# ioThinx 4510 Series User's Manual

**Version 5.0, April 2021**

**www.moxa.com/product**

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# ioThinx 4510 Series User's Manual

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# Safety Symbols

**DANGER**

Indicates a high-risk, imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

Indicates a moderate risk, which, if not avoided can cause a potentially hazardous situation.

**CAUTION**

Indicates a low-risk, potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

**NOTE** Indicates a potential malfunction which, if not avoided, will not result in damage to property.

**INFORMATION** This information is important for preventing errors.

# Table of Contents


**1. Preface ..... 1-1**
Revision History ..... 1-2
Relevant Models ..... 1-2
Package Contents ..... 1-2
Usage Scenarios ..... 1-2
Hardware and Software Requirements ..... 1-3
Safety Precautions ..... 1-3
Additional Resources ..... 1-4

**2. Product Overview ..... 2-1**
Technical Data ..... 2-2
Common Specifications ..... 2-2
Appearance ..... 2-3
Front View ..... 2-3
Physical Dimensions ..... 2-3
LED Indicators ..... 2-4

**3. Hardware Installation ..... 3-1**
Wiring System and Field Power ..... 3-2
System Power ..... 3-2
Field Power ..... 3-3
Wiring Ethernet Ports ..... 3-3
Wiring Serial Port(s) ..... 3-4
Grounding the Unit ..... 3-4
Connecting the System Power Ground ..... 3-4
Connecting the Field Power Ground ..... 3-5
Mounting the Unit ..... 3-6
Installing the Unit on a DIN Rail ..... 3-6
Removing the Unit from a DIN Rail ..... 3-7
Installing Covers on the Device and the Right-Most I/O Module ..... 3-8
Removing a Cover from the Right-Most Module ..... 3-8
Horizontal Installation ..... 3-9
Powering on the Unit ..... 3-9

**4. Software Tools ..... 4-1**
Preparing Software Tools ..... 4-2
Connecting Web Console ..... 4-2
Preparing IOxpress Utility ..... 4-2
Preparing Moxa CLI Configuration Tool ..... 4-2
Web Console ..... 4-3
Dashboard ..... 4-4
System ..... 4-7
Security ..... 4-10
Network ..... 4-14
Module ..... 4-15
I/O ..... 4-17
Serial Port ..... 4-27
Internal Register ..... 4-31
Protocol ..... 4-32

**5. Quick Start Guide ..... 5-1**
Configuring the Unit ..... 5-2
Login to the Unit ..... 5-2
Configuring Module Settings ..... 5-2
Changing Device Name ..... 5-4
Changing Username & Password ..... 5-4
Configuring Service Settings ..... 5-5
Configuring Account Settings ..... 5-5
Configuring Network Settings ..... 5-6
Configuring Serial Port & IR Settings ..... 5-6
Configuring I/O Settings ..... 5-7
Configuring Modbus Address Settings ..... 5-7
Configuring SNMP Settings ..... 5-8
Configuring MQTT Settings ..... 5-8
Mass-deploying the Settings ..... 5-9
Updating Configuration to Multiple Units ..... 5-12
Setting Date and Time to Multiple Units ..... 5-13
Changing IP Addresses to Multiple Devices ..... 5-14
Changing the Device Name of Multiple Devices ..... 5-14
Retrieving the System Log from Multiple Devices ..... 5-15
Getting a Self-signed Certificate from Multiple Devices ..... 5-16

Monitoring & Operating the Unit ..... 5-16
Monitoring Module & I/O Status ..... 5-17
Monitoring Connection Status ..... 5-17
Exiting Safe Mode Status ..... 5-18
Maintaining the Unit ..... 5-18
Backing up Configuration Files ..... 5-18
Updating the Firmware ..... 5-19
Restarting the Unit ..... 5-20
Loading Factory Default Settings ..... 5-20

**6. Tutorials ..... 6-1**

How to Use Modbus TCP to Connect to the ioThinx 4510 Series ..... 6-2
Using Modbus TCP via Modbus Poll ..... 6-2
How to Use RESTful API to Connect to the ioThinx 4510 Series ..... 6-7
Using RESTful API via Postman ..... 6-7
Send a GET request and a PUT request ..... 6-9
How to Use MQTT to Connect to the ioThinx 4510 Series ..... 6-11
Broker Settings on the Computer ..... 6-11
Set Up MQTT on the ioThinx 4510 ..... 6-11
Publisher and Subscriber Settings ..... 6-14
How to Connect ioThinx 4510 to an MQTT Broker over TLS ..... 6-16
Broker Settings on the Computer ..... 6-16
Client (publisher) setting ..... 6-20
Client (subscriber) setting ..... 6-20

**A. Appendix ..... A-1**

Network Port Usage ..... A-2
Modbus/TCP Slave Rules ..... A-2
Supported Function Code ..... A-2
Exception Code ..... A-2
System Registers ..... A-2
45MR-1600 (-T), 16 DIs Registers ..... A-3
45MR-1601 (-T), 16 DIs Registers ..... A-4
45MR-2404 (-T), 4 Relays Registers ..... A-4
45MR-2600 (-T), 16 DOs Registers ..... A-5
45MR-2601 (-T), 16 DOs Registers ..... A-5
45MR-2606 (-T), 8 DIs, 8 DOs Registers ..... A-6
45MR-3800 (-T), 8 AIs Registers ..... A-7
45MR-3810 (-T), 8 AIs Registers ..... A-7
45MR-4420 (-T), 4 AOs Registers ..... A-8
45MR-6600 (-T), 6 RTDs Registers ..... A-8
45MR-6810 (-T), 8 TCs Registers ..... A-9
45MR-7210(-T), System and Field Power Input Registers ..... A-9
SNMP Rules ..... A-9
RESTful API Rules ..... A-10
Supported Request Method ..... A-10
GET Request Components ..... A-10
PUT Request Components ..... A-10
RESTful API List ..... A-10
Exception Code ..... A-12
MQTT Rules ..... A-13
Publish Topic ..... A-13
Subscribe Topic ..... A-16
Troubleshooting ..... A-17
Forgot username & password ..... A-17
Forgot IP address of the unit ..... A-17
Failed to update firmware ..... A-18
Failed to update configuration ..... A-19
Failed to access the unit through IP address & IOxpress ..... A-19
Failed to enter System Ready Mode ..... A-19
Import Self-Signed Certificate ..... A-20
Return Value of a System Error ..... A-24

# 1

# Preface

In this chapter, we explain the scope of and how to use this document.

The following topics are covered in this chapter:

- **Revision History**
- **Relevant Models**
- **Package Contents**
- **Usage Scenarios**
- **Hardware and Software Requirements**
- **Safety Precautions**
- **Additional Resources**

# Revision History

| Version | Change | Date |
|---|---|---|
| v1.0 | First Release | 2018-11-12 |
| v2.0 | 1. Added 45MR-7210<br>2. Added MQTT<br>3. Added HTTPS<br>4. Added more mass deploy functions in IOxpress | 2019-05-10 |
| v2.1 | 1. Added power calculation links | 2019-08-22 |
| v3.0 | 1. Added 45MR-4420<br>2. Added SNMP Trap and Inform | 2019-09-11 |
| v4.0 | 1. Added SP/FP description<br>2. Added Modbus TCP, RESTful , MQTT tutorial | 2020-02-10 |
| V5.0 | 1. Modify description of HTTPS<br>2. Add LLDP<br>3. Add system error code<br>4. Modify profile information of Modbus RTU<br>5. Update content of Access IP<br>6. Update content of the RESTful API rule | 2021-02-25 |

# Relevant Models

This document is only applicable to the models listed below.

| Model Name | Description |
|---|---|
| ioThinx 4510 | Advanced I/O, Ethernet network adapter, 3-in-1 serial port(s), -20 to 60°C operating temperature |
| ioThinx 4510-T | Advanced I/O, Ethernet network adapter, 3-in-1 serial port(s), -40 to 75°C operating temperature |

# Package Contents

The following items are included in the product package.

- The ioThinx 4510 device
- Quick installation guide (Printed)
- Warranty card

# Usage Scenarios

The ioThinx 4510 Series can be used for the following applications:

1. PLC I/O expansion

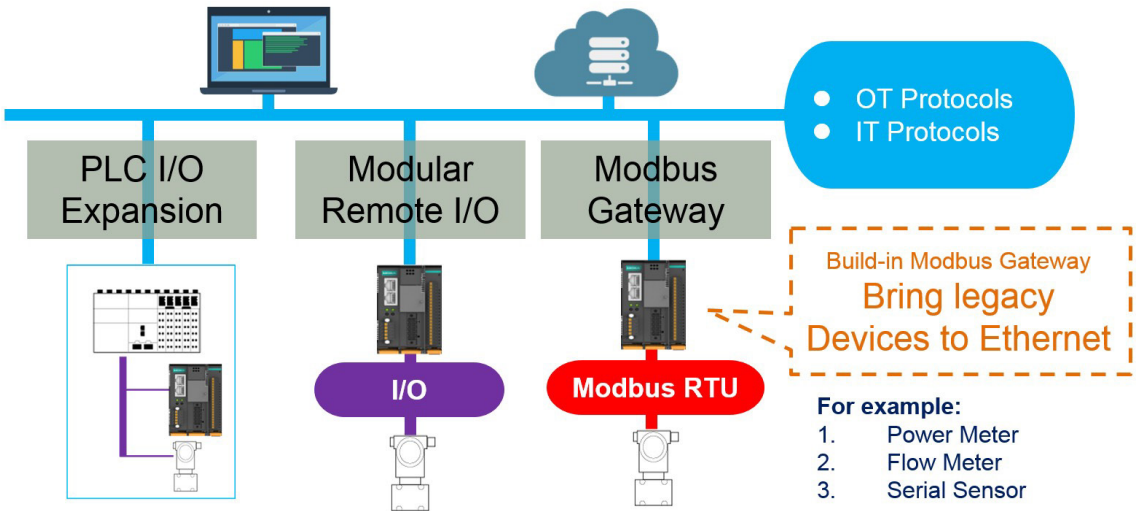
   The ioThinx 4510 Series can be used to expand the number of I/O points on a PLC.

2. Remote I/O

   The ioThinx 4510 Series can be accessed by master software, such as SCADA software, using IT or OT protocols to collect I/O data.

3. Modbus Gateway

   The ioThinx 4510 Series has one or more serial ports to connect serial devices. It collects serial data using a Modbus RTU master protocol, which can be accessed by a PLC or master software with IT or OT protocols.




# Hardware and Software Requirements

You will need the following hardware and software to use the ioThinx 4510 Series.

- A power source that provides 12 to 48 VDC, and power wires
- A PC running a Windows OS with Chrome installed and an Ethernet cable
- 45MR modules, if available
- IOxpress software utility (optional)
- Moxa CLI Configuration Tool (optional)

# Safety Precautions

Please observe the following safety precautions when installing and using the ioThinx 4510 Series:

**DANGER**

Never work on the device while the power source is switched on. Disconnect all power sources to the device before performing installation, repair, or maintenance work.

**DANGER**

Disconnect the power when you want to remove or replace components, or disconnect equipment unless the area is known to be free of ignitable substances.

- If you connect or disconnect the Removable Terminal Block when field power is applied, an electrical arc can occur. This could cause an explosion when installed in hazardous locations. Ensure that power is removed or the area is nonhazardous before installation.
- If you connect or disconnect wiring while the power is on, an electrical arc can occur. This could cause an explosion in hazardous environments. Ensure that power is removed or the area is nonhazardous before installation.
- Do not disconnect the unit unless the power has been disconnected or the area is known to be nonhazardous. In a hazardous area, the unit must be powered down before removing it.

**WARNING**

This unit is sensitive to Electrostatic Discharge, which can cause internal damage and affect operations. Follow these guidelines when you handle this unit:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wristband.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the device in appropriate static-safe packaging when not in use.

**WARNING**

Check the voltage supplied by the power source. Make sure the voltage provided by the power source matches the voltage required by the device.

**WARNING**

Check the voltage or current of the sensors or loads. Make sure the voltage and/or current indicated on the sensors or loads corresponds to the specifications of your 45M module before you connect the device.

**WARNING**

Connect your device to an earthed ground.

**CAUTION**

Do not use the device if the device is already damaged. Replace defective or damaged devices to ensure that your devices function properly.

**CAUTION**

Do not attempt to repair the device yourself. If your device needs to be repaired, return the device to Moxa's customer service department. Attempting to repair the device yourself could invalidate the device's warranty.

# Additional Resources

Refer to the following documents for additional information.

- Datasheets for the following products:
  - ioThinx 4510 Series
  - ioThinx 4500 Series (45MR) Modules
- User's Manual for the following products:
  - ioThinx 4500 (45M) Module Series
  - Moxa CLI Configuration Tool

# 2

# Product Overview

In this chapter, we give an overview of each ioThinx 4510 Series device.

The following topics are covered in this chapter:

- **Technical Data**
  - Common Specifications
- **Appearance**
  - Front View
  - Physical Dimensions
- **LED Indicators**

# Technical Data

## Common Specifications

### Input/Output Interface

**Expansion Slots:** Up to 32

Note: Compatible with the ioThinx 4500 Series (45MR) Modules only

### Ethernet Interface

**10/100BaseT(X) Ports (RJ45 connector):** 2, 1 MAC address (Ethernet bypass)

### Ethernet Software Features

**Industrial Protocols:**

Modbus TCP Server (Slave)

RESTful API

SNMPv1/v2c/v3

SNMPv1/v2c/v3 Trap

SNMPv2c/v3 Inform

MQTT

### Serial Interface

**Connector:** Spring-type Euroblock terminal

**No. of Ports:** 1 x RS-232/422 or 2 x RS-485 (2 wire)

### Serial Software Features

**Industrial Protocols:** Modbus RTU Client (Master)

### System Power Parameters

**Connector:** Spring-type Euroblock terminal

**Input Voltage:** 12 to 48 VDC

### Field Power Parameters

**Connector:** Spring-type Euroblock terminal

**Input Voltage:** 12/24 VDC

### Physical Characteristics

**Dimensions:** 42.3 x 99 x 75 mm (1.67 x 3.9 x 2.95 in)

**Installation:** DIN-rail mounting

**Wiring:**

Serial cable, 16 to 28 AWG

Power cable, 12 to 26 AWG

### Environmental Limits

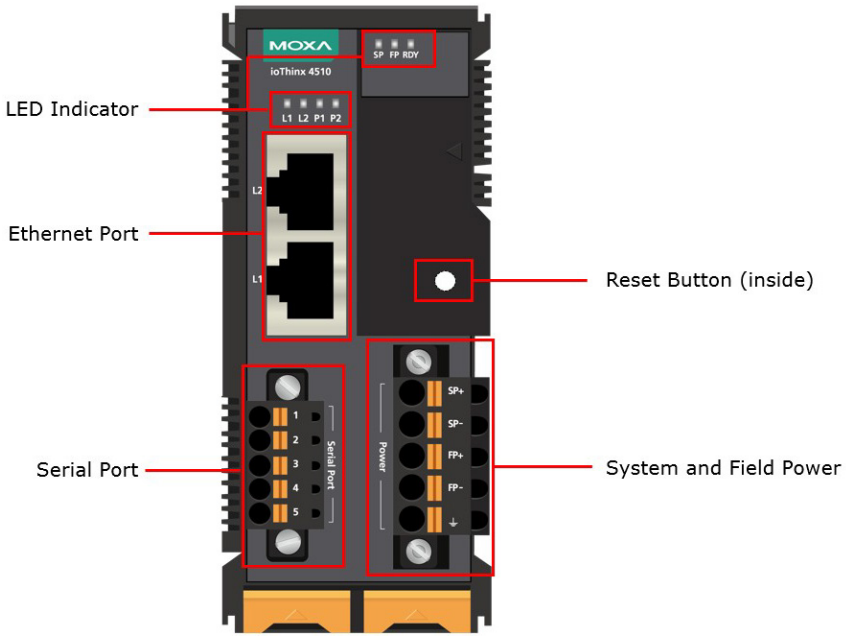
**Operating Temperature:**

ioThinx 4510: -20 to 60°C (-4 to 140°F)

ioThinx 4510-T: -40 to 75°C (-40 to 167°F)

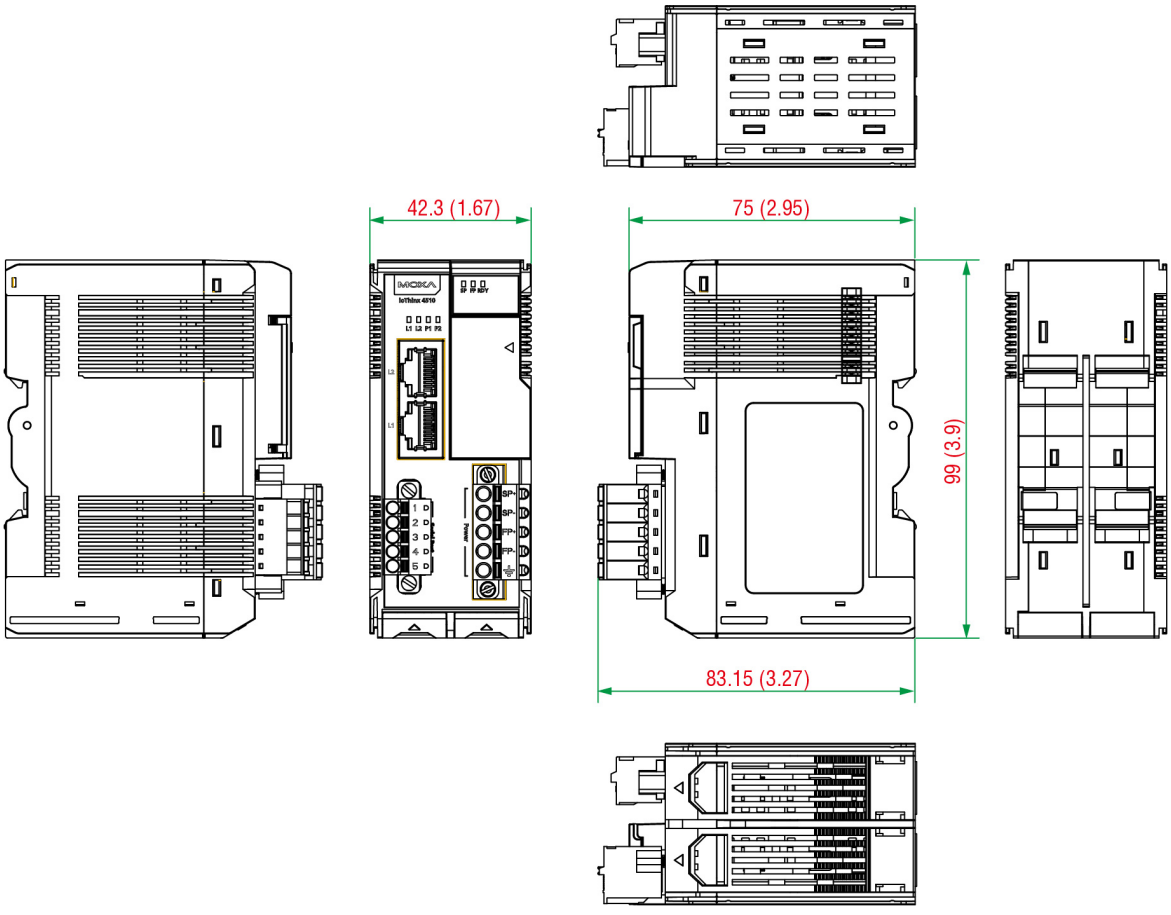
# Appearance

## Front View

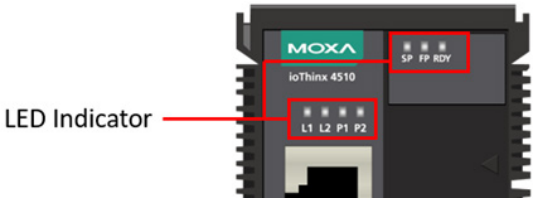



## Physical Dimensions

Unit: mm (in)



# LED Indicators




| Labeling | Indication | LED Qty | LED Color | LED Action |
|---|---|---|---|---|
| SP | System Power | 1 | Green | On: power on<br>Off: power off |
| FP | Field Power | 1 | Green | On: power on<br>Off: power off |
| RDY | System (Kernel) | 1 | Green/Red | Green: system ready<br>Green slow blinking: booting up<br>Red: system error or module mismatch<br>Red slow blinking: loading factory default settings, upgrading firmware, or system recovery<br>Red fast blinking: safe mode<br>Off: power off |
| L1/L2 | Ethernet | 1 for each | Green/Amber | Green: 100 Mbps<br>Amber: 10 Mbps<br>Blinking: data transmitting<br>Off: disconnected |
| P1/P2 | Serial | 1 for each | Green/Amber | Green: Tx<br>Amber: Rx<br>Non-simultaneous blinking: data transmitting<br>Off: disconnected or no data transmitting |

**NOTE** DO NOT DISCONNECT THE POWER OR NETWORK CABLE when the RDY LED is blinking slowly.

**INFORMATION** Refer to **Failed to Enter System Ready Mode** in the troubleshooting section for addition information about the system recovery process.

# 3

# Hardware Installation

In this chapter, we describe how to install the ioThinx 4510 Series devices.

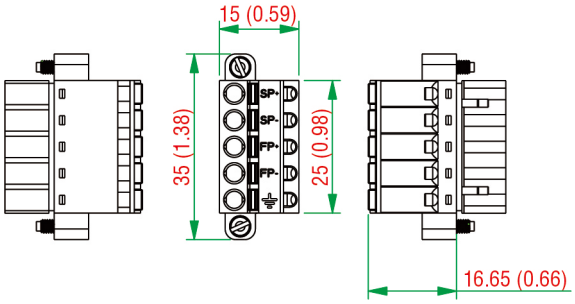
The following topics are covered in this chapter:

- **Wiring System and Field Power**
  - System Power
  - Field Power
- **Wiring Ethernet Ports**
- **Wiring Serial Port(s)**
- **Grounding the Unit**
  - Connecting the System Power Ground
  - Connecting the Field Power Ground
- **Mounting the Unit**
  - Installing the Unit on a DIN Rail
  - Removing the Unit from a DIN Rail
  - Installing Covers on the Device and the Right-Most I/O Module
  - Removing a Cover from the Right-Most Module
  - Horizontal Installation
- **Powering on the Unit**

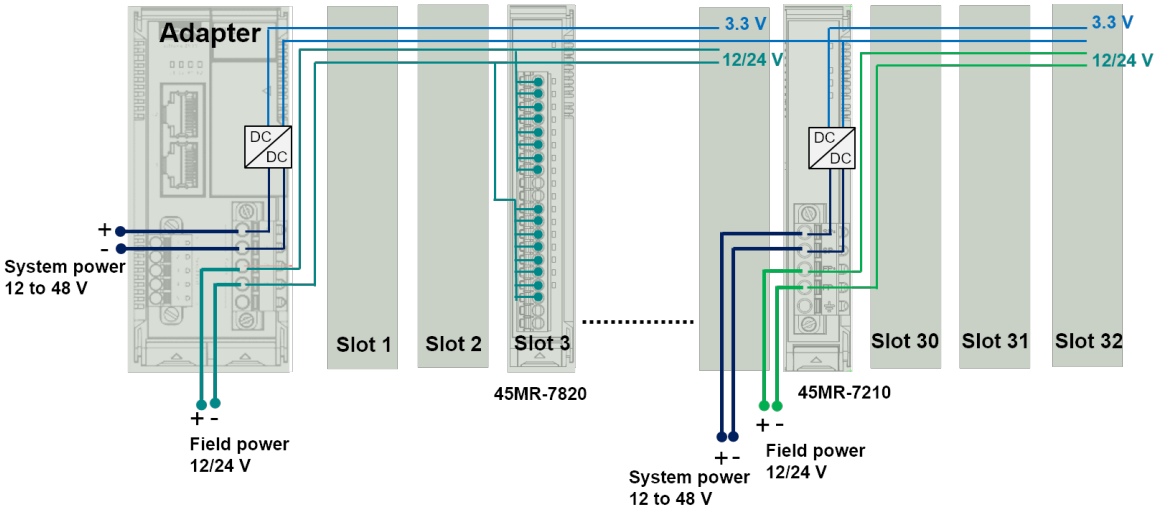
# Wiring System and Field Power

Wire range: 12 to 26 AWG (Ferrule diameter: 2.0 to 0.4 mm)
Wire strip length: 10 mm

Unit: mm (in.)



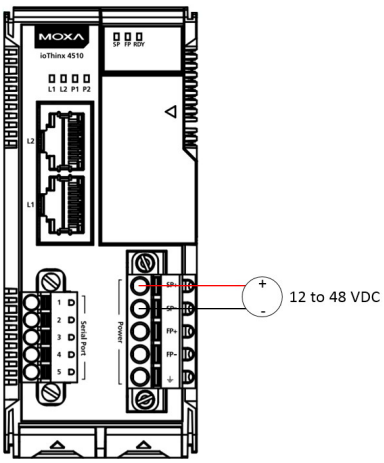

The device requires two sets of power inputs. One is for the system (internal logic circuit), and the other is for field I/O circuits.




**NOTE** All I/O points have 3 kV VDC or 2 kVrms isolation with the system. We recommended using different power supplies to ensure that the system power and field power are isolated from each other.

## System Power

This device requires a 12 to 48 VDC system power input. The system power powers this device and the expansion modules via an internal bus, which is galvanically connected to the system power supply.




The amount of system current required to support an expansion module is 1 A. If more modules and more power consumption is needed, an additional power module (45MR-7210) is required. Below is an example:

- 10 x 45MR-1600 (59.4 mA) = 594 mA
- 5 x 45MR-3810 (187 mA) = 935 mA

The total system current is 1.594 A, which is greater than 1 A. Therefore, an additional 45MR-7210 is needed.

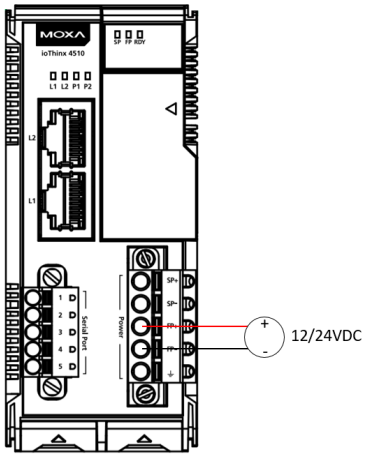
**NOTE** Install the 45MR-7210 to the left hand side of the module where the power consumption would be exceeded.

**NOTE** To avoid damaging your devices, reset all power supplies connected to this device and 45MR-7210 modules at the same time.

**NOTE** Click the following link to see how many 45MR-7210 power modules you will need to support your ioThinx 4500 series application: http://iothinxcalculator.moxa.com

## Field Power

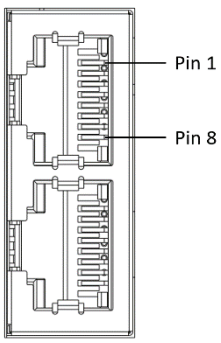
This device provides a field power input of 12/24 VDC that passes directly through the expansion modules and provides a maximum current output of 2 A.




**NOTE** The 12/24 VDC field power supply can be connected directly to 45MR modules. If more connection points are needed, purchase 45MR-7820 (8 x FP+ and 8 x FP-) modules.

# Wiring Ethernet Ports

The maximum cable length of a 10/100BaseT connection is usually stated as 100 m (350 feet), but the actual limit for your application could be longer or shorter depending on the amount of electrical noise in the environment. To minimize the amount of noise, Ethernet cables should not run parallel to power cables or other types of cables that generate electrical noise. The following diagram and table shows the pin assignments for the RJ45 Ethernet ports:



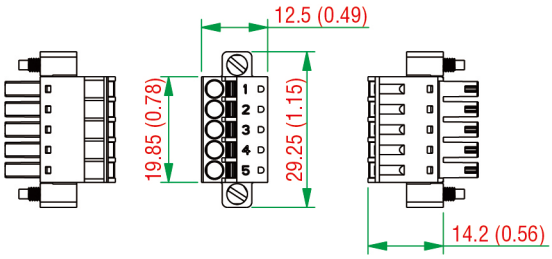

| Pin | Media Direct Interface Signal |
|---|---|
| 1 | Tx+ (transmit) |
| 2 | Tx- (transmit) |
| 3 | Rx+ (receive) |
| 4 | Not used |
| 5 | Not used |
| 6 | Rx- (receive) |
| 7 | Not used |
| 8 | Not used |

# Wiring Serial Port(s)

Wire range: 16 to 28 AWG (Ferrule diameter: 1.2 to 0.3 mm)

Wire strip length: 9.0 mm

Unit: mm (in.)




| Pin | RS-232 | RS-422 | RS-485 (P1/P2) |
|---|---|---|---|
| 1 | TXD | TXD+ | DATA1+ |
| 2 | RXD | TXD- | DATA1- |
| 3 | RTS | RXD+ | DATA2+ |
| 4 | CTS | RXD- | DATA2- |
| 5 | GND | GND | GND |

**NOTE** Connect the signal common pin (e.g. GND pin on the serial port pin assignment) between each of the serial device units. For insulated wire (shielding cable) that is used to reduce electrical noise, connect the cable shield drain wire to the chassis ground.

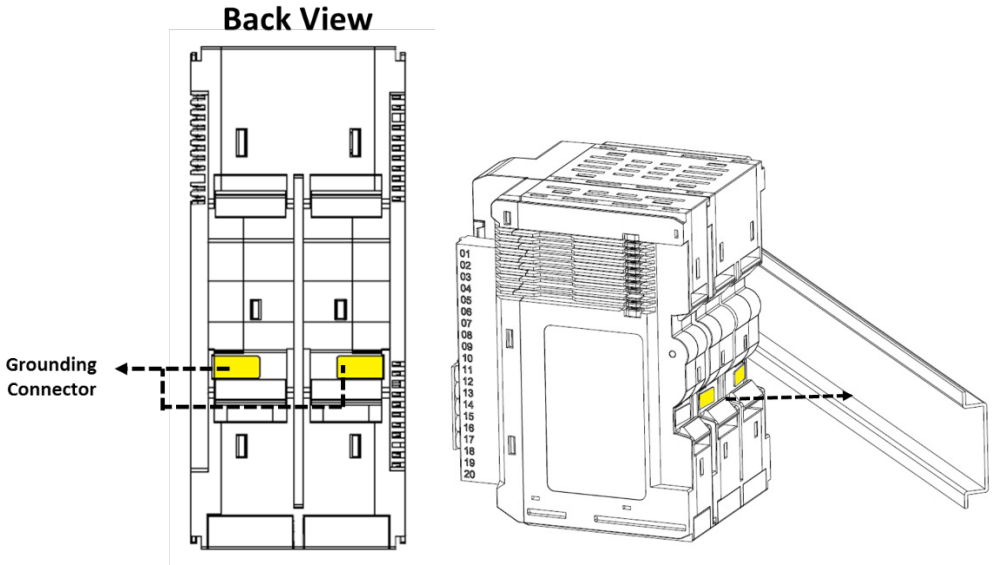
**NOTE** To ensure that wires are securely connected to terminal block connectors, strip 7 to 9 mm of insulation off the ends of the wires before connecting them to the terminal block.

# Grounding the Unit

This device has two ground pins. One pin is for system power and the other pin is for field power.

## Connecting the System Power Ground

The system power ground connector is at the back of the unit. Once the device has been installed on a DIN rail, the system power ground connector will connect to the DIN rail.

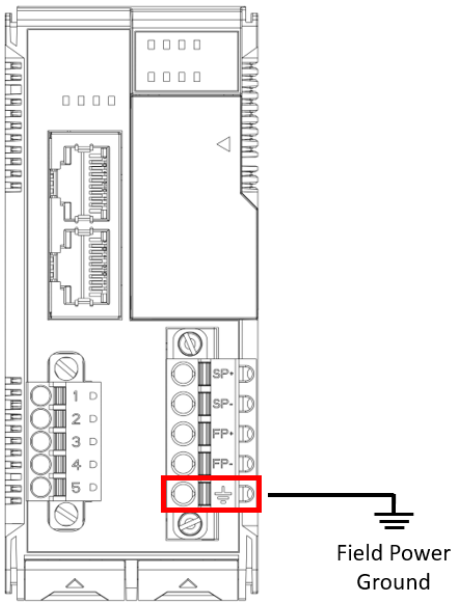


**CAUTION**

For surge protection, connect the DIN rail to earth ground.

# Connecting the Field Power Ground

Connect the field power ground pin (⏚) to your field power ground.




**CAUTION**

Be sure to note the maximum possible current for each power wire and common wire. Observe all electrical codes dictating the maximum current allowable for each wire size. If currents exceed the maximum rating, the wires will overheat, which could cause serious damage to your equipment. For safety reasons, we recommend using 2 mm diameter wire to connect to the power supply (e.g., 12 AWG).

# Mounting the Unit

In this section, we describe how to mount the device on a DIN rail and how to unmount the device from a DIN rail.

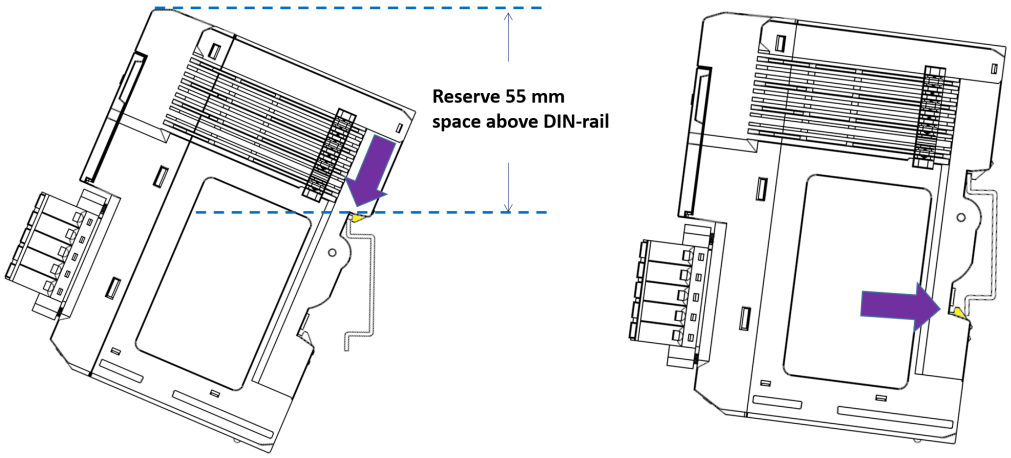
**DANGER**

Never install the device while the power source is switched on.

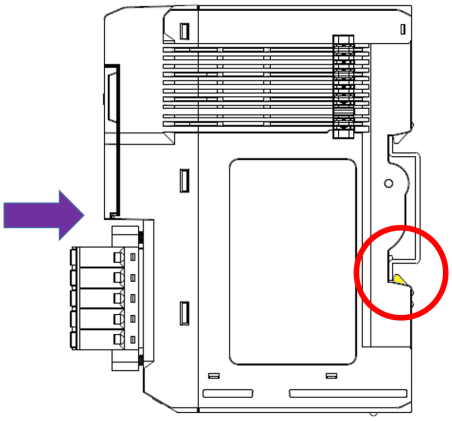
## Installing the Unit on a DIN Rail

Take the following steps to install the unit on a DIN rail.

**Step 1:** Hook the mounting clip of the unit onto the DIN rail, and then lower the clip onto the DIN rail. At least 55 mm of space above the DIN rail should be kept free to ensure that the installation can be done correctly.




**Step 2:** Push the unit towards the DIN rail until the end of the mounting clip snaps into place.

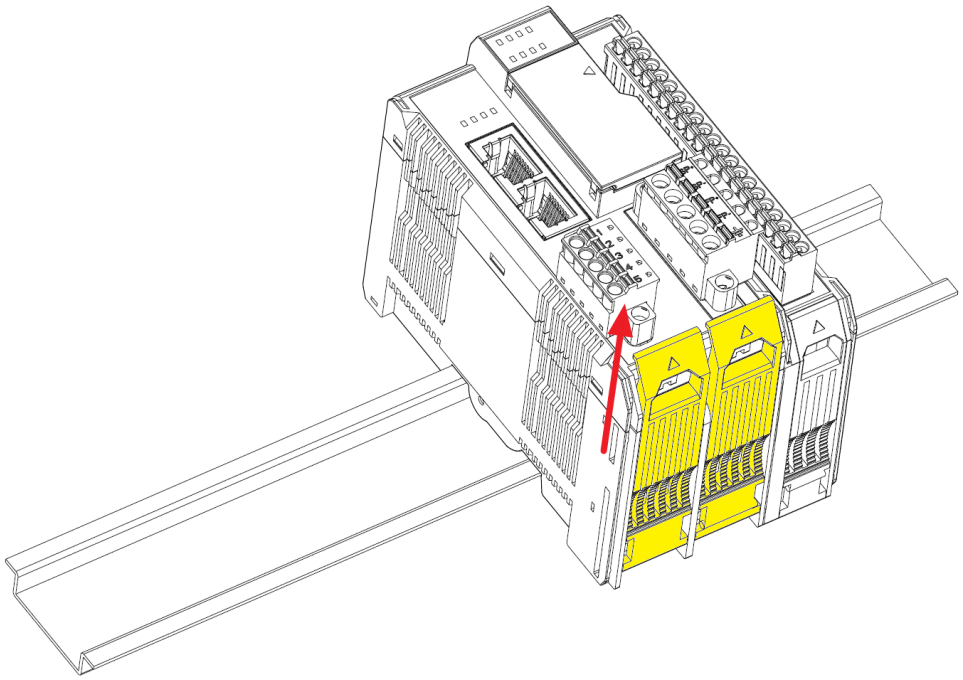


**INFORMATION** When the I/O module is inserted into the correct position, the connection between the internal bus and the previous module is established.

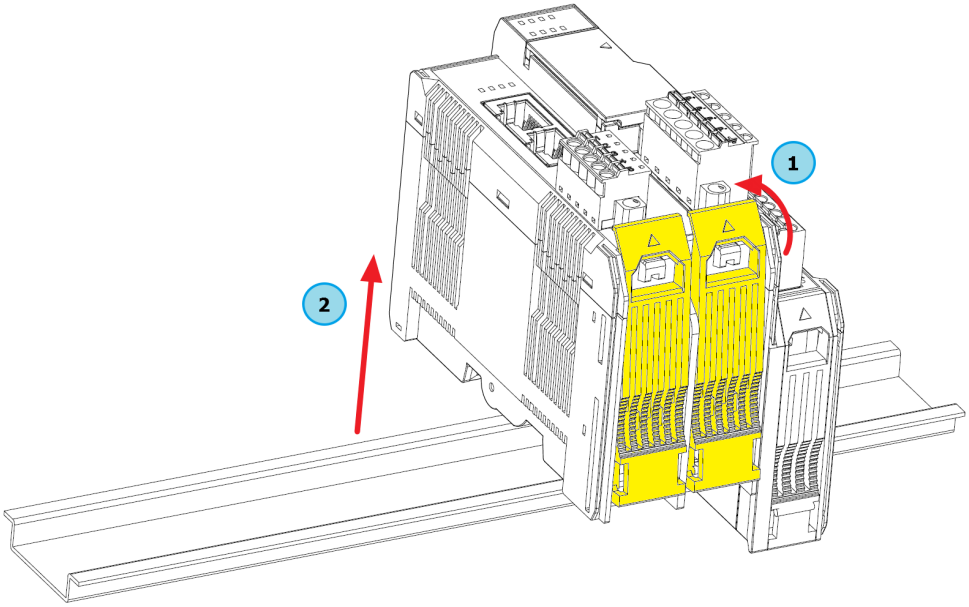
# Removing the Unit from a DIN Rail

Take the following steps to remove the unit from a DIN rail.

**Step 1:** Use your finger to pull the release tab on the lower part of the module.



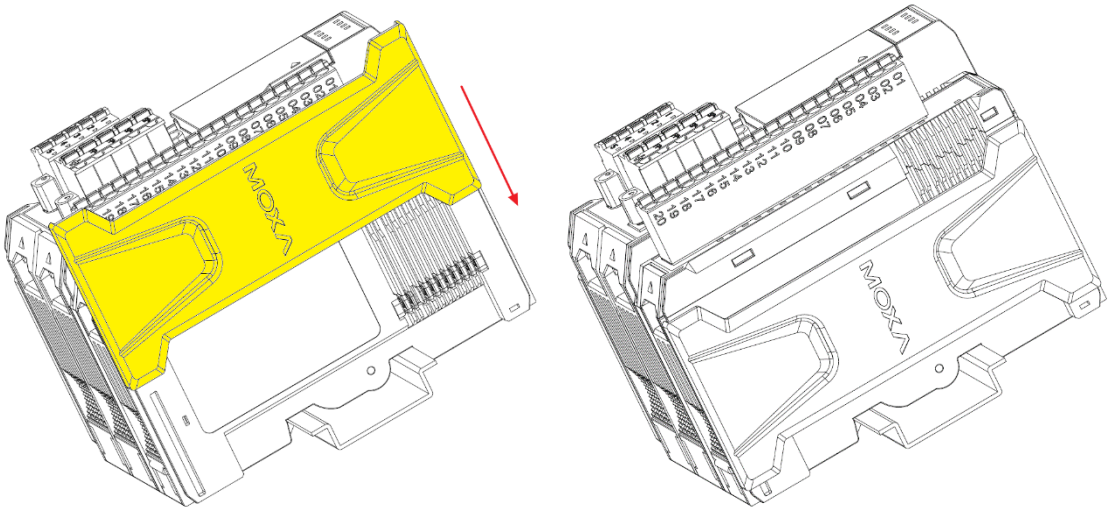
**Step 2:** Press the release tab (item 1 in the figure) and then remove the CPU module from the DIN rail (item 2 in the figure).




**NOTE** Disconnect all connections, including Ethernet, serial, and power cables, from the device before removing the device from the DIN rail.

# Installing Covers on the Device and the Right-Most I/O Module

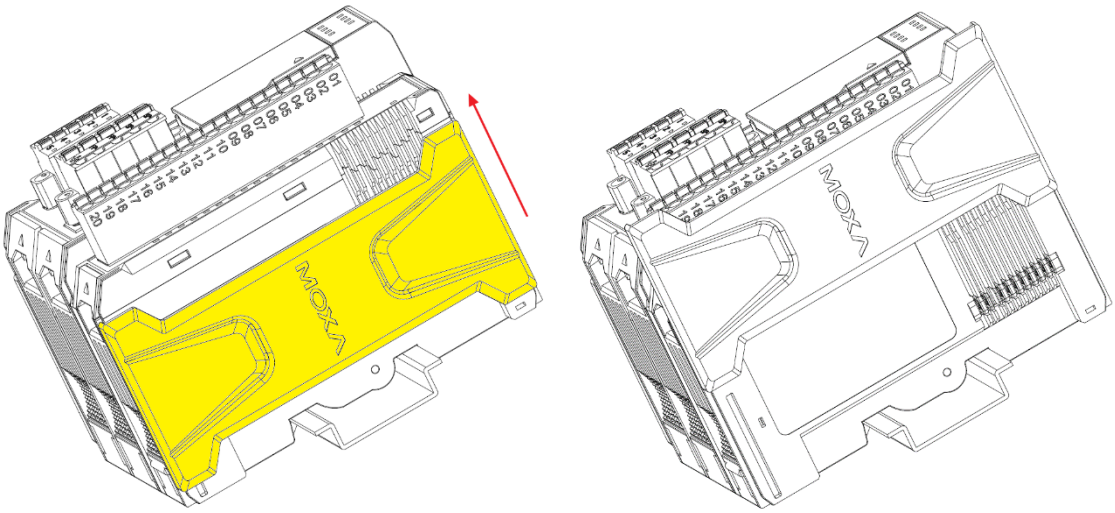
Insert the covers on the left side of the device and on the right side of the I/O module that is installed furthest to the right. Make sure the covers cover the internal bus of the module.




**NOTE** The covers provide protection against electrostatic discharge.

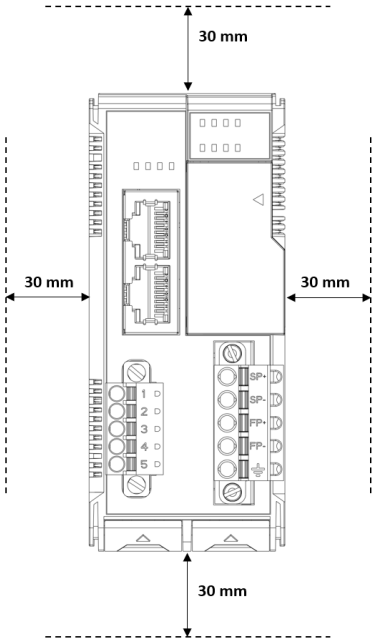
# Removing a Cover from the Right-Most Module

Before adding a new module to the right-most module, remove the cover first. Place your hand on the cover and slide it up as indicated in the diagram below.



## Horizontal Installation

Before installing the device, ensure there is enough space around the device so that it can dissipate heat. In order to ensure the device works properly, we suggest reserving the space shown in the figure below.




**CAUTION**

DO NOT install the device vertically, as the fan-less heat dissipation design will not perform as intended.

# Powering on the Unit

After turning on the power supply, it will take 5 to 10 seconds for the operating system to boot up. The green Ready LED will illuminate continuously until the operating system is ready.

# 4

# Software Tools

In this chapter, we introduce which software tools can be used with this device.

The following topics are covered in this chapter:

- **Preparing Software Tools**
  - Connecting Web Console
  - Preparing IOxpress Utility
  - Preparing Moxa CLI Configuration Tool
- **Web Console**
  - Dashboard
  - System
  - Security
  - Network
  - Module
  - I/O
  - Serial Port
  - Internal Register
  - Protocol

# Preparing Software Tools

## Connecting Web Console

The Web Console is already embedded in this device. Use the web console to check the device status, configure settings, or update the firmware of the device. Follow the steps below to connect to the web console.

1. Connect the device to your PC through an Ethernet cable.
2. Power on the unit.
3. Open a web browser (Chrome is recommended) on your PC, and type the default IP address shown on the model label of the unit.

**INFORMATION** Type in the IP address (if the IP address is not set by default). If the IP address is not available, use the IOxpress utility to search for the device, or load the factory default settings by holding down the RESET button to access the device through the default IP address.

## Preparing IOxpress Utility

The IOxpress Utility can be downloaded from the Moxa website at www.moxa.com. After downloading the file, unzip it and run setup.exe. The installation program will guide you through the installation process.

Refer to the **Mass-deploying the Settings** section for detailed instructions.

**NOTE** The ioThinx 4510 Series is only compatible with IOxpress v2.2 or later.

## Preparing Moxa CLI Configuration Tool

Moxa CLI Configuration Tool (MCC_Tool) can be downloaded from the Moxa website at www.moxa.com. After downloading the file, unzip it and run setup.exe. The installation program will guide you through the installation process.

It is a command line tool that provides the following functions to manage field devices.

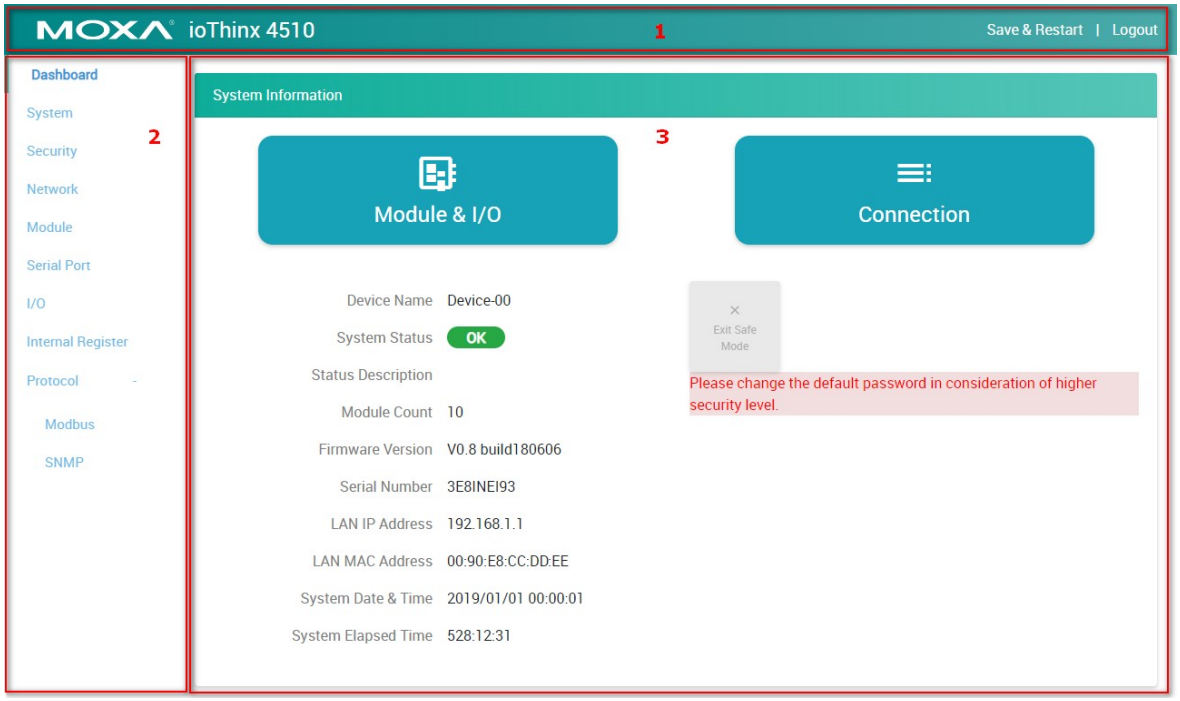
- Report firmware versions
- Upgrade firmware
- Import/export configuration files
- Change password

Management tasks can be performed according to which devices the user requires (1 for single device or 1 for multiple devices) and across different subnet networks.

Refer to **Moxa CLI Configuration Tool** User's Manual for detailed instructions.

# Web Console

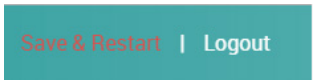
The Web Console is the main software tool to configure, monitor, and operate a device. If mass deploying to multiple devices is required, use IOxpress utility instead.




The Web Console is divided into three regions:

1. **Title Panel:** It provides Login, Save & Restart, and Logout functions.
2. **Menu panel:** It provides access to configure the functions or services.
3. **Web page panel:** The web page associated with the function selected in the Menu panel.

**INFORMATION** Whenever any configuration is modified, the **Save & Restart** will become red and blink. Click **Save & Restart** to make the changes effective.



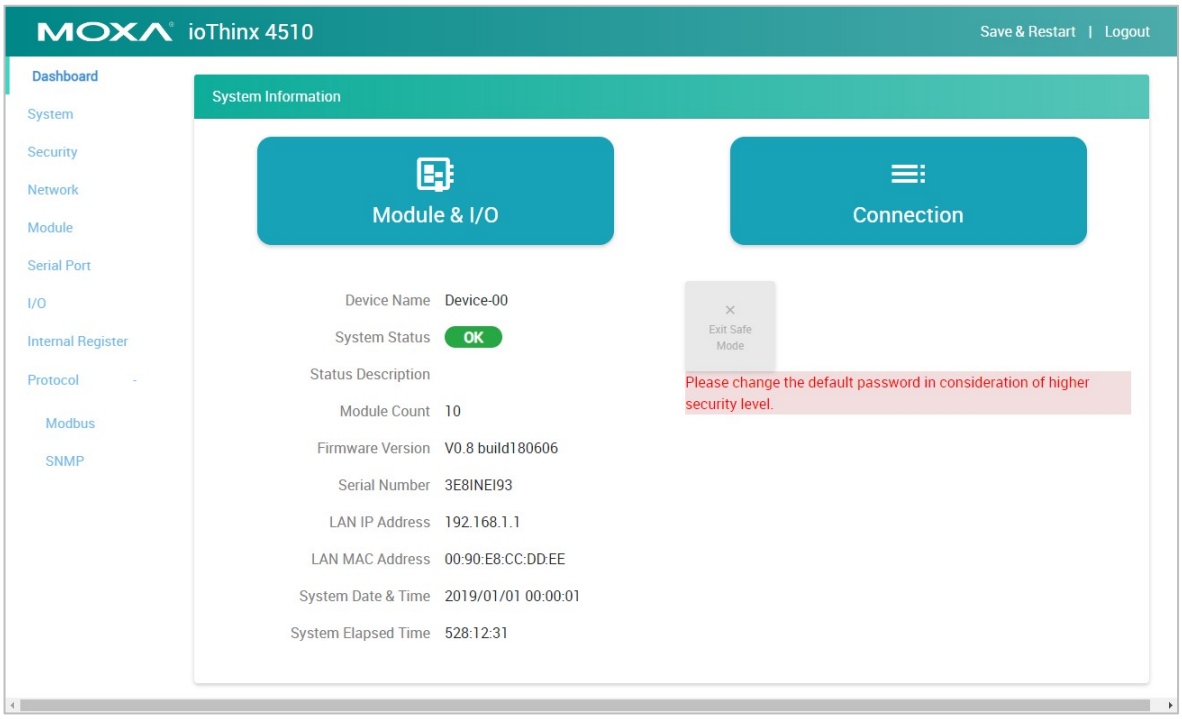

**NOTE** For security reasons, click **Logout** when no longer accessing this device. DO NOT leave the web console unattended.

# Dashboard

The dashboard provides information about the system, modules, I/Os, and the connection status. It also allows you to exit the safe mode status or to change the I/O status.

## System Information

The one page system information provides detailed information for this device. For information regarding modules and I/Os, click **Module & I/O** to get the detailed information. For the status of external connections, click **Connection** to get the detailed information.

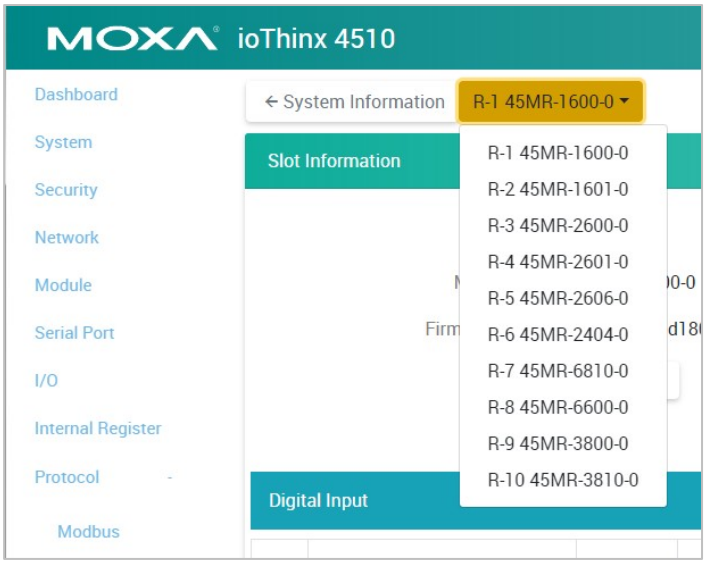



**Exit Safe Mode:** Manually exit the safe mode status of this device. Refer to the **Security** section for more information about the Safe Mode function.

## Module & I/O

The **Module & I/O** provides information about modules and I/Os status. It also allows you to change the I/O status.

**Module Drop-Down List:** It lists all of the I/O modules of this device. Select the specific module for its module and I/O information.



**Locate:** Identify the physical location of the module and the module's status LED will blink green.

**DI Channel (DI Mode):** It shows the status of this channel. No operation is allowed.

| No. | Name | Mode | Value | Trigger | Filter | Status | Operation |
|---|---|---|---|---|---|---|---|
| 0 | DI-00 | DI | -- | -- | 500 us | On | -- |

**DI Channel (Counter Mode):** It shows the status of this channel. Type a value between 0 and 4294967295, and then click **SET** to set the current counter value. Click **RUN** or **PAUSE** to change the counter status.

| No. | Name | Mode | Value | Trigger | Filter | Status | Operation |
|---|---|---|---|---|---|---|---|
| 0 | DI-00 | Counter | 65535 | Rising edge | 500000 us | Running | 65535 SET PAUSE |

**DO Channel (DO Mode):** It shows the status of this channel. Click **ON** or **OFF** to change the DO status.

| No. | Name | Mode | ON Width | OFF Width | Pulse Count | Status | Operation |
|---|---|---|---|---|---|---|---|
| 0 | DO-00 | DO | -- | -- | -- | On | OFF |

**DO Channel (Pulse Mode):** It shows the status of this channel. Click **START** or **STOP** to change the pulse output status.

| No. | Name | Mode | ON Width | OFF Width | Pulse Count | Status | Operation |
|---|---|---|---|---|---|---|---|
| 0 | DO-00 | Pulse | 500 us | 500 us | 10 | Start | STOP |

**Relay Channel:** It shows the status of this channel. Click **ON** or **OFF** to change the relay status.

| No. | Name | Mode | Status | Operation |
|---|---|---|---|---|
| 0 | RELAY-00 | Relay | On | OFF |

**AI Channel:** It shows the status of this channel. Click **RESET** to reset the minimum and maximum values.

| No. | Name | Scaled Range | Value | Min | Max | Min/Max |
|---|---|---|---|---|---|---|
| 0 | AI-00 | 0.000 - 20.000 mA | 11.000 mA | 8.000 mA | 16.000 mA | RESET |

**AO Channel:** It shows the status of this channel. Key in the value and click **SET** to set the output value.

| # | Name | Scaled Range | Status | Value | Operation |
|---|---|---|---|---|---|
| 0 | 45MR-4420-0@AO-00 | 4.000 - 20.000 mA | OK | 4.000 mA | 4.000 SET |

**NOTE** The AO channel **Status** will change to **Fault** when the channel is open in current mode, when the channel is short in voltage mode, or when field power is not connected.

**RTD Channel:** It shows the status of this channel. Click **RESET** to reset the minimum and maximum values. Apply the reference temperature value in the calibration field and click **SET** to start the RTD sensor calibration; each calibration requires approximately 30 seconds per channel.

| # | Name | Sensor Type | Value | Min | Max | Min/Max | Calibration |
|---|---|---|---|---|---|---|---|
| 0 | 45MR-6600-0@RTD-00 | PT 100 | 0.000 C | 0.000 C | 0.025 C | RESET | 0 SET |

**TC Channel:** It shows the status of this channel. Click **RESET** to reset the minimum and maximum values. Apply the reference temperature value in the calibration field and click **SET** to start the TC sensor calibration; each calibration requires approximately 30 seconds per channel.

| # | Name | Sensor Type | Value | Min | Max | Min/Max | Calibration |
|---|---|---|---|---|---|---|---|
| 0 | 45MR-6810-0@TC-00 | K TYPE | 0.000 C | 0.000 C | 0.000 C | RESET | 0 SET |

**SP Channel:** It shows the status of this channel. No operation is allowed.

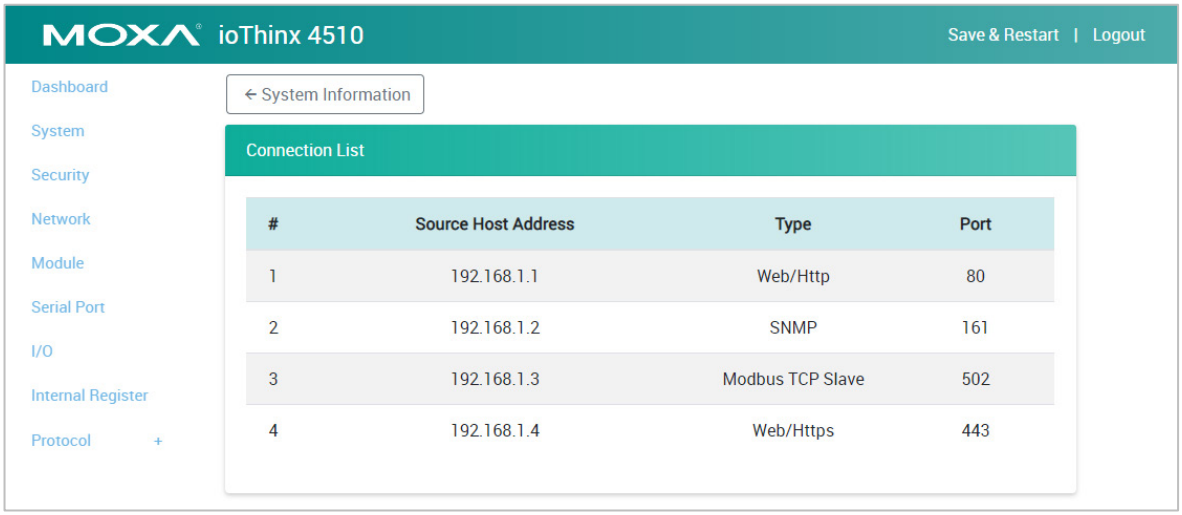
| # | Name | Status |
|---|---|---|
| 0 | 45MR-7210-0@SP-00 | Good |

**FP Channel:** It shows the status of this channel. No operation is allowed.

| # | Name | Status |
|---|---|---|
| 0 | 45MR-7210-0@FP-00 | Under Limit |

## Connection

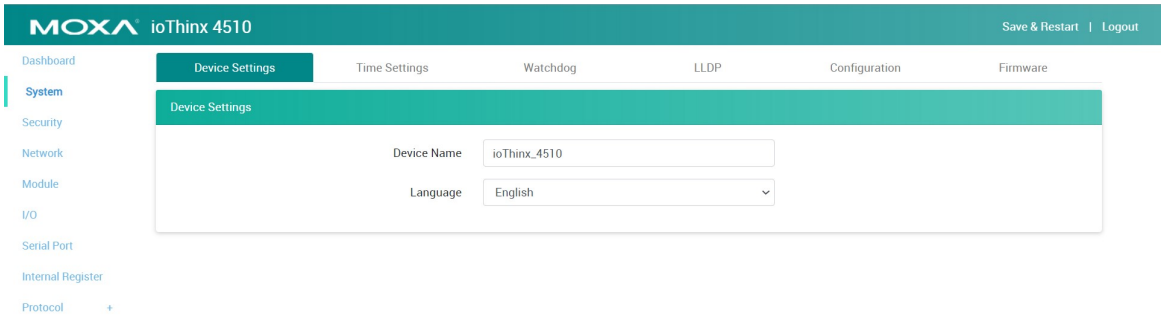
The connection page shows the connection status from other hosts. This information can assist you with managing your devices.



# System

This section introduces the functions of the device's system.

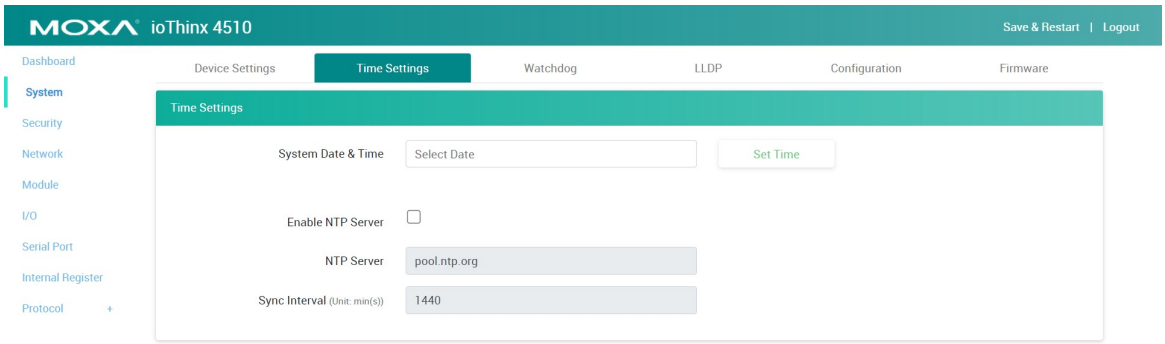
## Device Settings




**Device Name:** Set the name of this device (max length = 16, '.' is not allowed).

**Language:** Select the language of the web console.

## Time Settings




**System Date & Time:** Select the date for the device. Click **Set Time** to set the time of the device.

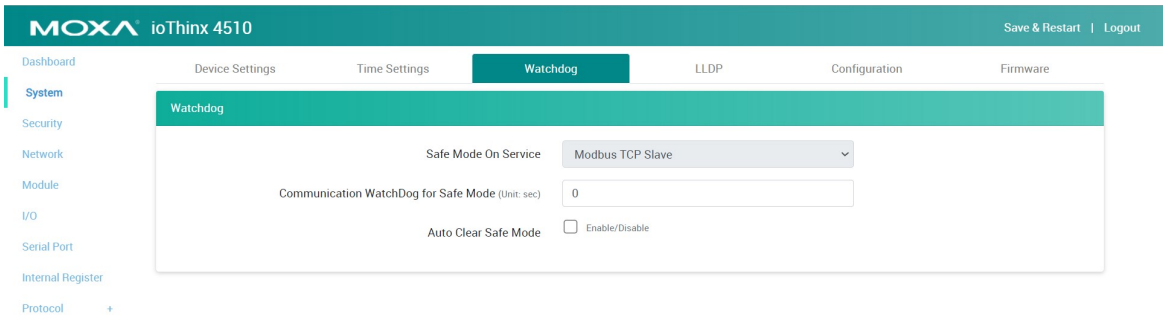
**Enable NTP Server:** Click the checkbox to enable date and time synchronization with the NTP sever.

**NTP Server:** Set the URL or IP address of the NTP server.

**Sync Interval:** Set the synchronization interval with the NTP sever (unit: min(s), 1 to 43200, default = 1440).

**INFORMATION** This device does not have a battery. Therefore, if the device is powered off, the system date and time will have to be set again. If the NTP server is not available, set the date and time of the device after rebooting.

# Watchdog




**Safe Mode on Service:** Select the service that you want to link the watchdog to in order to keep monitoring the connection status (option: Modbus TCP Slave).

**Communication Watchdog for Safe Mode:** The timeout value when the master of **Safe Mode on Service** is disconnected (unit: sec(s), 0 to 65535, 0 is disable).

**Auto Clear Safe Mode:** Click the checkbox to enable or disable automatically clearing the safe mode status.

Once the communication watchdog is timeout, the safe mode will be enabled. The behavior of ioThinx 4510 and 45MR modules are listed below:

| | **ioThinx 4510** | **45MR modules** |
|---|---|---|
| **Behavior** | • Wait for Modbus/TCP Master's re-connection<br>• Output channels cannot be controlled via any access e.g. RESTful API or web console | • Input channels: no change<br>• Output channels: set the channel status according to pre-defined safe mode settings |
| **LED status** | RDY: Red fast blinking | Status: Red fast blinking (applied to the modules which have output channels only) |

Once the connection is recovered, the behavior of the ioThinx 4510 and 45MR modules are listed below.

1. Auto Clear Safe Mode: Enabled

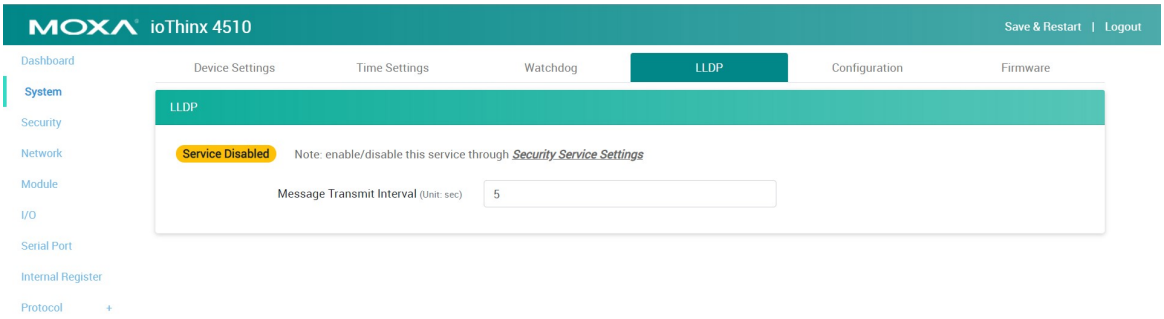
| | **ioThinx 4510** | **45MR modules** |
|---|---|---|
| **Behavior** | Recovered to normal status | Recovered to normal status |
| **LED status** | RDY: Green | Status: Green |

2. Auto Clear Safe Mode: Disabled

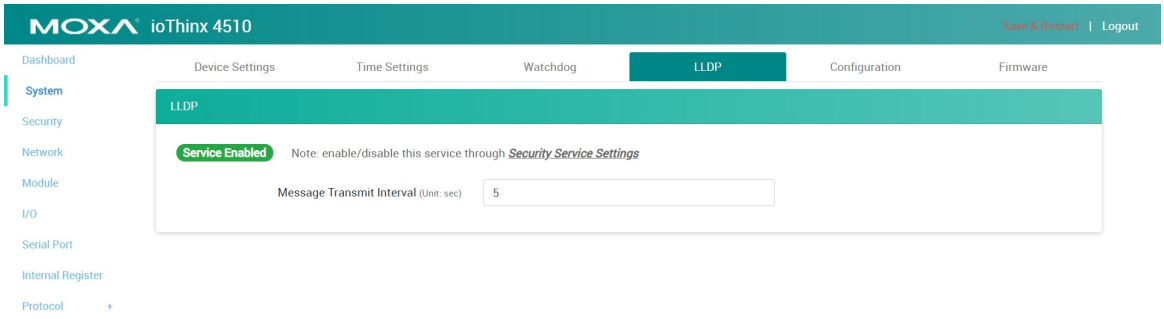
| | **ioThinx 4510** | **45MR modules** |
|---|---|---|
| **Behavior** | Status will remain on safe mode until the safe mode flag is cleared. | Status will remain on safe mode until the safe mode flag is cleared. |
| **LED status** | RDY: Red fast blinking until the error flag is cleared manually | Status: Red fast blinking until the error flag is cleared manually |

**NOTE** If auto clear safe mode is disabled in the watchdog configuration, once the Modbus connection reconnects, click the **Exit Safe Mode** button on the dashboard or type **0** in the **watchdogAlarmFlagClear** register through Modbus to exit safe mode status. Otherwise, output channels cannot be controlled via any access method, such as RESTful API and web console.

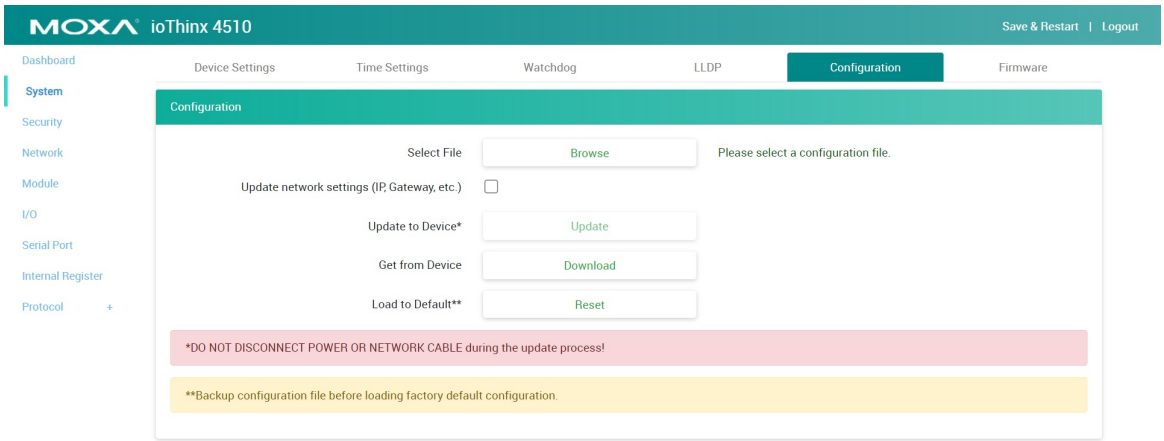
## LLDP




**Message Transmit Interval:** Set up interval time for message transmission via LLDP protocol.
The default status of LLDP is disabled. Please make sure the LLDP service is enabled in the Security Service Settings.




## Configuration




**Select File:** Click **Browse** to select a configuration file to update the device.

**Update network settings (IP, Gateway, etc.):** Click the checkbox if the network settings need to be updated.

**Update to Device:** Click **Update** to update the firmware to the device.

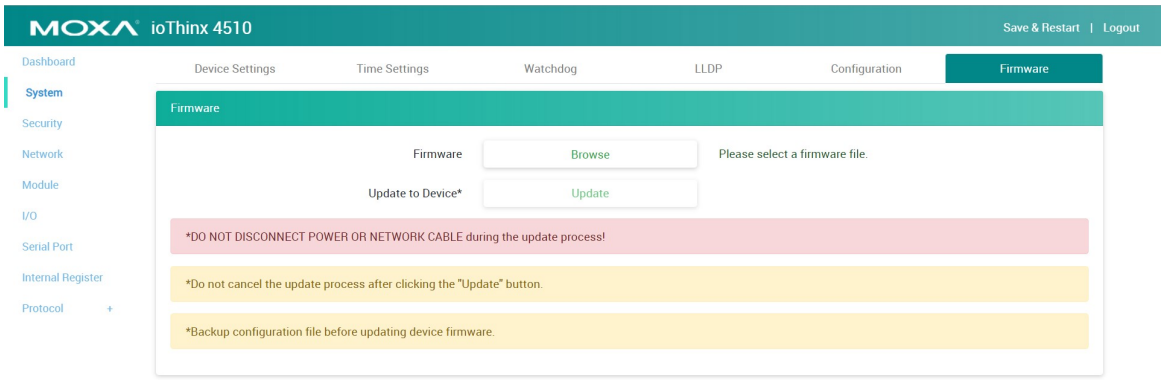
**Get from Device:** Get the configuration file of the device.

**Load to Default:** Load the factory default settings of the current firmware version.

**NOTE** Do not disconnect the power or network cable during the update process.

**INFORMATION** Back up the configuration file before loading the factory default configurations.

## Firmware




**Firmware:** Click **Browse** to select a firmware file to update the device.

**Update to Device:** Click **Update** to update the firmware to the device.

**NOTE** Do not disconnect the power or network cable during the update process.

**NOTE** This device supports firmware automatic recovery function. If the firmware in the device is corrupted, the system will load the backup firmware automatically to overwrite the corrupted one. When the system is in recovery mode, the RDY LED will slowly blink red. DO NOT DISCONNECT the power cable when the recovery process is underway. After the recovery process is complete, you can update the firmware again.

**CAUTION**

If you downgrade the device to firmware version v1.0.0, IOxpress will not be able to access the device. In this case, please connect to the device via a web service instead.

**INFORMATION** The update process cannot be canceled after "Update" is clicked.

**INFORMATION** Back up the configuration file before updating the device firmware.

**NOTE** Configurations saved when using v1.0/v1.1 firmware may not be compatible with v1.2 firmware. Please back up the configuration file before upgrading the firmware.

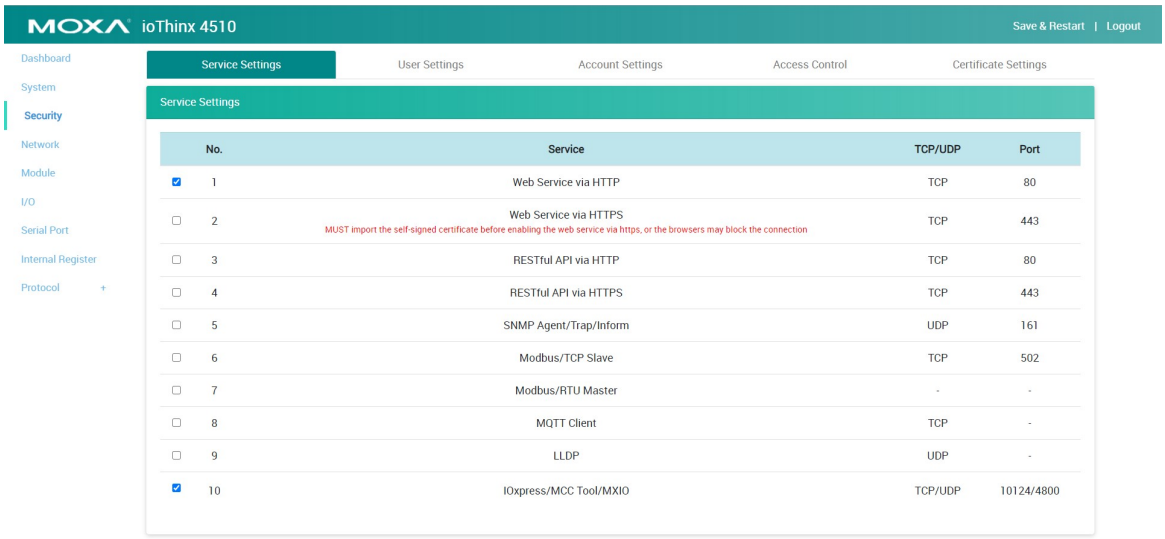
# Security

The **Security** section allows you to manage the security policy of the device.

**NOTE** Do not expose the device to the public Internet without any security protection. To increase the security of the device, we suggest configuring security settings prior to other settings.

## Service Settings

Enable/disable services to prevent unwanted access. The default configuration has Web Server via HTTP and IOxpress/MCC Tool/MXIO enabled.




**NOTE** If all services are disabled, this device will no longer be accessible, and you will need to load the factory default configurations to access the device.

**NOTE** For security reasons, we suggest disabling those services that your application will not use.

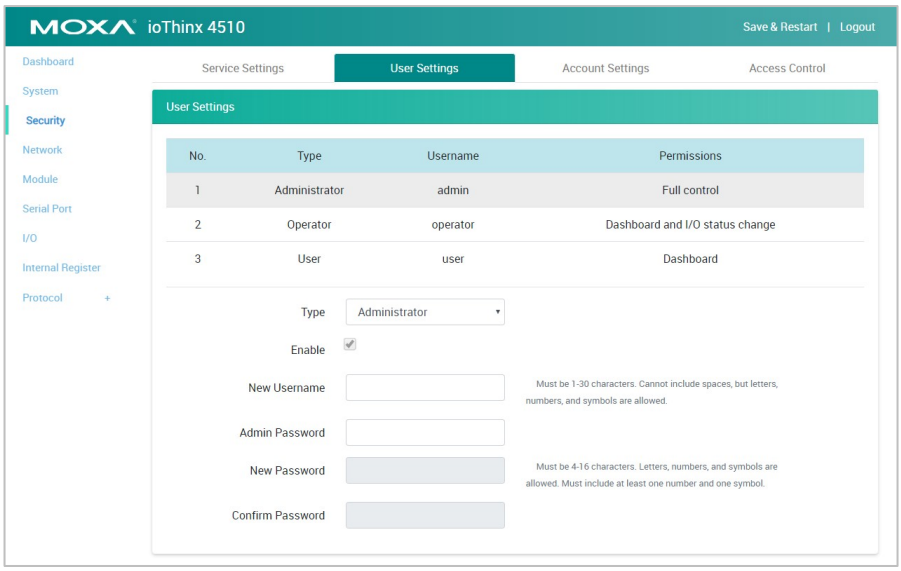
**NOTE** Because of device limitations, MQTT, RESTful API, and SNMP cannot be used at the same time.

**NOTE** Web Service via HTTPS is designed for configuration purposes. Because of device limitations, the other services cannot operate in parallel with HTTPS.

**NOTE** Before using the web service, import the self-signed certificate via https. Otherwise, the browser may block the connection.

# User Settings

Enable/Disable user type, or configure the username and password for Administrator, Operator, and Users.




**Type:** Select a user type to change the username and password.

**Enable:** Enable or disable the type you select.

**New Username:** It allows you to change the username of the selected user type (Must be 1 to 30 characters in length. Letters, numbers, and symbols are allowed, but not spaces).

**Admin Password:** Type the password for the administrator to gain authorization to make changes.

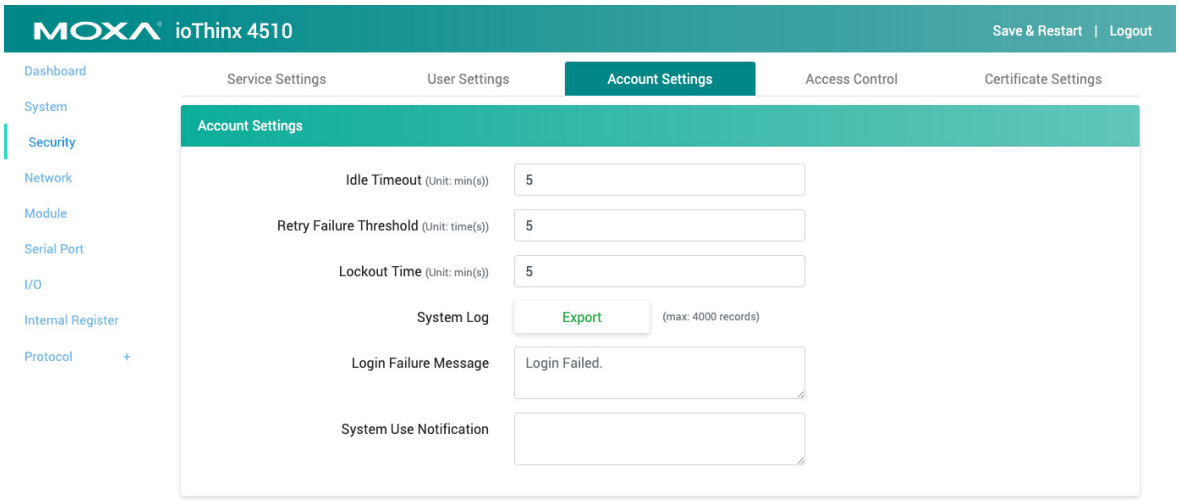
**New Password:** It allows you to change the password of the selected user type (Must be 4 to 16 characters in length and include at least one number and one symbol. Letters, numbers, and symbols are allowed but spaces are not).

**Confirm Password:** Type in your new password again.

**NOTE** Change the default password in order to enhance security when you first login.

**INFORMATION** The default username is admin, and the default password is moxa.

# Account Settings




**Idle Timeout:** The timeout value when the user account is idle (unit: min(s), 0 to 1440 mins, default: 5 mins) Note: 0 for disabled.

**Retry Failure Threshold:** The maximum number of retries for the user account to log in (unit: time(s), 1 to 10 times, default: 5 times).

**Lockout Time:** The timeout value for when the user account will be locked due to reaching the retry failure threshold (unit: min(s), 1 to 60 mins, default: 5 mins).

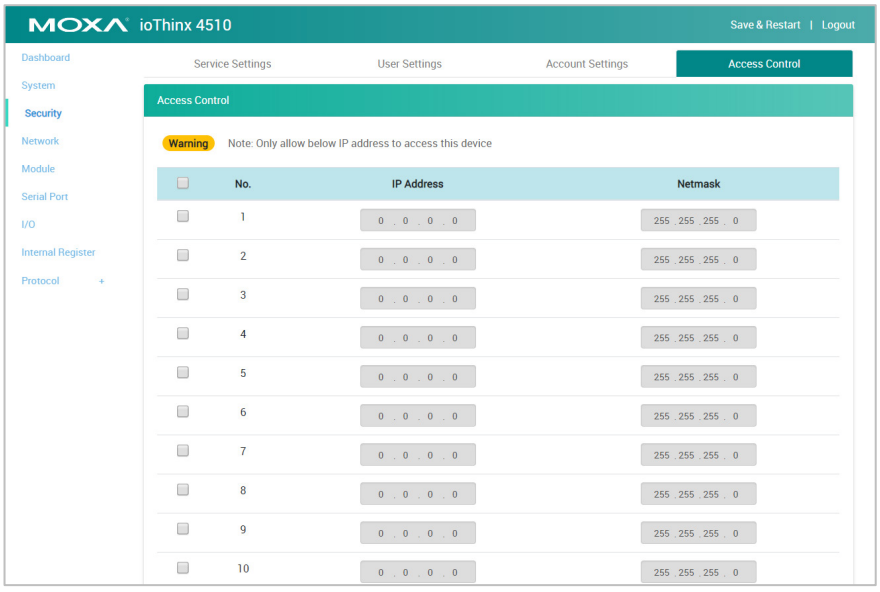
**System Log:** Users can download the system log by clicking the export button. You can access the most recent 2,000 records. The device will overwrite the oldest data when the memory is full.

**Login Failure Message:** Create the message shown on the login webpage after the user account fails to log in (character limit = 200).

**System Use Notification:** Define the message shown on the login webpage when the user account connects to the Web Console (character limit = 200).

# Access Control

Use IP Address/Netmask combinations to control which devices can access the device.



Enable access for a range of IP addresses by specifying the IP address and netmask, as follows:

**To allow access for a specific IP address**

Enter the IP address in the IP Address field and 255.255.255.255 in the Netmask field.

**To allow access for hosts on a specific subnet**

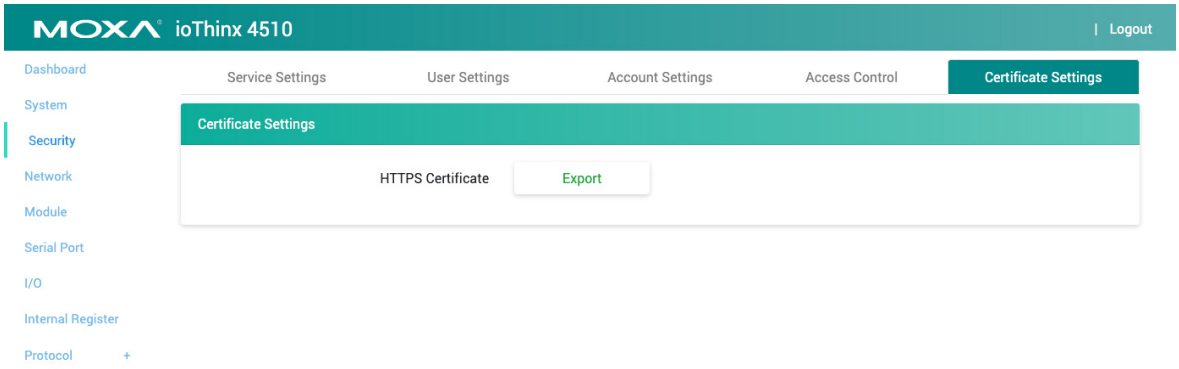
Enter 0 as the last digit in both the IP Address field and Netmask field (e.g., 192.168.1.0 and 255.255.255.0).

Refer to the following table for more details about the configuration.

| Allowable Hosts | Input Format |
|---|---|
| 192.168.1.120 | 192.168.1.120/255.255.255.255 |
| 192.168.1.1 to 192.168.1.254 | 192.168.1.0/255.255.255.0 |
| 192.168.0.1 to 192.168.255.254 | 192.168.0.0/255.255.0.0 |
| 192.168.1.1 to 192.168.1.126 | 192.168.1.0/255.255.255.128 |
| 192.168.1.129 to 192.168.1.254 | 192.168.1.128/255.255.255.128 |

## Certificate Settings

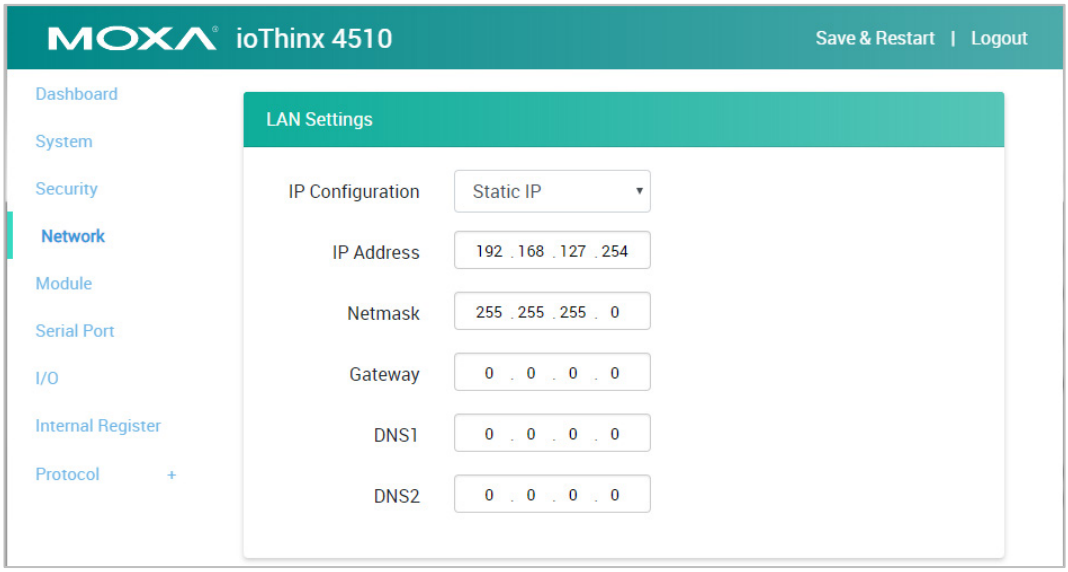
The ioThinx 4510 will generate a self-signed certificate based on the IP address. Users can download the certificate by clicking the **Export** button, and then import the certificate through the browser to enhance security.




# Network

This section introduces the Network settings function.

## LAN Settings




**IP Configuration:** Configure the following settings if **Static IP** is selected. If **DHCP** is selected, the following settings are not allowed (option: Static IP or DHCP).

**IP Address:** Set the IP address of the device (0 to 255).

**Netmask:** Define the logical subdivision of an IP network and specify the network's available hosts (0 to 255).

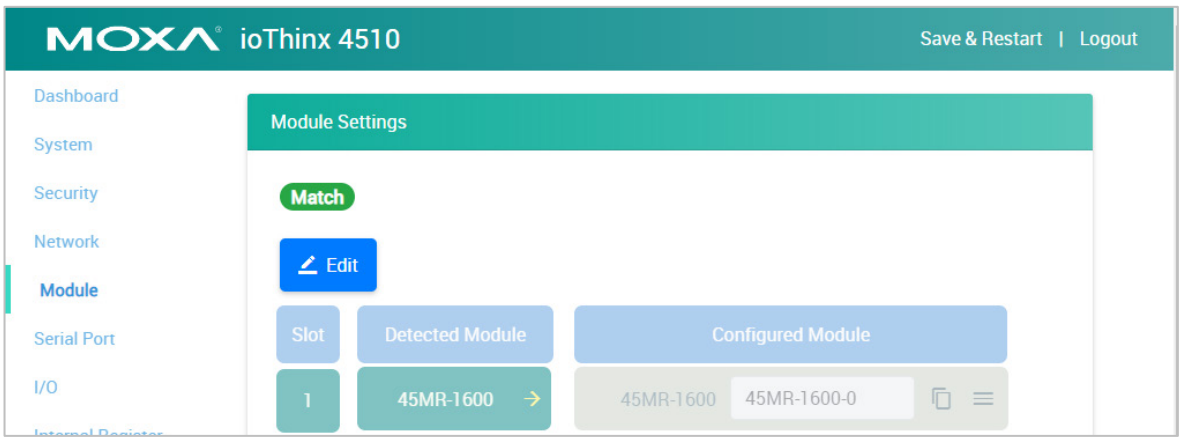
**Gateway:** Define the router that can route the network traffic to the other network or Internet (0 to 255).

**DNS1 and DNS2:** Define DNS server(s) that can translate URL to IP address (0 to 255).

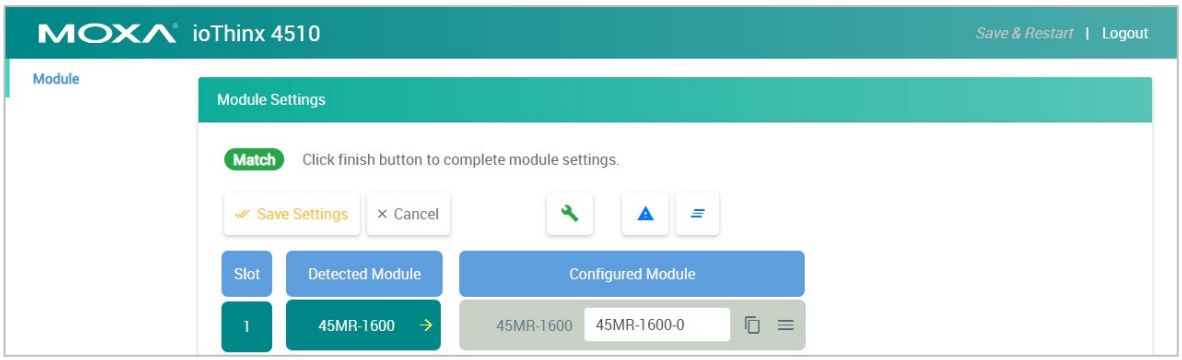
**INFORMATION** The IP address of the device must be unique. Two devices in the network cannot share the same IP address as it causes an IP address conflict.

# Module

This section introduces the Module settings function.



**Edit:** Click this button to enter edit mode.




**Save Settings:** This button only appears in edit mode. Click this button to finish module settings and exit edit mode.

**Cancel:** This button only appears in edit mode. Click this button to cancel module settings and exit edit mode.

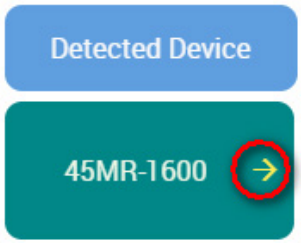
**Auto Matching** : Click this button to automatically match all configured modules with all detected modules.

**Load Default** : Click this button to load the default settings of all configured modules.

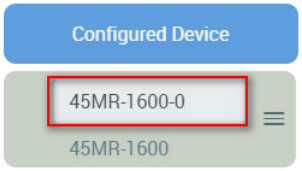
**Reload** : Click this button to reload the module settings before entering edit mode.

**Slot:** The slot position of the detected module.

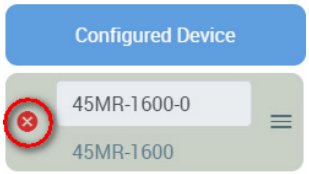
**Detected Module:** The physical module detected by the system. The yellow arrow allows you to insert the specific module into the configured module.



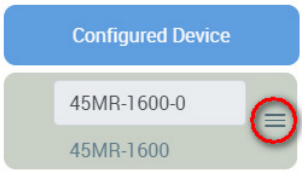

**Configured Module:** The module settings for the detected module. A unique module name is required in the textbox (max. length = 16, ".” character is not allowed).




The delete icon appears when you place your mouse over the place indicated below. It allows you to delete the configured module.



The drag icon allows you to drag the configured module and drop it to the position you need.

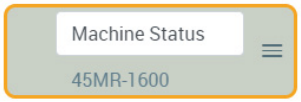



**NOTE** The detected module should match the configured module. Otherwise, the Web Console will not allow you to configure other settings.

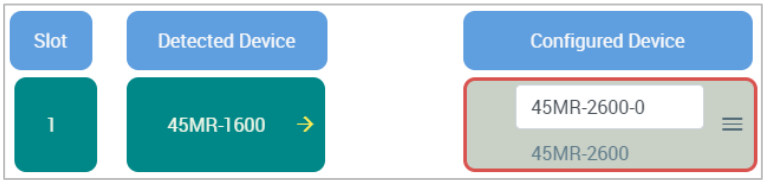
**NOTE** The detected module should match the configured module. Otherwise, the Web Console will not allow you to click **Finish**.

**INFORMATION** Use **Auto Matching** to quickly match the configured module with the detected module.

**INFORMATION** Once the setting of a configured module is changed, the configured module will be highlighted by an orange rectangle.




**INFORMATION** If the configured module does not match the detected module, the configured module will be highlighted by a red rectangle.

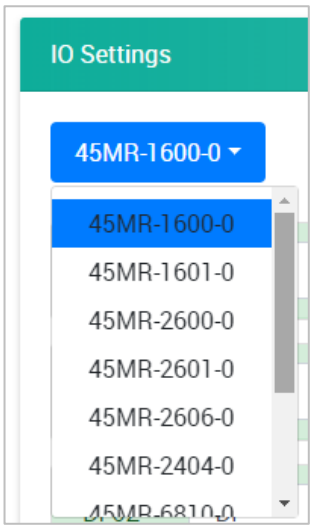



# I/O

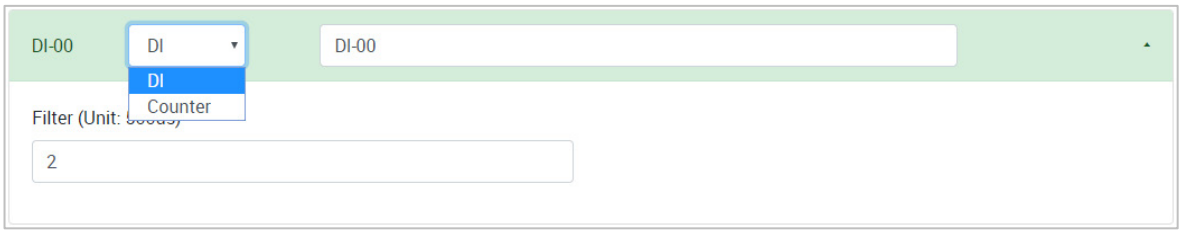
This section introduces the I/O and IR (Internal Register) settings functions.

## I/O Settings

**Module Drop-Down List:** It lists all the I/O modules of this device. Select the specific module for I/O configuration.



# Digital Input Channel Settings

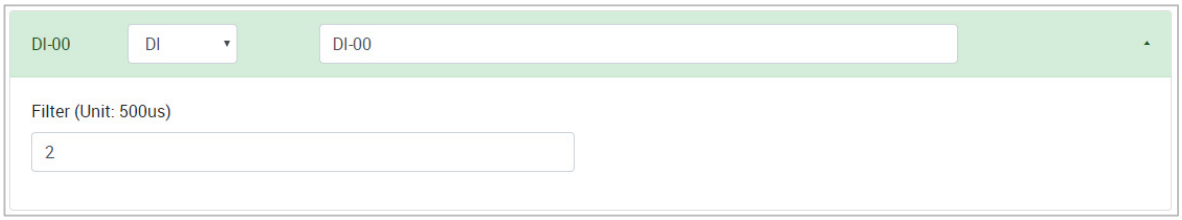



**Channel Mode Drop-Down List:** It lists all of the channel modes, which can be operated by this channel. Select **DI** or **Counter** mode for each channel (option: DI or Counter).

**Channel Name:** The channel name is used for representing this channel (max. length = 16, "." character is not allowed).

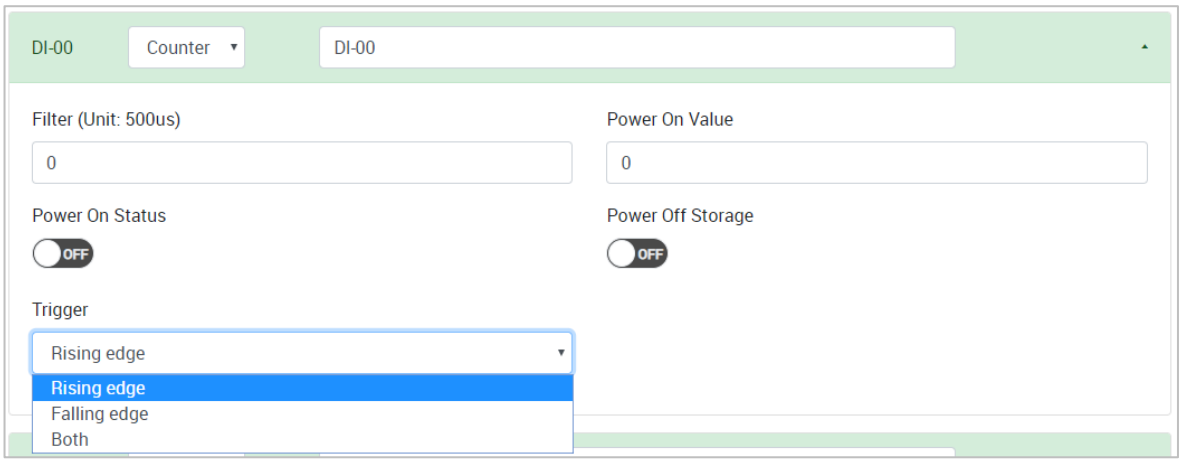
**INFORMATION** Every channel in each module must have a different name.

## DI Mode




**Filter:** Software filtering is used to avoid switch bounces (unit: 500μs, 0 to 65535).

## Counter Mode




**Filter:** Software filtering is used to avoid switch bounces (unit: 500μs, 0 to 65535).

**Power on Value:** The initial counter value upon powering up (0 to 4294927695).

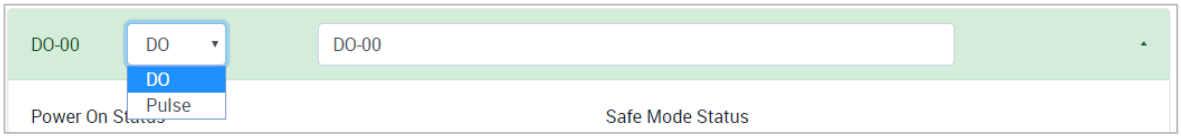
**Power on Status:** The counter status upon powering up (option: ON or OFF).

**Power off Storage:** Save counter value to memory during powering off. The saved value will be the initial value upon next powering up (option: ON or OFF).

**Trigger:** The channel accepts limit or proximity switches and counts events according to the ON/OFF status. When **Rising edge** is selected, the counter value increases when the attached switch is pushed. When **Falling edge** is selected, the counter value increases when the switch is released. When **Both** is selected, the counter value increases when the attached switch is pushed or released (option: Rising edge, Falling edge, or Both).

**NOTE** Not all DI channels support counter mode. Refer to the **ioThinx 4500 Series (45MR) Modules** datasheet for detailed specifications.

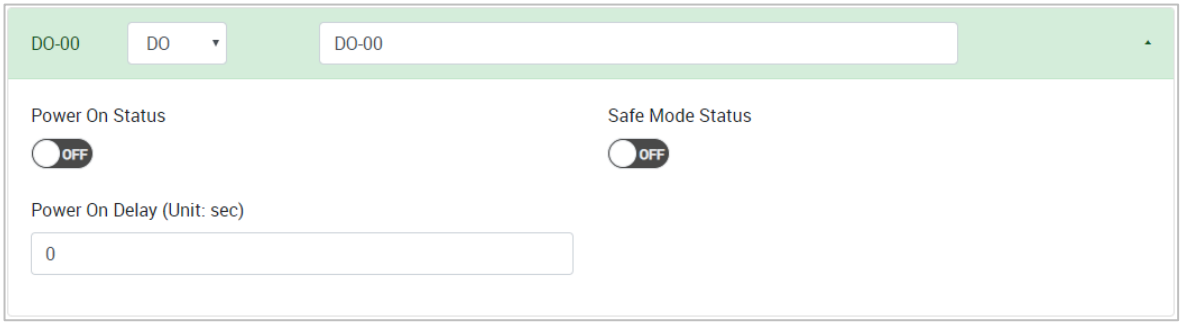
## Digital Output Channel Settings




**Channel Mode Drop-Down List:** It lists all of the channel modes, which can be operated by this channel. Select **DO** or **Pulse** mode for each channel (option: DO or Pulse).

**Channel Name:** The channel name is used for representing this channel (max. length = 16, "." character is not allowed).

### DO Mode

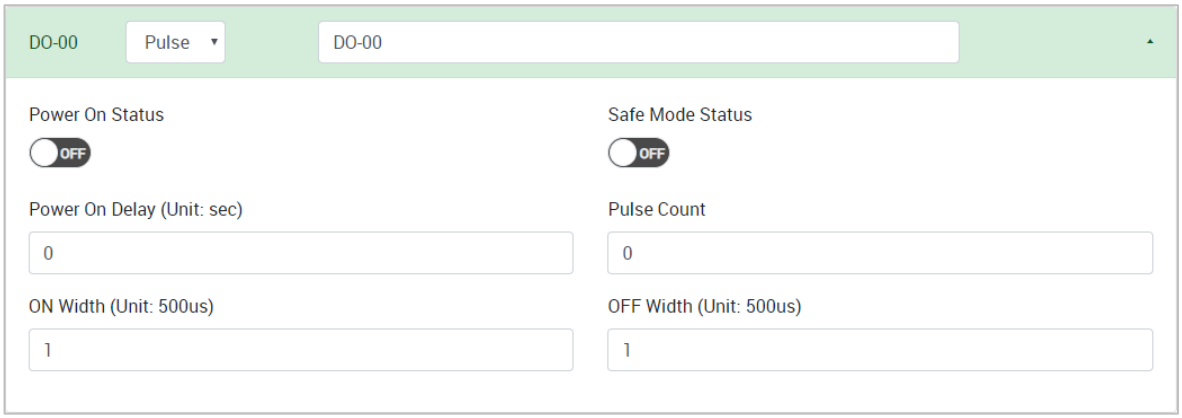



**Power on Status:** The DO status upon powering up (option: ON or OFF).

**Safe Mode Status:** The DO status when the device is in safe mode (option: ON or OFF).

**Power on Delay:** The time delay before triggering **Power on Status** after powering up (unit: sec(s), 0 to 65535).

### Pulse Mode



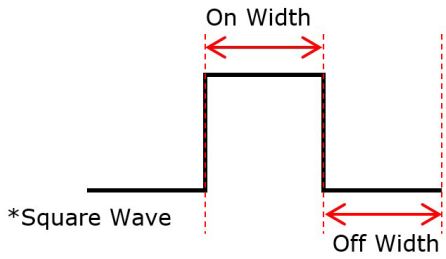

**Power on Status:** The Pulse status upon powering up (option: ON or OFF).

**Safe Mode Status:** The Pulse status when the device is in safe mode (option: ON, OFF, or Hold Last).

**Power on Delay:** The time delay before triggering **Power on Status** after powering up (unit: sec(s), 0 to 65535).

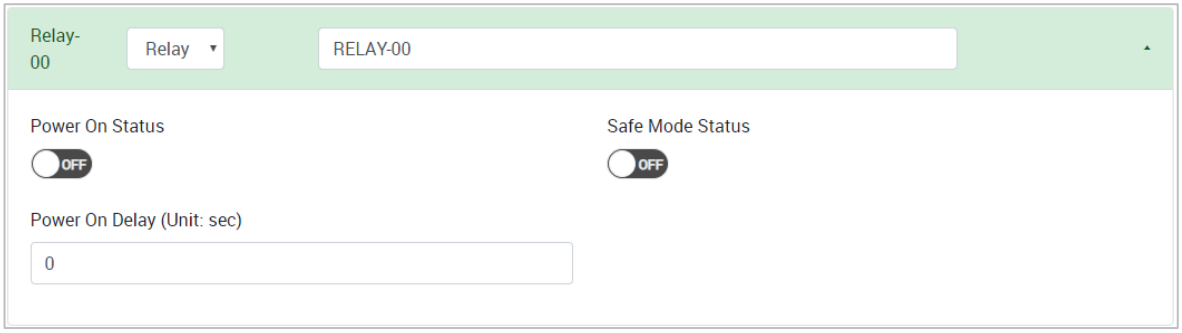
**Pulse Count:** The number of pulses per triggering (0 to 4294967295, "0" for continuous pulse output).

**On Width/Off Width:** The high and low level widths of a pulse (unit: 500μs, 1 to 65535).




| **NOTE** | Not all DO channels support pulse mode. Refer to the **ioThinx 4500 Series (45MR) Modules** datasheet for detailed specifications. |
|---|---|

## Relay Channel Settings




**Channel Name:** The channel name is used for representing this channel (max. length = 16, "." character is not allowed).

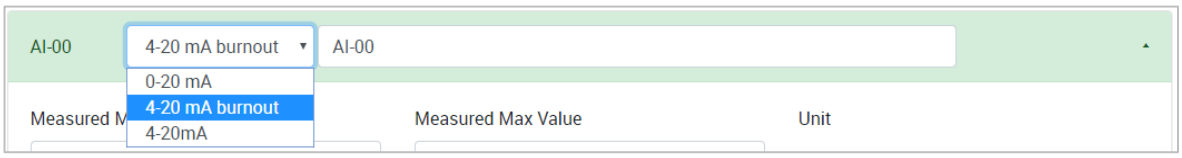
**Power on Status:** The Relay status upon powering up (option: ON or OFF).

**Safe Mode Status:** The Relay status when the device is in safe mode (option: ON or OFF).

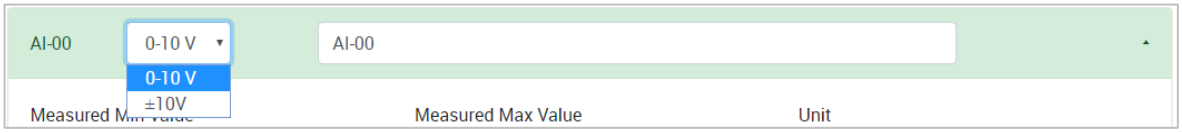
**Power on Delay:** The time delay before triggering **Power on Status** after powering up (unit: sec(s), 0 to 65535).

## Analog Input Channel Settings

### Current Module




### Voltage Module



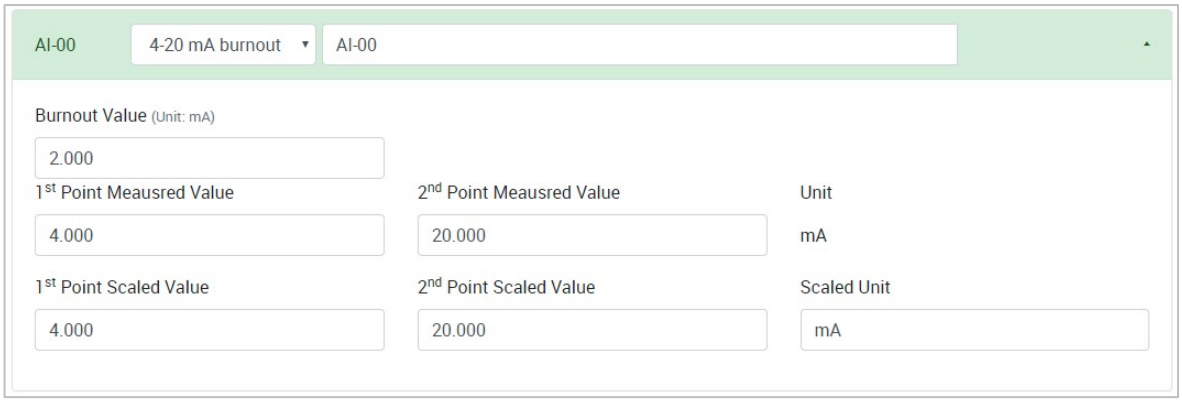

**Channel Mode Drop-Down List:** It lists all of the channel modes, which can be operated by this channel. Select **0-20 mA**, **4-20 mA burnout**, or **4-20 mA** mode for each channel of the current module. Select **0-10 V** or **±10 V** mode for each channel of the voltage module.

**Channel Name:** The channel name is used for representing this channel (max. length = 16, "." character is not allowed).

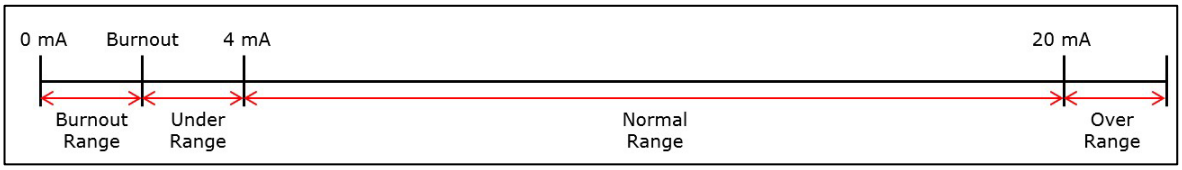
## Disable Mode

The AI channel can be disabled. It only allows you to disable channels one-by-one. When a channel has been disabled, the sample rate of the remaining channels will be increased automatically.

## 0-20 mA/4-20 mA burnout/4-20 mA/0-10 V/±10 V Mode

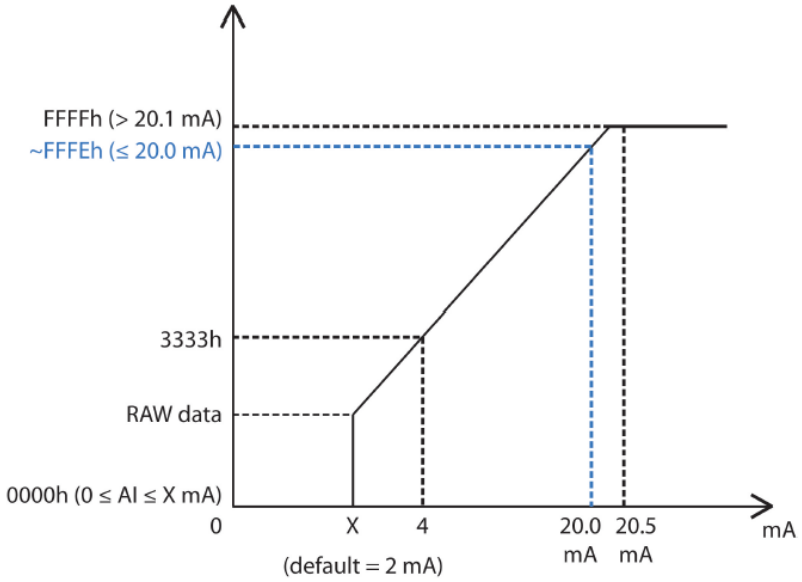



**Burnout Value (only for 4-20 mA burnout mode):** The 4–20 mA burnout mode is shown in the diagram below.




The Burnout Value (default = 2 mA) is definable (unit: mA, 0.000 to 4.000). When input values are in the burnout range, raw data will register as 0000h to indicate that the analog input has burned out. The definition of raw data can be found in the table below.

| Range | Modbus Data |
|---|---|
| 0.000 ≤ AI < Burnout Value | 0x0000h |
| Burnout Value ≤ AI ≤ 20.000 mA | Raw Data |
| AI > 20.000 mA | 0xFFFFh |




**1st Point Measured Value:** The 1st point value in the range of channel mode to be scaled to the **1st Point Scaled Value** (unit: mA, 4.000 to 20.000).

**2nd Point Measured Value:** The 2nd point value in the range of channel mode to be scaled to the **2nd Point Scaled Value** (unit: mA, 4.000 to 20.000).

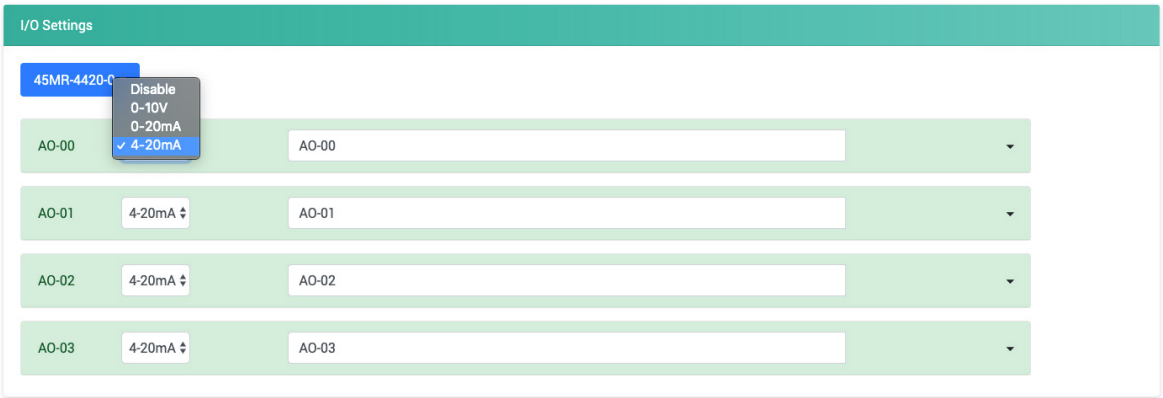
**Unit:** The unit of the measured value.

**1st Point Scaled Value:** The scaled value of the 1st point (-4294967295 to 4294967295).

**2nd Point Scaled Value:** The scaled value of the 2nd point (-4294967295 to 4294967295).

**Scaled Unit:** The unit of the scaled value (max. length = 8, "." character is not allowed).

## Analog Output Channel Settings



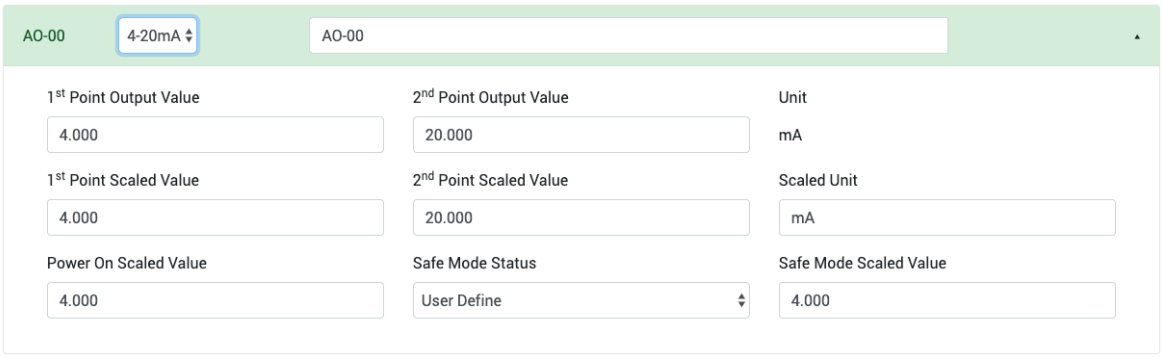

**Channel Mode Drop-down List:** It lists all of the channel modes which can be operated by this channel. Select **Disable**, **0-10 V**, **0-20 mA**, or **4-20 mA** for each channel.

**Channel Name:** The channel name is used to represent this channel (max. length = 16, "." character is not allowed).

## Disable Mode

Disable the AO channel. Channels must be disabled one-by-one.

## 0-10 V/0-20 mA/4-20 mA Mode




**1st Point Output Value:** The 1st point value in the range of channel mode to be scaled to the **1st Point Scaled Value** (range: 0-20 mA mode: 0.000 to 20.000, 4-20 mA mode: 4.000 to 20.000, 0-10V mode: 0.000 to 10.000).

**2nd Point Output Value:** The 2nd point value in the range of channel mode to be scaled to the **2nd Point Scaled Value** (range: 0-20 mA mode: 0.000 to 20.000, 4-20 mA mode: 4.000 to 20.000, 0-10V mode: 0.000 to 10.000).

**Unit:** The unit of the output value.

**1st Point Scaled Value:** The scaled value of the 1st point (range: -4294967295 to 4294967295).

**2nd Point Scaled Value:** The scaled value of the 2nd point (range: -4294967295 to 4294967295).

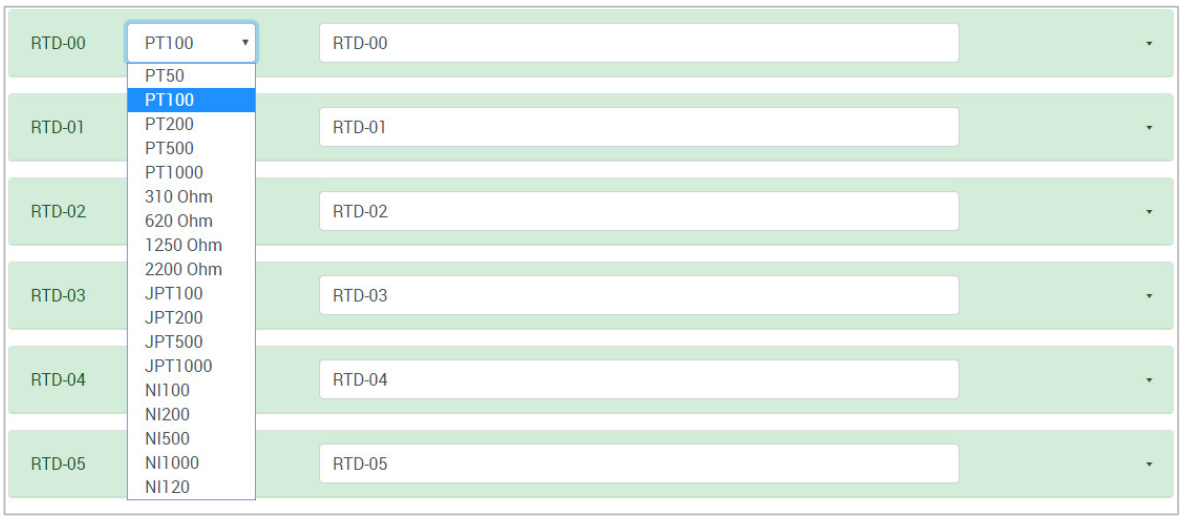
**Scaled Unit:** The unit of the scaled value (max. length = 8, "." character is not allowed).

**Power On Scaled Value:** The AO scaled value upon powering on.

**Safe Mode Status:** There are two options for defining the safe mode value: **User Define** and **Hold Last**.

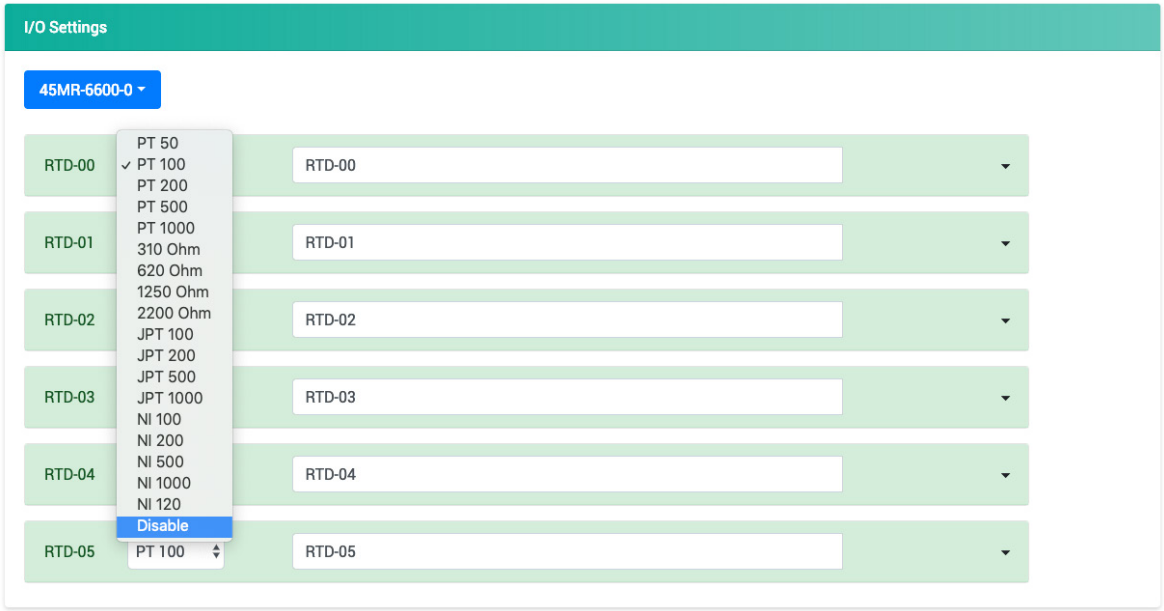
**Safe Mode Value:** The safe mode AO scaled value when the Safe Mode Status is set to User Define.

# RTD Channel Settings



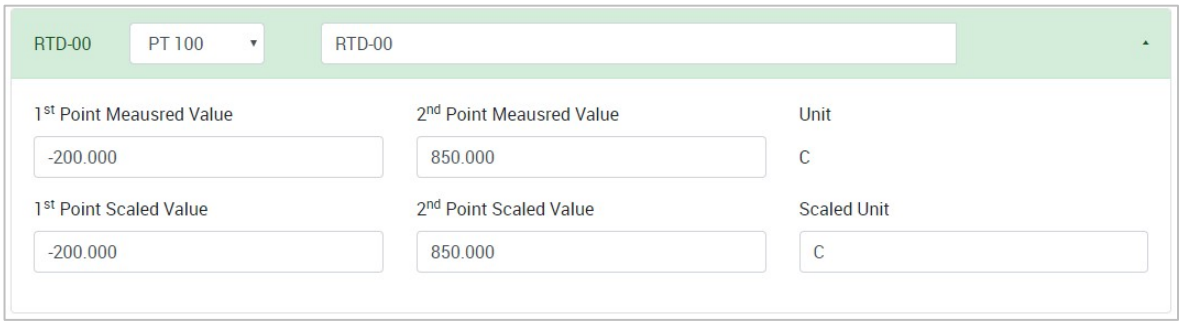

**Sensor Type Drop-Down List:** It lists all of the sensor types, which can be connected to this channel. Select the sensor type for each channel (option: PT50, PT100, PT200, PT500, PT1000, 310 ohms, 620 ohms, 1250 ohms, 2200 ohms, JPT100, JPT200, JPT500, JPT1000, NI100, NI200, NI500, NI1000, NI120, or Disable).

## Disable Mode




The RTD channel can be disabled. You may only disable channels one-by-one. When a channel has been disabled, the sample rate of the remaining channels will be increased automatically.

**Channel Name:** The channel name is used for representing this channel (max. length = 16, "." character is not allowed).




**1st Point Measured Value:** The 1st point value in the range of channel mode to be scaled to the **1st Point Scaled Value** (acceptable input value depends on the type of sensor).

**2nd Point Measured Value:** The 2nd point value in the range of channel mode to be scaled to the **2nd Point Scaled Value** (acceptable input value depends on the type of sensor).

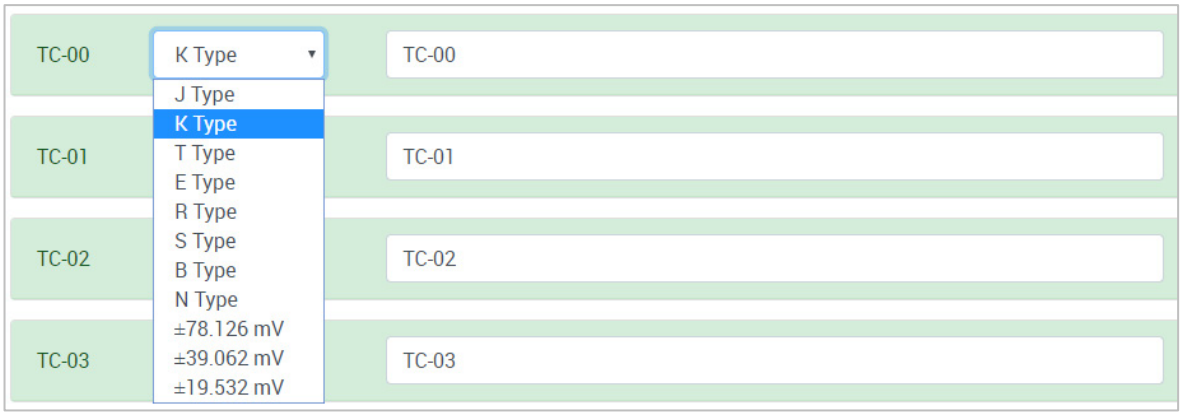
**Unit:** The unit of the measured value.

**1st Point Scaled Value:** The scaled value of the 1st point (-4294967295 to 4294967295).

**2nd Point Scaled Value:** The scaled value of the 2nd point (-4294967295 to 4294967295).

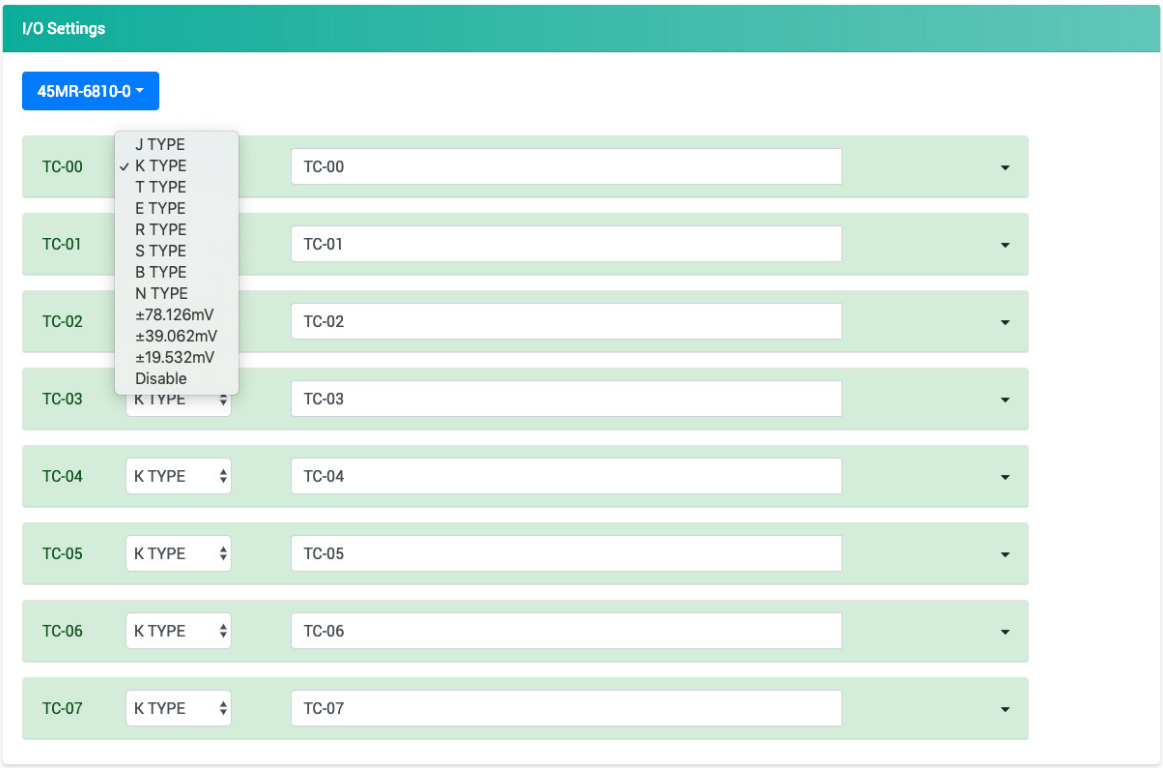
**Scaled Unit:** The unit of the scaled value (max. length = 8, "." character is not allowed).

## TC Channel Settings



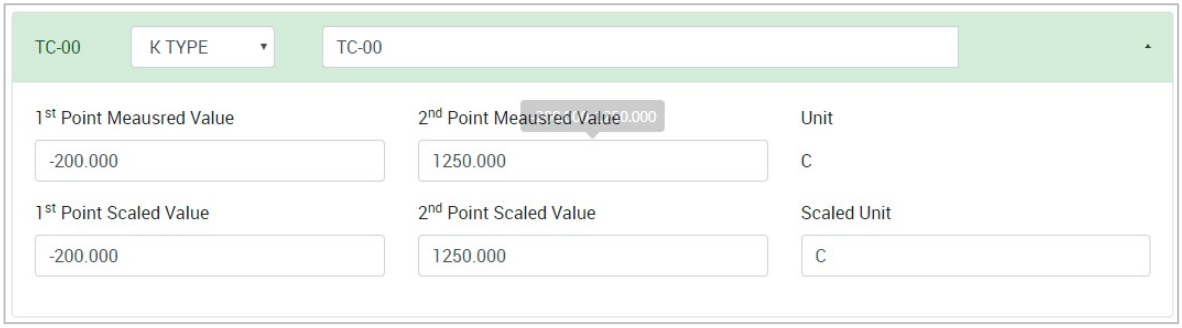

**Sensor Type Drop-Down List:** It lists all of the sensor types, which can be connected to this channel. Select the sensor type for each channel (option: J Type, K Type , T Type , E Type , R Type , S Type , B Type , N Type , ±19.532 mV, ±39.062 mV, ±78.126 mV, or Disable).

## Disable Mode




The TC channel can be disabled. You may only disable channels one-by-one. When a channel has been disabled, the sample rate of the remaining channels will be increased automatically.

**Channel Name:** The channel name is used for representing this channel (max. length = 16, "." character is not allowed).




**1st Point Measured Value:** The 1st point value in the range of the channel mode to be scaled to the **1st Point Scaled Value** (acceptable input value depends on the type of sensor).

**2nd Point Measured Value:** The 2nd point value in the range of the channel mode to be scaled to the **2nd Point Scaled Value** (acceptable input value depends on the type of sensor).

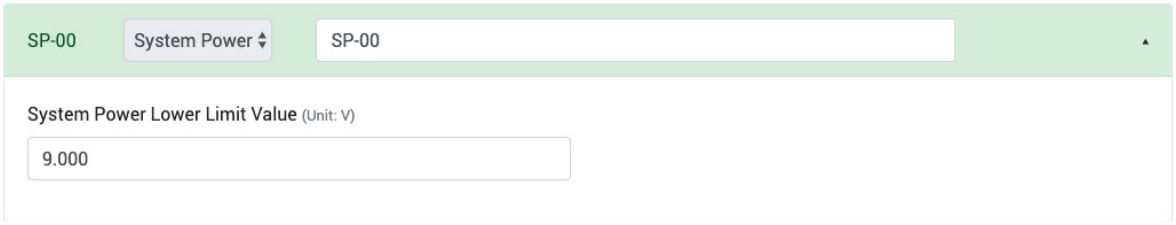
**Unit:** The unit of the measured value.

**1st Point Scaled Value:** The scaled value of the 1st point (-4294967295 to 4294967295).

**2nd Point Scaled Value:** The scaled value of the 2nd point (-4294967295 to 4294967295).

**Scaled Unit:** The unit of the scaled value (max. length = 8, "." character is not allowed).

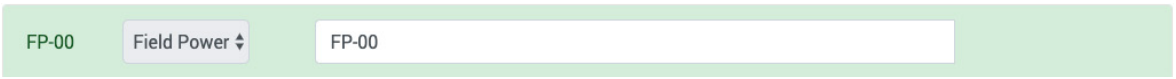
### System Power (SP) channel Setting




**Channel Name:** The channel name is used for representing this channel (max. length = 16, "." character is not allowed).

**System Power Lower Limit Value:** When the system power voltage drops below the limit, the system power alarm will be triggered.

### Field Power (FP) channel Setting




**Channel Name:** The channel name (FP-00) is used to represent this channel (max. length = 16, "." character is not allowed).

## Serial Port

This section introduces the serial port settings function.

The ioThinx 4510 serial port only supports Modbus RTU master in southbound communications. The retrieved data and/or the exception code from the Modbus RTU slave will be stored in the ioThinx 4510's internal register.

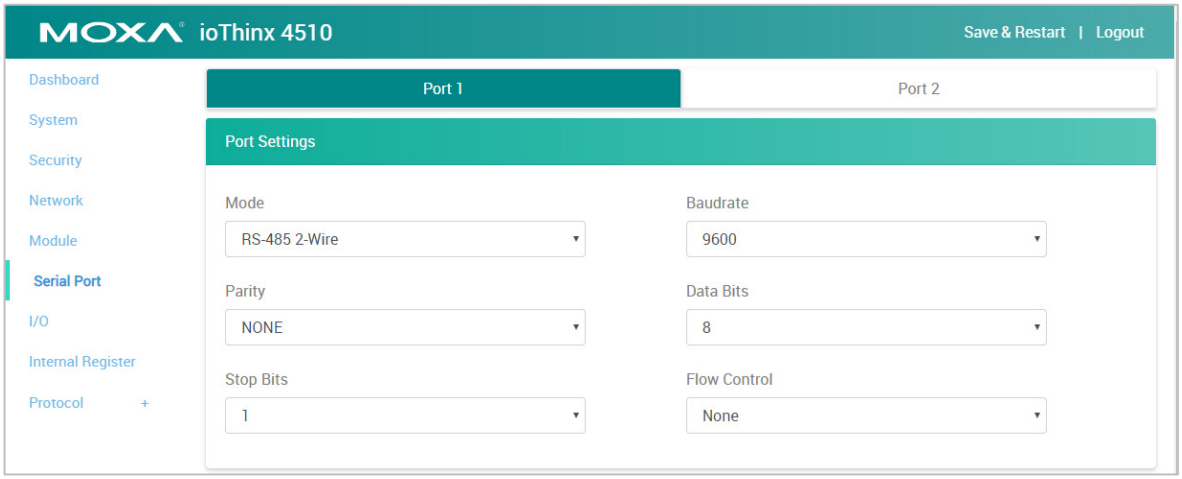
Three steps are required to complete the serial port settings:

- Port Setting
- Device Setting
- New Profile Setting.

## Port 1/Port 2

Click the tab to configure the settings of Port 1 or Port 2.

**NOTE** The Port 2 tab is only available when the **Mode** of the Port 1 is **RS-485 2-Wire**.




**Mode:** The standard of the serial device connected to this port (option: RS-232, RS-422, or RS-485 2-Wire).

**Baudrate:** The data transmission rate (option: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200 bps).

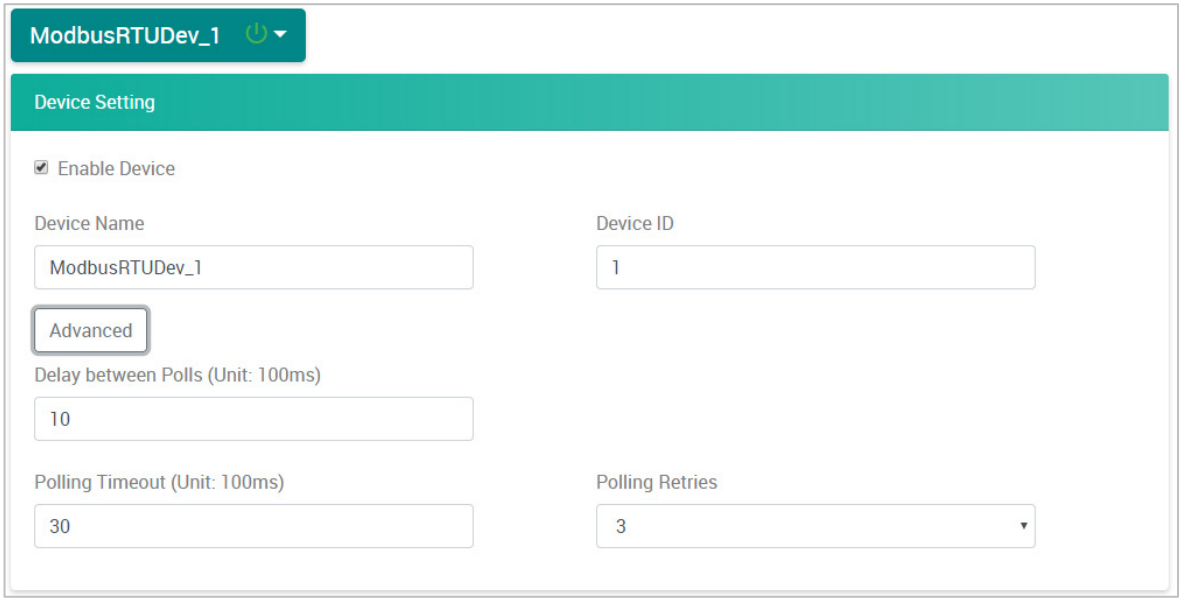
**Parity:** The method of detecting errors in transmission (option: Even, Odd, or None).

**Data Bits:** The data bits in each character (option: 5, 6, 7, or 8).

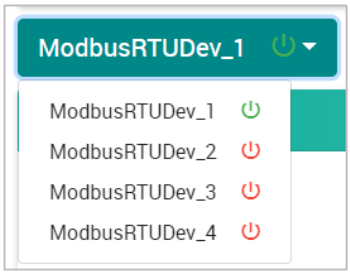
**Stop Bits:** The stop bits sent at the end of every character (option: 1 or 2).

**Flow Control:** The handshaking method (option: None, RTC/CTS, or XON/XOFF).

## Modbus RTU Device



**Device Drop-Down List:** It shows the device name of the Modbus RTU devices. Select one of the devices to configure its settings. The green icon shows that data collection from the device is enabled.




**Enable Device:** Click the checkbox to enable data collection from the device. The icon beside the Modbus device in the **Device Drop-Down List** will change from red to green after being enabled.

**Device Name:** Name of the Modbus device (max. length = 16; "." character is not allowed).

**Device ID:** The device ID of this Modbus device (options: 1 to 247; default: 1).

**Advanced Button:** Click this button to show/hide the following settings.

**Delay between Polls:** The delay time after polling the Modbus register(s) of the Modbus device (unit: 100 ms; 100 to 3600000; 0 disabled; default: 10).

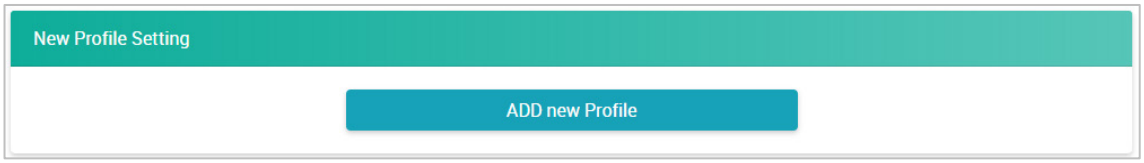
**Polling Timeout:** The timeout value when polling data from the Modbus device (unit: 100 ms; 0 to 30000; default: 30).

**Polling Retries:** The maximum number of retries after a polling timeout occurs (options: 0 to 10; default: 3).

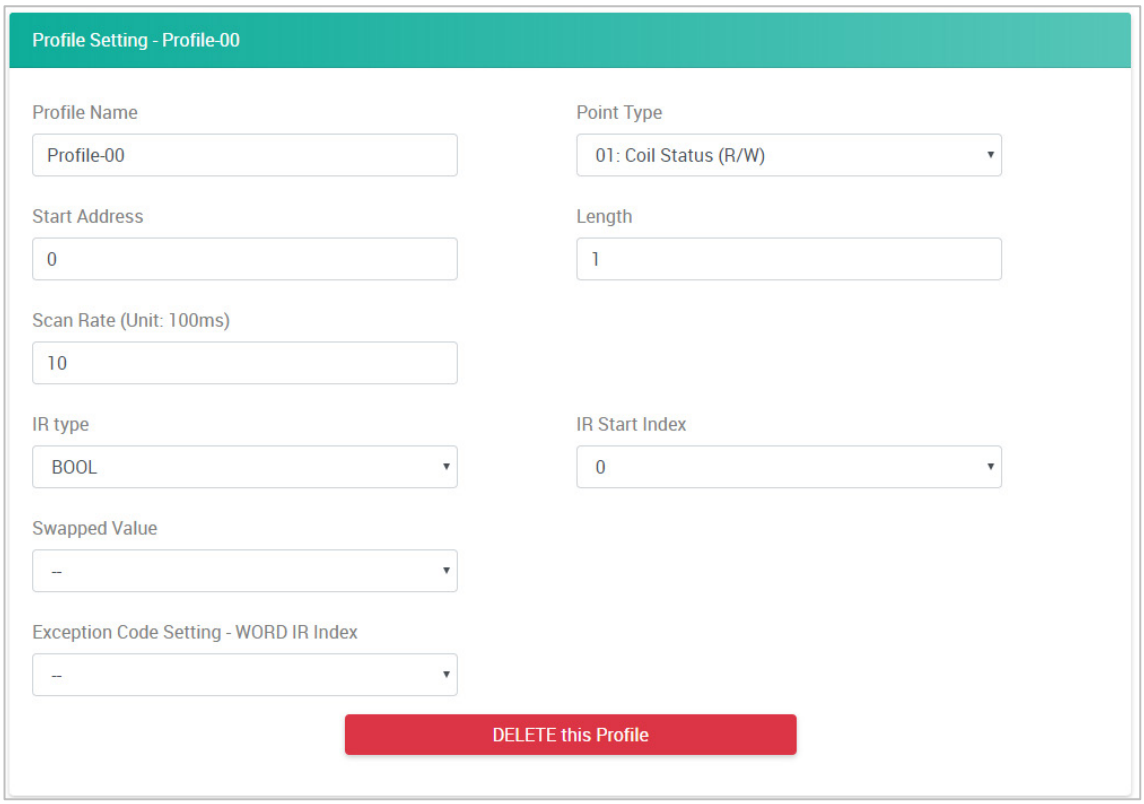
**NOTE** A maximum of four Modbus RTU devices can be connected to one serial port when the RS-485 mode is selected.

## Modbus RTU Device Profile

Click **Add New Profile** to create a profile of the selected device.



After creating a new profile, configure the settings of the profile.




**Profile Name:** Name the profile of the Modbus device (max. length = 16; "." character is not allowed).

**Point Type:** Set the corresponding Modbus point type setting (option: 01: Coil Status (R/W), 02: Input Status (R), 03: Holding Register (R/W), or 04: Input Register (R))

**Start Address:** Define the start address of this Modbus tag (0 to 65535).

**Length:** Define the length of the coil (1 to 2000) or the register (1 to 125).

**Scan Rate:** Define how quickly to poll the profile data (unit: 100 ms; 100 to 3600000; default: 10).

**IR Type:** Set the internal register data type (option: BOOL, WORD, DWORD, or FLOAT).

**IR Start Index:** Set the start number of the internal register for storing data. It only allows you to select available internal registers, depending on the length you define.

**Swapped Value:** Select a data conversion option.

| IR Type | Option |
|---|---|
| WORD | 1. HiByte & LoByte<br>2. LoByte & HiByte |
| DWORD | 1. HiWord & LoWord<br>2. LoWord & HiWord |
| FLOAT | 1. HiWord & LoWord<br>2. LoWord & HiWord |

**Exception Code Setting - WORD IR Index:** Set the internal register for exception code. It only allows you to select one of the available internal registers.

**Delete this Profile:** Click this button to delete this profile.

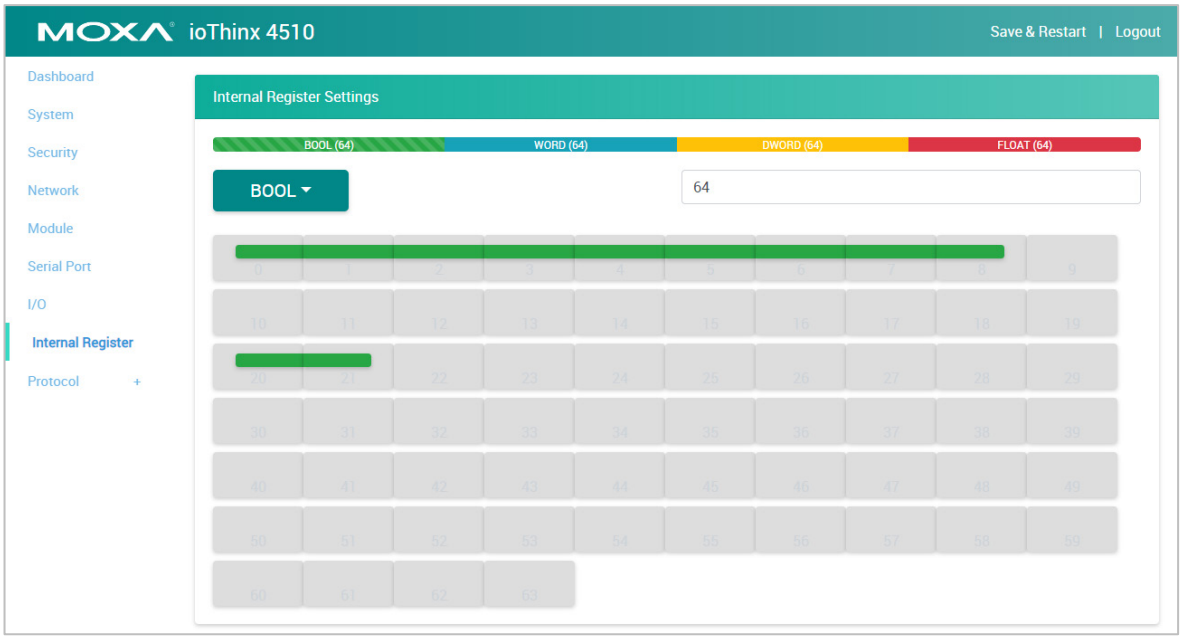
**NOTE** The maximum number of Modbus RTU device profiles that can be created is as follows.
- RS 232: 1 serial port/1 device/4 profiles
- RS 422: 1 serial port/4 devices/16 profiles
- RS 485: 2 serial port/8 devices/32 profiles

# Internal Register

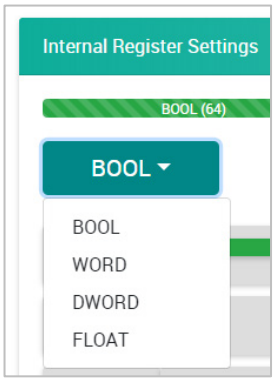
This section introduces functions of Internal Register settings.

The Internal Registers, which store the data retrieved from the Modbus/RTU master, can be mapped to the supported northbound protocols, such as Modbus/TCP, RESTful API, and MQTT.

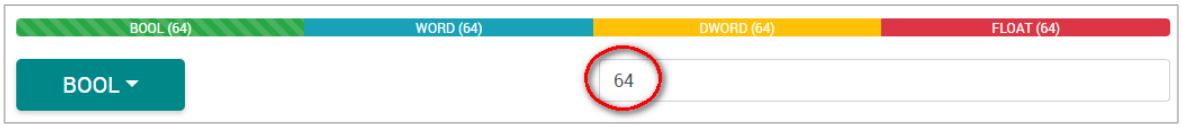
Each block represents one internal register location. Internal registers that are being used are indicated with a corresponding color bar at the top of the register, as shown below.



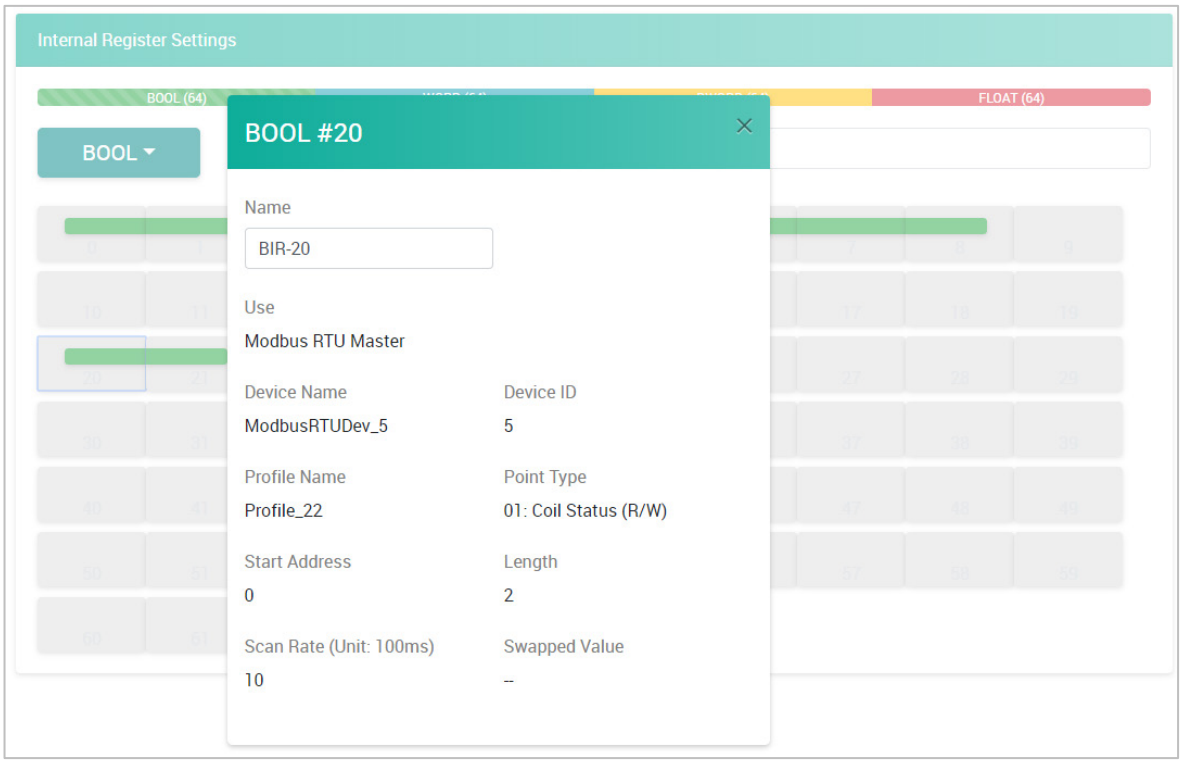

**IR Type Drop-Down List:** It lists all of the IR types. Select the IR type to modify or view its settings.




**IR Quantity:** Apply a number to adjust the quantity of the selected IR type. The total available IR quantity is 256.



**IR Information:** The IR status window will pop-up after you click one of the IR blocks. The name is used for representing this internal register (max. length = 16, "." character is not allowed).



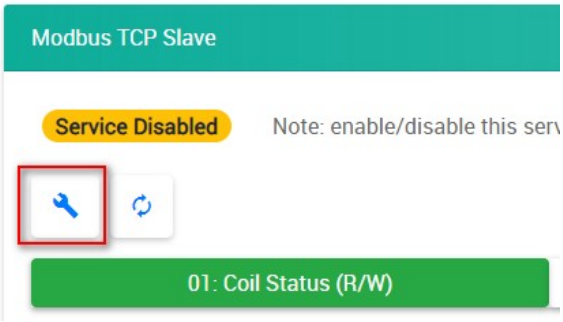

# Protocol

This section introduces the protocol settings functions.

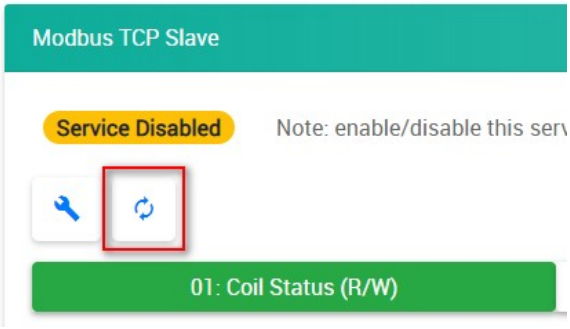
## Modbus TCP Slave

The **Modbus TCP Slave** section shows the definition of the device's Modbus registers. It allows you to define your own data point type or address of the Modbus registers. The point type and address of a register can be default, existing configuration, or user-defined.

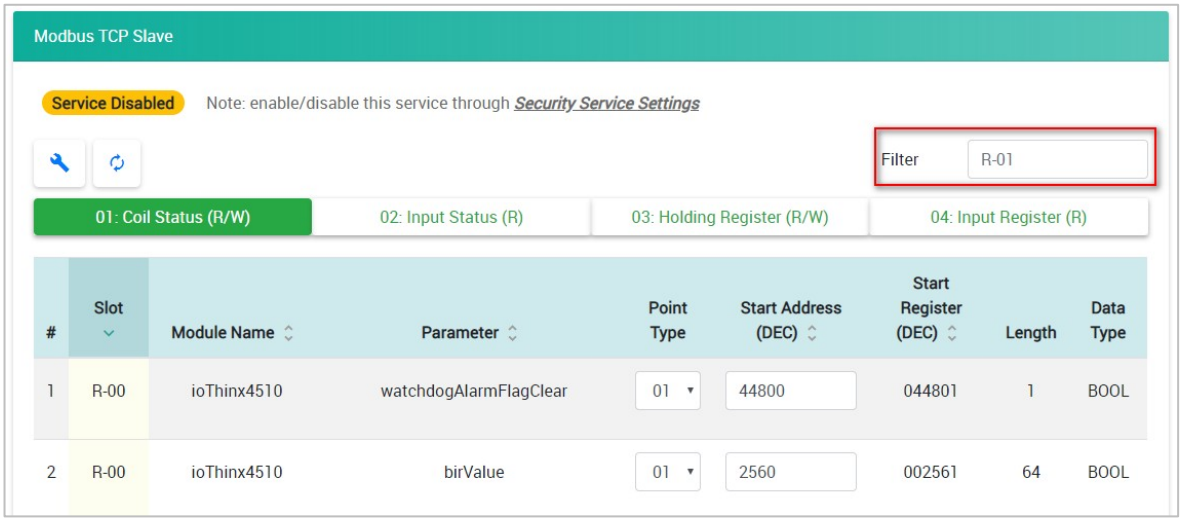
**Load Default:** Click this button to load default settings of all Modbus registers.



**Reload Configuration:** Click this button to reload the configuration settings of all Modbus registers.

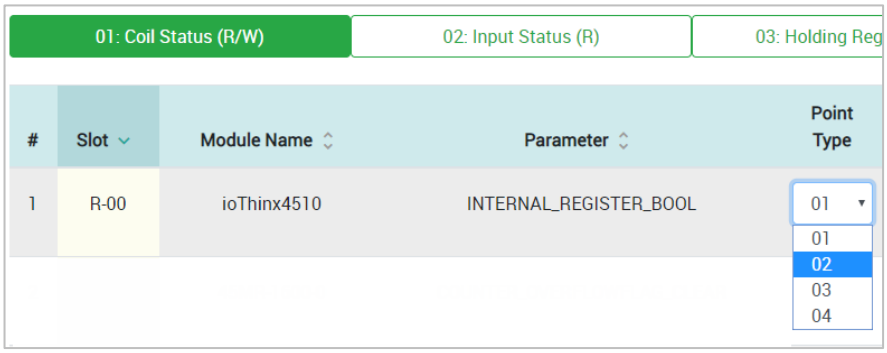



**Filter:** Type characters into the textbox to filter the items in the Modbus Table.

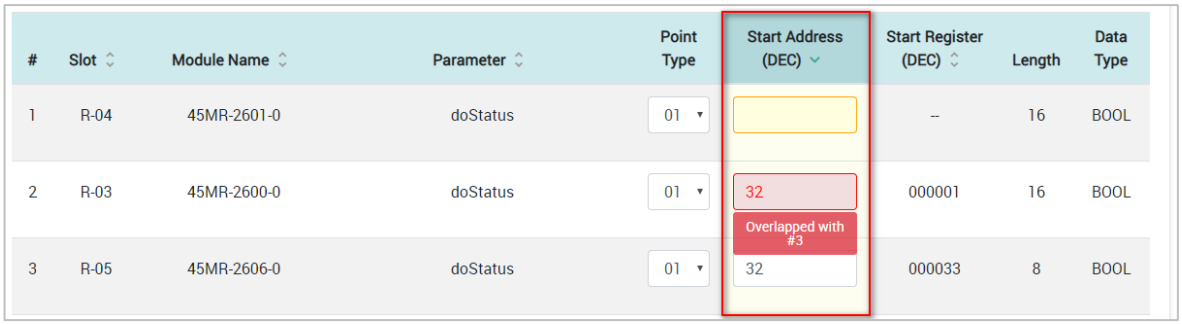



**Point Type Category:** Click **01: Coil Status (R/W)**, **02: Input Status (R)**, **03: Holding Register (R/W)**, or **04: Input Register (R)** tab to see the registers under the specific point type.

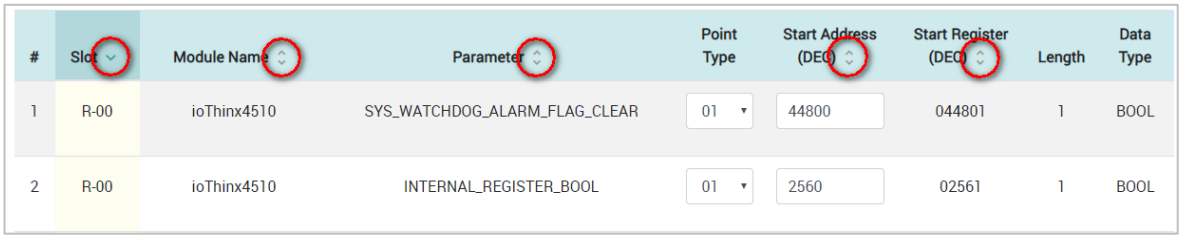
**Point Type Drop-Down List:** Select the point type of the parameter when it needs to move to the other point type. After you select the other point type, the parameter will disappear in the current-viewed category and will move to the point type category you just selected (option: 01, 02, 03, or 04).



**Start Address Textbox:** Change the value of the Start Address in the textbox (0 to 65535 or leave it blank). When there is no value in the textbox, it will be displayed in light yellow. When it conflicts with another register, it will be displayed in red. Revise the value to prevent address conflict. You can use the **Sort** function to see where there is a conflict of addresses.




**Sort:** The default-sorted column is the **Slot** from the lowest to highest slot number. Click the green arrow to change the sorting method. Click the gray arrows on the other columns to sort that specific column.



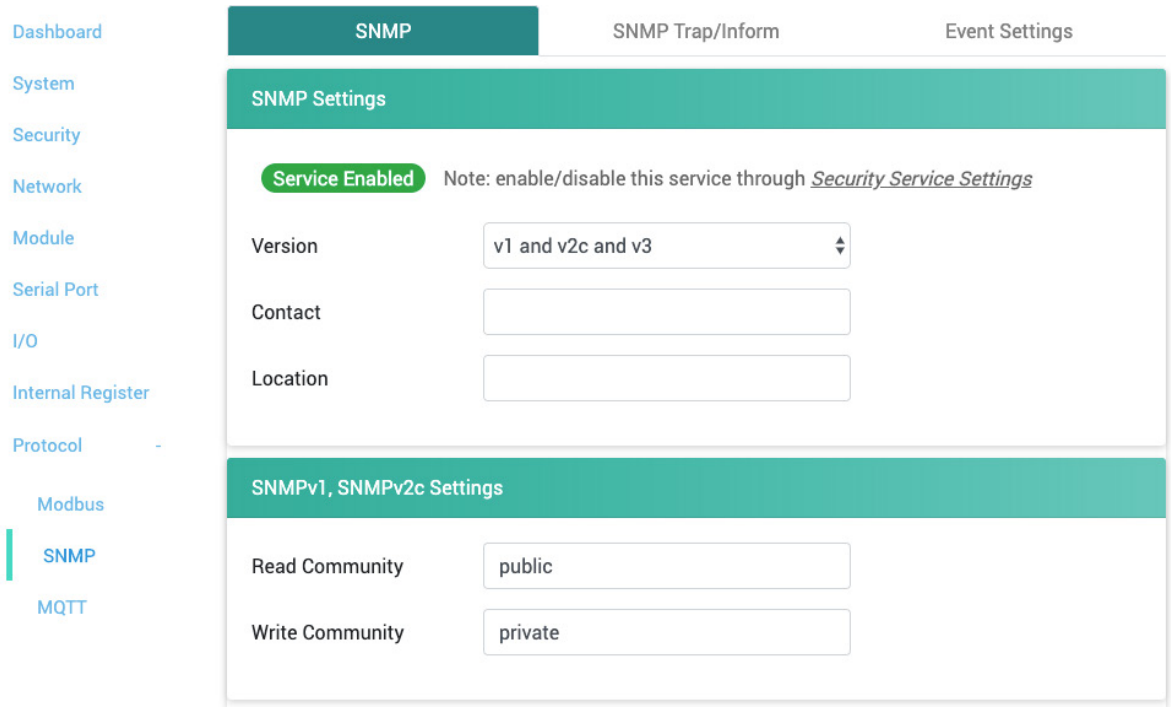

**INFORMATION** Enable/disable this service through **Security → Service Settings**.

**INFORMATION** In the event that a conflict address value is entered, whenever you click on a different point type tab, the previous configurations will be restored to avoid the conflict.

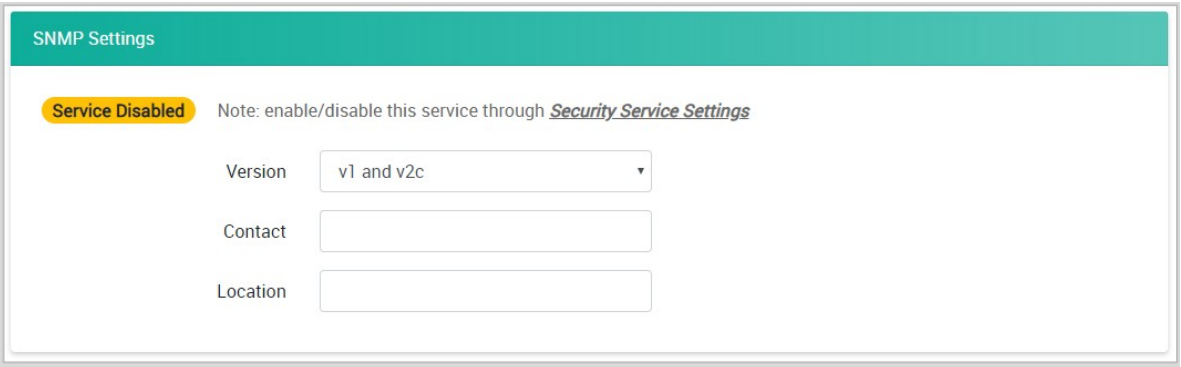
**INFORMATION** Refer to **Modbus/TCP Slave Rules** for the available Modbus register.

# SNMP

In the SNMP page, settings are divided into three tabs: SNMP, SNMP Trap/Inform, and Event Settings.




## SNMP Settings




**Version:** Select one of the SNMP version options (option: v1 and v2c, v3 only, or v1 and v2c and v3), through which the SNMP Manager can access the SNMP agent of the device.

**Contact:** Type the contact of the SNMP server (max length = 30).

**Location:** Type the physical location of the SNMP server (max length = 30).

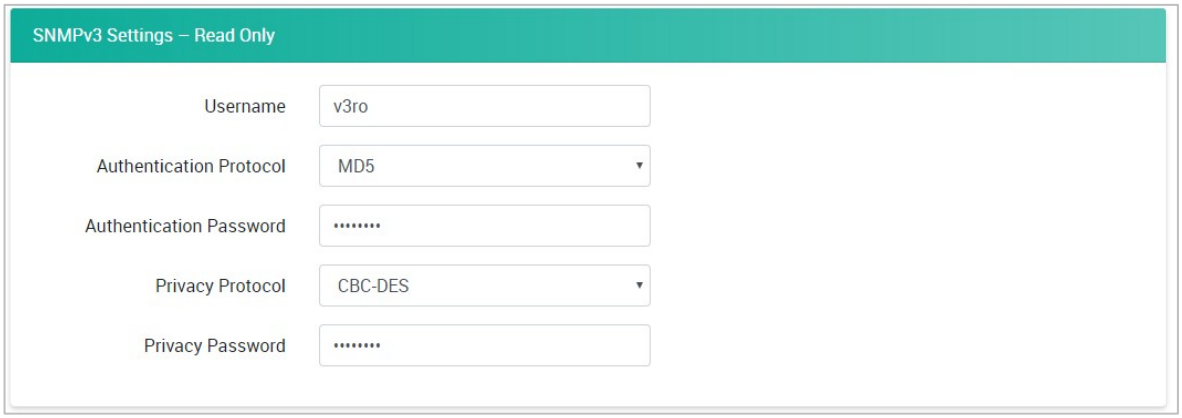
**INFORMATION** Enable/disable this service through **Security → Service Settings**.

## SNMPv1, SNMPv2c Settings

**Read Community:** Type the community string matching for read authentication (max length = 30, default = "public").

**Write Community:** Type the community string matching for write authentication (max length = 30, default = "private").

## SNMPv3 Settings – Read Only




**Username:** Type the username for SNMP v3 settings (min. length = 1; max length = 30; A to Z, a to z, 0 to 9, symbols, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "v3ro").

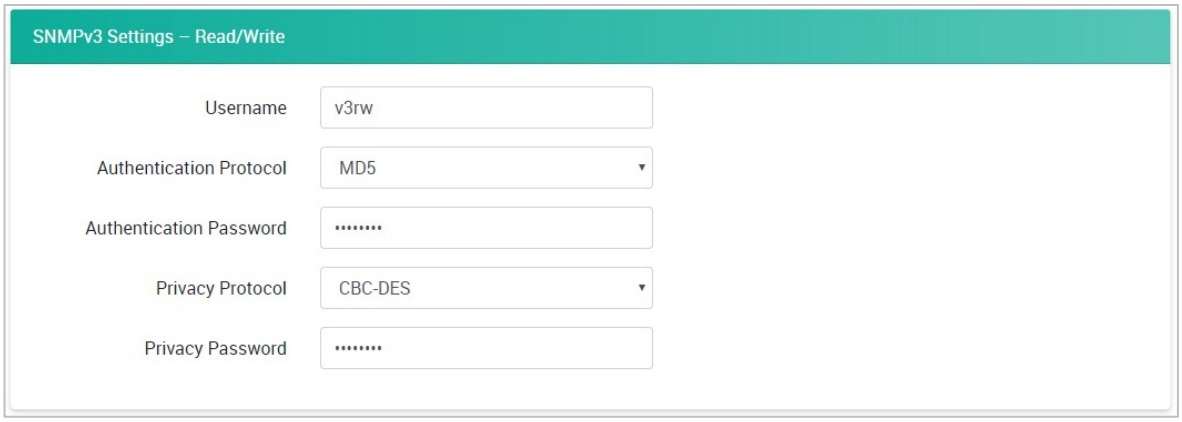
**Authentication Protocol:** Select **Disable**, **MD5**, **SHA1**, **SHA-224**, or **SHA-256** for the authentication protocol setting (default: MD5).

**Authentication Password:** Type the password for the authentication password settings (min. length = 8; max length = 16; A to Z, a to z, 0 to 9, symbols, at least one symbol and one number, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "moxa-123").

**Privacy Protocol:** Select **Disable**, **CBC-DES**, or **AES-128** for privacy protocol setting (default: CBC-DES).

**Privacy Password:** Type the password for the privacy password settings (min. length = 8; max length = 16; A to Z, a to z, 0 to 9, symbols, at least one symbol and one number, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "moxa-123").

### SNMPv3 Settings – Read/Write




**Username:** Type the username for the SNMP v3 settings (min. length = 1; max length = 30; A to Z, a to z, 0 to 9, symbols, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "v3rw").

**Authentication Protocol:** Select **Disable**, **MD5**, **SHA1**, **SHA-224**, or **SHA-256** for the authentication protocol settings (default: MD5).

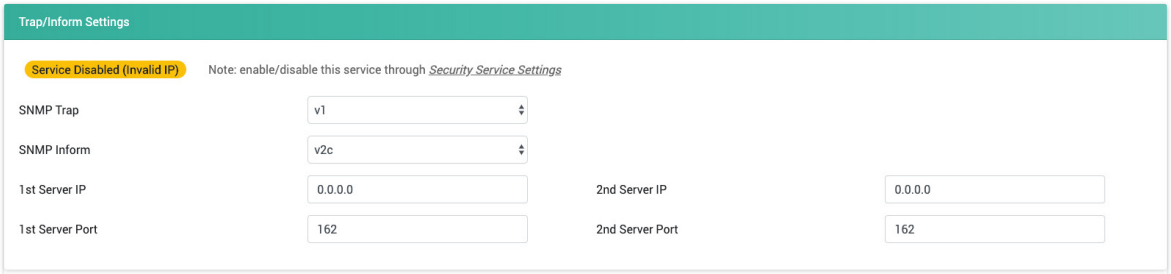
**Authentication Password:** Type the password for the authentication password settings (min. length = 8; max length = 16; A to Z, a to z, 0 to 9, symbols, at least one symbol and one number, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "moxa-123").

**Privacy Protocol:** Select **Disable**, **CBC-DES**, or **AES-128** for privacy protocol settings (default: CBC-DES).

**Privacy Password:** Type the password for the privacy password settings (min. length = 8; max length = 16; A to Z, a to z, 0 to 9, symbols, at least one symbol and one number, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "moxa-123").

**INFORMATION** Refer to **SNMP Rules** for detailed SNMP OID information.

## SNMP Trap and SNMP Inform



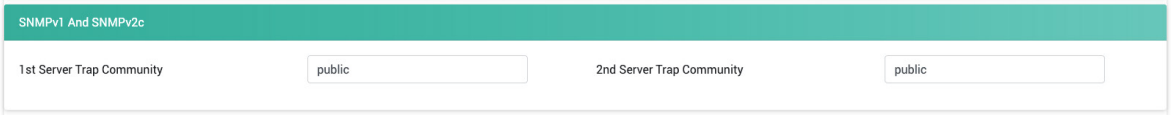

**SNMP Trap:** Select one of the SNMP version options (option: v1, v2c, or v3), through which the SNMP server can receive the SNMP Trap from the SNMP agent.

**SNMP Inform:** Select one of the SNMP version options (option: v2c or v3), through which the SNMP server can receive the SNMP Inform from the SNMP agent.

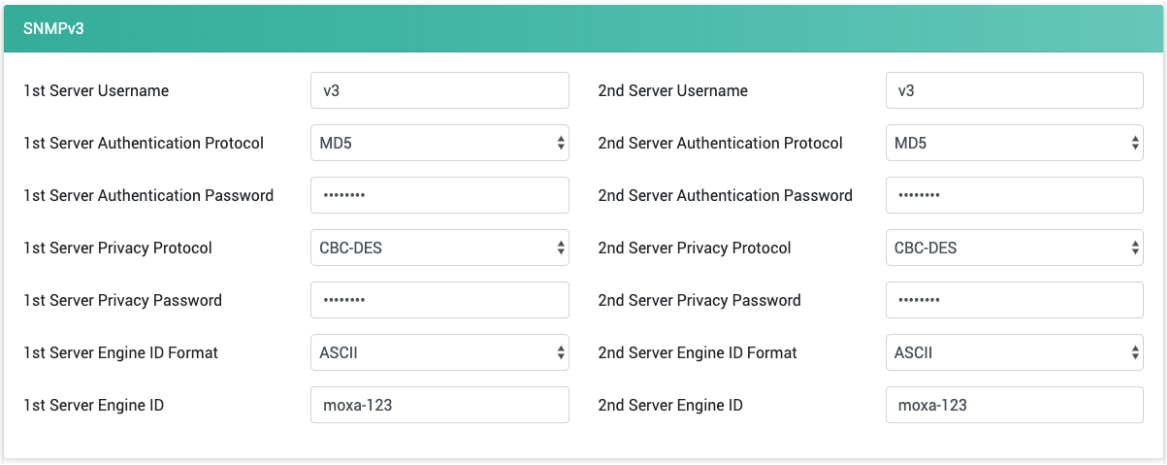
**IP:** Type the IP address of the SNMP server.

**NOTE** If the IP is 0.0.0.0, the ioThinx 4510 will not update the SNMP Trap/Inform to the server.

**Port:** Enter the port of the SNMP server(default = 162).



**Trap Community:** Type the community string matching for read authentication (max length = 30, default = "public").




**Username:** Type the username for the SNMP v3 settings (min. length = 1; max length = 30; A to Z, a to z, 0 to 9, symbols, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "v3").

**Authentication Protocol:** Select **Disable**, **MD5**, **SHA1, SHA-224,** or **SHA-256** for the authentication protocol settings (default = MD5).

**Authentication Password:** Type the password for the authentication password settings (min. length = 8; max length = 16; A to Z, a to z, 0 to 9, symbols, at least one symbol and one number, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "moxa-123").

**Privacy Protocol:** Select **Disable, CBC-DES,** or **AES-128** for privacy protocol settings (default = CBC-DES).

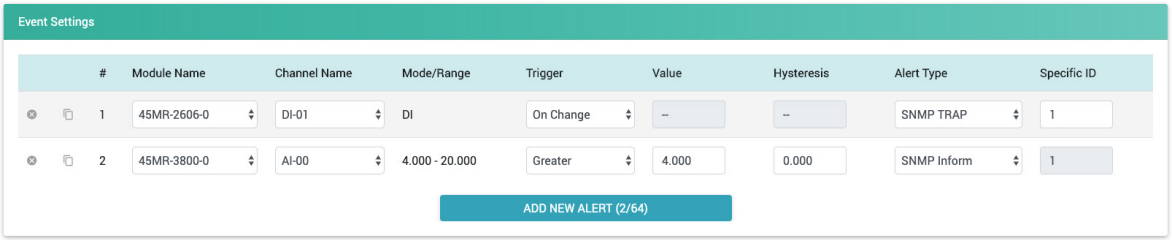
**Privacy Password:** Type the password for the privacy password settings (min. length = 8; max length = 16; A to Z, a to z, 0 to 9, symbols, at least one symbol and one number, spaces and .()[]{}/\'"@;: symbols are not allowed, default = "moxa-123").

**Engine ID format:** Select **ASCII** or **HEX** for the engine ID (default = ASCII).

**Engine ID:** Type the engine ID to use (max length = 32 (ASCII) / 64 (HEX), default = "moxa-123")

| **NOTE** | In HEX format, please add a "0" for single-digit engine IDs. (e.g. "3" should be "03"). |
|---|---|

## Event Settings




Each row in this page represents one monitored event.
Click the exit delete icon to delete the event:

Click the duplicate icon to duplicate the event:

The ioThinx 4510 supports a maximum of 64 events. Click **ADD NEW ALERT** to create a new event.

**Module Name:** Select a module. Only input modules will be listed here.

**Channel Name:** Select the channel you want to monitor the event.

**Trigger:** Select the event trigger type. For Digital Input, there are three options, **On Change**, **ON to OFF**, and **OFF to ON**. For Analog Input, the two trigger options are **Greater** and **Less**.

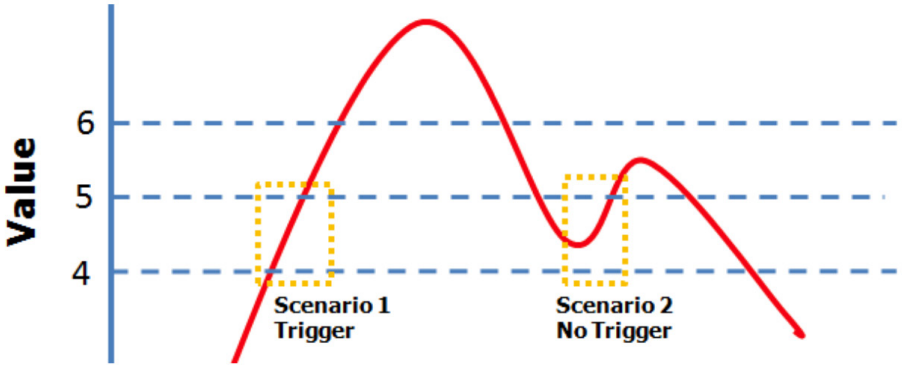
**Value:** Type the threshold value of the trigger. This is only used for Analog Input events.

**Hysteresis:** Type the hysteresis value of the trigger. This is only used for Analog Input events.

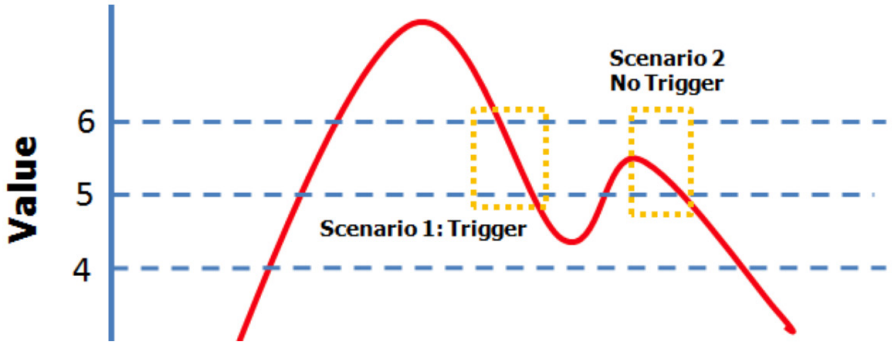
For illustration purposes, consider the following example where we set the AI-00 channel's trigger value to be greater than 5 with a hysteresis of 1, and also smaller than 5 with a hysteresis of 1.

| | # | Module Name | Channel Name | Mode/Range | Trigger | Value | Hysteresis | Alert Type | Specific ID |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 45MR-3800-0 | AI-00 | 4.000 - 20.000 | Greater | 5.000 | 1.000 | SNMP TRAP | 1 |
| | 2 | 45MR-3800-0 | AI-01 | 4.000 - 20.000 | Less | 5.000 | 1.000 | SNMP TRAP | 1 |

When Trigger = Greater, Value = 5, and Hysteresis = 1, the SNMP trap will only be triggered if the analog signal fluctuates from 4 to 5, as depicted in Scenario 1 below. However, if we change the settings to Value = 5 and Hysteresis = 2, the SNMP trap will only be triggered if the analog signal fluctuates from 3 to 5.

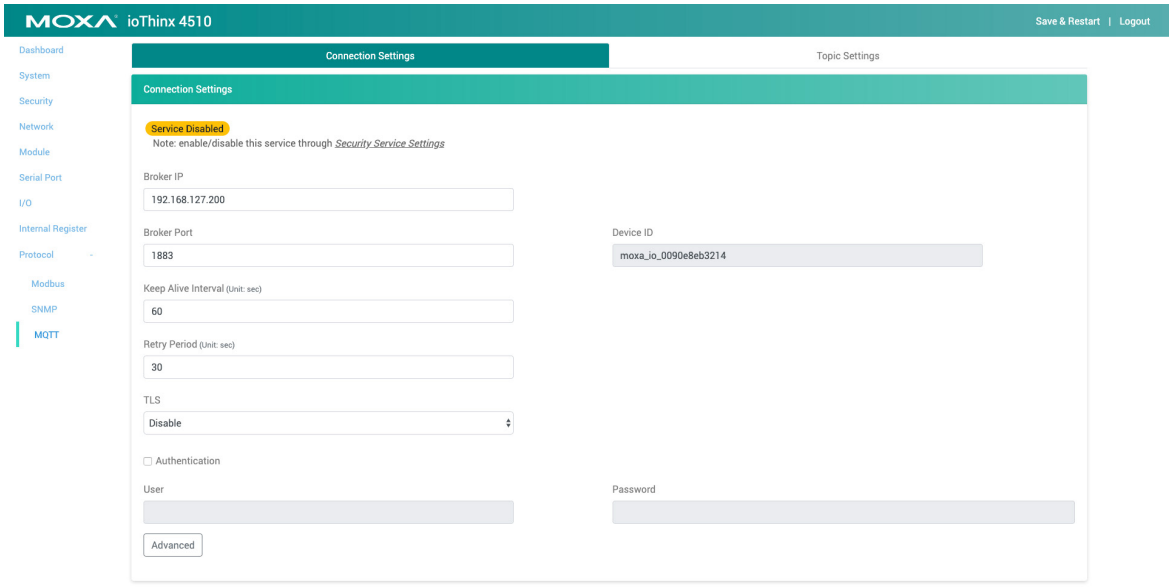



When Trigger = Less, Value = 5, and Hysteresis = 1, the SNMP trap will only be triggered if the analog signal fluctuates from 6 to 5, as depicted in Scenario 1 below. However, if we change the settings to Value = 5 and Hysteresis = 2, the SNMP trap will only be triggered if the analog signal fluctuates from 7 to 5.



# MQTT

The ioThinx 4510 supports MQTT version 3.1.1. In this section we introduce the MQTT settings. The MQTT configuration page has two channels: **Connection Settings** and **Topic Settings**.




## Connection Settings

**Broker IP** Specifies the broker IP name.

**Broker Port:** Specifies the broker port in this column.

**Authentication:** Select the Authentication checkbox to enable the username and password settings. The username and password are used when an MQTT client connects to a broker.

**Keep Alive Interval:** Keep alive is designed to ensure that a connection between the MQTT client and broker exists. The ioThinx 4510 will send the keep alive packets to the broker at designated intervals.

**Device ID:** The Device ID is used by the broker to identify each client that is connected to it. The ioThinx 4510's Device ID is unique and cannot be changed. The ID consists of the prefix **moxa_io_** followed by the MAC address of the ioThinx 4510.

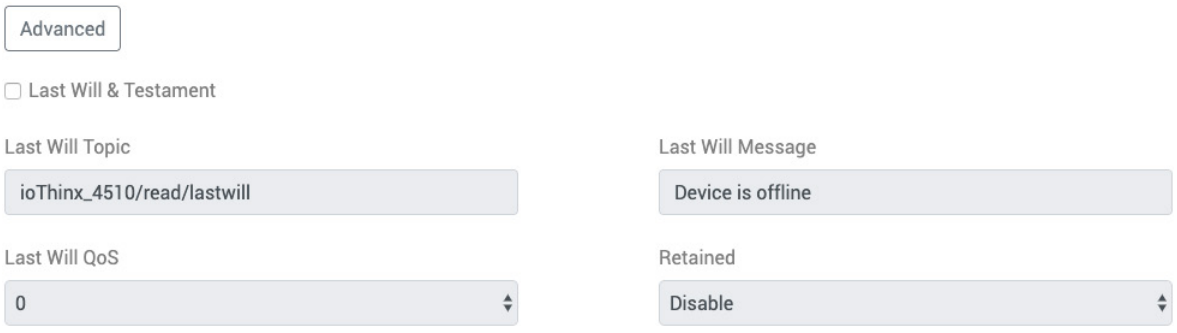
**TLS:** The ioThinx 4510 uses TLS to encrypt MQTT transmissions. You may enable or disable TLS.

**WARNING**

If TLS encryption is disabled, ***the username and password will be transmitted in plain text***.

### Advanced

Click the Advanced button to view the Last Will & Testament Settings.



**Last Will Topic:** The "topic" of the last will message that will be sent to the broker. This item is not configurable.

**Last Will Message:** The message that will be sent to the broker when the connection between the ioThinx 4510 and the broker is disconnected. This item is not configurable.

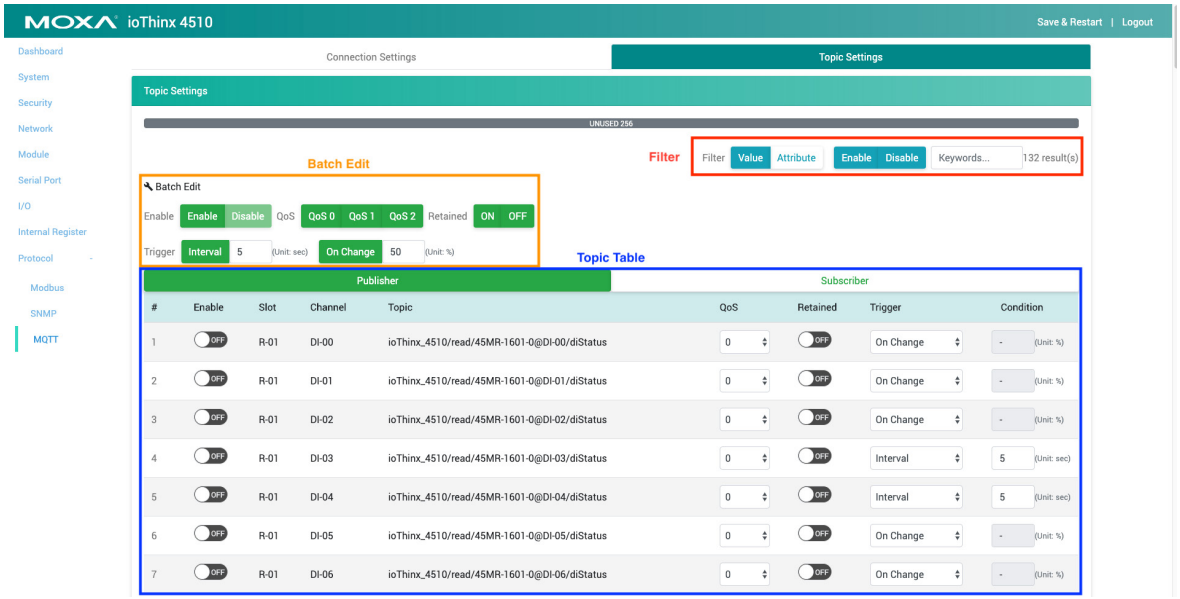
**Last Will QoS:** The ioThinx supports three QoS levels:

- QoS 0 (at most once): Data is delivered without acknowledgement. This level of QoS provides best-effort delivery but without guarantee.
- QoS 1 (at least once): Data is delivered with acknowledgement. In this case, when the ioThinx 4510 sends data, it expects to receive an Ack back from broker. With this level of QoS, data may be delivered multiple times.
- QoS 2 (exactly once): Data is delivered exactly once using a "four-part-handshake". This level of QoS is the most reliable, but is generally slower than QoS 0 and QoS 1.

**Retained:** The broker will save messages that are not delivered to a subscriber who is offline when the message is first delivered, and then resend the message when the subscriber comes back online.

## Topic Settings

All the topics provided by the ioThinx 4510 will be listed here. The topics are default disabled. User needs to select which topics are needed to be enabled. The topic which can be published or subscribed are listed in the page **Publication** or **Subscription**, respectively.




**Filter:** The ioThinx 4510 has a filter function in the top right corner of the subscribe page that allows users to find topics more easily. Click the **Value**/**Attribute**/**Enable**/**Disable** buttons and then type a keyword to find a topic within several seconds. The number of filtered topics will be shown as well.

**Value/Attribute:** The following most frequently used IO data will be filtered by **Value**. Other IO data, which is not listed, will be filtered by **Attribute**.

- diStatus
- diCounterValue
- diCounterStauts
- doStatus
- doPulseStatus
- relayStatus
- relayCurrentCount
- aiStatus

- aiValueScaled
- aoStatus
- aoValueScaled
- rtdStatus
- rtdValueScaled
- tcStatus
- tcValueScaled

**Enable/Disable:** Filter out the enabled or disabled topic.

**Textbox:** Type in the topic that you would like to filter.

**Batch Edit:** The ioThinx 4510 supports the **Enable**/**Disable**/**QoS**/**Retain**/**Trigger** function for batch editing. When the batch edit function is clicked, all filtered topics will be set. If the topic does not support the batch edit function (e.g., the topic does not support On Change but the user batch edits all), the edit will be skipped by the topic.

**NOTE** The ioThinx 4510 only supports 256 topics. If there are more than 256 filtered topics, the enable button will be disabled.

**Topic Table:** All data that can be published or subscribed are listed in the table on the Publisher or Subscriber page.

**Slot:** The slot associated with the data.

**Channel:** The channel associated with the data.

**Topic:** Topics include the following items:

- Publish: {deviceName}/read/{ioName}/{parameters}
- Subscribe: {deviceName}/write/{ioName}/{parameters}
  - **{deviceName}:** the device name which user specified in **Device Setting** Page
  - **{ioName}:** the {ioName} is in the format {moduleName@channelName}. User can specify the module name in **Module** page and channel name in **I/O** pages, respectively.
  - **{Parameters}:** the parameters is indicated the data which will be accessed by MQTT. Please refer to the Appendix for the detail description about data.

**QoS:** The QoS of each topic. It shares the same level with Slot/Channel/Topic.

**Retain:** Enables the retain function to force the broker to keep the latest data and send it to subscribers when subscribers are back online.

**Trigger and Condition:** Determines how the topic will be published.

- Interval: The topic will be published at specific intervals.
- OnChange: The topic will be published when the change criteria are met:
  - For Digital Input, the topic will be published when the value changes.
  - For Analog Input, the topic will be published when a specific percentage of the data changes compared with previous update. The percentage refers to the full range.

**NOTE** Setting a short interval may result in an unsuccessful publish.

# 5

# Quick Start Guide

The following topics are covered in this chapter:

- **Configuring the Unit**
  - Login to the Unit
  - Configuring Module Settings
  - Changing Device Name
  - Changing Username & Password
  - Configuring Service Settings
  - Configuring Account Settings
  - Configuring Network Settings
  - Configuring Serial Port & IR Settings
  - Configuring I/O Settings
  - Configuring Modbus Address Settings
  - Configuring SNMP Settings
  - Configuring MQTT Settings
- **Mass-deploying the Settings**
  - Updating Configuration to Multiple Units
  - Setting Date and Time to Multiple Units
  - Changing IP Addresses to Multiple Devices
  - Changing the Device Name of Multiple Devices
  - Retrieving the System Log from Multiple Devices
  - Getting a Self-signed Certificate from Multiple Devices
- **Monitoring & Operating the Unit**
  - Monitoring Module & I/O Status
  - Monitoring Connection Status
  - Exiting Safe Mode Status
- **Maintaining the Unit**
  - Backing up Configuration Files
  - Updating the Firmware
  - Restarting the Unit
  - Loading Factory Default Settings

# Configuring the Unit

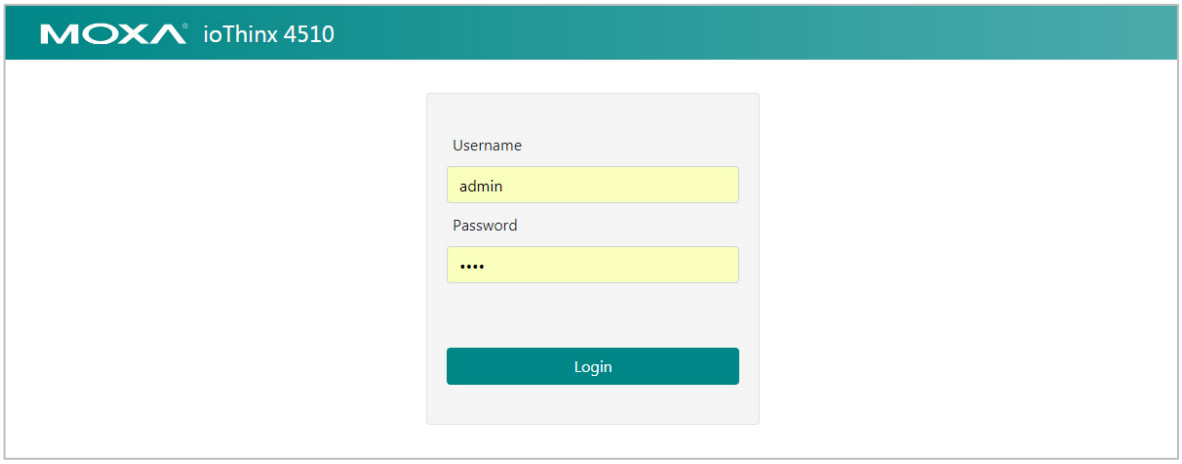
This section explains how to configure this device through the Web Console from the beginning. If you require additional information, please refer to Preparing Software Tools before reading this section.

## Login to the Unit

Follow the steps to log in to the unit.

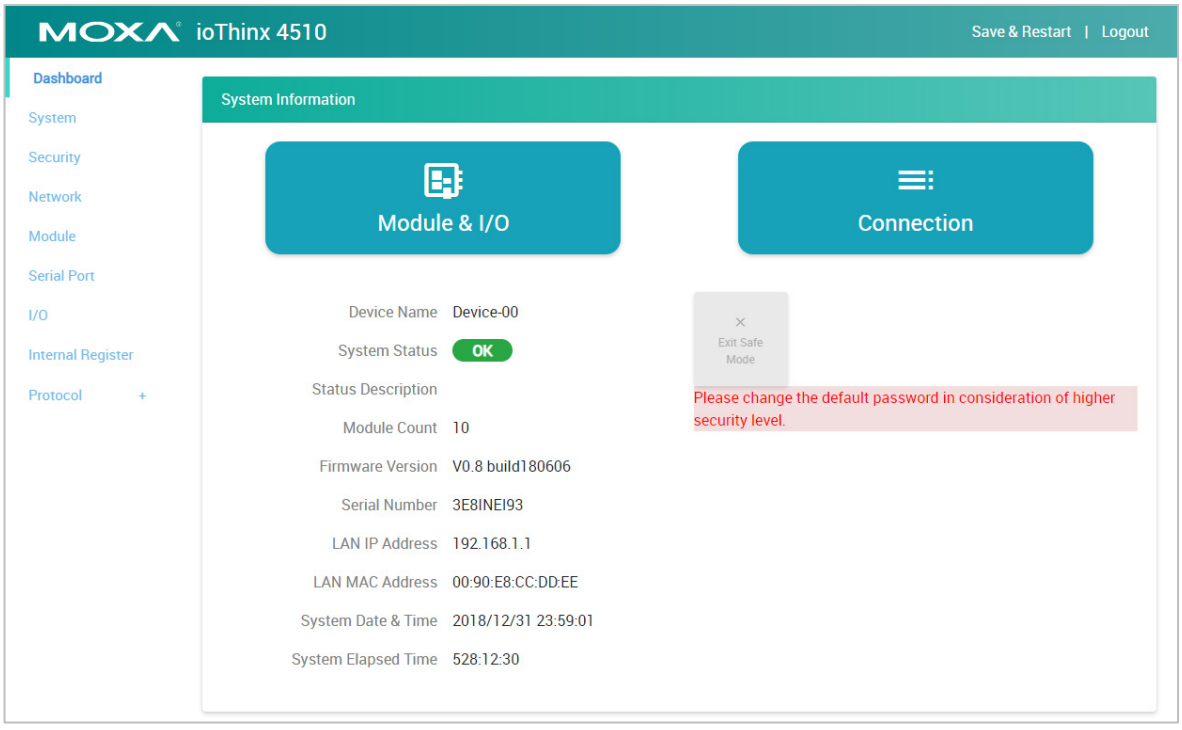
**Step 1:** Open your web browser and type the default IP address of the device, 192.168.127.254.

**Step 2:** On the login page, type the default username/password (admin/moxa) to log in to the Web Console.

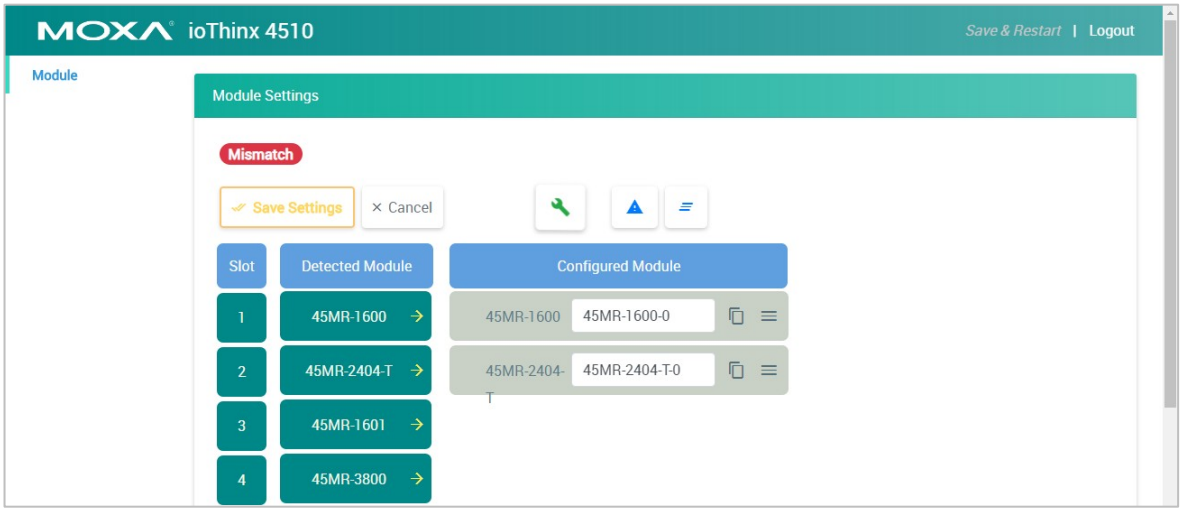



## Configuring Module Settings

After you have logged in, you can see the dashboard or the module settings page. If the detected module matches the configured module, you will see the **Dashboard** as below. Then click **Module** in the Menu panel to go to the module settings page.



If you see the module settings page as opposed to the dashboard, click **Edit** to enter the edit mode and start editing the module settings.

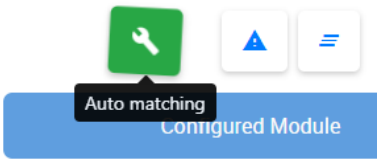



In edit mode, if any detected module and configured module do not match, the configured module will be highlighted as shown below.

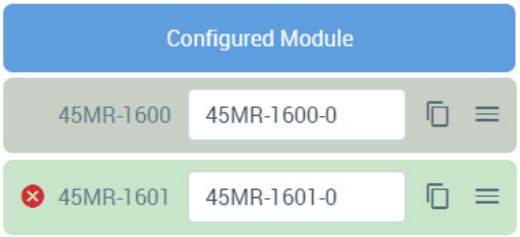
Click **Auto Matching** to match the conflicted modules.

If not, you can use the "Auto Match" function or swap the module to change the module sequence.

If you want to re-arrange the 45MR modules automatically, you can click "Auto Match".

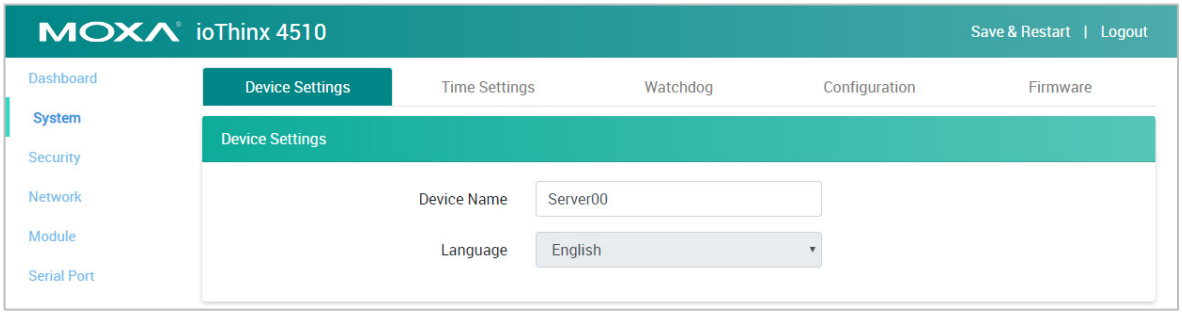



If you want to change configurations, you can use the swap function. To swap the module sequence, move the point to the module, click the left button on the mouse and hold it. After the module color changes to green, you can move it to change the position of the module.



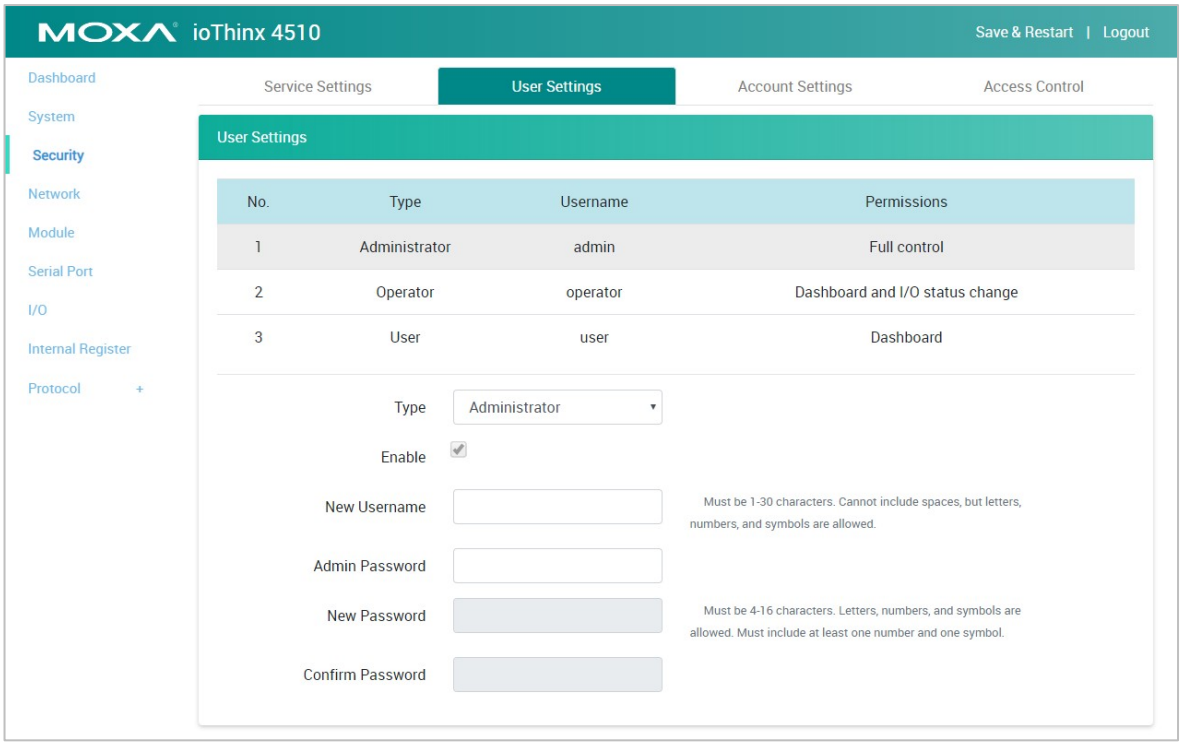
# Changing Device Name

Set the name of this device through **System → Device Settings**. We recommend choosing a unique name for the device in order to easily differentiate it from other devices.




# Changing Username & Password

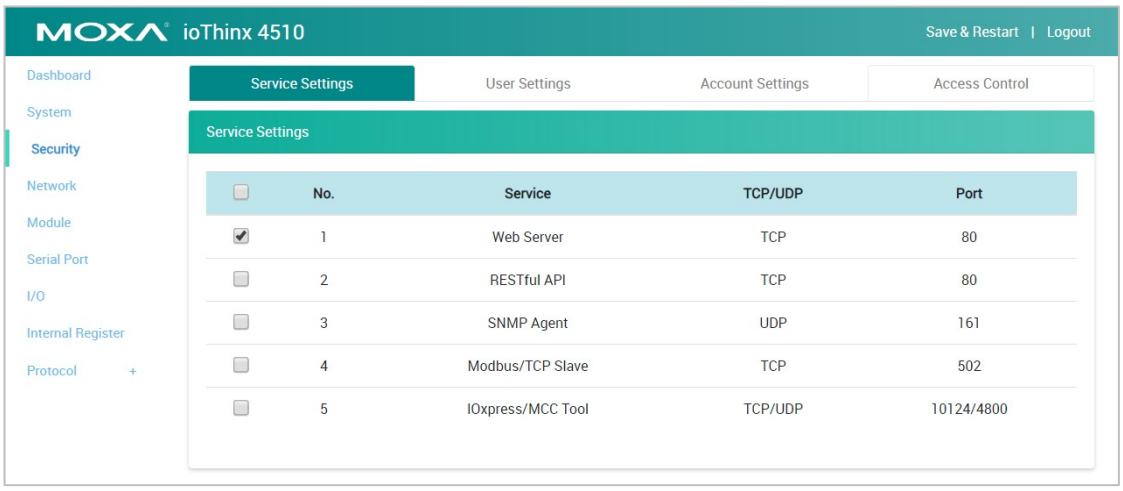
In order to have higher levels of security, we recommend changing the username and password after your first log in. Click **Security → User Settings** as shown in the screenshot below.




**INFORMATION** The default username is admin, and the default password is moxa.

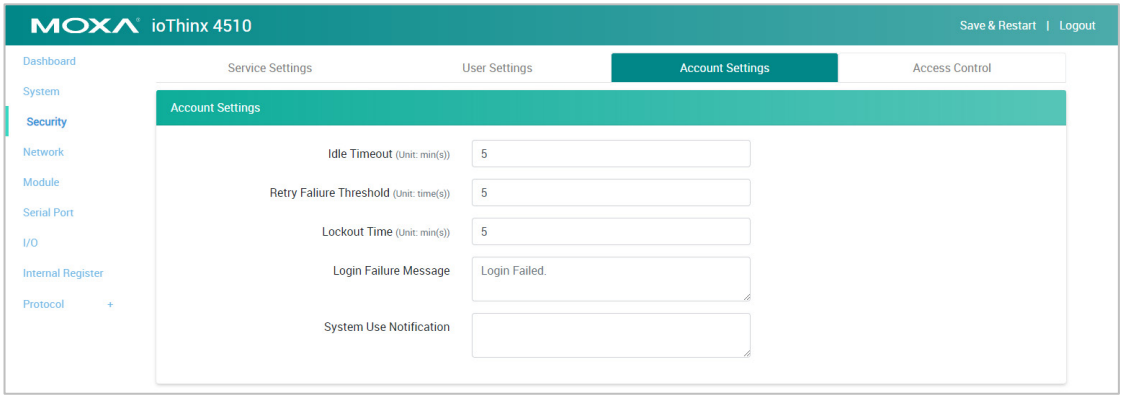
# Configuring Service Settings

Click **Security** on the menu panel to enter the security settings page as shown below. For service settings, the user can enable or disable the service in order to control access.



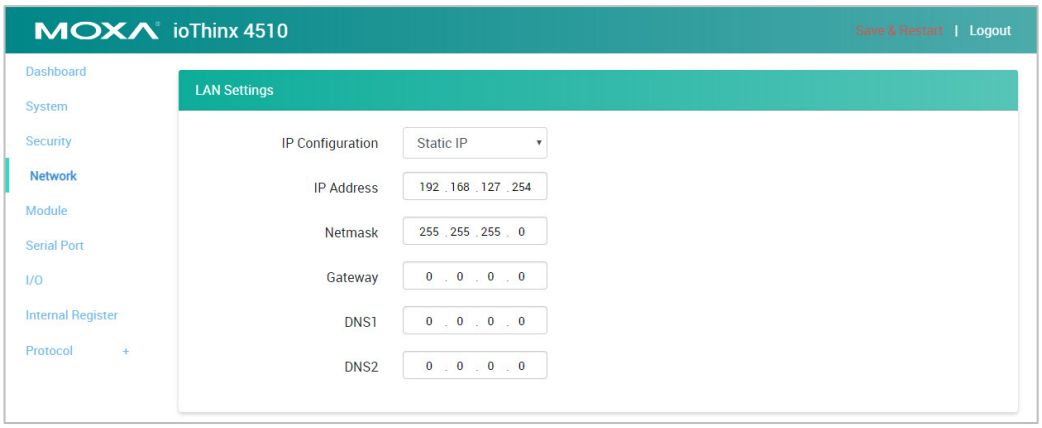

# Configuring Account Settings

For account settings, the user can modify the parameters and define the login failure message and system usage notifications. If the user wants to know the access history, the ioThinx 4510 Series supports access log export, which can store up to 1000 records.



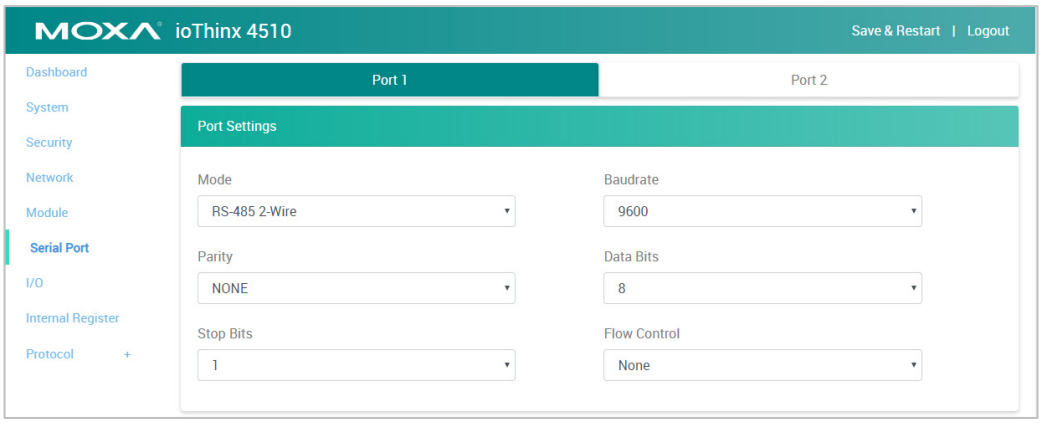
# Configuring Network Settings

Click **Network** on the menu panel to enter the network settings page as shown below. The ioThinx 4510 Series supports Ethernet daisy-chain topology with one MAC address. For this LAN port, it supports static IP and DHCP mode. The user can configure it via the LAN settings.

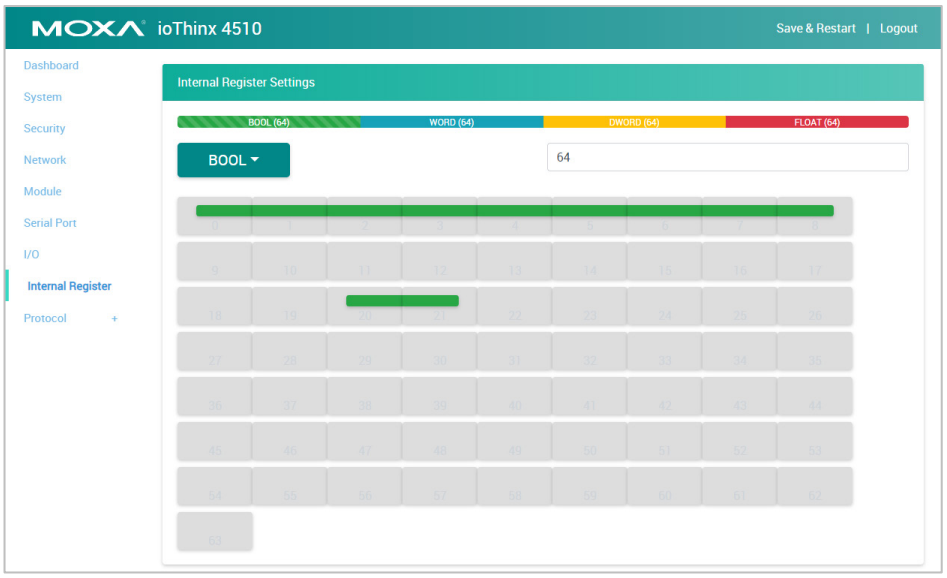



# Configuring Serial Port & IR Settings

Click **Serial Port** on the menu panel to enter the serial port settings page. For more detailed information, please refer to the **Serial Port** chapter.




Click **Internal Register** on the menu panel to enter the internal register settings page. For more detailed information, please refer to the **Internal Register** chapter.

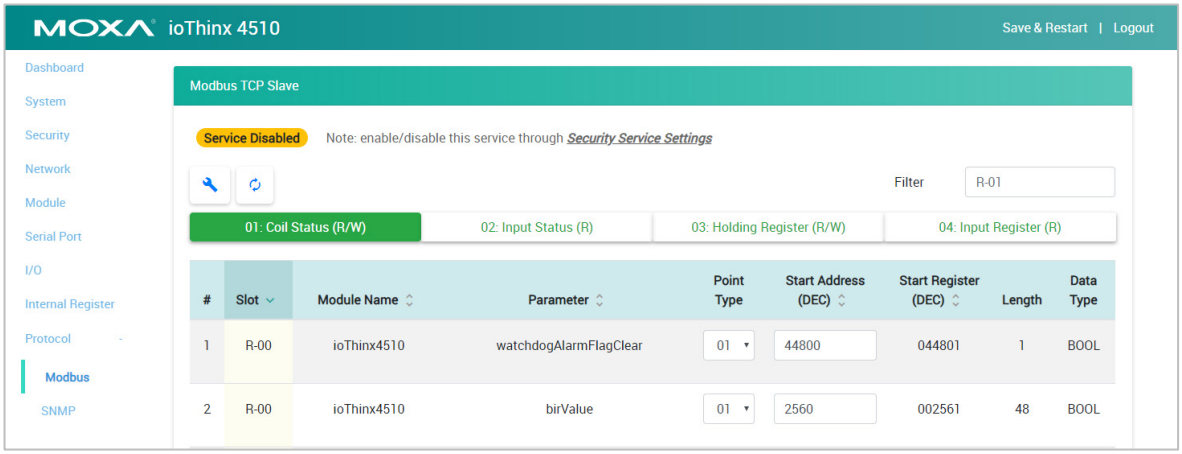


# Configuring I/O Settings

Click **I/O** on the menu panel to enter the I/O settings page. For more detailed information, please refer to the **I/O Settings** chapter.

# Configuring Modbus Address Settings

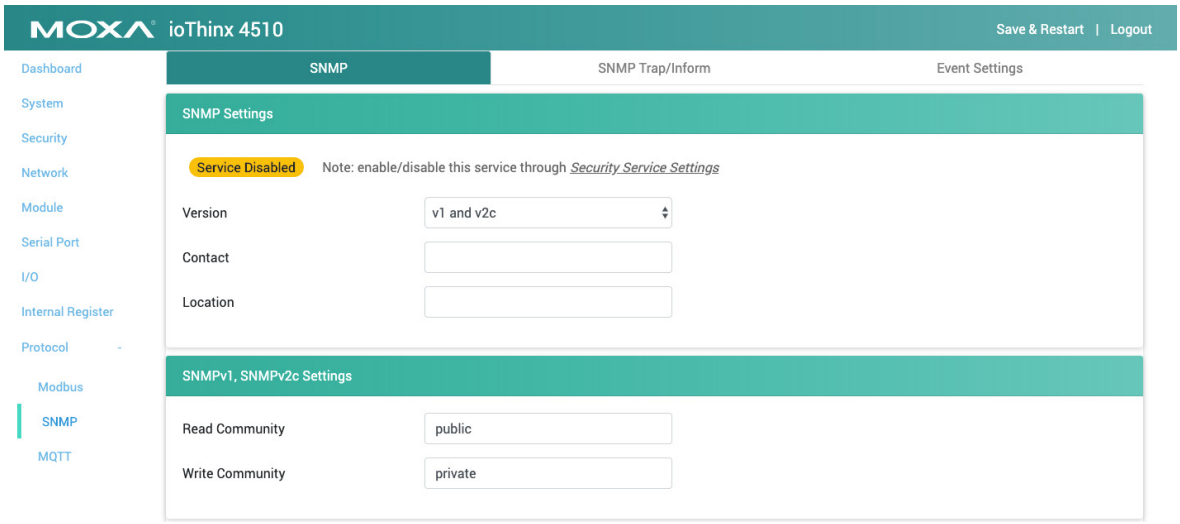
Click **Modbus** on the menu panel to enter the Modbus TCP Slave setting page. On this page, users can see all of the Modbus TCP addresses categorized by coil status, input status, holding register, and input register.




To change Modbus addresses, users can click **Reload default Modbus address**, **Reload current device address**, or manually modify the addresses.

# Configuring SNMP Settings

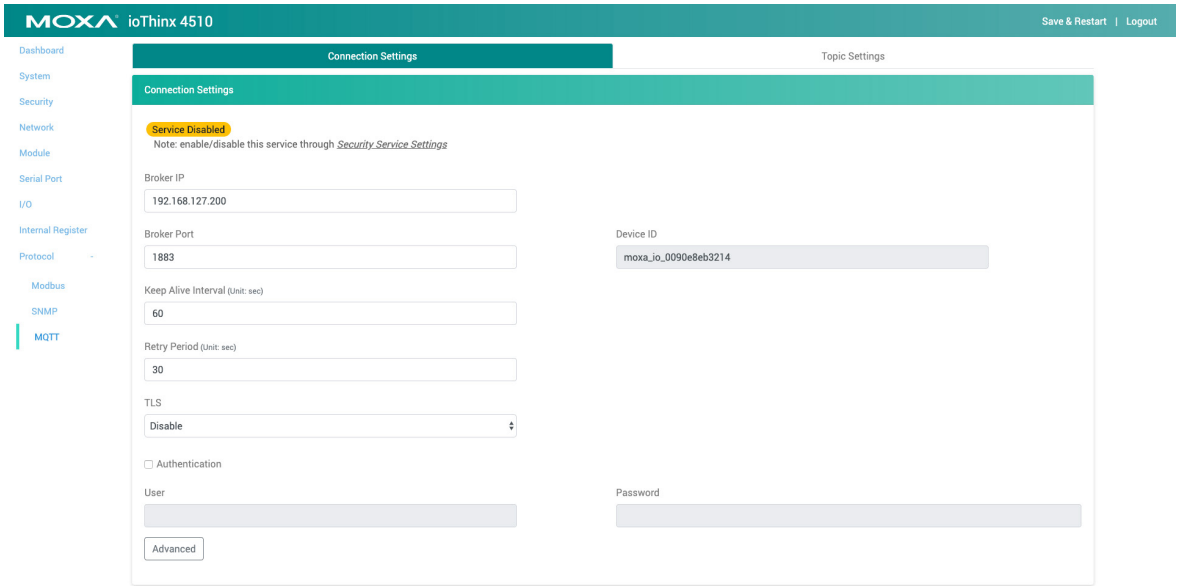
Click **SNMP** on the menu panel to enter the SNMP settings page as shown below.




The ioThinx 4510 Series supports SNMP, SNMP Trap, and SNMP Inform. After configuring these settings, please download the mib file from Moxa's website. For detailed information on the structure of the mib file, please refer to the **SNMP** chapter.

# Configuring MQTT Settings

Click MQTT on the menu panel to enter the MQTT settings page, as shown below.




The ioThinx 4510 supports generic MQTT, and after configuring it, the ioThinx 4510 will connect the MQTT broker automatically. For detailed information about topics and payloads, refer to the MQTT section.

# Mass-deploying the Settings

The mass-deploying function can be performed by IOxpress utility. IOxpress is a Windows utility and the system requirements are listed below:

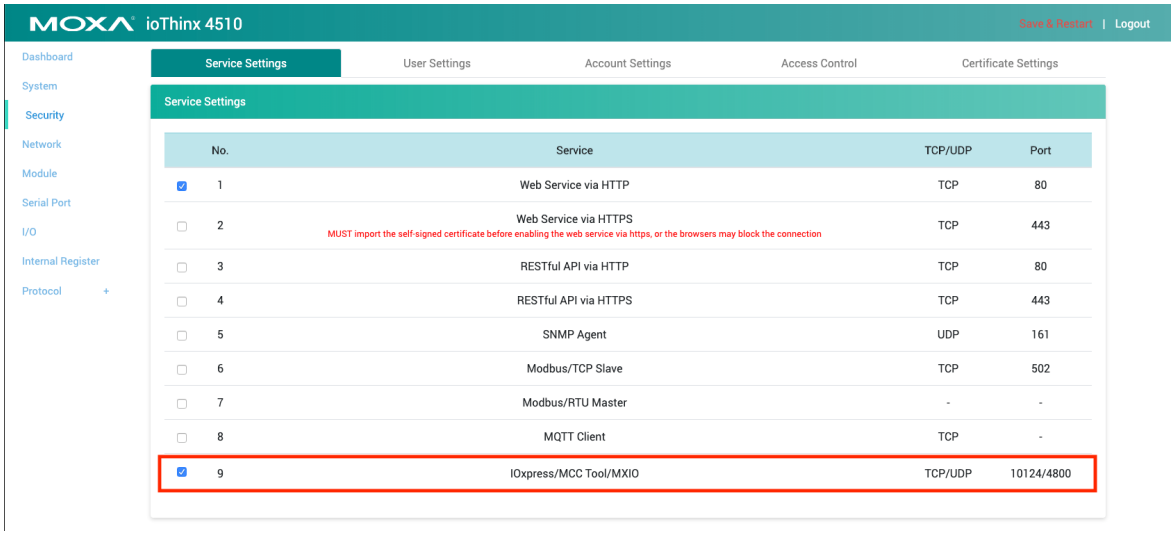
| | |
|---|---|
| OS | Microsoft Windows 2000, XP or later |
| CPU | Intel Pentium 4 CPU or higher |
| RAM | Min. 512 MB, 1024 MB is recommended |
| Network | 10/100 Ethernet |

**NOTE** The ioThinx 4510 Series is only compatible with IOxpress v2.4 or later.

**INFORMATION** To get the latest version of IOxpress, please download it from www.moxa.com

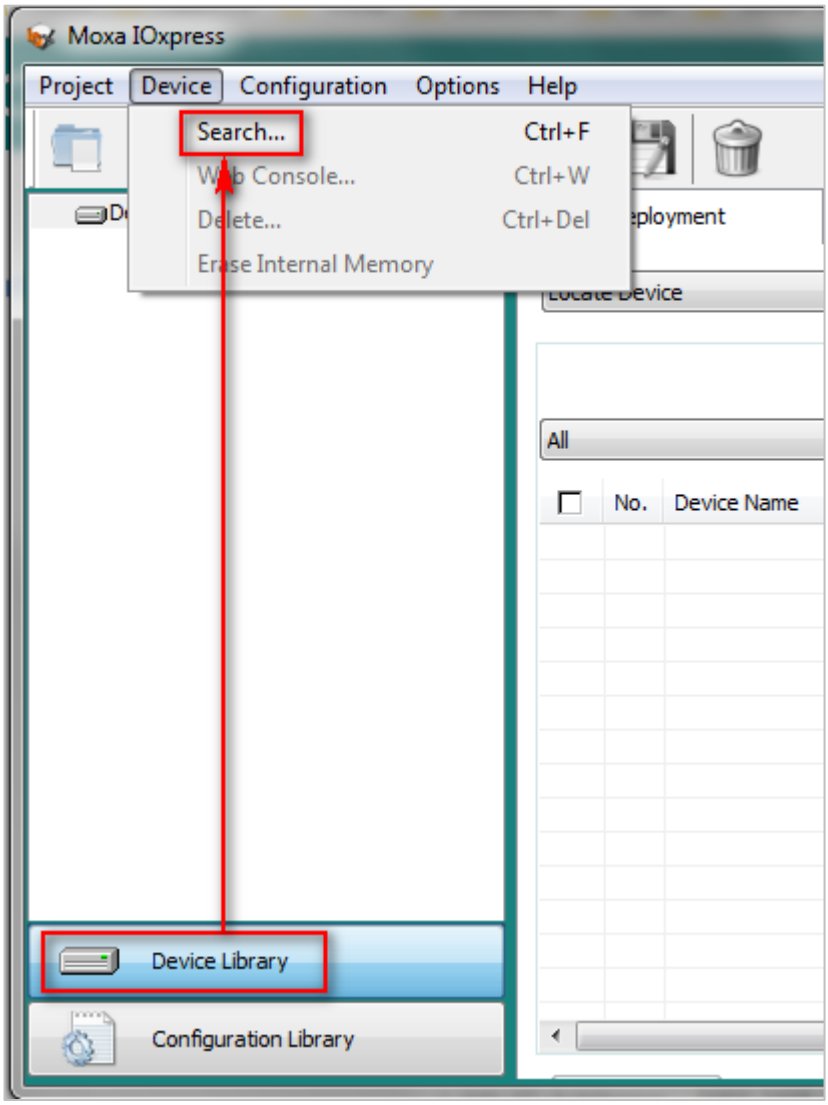
Users can change IP address, update configurations, change the device name, and set the date and time to multiple units by IOxpress. Before starting to use the mass-deploying function, please complete the following steps to search for all devices first.

**Step 1:** Make sure the IOxpress service is enabled in **Security → Service Settings**.

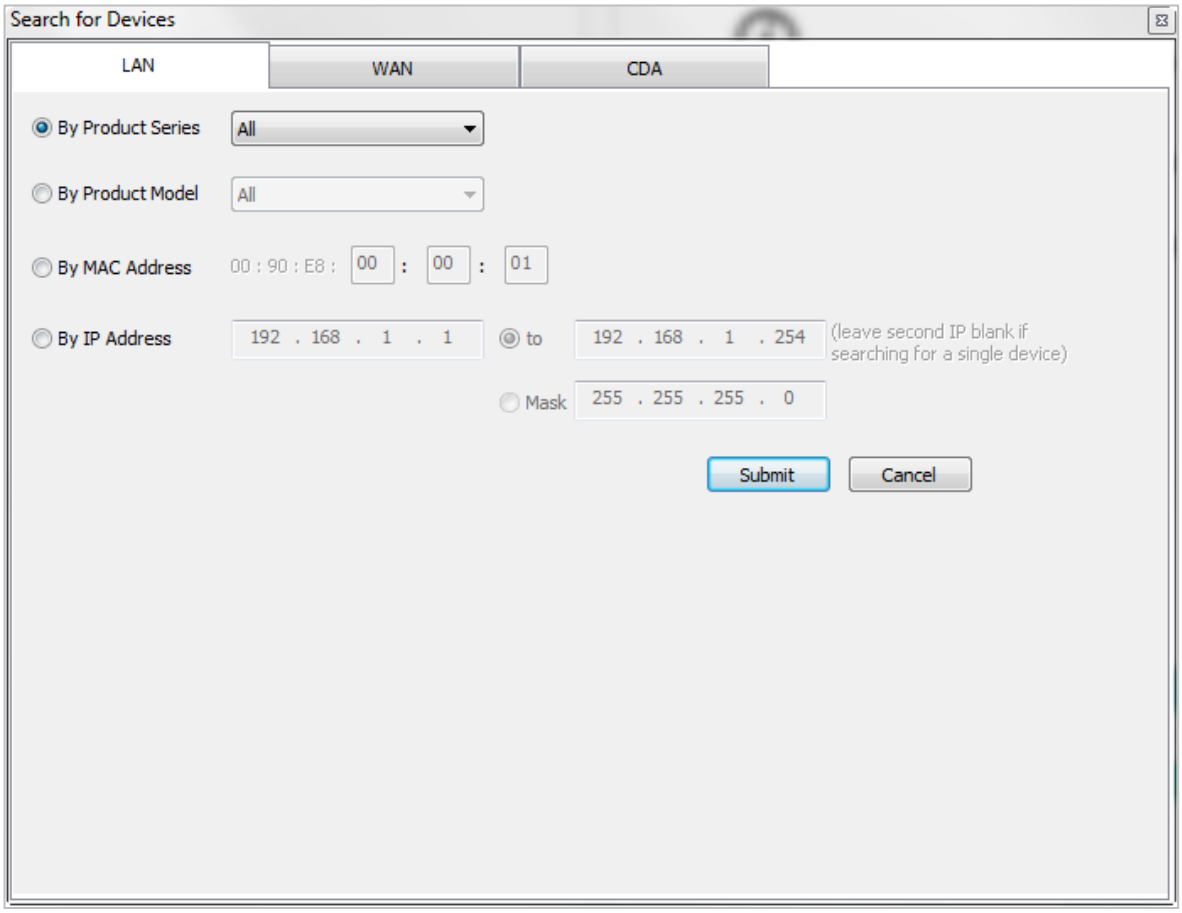



**Step 2:** Connect the devices by Ethernet cables and then power them on.

**Step 3:** Open IOxpress, go to the **Device Library** and click **Device** → **Search** in the menu.



**Step 4:** In the **Search for Devices** window, choose the product series you would like to search for in the **By Product Series** dropdown menu, and then click **Submit**. IOxpress will start to search the devices and list them in the table.



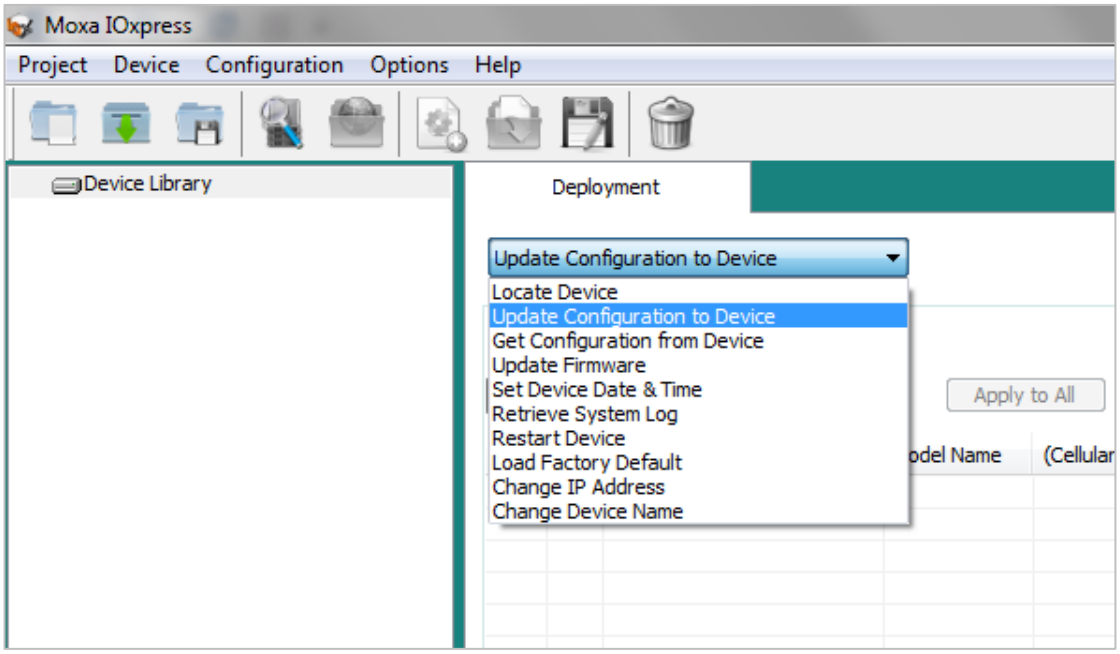

**NOTE** If the devices cannot be found, check the network setting of the devices.

# Updating Configuration to Multiple Units

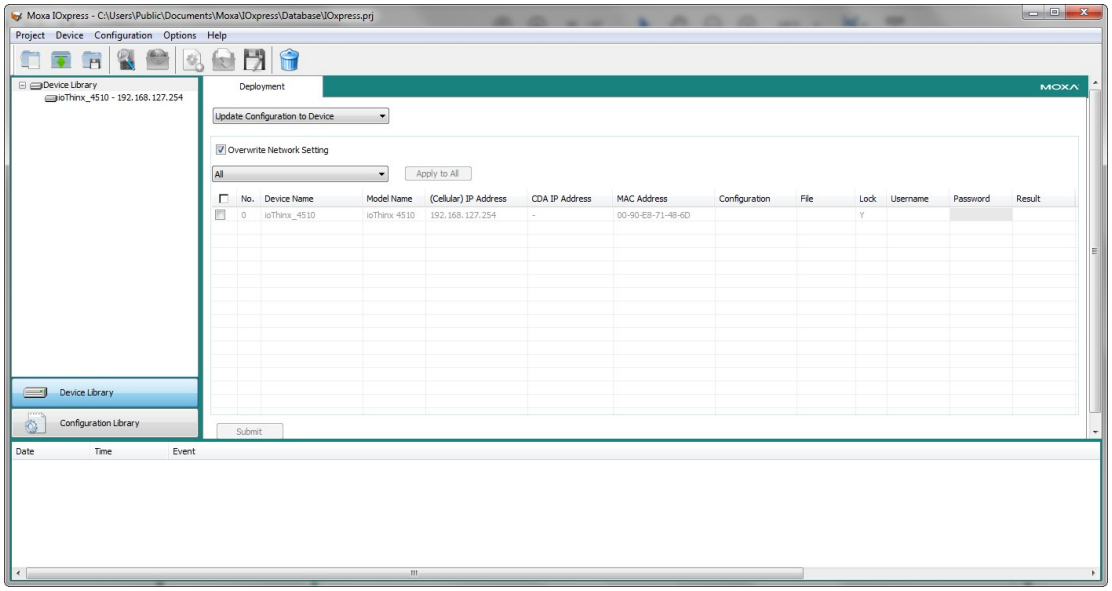
IOxpress supports updating configuration of multiple units. Follow the steps to complete this task.

**Step 1:** Export the configuration file of a device through the Web Console. Refer to **Backing up Configuration Files** for more details.

**Step 2**: Select **Update Configuration to Device** in the dropdown menu.




**Step 3:** Click the **File** column of the selected device in the table and then choose the configuration file from Step 1.




**Step 4:** Select the device(s), type the **Username** and **Password**, and then click **Submit**. Then, IOxpress will start to execute the task on the selected devices. The success message will show up in the **Result** column if the process is successfully completed.

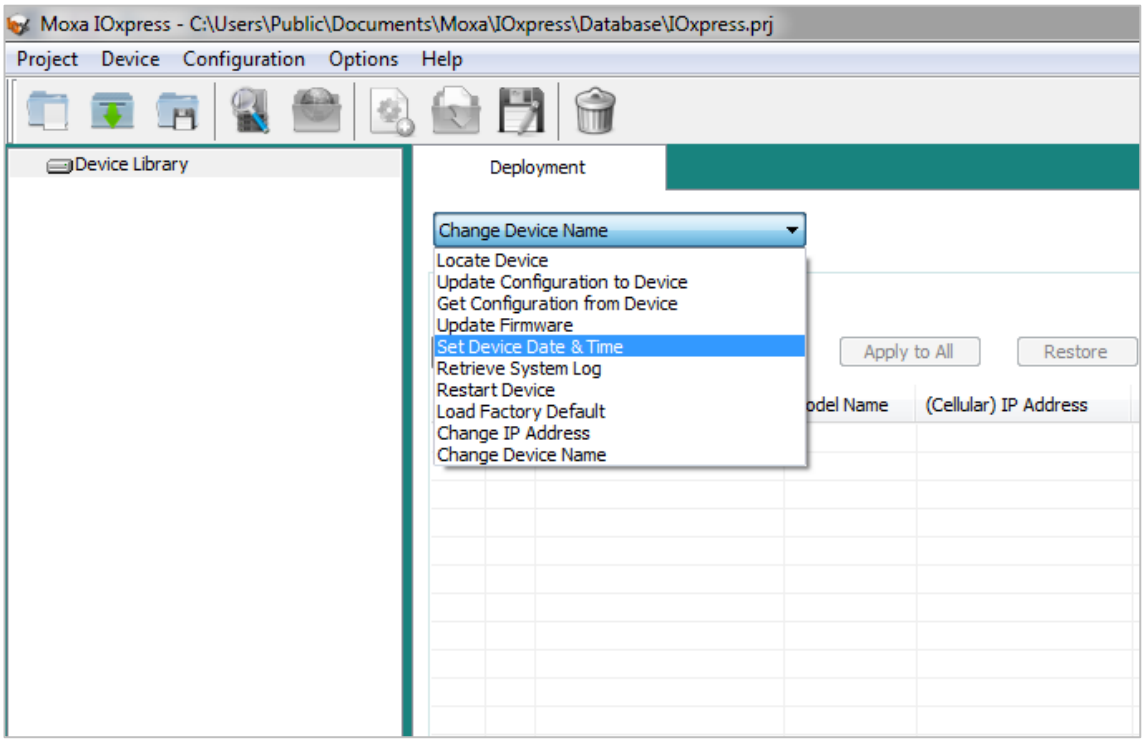
**INFORMATION** Click **Apply to All** if the selected devices have the same settings.

**INFORMATION** Back up the configuration before updating to a new configuration.

# Setting Date and Time to Multiple Units

The IOxpress supports setting the date and time of multiple units. Follow these steps to complete this task.

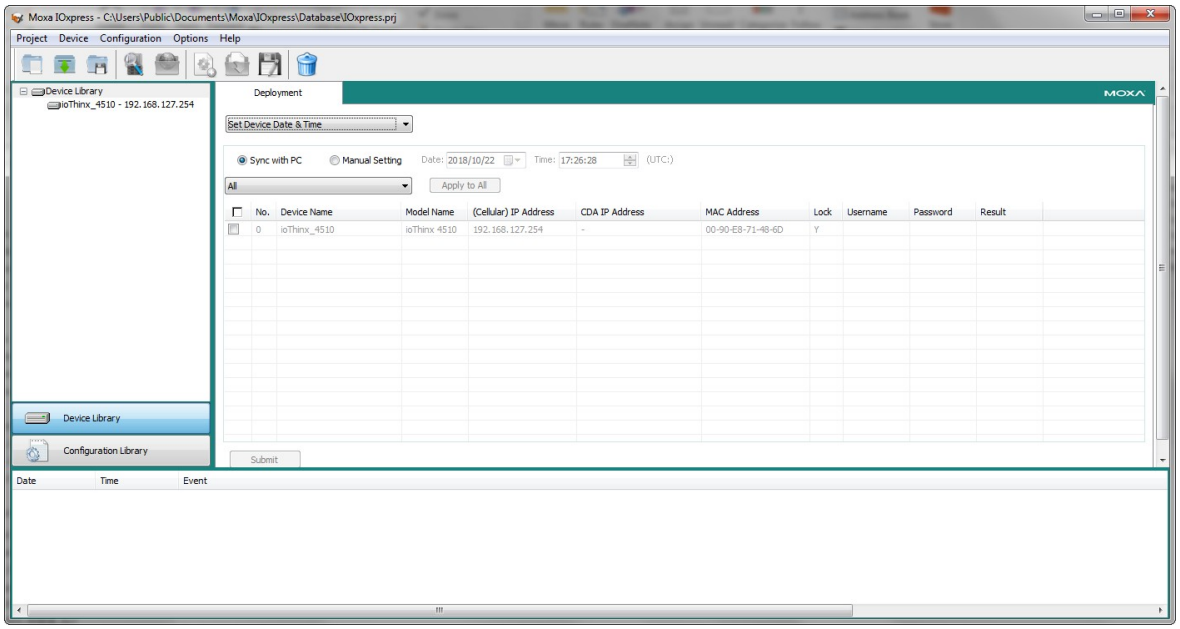
**Step 1**: Select **Set Device Date & Time** in the dropdown button




**Step 2:** Select either **Sync with PC** or **Manual Setting**. For Manual Setting, type the Local Date and Time, which will be set on the device(s).

**Step 3:** Select the device(s), type the **Username** and **Password**, and then click **Submit**. IOxpress will start to execute the task on the selected devices. The success message will show up in the **Result** column if the process is successfully completed.

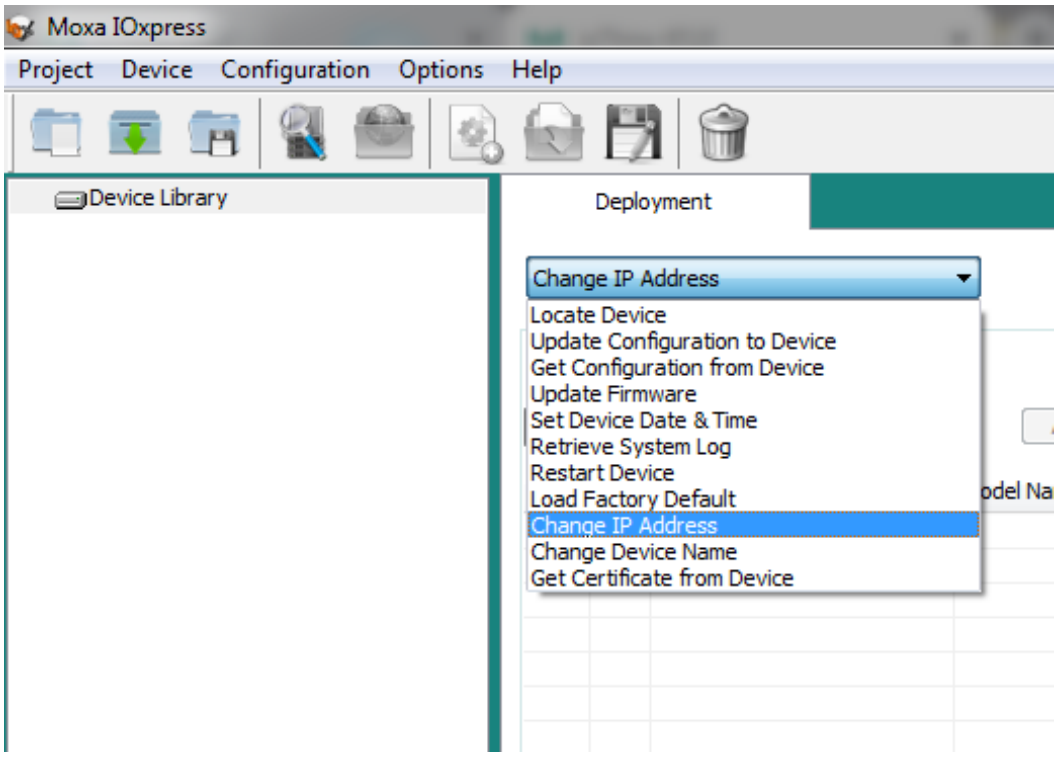
**INFORMATION** Click **Apply to All** if the selected devices have the same settings.



# Changing IP Addresses to Multiple Devices

IOxpress supports changing IP addresses for multiple devices:

**Step 1:** Select **Change IP Address** in the dropdown button list.

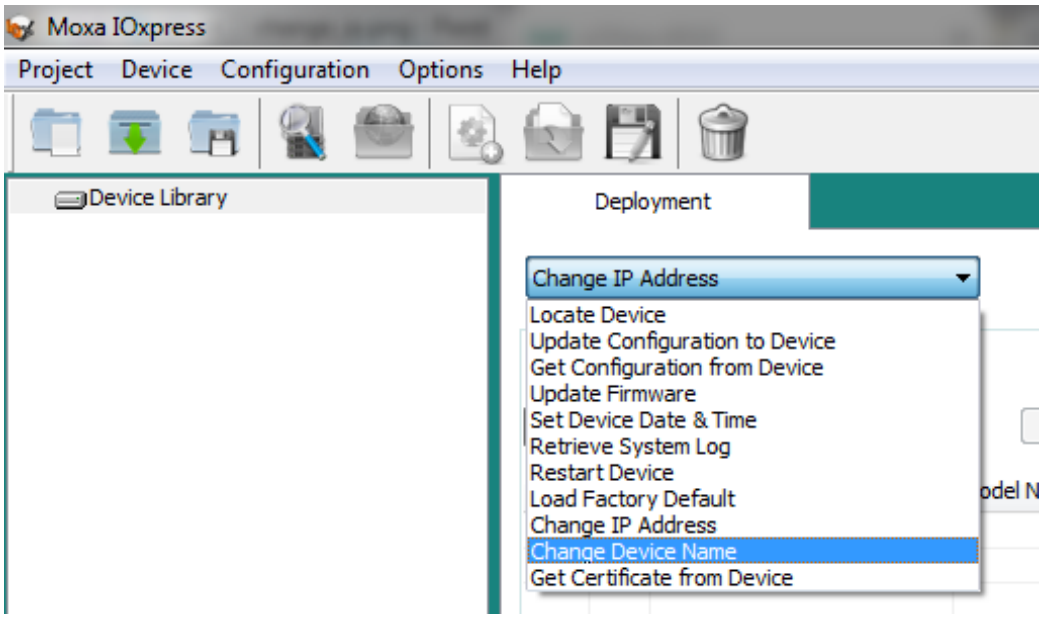



**Step 2:** Select the device(s), change the IP address, type the **Username** and **Password**, and then click **Submit**. IOxpress will start to execute the task on the selected devices. A message indicating success will appear in the **Result** column if the process was completed successfully.

# Changing the Device Name of Multiple Devices

IOxpress supports changing the device name of multiple devices:

**Step 1:** Select **Chang Device Name** from the dropdown list.

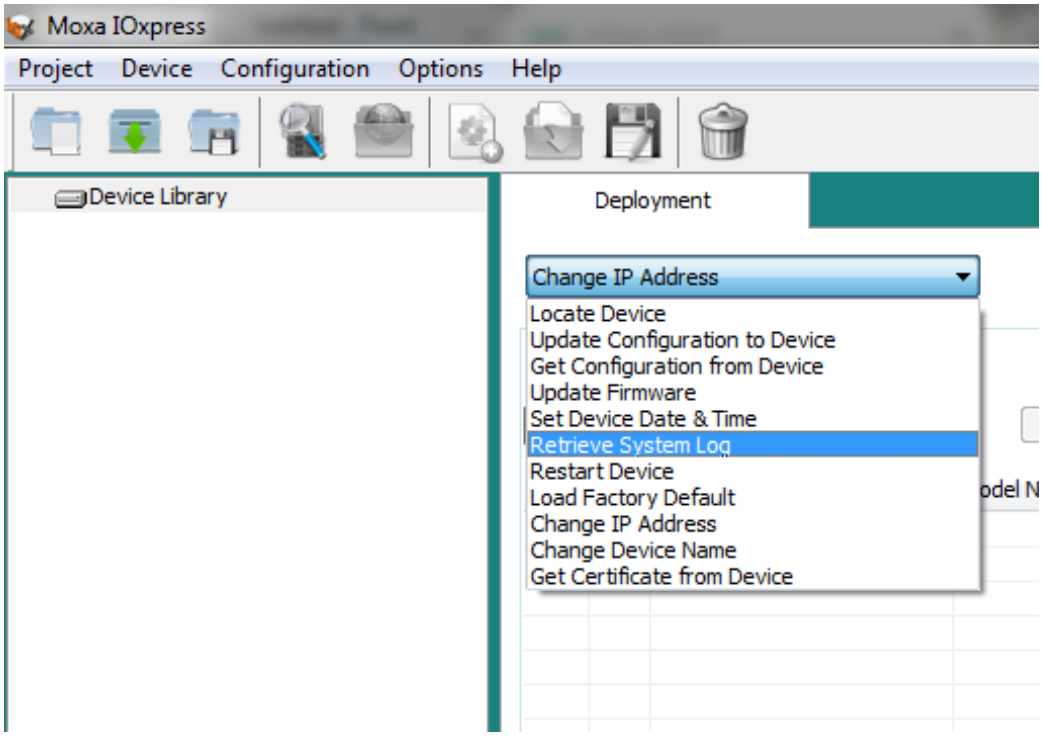


**Step 2:** Select the device(s), change the device name, type the **Username** and **Password**, and then click **Submit**. IOxpress will start to execute the task on the selected devices. A indicating success message will appear in the **Result** column if the process was completed successfully.

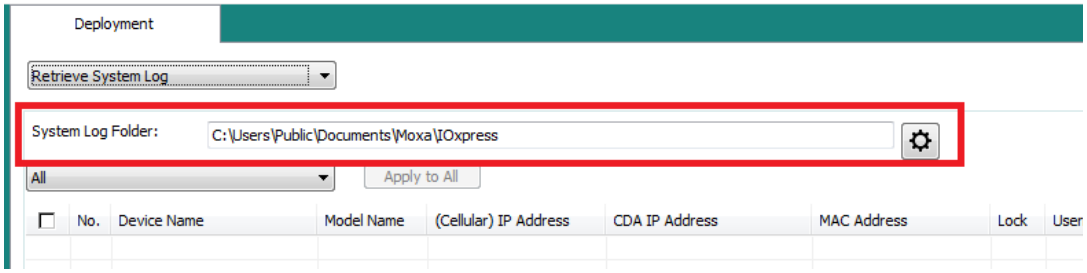
# Retrieving the System Log from Multiple Devices

IOxpress supports retrieving the system log from multiple devices.

**Step 1:** Select **Retrieve System Log** from the dropdown list.




**Step 2:** Specify the folder location.

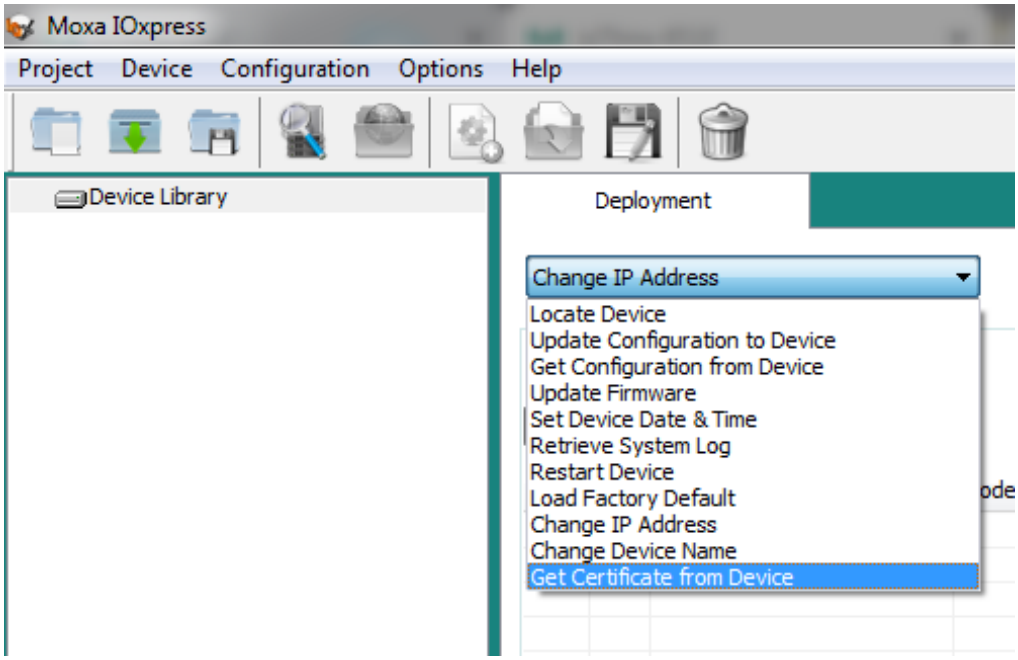



**Step 3:** Select the device(s), type the **Username** and **Password**, and then click **Submit**. IOxpress will start to execute the task on the selected devices. A success message will appear in the **Result** column if the process is completed successfully.

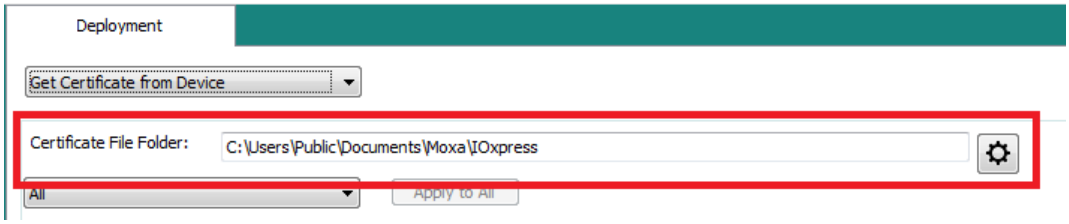
## Getting a Self-signed Certificate from Multiple Devices

IOxpress supports getting self-signed certificates from multiple devices.

**Step 1:** Select **Retrieve System Log** from the dropdown list.




**Step 2:** Specify the folder location.




**Step 3:** Select the device(s), type the **Username** and **Password**, and then click **Submit**. IOxpress will start to execute the task on the selected devices. A success message will appear in the **Result** column if the process is completed successfully.

# Monitoring & Operating the Unit

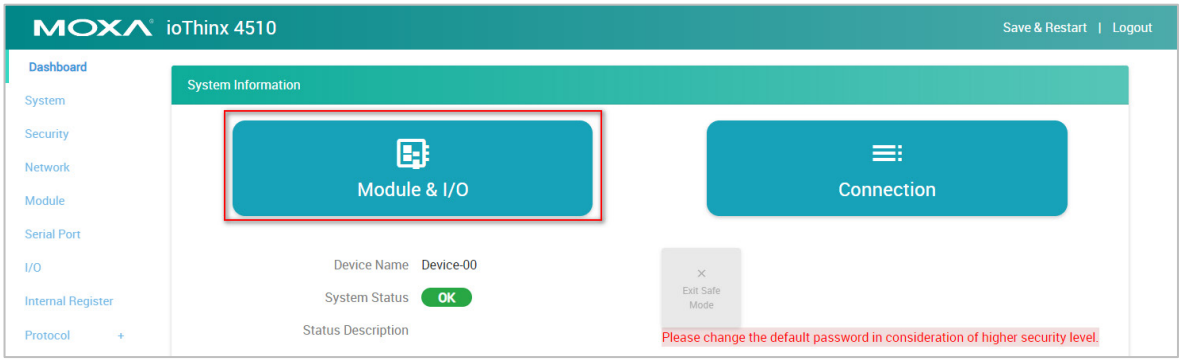
To monitor and operate the device, go to the **Dashboard** of the Web Console.

**INFORMATION** The ioThinx 4510 Series supports three different user profiles (Administrator, Operator, and User). Refer to **User Settings** for the permission information of each profile.

**NOTE** The HTTPS web service can only be used for configuration purposes; it cannot be used to monitor or operate the unit.

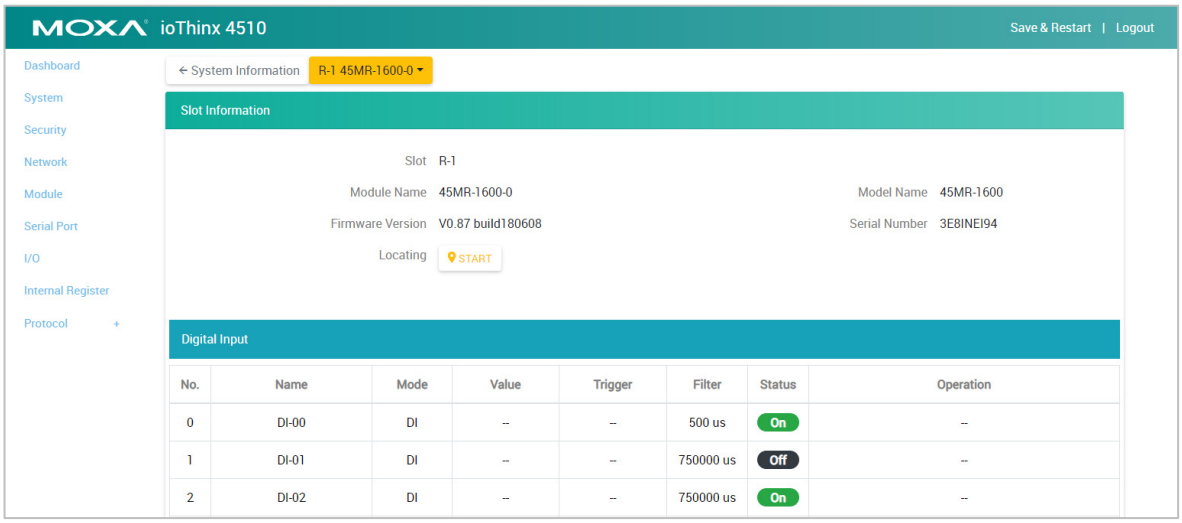
# Monitoring Module & I/O Status

Under the **Dashboard** of the Web Console, click **Module & I/O** to go to the module and I/O status web page.



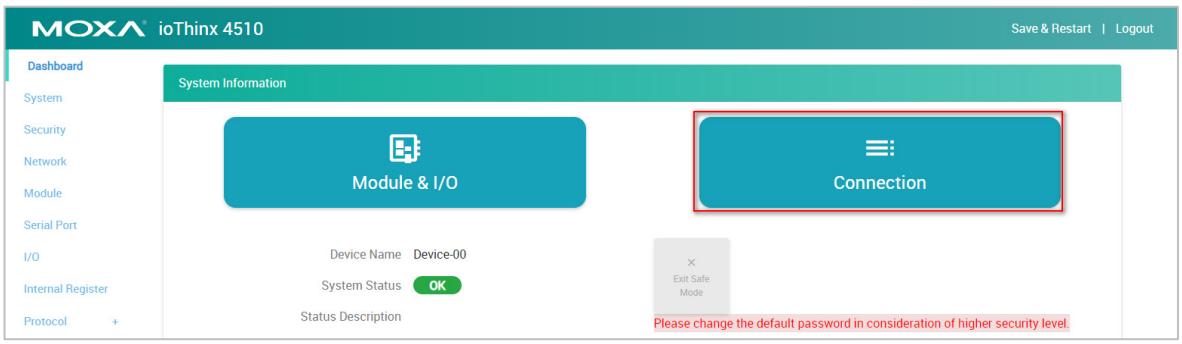

The upper side of this page shows the module status, including **Slot** position, module **Status**, **Firmware Version**, **Module Name**, **Model Name**, and **Serial Number**. Click **Locate** to identify the physical location of the module. The module's LED will blink green.

The lower side of the page shows the I/O status and allows you to operate the status of the output channels, such as DO, Pulse, or Relay channels. Refer to the **Module & I/O** section for detailed information.

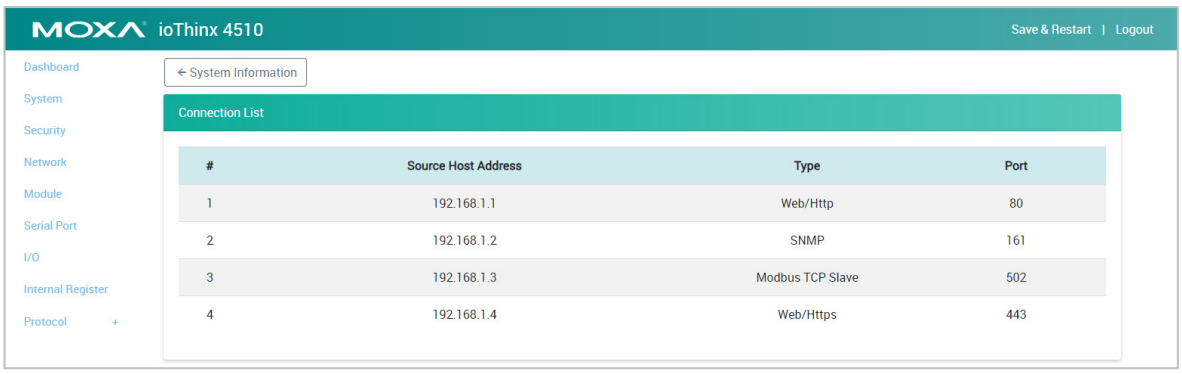



# Monitoring Connection Status

Under the **Dashboard** of the Web Console, click the **Connection** button to go to the connection status web page.



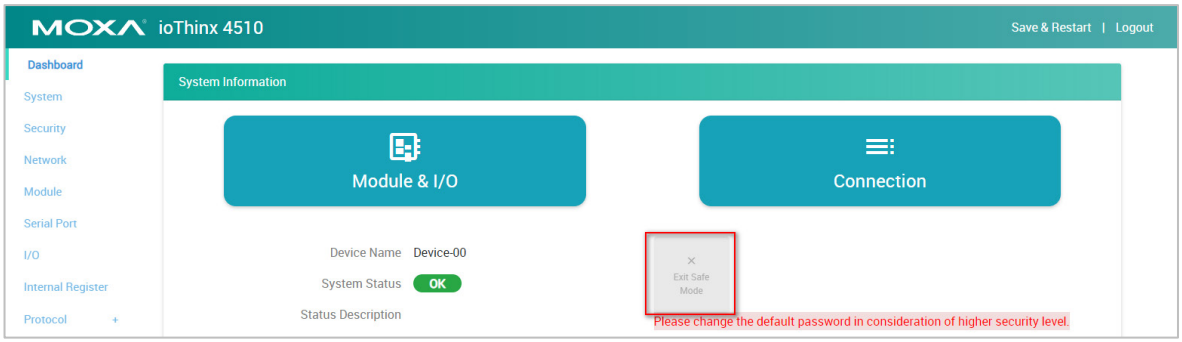
The connection status page lists the connection information from other hosts.




**NOTE** Some browsers may create more than one Web Https connection at the beginning. Once the connection is established, the browsers will only keep one and drop the others. Thus, it is normal that more than one Web Https connection is listed in the table at the beginning.

## Exiting Safe Mode Status

This device has a watchdog service to monitor the status of the pre-defined TCP connection (refer to **Account Settings** for detailed settings). If the pre-defined TCP connection has no response for a designated period, the device will enter the safe mode status. To exit safe mode status, if auto clear safe mode is disabled in the watchdog settings, log in to the device's Web Console and click the **Exit Safe Mode** button to revert the device back to normal mode after the Modbus connection has reconnected.




# Maintaining the Unit

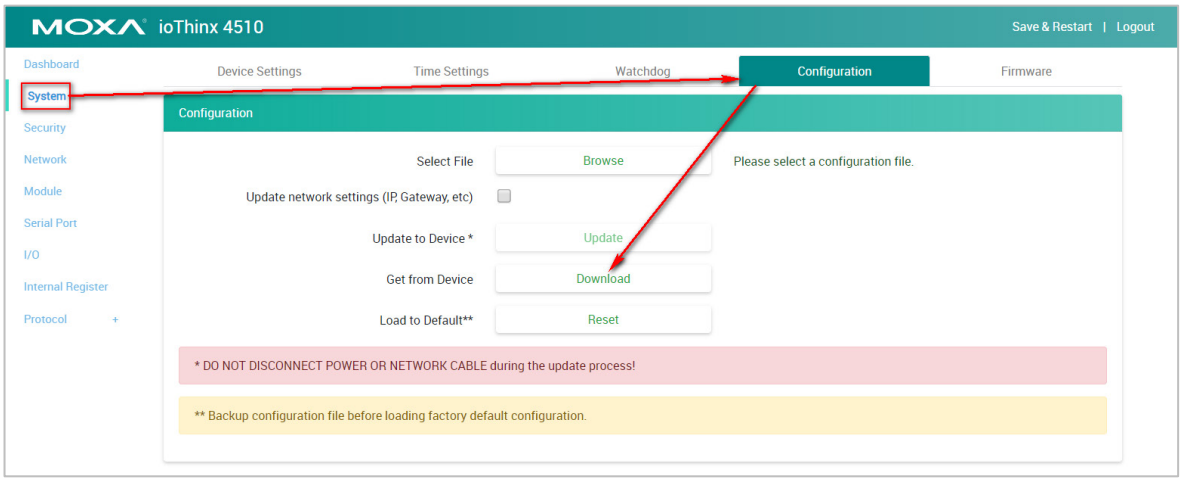
This section introduces the maintenance functions of the ioThinx 4510 Series.

## Backing up Configuration Files

This device can only be configured through the web console. After configuration, the configuration file can be retrieved from the device to perform backup and mass deployment. Follow the steps to retrieve the configuration file from the device.

**Step 1:** Go to the configuration page via **Menu** → **System** → **Configuration**

**Step 2:** Click **Download** from **Get from Device** and choose the location to save the .cfg file.



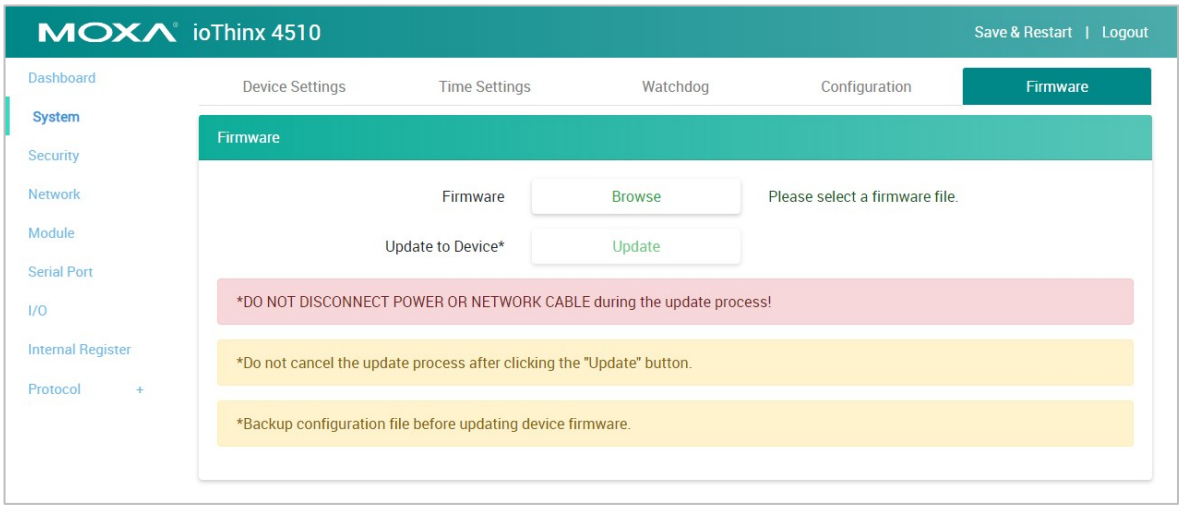

# Updating the Firmware

Follow the steps to update the firmware to the device.

**Step 1:** Go to the configuration page via **Menu** → **System** → **Firmware**

**Step 2:** Click the **Browse** button to select a firmware file to update

**Step 3:** Click the **Update** button to start the update process




**NOTE** When the device is updating, do not turn the power off as it might corrupt the device.

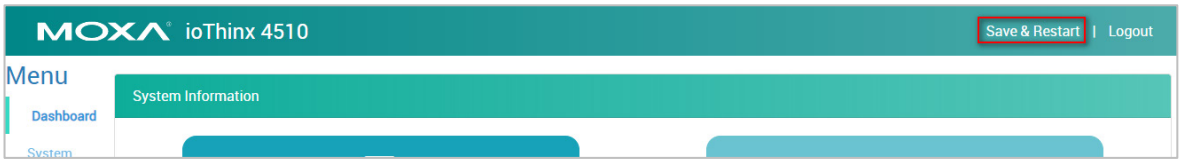
**NOTE** The firmware cannot be updated via https.

**NOTE** Performing a firmware update will delete the configurations in the device. Backup the configurations before performing the firmware update.

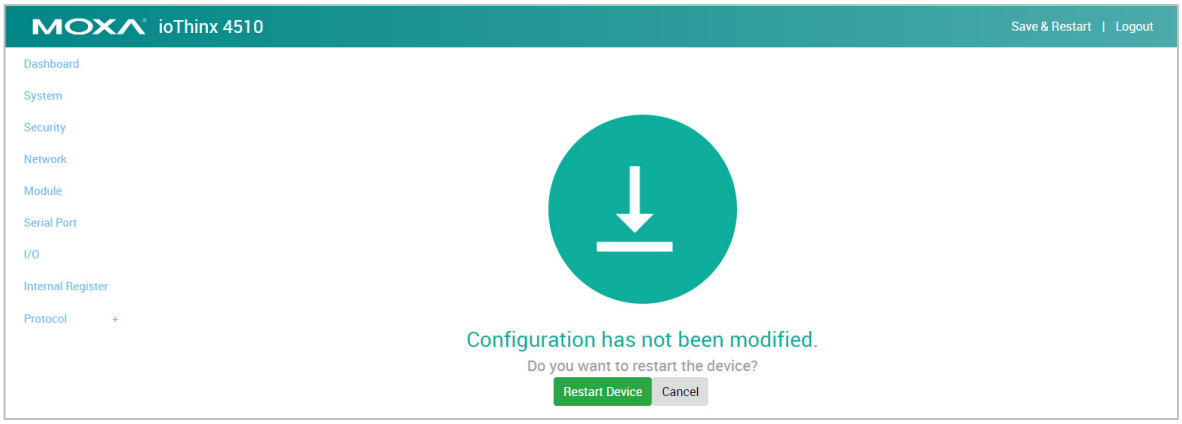
# Restarting the Unit

This device will restart automatically after the firmware and configurations have been updated. The user can also restart the device manually.

**Step 1:** Click **Save & Restart** on the right upper corner of the page.




**Step 2:** The device will confirm that you want to perform a restart. Click **Restart Device** in order to restart the device.




**INFORMATION** This device does not have a battery. Therefore, if the device is powered off, the system date and time will have to be set again. If the NTP server is not available, set the date and time of the device after rebooting.

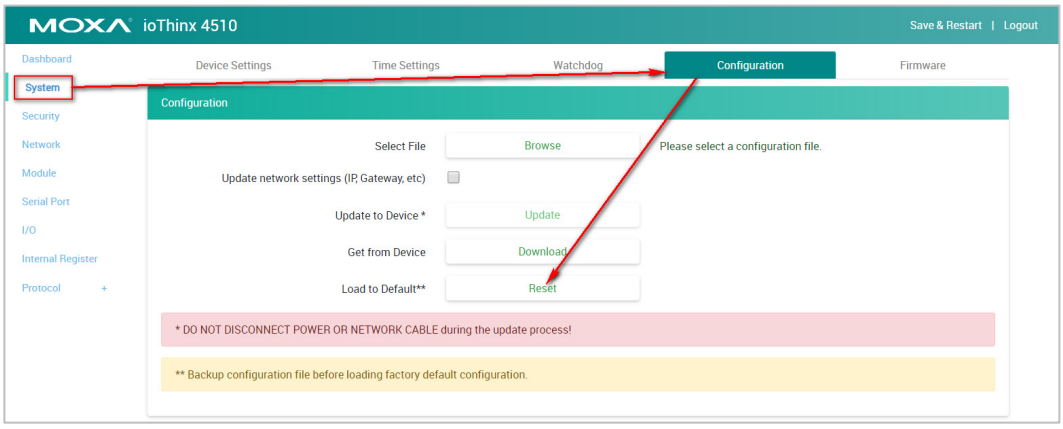
# Loading Factory Default Settings

There are three ways to restore the device to factory default settings.

1. Follow the steps to load the factory default settings from the web console.

   **Step 1:** Go to the configuration page via **Menu** → **System** → **Configuration**

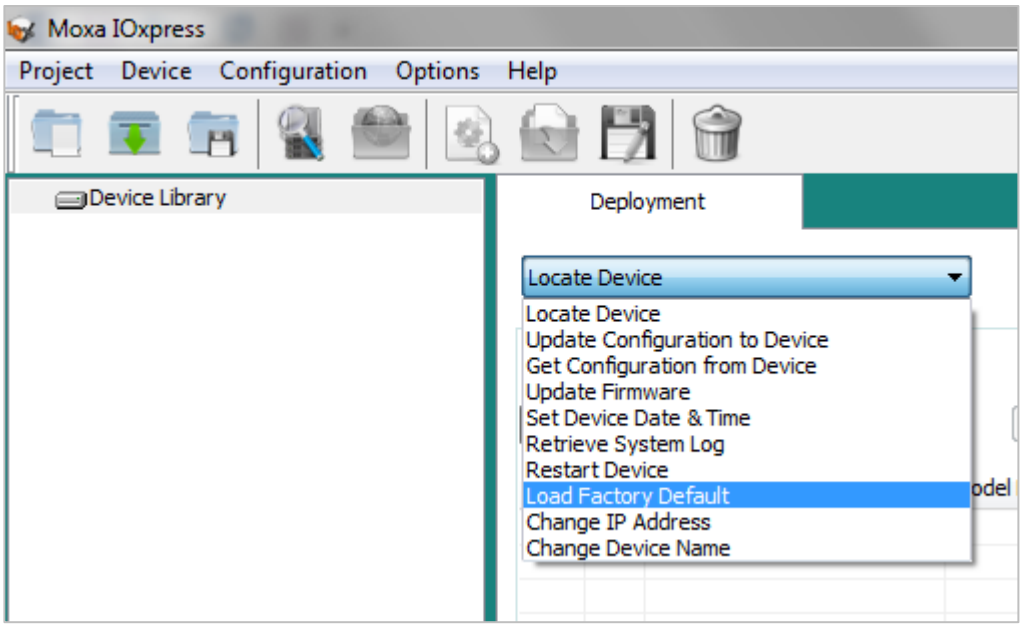
   **Step 2:** Click **Reset** located under **Load to Default** and then the device will return to default settings.




**NOTE** Loading the factory default settings will delete the configurations from this device. Please back up the configurations before loading the factory default settings.

2. Follow the steps to load the factory default settings from IOxpress.

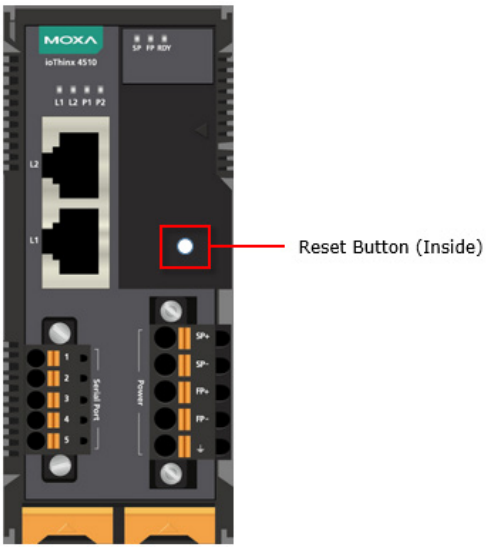
   **Step 1:** Select **Load Factory Default** from the dropdown menu.




   **Step 2:** Select the device(s), type the **Username** and **Password**, and then click **Submit**. IOxpress will start to perform the task on the selected devices. The success message will show up in the **Result** column when the process has been completed.

**INFORMATION** Click **Apply to All** if the selected devices have the same settings.

3. Hold down the RESET button for 10 seconds to load factory default settings. The system will load the default settings and then restart the device. The system is ready when the RDY LED turns green.



# 6

# Tutorials

Type page 1 content here.

The following topics are covered in this chapter:

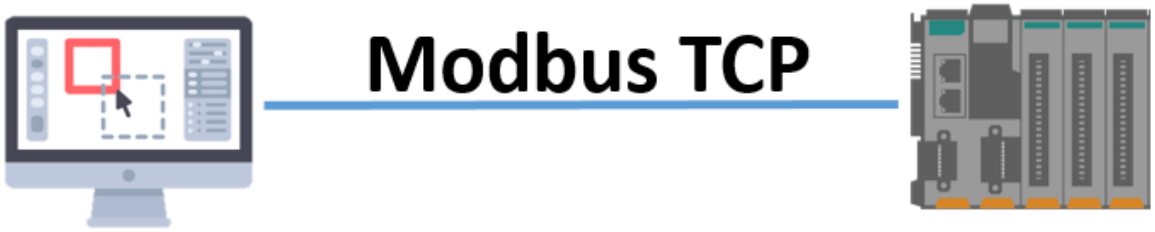
- **How to Use Modbus TCP to Connect to the ioThinx 4510 Series**
  - Using Modbus TCP via Modbus Poll
- **How to Use RESTful API to Connect to the ioThinx 4510 Series**
  - Using RESTful API via Postman
  - Send a GET request and a PUT request
- **How to Use MQTT to Connect to the ioThinx 4510 Series**
  - Broker Settings on the Computer
  - Set Up MQTT on the ioThinx 4510
  - Publisher and Subscriber Settings
- **How to Connect ioThinx 4510 to an MQTT Broker over TLS**
  - Broker Settings on the Computer
  - Client (publisher) setting
  - Client (subscriber) setting

# How to Use Modbus TCP to Connect to the ioThinx 4510 Series

## Using Modbus TCP via Modbus Poll

### Introduction to Modbus Poll

Please refer to the following web page for information about Modbus Poll:
https://www.modbustools.com/modbus_poll.html




**Modbus Poll**
**IP address: 192.168.127.200**

**Moxa ioThinx 4510**
**IP address: 192.168.127.254**

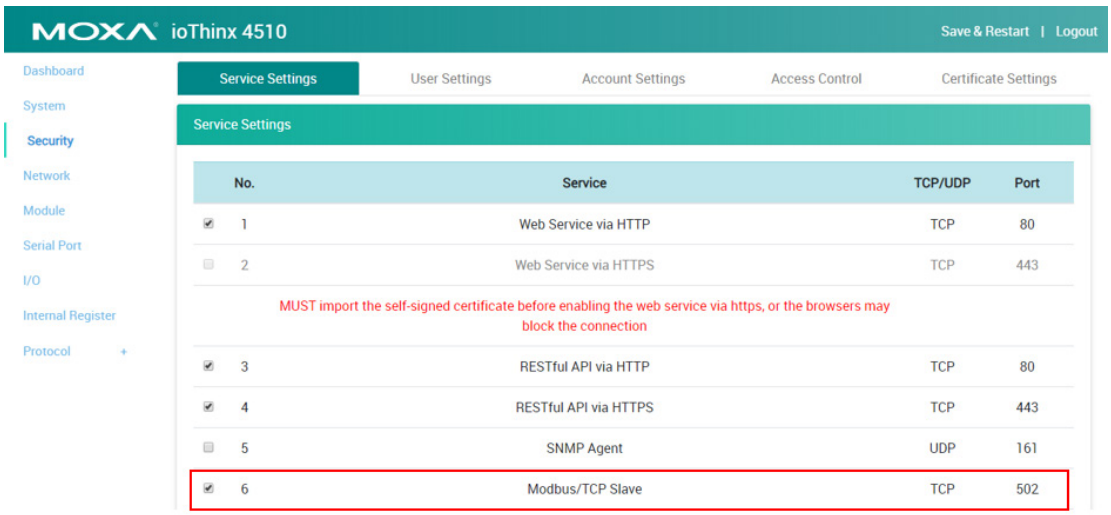
### Enable Modbus/TCP Slave Service on the ioThinx 4510

1. Log in to the ioThinx 4510

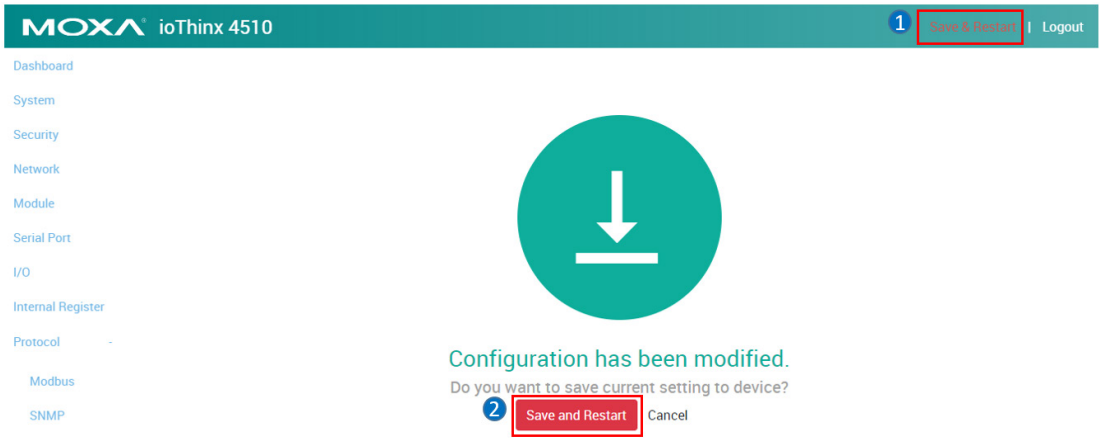
   **Step 1:** Open your web browser and type the default IP address of the device: 192.168.127.254.

   **Step 2:** On the login page, type the default username/password (admin/moxa) to log in to the Web Console.

2. Enable Modbus/TCP slave service.

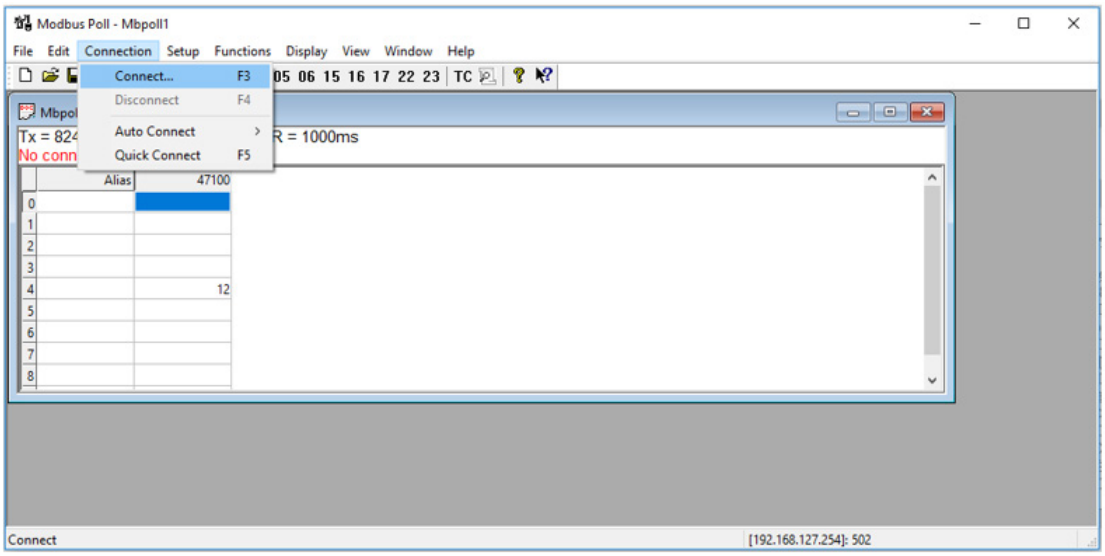


3. Click **Save & Restart** in the top right of the page and then click **Save and Restart** in the center of the page.

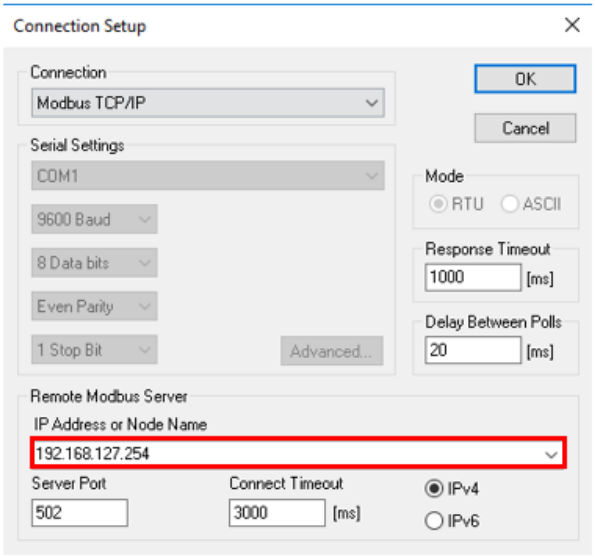



## Set Up a Connection on Modbus Poll

1. Select **Connect** on **Modbus Poll's Connection** panel.

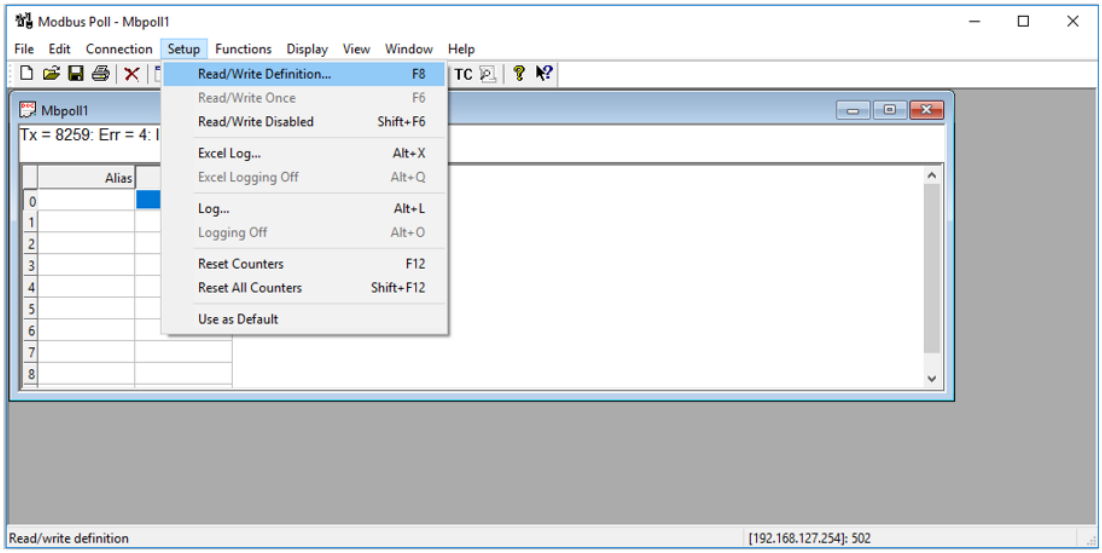



2. Enter the IP address of the device (default IP: 192.168.127.254).

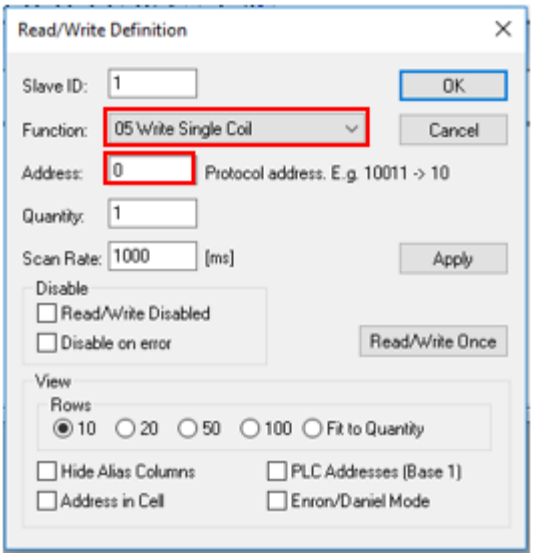


# Write Single Coil: Use Modbus Poll to turn on an ioThinx 4510 DO channel

1. Select **Read/Write Definition** under the **Setup** menu.

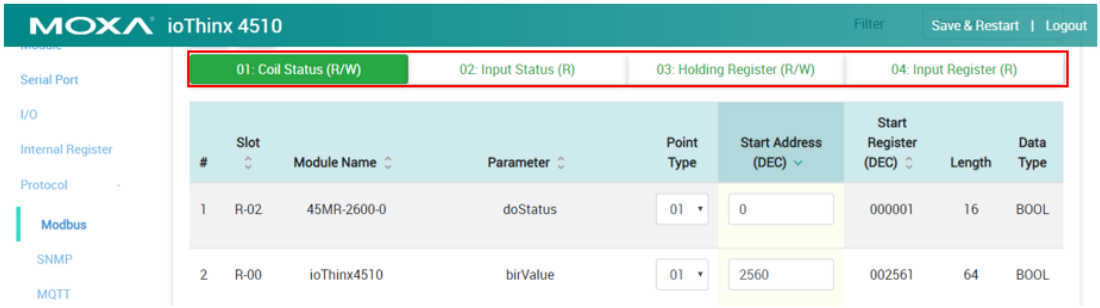



2. Select the **function** code **05 Write Single Coil** and then enter **0**, the start **Address** of the DO channel.

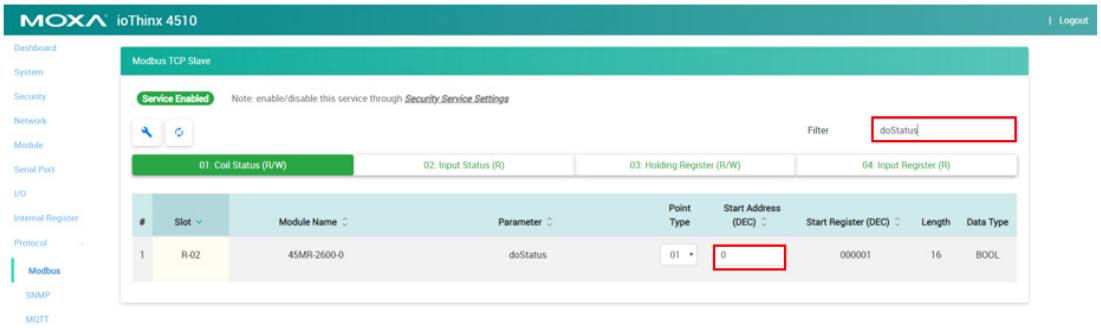



**NOTE** Take the following steps to check the **Start Address** of the device in the web console.

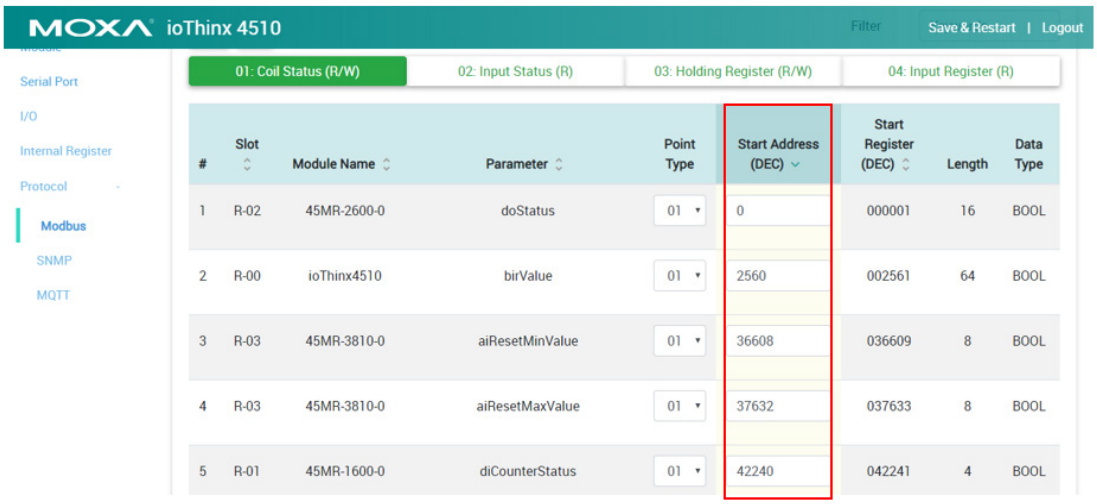
1. Open the web console and then click **Modbus** in the left panel. On this page, the Modbus TCP addresses are categorized as **Coil Status**, **Input Status**, **Holding Register**, and **Input Register**.



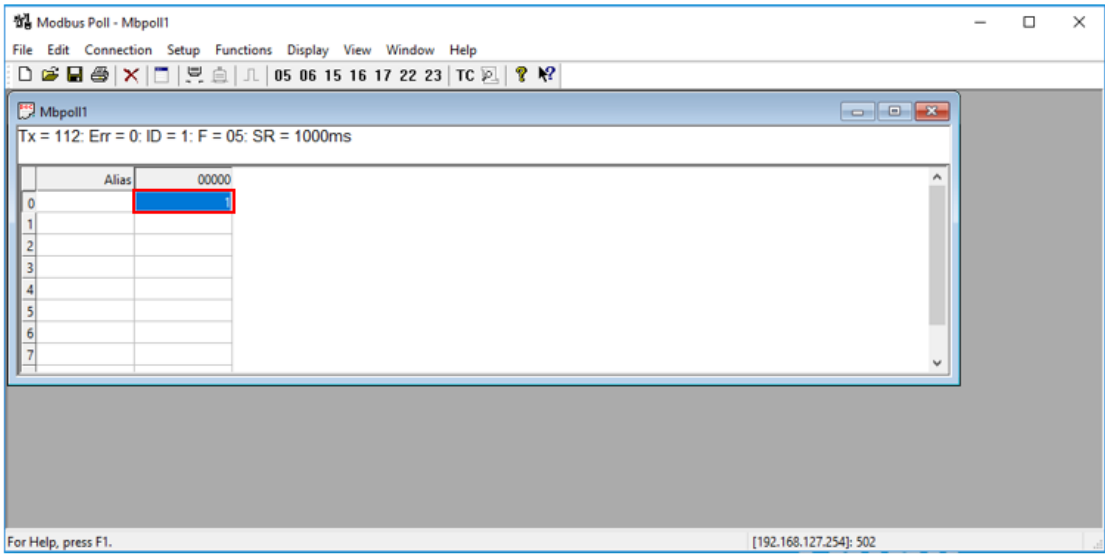
2. Type the text "doStatus" in the filter to find the **Start Address** of the DO channel.




**NOTE** You can also manually modify the addresses if needed. To do so, click **Save & Restart** in the top right of the page after changing the **Start Address**.

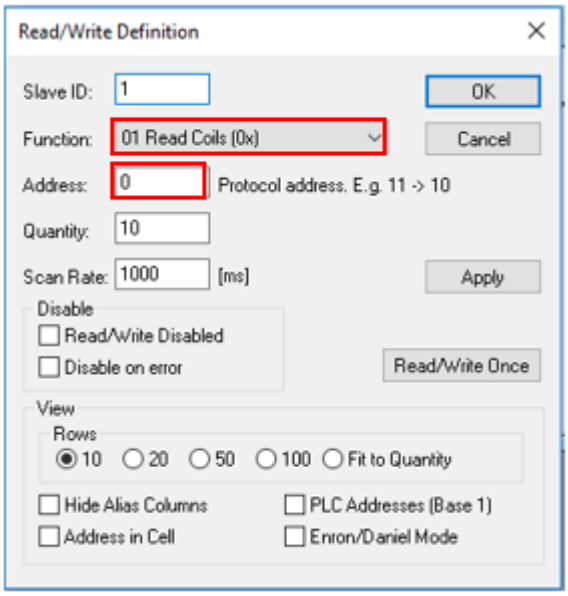



3. Change the DO-00 value from 0 to 1; DO-00 will respond by turning on the LED.

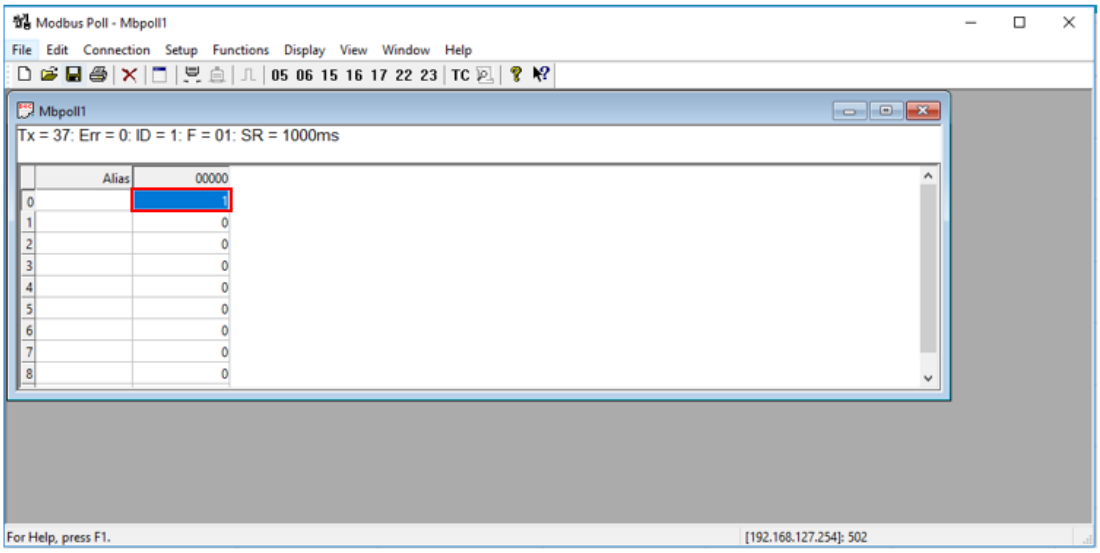


# Read Coils: Use Modbus Poll to read the ioThinx 4510 DO channel status.

1. Select **Read/Write Definition** in the **Setup** panel.
2. Select the **function** code **01 Read Coils** and enter **0**, the start **Address** of the DO channel.




3. The status will be shown in the table; when the DO-00 channel is turned on, the value should be 1).



# How to Use RESTful API to Connect to the ioThinx 4510 Series

## Using RESTful API via Postman

### Introduction to Postman

For information about Postman, please refer to the following web page: https://www.getpostman.com/. Step-by-step procedures on how to use Postman are described below.

**Postman(RESTful API client)**
**IP address: 192.168.127.200**

**Moxa ioThinx 4510**
**IP address: 192.168.127.254**

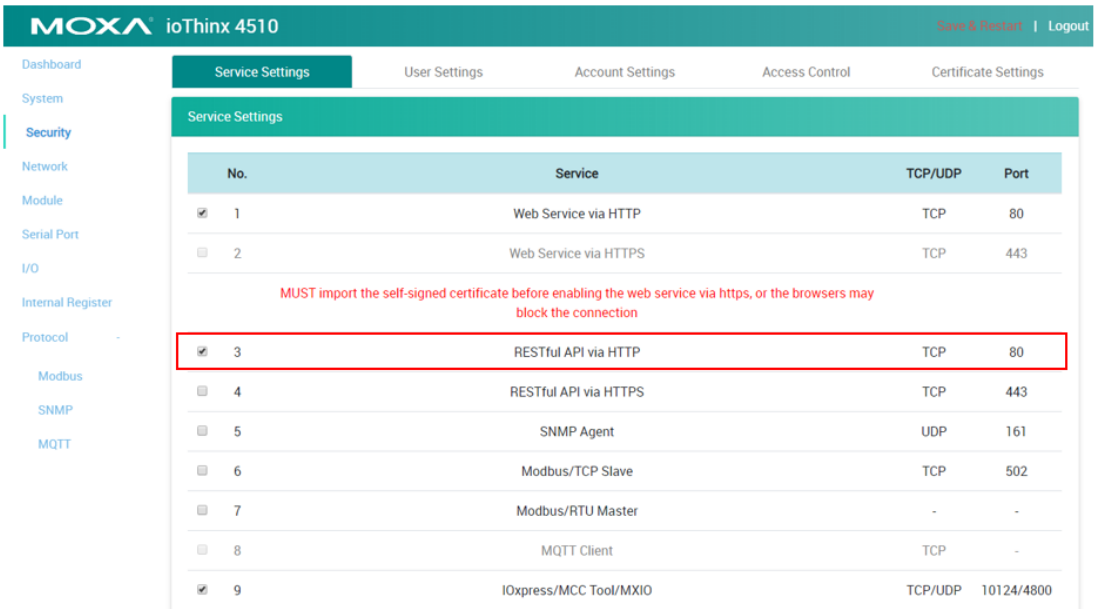
### Enable the RESTful API service on the ioThinx 4510

1. Log in to the ioThinx 4510

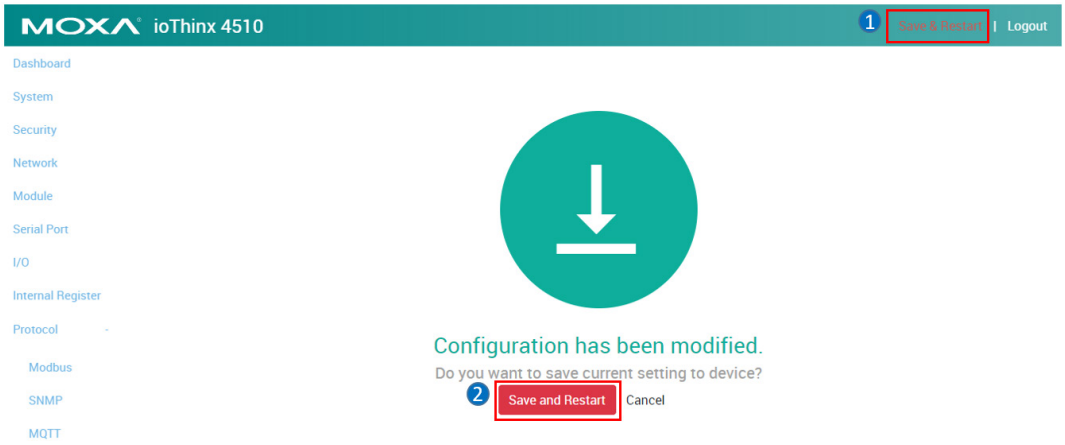
   **Step 1:** Open your web browser and type the default IP address of the device: 192.168.127.254.

   **Step 2:** On the login page, type the default username/password (admin/moxa) to log in to the Web Console.

2. Click **Security** in the left menu and then select **RESTful API via HTTP** Service Settings.

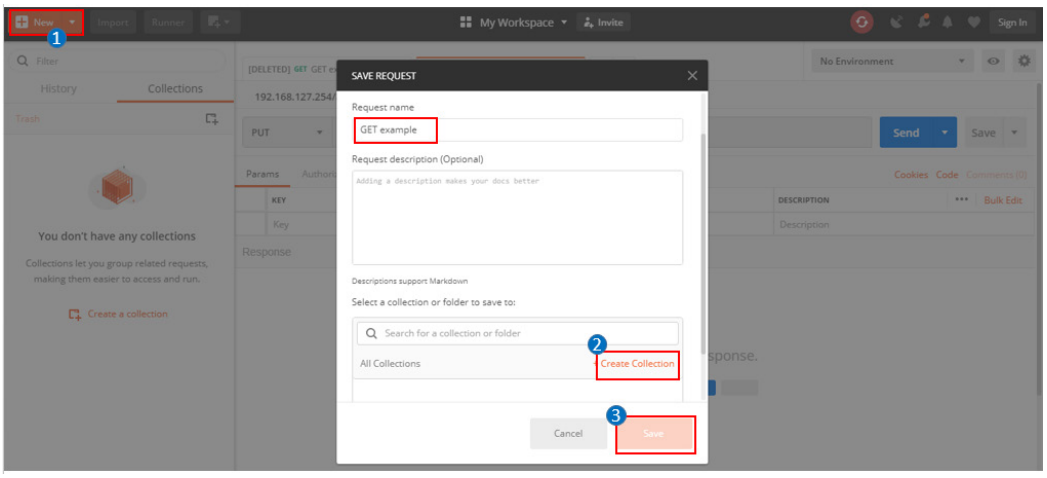


3. Click **Save & Restart** in the top right corner of the page and then click Save and Restart in the center of the page.

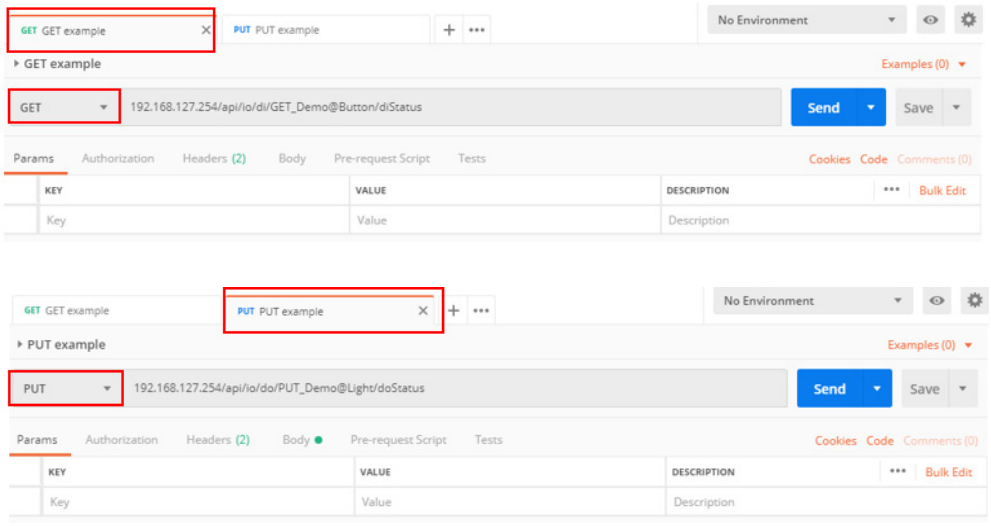



## Configuring Postman

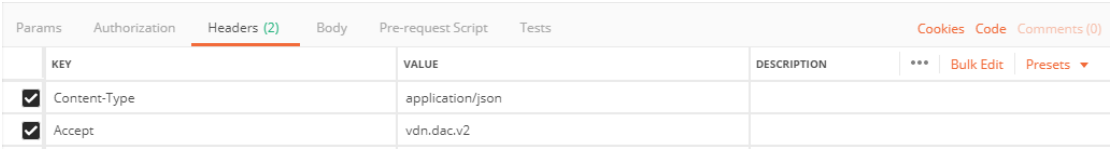
1. Open Postman and create a new Request (named **GET example**).
2. Create a **Collection**.
3. **Save** the new **Request** in the created **Collection**.
4. Create another new **Request** (named **PUT example**) and save it in the created **Collection**.




5. Select the **GET method** on the **GET example** tab, and select the **PUT method** on the **PUT example** tab.



6. Create the following content in the Headers of the GET example tab and PUT example tab.
   - Content-Type: application/json
   - Accept: vdn.dac.v2




# Send a GET request and a PUT request

## RESTful API List Rules

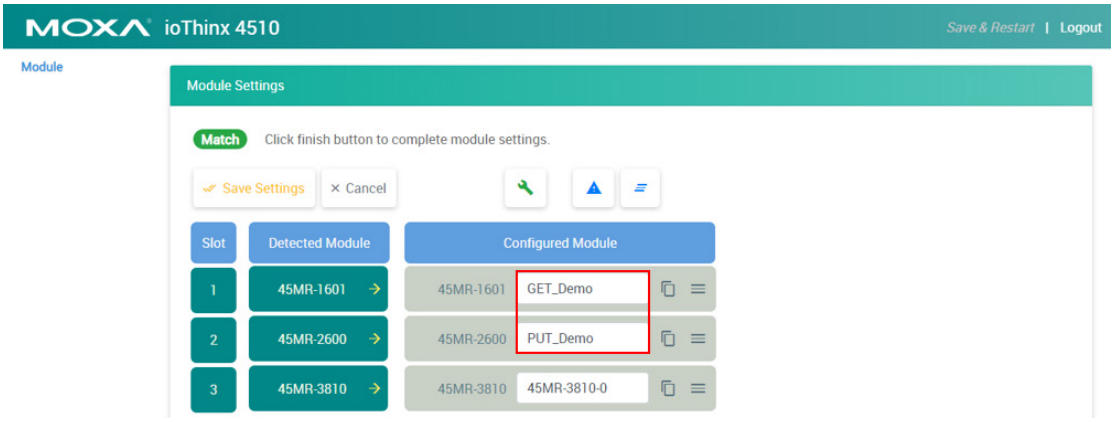
You can check the RESTful API list here: **RESTful API Rules**.

| RESTful API | Description | Access | Format |
|---|---|---|---|
| /api/io/do{ioName}/doStatus | DO - status (0: OFF; 1: ON) | R/W | 0 or 1 |
| /api/io/do{ioName}/doPulseCount | DO - Pulse mode - count | R/W | 0 to 65535 |
| /api/io/do{ioName}/doPulseOnWidth | DO - Pulse mode - ON width (unit 500 μs) | R/W | 1 to 65535 |
| /api/io/do{ioName}/doPulseOffWidth | DO - Pulse mode - OFF width (unit 500 μs) | R/W | 1 to 65535 |
| /api/io/do{ioName}/doPulseStatus | DO - Pulse mode - status (0: Stop; 1: Start) | R/W | 0 or 1 |

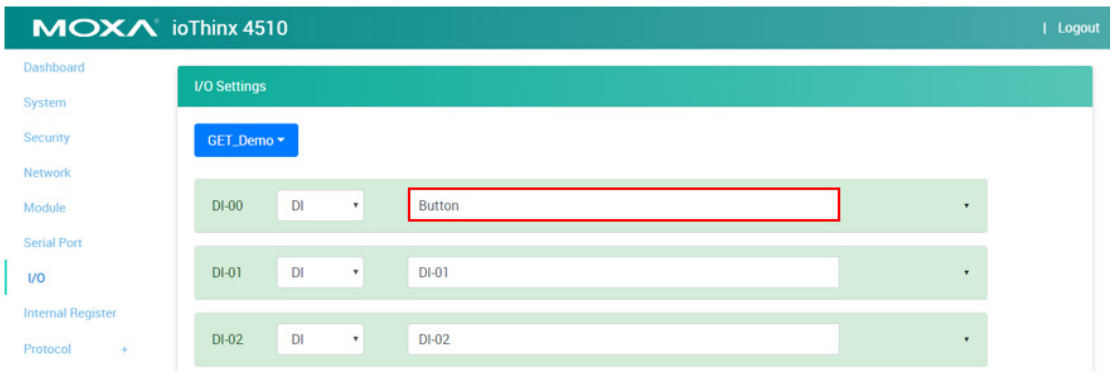
The {ioName} is composed of three elements: Module_Name, @, and I/O_Channel_Name. For example, the {ioName} associated with module name "45MR-2600-0" and DO channel name "DO-00" is 45MR-2600-0@DO-00.

**NOTE** The module and I/O channel name can be changed in **Module Settings** and **I/O Settings**.

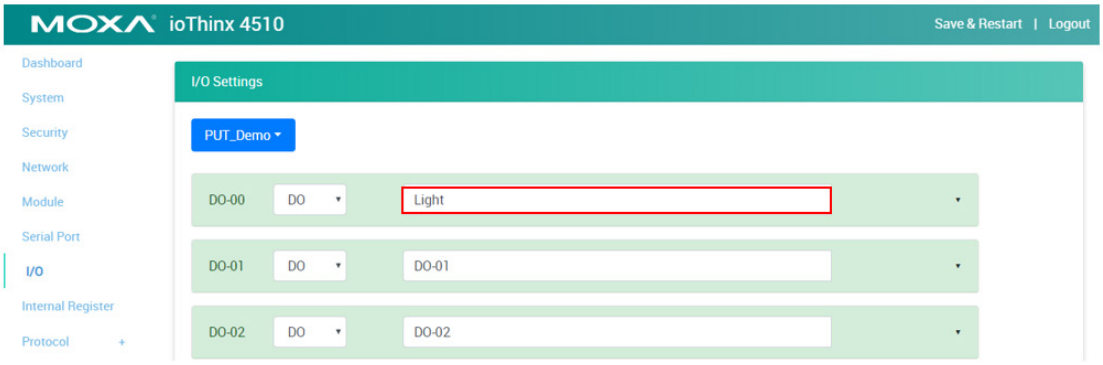
1. In this demonstration, we change the name of module **45MR-1601** to **GET_Demo** and the name of **45MR-2600** to **PUT_Demo**.




2. Change the **DI-00** channel name to **Button**.



3. Change the **DO-00** channel name to **Light**.

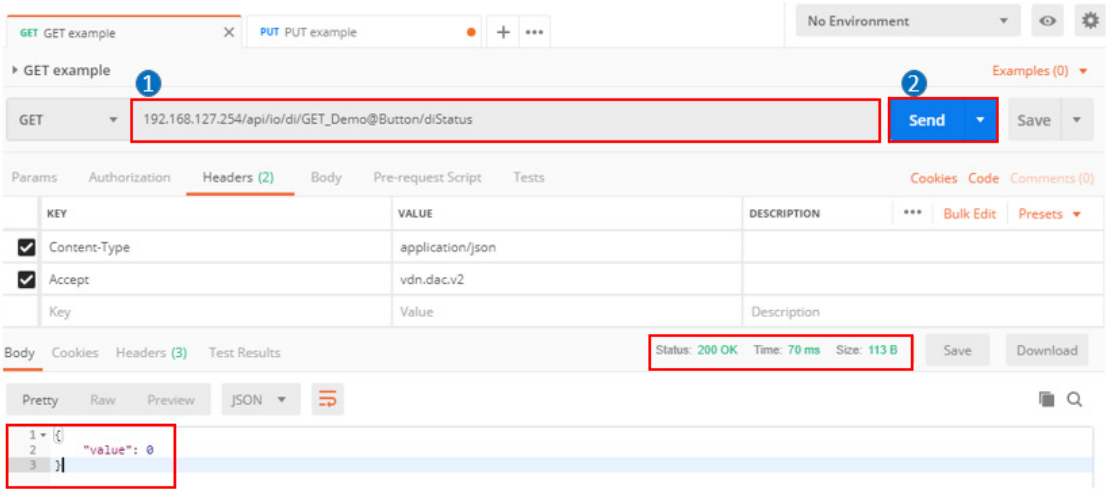



## Send a GET request

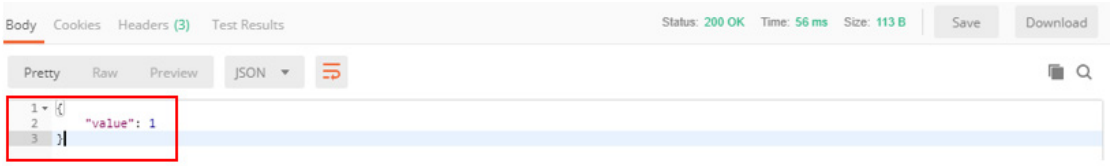
1. Enter the request URL based on the IP address, file type, and API map. For this example, the request URL should be written as:

   **192.168.127.254/api/io/di/GET_Demo@Button/diStatus**

2. Click the Send button. You should see the status code, response time, and results.




3. Press the DI0 button on the starter kit to trigger the DI-00 channel, and then click **Send** again. In response, the DI value will change.

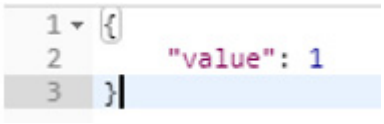



## Send a PUT request

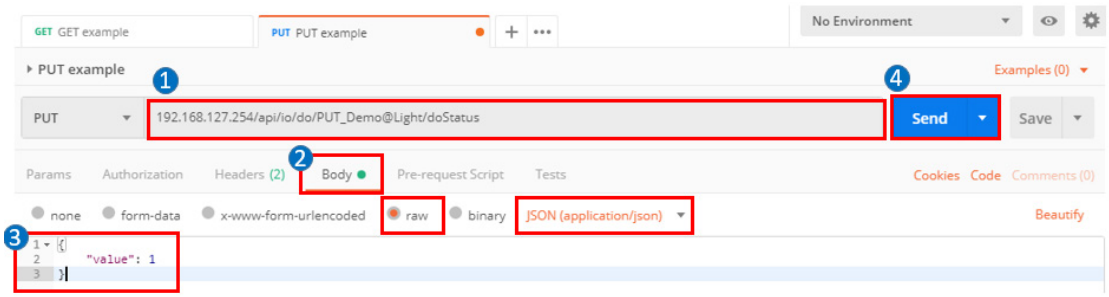
1. Enter the following request URL:

   **192.168.127.254/api/io/do/PUT_Demo@Light/doStatus**

2. Locate the Body tag, select raw, and choose the JSON format.
3. Enter the following message:



4. Click **Send**. The DO-00 channel should respond by turning the light on.

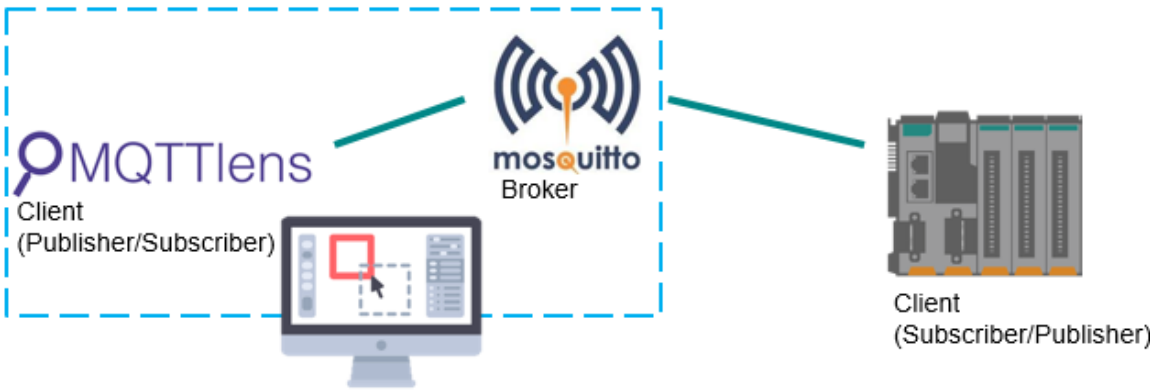



# How to Use MQTT to Connect to the ioThinx 4510 Series

## Broker Settings on the Computer

### Introduction to Mosquitto

For information about Eclipse Mosquitto, please refer to the following web page: https://mosquitto.org/. Mosquitto can be used to implement versions 5.0, 3.1.1, and 3.1 of the MQTT protocol.




**Host**
**IP address: 192.168.127.200**

**Moxa ioThinx 4510**
**IP address: 192.168.127.254**

### Run Mosquitto Broker from Task Manager

Type **Ctrl + Alt + Delete** to open **Task Manager**, click the **mosquito** row to select it, and then right click in the status column and select **Start**.

## Set Up MQTT on the ioThinx 4510

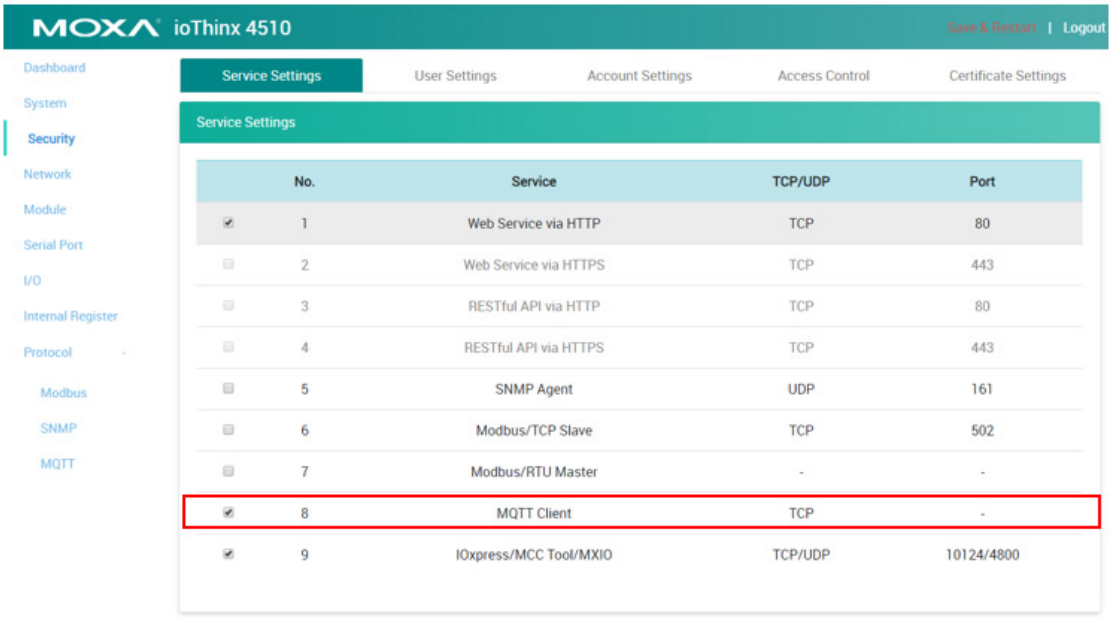
### Enable MQTT Client Service

1. Log in to the ioThinx 4510:

   **Step 1:** Open your web browser and type the default IP address of the device: 192.168.127.254.

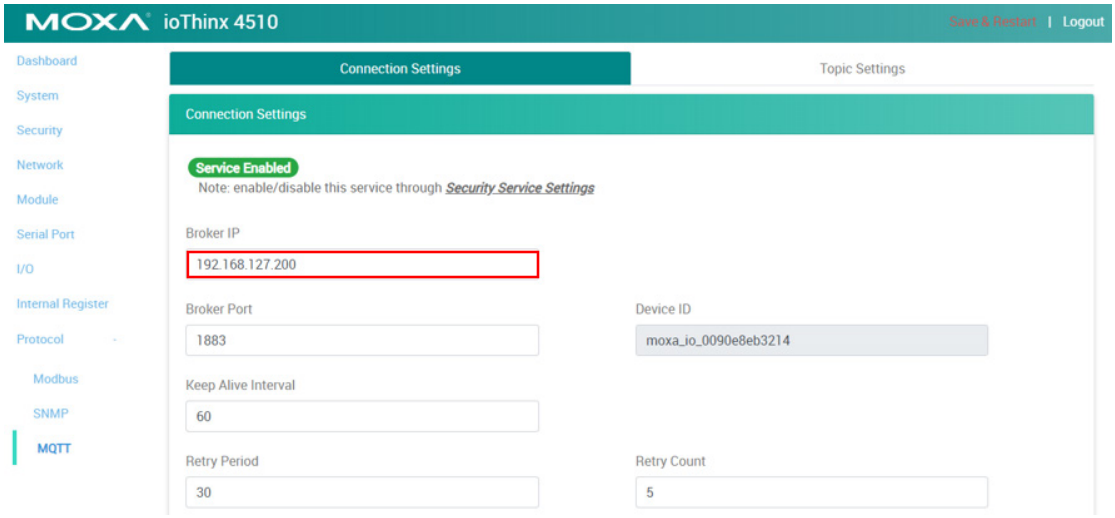
   **Step 2:** On the login page, type the default username/password (admin/moxa) to log in to the Web Console.

2. Click Security in the left menu. Select Service Settings at the top of the page and then select MQTT Client.

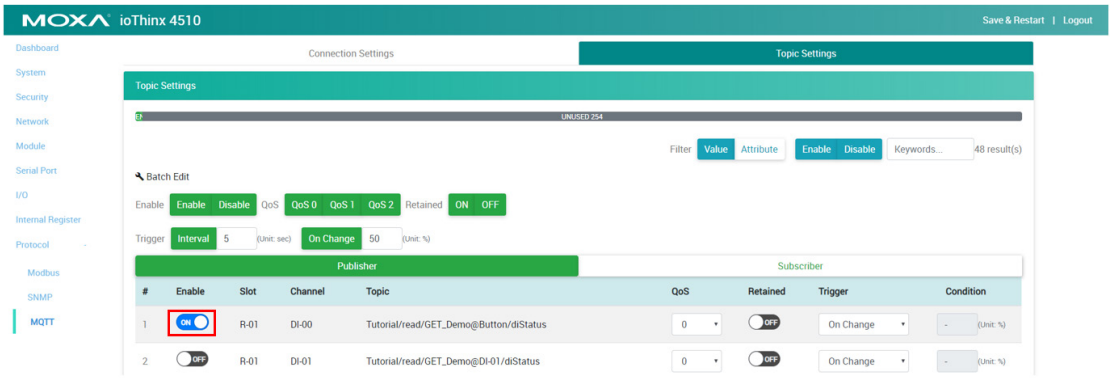


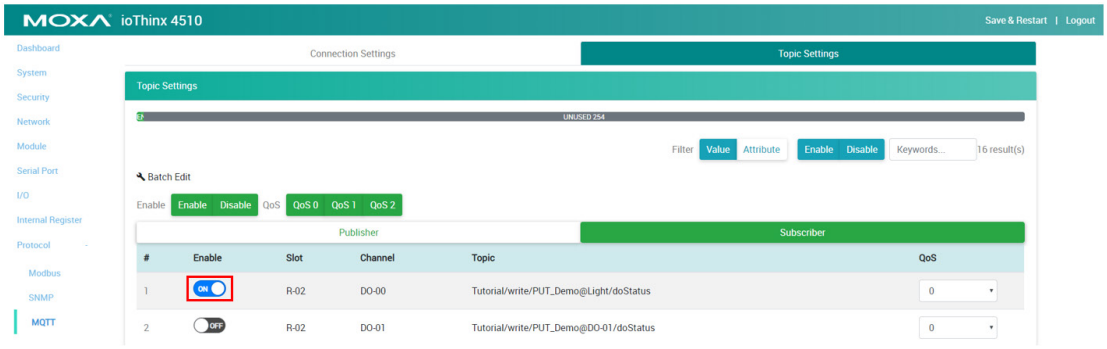

## Connection and Topic Settings

1. Select **MQTT** in the left menu and then set the **Broker IP** (your host's IP) under **Connection Settings**.

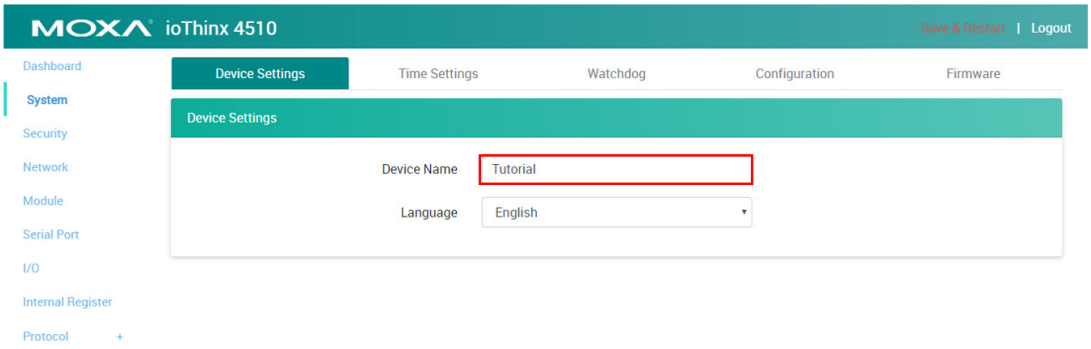


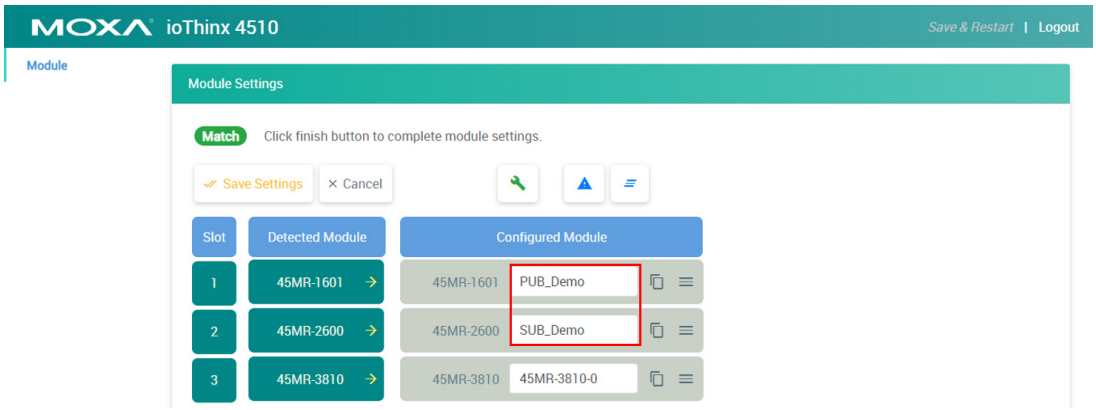

2. Click **Publisher** and enable **Topic#1 (DI-00)**, and then click **Subscriber** and enable **Topic#1 (DO-00)**.

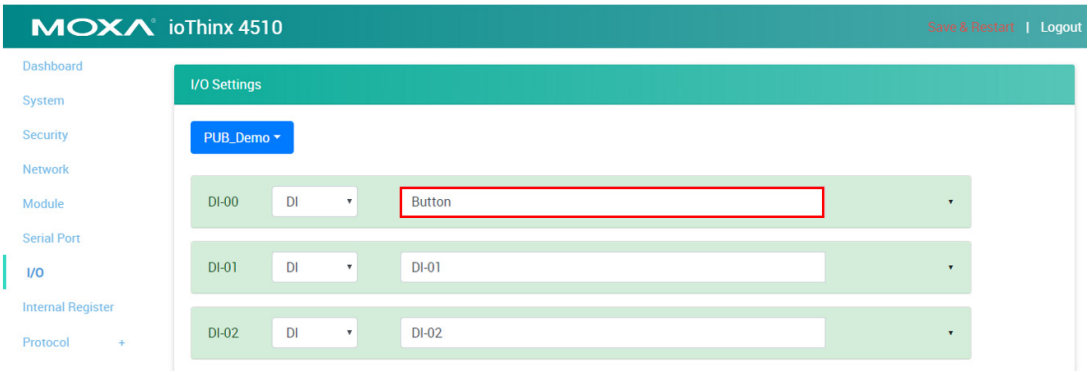





**NOTE** The content of the **Topic** is based on **Device Name**, **Module name**, and **I/O channel**. You can change these values in **Device Settings**, **Module Settings**, and **I/O Settings**.

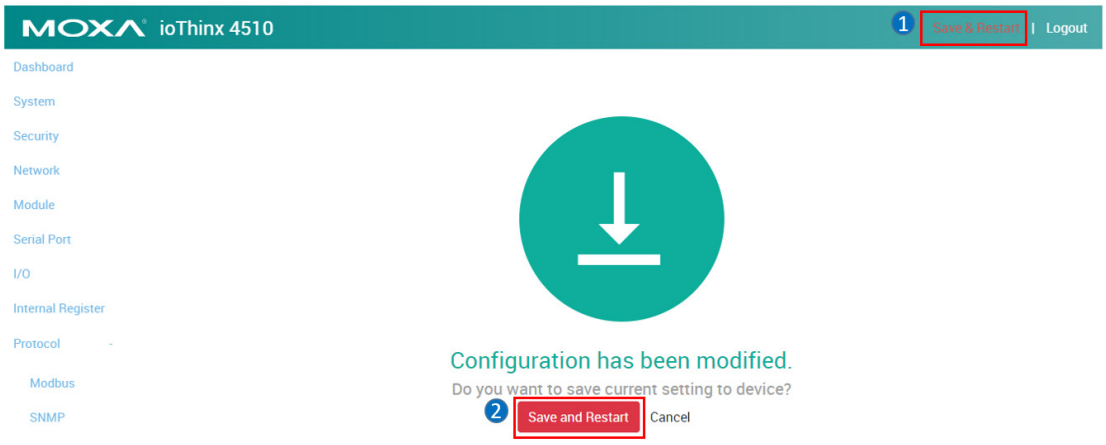



In this demonstration, we changed our **Topic #1 (DI-00 and DO-00)** as below:
Publisher **Topic#1**(DI-00):Tutorial/read/PUB_Demo@Button/diStatus
Subscriber **Topic#1**(DO-00):Tutorial/write/SUB_Demo@Light/doStatus

3. Click **Save & Restart** in the upper-right corner, and then click **Save and Restart** in the center of the page.



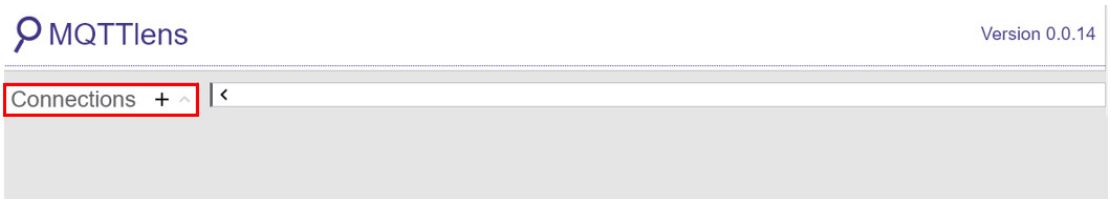

# Publisher and Subscriber Settings

## Introduction to MQTTlens

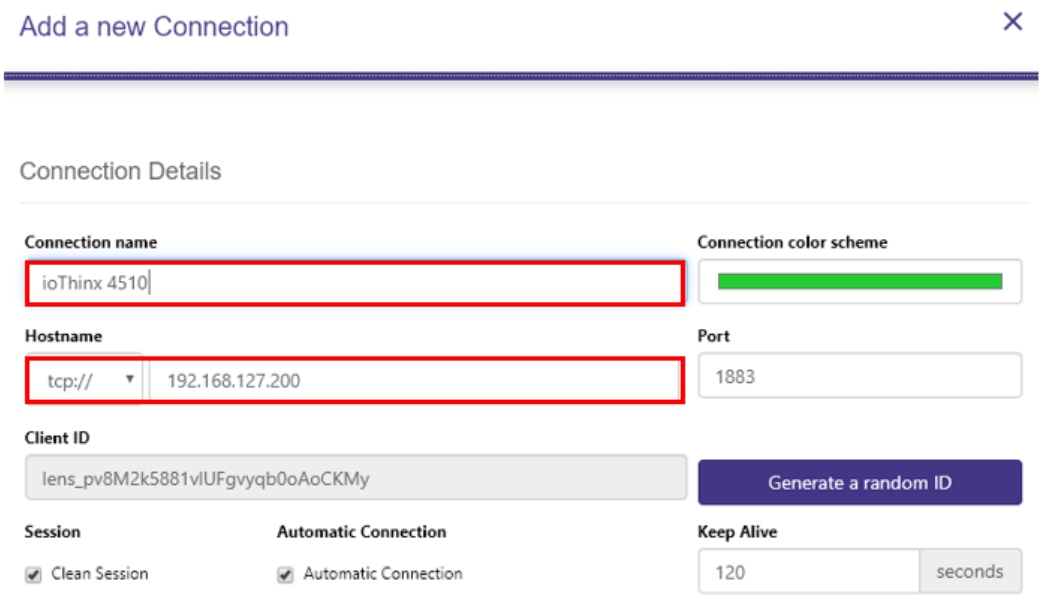
MQTTLens is a chrome application that supports MQTT communications. MQTTLens can be used to simulate communicating with the ioThinx 4510 via MQTT.

## Configuring MQTTlens

1. Add a new connection on **MQTTlens**



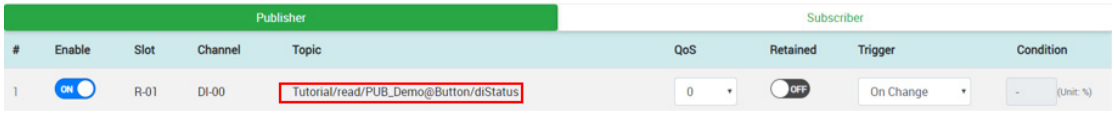

2. Enter your **Connection name** and **Hostname** (broker IP) in the associated text input boxes.



# Scenario 1: Publish DI status to MQTTlens

- Publisher: ioThinx 4510
- Subscriber: MQTTlens

1. Copy the topic from the ioThinx 4510 **MQTT publisher** tab.



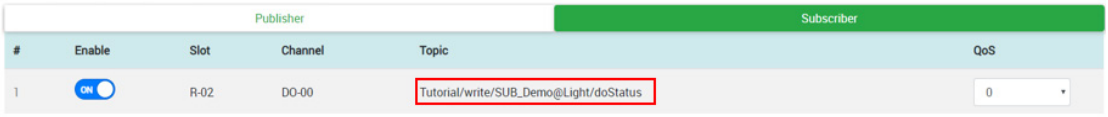

Paste the topic into the subscribe column of the MQTTlens, and then click subscribe.

2. Press the DI0 button on the starter kit to trigger the DI-00 channel; you should see the DI value change on your subscriber.

# Scenario 2: Turn on ioThinx 4510's DO channel

- Publisher: MQTTlens
- Subscriber: ioThinx 4510

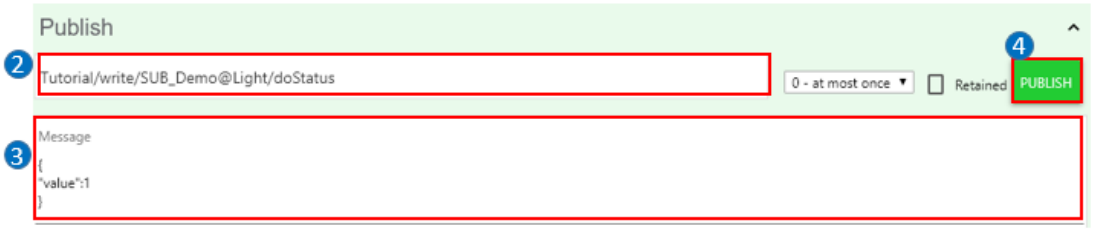
1. Copy the topic from the ioThinx 4510 **MQTT subscriber** page.




2. Paste the Topic into the MQTTlens publish column.
3. Enter the following message:

```
Message
{
"value":1
}
```

4. Click **Publish**. The DO-00 channel should respond by turning the light on.

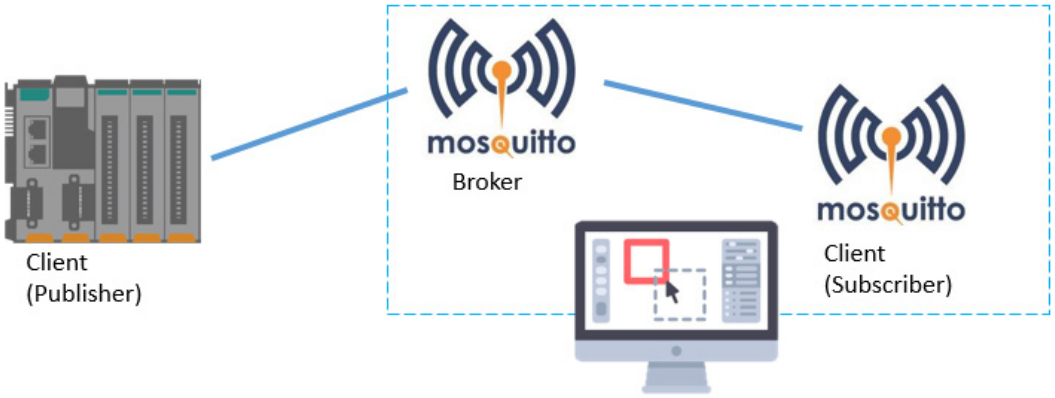


# How to Connect ioThinx 4510 to an MQTT Broker over TLS

When using MQTT over TLS, the broker should support the following encryption method, which is supported by ioThinx 4510.

- MBEDTLS_TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256
- MBEDTLS_TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256

## Broker Settings on the Computer



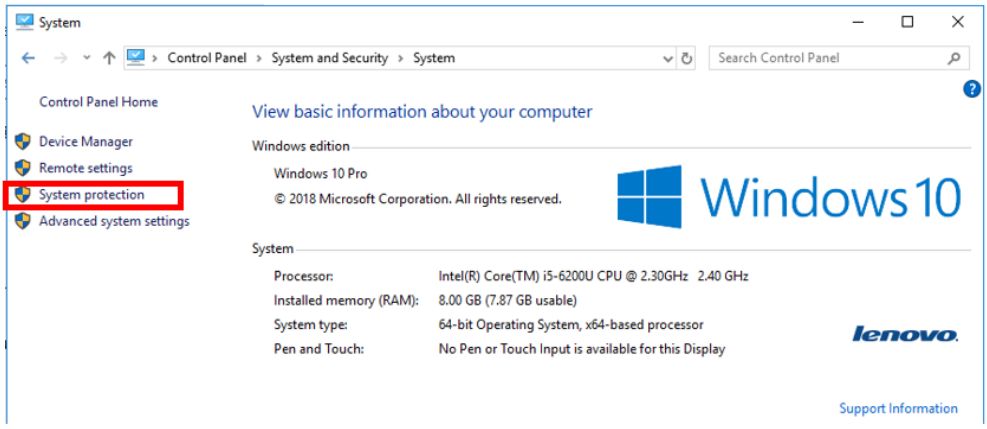

**Moxa ioThinx 4510**
**IP address: 192.168.127.254**

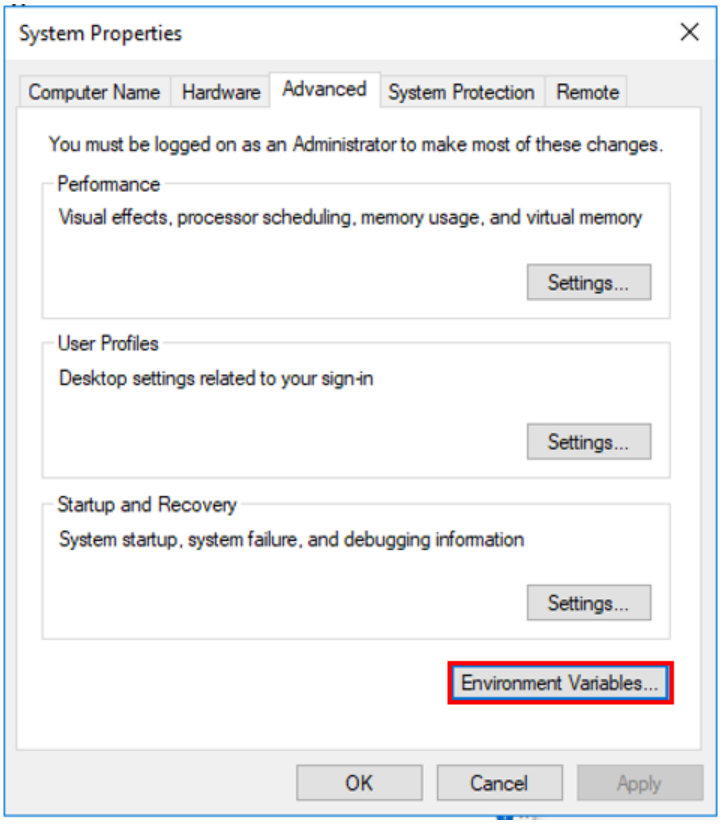
**IP address: 192.168.127.200**

### Install OpenSSL

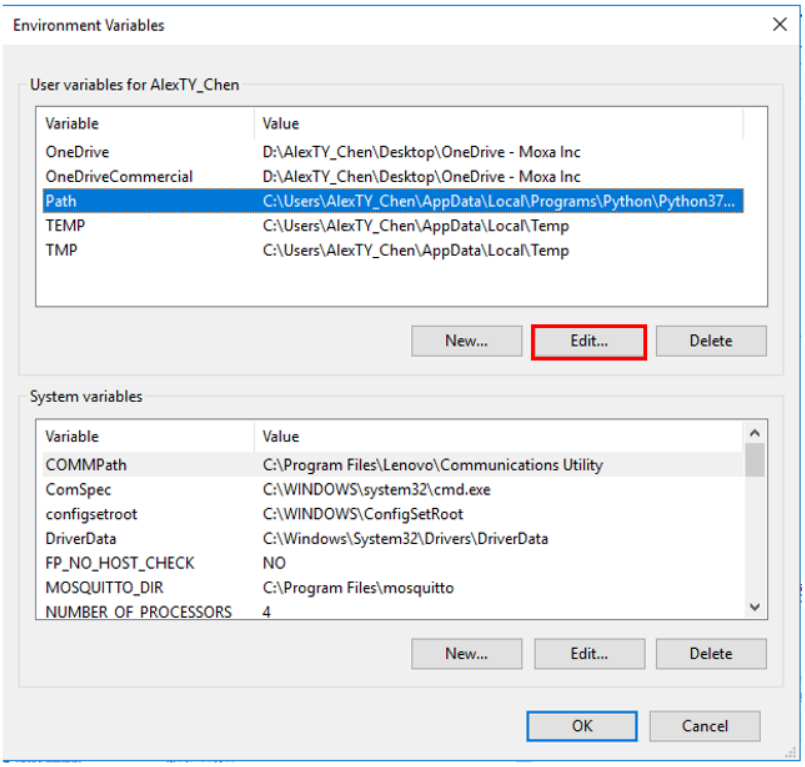
OpenSSL is a full-featured toolkit for the Transport Layer Security (TLS) and Secure Sockets Layer (SSL) protocols. User will need this for generating key.

1. Download and install OpenSSL from the website: https://www.openssl.org/source/
2. Set the environment variables to function OpenSSL properly on your system.

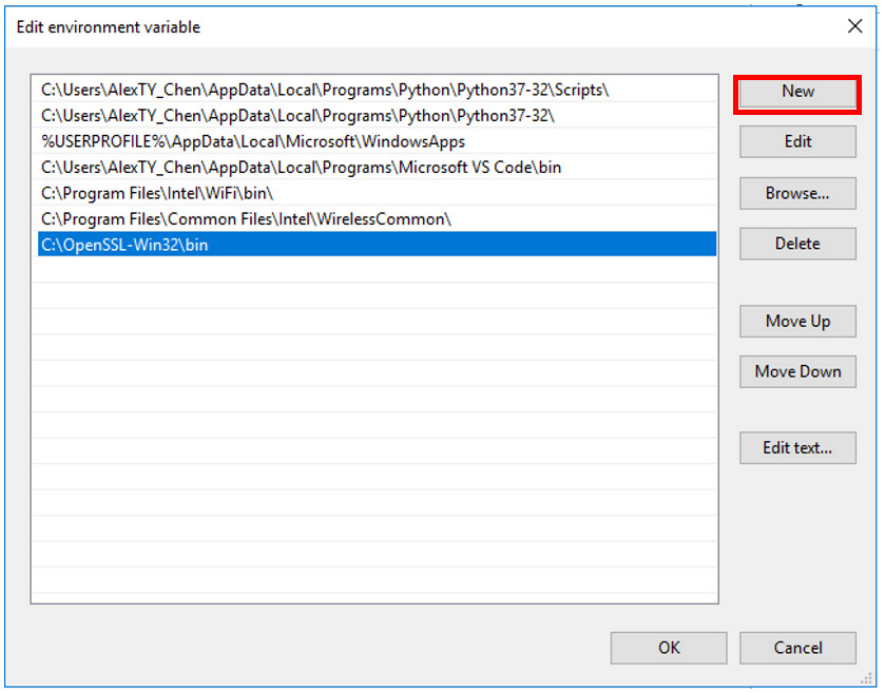





3. Select Path and click edit in the user variables section.



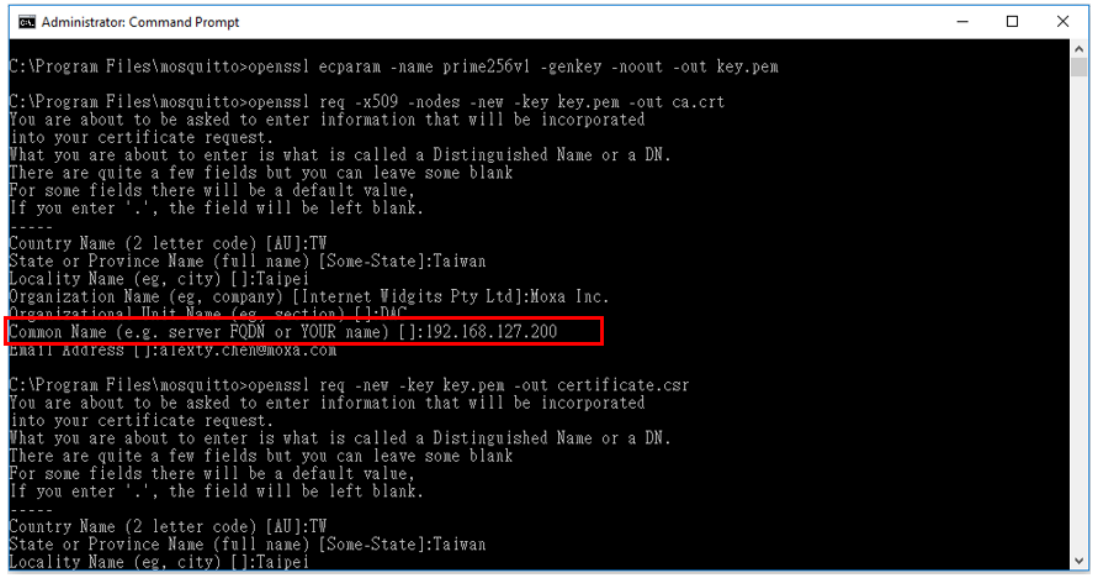
4. Create a new path for OpenSSL.




## Generate Certificate

1. Run CMD (Command Prompt) as administrator
2. Generate certificate for the broker by entering below commands in cmd:
   - openssl ecparam -name prime256v1 -genkey -noout -out key.pem
   - openssl req -x509 -nodes -new -key key.pem -out ca.crt
   - openssl req -new -key key.pem -out certificate.csr
   - openssl x509 -req -in certificate.csr -CA ca.crt -CAkey key.pem -CAcreateserial -out certificate.crt

   Note: the **Common Name** should be broker IP.



The files shown below will be generated. Put the files in the mosquitto folder.

| Name | Date modified | Type | Size |
|---|---|---|---|
| ca.srl | 11/27/2019 2:03 PM | SRL File | 1 KB |
| certificate.crt | 11/27/2019 2:03 PM | Security Certificate | 1 KB |
| certificate.csr | 11/27/2019 2:03 PM | CSR File | 1 KB |
| ca.crt | 11/27/2019 2:02 PM | Security Certificate | 1 KB |
| key.pem | 11/27/2019 2:02 PM | PEM File | 1 KB |

## Modify mosquitto.conf

1. Open mosquitto.conf in the mosquitto folder.
2. Type in below certificate information in the #Certificate based SSL/TLS support section.
   - Cafile C:\Program Files\mosquitto\ca.crt
   - Certfile C:\Program Files\mosquitto\certificate.crt
   - Keyfile C:\Program Files\mosquitto\key.pem

```
249   # ----------------------------------------------------------------
250   # Certificate based SSL/TLS support
251   # ----------------------------------------------------------------
252   # The following options can be used to enable SSL/TLS support for
253   # this listener. Note that the recommended port for MQTT over TLS
254   # is 8883, but this must be set manually.
255   #
256   # See also the mosquitto-tls man page.
257
258   # At least one of cafile or capath must be defined. They both
259   # define methods of accessing the PEM encoded Certificate
260   # Authority certificates that have signed your server certificate
261   # and that you wish to trust.
262   # cafile defines the path to a file containing the CA certificates.
263   # capath defines a directory that will be searched for files
264   # containing the CA certificates. For capath to work correctly, the
265   # certificate files must have ".crt" as the file ending and you must run
266   # "openssl rehash <path to capath>" each time you add/remove a certificate.
267   cafile C:\Program Files\mosquitto\ca.crt
268   #capath
269
270   # Path to the PEM encoded server certificate.
271   certfile C:\Program Files\mosquitto\certificate.crt
272   # Path to the PEM encoded keyfile.
273   keyfile C:\Program Files\mosquitto\key.pem
274
```

3. Add broker port 8883 to the end.

```
987   port 8883 # setting TLS port
988
```

4. Enter “mosquitto.exe -v -c mosquitto.conf” in the cmd to start broker

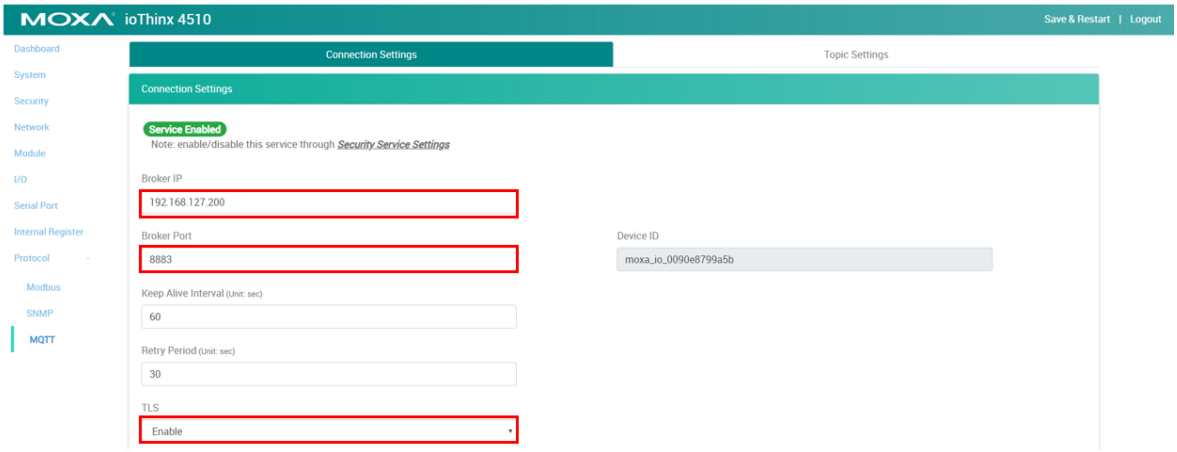
```
Administrator: Command Prompt - mosquitto.exe -v -c mosquitto.conf

C:\Program Files\mosquitto>mosquitto.exe -v -c mosquitto.conf
1579497626: mosquitto version 1.5.8 starting
1579497626: Config loaded from mosquitto.conf.
1579497626: Opening ipv6 listen socket on port 8883.
1579497626: Opening ipv4 listen socket on port 8883.
1579497634: New connection from 192.168.127.254 on port 8883.
1579497638: New client connected from 192.168.127.254 as moxa_io_0090e8799a5b (c1, k60).
1579497638: No will message specified.
1579497638: Sending CONNACK to moxa_io_0090e8799a5b (0, 0)
```

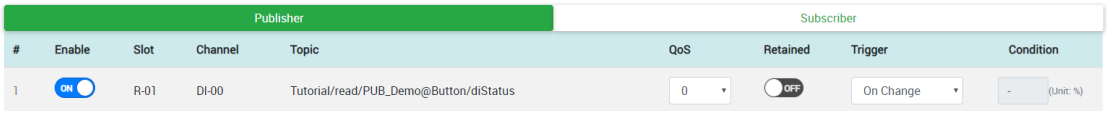
# Client (publisher) setting

## Use ioThinx 4510 to publish a message to the broker.

1. Set the Broker IP (your computer's IP) under Connection Settings. Enable TLS, the default Broker Port is 8883.

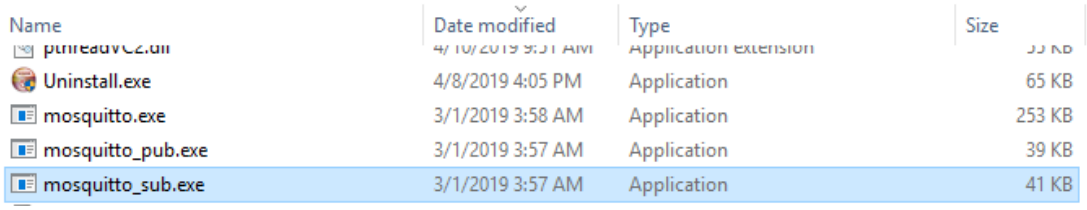



2. Click Publisher and enable Topic#1 (DI-00), then click Save and Restart.

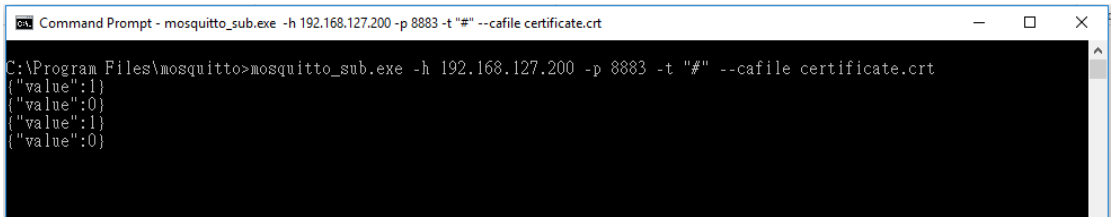



# Client (subscriber) setting

Use **mosquitto_sub** to subscribe the topic. **mosquitto_sub** is a simple MQTT version 5/3.1.1 client that will subscribe to topics and print the messages that it receives.




1. Enter "mosquitto_sub.exe -h 192.168.127.200 -p 8883 -t "#" --cafile certificate.crt" in the cmd to get the message from broker
2. When trigger the DI-00 channel, the client(subscriber) will get the message.



# A

# Appendix

The following topics are covered in this appendix:

- **Network Port Usage**
- **Modbus/TCP Slave Rules**
  - Supported Function Code
  - Exception Code
  - System Registers
  - 45MR-1600 (-T), 16 DIs Registers
  - 45MR-1601 (-T), 16 DIs Registers
  - 45MR-2404 (-T), 4 Relays Registers
  - 45MR-2600 (-T), 16 DOs Registers
  - 45MR-2601 (-T), 16 DOs Registers
  - 45MR-2606 (-T), 8 DIs, 8 DOs Registers
  - 45MR-3800 (-T), 8 AIs Registers
  - 45MR-3810 (-T), 8 AIs Registers
  - 45MR-4420 (-T), 4 AOs Registers
  - 45MR-6600 (-T), 6 RTDs Registers
  - 45MR-6810 (-T), 8 TCs Registers
  - 45MR-7210(-T), System and Field Power Input Registers
- **SNMP Rules**
- **RESTful API Rules**
  - Supported Request Method
  - GET Request Components
  - PUT Request Components
  - RESTful API List
  - Exception Code
- **MQTT Rules**
  - Publish Topic
  - Subscribe Topic
- **Troubleshooting**
  - Forgot username & password
  - Forgot IP address of the unit
  - Failed to update firmware
  - Failed to update configuration
  - Failed to access the unit through IP address & IOxpress
  - Failed to enter System Ready Mode
- **Import Self-Signed Certificate**
- **Return Value of a System Error**

# Network Port Usage

| Service Type | TCP/UDP | Port | Default |
|---|---|---|---|
| DHCP | UDP | 68 | Disabled |
| Web Server | TCP | 80 | Enabled |
| RESTful API | TCP | 80 | Disabled |
| SNMP Agent | UDP | 161 | Disabled |
| HTTPs | TCP | 443 | Disabled |
| Modbus/TCP Slave | TCP | 502 | Enabled |
| Auto Search | UDP | 4800 | Enabled |
| IOxpress/CLI | TCP | 10124 | Enabled |

# Modbus/TCP Slave Rules

## Supported Function Code

| Point Type | Register (decimal) | Access | Type | Supported Function Code |
|---|---|---|---|---|
| 01: COIL STATUS | 0xxxx | R/W | bit | 1, 5, 15 |
| 02: INPUT STATUS | 1xxxx | R | bit | 2 |
| 03: HOLDING REGISTER | 4xxxx | R/W | word | 3, 6, 16 |
| 04: INPUT REGISTER | 3xxxx | R | word | 4 |

## Exception Code

| Code | Name | Comments |
|---|---|---|
| 1 | ILLEGAL FUNCTION | Function code is not valid. |
| 2 | ILLEGAL DATA ADDRESS | Data address is not valid. |
| 3 | ILLEGAL DATA VALUE | Writing value is not accepted. |
| 4 | SLAVE DEVICE FAILURE | Unrecoverable error occurred. |

## System Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| boolInternalRegister | BOOL Internal Register (BIR) | 48 | BOOL |

### 02: INPUT STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| watchdogAlarmFlag | Watchdog alarm flag status (0: Normal, 1: alarm) | 1 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| wirValue | WORD IR - Value | 48 | WORD |
| dirValue | DWORD IR - Value | 96 | DWORD |
| firValue | FLOAT IR - Value | 96 | REAL |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| modbusRtuMasterDeviceStatus | Modbus/RTU Master - device status | 4 | WORD |
| modbusRtuMasterprofileErrorCode | Modbus/RTU Master - profile error code | 8 | WORD |
| deviceName | device name | 8 | BYTE |
| deviceDate | device date<br>e.g. 2016/06/28 -> 20160628 | 2 | DWORD |
| deviceTime | device local time<br>e.g. 15:48:25 -> 154825 | 2 | DWORD |
| deviceUpTime | unit: sec(s) | 2 | DWORD |
| firmwareVersion | Each byte represents ASCII code. e.g. 1.2.3 --> V1.2.3 , 11.13.12 -->V11.13.12 | 4 | BYTE |
| firmwareBuildDate | Each byte represents ASCII code. E.g. 16051718 --> Build16051718 | 4 | BYTE |
| serialNumber | Each byte represents ASCII code of serial number English character : e.g. TAGCB1100001 | 6 | BYTE |
| lanMac | MAC address | 4 | BYTE |
| lanIp | IP address | 2 | BYTE |
| systemError | System Error | 1 | WORD |

# 45MR-1600 (-T), 16 DIs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| diCounterStatus | DI - Counter mode - status (0: Pause, 1: Run) | 4 | BOOL |
| diCounterOverflowFlagClear | DI - Counter mode - clear overflow flag (1: Clear) | 4 | BOOL |

### 02: INPUT STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| diStatus | DI - DI mode - status (0: OFF, 1: ON) | 16 | BOOL |
| diMode | DI - mode (0: DI, 1: Counter) | 16 | BOOL |
| diCounterOverflowFlag | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | 4 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| diCounterValue | DI - Counter mode - value | 8 | DWORD |
| diCounterStatusAll | DI - Counter mode - status (0: Pause, 1: Run) | 1 | WORD |
| diCounterOverflowFlagClearAll | DI - Counter mode - clear overflow flag (1: Clear) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| diStatusAll | DI - DI mode - status (0: OFF, 1: ON) | 1 | WORD |
| diCounterOverflowFlagAll | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | 1 | WORD |
| diModeAll | DI - mode (0: DI, 1: Counter) | 1 | WORD |

# 45MR-1601 (-T), 16 DIs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| diCounterStatus | DI - Counter mode - status (0: Pause, 1: Run) | 4 | BOOL |
| diCounterOverflowFlagClear | DI - Counter mode - clear overflow flag (1: Clear) | 4 | BOOL |

### 02: INPUT STATUS?

| Parameter | Description | Length | Type |
|---|---|---|---|
| diStatus | DI - DI mode - status (0: OFF, 1: ON) | 16 | BOOL |
| diMode | DI - mode (0: DI, 1: Counter) | 16 | BOOL |
| diCounterOverflowFlag | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | 4 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| diCounterValue | DI - Counter mode - value | 8 | DWORD |
| diCounterStatusAll | DI - Counter mode - status (0: Pause, 1: Run) | 1 | WORD |
| diCounterOverflowFlagClearAll | DI - Counter mode - clear overflow flag (1: Clear) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| diStatusAll | DI - DI mode - status (0: OFF, 1: ON) | 1 | WORD |
| diCounterOverflowFlagAll | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | 1 | WORD |
| diModeAll | DI - mode (0: DI, 1: Counter) | 1 | WORD |

# 45MR-2404 (-T), 4 Relays Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| relayStatus | Relay - Relay mode - status (0: OFF, 1: ON) | 4 | BOOL |
| relayCurrentCountReset | Relay - reset current count (1: Reset) | 4 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| relayStatusAll | Relay - Relay mode - status (0: OFF, 1: ON) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| relayTotalCount | Relay - total count | 8 | DWORD |
| relayCurrentCount | Relay - current count | 8 | DWORD |

# 45MR-2600 (-T), 16 DOs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| doStatus | DO - status (0: OFF, 1: ON) | 16 | BOOL |
| doPulseStatus | DO - Pulse mode - status (0: Stop, 1: Start) | 4 | BOOL |

### 02: INPUT STATUS?

| Parameter | Description | Length | Type |
|---|---|---|---|
| doMode | DO - mode (0: DO, 1: Pulse) | 16 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| doStatusAll | DO - status (0: OFF, 1: ON) | 1 | WORD |
| doPulseCount | DO - Pulse mode - count | 8 | DWORD |
| doPulseOnWidth | DO - Pulse mode - ON width (unit: 500 us) | 4 | WORD |
| doPulseOffWidth | DO - Pulse mode - OFF width (unit: 500 us) | 4 | WORD |
| doPulseStatusAll | DO - Pulse mode - status (0: Stop, 1: Start) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| doModeAll | DO - mode (0: DO, 1: Pulse) | 1 | WORD |

# 45MR-2601 (-T), 16 DOs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| doStatus | DO - status (0: OFF, 1: ON) | 16 | BOOL |
| doPulseStatus | DO - Pulse mode - status (0: Stop, 1: Start) | 4 | BOOL |

### 02: INPUT STATUS?

| Parameter | Description | Length | Type |
|---|---|---|---|
| doMode | DO - mode (0: DO, 1: Pulse) | 16 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| doStatusAll | DO - status (0: OFF, 1: ON) | 1 | WORD |
| doPulseCount | DO - Pulse mode - count | 8 | DWORD |
| doPulseOnWidth | DO - Pulse mode - ON width (unit: 500 us) | 4 | WORD |
| doPulseOffWidth | DO - Pulse mode - OFF width (unit: 500 us) | 4 | WORD |
| doPulseStatusAll | DO - Pulse mode - status (0: Stop, 1: Start) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| doModeAll | DO - mode (0: DO, 1: Pulse) | 1 | WORD |

# 45MR-2606 (-T), 8 DIs, 8 DOs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| doStatus | DO - status (0: OFF, 1: ON) | 8 | BOOL |
| diCounterStatus | DI - Counter mode - status (0: Pause, 1: Run) | 2 | BOOL |
| diCounterOverflowFlagClear | DI - Counter mode - clear overflow flag (1: Clear) | 2 | BOOL |
| doPulseStatus | DO - Pulse mode - status (0: Stop, 1: Start) | 2 | BOOL |

### 02: INPUT STATUS?

| Parameter | Description | Length | Type |
|---|---|---|---|
| diStatus | DI - DI mode - status (0: OFF, 1: ON) | 8 | BOOL |
| diMode | DI - mode (0: DI, 1: Counter) | 8 | BOOL |
| doMode | DO - mode (0: DO, 1: Pulse) | 8 | BOOL |
| diCounterOverflowFlag | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | 2 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| diCounterValue | DI - Counter mode - value | 4 | DWORD |
| doStatusAll | DO - status (0: OFF, 1: ON) | 1 | WORD |
| doPulseCount | DO - Pulse mode - count | 4 | DWORD |
| doPulseOnWidth | DO - Pulse mode - ON width (unit: 500 us) | 2 | WORD |
| doPulseOffWidth | DO - Pulse mode - OFF width (unit: 500 us) | 2 | WORD |
| doPulseStatusAll | DO - Pulse mode - status (0: Stop, 1: Start) | 1 | WORD |
| diCounterStatusAll | DI - Counter mode - status (0: Pause, 1: Run) | 1 | WORD |
| diCounterOverflowFlagClearAll | DI - Counter mode - clear overflow flag (1: Clear) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| diStatusAll | DI - DI mode - status (0: OFF, 1: ON) | 1 | WORD |
| diCounterOverflowFlagAll | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | 1 | WORD |
| diModeAll | DI - mode (0: DI, 1: Counter) | 1 | WORD |
| doModeAll | DO - mode (0: DO, 1: Pulse) | 1 | WORD |

# 45MR-3800 (-T), 8 AIs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| aiResetMinValue | AI - reset minimum value (1: Reset) | 8 | BOOL |
| aiResetMaxValue | AI - reset maximum value (1: Reset) | 8 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| aiResetMinValueAll | AI - reset minimum value (1: Reset) | 1 | WORD |
| aiResetMaxValueAll | AI - reset maximum value (1: Reset) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| aiValueRaw | AI - raw value | 8 | WORD |
| aiValueRawMin | AI - minimum raw value | 8 | WORD |
| aiValueRawMax | AI - maximum raw value | 8 | WORD |
| aiValueScaled | AI - scaled value | 16 | REAL |
| aiValueScaledMin | AI - minimum scaled value | 16 | REAL |
| aiValueScaledMax | AI - maximum scaled value | 16 | REAL |
| aiStatus | AI - status (0: normal, 1: burnout, 2: over range, 3. under range) | 8 | WORD |
| aiBurnoutValueScaled | AI - scaled burnout value | 16 | REAL |
| aiMode | AI - mode (0: disable, 1: 0-10 V, 2: 0-20 mA, 3: 4-20 mA burnout, 4: 4-20 mA, 5: ±10 V) | 8 | WORD |

# 45MR-3810 (-T), 8 AIs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| aiResetMinValue | AI - reset minimum value (1: Reset) | 8 | BOOL |
| aiResetMaxValue | AI - reset maximum value (1: Reset) | 8 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| aiResetMinValueAll | AI - reset minimum value (1: Reset) | 1 | WORD |
| aiResetMaxValueAll | AI - reset maximum value (1: Reset) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| aiValueRaw | AI - raw value | 8 | WORD |
| aiValueRawMin | AI - minimum raw value | 8 | WORD |
| aiValueRawMax | AI - maximum raw value | 8 | WORD |
| aiValueScaled | AI - scaled value | 16 | REAL |
| aiValueScaledMin | AI - minimum scaled value | 16 | REAL |
| aiValueScaledMax | AI - maximum scaled value | 16 | REAL |
| aiStatus | AI - status (0: normal, 1: burnout, 2: over range, 3. under range) | 8 | WORD |
| aiBurnoutValueScaled | AI - scaled burnout value | 16 | REAL |
| aiMode | AI - mode (0: disable, 1: 0-10 V, 2: 0-20 mA, 3: 4-20 mA burnout, 4: 4-20 mA, 5: ±10 V) | 8 | WORD |

# 45MR-4420 (-T), 4 AOs Registers

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| aoValueRaw | AO - raw value | 4 | WORD |
| aoValueScaled | AO - scaled value | 8 | REAL |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| aoMode | AO - mode (0: disable, 1: 0-10 V, 2: 0-20 mA, 3: 4-20 mA, 4: ±10 V) | 4 | WORD |

# 45MR-6600 (-T), 6 RTDs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| rtdResetMinValue | RTD - reset minimum value (1: Reset) | 6 | BOOL |
| rtdResetMaxValue | RTD - reset maximum value (1: Reset) | 6 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| rtdResetMinValueAll | RTD - reset minimum value (1: Reset) | 1 | WORD |
| rtdResetMaxValueAll | RTD - reset maximum value (1: Reset) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| rtdValueScaled | RTD - scaled value | 12 | REAL |
| rtdValueScaledMin | RTD - minimum scaled value | 12 | REAL |
| rtdValueScaledMax | RTD - maximum scaled value | 12 | REAL |
| rtdType | RTD - Type (0: PT50, 1: PT100, 2: PT200, 3: PT500, 4: PT1000; 14: 310 Ohm, 15: 620 Ohm, 16: 1250 Ohm, 17: 2200 Ohm; 20: JPT100, 21: JPT200, 22: JPT500, 23: JPT1000; 30: NI100, 31: NI200, 32: NI500, 33: NI1000, 34: NI120) | 6 | WORD |
| rtdStatus | RTD - Status (0: normal, 1:burnout) | 6 | WORD |

# 45MR-6810 (-T), 8 TCs Registers

### 01: COIL STATUS

| Parameter | Description | Length | Type |
|---|---|---|---|
| tcResetMinValue | TC - reset minimum value (1: Reset) | 8 | BOOL |
| tcResetMaxValue | TC - reset maximum value (1: Reset) | 8 | BOOL |

### 03: HOLDING REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| tcResetMinValueAll | TC - reset minimum value (1: Reset) | 1 | WORD |
| tcResetMaxValueAll | TC - reset maximum value (1: Reset) | 1 | WORD |

### 04: INPUT REGISTER

| Parameter | Description | Length | Type |
|---|---|---|---|
| tcValueScaled | TC - scaled value | 16 | REAL |
| tcValueScaledMin | TC - minimum scaled value | 16 | REAL |
| tcValueScaledMax | TC - maximum scaled value | 16 | REAL |
| tcType | TC - Type (0: J Type, 1: K Type, 2: T Type, 3: E Type, 4: R Type, 5: S Type, 6: B Type, 7: N Type, 14: ±78.126 mV, 15: ±39.062 mV, 16: ±19.532 mV) | 8 | WORD |
| tcStatus | TC - Status (0: normal, 1:burnout) | 8 | WORD |

# 45MR-7210(-T), System and Field Power Input Registers

| Parameters | Description | Length | Type |
|---|---|---|---|
| spStatus | SP - system power Status | 1 | WORD |
| spLowerLimitValue | SP - system power lower limit value | 2 | REAL |
| spUpperLimitValue | SP - system power upper limit value | 2 | REAL |
| fpStatus | FP - Field Power Status | 1 | WORD |

# SNMP Rules

All OIDs of this device begin with .1.3.6.1.4.1.8691.10.4510. The data can be read or written by a network management software with the following OIDs. Download the latest version of the MIB file from www.moxa.com for additional information.

| OID | Type |
|---|---|
| .1.3.6.1.4.1.8691.10.4510.1 | systemInfo |
| .1.3.6.1.4.1.8691.10.4510.2 | systemPower |
| .1.3.6.1.4.1.8691.10.4510.3 | fieldPower |
| .1.3.6.1.4.1.8691.10.4510.11 | di |
| .1.3.6.1.4.1.8691.10.4510.12 | do |
| .1.3.6.1.4.1.8691.10.4510.13 | relay |
| .1.3.6.1.4.1.8691.10.4510.21 | ai |
| .1.3.6.1.4.1.8691.10.4510.22 | ao |
| .1.3.6.1.4.1.8691.10.4510.23 | rtd |
| .1.3.6.1.4.1.8691.10.4510.24 | tc |
| .1.3.6.1.4.1.8691.10.4510.41 | internalRegister |
| .1.3.6.1.4.1.8691.10.4510.91 | event |
| .1.3.6.1.4.1.8691.10.4510.92 | eventTriggerType |

# RESTful API Rules

## Supported Request Method

| Request | Description |
|---|---|
| GET | The GET method is used to retrieve information from the given server using a given URI. Requests using GET should only retrieve data and should have no other effect on the data. |
| PUT | Replaces all the current representations of the target resource with the uploaded content. |
| OPTIONS | Describe the communication options for the target resource. |

## GET Request Components

| Component | Content | Description |
|---|---|---|
| Request Method | GET | Use GET request to retrieve information |
| URL | http://{IP address}/{RESTful API} | Refer to **RESTful API List** |
| Headers | Accept: vdn.dac.v2<br>Content-Type: application/json | Headers are mandatory for all RESTful API requests |

## PUT Request Components

| Component | Content | Description |
|---|---|---|
| Request Method | PUT | Use PUT request to replace current representation |
| URL | http://{IP address}/{RESTful API} | Refer to **RESTful API List** |
| Headers | Accept: vdn.dac.v2<br>Content-Type: application/json | Headers are mandatory for all RESTful API requests |
| Body | {"value":1} | Uploaded content for replacing current representation |

## RESTful API List

Here lists the RESTful APIs supported by this device. The {ioName} is composed with three elements, including **Module_Name**, **@**, and **I/O_Channel_Name**. For example, the {ioName} of the module name "45MR-1600-0" and the DI channel name "DI-00" is 45MR-1600-0@DI-00.

| RESTful API | Description | Access | Format |
|---|---|---|---|
| /api/sysInfo | All system information | R | |
| /api/sysInfo/device | Device name | R | |
| | Device local date and time | R | yyyy/mm/dd hh:mm:ss |
| | Device up time | R | hh:mm:ss |
| | Firmware version | R | |
| | Serial number | R | |
| | System error | R | |
| /api/sysInfo/network | All network information | R | |
| /api/sysInfo/network/LAN | All LAN information | R | |
| /api/sysInfo/network/LAN/1 | MAC address | R | xx:xx:xx:xx:xx:xx |
| | IP address | R | xxx.xxx.xxx.xxx |
| /api/io/ir/{ioName} | IR - value | R | By data type |
| /api/io/ir/{ioname}/irvalue | IR - value | RW | By data type |
| /api/io/sp/{ioName}/spStatus | SP - system power status for 45MR-7210(-T) | R | 0, 1, 2 |

| RESTful API | Description | Access | Format |
|---|---|---|---|
| /api/io/sp/{ioName}/spLowerLimitValue | SP - system power lower limit value - for 45MR-7210(-T) | R | Float |
| /api/io/sp/{ioName}/spUpperLimitValue | SP - system power upper limit value - 45MR-7210(-T) | R | Float |
| /api/io/fp/{ioName}/fpStatus | FP - field power status - for 45MR-7210(-T) | R | |
| /api/io/di/{ioName}/diMode | DI - mode (0: DI, 1: Counter) | R | 0 or 1 |
| /api/io/di/{ioName}/diStatus | DI - DI mode - status (0: OFF, 1: ON) | R | 0 or 1 |
| /api/io/di/{ioName}/diCounterValue | DI - Counter mode - value | R/W | 0 to 4294967295 |
| /api/io/di/{ioName}/diCounterOverflowFlag | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | R | 0 or 1 |
| /api/io/di/{ioName}/diCounterOverflowFlagClear | DI - Counter mode - clear overflow flag (1: Clear) | R/W | 0 or 1 |
| /api/io/di/{ioName}/diCounterStatus | DI - Counter mode - status (0: pause, 1: run) | R/W | 0 or 1 |
| /api/io/do/{ioName}/doMode | DO - mode (0: DO, 1: Pulse) | R | 0 or 1 |
| /api/io/do/{ioName}/doStatus | DO - status (0: OFF, 1: ON) | R/W | 0 or 1 |
| /api/io/do/{ioName}/doPulseCount | DO - Pulse mode - count | R/W | 0 to 65535 |
| /api/io/do/{ioName}/doPulseOnWidth | DO - Pulse mode - ON width (unit: 500us) | R/W | 1 to 65535 |
| /api/io/do/{ioName}/doPulseOffWidth | DO - Pulse mode - OFF width (unit: 500us) | R/W | 1 to 65535 |
| /api/io/do/{ioName}/doPulseStatus | DO - Pulse mode - status (0: Stop 1: Start) | R/W | 0 or 1 |
| /api/io/relay/{ioName}/relayTotalCount | Relay - total count | R | 0 to 4294967295 |
| /api/io/relay/{ioName}/relayCurrentCount | Relay - current count | R | 0 to 4294967295 |
| /api/io/relay/{ioName}/relayCurrentCountReset | Relay - reset current count (1: Reset) | R/W | 0 or 1 |
| /api/io/relay/{ioName}/relayStatus | Relay - Relay mode - status (0: OFF, 1: ON) | R/W | 0 or 1 |
| /api/io/ai/{ioName}/aiMode | AI - mode (0: disable 1: 0-10 V, 2: 0-20 mA, 3: 4-20 mA burnout, 4: 4-20 mA, 5: ±10 V) | R | 0, 1, 2, 3, 4, 5 |
| /api/io/ai/{ioName}/aiValueRaw | AI - raw value | R | 0 to 65535 |
| /api/io/ai/{ioName}/aiValueRawMin | AI - minimum raw value | R | 0 to 65535 |
| /api/io/ai/{ioName}/aiValueRawMax | AI - maximum raw value | R | 0 to 65535 |
| /api/io/ai/{ioName}/aiResetMinValue | AI - reset minimum value (1: Reset) | R/W | 1 |
| /api/io/ai/{ioName}/aiResetMaxValue | AI - reset maximum value (1: Reset) | R/W | 1 |
| /api/io/ai/{ioName}/aiStatus | AI - status (0: normal, 1: burnout, 2: over range, 3. under range) | R | 0, 1, 2, 3 |
| /api/io/ai/{ioName}/aiBurnoutValueScaled | AI - scaled burnout value | R | Float |
| /api/io/ai/{ioName}/aiValueScaled | AI - scaled value | R | Float |

| RESTful API | Description | Access | Format |
|---|---|---|---|
| /api/io/ai/{ioName}/aiValueScaledMin | AI - minimum scaled value | R | Float |
| /api/io/ai/{ioName}/aiValueScaledMax | AI - maximum scaled value | R | Float |
| /api/io/ao/{ioName}/aoMode | AO - mode (0: disable, 1: 0-10 V, 2: 0-20mA, 3: 4-20 mA, 4: +/-10V) | R | 0, 1, 2, 3, 4 |
| /api/io/ao/{ioName}/aoValueRaw | AO - raw value | R/W | 0 to 65535 |
| /api/io/ao/{ioName}/aoValueScaled | AO - scaled value | R/W | 0 to 4294967295 |
| /api/io/rtd/{ioName}/rtdStatus | RTD - Status (0: normal, 1: burnout) | R | 0 or 1 |
| /api/io/rtd/{ioName}/rtdMode | RTD - Type (0: PT50, 1: PT100, 2: PT200, 3: PT500, 4: PT1000; 14: 310 Ohm, 15: 620 Ohm, 16: 1250 Ohm, 17: 2200 Ohm; 20: JPT100, 21: JPT200, 22: JPT500, 23: JPT1000; 30: NI100, 31: NI200, 32: NI500, 33: NI1000, 34: NI120) | R | |
| /api/io/rtd/{ioName}/rtdValueScaled | RTD - scaled value | R | Float |
| /api/io/rtd/{ioName}/rtdValueScaledMin | RTD - minimum scaled value | R | Float |
| /api/io/rtd/{ioName}/rtdValueScaledMax | RTD - maximum scaled value | R | Float |
| /api/io/rtd/{ioName}/rtdResetMinValue | RTD - reset minimum value (1: RESET) | R/W | 1 |
| /api/io/rtd/{ioName}/rtdResetMaxValue | RTD - reset maximum value (1: RESET) | R/W | 1 |
| /api/io/tc/{ioName}/tcStatus | TC - Status (0: normal, 1: burnout) | R | 0 or 1 |
| /api/io/tc/{ioName}/tcType | TC - Type (0: J Type, 1: K Type, 2: T Type, 3: E Type, 4: R Type, 5: S Type, 6: B Type, 7: N Type, 14: ±78.126 mV, 15: ±39.062 mV, 16: ±19.532 mV) | R | |
| /api/io/tc/{ioName}/tcValueScaled | TC - scaled value | R | Float |
| /api/io/tc/{ioName}/tcValueScaledMin | TC - minimum scaled value | R | Float |
| /api/io/tc/{ioName}/tcValueScaledMax | TC - maximum scaled value | R | Float |
| /api/io/tc/{ioName}/tcResetMinValue | TC - reset minimum value (1: RESET) | R/W | 1 |
| /api/io/tc/{ioName}/tcResetMaxValue | TC - reset maximum value (1: RESET) | R/W | 1 |

# Exception Code

| HTTP Status Code | | Moxa Status Code/Description | | User message |
|---|---|---|---|---|
| 400 | Bad Request | 101 | UnsupportedVersion | The content version specified in the request is not supported. |
| 400 | Bad Request | 102 | UnsupportedDocFormat | The document format specified in the request is not supported. |

| HTTP Status Code | | Moxa Status Code/Description | | User message |
|---|---|---|---|---|
| 400 | Bad Request | 201 | InvalidJsonFormat | The json format in the request is not valid. |
| 400 | Bad Request | 202 | InvalidNodeValue | One of the node value is invalid. |
| 400 | Bad Request | 203 | WrongChannelOrder | The I/O channels are disordered. |
| 400 | Bad Request | 204 | MissingRequiredChannel | A required channel index was not specified in the request body. |
| 400 | Bad Request | 206 | MissingRequiredNode | A required node was not specified in the request body. |
| 400 | Bad Request | 300 | ContentFailed | One of the channel contents in the request could not be set. Please refer to the detailed information. |
| 400 | Bad Request | 301 | ContentFailedToSet | The content in the request could not be set (invalid value). |
| 200 | OK | N/A | | |
| 404 | Bad Request | N/A | | |
| 405 | Method Not Allowed | N/A | | |

# MQTT Rules

## Publish Topic

| Topic | Description | Category | Trigger |
|---|---|---|---|
| {deviceName}/read/device/deviceName | device name | attribute | Interval |
| {deviceName}/read/device/deviceLocalDateTime | device local date and time | attribute | Interval |
| {deviceName}/read/device/deviceUpTime | device up time | attribute | Interval |
| {deviceName}/read/device/firmwareVersion | firmware version | attribute | Interval |
| {deviceName}/read/device/serialNumber | serial number | attribute | Interval |
| {deviceName}/read/device/systemError | system error | attribute | Interval |
| {deviceName}/read/network/lanMac/1 | MAC address | attribute | Interval |
| {deviceName}/read/network/lanIp/1 | IP address | attribute | Interval |
| {deviceName}/read/lastWill | Last Will Topic | attribute | Interval |
| {deviceName}/read/{ioName}/birValue | BIR - value | attribute | both (OnChange) |
| {deviceName}/read/{ioName}/wirValue | WIR - value | attribute | Interval |
| {deviceName}/read/{ioName}/dirValue | DIR - value | attribute | Interval |
| {deviceName}/read/{ioName}/firValue | FIR - value | attribute | Interval |
| {deviceName}/read/{ioName}/spStatus | SP—for 45MR-7210(-T)—system power status | attribute | Interval |
| {deviceName}/read/{ioName}/spLowerLimitValue | SP—for 45MR-7210(-T)—system power lower limit value | attribute | Interval |
| {deviceName}/read/{ioName}/spUpperLimitValue | SP—for 45MR-7210(-T)—system power upper limit value | attribute | Interval |

| Topic | Description | Category | Trigger |
|---|---|---|---|
| {deviceName}/read/{ioName}/fpStatus | FP—for 45MR-7210(-T)—field power status | attribute | Interval |
| {deviceName}/read/{ioName}/diMode | DI - mode (0: DI, 1: Counter) | attribute | Interval |
| {deviceName}/read/{ioName}/diStatus | DI - DI mode - status (0: OFF, 1: ON) | value | both (OnChange) |
| {deviceName}/read/{ioName}/diCounterValue | DI - Counter mode - value | value | Interval |
| {deviceName}/read/{ioName}/diCounterOverflowFlag | DI - Counter mode - overflow flag (0: Normal, 1: Overflow) | attribute | Interval |
| {deviceName}/read/{ioName}/diCounterOverflowFlagClear | DI - Counter mode - clear overflow flag (1: Clear) | attribute | Interval |
| {deviceName}/read/{ioName}/diCounterStatus | DI - Counter mode - status (0: pause, 1: run) | value | both (OnChange) |
| {deviceName}/read/{ioName}/doMode | DO - mode (0: DO, 1: Pulse) | attribute | Interval |
| {deviceName}/read/{ioName}/doStatus | DO - status (0: OFF, 1: ON) | value | both (OnChange) |
| {deviceName}/read/{ioName}/doPulseCount | DO - Pulse mode - count | attribute | Interval |
| {deviceName}/read/{ioName}/doPulseOnWidth | DO - Pulse mode - ON width (unit: 500us) | attribute | Interval |
| {deviceName}/read/{ioName}/doPulseOffWidth | DO - Pulse mode - OFF width (unit: 500us) | attribute | Interval |
| {deviceName}/read/{ioName}/doPulseStatus | DO - Pulse mode - status (0: Stop 1: Start) | value | both (OnChange) |
| {deviceName}/read/{ioName}/relayTotalCount | Relay - total count | attribute | Interval |
| {deviceName}/read/{ioName}/relayCurrentCount | Relay - current count | value | Interval |
| {deviceName}/read/{ioName}/relayCurrentCountReset | Relay - reset current count (1: Reset) | attribute | Interval |
| {deviceName}/read/{ioName}/relayStatus | Relay - Relay mode - status (0: OFF, 1: ON) | value | both (OnChange) |
| {deviceName}/read/{ioName}/aiMode | AI - mode (0: disable 1: 0-10 V, 2: 0-20 mA, 3: 4-20 mA burnout, 4: 4-20 mA, 5: ±10 V) | attribute | Interval |
| {deviceName}/read/{ioName}/aiValueRaw | AI - raw value | attribute | Interval |
| {deviceName}/read/{ioName}/aiValueRawMin | AI - minimum raw value | attribute | Interval |
| {deviceName}/read/{ioName}/aiValueRawMax | AI - maximum raw value | attribute | Interval |
| {deviceName}/read/{ioName}/aiResetMinValue | AI - reset minimum value (1: Reset) | attribute | Interval |
| {deviceName}/read/{ioName}/aiResetMaxValue | AI - reset maximum value (1: Reset) | attribute | Interval |
| {deviceName}/read/{ioName}/aiStatus | AI - status (0: normal, 1: burnout, 2: over range, 3. under range) | value | both (OnChange) |

| Topic | Description | Category | Trigger |
|---|---|---|---|
| {deviceName}/read/{ioName}/aiBurnoutValueScaled | AI - scaled burnout value | attribute | Interval |
| {deviceName}/read/{ioName}/aiValueScaled | AI - scaled value | value | both (interval) |
| {deviceName}/read/{ioName}/aiValueScaledMin | AI - minimum scaled value | attribute | Interval |
| {deviceName}/read/{ioName}/aiValueScaledMax | AI - maximum scaled value | attribute | Interval |
| {deviceName}/read/{ioName}/aoMode | AO - mode (0: Disable, 1: 0-10 V, 2: 0-20mA, 3: 4-20 mA) | attribute | Interval |
| {deviceName}/read/{ioName}/aoValueRaw | AO - raw value | attribute | Interval |
| {deviceName}/read/{ioName}/aoValueScaled | AO - scaled value | value | both (interval) |
| {deviceName}/read/{ioName}/aoStatus | AO – status (0: Normal, 1: Fault) | value | both (OnChange) |
| {deviceName}/read/{ioName}/rtdStatus | RTD - Status (0: normal, 1: burnout) | value | both (OnChange) |
| {deviceName}/read/{ioName}/rtdMode | RTD - Type (0: PT50, 1: PT100, 2: PT200, 3: PT500, 4: PT1000; 14: 310 Ohm, 15: 620 Ohm, 16: 1250 Ohm, 17: 2200 Ohm; 20: JPT100, 21: JPT200, 22: JPT500, 23: JPT1000; 30: NI100, 31: NI200, 32: NI500, 33: NI1000, 34: NI120, 50: disable) | attribute | Interval |
| {deviceName}/read/{ioName}/rtdValueScaled | RTD - scaled value | value | both (interval) |
| {deviceName}/read/{ioName}/rtdValueScaledMin | RTD - minimum scaled value | attribute | Interval |
| {deviceName}/read/{ioName}/rtdValueScaledMax | RTD - maximum scaled value | attribute | Interval |
| {deviceName}/read/{ioName}/rtdResetMinValue | RTD - reset minimum value (1: RESET) | attribute | Interval |
| {deviceName}/read/{ioName}/rtdResetMaxValue | RTD - reset maximum value (1: RESET) | attribute | Interval |
| {deviceName}/read/{ioName}/tcStatus | TC - Status (0: normal, 1: burnout) | value | both (OnChange) |
| {deviceName}/read/{ioName}/tcType | TC - Type (0: J Type, 1: K Type, 2: T Type, 3: E Type, 4: R Type, 5: S Type, 6: B Type, 7: N Type, 14: ±78.126 mV, 15: ±39.062 mV, 16: ±19.532 mV, 50: disable) | attribute | Interval |
| {deviceName}/read/{ioName}/tcValueScaled | TC - scaled value | value | both (interval) |
| {deviceName}/read/{ioName}/tcValueScaledMin | TC - minimum scaled value | attribute | Interval |
| {deviceName}/read/{ioName}/tcValueScaledMax | TC - maximum scaled value | attribute | Interval |

| Topic | Description | Category | Trigger |
|---|---|---|---|
| {deviceName}/read/{ioName}/tcResetMinValue | TC - reset minimum value (1: RESET) | attribute | Interval |
| {deviceName}/read/{ioName}/tcResetMaxValue | TC - reset maximum value (1: RESET) | attribute | Interval |
| {deviceName}/write/{ioName}/tcResetMinValue | TC - reset minimum value (1: RESET) | attribute | Interval |
| {deviceName}/write/{ioName}/tcResetMaxValue | TC - reset maximum value (1: RESET) | attribute | N/A |

# Subscribe Topic

| Topic | Description | Template | Category |
|---|---|---|---|
| {deviceName}/write/{ioName}/birValue | BIR - value | 0 to 1 | value |
| {deviceName}/write/{ioName}/wirValue | WIR - value | -32768 to 32767 | value |
| {deviceName}/write/{ioName}/dirValue | DIR - value | -2147483648 to 2147483647 | value |
| {deviceName}/write/{ioName}/firValue | FIR - value | Float | value |
| {deviceName}/write/{ioName}/diCounterValue | DI - Counter mode - value | 0 to 4294967295 | value |
| {deviceName}/write/{ioName}/diCounterOverflowFlagClear | DI - Counter mode - clear overflow flag (1: Clear) | 0 or 1 | attribute |
| {deviceName}/write/{ioName}/diCounterStatus | DI - Counter mode - status (0: pause, 1: run) | 0 or 1 | value |
| {deviceName}/write/{ioName}/doStatus | DO - status (0: OFF, 1: ON) | 0 or 1 | value |
| {deviceName}/write/{ioName}/doPulseCount | DO - Pulse mode - count | 0 to 65535 | attribute |
| {deviceName}/write/{ioName}/doPulseOnWidth | DO - Pulse mode - ON width (unit: 500us) | 1 to 65535 | attribute |
| {deviceName}/write/{ioName}/doPulseOffWidth | DO - Pulse mode - OFF width (unit: 500us) | 1 to 65535 | attribute |
| {deviceName}/write/{ioName}/doPulseStatus | DO - Pulse mode - status (0: Stop 1: Start) | 0 or 1 | value |
| {deviceName}/write/{ioName}/relayCurrentCountReset | Relay - reset current count (1: Reset) | 0 or 1 | attribute |
| {deviceName}/write/{ioName}/relayStatus | Relay - Relay mode - status (0: OFF, 1: ON) | 0 or 1 | value |
| {deviceName}/write/{ioName}/aiResetMinValue | AI - reset minimum value (1: Reset) | 1 | attribute |
| {deviceName}/write/{ioName}/aiResetMaxValue | AI - reset maximum value (1: Reset) | 1 | attribute |
| {deviceName}/write/{ioName}/aoValueRaw | AO - raw value | 0 to 65535 | attribute |
| {deviceName}/write/{ioName}/aoValueScaled | AO - scaled value | 0 to 4294967295 | value |
| {deviceName}/write/{ioName}/rtdResetMinValue | RTD - reset minimum value (1: RESET) | 1 | attribute |
| {deviceName}/write/{ioName}/rtdResetMaxValue | RTD - reset maximum value (1: RESET) | 1 | attribute |
| {deviceName}/write/{ioName}/tcResetMinValue | TC - reset minimum value (1: RESET) | 1 | attribute |

| | | | |
|---|---|---|---|
| {deviceName}/write/{ioName}/tcResetMaxValue | TC - reset maximum value (1: RESET) | 1 | attribute |

# Troubleshooting

This section provides troubleshooting instructions for this device.

## Forgot username & password

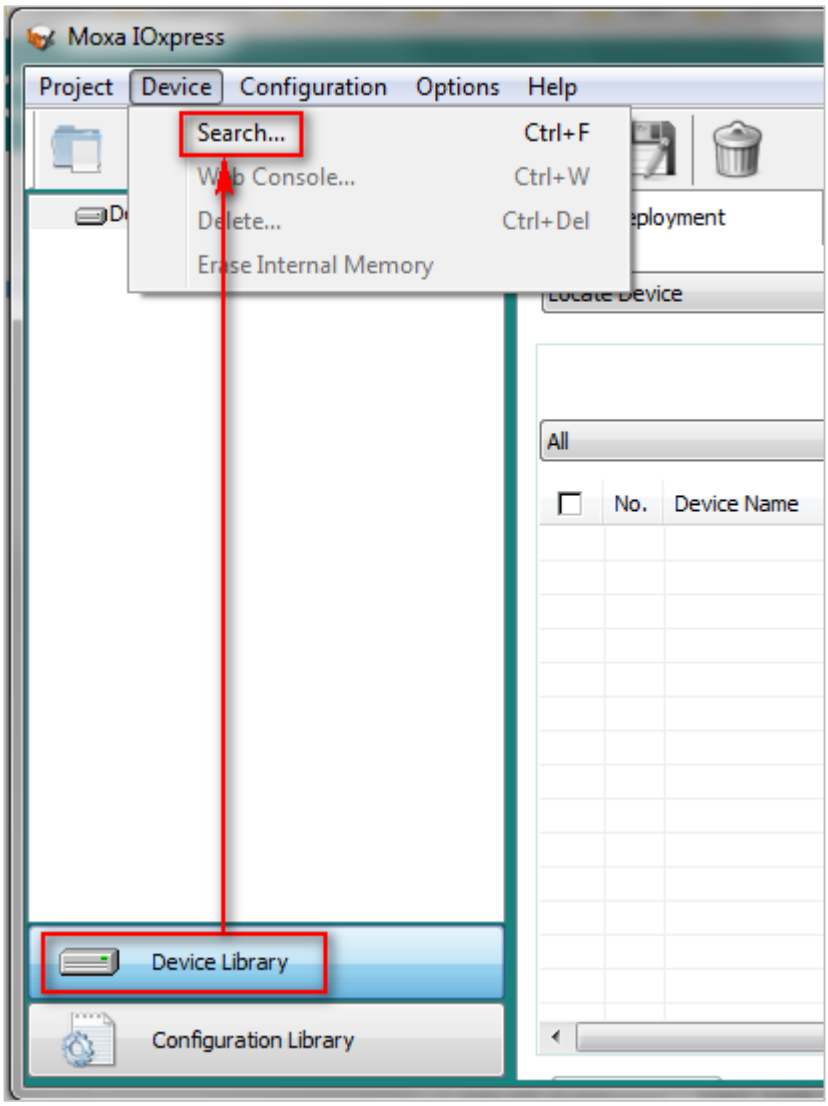
If you forget your username and password, use a pointed object such as a straightened paper clip to hold down the Reset Button for 10 seconds. This will restart the unit and reset all settings on the device, including the username and password. The factory defaults will be loaded once the READY LED turns green again.

**INFORMATION** The default username is admin, and the default password is moxa.

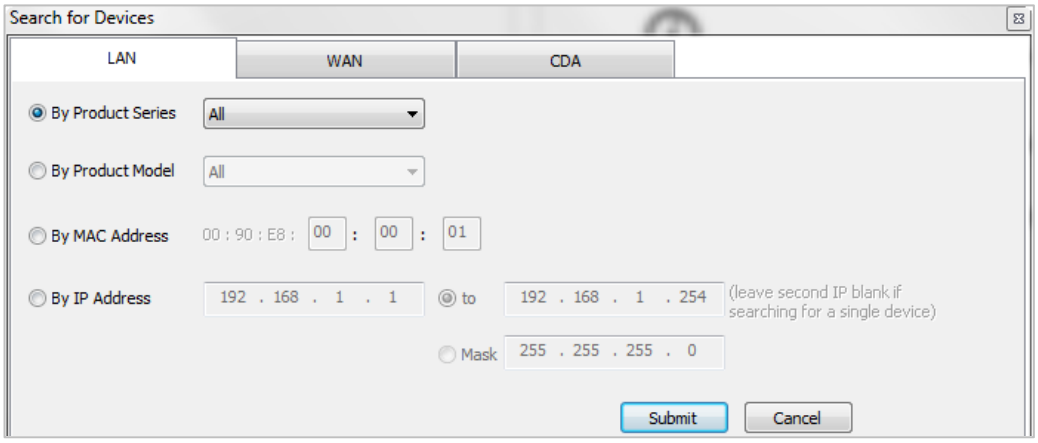
## Forgot IP address of the unit

If you forget the IP address of the unit, use IOxpress utility to search for the device if IOxpress service is already enabled in **Security** → **Service Settings**. Otherwise, load the factory default settings and access the unit with the default IP address.

**Step 1:** Open IOxpress, go to **Device Library** and click **Device** → **Search** in the menu.




**Step 2:** In the **Search for Devices** window, choose the product series you would like to search in the **By Product Series** dropdown menu, and then click the **Submit** button. IOxpress will start to search the devices and list them in the table.




# Failed to update firmware

If the firmware update process fails, the firmware file may be corrupted. Download the firmware file from Moxa's official website. Otherwise, check if the power supply is stable. An unstable power supply can lead to an incomplete firmware update.

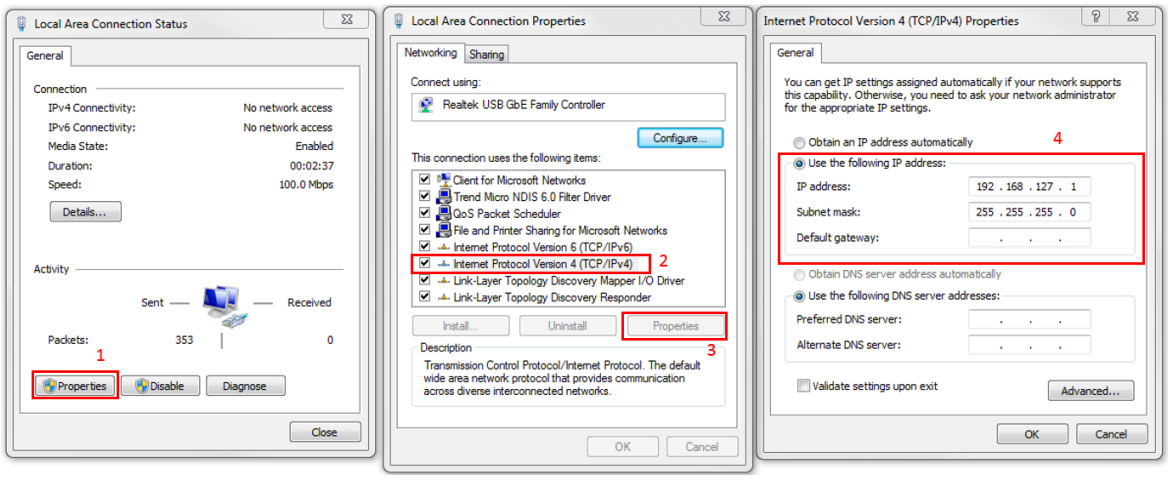
**NOTE** This device supports firmware automatic recovery function. If the firmware in the device is corrupted, the system will load the backup firmware automatically to overwrite the corrupted one. When the system is in recovery mode, the RDY LED will blink RED slowly. Do not disconnect the power cable when performing the recovery process. After the recovery process is complete, you can update firmware again.

# Failed to update configuration

If the configuration update process fails, the configuration file may be corrupted. Get the configuration file and update it again. Otherwise, check to see if the power supply is stable. An unstable power supply can result in the configurations not being successfully updated.

# Failed to access the unit through IP address & IOxpress

Incorrect network configurations can result in the user not being able to access the unit. Check if the device and PC are in the same subnet by following the procedure below.




**INFORMATION** The default IP address of the device is 192.168.127.254.

This may also occur when you try to configure multiple devices with the same computer. The reason for this could be that multiple devices have the same default IP address. When sending TCP/IP packets, the packet may get sent to the wrong MAC address, as it follows the previous record in the computer's ARP Cache. To rectify this problem, you can erase the ARP Cache records by entering "arp-d" command in the built-in Command-Line tools.

# Failed to enter System Ready Mode

If the RDY LED stays red, and your web console is not accessible, it means that the system is experiencing an error. Follow the steps to recover the system.

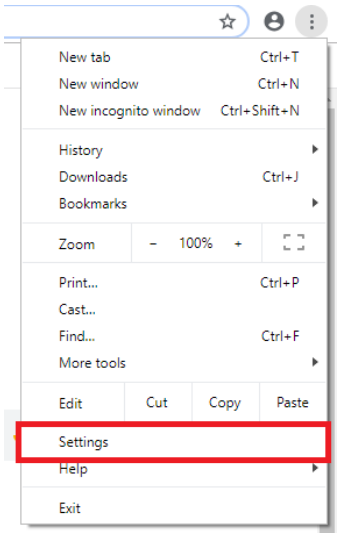
**Step 1:** Hold down the RESET button for 30 seconds to trigger the system recovery process. The system will load the backup firmware and then restart the unit. The system is ready when the RDY LED is green.

**Step 2:** Open the web console and then update the firmware and configurations to the device.

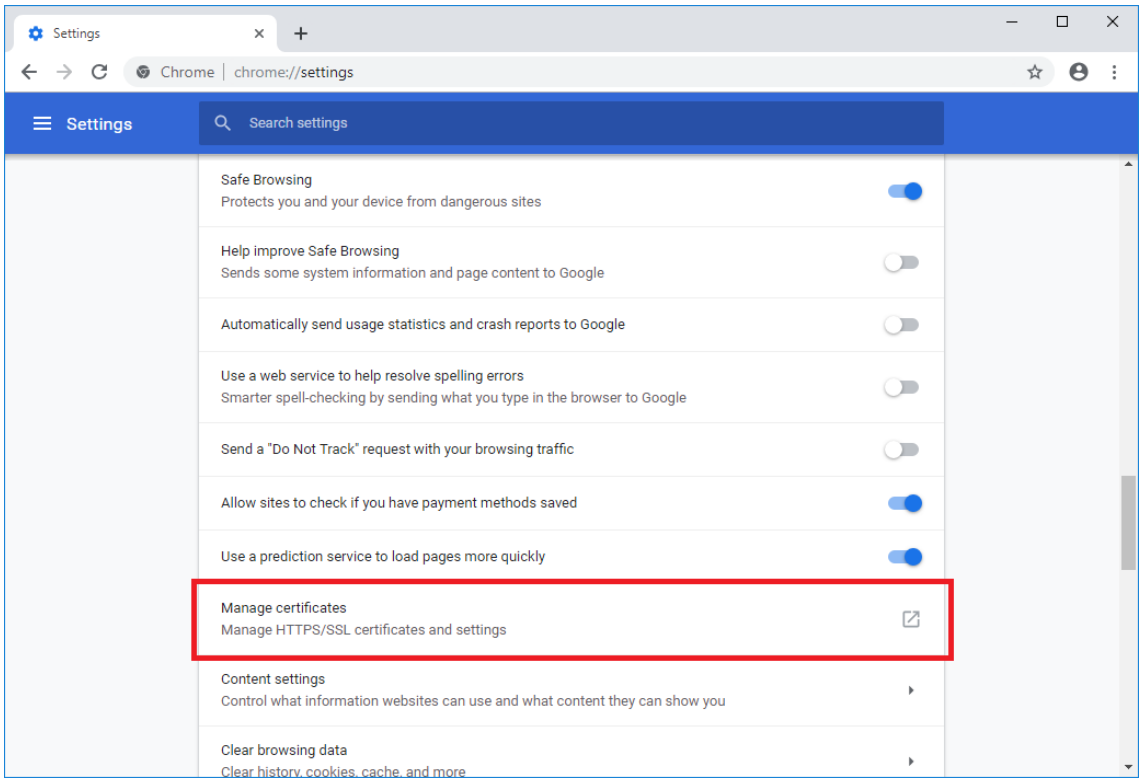
# Import Self-Signed Certificate

When using web service via https, you must import the self-signed certificate before using the web service via https, or the browser may block the connection. Take the following steps to import the self-signed certificate, which was generated by the ioThinx 4510, into the browser.

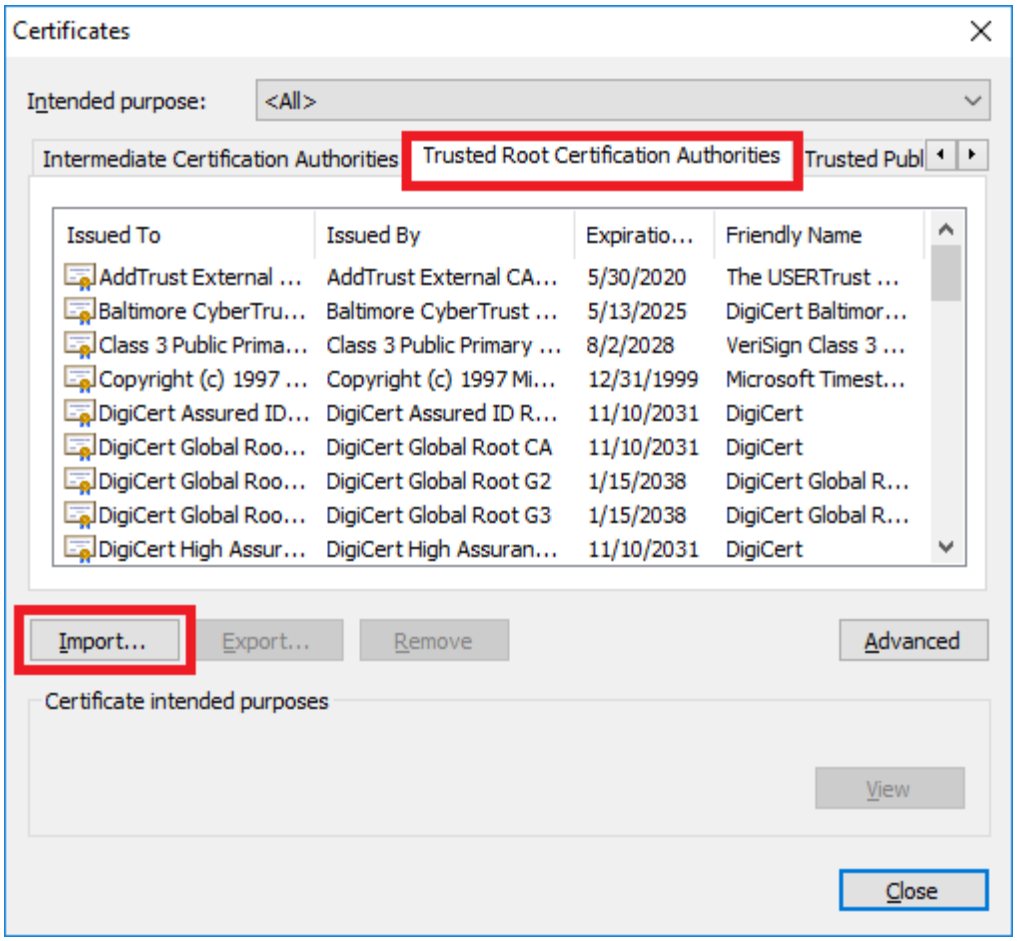
1. Download the self-signed certificate from the ioThinx 4510.
2. From the Chrome browser, click **Settings**.



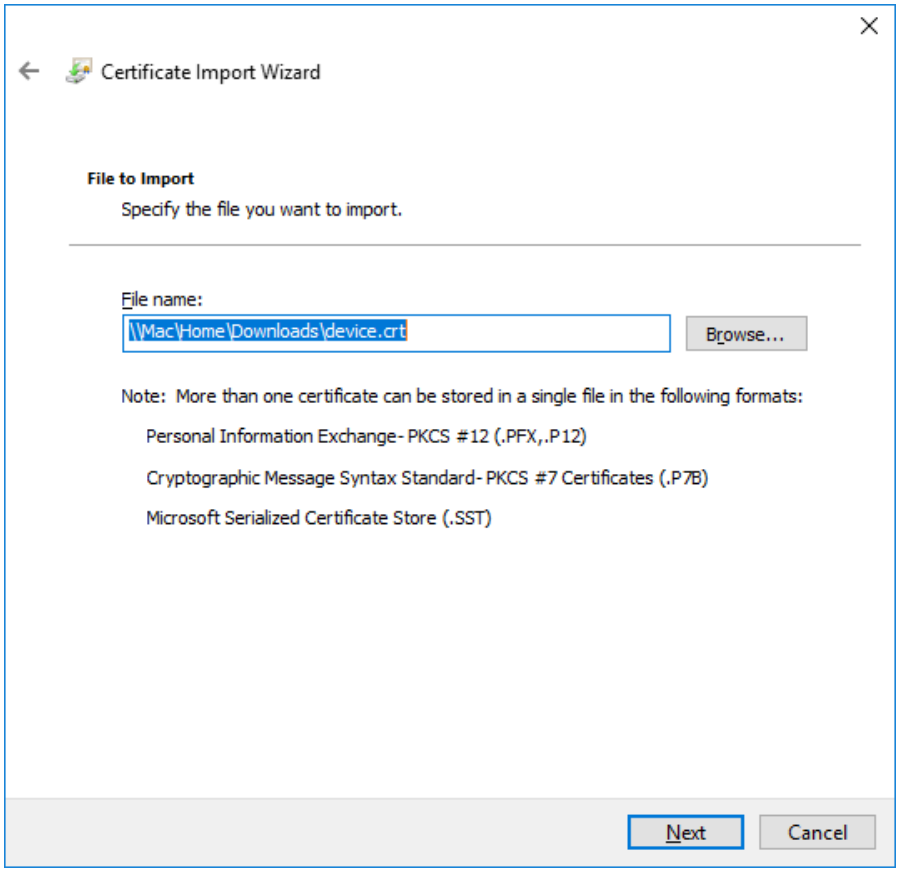

3. Click **Advanced** at the bottom of the browser window and then locate **Manage certificates**.



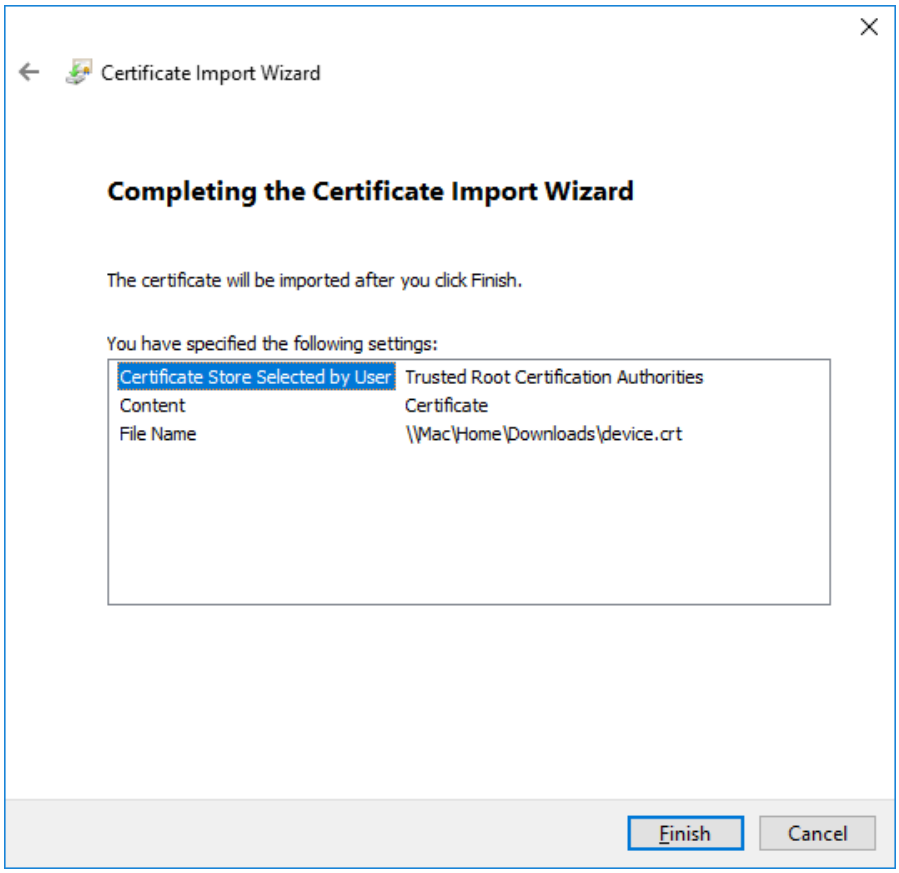
4. Click the **Trusted Root Certification Authorities** tab and then click **Import**



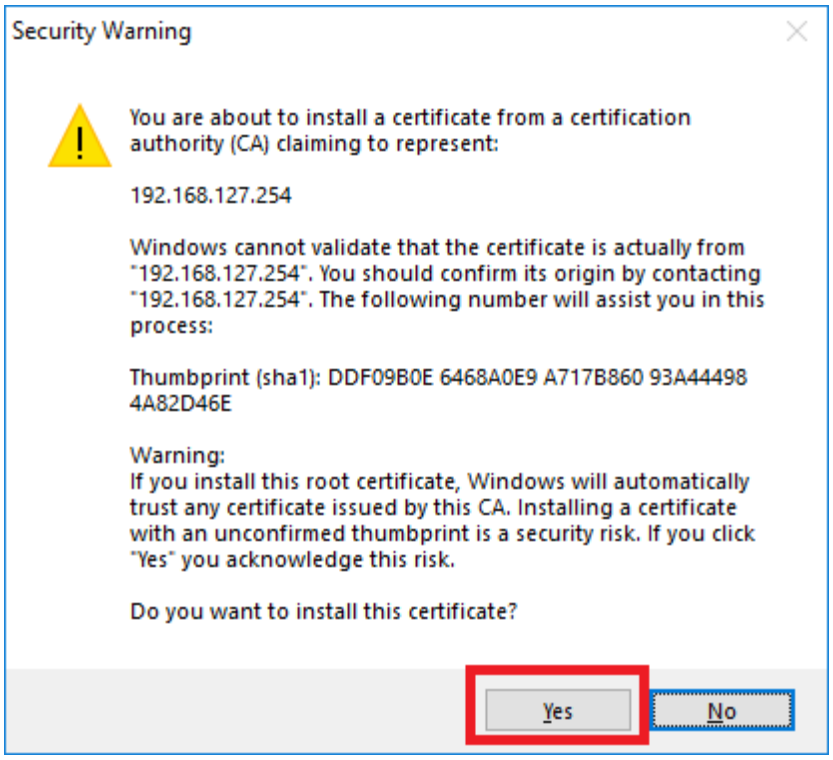
5. Choose the certificate exported by the ioThinx 4510 and then click **Next**.



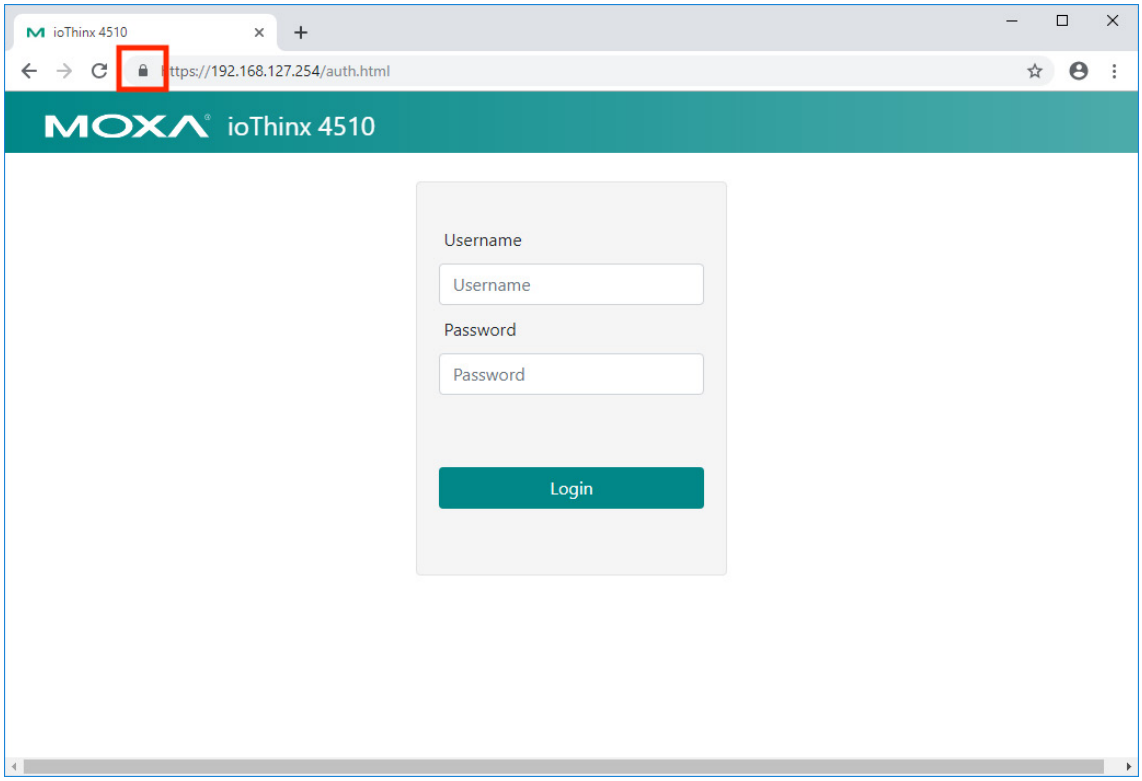

6. Click **Next** until you see the following page, and then click **Finish** to complete the certificate import.



7. When the security warning message pops up, click **Yes** to complete the certificate installation.




8. Open the browser and open the ioThinx 4510's web console. You should see the lock icon to the left of the web address.



# Return Value of a System Error

The ioThinx 4510 provides an error code to monitor the status of a system through protocols. Users can use protocols, including MQTT, RestfulAPI, SNMP and Modbus TCP, to monitor system status. The response value is based on the system status. You can find the definition of each return value as below.

| | |
|---|---|
| 0x00000000 | Normal |
| 0x00000001 | Resetting to default |
| 0x00000002 | Upgrading |
| 0x00000004 | Booting |
| 0x00000008 | Others |
| 0x00000010 | Eternal bus error. Communication watchdog will be triggered. |
| 0x00000020 | Internal bus error. |
| 0x00000040 | Extension module connection error |
| 0x00000080 | Failed to update the configuration file |
| 0x00000100 | Failed to update the firmware file. |
| 0x00000200 | Configuration file error. Default settings will be reloaded. |
| 0x00000400 | Module mismatch |
| 0x00000800 | Safe mode |
| 0x00001000 | Service warning: All IT protocols have been disabled. |