

Modbus TCP Manual for PLC Applications



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1 Overview

This document describes how to connect to IQ Home Gateway Modbus TCP interface. IQ Home Gateway Modbus TCP interface provides a solution to access Modbus Slave devices with IQ Home MB Series (MB-XXX-XX) products and read periodically collected battery powered sensor values as virtual devices.

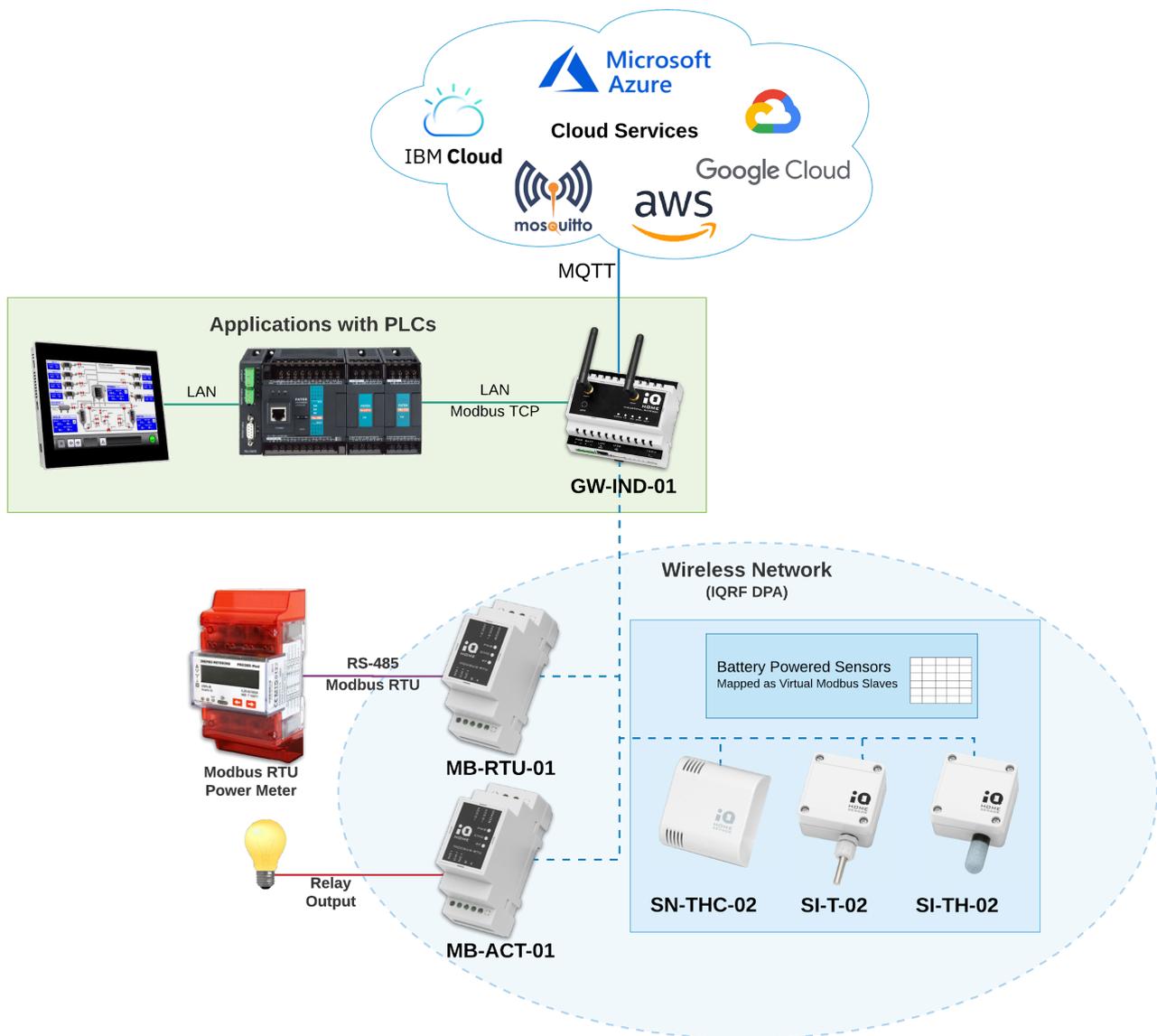


Figure 1 Architecture of using IQ Home Gateway Modbus TCP/IP interface using PLC applications

2 Connect to Modbus TCP Slaves

2.1 Connect to gateway

To connect to the gateway with Link It! Gateway Management Tool please follow the video tutorials at the following link:

<https://www.youtube.com/playlist?list=PLN9Mt98EPzN30TyGCDs-M0s0zSJRZdNpY>

You can download the Link It! Gateway Management Tool at the following link:

<https://www.iqhome.org/linkit>

2.2 IP address

IQ Home gateways in PLC applications have to be connected on the same local area network (LAN) as shown in Figure 2.

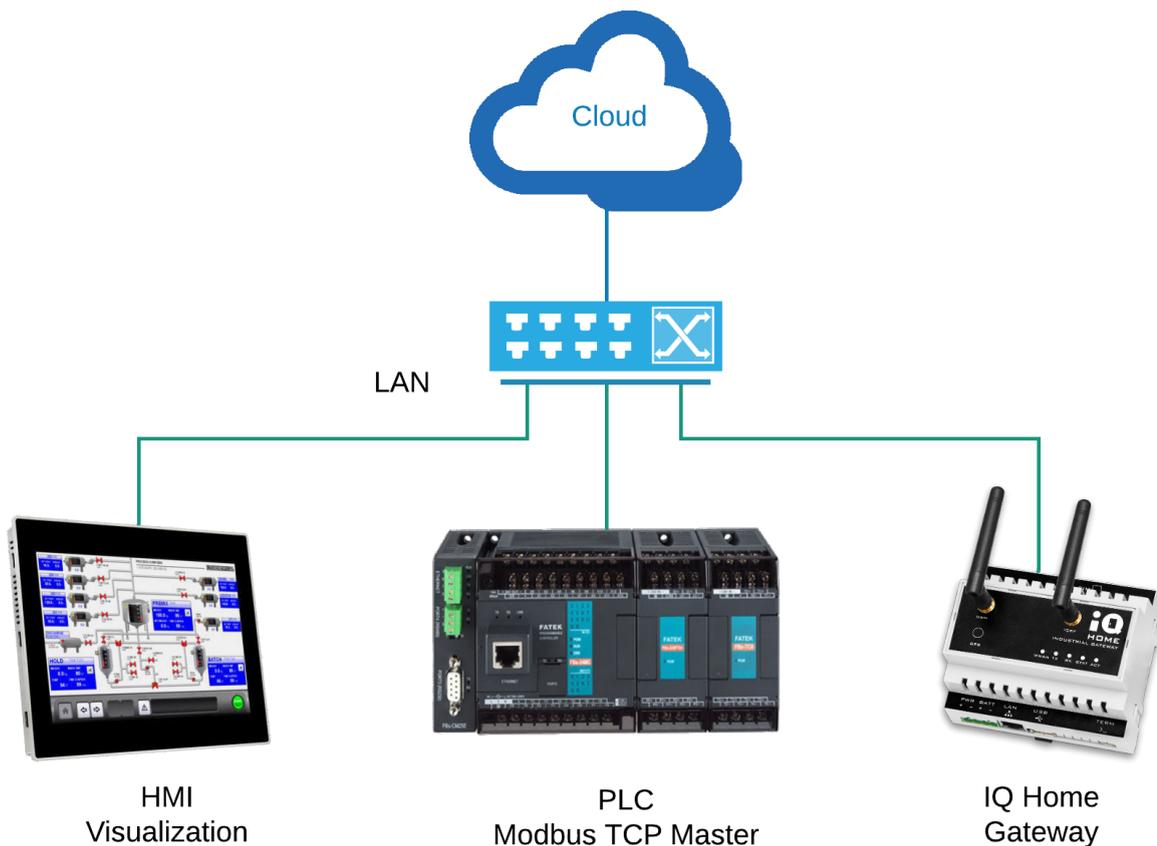
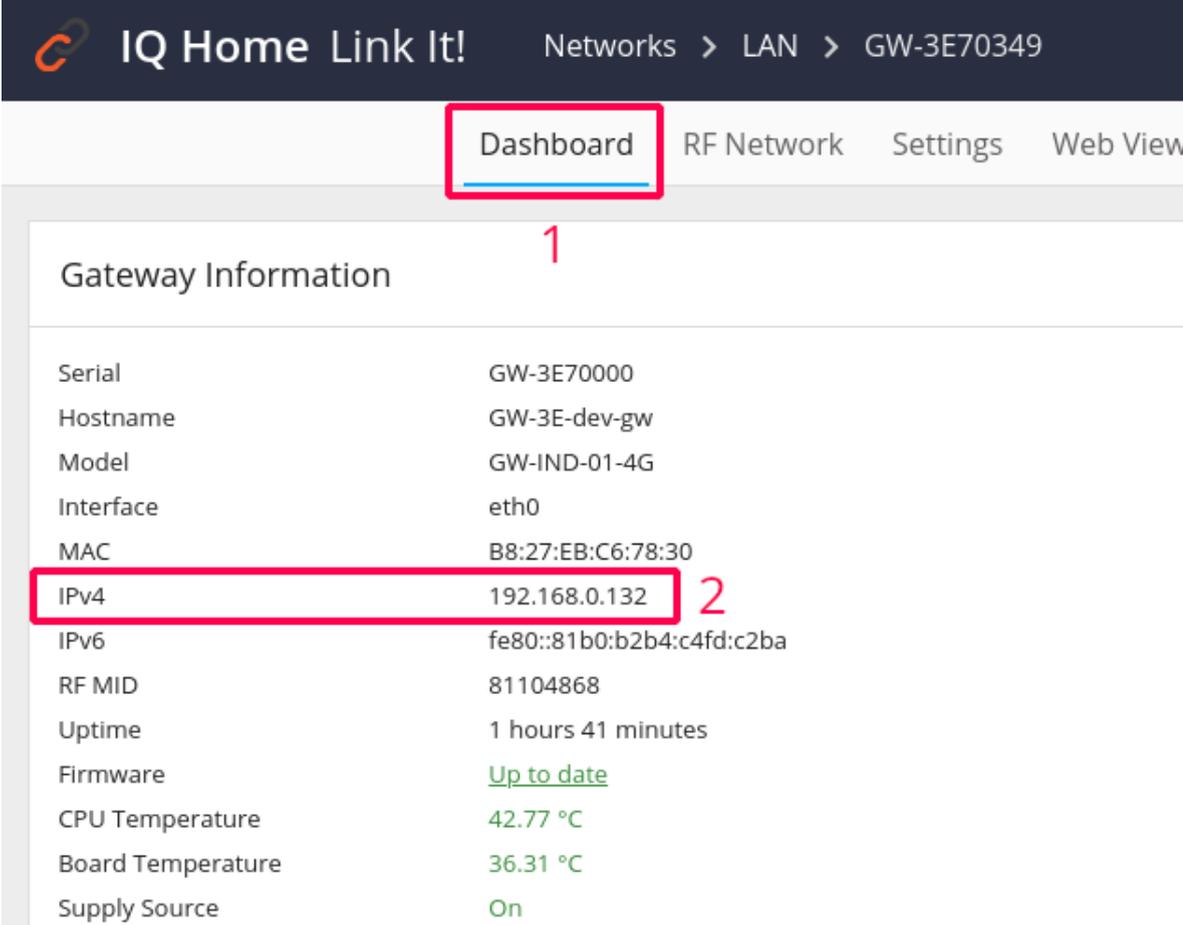


Figure 2 Local access to IQ Home Gateway Modbus TCP interface

The IQ Home gateways use DHCP for IP address configuration as default and can use with [Fixed IP address](#). The IP address information can be found in Link It at gateway Dashboard page shown on Figure 3 or ask your network administrator for the IP address of the gateway.



The screenshot shows the IQ Home Link It! interface. The breadcrumb navigation is "Networks > LAN > GW-3E70349". The "Dashboard" tab is selected and highlighted with a red box and a red "1". Below the navigation, the "Gateway Information" section is displayed. A table lists various gateway details, with the "IPv4" row highlighted by a red box and a red "2".

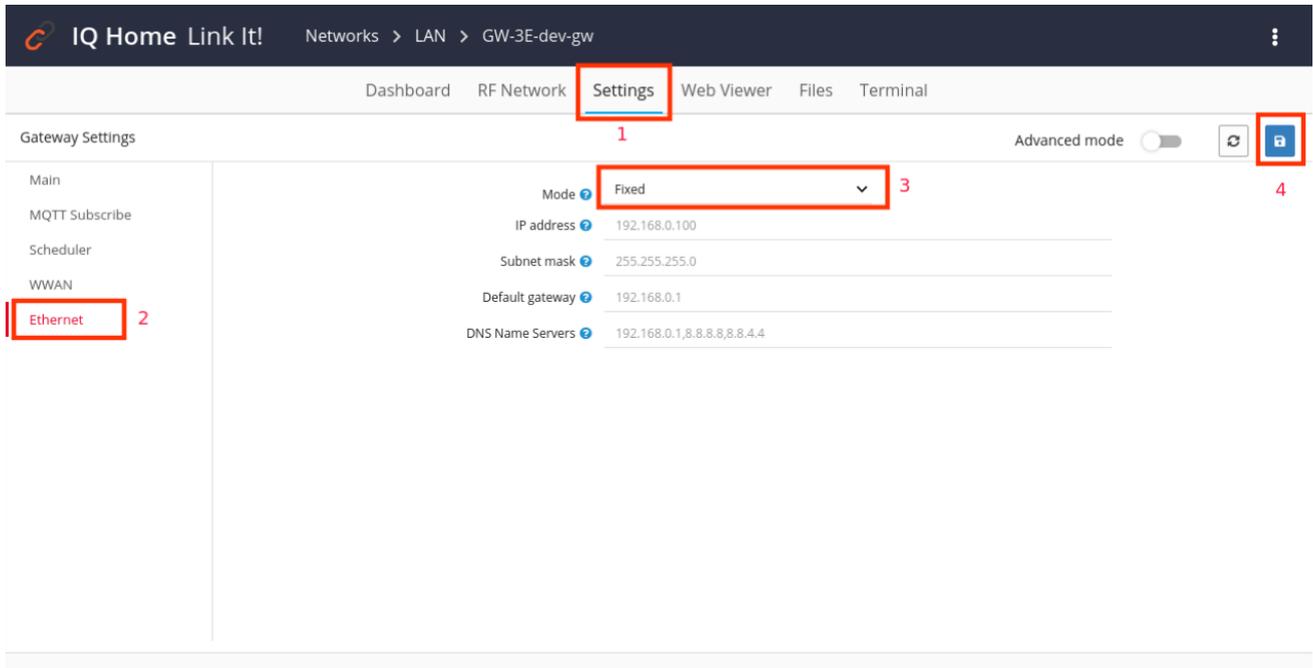
Gateway Information	
Serial	GW-3E70000
Hostname	GW-3E-dev-gw
Model	GW-IND-01-4G
Interface	eth0
MAC	B8:27:EB:C6:78:30
IPv4	192.168.0.132
IPv6	fe80::81b0:b2b4:c4fd:c2ba
RF MID	81104868
Uptime	1 hours 41 minutes
Firmware	Up to date
CPU Temperature	42.77 °C
Board Temperature	36.31 °C
Supply Source	On

Figure 3 LinkIt Gateway dashboard with IPv4 address

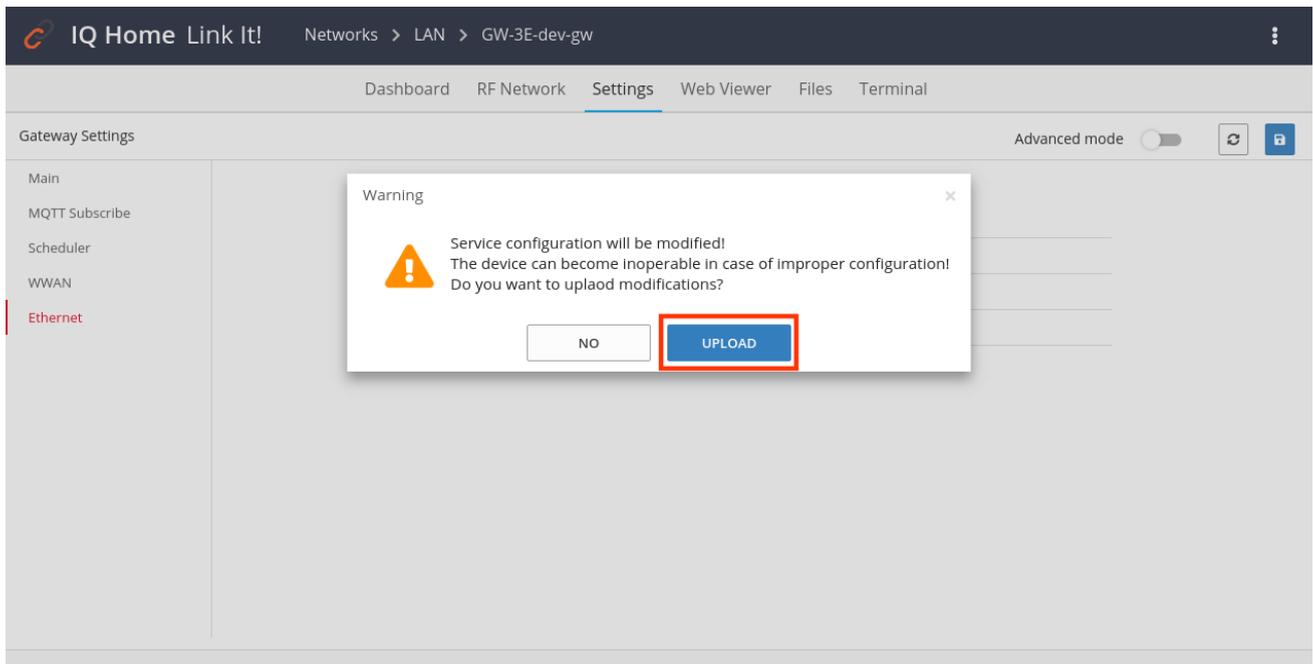
2.3 Static/Fixed IP address

The gateway supports setting up a static IP address or as known as fixed IP address.

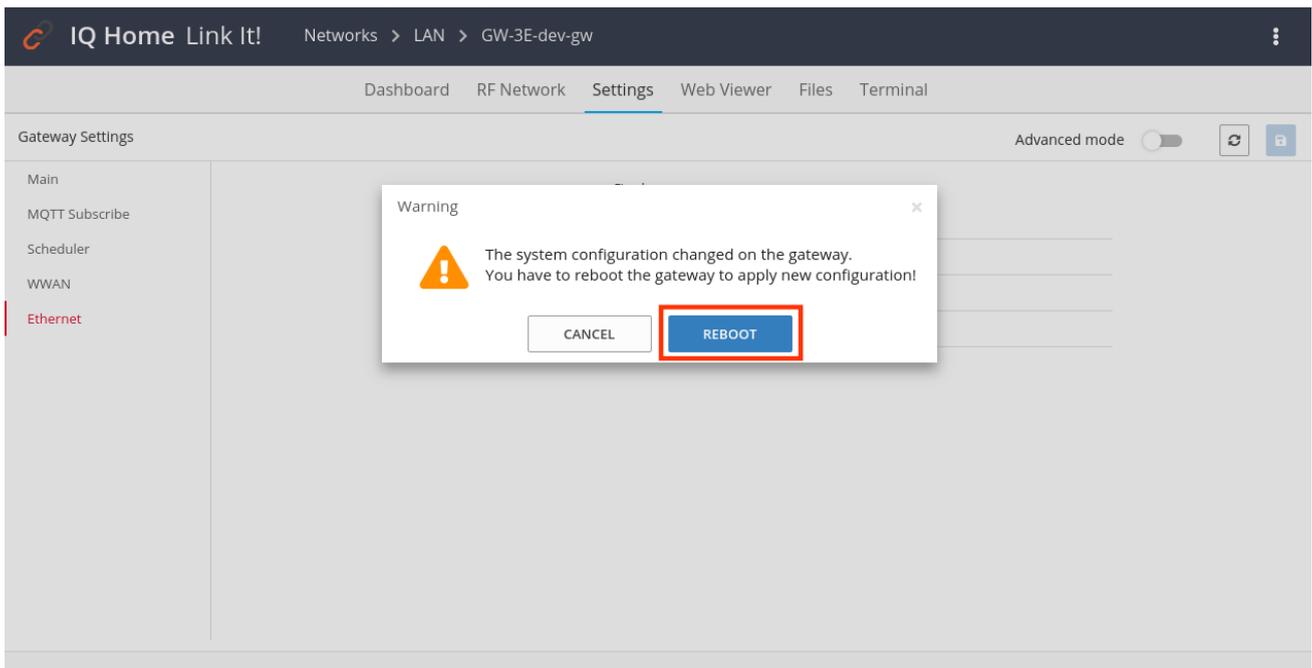
1. Click on the Settings tab
2. Click on the “Ethernet” tab on the left sidebar
3. Select Fixed option from the drop down menu and set IP properties
4. Save the configuration



5. Confirm configuration upload



6. Confirm to reboot the gateway



2.4 Enable Modbus interface

The Modbus TCP interface is not enabled as default. The remote access for external devices disabled too. You can enable the interface in LinkIt (Figure 4):

1. Click on the Settings tab
2. Scroll down on the bottom of the page and enable Modbus TCP interface
3. Enable Modbus TCP remote access
4. Click on the save button and confirm configuration upload and service restart

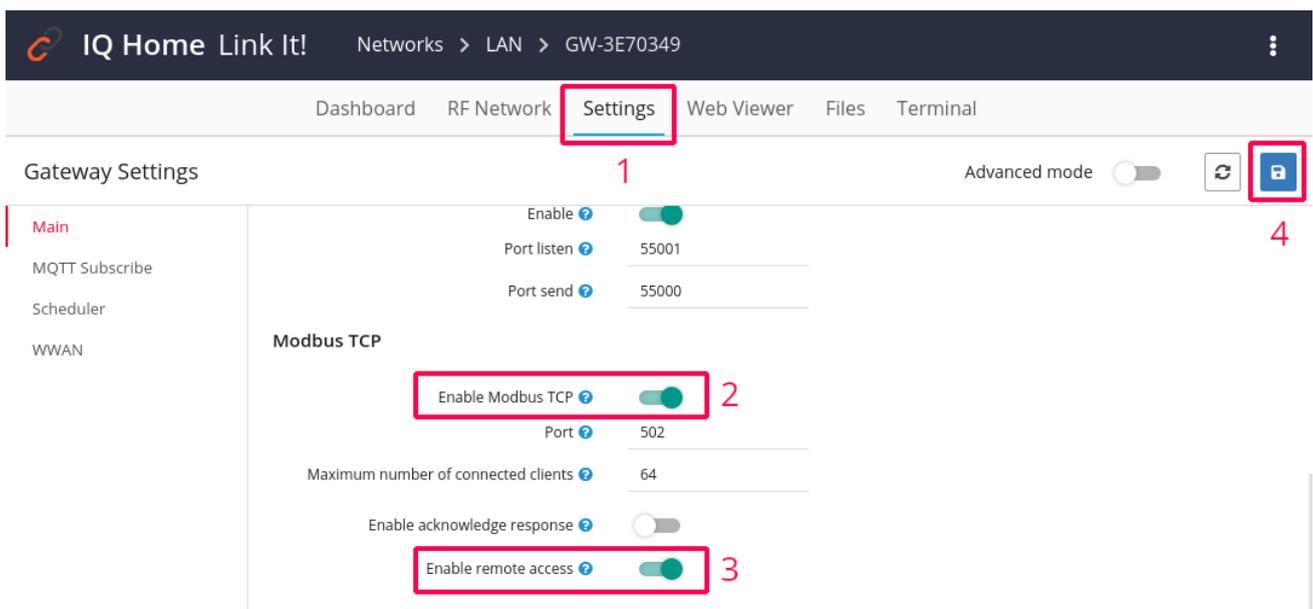


Figure 4 Enable Modbus TCP interface and remote access in LinkIt

2.5 Port number

IQ Home gateway Modbus TCP/IP service listening on the default port 502 to access Modbus Slave devices.

2.6 Modbus RTU Master device unit ID

IQ Home gateways with Modbus TCP feature handles Modbus TCP Slaves from the wireless network. Wireless Modbus RTU slave devices with IQ Home MB series network node address are the Modbus TCP Unit ID. The MB series devices can be placed in the network from address 1 to 239. The network address 240 is reserved for virtual devices.

Unit ID/ Node address	Device type
1-239	MB series device
240	Battery powered sensors as virtual devices

3 Configure Modbus devices

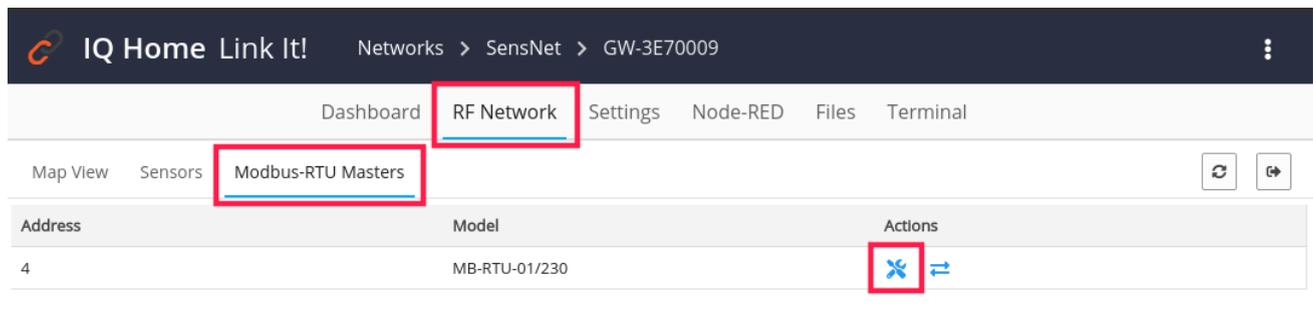
Set up communication settings of the Modbus devices can be done after successfully added to the RF network.

Please follow the next guidelines to setup the Modbus devices:

- Check the physical connection. The RS-485 A-B line is connected correctly
- The slave device is powered on
- Modbus-RTU communication settings according to the connected slave:
 - Baudrate
 - Parity

To setup the appropriate Modbus-RTU communication settings for the gateway's onboard Modbus-RTU master or the MB-RTU-01 device:

- Go to RF Network tab
- Open Sensors tab and refresh device list
- Click on the Configure Device icon at the given device



The screenshot shows the IQ Home Link It! interface. The top navigation bar includes "Networks > SensNet > GW-3E70009". Below this, there are tabs for "Dashboard", "RF Network", "Settings", "Node-RED", "Files", and "Terminal". The "RF Network" tab is selected. Underneath, there are sub-tabs for "Map View", "Sensors", and "Modbus-RTU Masters". The "Modbus-RTU Masters" sub-tab is selected. A table displays the following data:

Address	Model	Actions
4	MB-RTU-01/230	 

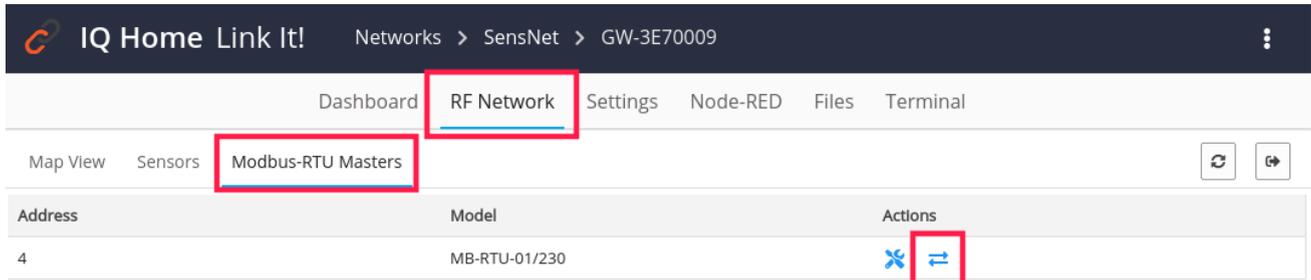
Opening the device configuration window will load the actual settings. After modifying the settings click on the Save button. The Modbus Master RTU device will automatically reload the new settings.

Modbus Settings

Modbus Settings		
Baudrate	9600	▼
Communication mode	Even parity + 1 stop bit	▼
Timeout [ms]	500	
Request count	3	

4 Testing Modbus communication

LinkIt! has a built-in feature to test the communication of Modbus devices.



Its includes the following basic Modbus commands:

- FC 1: Read Coils
- FC 2: Discrete Inputs
- FC 3: Read Holding Registers
- FC 4: Read Input Registers
- FC 5: Write Single Coil

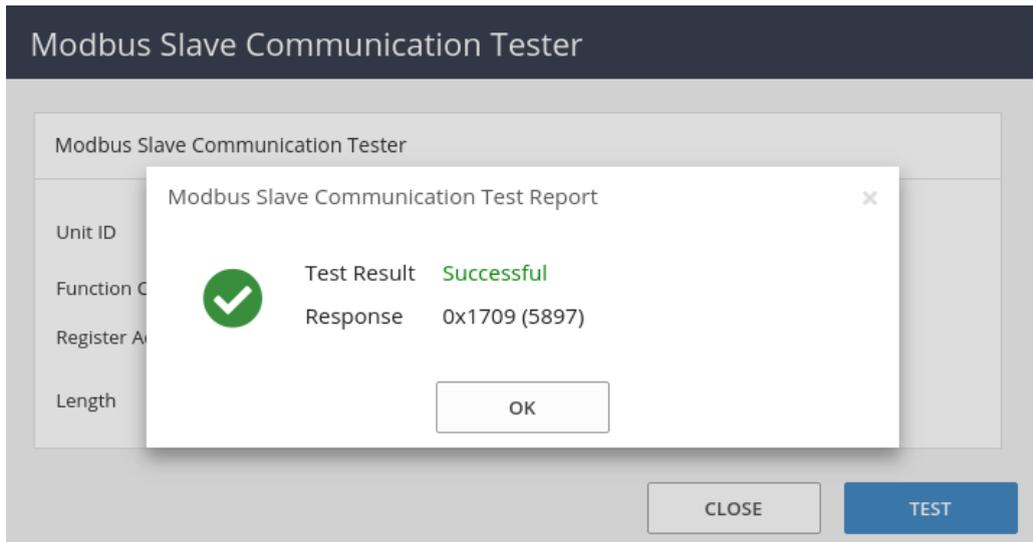
The 'Modbus Slave Communication Tester' dialog box is shown. It contains the following fields:

Modbus Slave Communication Tester		
Unit ID	1	▼
Function Code	FC 3: Read Holding Registers	▼
Register Address	0x5000	
Length	1	▼

At the bottom right, there are two buttons: 'CLOSE' and 'TEST'.

After click on the TEST button the gateway sending the test request to the device.

If everything is fine the following similar message will appear:



5 Gateway onboard Modbus-RTU Master

The GW-IND-01 series gateways enable to connect RS-485 Modbus RTU slaves to the gateway RS-485 connector. The following table describes the device addressing using Modbus TCP:

	Modbus TCP		Device
	Unit ID	RF Network Address	RS-485 Slave Address
Broadcast	0	All device	All RS-485 device
MB-RTU-XX RF devices	1-200	1-200	1
Local RS-485	201-231	Gateway local	1-31
Virtual RF devices	240	-	-

The RS-485 devices connected directly to the gateway can be accessed from address 201-231 with 200 address offset. For example, to access Modbus Slave connected to gateway RS-485 with address 1 the Unit ID should be set to 201.

6 Read virtual device data

Battery-powered IQ Home sensor values can be read from the gateway as virtual Modbus devices. The scheduler in the gateway requests sensor data periodically. The responses are stored in the gateway in-memory database. Sensor values can be accessed with register read Modbus commands. The registers are read-only registers.

- Go to RF Network tab
- Open Sensors tab and load sensor values
- Click on the Create Scheduler icon in the top right corner

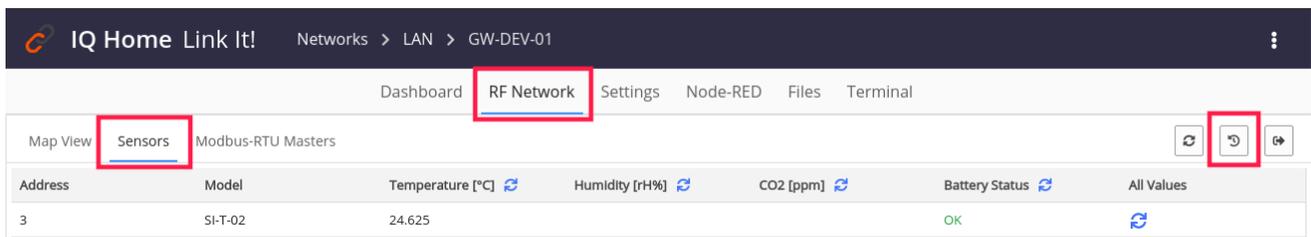


Figure 5 Setup scheduler for virtual devices - Scheduler Wizard

- Set up the required scheduled sensor data request
- Enable Modbus data output
- Select the appropriate configuration
(Internal by default to use Modbus TCP interface from CODESYS or Node-RED TCP)

Scheduler Wizard

Scheduler Settings

Measured values: Temperature

Battery saver mode:

Active days: Mon Tue Wed Thu Fri Sat Sun

Active hours: 8:00 - 16:59

Measurement period in active hours: 15 min

Measurement period in inactive hours: 60min

Estimated Battery Lifetime: 10.00 years

Response: Modbus Node-RED MQTT

Modbus access: Internal (CODESYS, Node-RED) External (PLC)

CANCEL SAVE

Figure 6 Setup scheduler for virtual devices - Add add remove scheduler jobs

NOTICE

In case of battery powered sensors and MB-RTU-XX devices used in the same network the request from scheduler and Modbus master are enqueued in the gateway. In the Modbus master consider the queue and RF network response time when defining timeout values.

6.1 Virtual devices unit ID

The Unit ID of the virtual devices is 240 (0xF0).

6.2 Memory map

IQ Home Gateway provides a solution for accessing battery powered IQ Home sensor values as Modbus slaves. The virtual devices are mapped into the gateway in-memory database and can be read from Modbus master. The table below describes the sensor values memory map.

Contents	Start Address	End Address	Function Code	Register Length	Unit	Format
Timestamp	0x0000	0x00F0	0x03	2	UNIX Epoch	UINT32

					timestamp	
Temperature	0x0100	0x01F0	0x03	2	°C	FLOAT
Relative Humidity	0x0200	0x02F0	0x03	2	%rH	FLOAT
CO2	0x0300	0x03F0	0x03	2	ppm	FLOAT

Format

Virtual device data stored in Big Endian (ABCD) format and can be read continuously in the valid ranges.

Format	Description	Example
UINT32	32-bit unsigned integer	0x12345678 = 305419896
FLOAT	32-bit single precision floating point number	0x41EF9999 = 29.949999

Example:

Request CO2 sensor value from device with network address 2.

Request						
Transaction ID [2B]	Protocol ID [2B]	Data length [2B]	Unit ID [1B]	Function code [1B]	Data [4B]	
0x0001	0x0000	0x0004	0x0F	0x03	0x0306	0x0002

CO2 sensor value with network address 2 at 0x0306

CO2 values range start: 0x0300

Number of holding registers: 2

Data address of CO2 sensor value with network address 2 is $0x3000 + 3 \times 2 = 0x0306$

Response						
Transaction ID [2B]	Protocol ID [2B]	Data length [2B]	Unit ID [1B]	Function code [1B]	Data [4B]	
0x0001	0x0000	0x0004	0x0F	0x03	0x447D	0x0000

In the example the CO2 level converted as a floating point number is 1012 ppm.