ThingsPro Gateway Software User's Manual

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www.moxa.com/product

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Technical Support Contact Information

www.moxa.com/support

Moxa Americas
Toll-free: 1-888-669-2872
Tel: +1-714-528-6777
Fax: +1-714-528-6778

Moxa China (Shanghai office)
Toll-free: 800-820-5036
Tel: +86-21-5258-9955
Fax: +86-21-5258-5505

Moxa Europe
Tel: +49-89-3 70 03 99-0
Fax: +49-89-3 70 03 99-99

Moxa Asia-Pacific
Tel: +886-2-8919-1230
Fax: +886-2-8919-1231

Moxa India
Tel: +91-80-4172-9088
Fax: +91-80-4132-1045

Table of Contents

1

Overview

The ThingsPro® Gateway is a software package built on Debian Linux, an open platform that enables the integration of Fieldbus communications, computing, data acquisition, and wireless networking in a few simple steps. Featuring the Data Logger and Wireless Manager tools, ThingsPro empowers you to focus primarily on application development instead of the complex integration between devices in the field and services in a centralized computing facility.

The following topics are covered in this chapter:

- **Introduction**
- **Installing ThingsPro Gateway Software on Eligible Devices**

Introduction

The ThingsPro Gateway offers easy-to-use remote configuration for systems, peripherals, and wireless functions. With ThingsPro, you do not need comprehensive Modbus knowledge. You can easily configure and manage the connections to all your remote Modbus/RTU and Modbus/TCP devices and acquire data from these devices in just a few steps. In addition, ThingsPro lets you schedule configuration and upgrade tasks on remote devices, essentially reducing human effort and maintenance cost. ThingsPro is a cellular-ready platform that provides the capability to keep the 4G-communication link always active, facilitating network troubleshooting and reducing system downtime.

Installing ThingsPro Gateway Software on Eligible Devices

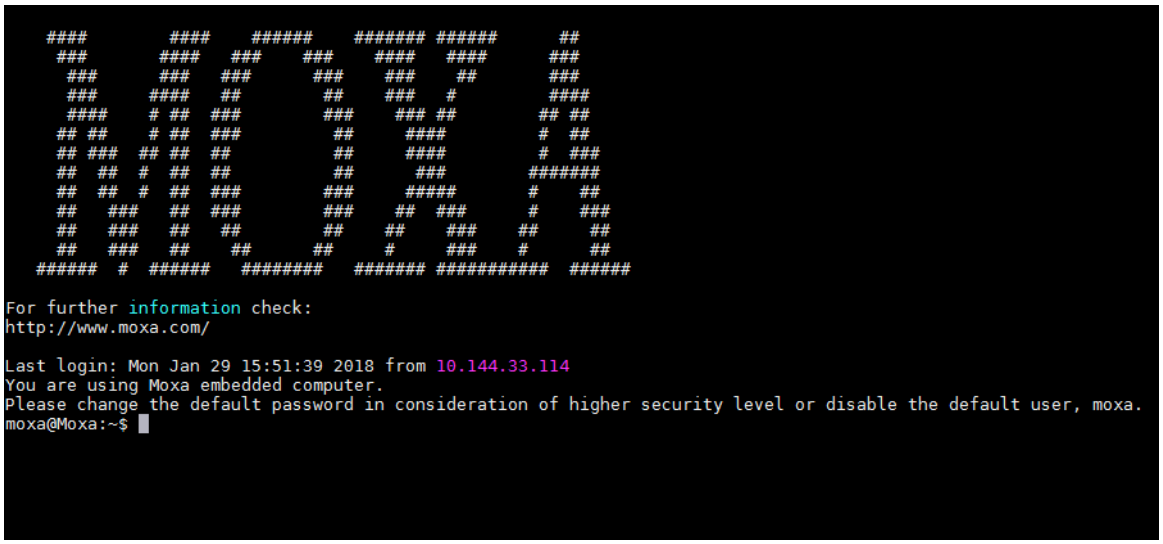
NOTE Ensure that your device is a ThingsPro eligible device. A list of eligible devices is available in the product datasheet and the ThingsPro product page on Moxa's website.

Download the ThingsPro Gateway software package from the Moxa website on to your computer.

NOTE
- We recommend that you use the latest version of ThingsPro Gateway software. In addition to new features, we include enhancements and bug fixes in newer versions of the ThingsPro Gateway software.
- You can use the installation file for ThingsPro Gateway software V2.6.0 to upgrade previous versions V2.5.1 and V2.5.2 to V2.6.0.

To install the software on an eligible device, do the following:

1. Log in to your device using a valid username and password.



2. Upload the installation file directly to the device or copy it to an SD card.
3. If the installation file is stored in an SD card, insert the card into the SD card slot of the device.

   For instructions on installing the SD card in the SD-card slot of your device, refer to the quick installation guide or the hardware user's manual for the device.

4. Switch the working directory to the directory in which the installation file is stored and extract the contents of the installation file to the same directory.

   Installation Files for Moxa Industrial Linux (Debian 9)

```
moxa@Moxa:~$ ls
thingspro.sh
```

```
thingspro_release-thingspro_v2.6.0_xxxxx_202006xx-xxxxxx.frm
thingspro_release-thingspro_v2.6.0_xxxxx_202006xx-xxxxxx.frm.md5
```

You should see the following three files.

- The installation script: **thingspro.sh**
- The ThingsPro Gateway v2.6.0 installation package**:** **thingspro_release-thingspro_v2.6.0_xxxxx_202006xx-xxxxxx.frm**:
- The md5 checksum file for the firmware: **thingspro_release-thingspro_v2.6.0_xxxxx_202006xx-xxxxxx.frm.md5**:

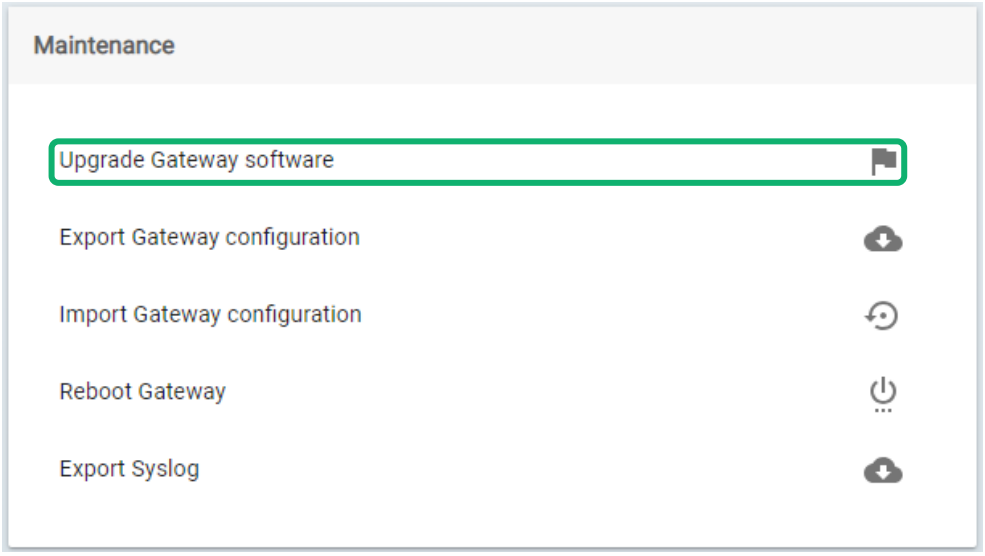
5. Run the following command on the device to install ThingsPro Gateway software.

```
moxa@Moxa:~$ sudo bash thingspro.sh install
```

You can check the installation log by typing the following command.

```
moxa@Moxa:~$ sudo nano /var/log/thingspro_install_202006xx-xxxxxx.log
```

You can use the **Upgrade Gateway software** function to upgrade to the latest ThingsPro Gateway version.



You can use the following command to check the upgrade log.

```
moxa@Moxa:~$ sudo tail -f /var/log/upgrade.log
```

6. Use the following command to start/stop the ThingsPro Gateway services.

```
moxa@Moxa:~$ sudo mx-tp-ctl -e <n>
```

- <n> = 0: Stop the ThingsPro Gateway
- <n> = 1: Start the ThingsPro Gateway

NOTE The start/stop function is available in ThingsPro Gateway V2.5.0 and higher versions.

If the ThingsPro Gateway services are no longer required, use the following command to remove them from the system.

```
moxa@Moxa:~$ sudo thingspro.sh uninstall
```

This command removes all ThingsPro Gateway configuration files from the system; reconfirm that you want to remove all configuration files before you run this command and only use it if you intend to completely remove ThingsPro Gateway software from your device.

2

Configuring the ThingsPro Gateway

This chapter describes how to configure the ThingsPro Gateway.

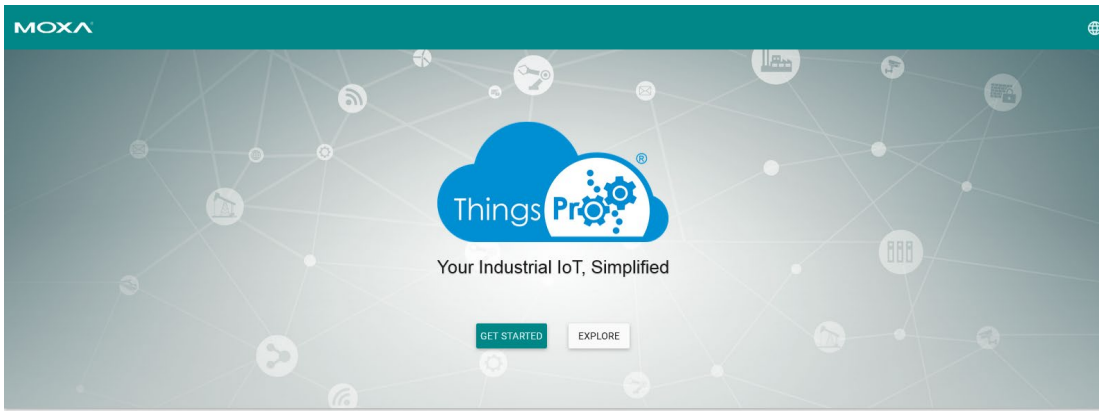
The following topics are covered in this chapter:

- **Basic Configuration**
  - Accessing Your ThingsPro Gateway
  - Viewing the Dashboard Status
  - Editing User Profiles
  - Checking System Notifications (V2.5.0 or above)
  - Choosing a Language for the User Interface
- **Using the Control Panel**
  - Device Information
  - Editing the Hostname
  - Editing the Device Name
  - Checking the Software Version
  - Checking the System Uptime
  - Checking the System Memory Size
- **Maintenance**
  - Upgrading the ThingsPro Gateway
  - Exporting the Gateway Configuration File
  - Importing a Gateway Configuration File
  - Rebooting the Gateway
  - Exporting the System Log Files
- **Configuration Settings**
  - Configuring the Gateway
  - Managing User Accounts
  - Managing User Programs
  - Configuring Modbus Settings for Data Acquisition
  - Modbus Management
  - Managing Modbus Slave Devices
  - Managing Log Profiles
  - Managing IIoT Applications

Basic Configuration

Accessing Your ThingsPro Gateway

1. Open a browser and connect to https://192.168.4.127.

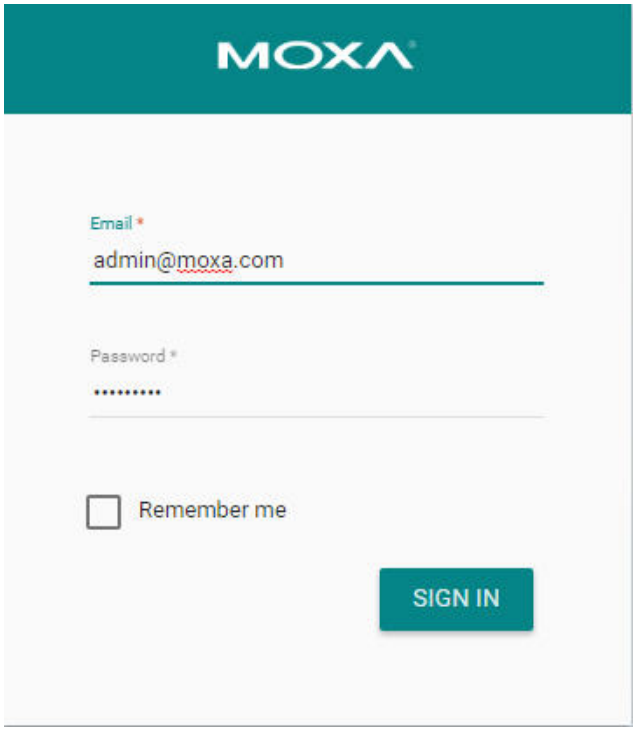


2. Click **Get Started** to continue and type the default username and password:

   Username: **admin@moxa.com**
   Password: **admin1234**

   For the root account, use the following information:

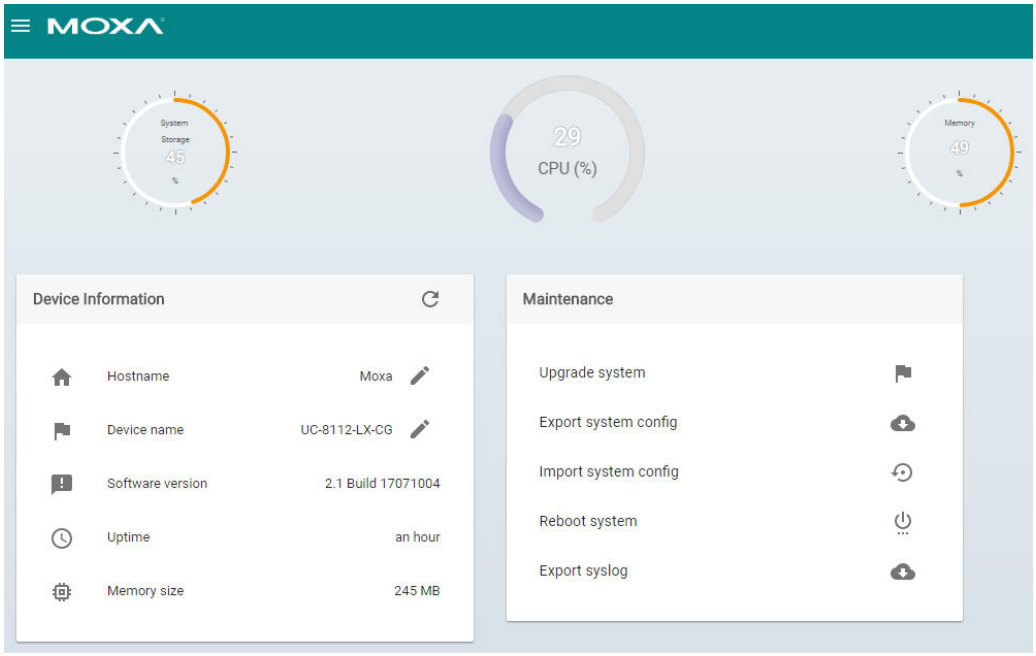
   Username: root@moxa.com
   Password: root1234



3. Click **Sign In** to continue. The ThingsPro dashboard and configuration page is displayed.

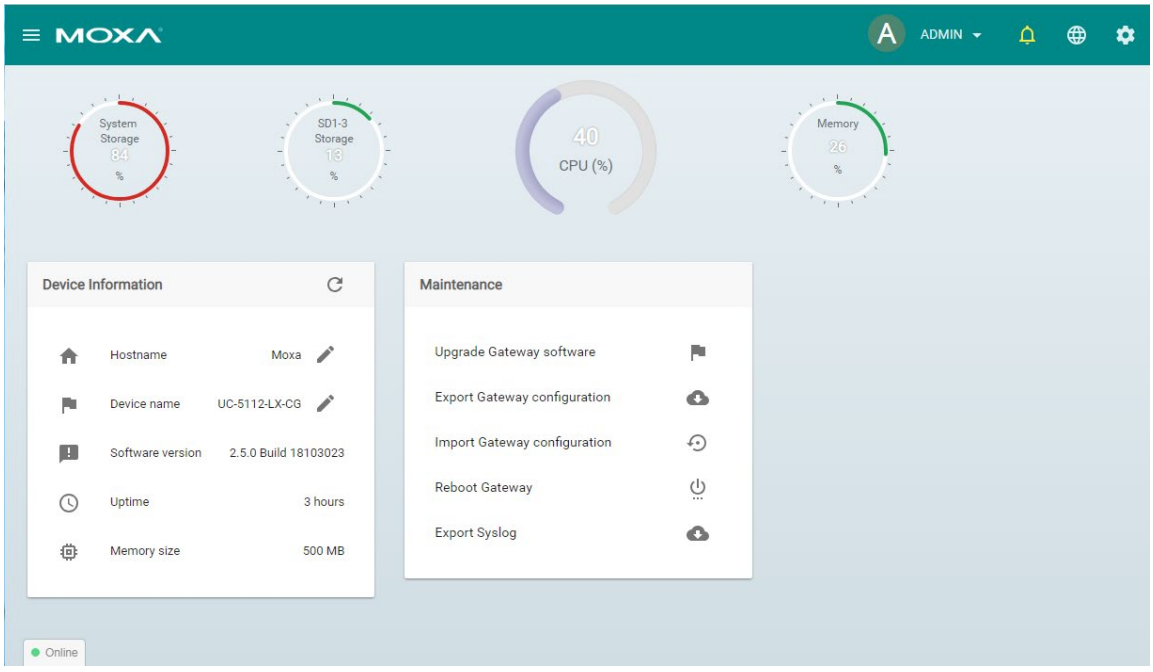
Viewing the Dashboard Status

The dashboard shows the real-time (update interval could be 15 to 30 seconds) status of your device. The information shown includes CPU, Memory, and Storage usage.



Dashboard Component	Description
Storage	Indicates how the system or external storage capacity is used
CPU	Indicates the current CPU usage
Memory	Indicates the current system memory usage

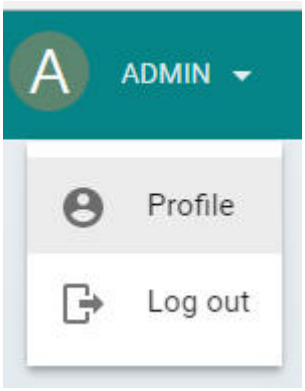
If an external storage device, such as an SD card or USB disk, has been mounted, the external storage icon will appear. All values are shown as percentages.



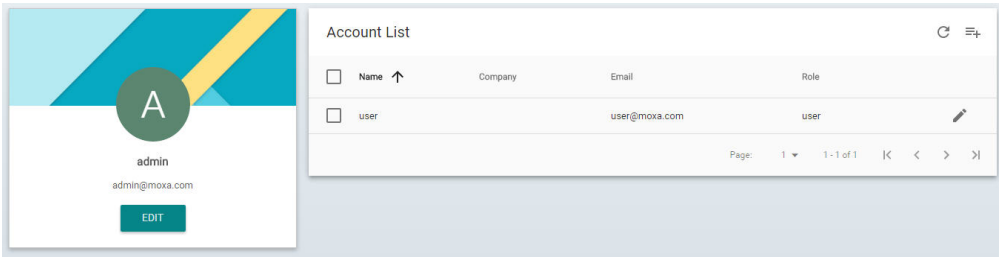
You may change the "Hostname" or "Device name" here. Also, you may proceed Maintenance tasks such as Upgrade system, export or import system configuration the quick maintenance panel.

Editing User Profiles

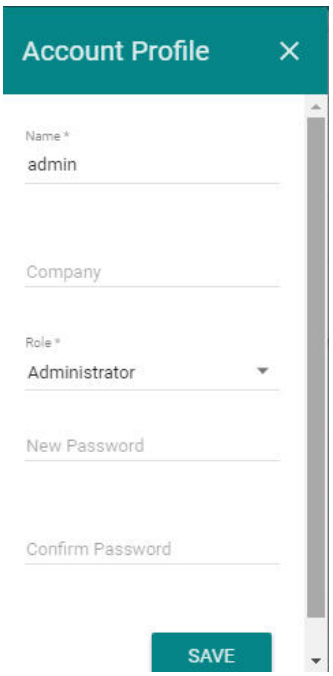
After you have successfully connected to the gateway, you can start configuring the ThingsPro Gateway functions. You might want to update your user profile first. Click on the **ADMIN** box on the upper-right corner of the main page and select **Profile.**



Click on **EDIT** to edit the profile.



Type the account profile and information in the fields. When finished, click **SAVE** to complete.

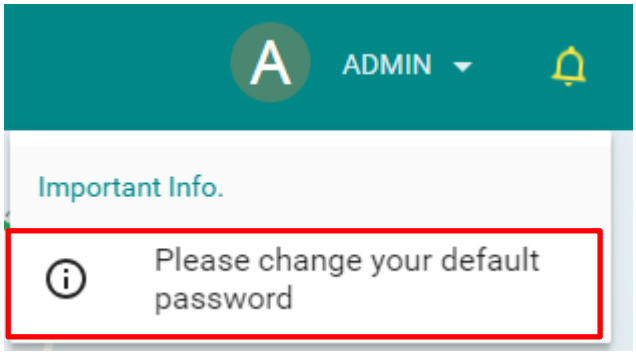


To add new users, click the add icon on the top right corner of the screen.

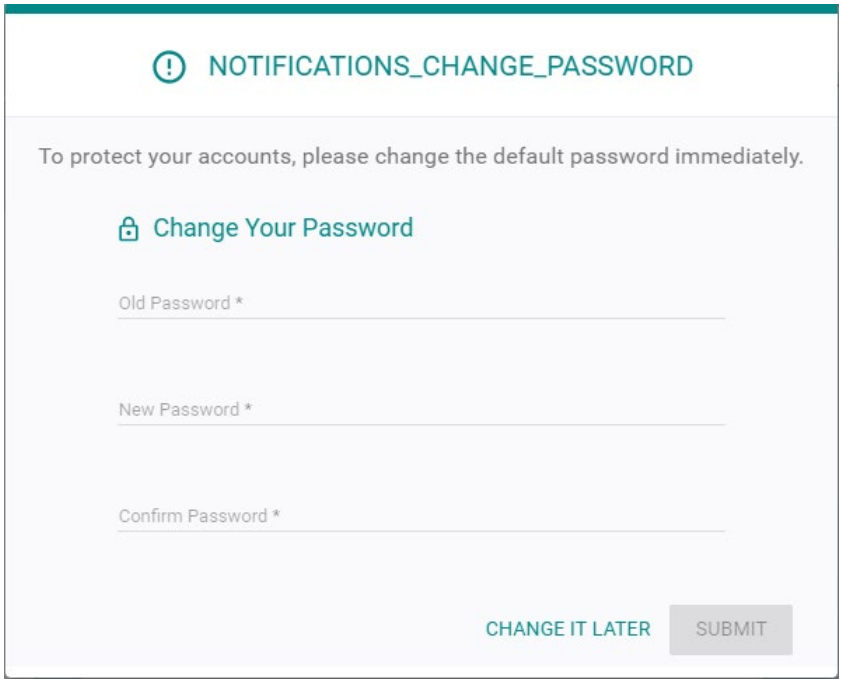
Checking System Notifications (V2.5.0 or above)

You can view the system notifications by clicking on the bell icon on the top-right corner of the main configuration page. The bell icon turns yellow and take the "ringing" position when there are unread notifications.

The system notifications consist of important system information that users are required to pay attention to or take actions. For example, users should change the default password to make the system more secure. When the system detects default passwords, it will send a notification to remind users to change their default passwords.

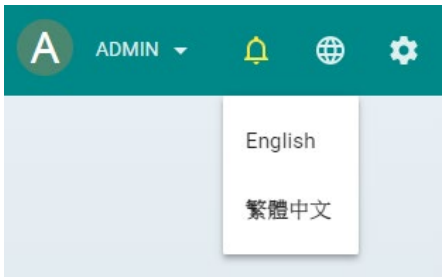


Usually, the system offers a quick and easy way to proceed with corrective actions. Take the example of the default password change; Users can click on the notification "Please change your default password" to open a dialog to change the password.



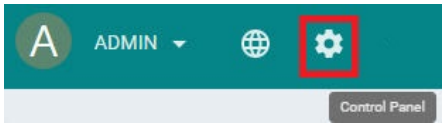
Choosing a Language for the User Interface

ThingsPro Gateway currently offers English and Traditional Chinese interfaces. Select from the language icon in the main configuration page.

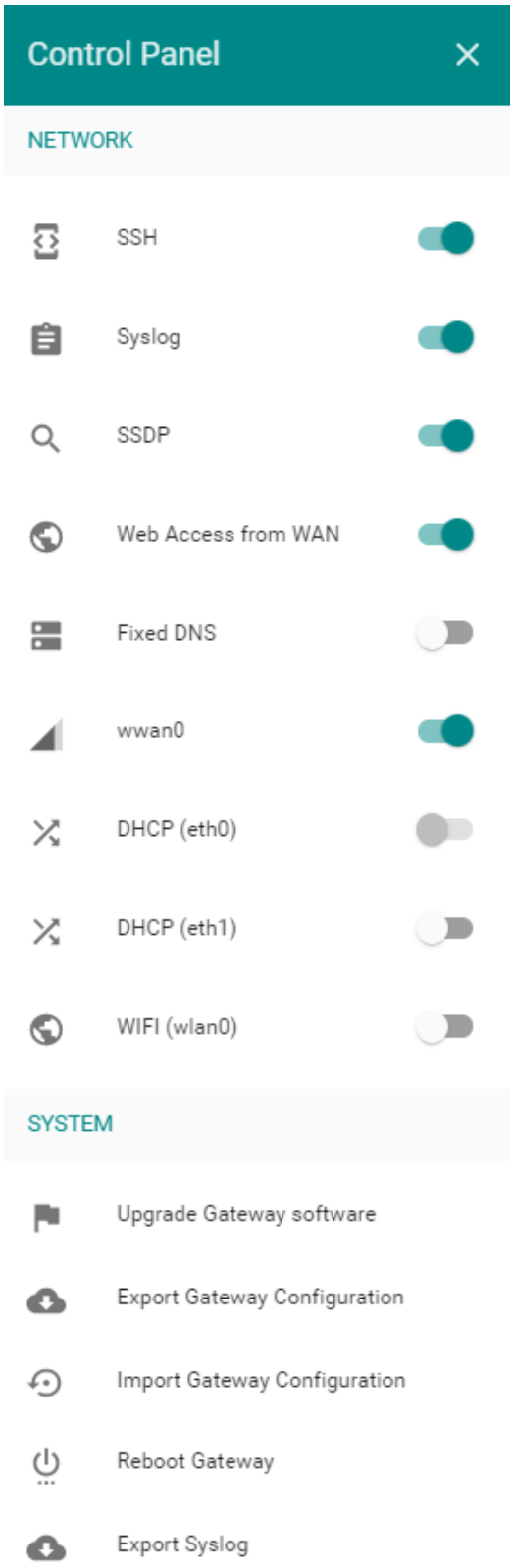


Using the Control Panel

ThingsPro Gateway provides a control panel that you can use to view, enable, or disable the some specific system settings. Click the Control Panel icon from the main page to access the panel.



View the current status of the settings from the page below. You can enable or disable the settings directly from the Control Panel page.

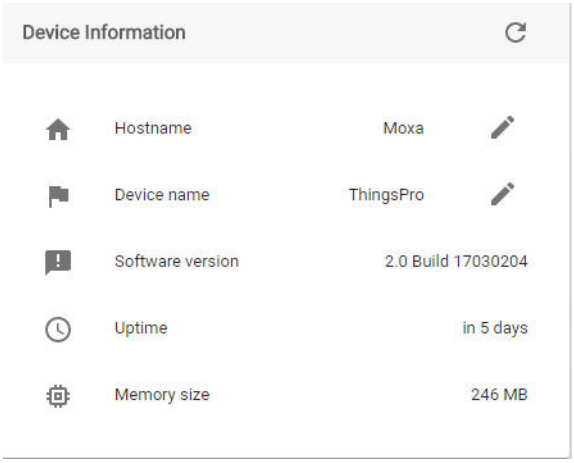


WARNING

Turning off the **Web Access from WAN** setting will disconnect the ThingsPro Gateway from the Server.

Device Information

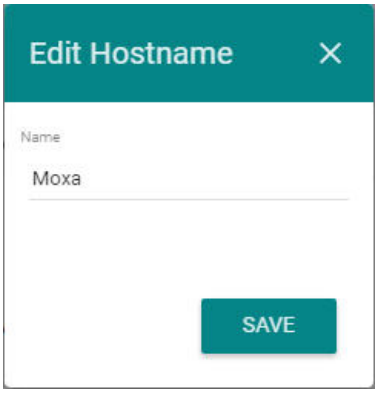
This section allows users to update system hostname and device name, and view the system status, such as software version, system uptime, and system memory size.



Editing the Hostname

In **Device Information**, click the edit icon, and edit the hostname.

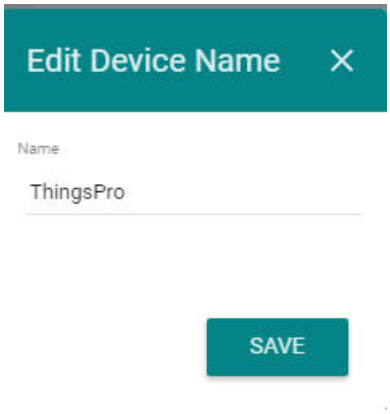
Provide the hostname in the field. When finished, click **SAVE**.



Editing the Device Name

In **Device Information**, click the edit icon, and edit the device name

Provide the device name in the field. When finished, click **SAVE**.



Checking the Software Version

You can check the software version from the control panel.

Checking the System Uptime

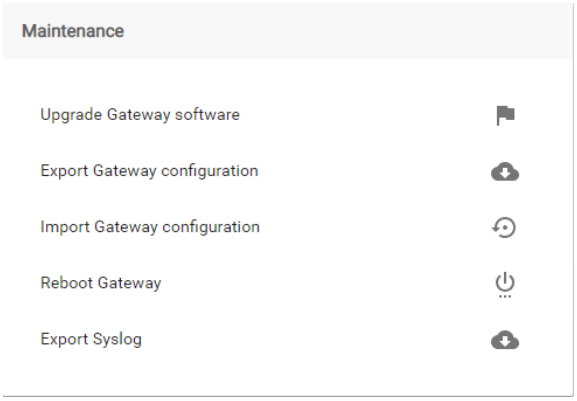
You can check the system uptime from the control panel.

Checking the System Memory Size

You can check the system memory size from the control panel.

Maintenance

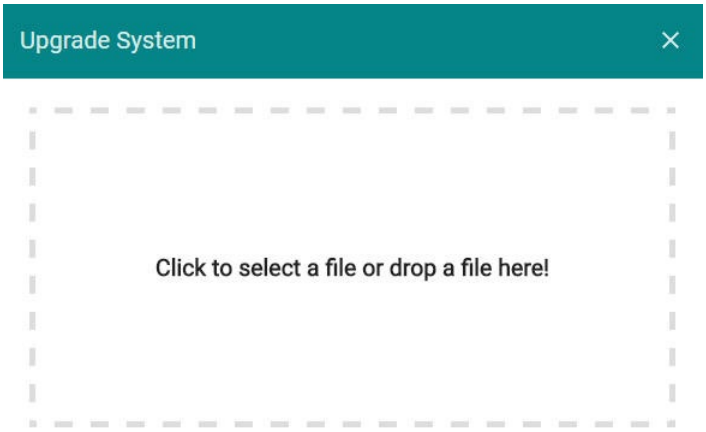
This section allows users to update various system settings.



Upgrading the ThingsPro Gateway

To upgrade the ThingsPro Gateway with the software packages provided by Moxa, click on the **Upgrade Gateway Software** icon in the **Maintenance** section.

Select the software package file in **.frm** format on your computer, or drop the file into the upgrade page. Wait for a few minutes for the system to upgrade.



ATTENTION

A system upgrade with incorrect firmware can cause system damage or failure. Contact Moxa technical support before upgrading your system.

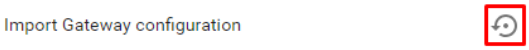
Exporting the Gateway Configuration File

In the **Maintenance** section, click on the icon to export the gateway configuration file.

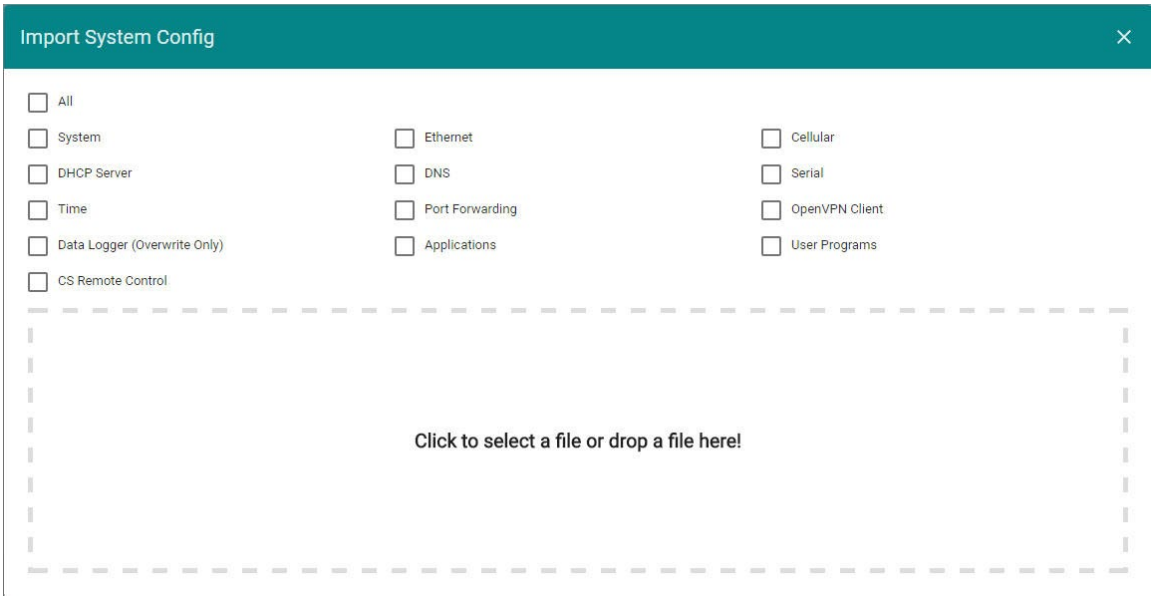
A gateway configuration file in the **tar.gz** format will be downloaded on to your computer.

Importing a Gateway Configuration File

In **Maintenance** section, click the icon to import the gateway configuration file. This function can help restore your system to the previous status, or save you time when configuring multiple gateways with similar configuration.



You can select the specific items you want to recover, or select **All** to recover the whole system.



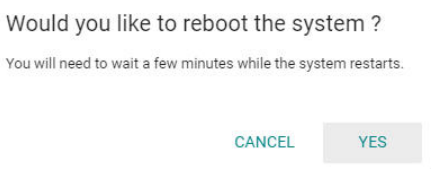
NOTE

- The GPS configuration is included in the system settings. If you want to export/import GPS configuration, select the **All** or **System** option.
- In Sparkplug, the MAC Address of a device is used as the default Edge Node ID and serves as the unique identity of the device. We strongly recommend that you maintain the uniqueness of the Edge Node ID to prevent the issue of duplicate Edge Node IDs when you configure the basic settings for Sparkplug.

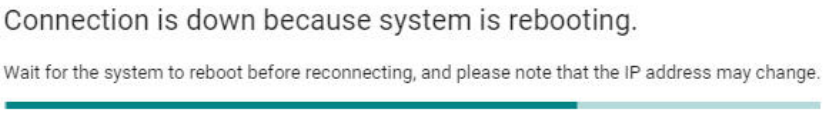
Rebooting the Gateway

In **Maintenance**, click on the **Reboot Gateway** icon to reboot the gateway.

Click **Yes** to reboot the gateway.



The following screen will appear; wait for the gateway to reboot.



Exporting the System Log Files

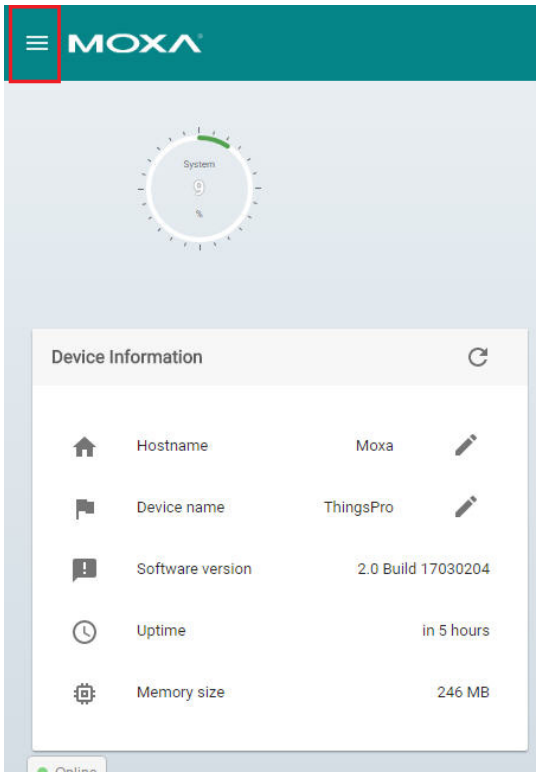
In **Maintenance**, click the icon to export the system.

A system log file in **tar.gz** format will be downloaded to your system.

Configuration Settings

You can use the configuration menu for various ThingsPro Gateway settings.

Click the menu bar icon to access the configuration menu.



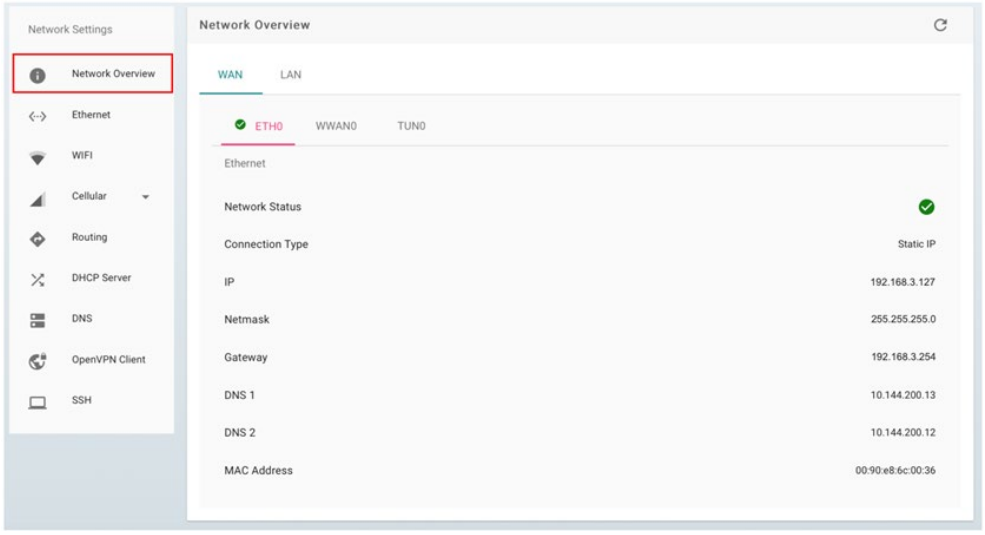
Configuring the Gateway

Click on the **Gateway** link to configure gateway settings, such as Network, Firewall, and System.

Configuring Network Settings

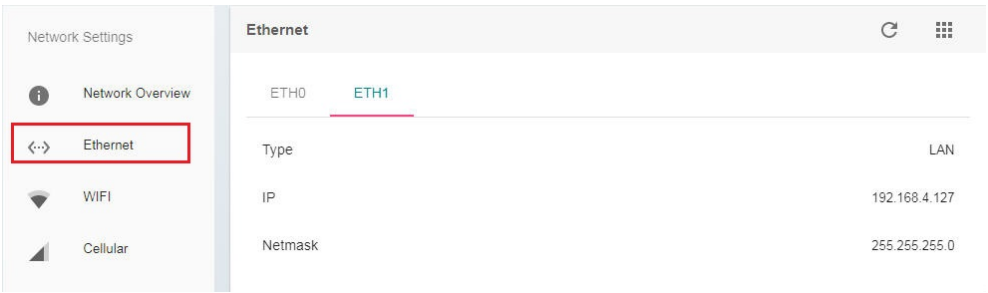
This section includes various network settings such as Ethernet, cellular, routing (only available in v2.3 and above), DCHP Server, DNS, Open VPN Client, and SSH.

Click **Network Overview** (only available in ThingsPro V2.3 and above) to check the current network status.



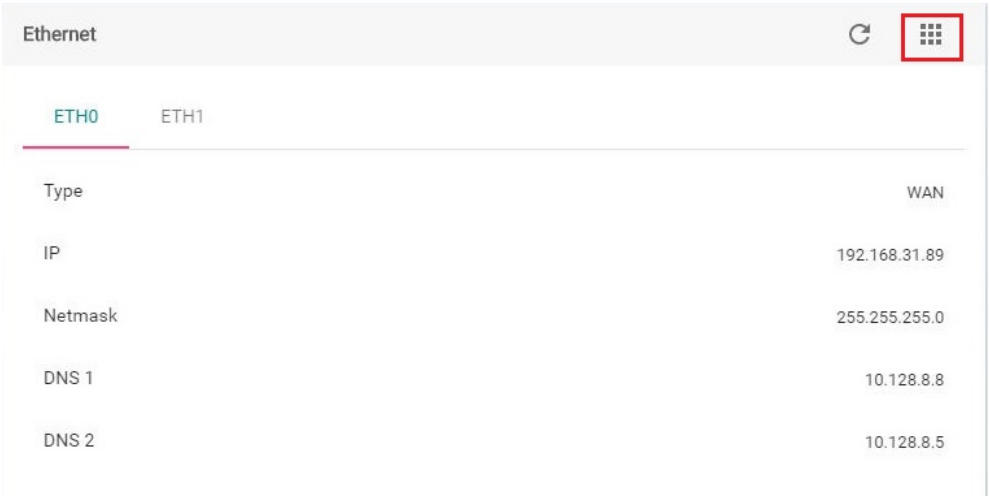
Configuring Ethernet Settings

Click **Ethernet** to view the current Ethernet settings.

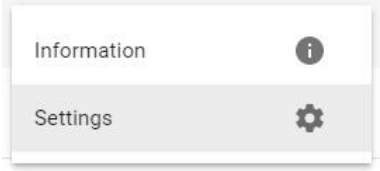


To configure the Ethernet settings:

1. Click on the tab for the Ethernet interface.
2. Click on the edit icon.

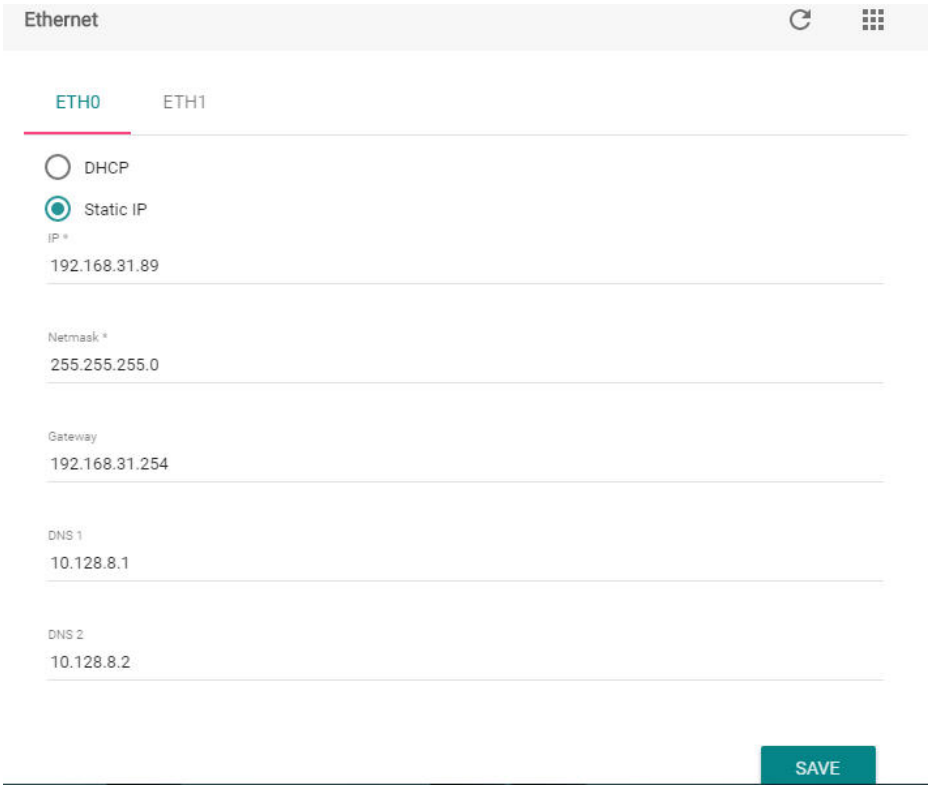


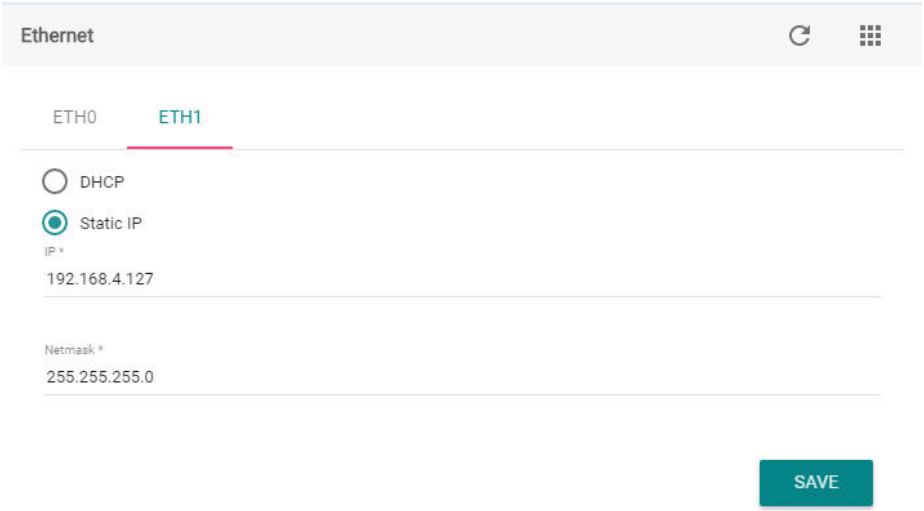
3. Select **Settings.**



4. Configure the Ethernet interface settings.

NOTE The **ETH0** Ethernet interface is used for the WAN and the **ETH1** interface is used for the LAN. The default IP addresses are:
eth0=192.168.3.127
eth1=192.168.4.127

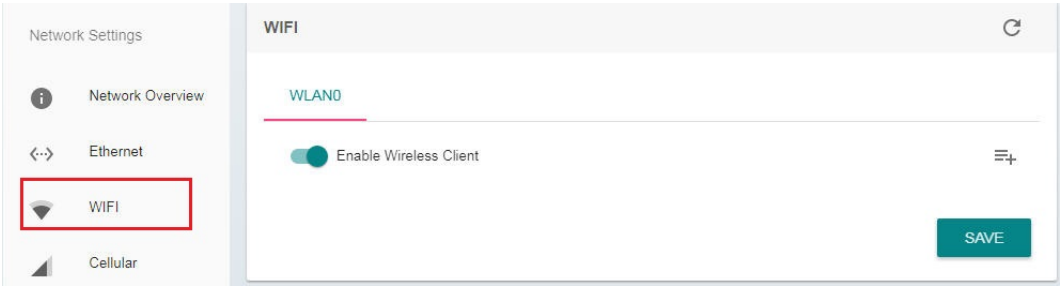




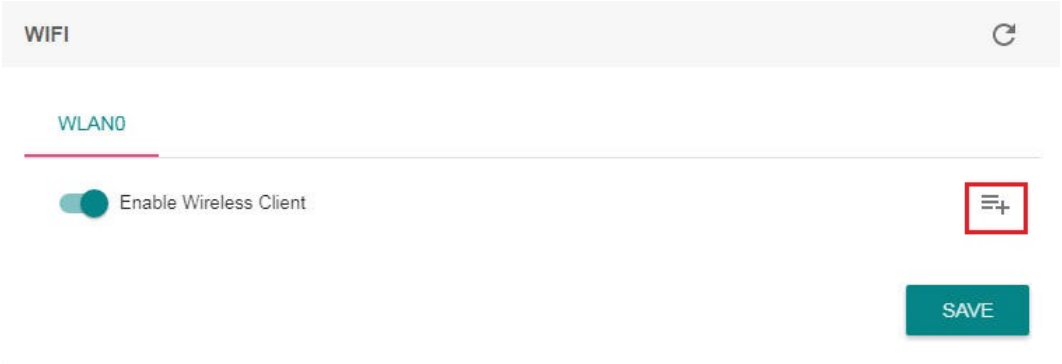
5. Click **SAVE**.

Configuring Wi-Fi Settings

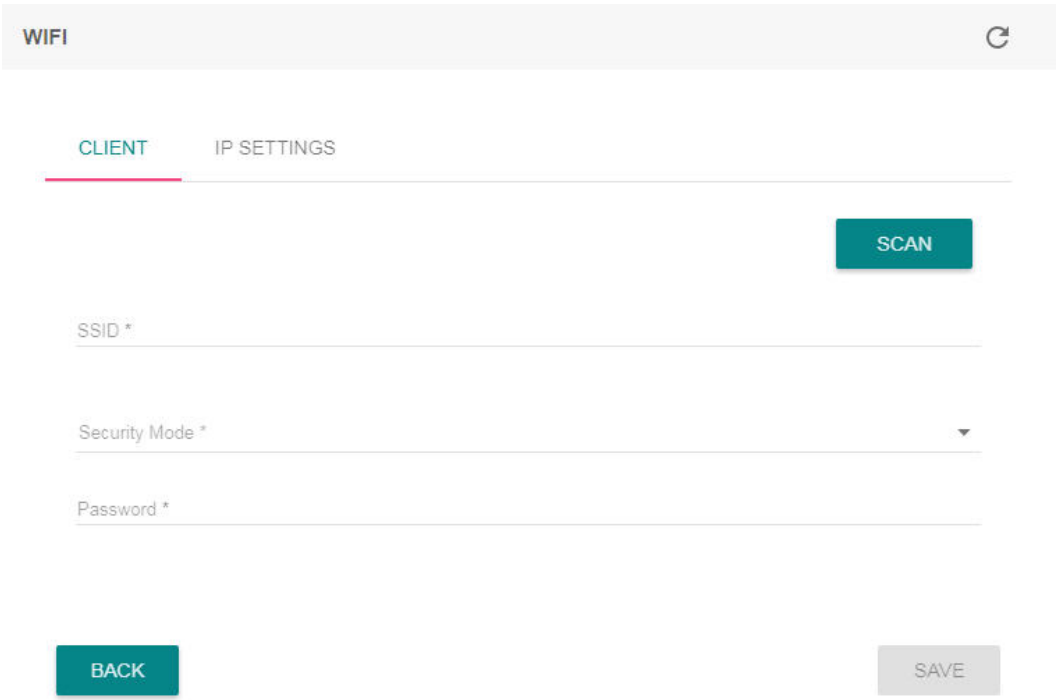
Click **WiFi** to check the current Wi-Fi status. Check **Enable Wireless Client** if you want this function to be activated.



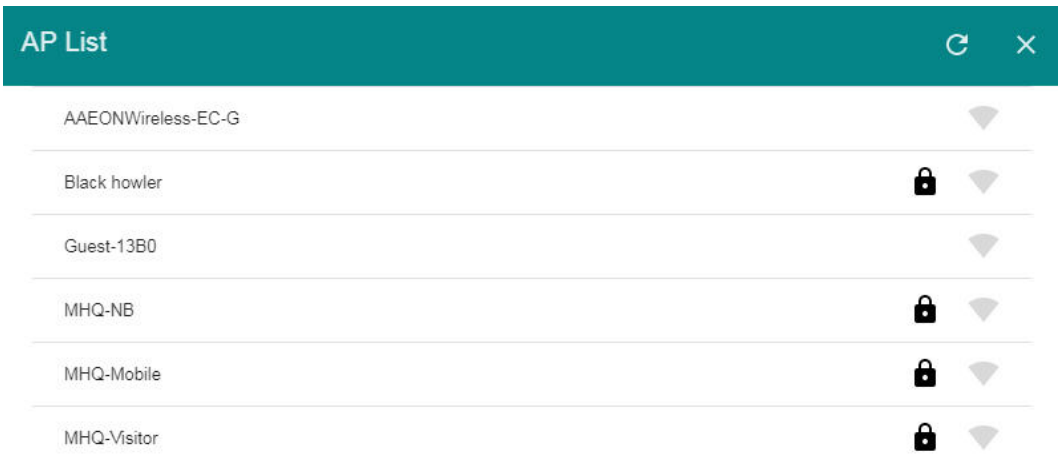
To add a Wi-Fi network, click the add icon.



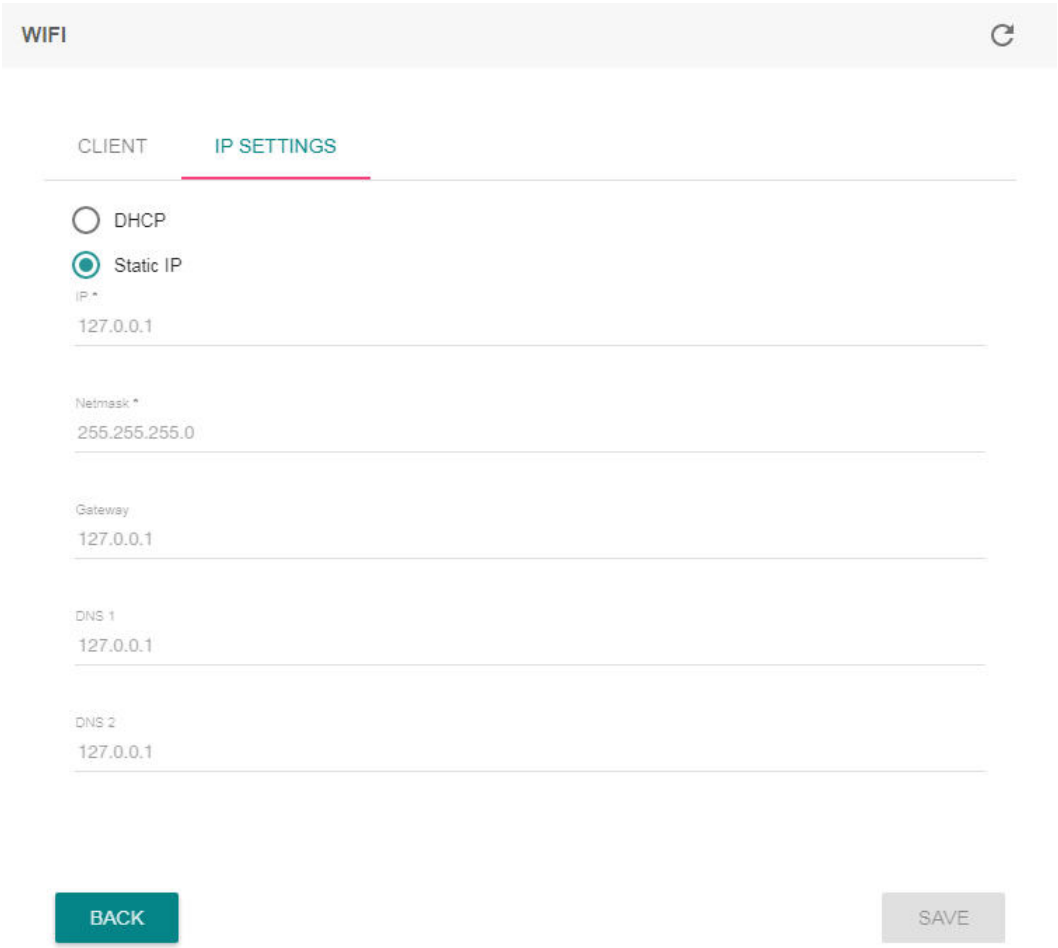
Click the **CLIENT** tab and enter the SSID, security mode, and the password for the wireless network you want to connect to. When finished, click **SAVE**.



You can also click **SCAN** to scan for all of the available access points that your computer can connect to. Select an access point to automatically fill in its SSID and security mode, then enter its password. You can also click the refresh icon to refresh the list.



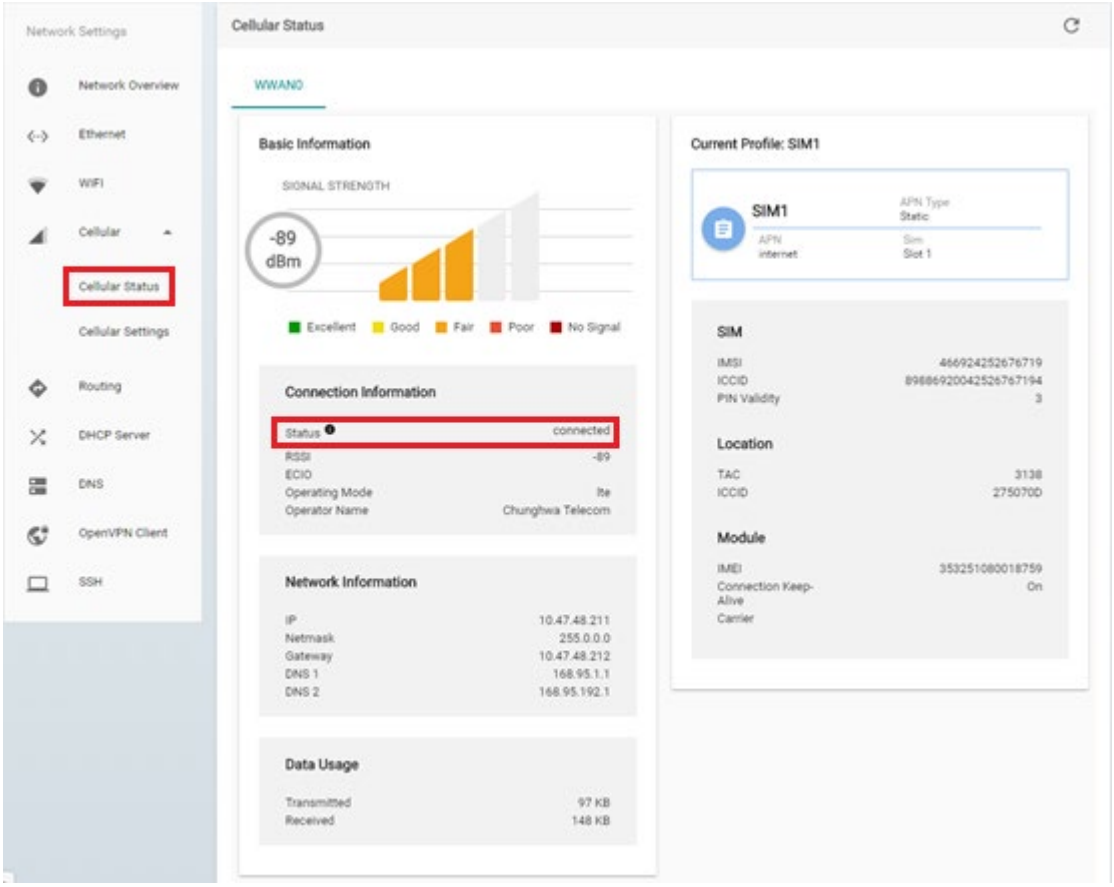
Click the **IP SETTINGS** tab to configure the IP settings. You may choose to set your IP using DHCP or static IP. If you select Static IP, enter all the necessary information in the text fields. When finished, click **SAVE**.



Configuring Cellular Settings

Viewing the Cellular Status

Click on the **Cellular Status** link to view the current settings. The **Basic Information** section shows a clear picture of the status of your cellular network including Signal Strength, Connection Information, Network Information, and Data Usage.



The table below lists the different statuses of a cellular connection and what they indicate.

Status	Description
initializing	Retrieving cellular module and SIM card information and unlocking the SIM card (if the SIM card is locked)
nosim	No SIM card detected or SIM card error
pin	SIM card is locked with a PIN code
ready	SIM card is ready for a connection
connecting	Establishing a connection
connect_failure	Connection failure or keep-alive function failure (if keep-alive is enabled)
connected	Connection succeeded with keep-alive enabled or disabled
powr_cycle	Power-cycling the cellular module
service_searching	Roaming*
service_attached	Connected to a base station
pin_error	PIN code error
switching_carrier	Switching between telecom carriers.
switching_sim	Switching between SIM card slots (only available in dual-SIM models).
initialize_failed	Initialization error

NOTE (*) If your device is stuck in the "service_searching" status for more than 5 minutes even though your SIM card works fine and the signal strength is good enough for a successful cellular connection, this might be due to the accidental activation of the flight mode. However, such cases are rare. When this happens, log in to your device's console and type the following command:

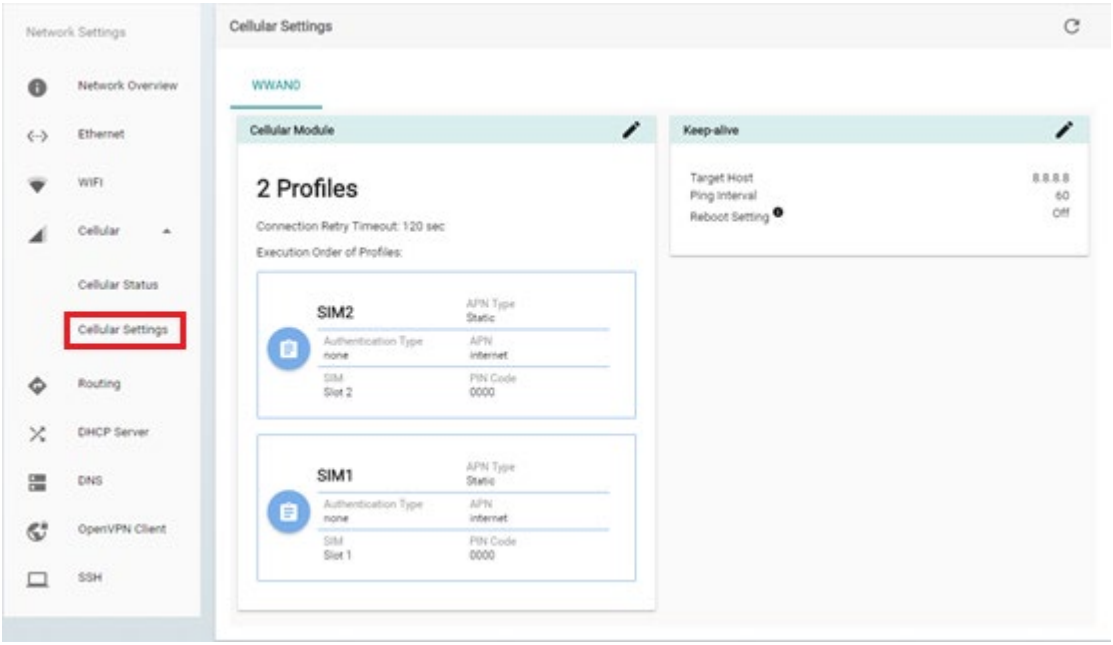
```
moxa@Moxa:/home/moxa$ sudo cell_mgmt set_flight_mode 0
```

For additional details on the cell_mgmt utility, refer to the *Arm-based Linux User's Manual.*

The **Current Profile** of your cellular connection (only available in V2.5.0 or above) along with the **SIM**, **Location,** and **Module** information is also displayed on the **Cellular Status** page.

Configuring the Cellular Settings

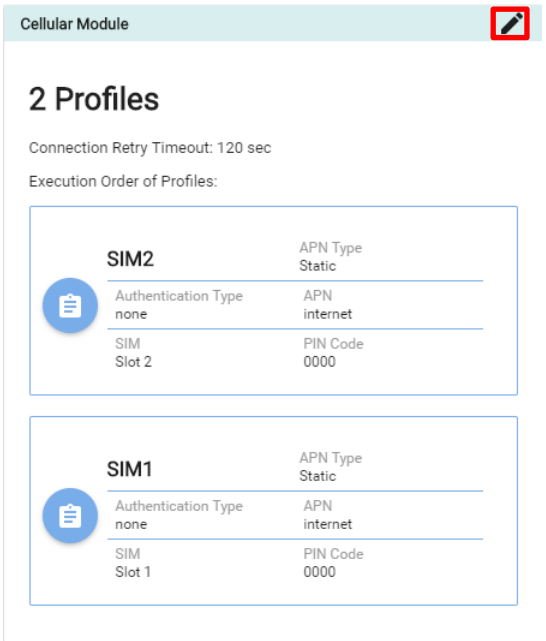
To modify the cellular network settings for your device, click on the **Cellular Settings** link (**Gateway** > **Network** > **Cellular** > **Cellular Settings)**.



You can check the status of the **Cellular Module** and **Keep-alive** function and modify the settings of your device's cellular network here.

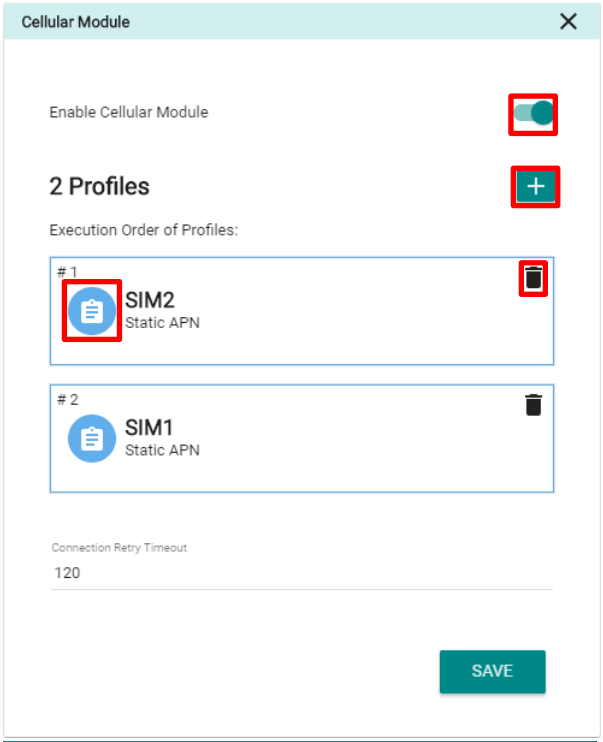
To modify the settings of your cellular module, do the following:

1. Click on the edit icon corresponding to the **Cellular Module** section.



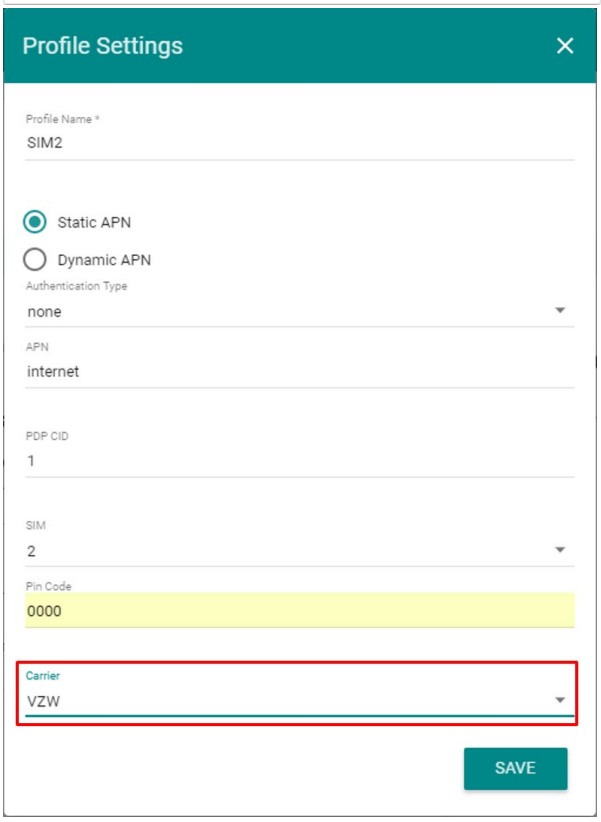
2. Configure the cellular module settings.

	Enable/disable the cellular module
	Add a new connection profile
	Modify an existing connection profile
	Remove an existing profile from the device



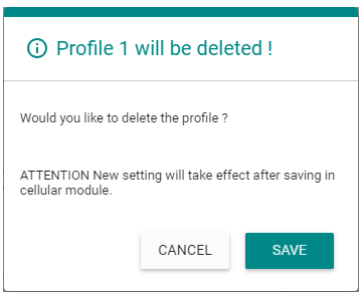
You can rearrange the profile boxes to change the priority in which the profiles are to be used, and specify the **Connection Retry Timeout value**.

3. If you are operating in the North American region, you will be able to switch between service providers.



4. Click **SAVE** to apply the changes.

To delete an existing profile, click on the delete icon for the profile. Click **SAVE** to confirm the deletion or **CANCEL** to retain the profile.

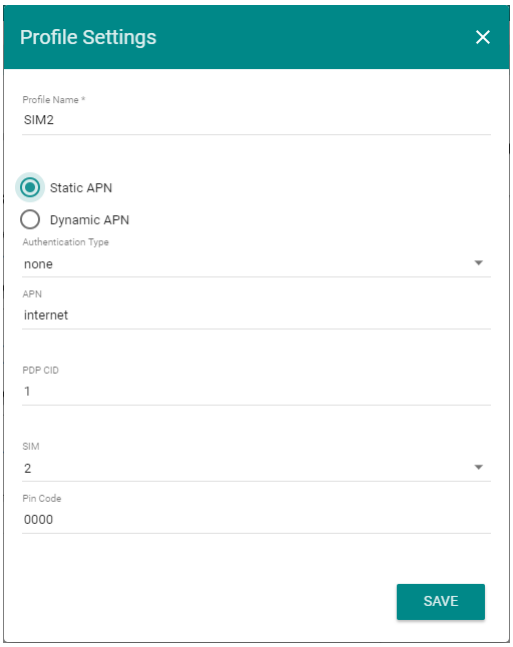


To create a new connection profile, do the following:

1. Click on the add icon.
2. Specify a unique name to the profile.
3. Refer to your carrier instruction to use **Static** or **Dynamic APN** and configure the corresponding settings.
4. If your carrier offers private network services, you may choose chap, pap, or both in the **Authentication Type**.
5. Enter your Username and Password to log in to the service network.
6. Enter the **PIN Code,** if your SIM card requests it (three wrong attempts will lock the SIM card).

   In ThingsPro V2.5.0 or above, ThingsPro supports Dual-SIM feature for eligible devices that have two SIM slots. You can assign a SIM card slot for each profile.
7. Click the **SAVE** button to save the **Profile Settings.**
8. Save the module settings by clicking on the **SAVE** button in the **Cellular Module** section.

NOTE: You can discard the changes at any time by clicking on the Cancel icon on the upper right corner.



When you click on the SAVE button on the **Cellular Module** section the module is restarted to apply the changes. The settings will take effect after the cellular module is successfully initialized.

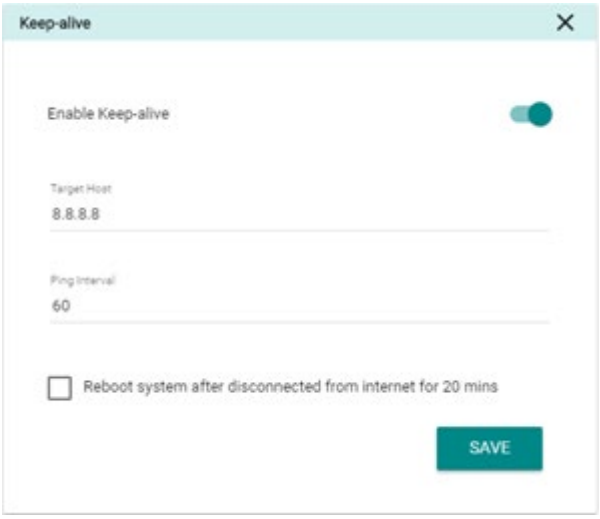
Keep-alive

Cellular carriers may disconnect user equipment (UE) when they are idle or do not transmit data via their cellular network for a certain period of time, depending on their policy. Once disconnected, your device will have to redial to connect back to the cellular network. The **Keep-alive** function will help you maintain the connection between your device and the carrier service by pinging a specific host on the Internet at periodic intervals.

To manage the **Keep-alive** settings for your cellular network, do the following.

1. Click the edit icon on keep-alive section.

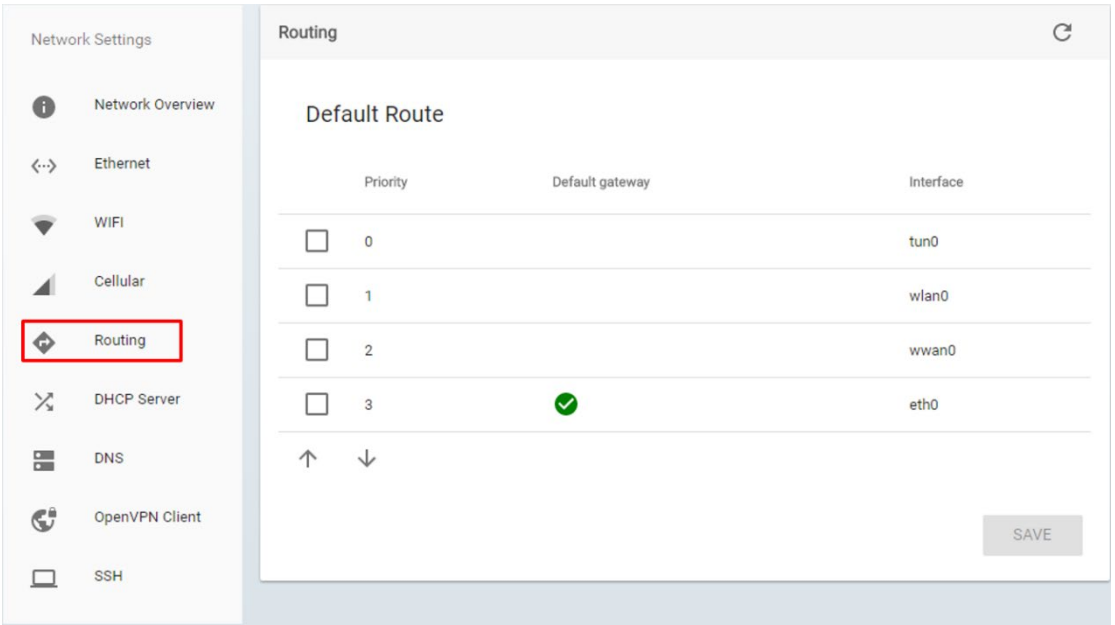
2. Enable the Keep-alive function



3. Specify the **Target Host** and the **Ping Interval** in seconds.
4. In some circumstances, a system reboot might bring an unstable or malfunctioning device back to normal state. You can select the **Reboot system after disconnected from Internet for 20 mins** to enable the system reboot function.
5. Click the SAVE button to apply the changes

Configuring Routing Settings (only available in v2.3 and above)

Click **Routing** to view the current default route settings.



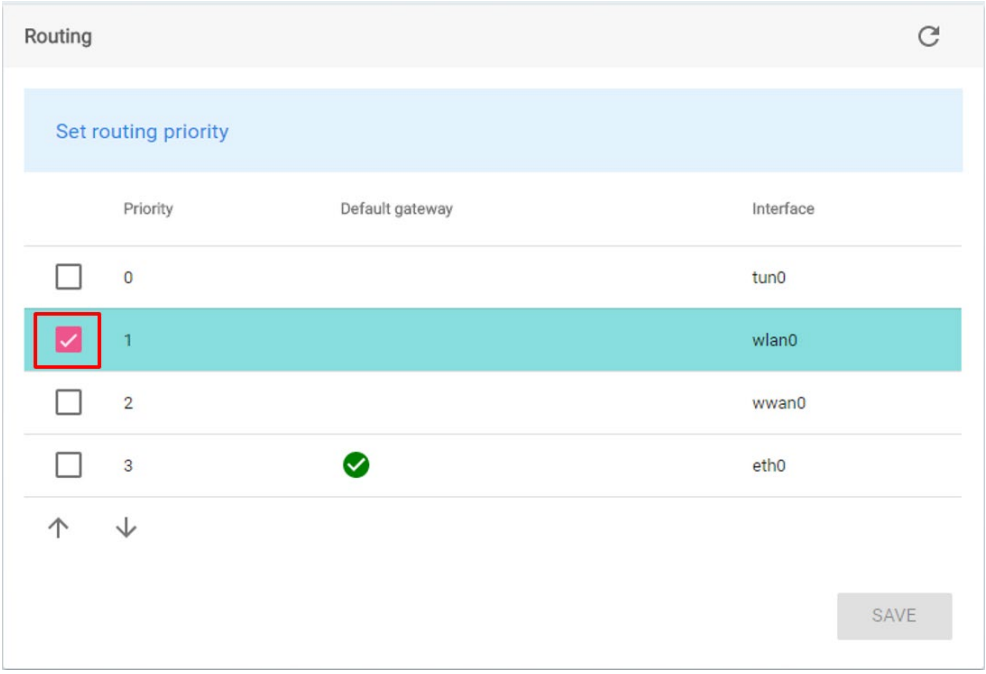
The routing sequence depends on the priority settings, with higher priorities (0 is the highest) given precedence. ThingsPro Gateway will use the interface associated with highest priority interface that is available.

Interfaces of your eligible device could include:

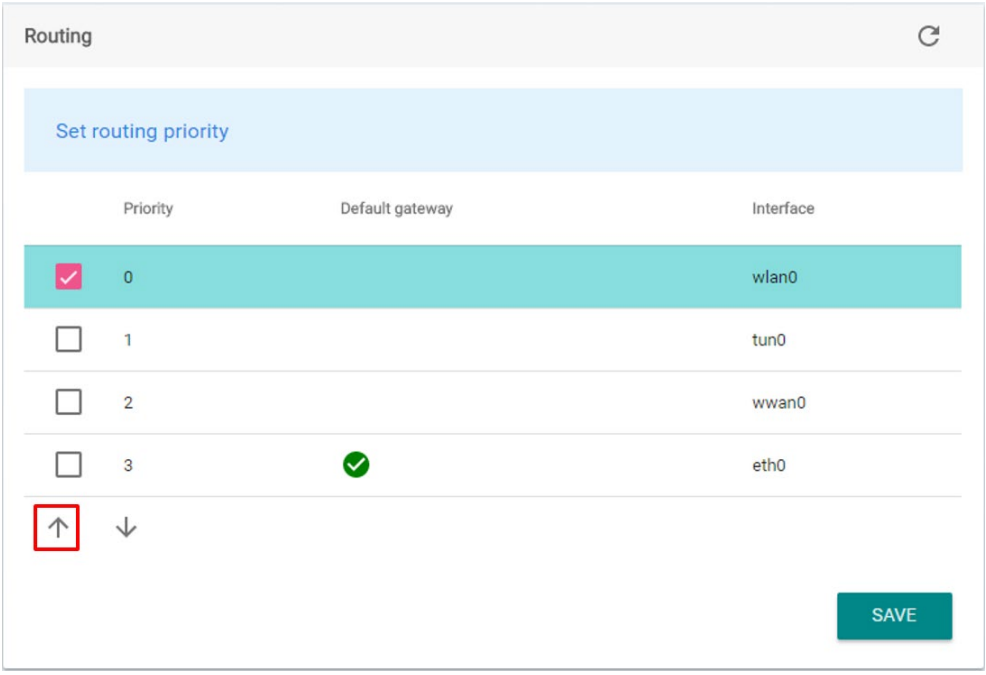
- *tun0*: VPN Tunnel
- *wlan0*: Wi-Fi
- *wwan0*: Cellular
- *eth0*: Ethernet (usually LAN1 when the default setting is WAN).

To change the priority of a certain interface, select the checkbox in front of the interface, and then click the arrow button to move the priority higher (move up) or lower (move down). Click the "SAVE" button to confirm the change. For example, the following steps apply to the Wi-Fi interface (wlan0):

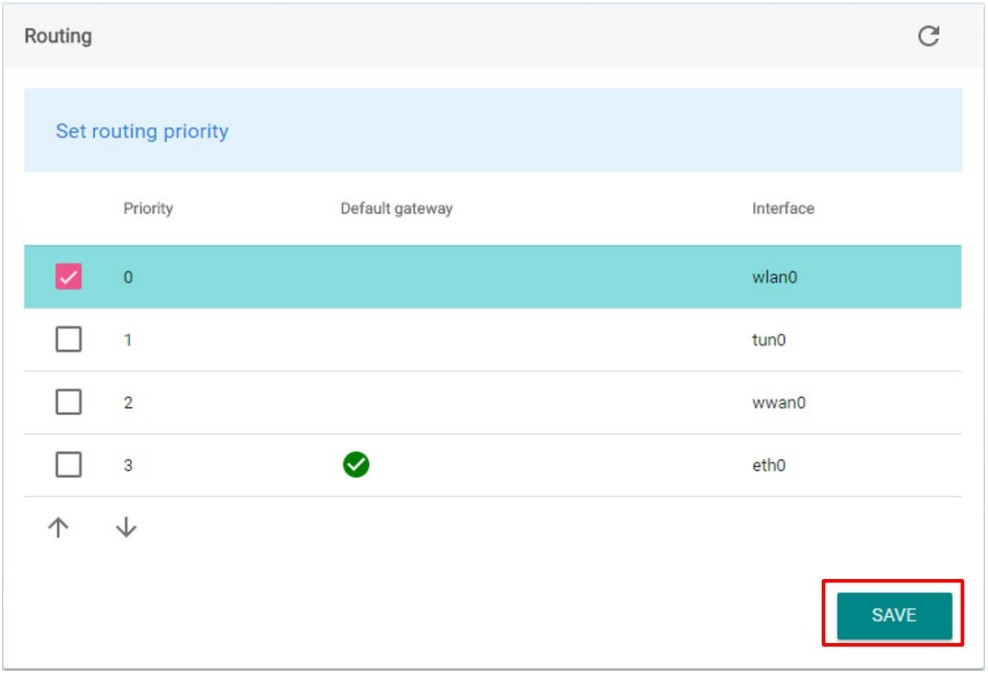
1. Select the "wlan0" (Wi-Fi) interface checkbox.



2. Click the "Up" arrow to set a higher priority.



3. Click the "SAVE" button to confirm the changes to the routing settings.

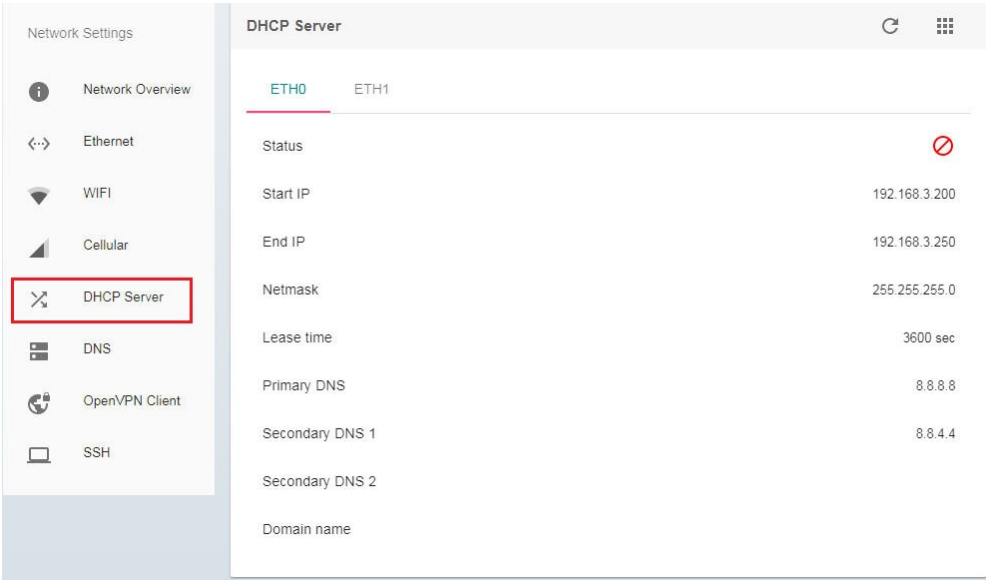


NOTE

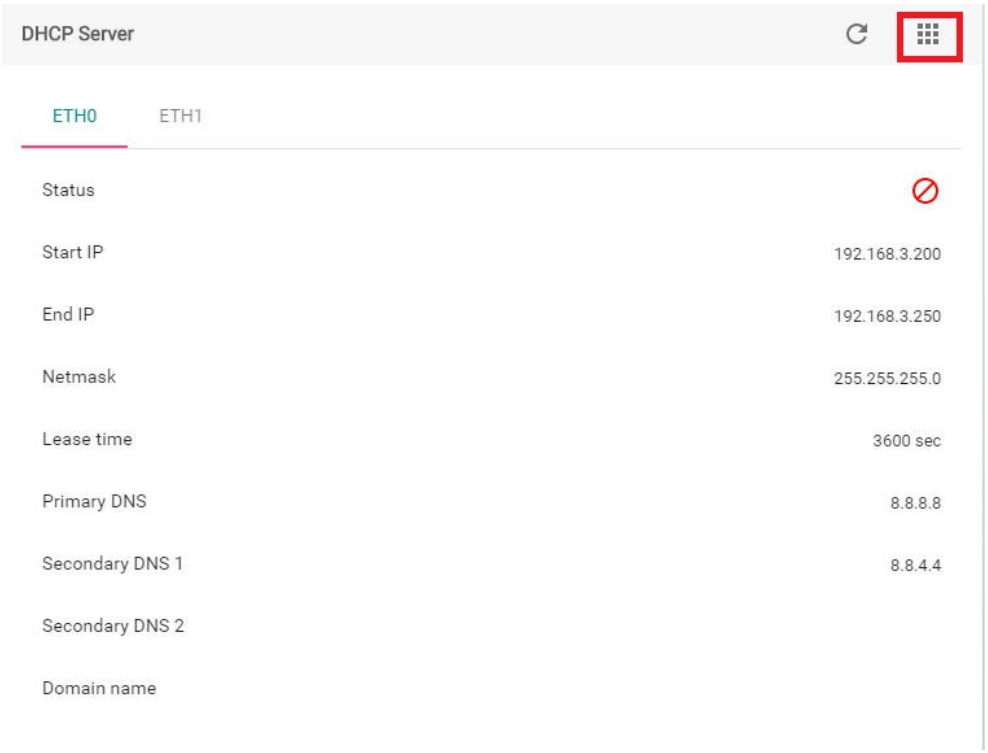
- If you are using a Gemalto cellular module, you might see an error message after you click on the SAVE button. You can ignore this warning, which is a result of Gemalto naming the cellular interface in their model as "Eth2". You can be assured that the default route was configured correctly.
- If no cellular module is installed on the device, you will see a timeout warning. This warning is displayed based on a comprehensive check of each communication interface that is implemented in the software. You can ignore this message; however, if this warning message still appears even when a cellular module is installed in the device, this could be because of a hardware malfunction or because the module is not installed properly.

Configuring DHCP Settings

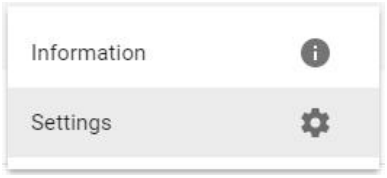
Click **DHCP Server** to view the current DHCP server settings on the main page.



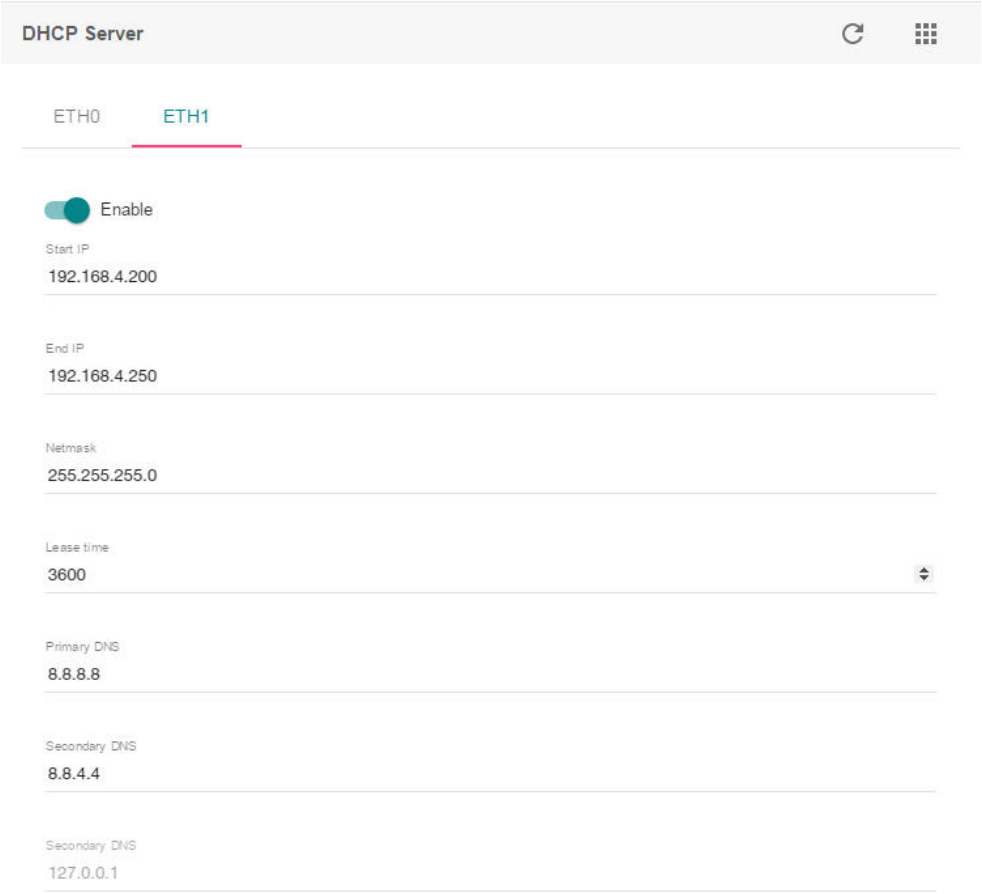
To configure the DHCP server settings, click the edit icon.



Select **Settings**.

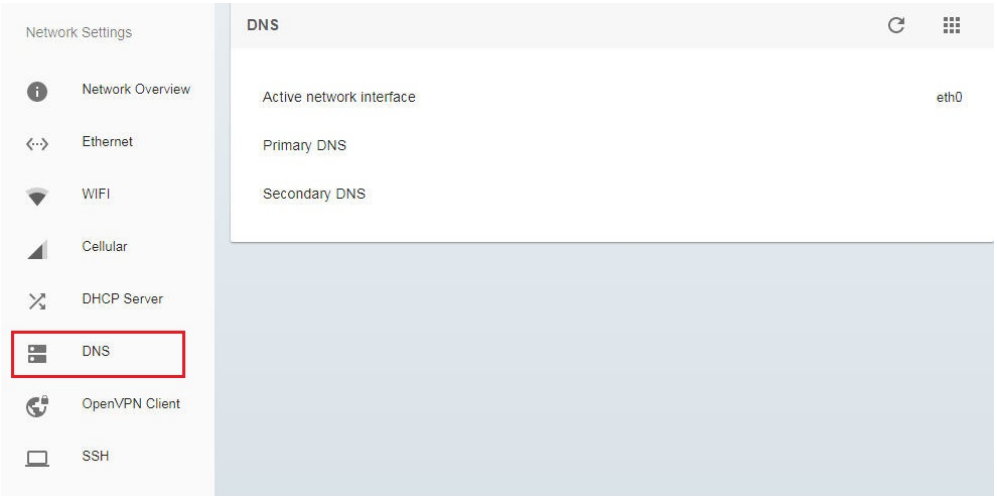


Configure the DHCP server for **ETH1**. Provide the necessary information, such as **Start IP, End IP, Netmask, Lease time, Primary DNS, Secondary DNS**, and **Domain name**. When finished, click **SAVE**.

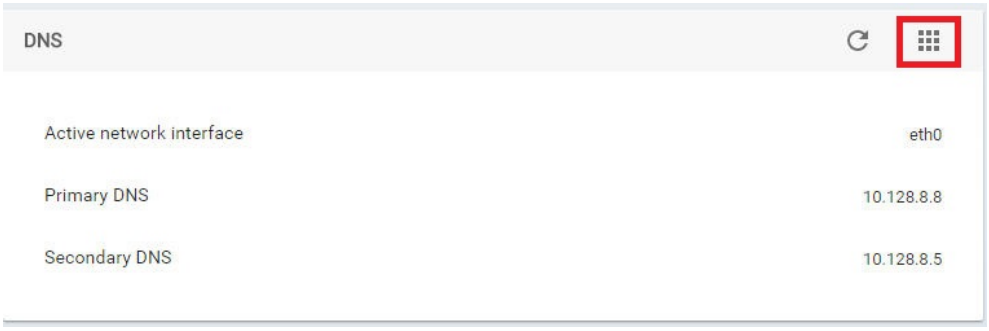


Configuring DNS Settings

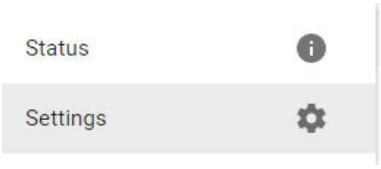
Click **DNS** to view the current DNS settings.



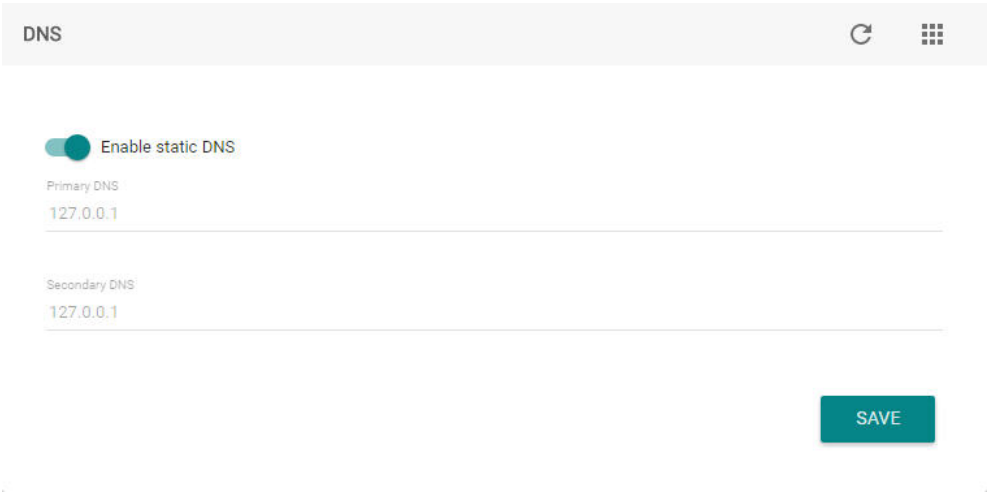
To configure the DNS settings, click the edit icon.



Select **Settings** to continue.

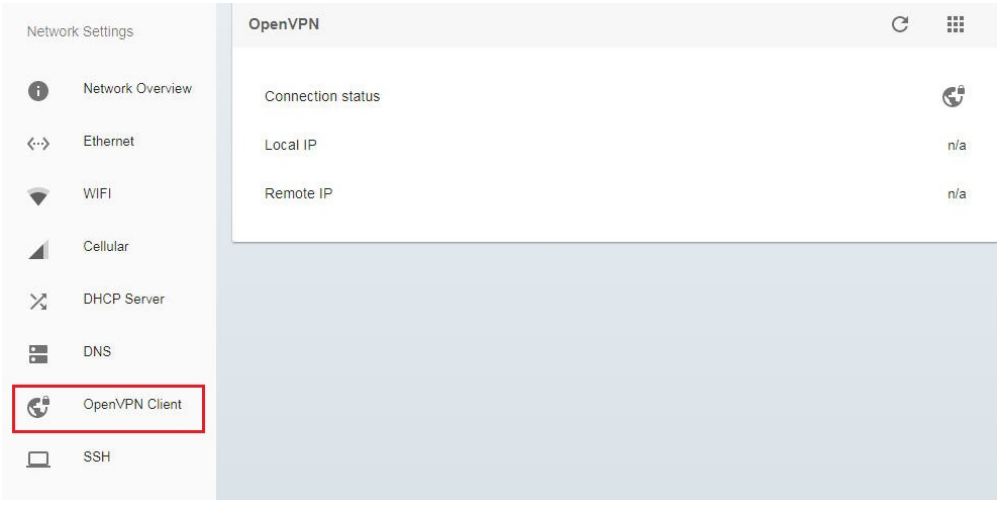


Select **Enable static DNS**, and provide **Primary DNS** and **Secondary DNS**. When finished, click **SAVE**.

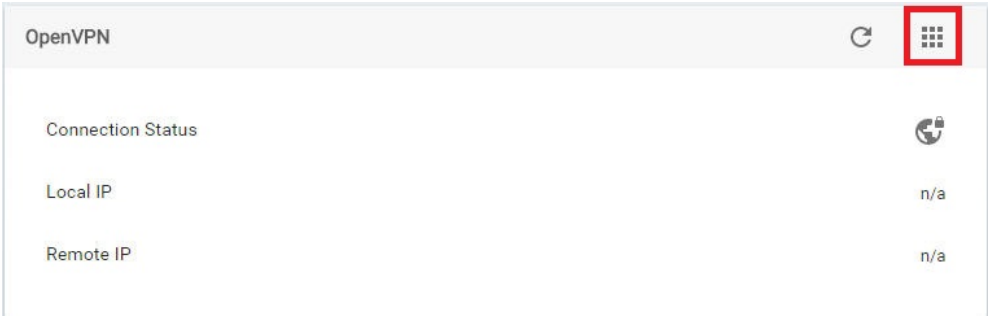


Configuring Open VPN Client Settings

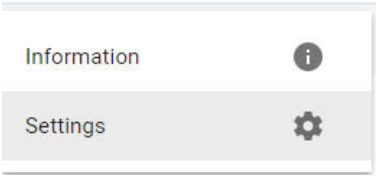
Click **OpenVPN Client** to view the current OpenVPN settings.



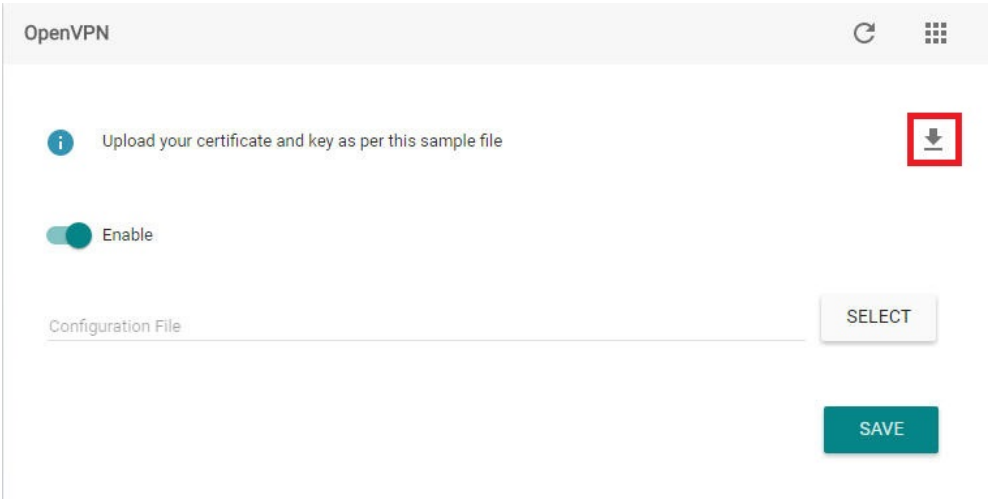
To configure the settings, click the edit icon.



Select **Settings**.

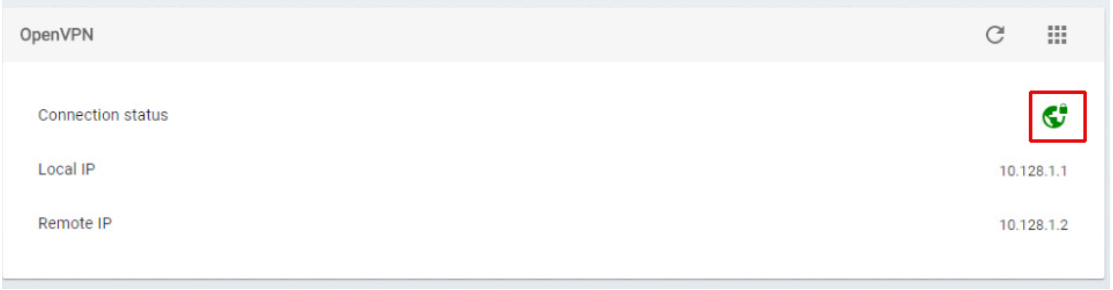


You can download an OpenVPN setting sample file by clicking on the download icon.



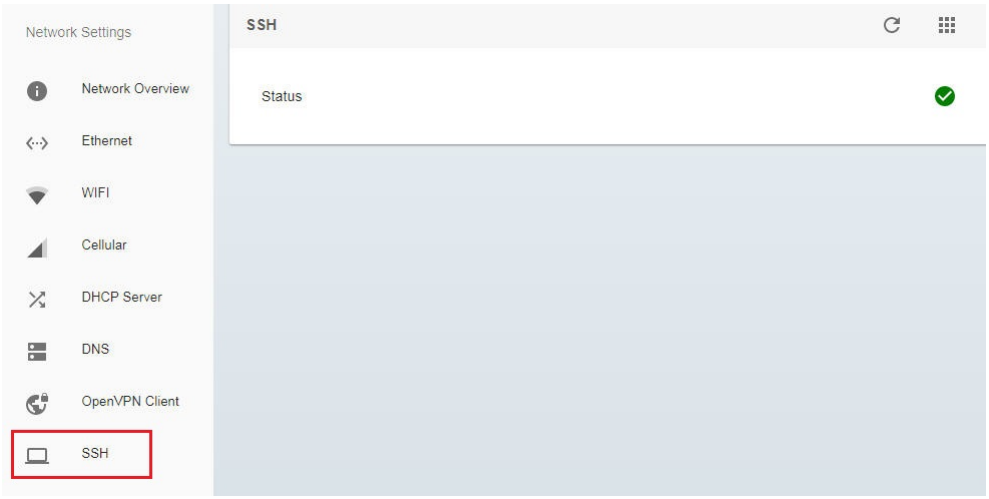
Select **Enable**, and then select the file from your computer, and then upload to the ThingsPro Gateway. When finished, click **SAVE**.

Check the **Connection status** icon. If the icon is green, the OpenVPN client is connected. If the icon remains gray, the client is not connected.



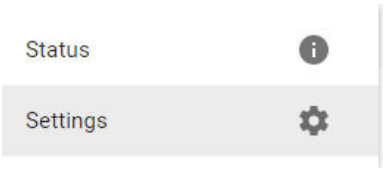
Configuring SSH Settings

Click **SSH** to view the current SSH settings.

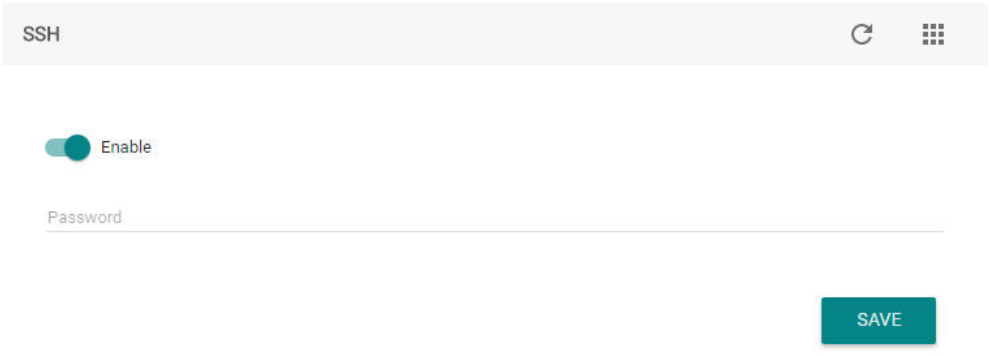


To configure the settings, click the edit icon.

Select **Settings** to continue.



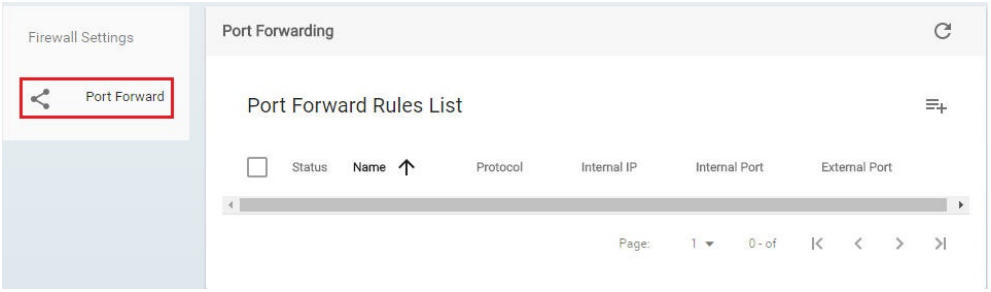
Select **Enable** and provide password. When finished, click **SAVE**.



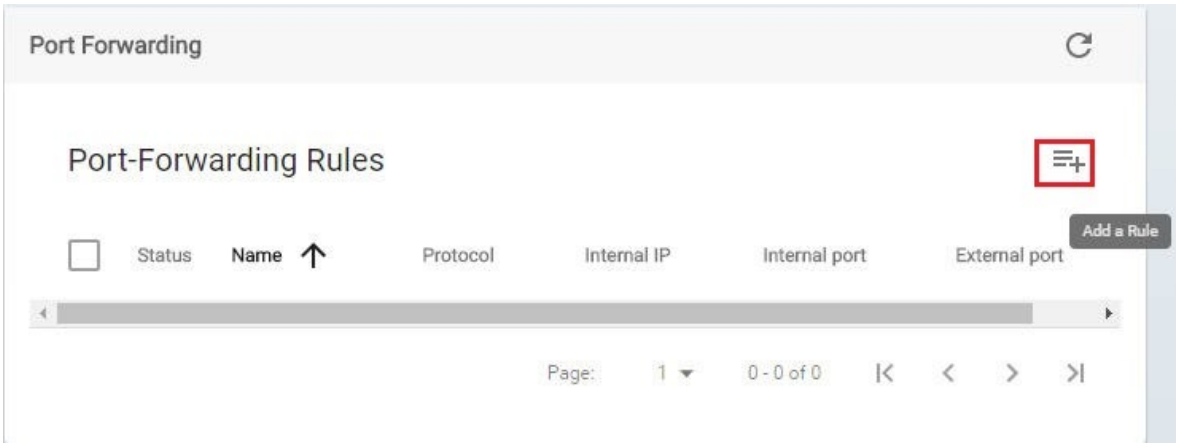
Configuring Firewall Settings

To configure firewall settings, select **Firewall** from the Gateway main menu.

Select **Port Forward** to view the current firewall settings.



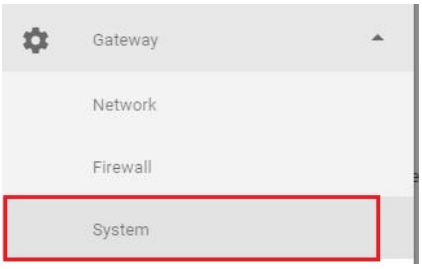
To add a new rule for port forward, click the icon.



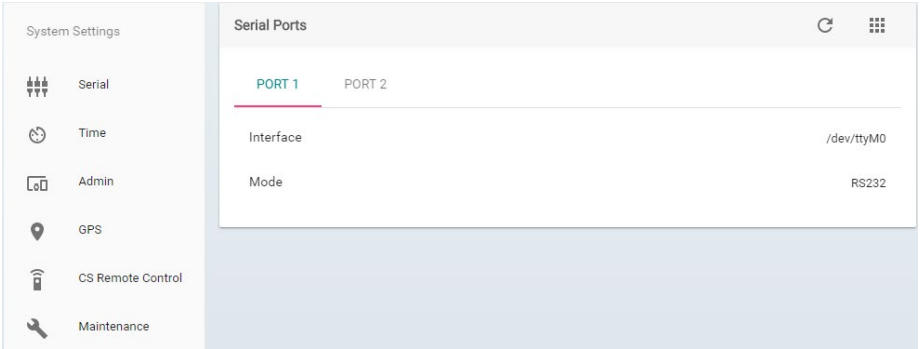
Select **Enable**, and then provide the necessary information such as **Name**, **Internal IP**, **Protocol**, **Internal Port**, and **External Port** in the specific fields. When finished, click **SAVE**.

Configuring System Settings

Select **System** from the Gateway menu.

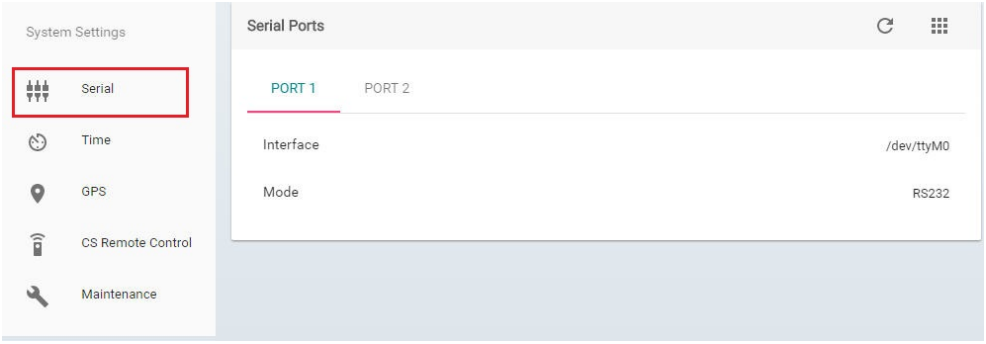


System settings include various options, such as **Serial**, **Time**, **Admin (only available in v2.3 and above)**, **GPS**, **CS Remote Control** and **Maintenance**.

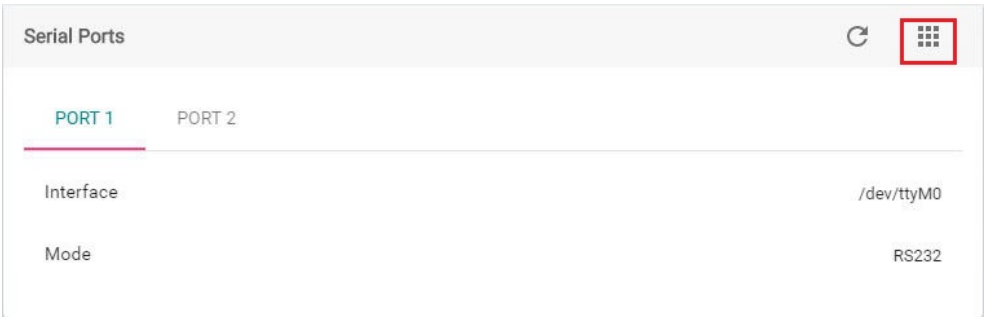


Configuring Serial Settings

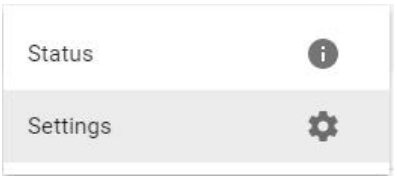
Select **Serial** to view the current serial settings.



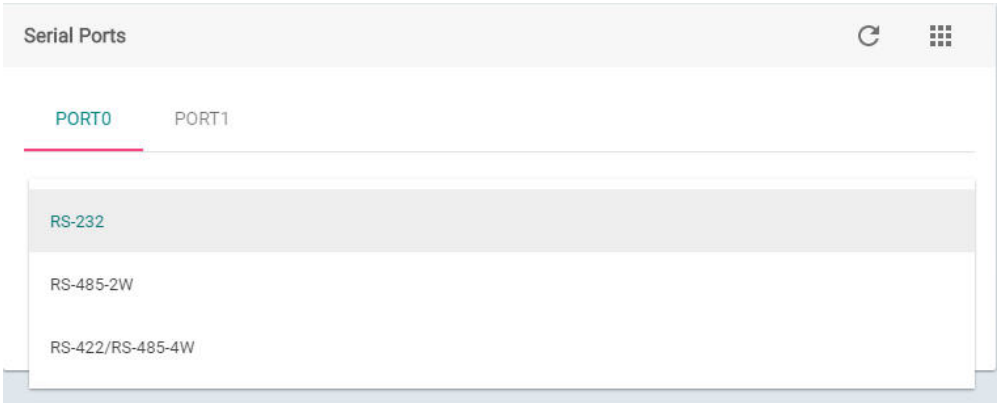
To configure the serial settings, click the edit icon.



Select **Settings**.

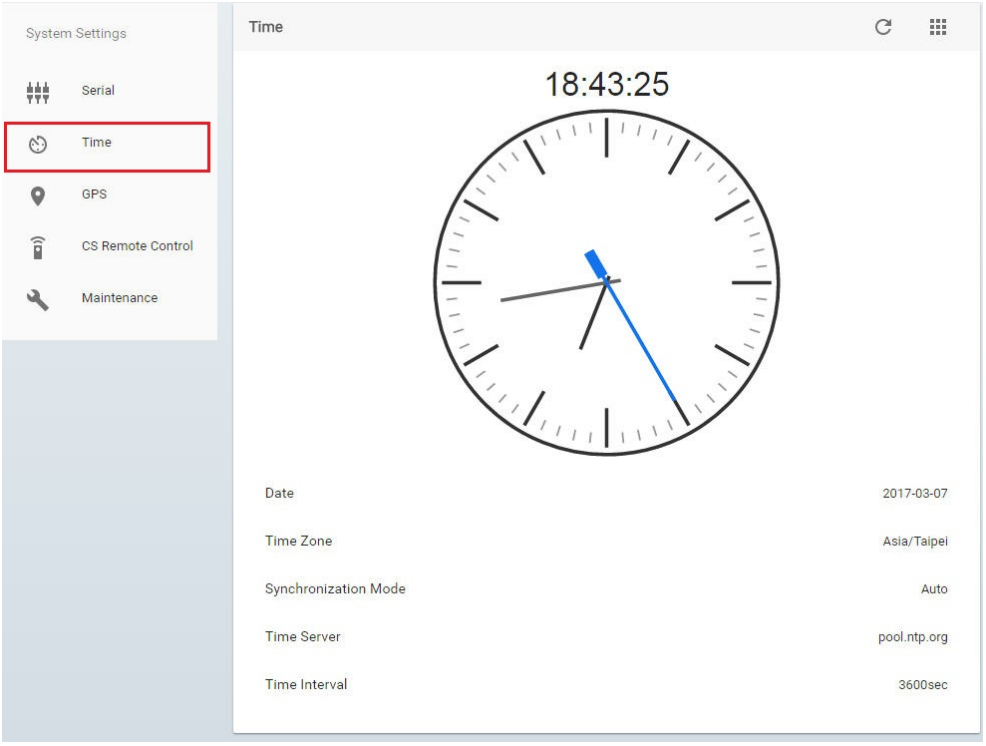


Configure the serial port interface by selecting from the drop-down list. When finished, click **SAVE**.

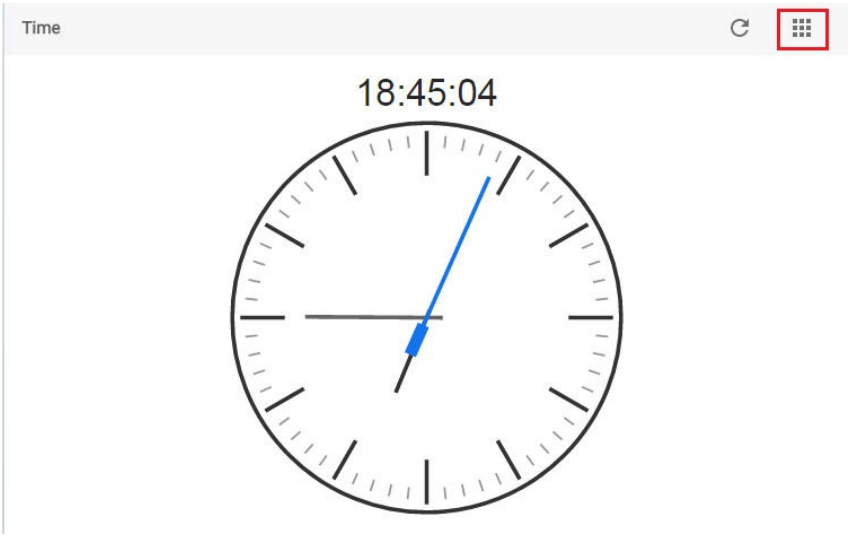


Configuring the System Time

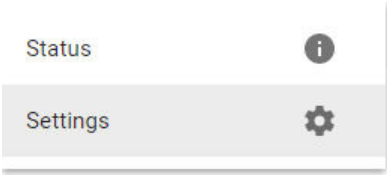
Select Time to view the current system time.



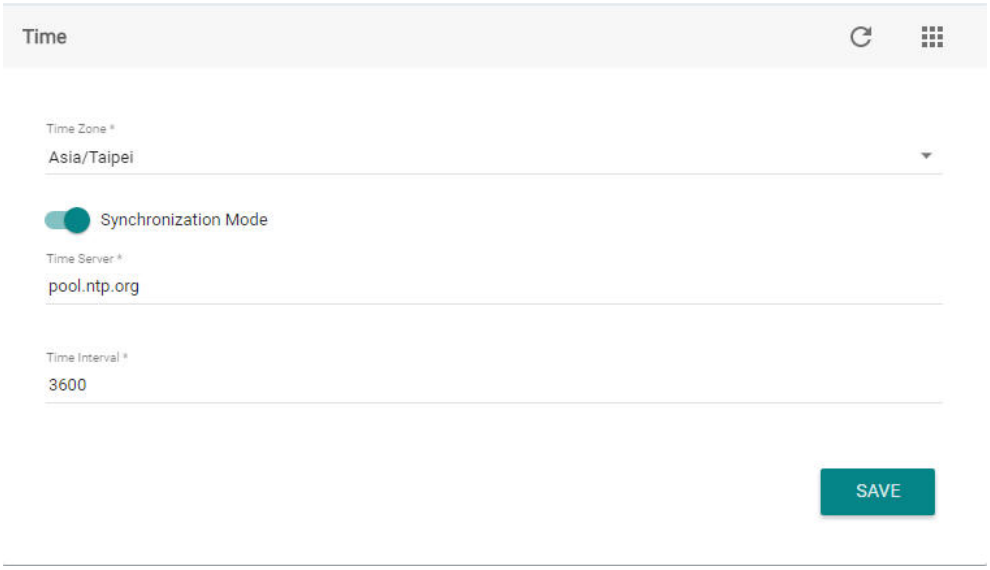
To configure the system time, click the edit icon.



Select **Settings**.

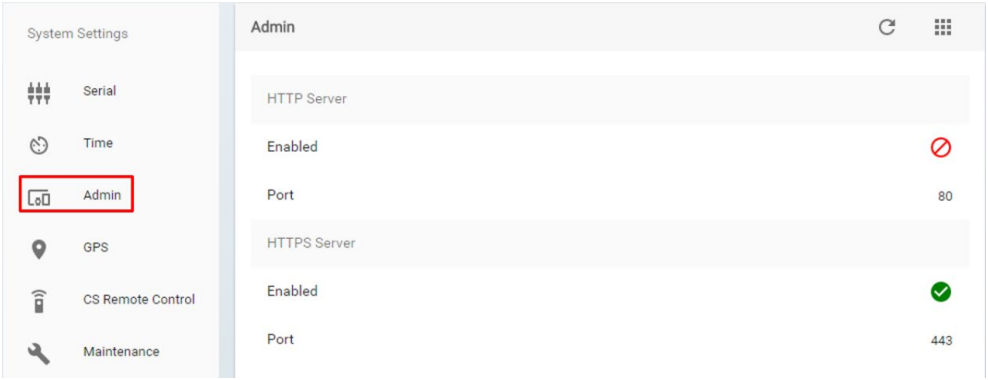


Select if you want to use **Synchronization Mode**, and offer the **Time Server** name and **Time Interval** value. When finished, click **SAVE**.

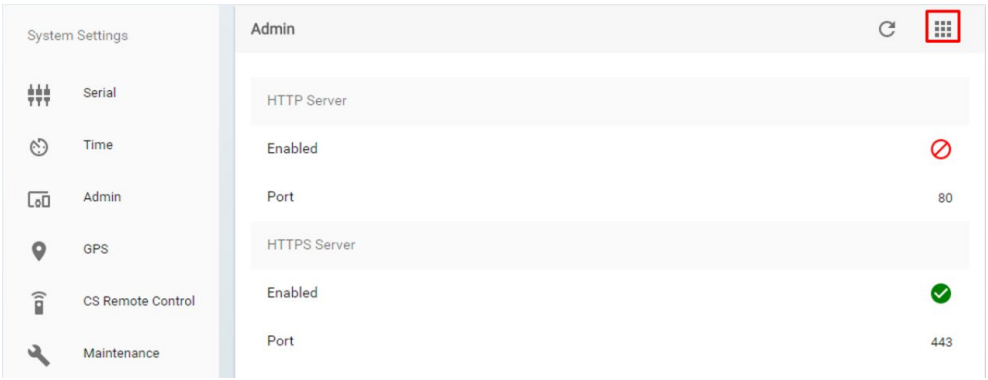


Configuring Admin Settings (only available with v2.3 and higher)

Click **Admin** to view the current HTTP/HTTPS services settings and corresponding port number.

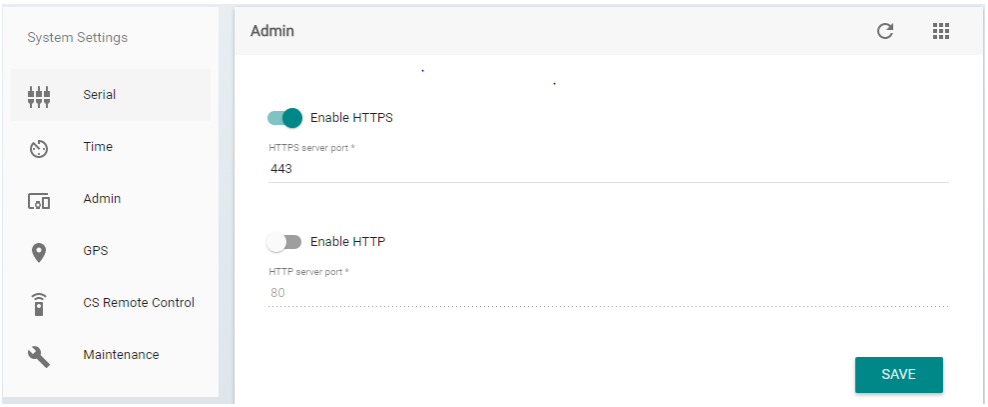


Click the edit icon to configure the Admin settings.



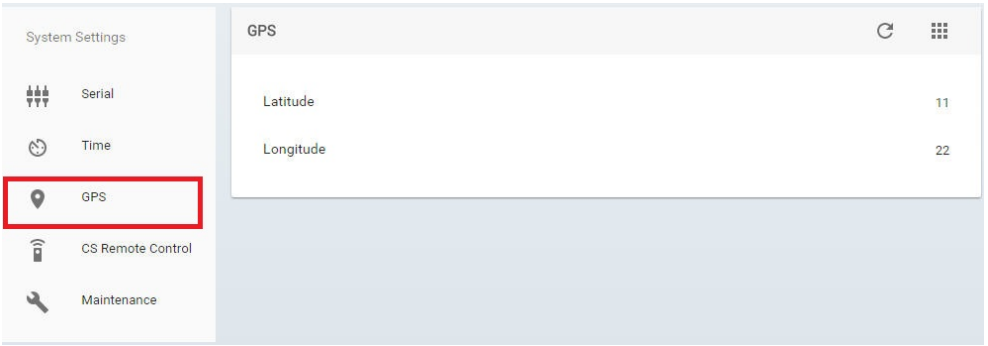
Select **Settings**.

Use the Toggle bars to enable/disable HTTPS and HTTP services for the current ThingsPro Gateway. You can assign a port to each of these two services. When finished, click **SAVE**.

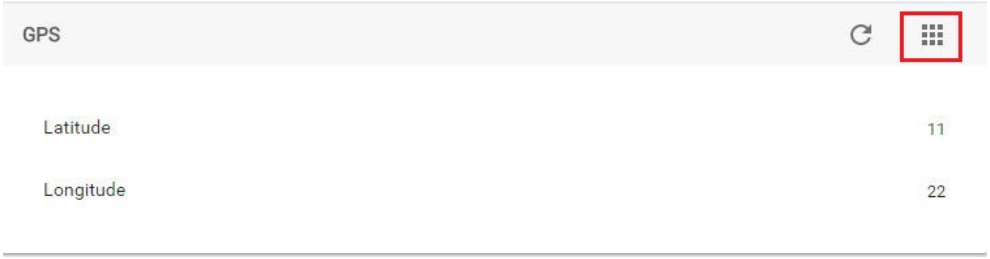


Configuring GPS Settings

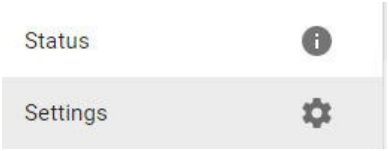
Select GPS to view the current GPS settings.



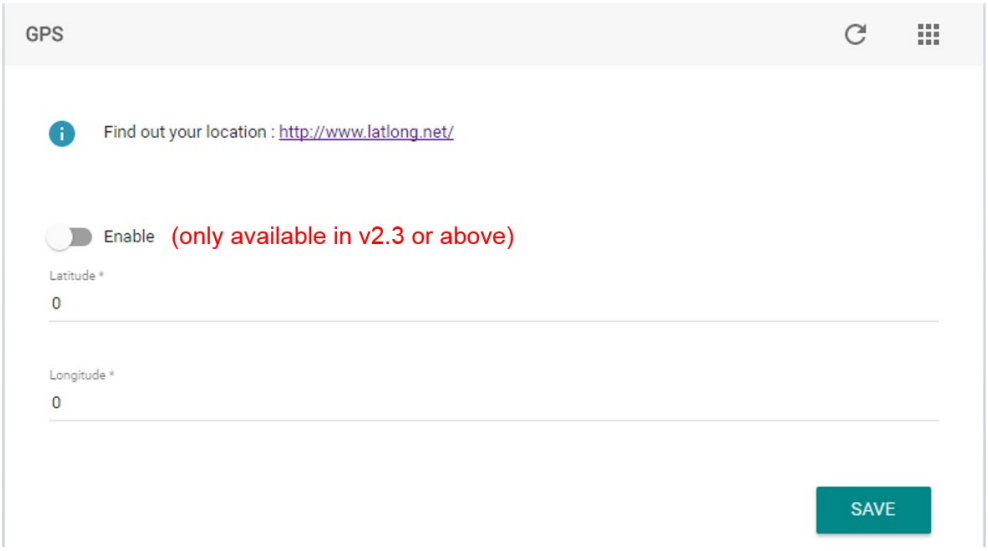
To configure the GPS settings, click the edit icon.



Select **Settings**.

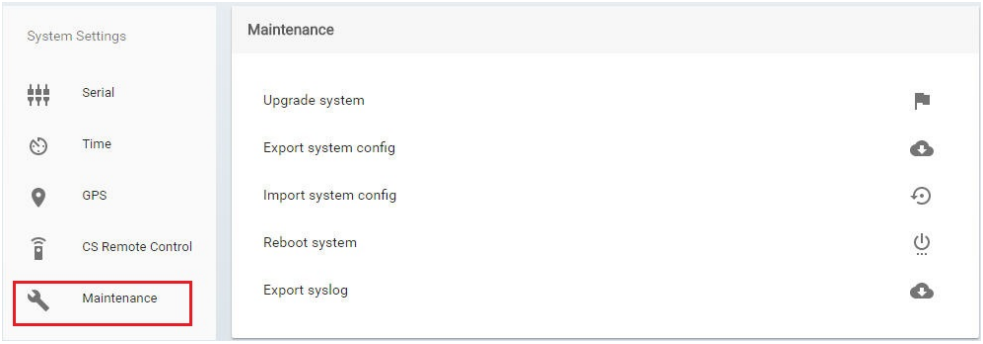


Provide the Latitude and Longitude values in the appropriate fields. Starting with ThingsPro v2.3, you may get the location information from the GPS data retrieved by your eligible device if you have purchased and installed the cellular module w/ GPS feature. You can enable this function to get GPS data automatically. When finished, click **SAVE**.



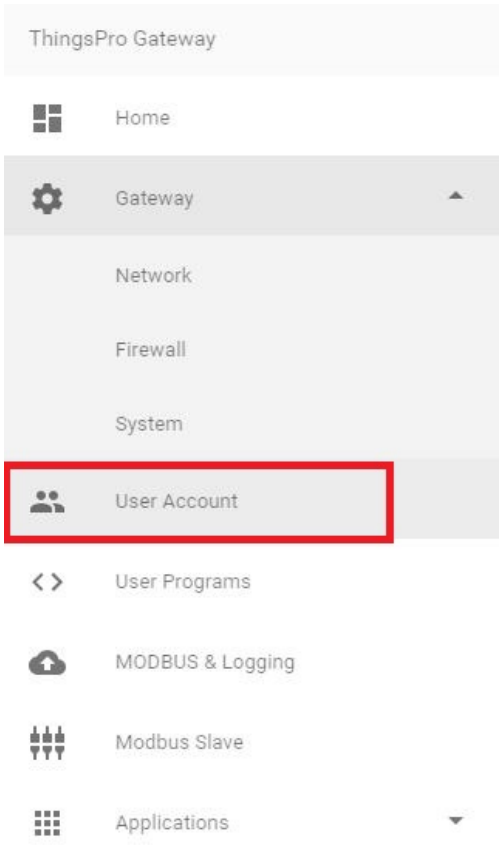
System Maintenance

This section is the same as the procedure in Maintenance in the main menu section. Refer to **Maintenance** section.



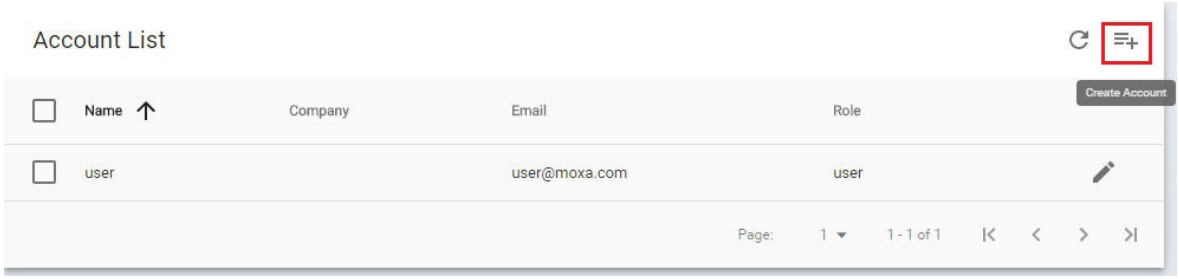
Managing User Accounts

This section describes how to add new account, and manage the existing account. Select **User Account** from the menu.

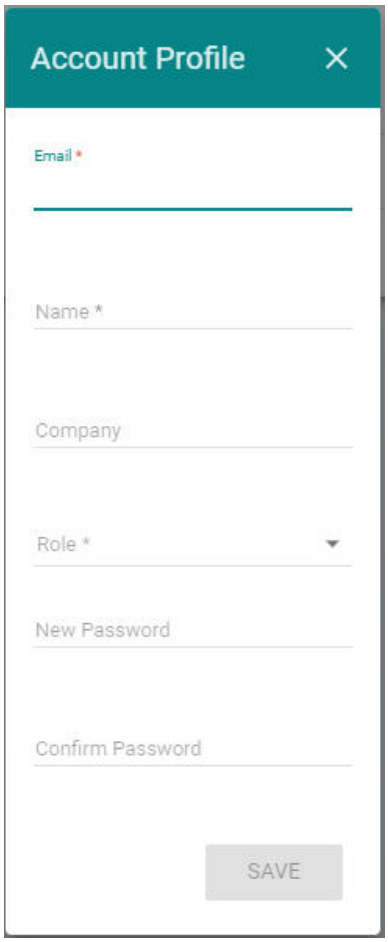


Creating a New Account

To create a new account, select the icon.

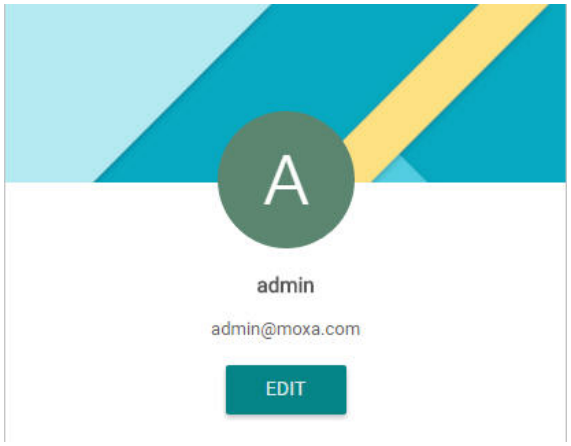


Provide the necessary information for the new account. When finished, click **SAVE**.

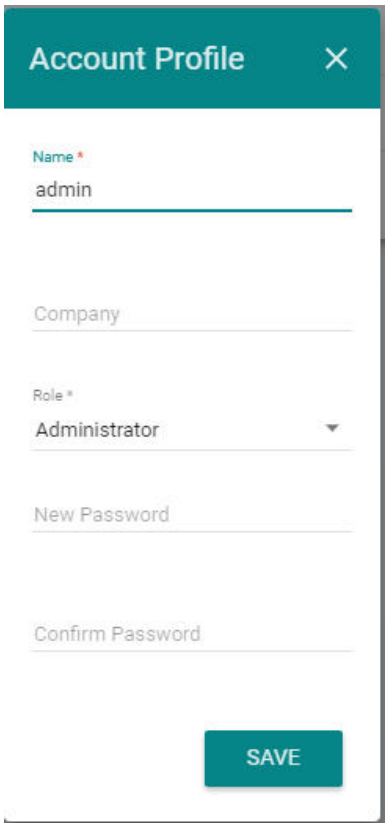


Editing the Administrator Information

To edit the administrator information, click **Edit**.

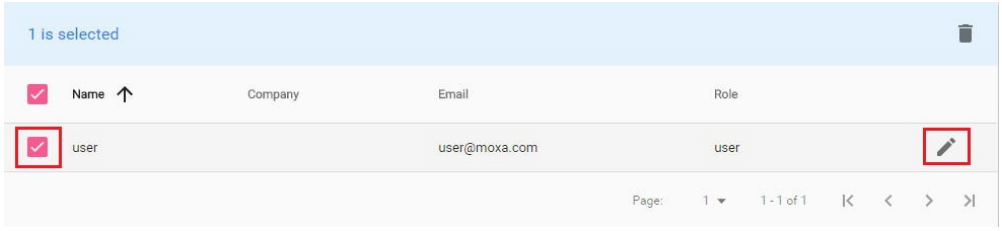


Edit the information in the specific fields. When finished, click **SAVE**.



Updating User Account Information

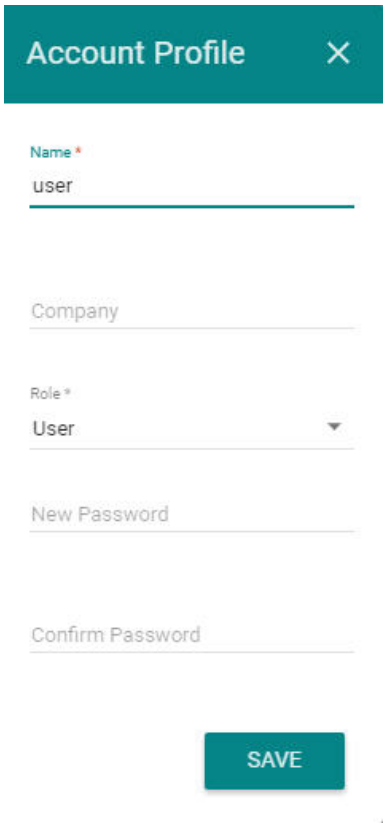
To update an existing user, check the user, and then select the edit icon.



For access rights of the root, admin, and user, refer to the following table.

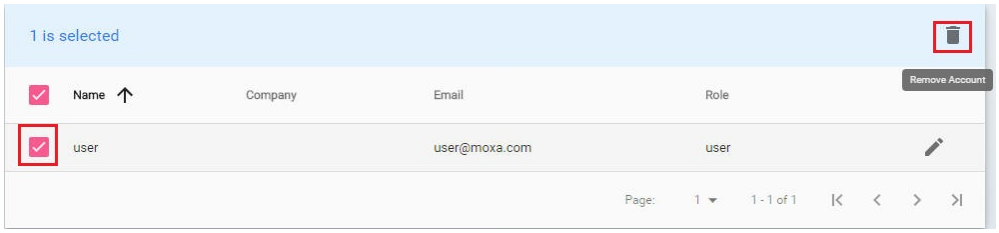
	Configuration	API Token
root	read/write	write
admin	read/write	N/A
user	read	N/A

Edit the information in the specific fields. When finished, click **SAVE**.



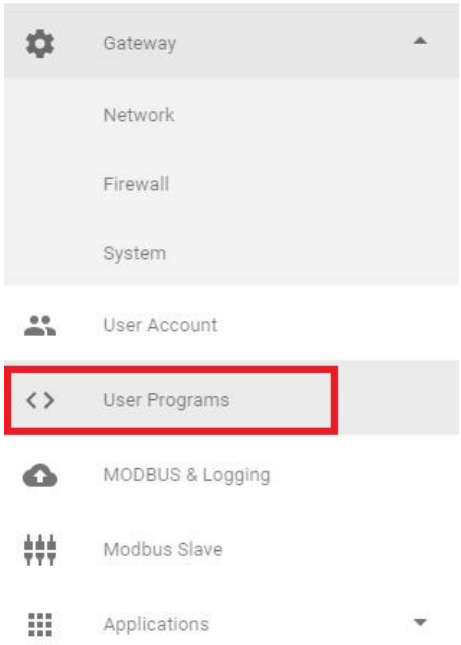
Deleting a User Account

To delete an account, select the account, and then click the delete icon.

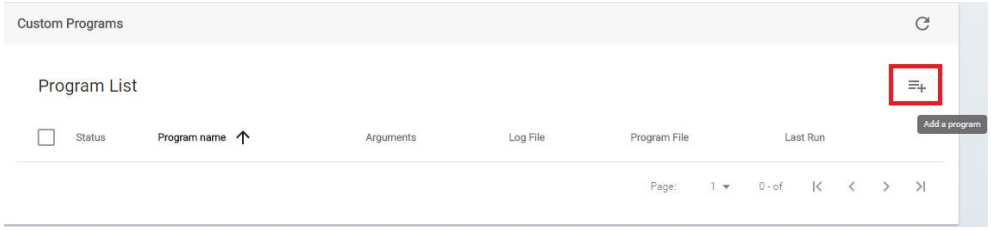


Managing User Programs

ThingsPro Gateway allows developers to develop their own programs or applications and upload them to ThingsPro Gateway. Select the **User Programs** tab from the main menu.



To add a program, click the add icon.



Select **Enable**, provide the name of the program, and select the file from a specific location (refer to the following example to create the file you want to upload). You can also specify when the program should run. For example, whenever the system starts up or at a periodic interval. When finished, click **SAVE**.

Example

Scenario: Synchronize system time with network time server every minute.

Follow the steps below to create the script file and upload it to ThingsPro gateway:

1. Connect to the UC-8112-LX computer through the console port or via an Ethernet cable. Log in to the computer.
2. Create a working directory on the ThingsPro Gateway.
   ```
   moxa@Moxa:~$ mkdir myproject
   ```
3. Enter this working directory and create a shell script file in this folder. The name of this file must be "exec". The content of this example shell script is:
   ```
   #! /bin/sh
   ntpdate $1
   ```
   Note: The UC-8112-LX computer generally supports C, C++, Python, shell script, and JavaScript. You may use these programming languages to develop your program.

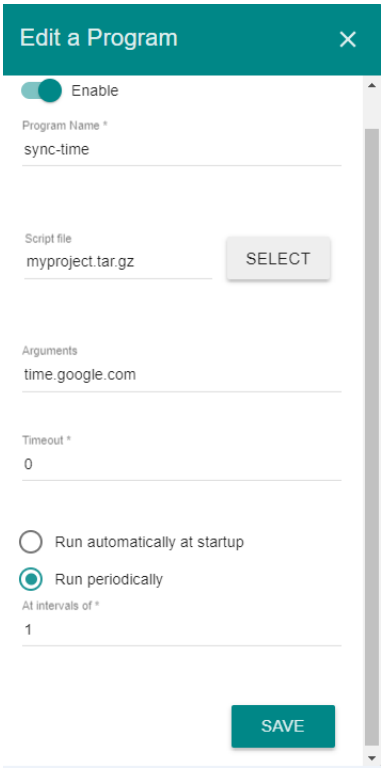
4. When you finish developing the program, set the "exec" file to have execution permissions.

```
moxa@Moxa:~/myproject$ chmod +x exec
```

5. Use the tar command to compress all files created in this folder.

```
moxa@Moxa:~/myproject$ tar cvzf myproject.tar.gz .
```

6. Enter a name for the program, then click **Select** to upload the compressed file. The shell script needs an argument to specify the network time server. ThingsPro Gateway will terminate the user program after the "timeout" value expires. If the timeout value is set to 0, then ThingsPro Gateway will leave the user program running permanently.

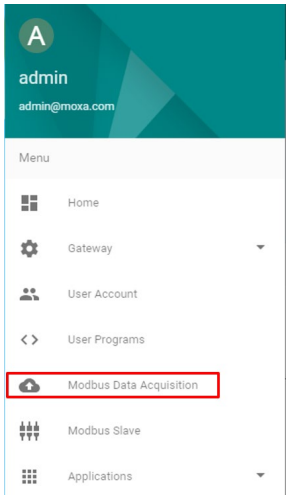


7. After clicking the **SAVE** button, the program will be available under the **User Programs** section of the main menu.

For more details on creating user programs, download the ThingsPro Programmer's Guide.

Configuring Modbus Settings for Data Acquisition

This section describes how to configure Modbus settings and logging. Select **Modbus Data Acquisition** on the main menu.



Equipment Template and Data Tag Management

You can use Modbus compatible templates to configure field devices in ThingsPro, and connect the devices to the gateway. By default, ThingsPro software includes preconfigured templates for Moxa ioLogik series. You can modify the ioLogik templates to set up connections to Modbus /RTU or Modbus /TCP devices.

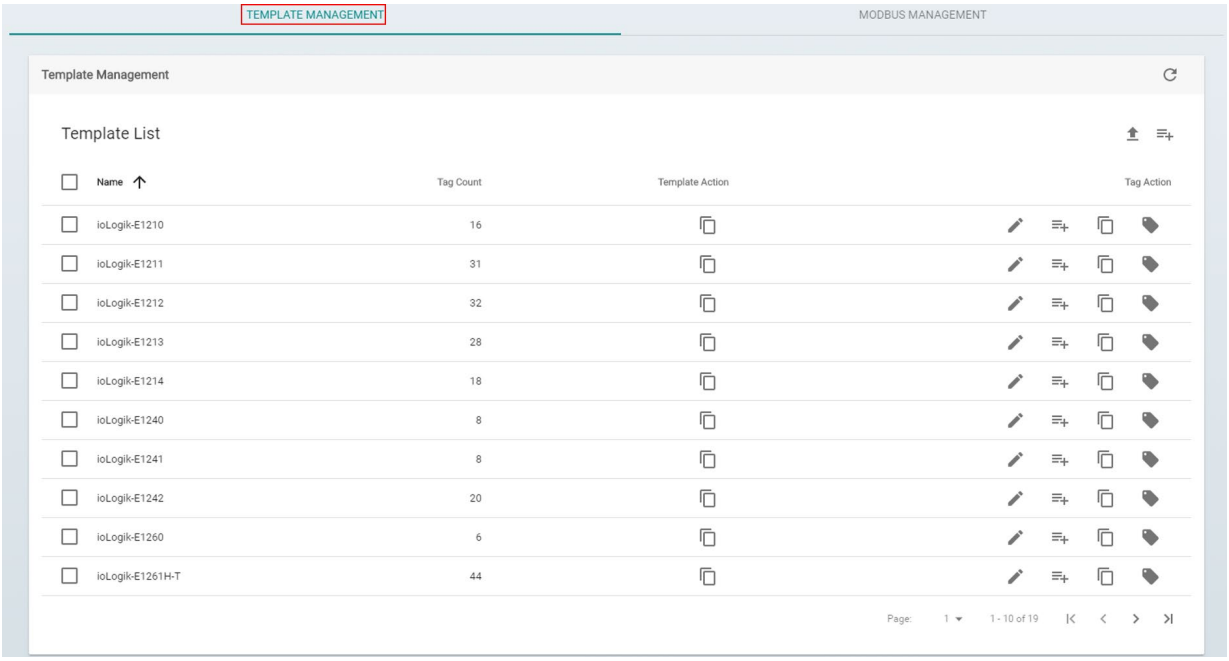
You can add, remove, or update equipment templates in the **Template Management** List section on the Settings page.

To configure a Modbus device in ThingsPro and connect it to the gateway, do the following:

1. Select a template from the **Template Management List**

   or

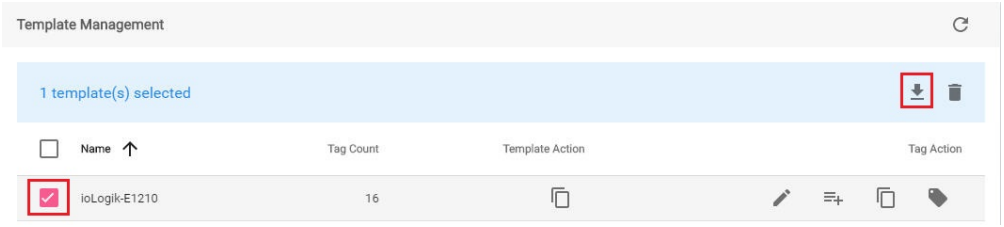
   Create a new template in the **Template Management List**.
2. Define a tag for the device in the template, and specify the device details.
3. Add the device to the ThingsPro system.



Downloading a Template

To download an equipment template, do the following:

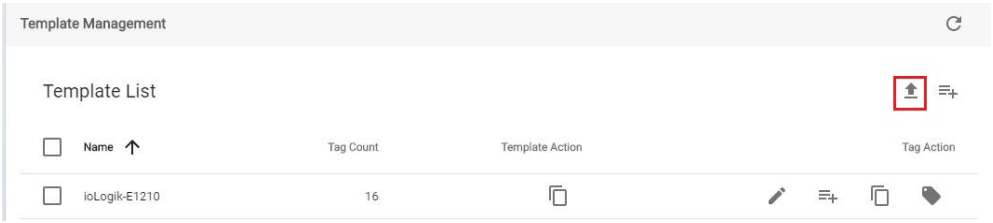
In the **Template Management** List, select the device and click download icon to download the current template to your local computer.



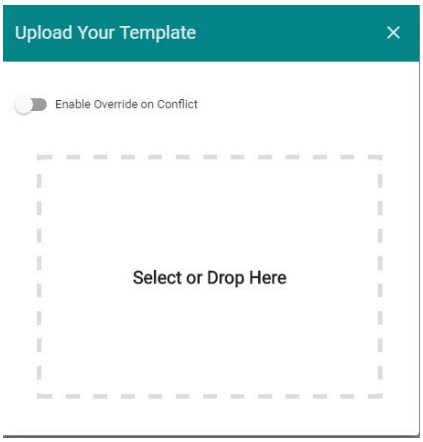
You can also select more devices and download all templates at one time.

Uploading a Template

To upload a template, click upload icon.

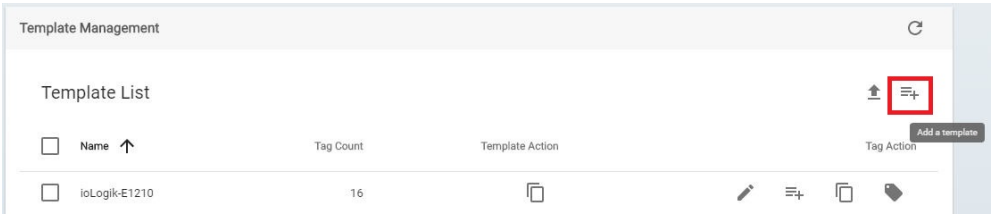


Select the template file from the local folder, and wait for a few second to complete the upload process.

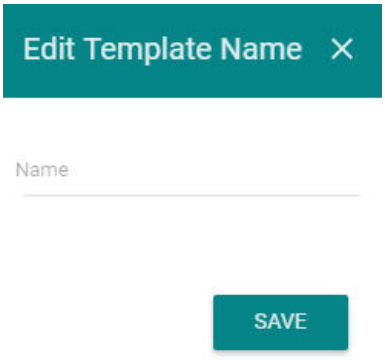


Adding a Template

To add a template, click the add icon.

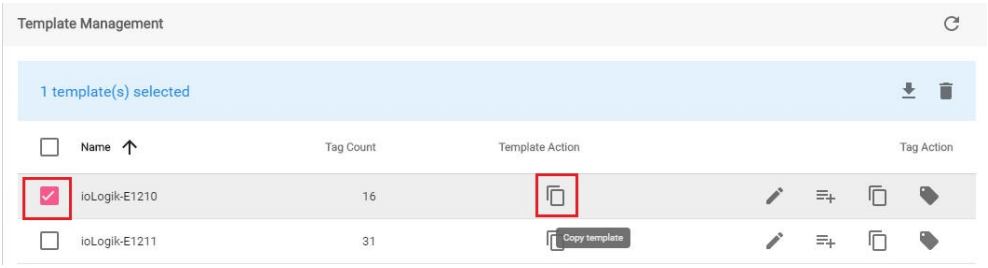


Add the template name. When finished, click **SAVE**.

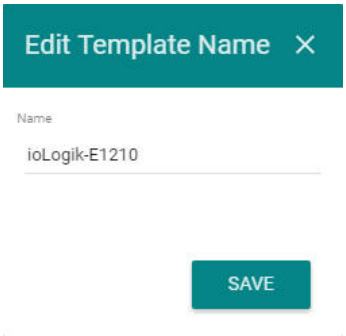


Copying a Template

Select the device, and then click the copy icon.

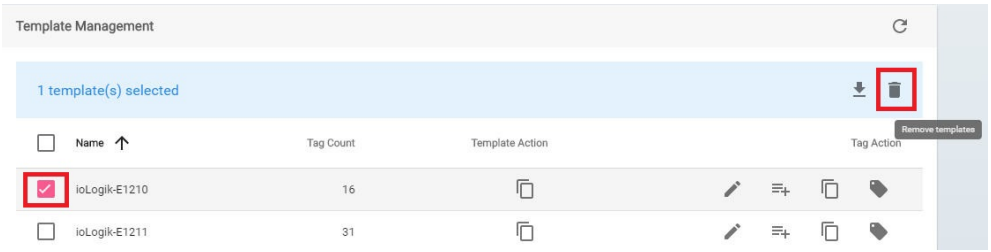


You can edit the new template name. When finished, click **SAVE**.



Removing a Template

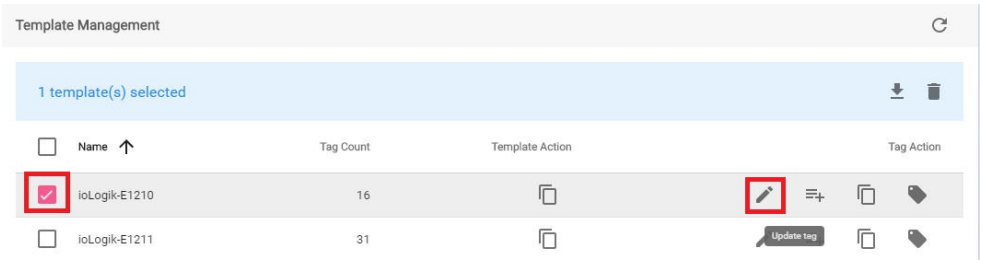
Select the device, and then click the remove icon. The template will be removed.



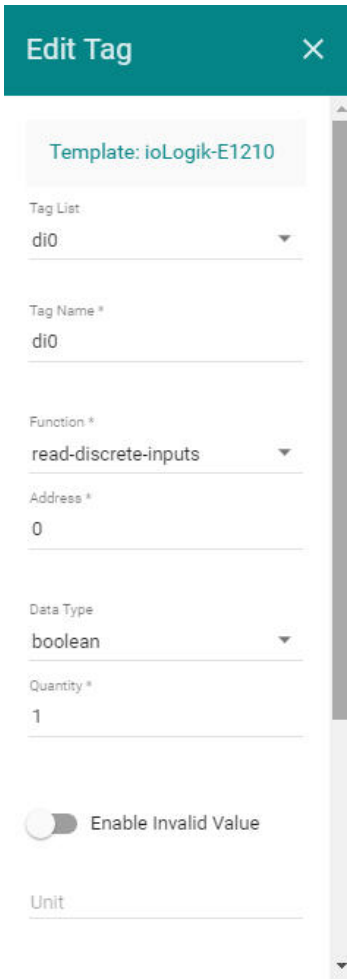
Note that if a Modbus template is being used, you cannot remove the template, and a device tag cannot be updated. Remove the device in Modbus Management page first.

Updating a Device Tag

Select the device, and then click the update tag icon.

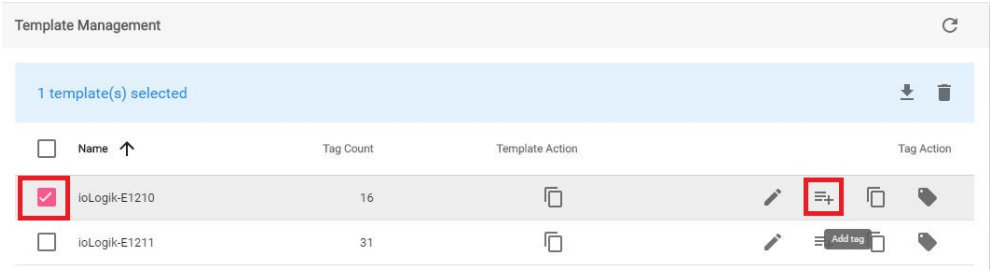


Update the tag in the following page. When finished, click **SAVE**.

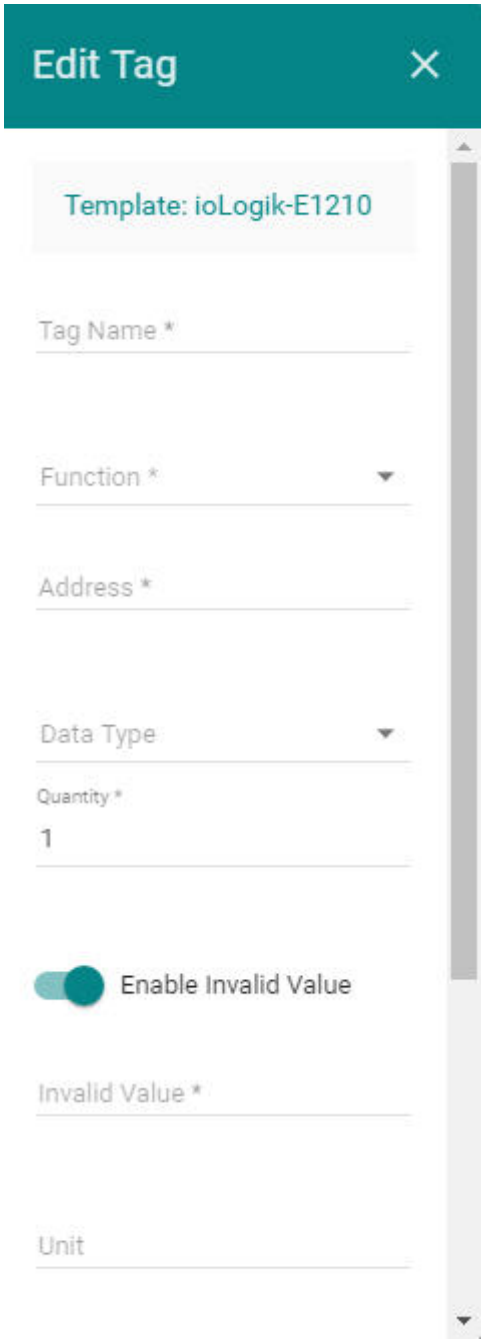


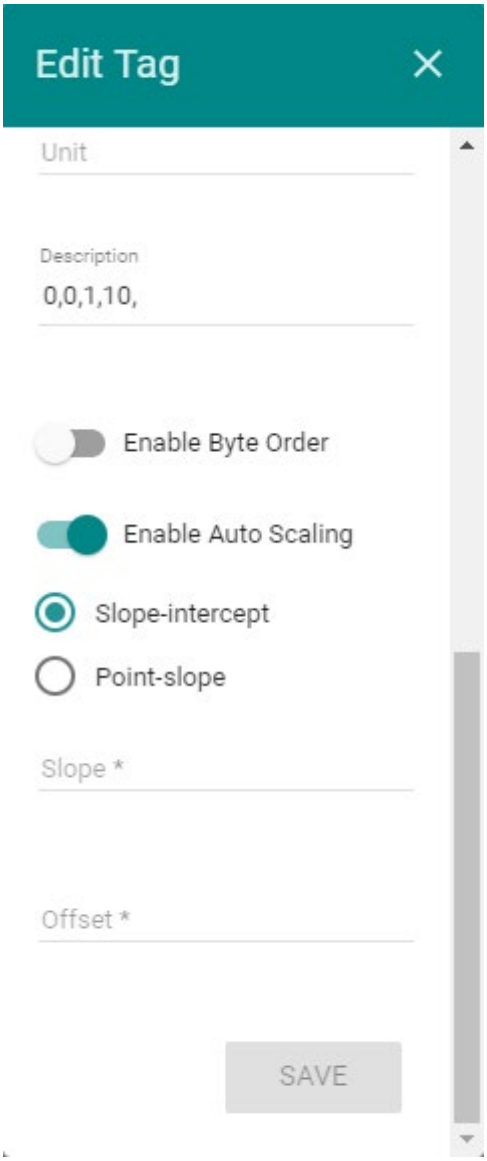
Adding a Device Tag

Select the device, and click the add tag icon to add a device tag.



Edit the tag information in the related fields. When finished, click **SAVE**.


Edit Tag
Template: ioLogik-E1210
Tag Name *
Function *
Address *
Data Type
Quantity *
1
Enable Invalid Value
Invalid Value *
Unit

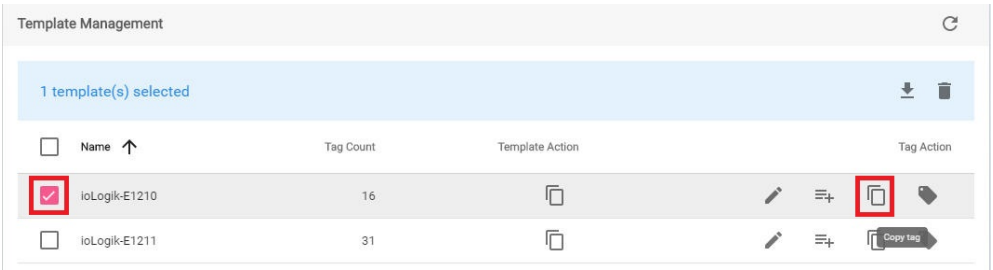

Edit Tag
Unit
Description
0,0,1,10,
Enable Byte Order
Enable Auto Scaling
Slope-intercept
Point-slope
Slope *
Offset *
SAVE

Refer to the following table for the description of the Modbus device details.

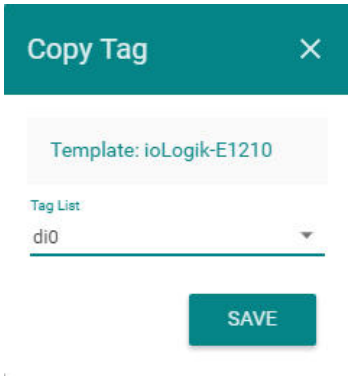
Field	Description
Tag Name	Assigns a tag name for the device
Function	Selects the Modbus command for the device. The commands supported include read-coils, read-input-registers, read-discrete-inputs, read-holding-registers, write-single-coil, write-single-register, write-multiple-coils, and write-multiple-registers.
Address	Specifies the read/write address of the device
Data Type	Specifies the data type for this tag/register for the device read operation (e.g.: uint16, uint8, uint32, float32, and float64). This field is mandatory.
Quantity	Specifies the amount of data read/write per read operation. For coil and discrete input, 1 means 1 bit; for input register and holding register, 1 means 1 word (16-bit).
Enable Invalid Value	Sets the specified number as an invalid value. First select the **Enable Invalid Value** option and then specify the value that you want to set as invalid in the field. When an invalid value is specified, ThingsPro will ignore the value and will retain only the valid value. This option will essentially reduce system loading and improve system efficiency. For example, if you do not want to receive 1, then 1 is set as an invalid value. When ThingsPro receives the value 1, it will ignore this value.
Unit	Specifies the unit that should be written into the logs for all the valid values received. For example, you can set the unit as MB, in which case, all values received will be logged with the unit "MB" next to the values. This option provides a way to make the logs more readable, which in turn makes it convenient for system administrators to analyze the data they receive.
Description	Provides additional description for the tag.
Enable Byte Order	Enables byte ordering of the composite data frame.
Enable Auto Scaling	Enables auto scaling of the value read from the device. The auto scaling is calculated based on the following formulas: **Slope-intercept: OUTPUT = Slope * INPUT + Offset** **Point-slope: OUTPUT =** **((INPUT-sourceMin) * (targetMax-targetMin) / (sourceMax-sourceMin)) + targetMin**

Copying a Device Tag

Select the tag you want to copy, and click the copy tag icon to copy a device tag.

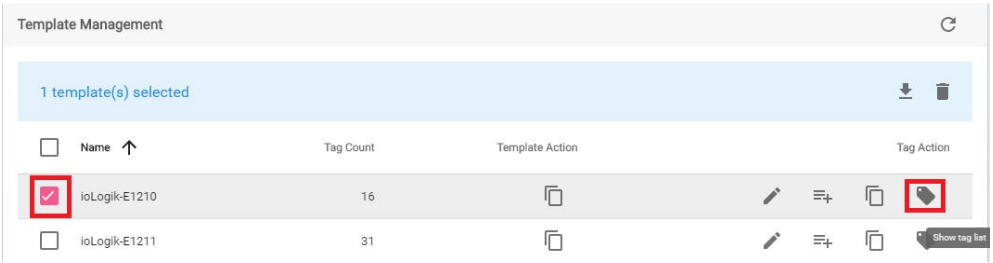


Select the tag from the list, and then click **SAVE**.

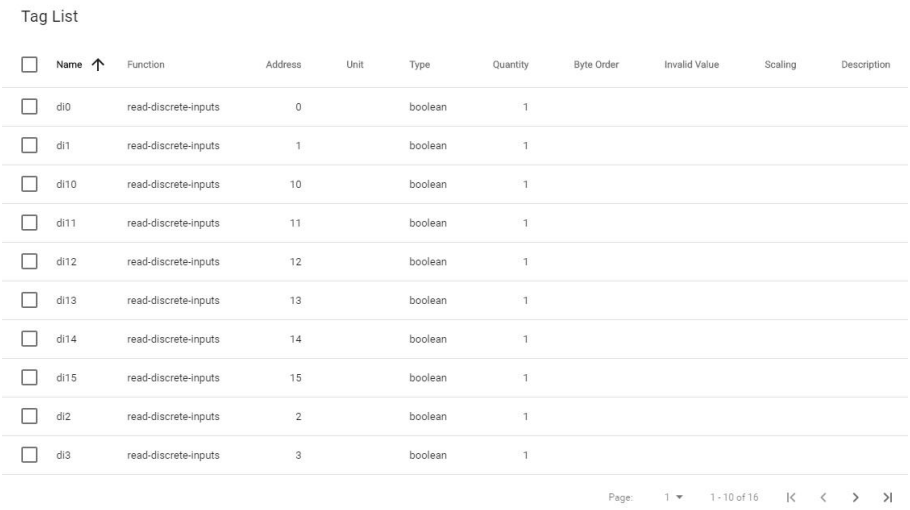


Showing a Tag List

Select the device, and click the show tag list icon to show a tag list.



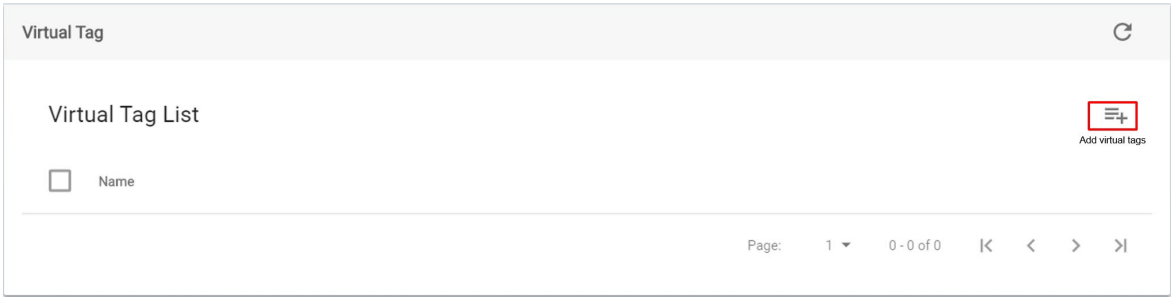
The tag list will be shown.



Creating Equipment Virtual Tags

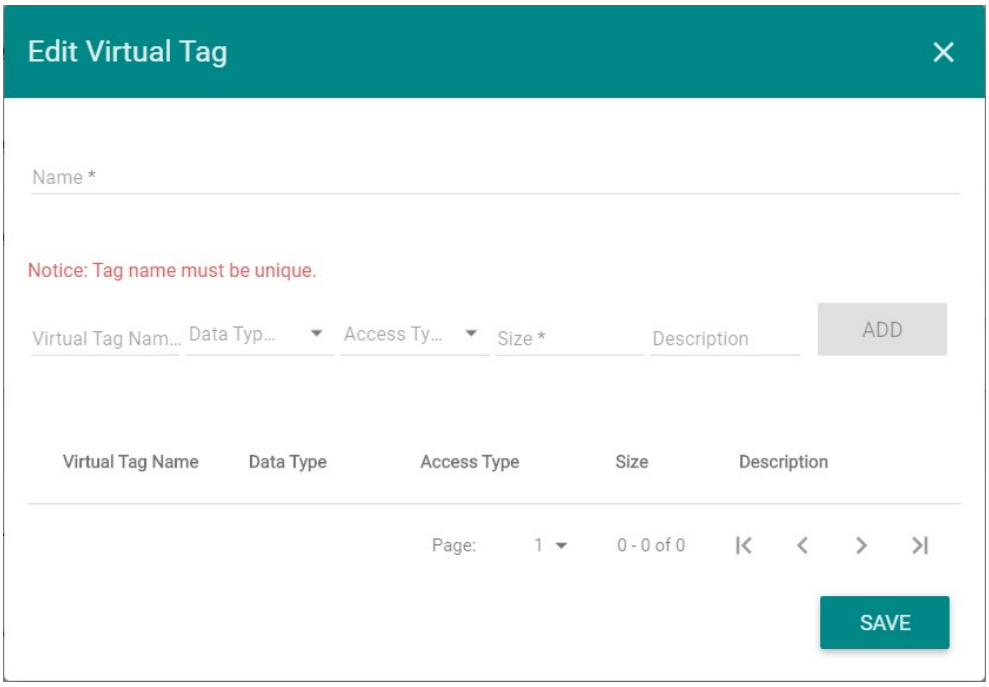
NOTE In ThingsPro Gateway versions prior to v2.5.1, this page is called **Custom Equipment Management**.

You can create a virtual tag for equipment and specify the details.



To add an equipment to the list,

1. Click the add equipment icon.
2. Provide the necessary information in the Edit Custom Equipment page.



3. Click **ADD**.
4. Click **SAVE**.

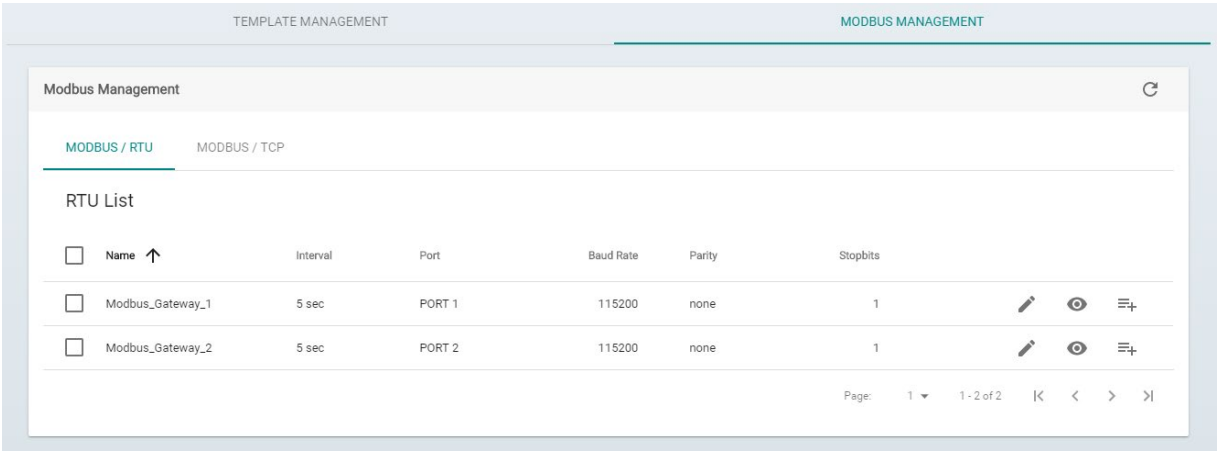
Modbus Management

This section helps users manage the Modbus/RTU, and Modbus/TCP devices.

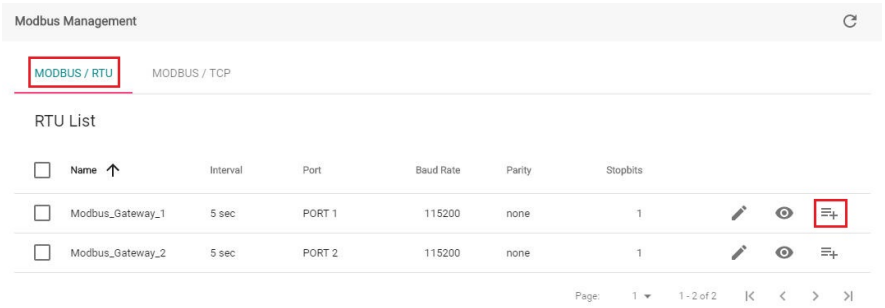
Add a Modbus/RTU Device

To add a Modbus/RTU device, do the following:

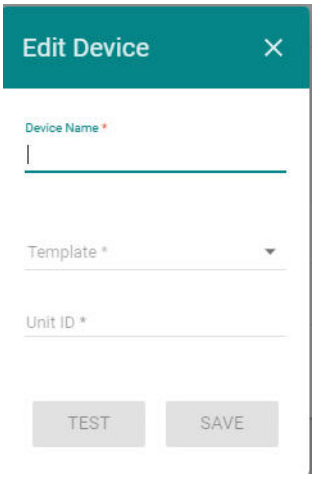
1. Click **MODBUS MANAGEMENT** tab.



2. Select **MODBUS/RTU** tab, select under what port that you want to add a new device, and then click the add icon.

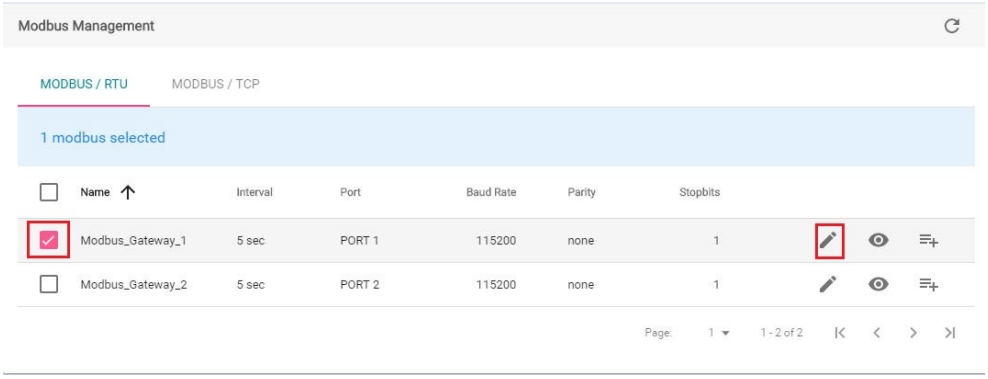


3. Edit the information for the new device. You can click **Test** for a testing connection, or **SAVE** to complete.

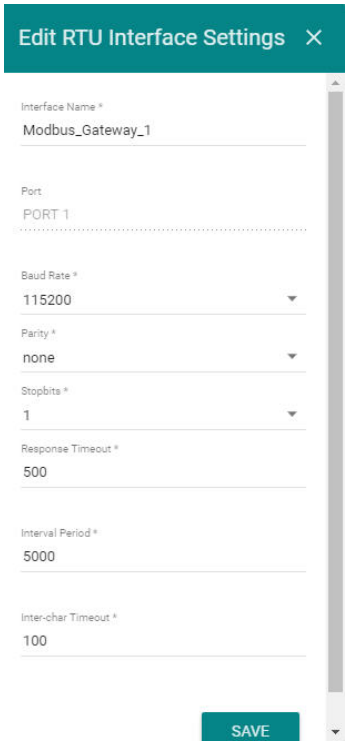


Edit Modbus/RTU Interface Settings

Click the edit icon.



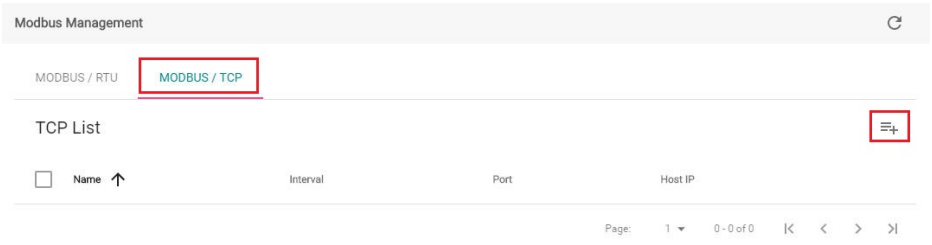
Edit the RTU interface settings in the following page. When finished, click **SAVE**.



Adding a Modbus/TCP Device

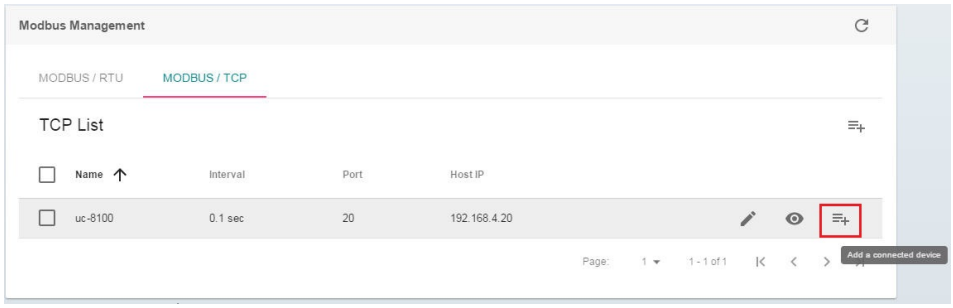
To add a Modbus/TCP device, do the following:

1. Select MODBUS/TCP tab, and click the add icon.

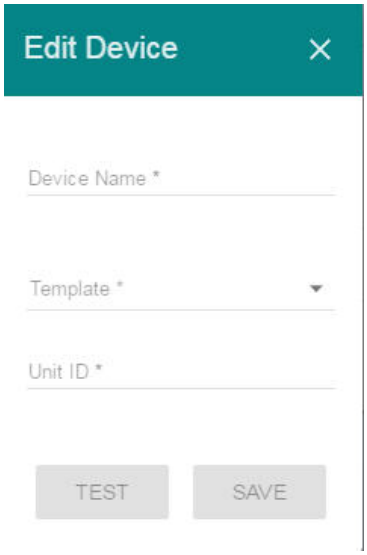


2. Edit the TCP interface settings.

3. When finished, click **SAVE**.
4. When a new TCP device is added, click Add a connected device to check the connection status.



5. Edit device in the fields, and click **SAVE** to complete.

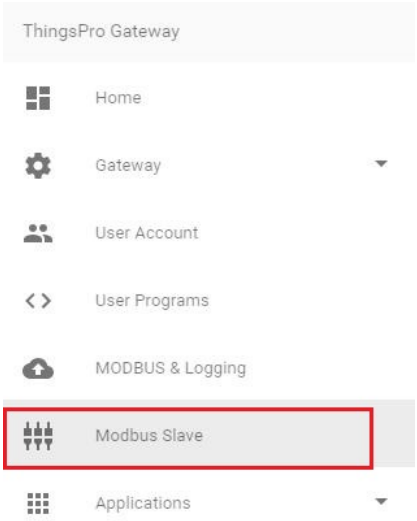


Managing Modbus Slave Devices

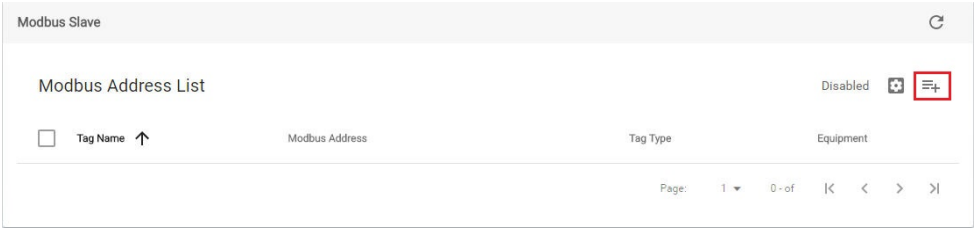
This section helps users manage Modbus Slave devices. The Modbus slave function helps users easily poll data from the connected end devices via ThingsPro Gateway to their system using Modbus protocol. This is a convenient design for users to acquire end-device data via ThingsPro Gateway without applying MQTT, which is useful for existing systems such as local SCADA.

Adding a New Modbus Slave Device

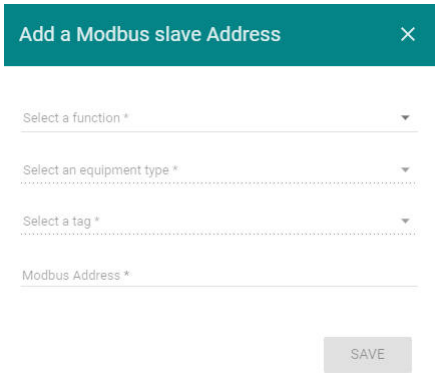
To add a Modbus Slave device, select **Modbus Slave** on the menu.



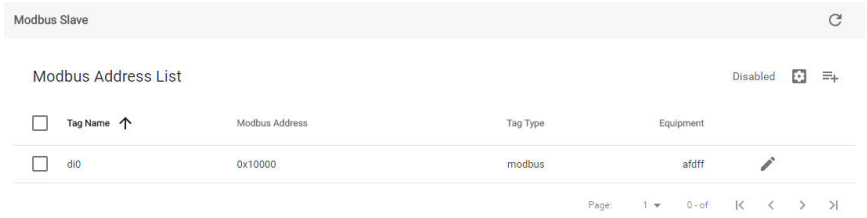
Click the add icon.



Provide the necessary information. When finished, click **SAVE**.

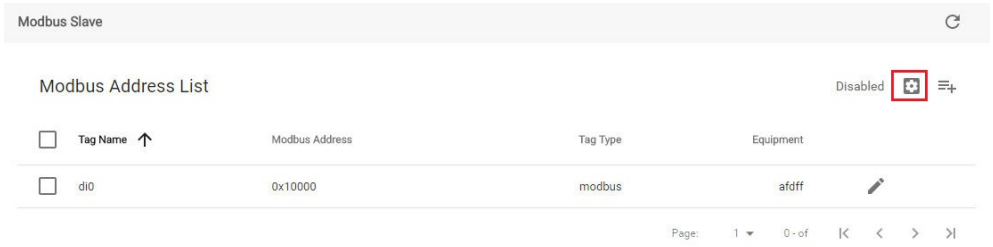


A new Modbus Slave device will be added.

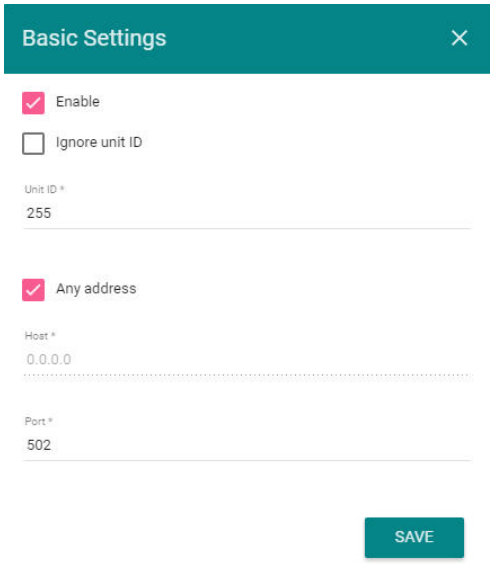


Enabling a Modbus Slave Device

To enable a Modbus Slave device, click Basic Settings icon.

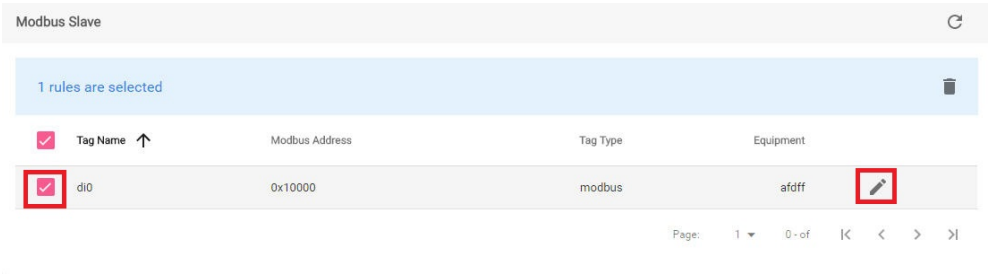


Check **Enable**, and configure the basic settings. When finished, click **SAVE**. If **ignore unit ID** is not checked, the Modbus master needs to set the same unit ID for Modbus access.

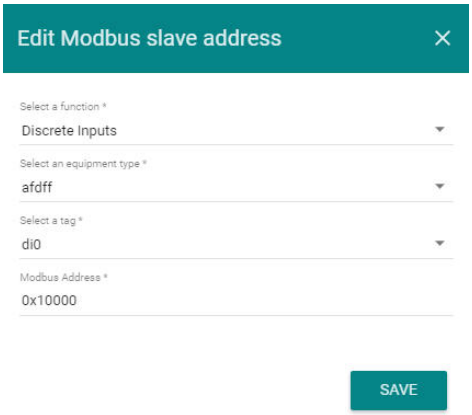


Editing a Modbus Slave Device

To edit a Modbus Slave device, select the device, and click the edit icon.

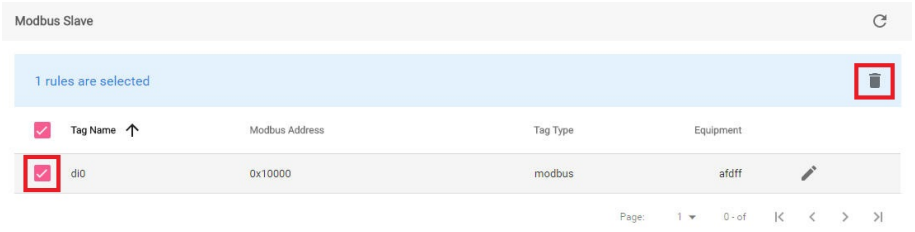


Edit the device, and click **SAVE** to finish.



Deleting a Modbus Slave Device

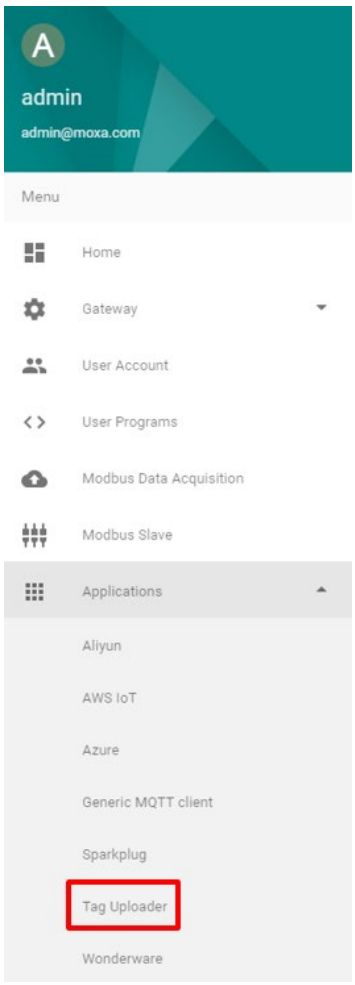
To delete a Modbus Slave device, select the device, and then click the delete icon.



Managing Log Profiles

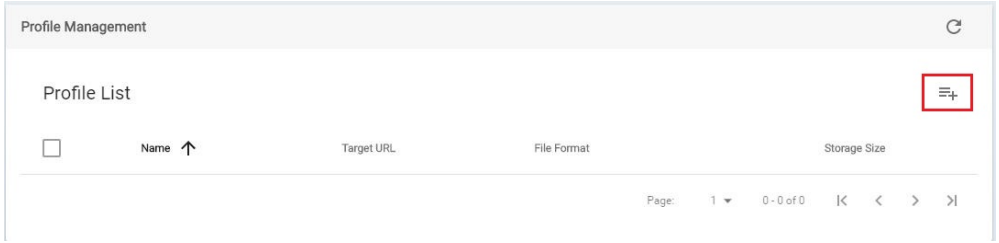
Log profiles are used to configure storage instructions for data files generated by ThingsPro. Once you have created a log profile, you can use it to automatically send data log files to a specified remote server. For example, you can connect a Modbus I/O module to a gateway, pull in data from the field devices and sensors connected to the I/O module, and store the data in the gateway. You can configure a log profile in ThingsPro to specify the remote server to which the data log files should be sent and the interval at which to send them. ThingsPro will send the log files to the remote server at the intervals that you have specified in the log profile.

To configure a log profile, update an existing one, or delete a log profile, click on the **Tag Uploader** link on the main menu.

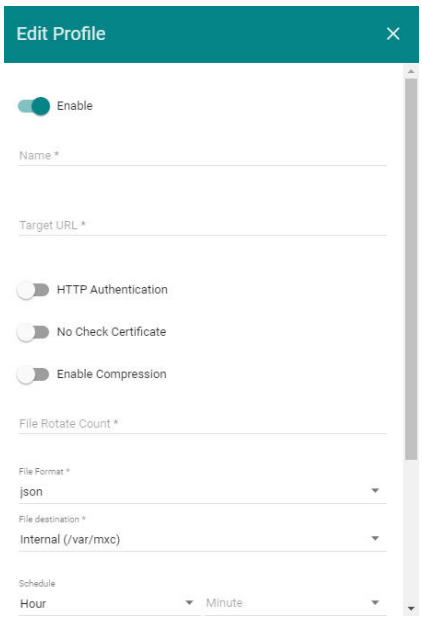


Adding a Data Log Profile

To add a new data log profile, click the add icon.



Edit the profile interface in the following page.



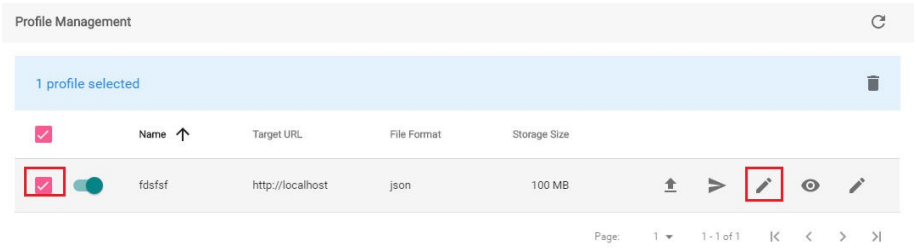
Refer to the following table for the detailed description.

Field	Description
Profile Name	Specify a name for the new log profile. Length: 3-255 characters Format: a-z, A-Z, 0-9, '_', '-'
Target URL	Specify the complete URL of the remote server to which the data log files associated with this profile should be uploaded.
Enable HTTP Basic Authentication	Select this option to enable HTTP basic authentication
No Check Certificate	Select this option to skip the certificate check on the HTTPS connection.
Enable Compression	Enable file compression of the data files.
File Rotate Count	Select file rotation unit. 1 unit is 1 MB. A file with capacity more than 1 MB will be generated as a new file.
File Format	Select a file format: XML, JSON, or CSV NOTE: These formats are not that of the device log file, but are the file formats that you can use to download/upload data from the data logger.
File Destination	Specifies the temporary storage destination when the log profile capacity is exceeded. ThingsPro will detect if there's an external storage device, such as an SD card, inserted. If an external storage is detected then you can specify the log files to be stored in this storage. If not, the log profile files can be saved only in the internal storage, "internal (var/mxc)".
Schedule	Sets an upload schedule for the data log files. For example, daily at a specified time, hourly, or even every minute. A data log file is uploaded only when the data size exceeds 1 MB as described below: 1. When a data log entry is generated, it will be saved in the RAM. 2. When this log increases and exceeds 1 MB, the data is saved as a file to the **File Destination** that you specify. 2. The log files can be retrieved by the minute, hour, or day, based on your configuration settings.
Options: create headers	Provide optional name and value for new headers.

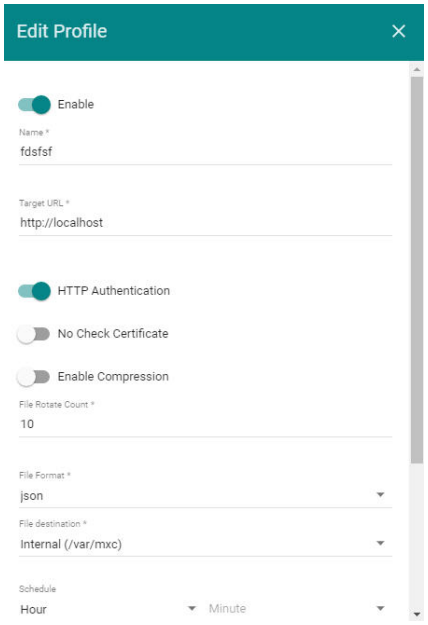
When finished, click **SAVE**.

Updating a Log Profile

To update a log profile, select the device and click edit icon.

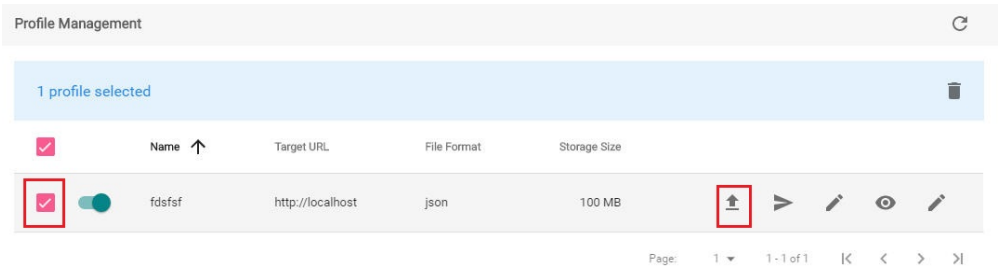


Update the information in the following page. When finished, click **SAVE**.



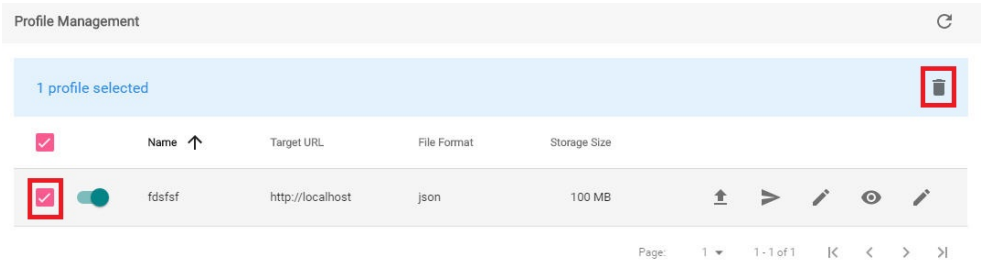
Uploading a Log Profile

To upload a log profile, select the log, and click the upload icon.



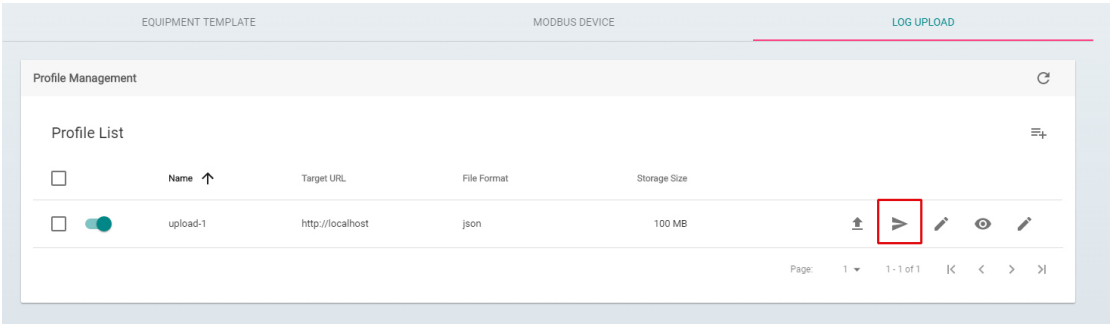
Deleting a Log Profile

To delete a log profile, select the log, and click the delete icon.



Testing Target Connection

Click Test target connect icon to test if the connection to target URL is successful.



Managing IIoT Applications

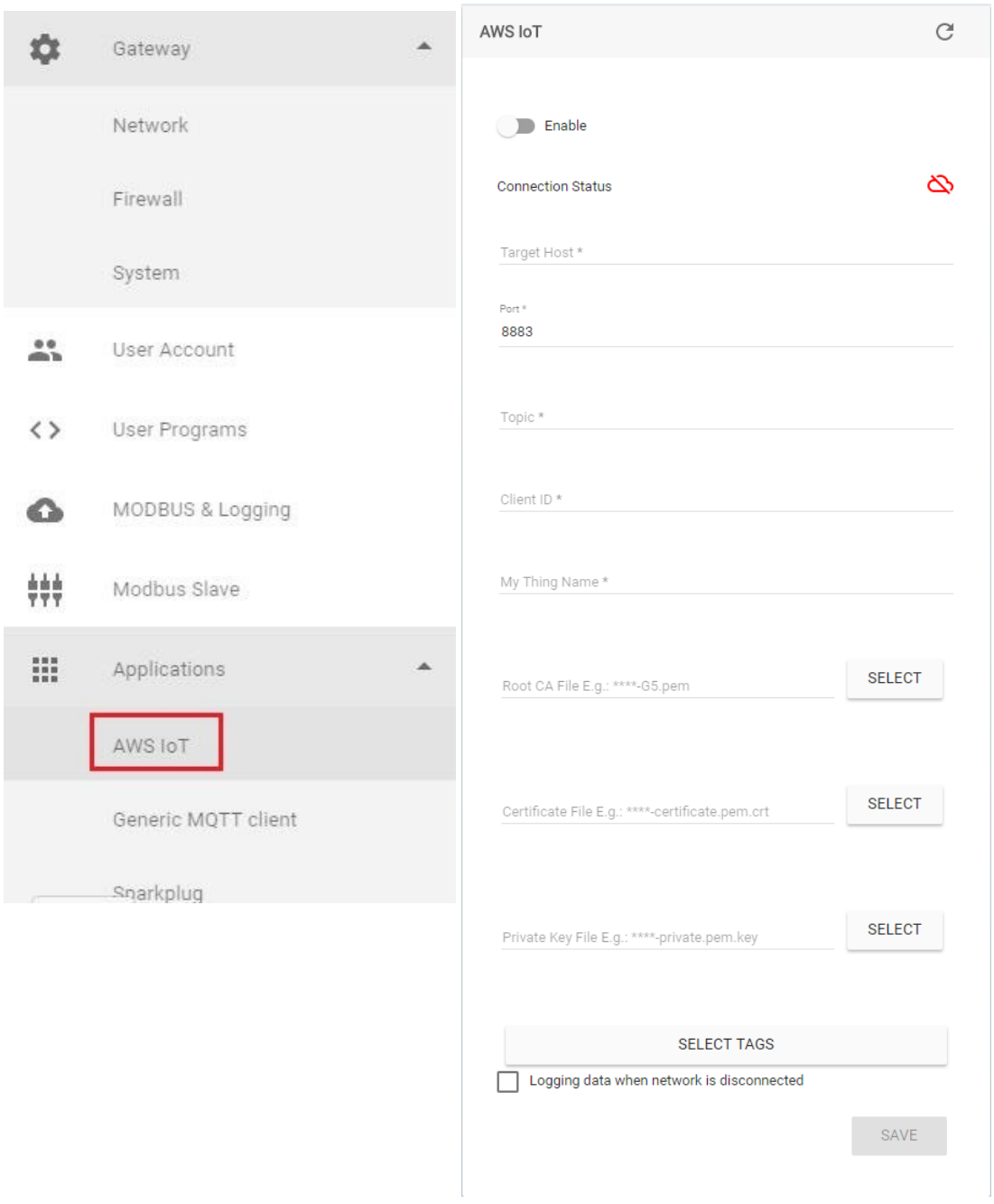
This section describes how to manage the IIoT applications integrated with the ThingsPro Gateway.

NOTE The data transfer speed via the integrated IIoT applications, both to an on-premise database and to cloud application, is highly dependent on your network infrastructure.

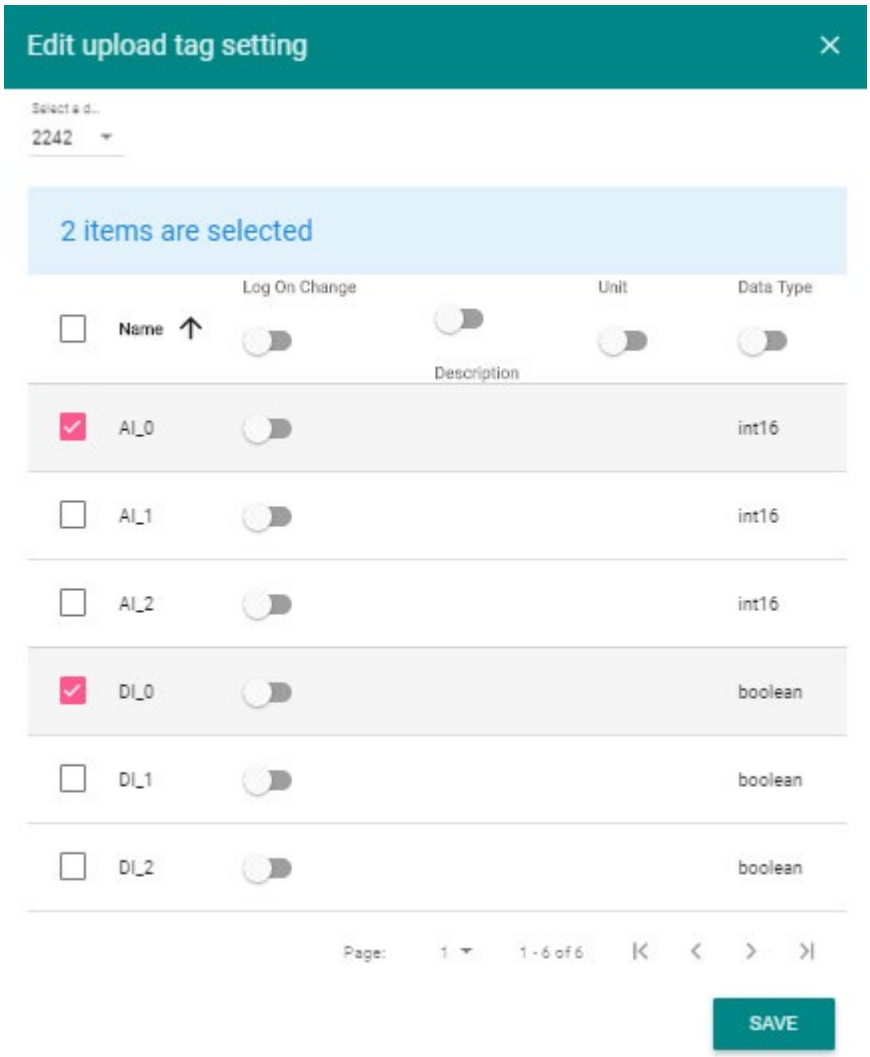
Managing AWS IoT Service for IoT Applications

To manage the AWS IoT Service for your IoT application, select **AWS IoT** from the main menu. Select **Enable** and fill in the AWS IoT service parameters. For details on obtaining the parameters of the AWS IoT service, refer to the *How to get the AWS IoT parameters for ThingsPro* section in the tech note, How to Build an IoT Application with Moxa's ThingsPro and AWS IoT Service.

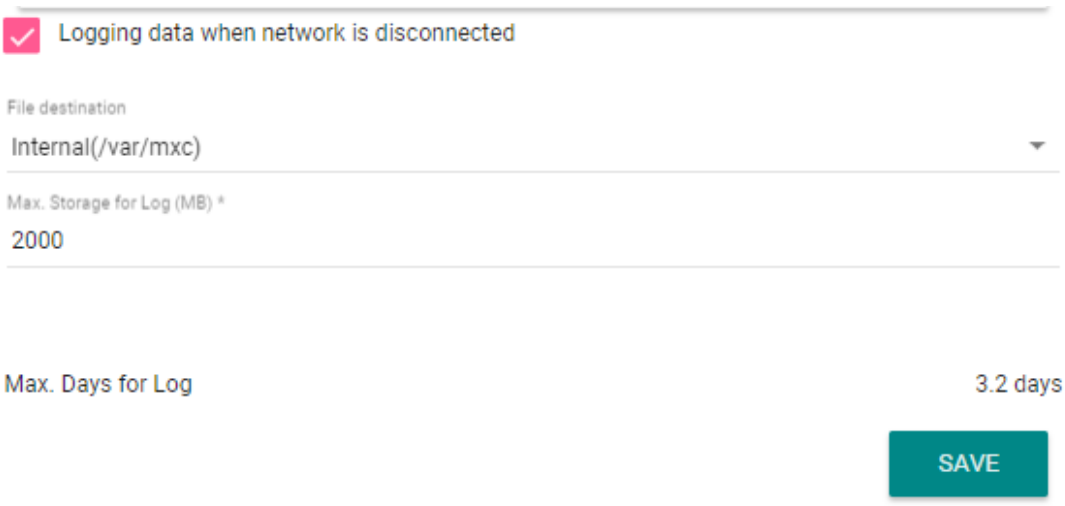
NOTE You will need to register an AWS account on the Amazon Web Services website to be able to managing the AWS IoT service for your IoT application.



Click on the **SELECT TAGS** button (only available in v2.3 and above) to select the tags you want to upload to the AWS IoT service. If you want to enable data caching in the Gateway when the network connection is down, check the **Logging data when network is disconnected** (only available in v2.3 and above) option and specify the **File destination** and the **Max. Storage for Log**.



Click **SAVE.**



The built-in AWS IoT client will use the information provided here to establish a connection with the AWS IoT service. Data collected from your AWS IoT application is then uploaded to the AWS IoT service in real time.

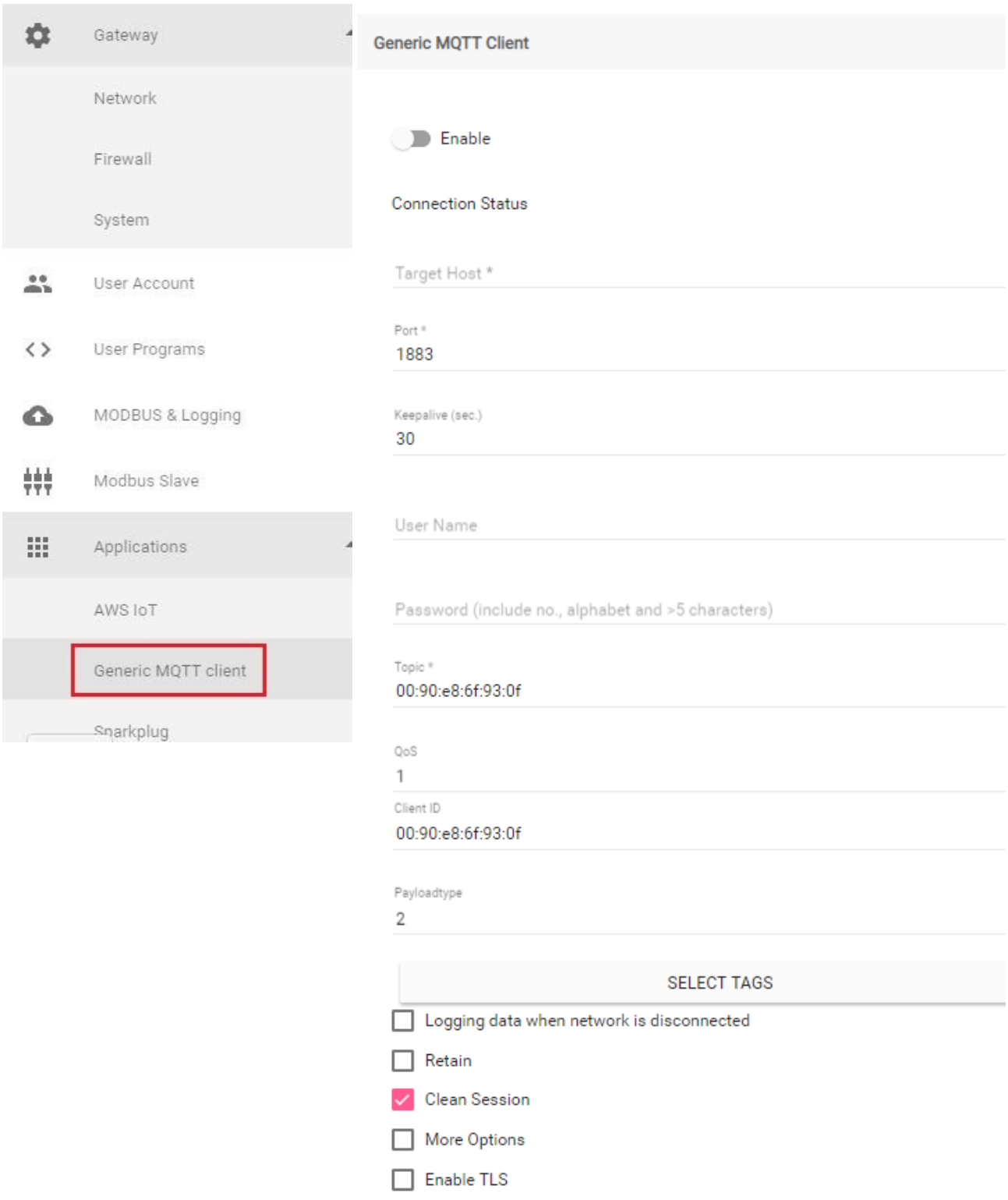
The **Connection Status** (only available in v2.3 and above) icon turns green once the AWS Client App successfully connects to the AWS service.

If you have selected the **Logging data when network is disconnected** option, the data collected from your IoT application will be cached locally in the gateway when the network connection is down. The cached data will be transmitted to the AWS IoT service once the network connection is restored.

NOTE The **SELECT TAGS, Logging data when the network is disconnected,** and **connection status** functions are only available with ThingsPro version v2.3 and above and also apply to other IoT applications such as Generic MQTT Client, Aliyun (Alibaba Cloud), Microsoft Azure, Sparkplug, and Wonderware Online.

Managing a Generic MQTT Client

The ThingsPro Gateway offers generic MQTT protocol support for your IIoT applications. To manage the MQTT Client, select the **Generic MQTT Client** item on the main menu. Select **Enable**. Check **Update on change** if you want to save data transmission workload as data will be updated only when the data tag has been changed from your Modbus devices. Provide all necessary information on the configuration page. Click **SAVE** to finish.

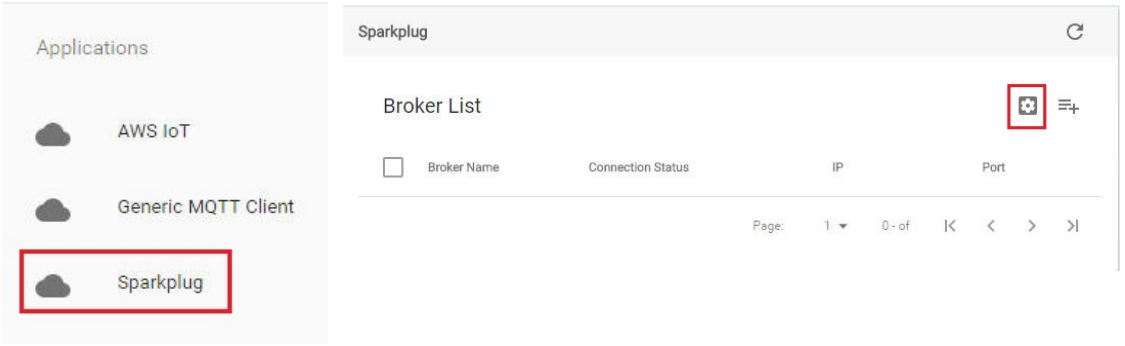

Gateway
Network
Firewall
System
User Account
User Programs
MODBUS & Logging
Modbus Slave
Applications
AWS IoT
Generic MQTT client
Snarkplug
Generic MQTT Client
Enable
Connection Status
Target Host *
Port *
1883
Keepalive (sec.)
30
User Name
Password (include no., alphabet and >5 characters)
Topic *
00:90:e8:6f:93:0f
QoS
1
Client ID
00:90:e8:6f:93:0f
Payloadtype
2
SELECT TAGS
Logging data when network is disconnected
Retain
Clean Session
More Options
Enable TLS

Managing Sparkplug Connections

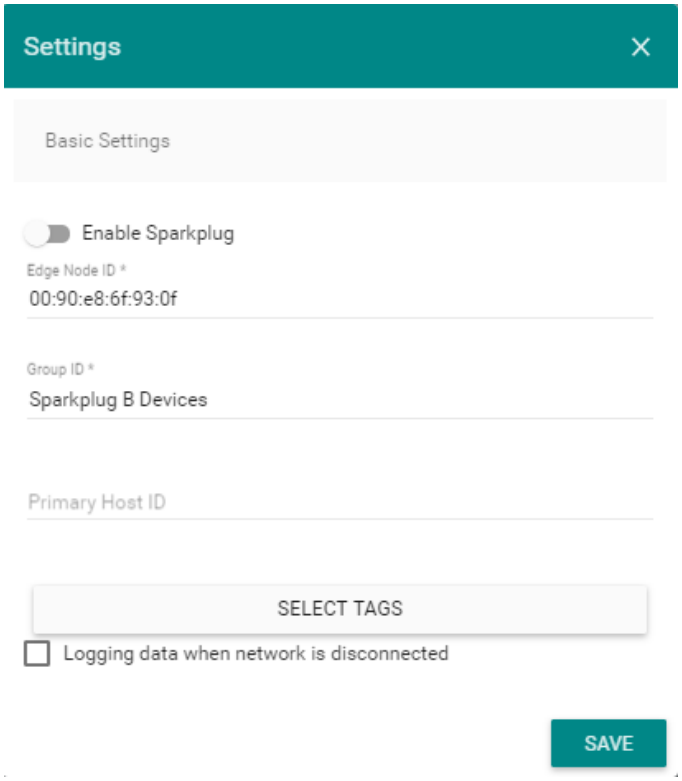
Sparkplug is a specification for MQTT-enabled devices and applications to send and receive messages in a stateful way. Sparkplug also provides a mechanism for ensuring that the messages from remote device or application are current and valid. ThingsPro provides an interface to enable sparkplug-based communication between the Server, Gateway, and edge devices.

To enable the sparkplug interface on ThingsPro, do the following:

1. Click on the **Sparkplug** link in the **Applications** section of the main menu.
2. Click on the (Basic Settings) icon.



3. Click on **Enable Sparkplug** to activate the function.
   The Edge Node ID will be automatically retrieved and displayed.
   You will also need to provide the group ID.

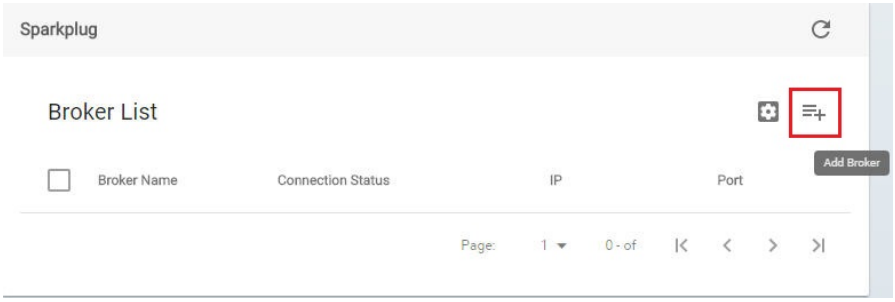


4. Click **SAVE**.

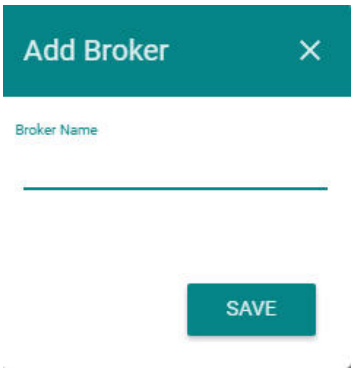
Adding a Message Broker

You must create a message broker in the Sparkplug interface.
To create a message broker, do the following:

1. Click on the (Add Broker) icon.



2. Specify the **Broker Name**.

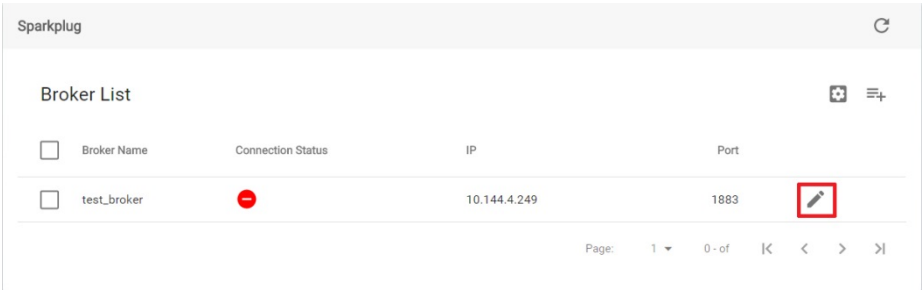


3. Click **SAVE**.

Configuring Broker Settings

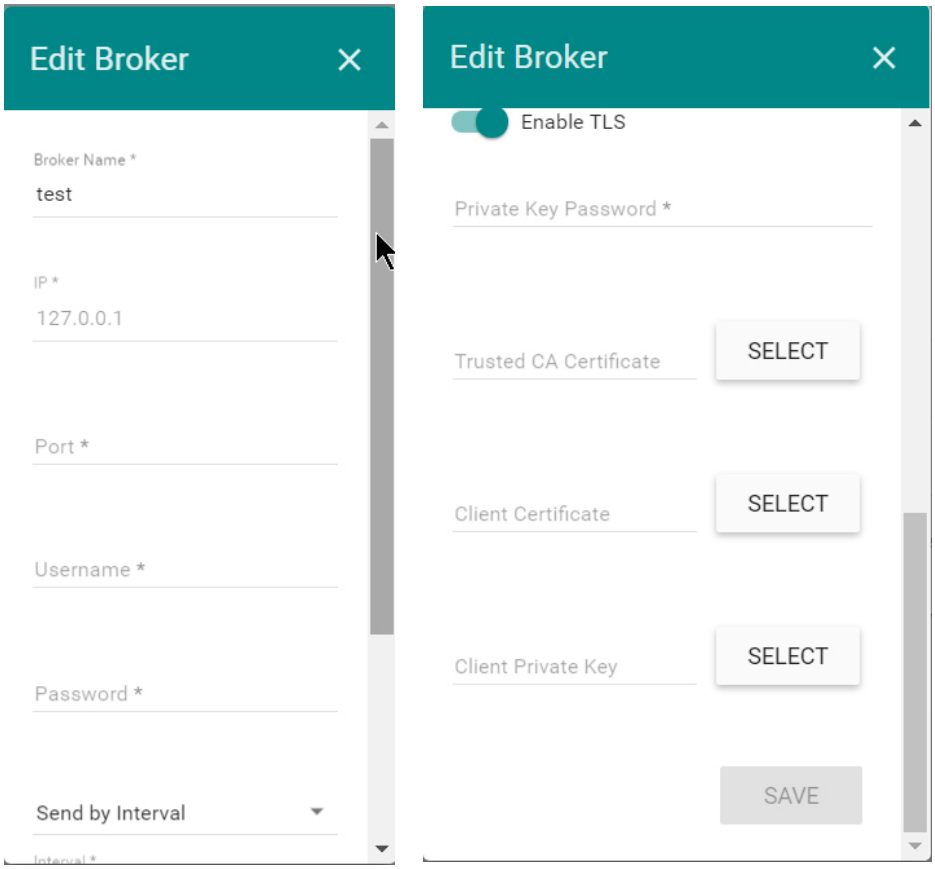
To configure/modify Broker settings, do the following:

1. Click on the (Edit Broker) icon on the Sparkplug configuration page.



2. Enter the broker configuration details.

   If necessary, enable TLS and fill in the certificate information for the TLS connection.



3. Click **SAVE**.

3

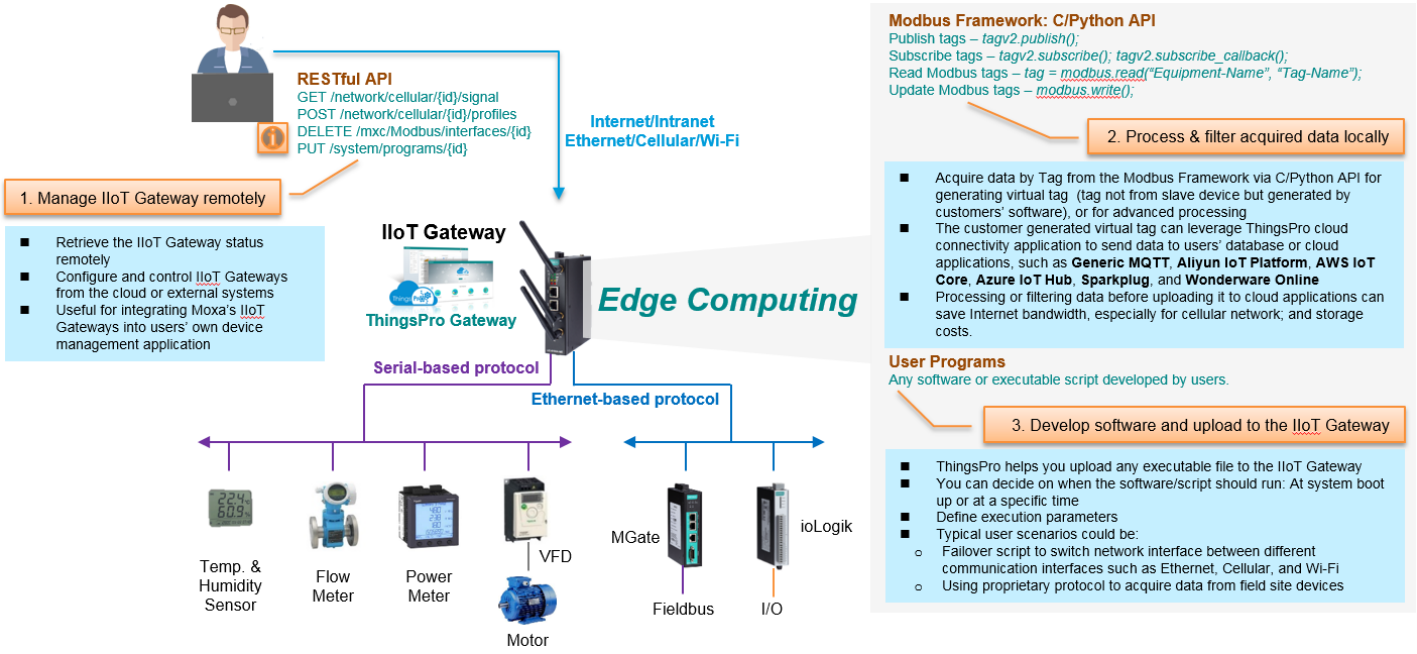
Software Development

The following topics are covered in this chapter:

- **Rapid Development**

Rapid Development

The ThingsPro Gateway software supports programmability for users to develop software that interacts with the software locally or remotely. The concepts and user scenarios are as follows:



① Users need a remote monitoring and control solution so that they can easily manage various end devices and assets at field sites. The IIoT Gateway connects to customers' end devices through different network interfaces by various protocols. ThingsPro Gateway software, installed on the IIoT Gateway, offers RESTful API for users to manage the gateway remotely, including over the cloud.

i) Use the ThingsPro RESTful API to retrieve system status and properties such as signal strength of cellular network.

ii) The RESTful API is quite useful when you need to manage Moxa's IIoT Gateways with your own device management software.

iii) You can control and configure IIoT Gateways from external systems or from your cloud. For example, you can add a new cellular profile for using SIM card 2 slots, delete a Modbus interface, or add a user program on the IIoT Gateway.

② Users can deploy Moxa's UC/MC computer (with ThingsPro Gateway software installed) as an IIoT Gateway at the field site. For customers who would like to program the IIoT Gateway for edge computing capability, Moxa offers C and Python APIs for Modbus data acquisition and to process and filter data at the field site.

i) Process or filter data before sending it to the cloud or a database. For example, you may only upload the average water level each hour when the rain gauge shows it is a sunny day, even though the IIoT Gateway is polling data from water-level sensor every minute. This will save Internet bandwidth for data transmission and cloud storage. A study indicates that over 90% of the data on the cloud could be garbage.

ii) Read or write a Modbus tag for any data type from the connected devices, process the tag to generate a new tag. We call this a virtual tag, which is different from the I/O tag that is generated by slave device directly. This is very useful for scaling your system.

iii) The virtual tag can be used as an I/O tag when you want to use a Northbound application to send data to the cloud. Which means that you can leverage ThingsPro's cloud connectivity when you are not acquiring raw data from the field.

③ Users can run software and scripts on the remote IIoT Gateway. These could be anything from software programs to a shell script.

i) ThingsPro allows you to upload software and scripts via a built-in, easy-to-use web GUI.

ii) You can decide on when the software/script should run.

iii) Define/set the execution parameters for the software/script.

In short, you can use programs and scripts to do almost anything. Some of our customers develop their own data-acquisition program for their proprietary devices. They then use the platform that we provide to upload and manage the data-acquisition software, store the acquired data in virtual tags, and upload data to the cloud.

For details on how to develop programs that integrate with our ThingsPro Gateway software, refer to our programming guide at https://thingspro-programming-guide.netlify.com/.