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USR-N720-ETH

Industrial Edge IoT Gateway

User Manual V1.0.0

Build a Smarter IoT world, Your Trustworthy Partner

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1. Introduction

1.1. Overview

The USR-N720 is a high-performance, integrated edge computing data acquisition gateway that integrates multiple core functions such as edge data collection and computation, point reading and writing, rapid cloud connectivity, and data encryption.

The product features a RISC-V core with a clock speed of up to 600MHz, enabling faster data processing. It is designed for industrial applications, withstanding extreme temperatures to ensure stable data transmission. The USR-N720 supports diverse communication methods, including TCP and MQTT protocols, and can protect data security using SSL/TLS encryption. It also supports protocol conversion between Modbus RTU/TCP and bidirectional data interaction with custom JSON protocols.

1.2. Specification

Model	USR-N720-ETH
Processor	RISC-V core
Frequency	Up to 600MHZ
Power	
Power Supply	DC 9-36V, 2-pin terminal blocks
Consumption	Avr: 75mA@12V Max: 85mA@12V
Ethernet	
Port Number	1 x RJ45
Rate	10 /100 Mbps, auto MDI/MDX
Protection	2KV electromagnetic isolation
Serial Port	
Port Number	2 x RS485, 7-pin terminal blocks
Baud rate	600 bps~230400 bps
Data Bits	7, 8
Stop Bit(s)	1, 2
Parity Bit	None, Even, Odd
Physical Character	
Dimensions(mm)	98.5 x 30 x 86 (not including terminal blocks) 118.5 x 30 x 95.1 (Including teiminal blocks)
Installation	DIN rail or wall mounting
Operating Temperature	-40～85℃
Storage Temperature	-40~105℃
Operating Humility	5%～95%（Non-condensing）
Storage Humility	5%～95%（Non-condensing）
Basic Features	
Network protocol	IP,TCP,MQTT,SSL/TLS,ICMP,ARP,DNS,NTP,DHCP, IPv4
IP Assignment	Static/DHCP
DNS Service	√
Built-in Webpage	√
Config Method	Built-in Webpage, Config Software
Work Mode	TCP Server/TCP client

	2 * independent TCP connection supported
Edge acquisition protocol	Modbus RTU, DLT645/2007
Data reporting format	Json, Modbus TCP
Data points	Up to 1000 points
MQTT	Standard MQTT protocol Easy access to mainstream paltform: Thingsboard, AWS,Azure,etc. 2 * independent MQTT connection supported
SSL Encryption	√
Offline data cache	External SD card
Others	
Certificate	*CE, *FCC, *RoHS, *WEEE
Warranty	2 year

1.3. Features

- High-performance CPU processing ability, up to 600MHz frequency
- Provides remote serial access over the Internet for industrial serial devices
- 10/100Mbps Ethernet port and support Auto MDI/MDIX
- Built-in 15KV ESD serial port protection
- Supports a wide industrial operating temperature,-40℃~85℃
- Baud rate: 0.6~230.4 Kbps, and any baud rate setting, support None, Odd, Even, Mark, Space Parity bit
- Flexible serial port data framing packing, which can satisfy user’ s various demands for data packets segmentation
- Versatile operation modes: TCP Server, TCP Client
- Provides rich configuration access, including: Windows configuration tool, and Web Browser
- Firmware upgrading via Web Browser and Windows configuration tool
- High security via certificate verification SSL/TLS encryption for serial data transmission,TCPS,MQTTS
- Support modbus RTU master,edge computing, modbus gateway,MQTT gateway
- Support 2 RS485 serial port
- Cloud support: MQTT via AWS IOT, Microsoft Azure, Thingsboard, Alibaba Cloud, EMQX, Tuya,Cumulocity IoT and so on

1.4. Dimensions

Unit:mm

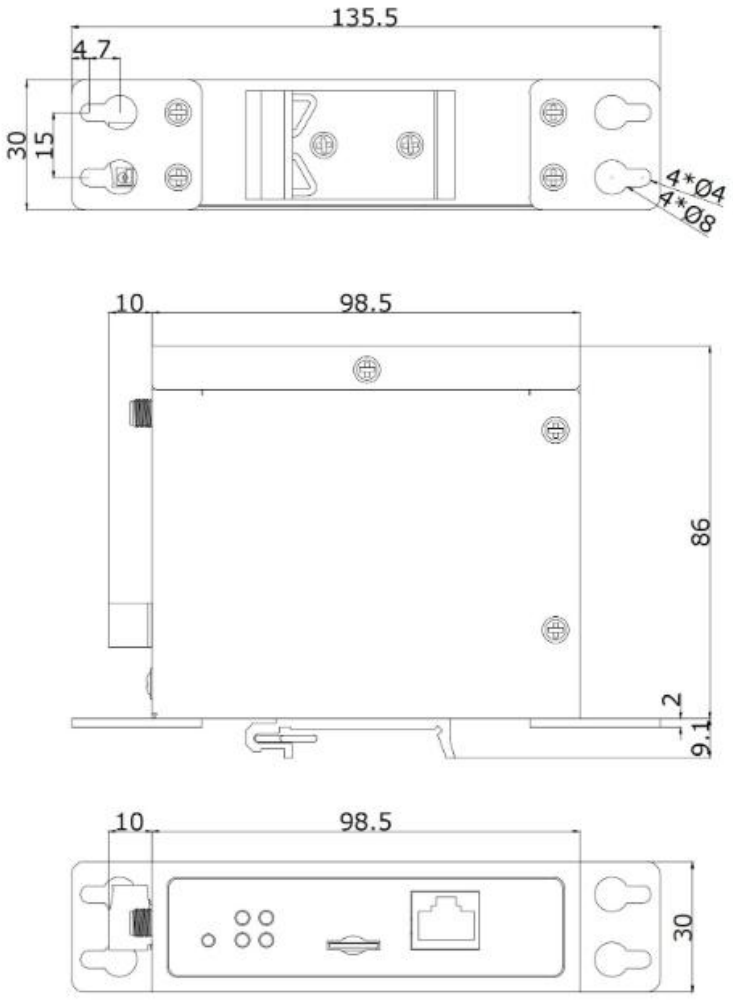


Fig. 1 Dimensions of N720-ETH

1.5. LED indicators

The USR-N720-ETH provides LED indicators to monitor the device working status with a comprehensive simplified troubleshooting, the LED indicator behaviors are defined below.

Table 1 LED indicators

LED name	status	description
POW	Steady on	Power supply is normal.
	Off	No power supply or abnormal power supply.
WORK	Blinking	Power is on and the device is ready. System is booted up and running.
NET	Steady on	Ethernet connection is successful.
	off	No network.
DATA	Blinking	Serial port is transmitting data.

1.6. Ethernet RJ45 interface

The 10Base-T/100Base-TX adaptive Ethernet RJ45 interface supports automatic MDI/MDIX connection, refer to Fig.7 below for the pin distribution of the RJ45 interface.

Link LED: green color. Lights(steady on) when the module is connected to a network.

Activity LED: orange color. Blinks when network data is transmitted through the port.

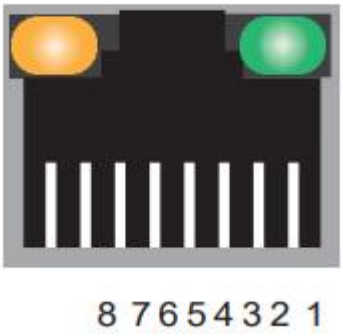


Fig. 2 RJ45 with light

Table 2 Ethernet pin assignments

Pin number	Signal name
1	Send data+(TD+)
2	Send data-(TD-)
3	Receive data+(RD+)
6	Receive data-(RD-)
4,5,7,8	Unused

1.7. Factory default settings

The USR-N720-ETH comes with the following default settings.

Table 3 Default parameters

Parameter	Default Values
User Name	admin
Password	admin
Device IP address	192.168.0.7
Subnet Mask	255.255.255.0
Gateway IP	192.168.0.1
COM port	9600,None,8,1
Socket function	Disable
MQTT	Disable
Edge computing	Disable

1.8. Quick test

USR-N720-ETH has a built-in Web server, which provides a convenient way to access and configure the device. Users can use Edge , Firefox or Google browser to access it. This chapter is a quick introduction to the USR-N720-ETH IoT gateway. It is recommended that users read this chapter and follow the instructions once for the system, and you will have a basic understanding of the product. For specific function details and instructions, please refer to the subsequent chapters.

1.8.1. Download the software

Download the setting software from PUSR’ s website:

https://www.pusr.com/support/downloads/usr-tcp232-test-V13.html

https://www.pusr.com/support/download/Setup-Software-EthernetTool-V1-4-Edge-computing.html

You may find it in the download section under your product page. Run the software when the installation has been completed as shown in the following picture.

It is strongly recommended for the users to set the Network Parameters through configuration tool first. Other device-specific configurations can later be carried out via user-friendly Web-Interface.

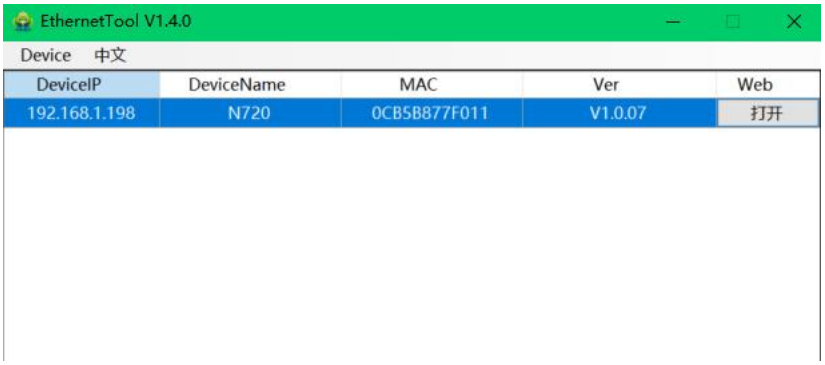


Fig. 3 Windows configuration tool

1.8.2. Hardware connection

- ✧ Connect the power line with the USR-N720-ETH power input. If the power is properly supplied, the "PWR" LED will show a solid red color. After the system is ready, the "WORK" LED will blink.
- ✧ Connect one end of the Ethernet cable to the N720-ETH' s 10/100M Ethernet port and the other end of the cable to the same Ethernet network(same router or switch).
- ✧ Connect a serial data cable(USB to RS485) between the USR-N720-ETH and PC.

1.8.3. Network configuration

The Broadcast Search function is used to locate all USR-N720-ETH gateways that are connected to the same LAN as your computer. Since the Broadcast Search function searches by MAC address and not IP address, all N720-ETH connected to the LAN will be located, regardless of whether or not they are part of the same subnet as the host.

Click Search to search for USR-N720-ETH gateways. When your unit appears in the search results, you can click device to select it and change the IP type to DHCH, save your change. Wait for 5s and search it again.

When accessing the N720-ETH gateway through the Web, the IP address of the N720-ETH gateway and the PC must be in the same network segment. After changing the IP address of the N720-ETH gateway, you can access the Web page of the N720-ETH gateway through browser and perform related configuration operations on it.

The user name and initial password are both "admin".After entering the user name and password, click "OK" and the server will authenticate. After success, you will enter the main page of the Web server, as shown in the following picture.

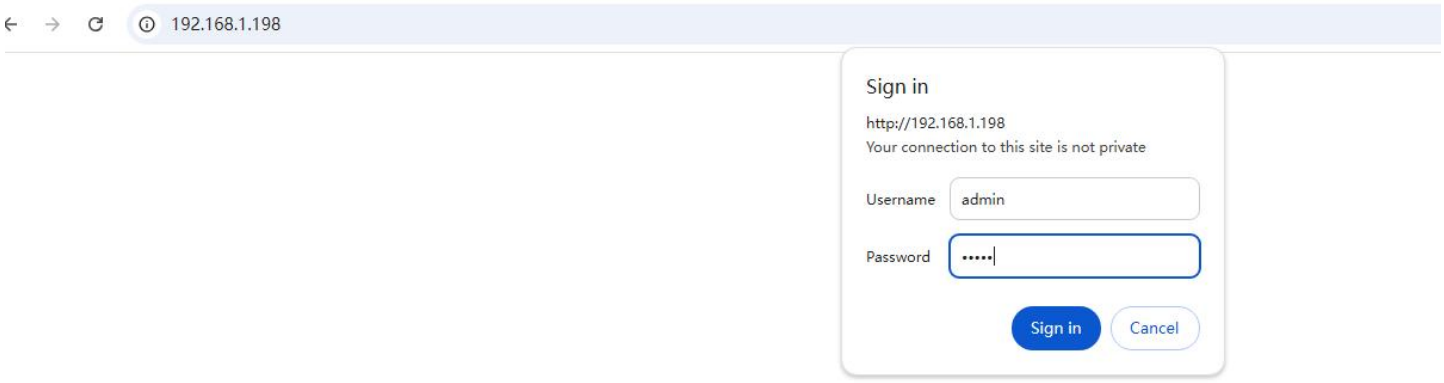


Fig. 4 Login page

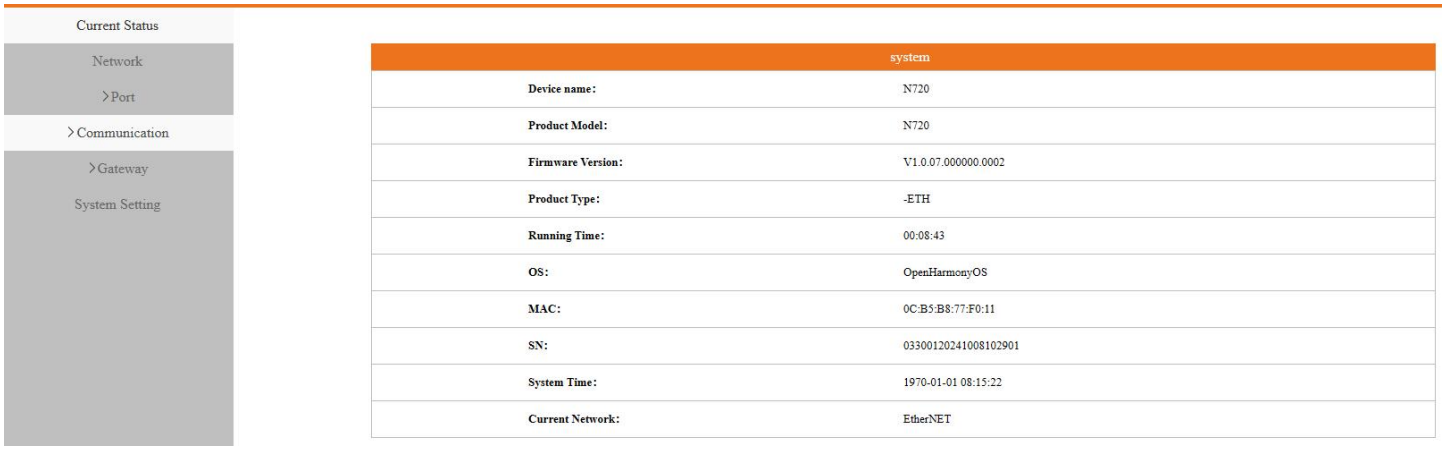


Fig. 5 The main interface of the Web server

The IP address of the PC must be modified to ensure that it is in the same local area network as the IP of the N720-ETH gateway if you want to connect N720-ETH to PC directly via a net cable. The default IP address of N720-ETH IO gateway is: 192.168.0.7. Set the PC's IP address as: 192.168.0.X (X is any valid value from 2 to 253 except 7). The specific Windows system operation page is shown in Fig.14. you can access the Web page of the USR-N720-ETH gateway through browser as mentioned above.

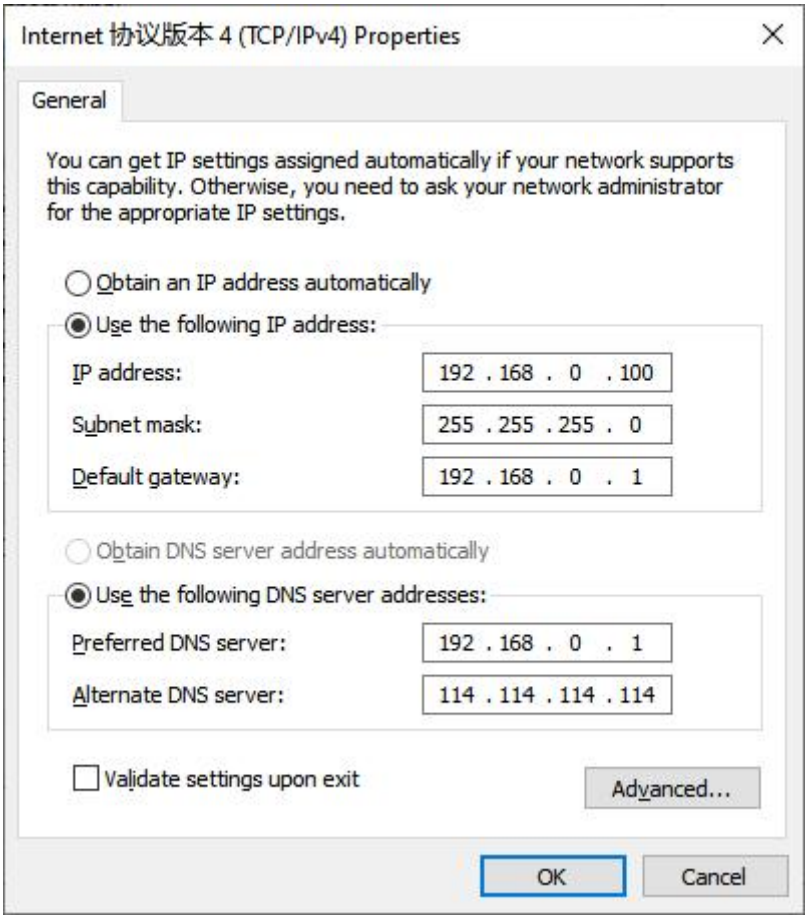


Fig. 6 IP setting of PC

1.9. Reload factory settings button

Press the "Reload" button (inside a small hole) on the back panel for 3-15 seconds and then release or follow the procedure in Section 3.1.9, to restore the USR-N720-ETH gateway to the factory default settings.

1.10. Technical support and assistance

Please visit the USR IoT website: https://www.pusr.com where you can find the latest information about the product.

Contact your distributor, sales representative, or PUSR's support center:

http://h.usriot.com/index.php?c=frontTicket&m=sign for technical support if you need additional assistance. Please have the following information ready before you submit a ticket:

- Product model
- Description of your peripheral attachments
- Description of your software (firmware version, application,function description,etc.)
- A complete description of the issue and steps to reproduce

2. Configuration and parameter details

2.1. Web interface

The USR-N720-ETH' s user-friendly web configuration tool was designed specifically to make configuration and reconfiguration easy; no reconfiguration effort is required for the unchanged modules.

Every USR-N720-ETH Industrial IO gateway is equipped with a built-in web server in the firmware. Therefore, the device can be accessed by using a web browser for configuring by entering the device' s IP address in the URL field of your web browser. An authentication will be required and you will have to enter the username (Default value is "admin") and password (Default value is "admin") for accessing the web interface as shown in Fig. 16. This approach (web interface) for configuring your device is the most user-friendly. Please go to its corresponding section for a detailed explanation.

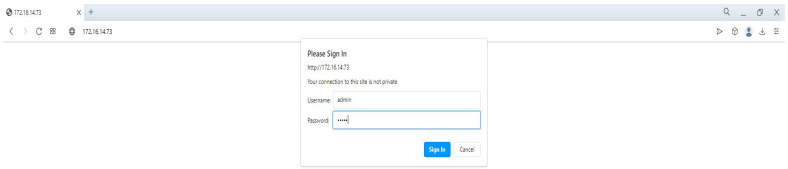


Fig. 7 Authentication Required for Accessing Web Interface

2.1.1. Status

After entering the correct user name and password and the authentication is successful, you will enter the main page of the Web, as shown in the following picture.

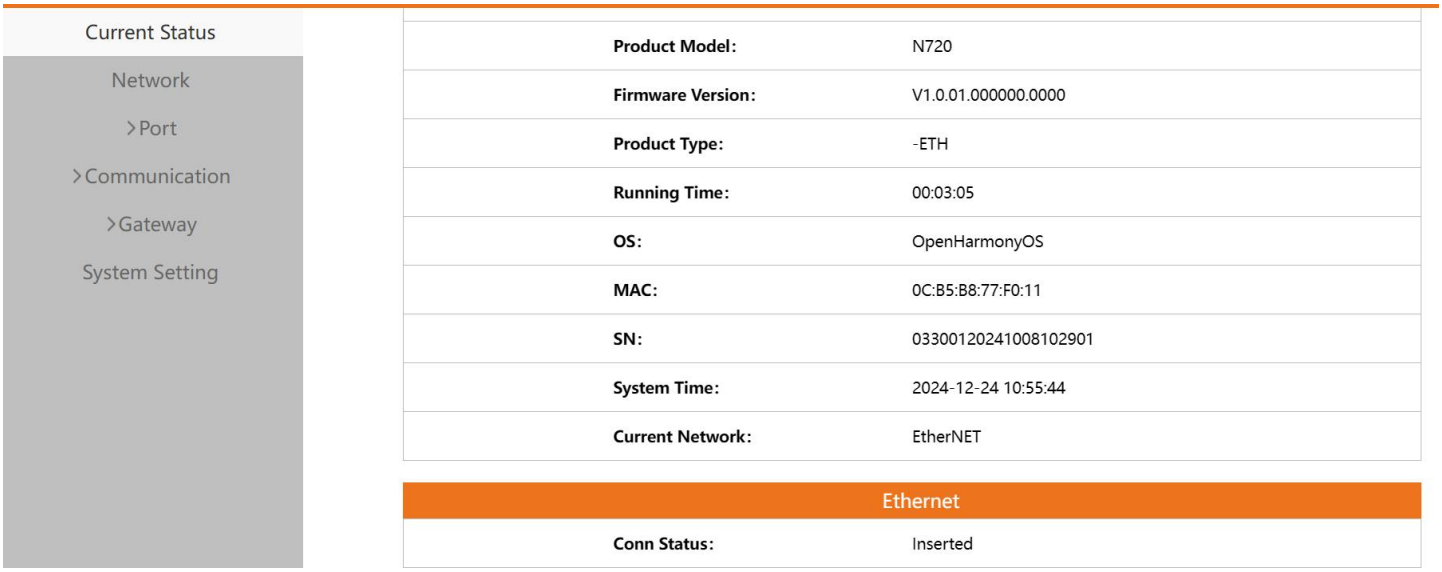


Fig. 8 Status

The function of the device status part is to display some specific information of the current device, including system, network, serial port, mqtt gateway and Edge computing status.

Table 4 Overview status list

Parameter Item	Description
System	
Model name	The name of the gateway, which can be customized by the user on the "Miscellaneous settings" page.
Firmware version	The current software version of the gateway.
Type	The current hardware version of the gateway.
Running time	Total time after the device start work. It will starts from 0 after reboot.
OS	Operating system.
MAC address	The MAC address of the gateway.
Current network type	Which interface to access the internet, default WAN interface, that is ethernet port.
Ethernet	
Conn Status	If the Network cable is connected
Network Type	DHCP or static
Local IP address	The IP address of the gateway.
TCP connection status	
Socket1	Whether socket1 is enable
Socket2	Whether socket2 is enable
MQTT connection status	
MQTT1	Whether MQTT1 is enable
MQTT2	Whether MQTT2 is enable
Cloud connection status	
Enable status	Whether PUSR cloud is enable
Connection status	Connection status of Edge computing. CONNECTING:N720-ETH is connecting to PUSR cloud CONNECTED: N720-ETH has connected to PUSR cloud

2.1.2. Network configuration

If using Ethernet port to connect to the Internet, you must assign a valid IP address to the USR-N720-ETH before it will work in your network environment. The IP address must be unique within the network. If the device is connected to the Internet and should connect to other servers over the Internet to get some services such as Network Time Protocol (NTP) server, you will need to configure the DNS server in order to be able to resolve the host name of the NTP server. The detailed description of the configuration parameters on this interface is shown in table 8.

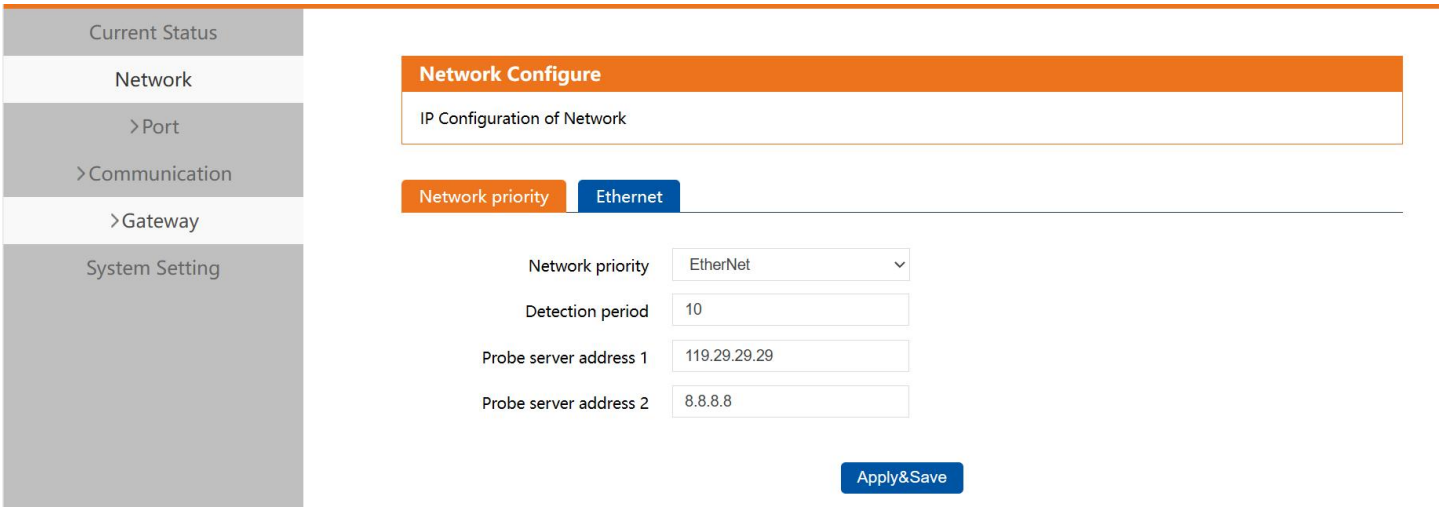


Fig. 9 Network web page

Table 5 Network configuration list

Parameter Item	Description	Default Value
Network priority	EtherNET : Connect to the Internet via Ethernet port(WAN). default setting.	
Detection period	Interval of PING detection. Unit: s	10
Probe server address 1	The main destination host of PING detection.	119.29.29.29
Probe server address 2	The alternate destination host of PING detection.	8.8.8.8
IP obtaining type	Click the drop-down menu to select the IP Address Setting mode. Static IP: User need to set the IP settings manually. DHCP/AutoIP: If you choose DHCP, the rest of the options will be greyed out or disabled.	Static IP
DNS type	It's associated with IP address. Static IP: This blank is grayed and can't choose. The DNS is the settings on the network priority page. DHCP: auto/manual	
IP address	IP address is a 32-bit address assigned to devices connected to the Internet. The IP address consists of two fields: the network number field (Net-id) and host number field (host-id). In order to facilitate the management of IP addresses,IP addresses are divided into five categories: Class A, B, and C addresses are unicast addresses, Class D addresses are multicast addresses, Class E addresses are reserved addresses for future special purposes. The IP addresses currently in large numbers belong to three types of addresses: A, B, and C.	192.168.0.7
Subnet mask	The mask is a 32-bit number corresponding to an IP address. Some of these numbers are 1, and the others are 0. The mask can divide the IP address into two parts: the subnet address and the host address. The part of the IP address corresponding to the 1 bit in the mask is the subnet address, and the other bits are the host address. The mask for class A addresses is 255.0.0.0, the mask for class B addresses is 255.255.0.0, the mask for class C addresses is 255.255.255.0.	255.255.255.0
Gateway	The default gateway in the host is usually called the default route. The default	192.168.0.1

	route (Default route) is the route chosen by the router when no other route exists for the destination address in the IP packet. All packets whose destination is not in the router's routing table will use the default route.	
DNS	The IP address of the DNS server. DNS Server part is where you can specify the IP Address of your Preferred DNS (Domain Name Server) and Alternate DNS. When the device uses a static IP address, the user is required to fill in this item, 8.8.8.8(Google) will be a good choice. If a specific DNS server is not used, the default gateway IP address is generally sufficient.	119.29.29.29

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

2.1.3. Serial port settings

The serial port module includes: serial port parameter configuration, network parameter configuration. The main function of the gateway is to carry out the data communication between serial port and Ethernet port. The Port configuration page can configure the parameters of the serial port and socket, as shown in the following pictures. Details on work mode connectivity protocols and its settings of USR-N720-ETH gateway are given in Operation modes, this section will only focus on the part of parameter description. The description of the configuration parameters on this interface is shown in the following tables.

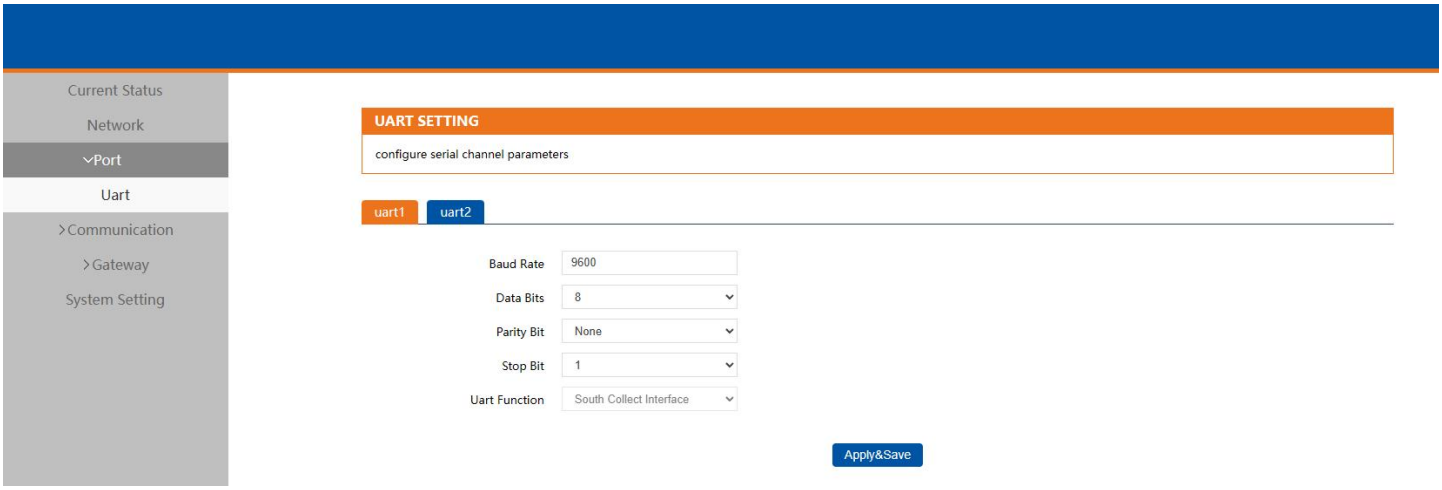


Fig. 10 Serial port configuration web page

Table 6 Serial settings list

Parameter Item	Description	Default Value
Baud rate	This sets the port' s data transfer speed. Choices are from 600—230400. Set this to match the baud rate setting of the connected device.	9600
Data bits	This sets the number of bits used to transmit one character of data. Choices are: 7 and 8. Set this to match the data bit setting of the connected device.	8
Parity bits	This bit checks the integrity of the transmitted data. Choices are: None, Odd, Even. Set this to match the parity setting of the connected device.	None
Stop bits	This indicates that a character has been transmitted. Set this to match the stop bit setting of the connected device. Choices are: 1 and 2.	1

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

2.1.4. Socket function

For socket function, the device supports two working modes: TCP Client and TCP Server. And the device support two socket connections, each of which is configured and communicated independently. At the same time, each channel supports the independent network cache function. SSL encryption is valid for TCP client mode.

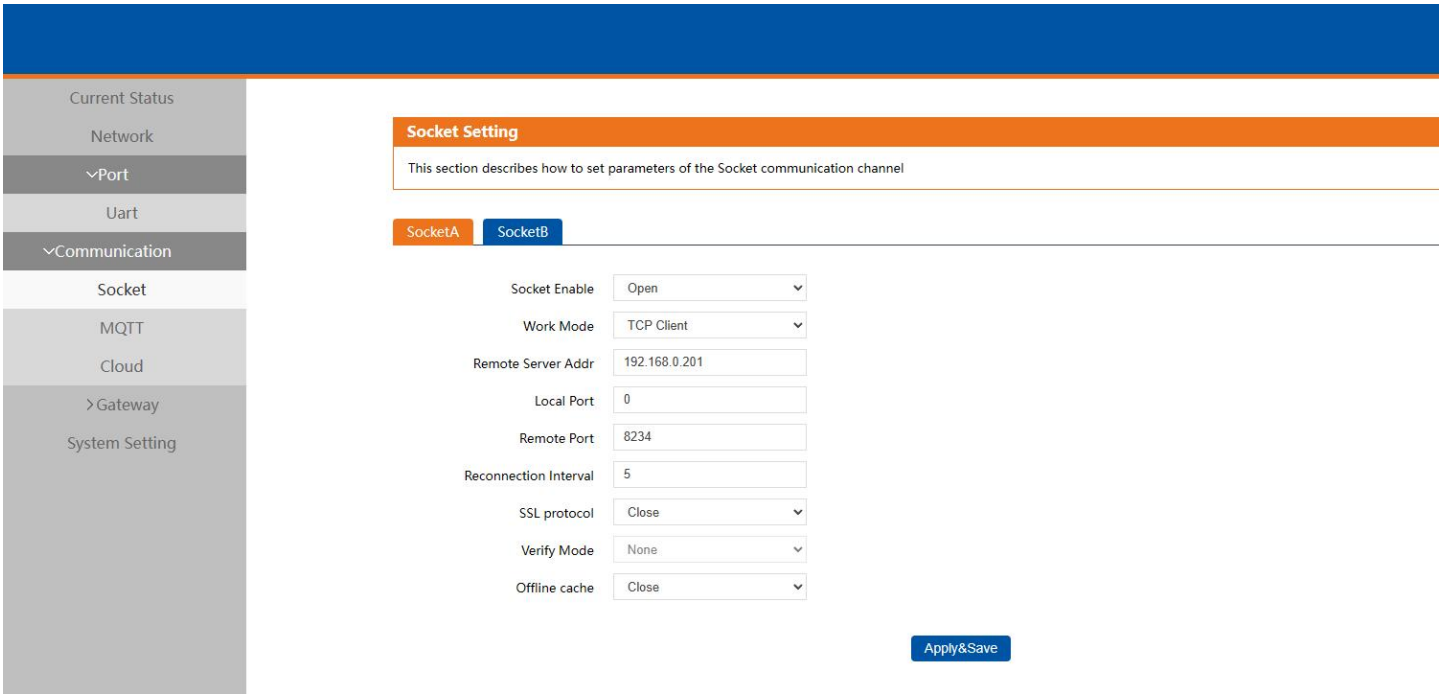


Fig. 11 Socket configuration web page

Table 7 Operation modes settings list

Parameter Item	Description	Default Values
Socket enable	Whether the socket function is enabled Close: Not enabled Open: Enabled	Close
Working mode	USR-N720-ETH gateway supports 2 different operation Modes which are TCP Server, TCP Client. The operation Mode describes the role of the device and the connection between the device and other remote devices in the network which would like to communicate with serial device on N720-ETH’ s COM port.	TCP Client
Maximum socket no.(TCP server only)	This option specifies the maximum number of remote devices/clients (with maximum of 16 clients)	4
Exceeding Maximum	Keep: Kick:	
Local port	This option specifies the port number that the TCP server should listen to. It is also used by the remote TCP client to connect to the TCP server. The default local port is 20108. You can enter different port numbers in this option.	0
Remoter server addr.	Please specify the IP address of the TCP server program on the remote host in this field. This should match the IP settings of the TCP server program.	192.168.0.201
Remote port	Please specify the port number of the TCP server program on the remote host in this field. Once again, this should match the IP setting of the TCP server program.	8234

Re-connection Interval (TCP client)	If TCP client doesn’ t connect to TCP server, the device will connect in reconnection interval. Unit: second Range: 1-65536s	5
SSL protocol(TCP client)	Choose TLS/SSL data encryption protocol version Close: Don’ t enable SSL encryption. TLS1.2: Adopt TLS1.2 version encryption.	Close
Verify Mode	None: No need to verify. Verify Server Certificate: Verify server’ s certificate. Verify all: Self signed certificate.	None
Offline cache	Whether to enable the offline cache function	

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

2.1.5. MQTT connection

If you enable MQTT Broker as your northbound connection, the N720-ETH gateway will be configured as MQTT Client. In Client mode, you can setup MQTT broker basic settings, TLS secure transmission, last will message.

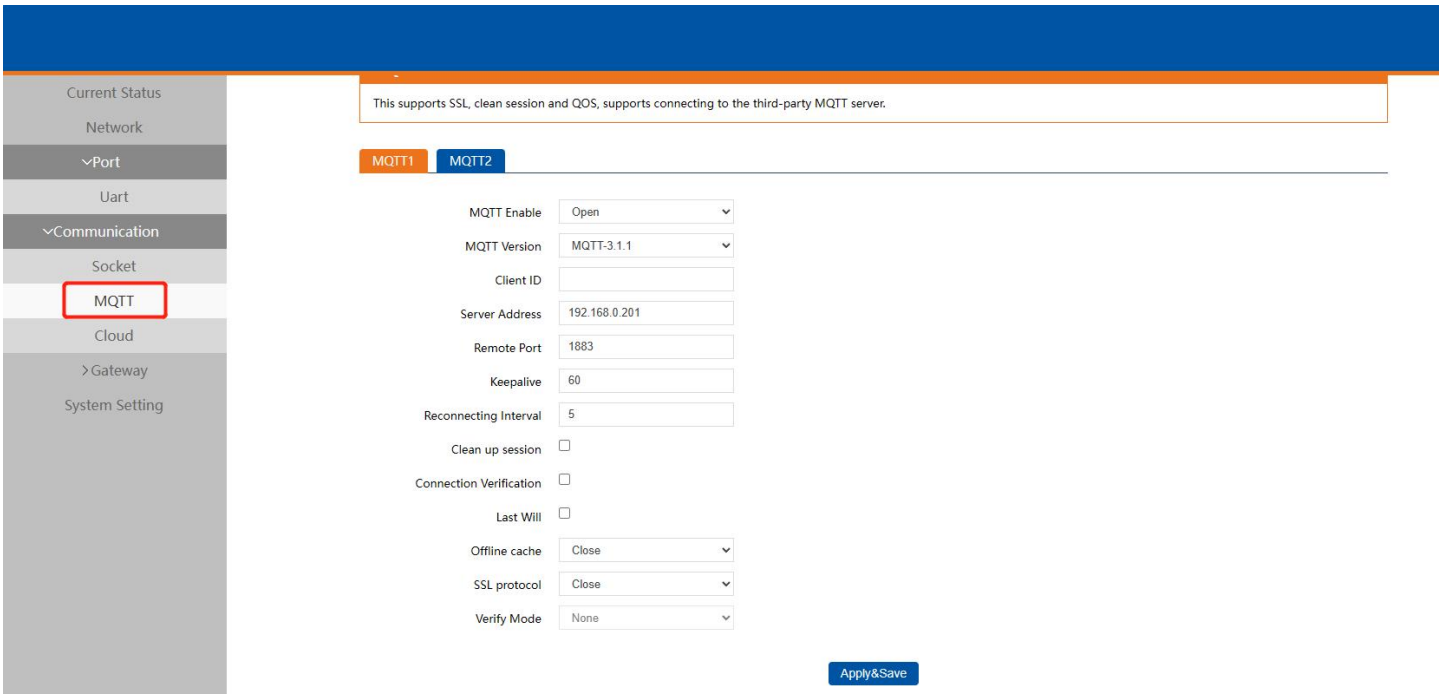


Fig. 12 MQTT connection profiles

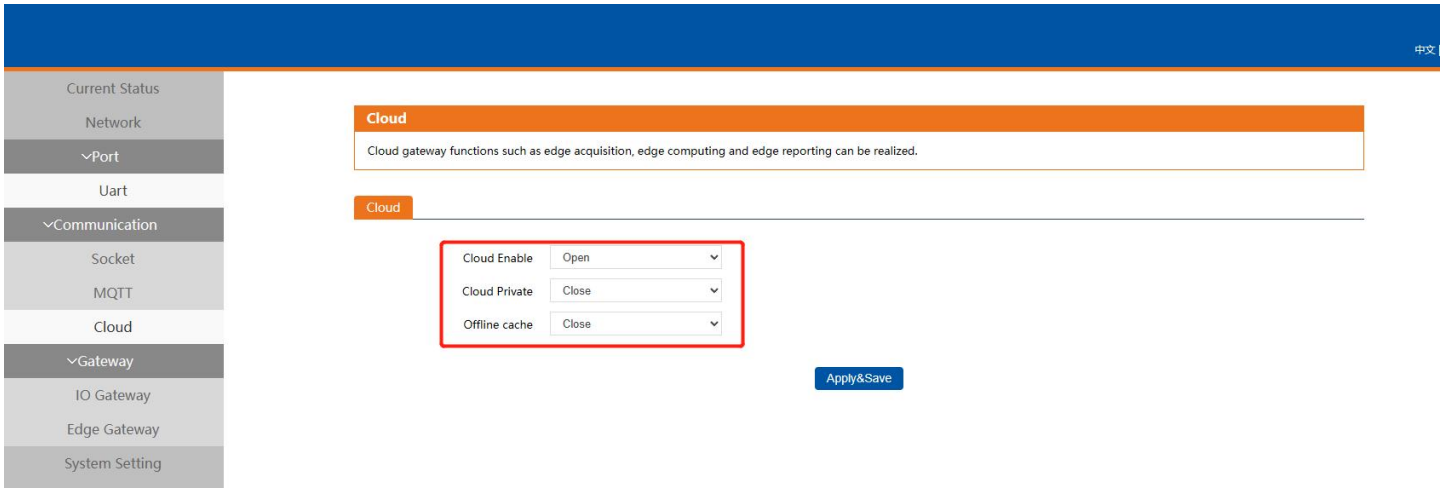
Table 8 MQTT basic setting

Parameter Item	Description	Default value
Enable MQTT	Turns MQTT gateway on or off. Close: Disable the MQTT function. Open: Enable the MQTT function.	close
MQTT Version	Select the mqtt protocol version. V3.1 and V3.1.1 are supported.	V3.1.1
Client ID	The client ID defined the identifier of the USR-N720-ETH Gateway. The IDs of the various MQTT clients have to be unique for the respective MQTT Broker. If two MQTT clients are using an identical ID, the connections of theses clients to the MQTT Broker are disconnected. For an individual client, there is no	None

	way to find out whether a specific client ID is already used by another client or not. Range: 0-128 characters.	
Server address	IP address or hostname of an MQTT broker. Range: 1-128 characters for hostname.	192.168.0.201
Remote Port	Port number of the MQTT broker.	1883
Keep alive	The Keep Alive is a time interval measured in seconds. It is the maximum time interval that the broker permits between when a client finishes sending one MQTT packet and starts to send the next. If the value is 0, it means close the keepalive function. Range: 0-65535s.	60
Re-connection interval	Automatic reconnection interval after a fail network connection. Range: 1-65535s	5
Clean session	Valid only for Qos1 and Qos2. When the clean session is checked, the client does not want a persistent session. If the client disconnects for any reason, all information and messages that are queued from a previous persistent session are lost. When the clean session is unchecked, the broker creates a persistent session for the client. All information and messages are preserved until the next time that the client requests a clean session.	Not checked
Connection Verification	If enabled, it needs user name and password.	Not checked
User name	Username for authentication to the MQTT broker. Range: 0-200 characters	None
Password	Password for authentication to the MQTT broker. Range: 0-200 characters	None
Last will	The last will message is part of the Last Will and Testament (LWT) feature of MQTT. The will message notifies other clients when a client disconnects ungracefully.	Not checked
Offline cache	Whether to enable the offline cache function, the default is off.	Close
SSL/TLS	If you use a TLS connection, click the SSL/TLS tab, select Enable SSL/TLS, and then set the Protocol parameter to TLSv1.2	Range: 0-200 characters

2.1.6. PUSR cloud

Users can achieve remote management of the USR-N720-ETH through PUSR cloud. And for PUSR cloud, users can deploy the full platform on local server(the private cloud platform). By default, the PUSR cloud is enabled.



2.1.7. Edge gateway

The N720-ETH gateway supports southbound fieldbus protocols of Modbus RTU protocols. It also supports northbound MQTT/TCP in socket, AWS IOT, and Alibaba Cloud IoT Platform. The N720-ETH gateway fulfills a different role on each of its sides. Each role is determined by your devices' settings. Therefore, set the role of each of your devices correctly. The device supports up to 1000 points in total.

The edge gateway is disabled by default. Users need to open it manually.

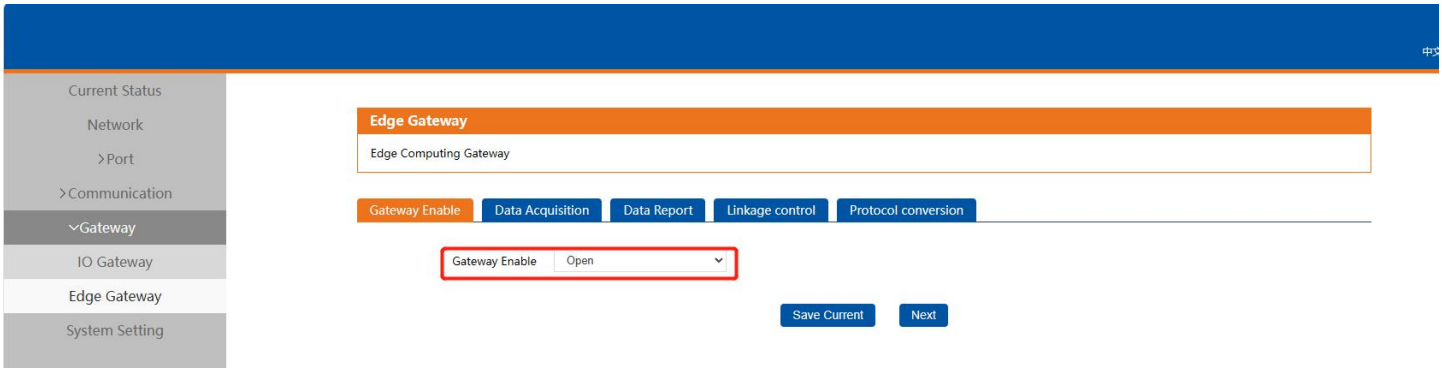


Fig. 13 Edge computing enabled

1.1.1.1. Add Slave Device

On data acquisition page, users can add slave device, and can add node based on the slave device.

If a large number of data points need to be configured, you can export the default data collection configuration as a.csv file, use software such as office to edit the data in batches, and then import the configuration to the device for rapid configuration.

If multiple devices need to configure the same point parameters, you can export the point configuration file to quickly configure the point parameters for multiple devices.

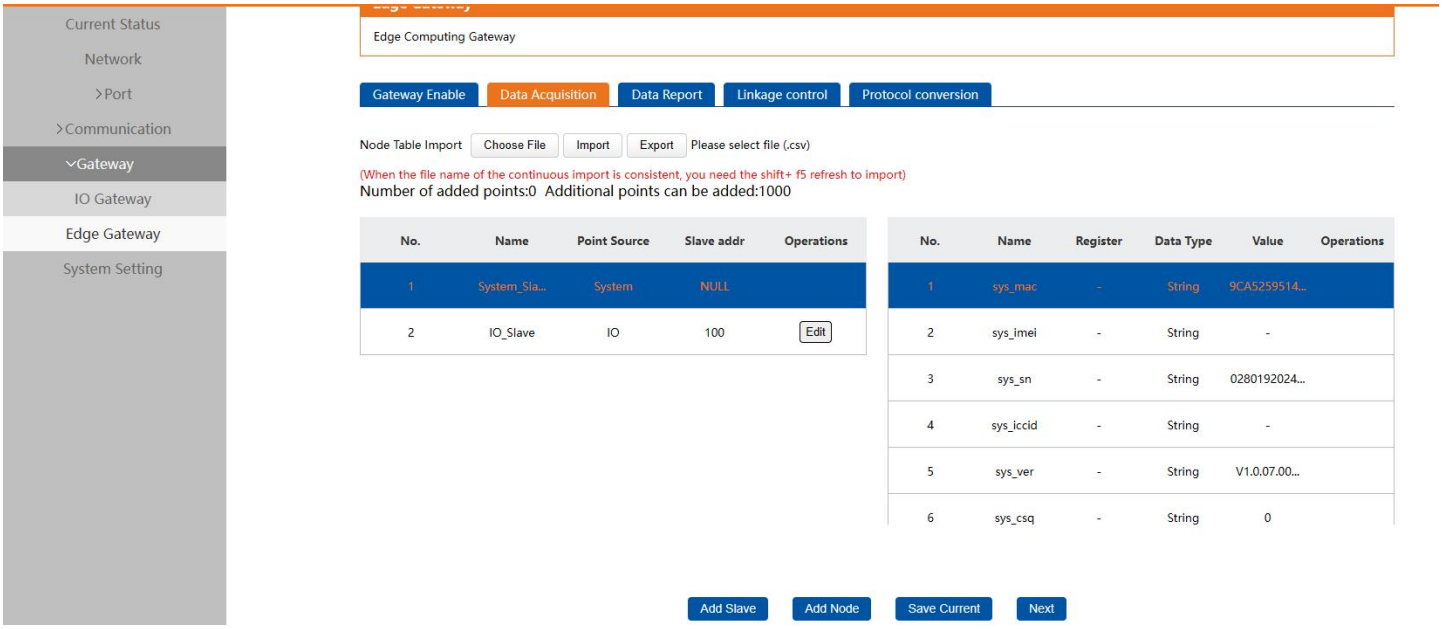


Fig. 14 Data acquisition settings

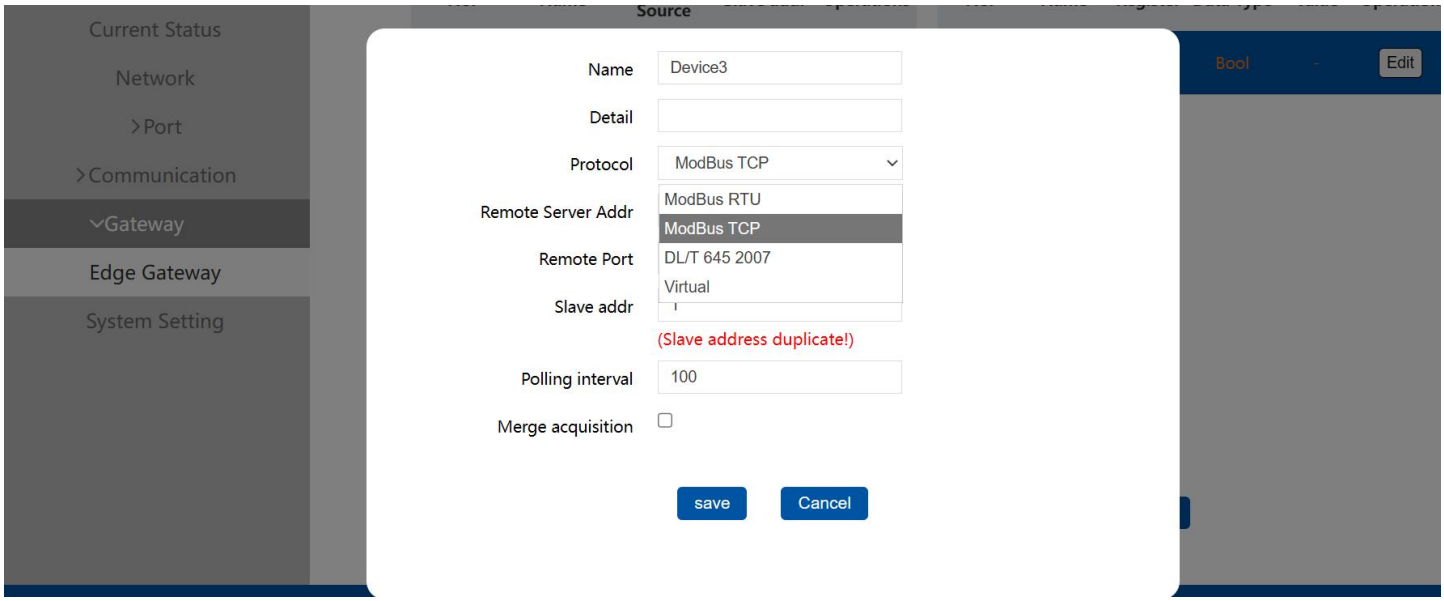


Fig. 15 Add slave device

Table 9 Slave device parameters

Parameter Item	Description	Default Value
Device name	Name of slave device, which is unique for the current gateway. Range: 1-32 characters	Device x
Detail	Detail information of the slave device. Range: 0-32 characters	None
Protocol	The are 4 options for users: Modbus RTU: the slave device supports Modbus RTU, and send query command in Modbus RTU. Modubs TCP:the slave device supports Modbus TCP, and send query command in Modbus TCP. DLT645/2007:the slave device supports DLT645/2007, and send query command in DLT645/2007. Virtual: The data point is from the virtual register.	Modubs TCP

Modbus RTU protocol	Uart: Select the serial port to which the Modbus slave device is connected. Default is Uart1. Slave address: the Modbus ID of slave device. Range: 1-255. Default is 1. Polling interval: the time interval between 2 consecutive query command. Range: 10-65535ms. Default is 100ms. Merge acquisition: This function is used when the register address of many data points are sequential.	None
Modbus TCP protocol	Remote Server Addr: the IP address of the Modbus slave device. The default is 192.168.0.21. Remote Port: the listening port of the modbus slave device. The default is 2100. Slave address: the Modbus ID of slave device. Range: 1-255. Default is 1. Polling interval: the time interval between 2 consecutive query command. Range: 10-65535ms. Default is 100ms. Merge acquisition: This function is used when the register address of many data points are sequential.	None
DLT645/2007 protocol	Uart: Select the serial port to which the DLT645/2007 slave device is connected. Default is Uart1. Electricity meter number: the ID of the electrical meter. Initializing activation: If enable initializing activation. Some meters need to add a leading code. Add 4 bytes of leading (FE FE FE FE FE) to the front of each message. If the meter is not needed, turn off the leading code	Noe checked

1.1.1.2. Add modbus TCP/RTU data point

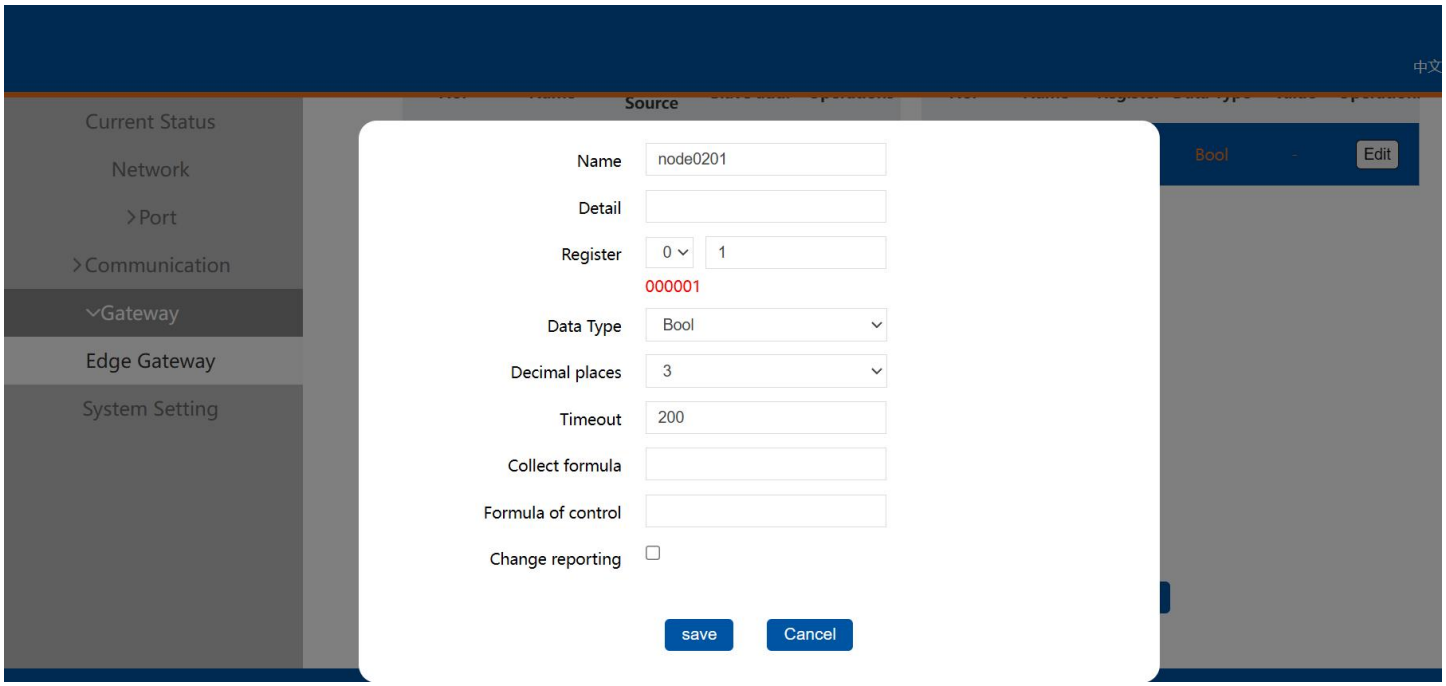


Table 10 Data point(node) configuration of Modbus TCP/RTU

Parameter Item	Description	
Data point name	Identifier of the data point, which must be unique for the gateway.	Node xxxx
Detail	Detail information of the data points. Range: 0-32 characters	None
Register	The first blank:Modbus function code 1 Read Coils, 2 Read Discrete Inputs,3 Read Multiple Holding Registers, 4 Read Input Registers. The second blank:Register address The address of the register from which data will be read.	0, 1
Data type	Defines how read data will be stored. Bool / Unsigned / Signed / 32 Bit Unsigned (AB CD) / 32 Bit Unsigned (CD AB) / 32 Bit Signed (AB CD) / 32 Bit Signed (CD AB) / 32 Bit Float (AB CD) / 32 Bit Float (CD AB) / Bit	bool
Decimal places	How many places do we keep after the decimal point. Range:0-6	3
Timeout	If the Modbus device does not receive a response within the time specified here, the communication times out. Range:100-65535ms	200
Collect formula	Modbus register store only whole numbers. For this reason a scale factor often needs to be applied. For example a modbus register with a temperature value may read as 723 and a multiplier of 0.1 need to be applied to get the correct value of 72.3 in the SCADA system,the formula is %s*0.1. If the data type is a Float then the multiplier is not needed. This computation supports +, -, * and / operators.	None

	This formula is for data collecting.	
Formula of control	This formula is for data writing.	None
Change reporting	Enable change reporting function. The report is triggered if the collected data changes. You can use a tolerance to only log the data point if the value changes more than X amount.	Not checked
Range	The report is triggered if the collected data changes. You can use a tolerance to only log the data point if the value changes more than preset range.	2

1.1.1.3. Add DL/T 645 2007 data points

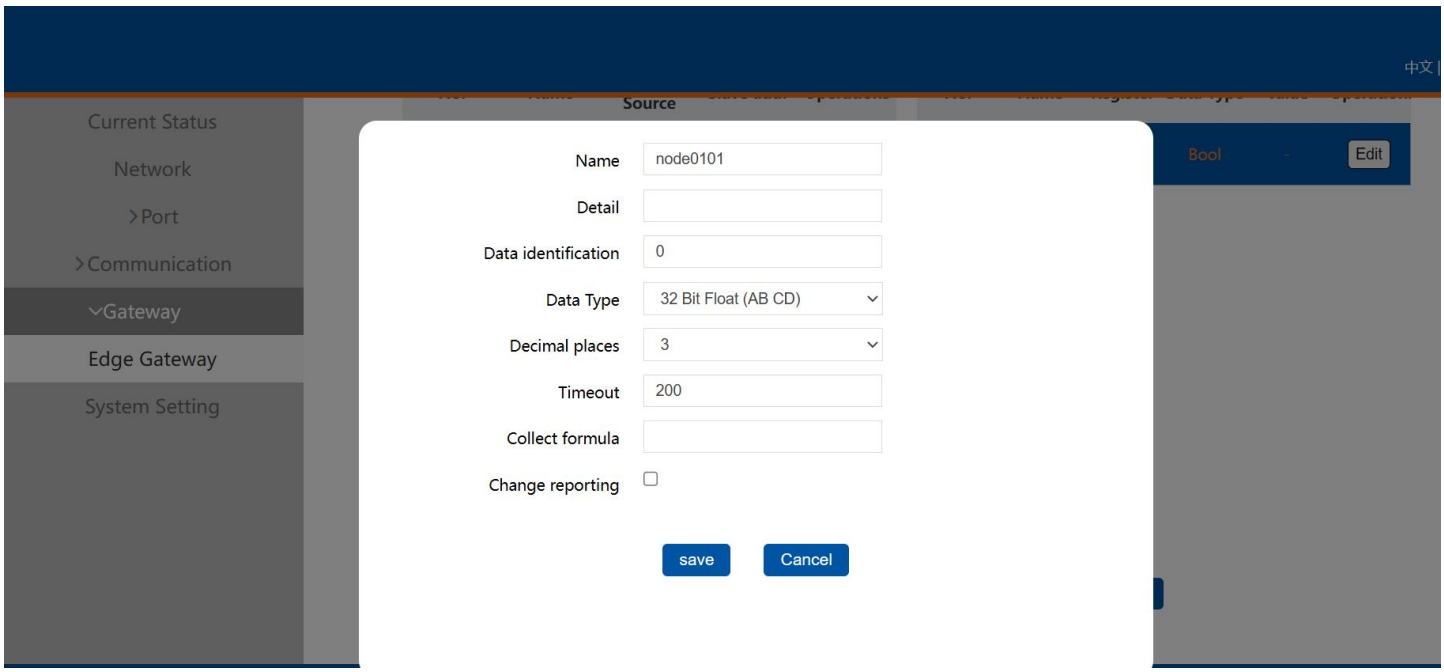


Table 11 Data point(node) configuration of Modbus TCP/RTU

Parameter Item	Description	
Data point name	Identifier of the data point, which must be unique for the gateway.	Node xxxx
Detail	Detail information of the data points. Range: 0-32 characters	None
Data identification	Address of the data point	0
Data type	Defines how read data will be stored. 32 Bit Float (AB CD)	32 Bit Float (AB CD)
Decimal places	How many places do we keep after the decimal point. Range:0-6	3
Timeout	If the Modbus device does not receive a response within the time specified here, the communication times out. Range:100-65535ms	200
Collect formula	Modbus register store only whole numbers. For this reason a scale factor often needs to be applied. For example a modbus register with a temperature value may read as 723 and a multiplier of 0.1 need to be applied to get the correct value of 72.3 in the SCADA system,the formula is %s*0.1. If the data type is a Float then the multiplier is not needed. This computation supports +, -, * and / operators. This formula is for data collecting.	None

Change reporting	Enable change reporting function. The report is triggered if the collected data changes. You can use a tolerance to only log the data point if the value changes more than X amount.	Not checked
Range	The report is triggered if the collected data changes. You can use a tolerance to only log the data point if the value changes more than preset range.	2

1.1.1.4. Add data report group

Note: this device supports up to 20 groups.

The report template supports up to 8K bytes.

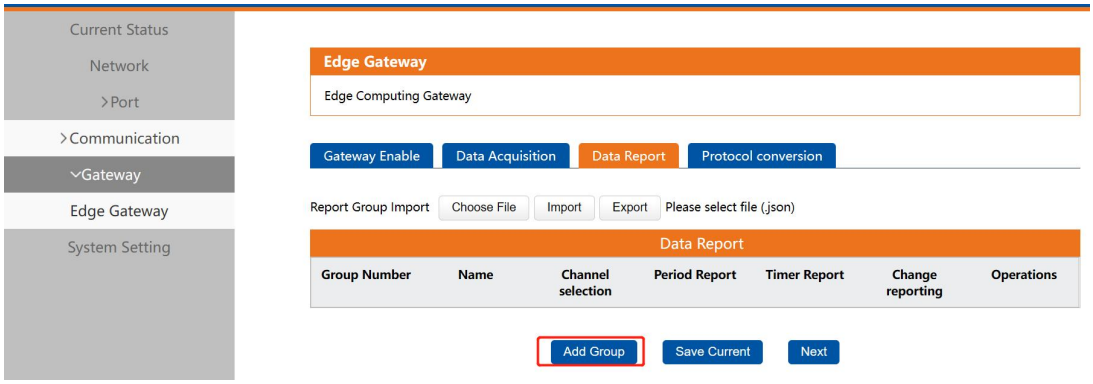


Fig. 16 Add data report group

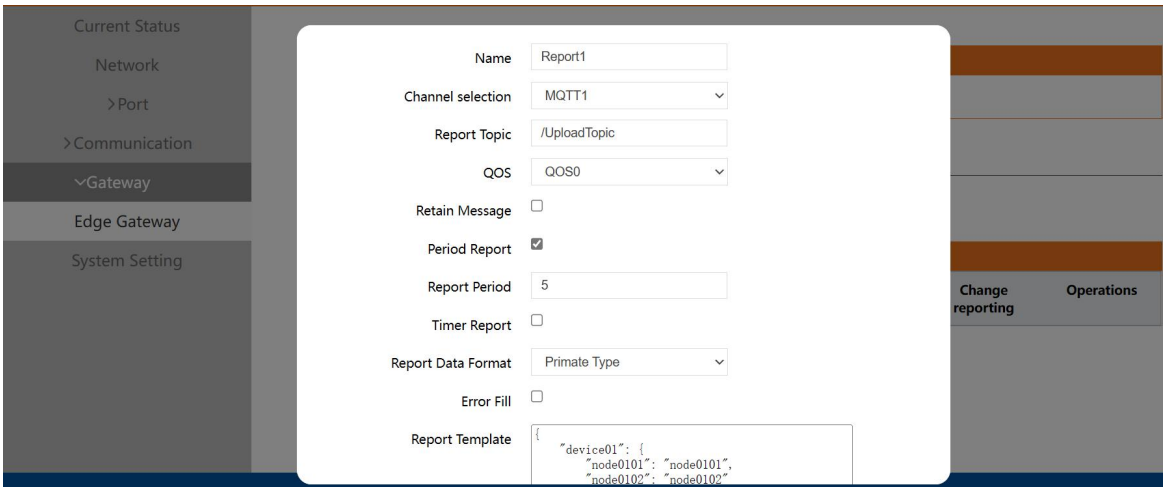


Fig. 17 Settings of report group

Table 12 Details of data report group

Parameter Item	Description	Default value
Channel Selection	Select the channel in the socket type. MQTT1 / MQTT2 / Socket A/ Socket B/ Cloud	MQTT1
Report Topic	Topic that used to report data to MQTT broker. Range: 1-200 characters	/UploadTopic
QOS	QoS 0: at most once. In this case, the client publishes a message to the broker only once. QoS 1: at least once. In this case, when a client publishes a message to the broker, the client expects the broker to acknowledge whether or not a client has received the message. If the publisher does not receive acknowledgement from the broker within a preset time interval, it will republish the message again and	QOS0

	again until acknowledgment is received. QoS 2: exactly once. The MQTT protocol uses the confirmation of confirmations to ensure that a message is delivered exactly once.	
Retain Message	By setting the Retain flag the MQTT Broker is instructed to save the most recent data value for the topic. Data values without Retain flag are only transferred from the MQTT Broker to those MQTT Subscribers that are registered at the broker and have subscribed to the appropriate topic in the moment when sending the data to the broker.	Not checked
Period Report	Data is automatically reported at a certain interval. The reporting interval can be configured.	Checked
Report Period	The data reporting interval. Range: 1-65535s.	5
Timer Report	In the 24-hour system, the NTP function need be enabled first to correct the device clock. Four types of timing logic are supported: *Report at the exact hour*: Reporting every hour from 0'clock. *Report at the exact quarter*:Reporting every 15 minutes from 0'clock. *Report at the exact minute*: Reporting every 1 minute from 0'clock. *Report at the fixed time*: Reporting data at a fixed time every day, For example, if you select 12:05, data is reported at 12:05 every day.	Not checked
Report Data Format	*Primate type*: Reporting data to server by the original format. *To string*: Convert the collected data to string format to reporting to the server.	Primate type
Error Fill	After data points fail to be collected, the value in the data template is replaced with the filling content, for example, {"temperature":"error"}.	Not checked
Error Message	The payload format. Users can custom which data points should report to the server.	error

1.1.1.5. Protocol conversion

The protocol conversion function is mainly applied to the scenario where the server actively sends protocol commands to obtain data or control points from the N720-ETH. Because there are various point collection protocols in the point table, the server cannot fully interconnect with only one protocol. Through protocol conversion, the server can perfectly solve the problem of interconnecting the collection and control of the server with multiple protocols.

After the N720-ETH is connected to the server through the link of protocol conversion, the server issues standard protocol commands to realize the collection and control of all point data of the N720-ETH. The current protocol conversion supports two protocol standards, namely Modbus TCP and Json. The protocol conversion only supports single-channel communication, and the specific protocol can be selected.

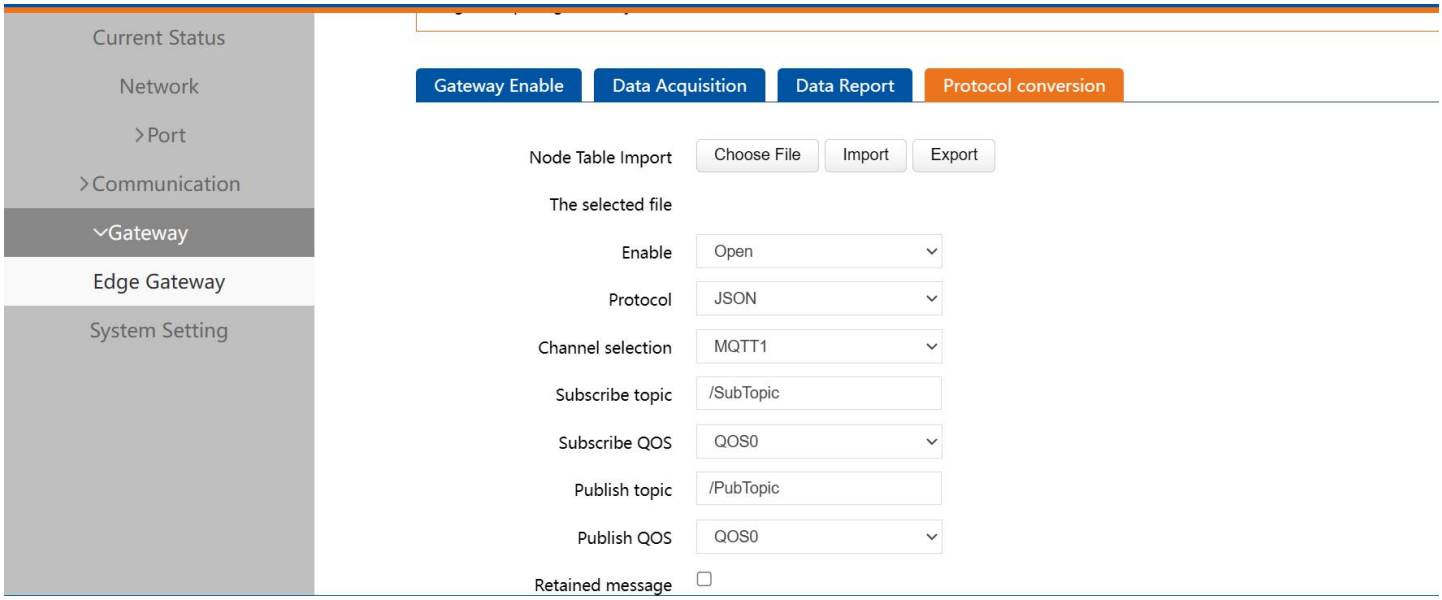


Fig. 18 Protocol conversion

Table 13 Details of protocol conversion

Parameter Item	Description	Default value
Enable	Close: not enable protocol conversion function. Open: enable protocol conversion function.	Close
Protocol	Users can send the right format query command from remote modbus master or MQTT publisher to the N720-ETH gateway. JSON: Remote server send JSON format command to query slave's data Modbus TCP: Remote server send Modbus TCP format command to query slave's data	JSON
Channel Selection	Select the channel in the socket type. MQTT1 / MQTT2 / Socket A/ Socket B/ Cloud	MQTT1
Subscribe topic	Topic that used to receive data from MQTT broker. Range: 1-200 characters	/SubTopic
Subscribe QOS	QOS0/QOS1/QOS2	QOS0
Publish topic	Topic that used to publish data to MQTT broker. Range: 1-200 characters	/PubTopic
Publish QOS	Topic that used to receive data from MQTT broker. Range: 1-200 characters	QOS0
Retain Message	By setting the Retain flag the MQTT Broker is instructed to save the most recent data value for the topic. Data values without Retain flag are only transferred from the MQTT Broker to those MQTT Subscribers that are registered at the broker and have subscribed to the appropriate topic in the moment when sending the data to the broker.	Not checked

2.1.8. System setup

- Parameter setting

This setting tab includes several system level settings, such as host name, user name, password, web port, parameter export and parameter import. Most of these settings are optional.

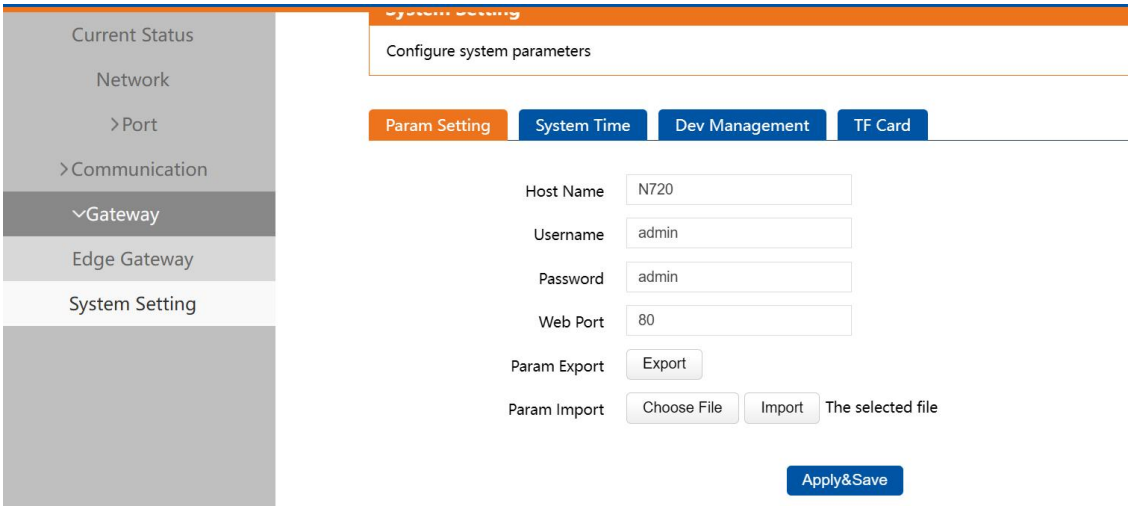


Fig. 19 System settings

Table 14 System settings list

Parameter Item	Description	Default value
Host name	The name of the device, up to 32 characters,can't be null	N720
User name	The user name of web console and can be modified. up to 16 characters,can't be NULL	admin
Password	The password of web console and can be modified. up to 16 characters,can't be NULL	admin
Web port	The port of login page	80
Param Export	Export the configured parameters and users can import the file to the other device directly.	None
Param Import	Import the parameters to simple the configuration steps	None

The configuration will save to flash memory after clicking Save button. All configurations take effect after a system reboot.

- System time

Users can configure time relevant parameters on this page.

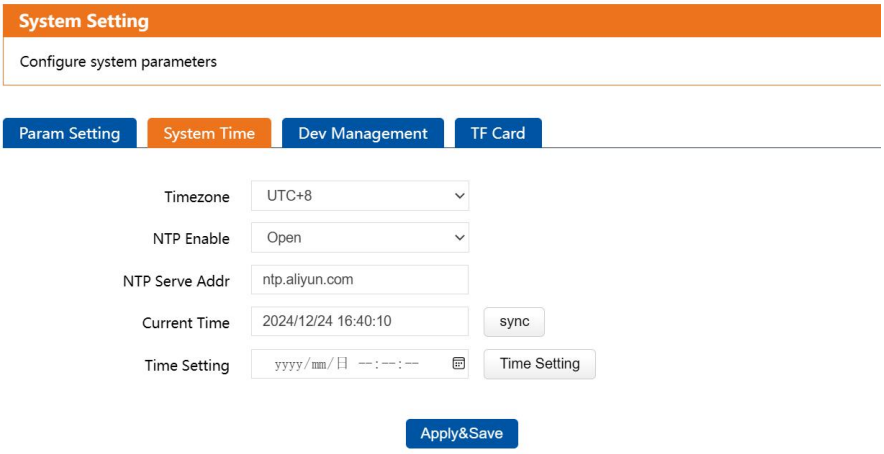
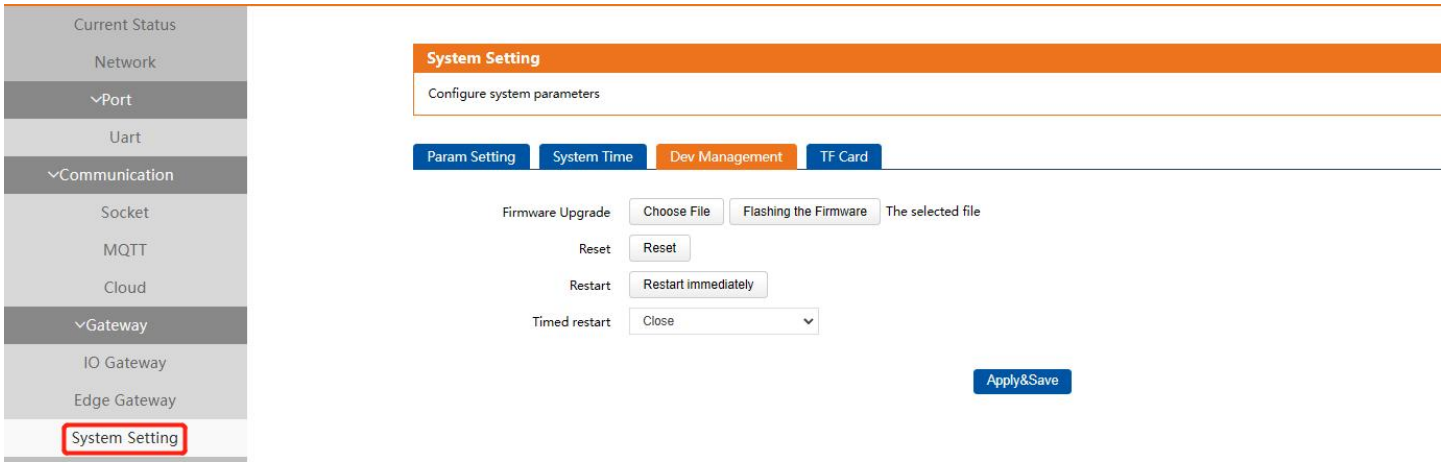


Fig. 20 System time

- **Device management**



A. Firmware upgrade

USR IoT continually upgrades its firmware to add new features and optimize performance. Please contact the sales to obtain the latest version of the firmware. Before upgrading the firmware, please make sure that the device has a reliable power source that will not be powered off or restarted during the firmware upgrading process(please be patient as this whole process might take up to 1 -2 minutes). Choose file to upload and flashing the firmware.

B. Reset(Restore factory defaults)

This function is used to restore the gateway to the factory settings and automatically restart the gateway at the same time. Before the gateway restarts successfully, the device does not work and cannot forward any data packets. This function is to restore the factory default configuration value once the user sets the wrong parameter and causes the gateway to work abnormally. Click the "Restore factory defaults" button, and a prompt box will pop up on the page. Click "OK".

C. Restart

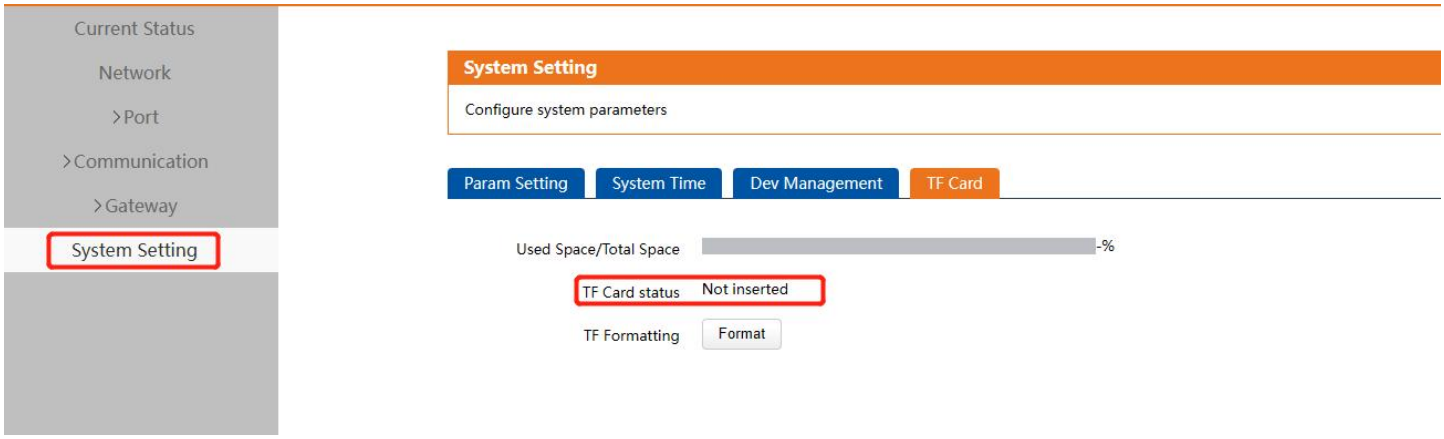
This function is used to restart the gateway by software. Before the gateway is completely restarted, the device does not work and cannot forward any data packets. This restart is different from the hardware reset of power-on restart, but the gateway system software is reset, just like the "warm restart" of the windows operating system. Once a new setting is changed, you can use the Save function to accept the changes. You will need to reset the device to save the settings to flash memory. Click on "restart" Button, the page pops up a prompt box, click "OK".

D. Time restart

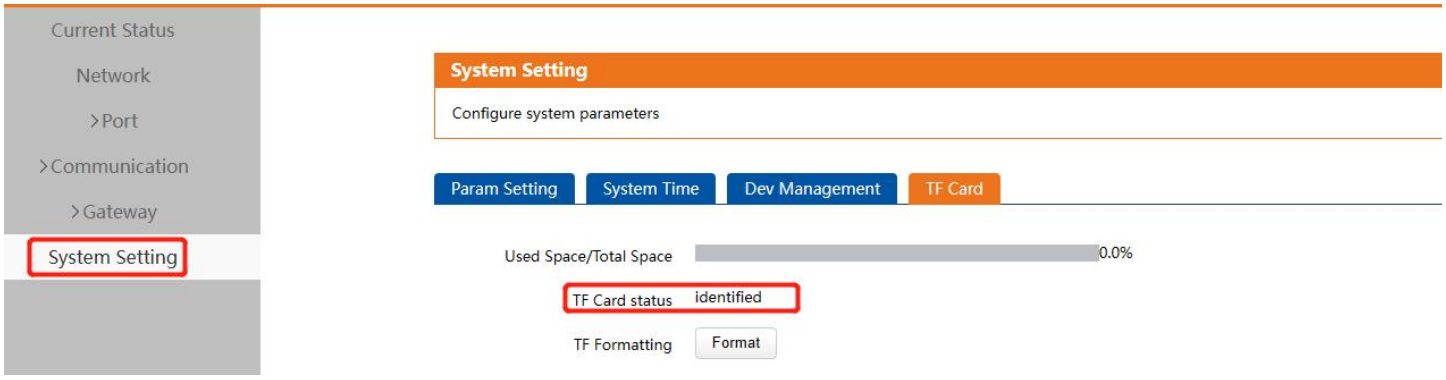
After opening this function, the device will restart at the preset time.

2.1.9. SD card function

The USR-N720-ETH supports external SD card to restore the collected data when the Internet connection is disconnected. When the SD card is not inserted, the webpage will give the status.



When inserting the SD card, the web page will identify and display.



2.2. Configuration software

2.2.1. Discovering your gateway

After you start configuration software, if the USR-N720-ETH gateway is already connected to the same gateway as your PC, the device can be accessed via broadcast packets. Users can search all the USR-N720-ETH gateways on the network and show them on the Deivce List Area of the utility. Please select the right Ethernet adapter(Device menu) if you did not see any gateway.

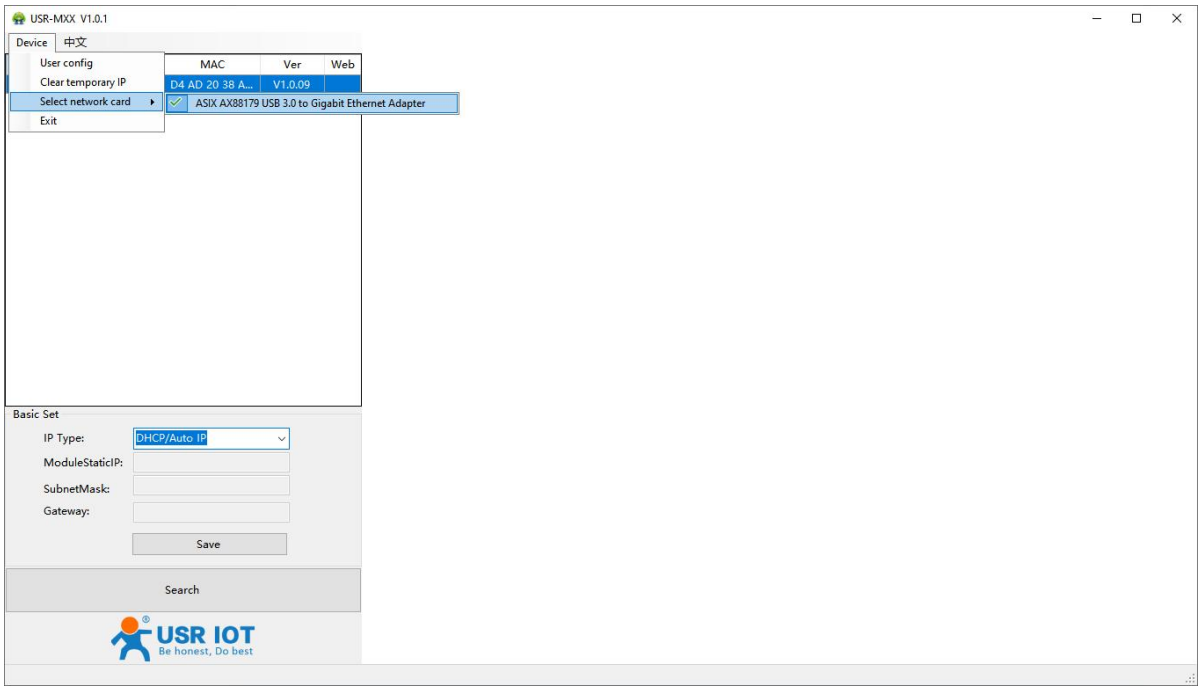


Fig. 21 Searching

2.2.2. Network setting

Sometime the USR-N720-ETH gateway might not be in the same subnet as your PC, therefore, you will have to use this utility to locate it in your environment. To configure each device, first click to select the desired device (default IP:192.168.0.7) in the list of configuration utility, and then change the IP address to avoid any IP address conflict with other hosts on your LAN, save your change.

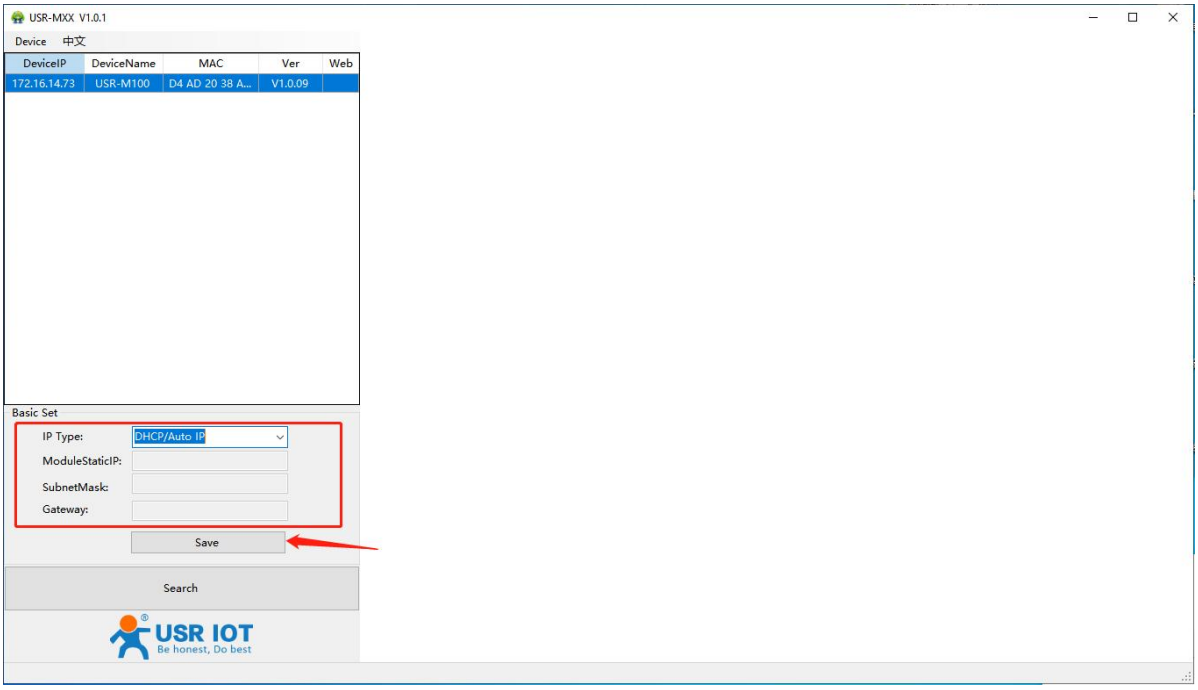


Fig. 22 Changing network settings

2.2.3. Reboot the device

This function is available to allow you to reset the gateway. The function disconnects both the ethernet and serial connections. The function also allows the gateway to save new configuration settings to flash memory. To reset the device:

1. Right-click a desired device to display the settings menu.

2. Select Reboot.

Press the Reboot button and the system will give a reset response.

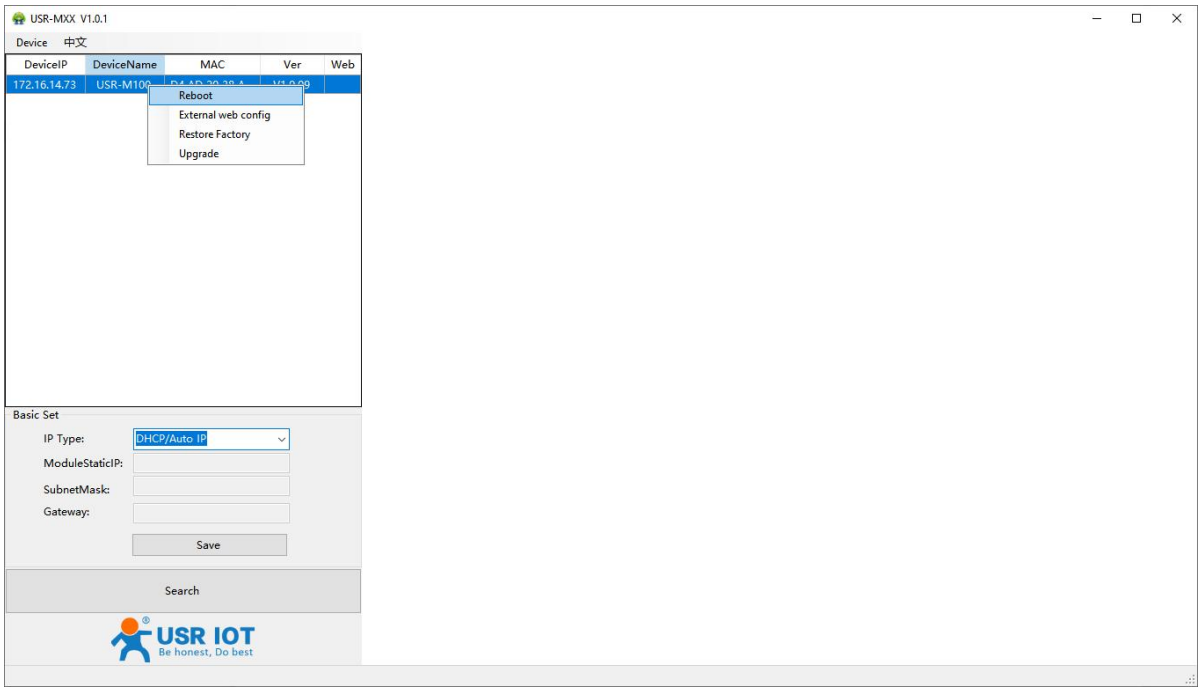


Fig. 23 Reboot the device

2.2.4. Restore to factory default settings

The configuration utility provides the function to restore the gateway to factory default settings. If you really want to restore the gateway to factory default settings, please click restore factory button to continue. As shown in Fig.34.

3. Edge Gateway

The USR-N720-ETH supports Modbus RTU Master for retrieving field site data from serial meters. After collecting data, users can convert serial data to MQTT json format data, allowing users to get field site data. This two-in-one design reduces system complexity and the amount of space required in the network topology, as well as overall installation time. In addition, you can extend the useful life of legacy devices by connecting them to Ethernet and accessing the devices using a preferred protocol,TCP/UDP , HTTP , MQTT.

First,users need to enable edge computing function.

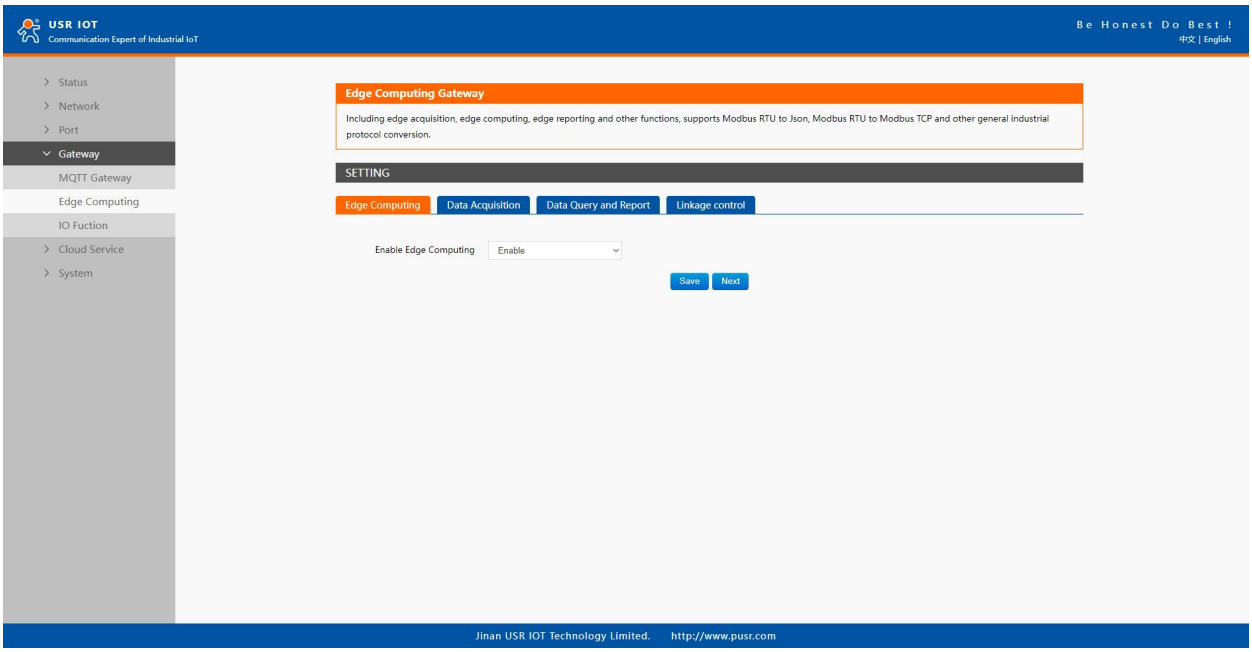


Fig. 24 Enable edge computing

3.1. Add modbus slave device

Connect serial device to the serial port of USR-N720-ETH gateway, and then configure the slave parameter on the data acquisition tab.

Click add slave to add a device, click edit to configure the device.

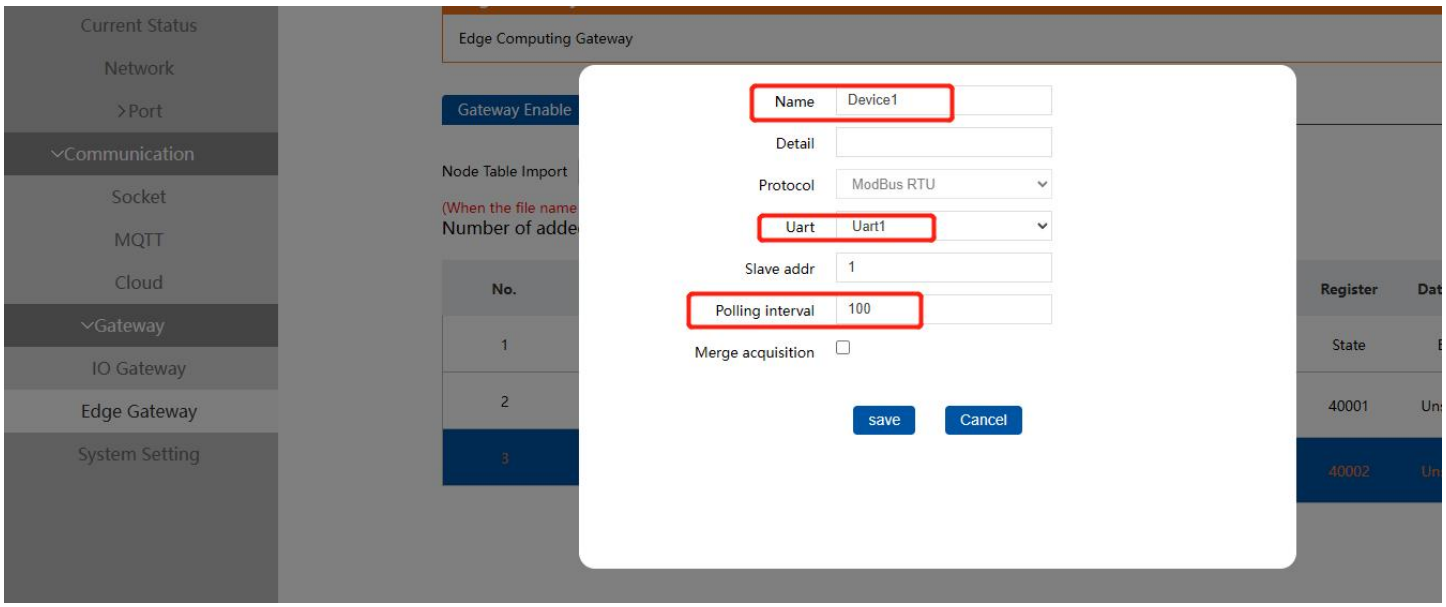


Fig. 25 Add a slave device

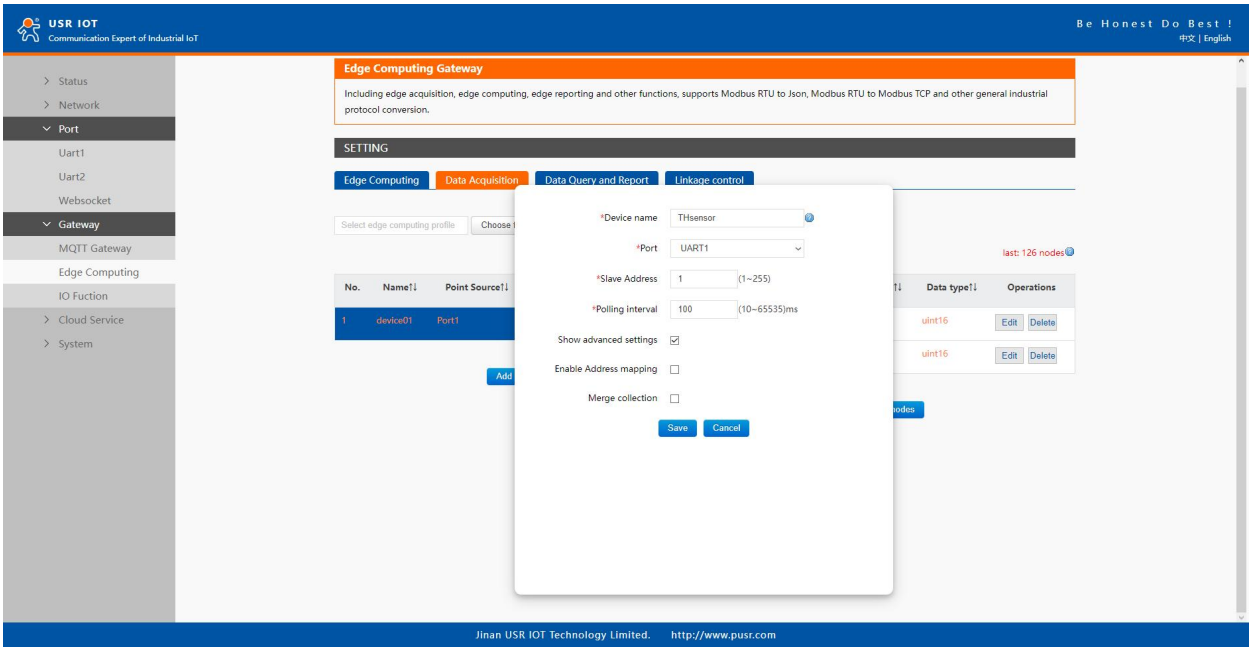
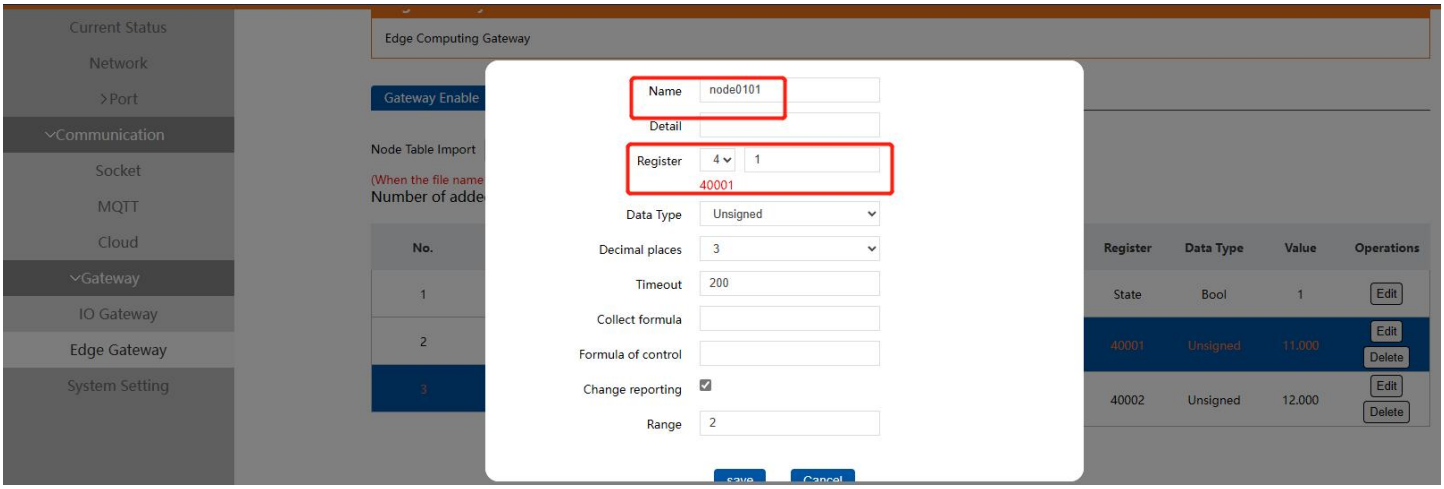
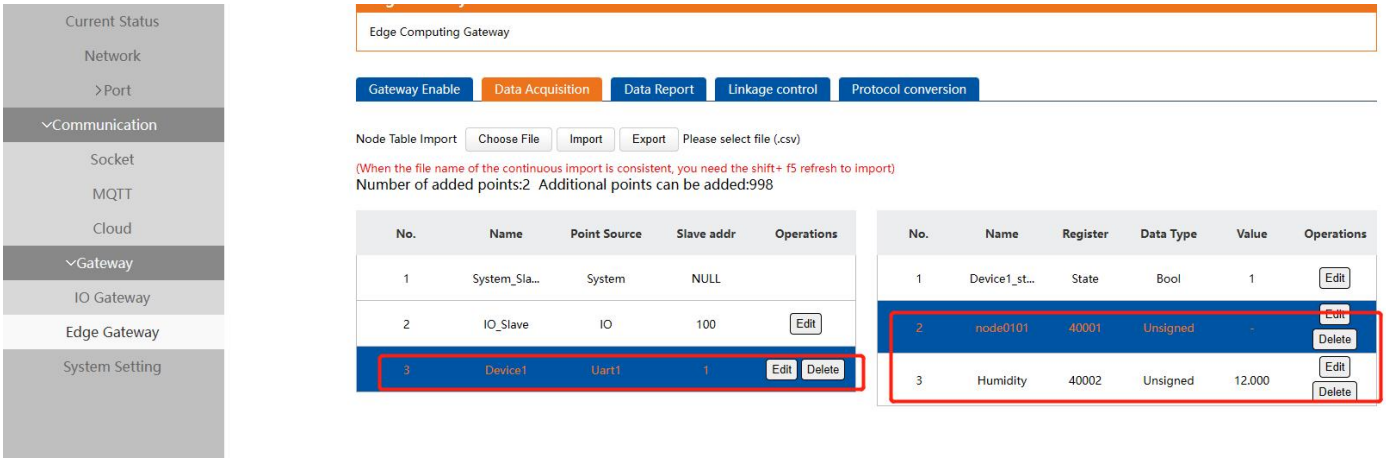


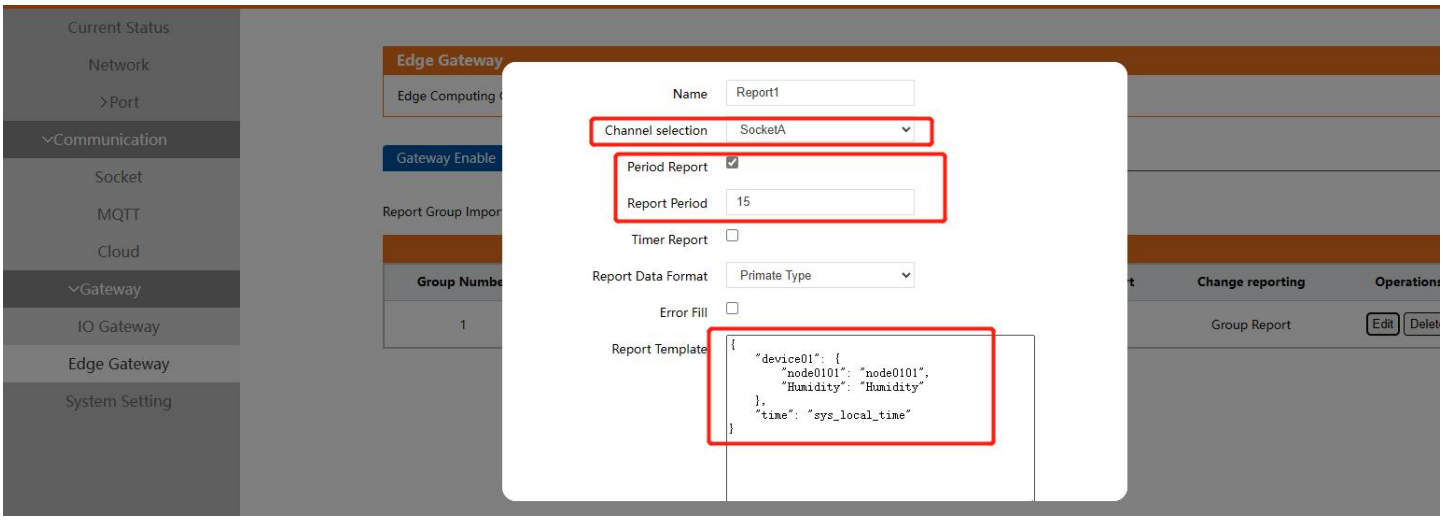
Fig. 26 Polling slave device configuration

3.2. Add modbus data points

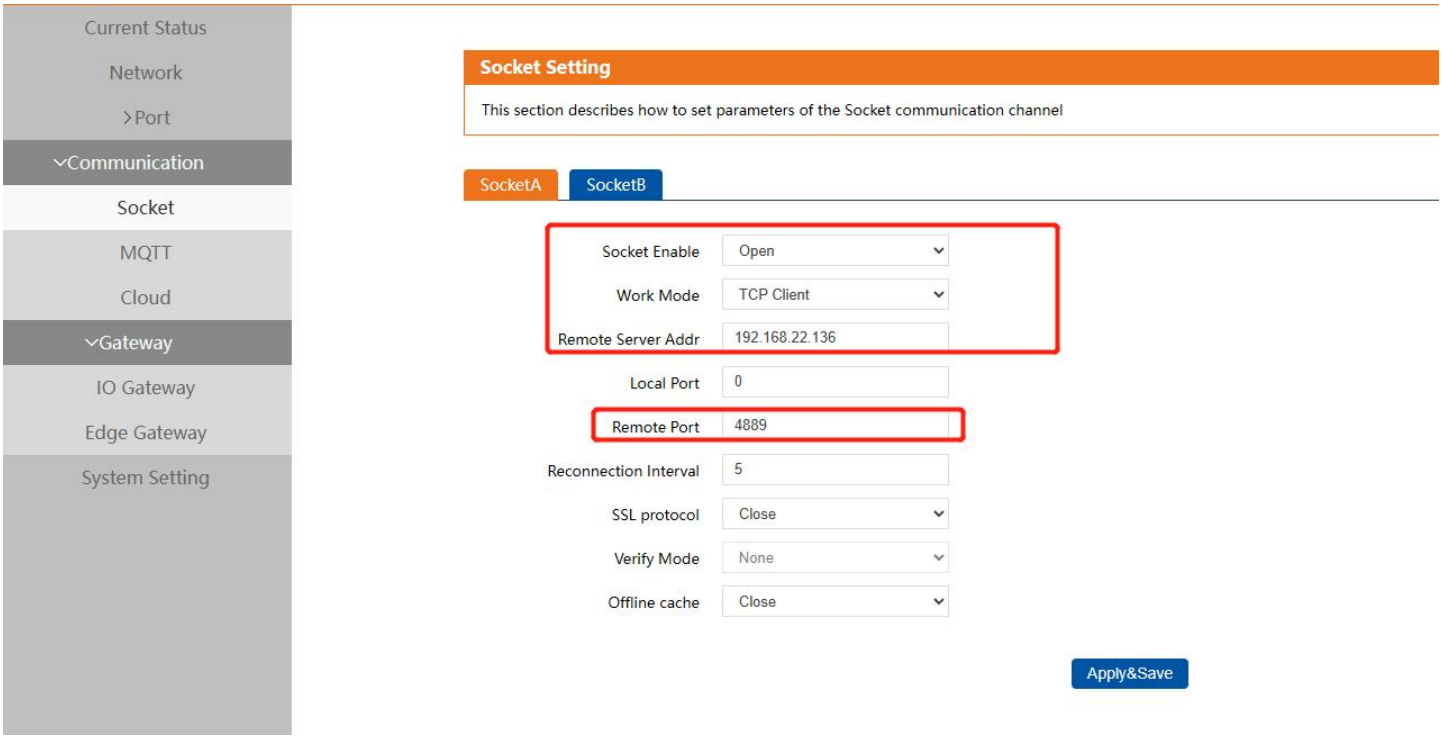




3.3. Add group

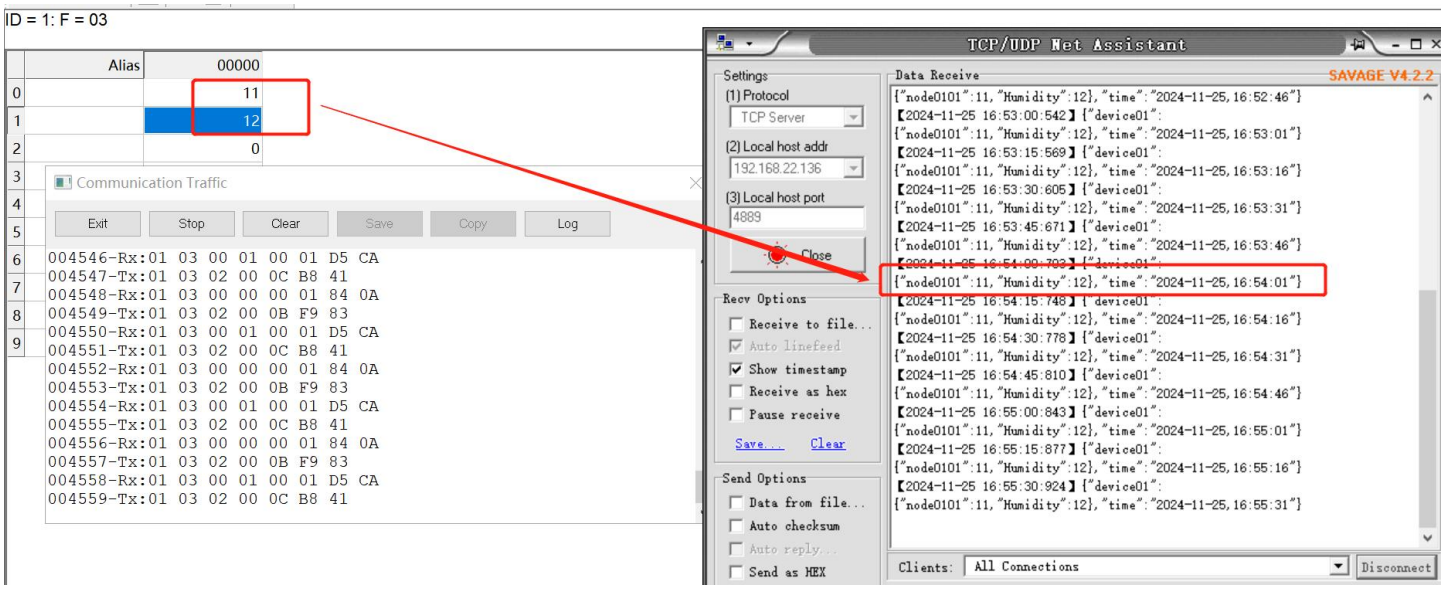


If reporting the data via socket A, users need to configure the socket A parameters first.



3.4. Test result of data report

In this document, we use Modbus Slave software to replacement the real Modbus Slave device to do the test. From the TCP server side, we can notice that the data interval is 15s, it's keep the same that we set in the adding group page.

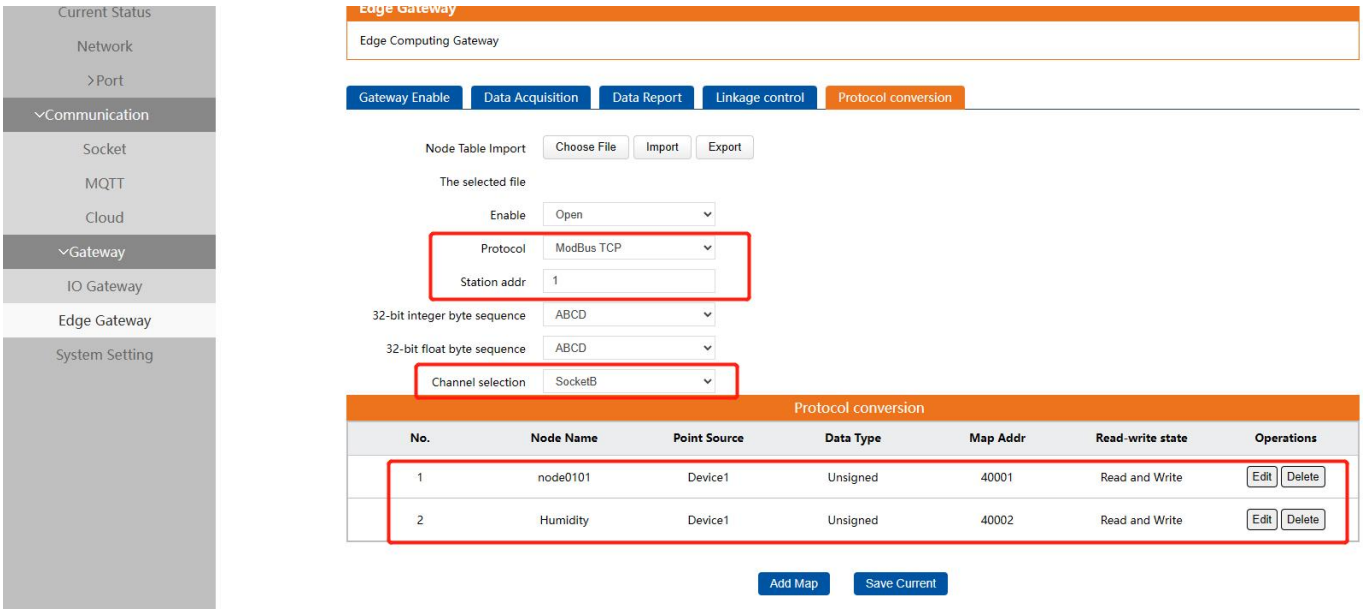


3.5. Protocol conversion

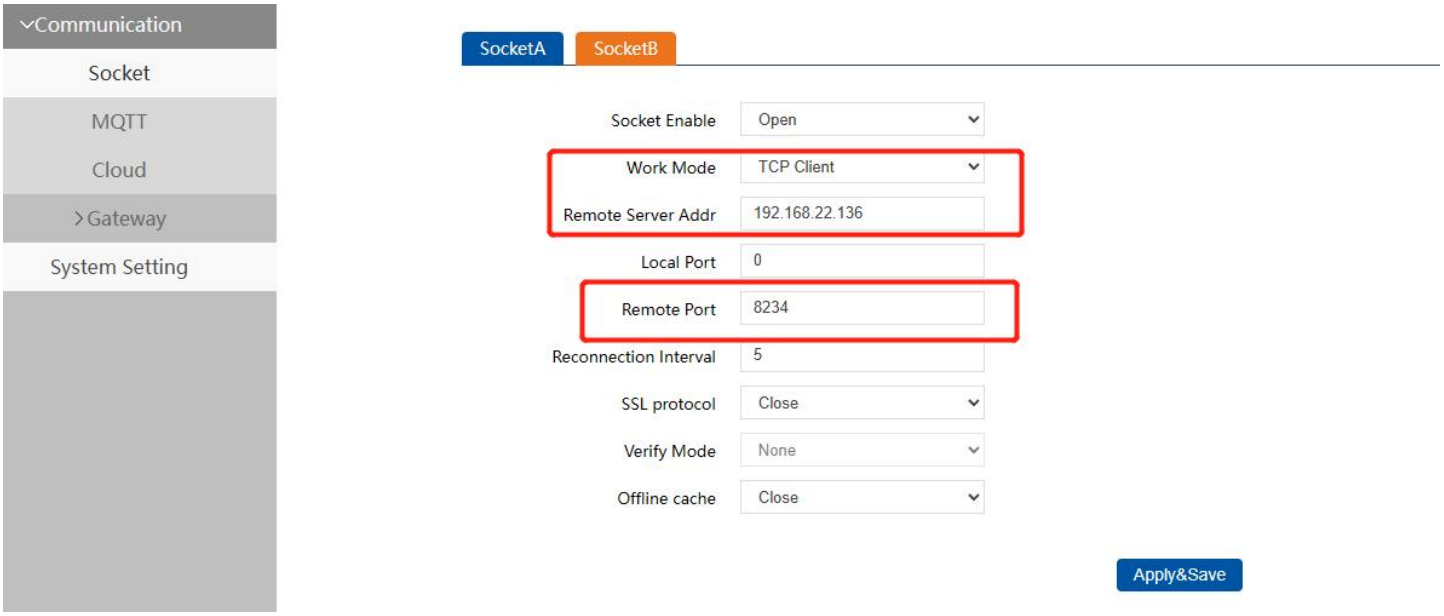
The protocol conversion function is mainly applied in the scenario where the server actively sends protocol commands to obtain data or control points from the N720-ETH.

After the N720-ETH is connected to the server through the link of protocol conversion, the server issues standard protocol commands to realize the collection and control of all point data of the N720-ETH. Current protocol conversion including 2 protocol standards: Modbus TCP and Json.

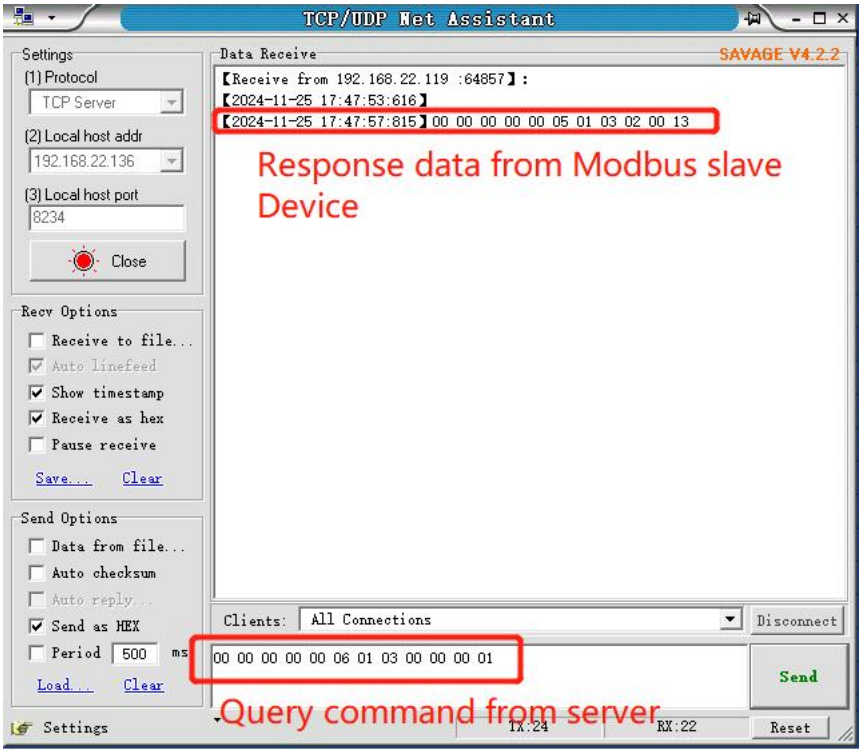
Query data using Modbus TCP:



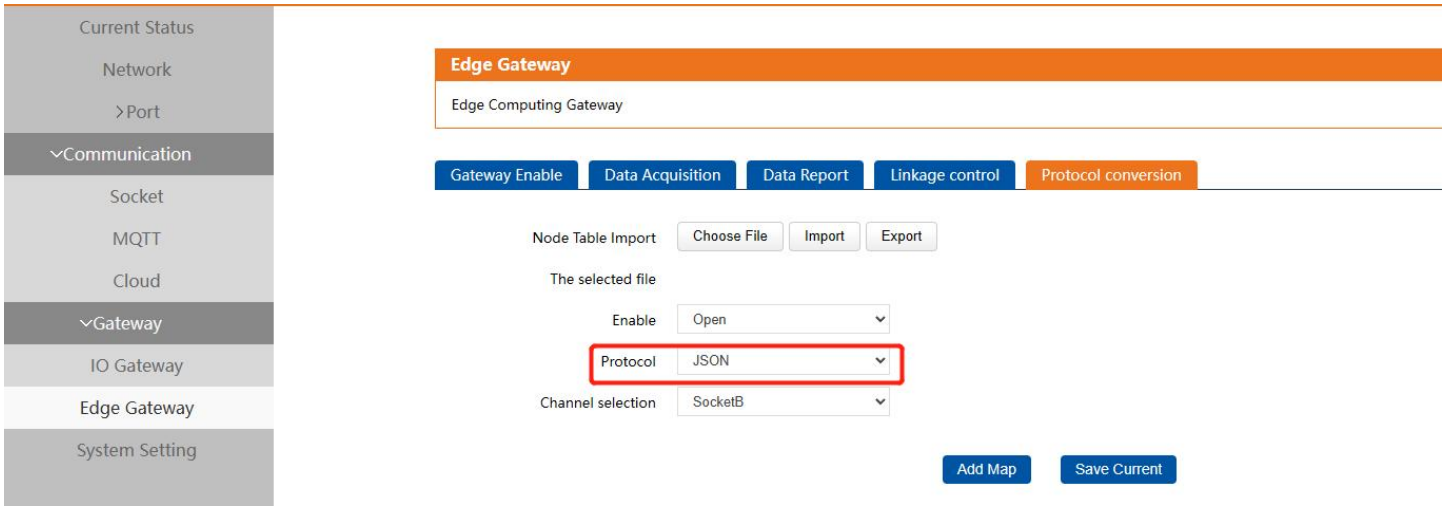
Parameters of socket B:



Query command from TCP server:



Query data using JSON:



When sending query command from the server should in specific format. The query/control

Json contents are the following format:

{"rw_prot": {"Ver": "protocol version","dir": "transmission direction","id": "id","r_data": [{"name": "name of data points"],"w_data": [{"name": "name of data points","value": "data"}]}

Key-value	Description
rw_prot	Protocol header
ver	Protocol version, fixed value: 1.0.1
dir	Data transmission direction In query/control command, the option should be down. Means transmit data from network to serial device, “down” must be lowercase.
id	User defined parameter. The id is same in query/control and response data. Sometimes, the query/control data is high frequency, the response data may be disordered. The program in network can confirm the relevant response data by the id.
r_data	The data load for querying data
w_data	The data load for controlling data
name	The name of data points
value	Means the data need to be sent to the data points. In query data, this key-value can be ignored.

The response data contents are the following format:

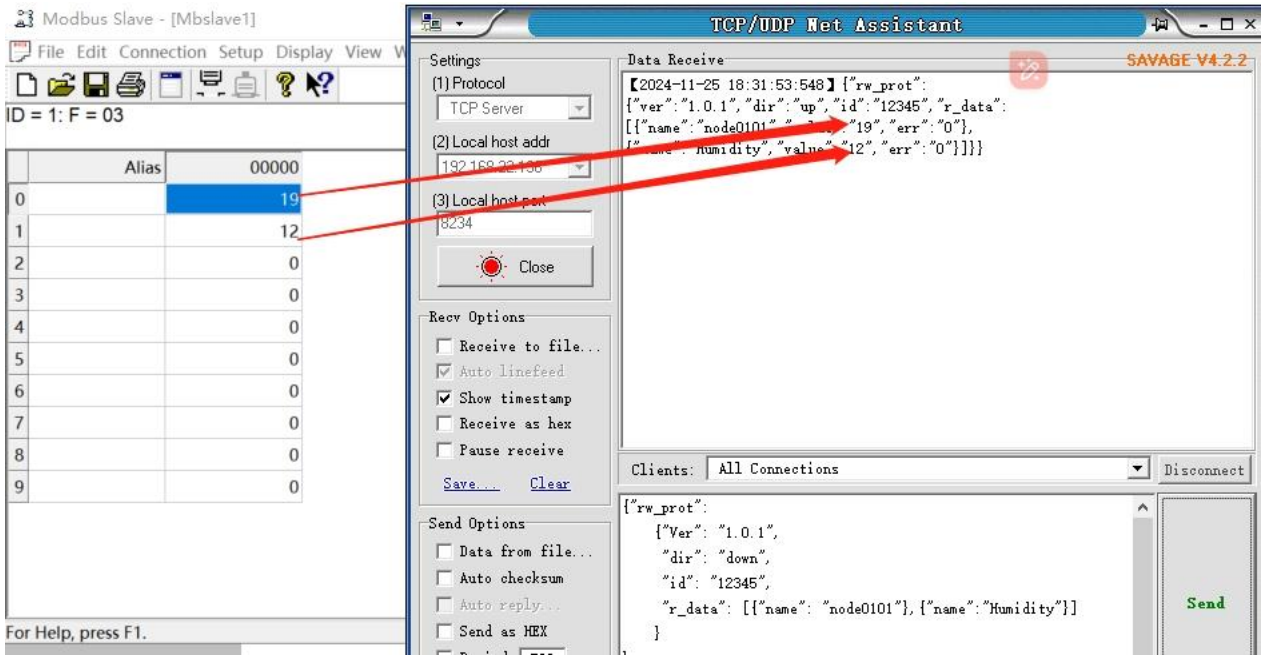
{"rw_prot": {"Ver": "protocol version","dir": "transmission direction","id": "id","r_data": [{"name": "name of data points","value": "data","err": "error code"}],"w_data": [{"name": "name of data points","value": "data","err": "error code"}]}

Key-value	Description
rw_prot	Protocol header
ver	Protocol version,fixed value: 1.0.1
dir	Data transmission direction In response data, the option should be up. Means transmit data from serial device to network, “up” must be lowercase.
id	User defined parameter. The id is same in query/control and response data. Sometimes, the query/control data is high frequency, the response data may be disordered. The program in network can confirm the relevant response data by the id.
r_data	The data load for querying data
w_data	The data load for controlling data
name	The name of data points.
value	The valid data of the data points
err	Error code, 0: The command can be operated by the USR-N720-ETH, 1: The command can’ t be operated by the USR-N720-ETH.

To read the value of node0101 and the Humidity, we can send data like the following:

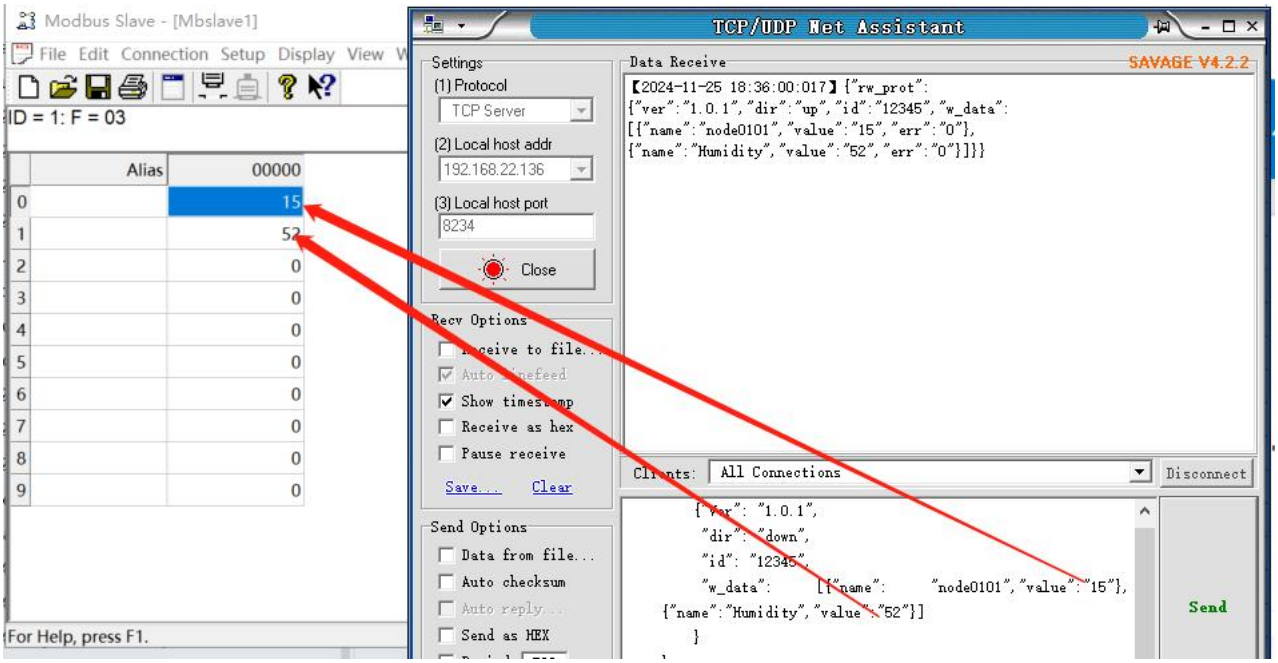
```
{"rw_prot":
    {"Ver": "1.0.1",
     "dir": "down",
     "id": "12345",
```

```
    "r_data": [{"name": "temperature"},{"name":"Humidity"}]
  }
}
```



To write the value of node0101 and the Humidity, we can send data like the following:

```
{"rw_prot":
    {"Ver": "1.0.1",
     "dir": "down",
     "id": "12345",
     "w_data": [{"name": "node0101","value":"15"},{"name":"Humidity","value":"52"}]
    }
}
```



There are 3 response data for the unoperated command:

- The USR-N720-ETH responses no data to the command,
- The USR-N720-ETH will response data conforming to the error protocol if the ver/dir/id is not right,

- The USR-N720-ETH will response data conforming to the error protocol if the contents of r_data and w_data are both wrong,

  the USR-N720-ETH will response data of the right one if only one of the r_data and w_data is wrong.

The error protocol format is the following:

{"rw_prot": {"Ver": "1.0.1","dir": "up","err":"1"}

Tips:

1. If the query command is incorrect, the value of the read command reply is empty, and the value of the write command reply is the historical data value.

2. The maximum read and write operation is 127 data points at the same time.

4. Warranty

5. Contact Us

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7. Revision History

Version	Date	Author	Description
1.0.0	2023.01.30	Dean,Gao	Initial
1.0.1	24.03.06	May	Add expansion machine selection

			table