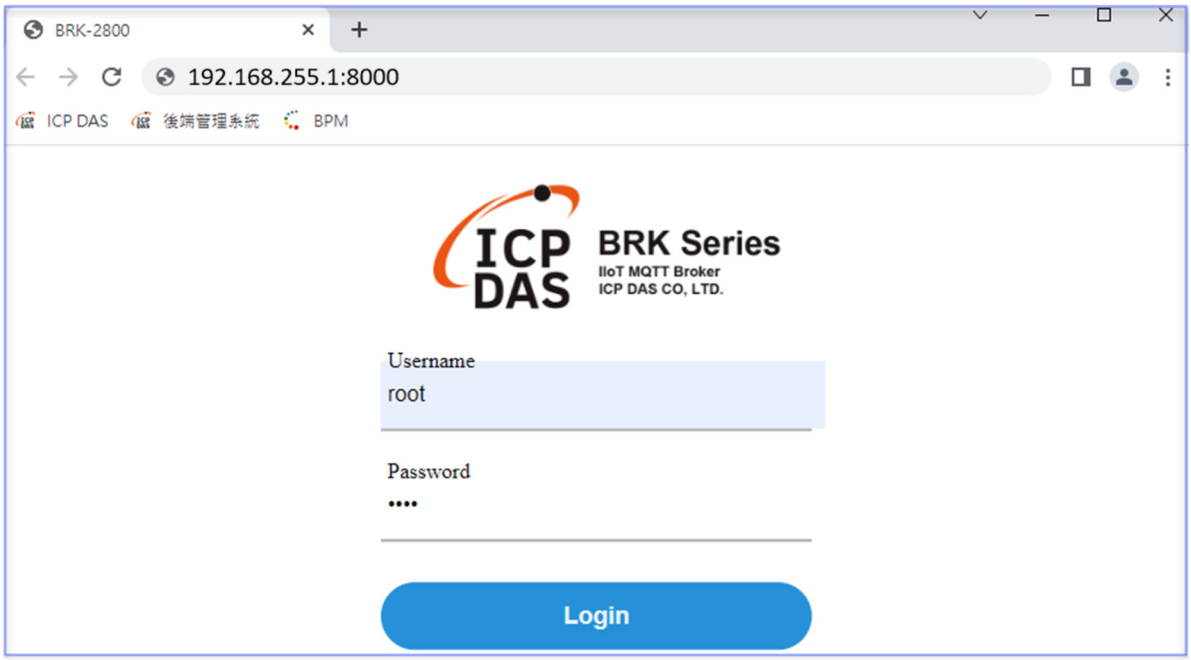
Factory Default Settings of BRK			
Network	**IP**	**192.168.255.1:8000**	Assign BRK-2800 a new IP setting according to your case.
	Netmask	**255.255.0.0**	
	Gateway	**192.168.1.1**	
Web UI Account	**Username**	**root**	**After the first login, change the default username/password to use other functions.**
	Password	**root**	

1. Change the **PC's IP** setting as following. **(Write down the PC original network settings before modify.)**

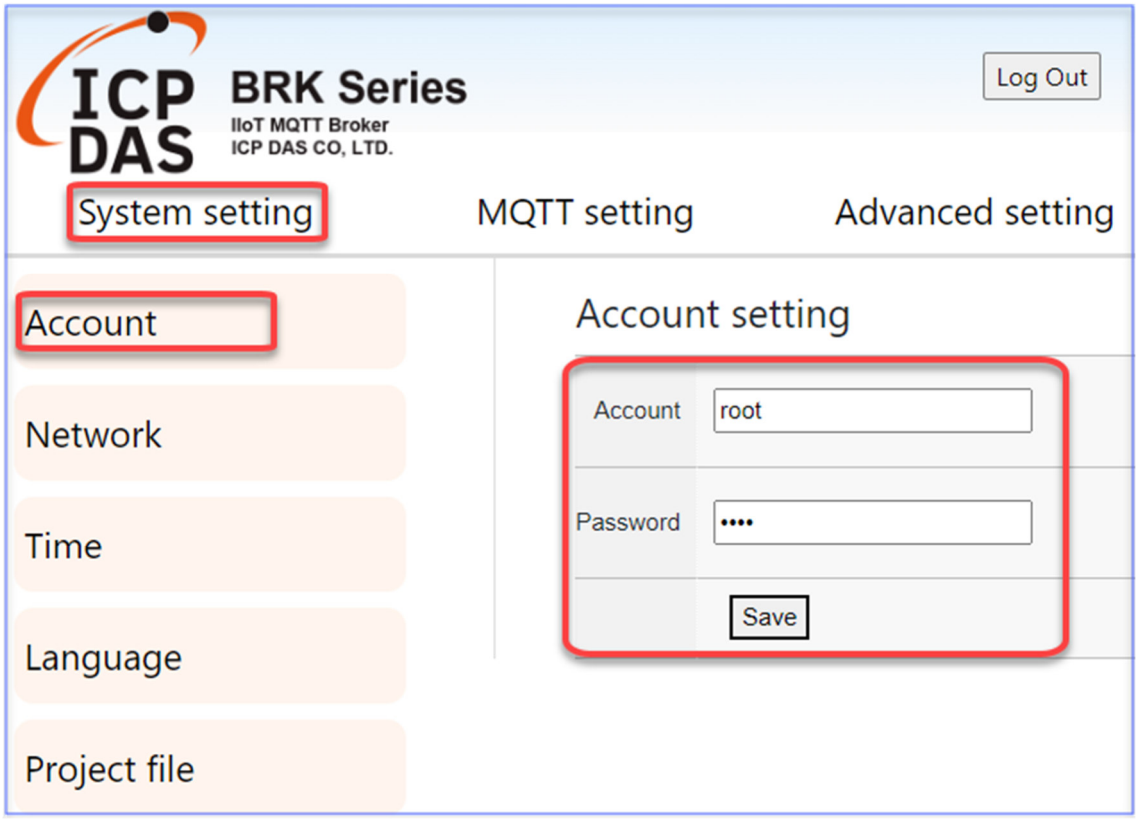
IP	**192.168.255.10:8000**
Subnet mask	**255.255.0.0**
Gateway address	**192.168.1.1**

2. Make sure the PC and BRK is connecting through Ethernet. Then open a PC side browser (Ex: Chrome, IE…).

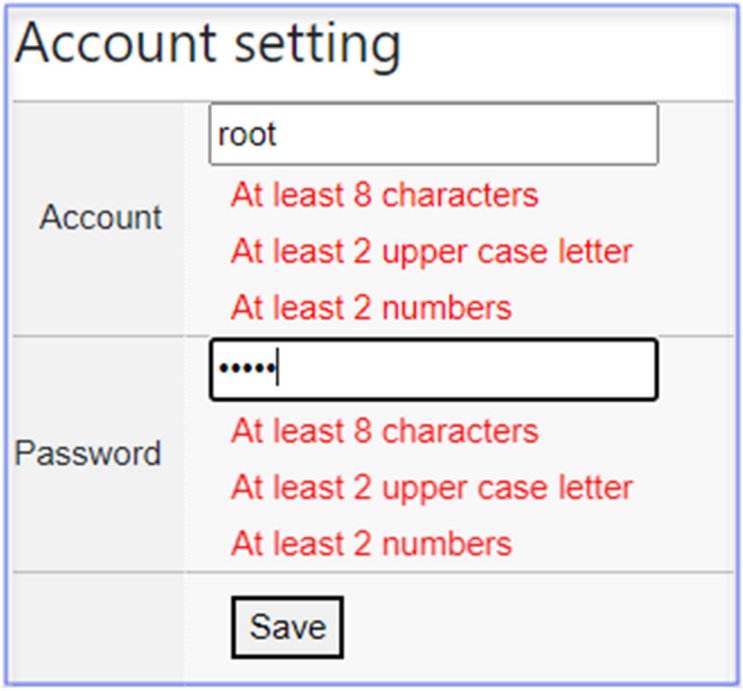
   Type **http://192.168.255.1:8000** in the URL address. Use Web UI **default username / password** "**root" / "root"** to login the system.



3. Click【System Setting】➔【Account Setting】, change the Username/password first, or user cannot use any other function (New design for data security)

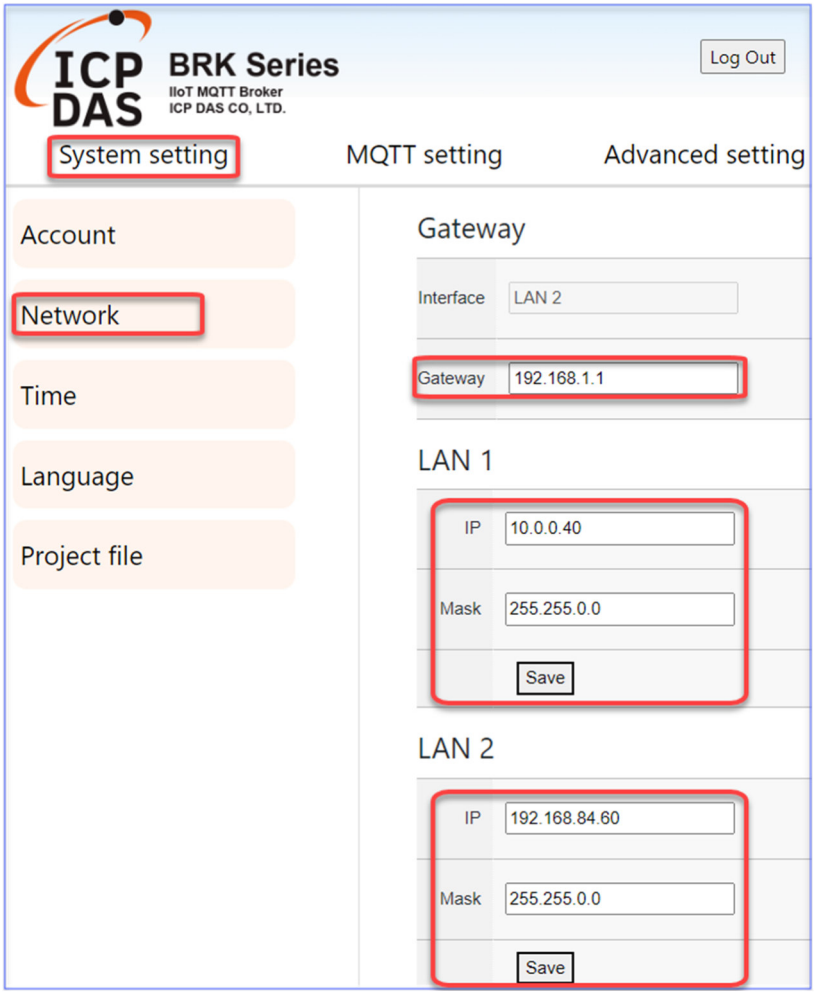


Password Setting rules:

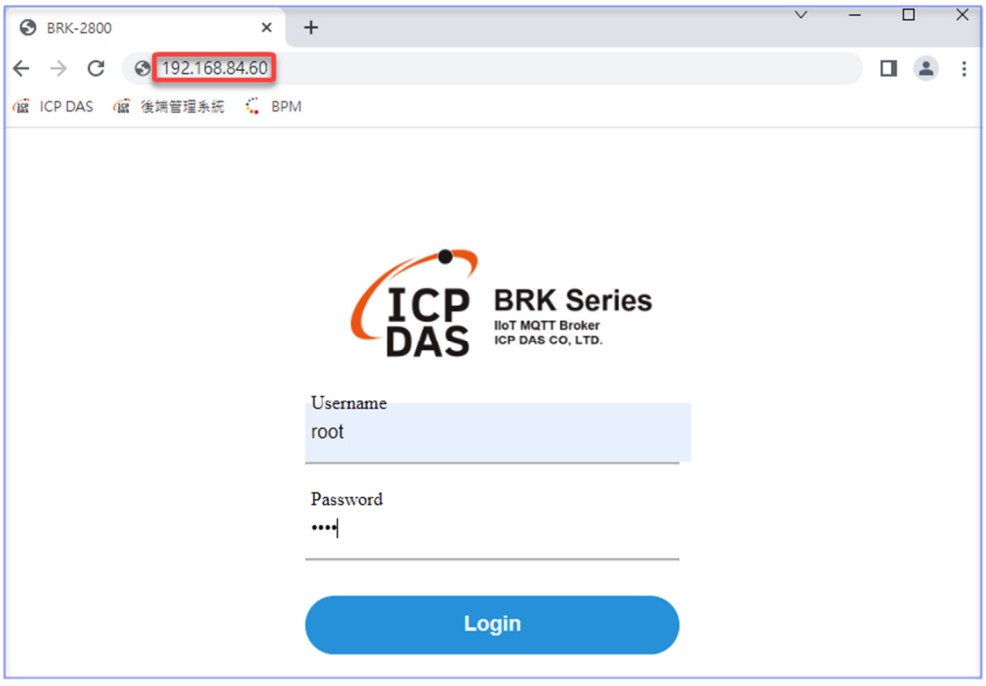


4. Click【System Setting】➔【Network Setting】to change the IP setting by user network.

Note: While the network cable has been correctly connected to LAN1 and LAN2 will show up setting interface.



5. Save the IP setting, restore the PC original IP settings, and type the new IP in the browser as step-2 to login the Web UI of BRK. Then configure user's BRK project.



2.2.2. Connection by Utility Searching

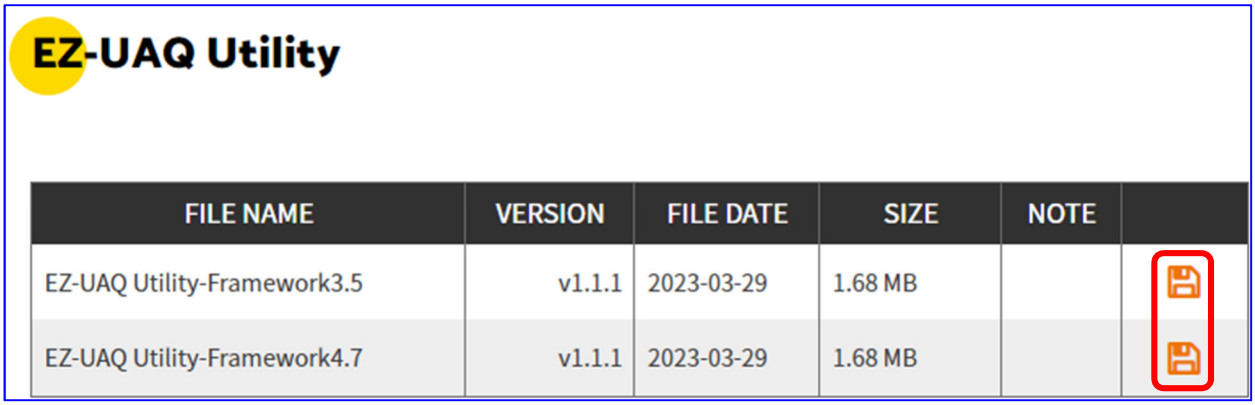
Setting new BRK or the new user please use the method in the Chapter 2.2.1. (Method A)

If the BRK has a fixed IP and in the same domain as the PC, users can directly enter the IP in the address bar of a web browser and log in to the Web UI of the BRK. (Method C)

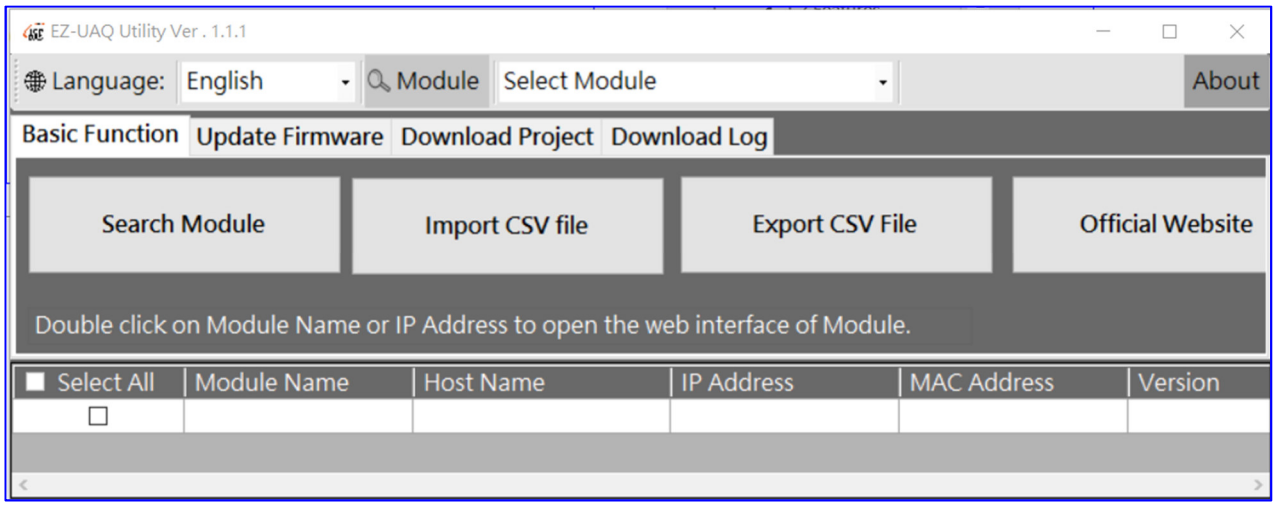
This section introduces the 2nd method(B) that users use the BRK Utility to search the Network IP. This method is suitable for connecting multiple BRK series controllers to the Internet, but the IP addresses of BRK are unknown or need to modify the BRK quickly.

The Utility is a free tool software to quickly search each UA/BRK/UA_IO series in the network and connect to its Web UI for setting UA/BRK/UA_IO series products and project.

In the PC, download and install the **Utility (EZ-UAQ Utility)** suitable for your PC, and then run it to connect the device. Please download the utility program from the website:
https://www.icpdas.com/en/download/show.php?num=8560&model=BRK-

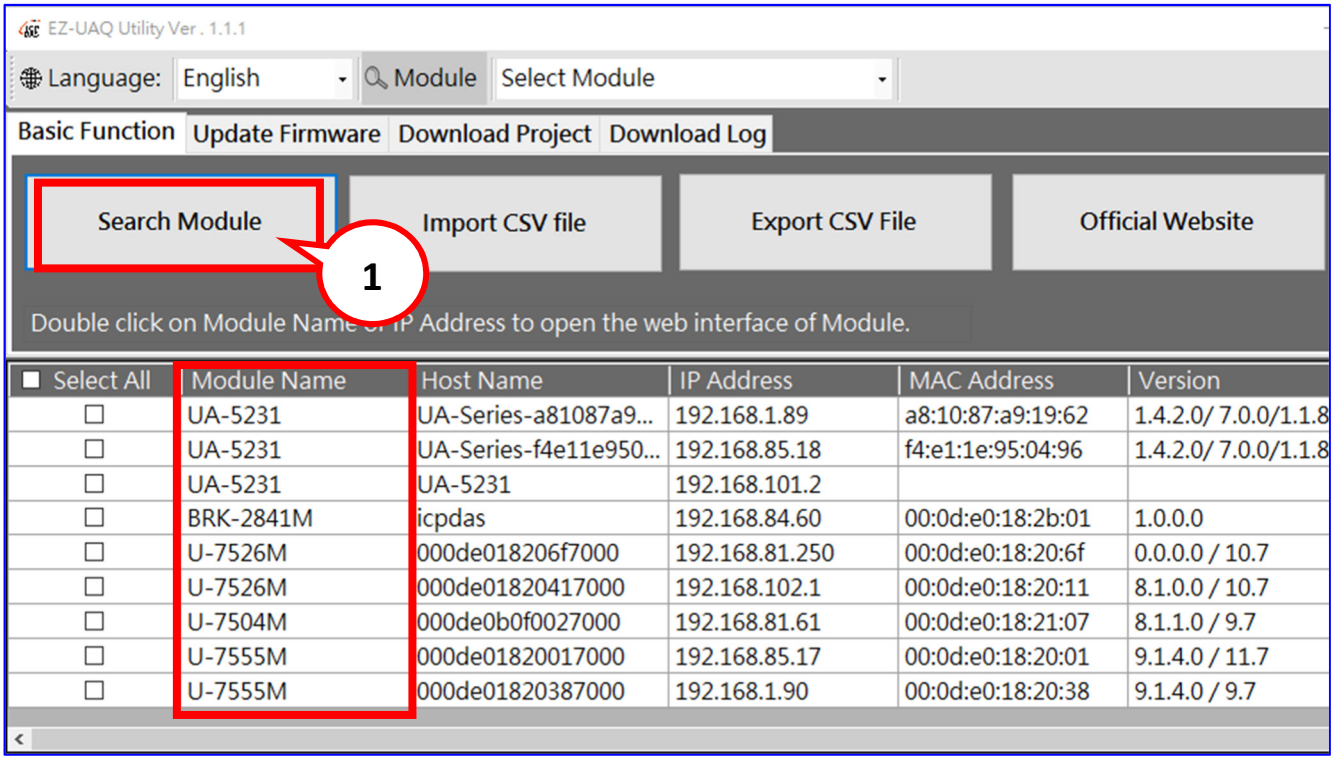


1. **Install and execute the Utility**
   Download and unzip the Utility, double-click the executable file (**EZ-UAQ Utility.msi**) to install and execute the Utility software.
   (If there is an old version of Utility on the PC, please uninstall it first.)



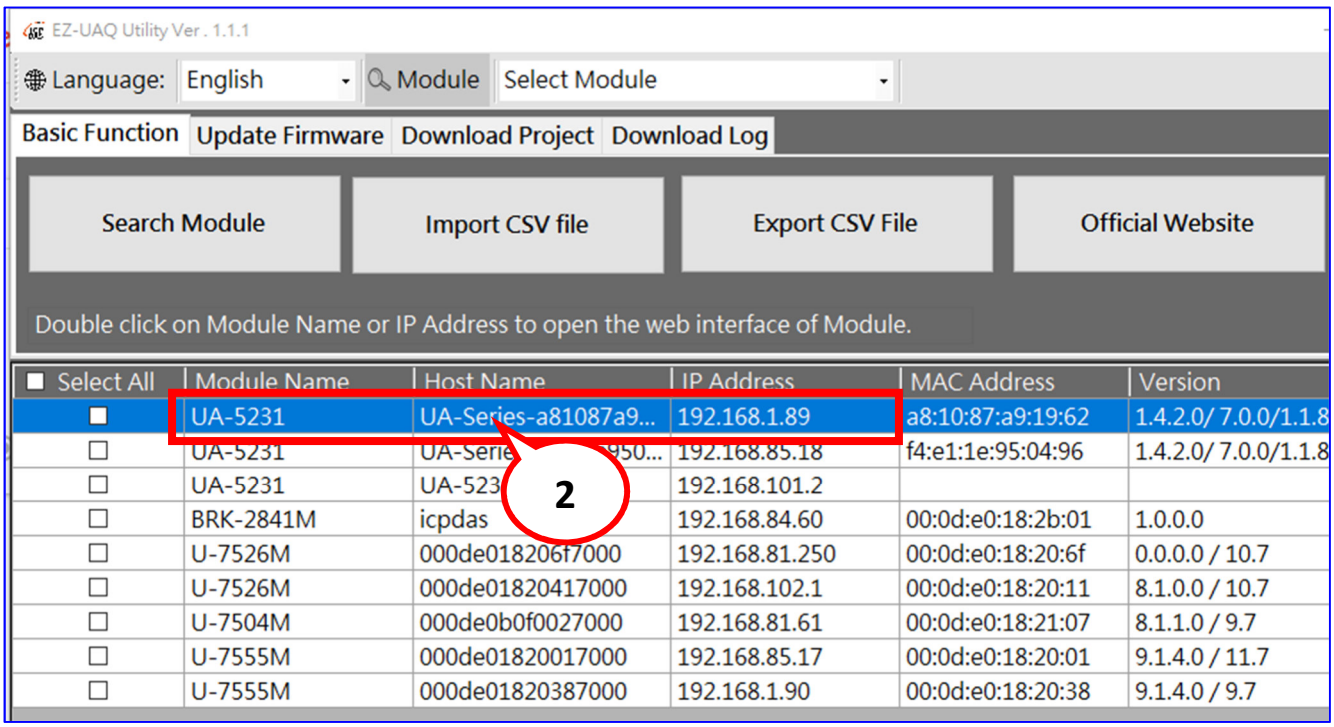
2. Search the UA/BRK/UA-IO series modules

Click the "**Search Module**" button, the utility will search and list all UA/BRK/UA-IO modules in the network.



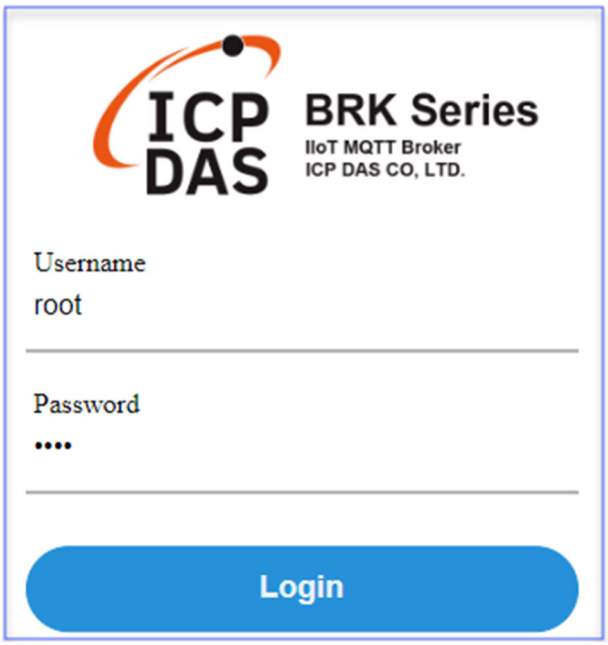
3. Connect to the BRK Series

Double click the module list (from the Module Name to the IP address) you want to connect to, and it will directly link to the UA/BRK/UA-IO webpage via the default Web browser (Chrome, Edge, IE…).



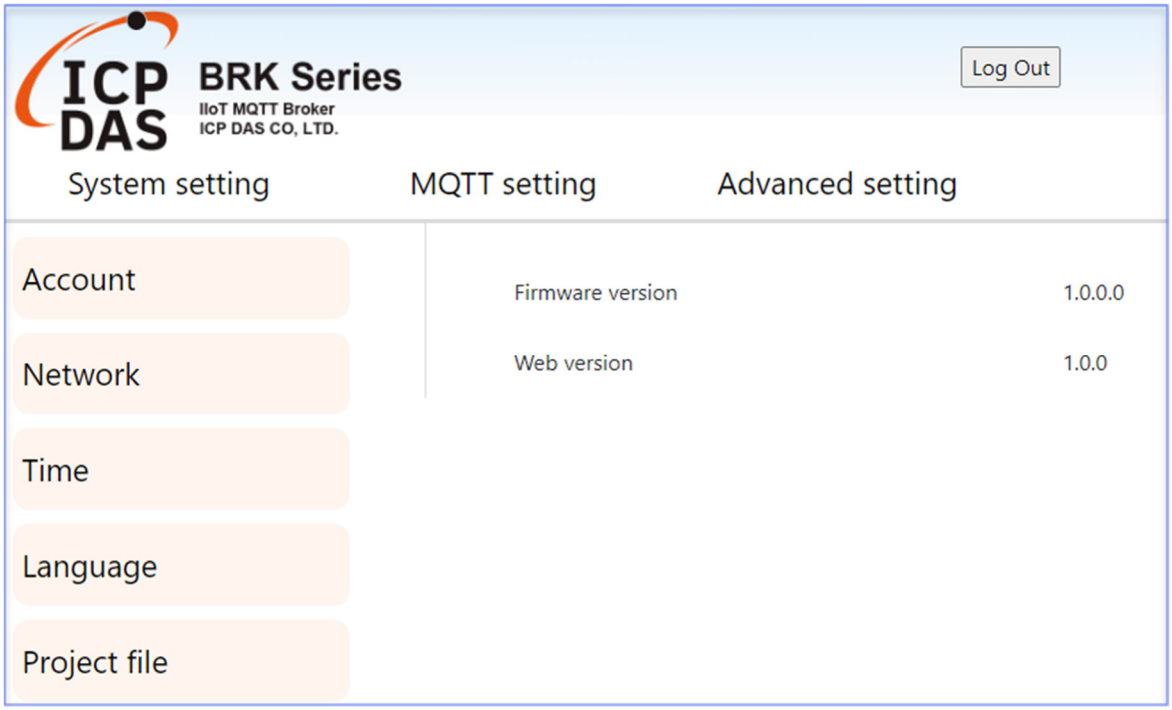
4. Connection to the BRK Web UI

The default web browser will be run and direct go to the BRK login web site.
Please enter the username and password to login the BRK Web UI.
The default username: root.
The default password: root.
After login in, change the default Username/password first, or user cannot use any other function (New design for data security).



5. Login the Web BRK of the BRK Series

When login into the web interface, the BRK default home page (the main configuration screen) will show as below, and will automatically read setting of that BRK to the webpage.



3. Main Function Settings

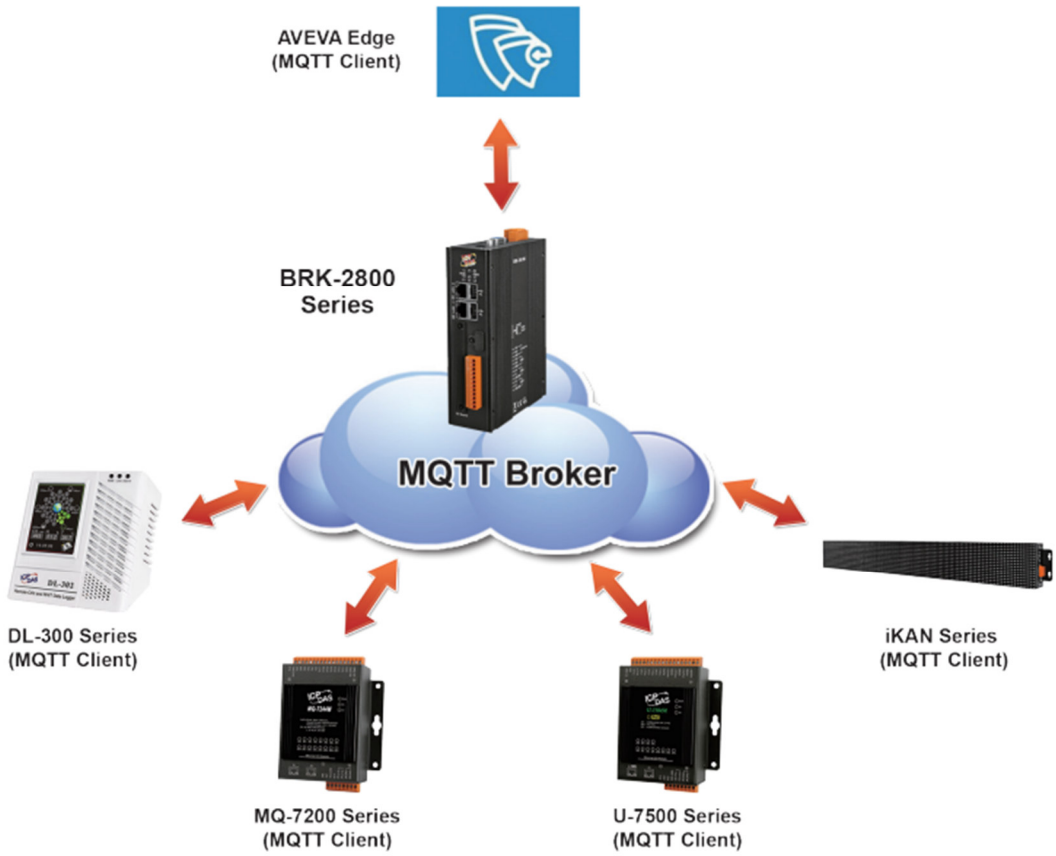
This chapter describes the main function and setting method of the BRK .

3.1 MQTT Introduction

MQTT (Message Queuing Telemetry Transport) is a communication architecture developed by IBM for the Internet of Things (IoT). It is useful for mobile applications because of its small size, low power usage, minimized data packets, and efficient distribution of information to one or many receivers, especially in unstable networks. MQTT is implemented based on the publish/subscribe architecture. In its network, there is a server (Broker) responsible for the intermediary layer of information, and other devices can send information to the Broker by publishing a topic, or get information from the Broker by subscribing to a topic.

BRK-2800 is Sever of MQTT, can connect with large amount of ICP DAS modules with MQTT protocol: for example, the DL-300 series of data Logger sensors which can measure CO, CO2, Temperature, Humidity and Dew Point information. The communication mechanism that supports MQTT publishes the collected on-site environment parameters to the BRK-2800, and can simply monitor the on-site environment from a long distance by subscribing to the BRK-2800 using a mobile device or SCADA software that supports MQTT Client. The Ethernet I/O modules of the MQ-7200M series can automatically publish the collected digital I/O values to the BRK-2800 through MQTT. The MQTT Client only needs to subscribe and publish to the BRK-2800 to monitor or change remotely DO status of the Ethernet I/O modules.

MQTT Architecture of the BRK:

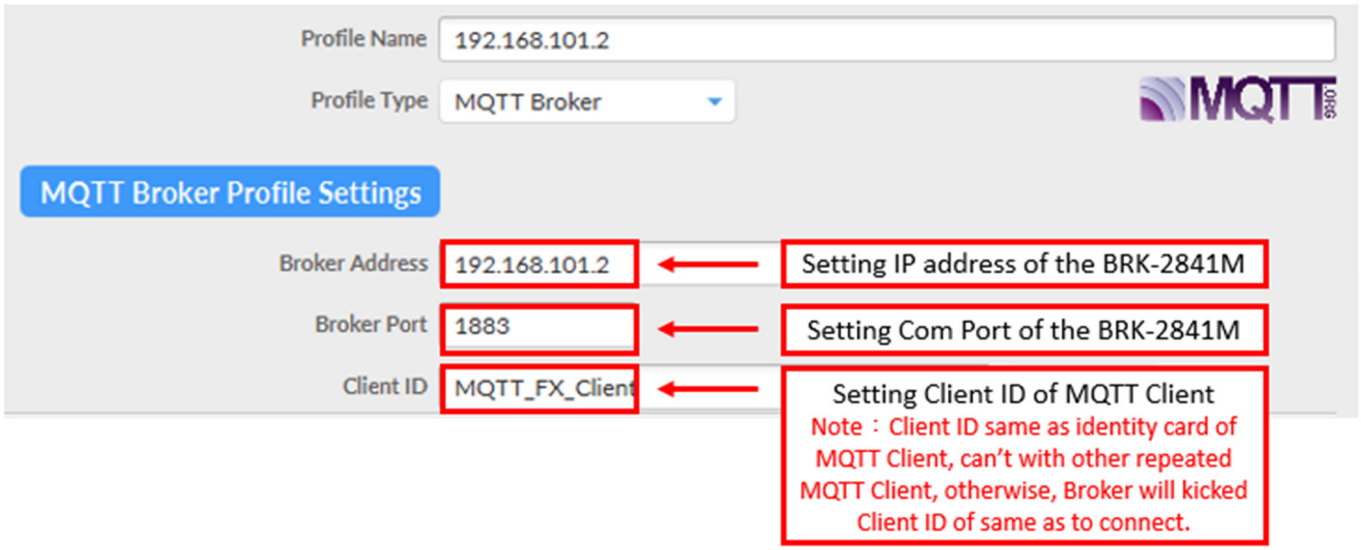


3.1.1 Forward the MQTT messages for BRK-2800

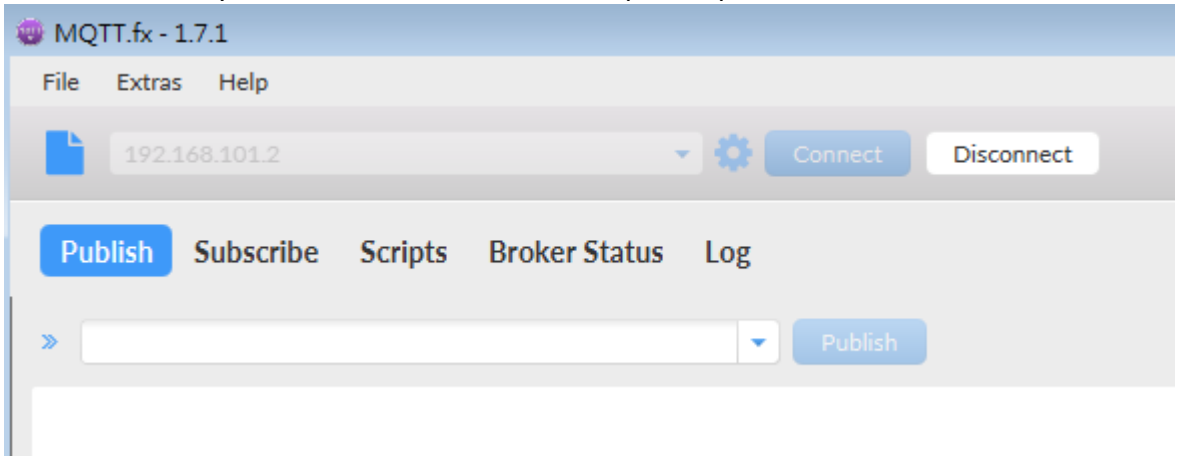
This chapter use the DL-302 (Client) as an example, to perform “Forward the MQTT message by BRK-2800 (Broker)”.

DL-302 need to set up the IP and Port of Broker Just communication, please refer to the DL-302 user manual **chapter 4.5 MQTT** (https://www.icpdas.com/web/product/download/iiot/sensor/dl-300/document/manual/DL-300_User_Manual_v1.2.0_en.pdf)

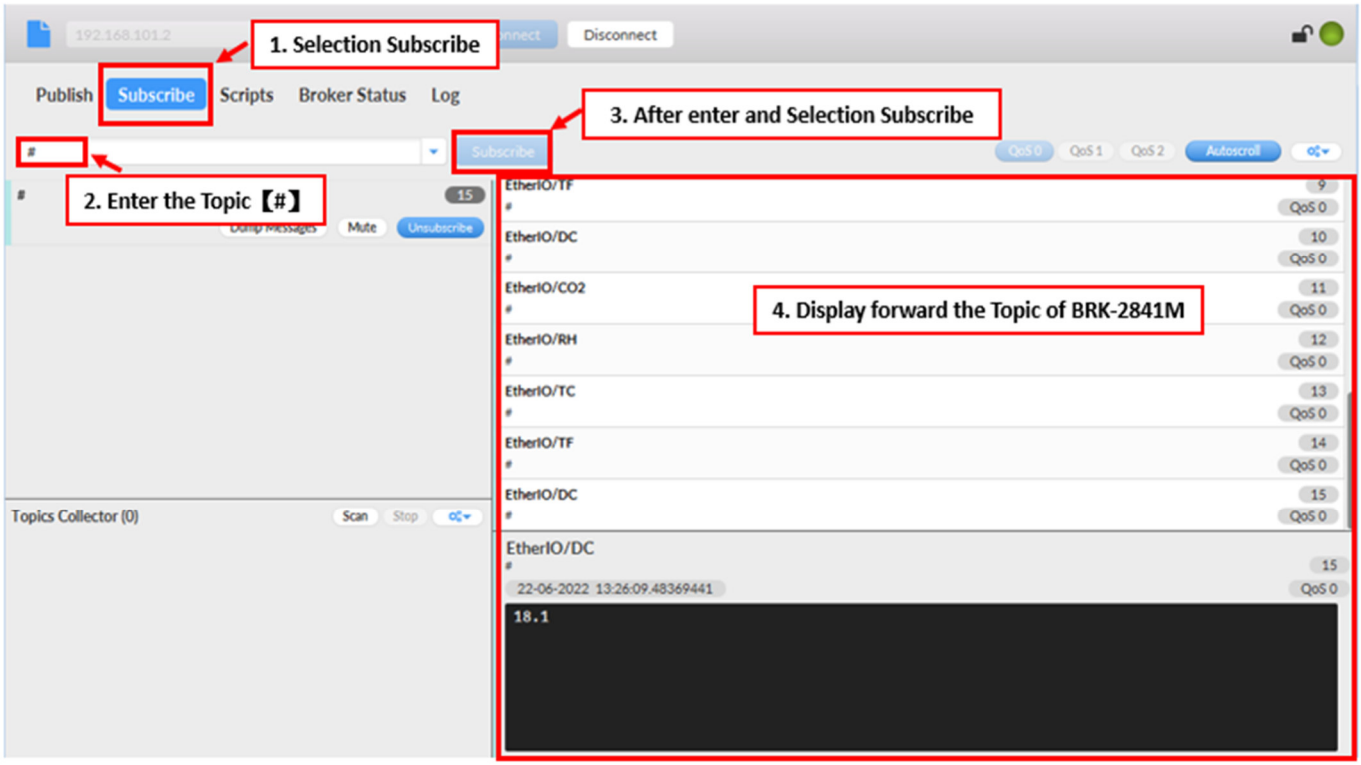
After setting is completed, DL-302 will automatic publish message for the BRK-2800; any MQTT Client device can subscribe to BRK-2800 to receive messages published by DL-302. Here we take the MQTT_fx_Client as an example: enter the IP address and Communication Port of BRK-2800, and connect to the BRK-2800 after the settings are correct.



After successfully connect, now BRK-2800 can operate publish and subscribe.



In order to make sure that the DL-302 has correctly published the environmental information to the BRK-2800, subscribe to the Wildcards character [#] of the topic to see the information published by the DL-302. Please refer to the following capture for the steps.



4. Main Menu: Parameter Descriptions

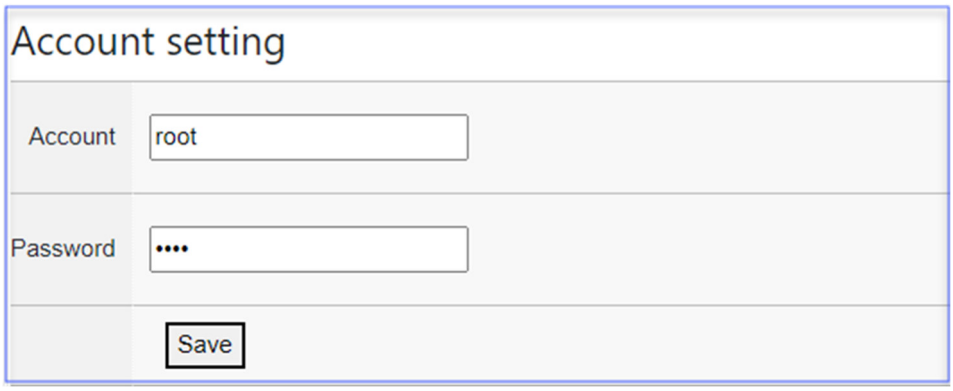
4.1 Main Menu - System Setting

System Setting is the first item of the Main Menu. This item is about the settings related to the hardware and operating system.

4.1.1 Account Setting

Function: Display and set up the login username and password of the BRK Web UI.

Menu Path:【System Setting】➔【Account Setting】



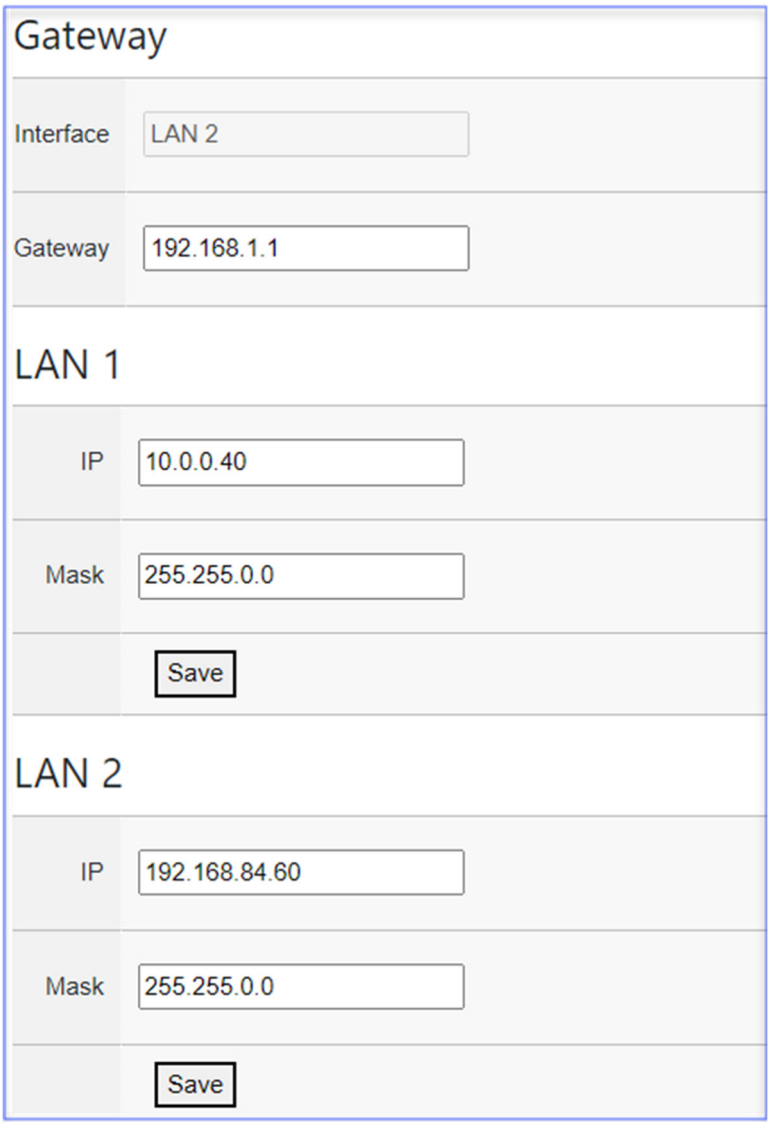
System Setting > Account Setting	
Account	The username for login the BRK Web UI. Factory default: root. Cannot be null. **After the first login with the factory default settings, change the default username/password first, or user may not be able to use any other function.** **Account setting rules:** **1. At least 8 characters** **2. At least 2 upper case letter** **3. At least 2 numbers**
Password	The login password for the BRK Web UI. Factory default: root. Cannot be null. **After the first login with the factory default settings, change the default username/password first, or user may not be able to use any other function.** **Password setting rules:** **1. At least 8 characters** **2. At least 2 upper case letter** **3. At least 2 numbers**
Save	Click to save the settings of this page.

4.1.2 Network Setting

Function: Display and set up the network settings of the BRK.

Menu Path：【System Setting】➔【Network Setting】

Note: While the network cable has been correctly connected to LAN1 and LAN2 will show up setting interface.

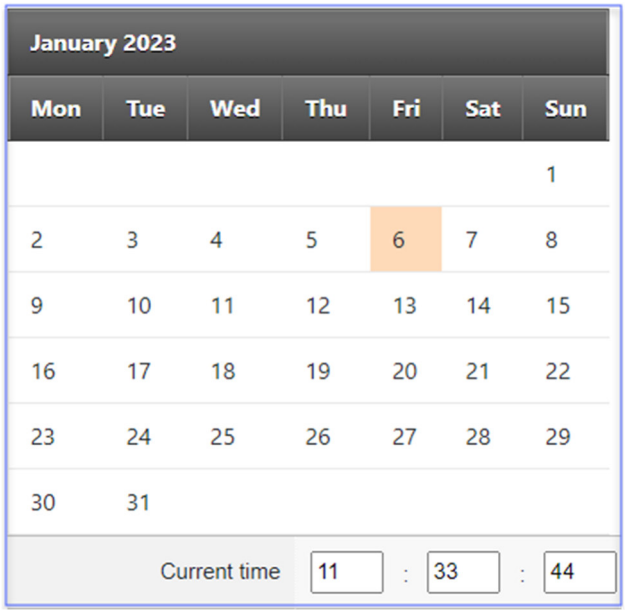


System Setting > Network Setting - Network Setting (LAN)	
IP	The LAN IP address of this BRK. Factory Default: 192.168.255.1:8000
Mask	The LAN mask address of this BRK. Factory Default: 255.255.0.0
Gateway	The LAN gateway address of this BRK. Factory default: 192.168.1.1
Save	Click to save the settings of LAN item.

4.1.3 Time Setting

Function: Display and set up the date and time of the BRK.
Menu Path:【System Setting】➔【Time Setting】

- **Display Date and Time**



System Setting > Time Setting - Date and Time Display	
Date	Display the date of the BRK, including year, month and day.
Time	Display the current time of the BRK, including hour, minute and second.

- **Set the date manually**

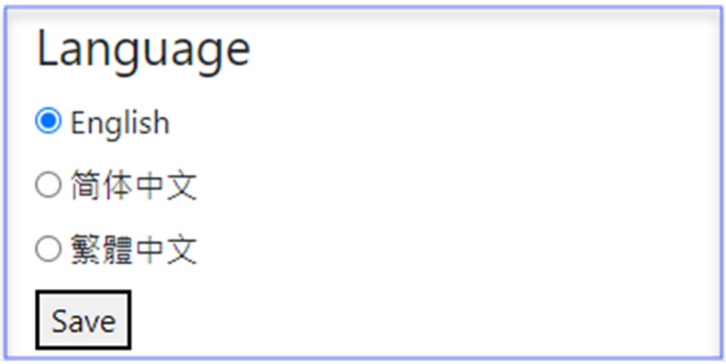
System Setting > Time Setting - Set date and time Manually	
Date	Set the system date of the BRK by manually. Directly enter the year/month/day, and then click “Save”.
Time	Set the system time of the BRK manually. Directly enter the hour : minute

	second, and then click “Save”.
Time Zone	Select the time zone of your location.
Save	Click to save the settings of this item and update the data of “Time Setting” to the “Date And Time Display” on the top of this page.

4.1.4 Language

Function：Change the Language settings of the BRK.

Menu Path：【System Setting】➔【Language】

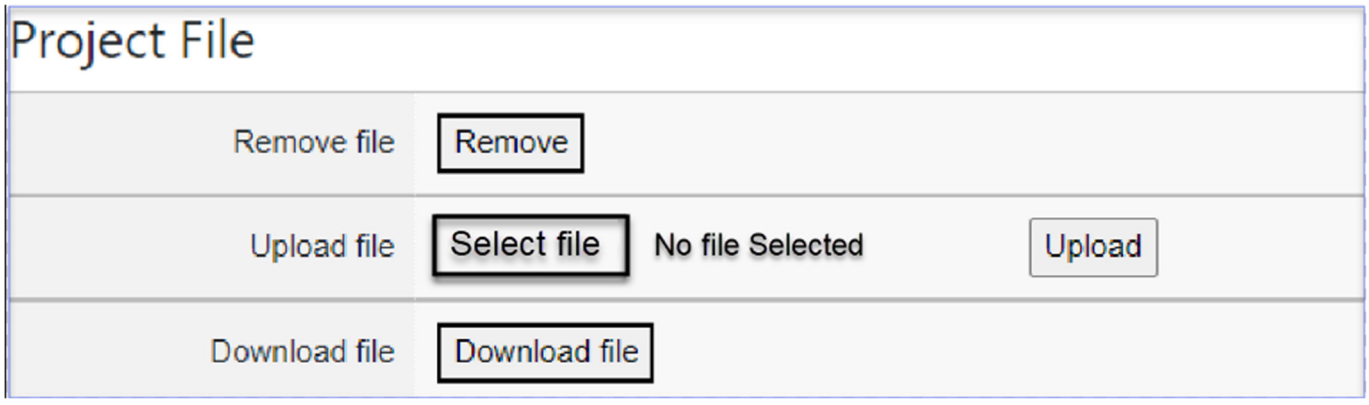


System Setting > Language	
Language	Select to change the language.
Save	Click to save the settings of this page.

4.1.5 Project File

Function: Provide back-up and restore setting for the BRK project.

Menu Path:【System Setting】➔【Project File】



- Remove the project

Remove the current project and recover to factory setting.

- Upload the project

Upload the project file to the BRK. This function can quickly replace the previously backed up project file.

System Setting > Project File > Upload the project	
Select File	Select to restore the project file.
Upload	Upload project file.

- Download the project

Download the project file, for easily back up the project settings.

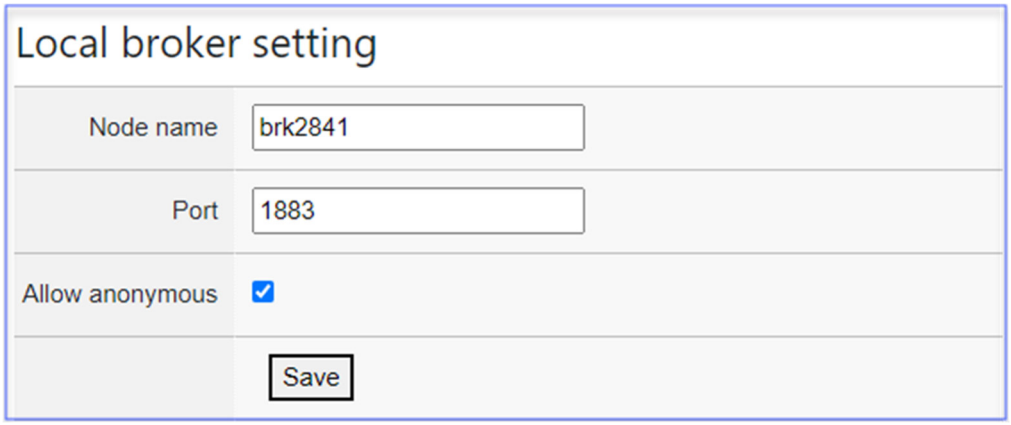
4.2 Main Menu – MQTT Setting

This main menu represents all information of MQTT Broker and provide related settings of MQTT services.

4.2.1 Local broker Setting

Function: Provide built-in Broker setting of the BRK.

Menu Path:【MQTT Setting】➔【Local broker Setting】

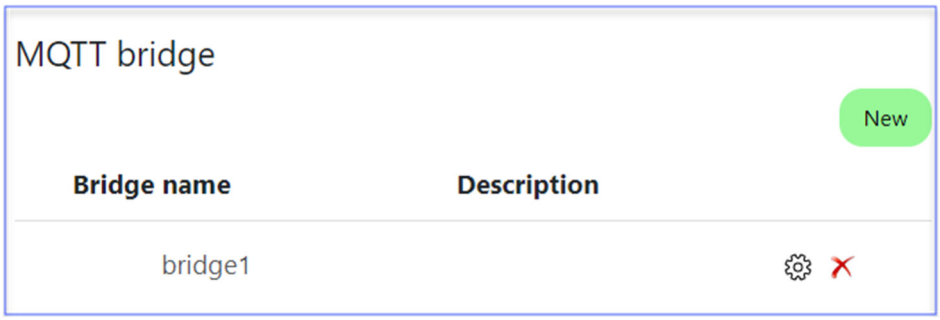


MQTT Setting > Local broker Setting	
Node name	The name of local Broker.
Port	COM Port of Broker, default: 1883.
Allow anonymous	1. Check the box: it can connect without a username and password.(Login anonymously) 2. Uncheck the box: the connection requires to set up the username and password. **(Please refer to 4.2.3 Broker Account Setting- Add Broker Account)**

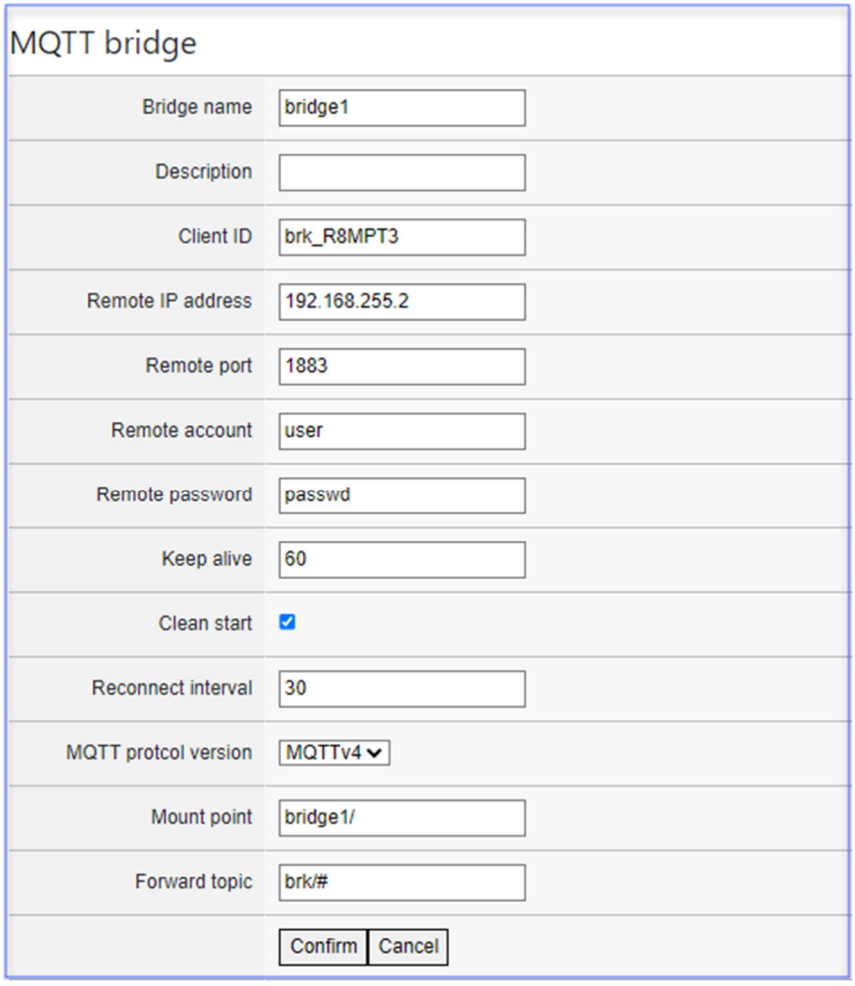
4.2.2 MQTT Bridge

Function: Provide MQTT Bridge setting.

Menu Path:【MQTT Setting】➔【MQTT Bridge】



MQTT Setting > MQTT bridge	
Bridge name	Name of connection of Local Broker bridge to remote Broker.
Description	The note of bridge name.
Edit	Edit setting of remote Broker bridge .
Remove	Remove the remote Broker bridge.

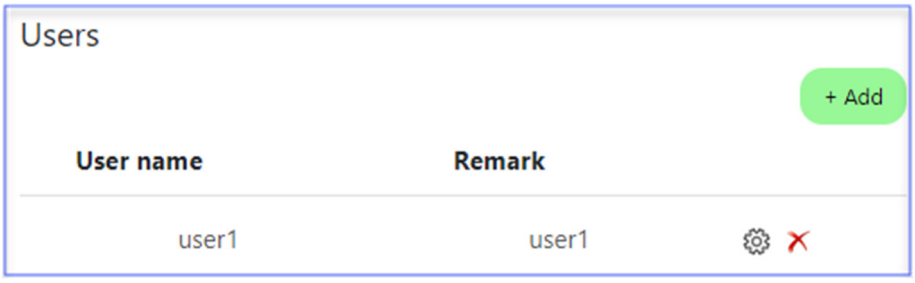


MQTT Setting > MQTT bridge	
Bridge name	Name of connection of Local Broker bridge to remote Broker.
Description	The note of bridge name.
Client ID	Client connection to remote Broker ID.
Remote IP Address	The IP address of the remote Broker.
Remote Port	The COM port number of the remote MQTT Broker, default: 1883.
Remote account	Account of remote Broker. (This field can be null if remote Broker allow Anonymous login)
Remote password	Password of remote Broker. (This field can be null if remote Broker allow Anonymous login)
Keep Alive	Diagnosis whether local Broker and remote Broker interrupt. unit time: second.
Clean Start	Clean Cloud to Device(C2D) Message Some IoT platforms require to Clean it.
Reconnect interval	The interval for resetting the connection after the connection between the local broker and the remote broker is disconnected. (unit: second)
MQTT protocol version	Select the version of MQTT.
Mount Point	Prefix of the Topic.
Forward Topic	Forward the Topics

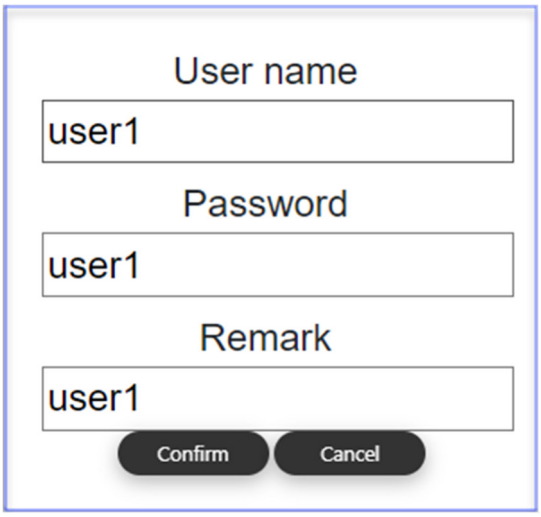
4.2.3 Users

Function：Allow specific user connect with Broker.

Menu Path：【MQTT Setting】➔【Users】



MQTT Setting > Users	
User name	The local Broker account in use.
Remark	Remarks of the Account.
Edit	Edit password and remarks of the account.
Remove	Remove the account from local Broker.

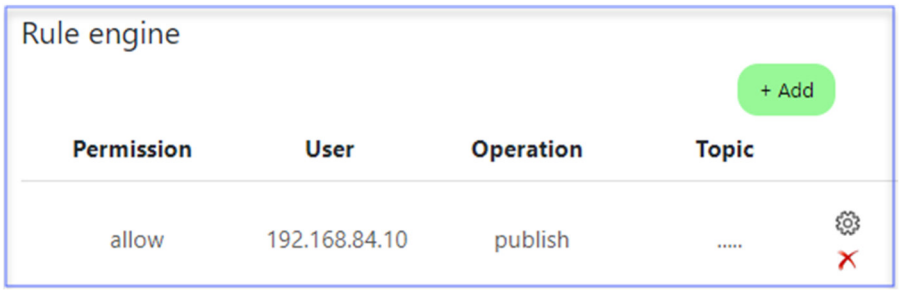


MQTT Setting > Broker Account – Add User	
User name	Add account name for local Broker.
Password	Add password for local Broker.
Remark	Remarks of the Account.

4.2.4 Rule engine

Function：Manage read and write permissions of MQTT Topic.

Menu Path：【MQTT Setting】➔【Rule engine】



MQTT Setting > Rule Management	
Permission	Permissions after enabling the rule. allow: allow deny: deny
User	The objects for which this rule takes effect can be selected from following three objects. User：Broker account can only display account that is created by **4.2.3 Broker account.** Client ID：Client ID of MQTT session IP Address：IP Address

Operation	Set the MQTT operations allowed after the rule is enabled. There are three options below. publish：publish are limited to MQTT publish. subscribe：subscribe are limited to MQTT subscribe. publish/subscribe：Allows MQTT publish and subscribe.
Topic	MQTT Topic applied to this rule. **Note**：Topic string longer than 7 characters (including symbols) will be represented by "….".

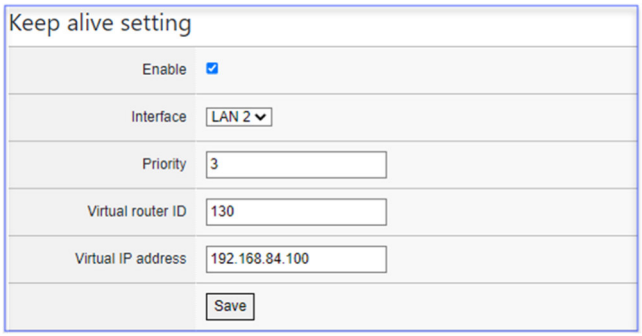
4.3 Main Menu – Advanced Setting

This main menu is a collection of the advanced setting, such as the BRK device redundancy settings and more advanced functions will be developed in the succession.

4.3.1 Keep alive Setting

Function：Set up the redundancy function of BRK device.

Menu Path：【Advanced Setting】➔【Keep alive Setting】



Advanced Setting > Keep alive Setting	
Enable	Decide whether to enable BRK redundancy service..
Interface	Network card interface for communication.
Priority	Set the BRK redundancy service takeover order. The larger the number, the higher the takeover priority, and vice versa. **Note: Please set up the range value within 0 to 255, if it exceeds, it will automatically switch to default value.**
Virtual router ID	Set the ID numbers of the redundancy BRK devices in the same group. MUST be the same.
Virtual IP address	Set the IP Address of redundancy group. MUST be the same.