# ioPAC 6500 Series User Manual

**Version 1.2, January 2026**

**www.moxa.com/products**

# ioPAC 6500 Series User Manual

The software described in this manual is furnished under a license agreement and may be used only in accordance with the terms of that agreement.

## Copyright Notice



## Trademarks



## Disclaimer

- Information in this document is subject to change without notice and does not represent a commitment on the part of Moxa.
- Moxa provides this document as is, without warranty of any kind, either expressed or implied, including, but not limited to, its particular purpose. Moxa reserves the right to make improvements and/or changes to this manual, or to the products and/or the programs described in this manual, at any time.
- Information provided in this manual is intended to be accurate and reliable. However, Moxa assumes no responsibility for its use, or for any infringements on the rights of third parties that may result from its use.
- This product might include unintentional technical or typographical errors. Changes are periodically made to the information herein to correct such errors, and these changes are incorporated into new editions of the publication.

## Technical Support Contact Information

**www.moxa.com/support**

# Table of Contents

# 1. About This Manual

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

## Revision History

| Version | Change | Date |
|---|---|---|
| v1.0 | First release | 2024-11-27 |
| v1.1 | Add 5290, 3800H, 5801. Updating Services, Software Configuration | 2025-08-01 |

## Relevant Models

This document only applies to the models listed below.

| Model Name | Description |
|---|---|
| 65M-CPU14-IEC-CT-T | Control CPU Module with IEC61131 programming, 3-in-1 serial port x 2, 10/100/1000 Ethernet port x 2 |
| 65M-PW0075-CT-T | Power module, 24 VDC, 75 W |
| 65M-5011M-CT-T | Layer 2 managed Ethernet switch module 100/1000 Fiber x 2 + 10/100/1000 RJ45 x 8 |
| 65M-5290-CT-T | Expansion module, RJ45 x 2, SFP x 2, Combo Port |
| 65M-1900-CT-T | 32 DI module, 24 VDC, with 8CH/10 KHz counter mode |
| 65M-2901-CT-T | 32 DO module, 24 VDC, with 8CH pulse-out mode |
| 65M-3600-CT-T | 16 AI modules 0-20 mA/4-20 mA |
| 65M-3610-CT-T | 16 AI modules,1 to 5 VDC/0 to 10 VDC |
| 65M-3800H-CT-T | 8 AI module 4-20 mA with HART |
| 65M-4820-CT-T | 8 AO group isolation modules, voltage and current mode |
| 65M-5801-CT-T | 8 serial module RS232/422/485-2w |
| 65M-BMPW01-CT-T | Power module backplane 1 slot |
| 65M-BMPW02-CT-T | Power module backplane 2 slots |
| 65M-BMCM01-CT-T | Communication or networking module backplane 1 slot |
| 65M-BMCM02-CT-T | Communication or networking module backplane 2 slots |
| 65M-BMCPU01-CT-T | CPU module backplane 1 slot |
| 65M-BMCPU02-CT-T | CPU module backplane 2 slots |
| 65M-BMIO02-CT-T | I/O module backplane 2 slots |
| 65M-BMIO04-CT-T | I/O module backplane 4 slots |
| 65M-TB-1900-CT-T | Terminal block for 32 DI modules, 24 VDC, with 8CH/10 KHz counter mode |
| 65M-TB-2901-CT-T | Terminal block for 32 DO modules, 24 VDC, with 8CH pulse-out mode |
| 65M-TB-3600-CT-T | Terminal block for 16 AI modules 4-20 mA |
| 65M-TB-3610-CT-T | Terminal block for 16 AI modules 1 to 5 VDC/0 to 10 VDC |
| 65M-TB-4820-CT-T | Terminal block for 8 AO group isolation modules 4-20 mA/1 to 5 VDC |
| 65M-TB-3800H-CT-T | Terminal block for 8 AI module 4-20 mA with HART |
| 65M-TB-5801-CT-T | Terminal block for 8 serial modules |

# Package Contents

The following items are included in the product package.

- The 65M module device
- Quick installation guide (Printed)
- Pinout card (65M-TB Series only)
- Warranty card

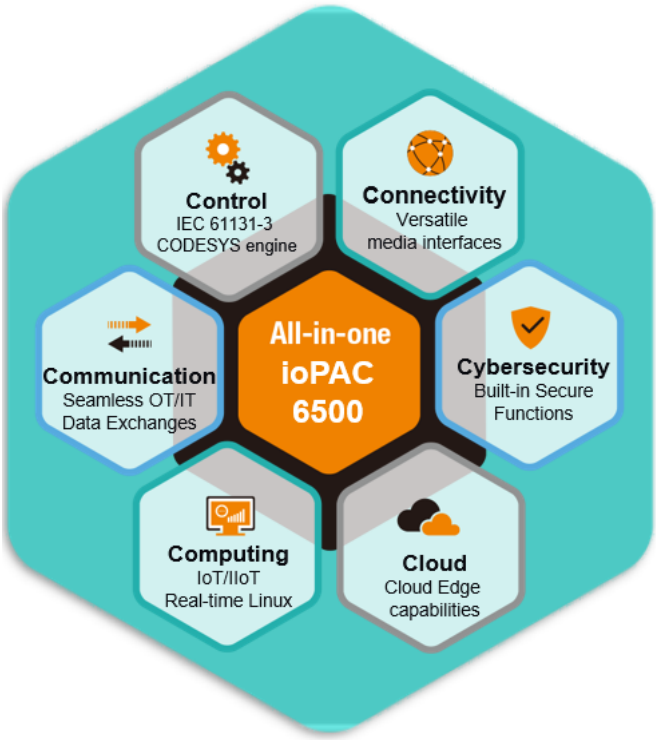
# Usage Scenarios

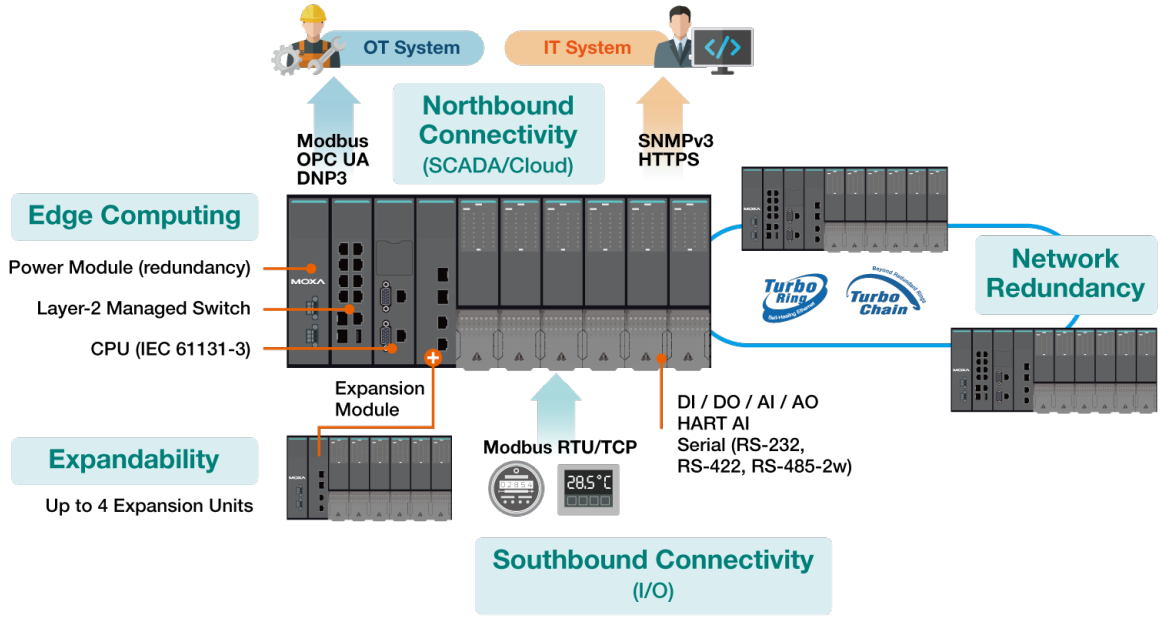
The ioPAC 6500 Series is designed with 6C core competencies.

- Control: the ability to perform precision control
- Communication: the ability to support protocols to connect to other devices or systems
- Computing: the ability to execute the program that is not related to precision control
- Connectivity: the wired, wireless interface, which is supported by the ioPAC 6500 Series
- Cloud: the ability of cloud connectivity and cloud edge computing
- Cybersecurity: the ability to protect the users' device, information, and data

The major functions of the ioPAC 6500 Series are categorized into 4 groups.

- Southbound: the I/O and the protocols to collect the data from other devices
- Northbound: the protocols to deliver the data to other systems
- Computing: the ability to process the data and event
- Networking: the ability to enhance the network reliability
- Expandability: the ability to have more I/O points






# Hardware and Software Requirements

You will need the following hardware and software to use the ioThinx 6500 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
- IINxpress software utility
- PACTware (If HART module is used)

# Safety Precautions

Observe the following safety precautions when installing and using the ioPAC 6500 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 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 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 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 shown on the sensors or loads correspond 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 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:
  - ioPAC 6500 Series

# 2. Product Overview

In this chapter, we summarize each ioPAC 6500 Series device.

# Technical Data

## Common Specifications

### System Performance

**Maximum Unit(s):** 1 (Control unit)
**Maximum Expansion Unit (s):** 4 (Expansion units)
**Maximum Power backplane in control unit:** 1 (1-slot or 2-slot)
**Maximum CPU backplane in control unit:** 1 (1-slot or 2-slot)
**Maximum Communication backplane in control unit:** 1 (1-slot or 2-slot)
**Maximum I/O backplane in control unit:** 2 (2-slot or 4-slot)

### Physical Characteristics

**Housing:** Plastic

### Mounting Options

**DIN-rail Mounting:** Default
**Rack Mounting:** Supported (with optional kit)

### Environmental

**Operating Temperature:** -40 to 75°C (-40 to 167°F, airflow is required in an environment over 65°C)
**Storage Temperature:** -40 to 85°C (-40 to 185°F, package included)
**Relative Humidity:** 5 to 95% (non-condensing)
**IP Protection:** IP20
**Operating Altitude:** Up to 2000 meters

### Standard and Certifications

**EMC:**
EN 55032/35
EN 61000-6-2/6-4
**EMI:**
CISPR 32
FCC Part 15B Class A
**EMS:**
IEC 61000-4-2 ESD: Contact: 4 kV; Air: 8 kV
IEC 61000-4-3 RS: 80 MHz to 1 GHz: 10 V/m
IEC 61000-4-4 EFT: DC Power: 1 kV; Signal: 1 kV
IEC 61000-4-5 Surge: DC Power: 0.5 kV L-N, 1 kV L/N-PE; Signal: 1 kV; IO: 0.5 kV
IEC 61000-4-6 CS: DC Power: 10 Vrms; Signal: 10 Vrms
IEC 61000-4-8 PFMF: 30 A/m
**Safety:** UL 61010-1, UL 61010-2-201
**Shock:** IEC 60068-2-27
Half Sine Wave:
Acceleration: 15 g
Duration Time: 11 ms
**Vibration:** IEC 60068-2-6
DIN-rail Mounted: 7 mm peak-peak (p-p) (2 to 8.42 Hz), 1 g (8.42 to 150 Hz)
Rack Mounted (with optional kit): 7 mm peak-peak (p-p) (2 to 8.42 Hz), 0.5 g (8.42 to 150 Hz)
**Package vibration / drop test:** STA-1A

### Warranty

**Warranty period:** 5 years
**Details:** See www.moxa.com/tw/warranty

# 65M-CPU14-IEC-CT-T

### Controller

**CPU:** ARM Cortex-A53 Quad-core 1.6 GHz
**DDR SDRAM:** 4 GB
**Storage (eMMC):** 8 GB (4 GB reserved for users)
**NVRAM:** 512 kB MRAM for data logger
**OS:** Moxa Industrial Linux
**Automation Language:** IEC 61131-3
**Physical I/O Capacity:** 512 points

### Interface

**Ethernet Ports:** Auto-sensing 10/100/1000 Mbps ports (RJ45 connector) x 2
**Serial Ports:** RS-232/422/485 ports x 2, software selectable (DB9)
**Console Ports:** RS-232 (TxD, RxD, GND), 4-pin header output (115200, n, 8, 1)
**Mode Switch:** Remote, Run, Stop
**microSD slot:** 1 (function reserved)
**Reset button:** 1

### Ethernet

**LAN:** 2 x 10/100/1000 Mbps, 2 MACs (IPs), RJ45
**Magnetic Isolation Protection:** 1.5 kV magnetic isolation

### Serial

**No. of Ports:** 2, DB9
**Serial standard:** RS-232, RS-422, RS-485-2w
**Baudrate:** 300, 1200, 1800, 2400, 4800, 9600, 19200, 28800, 38400, 57600, 115200 bps
**Data Bits:** 8
**Stop Bits:** 1, 2
**Parity:** None, Even, Odd
**Flow Control:** RTS/CTS, XON/XOFF

### Serial Signals

**RS-232:** TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
**RS-422:** Tx+, Tx-, Rx+, Rx-, GND
**RS-485-2w:** Data+, Data-, GND
**RS-485-4w:** Tx+, Tx-, Rx+, Rx-, GND

### Power Parameters

**Input Current:** 0.8 A @ 12 VDC

### Physical Characteristics

**Dimensions:** 42 x 177 x 134.8 mm (1.65 x 6.97 x 5.31 in)
**Weight:** 625 g (1.38 lb)

### MTBF

**Time:** 1,830,589 hrs
**Standard:** Telcordia SR332

## 65M-PW0075-CT-T

### System Power

**Input Voltage:** 24 VDC; 21.6 to 26.4 VDC
**Input Current:** 4 A (max.)
**Inrush Current:** 20 A (max.)
**Input Internal Fuse Rating:** 10 A
**Output Voltage:** 12 VDC
**Output Current:** 6.25 A (max.)
**Output Power:** 75 W (max.)
**Output Hold Up Time:** 10 ms (min.)
**Output Startup Delay Time:** 100 ms (max.)
**Output Over Voltage Protection:** 15.6 V (max.)
**Output Over Current Protection:** 9 A (min.)
**Efficiency:** 87%
**Isolation:** 3k VDC (input to output), 3k VDC (system-to-field power)

### Field Power

**Input Voltage:** 24 VDC; 21.6 to 26.4 VDC
**Input Current:** 3 A (max.)
**Input Internal Fuse Rating:** 8 A
**Output Voltage:** Input voltage minus 0.4 VDC (max. matching-diode drop at 3 A)
**Output Current:** 3 A (max.)
**Output Over Voltage Protection:** 29 V (max.)
**Output Over Current Protection:** 5 A (min.)

### Physical Characteristics

**Dimensions:** 42 x 177 x 149.4 mm (1.65 x 6.97 x 5.88 in)
**Weight:** 713 g (1.57 lb)

### MTBF

**Time:** 2,847,774 hrs
**Standard:** Telcordia SR332

## 65M-5011M-CT-T

### Ethernet Interface

**10/100/1000BaseT(X) Ports (RJ45 connector):** 8
Auto MDI/MDI-X connection
Auto-negotiation speed
Full/Half-duplex mode
**100/1000BaseSFP Ports:** 2
**Standards:**
IEEE 802.3 for 10BaseT, IEEE 802.3u for 100BaseT(X), IEEE 802.3ab for 1000BaseT(X),
IEEE 802.3z for 1000BaseX, IEEE 802.3x for flow control, IEEE 802.3ad for port trunk with LACP,
IEEE 802.1Q for VLAN Tagging, IEEE 802.1D-2004 for Spanning Tree Protocol,
IEEE 802.1w for Rapid Spanning Tree Protocol, IEEE 802.1p for Class of Service,
IEEE 802.1X for authentication

### Ethernet Software Features

**Filter:** GMRP, GVRP, GARP, 802.1Q VLAN, IGMP Snooping v1/v2/v3, IGMP Querier
**Management:** IPv4/IPv6, Flow control, Back Pressure Flow Control, DHCP Server/Client, ARP, RARP, LLDP, Port Mirror, Linkup Delay, SMTP, SNMP Trap, SNMP Inform, SNMPv1/v2c/v3, RMON, TFTP, SFTP, HTTP, HTTPS, Telnet, Syslog, Private MIB, fiber check
**MIB:** P-BRIDGE MIB, Q-BRIDGE MIB, IEEE8021-SPANNING-TREE-MIB, IEEE8021-PAE-MIB, IEEE8023-LAG-MIB, LLDP-EXT-DOT1-MIB, LLDP-EXT-DOT3-MIB, SNMPv2-MIB, RMON MIB Groups 1, 2, 3, 9
**Redundancy Protocols:** STP, RSTP, Turbo Ring v2, Turbo Chain, Ring Coupling, Dual-Homing, Link Aggregation
**Security:** Broadcast storm protection, Rate Limit, Trust access control, Static Port Lock, MAC Sticky, HTTPS/SSL, SSH, RADIUS, TACACS+, Login and Password Policy
**Time Management:** SNTP, NTP Server/Client, NTP Authentication
**Protocols:** IPv4/IPv6, TCP/IP, UDP, ICMP, ARP, RARP, TFTP, DNS, NTP Client, DHCP Server, DHCP Client, 802.1X, QoS, HTTPS, HTTP, Telnet, SMTP, SNMPv1/v2c/v3, RMON, Syslog

### Switch Properties

**MAC Table Size:** 16 K
**Jumbo Frame Size:** 9.216 KB
**Max. No. of VLANs:** 256
**VLAN ID Range:** VID 1 to 4094
**IGMP Groups:** 512
**Priority Queues:** 4
**Packet Buffer Size:** 1 MB

### Serial Interface

**Console Port:** RS-232 (TxD, RxD, GND), 8-pin RJ45 (115200, n, 8, 1)

### Input/Output Interface

**Buttons:** RESET Button
**USB Connector:** USB Type A (only supports the ABC-02-USB from Moxa)

### Power Parameters

**Input Current:** 0.9 A @ 12 VDC

### Physical characteristics

**Dimensions:** 42 x 177 x 131.5 mm (1.65 x 6.97 x 5.18 in)
**Weight:** 660 g (1.46 lb)

### Environmental

**Operating Temperature:**
-40 to 75°C (-40 to 167°F)
-40 to 65°C (-40 to 149°F) with SFP module installed
**NOTE: Proper airflow is required in an environment over 65°C.**

### MTBF

**Time:** 3,104,403 hrs
**Standard:** Telcordia SR332

## 65M-5290-CT-T

### Ethernet Interface

**Port Interfaces:** RJ45 Ports x 2, SFP Fiber Ports x 2
**Protocol:** Proprietary

### Power Consumption

**System Power:** 0.38 A @ 12 VDC

### Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 501 g (1.1 lb)

### MTBF

**Time:** 2,800,019 hrs
**Standard:** Telcordia SR332

## 65M-1900-CT-T

### Digital Input

**Number of Channels:** 32
**Input Type:** Current Sink (internal or external sensor supply for dry contact)
**Input Pulse Width:** 50 µs (min.)
**Internal Field Circuit Supply (only for dry contact):**
Voltage: 24 VDC; 22.8 to 25.2 VDC
Current: 125 mA (max.) (Only for dry contact)
**Input ON Voltage:** 11 to 30 VDC
**Input OFF Voltage:** 0 to 5 VDC
**Input Current:** 2.35 mA ±20 % per channel (at Input ON Voltage)
**Input Filtering:** Software configurable
**Isolation:** 3k VDC (signal to system)

### Counter

**Number of Channels:** 8 (Channel 1 to 8, group configurable by software)
**Counting Frequency:** Square wave 0 to 10 kHz
**Frequency Measurement:** No
**Counter Size:** 32 bits

### Diagnostic

**Input Wire-Break Detection:**
Input Current < 50 µA
Detection Delay Time: 20 ms (typ.)
**Internal Field Circuit Supply Detection:** 17.5 VDC (typ.); 16 to 19 VDC

### Power Consumption

**System Power:** 0.068 A @ 12 VDC
**Field Power:**
0.019 A @ 24 VDC (without field circuit supply)
0.115 A @ 24 VDC (32 channels dry contact with internal field circuit supply)

### Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 253 g (0.56 lb)

### MTBF

**Time:** 2,057,118 hrs
**Standard:** Telcordia SR332

## 65M-2901-CT-T

### Digital Output

**Number of Channels:** 32
**Output Type:** Current source
**Common Power Input Voltage:** 24 VDC; 19.2 to 28.8 VDC
**Common Power Input Current:** 6.4 A (max.)
**Load Current:**
200 mA / 1 channel (typ.)
500 mA / 1 channel (max.)
**Leakage Current:** 0.11 mA (max. at OFF State)
**Load Resistance Range:** 48 to 8k Ω
**Protection:**
Output short-circuit protection
Common power input over voltage protection
Inductive load shutdown voltage protection
**Isolation:** 3k VDC (signal to system)

### Pulse

**Number of Channels:** 8 (Channel 1 to 8, group configurable by software)
**Pulse Duration:** 500 μs (min.)

### Diagnostic

**Output Wire-Break Detection:**
Output Current < 3 mA (ON state);
Output Load Impedance > 58 KΩ (OFF state)
**Output Short-Circuit Detection:** Output current > 0.87 A (typ.); 0.64 to 1.2 A
**External Power Detection:** 17.5 VDC (typ.); 16 to 19 VDC
**Fail-Safe Configuration:** Hold last / Fail-safe state

### Power Consumption

**System Power:** 0.068 A @ 12 VDC
**Field Power:** 0.01 A @ 24 VDC

### Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 254 g (0.56 lb)

### MTBF

**Time:** 2,007,795 hrs
**Standard:** Telcordia SR332

# 65M-3600-CT-T

## Analog Input

**Number of Channels:** 16 (8 channels per group)
**Input Mode:**
0 to 20 mA
4 to 20 mA
**Permitted Overload on Inputs:** ±30 mA
**IO type:** Differential
**Internal Loop Power Supply (only for 2-wire connection):**
Voltage: 24 VDC; 22.8 to 25.2 VDC
Current: 200 mA/Group (max.)
**Resolution:** 16 bits
**Measurement Resolution:**
2 μA (0 to 20 mA)
1.6 μA (4 to 20 mA)
**Conversion Time:** 100 ms
**Normal Mode Rejection Ratio:** > 60 dB @ 60 Hz ; conversion time: 100 ms
**Common Mode Rejection Ratio:** > 90 dB @ 60 Hz ; conversion time: 100 ms
**Accuracy:**
± 0.1% Full-scale range @ 25°C
± 0.3% Full-scale range @ -40 to 75°C
**Input Resistance:** 250 Ω
**Isolation:**
3k VDC (signal to system)
1k VDC for 1 min. (group to group)

## Diagnostic

**Internal Loop Power Detection:** 17.5 VDC (typ.); 16 to 19 VDC
**Input Wire-Break Detection:** Yes, (4 to 20 mA mode only, detection delay time: 0.8 s (max.))
**Input Short-Circuit Detection:** Yes
**Input Underflow / Overflow Detection:** Yes

## Power Consumption

**System Power:** 0.073 A @ 12 VDC
**Field Power:**
0.053 A @ 24 VDC (without internal loop power)
0.466 A @ 24 VDC (16 channels 20 mA current input with internal loop power)

## Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 267 g (0.59 lb)

## MTBF

**Time:** 1,686,798 hrs
**Standard:** Telcordia SR332

# 65M-3610-CT-T

## Analog Input

**Number of Channels:** 16 (8 channels per group)
**Input Mode:**
0 to 10 V
1 to 5 V
**Permitted Overload:** ±12 V
**IO type:** Differential
**Resolution:** 16 bits
**Measurement Resolution:**
1 mV (0 to 10 V)
0.4 mV (1 to 5 V)
**Conversion Time:** 100 ms
**Normal Mode Rejection Ratio:** > 60 dB @ 60 Hz ; conversion time: 100 ms
**Common Mode Rejection Ratio:** > 90 dB @ 60 Hz ; conversion time: 100 ms
**Accuracy:**
± 0.1% Full-scale range @ 25°C
± 0.3% Full-scale range @ -40 to 75°C
**Input Resistance:** > 1 MΩ
**Isolation:**
3k VDC (signal to system)
1k VDC for 1 min. (group to group)

## Diagnostic

**Input Wire-Break Detection:** Yes (detection delay time: 1.6 s (max.))
**Input Underflow / Overflow Detection:** Yes

## Power Consumption

**System Power:** 0.069 A @ 12 VDC
**Field Power:** 0.038 A @ 24 VDC

## Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 250 g (0.55 lb)

## MTBF

**Time:** 1,885,953 hrs
**Standard:** Telcordia SR332

# 65M-3800H-CT-T

### HART Analog Input

**Number of Channels:** 8
**Channel Enable/Disable:** Yes
**Input Mode:** 4 to 20 mA
**Permitted Overload on Inputs:** 30 mA
**IO type:** Differential
**Internal Loop Power Supply (only for 2-wire connection):**
Voltage: 24 VDC; 22.8 to 25.2 VDC
Current: 500 mA (max.)
**Resolution:** 16 bits
**Measurement Resolution:** 1.6 µA (4 to 20 mA)
**Conversion Time:** 100 ms
**Accuracy:**
± 0.1% Full-scale range @ 25°C
± 0.3% Full-scale range @ -40 to 75°C
**Input Resistance:** 250 Ω
**Isolation:**
3k VDC (signal to system)
1k VDC for 1 min. (group to group)

### HART

**Number of HART Modem:** 1
**Data Update Time:** 1 sec/field device
**Operation Type:** Primary client
**Topology:** Point-to-point
**HART Enable/Disable:** Yes

### Diagnostic

**Internal Power Detection:** 17.5 VDC (typ.); 16 to 19 V DC
**Input Wire-Break Detection:** Yes
**Input Underflow/Overflow Detection:** Yes
**Input Short-Circuit Detection:** Yes

### Power Consumption

**System Power:** 0.072 A @ 12 VDC
**Field Power:**
0.05 A (max.), 24 VDC (without using internal loop power)
0.25 A (max.), 24 VDC (8 channels 4 to 20 mA input using internal loop power all in 20 mA)
0.66 A (max.), 24 VDC (internal loop power supply at 500 mA)

### Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 262 g (0.58 lb)

### MTBF

**Time:** 1,016,573 hrs
**Standard:** Telcordia SR332

## 65M-4820-CT-T

### Analog Output

**Number of Channels:** 8 (4 channels per group)
**Output Mode:**
0 to 10 V
1 to 5 V
0 to 20 mA
4 to 20 mA
**Resolution:** 16 bit
**Output Resolution:**
1 mV (0 to 10 V)
0.4 mV (1 to 5 V)
2 μA (0 to 20 mA)
1.6 μA (4 to 20 mA)
**Output Refresh Time:** 16 ms
**Output Step Response Time:** 1 ms (max.)
**Accuracy:**
± 0.1% Full-scale range @ 25°C
± 0.3% Full-scale range @ -40 to 75°C
**Output Load Impedance:**
≥ 1 KΩ ( 0 to 10 V/1 to 5 V)
≤ 750 Ω (0 to 20 mA/4 to 20 mA)
**Isolation:**
3k VDC (signal to system)
1k VDC for 1 min. (group to group)

### Diagnostic

**Output Wire-Break Detection:** Yes, for Current Mode
**Output Short-Circuit Detection:** Yes, for Voltage Mode
**Fail-Safe Configuration:** Hold last/Fail-safe state

### Power Consumption

**System Power:** 0.069 A @ 12 VDC
**Field Power:**
0.022 A @ 24 VDC (without external load)
0.266 A @ 24 VDC (4 channels with 20 mA current output)

### Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 257 g (0.57 lb)

### MTBF

**Time:** 1,874,152 hrs
**Standard:** Telcordia SR332

## 65M-5801-CT-T

### Serial

**No. of Ports:** 8 (4 Channels/Group), Terminal Block
**Serial Standards:** RS-232, RS-422, RS-485-2w
**Baud Rate:** 300, 1200, 1800, 2400, 4800, 9600, 19200, 28800, 38400, 57600, 115200 bps
**Data Bits:** 7, 8
**Stop Bits:** 1, 2
**Parity:** None, Even, Odd
**Flow Control:** RTS/CTS, XON/XOFF
**Isolation:** 3k VDC (signal to system), 1k VDC (between groups)

### Power Consumption

**System Power:** 0.143 A @ 12 VDC
**Field Power:** 0.11 A @ 24 VDC

### Physical characteristics

**Dimensions:** 42 x 116 x 130 mm (1.65 x 4.57 x 5.12 in)
**Weight:** 259 g (0.57 lb)

### MTBF

**Time:** 2,310,512 hrs
**Standard:** Telcordia SR332

## 65M-BMPW01-CT-T

### Physical characteristics

**Slots:** 1 (for Power module)
**Dimensions:** 43 x 177 x 45.5 mm (1.69 x 6.97 x 1.79 in)
**Weight:** 162 g (0.36 lb)

### MTBF

**Time:** 1,130,092,735 hrs
**Standard:** Telcordia SR332

## 65M-BMPW02-CT-T

### Physical characteristics

**Slots:** 2 (for power module)
**Dimensions:** 86 x 177 x 45.5 mm (3.39 x 6.97 x 1.79 in)
**Weight:** 320 g (0.71 lb)

### MTBF

**Time:** 1,382,748,219 hrs
**Standard:** Telcordia SR332

## 65M-BMCM01-CT-T

### Physical characteristics

**Slots:** 1 (for switch module)
**Dimensions:** 43 x 177 x 45.5 mm (1.69 x 6.97 x 1.79 in)
**Weight:** 169 g (0.37 lb)

### MTBF

**Time:** 1,856,744,727 hrs
**Standard:** Telcordia SR332

## 65M-BMCM02-CT-T

### Physical characteristics

**Slots:** 2 (for switch module)
**Dimensions:** 86 x 177 x 45.5 mm (3.39 x 6.97 x 1.79 in)
**Weight:** 330 g (0.73 lb)

### MTBF

**Time:** 1,856,744,727 hrs
**Standard:** Telcordia SR332

## 65M-BMEXP01-CT-T

### Physical characteristics

**Slots:** 1 (for Expansion module)
**Dimensions:** 43 x 177 x 45.5 mm (1.69 x 6.97 x 1.79 in)
**Weight:** 173 g (0.38 lb)

### MTBF

**Time:** 1,856,744,727 hrs
**Standard:** Telcordia SR332

## 65M-BMEXP02-CT-T

### Physical characteristics

**Slots:** 2 (for Expansion module)
**Dimensions:** 86 x 177 x 45.5 mm (3.39 x 6.97 x 1.79 in)
**Weight:** 322 g (0.71 lb)

### MTBF

**Time:** 1,856,744,727 hrs
**Standard:** Telcordia SR332

## 65M-BMCPU01-CT-T

### Physical characteristics

**Slots:** 1 (for CPU module)
**Dimensions:** 43 x 177 x 45.5 mm (1.69 x 6.97 x 1.79 in)
**Weight:** 170 g (0.37 lb)

### MTBF

**Time:** 5,032,783,357 hrs
**Standard:** Telcordia SR332

## 65M-BMCPU02-CT-T

### Physical characteristics

**Slots:** 2 (for CPU module)
**Dimensions:** 86 x 177 x 45.5 mm (3.39 x 6.97 x 1.79 in)
**Weight:** 325 g (0.72 lb)

### MTBF

**Time:** 3,554,206,267 hrs
**Standard:** Telcordia SR332

## 65M-BMIO02-CT-T

### Power Consumption
**System Power:** 0.093 A @ 12 VDC

### Physical characteristics
**Slots:** 2 (for IO module)
**Dimensions:** 86 x 177 x 45.5 mm (3.39 x 6.97 x 1.79 in)
**Weight:** 205 g (0.45 lb)

### MTBF
**Time:** 6,140,939 hrs
**Standard:** Telcordia SR332

## 65M-BMIO04-CT-T

### Power Consumption
**System Power:** 0.117 A @ 12 VDC

### Physical characteristics
**Slots:** 4 (for IO module)
**Dimensions:** 172 x 177 x 45.5 mm (6.77 x 6.97 x 1.79 in)
**Weight:** 395 g (0.87 lb)

### MTBF
**Time:** 6,124,471 hrs
**Standard:** Telcordia SR332

## 65M-TB-1900-CT-T

### Physical characteristics
**ID:** D1
**Dimensions:** 42.3 x 102.38 x 80.8 mm (1.67 x 4.03 x 3.18 in)
**Weight:** 164 g (0.36 lb)

## 65M-TB-2901-CT-T

### Physical characteristics
**ID:** D2
**Dimensions:** 42.3 x 102.38 x 80.8 mm (1.67 x 4.03 x 3.18 in)
**Weight:** 164 g (0.36 lb)

## 65M-TB-3600-CT-T

### Physical characteristics
**ID:** A1
**Dimensions:** 42.3 x 102.38 x 80.8 mm (1.67 x 4.03 x 3.18 in)
**Weight:** 164 g (0.36 lb)

## 65M-TB-3610-CT-T

### Physical characteristics
**ID:** A2
**Dimensions:** 42.3 x 102.38 x 80.8 mm (1.67 x 4.03 x 3.18 in)
**Weight:** 164 g (0.36 lb)

## 65M-TB-3800H-CT-T

### Physical characteristics
**ID:** A3
**Dimensions:** 42.3 x 102.38 x 80.8 mm (1.67 x 4.03 x 3.18 in)
**Weight:** 164 g (0.36 lb)

### 65M-TB-4820-CT-T

#### Physical characteristics

**ID:** A5
**Dimensions:** 42.3 x 102.38 x 80.8 mm (1.67 x 4.03 x 3.18 in)
**Weight:** 164 g (0.36 lb)

### 65M-TB-5801-CT-T

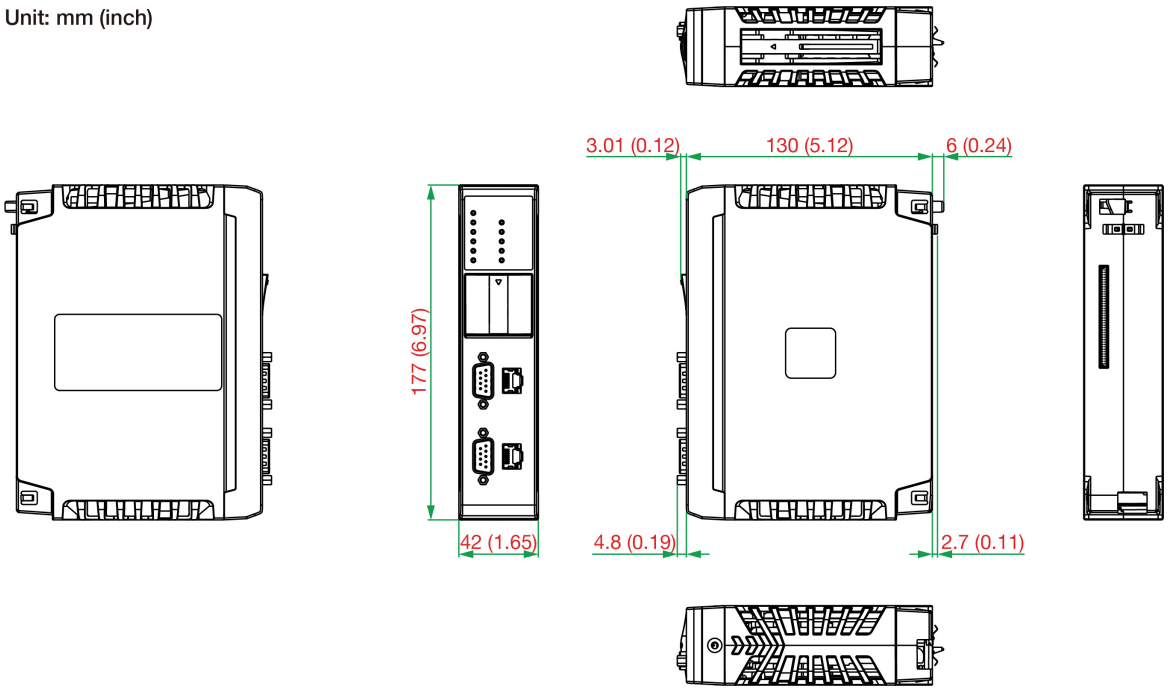
#### Physical characteristics

**ID:** F1
**Dimensions:** 42.3 x 102.38 x 80.8 mm (1.67 x 4.03 x 3.18 in)
**Weight:** 164 g (0.36 lb)

# Physical Dimensions

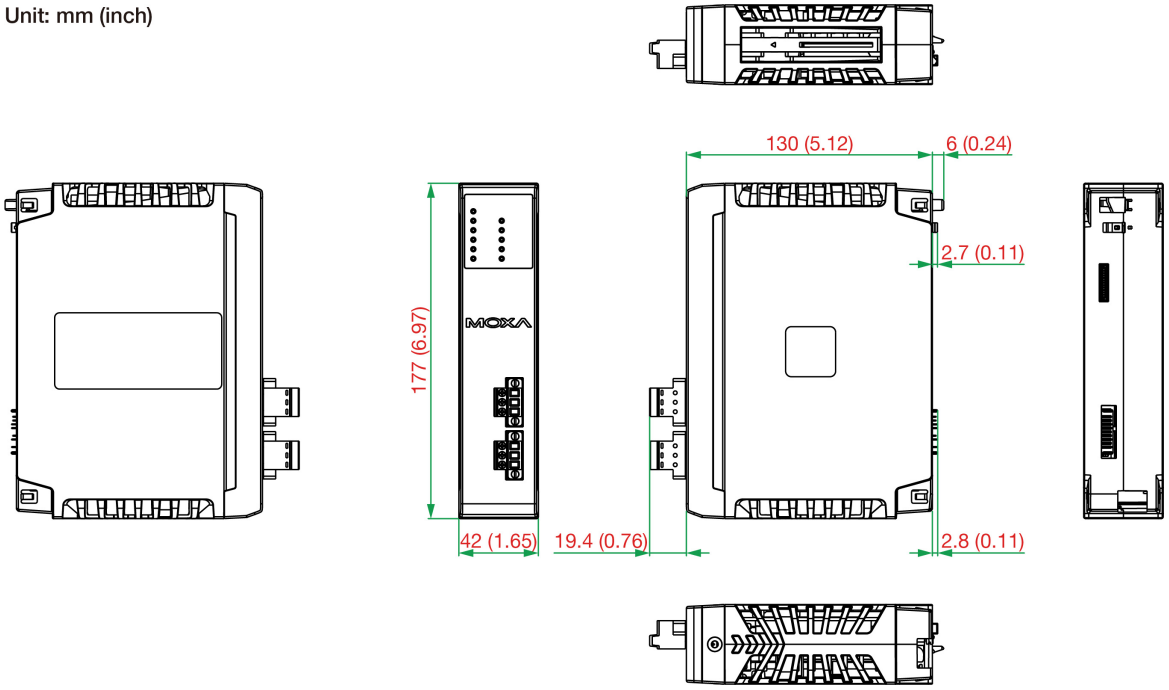
### 65M-CPU14-IEC-CT-T

Unit: mm (inch)



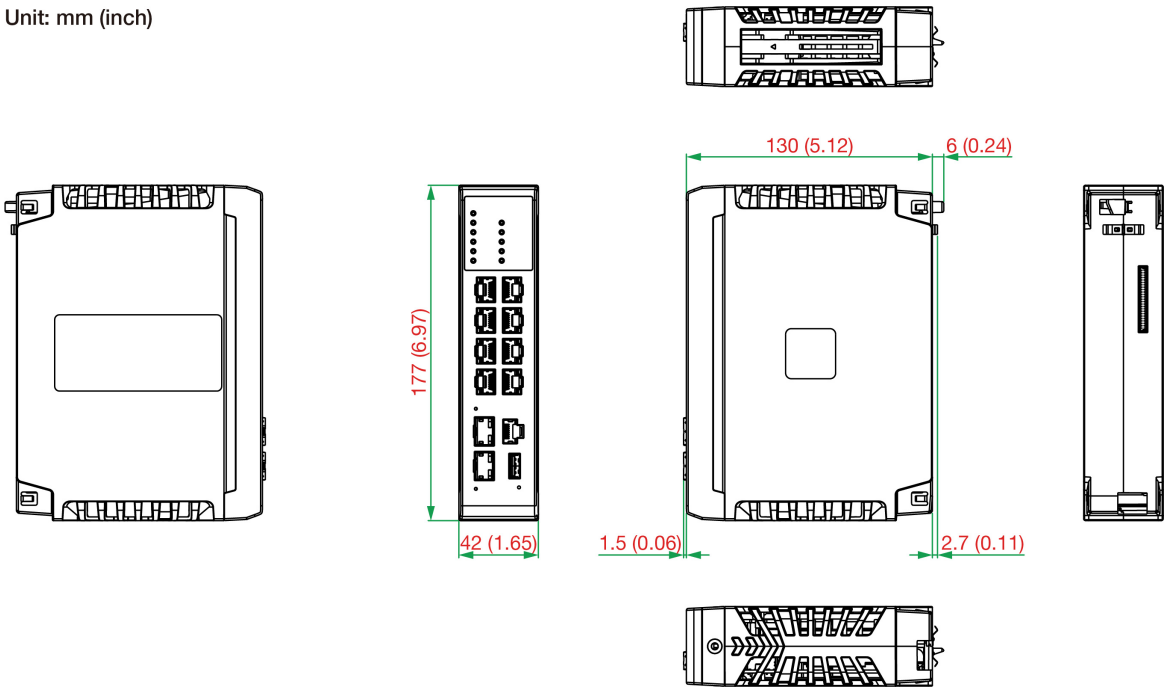
## 65M-PW0075-CT-T

Unit: mm (inch)



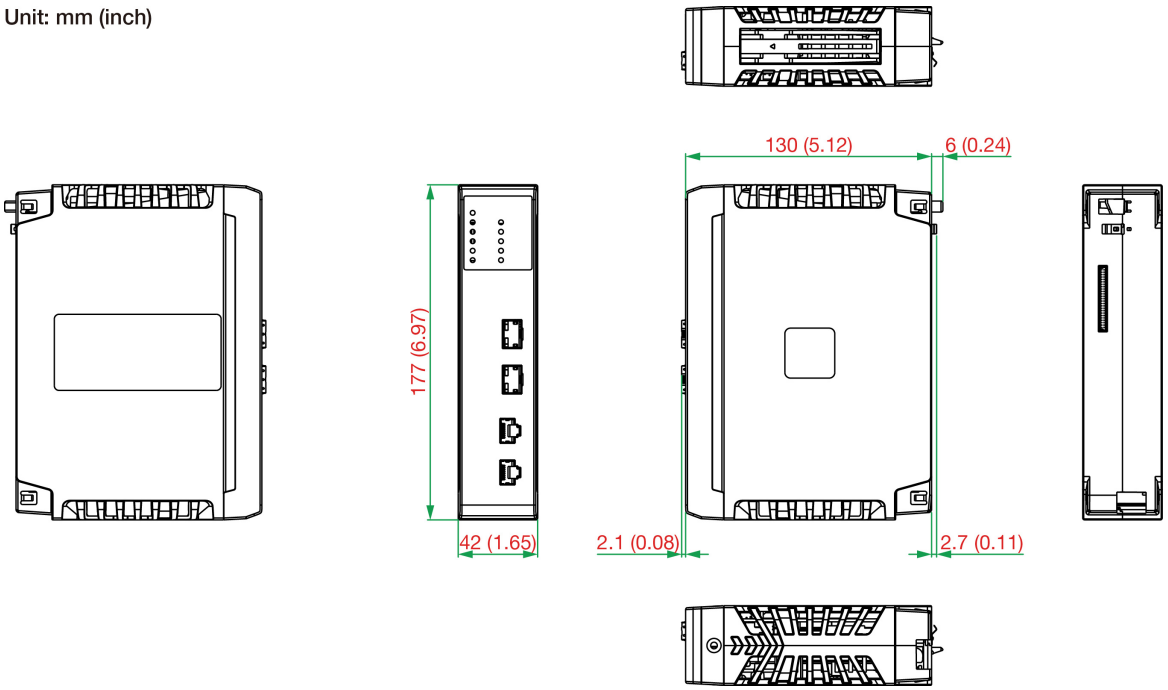

## 65M-5011M-CT-T

Unit: mm (inch)



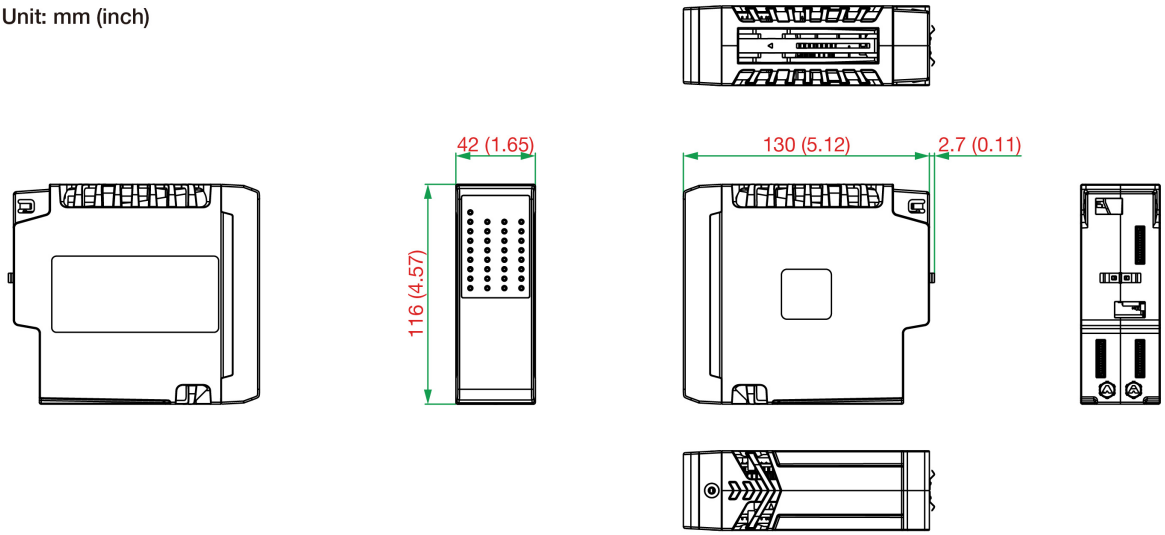
## 65M-5290-CT-T

Unit: mm (inch)



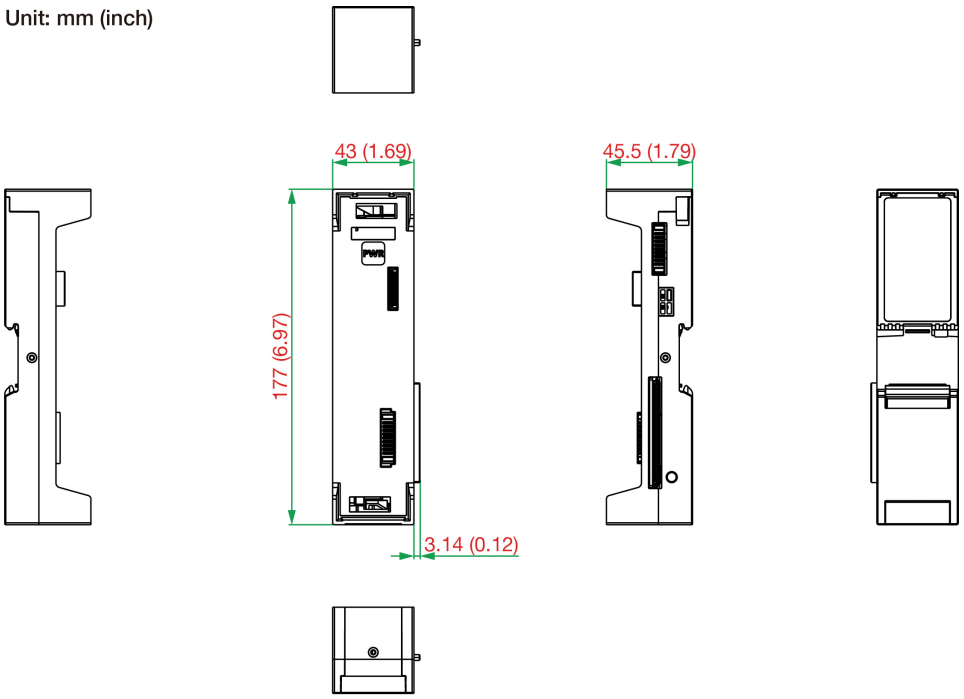

## 65M-1XXX/2XXX/3XXX/4XXX/5801-CT-T (IO Module)

Unit: mm (inch)



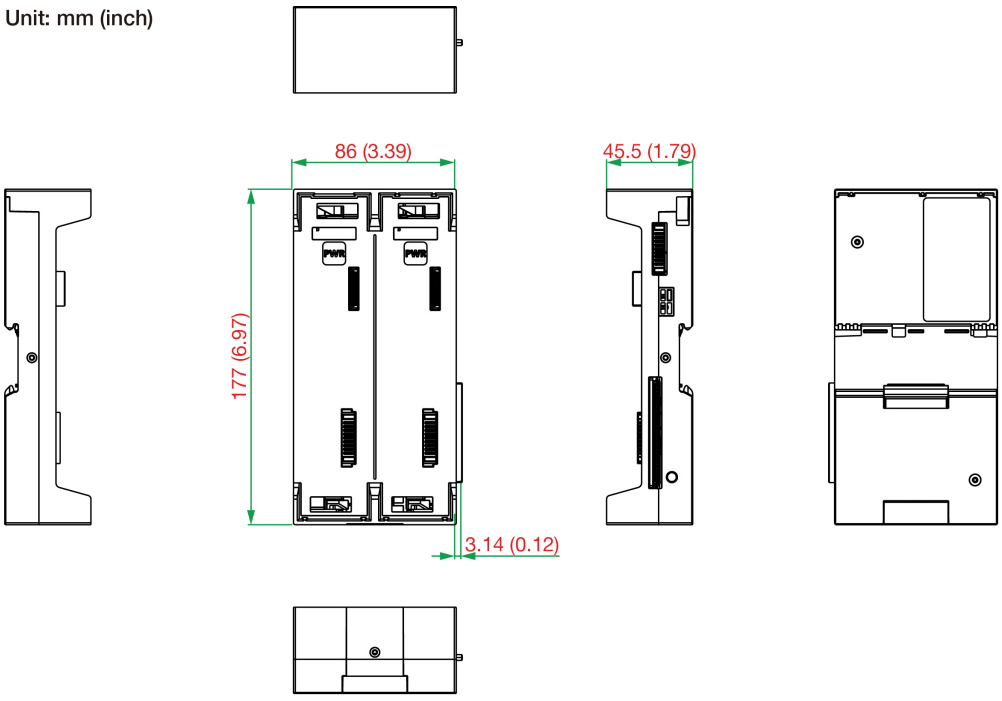
## 65M-BMPW01-CT-T

Unit: mm (inch)



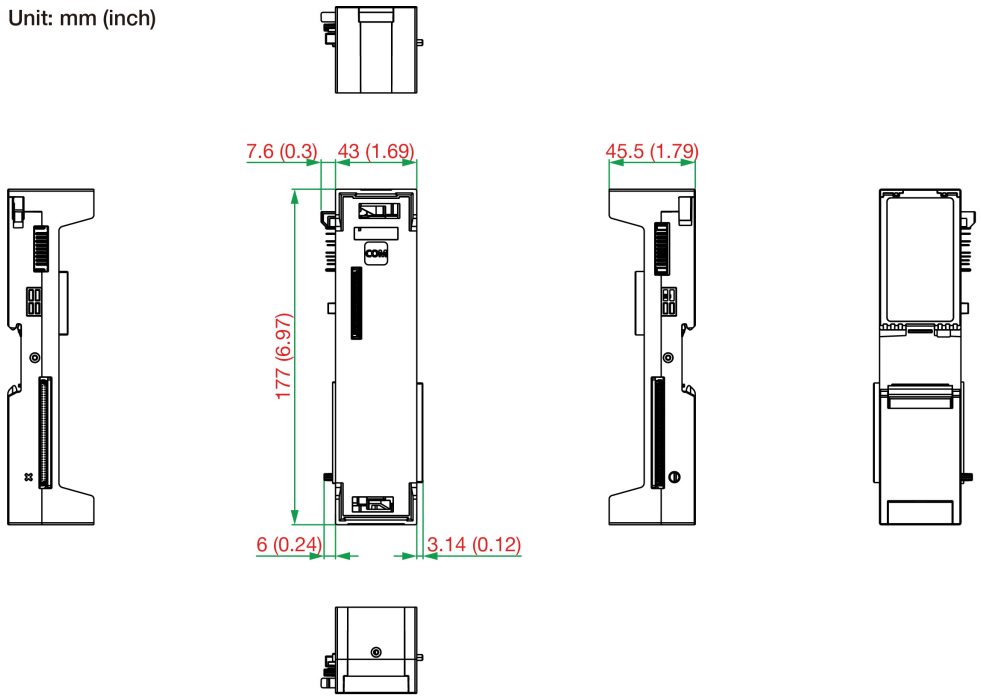

## 65M-BMPW02-CT-T

Unit: mm (inch)



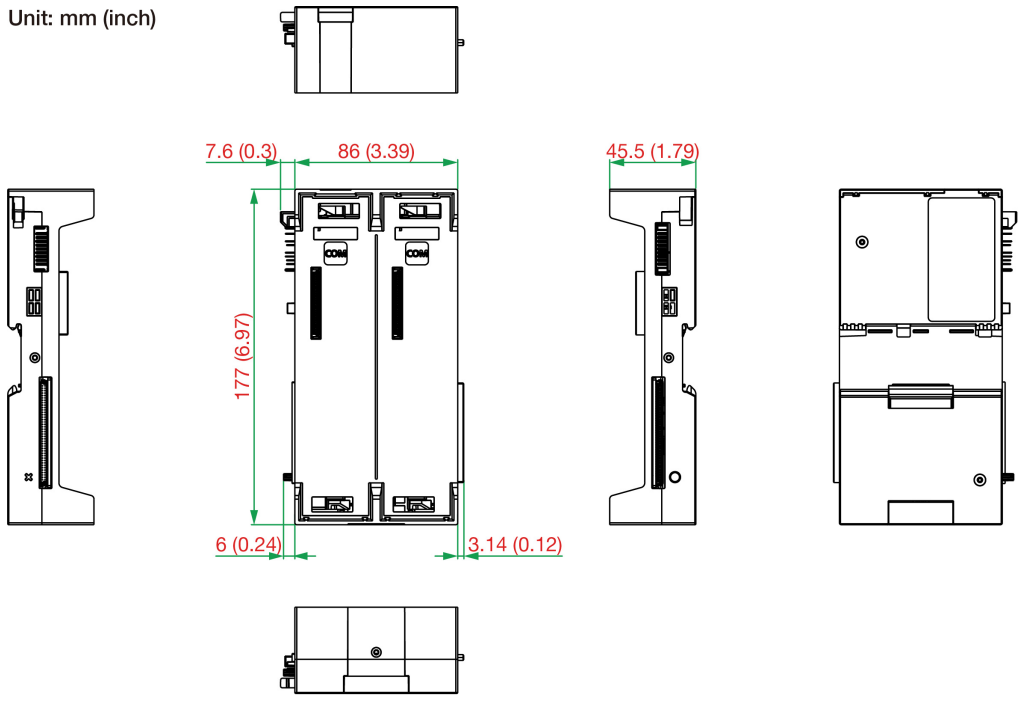
## 65M-BMCM01-CT-T

Unit: mm (inch)



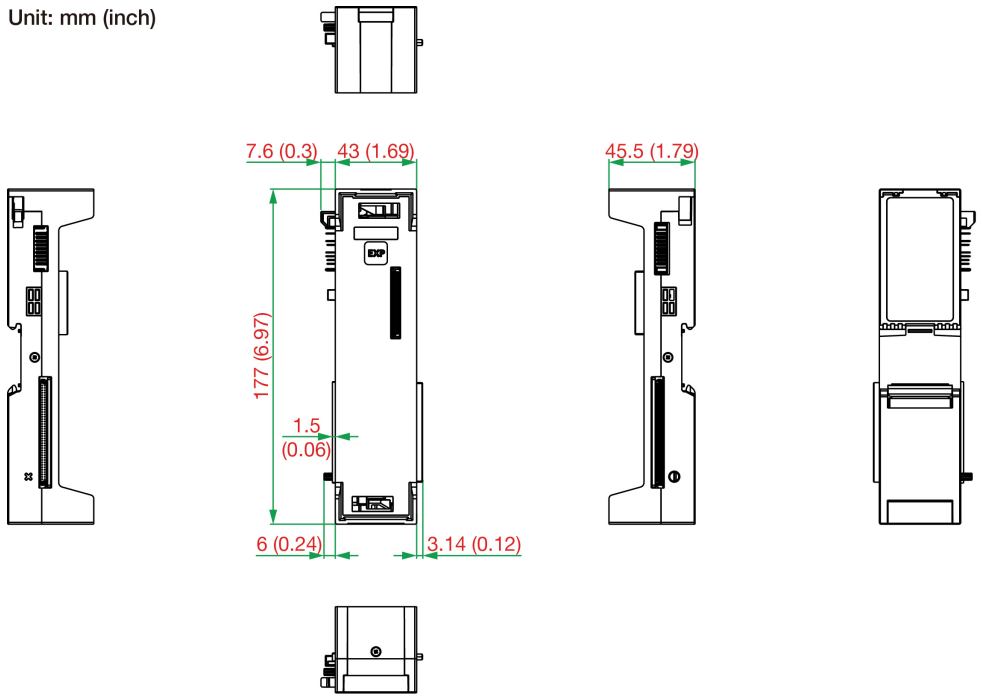

## 65M-BMCM02-CT-T

Unit: mm (inch)



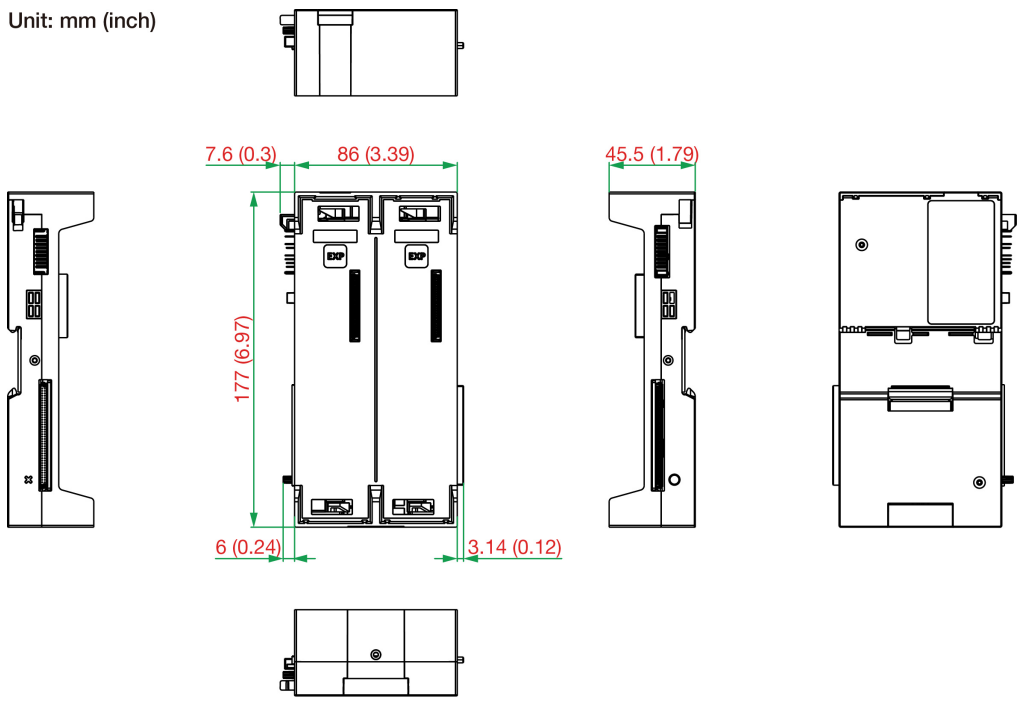
## 65M-BMEXP01-CT-T

Unit: mm (inch)



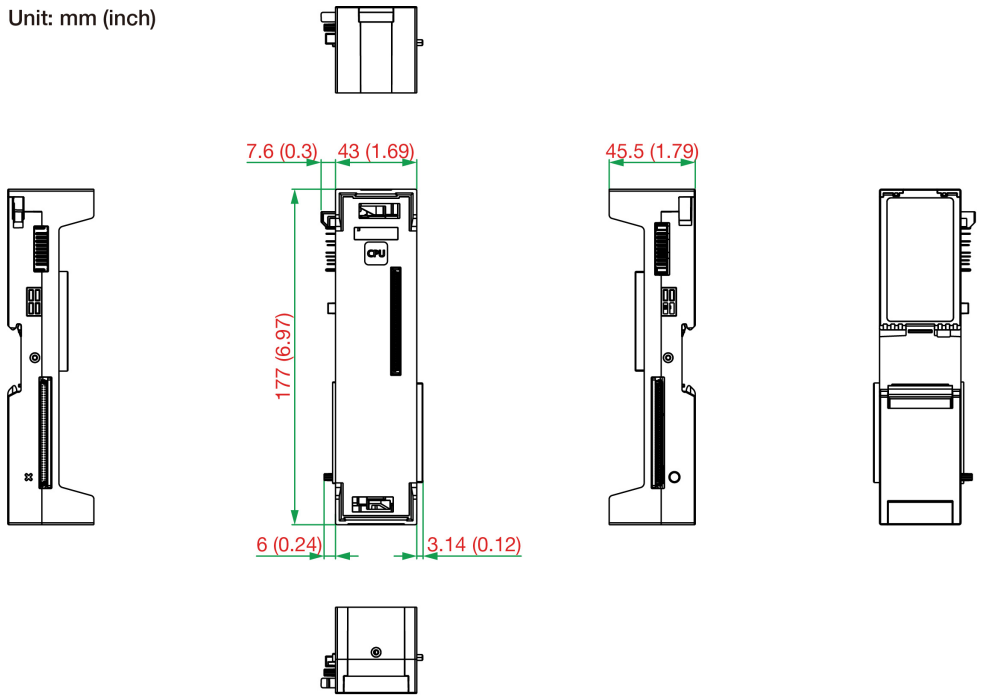

## 65M-BMEXP02-CT-T

Unit: mm (inch)



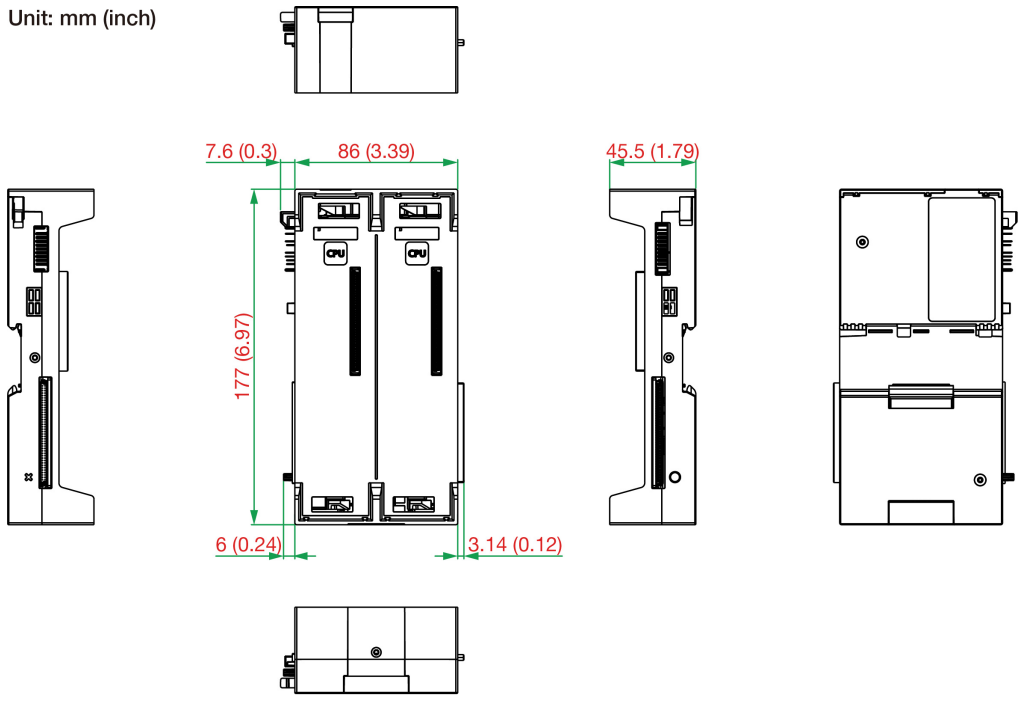
## 65M-BMCPU01-CT-T

Unit: mm (inch)



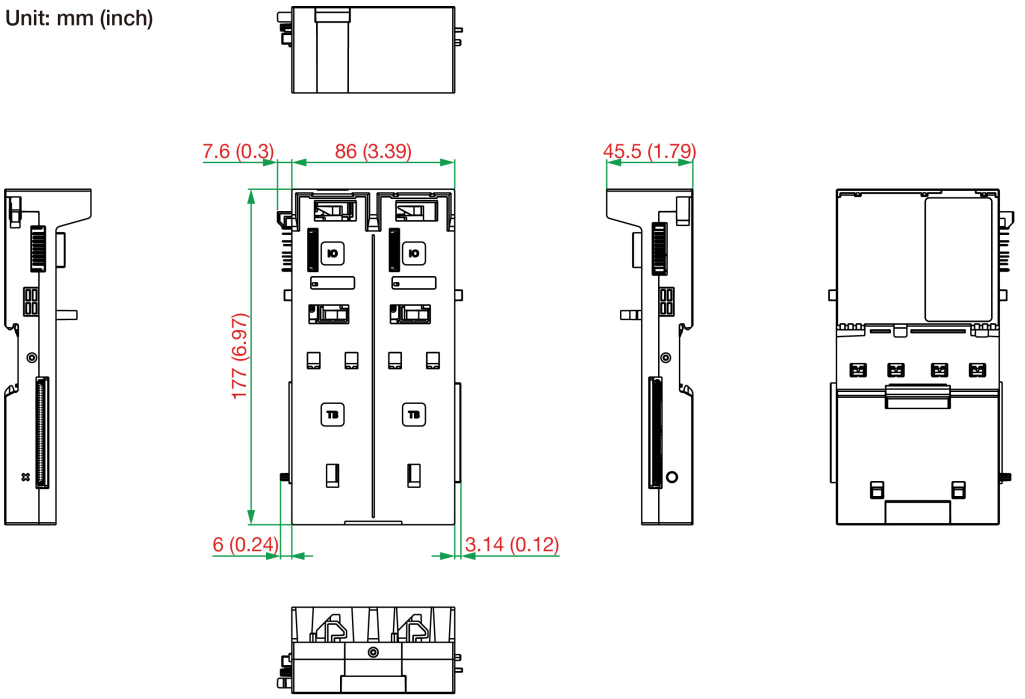

## 65M-BMCPU02-CT-T

Unit: mm (inch)



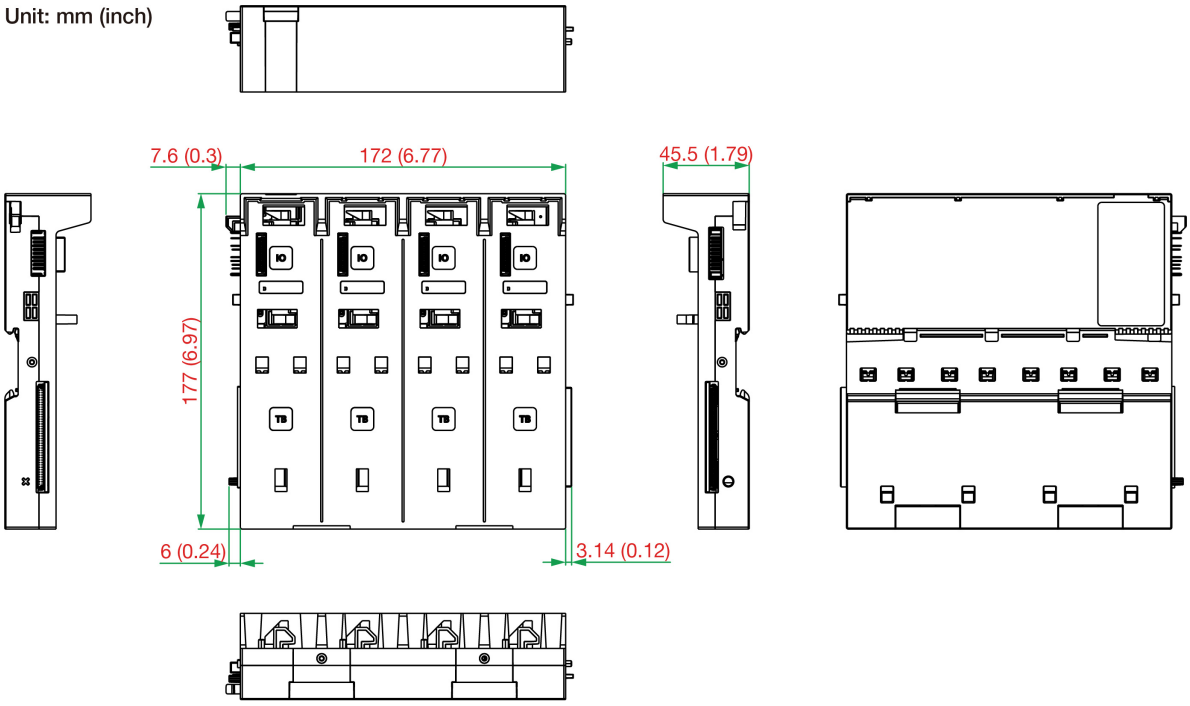
## 65M-BMIO02-CT-T

Unit: mm (inch)



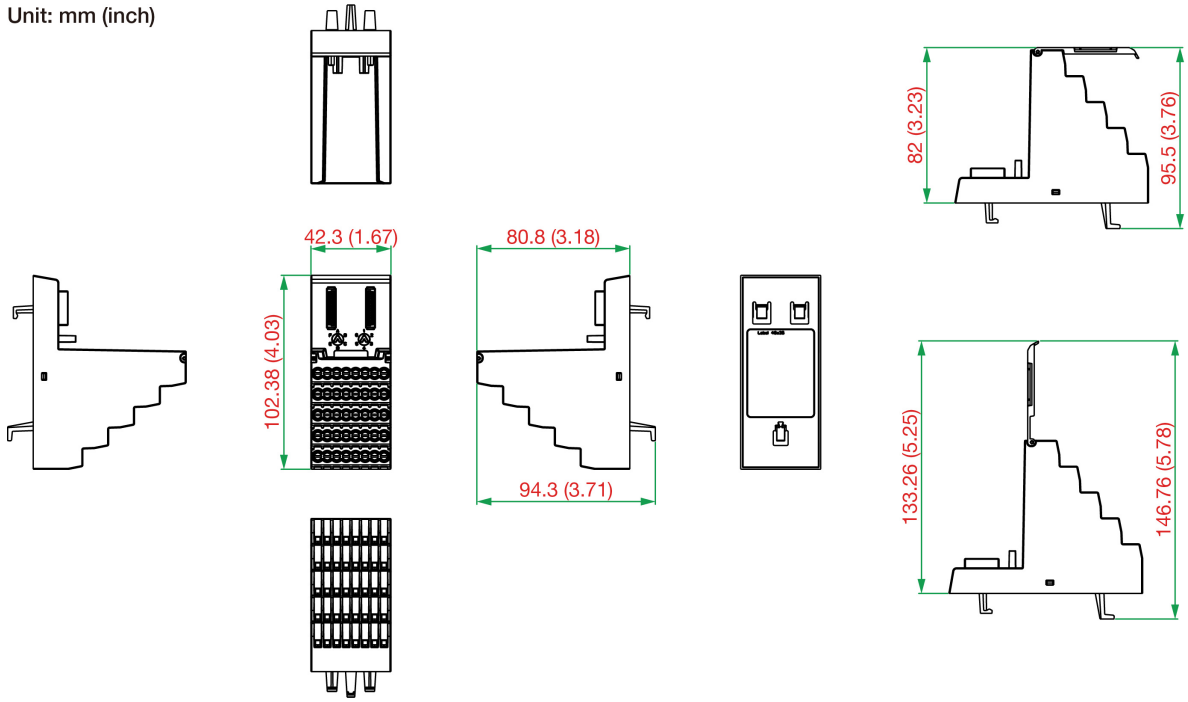

## 65M-BMIO04-CT-T

Unit: mm (inch)



## 65M-TB-1XXX/2XXX/3XXX/4XXX/5801-CT-T

Unit: mm (inch)



# LED Definition

## 65M-CPU14-IEC-CT-T

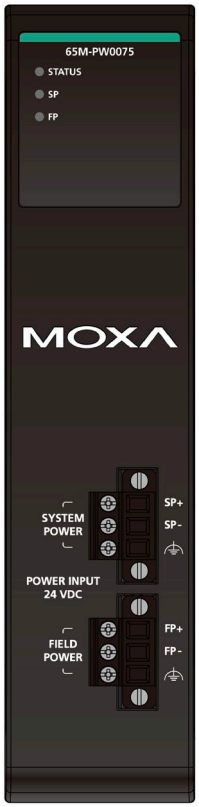
### Front View


### LED Description

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in Progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module locating |
| | | | Red | On | System failure |
| | | | | Blinking at 0.5 Hz | Service failure |
| | | | | Double Blinking | Press reset button for 15 seconds, the STATUS will start to RED double blinking, release the reset button to start the reset to default. |
| ACT | Active | 1 | N/A | N/A | Reserved |
| PROG | Program | 1 | Green | On | Program is running |
| | | | Red | On | Runtime failure |
| | | | Off | | Program has stopped |
| SD | SD card | 1 | Green | Blinking at 0.5 Hz | SD card is reading |
| P1/P2 | Serial | 1 for each | Green | Blinking at 0.5 Hz | Tx |
| | | | Amber | Blinking at 0.5 Hz | Rx |
| LAN1/ LAN2 | Ethernet | 1 for each | Green | On | Connected on 1000M |
| | | | | Blinking | Data is transmitting |
| | | | Amber | On | Connected on 10/100M |
| | | | | Blinking | Data is transmitting |
| | | | Off | | Disconnected |

## 65M-PW0075-CT-T

### LED Indicators

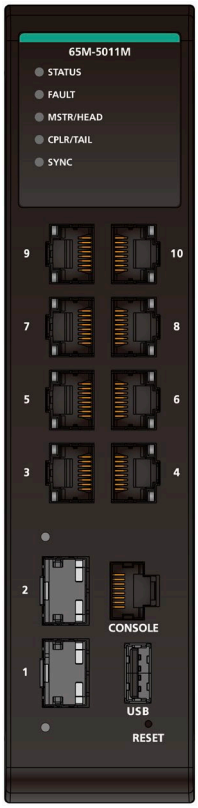



### LED Description

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Lost the connection to CPU |
| | | | | Blinking at 0.5 Hz | Diagnostic error |
| SP | System Power | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Abnormal |
| FP | Pield Power | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Abnormal |

## 65M-5011M-CT-T

### Front view



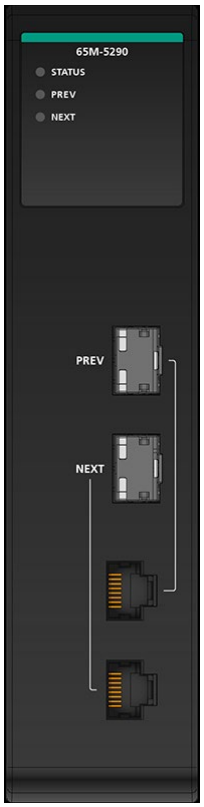

### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | When the system has passed a power-on self-test (POST) and is ready to run. |
| | | | | Blinking at 1 Hz | 1. When pressing the reset button, depress for 1 second to reboot the switch.<br>2. System service initialization. |
| | | | | Blinking at 2 Hz | 1. When pressing the reset button, depress for 5 seconds to reset to factory default.<br>2. While external storage is connected to the switch. |
| | | | Red | On | System failed in boot up process. Reading system info failed or EEPROM info error. |
| FAULT | Fault indication | 1 | Red | On | 1. Network loop is detected when loop protection is enabled.<br>2. External storage Loading/Saving Fail.<br>3. The port is being disabled because exceeding the ingress rate limit of shut down mode.<br>4. Invalid Ring port connection. |
| | | | | Off | When the system boots up and runs correctly or a user-configured event is not triggered. |
| Client/ HEAD | Client or head | 1 | Green | On | When the switch is Client/Head of Turbo Ring/Turbo Chain. |
| | | | | Blinking at 4 Hz | 1. The switch has become the Client of Turbo Ring after Turbo Ring has gone down.<br>2. The switch is set as Head of Turbo Chain and Turbo Chain has gone down.<br>3. The switch is set as the Turbo Ring's Member and the corresponding Ring port is down.<br>4. The switch is set as the Turbo Chain's Member/ Tail and the corresponding Head-end Chain port is down. |

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| | | | | Off | When the switch is not the Client/Head of this Turbo Ring/Turbo Chain. |
| CPRL/ TAIL | Coupling or Tail | 1 | Green | On | 1. The switch's ring coupling or dual homing function is enabled.<br>2. The switch is set as the Tail of Turbo Chain. |
| | | | | Blinking at 4 Hz | 1. Chain and the Chain has gone down.<br>2. The switch is set as the Turbo Chain's Member/ Head and the corresponding Tail-end Chain port is down. |
| | | | | Off | When the switch disables the coupling or tail role of Turbo Chain. |
| SYNC | Synchroniz ation | 1 | N/A | N/A | Reserved |
| 3-10 | 10M/100M/ 1000M RJ45 Top LED | 1 for each | Green | On | When the port is active and links on 1000Mbps. |
| | | | | Blinking | When the port's data is being transmitted at 1000Mbps. |
| | | | | Off | When the port is inactive or link is down. |
| | 10M/100M/ 1000M RJ45 Bottom LED | 1 for each | Amber | On | When the port is active and links on 10/100Mbps. |
| | | | | Blinking | When the port's data is being transmitted at 10/100Mbps. |
| | | | | Off | When the port is inactive or link is down. |
| 1-2 | 100M/1000 M SFP Port | 1 for each | Green | On | When the port is active and links on 1,000Mbps. |
| | | | | Blinking | When the port's data is being transmitted at 1,000Mbps. |
| | | | | Off | When the port is inactive or link is down. |
| | | | Amber | On | When the port is active and links on 100Mbps. |
| | | | | Blinking | When the port's data is being transmitted at 100Mbps. |
| | | | | Off | When the port is inactive or link is down. |

## 65M-5290-CT-T

### Front view




### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | Module status | 1 | Green | Blinking at 0.5 Hz | Module starts up |
| | | | | On | Module operates normally |
| | | | | Double Blinking | Locate |
| | | | | Blinking at 5 Hz | Firmware upgrade in process |
| | | | Red | On | Startup failed or other component error |
| | | | | Blinking at 5 Hz | Connection to CPU lost |
| | | | | Blinking at 0.5 Hz | Firmware upgrade failed |
| PREV | PREV status | 1 | Green | On | • Module starts up<br>• I/O link connection established between the client PRE and server NEXT |
| | | | | Blinking at 0.5 Hz | Acting as the client PREV module without an active IO link |
| NEXT | NEXT status | 1 | Green | On | • Module Startup<br>• IO link connection established between the client NEXT and server PREV |
| | | | | Blinking at 0.5 Hz | Acting as the client NEXT module without an active I/O link |

## 65M-1900-CT-T

### Front View


### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Lost the connection to CPU |
| | | | | Blinking at 0.5 Hz | Diagnostic failure |
| | | | | Double Blinking | No field power |
| 1-32 | DI channels | 1 for each | Green | On | ON |
| | | | Red | On | Diagnostic error |
| | | | Off | | OFF/Inactive |

## 65M-2901-CT-T

### Front View


### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Failsafe mode |
| | | | | Blinking at 0.5 Hz | Diagnostic failure |
| | | | | Double Blinking | No field power |
| 1-32 | DO channels | 1 for each | Green | On | ON |
| | | | Red | On | Diagnostic error |
| | | | Off | | OFF/Inactive |

## 65M-3600-CT-T

### Front view


### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Lost the connection to CPU |
| | | | | Blinking at 0.5 Hz | Diagnostic failure |
| | | | | Double Blinking | No field power |
| 1-16 | AI channels | 1 for each | Green | On | ON |
| | | | Red | On | Diagnostic error |
| | | | Off | | Inactive |

## 65M-3610-CT-T

### Front View


### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Lost the connection to CPU |
| | | | | Blinking at 0.5 Hz | Diagnostic failure |
| | | | | Double Blinking | No field power |
| 1-16 | AI channels | 1 for each | Green | On | ON |
| | | | Red | On | Diagnostic error |
| | | | Off | | Inactive |

## 65M-3800H-CT-T

### Front View


### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Lost the connection to CPU |
| | | | | Blinking at 0.5 Hz | Diagnostic failure |
| | | | | Double Blinking | No field power |
| 1-8 | AI channels | 1 for each | Green | On | ON |
| | | | Red | On | Diagnostic error |
| | | | Off | | Inactive |

## 65M-4820-CT-T

### Front View


### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Failsafe mode |
| | | | | Blinking at 0.5 Hz | Diagnostic failure |
| | | | | Double Blinking | No field power |
| 1-8 | AO channels | 1 for each | Green | On | ON |
| | | | Red | On | Diagnostic error |
| | | | Off | | Inactive |

## 65M-5801-CT-T

### Front View


### LED Definition

| Labeling | Indication | Qty | Color | Behavior | Description |
|---|---|---|---|---|---|
| STATUS | System status | 1 | Green | On | Normal |
| | | | | Blinking at 5 Hz | Firmware upgrade in progress |
| | | | | Blinking at 0.5 Hz | Booting up |
| | | | | Double Blinking | Module located |
| | | | Red | On | System failure |
| | | | | Blinking at 5 Hz | Failsafe mode |
| | | | | Blinking at 0.5 Hz | Diagnostic failure |
| | | | | Double Blinking | No field power |
| 1-8 | Serial channels | 1 for each | Green | Blinking at 0.5 Hz | Tx |
| | | | Red | | Rx |
| | | | Off | | Inactive |

# 3. Hardware Installation

In this chapter, we describe how to install the ioPAC 6500 Series devices.

## Mounting the Unit

In this section, we describe how to mount the devices and how to dismount the device.

### NOTE

ioPAC 6500 Series supports the following modules, collecting all the modules you need before installing the system.

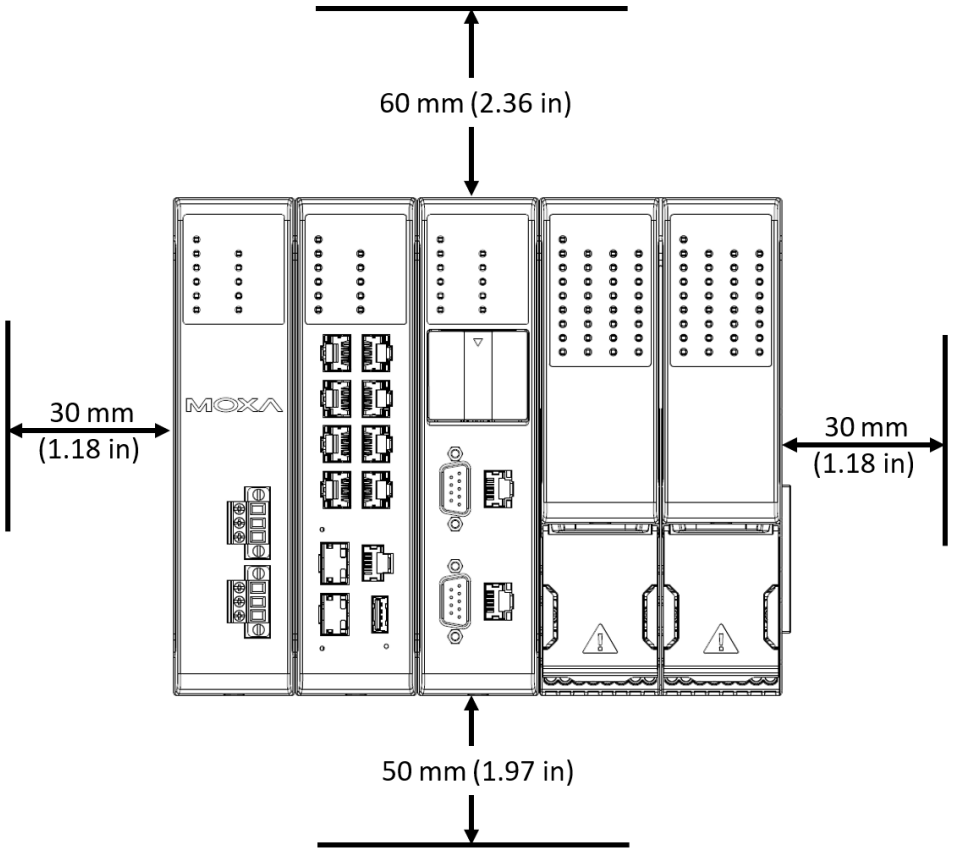
- CPU module
- Power module
- Backplane module for CPU
- Backplane module for power
- Communication (switch) module (optional, based on the application)
- IO module (optional, based on the application)
- Backplane module for communication (switch) (optional, based on the application)
- Backplane module for IO (optional, based on the application)
- Terminal block (TB) module for IO (optional, based on the application)
- Backplane module for expansion
- Expansion (optional, based on the application)

### NOTE

The ioPAC 6500 Series needs to be installed by the order: **Power Module > communication(switch) Module (optional) > CPU Module > Expansion Module (optional) > IO Module (optional)**

# Horizontal Installation

Before mounting the device onto the DIN rail, make sure that there is enough space around the device so that heat generated from the system can be dissipated. The suggested space dimension is shown below.




**CAUTION**

DO NOT install the device upright, as the fanless heat dissipation design will not perform as intended.

# Installing the System on the DIN Rail

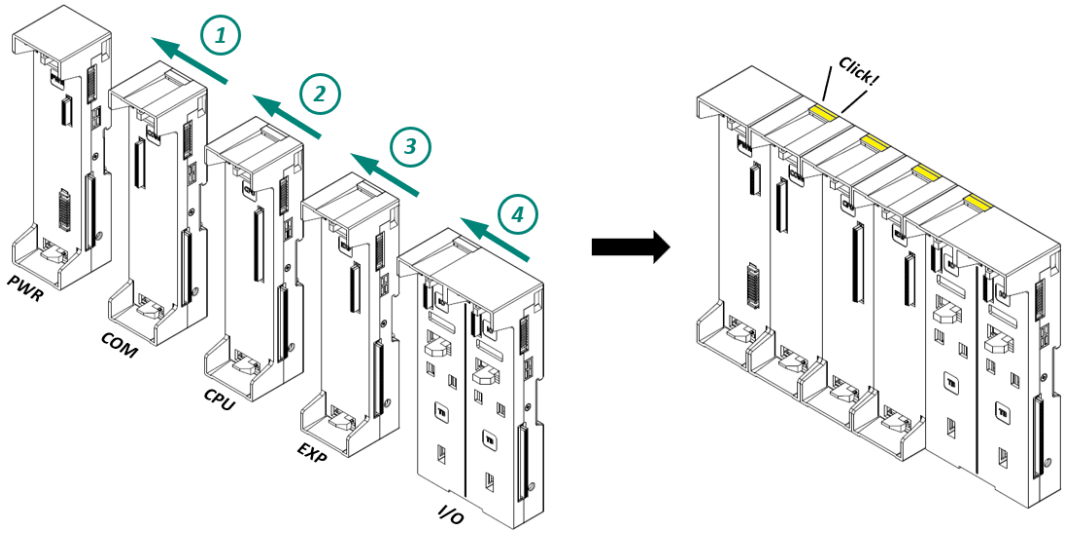
Follow the steps to mount the modules onto the DIN rail.

## NOTE

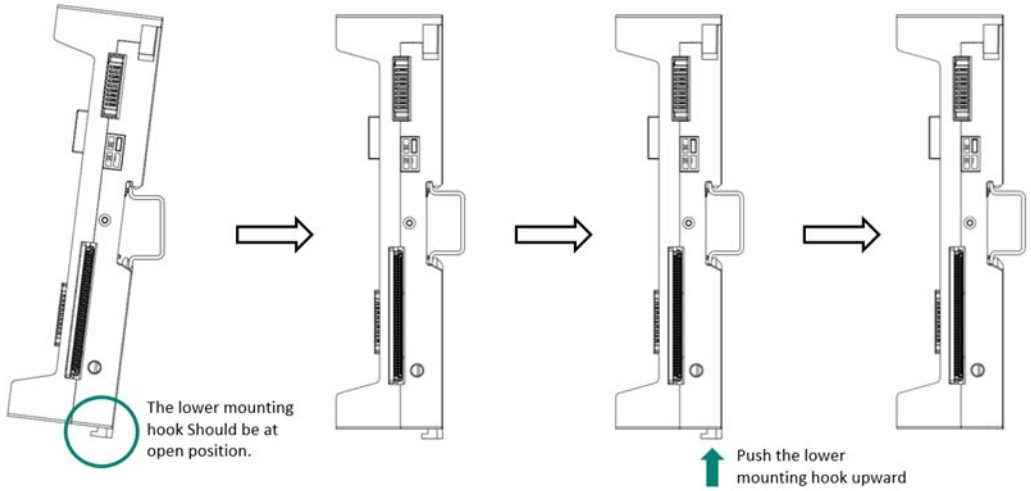
Use a DIN rail with a thickness of 1.5 mm and made of stainless steel to ensure a safe installation.

The demonstrated configuration includes one power module, one communication module (Switch), one CPU module, one expansion module, and two IO modules.

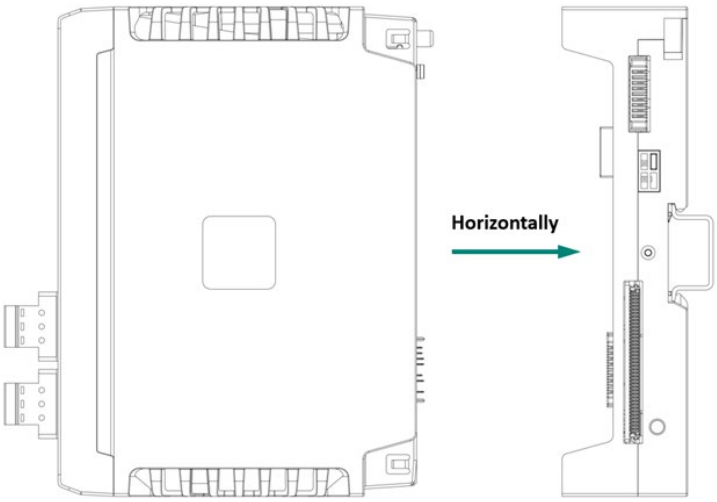
**Step 1:** Assemble all the backplane modules you need all at once before mounting them onto the DIN-rail. Follow the order: Power Module > Communication Module (Switch) > CPU Module > Expansion Module > IO Module. When hearing a "click" from the top clip, meaning the backplane modules are connected.



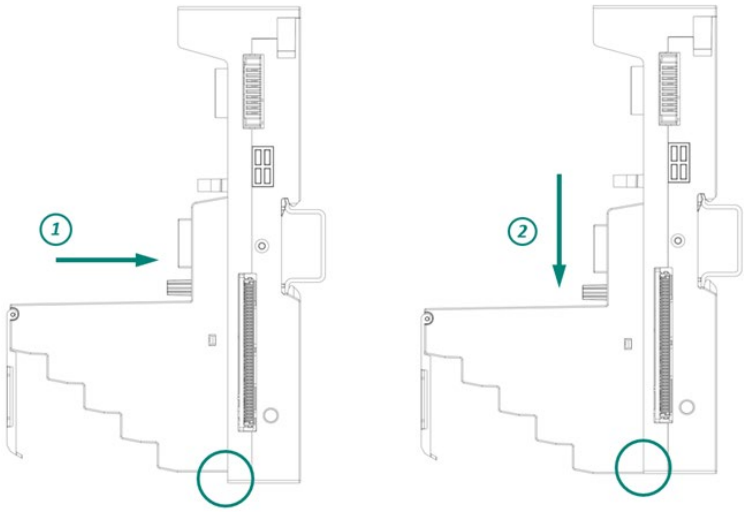

**Step 2:** Mount the upper mounting hook of all assembled backplanes onto the DIN rail while making sure the lower mounting hook of it is at an open position as shown below (side view). Push the assembled backplane towards the DIN rail, then push the lower mounting hook upward until latch so that all the backplane modules are fixed in position.



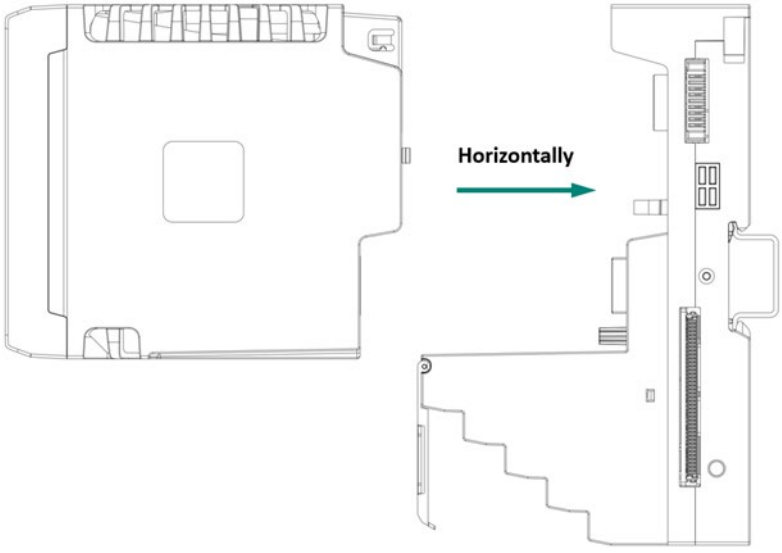
**Step 3:** Hold the Power module with two hands and install onto the power backplane module vertically. As with the CPU module, also the expansion module and communication module (if applicable).




**Step 4:** Place the terminal block module on the I/O backplane module, then pull down the TB module to fix the position.




**Step 5:** Hold the I/O module and install it onto the I/O backplane module horizontally. Note that there is a poka-yoke design to make sure the I/O module is installed on the correct terminal block.



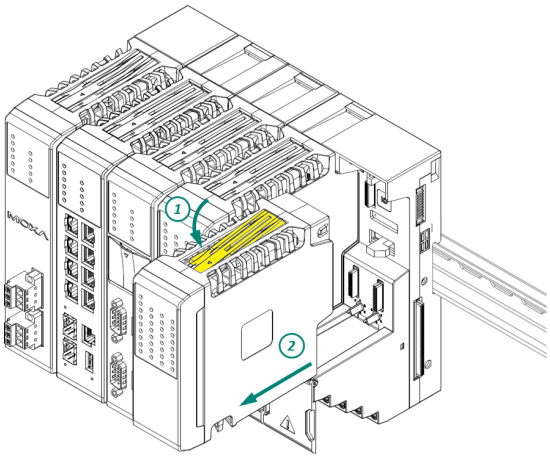
# Unmounting the System from a DIN Rail

Follow the steps to demount the modules from the DIN rail.

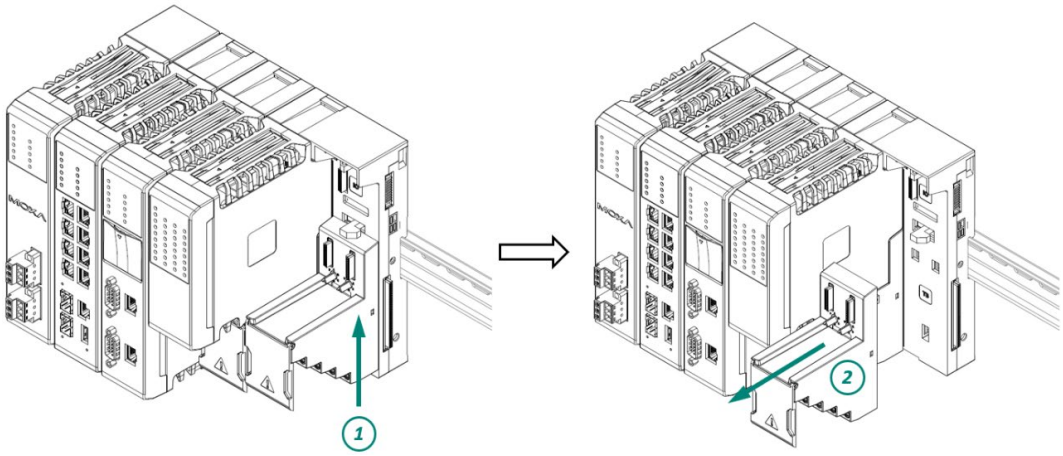
The demonstrated configuration includes 1 power module, 1 communication module (switch), 1 CPU module, and 2 IO modules.

**Step 1:** Turn off the power to shut down the system.

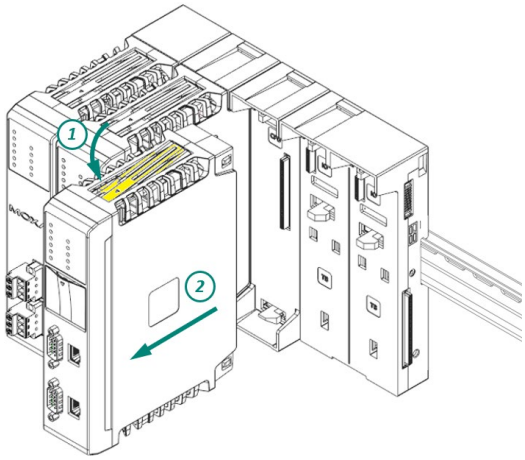
**Step 2:** Press the release tab on top of the IO module, then remove the I/O module from the backplane as shown below.



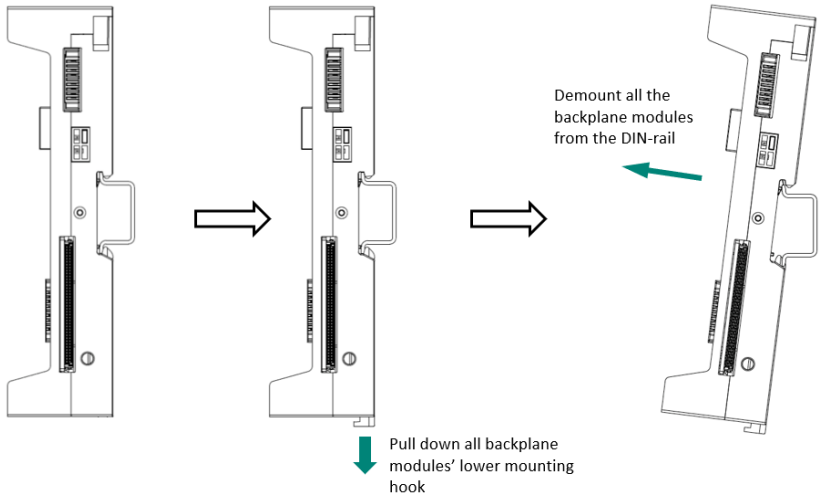

**Step 3:** Pull up the terminal block module, then remove it from the backplane.



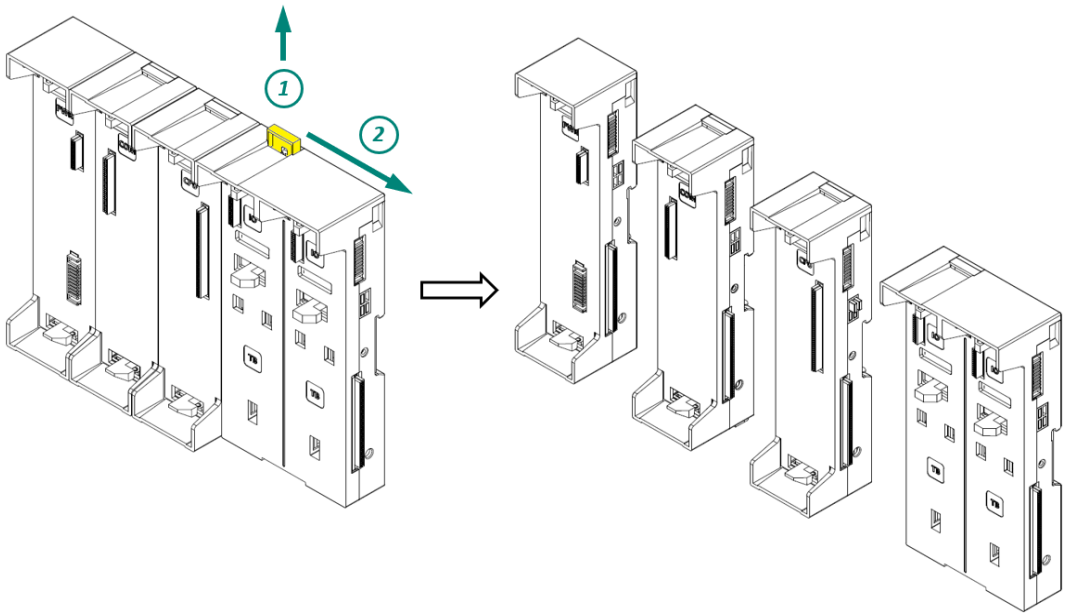
**Step 4:** Press the release tab on top of the CPU module, then remove the CPU module from the backplane horizontally. Remove the module with two hands to prevent dropping. Repeat the same procedure for removing the switch and power module as well.




**Step 5:** Pull down all backplane modules' lower mounting hook as shown below, then demount all the backplane modules from the DIN rail.



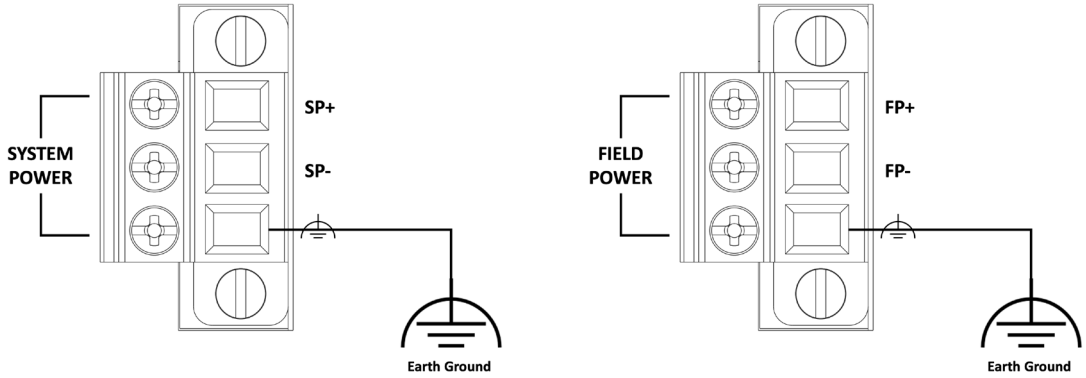

**Step 6:** Pull up the top clip (yellow part) of the IO backplane module to disassemble. Repeat the procedure for the CPU backplane and switch the backplane module.



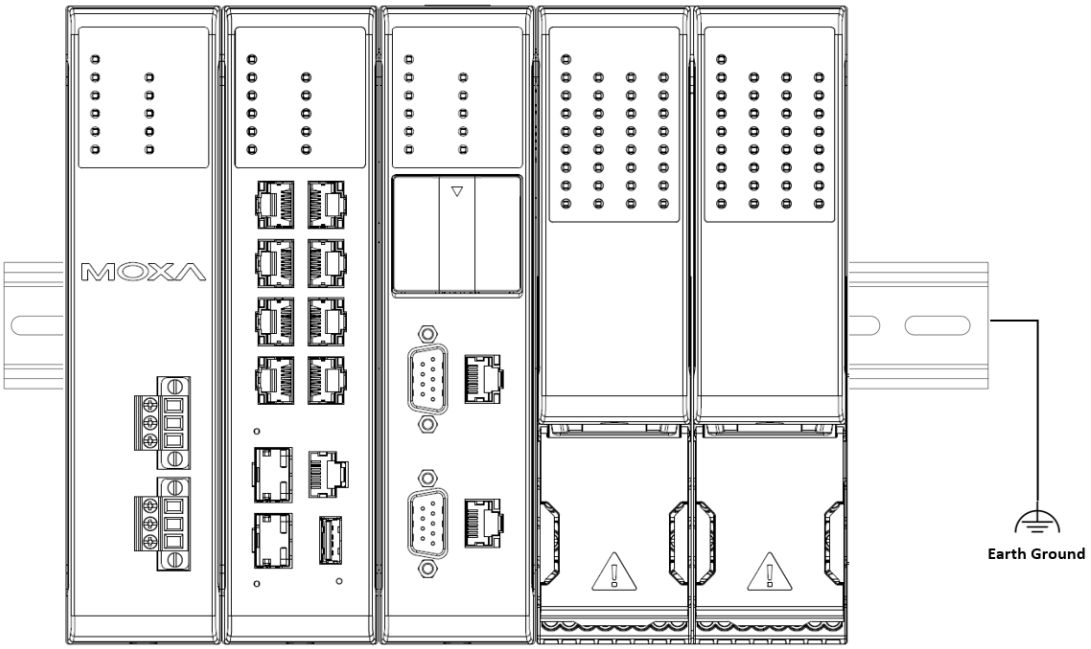
# Grounding the System

Ensure that you properly ground the system. There are three places that should be grounded as shown below. Use the different power supplies for system and field power to ensure the system and I/Os are isolated.

The first and second grounding points are the earth ground pin of the system, and field power connector.




The third grouding point is on the back side of each backplane module. The grounding spring will be connected to the DIN rail directly when successfully mounted.



# Wiring System and Field Power

Wire range: 12 to 18 AWG (ferrule diameter: 2.0 to 1.0 mm)

Wire strip length: 12 to 13 mm

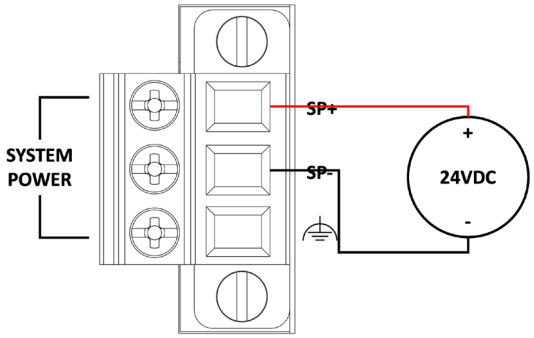
Unit: mm (in.)

**NOTE**

We recommend using different power supplies for system power and field power to ensure the system and I/Os are isolated.

## System Power

The system requires a 24-VDC system power input. The system powers this system via an internal bus, which is on the backplane module.

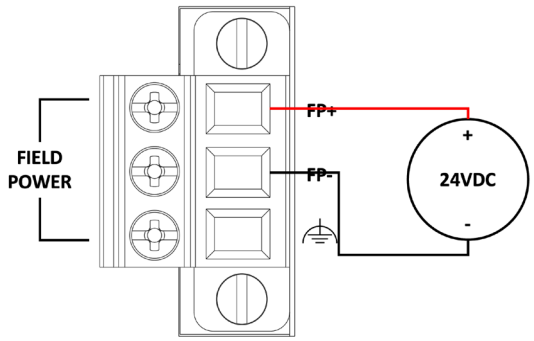



**NOTE**

The suggested tightening torque: 5.0 kgf-cm.

## Field Power

The ioPAC 6500 provides a field power input of 24 VDC that powers up the IO circuit inside the I/O module through the internal bus.

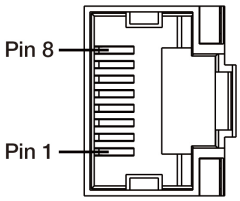



**NOTE**

The suggested tightening torque: 5.0 kgf-cm.

# Wiring Ethernet Ports

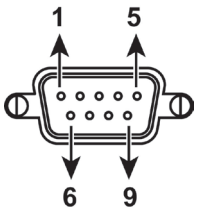
The maximum cable length is 100 m (350 feet), but the actual limit for your application could be longer or shorter depending on the amount of electrical noise in the environment. To minimize the amount of noise, Ethernet cables should not run parallel to power cables or other types of cables that generate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




| Pin | Media Direct Interface Signal |
|---|---|
| 1 | TRD(0)+ |
| 2 | TRD(0)- |
| 3 | TRD(1)+ |
| 4 | TRD(2)+ |
| 5 | TRD(1)- |
| 6 | TRD(2)- |
| 7 | TRD(3)+ |
| 8 | TRD(3)- |

# Wiring Serial Port(s)

The ioPAC 6500 is equipped with two 3-in-1 serial ports that support RS-232/422/485, making it more convenient to connect field serial devices.




| Pin | RS-232 | RS-422 | 2-wire RS-485 |
|---|---|---|---|
| 1 | DCD | TxD-(A) | – |
| 2 | RXD | TxD+(B) | – |
| 3 | TXD | RxD+(B) | Data+(B) |
| 4 | DTR | RxD-(A) | Data-(A) |
| 5 | GND | GND | GND |
| 6 | DSR | – | – |
| 7 | RTS | – | – |
| 8 | CTS | – | – |
| 9 | RI | – | – |

# Wiring the Fiber Port(s)

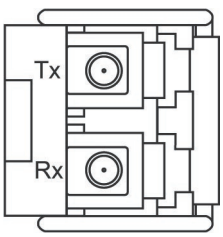
## 100/1000BaseSFP (mini-GBIC) Fiber Port

The Gigabit Ethernet fiber ports on the switch are 100/1000BaseSFP fiber ports, which must use 100/1000M mini-GBIC fiber transceivers to work properly.

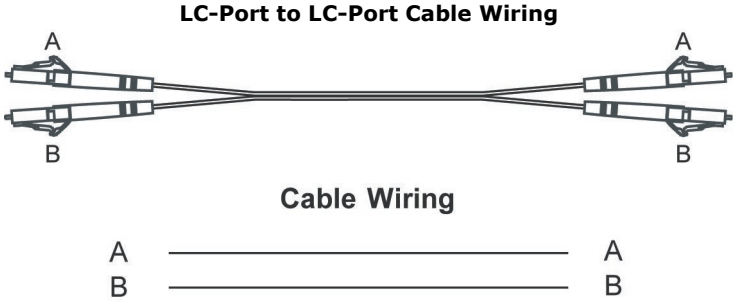
The concept behind the LC port and cable is straightforward. Suppose you are connecting devices I and II. Contrary to electrical signals, optical signals do not require a circuit to transmit data. Consequently, one of the optical lines is used to transmit data from device I to device II, and the other optical line is used to transmitting data from device II to device I for full-duplex transmission.

Remember to connect the Tx (transmit) port of device I to the Rx (receive) port of device II, and the Rx (receive) port of device I to the Tx (transmit) port of device II. If you make your own cable, we suggest labeling the two sides of the same line with the same letter (A-to-A and B-to-B, as shown below, or A1-to-A2 and B1-to-B2).

**LC-Port Pinouts**




**LC-Port to LC-Port Cable Wiring**

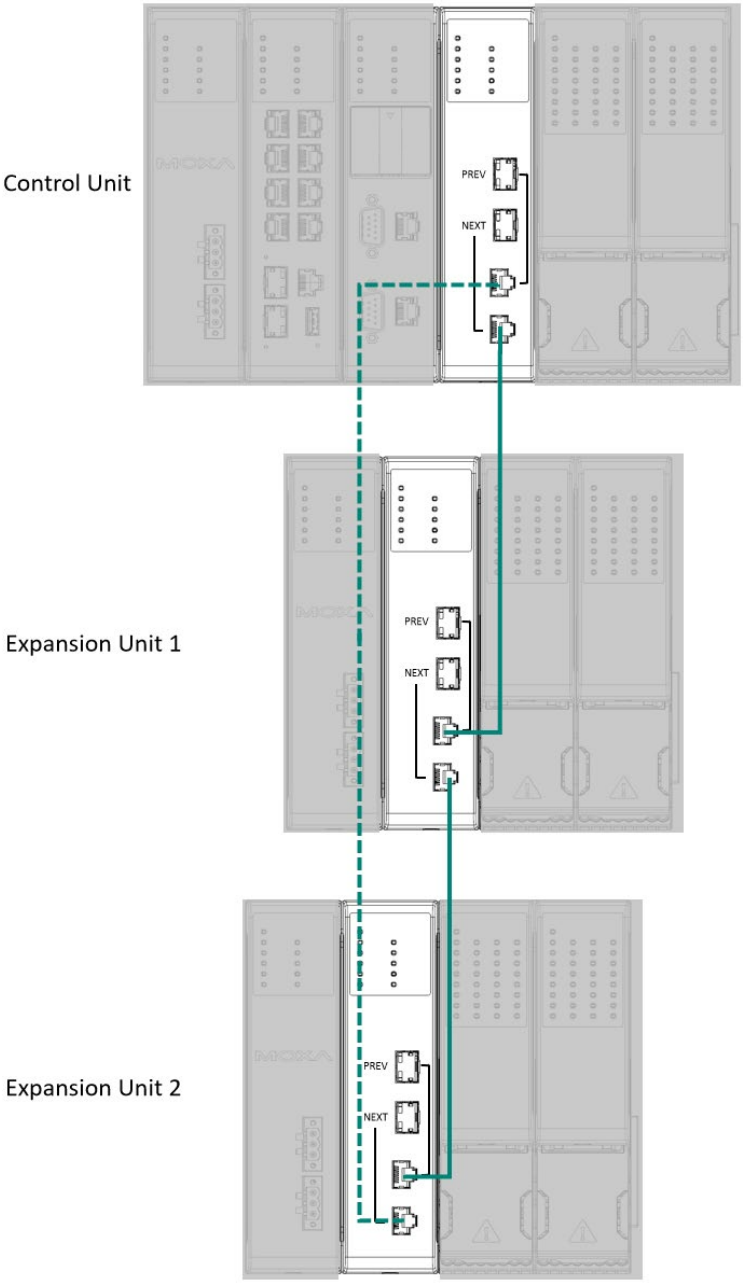


# Connecting Expansion Module

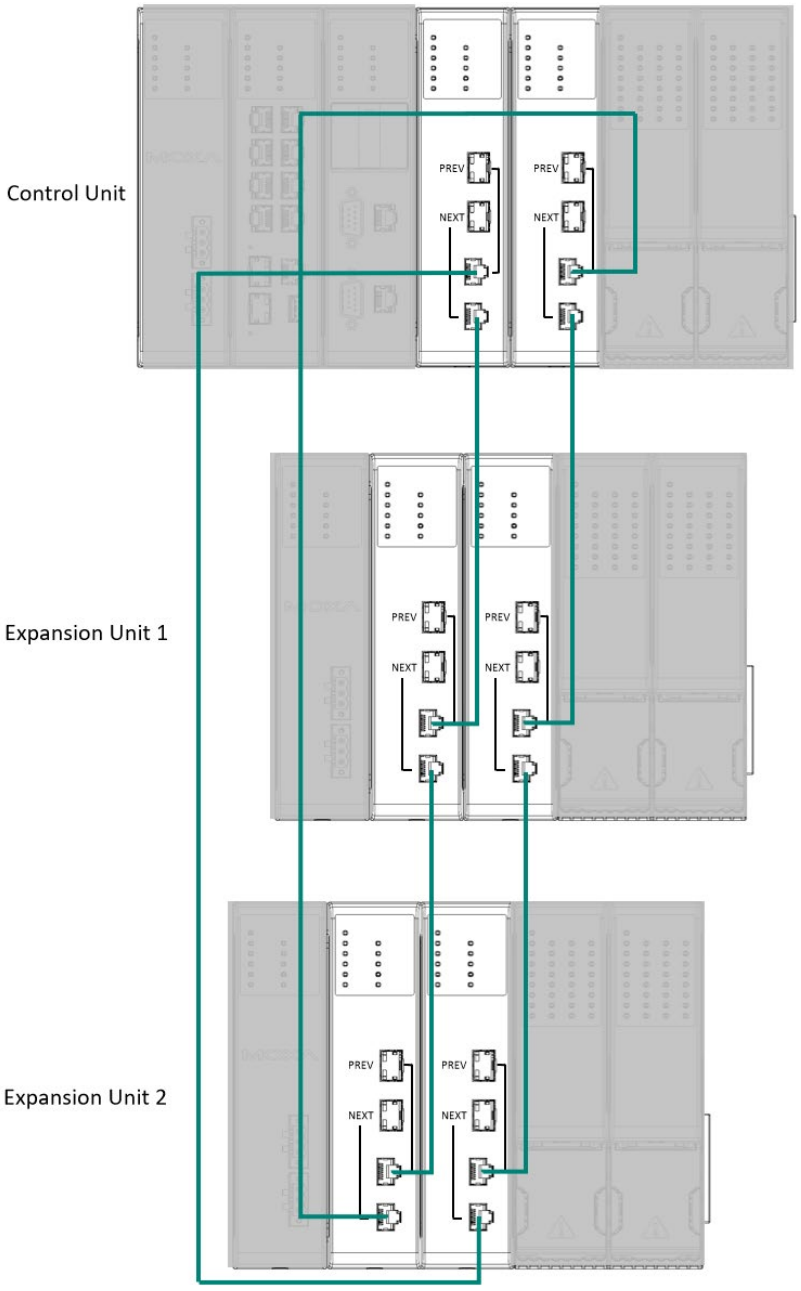
The ioPAC 6500 supports expansion modules, ensuring the expandability of the system. The connecting method shown below ensures redundancy.

1 Expansion module per Unit Ring Topology—ensuring single cable fault tolerance.

Daisy-chain: Without the dashed line.



2 Expansion modules per Unit Ring Topology—Ensuring single-cable or single-module fault tolerance. We recommend using two expansion modules per unit ring topology for critical applications, as this structure ensures I/O data communication even when executing maintenance, e.g., hot swapping modules.

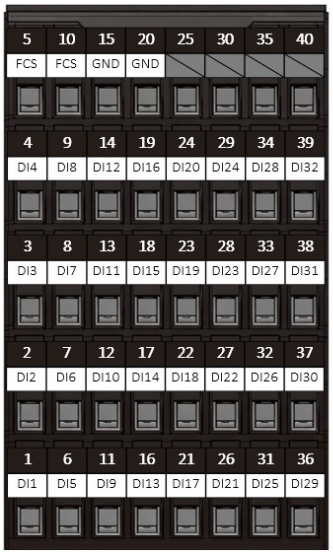



## ATTENTION

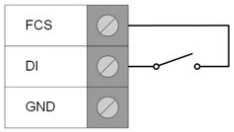
This is a Class 1 Laser/LED product. To avoid causing serious damage to your eyes, do not stare directly into the laser beam.

# I/O Terminal Block Pin Definitions and Wiring

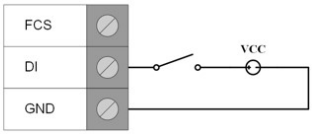
## DI: 65M-TB-1900-CT-T



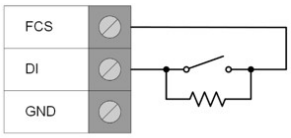

**Dry Contact**
**(Internal FCS)**



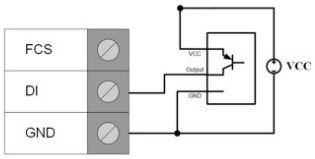

**Dry Contact**
**(External Power)**



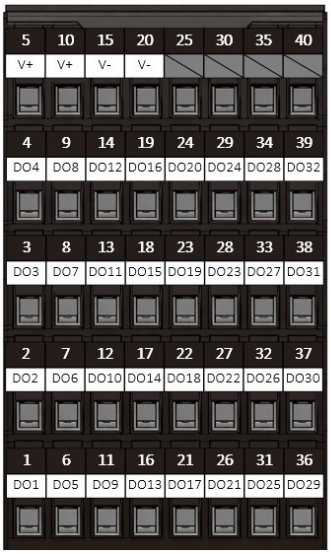

**Dry Contact**
**(With Wire Break Diagnostic)**



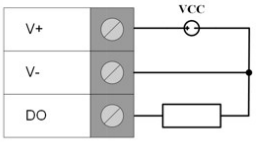

**Wet Contact**



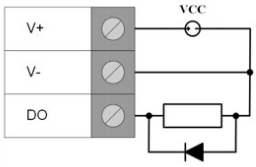

## DO: 65M-TB-2901-CT-T




**Resistive Load**

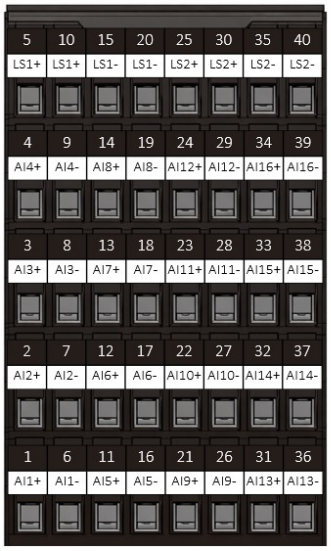



**Inductive Load**

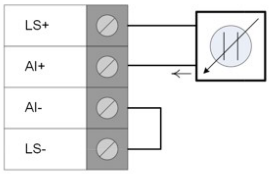


## AI (mA): 65M-TB-3600-CT-T

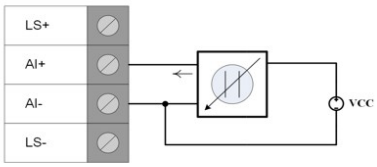
> **NOTE**
>
> LS1 should be wired with AI1-AI8 and LS2 should be wired with AI9-AI16.



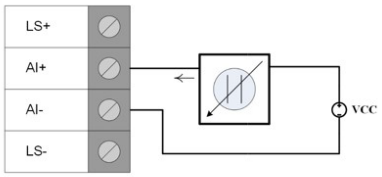

**2-Wire Current Sensor**
**(Internal Loop Power)**



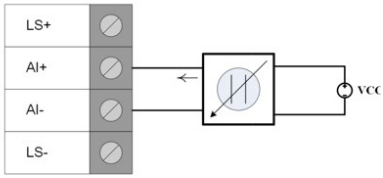

**3-Wire Current Sensor**



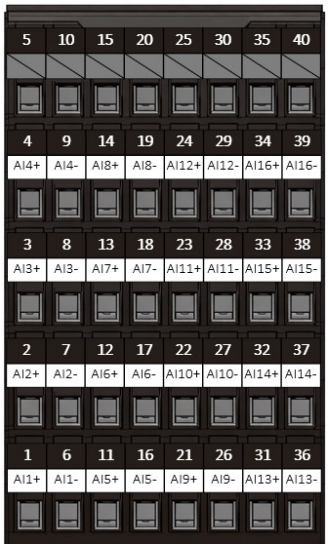

**2-Wire Current Sensor**
**(External Loop Power)**



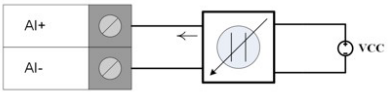

**4-Wire Current Sensor**



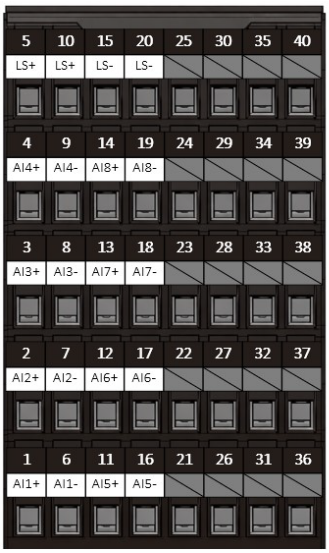

## AI (V): 65M-TB-3610-CT-T



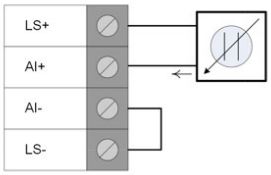

**4-Wire Voltage Sensor**



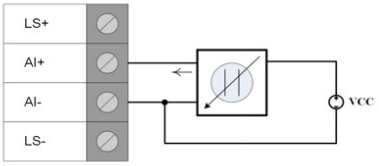
## AI (HART): 65M-TB-3800H-CT-T



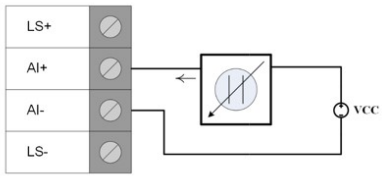

**2-Wire Current Sensor**
**(Internal Loop Power)**



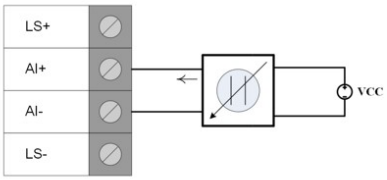

**3-Wire Current Sensor**



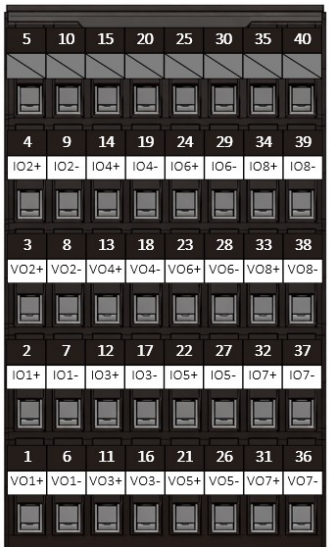

**2-Wire Current Sensor**
**(External Loop Power)**



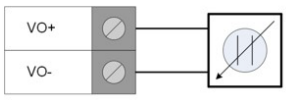

**4-Wire Current Sensor**



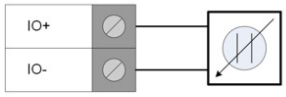

## AO: 65M-TB-4820-CT-T



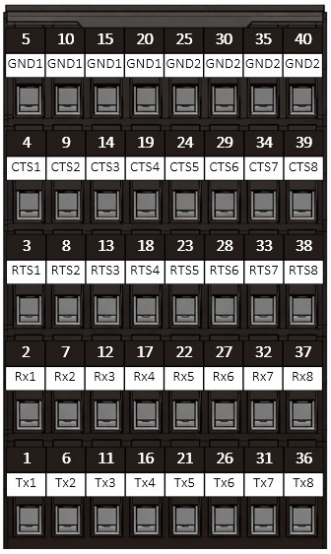

**Voltage Output**



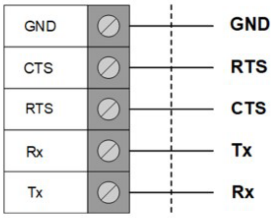

**Current Output**

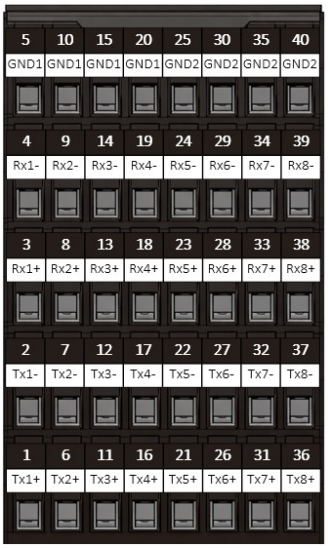


## Serial: 65M-TB-5801-CT-T

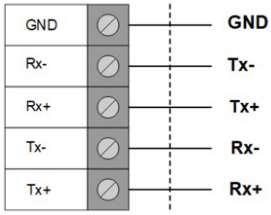


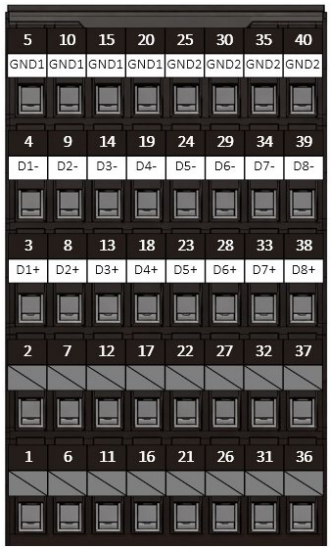

**RS-232**



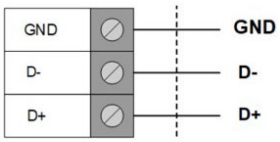




**RS-422**



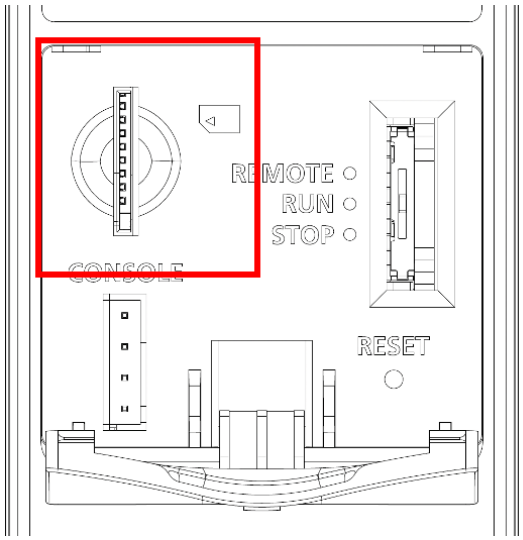




**RS-485-2w**



# Inserting the microSD™ Card

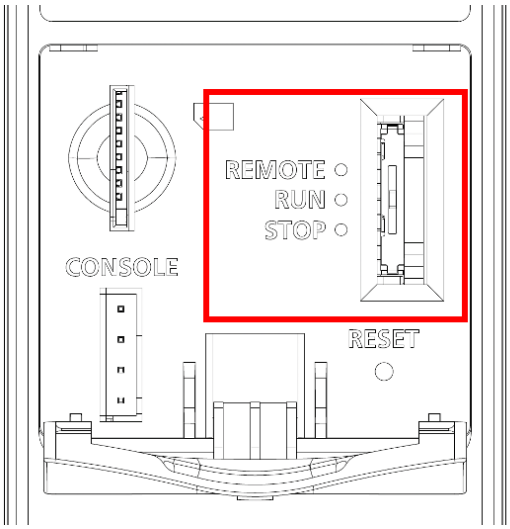
The ioPAC 6500 CPU module offers a microSD slot. This function is currently reserved. Open the cover on the CPU module, you can see the microSD slot inside.




# Powering on the Unit

When all the installation and wiring are complete, you can turn on the power to boot up the system. After turning on the system power supply, it will take 90 seconds for the operating system to boot up. The green Ready LED will illuminate continuously until the operating system is ready.

# Mode Switch




Open the cover on the CPU module, you can see the mode switch inside. The ioPAC 6500 CPU module offers a mode switch for you to change the system status.

**Remote:** the device is allowed to download the program and change the device setting remotely. The authorized user with secure access is required.

**Run:** The device is actively running the program. It rejects any attempt to interrupt the device running, either locally or over the network. The device information is set to read only.

**Stop:** The device will not execute the program in any condition. The authorized user is allowed to download the program and change the device setting.

The table shows which action can be performed in each mode.

| | STOP | RUN | REMOTE – Run | REMOTE - STOP |
|---|---|---|---|---|
| **IDE** | | | | |
| **Configuration Download** | Yes | No | Yes | Yes |
| **Online Change** | Yes | No | Yes | Yes |
| **Firmware Upgrade** | Yes | No | No | Yes |
| **Warm / Cold Reboot** | Yes | No | Yes | Yes |
| **Force Output** | Yes | Yes | Yes | Yes |
| **Reset Warm, Reset Cold, Reset Origin** | Yes | No | No | Yes |
| **STOP COMMAND** | No | No | Yes | No |
| **Factory Default/ Device Decommission** | Yes | No | No | Yes |
| **Backup** | Yes | Yes | Yes | Yes |
| **Restore** | Yes | No | Yes | Yes |
| **Security Hot Plug** | Yes | Yes | No | No |
| **Web** | | | | |
| **System Settings** | Yes | View/Export only | Yes | Yes |
| **Maintenance** | Yes | View/Export only | Yes | Yes |
| **Diagnostic** | Yes | View/Export only | Yes | Yes |
| **Certificate** | Yes | View/Export only | Yes | Yes |
| **Security** | Yes | View/Export only | Yes | Yes |

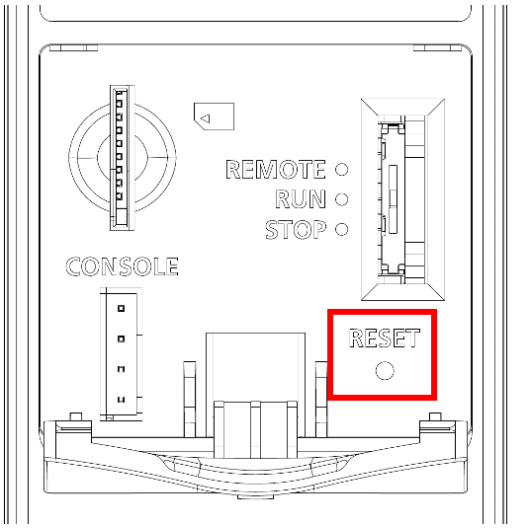
# Reset Button: Reset Origin Device

Open the cover on the CPU module; you can see the reset button inside. Follow the steps to perform **Reset Origin Device**, which will reset the whole system to its original status.

1. Keep pressing the reset button for **15 seconds**; the STATUS LED starts double blinking RED.
2. Releasing the reset button when the STATUS LED is double blinking RED, the ioPAC 6500 system will start to reset the system to its original status.

## NOTE

Except for the system logs, all other data and settings of the system will be reset once Reset Origin Device is performed successfully.



# 4. Software Configuration

In this chapter, we introduce the web interface and serial console of the ioPAC 6500 CPU module.

# Connecting the Web Interface

The Web Console is already embedded in the ioPAC 6500 system. Use the web console to check the device status, configure network settings, or update the firmware of the device. Follow the steps below to connect to the web interface.

1. Connect the system 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.
4. Default IP LAN1: 192.168.126.1~2

   Default IP LAN2: 192.168.127.1~2

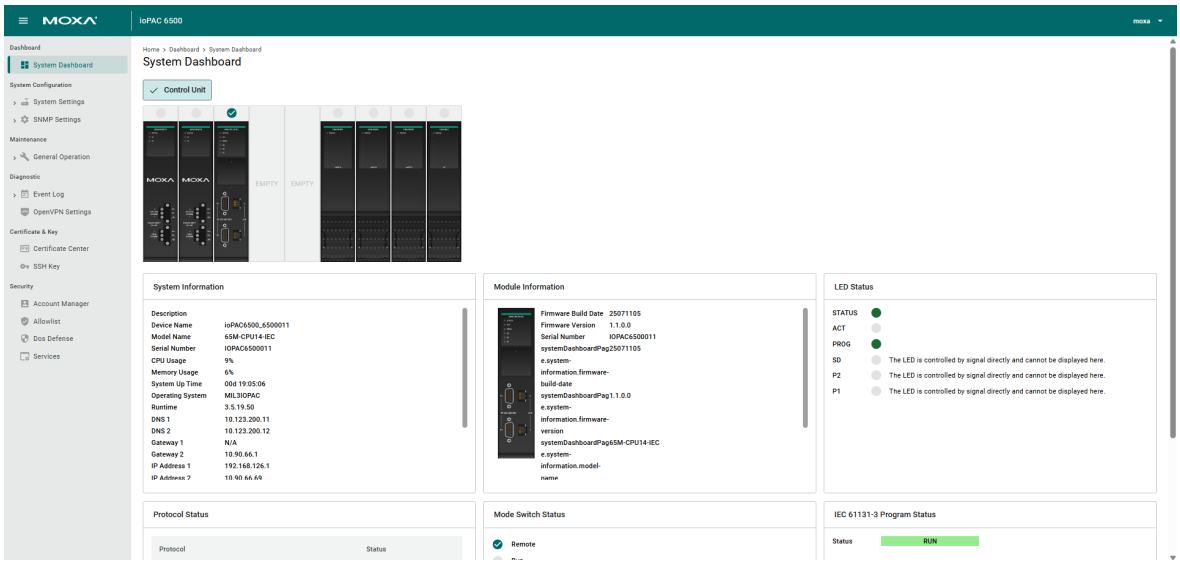
   The last octet is 1 or 2, depending on which slot is plugged. (Only applicable when 2-slot CPU backplane module is used)
5. Default Account Name: moxa

   Default Password: moxa

## INFORMATION

Type in the IP address (if the IP address is not set by default). If the IP address is not available, use the IINxpress 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.

When you log into the system successfully, you will see the product page is composed of three parts.




1. **Title panel:** Provides the log out function. The login account will be shown at the top right corner.
2. **Menu panel:** Provides the access monitor the device status to configure functions or services.
3. **Information panel:** The device information associated with the functions selected in the menu panel.

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

# Dashboard

## System Dashboard

System Dashboard is the first page when you log in the device. The dashboard provides information about the module information, panel status, service status, protocol status, and IEC 61131-3 program status.

On the top of the system dashboard, the system combination will be displayed. Select the Control Unit, Expansion Unit 1, etc. to check the system combination of each unit.


On the bottom of the system dashboard, the information will be displayed.

### System Information

The system information will be displayed here. For example, device name, system status, Ethernet status, time status, etc.

### Module Information

The information of the selected module will be displayed here. For example, model name, firmware version, serial number, etc.

> **NOTE**
>
> For detailed information on the switch module, check in the built-in web of the switch module.

### LED Status

The LED status of all modules will be displayed here. For the LED definition, refer to the LED definition section.

> **NOTE**
>
> For the LED status of the switch module, check in the built-in web of switch module.

### Mode Switch Status

The mode switch status will be displayed here. There are three statuses of mode switch.

**Remote:** The device is allowed to download the program and change the device setting remotely. An authorized user with secure access is required.

**Run:** The device is actively running the program. It rejects any attempt to download the program or change the device settings. The device information is set to read only.

**Stop:** The device will not execute the program in any condition. The authorized user is allowed to download the program and change the device setting.

### Protocol Status

The status of all protocol services will be displayed here. There are three statuses.

**Run:** the service is running.

**Stop:** the service is stopped.

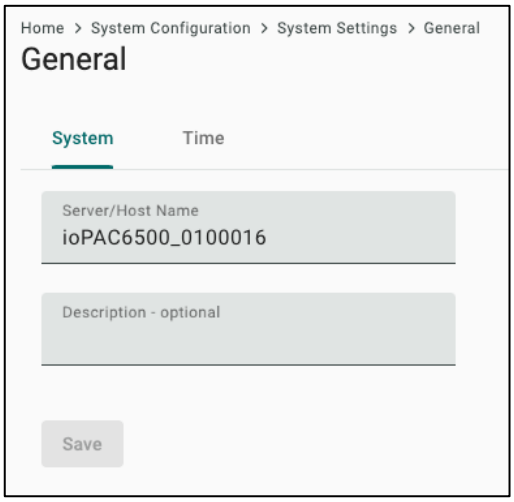
**Disable:** the service is currently disabled.

### IEC 61131-3 Program Status

The IEC engine status will be displayed here. **RUN** and **STOP** are two statuses for you to identify if the engine is running or not.

# System Configuration

## System Settings—General

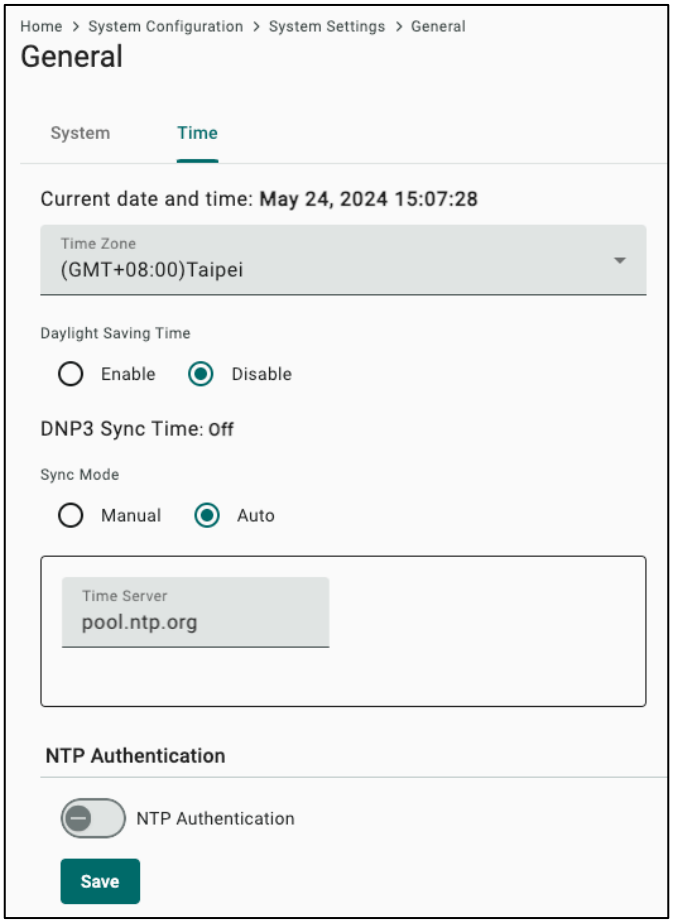



Go to **System Settings > General > System** to specify a new device name and enter a description for the device.

**Device Name:** Set enter a name to identify the whole ioPAC 6500 system. The maximum length is 64 characteristics, alphanumeric, and special characteristics are allowed.

**Description:** Extra information for you to better identify the device.

Go to **System Settings > General > Time** to set up the time of the device.

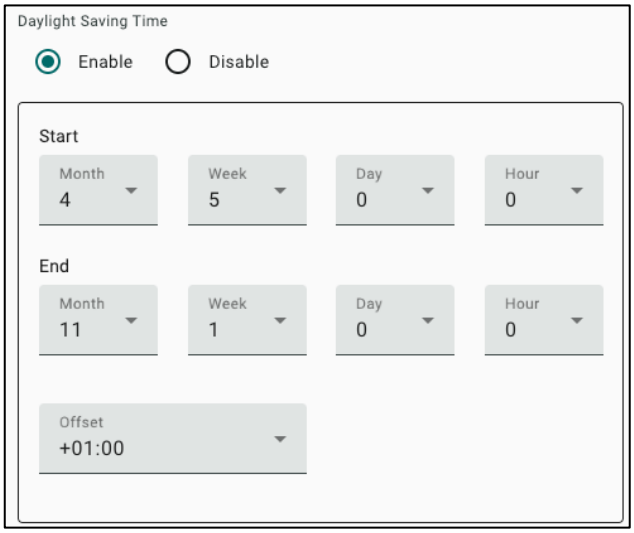



The current data and time will be displayed here.

## NOTE

The current date and time are based on the system setting.

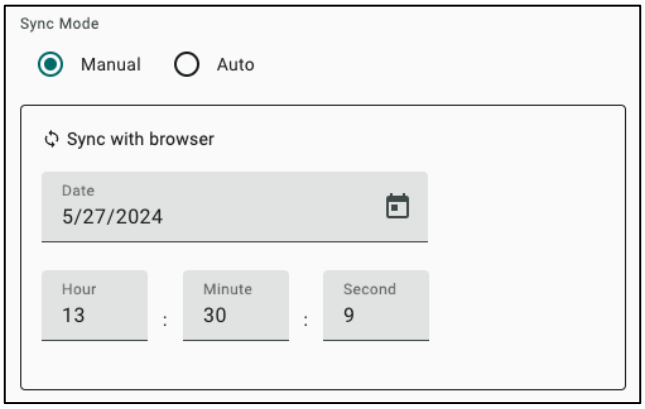
**Time Zone:** Specify the time zone where the devices is located.



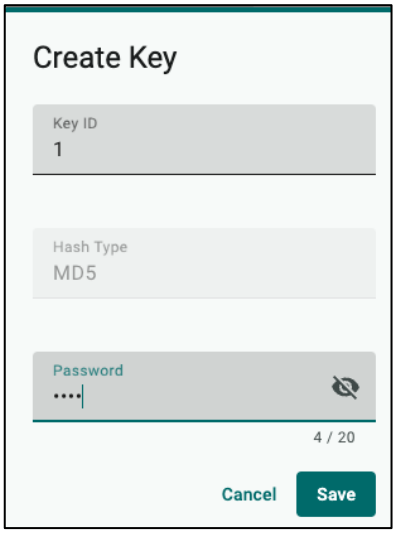

**Daylight Saving Time:** Enable and enter the daylight-saving time of the device.

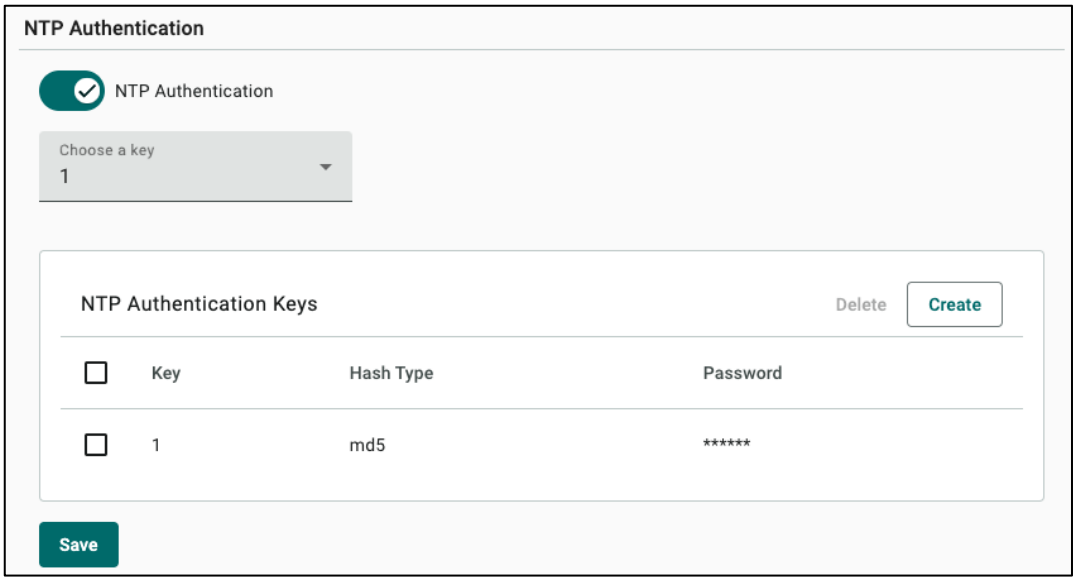
## NOTE

0 to 6 in Day represents Sunday to Saturday, respectively.




**Sync Mode:** How to sync up the device time. In **Auto** mode, the device will sync with the time server you specified automatically. In Manual mode, select Sync with browser icon to sync with the browser, or input a specific time.

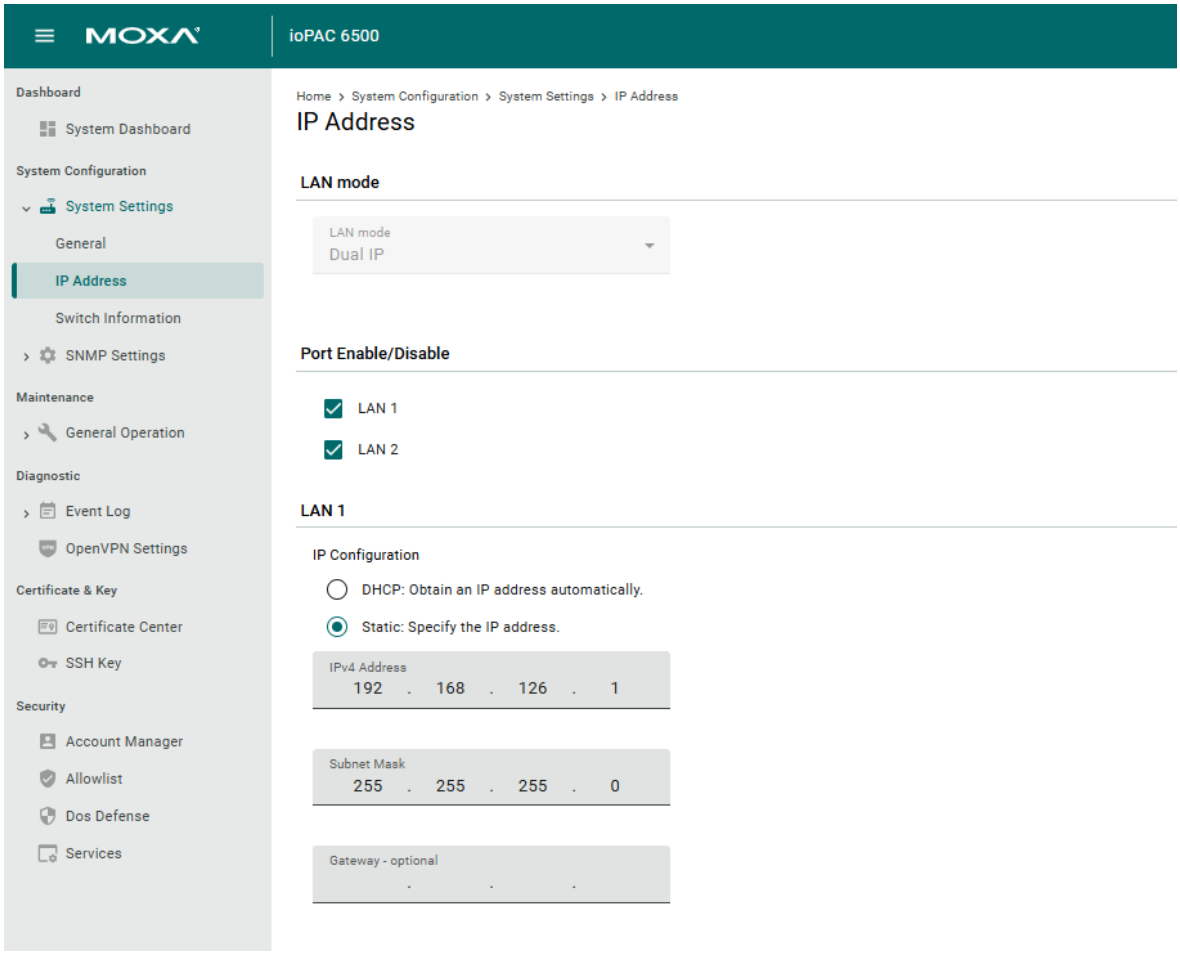


**NTP Authentication:** The device supports NTP Authentication for a secured connection between NTP servers. If you want to use the NTP authentication, follow the steps to enable the NTP authentication.

1. Select **Create**, enter the key ID and password in the pop out window, and then **Save** to close the window.
2. Choose the created key, then **Save** to enable the NTP Authentication.

## System Settings—IP Address



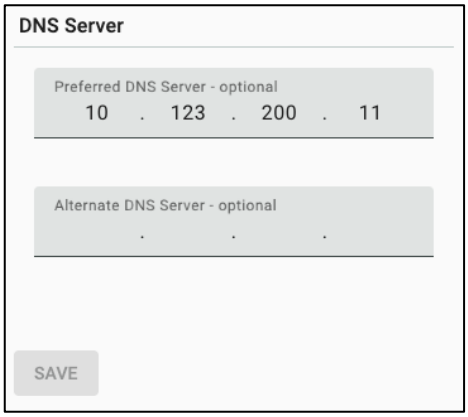

Go to **System Settings > IP Address** to set up the device IP.

**LAN mode:** The device supports **Dual IP** mode currently.

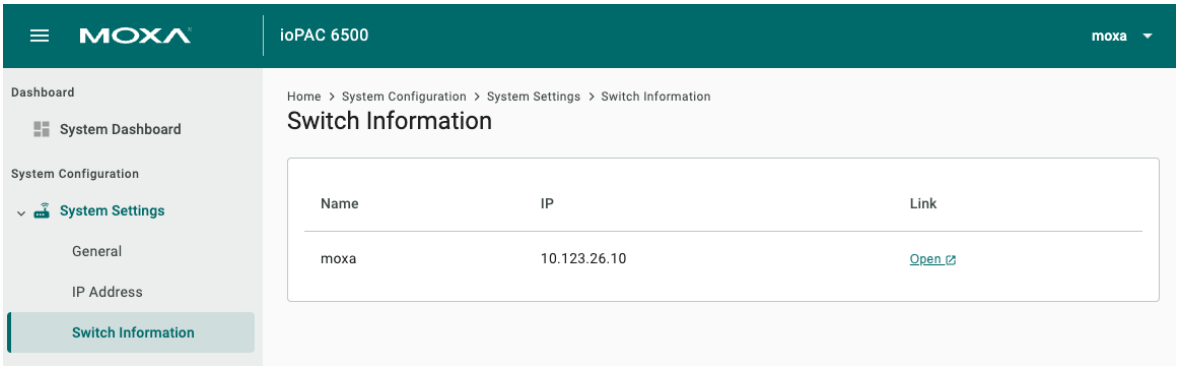
**Port Enable/Disable:** Enable or disable port by selecting LAN1 or LAN2

**LAN1/LAN2:** Set up the IP for LAN1 or LAN2. The device supports **DHCP** or **Static** mode.

**DNS Server:** Need to input the DNS server.



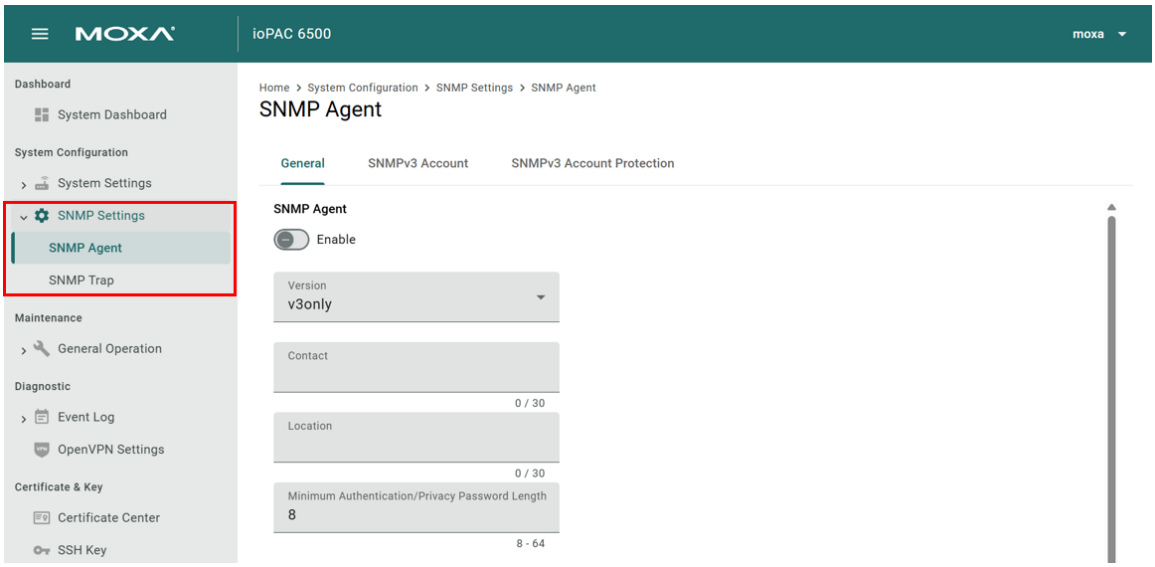

## System Settings—Switch Information




Go to **System Settings > Switch Information** to check the switch information. If any switch module is installed in the system, the IP information will be displayed here. For the switch module setup, select Open and set up in the web of the switch module.

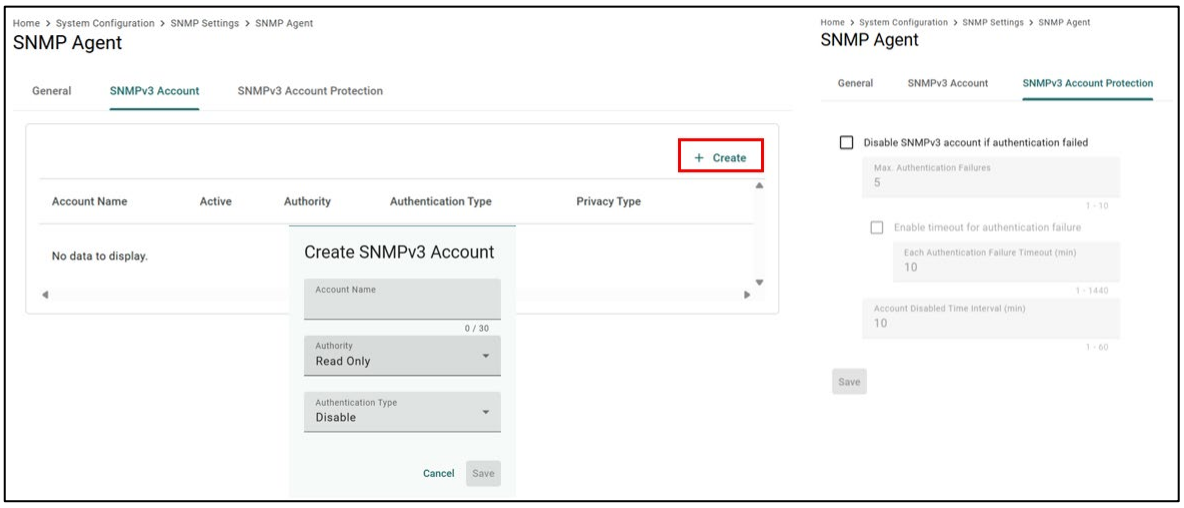
## SNMP Settings

**SNMP Agent:** The SNMP agent continuously gathers information about the device. When an SNMP manager sends a request, the agent responds with the requested data. **Versions: v1v2c, v3only, v1v2cv3**.

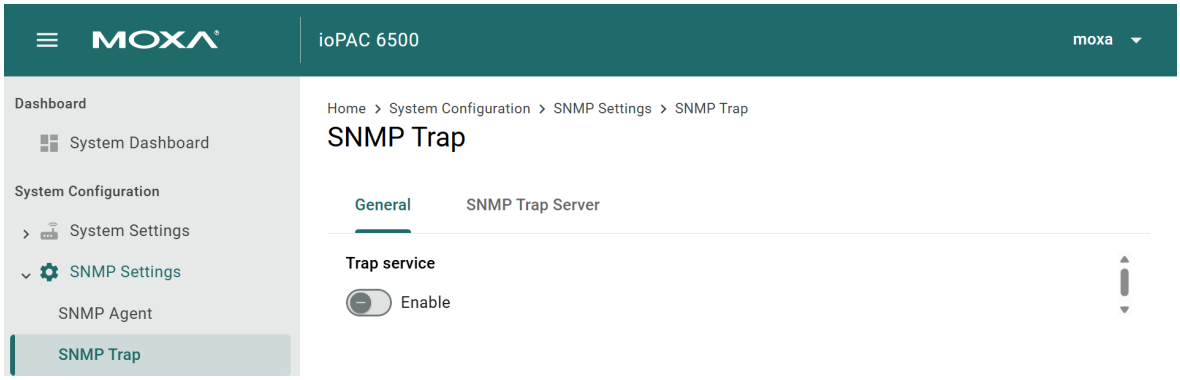


## SNMPv3 Account and Account Protection

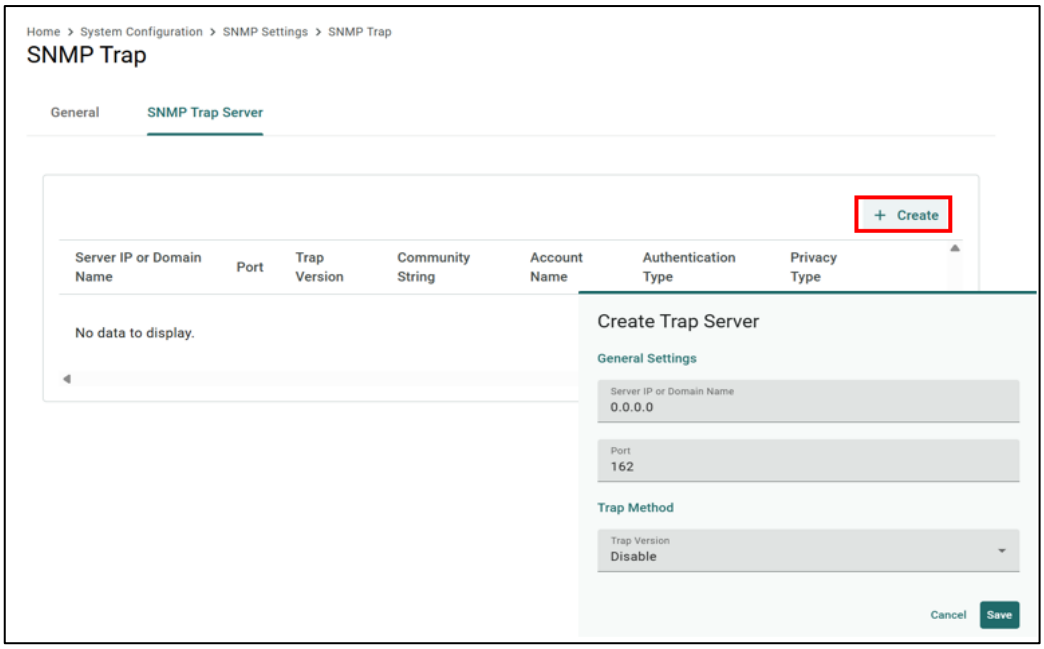
Click “Create” to configure the SNMPv3 Account and you could decide whether to disable the SNMPv3 Account if authentication failed.




**SNMP Trap:** The agent proactively sends a notification to the server without waiting for a request, should a critical event occur.

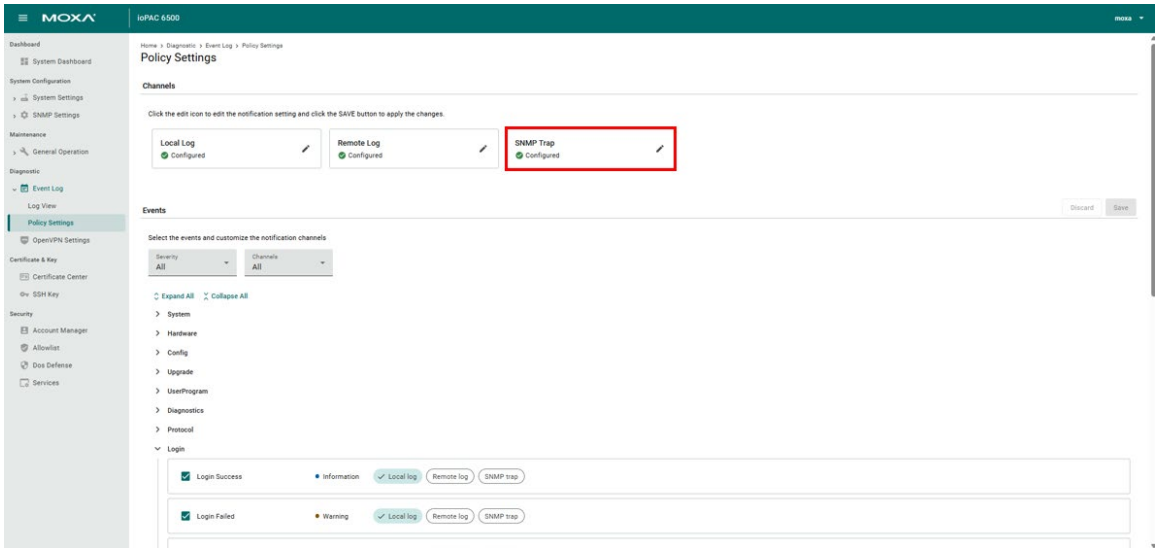



Click “Create” to configure the Trap Server.



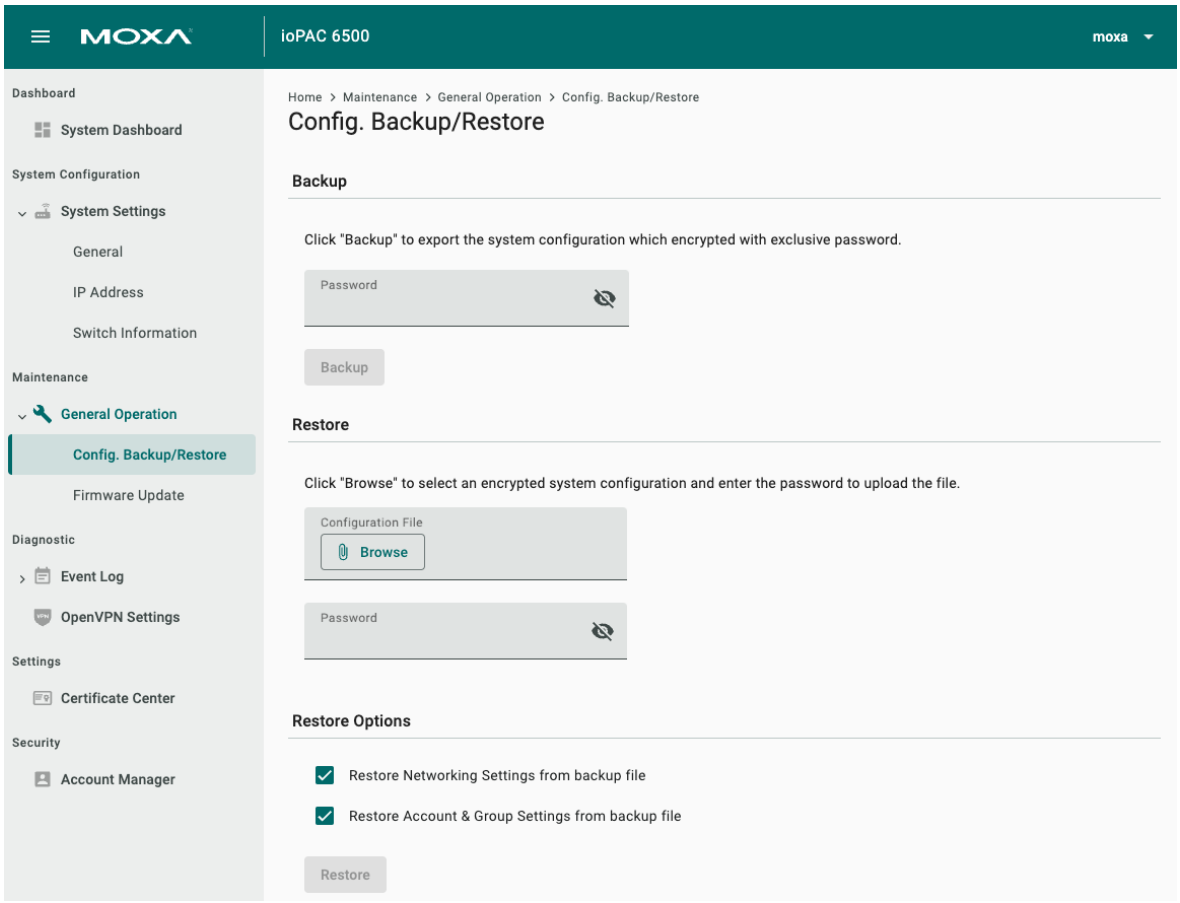
## NOTE

Events could also be sent via SNMP Trap. See **Event Log - Policy Settings.**




# Maintenance

## General Operation—Config. Backup/Restore

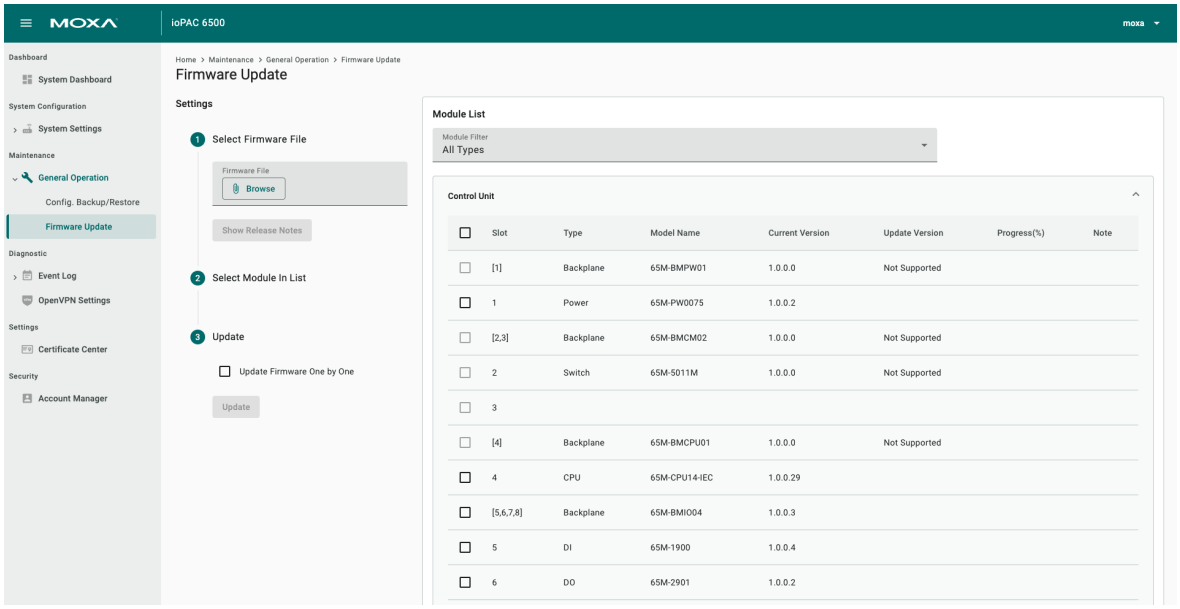



Go to **General Operation > Config. Backup/Restore** to back up the system settings to the encrypted configuration file or restore the system settings from an encrypted configuration file.

**Backup:** Input a password first, then select **Backup** to save the configuration file which is encrypted with the password specified by you. The maximum length of password is 40 characteristics, alphanumeric, and special characteristics are allowed.

**Restore:** Restore the system with an encrypted configuration file. Select **Browse** to choose the file and input the password. You can choose to restore the networking, account, and group setting from the backup file by selecting the checkbox or not. Once all the information is ready, select the **Restore** to restore the system.

## General Operation—Firmware Update




Go to **General Operation > Firmware Update** to update the firmware to the system. The page provides three steps to guide you in updating the firmware.

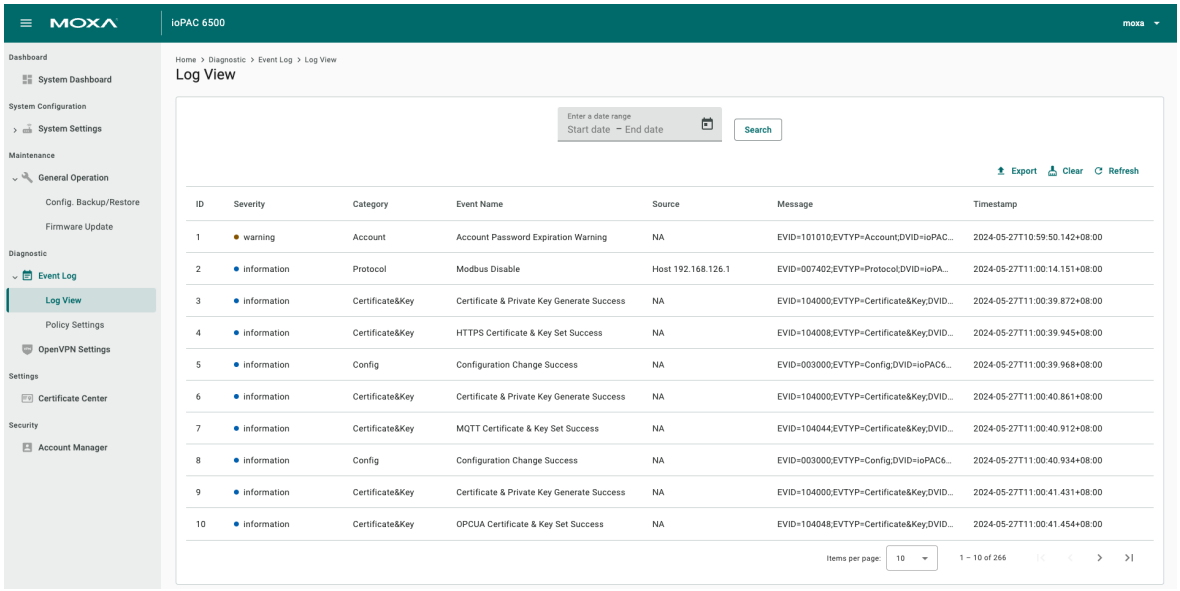
1. **Select Firmware File:** Select **Browse** to choose the firmware file that needs to be updated to the system. Select the release note to check the details.
2. **Select Module on List:** Select the modules that need to be updated on the **Module List**. Use the module filter to speed up the module selection. Module information will be displayed in the module list.
   - **Slot:** It shows the slot that the module is installed in. The slot number is calculated based on the current system combination. The number 1 shows the leftmost module of each unit. The slot of the backplane module will be displayed with a number in square brackets, e.g., [1].
   - **Type:** It shows the module type. E.g. CPU, DI, Backplane, etc.
   - **Model Name:** The model name of the module will be displayed here.
   - **Current Version:** Current firmware version of the module will be displayed here.
   - **Update Version:** The firmware version included in this firmware file will be displayed here.

> **NOTE**
>
> Update the switch module's firmware on the web page of the switch module.

   - **Progress(%):** The progress of the update will be here
   - **Note:** Any other information that cannot be categorized will be displayed here.
3. **Update:** Select **Update** to start the system firmware update. Choose **Update Firmware One by One** to update the firmware module by module.

# Diagnostic

## Event Log—Log View

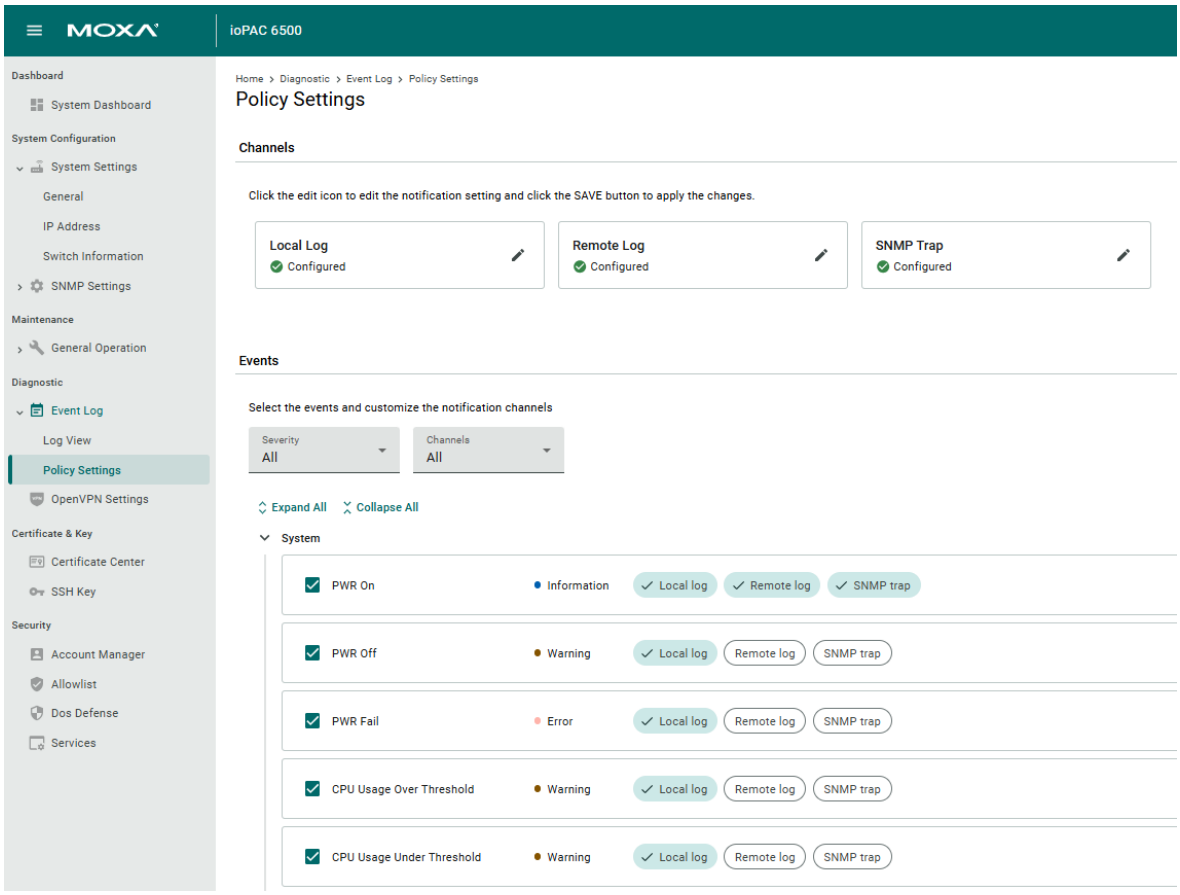



Go to **Event Log > Log View** to check all logs generated by the system. The following information of the logs will be displayed in the table.

- **ID:** The orders of the logs in the list
- **Severity:** The severity of the event; three severities (alert, warning, information).
- **Category:** The category from which the log is generated. Check the categories in the Policy Settings page.
- **Event Name:** Event name shows why the log was generated.
- **Source:** If the log is generated by an external source, the information will be displayed here.
- **Message:** The message included in the log.
- **Timestamp:** When the log is generated.

**Export**, **Clear**, and **Refresh** the log list based on the requirement.

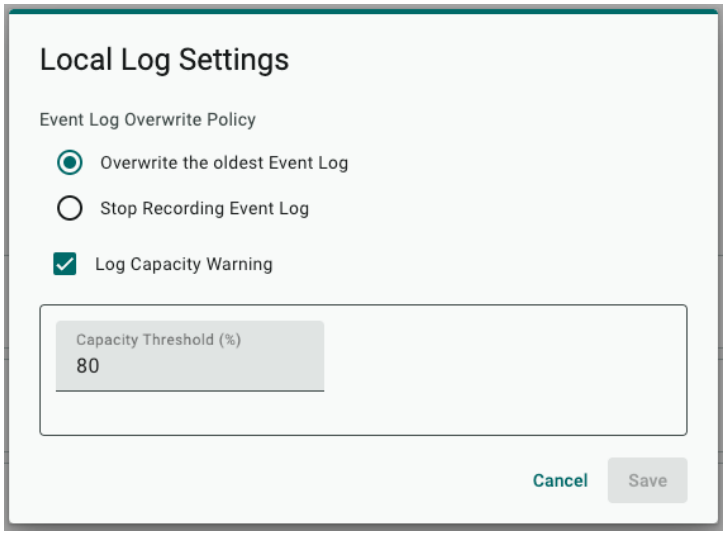
# Event Log—Policy Settings



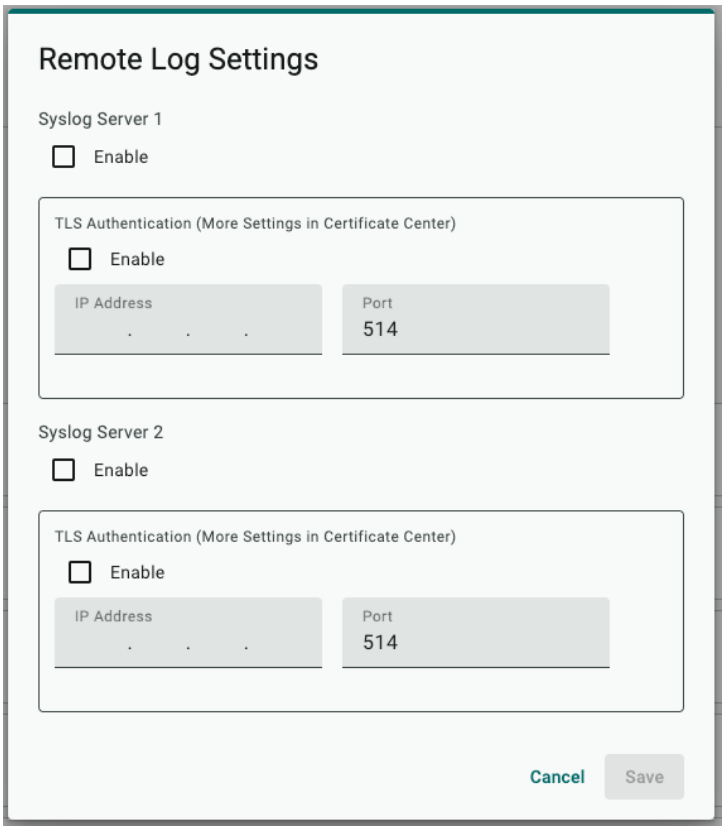

Go to **Event Log > Policy Settings** to check the policy settings of the log.

The log will be stored locally as the default. The modification can be done in the **Channels**.

**Local Log:** Select the ✎ to change the settings. **Event Log Overwrite Policy** and **Log Capacity Warning** can be configured.

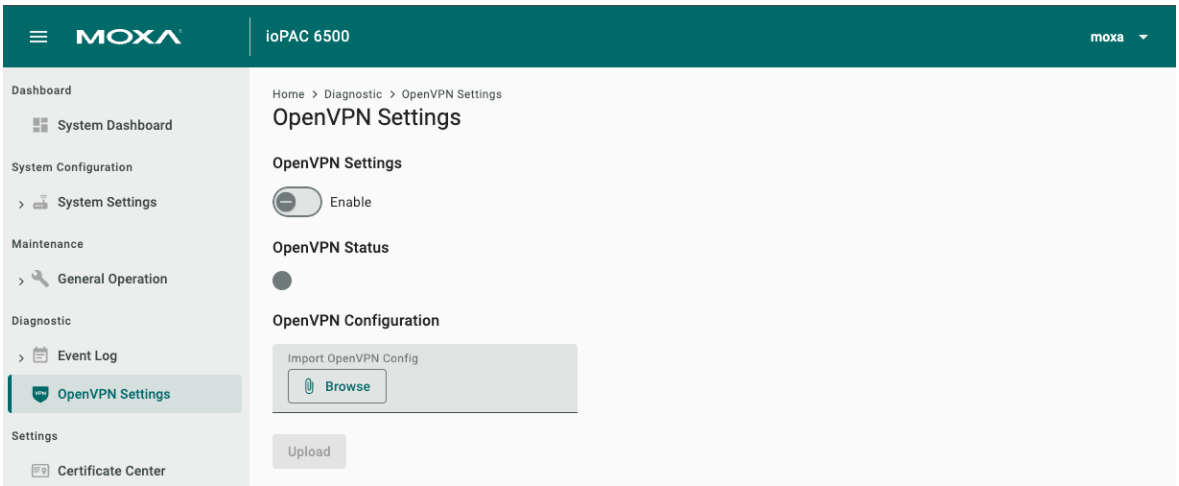


**Remote Log:** Select the ✎ to change the settings. The system supports two syslog servers and can deliver the log to two syslog servers simultaneously. Enable the server and key in the IP to activate the syslog server. The system supports TLS authentication. Remember to complete the settings in the **Certificate Center**.




The logs supported by systems are listed in the **Events** section. The events are enabled and stored locally in default. Change the logs based on the application.

## OpenVPN Settings

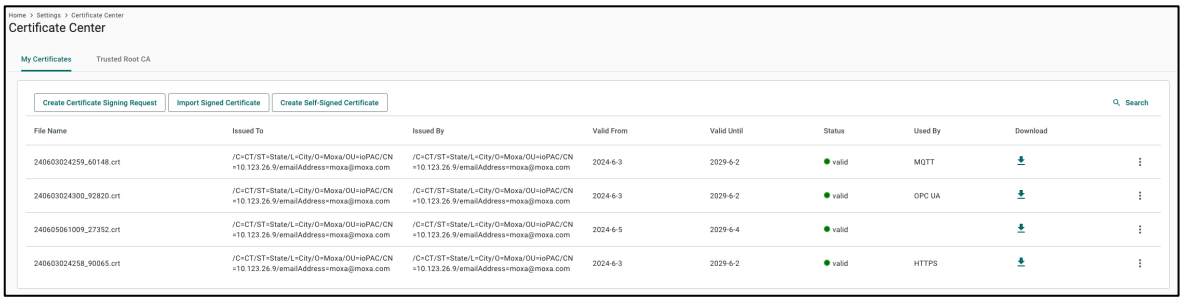



Go to **OpenVPN Settings** to configure the OpenVPN settings. Follow the steps to enable the OpenVPN

1. Import the OpenVPN config file. The file is generated in an OpenVPN server.
2. Enable the OpenVPN.
3. If connected successfully, the status will become Green.

# Certificate

## Certificate Center



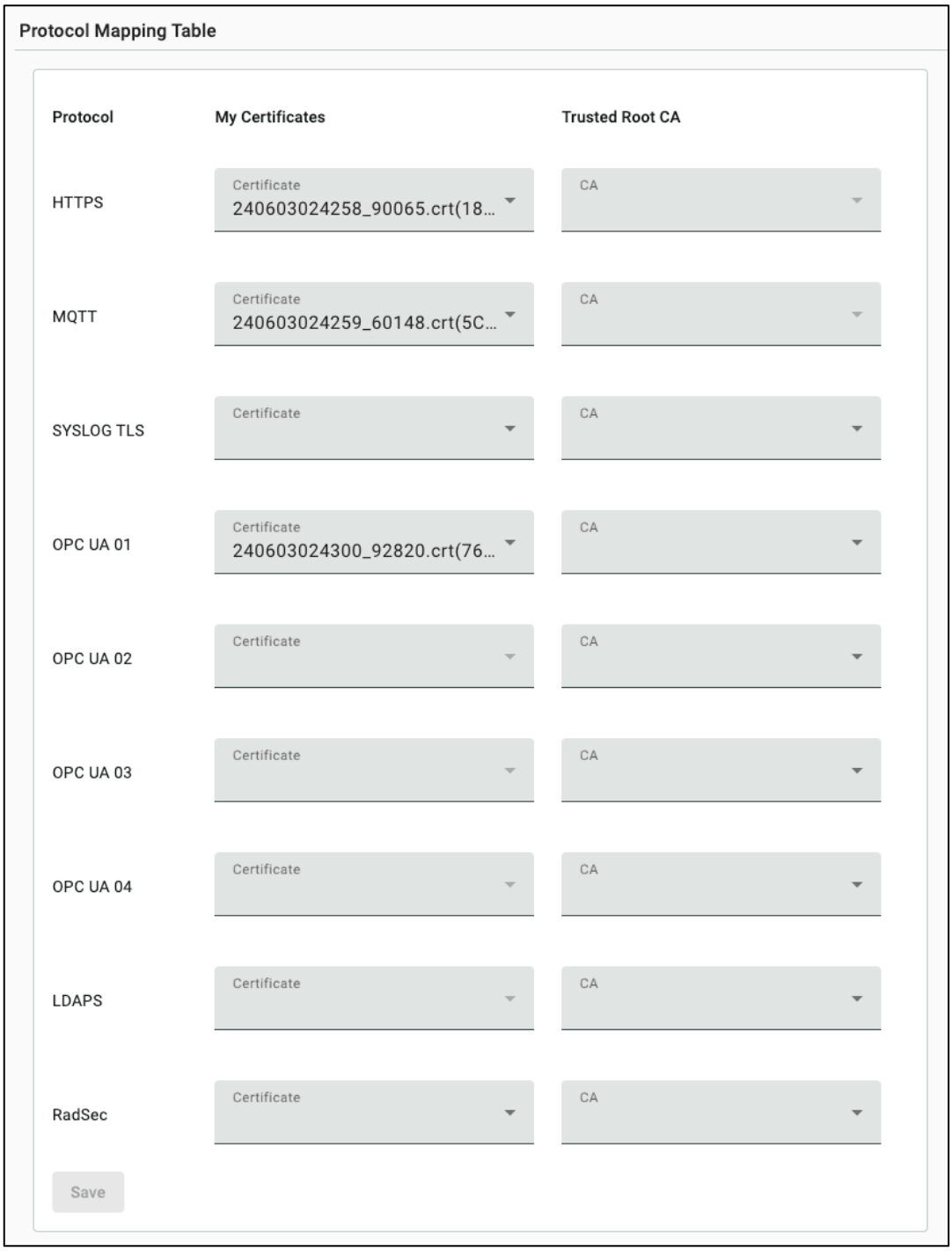

Go to **Certificate Center > My Certificates** to check the search, view the status, and download the system certificates.

**Create Certificate Signing Request:** This function will generate a .csr file based on current system status. Use the .csr file to obtain a signed certificate from Root CA.

**Import Signed Certificate:** The signed Certificate generated by Root CA in the previous step should be imported here.

**Create Self-signed Certificate:** If the Root CA is not available, the system also provides the self-signed certificate for you to download.

Go to **Certificate Center > Trusted Root CA** to import the certificate of the Trusted Root CA.

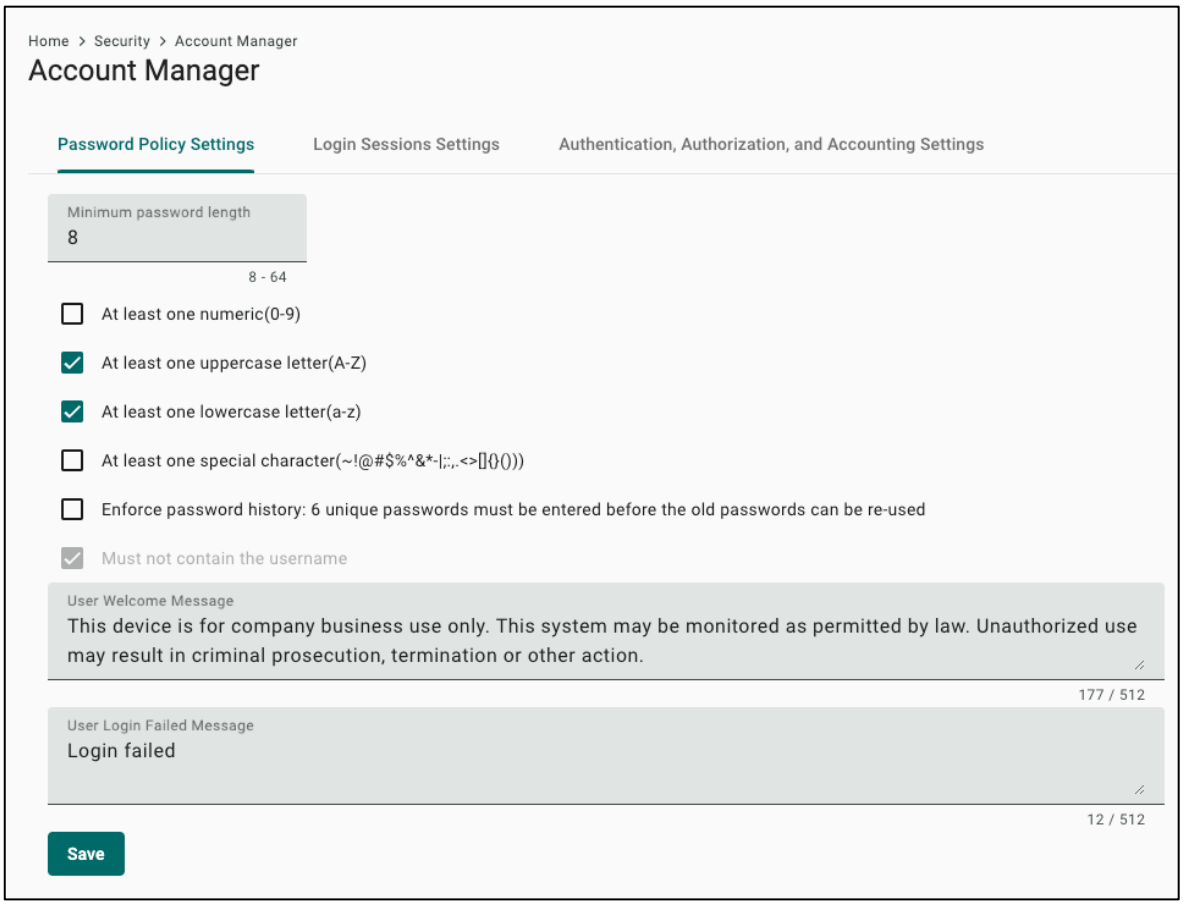



Go to **Certificate Center > Protocol Mapping Table** to link the saved My Certificates and Trusted Root CA to a protocol. Note that not all protocols need My Certificate and Trusted Root CA.

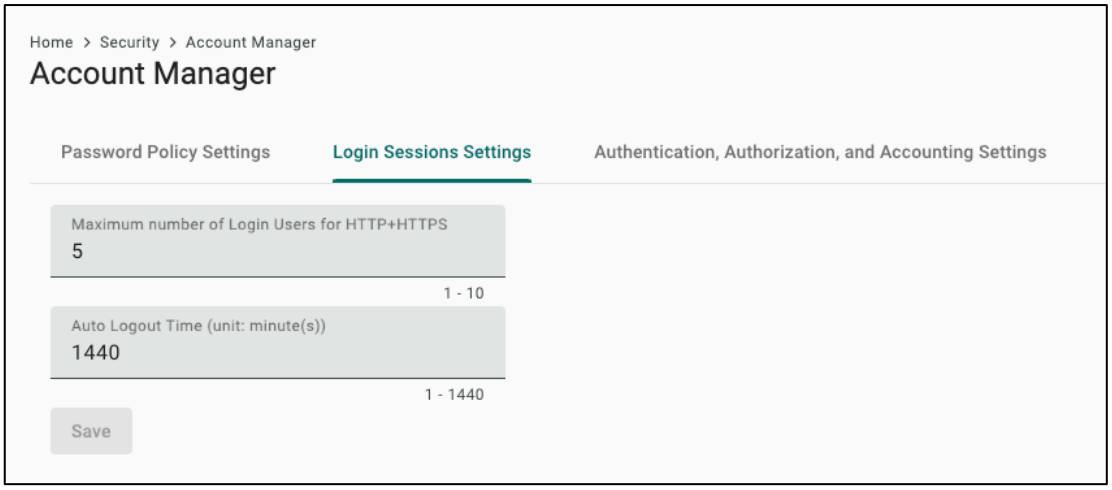
- Only My Certificate: HTTPS, MQTT
- Only Trusted Root CA: OPC UA 2/3/4, LDAPS, RadSec

# Security

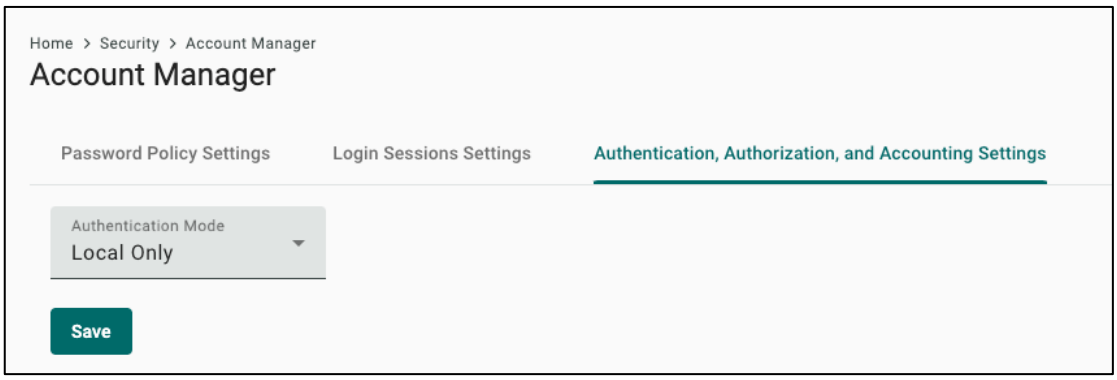
## Account Manager




Go to **Account Manager > Password Policy Settings** to set up the password policy of the device. The length, letter combination, and uniqueness of the password can be set up. Besides the password policy, change the welcome and login-failed message on this page.



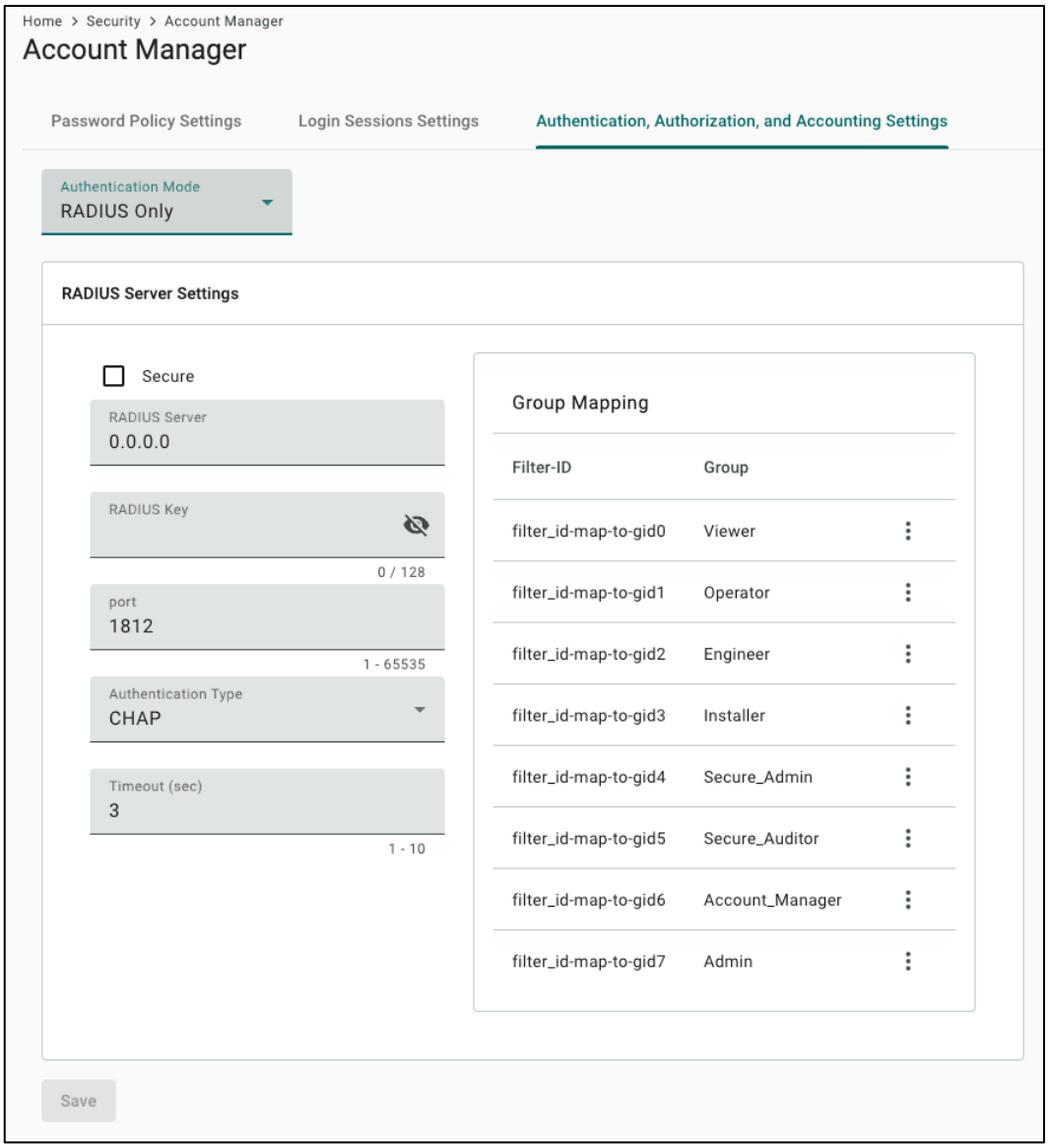

Go to **Account Manager > Login Session Settings** to set up the login sessions. The maximum connection and logout time.




Go to **Account Manager > Authentication, Authorization and Accounting Settings** to set up the AAA settings. Several authentication modes are available.

- **Local Only:** Use the accounts that have been set up in the system.
- **RADIUS Only:** Link to the RADIUS server to verify the login account.
- **TACACS+ Only:** Link to the TACACS+ server to verify the login account.
- **LDAP Only:** Link to the LDAP server to verify the login account.
- **RADIUS Then Local:** Link to the RADIUS server to verify the login account first. If a timeout happens, use the accounts set up in the system as an alternative.
- **TACACS+ Then Local:** Link to the TACACS+ server to verify the login account first. If a timeout happens, use the accounts set up in the system as an alternative.
- **LDAP Then Local:** Link to the LDAP server to verify the login account first. If a timeout happens, use the accounts set up in the system as an alternative.

## RADIUS Settings




The ioPAC 6500 supports RADIUS. Here are detailed descriptions of the RADIUS server settings:

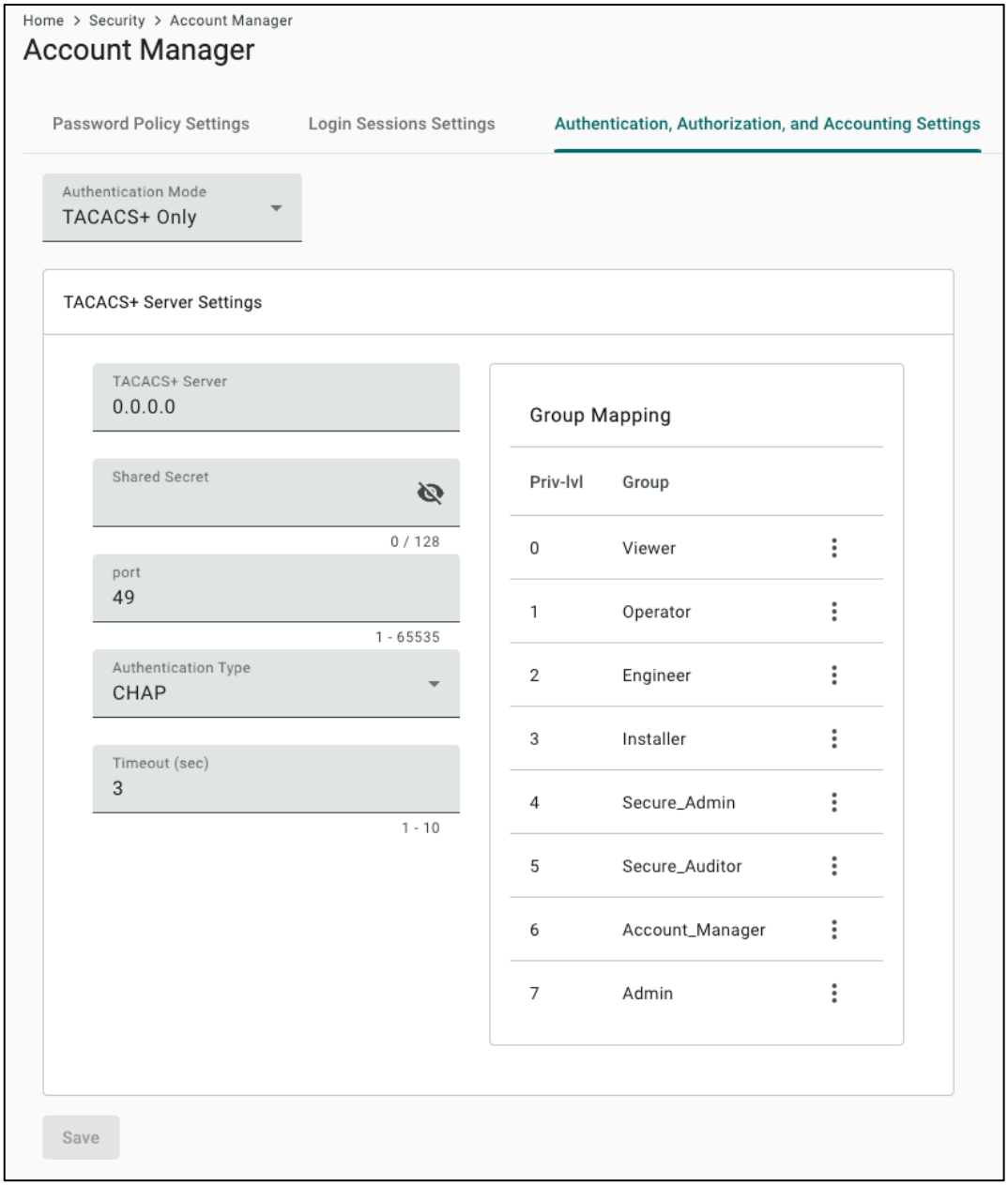
- **Secure:** Enabling the system to communicate encrypted data with the RADIUS server. The certificate will be specified in the Certificate Center.
- **RADIUS Server:** Input the IP of the RADIUS server here.
- **RADIUS Key:** Input the key of the RADIUS server here.
- **Port:** The port that communicates with the RADIUS server.
- **Authentication Type:** The authentication type used in the RADIUS server. The ioPAC 6500 supports PAP, CHAP, MSCHAP, and EAP-MD5, offering a total of four authentication types.
- **Timeout:** How long the ioPAC 6500 will wait for the response from the RADIUS server.
- **Group Mapping:** It listed the Filter-ID and Group mapping in the ioPAC 6500 system. The current groups will be displayed here. The table shows the authority of each default group of users.

### NOTE

1. The ioPAC 6500 system supports a maximum of 16 groups, eight are default and another eight are user-defined.
2. The group's modification should be done in IINxpress.

| Group | Monitor and Diagnostic | Operational Activities | Configu-ration | IEC Code | System Log | Security Configu-ration and Secure Log | Upgrade and Rollback | Account Management |
|---|---|---|---|---|---|---|---|---|
| Viewer | R | R | | R | R | | | |
| Operator | R | R/W | | R/W | R | | | |
| Engineer | R/W | R/W | R/W | R/W | R | | | |
| Installer | R/W | R | R/W | R/W | R | R | R/W | |
| Secure Admin | R/W | R | R/W | R | R/W | R/W | R/W | R/W |
| Secure Auditor | R | R | R | | R | R | | R |
| Account Manager | R | | | | | R/W | | R/W |
| Admin | R/W | R/W | R/W | R/W | R/W | R/W | R/W | R/W |

## TACACS+ Settings



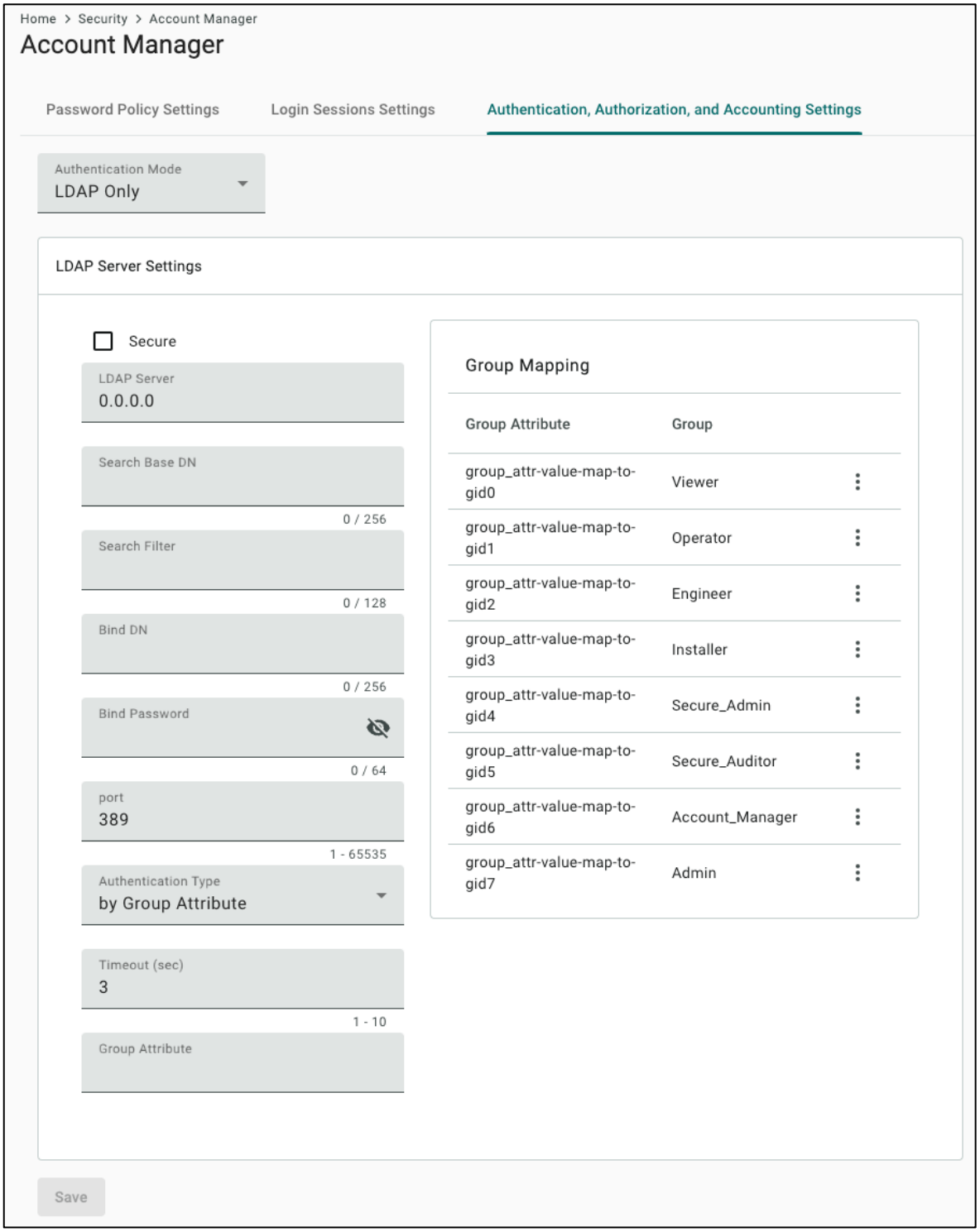

The ioPAC 6500 supports TACACS+. Here are detailed descriptions of the TACACS+ server settings:

- **TACACS+ Server:** Input the IP of TACACS+ server here.
- **Shared Secret:** Input the key of TACACS+ server here.
- **Port:** The port used to communicate with the TACACS+ server.
- **Authentication Type:** The authentication type used in the TACACS+ server. The ioPAC 6500 supports PAP, CHAP, ASCII, three authentication types in total.
- **Timeout:** How long the ioPAC 6500 will wait for the response from the TACACS+ server.
- **Group Mapping:** The privilege level and group mapping in the ioPAC 6500 system. The current groups will be displayed here. The authority of each default group of users is the same as RADIUS.

### NOTE

1. The ioPAC 6500 system supports a maximum of 16 groups; eight are default and another eight are user-defined.
2. The group modification should be done in IINxpress.

## LDAP Settings



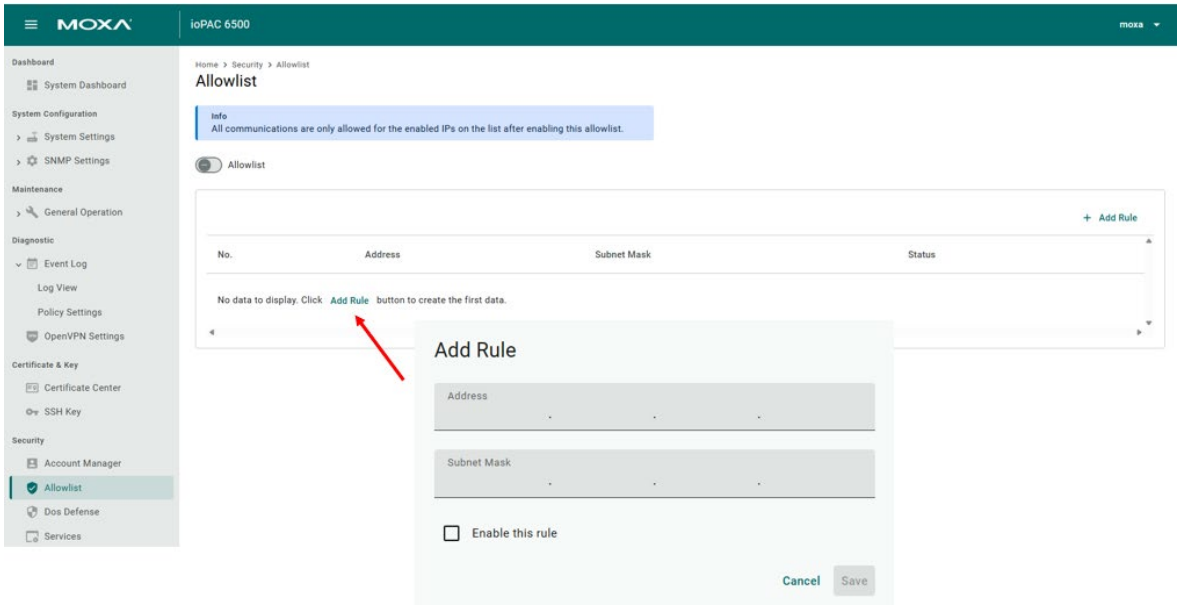

The ioPAC 6500 supports LDAP. Here are the detailed descriptions of the LDAP server settings:

- **Secure:** Enabling the system to communicate encrypted data with the LDAP server. The certificate will be specified in the Certificate Center.
- **LDAP Server:** Input the IP of LDAP server here.
- **Search Base DN:** The LDAP DN (Distinguished name) that serves as a starting point for the search for users over all child nodes.
- **Search Filter:** The LDAP search filter used for the search for users
- **Bind DN:** Enter the Distinguished Name of the user to search in the LDAP directory.

- **Port: T**he port used to communicate with the LDAP server.
- **Authentication Type:** The authentication type used in the server. The ioPAC 6500 supports Group Attributes and DN, two authentication types.
- **Timeout:** How long the ioPAC 6500 will wait for the response from the LDAP server.
- **Group Mapping:** Listing the Group Attributes and Group mapping in the ioPAC 6500 system. The systems consist of eight groups. The authority of each group of users is the same as RADIUS.

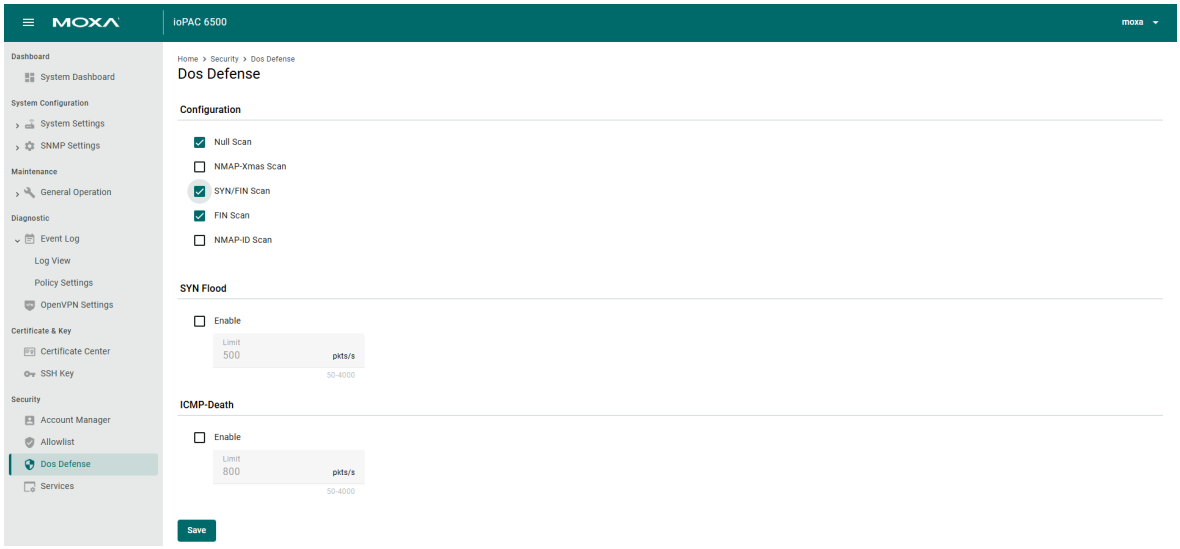
## Allowlist

All communications are only allowed for the enabled IPs on the list after enabling this allowlist. Select **Add Rule** to edit the IP and subnet mask.




## DoS Defense

This section configures protections against **Denial-of-Service attacks**, which are attempts to make a device or network service unavailable by overwhelming it with traffic.



### Configuration

| Items | Description |
|---|---|
| Null Scan | TCP scan with no flags set; used in stealth attacks to probe for open ports |
| NMAP-Xmas Scan | TCP scan with FIN, URG, PSH flags; used to bypass simple detection methods |
| SYN/FIN Scan | Sends TCP packets with both SYN and FIN flags set; non-standard combination |
| FIN Scan | Sends TCP packets with only the FIN flag; used for stealth port scanning |
| NMAP-ID Scan | Detects IP ID-based scans used in host discovery and fingerprinting |

### SYN Flood

When enabled, it activates protection against SYN flood attacks. The packet limit can be set from 50 to 4000.

### ICMP-Death

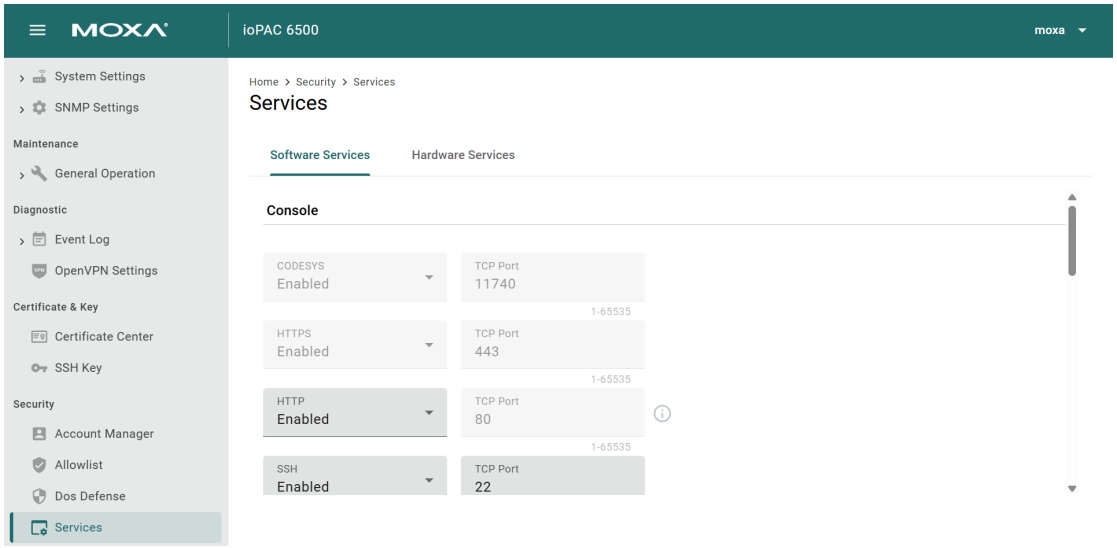
When enabled, it activates protection against ICMP flood attacks. The packet limit can be set from 50 to 4000.

## Services

This section allows you to supervise and configure the software and hardware services, including the service and its corresponding port.

**Software services:** Console, System, Industrial Data.

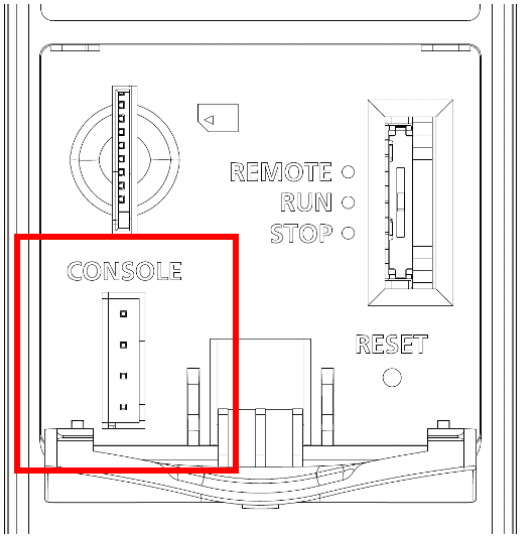
**Hardware services:** CPU module.



# Logging in by Console Port

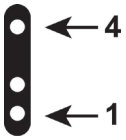
The ioPAC 6500 Series offers a serial console port, allowing you to reboot and reset to default. Followed the steps to use the console port.

**Step 1:** Open the cover on the CPU module to see the console port inside.




**Step 2:** Connect the 4-pin serial console cable to the console port. The following diagram shows the 4-pin serial connector and pin connections.

**Pin Assignment for the Serial Console Port**




| Pin | Definition |
|---|---|
| 1 | TxD |
| 2 | RxD |
| 3 | NC |
| 4 | GND |

**Serial Console Default Settings**

| Parameter | Value |
|---|---|
| Baudrate | 115200 bps |
| Parity | None |
| Data bits | 8 |
| Stop bits | 1 |
| Flow Control | None |

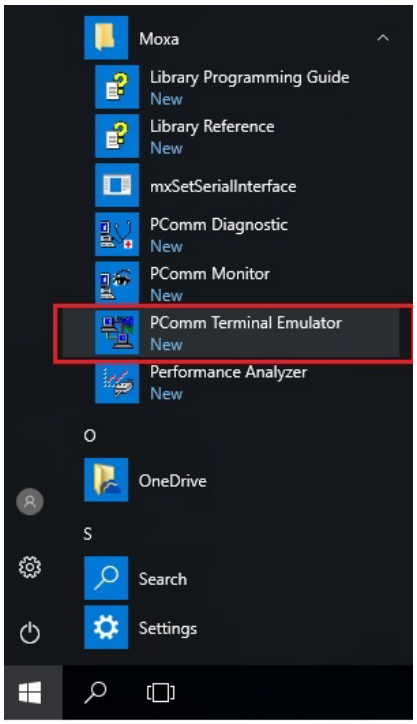
## NOTE

Contact the sales representative in your region for the console cable.

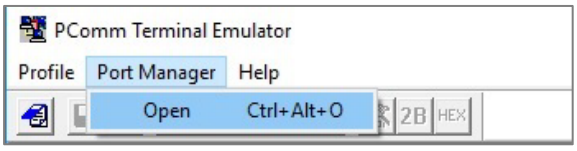
We recommend you use PComm Terminal Emulator for serial communication. Download the software free from Moxa's website.

After installing PComm Terminal Emulator, access the Moxa switch's console:

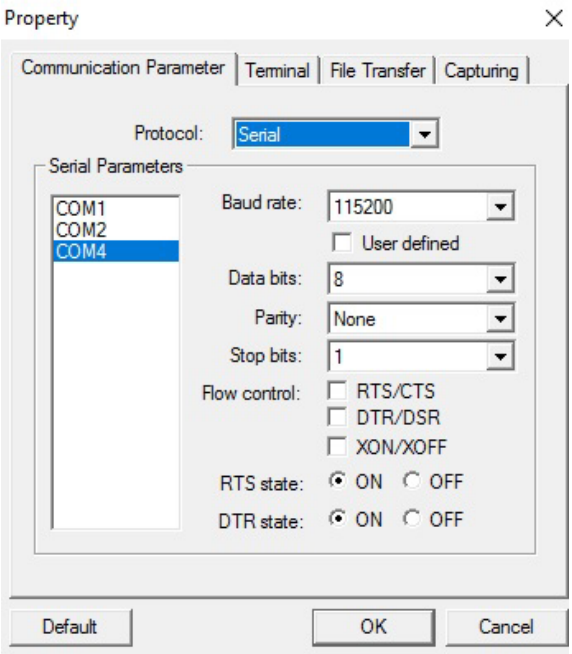
1. From the Windows desktop, select **Start > Moxa > PComm Terminal Emulator**.



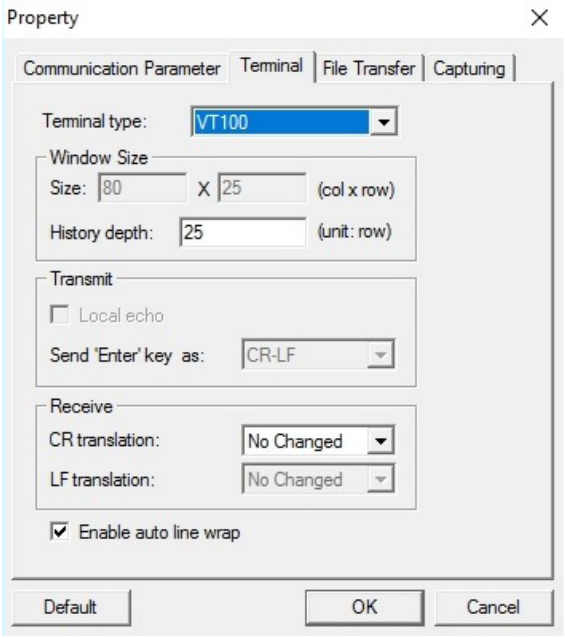

2. Select **Open** under the **Port Manager** menu to open a new connection.



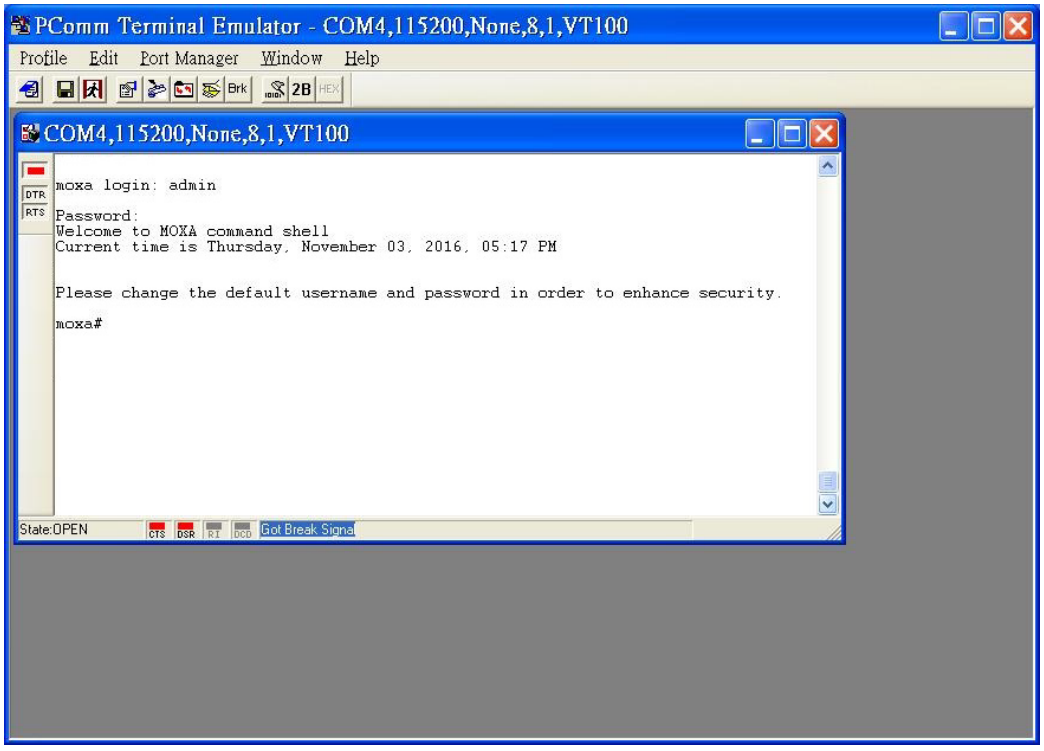

3. The **Property** window will open. On the **Communication Parameter** tab for **Ports**, select the COM port that is being used for the console connection. Set the other fields: **115200** for **Baud Rate**, **8** for **Data Bits**, **None** for **Parity**, and **1** for **Stop Bits**.



4. On the **Terminal** tab, select **VT100** for **Terminal Type**, and then select **OK** to continue.




5. The console will prompt you to log in. The default login name is **admin**, and the default password is **moxa**. This password will be required to access any of the consoles (web, serial, Telnet).




6. After successfully connecting to the switch by serial console, start configuring the switch's parameters by using command line instructions. Refer to the **Moxa Command-line Interface Manual** for details.

## NOTE

By default, the password assigned to the Moxa switch is **moxa**. Be sure to change the default password after you first log in to help keep your system secure.

# 5. IINxpress

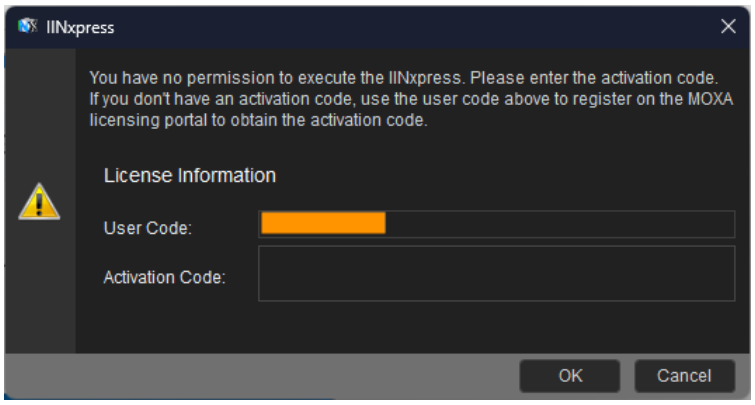
In this chapter, we introduce how to configure the ioPAC 6500 by IINxpress. IINxpress is a Moxa utility, which is the integrated development environment (IDE) software for the Moxa ioPAC 6500 Series. IINxpress provides easy access to all status information, ready-to-run service settings, and IEC 61131-3 programming ability. IINxpress requires a paid license, but it can be upgraded for free when future basic functions are available.

## NOTE

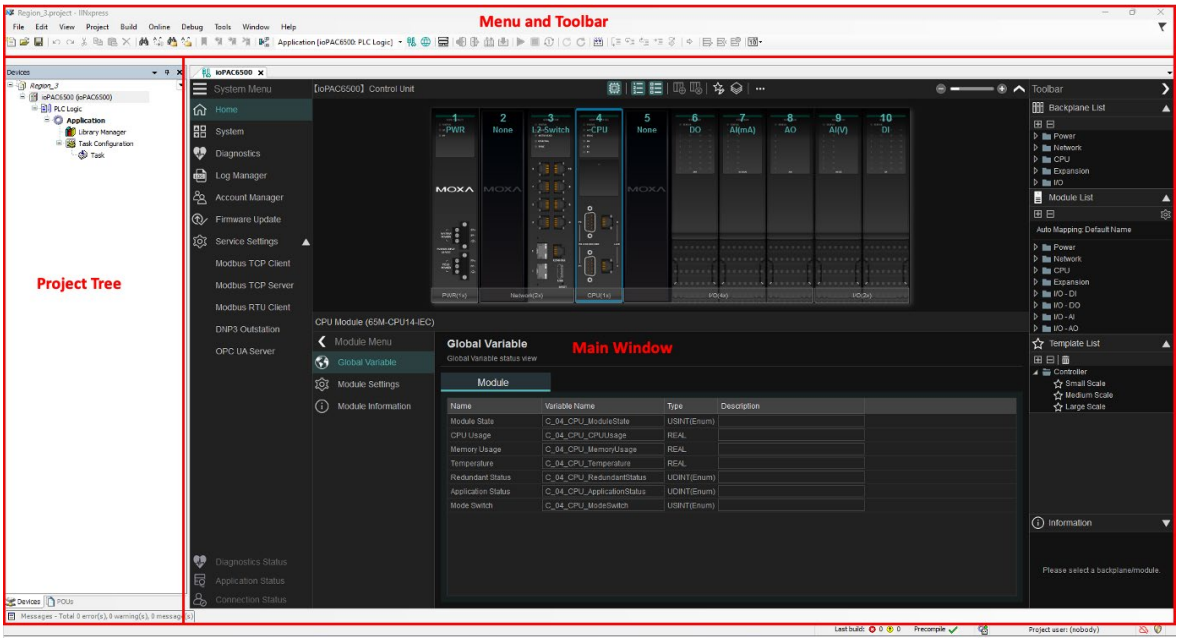
Avoid installing IINxpress on ARM-based CPUs. To ensure a smooth user experience, the recommended specifications are: x86-64 CPU (i5 or above), 8+ GB of RAM, and 256+ GB of storage and make sure enough storage is reserved for the project; project file size varies depending on the application.

## NOTE

Download the IINxpress software from Moxa's official website (https://www.moxa.com/) to do the installation. Once the installation is completed, the following window will appear to ask you to activate the IINxpress. The window will display a 21-digit encrypted user code. Use this code to register on the Moxa Licensing Portal (https://license.moxa.com/) and get an activation code. Then, activate IINxpress.



When IINxpress is launched successfully, you see the following windows. The IINxpress user interface can be divided into three blocks.




**Menu and Toolbar:** The settings related to the device can be found here.

**Project Tree:** The functions of the projects will be listed here hierarchical.

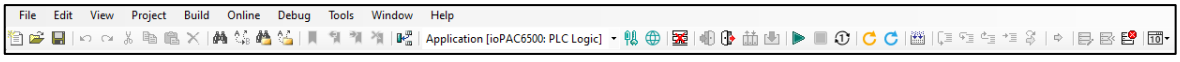
**Main window:** The detailed parameters of each function will be displayed here, switch between each function by the tab.

## NOTE

When logging in for the first time into IINxpress, follow the iinstructions in the **Build New Project** section to create a new project.

# Menu and Toolbar

IINxpress' menu and toolbar provide the functions for you to develop the program. We will now discuss functions related to the device's configuration and program execution.




**New Project:** Built a new project. Refer to the **Build New Project** section for details.

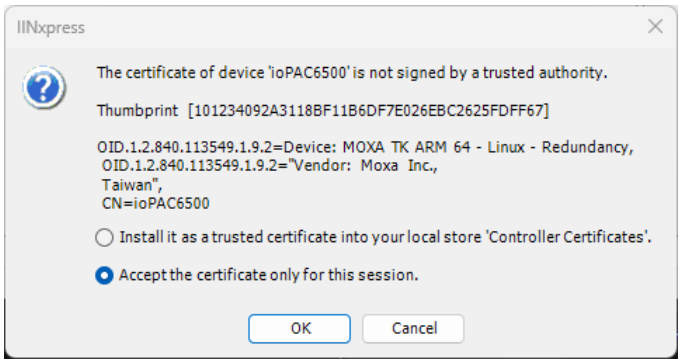
**Open project:** Opens an existing project.

**Device helper:** Provides the device scan, mapping functions, and performs some basic settings.

**Open ioPAC 6500 Configuration:** Opens the ioPAC 6500 configuration page where you configure all the device settings. Refer to the **ioPAC 6500 Configuration** section for details.

**Open ioPAC 6500 Web page:** Opens the ioPAC 6500 webpage where you configure IT-related device settings.

**Connect device:** Used to connect the ioPAC 6500 devices. When connecting the device for the first time, IINxpress will show the warning message about the certificate. Choose the preference option to **accept the certificate once** or **put the certificate into a local store**. The log-on window will show. Key in the username and password to log into the device. After a successful connection, monitor the real-time device status on the ioPAC 6500 Configuration page.




**Login application:** When you log in the application, you can control the device to run and stop the program remotely. Note: The mode switch should be switched to "REMOTE" to allow the control from the remote side.

**Logout application:** Logs out the application to close the remote control session.

**Online change:** You can use this command to initiate an online change on the current application. When this is done, CODESYS re-downloads only the changed parts of an application that is already running on the PLC.

**Download:** Downloads the compiled program to the device.

**Run:** Runs the program remotely.

**Stop:** Stops the program remotely.

**Single cycle:** Asks the device to run one cycle.

**Reset warm:** Resets the program with warm-start condition.

**Reset cold:** Resets the program with cold-start condition.

**Generate code:** Compiles the code on completing the program.

**Step over:** The command executes the statement where the program is currently located and stops before the next statement in the POU. For details, check **Help**.

**Step into:** The command executes the statement where the program is currently located and stops before the next statement. For details, check **Help**.

**Step out:** The command executes the program until the next return and stops afterwards. For details, check **Help**.

**Run to cursor:** The command executes a program until a specified position as marked by the cursor. For details, check **Help**.

**Set next statement:** The command determines which statement is executed next. For details, check **Help**.

**Show next statement:** The command displays the program statement that is processed in the next step. For details, check **Help**.

**Write values:** This command sets a predefined value to a variable on the controller once. For details, check **Help**.

**Force values:** The command sets a permanent predefined value to a variable on the controller. For details, check **Help**.

**Unforce values:** This command resets the forcing of all variables. The variables receive their current values from the PLC. For details, check **Help**.

**Display mode:** The value in the project is displayed in Binary, Decimal, and Hexadecimal.

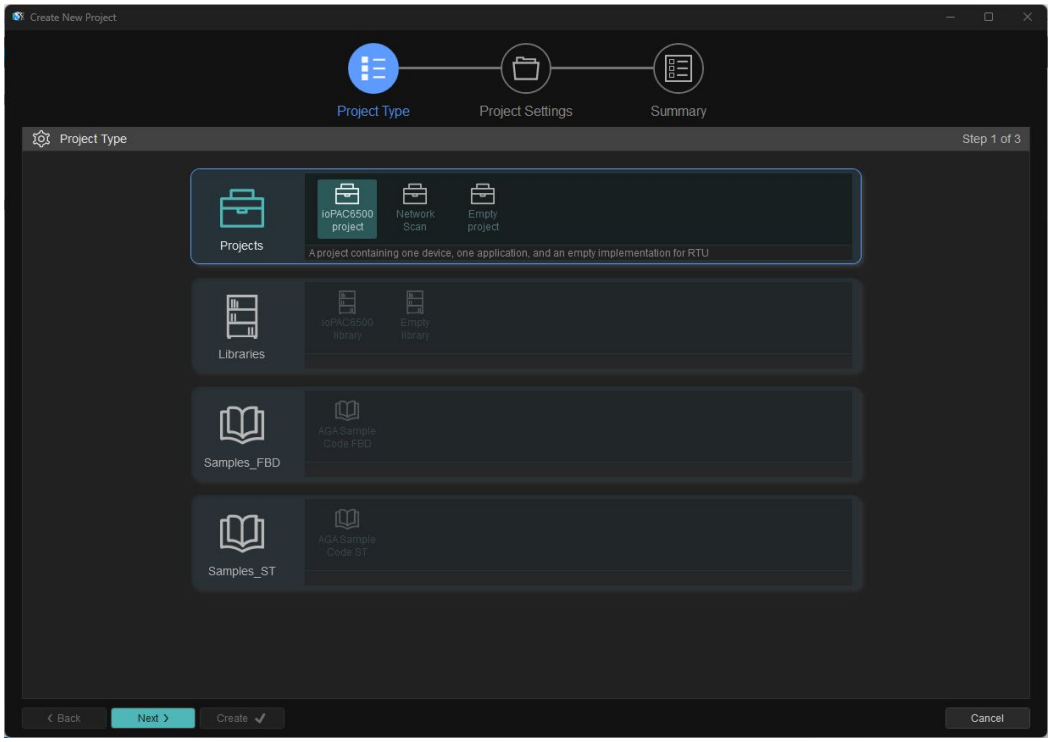
# Build New Project

Selecting the New project button allows you to select from three ways to create a new project.

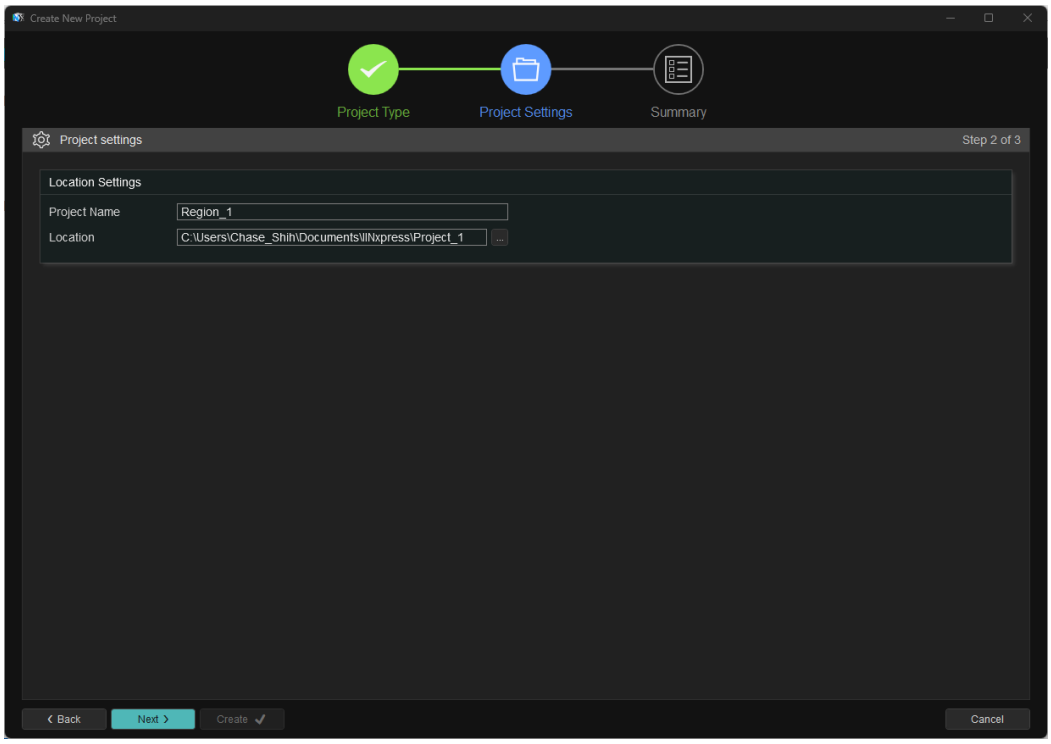
## ioPAC 6500 Project

If there are no ioPAC 6500 devices on hand, we suggest using this option to start a project.

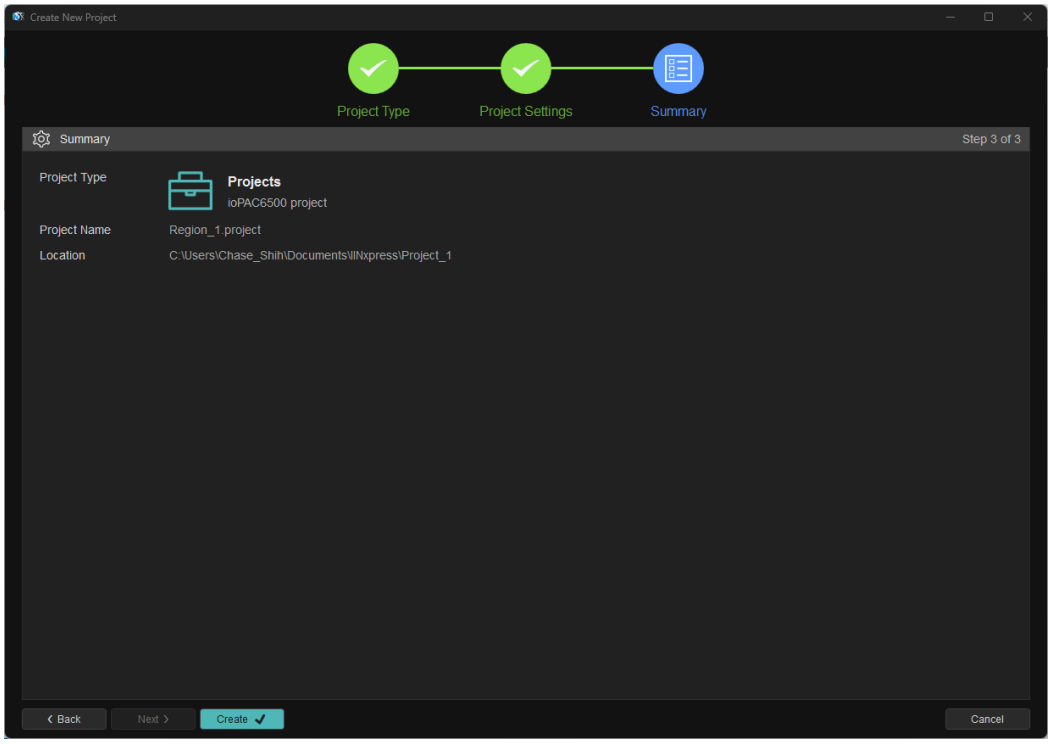
**Step 1:** Choose ioAPC 6500 Project icon and select **Next**.



**Step 2:** Specific a project name and assign a location. Customize a location by selecting  .



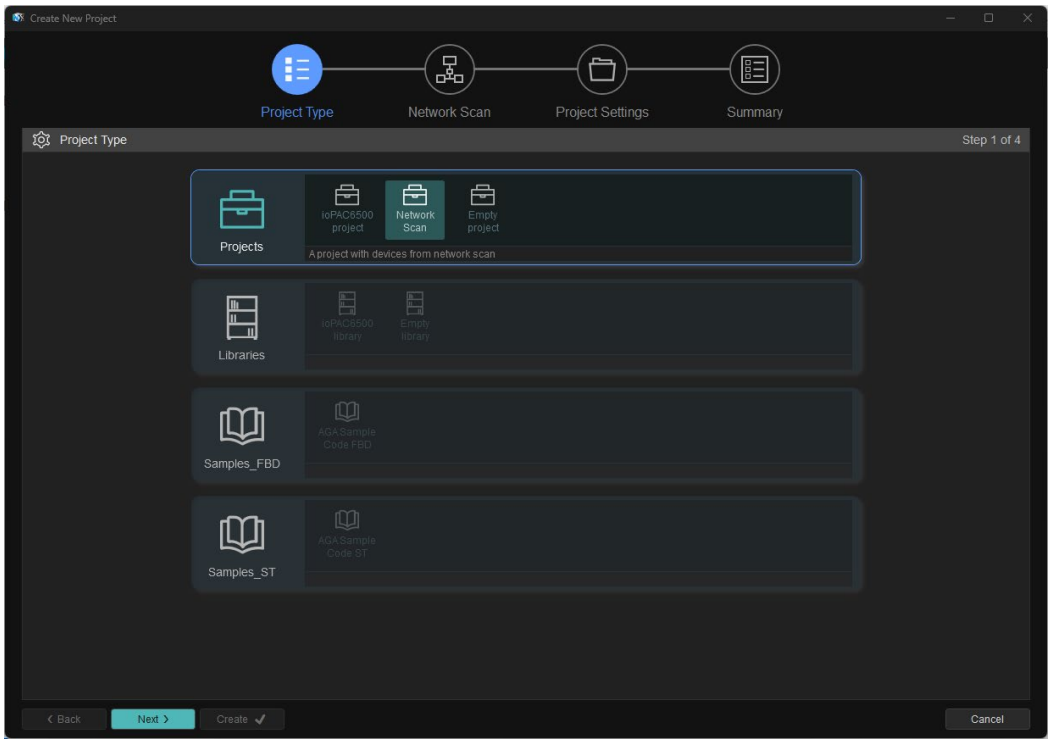

**Step 3:** Finally, review the project information, and then select **Create** to create a project.



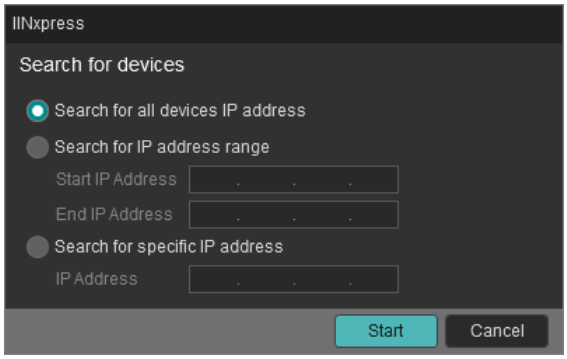
# Network Scan

When powering up the device and connecting it to the Ethernet, use the scan function to find the device.

**Step 1:** Choose Network Scan icon and select **Scan Network**.



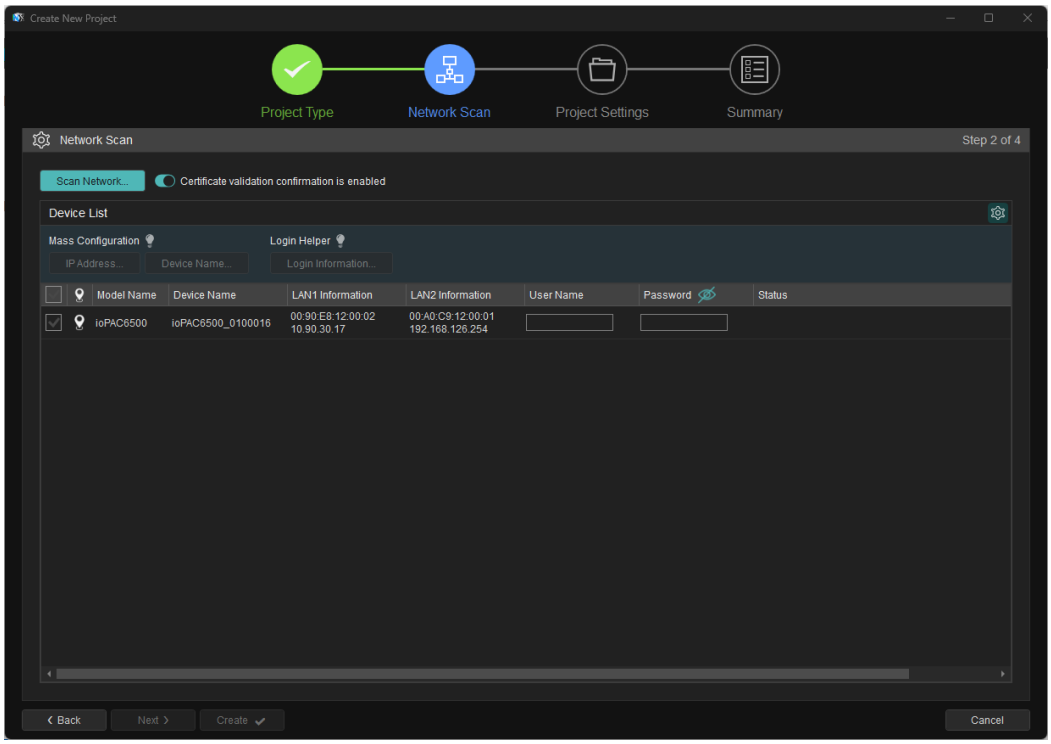

**Step 2:** Choose one from Scan all network, scan an IP range, and appoint a specific IP.



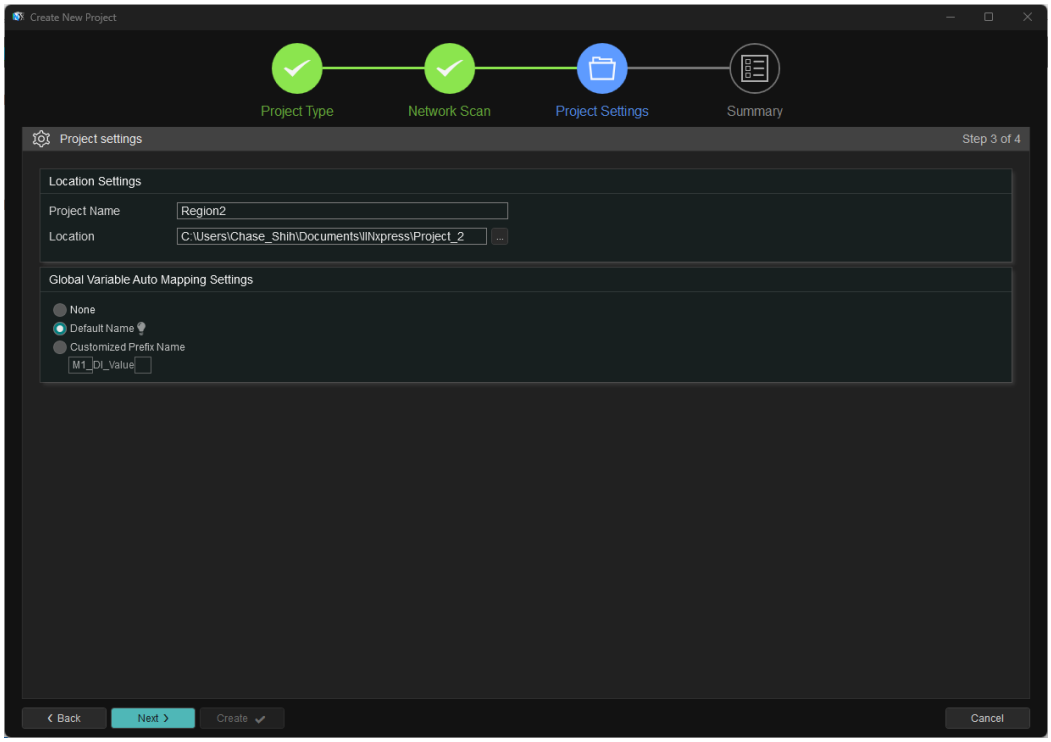
**Step 3:** The scanned device(s) will be displayed in the table. Choose the device, input the **Username** and **Password**, then select **Next**.

Default Username: moxa

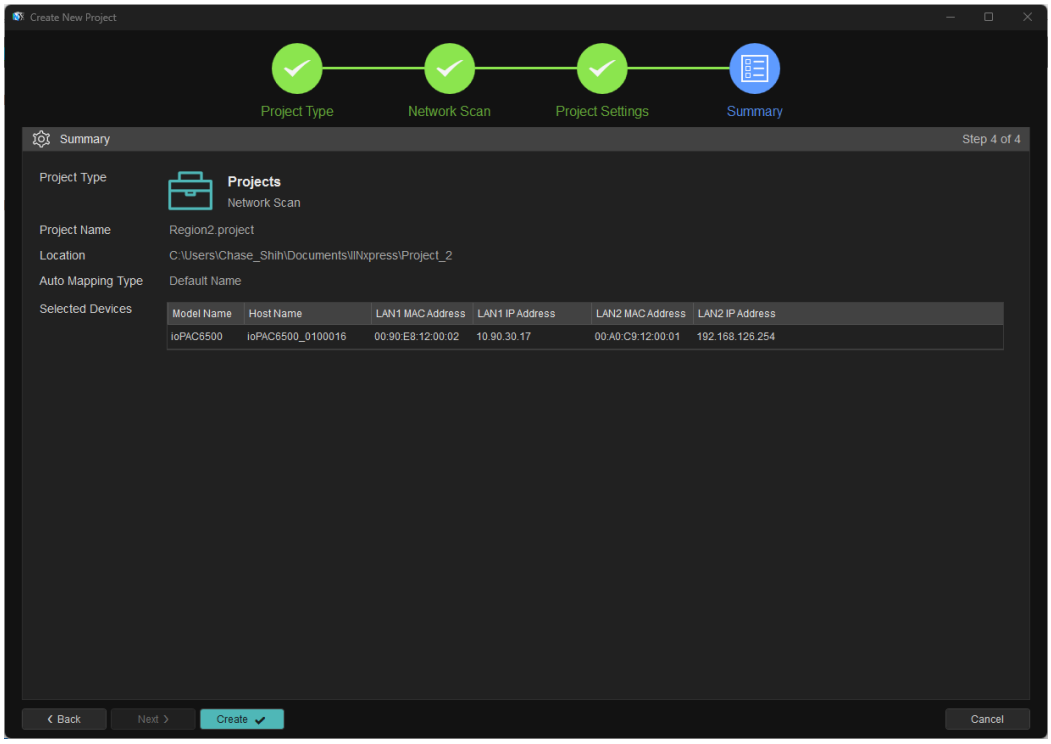
Deafault Password: moxa




**Step 4:** Input the project information. Set up the mapping of the global variable in this step. When the setup is completed, select **Next**.



**Step 5:** Finally, review the project and device information, and then select **Create** to create a project.



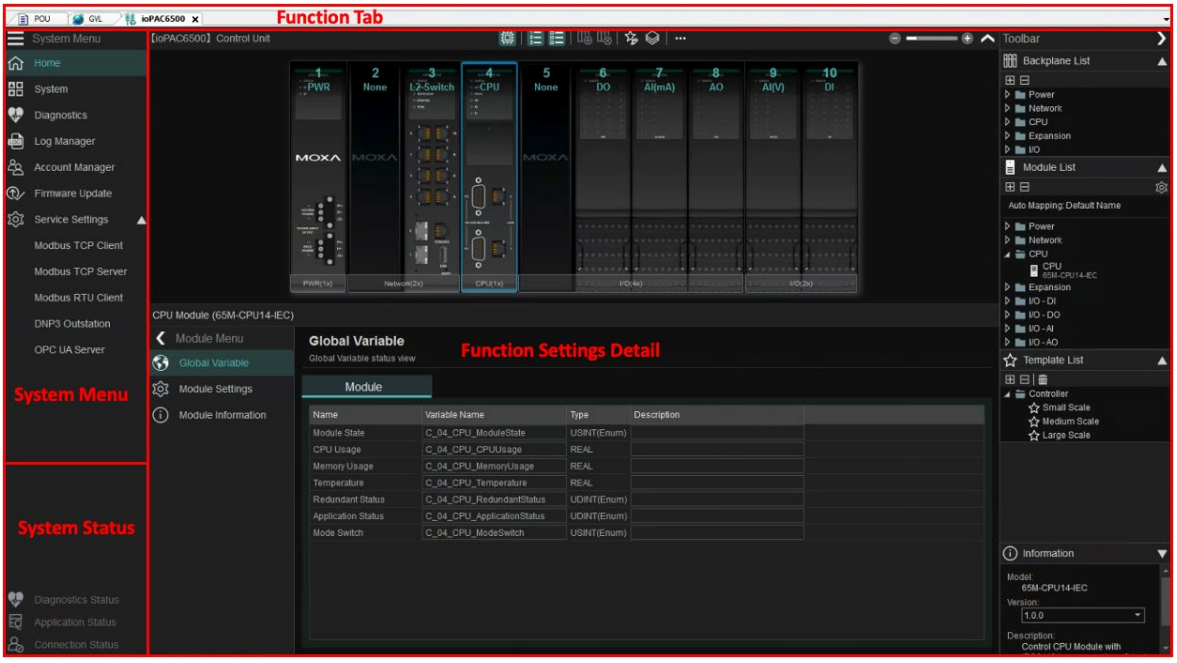

## Empty Project

The process to open an empty project is the same as opening an ioPAC 6500 project. The only difference is there will be no pre-loaded ioPAC 6500 in the project file.

# ioPAC 6500 Configuration

The ioPAC 6500 Configuration is one of the most important parts of IINxpress. Double-click the ioPAC 6500 (ioPA 6500) in the project tree or the icon on the toolbar to open it.

The ioPAC 6500 configuration page can be categorized into the following parts.



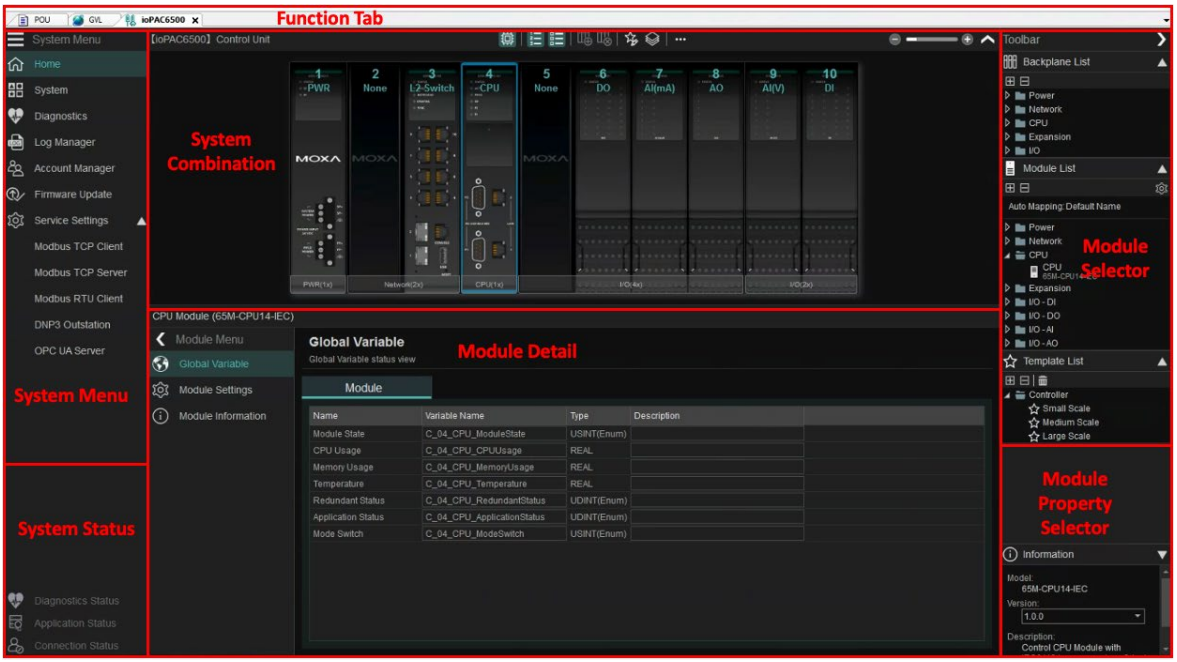
**System Menu:** The function related to the devices are listed here.

**System Status:** The diagnostic status (error or not), application status (run or stop), and connection status (which connection is established) are displayed here.

**Function Settings Detail:** The settings detail of each function is displayed here once the function was selected in the system menu.

# Home

On the home page, the function settings detail window is categorized into the following parts.




## System Combination

The module list of the system will be displayed here. There are some operations can be done in the system combination window.

1. Left select on the module: The module details will be displayed in the module detail window.
2. Right select on the module: You can remove and remap the variables supported by the module and import/export the module configuration.
3. Drag and drop the module: The module can be moved to the empty slot or be deleted.
4. For frequently used system combinations, select **Save as Template** (  ) to save the combination in the Template List.
5. Add/Remove expansion unit:

   Select **Add Expansion** (  ) to add an expansion unit. The ioPAC 6500 Series supports up to four expansion units.

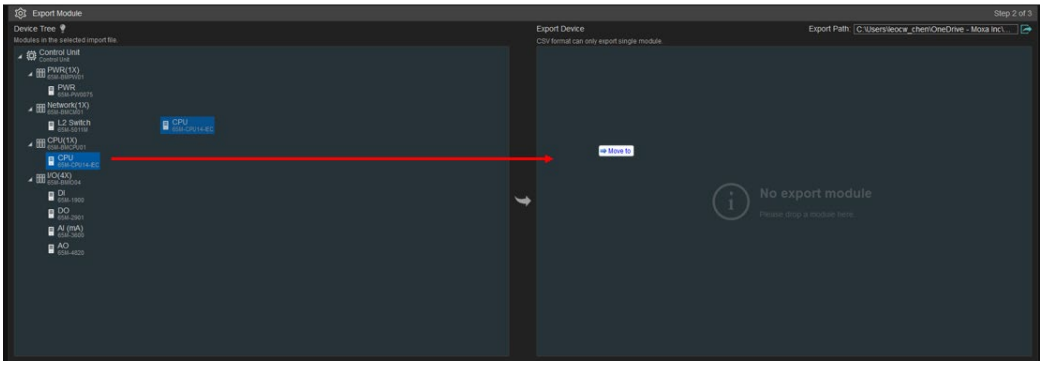
   Select **Remove Expansion** (  ) to remove the expansion unit.

6. Mass configuration:

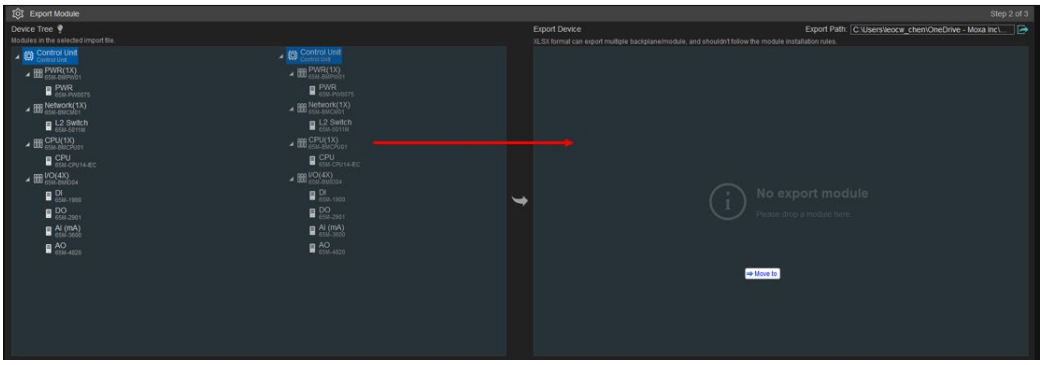
   Select **Mass Configuration** (  ) to export/import configuration.

   ➢ **Export Configuration:**

   ❒ Export module file (csv.)—supports only single module

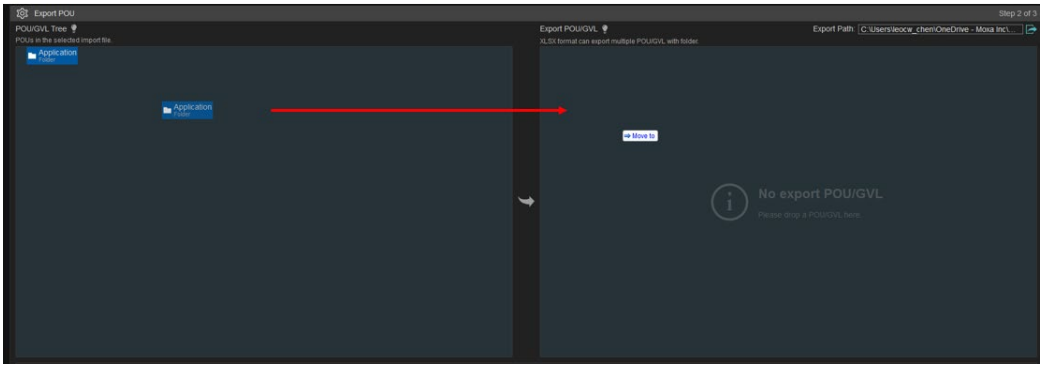

   ❒ Export module file (xlsx.)—supports multiple modules

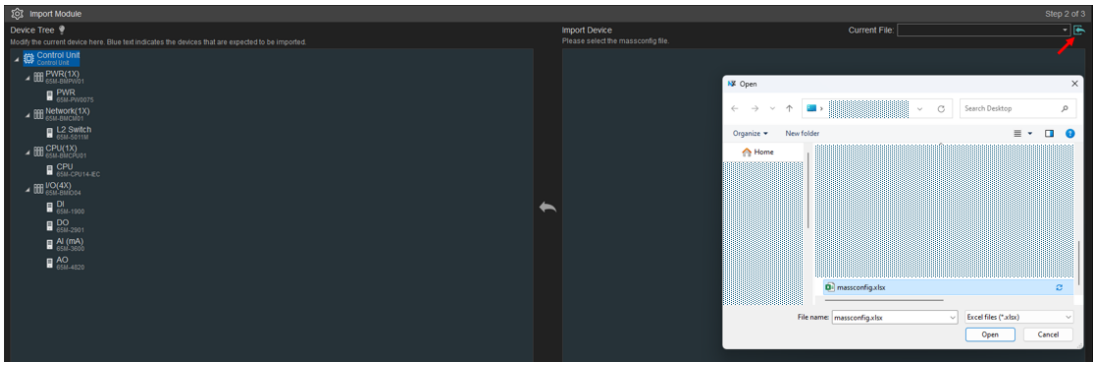

   ❒ Export Service file—see details in Service Settings

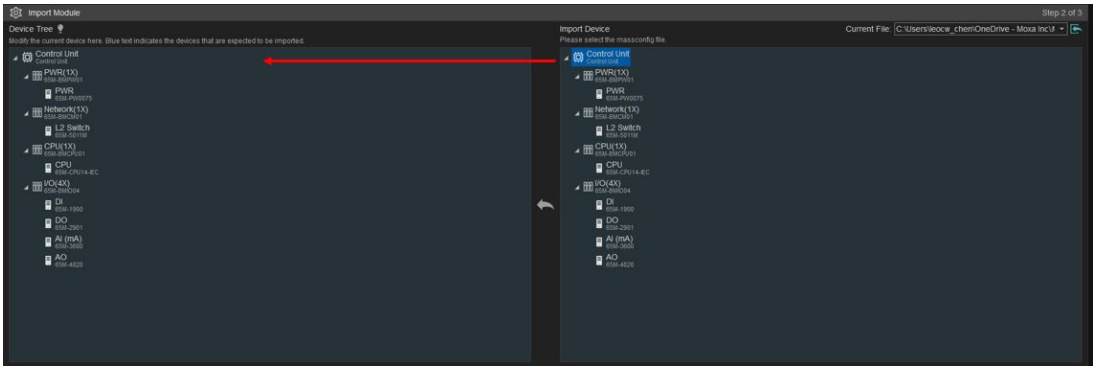
   ❒ Export POU file (xml. or xlsx.)—POU and GVL



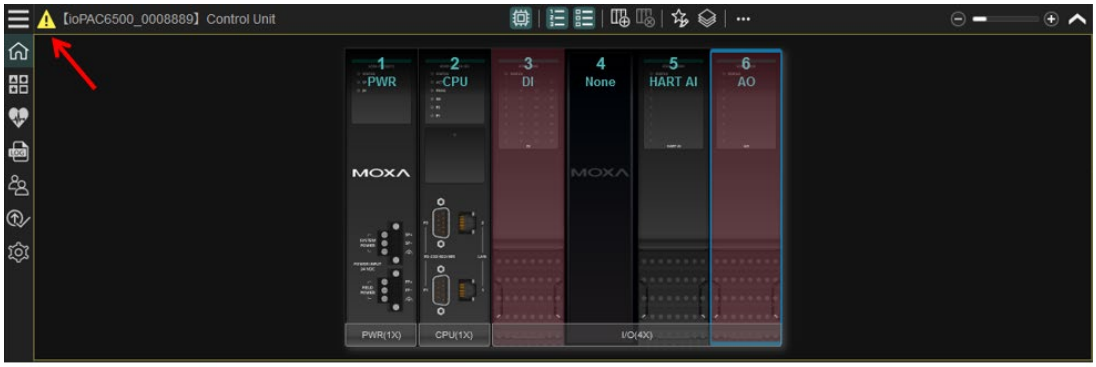


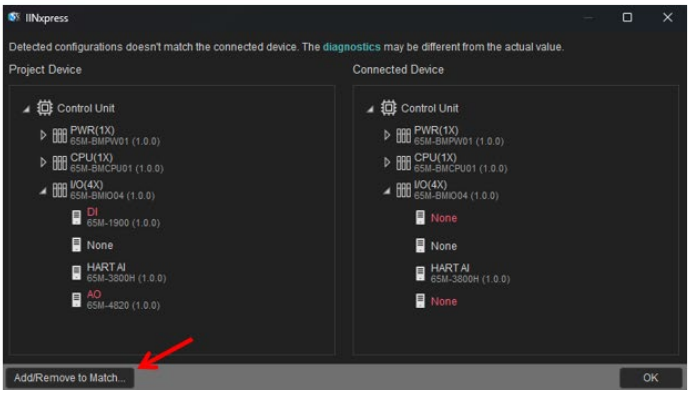
- **Import Configuration:** Reverse the process of exporting. Choose the file that's meant to be imported, drag and drop the configuration from right to left.




7. When connecting device, please ensure there is no topology or configuration mismatch between projects and devices. If a mismatch occurs, please address it promptly (See top left yellow exclamation mark)



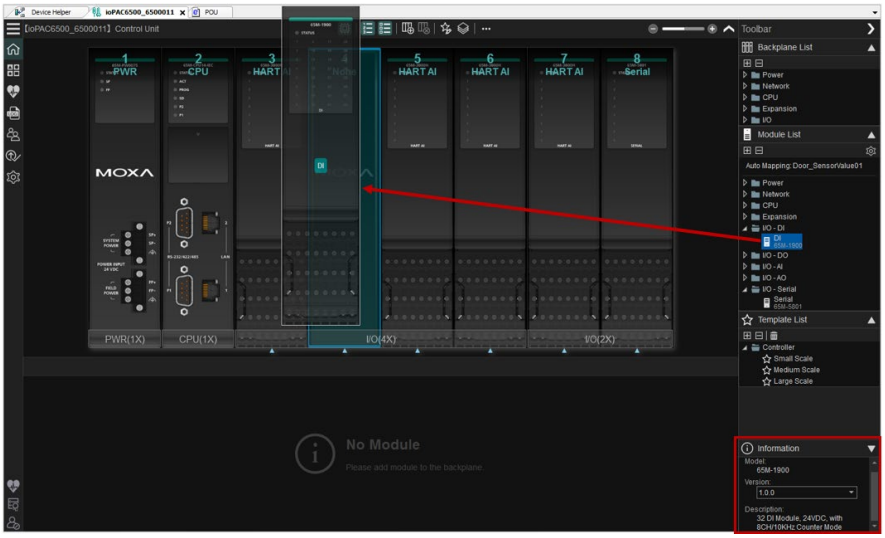



## Module Detail

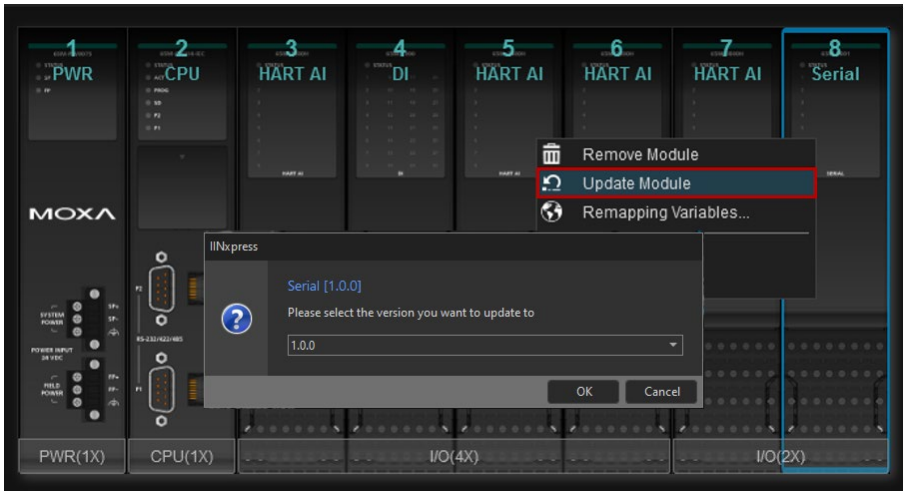
The selected module details will be displayed here. The details can be grouped into three sections: **Global Variables, Module Settings, Module Information**.

**General information and settings for all modules:**

- Before dragging and dropping the module into the desired slot, be sure to check the firmware version on the bottom right to avoid any incompatible issues.




- Right-select on the module to update module firmware when deemed necessary.

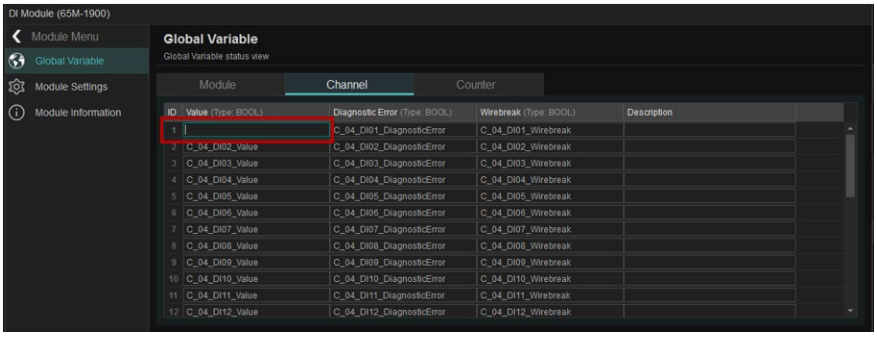



### NOTE

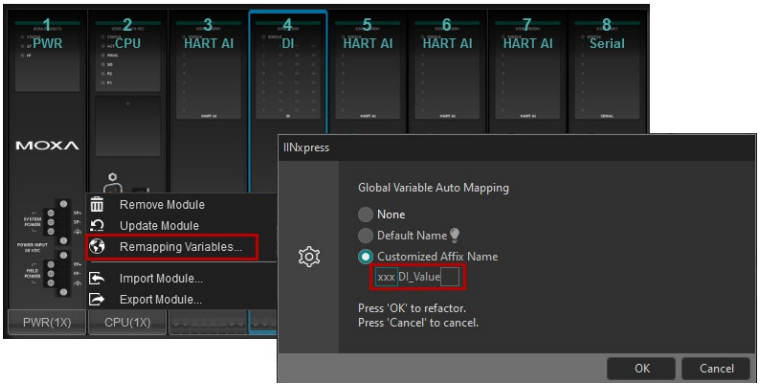
Be aware that an old project (configuration) must be updated to be compatible with hardware preloaded with newer firmware to enable the use of new functions (if applicable).

**Global Variables:** The Global Variables supported by the module will be displayed here. The module and channel will be listed as global variables, which can be used in POUs. When the device is connected, the value of variables can also be monitored as well.

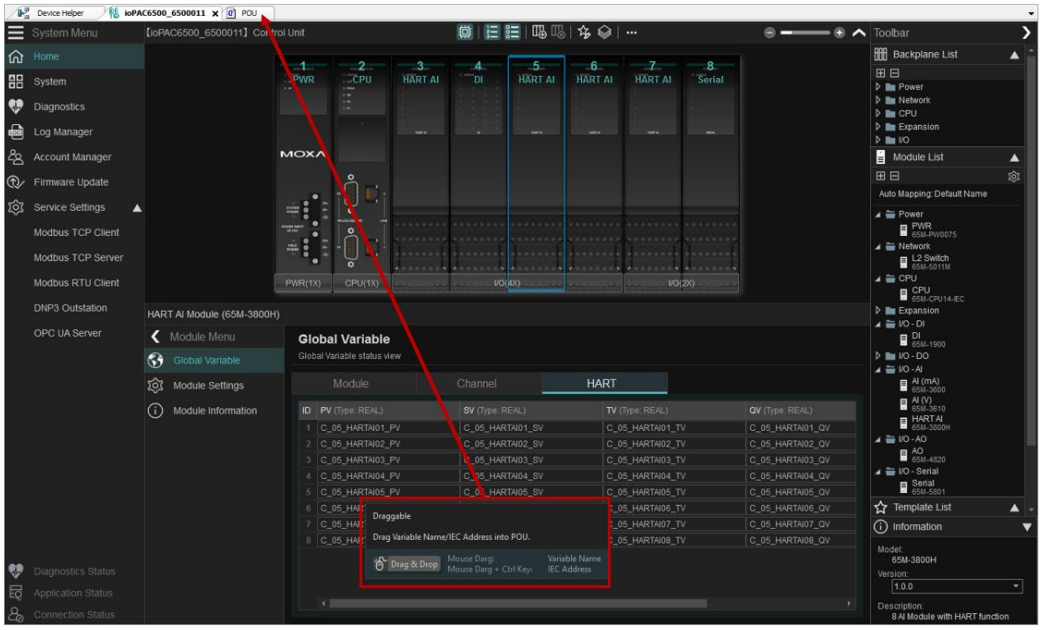
- Double-click the default name to rename the Global Variable based on the application's context, which can be useful when later called in the POU.




- Right-select on the module and select "Remapping Variables" to customize in a batch the affix naming of the Global Variables.



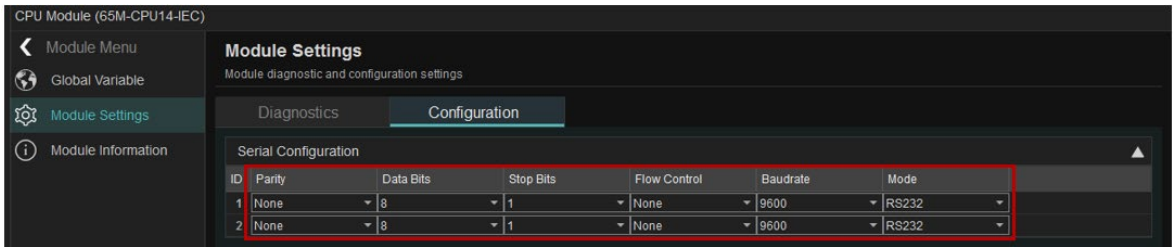

- After renaming the Global Variables, they can simply be dragged and dropped into the POU.



**Module Settings:** The diagnostic variable and module configuration will be displayed here. See below for more detailed module information.

**65M-CPU14-IEC CPU module:**

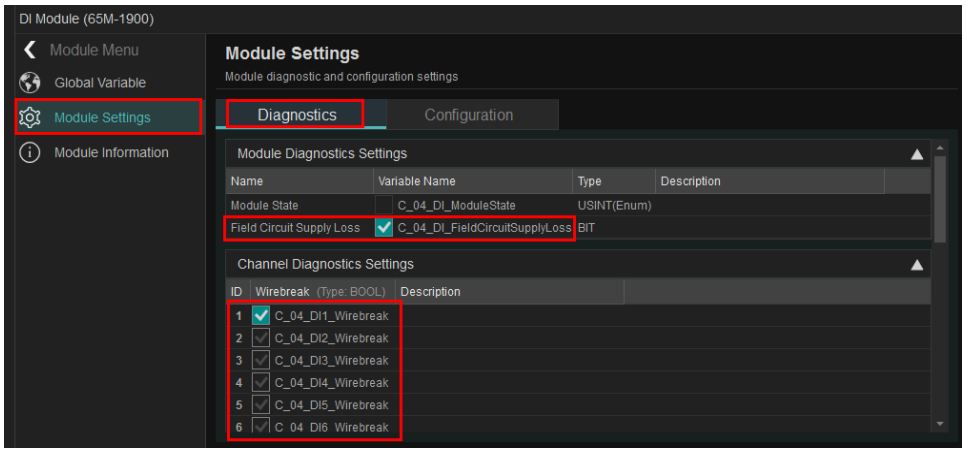
Configuration: There are two serial ports on the CPU module with DB9 interfaces. The parameters for serial communication can be configured as shown below.




**65M-1900 DI module settings:**

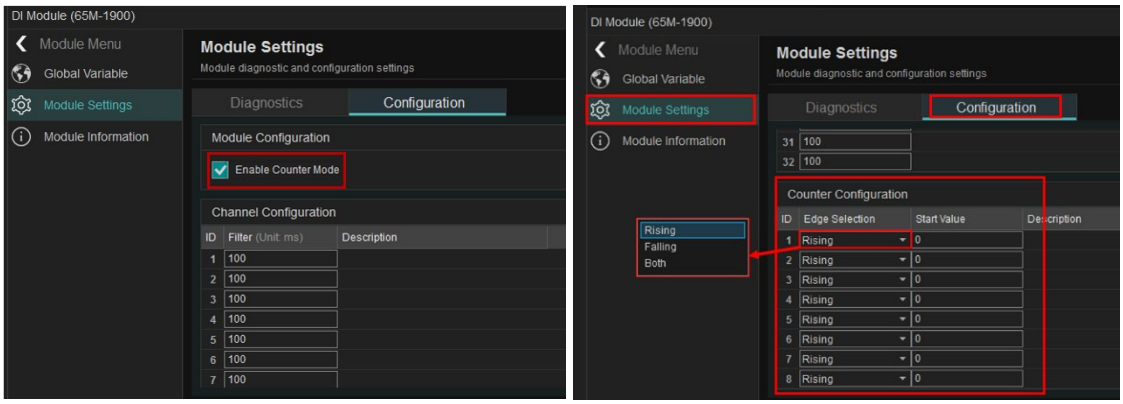
Enable/Disable Diagnostics:

- Field Circuit Supply Loss: To detect if the field power supplying for DI contacts fails.
- Wirebreak: To detect if the wiring between the DI contact to the channel is broken.

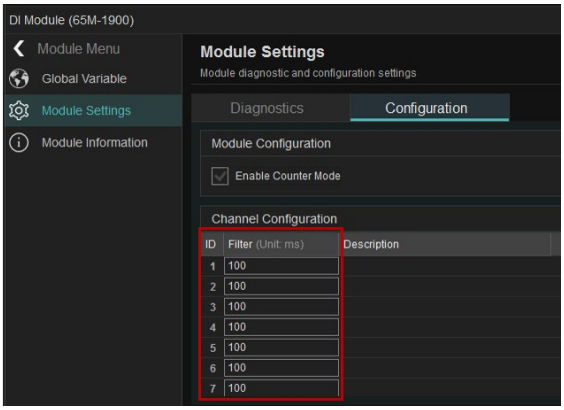



Configuration:

- Enable counter mode: Only Channel 1 to 8 can be configured in counter mode, while the triggering condition can be defined as rising, falling, or both.



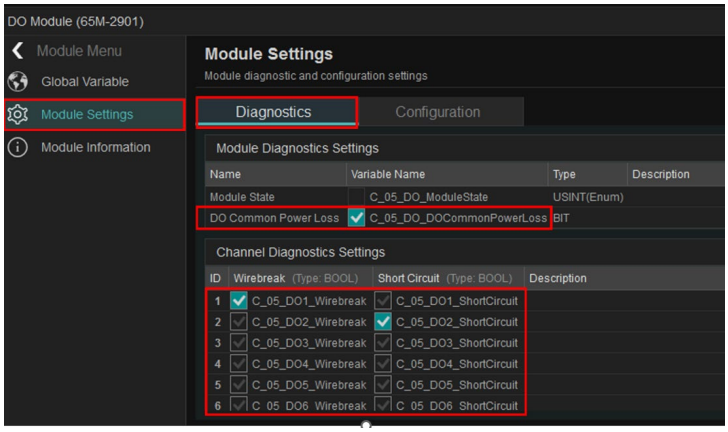
- Filter: The filter can be set to ignore the spurious signals by waiting for a certain period before registering a valid state change.




**65M-2900 DO module settings:**

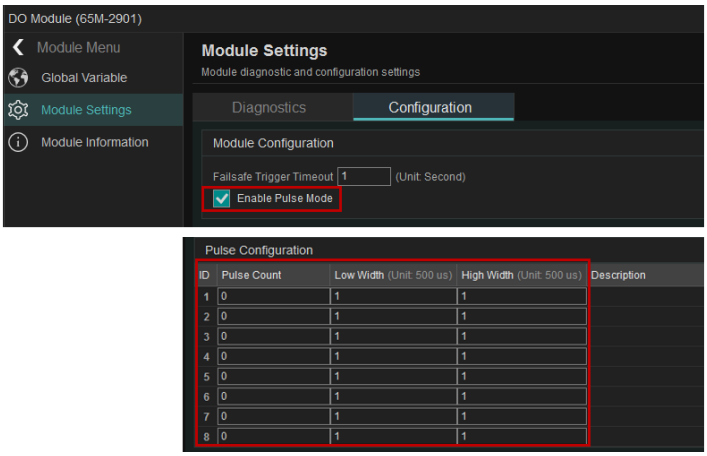
Enable/Disable Diagnostics:

- DO Common Power Loss: To detect if external power supplying for DO contacts fails.
- Wirebreak: To detect if the wiring between the DO unit to the channel is broken.
- Short Circuit: To detect if there is a short circuit on the DO channel.



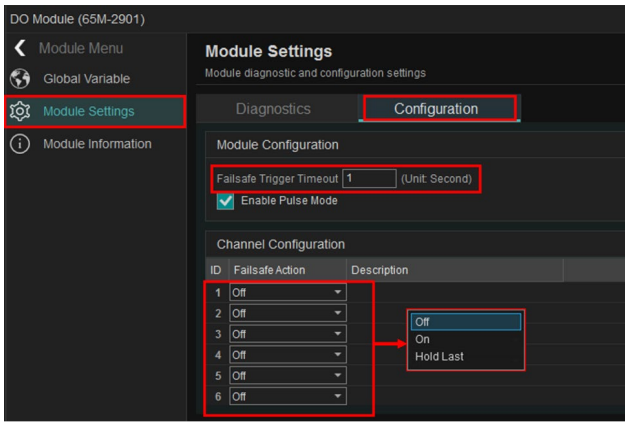

Configuration:

- Enable Pulse Mode: Only Channel 1 to 8 can be configured in Pulse mode. Scroll down in configuration, set the following parameters for counter mode.
- Pulse Count: Set the number of counts to output after the start.
- Low Width: Set the time of the low state in the pulse.
- High Width: Set the time of the high state in the pulse.



Failsafe configuration:

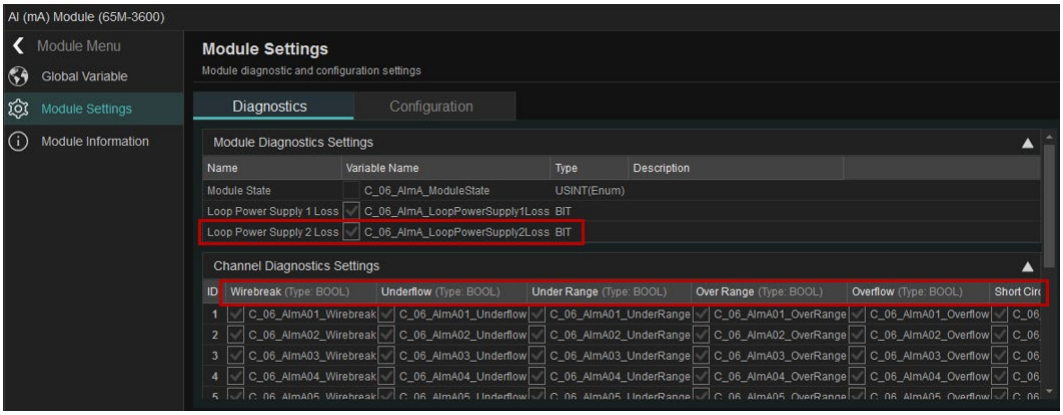
- Failsafe Trigger Timeout: Set timeout failsafe will be triggered after DO module communication loss.
- Failsafe Action: Set the action of each DO channel after DO module communication loss. The action of the DO channel can be OFF/ON/Hold Last.




**65M-3600 AI (mA) module settings:**

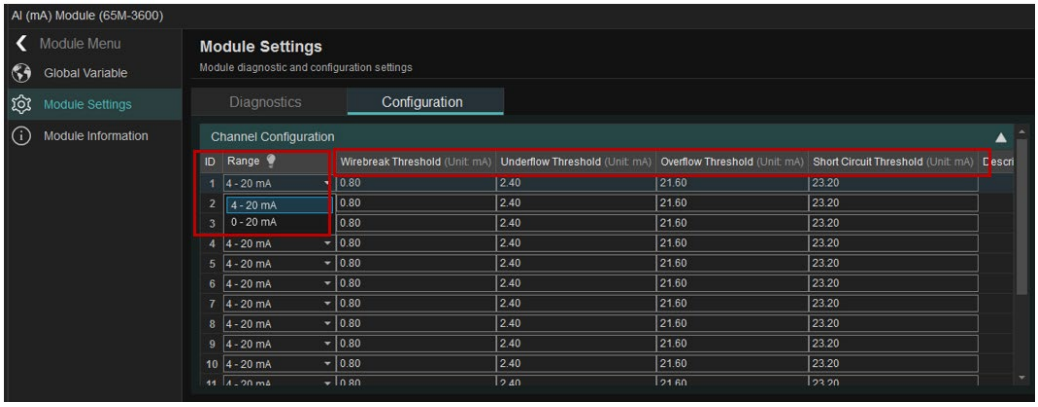
Enable/Disable AI (mA) diagnostics:

- Loop Power Supply Loss: To detect if the field power supplying for AI fails.
- Wirebreak: To detect if the wiring between the sensor and the channel is broken, which means the current value is smaller than the wirebreak threshold.
- Underflow: To detect if the current value is smaller than the underflow threshold.
- Under Range: To detect if the current value is below the range of the AI (mA) channel.
- Over Range: To detect if the current value is over the range of the AI (mA) channel.
- Overflow: To detect if the current value is larger than the overflow threshold.
- Short Circuit: To detect if there is a short circuit on the AI (mA) channel, which means the current value is larger than the short-circuit threshold.



Configuration:

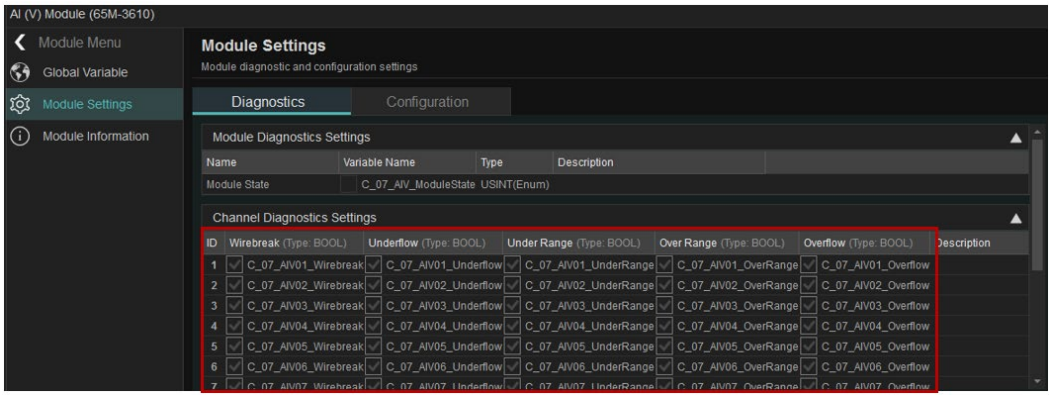
- Range: 0 to 20 (mA), 4 to 20 (mA)
- The Diagnostics threshold for Wirebreak, Underflow, Over Range and Short Circuit can be adjusted.




**65M-3610 AI (V) module settings:**

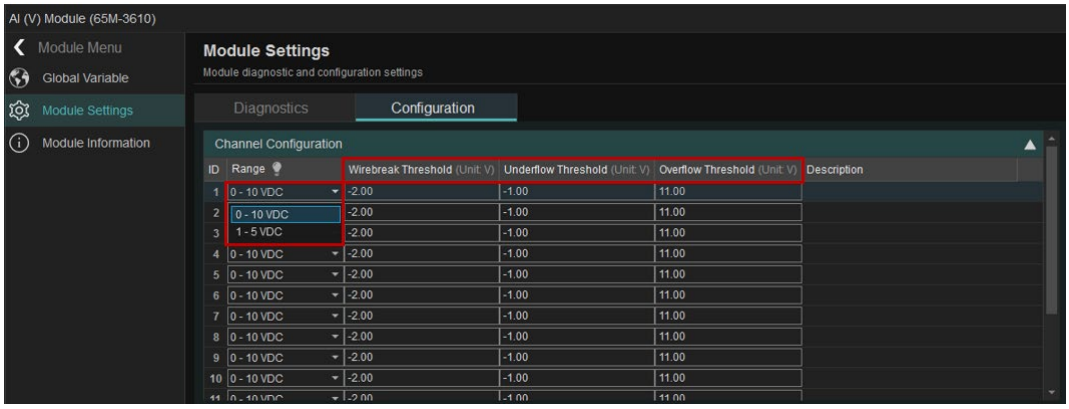
Enable/Disable AI (V) diagnostics:

- Wirebreak: To detect if the wiring between the sensor and the channel is broken, which means the voltage value is smaller than the wirebreak threshold.
- Underflow: To detect if the voltage value is smaller than the underflow threshold.
- Under Range: To detect if the voltage value is below the range of the AI (V) channel.
- Over Range: To detect if the voltage value is over the range of the AI (V) channel.
- Overflow: To detect if the voltage value is larger than the overflow threshold.




Configuration:

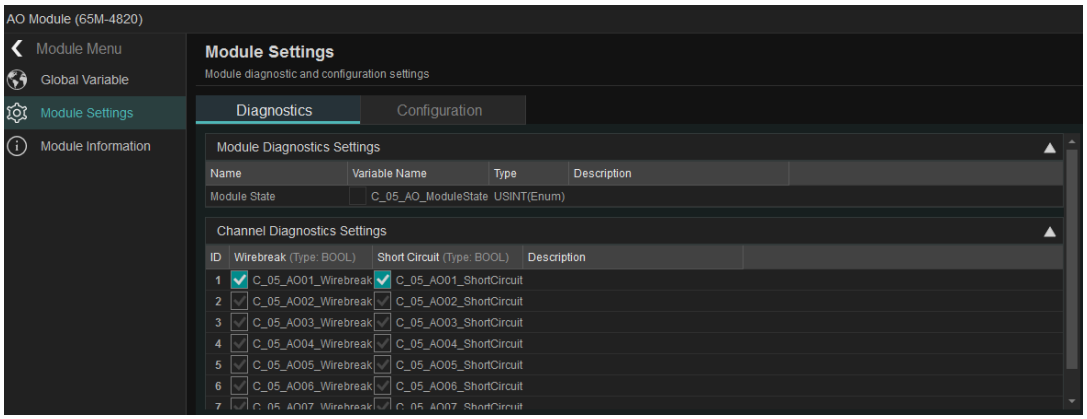
- Range: 1 to 5 (V), 0 to 10 (V)
- The diagnostic thresholds for Wirebreak, Underflow, and Overflow can be adjusted.



**65M-4820 AO module settings:**

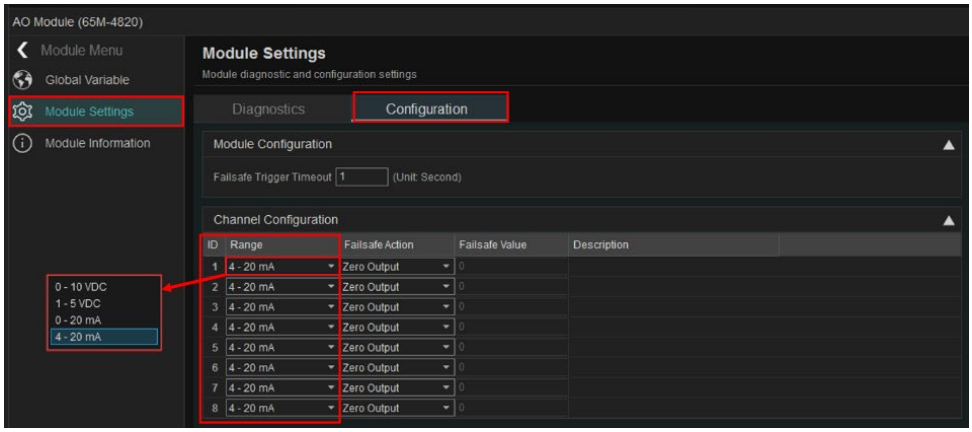
Enable/Disable AO diagnostics:

- Wirebreak: To detect if the wiring between the AO unit and the channel is broken.
- Short Circuit: To detect if there is a short circuit on the AO channel.




Configuration:

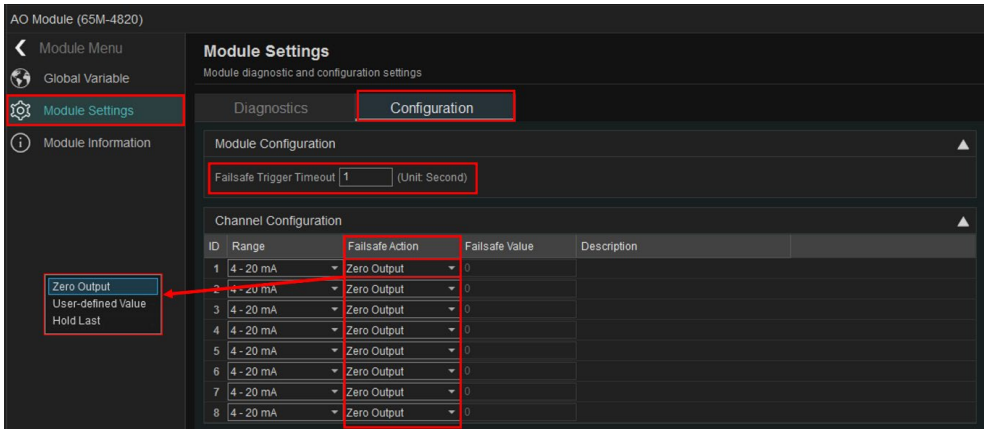
- Configure the Range of the AO channel. Choose 0 to 0 VDC / 1 to 5 VDC / 0 to 20 mA / 4 to 20 mA.




- Set the parameters for Failsafe.

  **Failsafe Trigger Timeout:** Set timeout failsafe will be triggered after AO module communication loss.

  **Failsafe Action:** Set the action of each AO channel after AO module communication loss. The action of the AO channel can be Zero Output / User-defined Value / Hold Last.



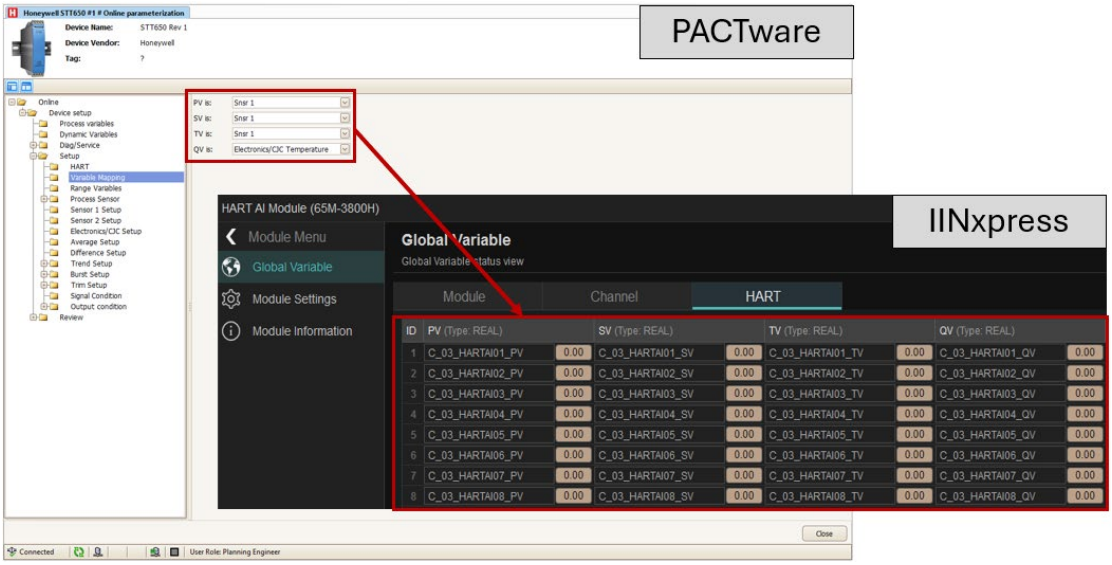
**65M-3800H HART AI (mA) module Settings:**

Global Variable:

PV, SV, TV, QV Setting—After configuring PV, SV, TV, and QV via PACTware, these data will also be sent to IINxpress (ioPAC 6500 IDE Utility Software) and can be accessed in the POU. Make sure the HART is enabled.

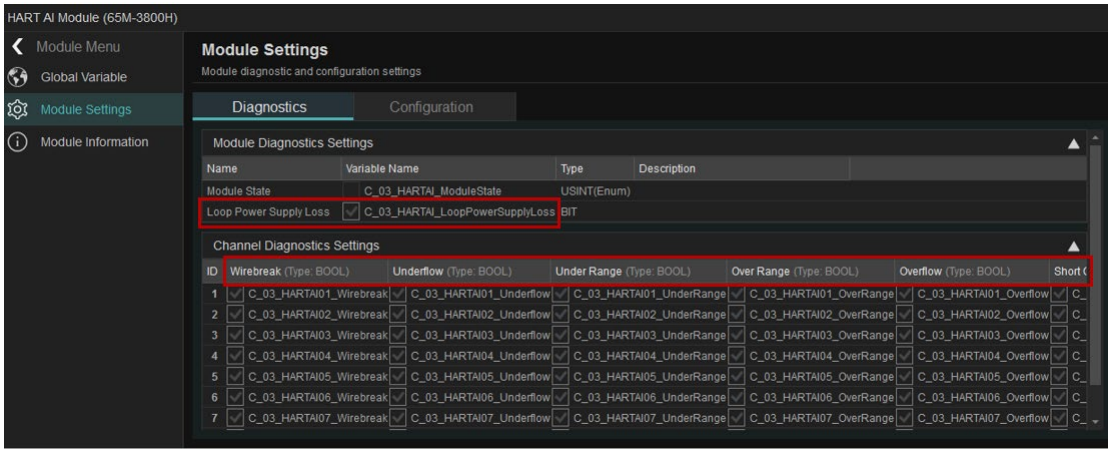
## NOTE

For detailed PACTware configuration guidance, refer to "ioPAC 6500 Series HART Module Configuration Manual—PACTware"



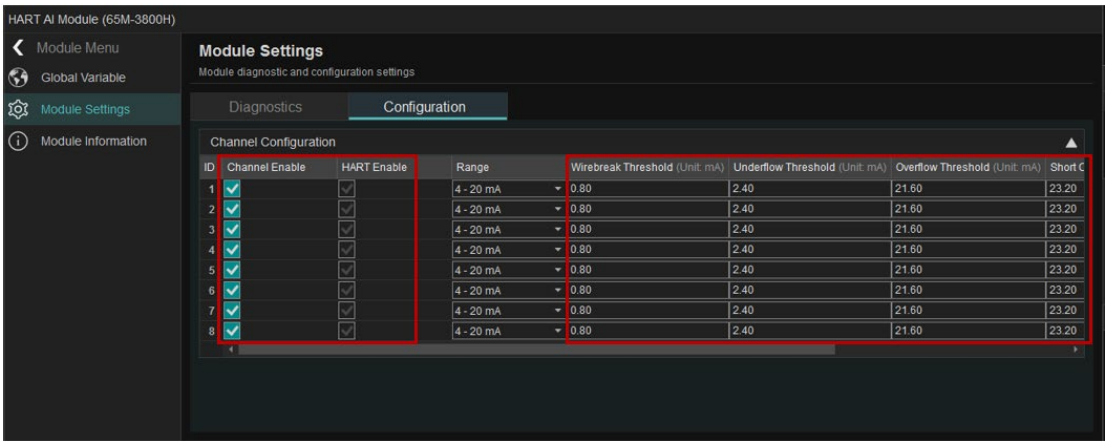

Enable/Disable AI (mA) diagnostics:

- Loop Power Supply Loss: To detect if field power supplying for AI fails.
- Wirebreak: To detect if the wiring between the sensor to the channel is broken, which means the current value is smaller than the wirebreak threshold.
- Underflow: To detect if the current value is smaller than the underflow threshold.
- Under Range: To detect if the current value is below the range of the AI (mA) channel.
- Over Range: To detect if the current value is over the range of the AI (mA) channel.
- Overflow: To detect if the current value is larger than the overflow threshold.
- Short Circuit: To detect if there is a short circuit on the AI (mA) channel, which means the current value is larger than the short-circuit threshold.



Configuration:

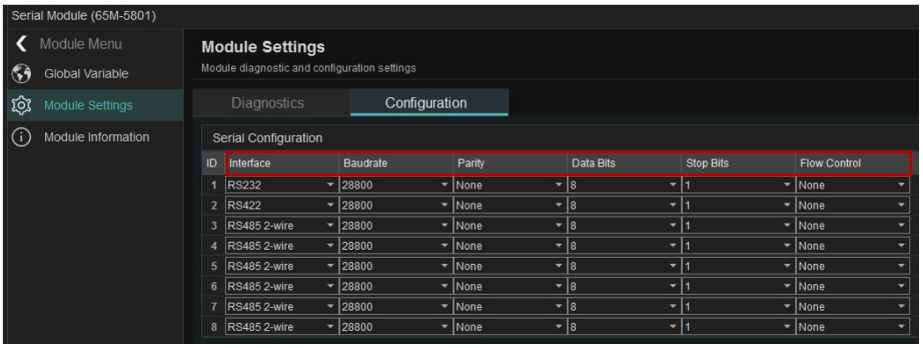
- Channel Enable/Disable (Default Enabled): The disabled channel will be skipped when polling.
- HART Enable/Disable (Default Disabled): The disabled channel is used as a regular 4-20 (mA) AI. Check "enable" box if HART field device is used.
- The range is set to be 4-20 (mA) and can't be adjusted.
- The threshold for Wirebreak, Underflow, Overflow, and Short Circuit can be adjusted.




**65M-5801 Serial module settings:**

Configuration:

- Interface, Baud rate, Parity, Data bits, Stop bits and Flow control can be adjusted in configuration.




**Module Information:** The module information (e.g., firmware version, module serial number, LED status, serial status, mode switch, etc.) will be displayed here. IINxpress shows product specifications here for reference. **Connect the device** to access information.

## NOTE

All the information and settings of the switch module can be completed in the web interface of the switch module. Select the link in the module detail page, and the web interface of the switch module will open in the default browser.

### Module Selector

The available modules are listed here. Drag and drop the selected module to the system combination window for the system setup. Follow the steps to set up the system combination.

1. Choose the backplane module: The ioPAC 6500 is fully modular design. Drag and drop the needed backplane module in designated order.
2. Choose the other modules: Drag and drop other modules to the designated slot. The module can only be placed on the corresponding backplane. The restricted sign will appear when you drag a module to an unsupported backplane, reminding you not to place it in the slot.

IINxpress also supports the template list. Drag and drop the whole system combination and make some minor changes to meet your application's requirements. IINxpress provides small, medium, and large scale as template. You can also reuse a system combination that you saved previously.

### Module Property Selector

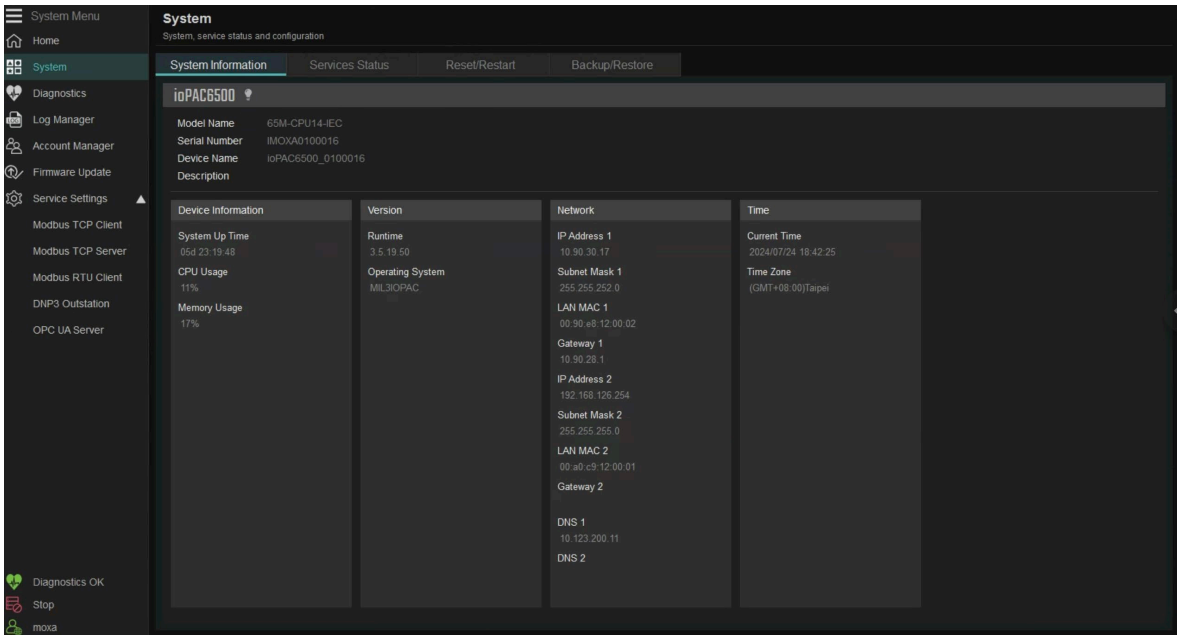
When you select an available module, you will see its properties displayed here. Choose the property version here to match the combination you need.

# System

All the system information, settings, and configuration can be found on the system page.

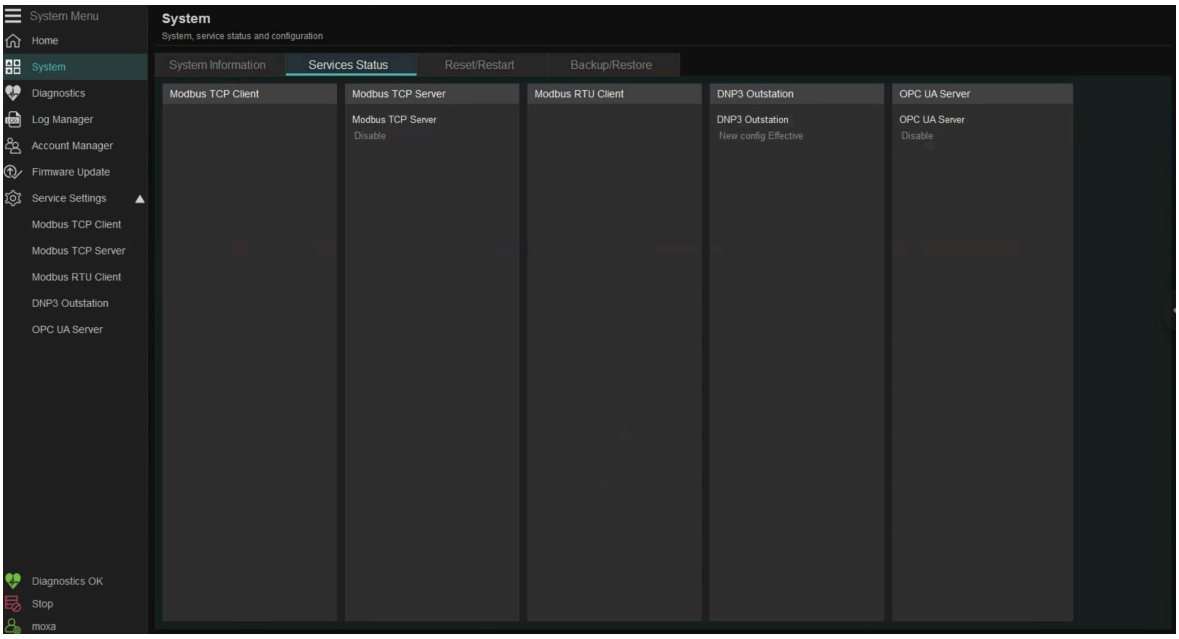
### System Information

System identification (model name, serial number, device name), device information (system uptime, CPU/memory usage), runtime/OS version, network information, and time can be found here. All the information is read-only.



## Service Status

It shows the status of all supported services, which include the Modbus TCP/RTU Server/Client, DNP3 outstation, OPC UA, etc.




## Reset/Restart

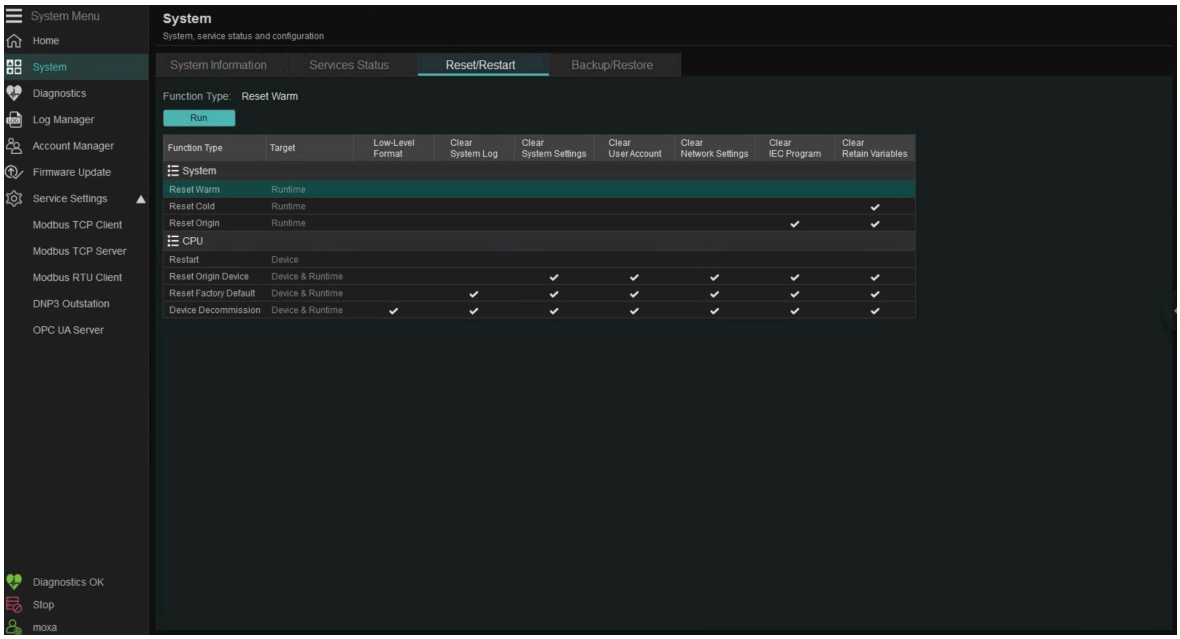
There are several reset/restart types supported by ioPAC 6500, and all of them are listed on the page. Select an action first, then select Run. A pop-up warning message will appear. Follow the instructions to complete the reset/restart process.

### NOTE

Resetting or restarting the system will clear different system information. Make sure to read the table before performing the rest/restart process.

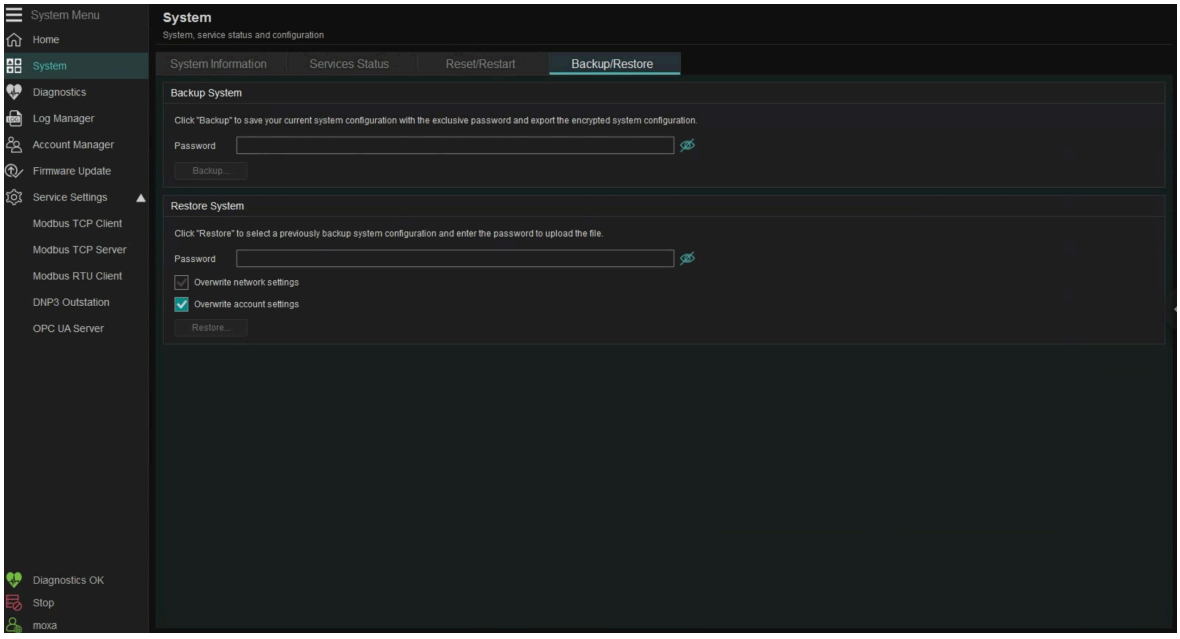
### NOTE

Push the reset button to complete the **Reset Factory Default** and **Device Decommission**. Follow the instructions to complete the process.




## Backup/Restore

Back up and restore the system configuration on this page.




Follow these steps to back up the system configuration.

1. Key in the password.
2. Select the **Backup** button and choose where you want to save the configuration file. The password length is required to be between 8 and 63 characteristics.

Follow these steps to restore the system configuration.

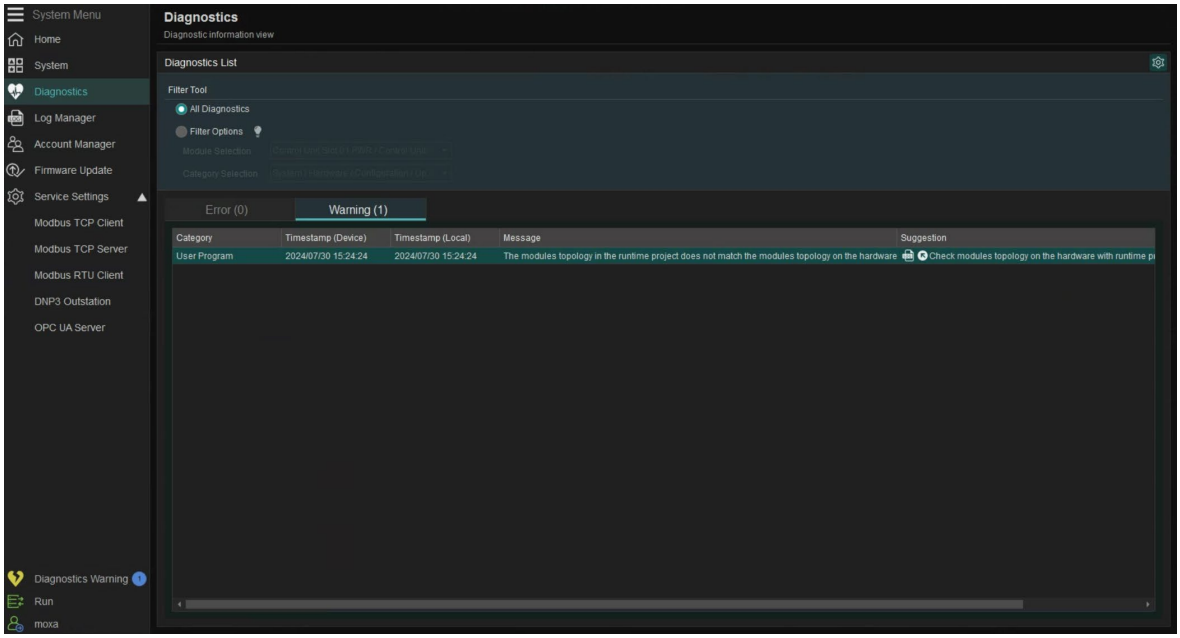
1. Key in the password
2. Choose to overwrite the network and account settings or not.
   - Overwrite the network settings: The restore process will overwrite the network settings. The system's Ethernet connection might be lost during the restoration.
   - Overwrite the account settings: The restore process will overwrite the account settings. The account you are using might not be available anymore.
3. Select the **Restore** button and choose the configuration file which you want to restore.

# Diagnostic

The diagnostic information will be displayed on the Diagnostic page. The error and warning messages that are persistent can be found in the Error and Warning tab, respectively.

## NOTE

Diagnostics will not display the error and warning messages that occur once.

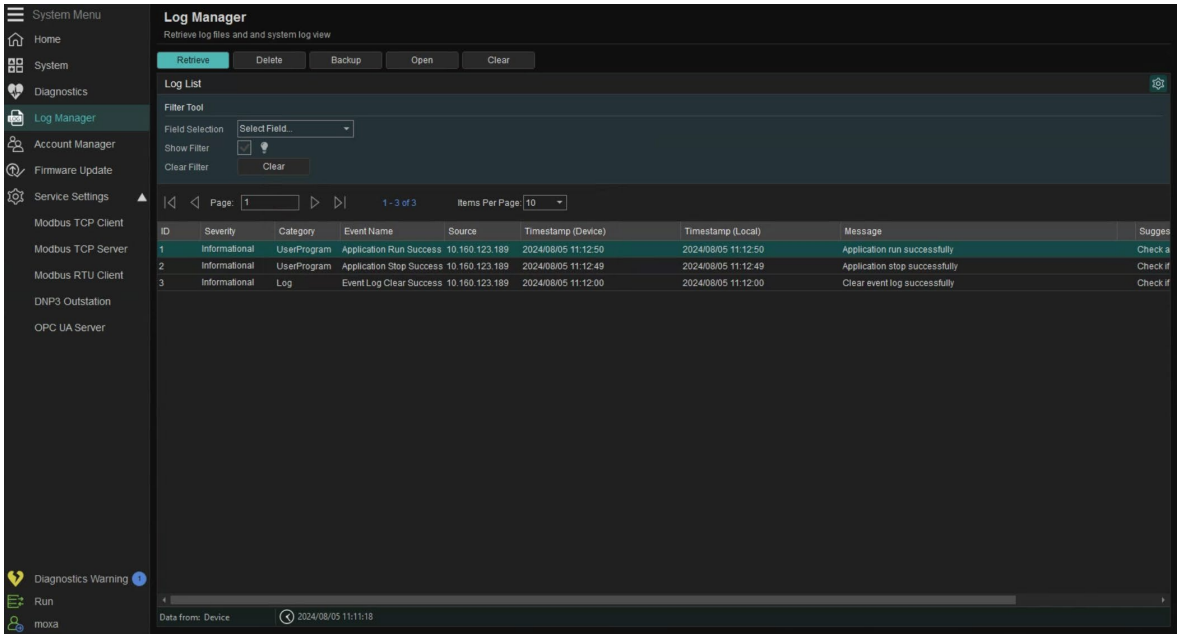


# Log Manager

All the logs will be stored inside the ioPAC 6500 system. Use IINxpress to retrieve the log and show in IINxpress. IINxpress can perform five actions in a log.

- **Retrieve:** Retrieves the log from the device and shows it in IINxpress.
- **Delete:** Deletes the log stored in the device.
- **Backup:** Back ups the displayed log to the file.
- **Open:** Opens the backup log file.
- **Clear:** Clears the log list in IINxpress. This action will not clear the log inside the device.

For the detailed log list, refer to the log section of the web interface.

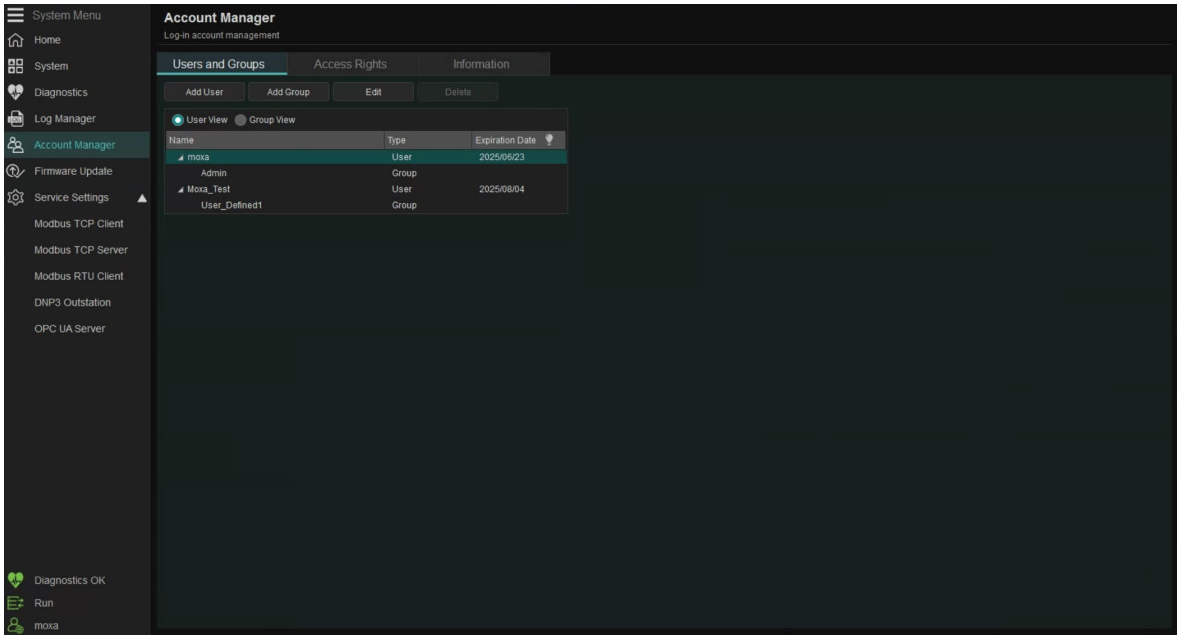


# Account Manager

The account and its authority can be managed on the Account Manager page. Account manager settings consist of three main parts.

## Users and Groups

On this page, make changes related to the users and groups. All user accounts will be displayed on this page. Choose to show in User view and Group view. In the ioPAC 6500 system, the login property of account belongs to the user group.

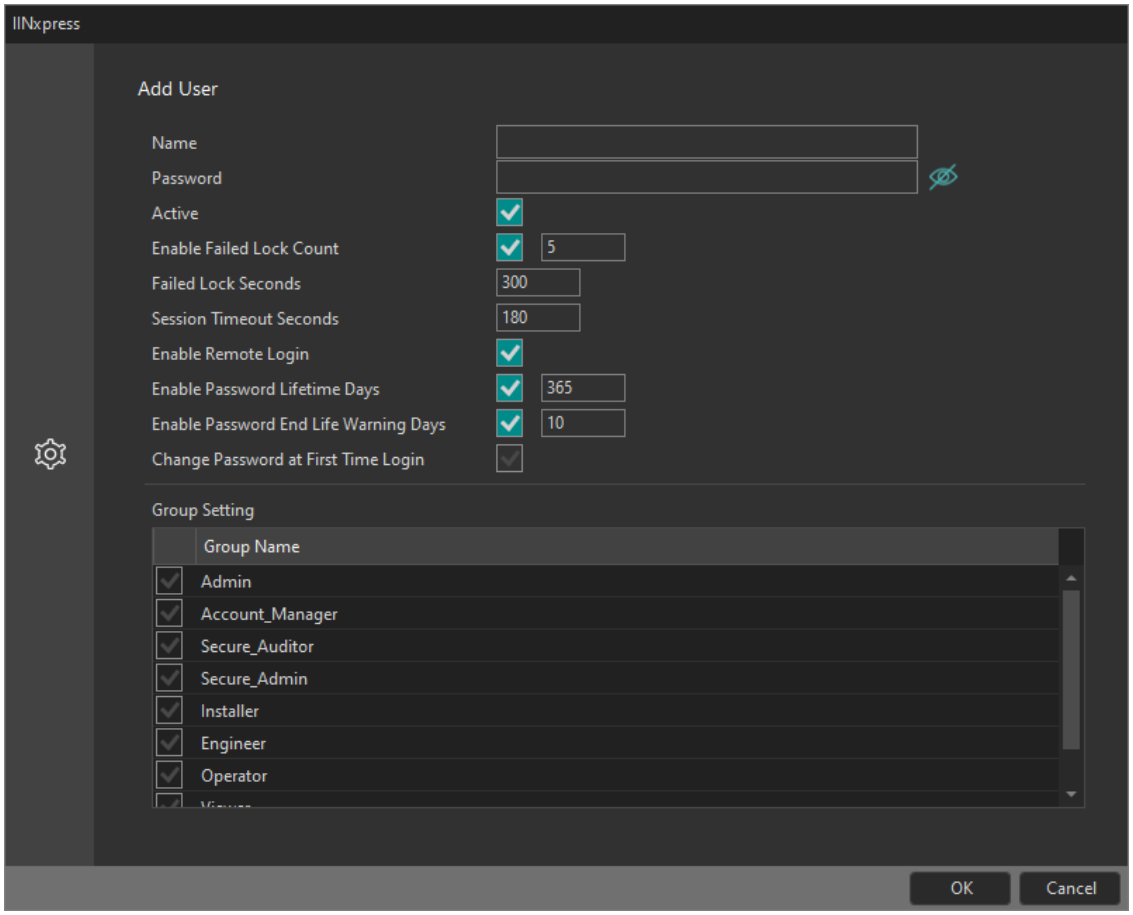


**Add User**

When you want to create a new user account, select the **Add User** and a window will pop up. Once you confirmed all the account property and group assignments, select OK to complete the account creation.

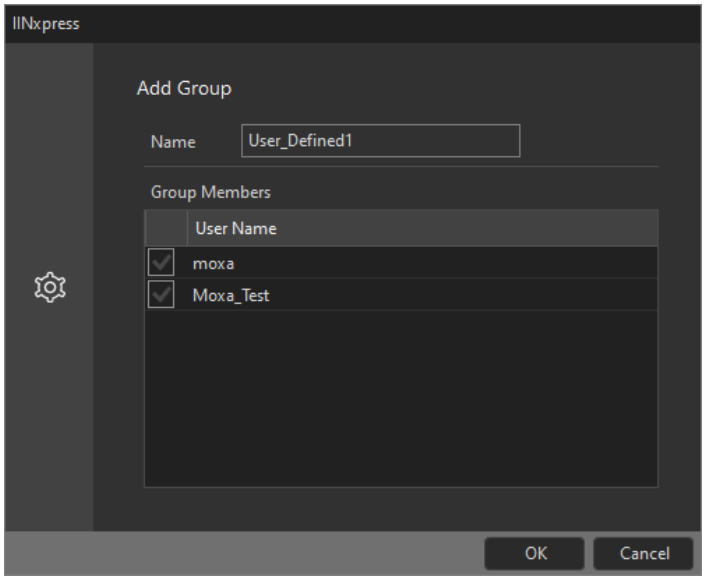
## NOTE

Before editing the users and groups, make sure the login account has permission to change the account settings.



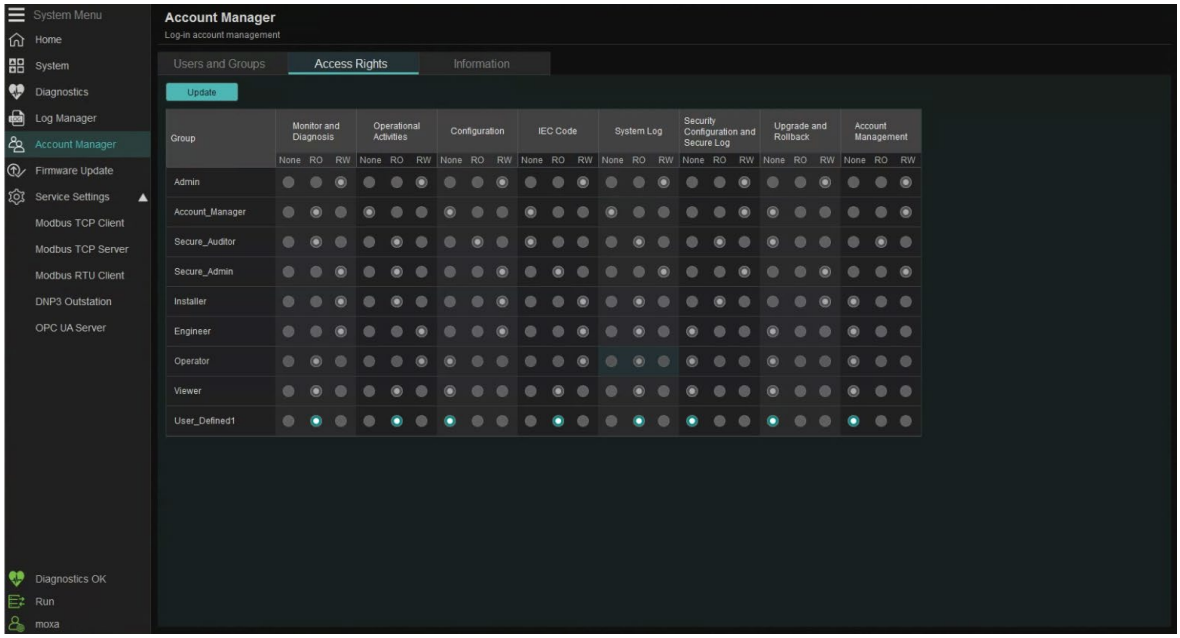
**Add Group**

When you want to create a new user group, select the **Add Group** and a window will pop up. Specify the group name and assign the user accounts to the group. For the group property, change in Access Rights tab.



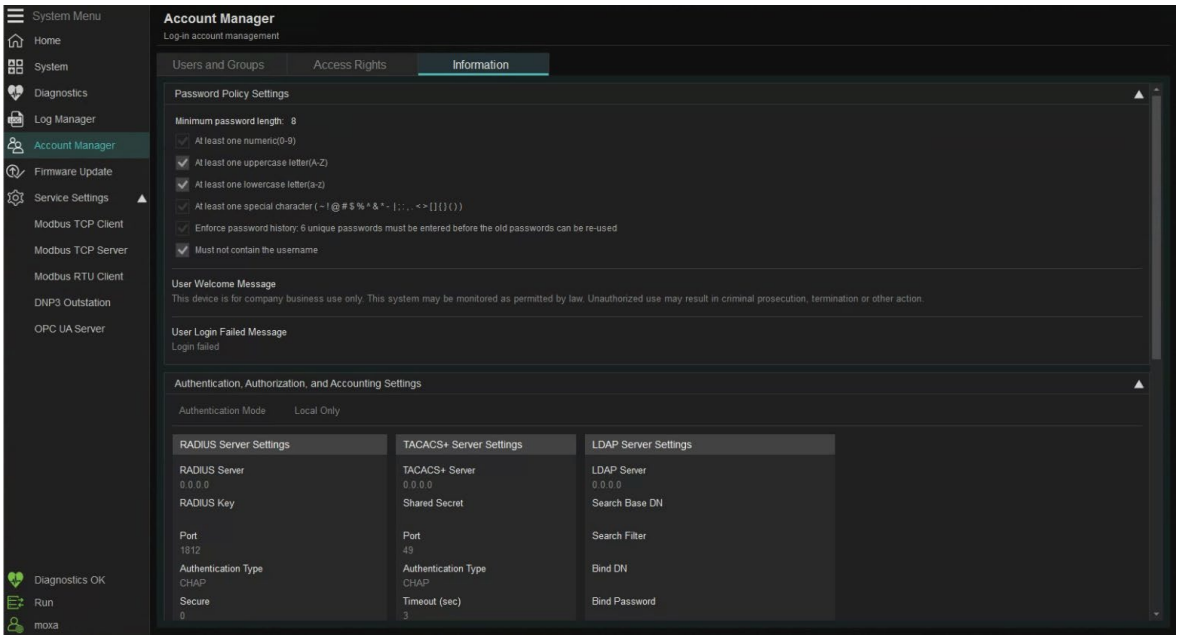

## Access Rights

Change the property of the group on the Access Rights page. You cannot change the authority of the default 8 groups. You can only change the authority of the user-created group.



### Information

The information will display the current password policy. It can only be modified on the system webpage. When IINxpress connects the device, the latest password policy will be loaded automatically. For the details about the password policy, refer to the Account Manager section on the webpage.




# Firmware Update

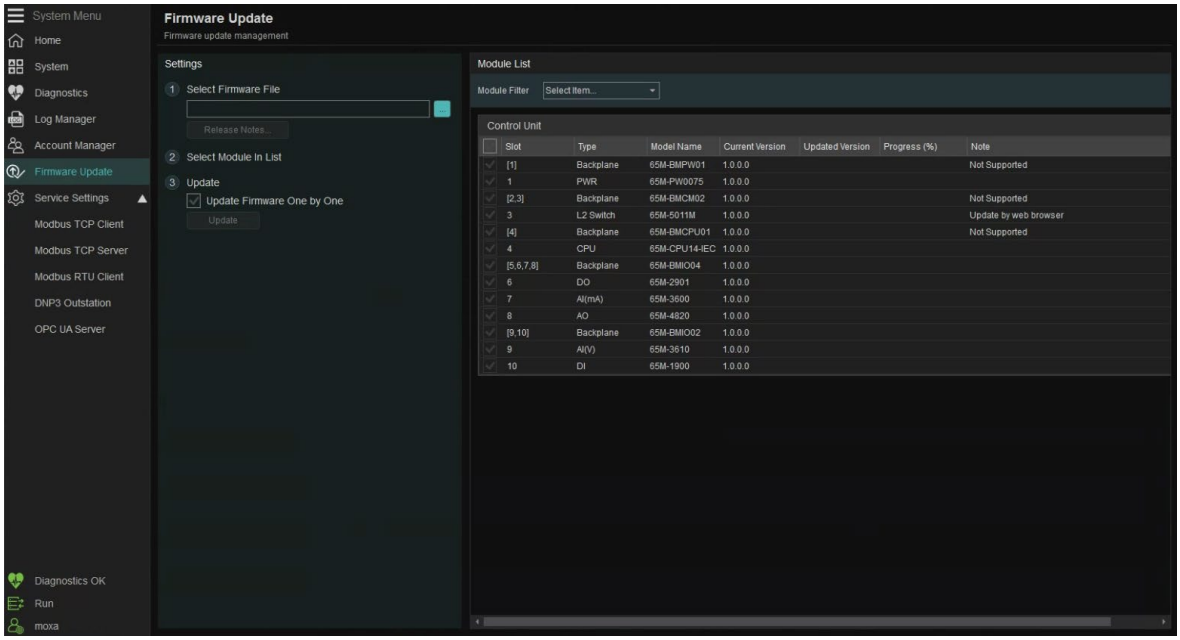
IINxpress also allows you to update the firmware to the system. Follow the following three steps to complete the firmware update.

1. **Select Firmware File:** Select to choose the firmware file that needs to be updated to the system.

   The firmware file can be chosen from the local disk or a SFTP from a remote site. You can also select the Release Notes button to check the release details.
2. **Select Module on List:** Select the modules that need to be updated on the **Module List**. Use the module filter to speed up module selection. The module list will display module information.
   - **Slot:** Shows the slot where the module is installed. The system combination determines the slot number. The number 1 shows the most leftmost module of each unit. The slot of the backplane module will be displayed with a number in square brackets, e.g., [1].
   - **Type:** It shows the module type. E.g., CPU, DI, backplane, etc.
   - **Model Name:** The model name of the module will be displayed here.
   - **Current Version:** The current firmware version of the module will be displayed here.
   - **Update Version:** The firmware version included in this firmware file will be displayed here.
   - **Progress(%):** The updated progress will be here.
   - **Note:** Any other information that cannot be categorized will be displayed here.
3. **Update:** Select **Update** to start the system firmware update. Choose Update **Firmware One by One** to update the firmware module by module.

**NOTE**

Update the switch module's firmware on the web page of the switch module.

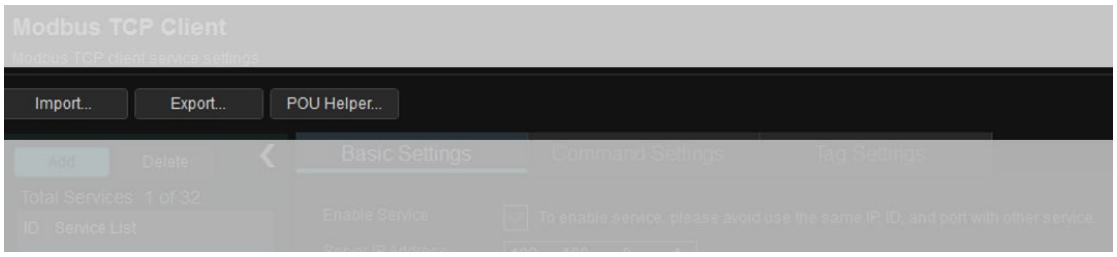



# Service Settings

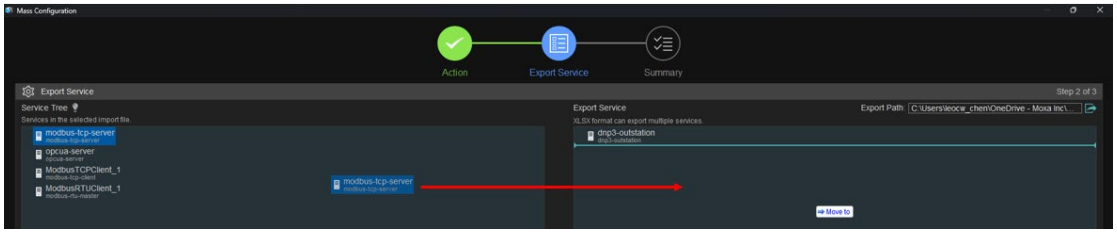
The ioPAC 6500 system provides a protocol service to lower your programming effort. Use the protocol service to collect data from other devices and use the collected data in the program or deliver to the upper-level system.

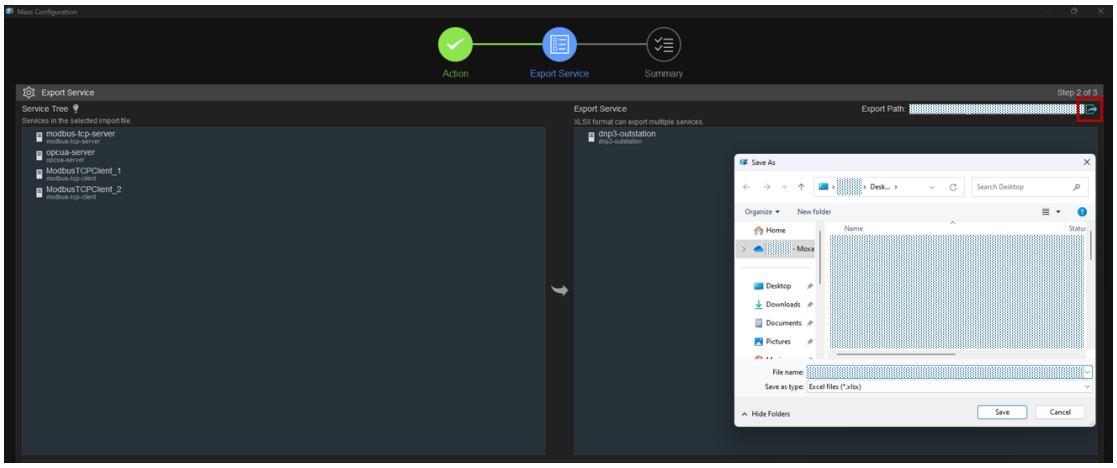
## General Information for All Services

**Import, Export, and POU Helper:** They can be seen in each of the service pages, prompting easier mass configuration and better service management.

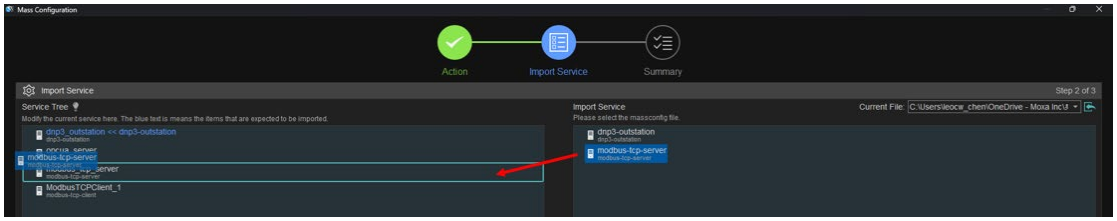


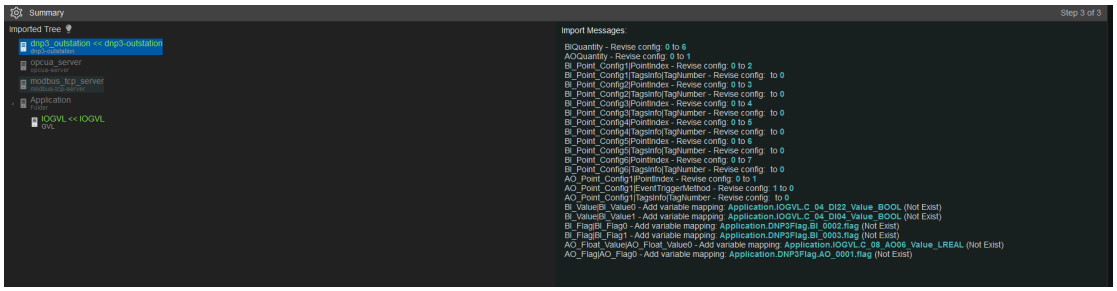

**Export:** Drag and drop the service from Service Tree to Export Service. The configuration will be stored as .xlsx file.






**Import:** Select the desired .xlsx file. Drag and drop from import service to service tree. Blue text indicates the services that are expected to be imported



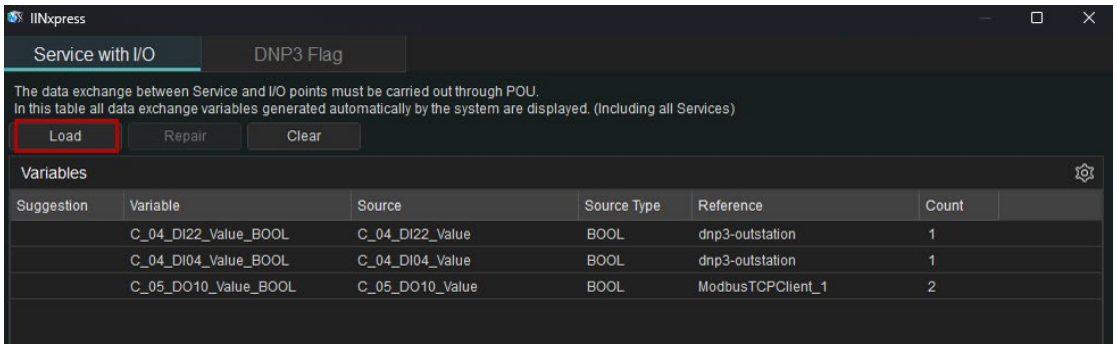

## NOTE

When importing the service configuration, the system checks the following:

1. When a new variable is specified, the system checks whether the variable name already exists. If a duplicate is found, the variable cannot be created, and the importing operation will be blocked.
2. When an existing variable is specified, the system checks whether it is an I/O variable. If so, the system will attempt to generate the corresponding IOGVL. If the generation fails, the importing operation will also be blocked.

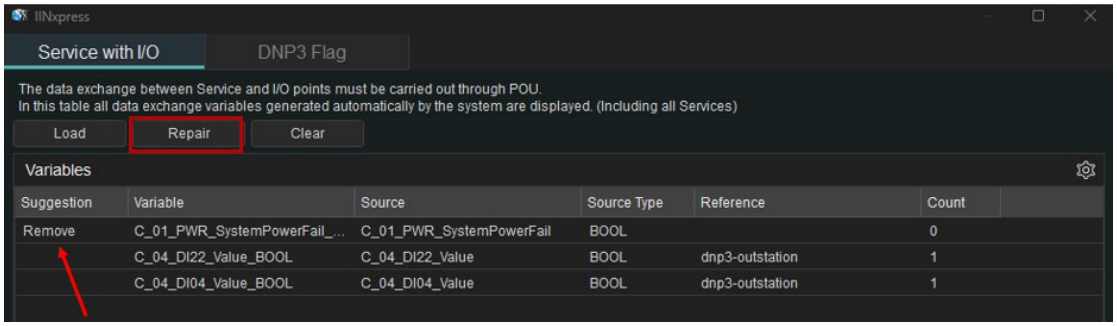
Uncheck the “Global Variable” in import Configurations, if variables importing is not needed.

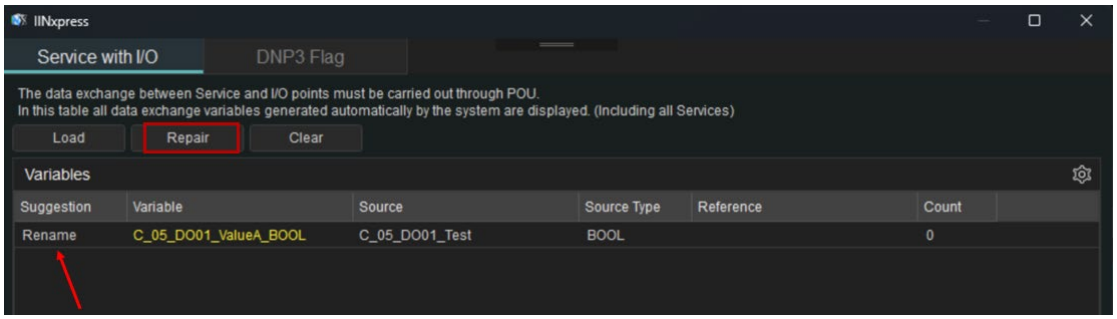
**POU Helper:** POU Helper shows detailed information on how sources and variables are mapped, as the data exchange between service and I/O points are carried out via POU. Select **Load** to get the status. Select **Clear** to delete everything.

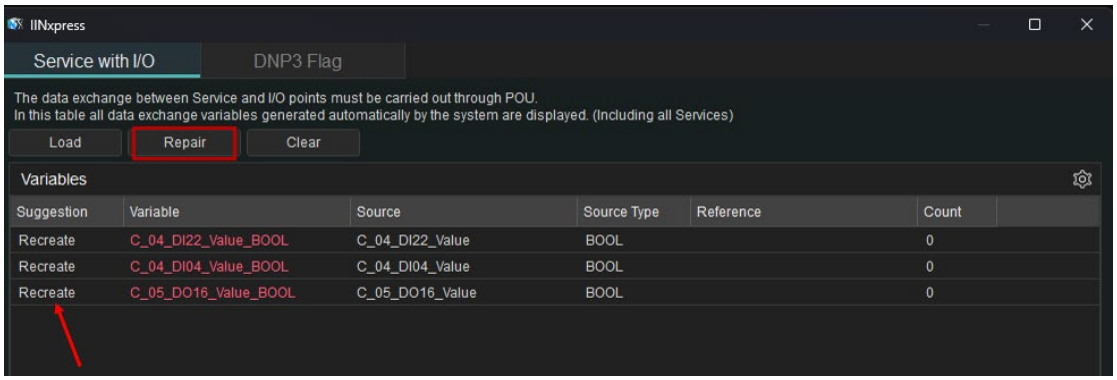



## NOTE

If "Remove", "Rename" or "Recreate" appears in the suggestion, revisit the configuration within your application or select **Repair**.

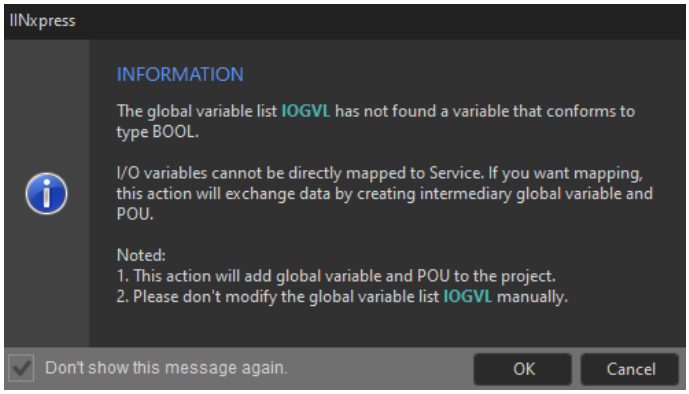


## NOTE

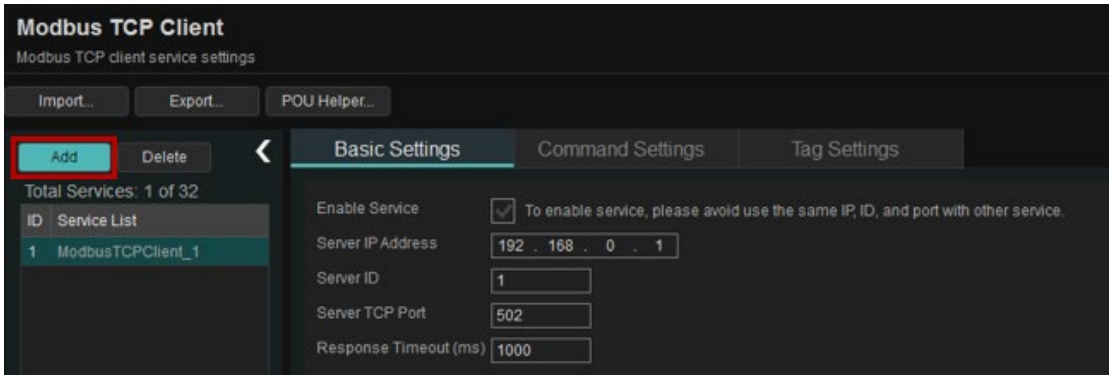
When mapping the variables, a message tells you that a variable was automatically created. Select OK to proceed.




### Modbus TCP Client

Modbus TCP Client can collect data from up to 32 Modbus TCP servers. To add a Modbus TCP client, clselectick the Add button and a new Modbus client profile will be added to the Service List. All properties of the Modbus TCP client are categorized into **Basic Settings**, **Command Settings**, and **Tag Settings**.

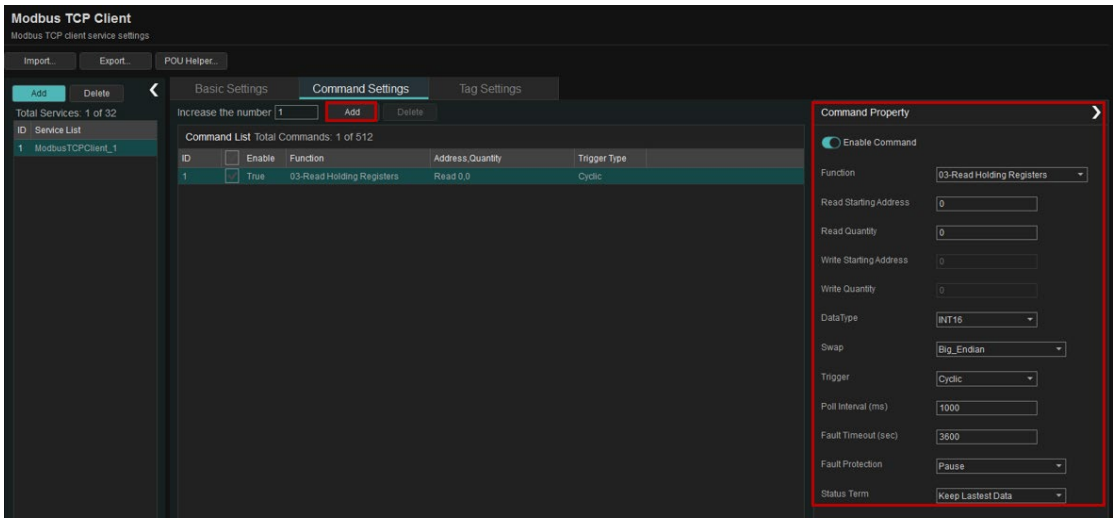
**Basic Settings:** Enable the service, set up the Server IP Address, Server ID, Server port, and response timeout on this page.



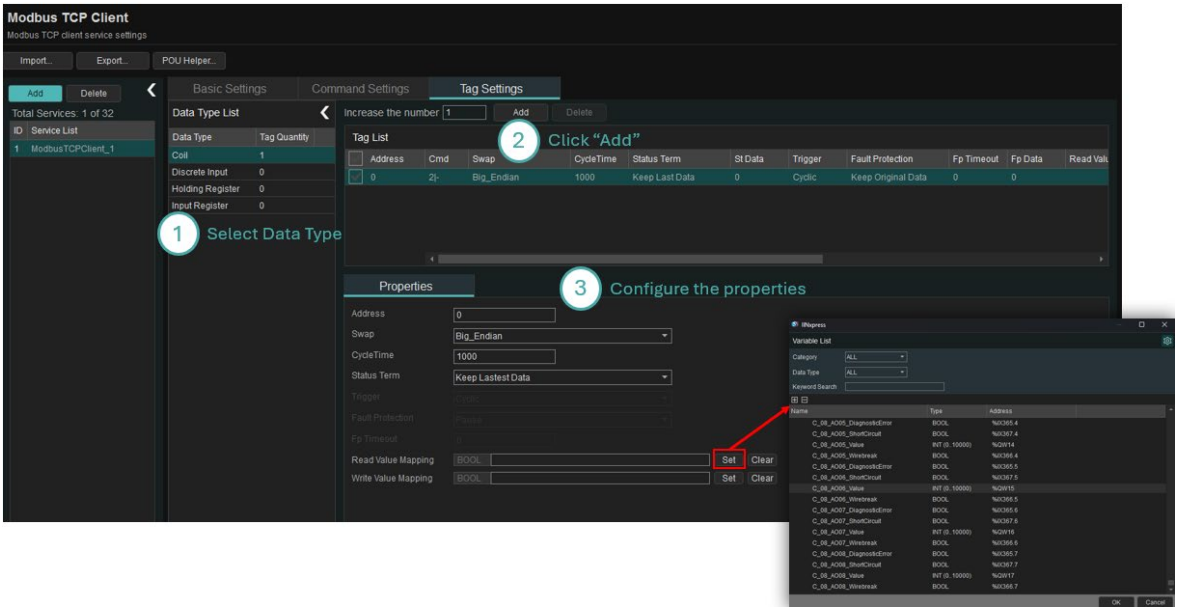

## NOTE

Double-click the Name (ModbusTCPClient_1) on the Service list to rename.

**Command Settings:** Create command profiles to read from or write to Modbus TCP Server devices. Select **Add** and configure the command property on the right-hand side, e.g., Function Code, Start Address, Read Quantity, etc.



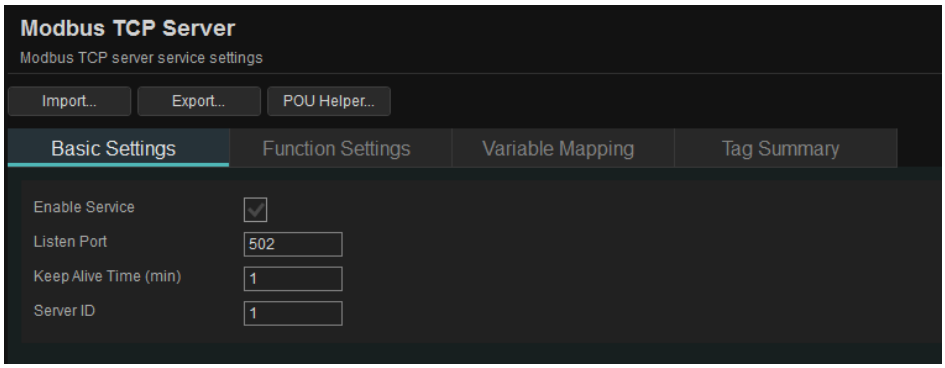

**Tag Settings:** The data array created on the Command Settings page will automatically appear on the Tag Settings page. Select **Set** to map the variables. Alternatively, follow the steps below to create tags manually.



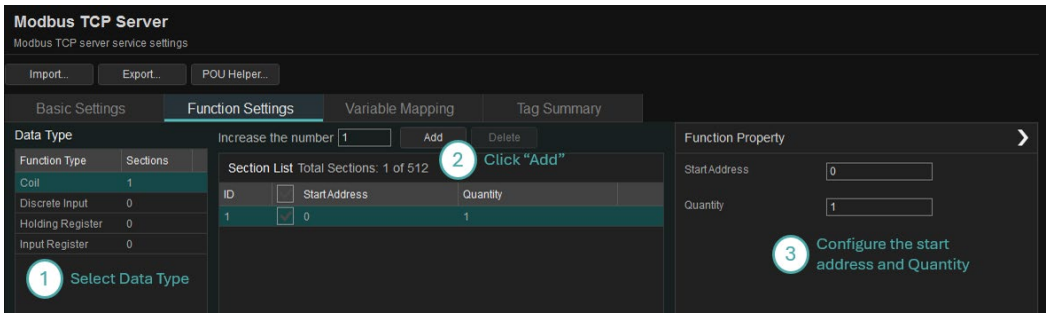
## Modbus TCP Server

Modbus TCP Server services can provide data to other Modbus TCP Client systems. All properties of the Modbus TCP Client are categorized into **Basic Settings**, **Function Settings**, **Variable Mapping**, and **Tag Summary**.

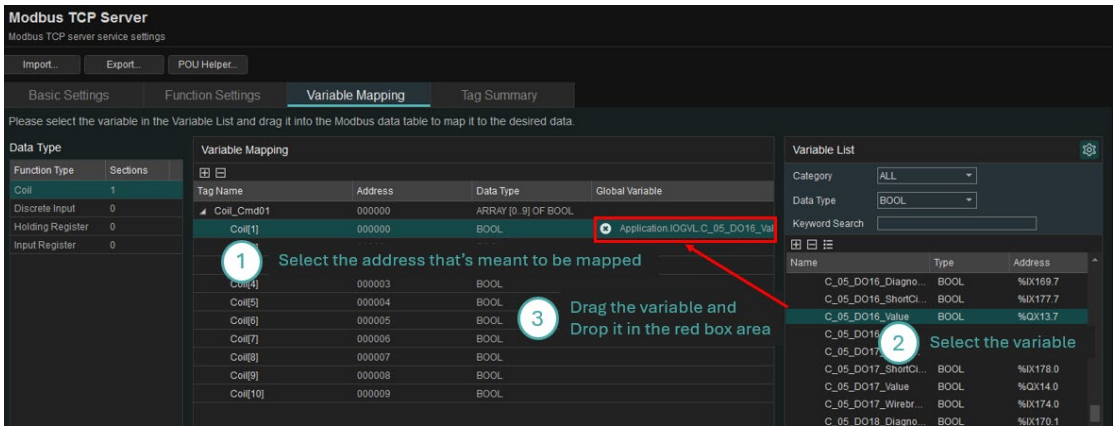
**Basic Settings:** Enable Service, Listen Port, Keep Alive Time and Server ID can be configured here.



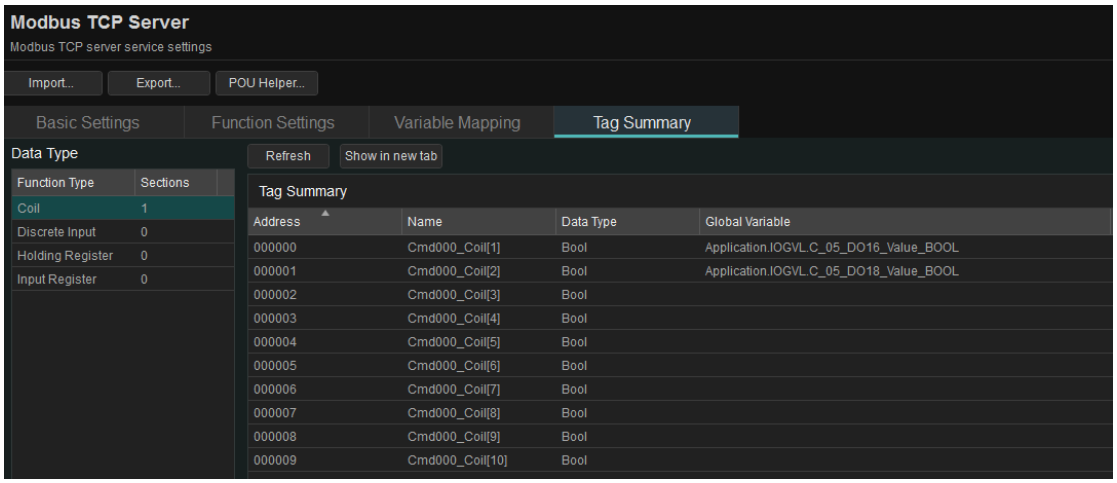

**Function Settings:** The ioPAC 6500 supports the function types: Coil, Discrete Input, Holding Register, and Input Register. Set up the tag quantity in the Function Settings based on the application. Follow the steps below to configure the functions.




**Variable Mapping:** The tag quantity defined in Function Settings will appear here automatically. Sort the variables in the Variable List, then drag and drop them into the array to complete data mapping.



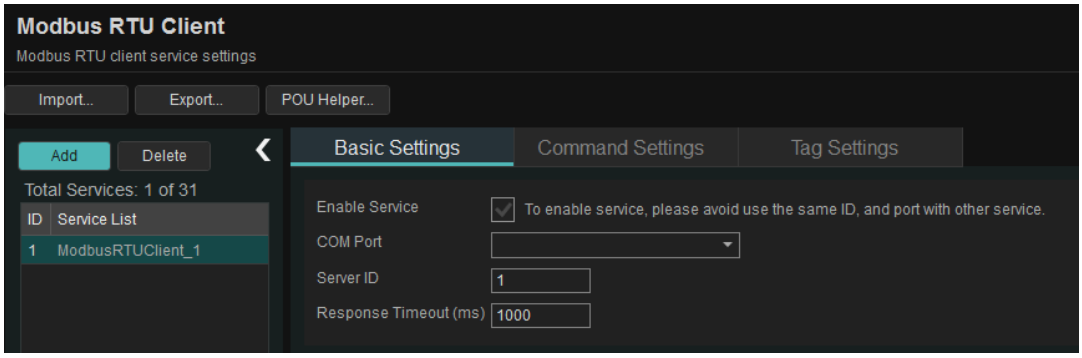
**Tag Summary:** Overview of all tags



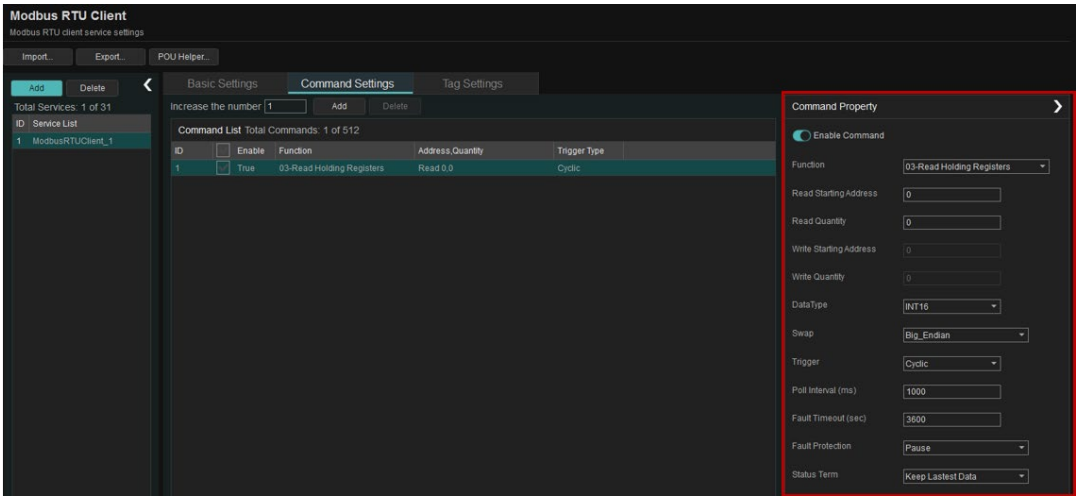

## Modbus RTU Client

The ioPAC 6500 system also supports the Modbus RTU client service. The only difference between Modbus TCP and RTU client service is the COM Port settings, which can be found on the basic setting page.

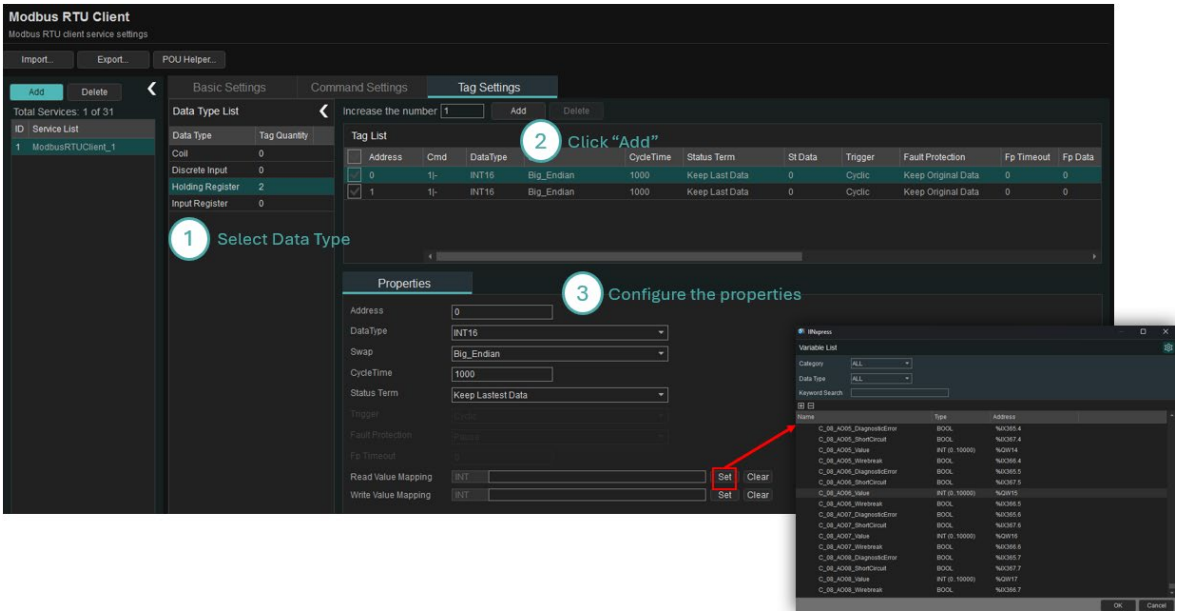
**Basic Settings:** Select **Add**, Enable Service, COM Port, Server ID, and Response Timeout can be configured here.




**Command Settings:** Create command profiles to read from or write to Modbus RTU Server devices. Select **Add** and configure the command property on the right-hand side, e.g., Function Code, Start Address, Read Quantity, etc.



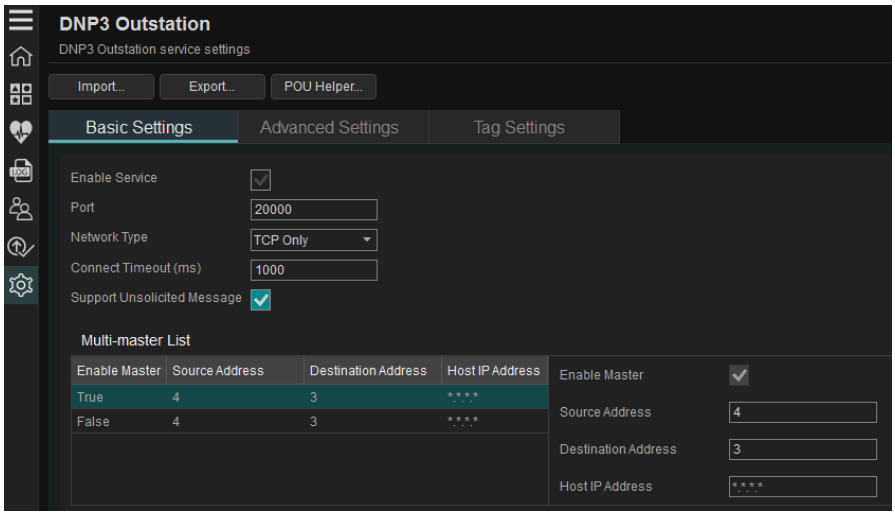
**Tag Settings:** The data array created on the Command Settings page will automatically appear on the Tag Settings page. Select **Set** to map the variables. Alternatively, follow the steps below to create tags manually.




## DNP3 Outstation

DNP3 Outstation services can be used to provide data to other systems via DNP3 protocol. All properties of the DNP3 Outstation are categorized into **Basic Settings**, **Advanced Settings**, and **Tag Settings**.

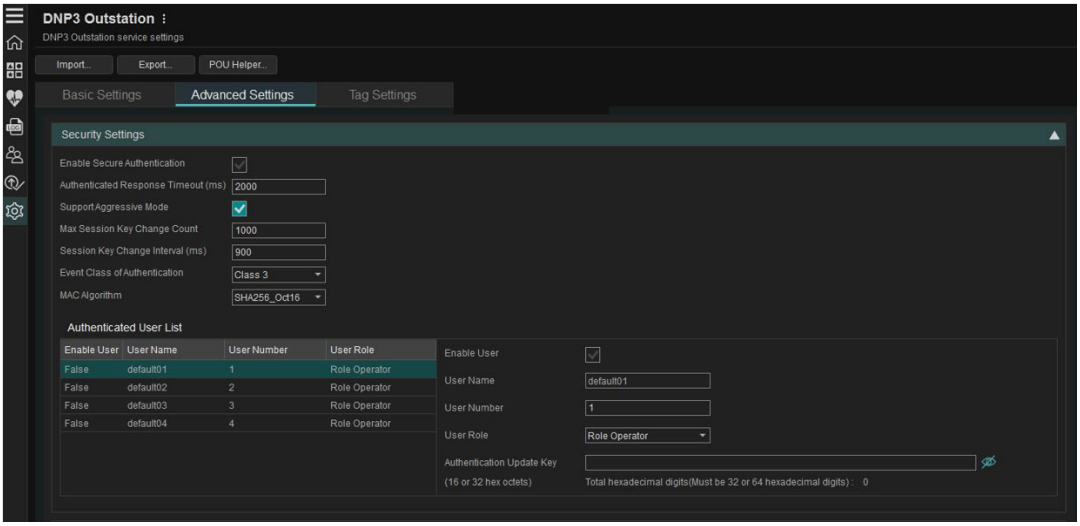
**Basic Settings:** The basic settings page provides the essential functions, such as port, Network Type, etc., for you to set up. Multi-master can be enabled on this page as well. The ioPAC 6500 Series supports up to 2 clients. When the DNP 3 Outstation service is enabled, the first client is set to enabled.



### Advanced settings

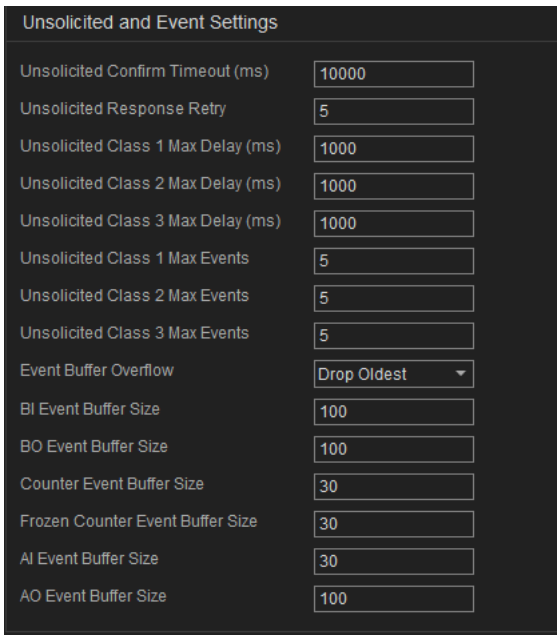
**Security settings:** These settings configure DNP3 Secure Authentication (SA) to protect communication between master and outstation from spoofing, tampering, or replay attacks.

**Authenticated User List:** This list defines who may operate or view. Please type the authentication update key before checking the "Enable User" box.



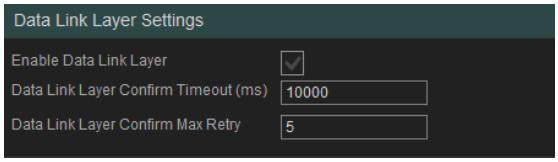

| Item | Description |
|---|---|
| Enable Secure Authentication | Enables DNP3 Secure Authentication. Required to authenticate control commands or data exchanges. |
| Authenticated Response Timeout (ms) | Time (in milliseconds) the outstation waits for a “challenge” response from the client. If exceeded, the request is rejected. |
| Support Aggressive Mode | When enabled, the outstation proactively initiates challenge. |
| Max Session Key Change Count | The number of authenticated operations before a new session key must be generated. Enhances security by limiting key reuse. |
| Session Key Change Interval (ms) | Minimum time interval (in milliseconds) between session key changes. Prevents overly frequent updates. |
| Event Class of Authentication | Defines the class of authentication events. |
| MAC Algorithm | Specifies the Message Authentication Code (MAC) algorithm.<br>3 options are available: SHA1_Oct10, SHA256_Oct16 and AES_GMAC. |

**Unsolicited and event settings:**



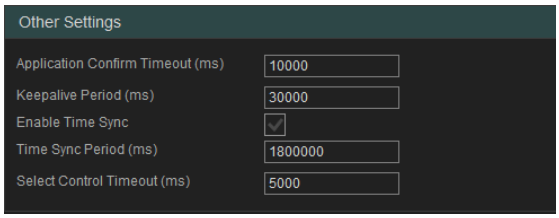

| Item | Description |
|---|---|
| Unsolicited Confirm Timeout (ms) | Timeout for waiting for an application layer confirmation (ACK) from the client after the outstation sends an unsolicited message. |
| Unsolicited Response Retry | Number of retries if the unsolicited message is not confirmed. |
| Unsolicited Class (X) Max Delay (ms) | Maximum delay allowed before the outstation sends an unsolicited message if any events are waiting in each class. |
| Unsolicited Class (X) Max Events | Limits how many events of each class are bundled into a single unsolicited response. |
| Event Buffer Overflow | What would be dropped if buffer overflows? Two options are available: Drop Oldest or Drop Latest. |
| BI Event Buffer Size | Number of Binary Input events stored |
| BO Event Buffer Size | Number of Binary Output events stored |
| Counter Event Buffer Size | Number of Counter events (e.g., pulse count changes) stored |
| Frozen Counter Buffer Size | Number of frozen counters (e.g., snapshots) values stored |
| AI Event Buffer Size | Number of Analog Input changes stored |
| AO Event Buffer Size | Number of Analog Output feedback or confirmation events stored |

**Data Link Layer Settings:**



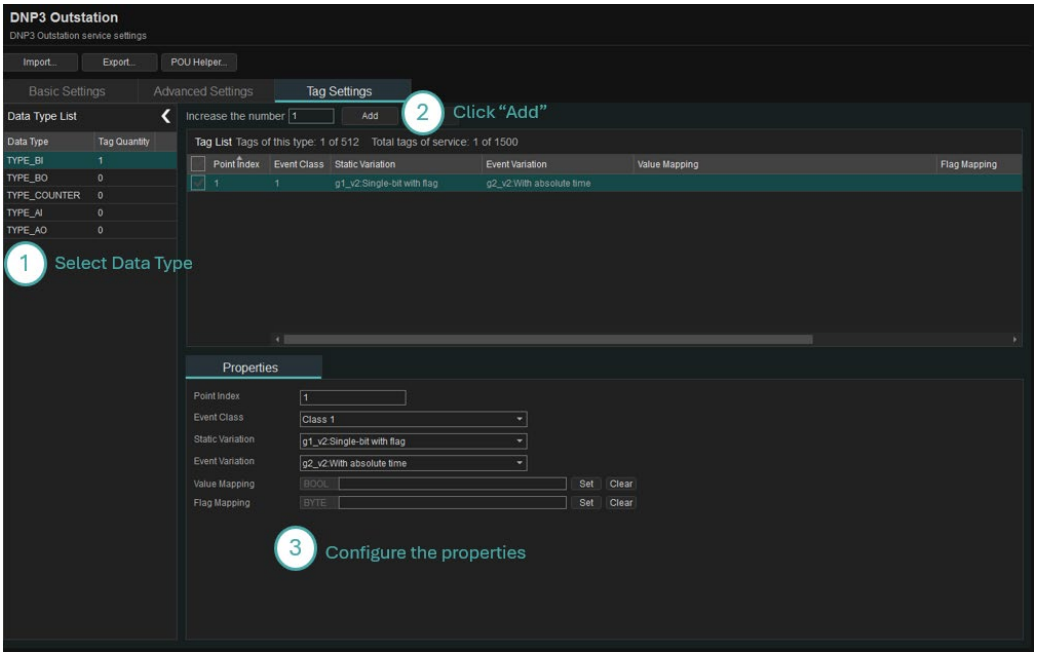

| Item | Description |
|---|---|
| Enable Data Link Layer | Enables data link layer functions |
| Data Link Layer Confirm Timeout (ms) | Time to wait for data link acknowledgment before retrying |
| Data Link Layer Confirm Max Retry | Number of times the outstation will retry a message if the link-layer acknowledgment isn't received |

**Other Settings:**

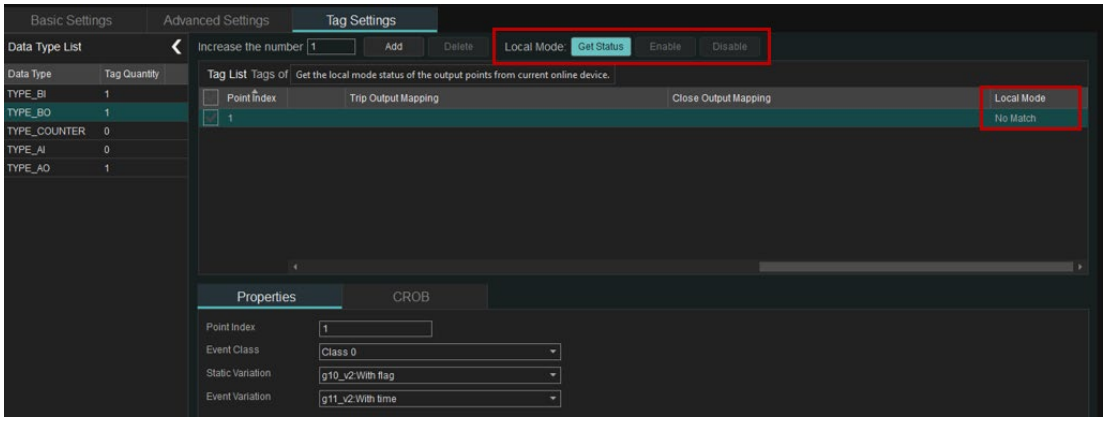



| Item | Description |
|---|---|
| Application Confirm Timeout | The time the outstation waits for an application-layer confirmation (APPL-CONFIRM) after sending a message that requires one. |
| Keepalive Period | Interval at which the outstation sends an idle test message. If no activity has occurred, to keep the session alive. |
| Enable Time Sync | Whether the outstation allows the client to synchronize its internal clock. |
| Time Sync Period | How often does the outstation expect a time sync. |
| Select Control Timeout | Time allowed between the Select and Operate commands in a Select-Before-Operate (SBO) control. |

**Tag settings:** Follow the steps below to configure Tags

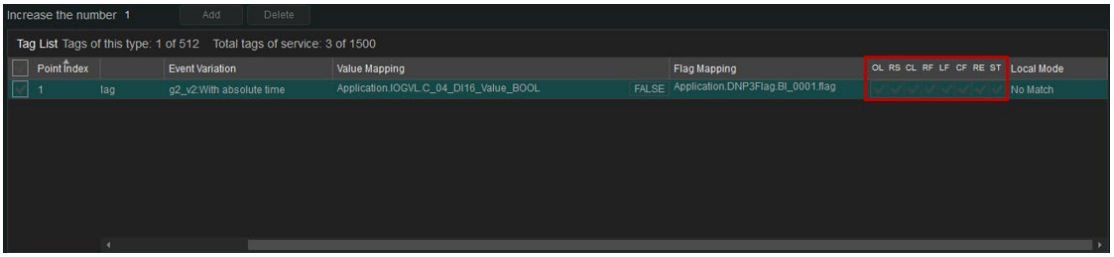


**Local Mode:** The DNP3 Outstation service in ioPAC 6500 system supports Local Mode. It prevents all output categories, including TYPE_BO and TYPE_AO, from being remotely controlled when the ioPAC 6500 is connected locally, ensuring the safety of field site personnel. To enable/disable the Local Mode, steps are as follows: Download Application (Connect the device) > Select **Get Status > Select Point > Enable/Disable Local Mode.**




**Flag:** Log in to application to see the flag status.

| OL | RS | CL | RF | LF | CF | RE | ST |
|---|---|---|---|---|---|---|---|
| Online | Restart | Comm Lost | Remote Forced | Local Forced | Chatter Filter | Reserved | State |

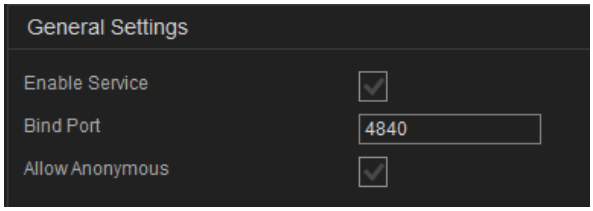



## OPC UA Server

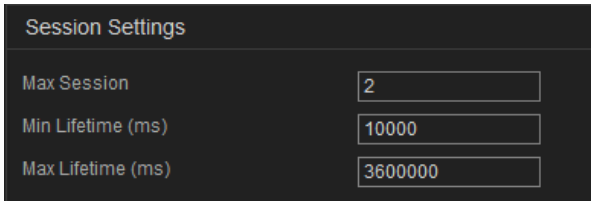
OPC UA Server services can be used to provide data to other systems via the OPC UA protocol. All properties of the OPC UA are categorized into **Basic Settings**, **Tag Settings**, and **Variable Mapping**.

**Basic Settings:** The Basic Function Settings page provides the essential functions setup, including General Settings, Session Settings, and Subscription Settings.

**General Settings:**

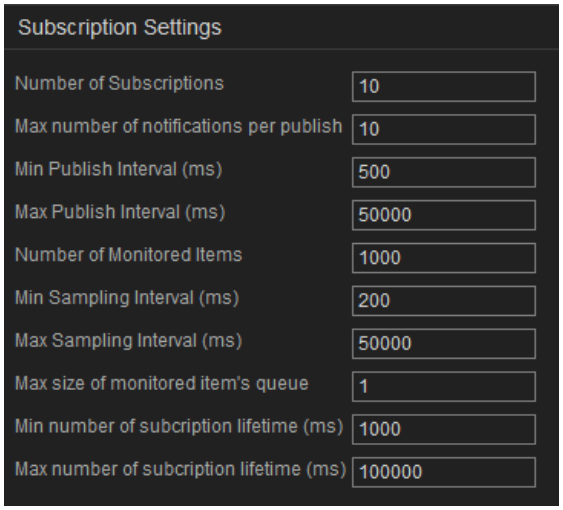


**Session Settings:**



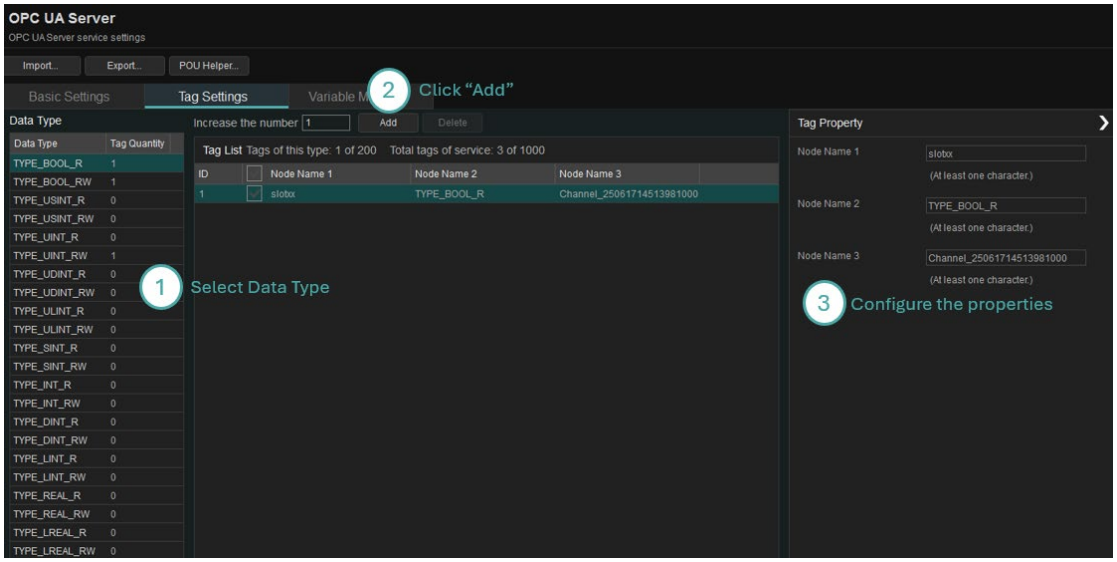

| Items | Description |
|---|---|
| Max Session | Maximum number of concurrent client sessions allowed |
| Min Lifetime (ms) | Minimum time (in milliseconds) a session is held before being eligible for termination. |
| Max Lifetime (ms) | Maximum duration a session can stay active without being renewed by the client. |

**Subscription Settings:**

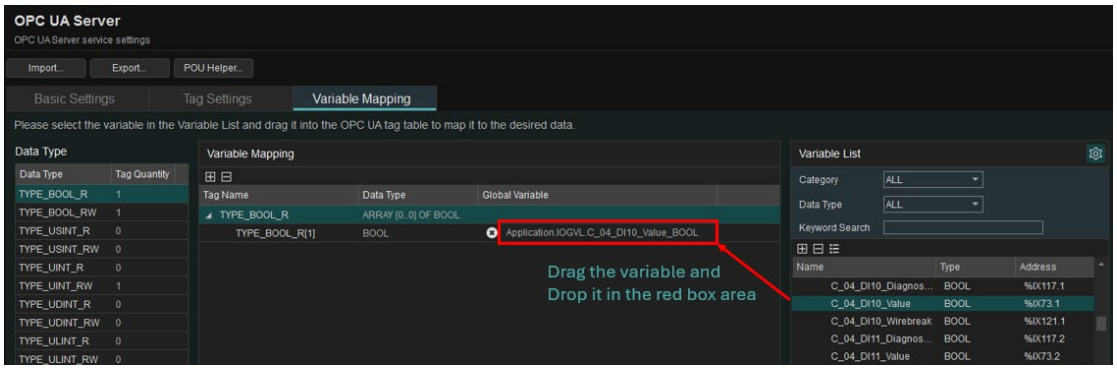



| Items | Description |
|---|---|
| Number of Subscriptions | Maximum number of concurrent OPC UA subscriptions the server will allow. |
| Max number of notifications per publish | Limits how many data change events are sent in a single publish response. |
| Min Publish Interval (ms) | Minimum interval for sending published responses. |
| Max Publish Interval (ms) | Maximum interval for sending published responses. |
| Number of Monitored Items | Max number of variables (tags) that can be monitored across all subscriptions. |
| Min Sampling Interval (ms) | Fastest rate at which a monitored item is sampled. |
| Max Sampling Interval (ms) | The slowest rate at which a monitored item is sampled. |
| Max size of monitored item’s queue | The number of historical values stored in the queue per monitored item. |
| Min number of subscription lifetime (ms) | Minimum amount of time a subscription remains valid without interaction. |
| Max number of subscription lifetime (ms) | Maximum allowable time a subscription can exist before it's deleted. |

**Tag Settings:** The ioPAC 6500 supports multiple data types to suit various applications. Each type allows up to 200 tags, with a total limit of 2,000 tags. Up to three names can be assigned to each tag for identification purposes. Follow the steps below to configure tags.




**Variable Mapping:** The tag quantity defined in Tag Settings will appear here automatically. Sort the variables in the Variable List, then drag and drop them into the array to complete data mapping. Follow the step below to map variables.



## System Status

In the ioPAC 6500 Configuration page, the system status is in the bottom-left corner. The Diagnositc Status, Application Status, and Connection Status will be displayed here. Log in the system and all status will be displayed here.

**Diagnostic Status:** Diagnostic Status: Warnings and errors will trigger an alert here, reminding you to check the status. Select the icon and open the Diagnostic page to review the status.

**Application Status:** Shows the system is in run or stop mode.

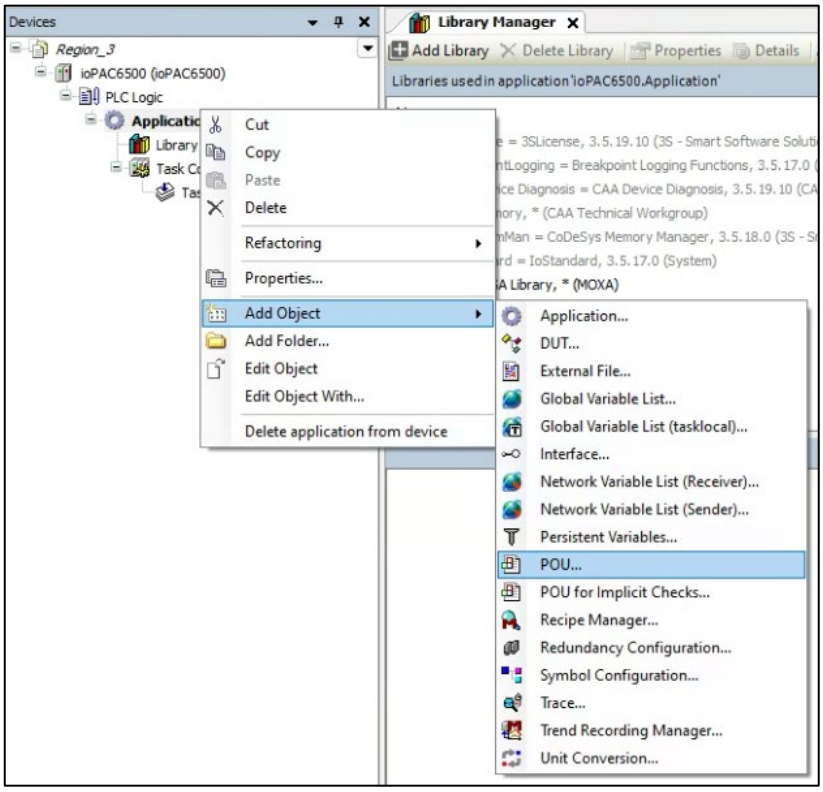
**Connection Status:** Shows which accounts are logged into the system.


# Library Manager

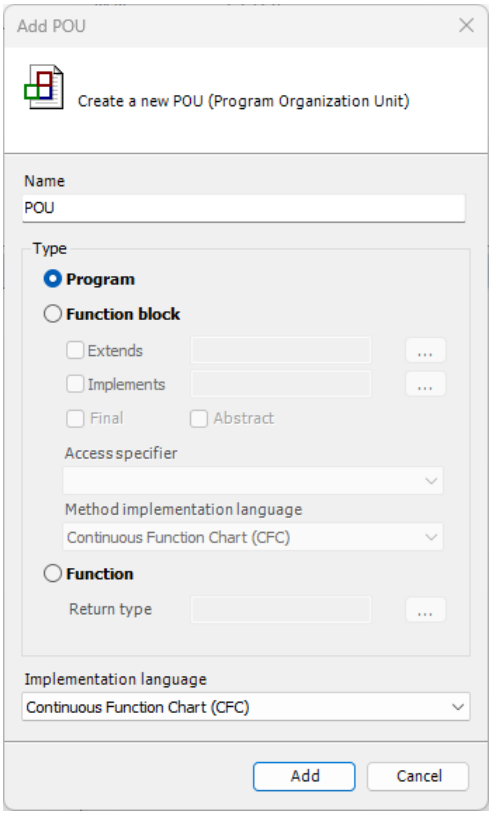
Double-click the Library Manger in the project tree, and the Library Manager page will show in the main window. The libraries supported by IINxpress can be found here. Besides the standard library, Moxa also provides the AGA3, 5, 8 libraries for oil-and-gas applications.

# POU

POU stands for Programming Organization Unit, where you can develop your application. Add the POU by the path **Application (right-select) > Add Objects > POU**.




Once opening the POU, you will see the following window. Specify the information you need, then select **Add** to create the POU.



**Name:** The name to identify the program.

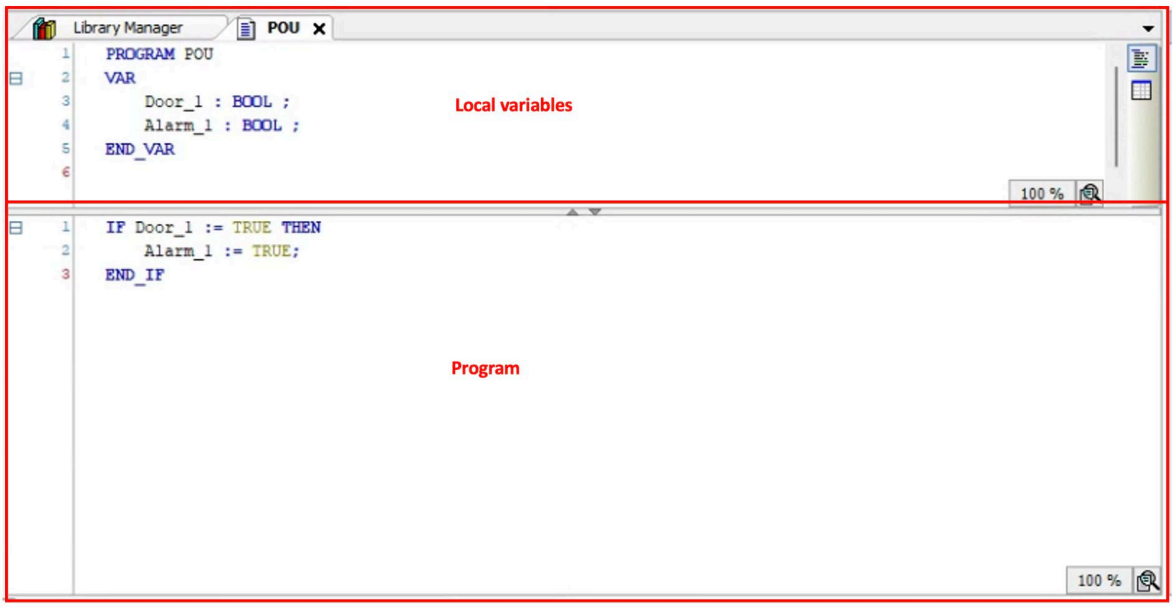
**Type:** You can choose from three different types.

- **Program:** These POUs contain logical control or function block calls.
- **Function Block:** These are POUs with multiple input and output parameters and can be called into other programs.
- **Function:** These are POUs with multiple input parameters and only one output parameter.

**Implemented language:** You can choose the familiar IEC 61131-3 language to develop the program. The following languages are supported.

- Continuous Function Chart (CFC)
- Function Block Diagram (FBD)
- Ladder Logic Diagram (LD)
- Sequential Function Chart (SFC)
- Structured Test (ST)

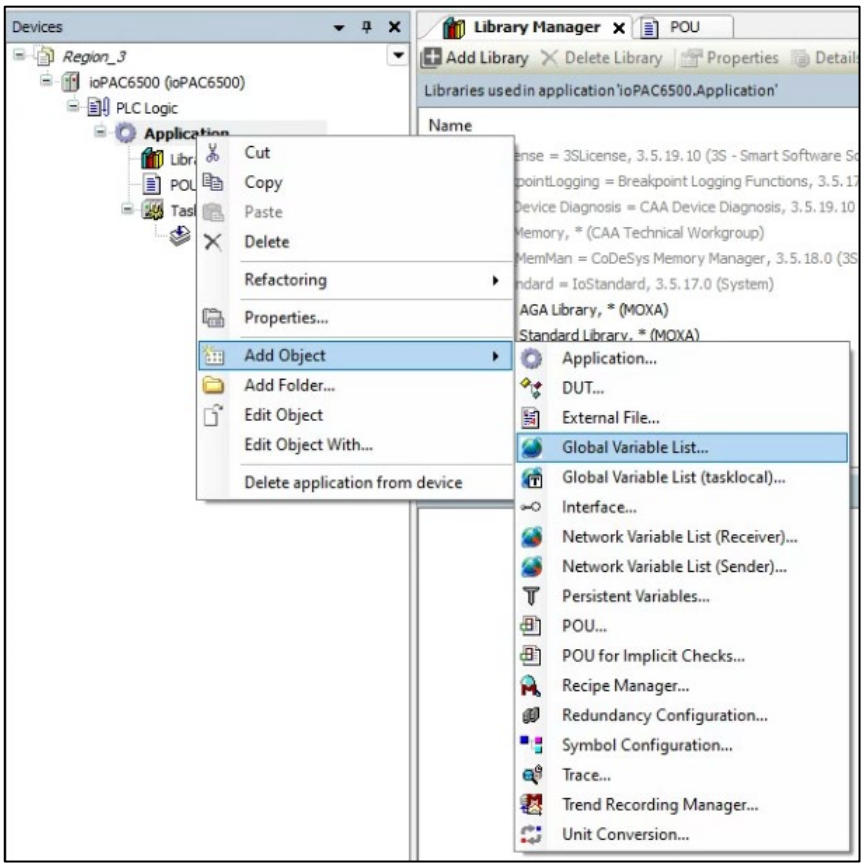
After selecting **Add**, one POU page will be created. You will see the following page.



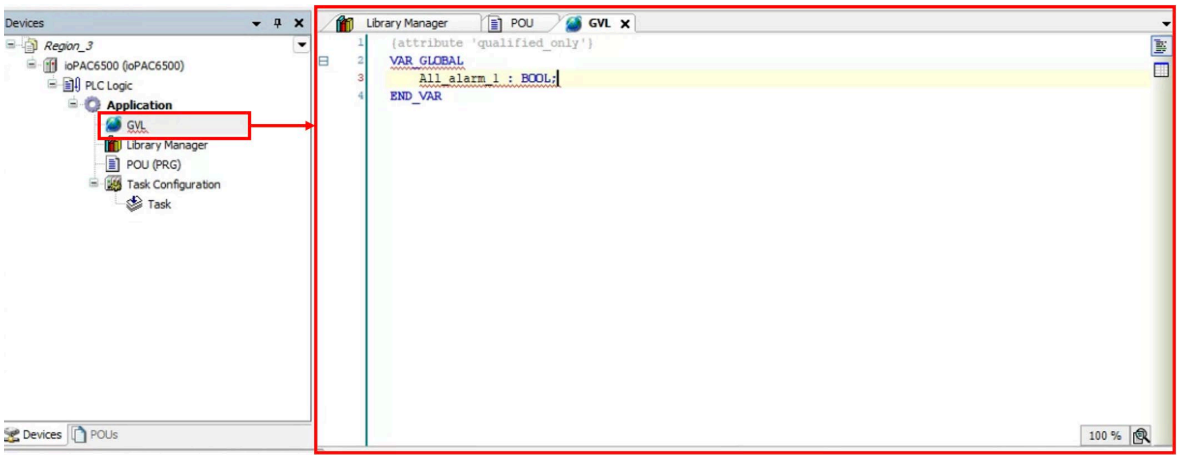

The POU window can be separated into two parts. You can define the local variable on the upper side. The lower side is where you develop your own program.

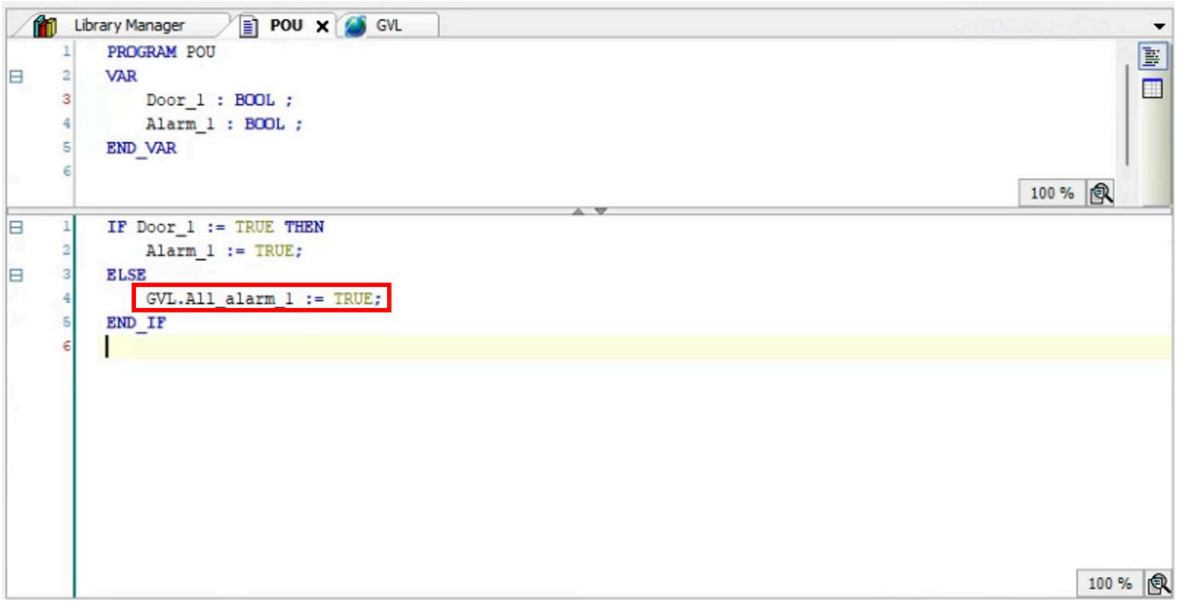
# GVL

If you have the global variable demand, you can create the global variables by the path **Application (right-select) > Add Objects > GVL**.




Define the global variable in the window, and these global variables can be used in the program. Add a "GVL." prefix to distinguish the variables are local or global.




Library Manager
POU
GVL
PROGRAM POU
VAR
Door_1 : BOOL ;
Alarm_1 : BOOL ;
END_VAR
100 %
IF Door_1 := TRUE THEN
Alarm_1 := TRUE;
ELSE
GVL.All_alarm_1 := TRUE;
END_IF
100 %

# 6. Switch Module Configuration

## About This Chapter

In this chapter, learn how to connect your switch module with various interfaces and how to configure all settings and parameters via the user-friendly web interface.

## Meanings of the Symbols in the Web Interface Configurations

The Web Interface Configuration includes various symbols. Refer to the following table for the meanings of the symbols.

| Symbols | Meanings |
|---|---|
|  | Add |
|  | Read detailed information |
|  | Clear all |
|  | Column selection |
|  | Refresh |
|  | Enable/Disable Auto Save<br>When Auto Save is disabled, users need to select this icon to save the configurations. |
|  | Export* |
|  | Edit |
|  | Re-authentication |
|  | Delete |
|  | Panel View |
|  | Expand |
|  | Collapse |
|  | Hint Information |
|  | Settings |
|  | Data Comparison |
|  | Menu icon |
|  | Change mode |
|  | Locator |
|  | Reboot |

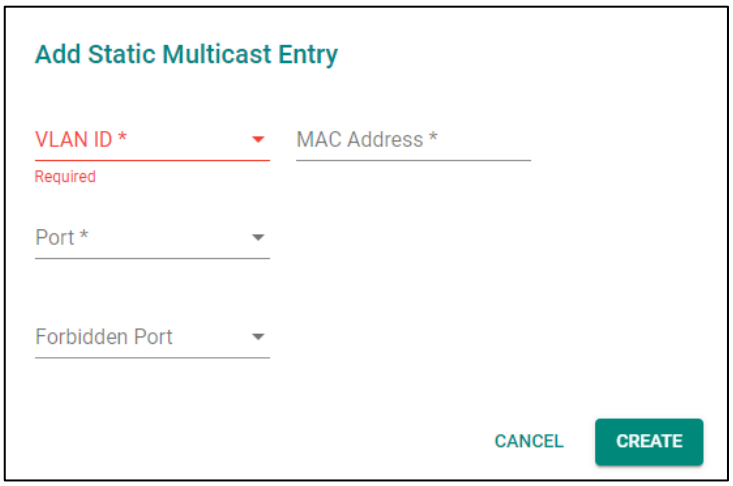
| Symbols | Meanings |
|---|---|
| | Reset to default |
| | Logout |
| | Increase |
| | Decrease |
| | Equal |
| | Menu |
| | Search |
| | Hide text that is typed into a text box (usually used when typing a password) |
| | Show text typed into a text box (usually used when providing password) |

*The **Export** function helps you save the current configurations or information for the specific functions. It is on the upper part of the configuration area. Two formats are available: CVS or PDF. Select the format and save it on your local computer.

# Configuration Reminders

In this section, several examples will remind you when configuring the settings for a switch module.

## A: About Mandatory Parameters

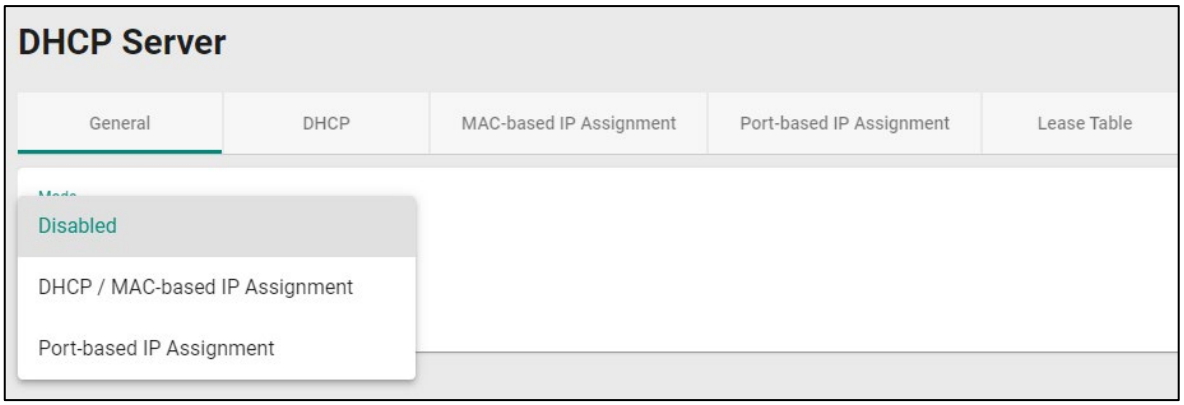



1. The items with asterisks mean they are mandatory parameters that must be provided. In the figure above, the parameters for VLAN, Version, and Query Interval need to be provided, or it will not be created or applied.
2. If the item is marked with red, it means this item has been skipped. Fill in the parameters or you cannot apply or create the function.

In addition, some parameter values will be limited to a specific range. If the values exceed the range, they cannot be applied or created.

## B: Configurations Before Enable/Disable

In another situation, some settings can be configured first but remain disabled. Enable them, when necessary, without configuring the same settings again. This is particularly convenient and user-friendly when configuring various settings. For example, on the **DHCP Server** configuration page, configure the **DHCP** settings first, but later select to disable the **DHCP** settings in the **General** tab. When enabling the **DHCP** settings, only select **Enable** in **General** settings, so that the **DHCP** settings (either **MAC-based IP Assignment** or **Port-based IP Assignment** as shown as an example in the following figure) can be enabled at the same time.



# Getting Started

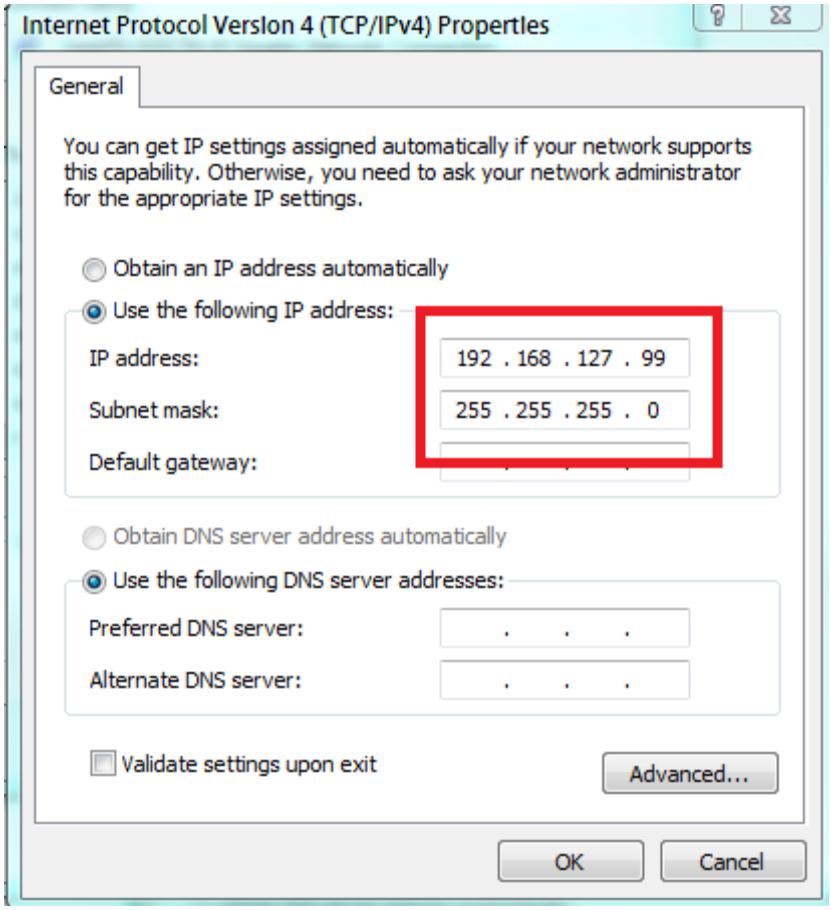
In this section, we explain how to log in a switch module for the first time. There are three ways to access the switch module's configuration settings: RS-232 console, Telnet (disabled by default) or web-based interface.

## Log In by Web Interface

Directly connect the switch module to your computer with a standard network cable or install your computer at the same intranet as your switch. Then you need to configure your computer's network setting. The default IP address for the switch module is based on the slot index value:

**192.168.127.101-102**

For example, configure the computer's IP setting as **192.168.127.99**, and the subnet mask as 255.255.255.0.




Select **OK** when finished.

## Connecting to the Switch

Open a browser, such as Google Chrome, Internet Explorer 11, or Firefox, and connect to the following IP address based on the corresponding slot index value.

### 1-slot Communication Module Backplane

| | |
|---|---|
| Index Value | 0 |
| IP Address | 192.168.127.101 |

### 2-slot Communication Module Backplane

| | | |
|---|---|---|
| Index Value | 0 | 1 |
| IP Address | 192.168.127.101 | 192.168.127.102 |


### NOTE

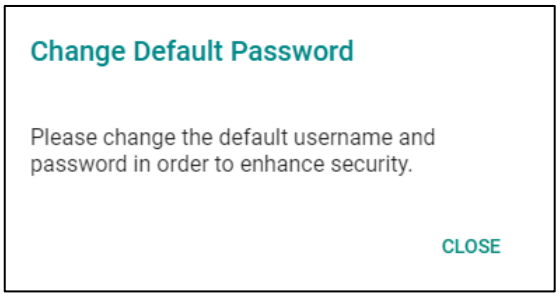
For network security consideration, all HTTP connections will be automatically redirected to HTTPS connections. The web browser will display a warning message if the device uses a certificate which isn't signed by the certification authority. You may add an exception rule for the certificate in the web browser to continue. We recommend using a certificate signed by a certification authority for security reasons. Refer to "**Security > Device Security > SSH & SSL > SSL**" for the configuration steps.

The default username and password are:

Username: **admin**
Password: **moxa**

Select **LOG IN** to continue. If you have logged in before, you will see a screen showing the previous login records. Select **CLOSE**.

Another system message will appear, reminding you to change the default password. We recommend you change your password, or a message will appear whenever you log in. Change the password in the **Account Management** section. Select **CLOSE** to continue.



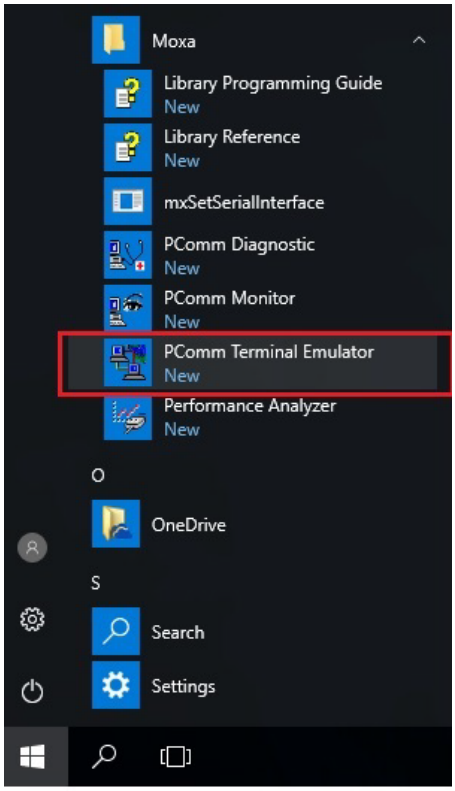

# Log In by RS-232 Console

The ioPAC 6500 Layer 2 Managed Ethernet Switch Module offers a serial console port, allowing you to connect to the switch and configure the settings. Do the following steps for the serial connection and configuration.

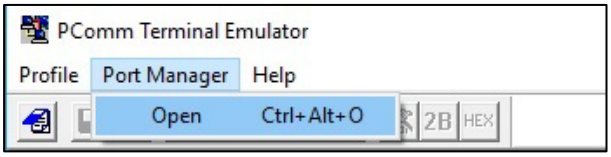
1. Prepare an RS-232 serial cable with an RJ45 interface.
2. Connect the RJ45 interface to the console port on the switch, and the other end to the computer.
3. We recommend you use **PComm Terminal Emulator** for serial communication. Download the software free from Moxa's website.

After installing PComm Terminal Emulator, open the switch module's console:

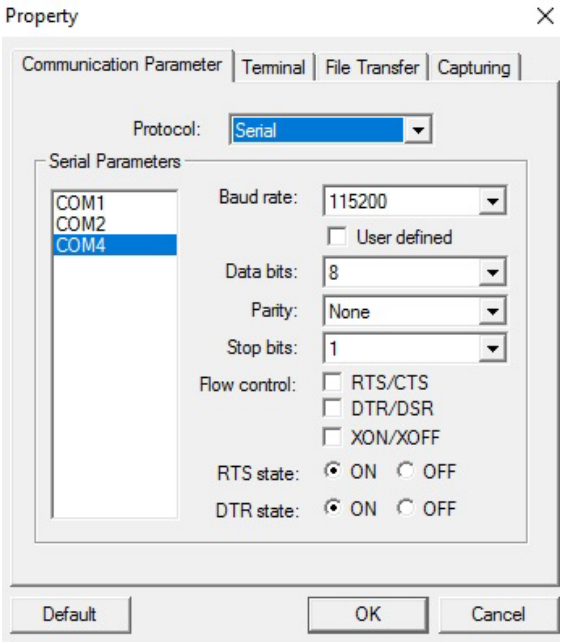
1. From the Windows desktop, select **Start > Moxa > PComm Terminal Emulator**.



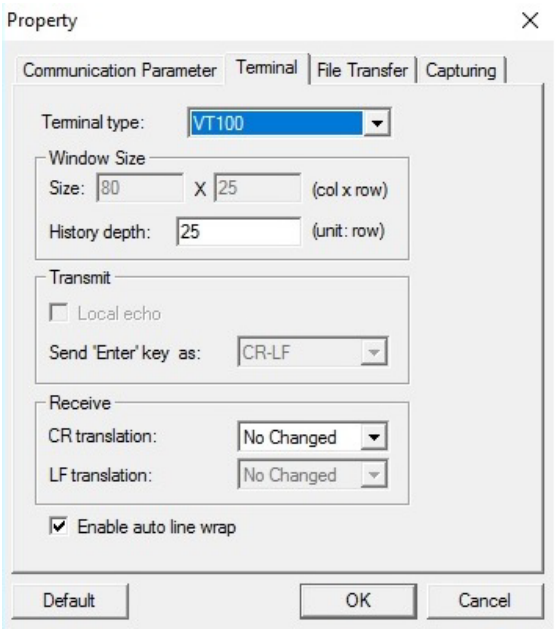

2. Select **Open** under the **Port Manager** menu to open a new connection.



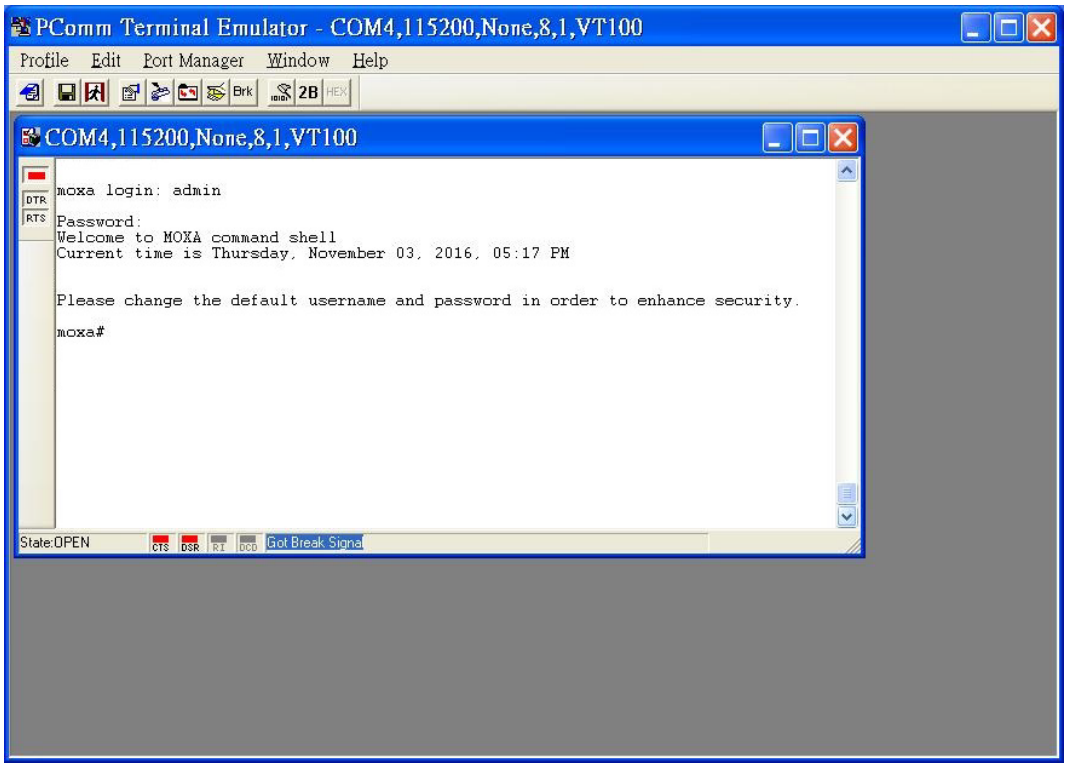
3. The **Property** window will open. On the **Communication Parameter** tab for **Ports**, select the COM port that is being used for the console connection. Set the other fields: **115200** for **Baud Rate**, **8** for **Data Bits**, **None** for **Parity**, and **1** for **Stop Bits**.




4. On the **Terminal** tab, select **VT100** for **Terminal Type**, and then select **OK** to continue.



5. The console will prompt you to log in. The default login name is **admin**, and the default password is **moxa**. This password will be required to access any of the consoles (web, serial, Telnet).




6. After successfully connecting to the switch by serial console, start configuring the switch parameters by using command line instructions. Refer to the **Moxa Command Line Interface Manual**.

### NOTE

By default, the password assigned to the switch module is **moxa**. Be sure to change the default password after you first log in to help keep your system secure.

## Log In by Telnet

### NOTE

The Telnet protocol is disabled by default. Go to the **Security > Device Security > Management Interface** section to enable the telnet function first.

Opening the switch module's Telnet or web console over a network requires that the PC host and switch module are on the same logical subnet. You might need to adjust your PC host's IP address and subnet mask. By default, the switch module's IP is based on the slot index value:(192.168.127.101-102) and the switch module's subnet mask is 255.255.255.0. If the subnet mask is 255.255.0.0, you must set your PC's IP address to 192.168.xxx.xxx. If the subnet mask is 255.255.255.0, you must set your PC's IP address to 192.168.127.xxx.

### NOTE

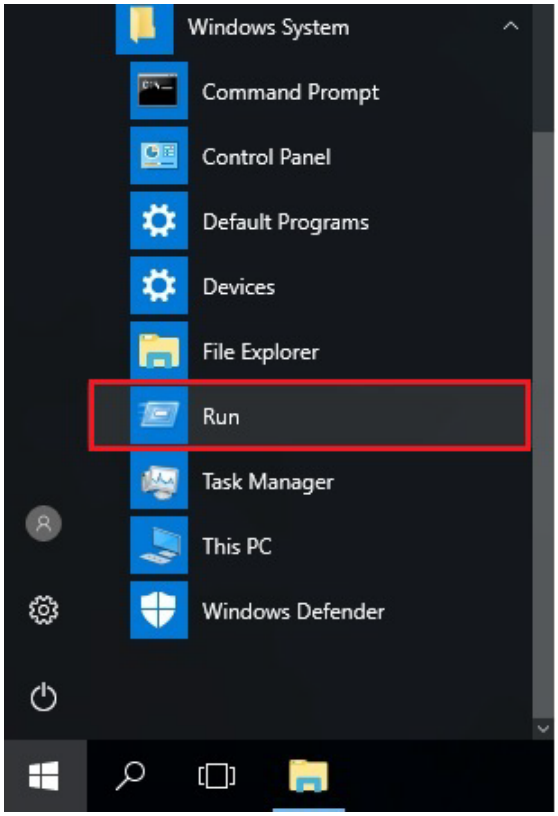
When connecting to the switch module's Telnet or web console, first connect one of the switch module's Ethernet ports to your Ethernet LAN, or directly to your PC's Ethernet port. Use either a straight-through or crossover Ethernet cable.

## NOTE

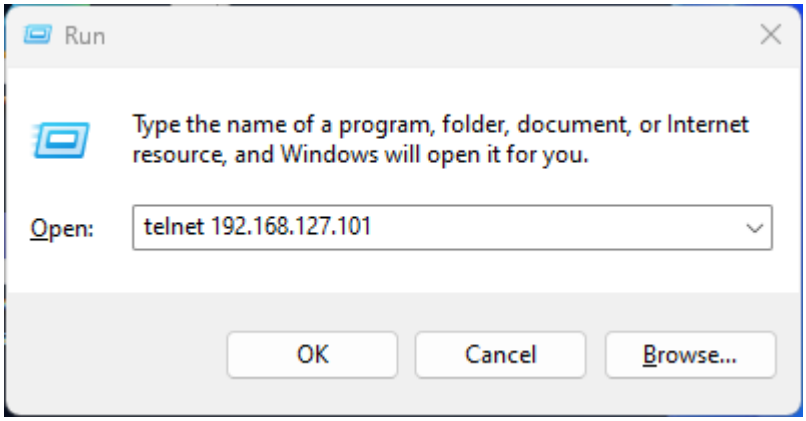
The Moxa switch’s default IP address is 192.168.127.101-102 (by slot index).

After making sure that the switch module is connected to the same LAN and logical subnet as your PC, open the switch module's Telnet console:

1. Select **Start > Run** from the Windows Start menu and then Telnet to the switch module's IP address from the Windows **Run** window. You can also issue the Telnet command from a DOS prompt.




2. Next, use Telnet to connect the switch module's IP address (192.168.127.101~104) from the Windows **Run** window. You can also issue the Telnet command from a DOS prompt.



3. The Telnet console will prompt you to log in. The default login name is **admin**, and the password is **moxa**. This password will be required to access any of the consoles (web, serial, Telnet).

```
moxa login: admin
Password:
Welcome to MOXA command shell
Current time is Friday, December 21, 2018, 08:51 PM


Please change the default username and password in order to enhance security.

moxa# _
```

4. After successfully connecting to the switch by Telnet, start configuring the switch parameters by using command line instructions. Refer to the **Moxa Command-line Interface Manual**.

**NOTE**

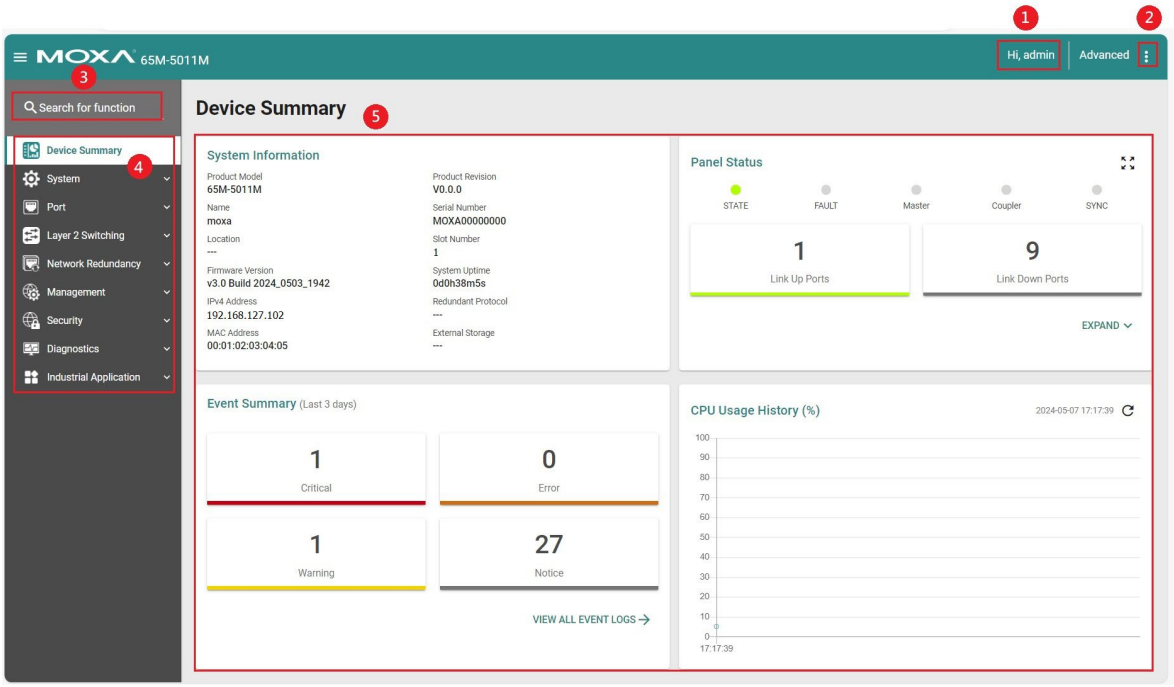
By default, the password assigned to the switch module is moxa. Be sure to change the default password after you first log in to help keep your system secure.

# Web Interface Configuration

The ioPAC 6500 Layer 2 Managed Ethernet Switch Module offers a user-friendly web interface for easy configurations. It is easy to configure various settings over the web interface. All configurations for the switch module can be easily set up and done via this web interface, essentially reducing system maintenance and configuration effort.

## Function Introduction

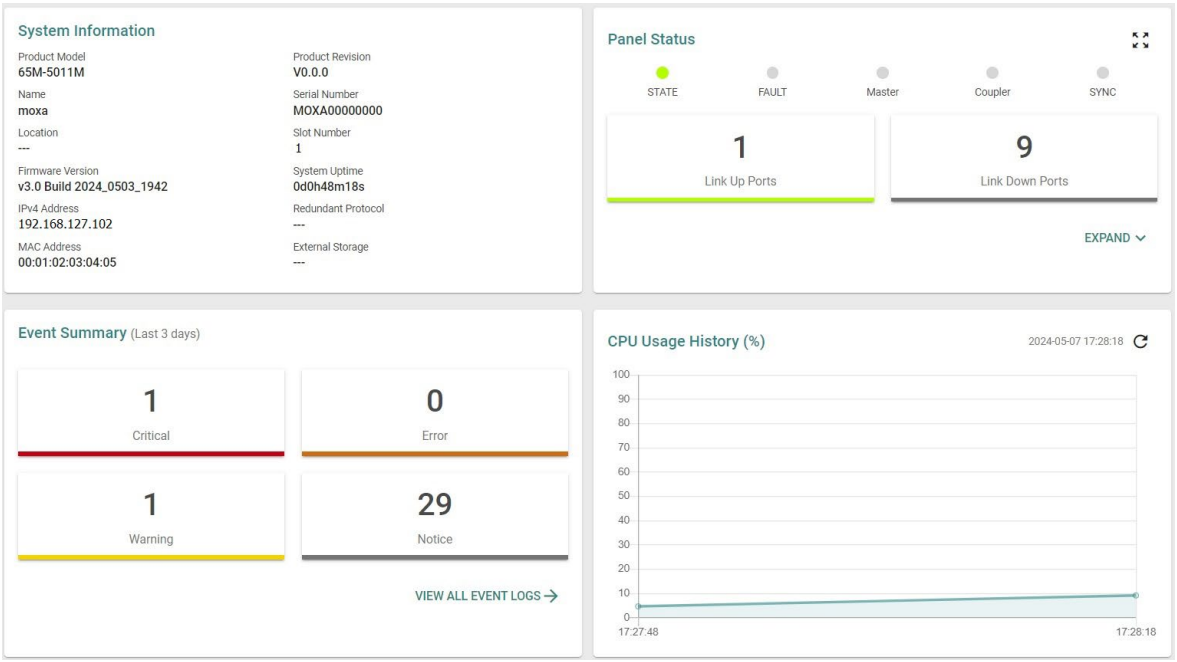
This section describes the web interface design, providing a basic visual concept for users to understand the main information or configuration menu for the web interface pages.



1. **Login Name:** It shows the role of the login name.
2. **Configuration Mode:** Two modes can be shown: **Standard Mode** and **Advanced Mode**.
   - **Standard Mode:** Some features and parameters will be hidden to make the configurations simpler (default).
   - **Advanced Mode:** More features and parameters will be shown for you to configure detailed settings.
3. **Search Bar:** Type the items you want to search for in the function menu tree.
4. **Function Menu:** Functions of the switch are shown here. Select the function you want to view or configure.
5. **Device Summary:** Important device information of the functions will be shown here.

# Device Summary

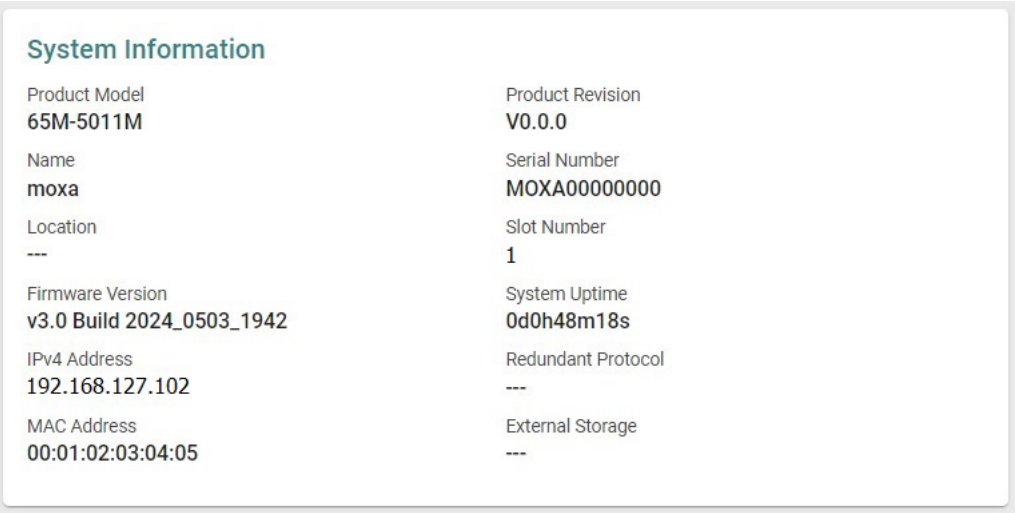
After successfully connecting to the switch, the **Device Summary** will automatically appear. View the whole web interface on the screen. If you are in the middle of performing configurations, select Device Summary on the Function Menu and you can view the detailed information of the switch.




See the following sections for detailed descriptions of the specific items.

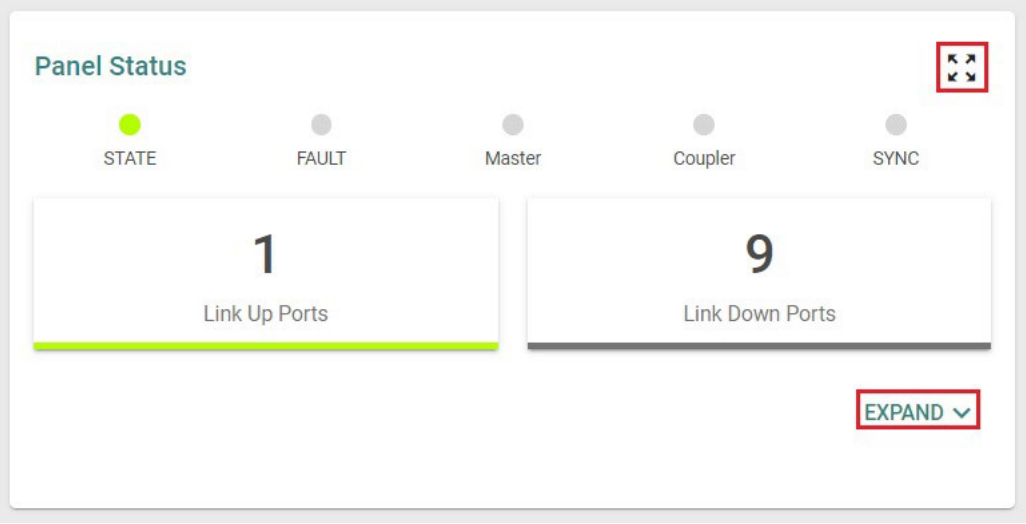
## System Information

This shows the system information, including the product model name, product revision, serial number, firmware version, system uptime, etc.

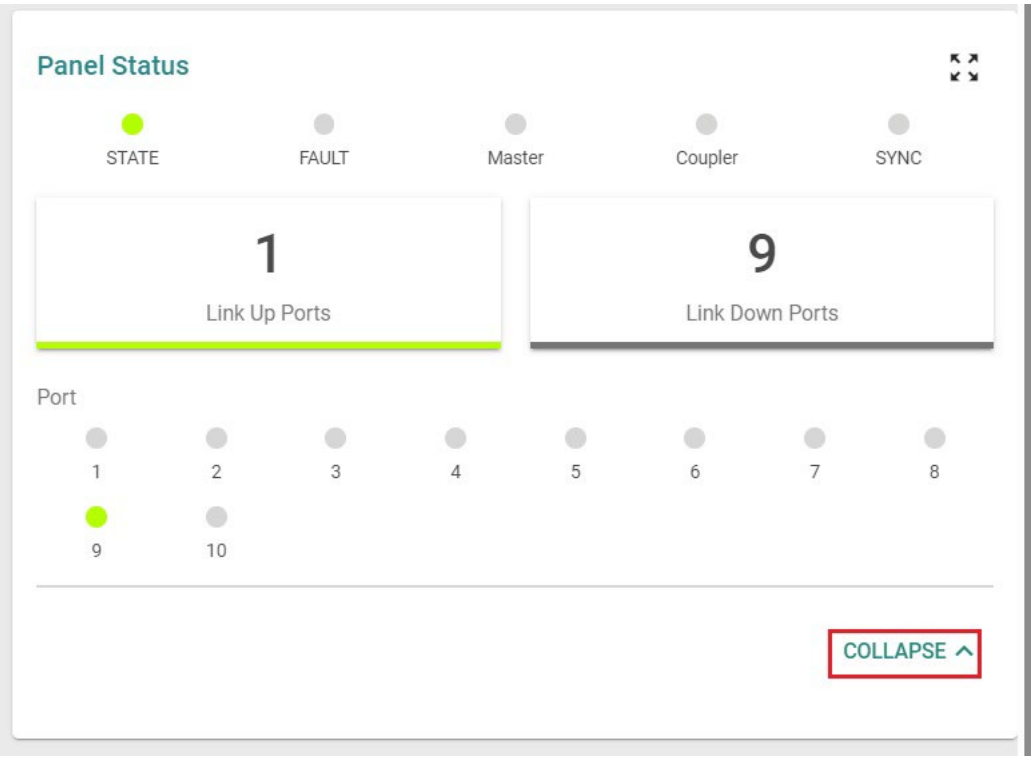



## Panel Status

This section illustrates the panel status. For example, the connecting ports will be shown in green, while the disconnected ports will be shown in gray. Select **EXPAND** to view more detailed information on the panel status and select **Collapse** to return.




Select **EXPAND** to view more detailed information on the panel status and select **COLLAPSE** to return.



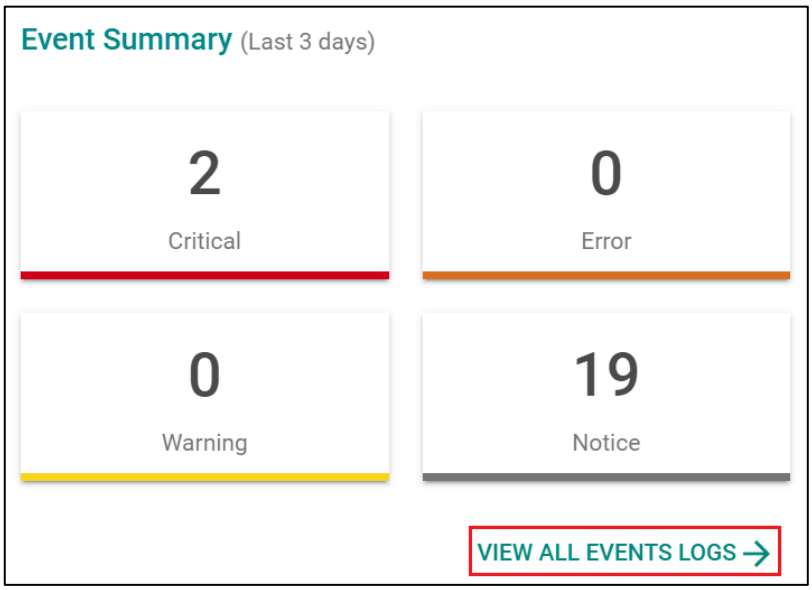

## Panel View

Select the icon with four arrows ( ) to view the device's port status. Select the close icon in the upper-right corner to return to the main page.

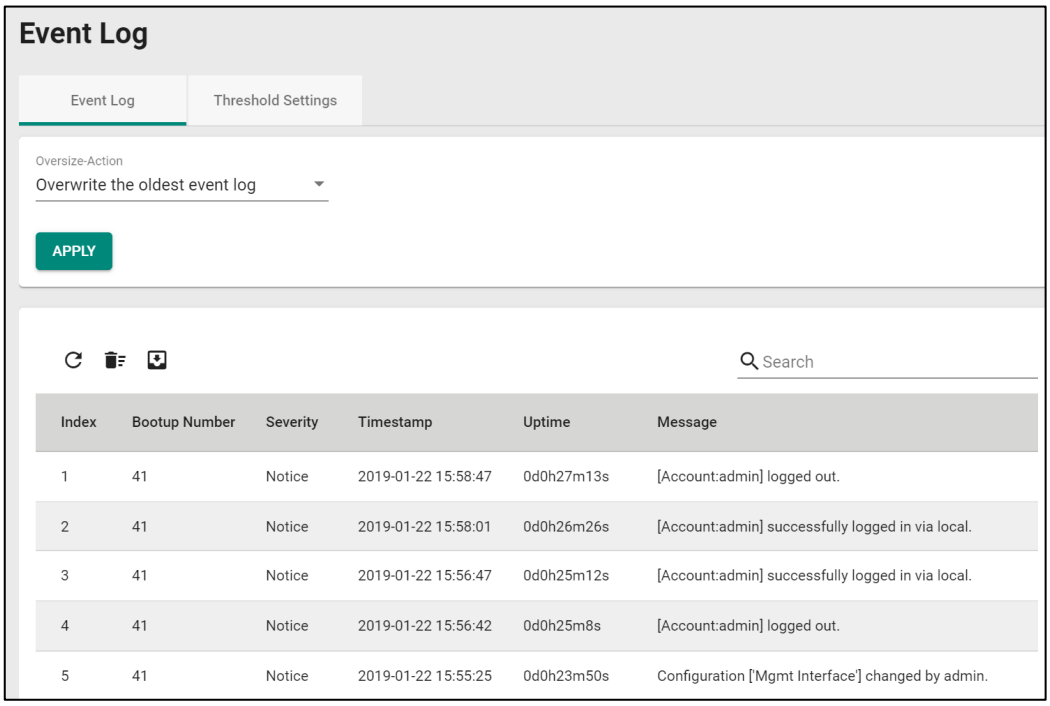
This appearance of the panel view figure depends on which model is being used. So, what you see might differ from the panel view shown below.

## Event Summary (Last 3 Days)

This section shows the event summary for the past three days.



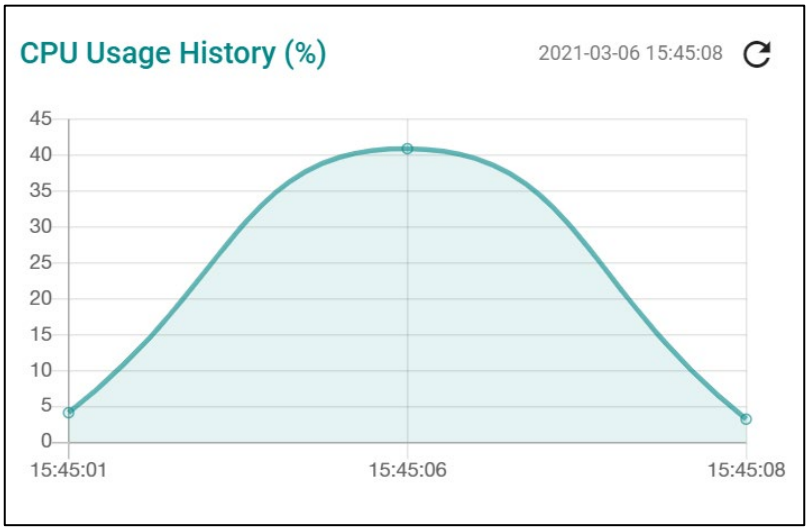

Select **VIEW ALL EVENTS LOGS** to go to the Event Log page, where you can view the event logs.




For Event Log settings, refer to **Event Log** under the **Diagnosis** section.

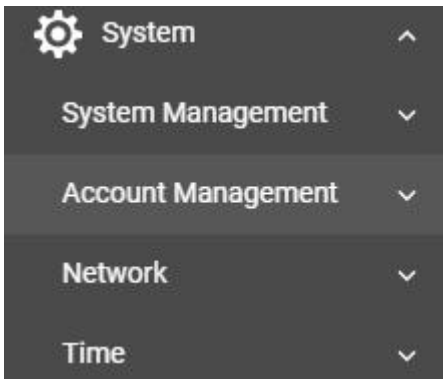
## CPU Utilization History

This section shows the CPU usage. The data will be shown as a percentage over time. Select the refresh icon on the page to show the latest information.



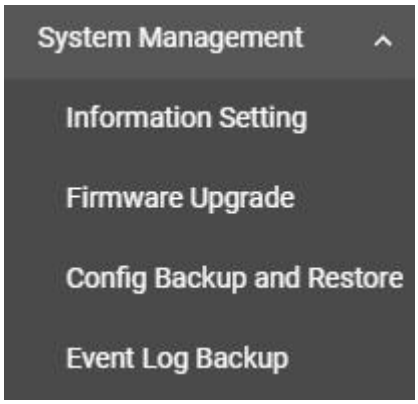

# System

Select **System** on the function menu. Configure the **System Management, Account Management, Network,** and **Time** configurations.



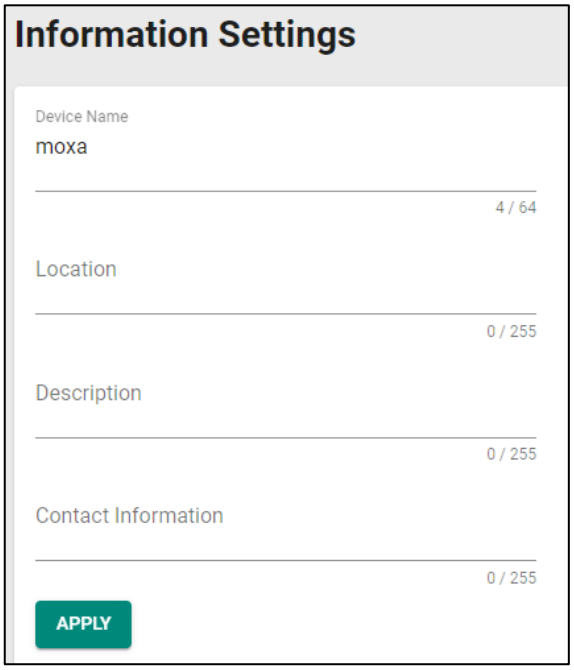

## System Management

Select **System Management**, four functions can be configured under this section: **Information Setting, Firmware Upgrade, Configure Backup and Restore,** and **Event Log Backup**.



## Information Setting

Define **Information Setting** items to make it easier to identify different switches that are connected to your network.




***Device Name***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 64 characters | This option is useful for differentiating between the roles or applications of different units. Note that the device name cannot be empty. | moxa |

### NOTE

The Device Name field follows the PROFINET I/O naming rule. The name can only include the following characters, **a-z/0-9/-**.

***Location***

| Setting | Description | Factory Default |
|---|---|---|
| Max. 255 characters | This option is for differentiating between the locations of different switches. Example: production line 1. | None |

***Description***

| Setting | Description | Factory Default |
|---|---|---|
| Max. 255 characters | This option is for recording a more detailed description of the unit. | None |

***Contact Information***

| Setting | Description | Factory Default |
|---|---|---|
| Max. 255 characters | Input contact information, such as email address, or telephone number when problems occur. | None |

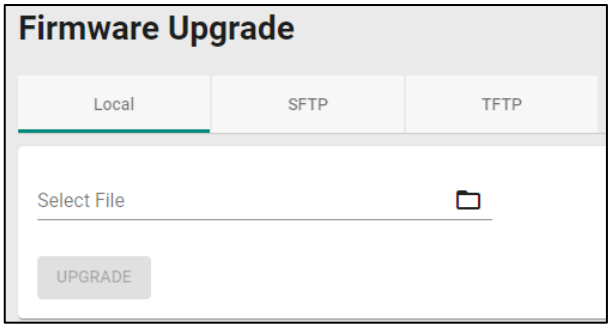
When finished, select **APPLY** to save your changes.

## Firmware Upgrade

There are three ways to update your switch module's firmware: from a local *.rom file, by remote SFTP server, and remote TFTP server.

### Local

Select **Local** tab.



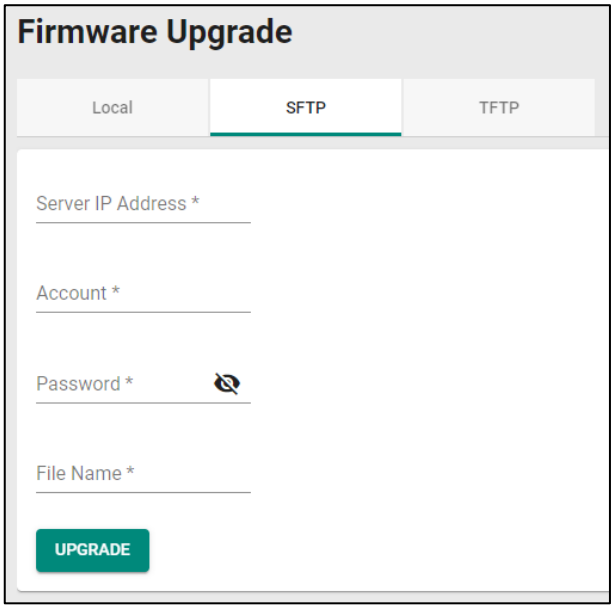

***Select File***

Before performing firmware upgrade, download the updated firmware (*.rom) file first from Moxa's website (www.moxa.com).

| Setting | Description | Factory Default |
|---|---|---|
| Select the firmware file | Select the icon on the right and select the firmware file from the location where the updated firmware is located. | None |
| Browse for the (*.rom) file, and then select the **UPGRADE** button. | This option allows you to select the updated firmware file and perform the firmware upgrade. | None |

### SFTP

Select **SFTP** tab.




***Server IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the SFTP server. | Input the server IP address of the computer where the new firmware file (*.rom) is located. | None |

***Account***

| Setting | Description | Factory Default |
|---|---|---|
| Input the account of the SFTP server | The account must be authorized for the SFTP Server to have a secure connection. | None |

***Password***

| Setting | Description | Factory Default |
|---|---|---|
| Input the password for the SFTP server | The account must be specified to authorize the SFTP Server for secure connection. | None |

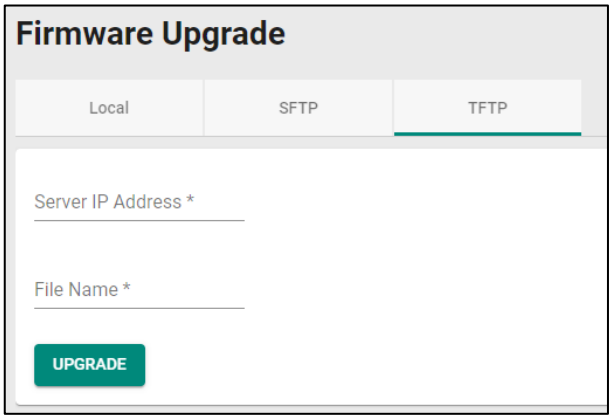
***File Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input the filename of the firmware | Input the filename of the new firmware. | None |

When finished, select **UPGRADE** to perform the firmware upgrade. The switch will reboot automatically and perform the firmware upgrade.

## TFTP Server

Upgrade firmware via the TFTP server. Select **TFTP** tab first.




***Server IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the TFTP server | Input the IP address of the TFTP server where the new firmware file (*.rom) is located. | None |

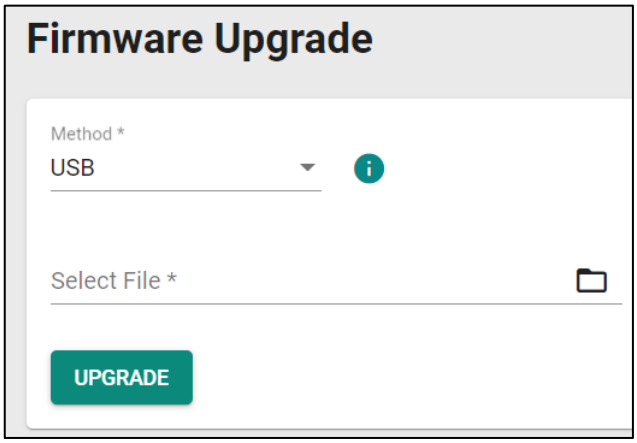
***File Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input the filename of the firmware | Input the filename of the new firmware. | None |

When finished, select **UPGRADE** to perform the firmware upgrade.

### USB

Upgrade the firmware via Moxa's USB-based ABC-02 configuration tool. Connect the ABC-02 to the switch and select **USB** from the drop-down list under **Method**.




***Select File***

Before performing the firmware upgrade, download the latest firmware (*.rom) file first from Moxa's website (www.moxa.com).

| Setting | Description | Factory Default |
|---|---|---|
| Select the firmware file | Select the firmware file from the location where the updated firmware is located. | None |
| Browse for the (*.rom) file | This option allows you to select the updated firmware file and perform the firmware upgrade. | None |

When finished, select **UPGRADE** to perform the firmware upgrade.

## Note

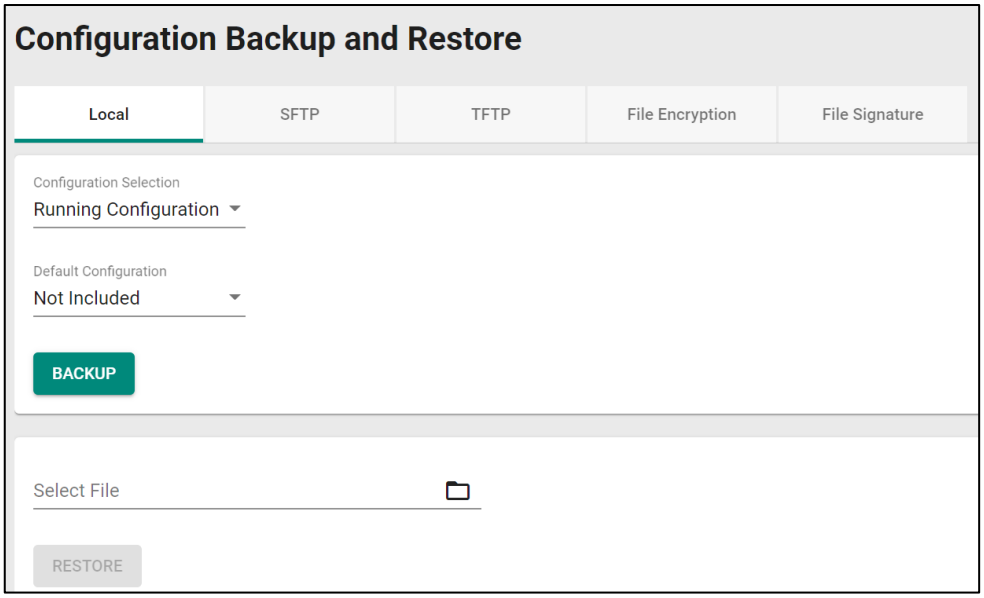
If you have difficulty using the ABC-02 configuration tool, check if the **USB Function** has been enabled in the **Hardware Interface** section.

## Configuration Backup and Restore

Back up the configurations of your switch module in five ways: using a local configuration file, a remote SFTP server, a remote TFTP server, or a USB tool.

### Local

Select **Local** tab first.




***Configuration Selection***

| Setting | Description | Factory Default |
|---|---|---|
| Running Configuration | Back up the running configuration. | Running Configuration |
| Startup Configuration | Back up the startup configuration. | |

***Default Configuration***

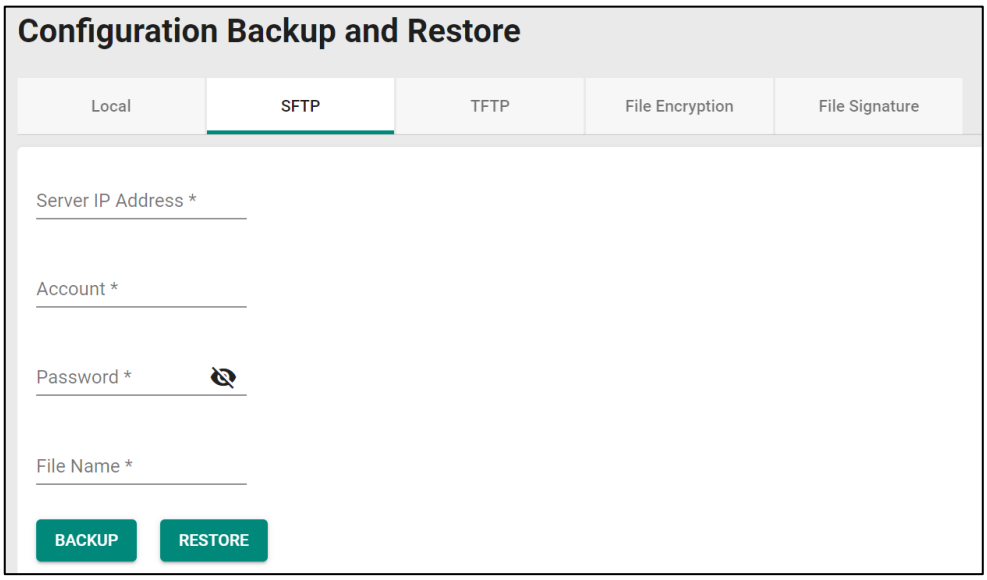
| Setting | Description | Factory Default |
|---|---|---|
| Not Included | Back up the configuration without default settings. | Not Included |
| Included | Back up the configuration with default settings. | |

***Select File***

| Setting | Description | Factory Default |
|---|---|---|
| Select the Backup button to back up the configuration file to a local drive. | Back up the system file to your local computer. | None |
| Browse for a configuration file on a local disk, and then select the **RESTORE** button. | Select the configuration file and perform system restoration. | None |

## SFTP Server

Select **the SFTP** tab first.




***Server IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the SFTP server | Input the IP address of the SFTP server where the new firmware file (*.rom) is located. | None |

***Account***

| Setting | Description | Factory Default |
|---|---|---|
| Input the account of the SFTP server | An account must be provided to authorize the SFTP server for a secure connection. | None |

***Password***

| Setting | Description | Factory Default |
|---|---|---|
| Input the passwords for the SFTP server | The password has to be specified to authorize the SFTP Server for secure connection. | None |

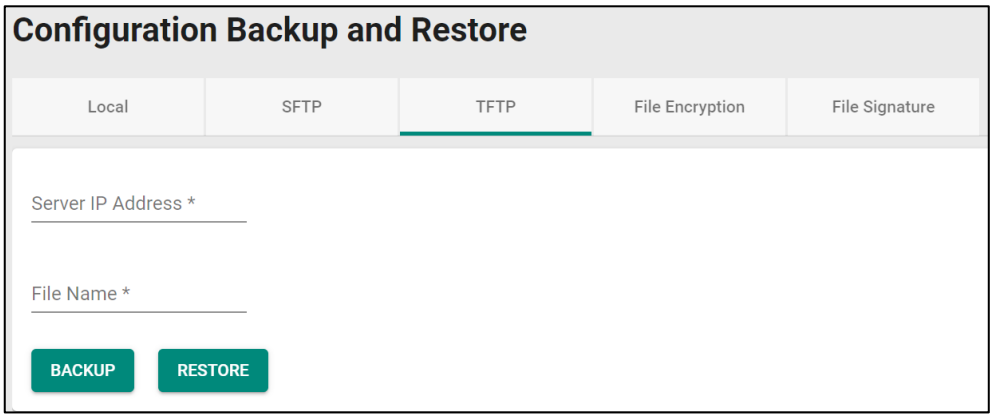
***File Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input the backup/restore file name (support up to 54 characters, including the .ini file extension). | Input the filename of the configuration backup or restoration file. | None |

When finished, select **BACKUP** or **RESTORE** to back up or restore the system configuration file.

### TFTP Server

Select **TFTP** tab first.




***Server IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the TFTP server | Input the IP address of the TFTP server. | None |

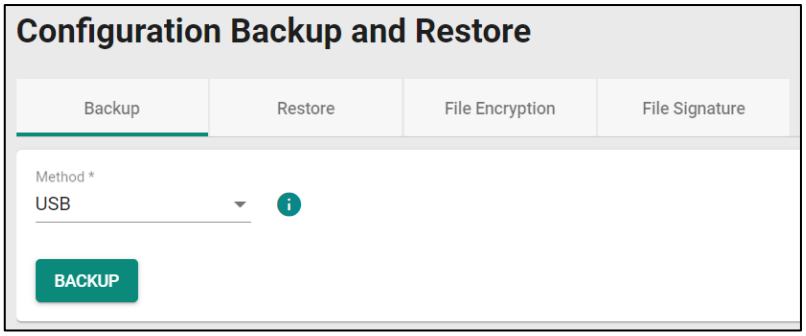
***File Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input the backup/restore file name (supports up to 54 characters, including the .ini file extension). | Input the filename to back up or restore the system configuration file. | None |

When finished, select **BACKUP** or **RESTORE** to perform the firmware upgrade.

### USB

Select **USB** from the drop-down list under **Method**.

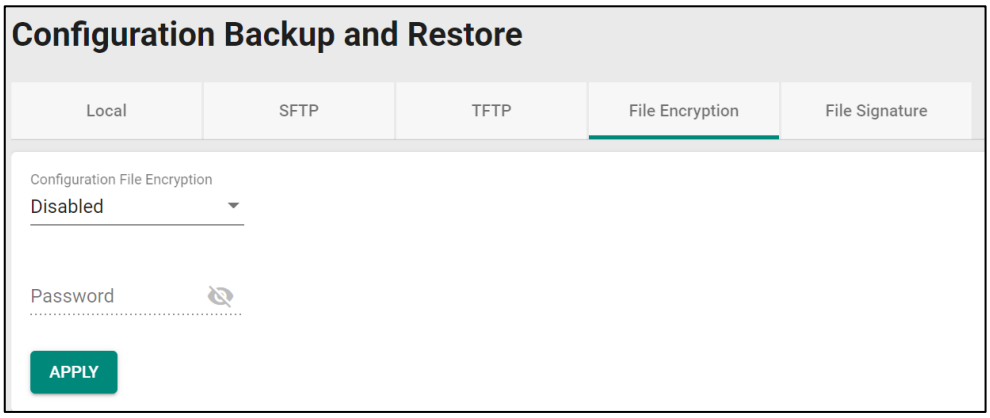



Insert Moxa's ABC-02 USB-based configuration tool into the USB port of the switch, select **BACKUP** to back up the system configuration file.

> **Note**
>
> If you have difficulty using the ABC-02 configuration tool, check if the **USB Function** has been enabled in the **Hardware Interface** section.

## File Encryption

To encrypt the configuration file, select the **File Encryption** tab first.




***Enable Configuration File Encryption***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the configuration file to be encrypted. | Disabled |
| Disabled | Disable the feature that allows the configuration file to be encrypted. | |

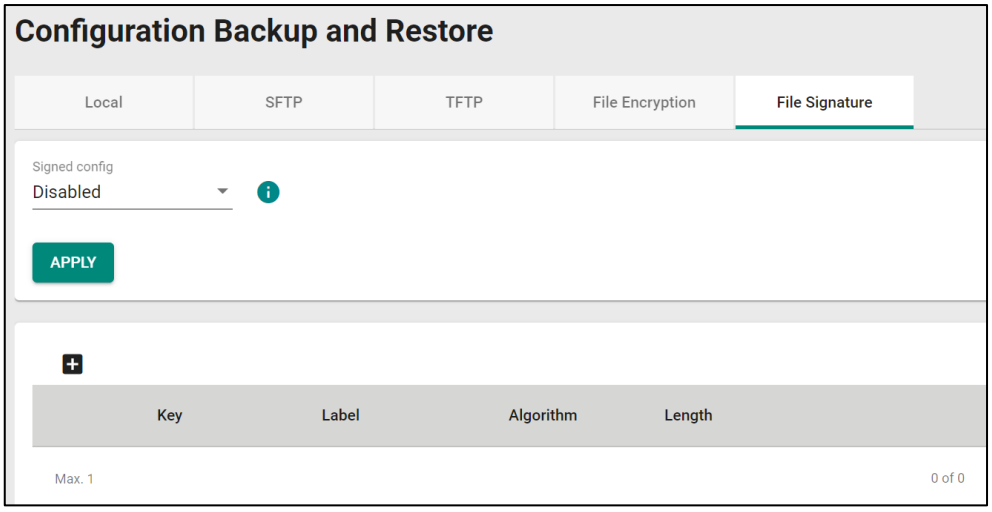
***Password***

| Setting | Description | Factory Default |
|---|---|---|
| 4 to 16 characters, numbers only. | Input the password when you encrypt the configuration file. | None |

When finished, select **APPLY** to save your changes.

## File Signature

Select **File Signature** tab to see additional configuration options. Enabling the file signature can ensure file integrity and authenticity.

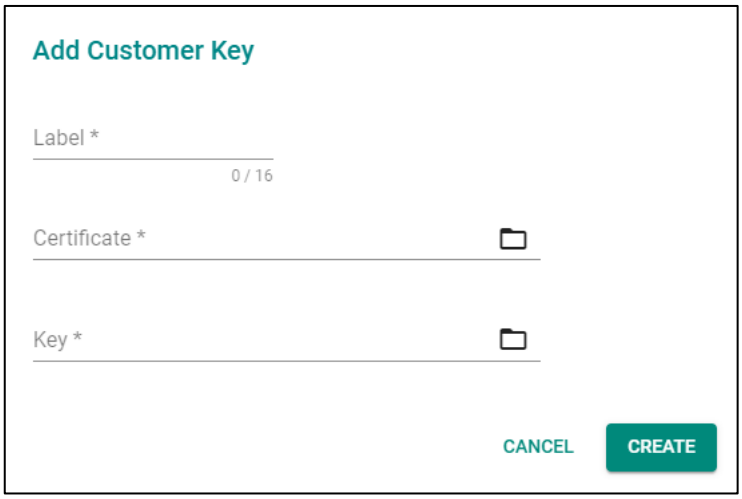



***Enable Signed Configuration***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the configuration file signature. | Disabled |
| Disabled | Disable the configuration file signature | |

Select **APPLY** to save your changes.

Select **+** icon to add customer key.




***Label***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 16 characters | Provide the name for the certificate and the key. | None |

***Certificate***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import file icon to select the file from your computer | Import the certificate file. | None |

***Key***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import file icon to select the file from your computer | Import the key file. | None |

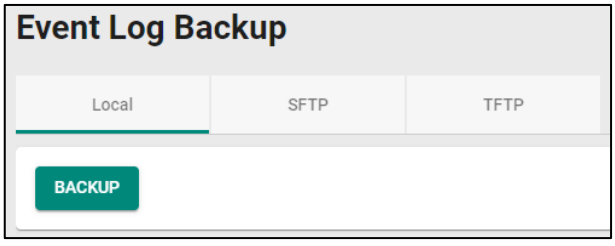
When finished, select **CREATE** to save your changes.

## Event Log Backup

Three methods exist for backing up switch module's log files: using a local drive, through a remote SFTP server, or via remote TFTP.

### Local

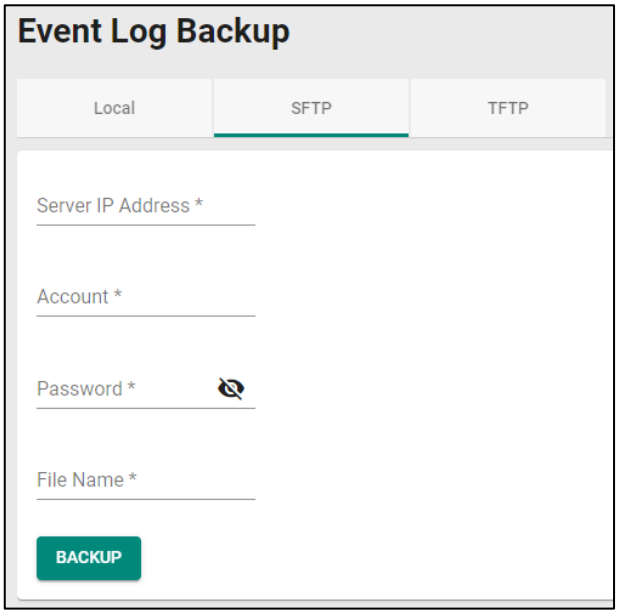
Select Local tab.




Select **BACKUP** to back up the log file to a local drive.

### SFTP Server

Select **SFTP** tab.




***Server IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the SFTP server | Input the IP address of the SFTP server. | None |

***Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port of the SFTP server, 1 to 65535 | Specify the port used in the SFTP server. | None |

***Account***

| Setting | Description | Factory Default |
|---|---|---|
| Input the account of the SFTP server | An account must be specified to authorize the SFTP server for a secure connection. | None |

***Password***

| Setting | Description | Factory Default |
|---|---|---|
| Input the password for the SFTP server | The password must be entered to authorize the SFTP server for a secure connection. | None |

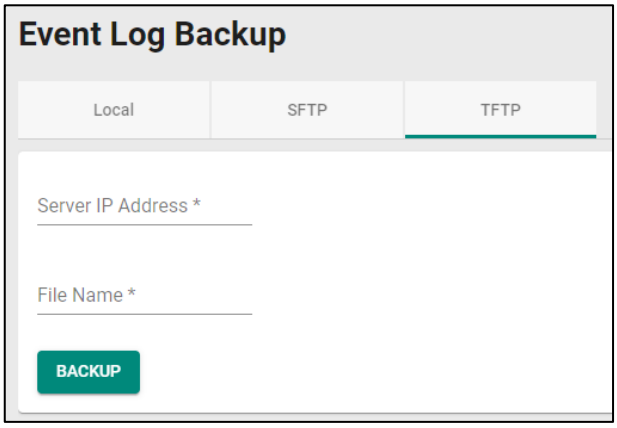
***File Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input the file name for event log backup | Input the filename of the event log. | None |

When finished, select **BACKUP** to back up the event log file.

### TFTP Server

Select **TFTP** tab.




***Server IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the TFTP server | Input the IP address of the TFTP server. | None |

***Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port of the TFTP server, 1 to 65535 | Input the port used in the TFTP server. | None |

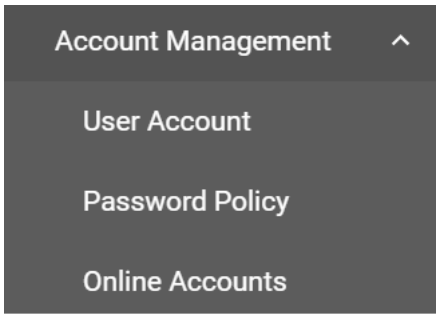
***File Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input the file name for event log backup | Input the filename of the event log. | None |

When finished, select **BACKUP** to back up the event log file.

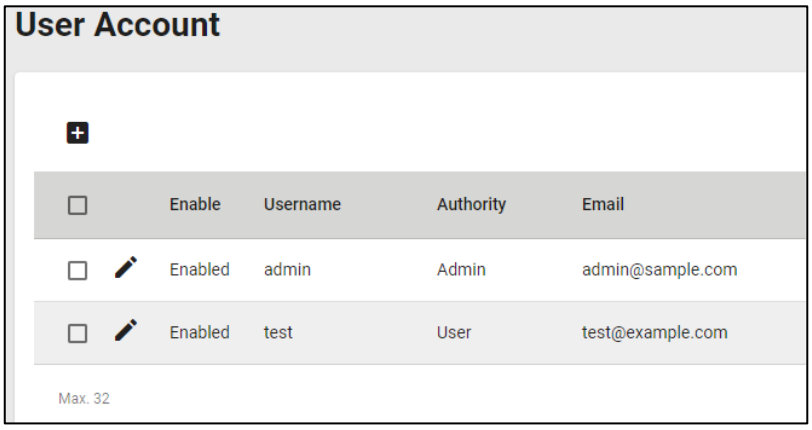
## Account Management

The **Account Management** feature allows you to manage the accounts of the switch. Enable different accounts with different roles to facilitate convenient management and safe access.

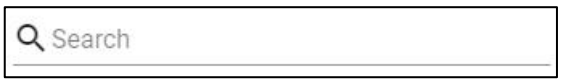


## User Account

This section describes how to manage the existing accounts of the switch. Here, you can add, edit, and delete user accounts for the switch. Only one account, admin, exists by default. To enhance security, we suggest you create a new account with the user authority.

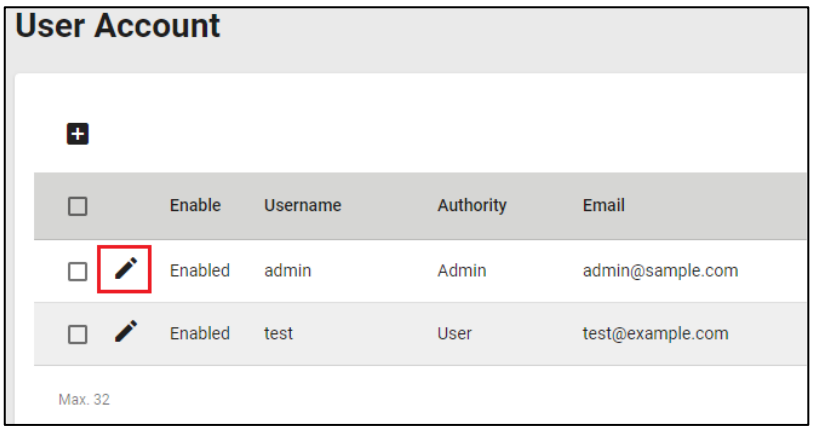



The User Account page features a search function on the upper right. Type the username you want to search for.

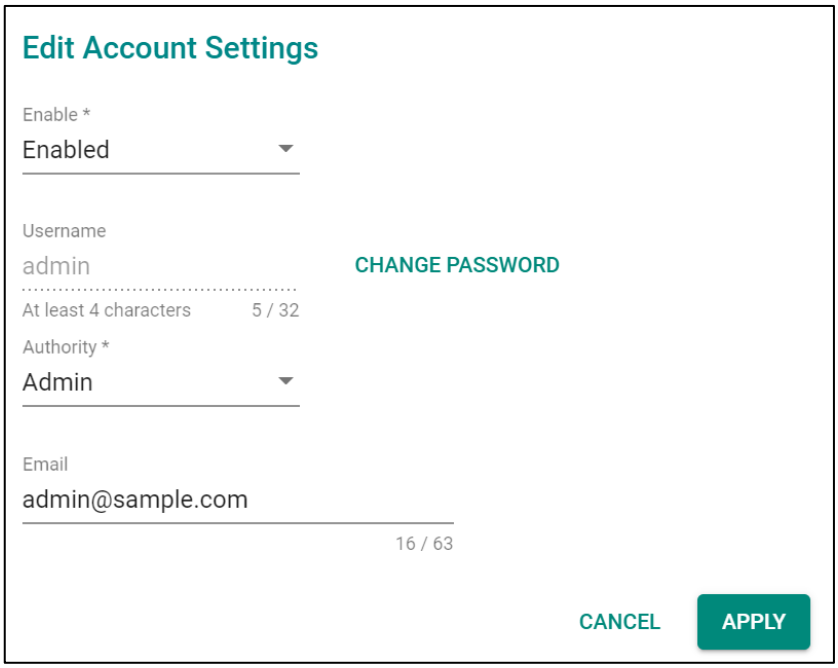



### Editing Existing Accounts

Select the account you want to edit and select the edit icon.



Configure the following settings.




***Enabled***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | This enables the user account. | Enabled |
| Disabled | This disables the user account. | |

***Authority***

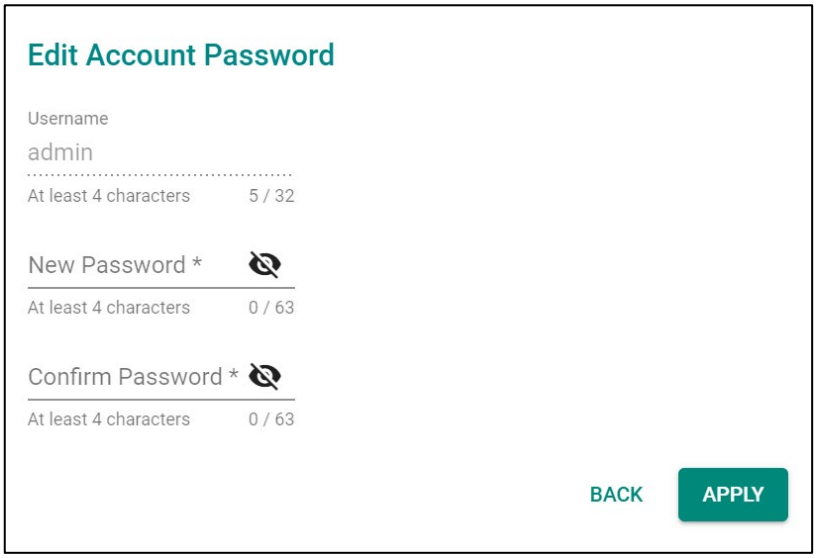
| Setting | Description | Factory Default |
|---|---|---|
| admin | This account has read/write access for all configuration parameters. | admin |
| supervisor | This account has read/write access for some specific configuration parameters. | |
| user | This account can only view some specific configuration parameters. | |

***Email***

| Setting | Description | Factory Default |
|---|---|---|
| Input an email address | Input an email address for the account if required. | None |

When finished, select **APPLY** to save your changes.

To change the password for the user, select **CHANGE PASSWORD**.




***New Password***

| Setting | Description | Factory Default |
|---|---|---|
| 4 to 63 characters | Enter the password to use for this account. | None |

***Confirm Password***

| Setting | Description | Factory Default |
|---|---|---|
| 4 to 63 characters | Reenter the password to confirm it. | None |

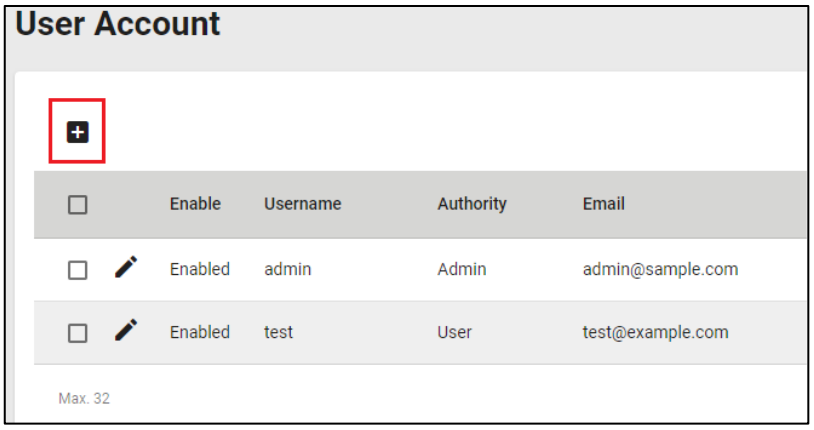
When finished, select **APPLY** to save your changes.

## NOTE

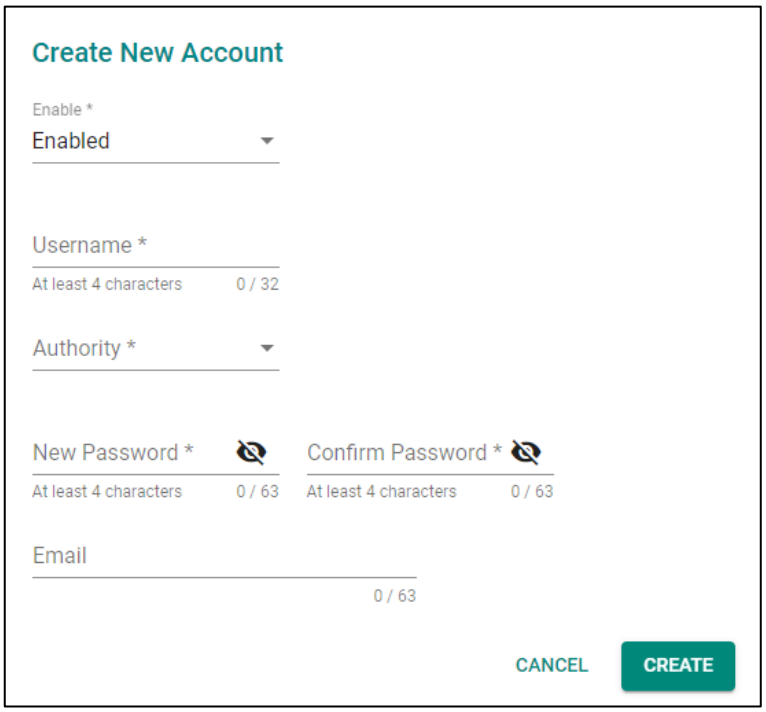
Refer to **Appendix B** for detailed descriptions for read/write access privileges for the admin, supervisor, and user authority levels.

### Creating a New Account

Create a new account by selecting the **+** icon on the Configuration page.



Configure the following settings.




***Enabled***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | This enables the account. | Enabled |
| Disabled | This disables the account. | |

***Username***

| Setting | Description | Factory Default |
|---|---|---|
| Input a username, 4 to 32 characters | Input a new username for this account. | None |

***Authority***

| Setting | Description | Factory Default |
|---|---|---|
| admin | This account has read/write access of all configuration parameters. | None |
| supervisor | This account has read/write access for some specific configuration parameters. | |
| user | This account can only view some specific configuration parameters. | |

To enhance security, we suggest you create a new account with the user authority.

***New Password***

| Setting | Description | Factory Default |
|---|---|---|
| 4 to 63 characters | Input a new password for this account. | None |

***Confirm Password***

| Setting | Description | Factory Default |
|---|---|---|
| 4 to 63 characters | Reenter the password to confirm. | None |

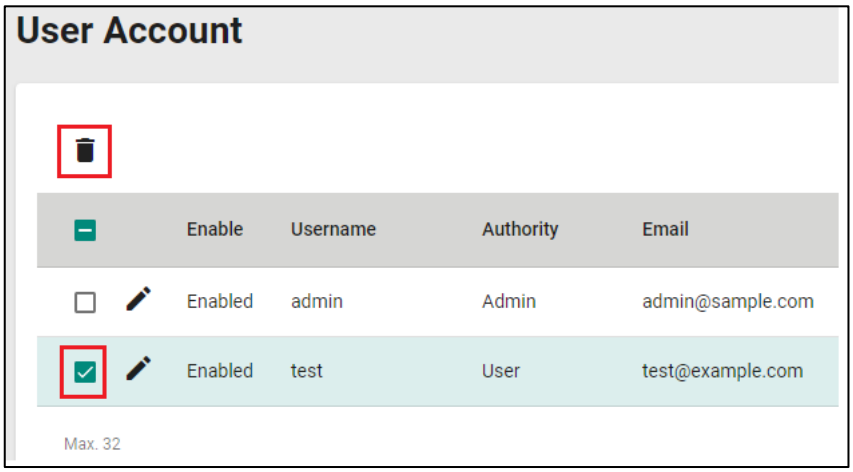
***Email***

| Setting | Description | Factory Default |
|---|---|---|
| Input an email address | Input an email address for the account if required. | None |

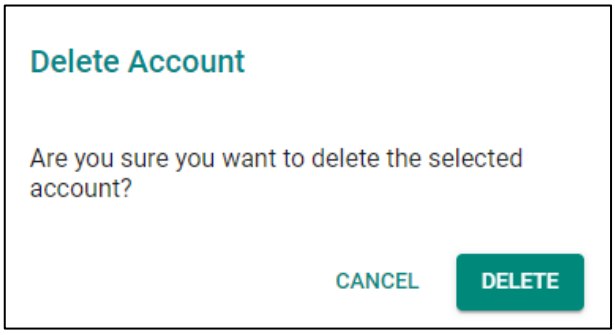
When finished, select **CREATE** to complete.

### Delete an Existing Account

To delete the existing account, simply select the account you want to delete, and then select the delete icon on the configuration page.

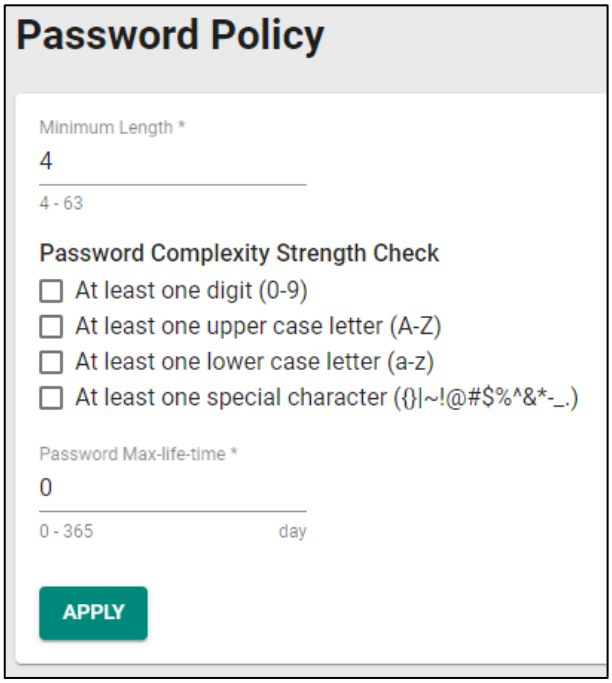



Select **DELETE** to delete the account.



## Password Policy

To prevent hackers from cracking weak passwords, a password policy can be set. The password policy can enforce users to create passwords with a minimum length and complexity, and it can also establish a maximum lifetime for the password to ensure it is changed periodically.




***Minimum Length***

| Setting | Description | Factory Default |
|---|---|---|
| Input from 4 to 63 | This sets the minimum length of the password. | 4 |

***Password Complexity Strength Check***

| Setting | Description | Factory Default |
|---|---|---|
| digit, letter cases, special characters | These determine the required complexity for the password. Multiple options may be checked. | None |

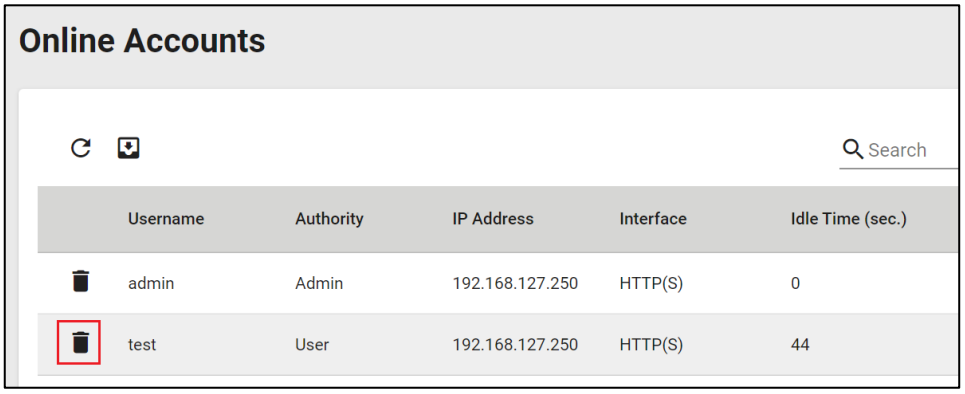
***Password Max-life-time (day)***

| Setting | Description | Factory Default |
|---|---|---|
| Input from 0 to 365 | This determines how long the password can be used before it must be changed. | 0 |

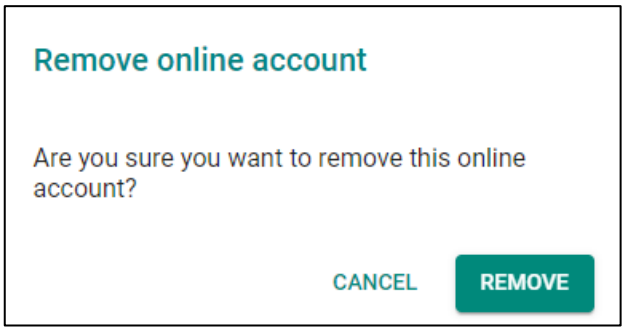
When finished, select **Apply** to save your changes.

## Online Accounts

The **Online Accounts** function allows you to view who has connected to the device. You may immediately remove the user who is currently online.

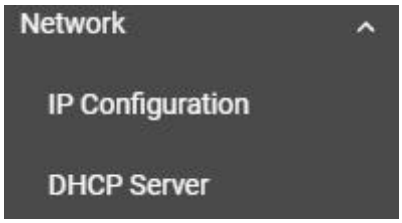



Select the remove icon and select **REMOVE** to disconnect the user.



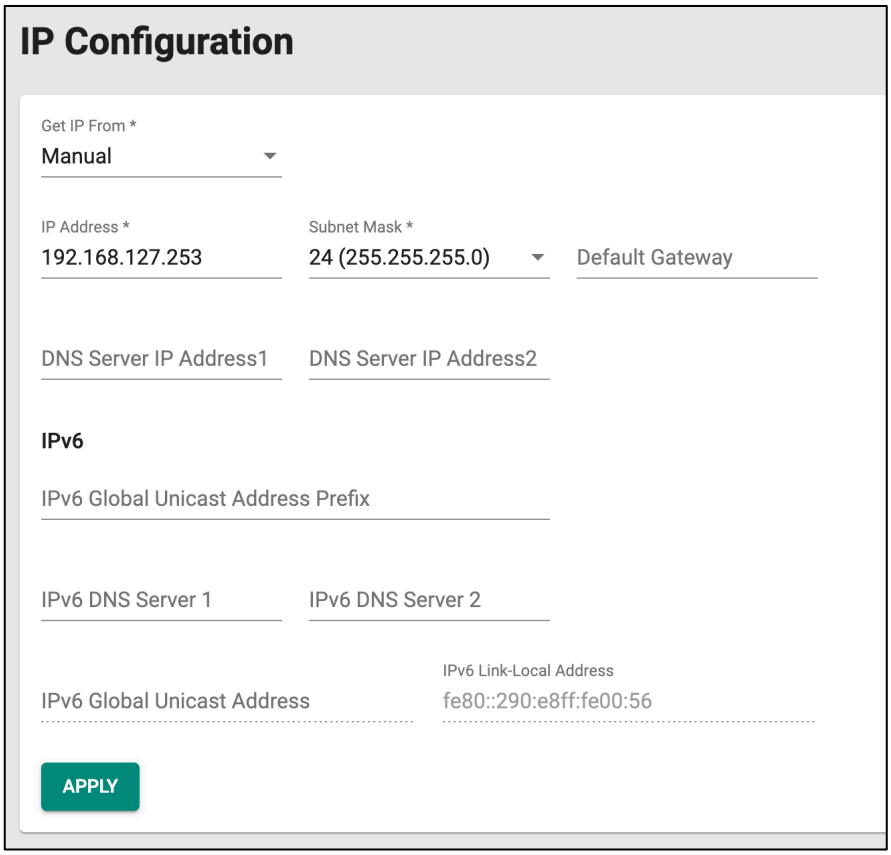

# Network

This section describes how to configure the switch's network settings, including **IP Configuration** and the **DHCP Server**.



## IP Configuration

You can configure the IP settings of the switch.




***Get IP From***

| Setting | Description | Factory Default |
|---|---|---|
| Manual | The IP address of the switch must be set manually. | Slot Index |
| DHCP | The IP address of the switch will be assigned automatically by the network's DHCP server. | |
| Slot Index | The IP address of the switch will be assigned automatically by the slot index. | |

***IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address for the switch | Specify the IP address to use for the switch. | IP address is based on the slot index value. |

***Subnet Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Input the subnet mask for the switch | Specify the subnet mask to use for the switch. | 24 (255.255.255.0) |

***Default Gateway***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address for the gateway | Specify the IP address of the gateway that connects the LAN to a WAN or another network. | None |

***DNS Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the first DNS server | Specify the IP address of the first DNS server used by your network. After specifying the DNS server's IP address, you can use the switch's URL (e.g., www.mymoxaswitch.com) to open the web console instead of entering the IP address. | None |

***DNS Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the second DNS server | Specify the IP address of the second DNS server used by your network. The switch will use the secondary DNS server if the first DNS server cannot connect. | None |

***IPv6 Global Unicast Address Prefix (Prefix Length: 64 bits) Default Gateway***

| Setting | Description | Factory Default |
|---|---|---|
| Global Unicast Address Prefix | The prefix value must be formatted according to the RFC 2373 IPv6 Addressing Architecture, using 8 colon-separated 16-bit hexadecimal values. One double colon can be used in the address to show the number of zeros required to fill the undefined fields.<br>**Note:** This feature is only available in **Advanced Mode**. | None |

***IPv6 DNS Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IPv6 IP address of the first DNS server | Specify the IPv6 address of the first DNS server used by your network. After specifying the DNS server's IP address, you can use the switch's URL (e.g., www.mymoxaswitch.com) to open the web console instead of entering the IP address.<br>**Note:** This feature is only available in **Advanced Mode**. | None |

***IPv6 DNS Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IPv6 address of the second DNS server | Specify the IPv6 address of the second DNS server used by your network. The switch module will use the secondary DNS server if the first DNS server cannot connect.<br>**Note:** This feature is only available in **Advanced Mode**. | None |

***IPv6 Global Unicast Address***

| Setting | Description | Factory Default |
|---|---|---|
| None | Displays the IPv6 Global Unicast address. The network portion of the Global Unicast address can be configured by specifying the Global Unicast Prefix and using an EUI-64 interface ID in the low order 64 bits of the address. The host portion of the Global Unicast address is automatically generated using the modified EUI-64 form of the interface identifier (the switch's MAC address).<br>**Note:** This feature is only available in **Advanced Mode**. | None |

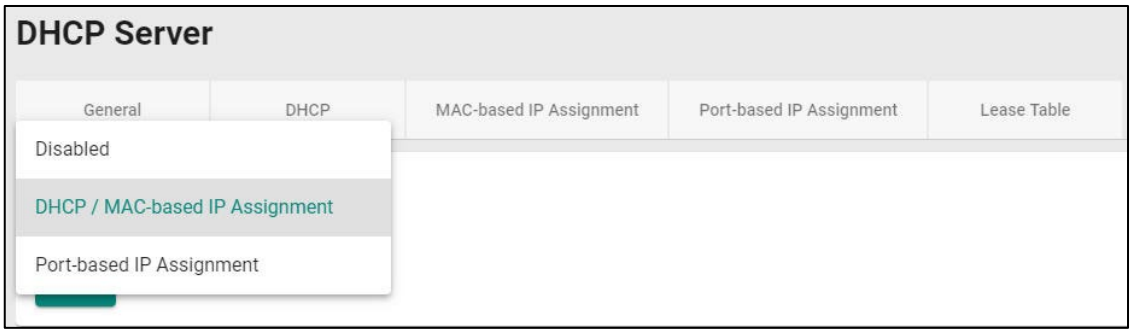
***IPv6 Link-Local Address***

| Setting | Description | Factory Default |
|---|---|---|
| None | The network portion of the Link-Local address is FE80, and the host portion of the Link-Local address is automatically generated using the modified EUI-64 form of the interface identifier (the switch's MAC address).<br>**Note:** This feature is only available in **Advanced Mode**. | None |

When finished, select **APPLY** to save your changes.

## DHCP Server

This section describes how to configure the DHCP server settings for switch module. First, select the **General** tab.



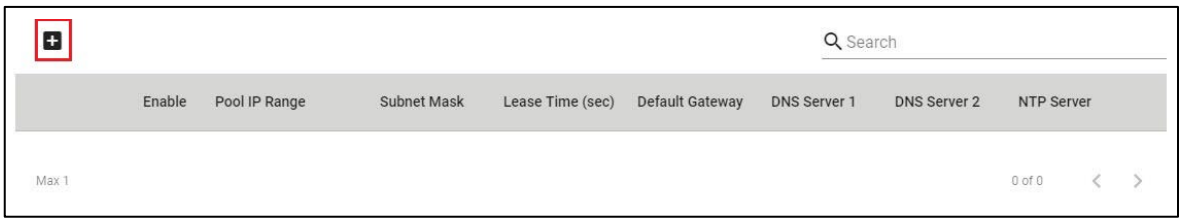

Then, select **DHCP/MAC-based IP Assignment** and **APPLY**.

### NOTE

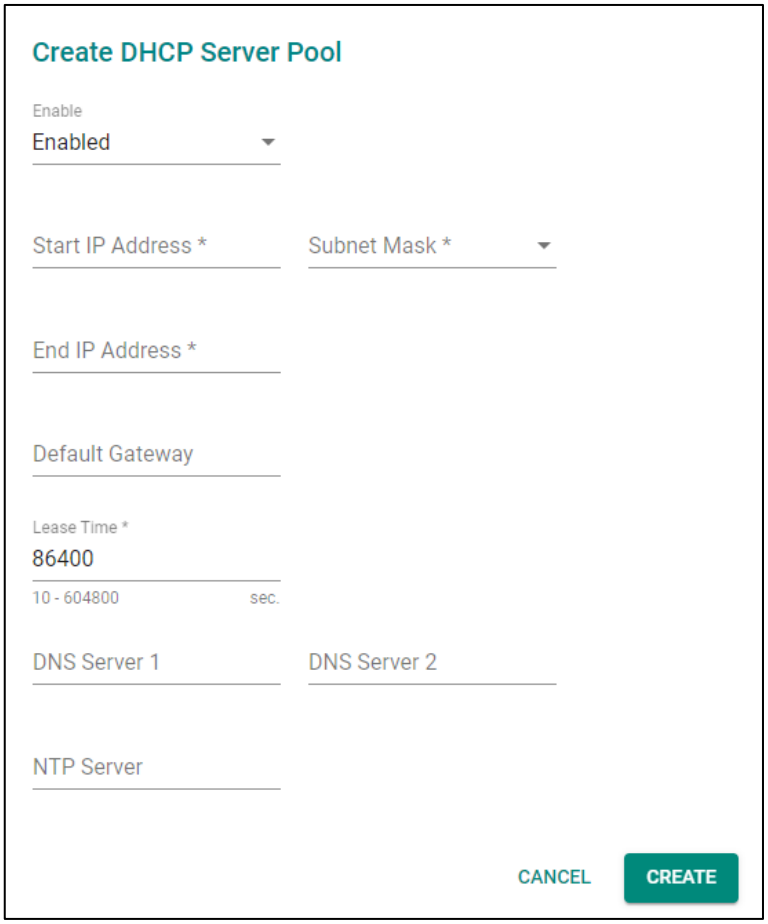
The DHCP server will use UDP port 67 to send messages to the DHCP client.

### DHCP

Select the **DHCP** tab and the **+** icon on the configuration page to create a new DHCP server pool.



Configure the following parameters.




## NOTE

You can only create one IP pool. It can be connected to different network subnets with the Management IP of the switch.

***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables the DHCP server pool. | Disabled |
| Disable | Disables the DHCP server pool. | |

***Start IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the first IP address | Specify the first IP address for the pool. | None |

***Subnet Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the drop-down list | Specify the subnet mask for the pool. | None |

***End IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the last IP address | Specify the last IP address for the pool. | None |

***Default Gateway***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the default gateway | Specify the default gateway for clients to use. | None |

***Lease Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| Input the lease time for the DHCP, from 10 to 604,800 seconds (up to 7 days) | Specify the lease time for DHCP IP assignments. | 86400 |

***DNS Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the first DNS server | Specify the IP address of the first DNS server for clients to use. | None |

***DNS Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the second DNS server | Specify the IP address of the second DNS server for clients to use. | None |

***NTP Server***

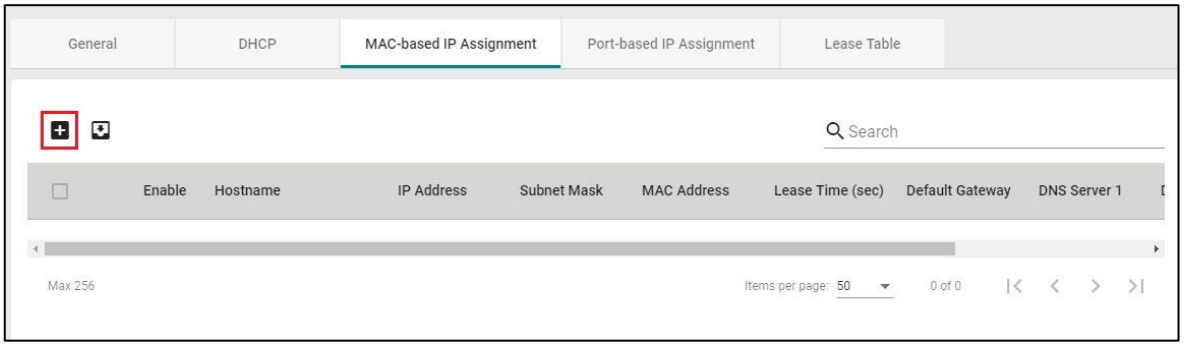
| Setting | Description | Factory Default |
|---|---|---|
| Input the address of the NTP server | Specify the NTP server clients will use. | None |

When finished, select **CREATE**.

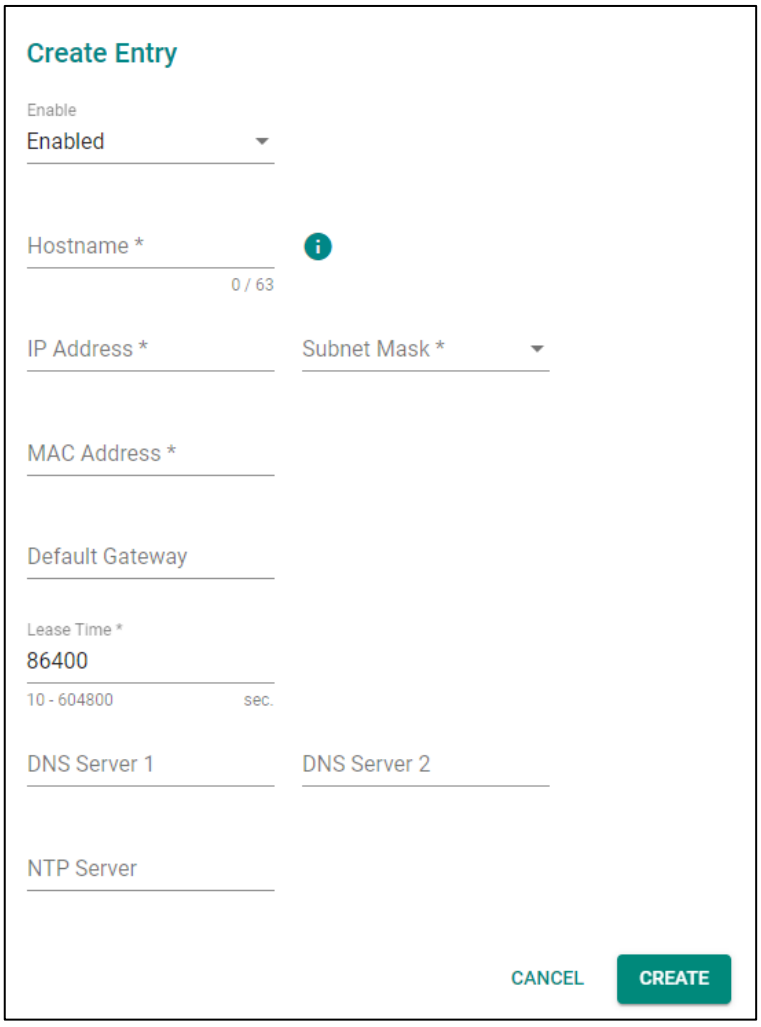
## MAC-based IP Assignment

Assign an IP address to a specific MAC address. This can be useful if you always want the same IP address to be assigned to a specific device, even if it is reconnected or connected to a different port.

Select the **MAC-based IP Assignment** tab and then select the + icon on the configuration page.



Configure the following parameters.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables the MAC-based IP assignment entry. | Enabled |
| Disabled | Disables the MAC-based IP assignment entry. | |

***Hostname***

| Setting | Description | Factory Default |
|---|---|---|
| Enter a host name between 0 and 63 characters | Specify a host name to use for the DHCP client. | None |

***IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the assigned IP address | Specify the IP address to assign to the client. | None |

***Subnet Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the drop-down list | Specify the subnet mask to use for the client. | None |

***MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the assigned MAC address | Specify the MAC address of the device you want to assign an IP address to. Make sure the MAC address is entered in the correct format. Here is an example: 28-d2-44-D3-e3-f2 or 28:d2:44:D3:e3:f2. | None |

***Default Gateway***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the default gateway | Specify the default gateway for the client to use. | None |

***Lease Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| Input the lease time for the DHCP, from 10 to 604800. | Define how long before the IP address needs to be reassigned. | 86400 |

***DNS Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the first DNS server | Specify the IP address of the first DNS server for the client to use. | None |

***DNS Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the second DNS server | Specify the IP address of the second DNS server for the client to use. | None |

***NTP Server***

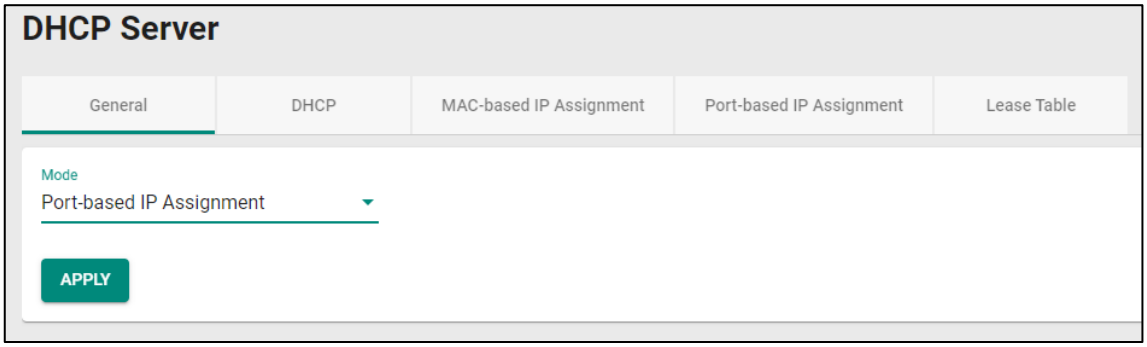
| Setting | Description | Factory Default |
|---|---|---|
| Input the address of the NTP server | Specify the NTP server the client will use. | None |

When finished, select **CREATE**.

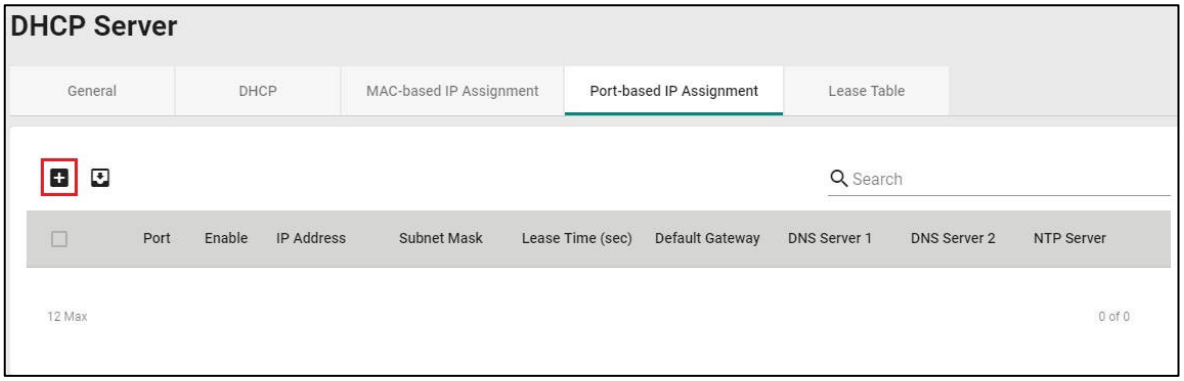
## Port-based IP Assignment

Assign an IP to a device based on what switch port it is connected to. This can be useful if you want to always use the same IP for a device connected to a specific port, even if it is replaced with a different device.

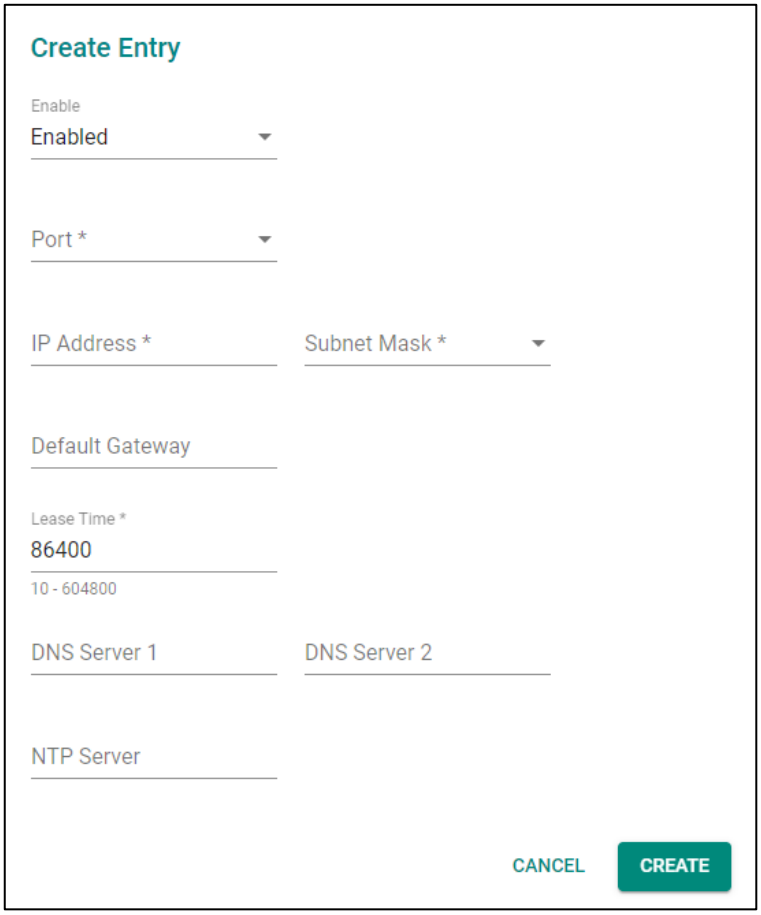
On the **General** tab, select **Port-based IP Assignment**. Select **APPLY**.



Next, select the **Port-based IP Assignment** tab, and then the **+** icon on the configuration page.




Configure the following parameters.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables the port-based IP assignment entry. | Enabled |
| Disabled | Disables the port-based IP assignment entry. | |

***Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select from 1 to 28 | Select which switch port the DHCP server will assign an IP address for. | None |

***IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the assigned IP address | Specify the IP address to assign to the client. | None |

***Subnet Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the drop-down list | Specify the subnet mask to use for the client. | None |

***Default Gateway***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the default gateway | Specify the default gateway for the client to use. | None |

***Lease Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| Input the lease time for the DHCP, from 10 to 604800 | Define how long before the IP address needs to be reassigned. | 86400 |

***DNS Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the first DNS server | Specify the IP address of the first DNS server for the client to use. | None |

***DNS Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the IP address of the second DNS server | Specify the IP address of the second DNS server for the client to use. | None |

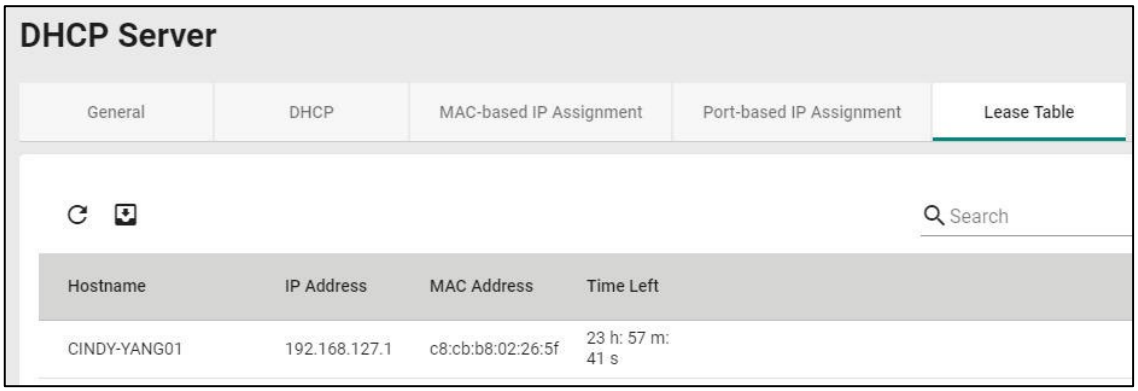
***NTP Server***

| Setting | Description | Factory Default |
|---|---|---|
| Input the address of the NTP server | Specify the NTP server the client will use. | None |

When finished, select **CREATE**.

## Lease Table

Select **Lease Table** to view detailed information for the host name, IP address, MAC address, and time left for each port.




| Item | Description |
|---|---|
| Host name | The Host name of the client. |
| IP Address | The IP address of the client. |
| MAC Address | The MAC address of the client. |
| Time Left | The time left on the DHCP lease for the client. |

## Time

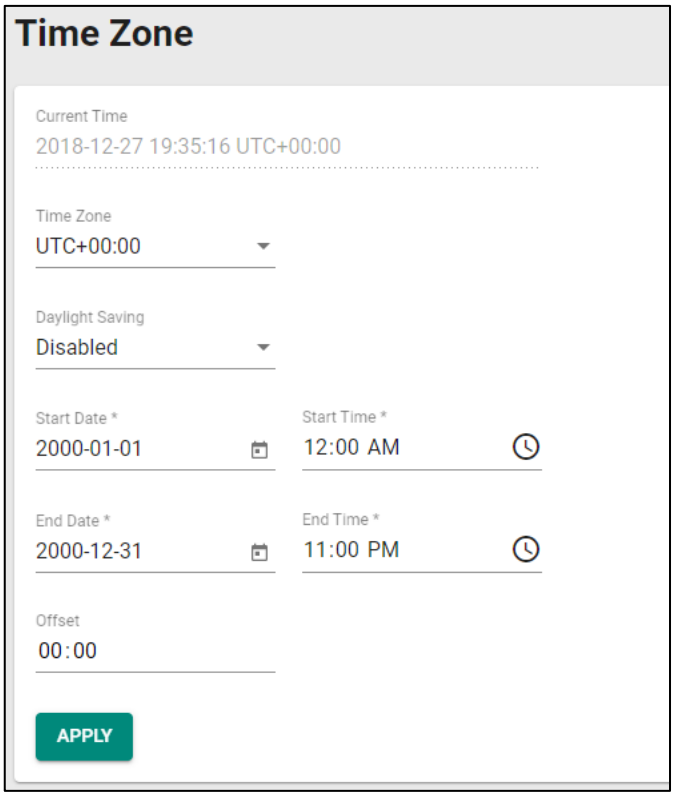
This section describes how to configure the **Time Zone** and **System Time** settings for the switch. The switch has a time calibration function based on information from an NTP server or a user-specified time and date, allowing functions such as automatic warning emails to include a time and date stamp.


### NOTE

Update the Current Time and Current Date after the switch has been powered off for an extended period (e.g., three days). Pay particular attention to this when there is no NTP server or Internet connection available.

### Time Zone

Configure the time zone for the switch.




***System Uptime***

| Setting | Description | Factory Default |
|---|---|---|
| System-specified time | This shows how long the switch has been running since the last cold start. | N/A |

***Current Time***

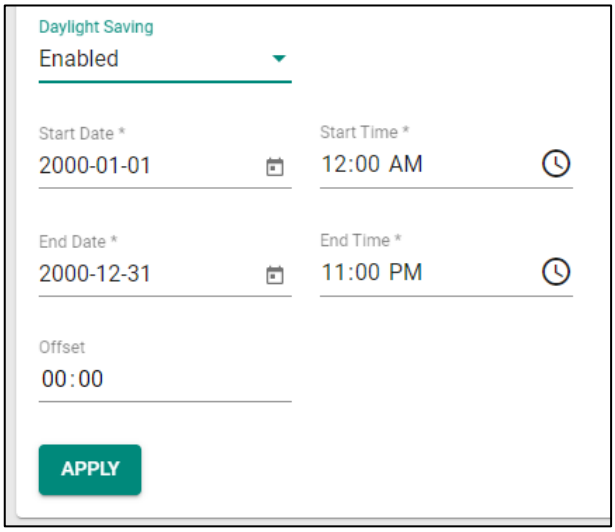
| Setting | Description | Factory Default |
|---|---|---|
| User-specified time | Shows the current system time. | None |

***Time Zone***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the drop-down list | Specify the time zone to use for the switch. | GMT (Greenwich Mean Time) |

## Daylight Saving Time

The Daylight Saving Time settings are used to automatically adjust the time according to regional standards.




Configure the following settings.

***Daylight Saving Time***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Daylight Saving Time. | Disabled |
| Disabled | Disables Daylight Saving Time. | |

***Start Date***

| Setting | Description | Factory Default |
|---|---|---|
| User-specified date | Specify the date that Daylight Saving Time begins. | None |

***End Date***

| Setting | Description | Factory Default |
|---|---|---|
| User-specified date | Specify the date that Daylight Saving Time ends. | None |

***Offset***

| Setting | Description | Factory Default |
|---|---|---|
| User-specified hour | Specify the offset (in HH:MM format) to use during Daylight Saving Time. | None |

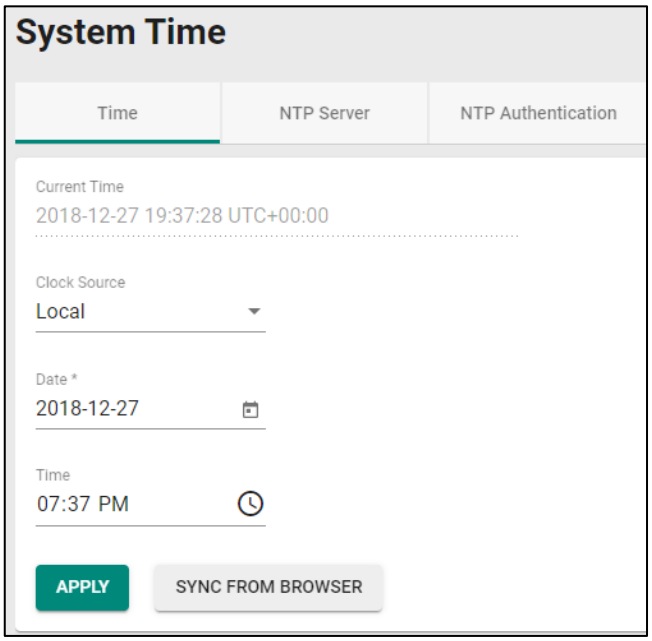
When finished, select **APPLY** to activate the time zone settings.

## System Time

This section describes how to configure the **Time**, **NTP Server**, and **NTP Authentication** settings.

### Time

The section describes how to configure the system's time. Select the Time tab.




***Current Time***

| Setting | Description | Factory Default |
|---|---|---|
| None | This automatically shows the current time according to your default settings. | Local |

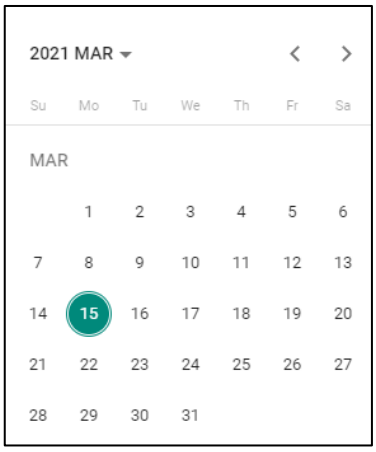
***Clock Source***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the drop-down list | Specify whether to set the time manually (Local), from an SNTP server, or from an NTP server. | Local |

**Clock Source is from Local**

***Date***

| Setting | Description | Factory Default |
|---|---|---|
| Select the date | Select the current date. | Local |



***Time***

| Setting | Description | Factory Default |
|---|---|---|
| Input the current time | Specify the current time. Manually input the time or select Sync from Browser to set the time based on the time used by your web browser. | None |

**Clock Source is from SNTP**

***Time Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the address of the first SNTP time server | Specify the IP or domain address of the first SNTP server to use (e.g., 192.168.1.1, time.stdtime.gov.tw, or time.nist.gov). | Time.nist.gov |

***Time Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the address of the second SNTP time server | Specify the IP or domain address of the secondary SNTP server to use if the first SNTP server cannot connect. | None |

Select **APPLY** to complete.

**Clock Source is from NTP**

If the switch is connected to an NTP server that requires authentication, refer to the **NTP Authentication** section to configure the NTP key to use.

***Time Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the address of the first NTP time server | Specify the IP or domain address of the first NTP server to use (e.g., 192.168.1.1, time.stdtime.gov.tw, or time.nist.gov). | Time.nist.gov |

***Authentication***

| Setting | Description | Factory Default |
|---|---|---|
| Disabled | Enable or disable NTP authentication for Time Server 1. | Disabled |

***Time Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the address of the second time server | Specify the IP or domain address of the secondary NTP server to use if the first NTP server cannot connect. | None |

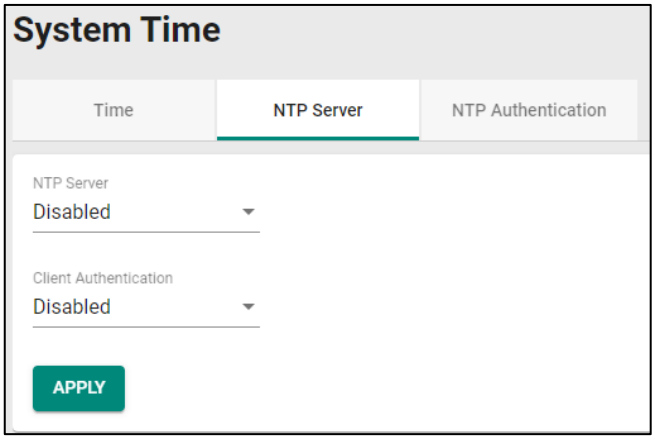
***Authentication***

| Setting | Description | Factory Default |
|---|---|---|
| Disabled | Enable or disable NTP Authentication for Time Server 2. | Disabled |

Select **APPLY** to complete.

## NTP Server

Select the **NTP Server** Tab to perform further configuration.



***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the NTP server. | Disabled |
| Disabled | Disable the NTP server. | |

***Client Authentication***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable NTP authentication. | Disabled |
| Disabled | Disable NTP authentication. | |

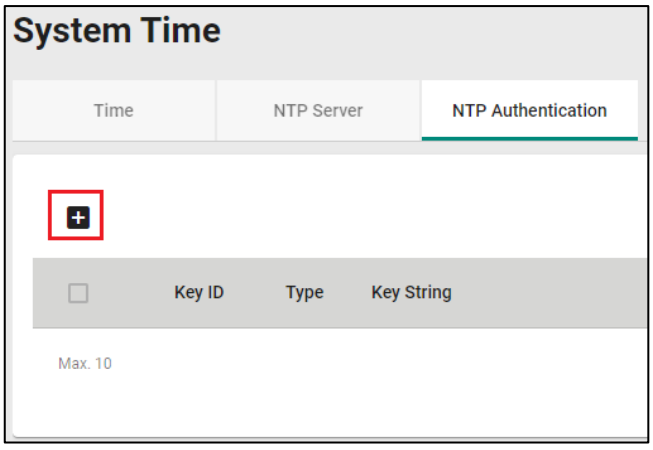
When finished, select **APPLY** to save your changes.

## NOTE

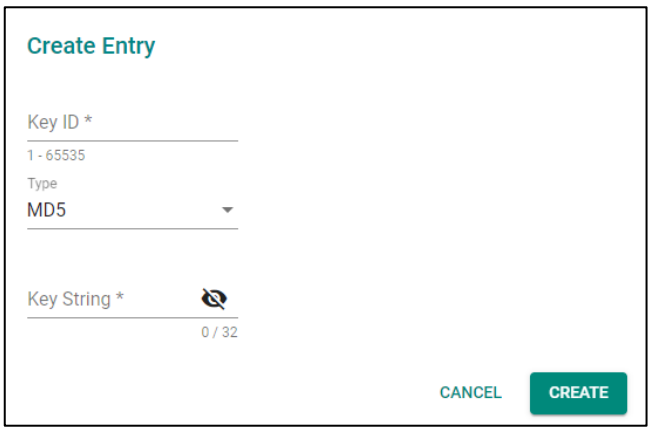
The NTP server will use TCP port 123 to send messages to the NTP client.

### NTP Authentication

This section describes how to configure NTP Authentication. Select the **NTP Authentication** tab, and then select the **+** icon on the page.




Configure the following settings.




***Key ID***

| Setting | Description | Factory Default |
|---|---|---|
| Input the Key ID from 1 to 10 | Input the Key ID to use for NTP authentication. | None |

***Type***

| Setting | Description | Factory Default |
|---|---|---|
| Input the authentication type | Input the authentication type. | MD5 |

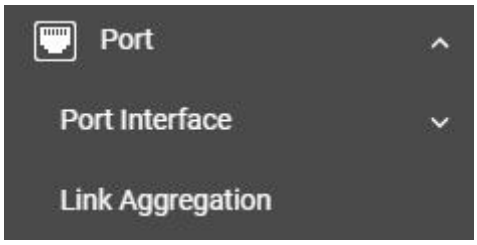
***Key String***

| Setting | Description | Factory Default |
|---|---|---|
| Input the key string for authentication, from 0 to 32 characters. | Input the password to use for the authentication key. | None |

When finished, select **CREATE**.

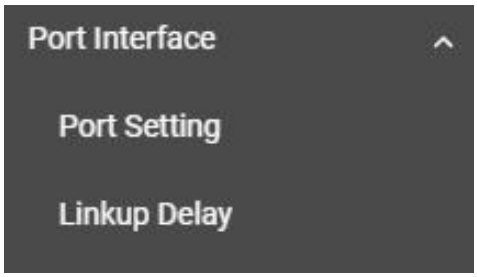
# Port

This section describes how to configure the **Port Interface** and **Link Aggregation** functions for the switch.



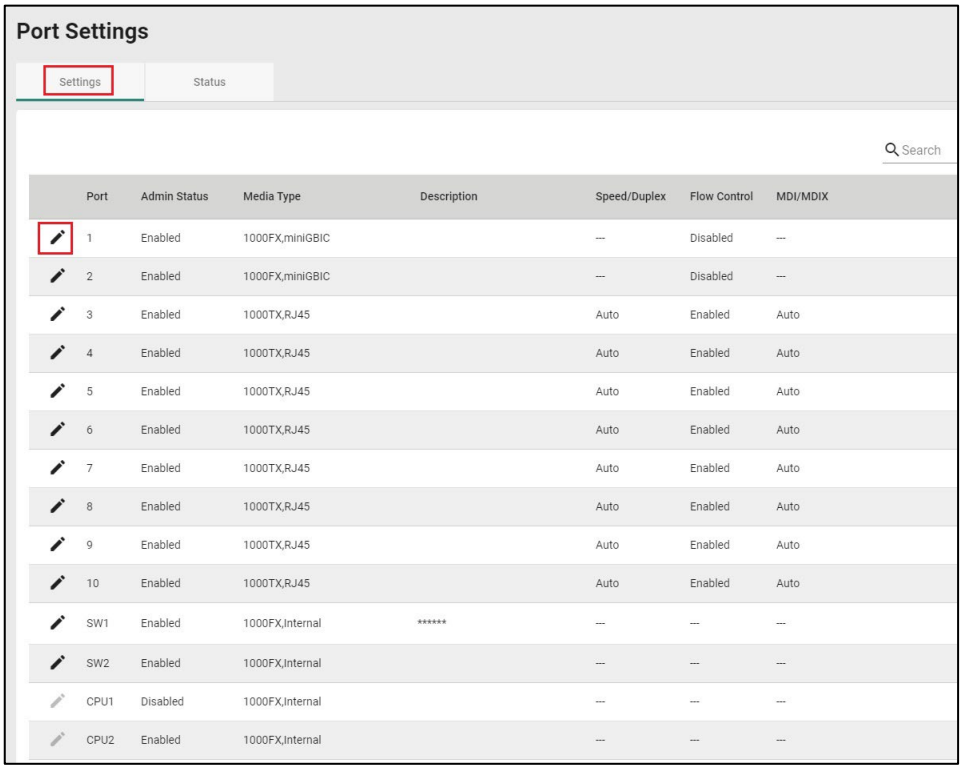

## Port Interface

Two functions are included in this section: **Port Setting** and **Linkup Delay**.

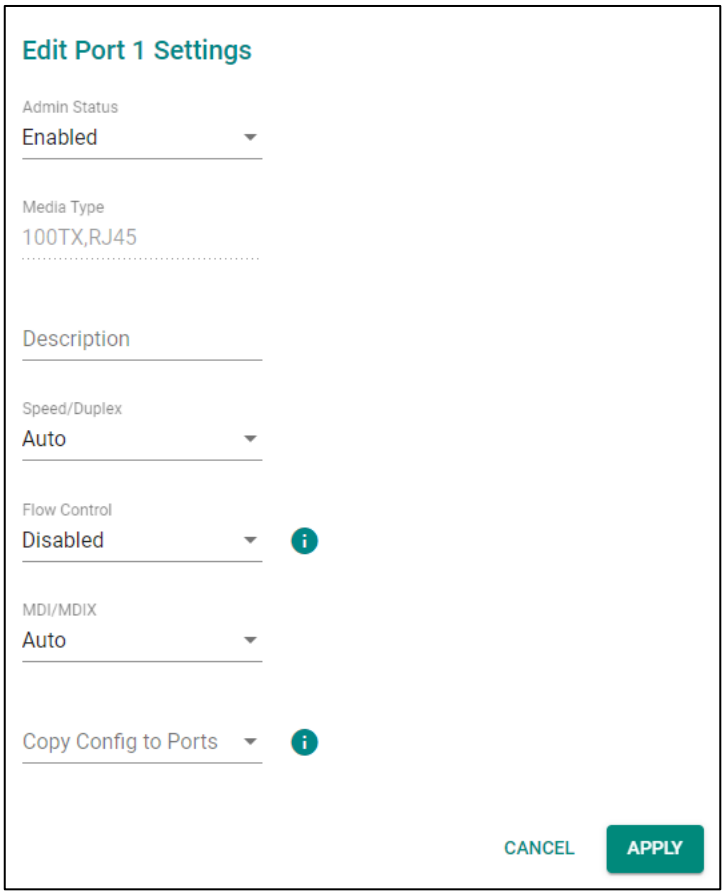


## Port Setting

Under **Port Setting**, select the **Setting** tab and then select the edit icon on the port you want to configure.




Configure the following parameters.



***Admin Status***

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Allows data transmission through this port. | Enabled |
| Disabled | Disables data transmission through this port. | |

***Media Type***

| Setting | Description | Factory Default |
|---|---|---|
| Media type | Displays the media type for each module's port. | 1000TX,RJ45,PTP |

***Description***

| Setting | Description | Factory Default |
|---|---|---|
| Max. 63 characters | Specify an alias for the port to help differentiate between different ports (e.g., PLC1). | None |

***Speed/Duplex***

| Setting | Description | Factory Default |
|---|---|---|
| Auto | Allows the port to use the IEEE 802.3u protocol to negotiate with connected devices. The port and connected devices will determine the best speed for that connection. | Auto |
| 10M Half | Choose a fixed speed option if the connected Ethernet device has trouble auto-negotiating line speed. | |
| 10M Full | | |
| 100M Half | | |
| 100M Full | | |

***Flow Control***

This setting enables or disables flow control for the port when the port's speed is set to Auto. The result will be determined by the Auto process between the switch and connected devices.

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Enables flow control for this port when the port's speed is set to Auto. | Disabled |
| Disable | Disables flow control for this port when the port's speed is set to Auto. | |

***MDI/MDIX***

| Setting | Description | Factory Default |
|---|---|---|
| Auto | Allows the port to auto-detect the port type of the connected Ethernet device and changes the port type accordingly. | Auto |
| MDI | Choose MDI or MDIX if the connected Ethernet device has trouble auto-detecting the port type. | |
| MDIX | | |

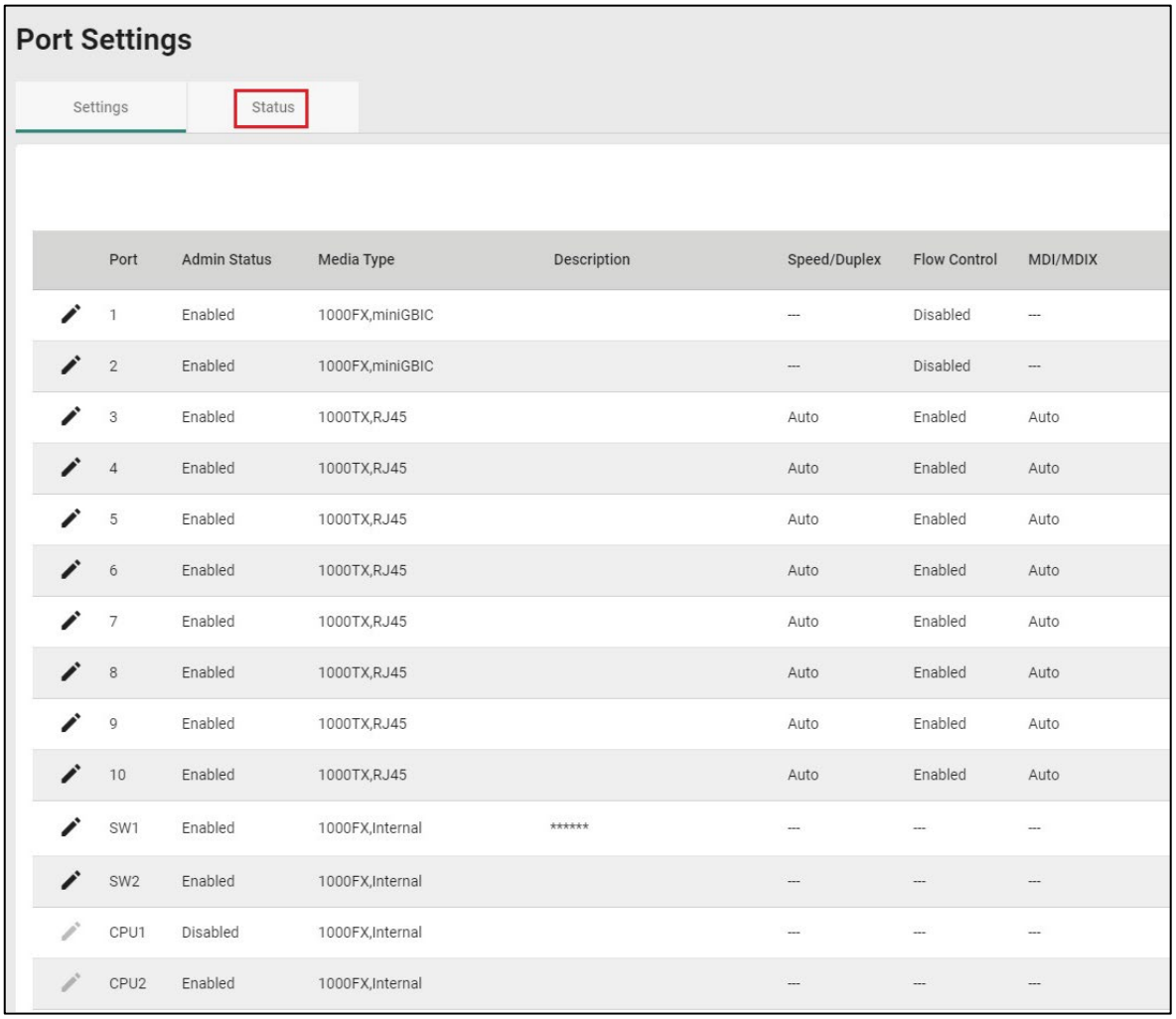
***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Allows you to copy the configuration to other port(s). | None |

When finished, select **APPLY** to save your changes.

### Port Status

To view the status of the ports, select the **Status** tab.




## Linkup Delay

### Linkup Delay Overview

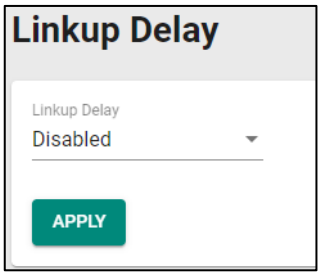
Linkup delay is used to prevent a port alternating between link up and link down. It is also sometimes called link flap prevention. This feature is useful when the link connection is unstable. An unstable connection might be caused by a faulty cable, faulty fiber transceiver, duplex mismatch, etc. This feature helps administrators to mitigate the risk of an unstable network, particularly when the topology changes frequently.

### Linkup Delay Settings

This section describes how to configure the linkup delay for the ports. Select the **Linkup Delay** menu. The default setting disables linkup delay for all ports.

**NOTE**

Only ports 1 to 10 support Linkup Delay Setting. SW1, SW2, CPU1, CPU2 are internal communication ports. This function cannot be edited in these ports.

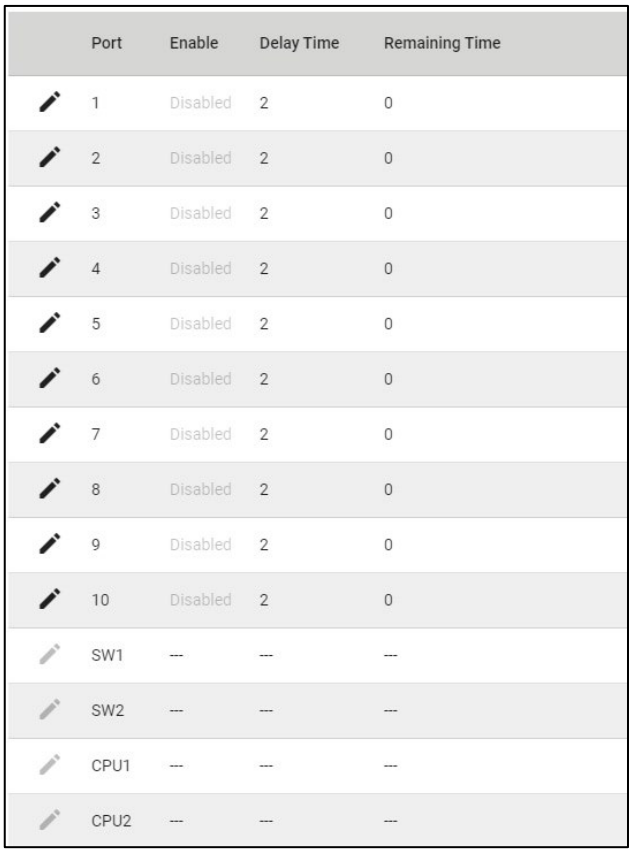



***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Enables linkup delay. | Disabled |
| Disabled | Disables linkup delay. | |

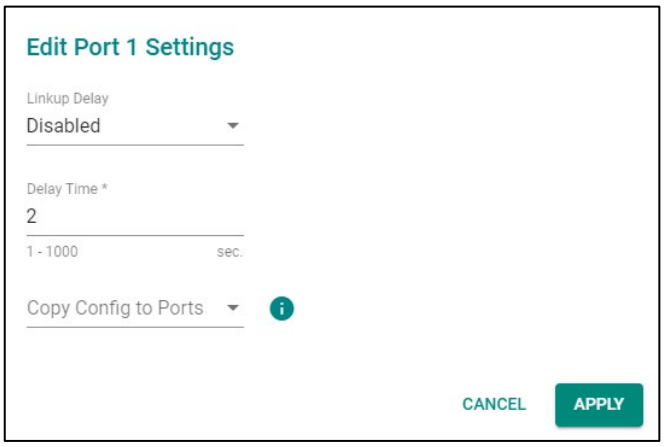
When finished, select **APPLY** to save your changes.

To configure the linkup delay for a port, select the edit icon on the port you want to configure.



| | Port | Enable | Delay Time | Remaining Time |
|---|---|---|---|---|
| ✎ | 1 | Disabled | 2 | 0 |
| ✎ | 2 | Disabled | 2 | 0 |
| ✎ | 3 | Disabled | 2 | 0 |
| ✎ | 4 | Disabled | 2 | 0 |
| ✎ | 5 | Disabled | 2 | 0 |
| ✎ | 6 | Disabled | 2 | 0 |
| ✎ | 7 | Disabled | 2 | 0 |
| ✎ | 8 | Disabled | 2 | 0 |
| ✎ | 9 | Disabled | 2 | 0 |
| ✎ | 10 | Disabled | 2 | 0 |
| ✎ | SW1 | --- | --- | --- |
| ✎ | SW2 | --- | --- | --- |
| ✎ | CPU1 | --- | --- | --- |
| ✎ | CPU2 | --- | --- | --- |

Some parameters need to be configured.




***Linkup Delay***

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Enables linkup delay for the port. | Disabled |
| Disable | Disables linkup delay for the port. | |

***Delay Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 1000 | Specify the linkup delay time from 1 to 1000 seconds. | 2 |

***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Allows you to copy the configurations to other port(s). | None |

When finished, select **APPLY** to save your changes.

# Link Aggregation

## Link Aggregation (Port Channel) Overview

Link Aggregation helps balance, optimize, and facilitate the switch's throughput. This method can combine multiple network communications in parallel to maximize data throughput, increasing data communication efficiency for each port. In addition, it also acts as a useful method for network redundancy when a link fails. In general, Link Aggregation supports combining multiple physical switch ports into a single, efficient bandwidth data communication route. This can improve network load sharing and increase network reliability.

## Static Trunk

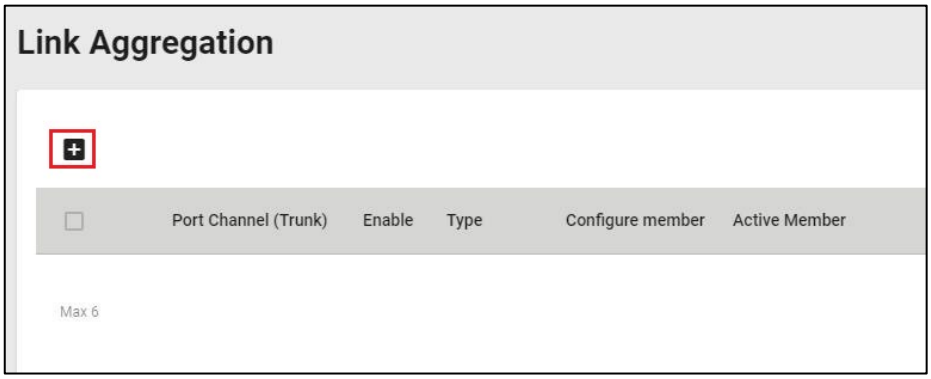
For some networking applications, a situation can arise where traffic from multiple ports is required to be filtered through one port. For example, if there are 30 UHD IP surveillance cameras deployed and connected in a ring, the traffic can reach up to 1 Gbps, causing a surge in traffic that can increase network loading by up to 50%. Hence, the uplink port needs to use the static trunk function to provide more bandwidth and redundancy protection.

## LACP

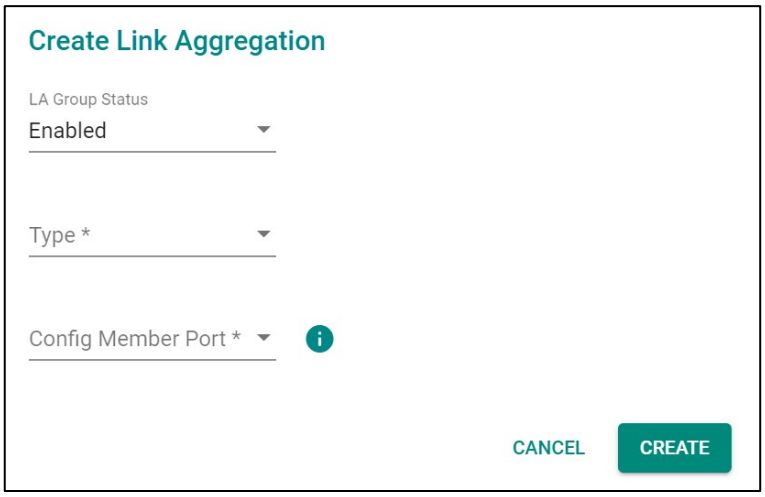
The Link Aggregation Control Protocol (LACP) allows a network device to negotiate an automatic bundling of several ports by sending LACP packets to the peer, a directly connected device that also uses LACP.

## Link Aggregation Settings

This section describes how to configure link aggregation for each port. Select **Link Aggregation** on the menu and then select the + icon on the configuration page.




To create a link aggregation group, configure the following parameters.




***LA Group Status***

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Enable link aggregation grouping. | None |
| Disable | Disable link aggregation grouping. | |

***Type***

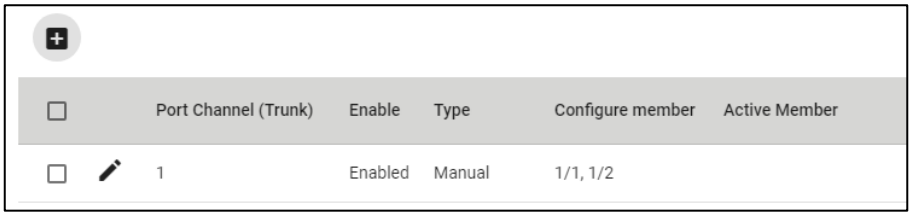
| Setting | Description | Factory Default |
|---|---|---|
| Manual | Configure the link aggregation type manually. | None |
| LACP | Configure the link aggregation type by LACP. | |

***Config Member Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the ports | Select the ports you want to create for link aggregation grouping. | None |

When finished, select **CREATE** to continue.

View the current Link Aggregation or Port Channel (Trunk) status on the configuration page. Edit or delete by selecting the edit or delete icon on the page.

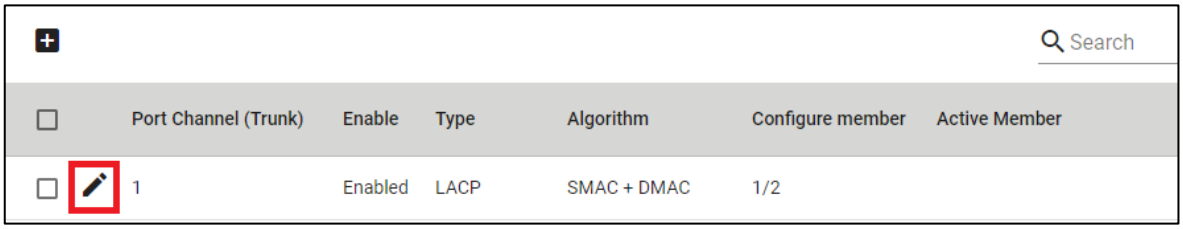


### Editing Port Setting for Link Aggregation

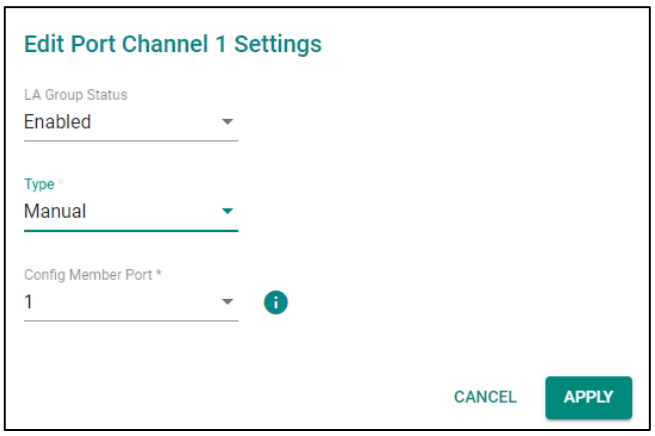
To edit each port's setting for Link Aggregation, select the edit icon on the port name. You can also check the port and then select the edit icon for editing the port settings for Link Aggregation.

**NOTE**

Only port 1 to 10 support Link Aggregation setting. SW1, SW2, CPU1, CPU2 are internal communication ports. This function cannot be edited in these ports.




Edit the following port settings.




***LA Group Status***

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Enable link aggregation grouping. | None |
| Disable | Disable link aggregation grouping. | |

***Type***

| Setting | Description | Factory Default |
|---|---|---|
| Manual | Configure link aggregation manually. | None |
| LACP | Configure link aggregation by LACP. | |

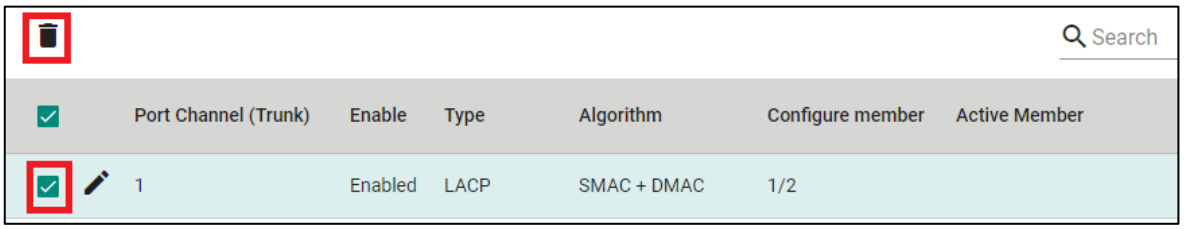
***Config Member Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the ports | Select the ports you want to create link aggregation grouping for. | None |

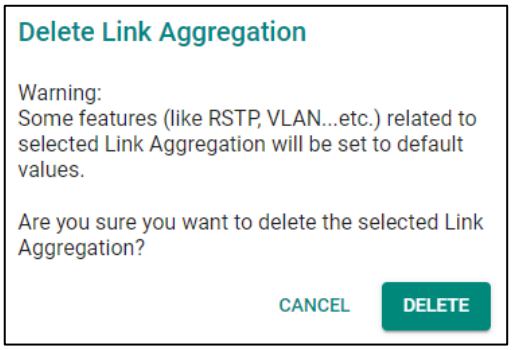
When finished, select **APPLY** to save your changes.

### Deleting the Port for Link Aggregation

To delete the port for Link Aggregation, check the port and then select the delete icon.

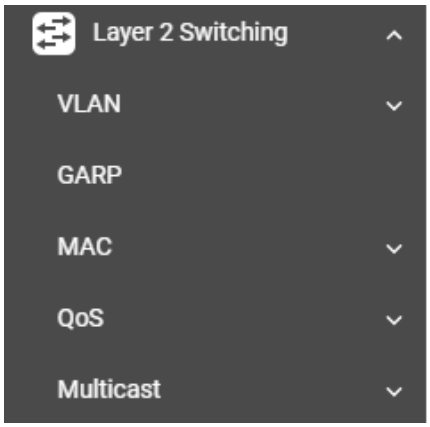



Select **DELETE** to finish. Note that some features, such as RSTP and VLAN, will be set to default values once you delete the Link Aggregation setting.



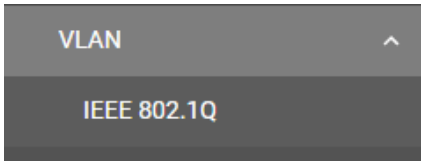

# Layer 2 Switching

This section describes how to configure various parameters, such as **VLAN, GARP, MAC, QoS,** and **Multicast**, for switch module. Select **Layer 2 Switching** on the function menu.




## VLAN

This section includes **IEEE802.1Q** configurations.



## IEEE 802.1Q Overview

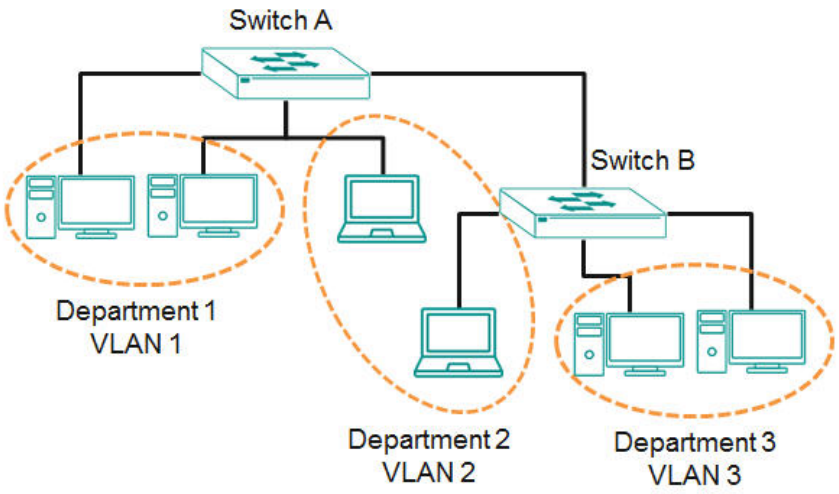
The IEEE 802.1Q is a network communication protocol that falls under the IEEE 802.1 standard regulation, allowing various segments to use a physical network at the same time to block broadcast packets by different segmentations. It specifies the VLAN tagging for Ethernet frames on switches that can control the path process.

## How A VLAN Works

### What Is a VLAN?

A VLAN is a group of devices that can be located anywhere on a network, but which communicate as if they are on the same physical segment. With VLANs, you can segment your network without being restricted by physical connections—a limitation of traditional network design. With VLANs you can segment your network into:

- **Departmental groups—**You could have one VLAN for the marketing department, another for the finance department, and another for the product development department.
- **Hierarchical groups—**You could have one VLAN for directors, another for managers, and another for general staff.
- **Usage groups—**You could have one VLAN for email users and another for multimedia users.




### Benefits of VLANs

The main benefit of VLANs is that they provide a network segmentation system that is far more flexible than traditional networks. Using VLANs also provides you with three other benefits:

- **VLANs ease the relocation of devices on networks:** With traditional networks, network administrators spend much of their time dealing with changes. If you move to a different subnetwork, the addresses of each host must be updated manually. With a VLAN setup, if a host originally on the Marketing VLAN is moved to a port on another part of the network, and retains its original subnet membership, you only need to specify that the new port is on the Marketing VLAN. You do not need to do any recalling.
- **VLANs provide extra security:** Devices within each VLAN can only communicate with other devices on the same VLAN. If a device on the Marketing VLAN needs to communicate with devices on the Finance VLAN, the traffic must pass through a routing device or Layer 3 switch.
- **VLANs help control traffic:** With traditional networks, congestion can be caused by broadcast traffic that is directed to all network devices, regardless of whether they need it. VLANs increase the efficiency of your network because each VLAN can be set up to contain only those devices that need to communicate with each other.

## VLANs and the Switch Module

Your switch module includes support for VLANs using IEEE Std 802.1Q-2005. This standard allows traffic from multiple VLANs to be carried across one physical link. The IEEE Std 802.1Q-2005 standard allows each port on your switch module to be placed:

- On a single VLAN defined in the switch
- On several VLANs simultaneously using 802.1Q tagging

The standard requires that you define the 802.1Q VLAN ID for each VLAN on your switch module before the switch can use it to forward traffic:

## Managing a VLAN

A new or initialized switch module contains a single VLAN—the Default VLAN. This VLAN has the following definition:

- Management VLAN ID 1 can be changed
- 802.1Q VLAN default ID 1 cannot be deleted

All the ports are initially placed on this VLAN, and it is the only VLAN that allows you to access the management software of the switch module over the network.

## Communication Between VLANs

If devices connected to a VLAN need to communicate with devices on a different VLAN, a router or Layer 3 switching device with connections to both VLANs needs to be installed. Communication between VLANs can only take place if they are all connected to a routing or Layer 3 switching device.

## VLANs: Tagged and Untagged Membership

Switch module supports 802.1Q VLAN tagging, a system that allows traffic for multiple VLANs to be carried on a single physical link (backbone, trunk). When setting up VLANs you need to understand when to use untagged or tagged membership of VLANs. Simply put, if a port is on a single VLAN it can be an untagged member, but if the port needs to be a member of multiple VLANs, a tagged membership must be defined.

A typical host (e.g., clients) will be an untagged member of one VLAN, defined as an **access port** in a switch module, while an inter-switch connection will be a tagged member of all VLANs, defined as a **trunk port** in a switch module.

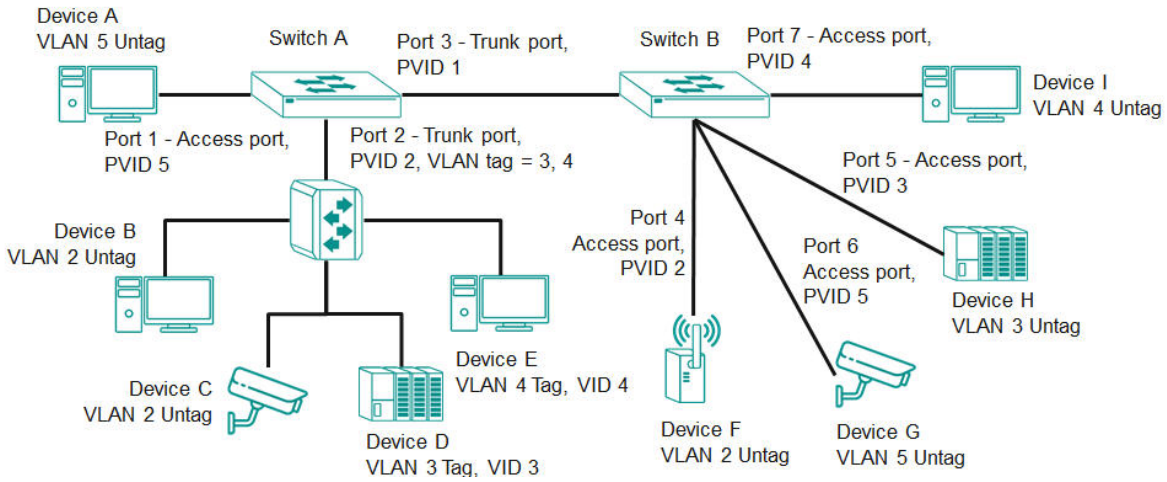
The IEEE Std 802.1Q-2005 defines how VLANs operate within an open packet-switched network. An 802.1Q compliant packet carries additional information that allows a switch to determine which VLAN the port belongs to. A frame is called a tagged frame if it carries additional information.

To carry multiple VLANs across a single physical link (backbone, trunk). Each packet must be tagged with a VLAN identifier so that the switches can identify which packets belong to which VLAN. To communicate between VLANs, a router must be used.

Switch module supports three types of VLAN port settings:

- **Access Port:** The port connects to a single device that is not tagged. You must define the default port PVID that assigns which VLAN the device belongs to. Once the ingress packet of this access port egresses to another trunk port (the port needs all packets to carry tag information), the switch will insert this PVID into this packet so the next 802.1Q VLAN switch can recognize it.
- **Trunk Port:** The port connects to a LAN that comprises untagged devices and tagged devices. In general, the traffic of the trunk port must have a tag. You can also assign a PVID to a trunk port. The untagged packet on the trunk port will be assigned the default port PVID as its VID.
- **Hybrid Port:** The port is like a trunk port, except users can explicitly assign tags to be removed from egress packets.

The following section illustrates how to use these ports to set up different applications.




In this application:

- Port 1 connects a single untagged device and assigns it to VLAN 5; it should be configured as an **access port** with PVID 5.
- Port 2 connects a LAN with two untagged devices belonging to VLAN 2. One tagged device with VID 3 and one tagged device with VID 4. It should be configured as a **hybrid port** with PVID 2 for untagged devices and Fixed VLAN (Tagged) with 3 and 4 for tagged device. Since each port can only have one unique PVID, all untagged devices on the same port must belong to the same VLAN.
- Port 3 connects with another switch. It should be configured as a **trunk port**. GVRP protocol will be used through the trunk port.
- Port 4 connects a single untagged device and assigns it to VLAN 2; it should be configured as an **access port** with PVID 2.
- Port 5 connects a single untagged device and assigns it to VLAN 3; it should be configured as an **access port** with PVID 3.
- Port 6 connects a single untagged device and assigns it to VLAN 5; it should be configured as an **access port** with PVID 5.
- Port 7 connects a single untagged device and assigns it to VLAN 4; it should be configured as an **access port** with PVID 4.

After the application is properly configured:

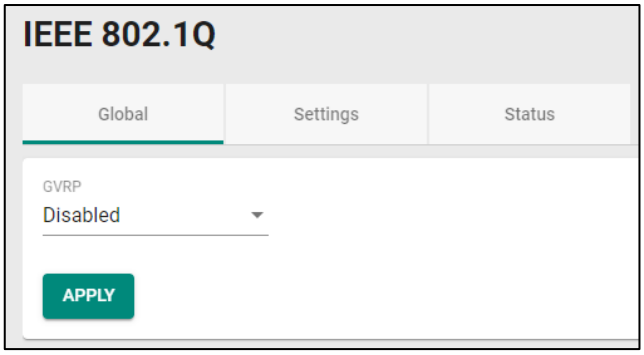
- Packets from Device A will travel through **Trunk Port 3** with tagged VID 5. Switch B will recognize its VLAN, pass it to port 6, and then remove tags received successfully by Device G, and vice versa.
- Packets from Devices B and C will travel through **Hybrid Port 2** with tagged VID 2. Switch B recognizes its VLAN, passes it to port 4, and then removes tags received successfully by Device F, and vice versa.
- Packets from Device D will travel through **Trunk Port 3** with tagged VID 3. Switch B will recognize its VLAN, pass to port 5, and then remove tags received successfully by Device H. Packets from Device H will travel through **Trunk Port 3** with PVID 3. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by Device D.
- Packets from Device E will travel through **Trunk Port 3** with tagged VID 4. Switch B will recognize its VLAN, pass it to port 7, and then remove tags received successfully by Device I. Packets from Device I will travel through **Trunk Port 3** with tagged VID 4. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by Device E.

## VLAN Settings

To configure VLAN, select **VLAN** on the function menu, then select **IEEE 802.1Q**. Select **Global** tab.

GVRP (Generic VLAN Registration Protocol) is an IEEE 802.1Q standard protocol that helps specify how to define a method of tagging frames with VLAN configuration data. It essentially facilitates the management of VLAN within a larger network of data communication.

To edit the GVRP function, select the **Global** tab.




Configure the following setting.

***GVRP***

| Setting | Description | Factory Default |
|---|---|---|
| Disabled | Disables GVRP. | Disabled |
| Enabled | Enables GVRP. | |

Select **APPLY** to finish.

## VLAN Management Port Quick Settings

In the lower part of the configuration page, you can quickly configure the VLAN settings.


Configure the following settings.

***Management VLAN***

| Setting | Description | Factory Default |
|---|---|---|
| Select the Management VLAN from the drop-down list | Show the list of selectable VLANs. | 1 |

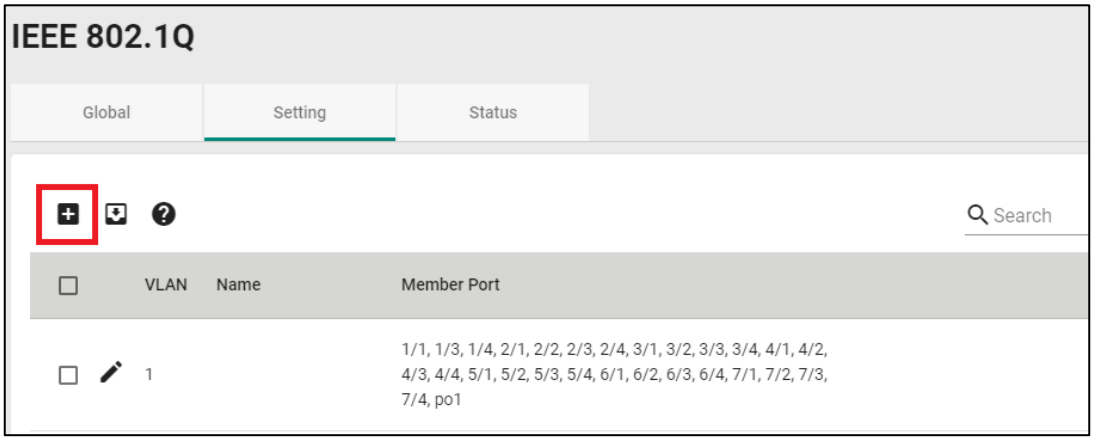
***Management Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) as the VLAN port(s) from the drop-down list | To select the port(s) as the VLAN port(s). | None |

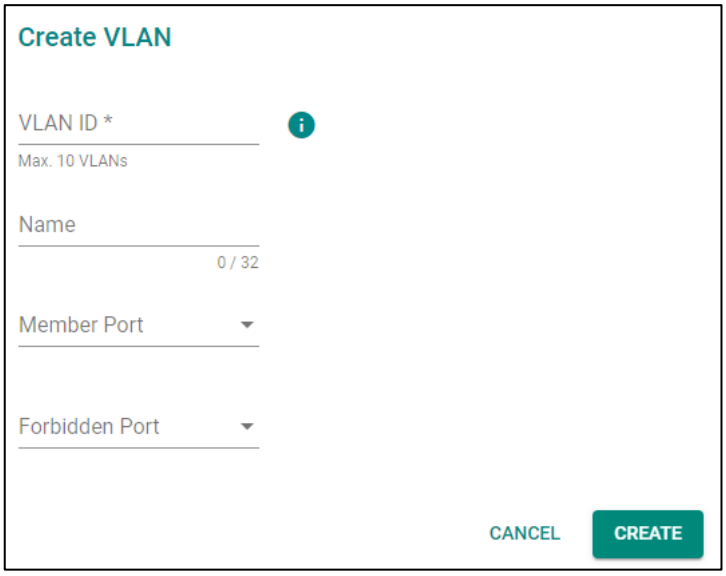
When finished, select **APPLY** to save your changes.

## Detailed VLAN Settings

On the IEEE 802.1Q page, first select the Setting tab, and then select the edit icon.




Configure the following parameters.




***VID***

| Setting | Description | Factory Default |
|---|---|---|
| Input a VLAN ID, (10 VLANs max.) | Input a VLAN ID. | None |

***Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input a name for the VLAN, (32 characters max.) | Specify a name for the VLAN. | None |

***Member Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list. | Specify the ports that are the member ports for the VLAN. | None |

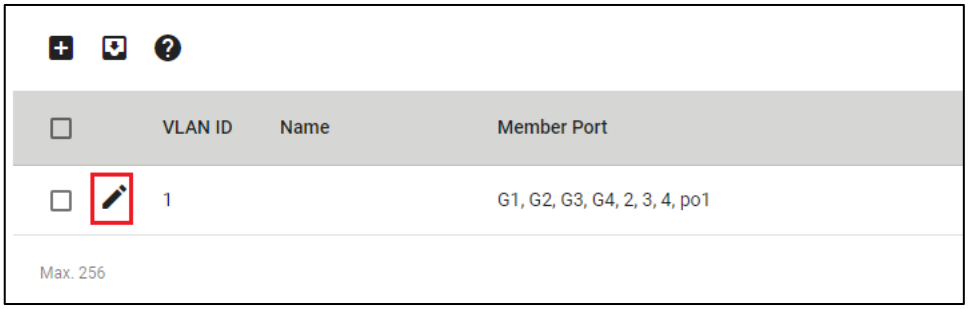
When finished, select **CREATE**.

***Forbidden Port (in Advanced Mode only)***

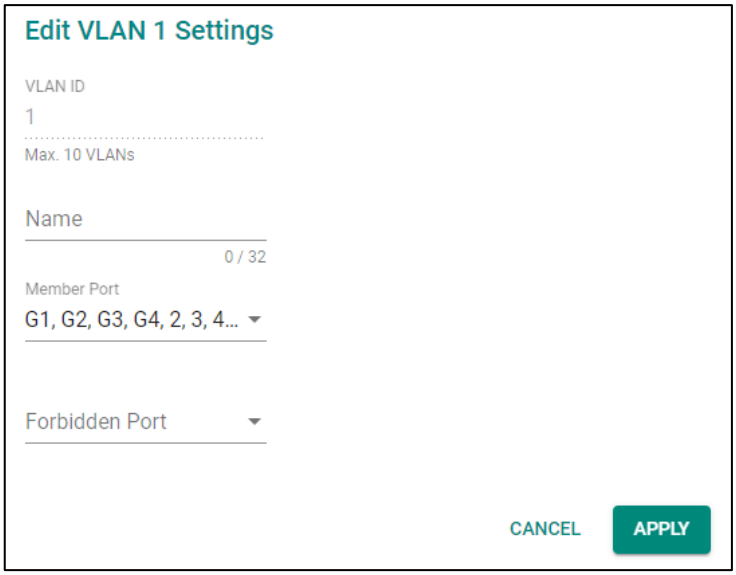
| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list | Specify the ports that are forbidden for the VLAN. | None |

## Editing the Existing VLAN Settings

To edit the exiting VLAN settings, select the edit icon of the VLAN you want to edit.




Configure the following settings.




***VID***

| Setting | Description | Factory Default |
|---|---|---|
| Show the VLAN ID | Display the VLAN ID. | None |

***Name***

| Setting | Description | Factory Default |
|---|---|---|
| Show the name of the VLAN | Display the VLAN name. | None |

***Member Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list | Specify the ports that are member ports for the VLAN. | None |

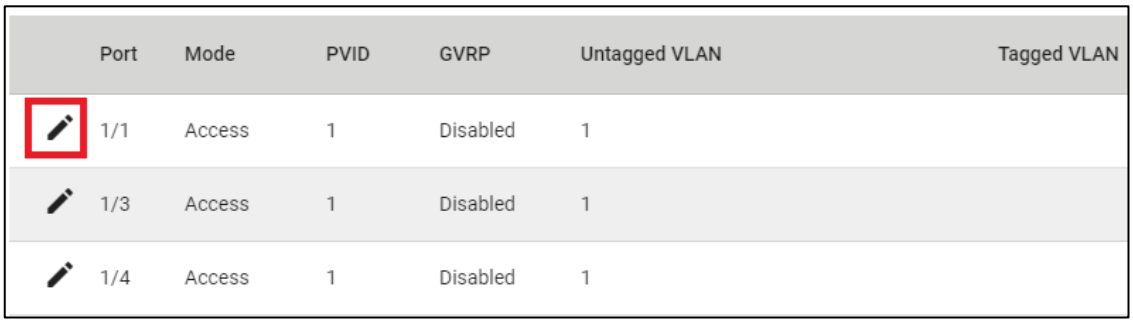
When finished, select **APPLY** to save your changes.

***Forbidden Port (in Advanced Mode only)***

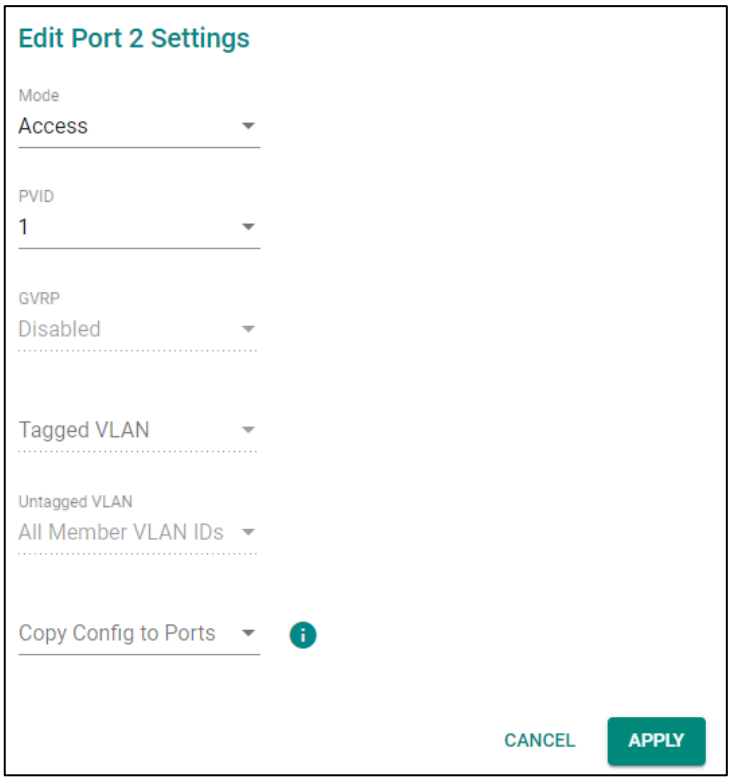
| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list | Specify the ports that are forbidden for the VLAN. | None |

## Editing the Port Settings

To edit the port settings, in the **VLAN** tab, select the edit icon on the port you want to configure on the lower part of the page.




Configure the following settings.




***Mode***

| Setting | Description | Factory Default |
|---|---|---|
| Access | When this port is connected to a single device, without tags. | Access |
| Trunk | When this port is connected to another 802.1Q VLAN aware switch. | |
| Hybrid | When this port is connected to another Access 802.1Q VLAN aware switch or another LAN that combines tagged and/or untagged devices. | |

***PVID***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 4094 | Sets the default VLAN ID for untagged devices connected to the port. | None |

***GVRP***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables GVRP. | Disabled |
| Disabled | Disables GVRP. | |

***Tagged VLAN***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 4094 | This field will be active only when selecting the trunk or hybrid port type. Set the other VLAN ID for tagged devices that connect to the port. | None |

***Untagged VLAN***

| Setting | Description | Factory Default |
|---|---|---|
| VID range from 1 to 4094 | This field is only active when the hybrid port type is selected. Set the other VLAN ID for tagged devices that connect to the port and tags that need to be removed in egress packets. | 1 |

***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Copy the configuration to other port(s). | None |

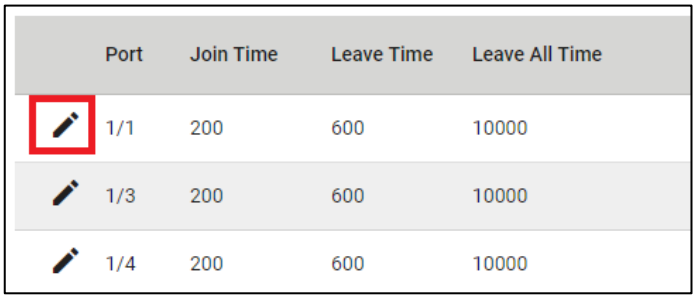
When finished, select **APPLY** to save your changes.

## GARP Overview

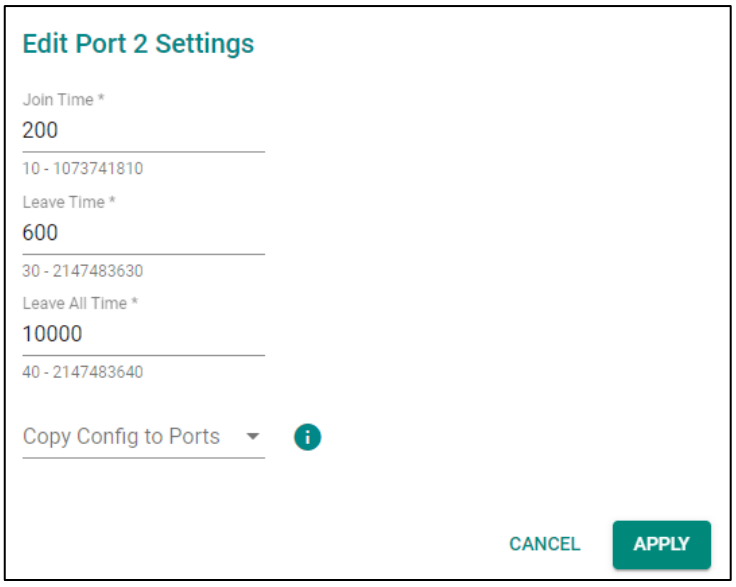
GARP stands for **Generic Attribute Registration Protocol**, which is a communication protocol defined by IEEE 802.1, offering a generic framework for bridges to register and de-register an attribute value. In a VLAN structure, two applications can be applied: **GARP VLAN Registration Protocol (GVRP)** is used to register VLAN trunking between multilayer switches, and **GARP Multicast Registration Protocol (GMRP)** to provide a constrained multicast flooding facility.

## GARP Settings

Select **GARP** on the menu page and then select the edit icon on the port you want to configure.




Configure the following settings.



***Join Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 10 to 499999980 | Input the join time from 10 to 499999980 seconds. | 200 |

***Leave Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 30 to 499999980 | Input the leave time from 30 to 499999980 seconds. | 600 |

***Leave All time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 30 to 499999990 | Input the leave all time. | 10000 |

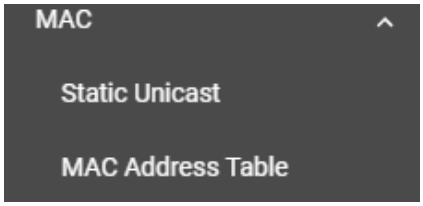
***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Copy the configurations to other port(s). | None |

When finished, select **APPLY** to save your changes.

# MAC

This section explains Independent VLAN learning and describes how to configure **Static Unicast** and the **MAC Address Table**.



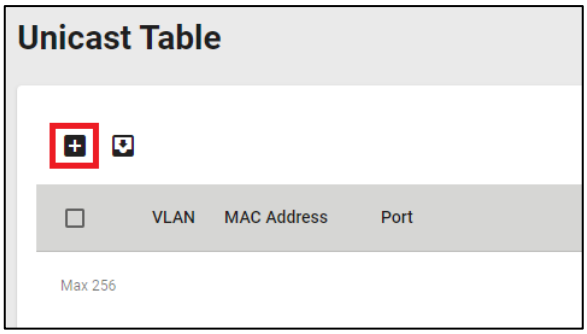

## Independent VLAN Learning

The switch module uses the **Independent VLAN Learning (IVL)** mode.

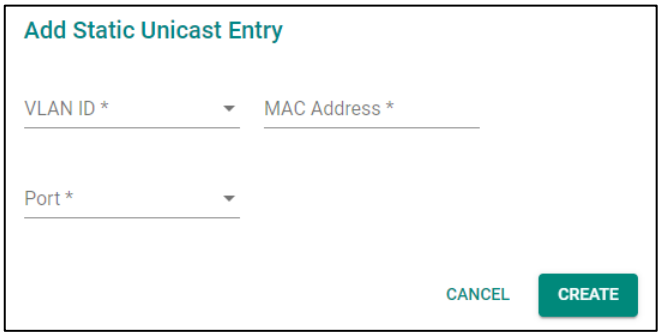
In an **IVL Mode**, a MAC table will be created in each VLAN, which will make up many MAC tables. However, the same VID record will be selected and put in a table. A MAC table will be stored in the format of MAC + VID, the same MAC will be stored in different tables with different VIDs.

## Static Unicast

Select **Static Unicast** on the function menu page and select the + icon on the configuration page.



Configure the following settings.




***VID***

| Setting | Description | Factory Default |
|---|---|---|
| Input a VLAN ID | Input a VLAN ID. | None |

***MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| MAC address of the port | Input the MAC address of the port. | None |

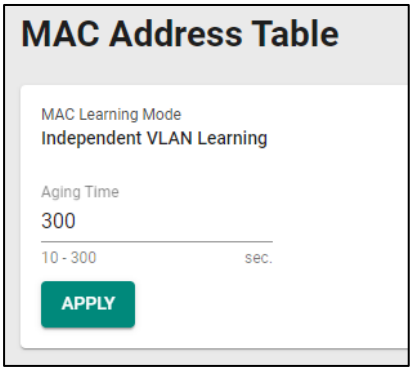
***Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list | Specify the port you want to create a VLAN for. | None |

When finished, select **CREATE**.

## MAC Address Table

Select **MAC Address Table and** configure the following settings.




***MAC Learning Mode***

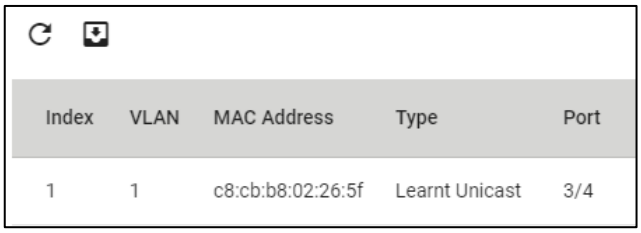
| Information | Description | Factory Default |
|---|---|---|
| Independent VLAN learning | Show the current MAC Learning Mode. | Independent VLAN learning |

***Aging Time***

| Setting | Description | Factory Default |
|---|---|---|
| 10 to 300 | Input a VLAN ID. | None |

When finished, select **APPLY** to save your changes.

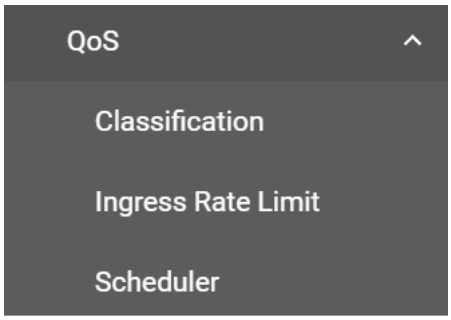
View the current MAC Address Table on the bottom part of the configuration page.




| Item Name | Description |
|---|---|
| Index | The number of the MAC address. |
| VLAN | The VLAN number |
| MAC Address | The MAC address on this device. |
| Type | Learnt Unicast, Learnt Multicast, Static Unicast, Static: Multicast |
| Port | The forwarding port of this MAC address. |

# QoS

This section describes how QoS works and how to configure the settings.




## QoS Overview

The switch's traffic prioritization capability provides Quality of Service (QoS) to your network by making data delivery more reliable. Prioritize traffic on your network to ensure that high priority data is transmitted with minimum delay. Traffic can be controlled by a set of rules to obtain the required Quality of Service for your network. The rules define different types of traffic and specify how each type should be treated as it passes through the switch. The switch can inspect both IEEE 802.1p/1Q layer 2 CoS (Class of Service) tags, and even layer 3 DSCP (Differentiated Services Code Point) information to provide a consistent classification of the entire network. The switch's QoS capability improves the performance and determinism of industrial networks for mission-critical applications.

## The Traffic Prioritization Concept

Traffic prioritization allows you to prioritize data so that time-sensitive and system-critical data can be transferred smoothly and with minimal delay over a network. The benefits of using traffic prioritization are:

- Improve network performance by controlling a wide variety of traffic and by managing congestion.
- Assign priorities to different categories of traffic. For example, set higher priorities for time-critical or mission-critical applications.
- Provide predictable throughput for multimedia applications, such as videoconferencing or voice over IP, and minimize traffic delay and jitter.
- Optimize the network utilization depending on application usage and usage needs. Hence, asset owners do not always need to expand their backbone bandwidth as the amount of traffic increases.

Traffic prioritization uses eight traffic queues to ensure that higher priority traffic can be forwarded separately from lower priority traffic, which guarantees Quality of Service (QoS) to your network.

Switch module traffic prioritization is based on two standards:

- **IEEE 802.1p**—a layer 2 QoS marking scheme
- **Differentiated Services (DiffServ)**—a layer 3 QoS marking scheme.

## IEEE 802.1p Class of Service

The IEEE Std 802.1D 2005 Edition marking scheme, which is an enhancement to IEEE Std 802.1D, enables Quality of Service on the LAN. Traffic service levels are defined in the IEEE 802.1Q 4-byte tag, which is used to carry VLAN identification and IEEE 802.1p priority information. The IEEE 802.1p occupying 3 bits of the tag follows the destination MAC address and Source MAC address.

The IEEE Std 802.1D 2005 Edition priority marking scheme assigns an IEEE 802.1p priority level between 0 and 7 to each frame, which specifies the level of service that the associated packets shall be handled. The table below shows an example of how different traffic types can be mapped to the eight IEEE 802.1p priority levels.

| IEEE 802.1p Priority Level | IEEE 802.1D Traffic Type |
|---|---|
| 0 | Best Effort |
| 1 | Background (lowest priority) |
| 2 | Reserved |
| 3 | Excellent Effort (business critical) |
| 4 | Controlled Load (streaming multimedia) |
| 5 | Video (interactive media) |
| 6 | Voice (interactive voice) |
| 7 | Network Control Reserved traffic |

Even though the IEEE 802.1p standard is the most widely used prioritization scheme for LAN environments, it still has some restrictions:

- It requires an additional 4-byte tag in the frame, which is normally optional for Ethernet networks. Without this tag, the scheme cannot work.
- The tag is part of the IEEE 802.1Q header, so to implement QoS at layer 2, the entire network must implement IEEE 802.1Q VLAN tagging.
- It is only supported within a LAN and does not cross the WAN boundaries, since the IEEE 802.1Q tags will be removed when the packets pass through a router.

## Differentiated Services (DiffServ) Traffic Marking

DiffServ is a Layer 3 marking scheme that uses the DiffServ Code Point (DSCP) field in the IP header to specify the packet priority. DSCP is an advanced intelligent method of traffic marking that allows you to choose how your network prioritizes different types of traffic. The DSCP field can be set from 0 to 63 to map to user-defined service levels, enabling you to regulate and categorize traffic by applications with different service levels.

The advantages of DiffServ over IEEE 802.1Q are:

- Prioritize and assign different traffic with appropriate latency, throughput, or reliability by each port.
- No extra tags are required.
- The DSCP priority tags are carried in the IP header, which can pass the WAN boundaries and through the Internet.
- DSCP is backwards compatible with IPv4 ToS (Type of Service), which allows operation with legacy devices that use IPv4 layer 3.

### Traffic Prioritization

Switch module classifies traffic based on layer 2 of the OSI 7 layer model, and the switch prioritizes outbound traffic according to the priority information defined in the received packet. Incoming traffic is classified based upon the IEEE 802.1p service level field and is assigned to the applicable egress priority queue. The traffic flow through the switch is as follows:

- A packet received by the switch module may or may not have an 802.1p tag associated with it. If it does not, then it is given a default CoS value (according to the port settings in the classification section). Alternatively, the packet might be marked with a new 802.1p value, which will cause all knowledge of the previous 802.1p tag being lost.
- Each egress queue has associated 802.1p priority levels, and can be defined by users, the packet will be placed in the appropriate priority queue. When the packet reaches the head of its queue and is about to be transmitted, the device determines whether the egress port belongs to the VLAN group. If it is, then the new 802.1p tag is used in the extended 802.1D header.

### Traffic Queues

The hardware of switch module has multiple traffic queues that allow packet prioritization to occur. Higher priority traffic can pass through the switch module without being delayed by lower priority traffic. As each packet arrives in the switch module, it undergoes ingress processing (which includes classification, marking/re-marking), and is then sorted into the appropriate queue. The switch then forwards packets from each queue.

Switch modules support two different queuing mechanisms:

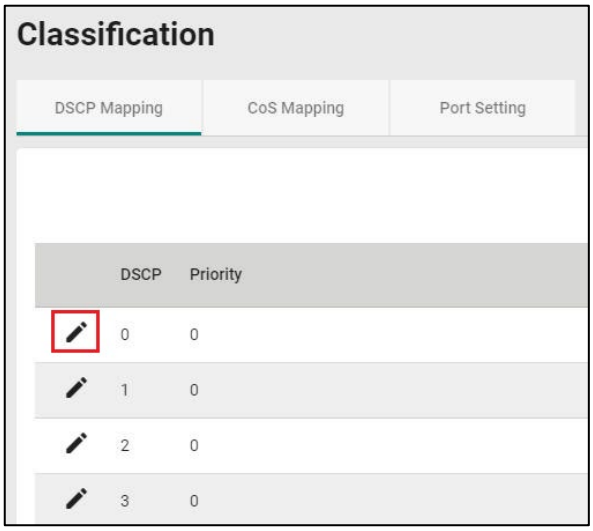
- **Weight Fair:** This method services all the traffic queues, giving priority to the higher priority queues. Under most circumstances, the Weight Fair method gives high priority precedence over low priority, but if high priority traffic does not reach the link capacity, lower priority traffic is not blocked.
- **Strict:** This method services high traffic queues first; low priority queues are delayed until no more high priority data needs to be sent. The Strict method always gives precedence to high priority over low priority.

## Classification

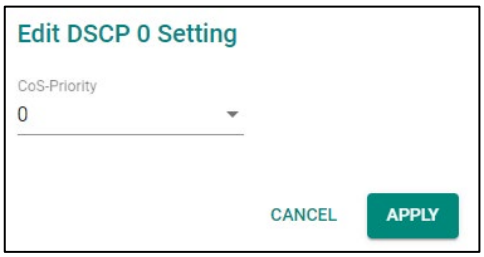
This section includes three parameters: **DSCP Mapping, CoS Mapping,** and **Port Setting**. The three parameters are described below.

### DSCP to CoS Mapping

In the **Classification** menu, select the **DSCP Mapping** tab, and then select the edit icon.



Configure the priority setting from the drop-down list for this port.



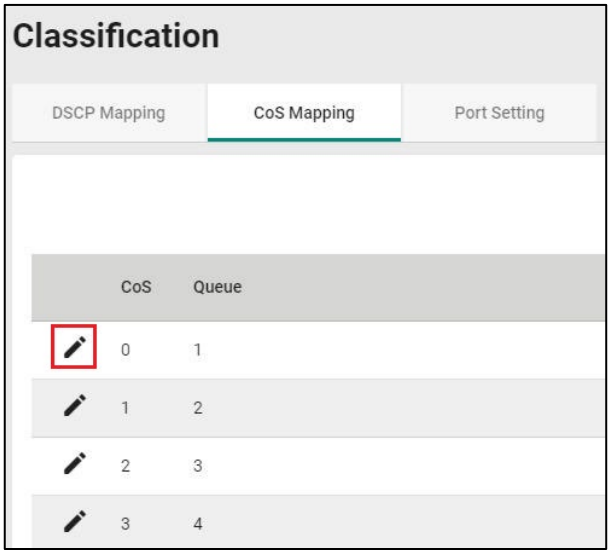

***DSCP Value and Priority***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 7 | Different DSCP values map to one of eight different priorities from 0 to 7. | 0 |
| 8 to 15 | | 1 |
| 16 to 23 | | 2 |
| 24 to 31 | | 3 |
| 32 to 39 | | 4 |
| 40 to 47 | | 5 |
| 48 to 55 | | 6 |
| 56 to 63 | | 7 |

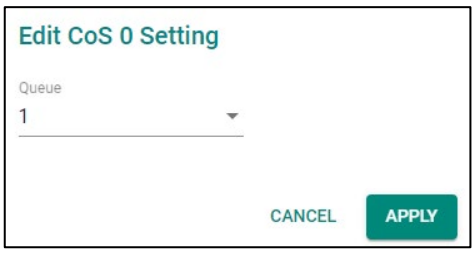
When finished, select **APPLY** to save your changes.

## CoS to Queue Mapping

In the **Classification** menu, select the **CoS Mapping** tab, and then select the edit icon.




Configure the Queue priority setting for the port.



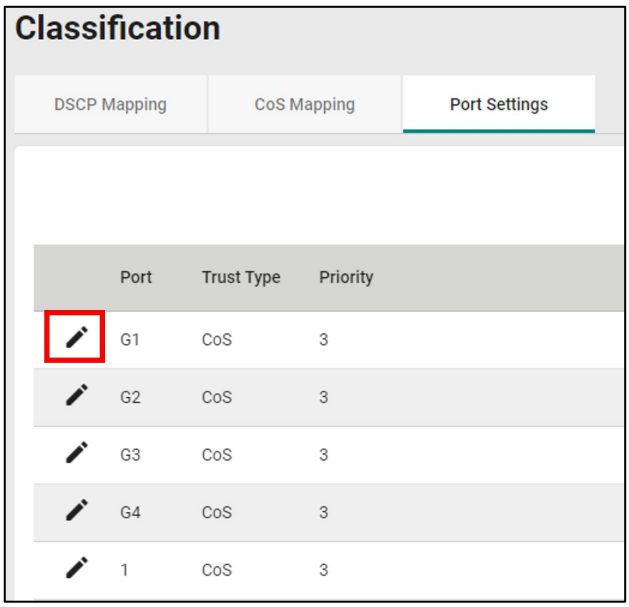
***Queue Priority***

| Setting | Description | Factory Default |
|---|---|---|
| 0 | Different 802.1p values map to one of the eight different queues from 1 (lowest priority) to 8 (highest). | 1 |
| 1 | | 2 |
| 2 | | 3 |
| 3 | | 4 |
| 4 | | 5 |
| 5 | | 6 |
| 6 | | 7 |
| 7 | | 8 |

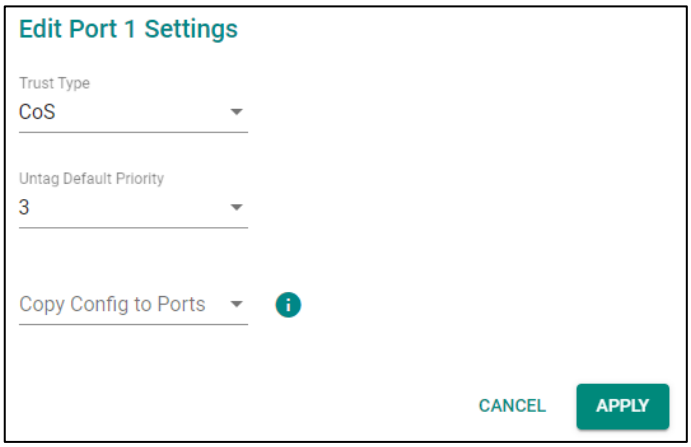
When finished, select **APPLY** to save your changes.

## Port Settings

In the **Classification** menu, select the **Port Setting** tab, and then select the edit icon.




Configure the following settings.




***Trust Type***

| Setting | Description | Factory Default |
|---|---|---|
| CoS | Enables the port with CoS-based traffic classification. | CoS |
| DSCP | Enables the port with DSCP-based traffic classification. | |

***Untag Default Priority***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 7 | 802.1p tag (CoS) can be ranged from 0 (lowest) to 7 (highest). | 3 |

**NOTE**

Certain functions such as redundancy mechanisms use the highest traffic class. Therefore, assign another traffic class to application data for the 65M-5011M Series.

***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select from the drop-down list | Copy the settings to other ports you select. | None |

When finished, select **APPLY** to save your changes.

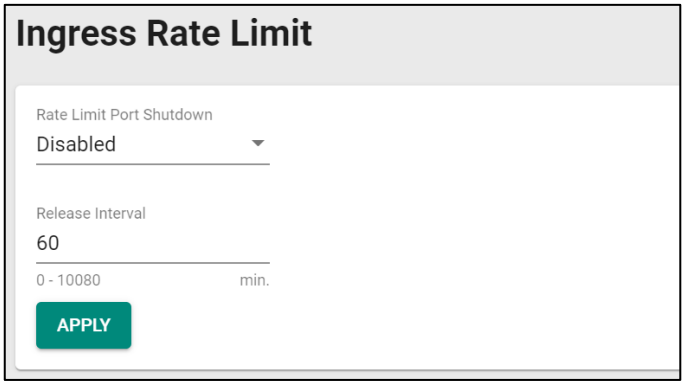
## Ingress Rate Limit

### Exceed Rate Limit Threshold Port Shutdown

In general, any user shall not consume unlimited bandwidth and influence others' access. One scenario is that a malfunctioning switch or mis-configured network might cause "broadcast storms". ioPAC 6500 Layer 2 Managed Ethernet Switch Module not only prevents broadcast storms but also regulates ingress packet rates, giving administrators full control of their limited bandwidth to prevent undesirable effects caused by unpredictable faults.

### Editing Port Shutdown

To edit the port shutdown configurations, select the **Port Shutdown** tab.




Configure the following settings.

***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Enable the port to be shut down. | Disabled |
| Disable | Disable the ability for the port to be shut down. | |

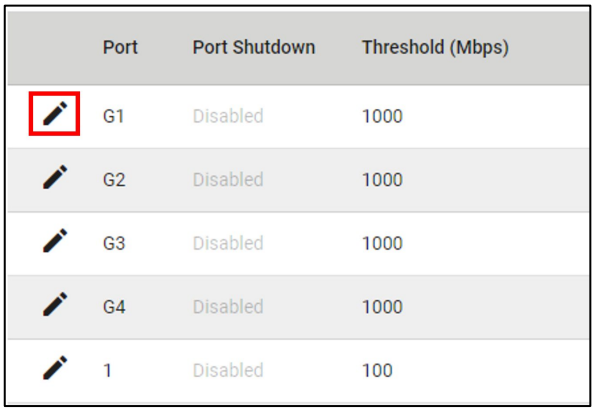
***Release Interval (min.)***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 10080 | Specify the release interval for the port to shut down. 0 means this port will be shut down until manually enabled. | 60 |

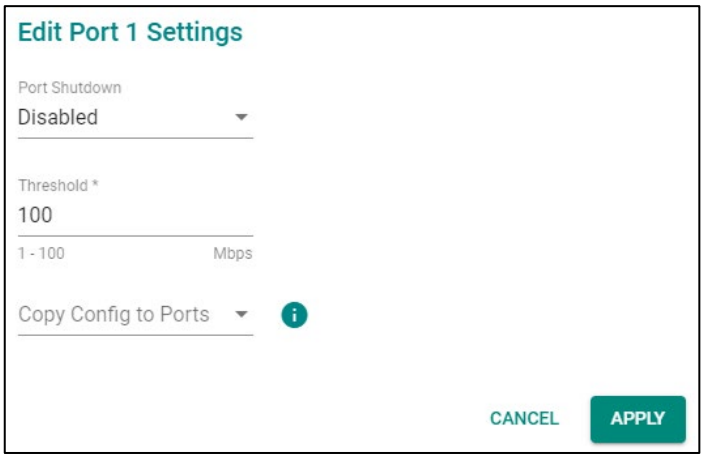
When finished, select **APPLY** to save your changes.

### Editing the Port for Port Shutdown

Edit the specific port you want to edit the port shutdown configurations for.




Configure the following settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enable | Enable port shutdown for this port. | Disable |
| Disable | Disable port shutdown for this port. | |

***Threshold (Mbps)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 100 or 1000 for Gigabit ports | Specify the threshold for port shutdown | 100 or 1000 |

***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Copy the configurations to other port(s). | None |

When finished, select **APPLY** to save your changes.

## Scheduler

### Scheduler Overview

Scheduler is an arbiter in a switch forwarding path to prioritize traffic flows by users' defined criteria. This essentially enhances data transmission efficiency and guarantees that critical packets can be transmitted earlier. Switch modules support two scheduling algorithms: Strict Priority and Weighted Round Robin.

### Strict Priority

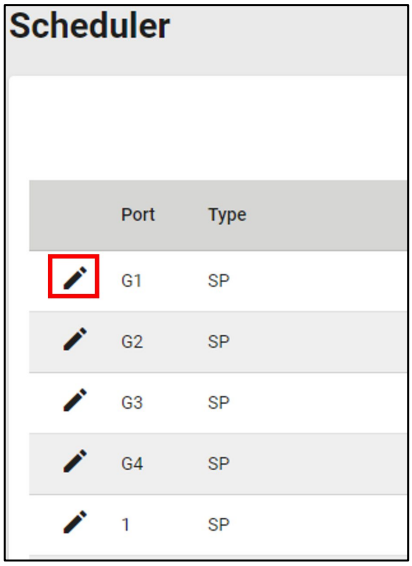
The **Strict Priority** type allows you to determine to transmit packets in the highest priority queue first, while packets with lower priority will be transmitted later. This guarantees that traffic with the highest level of priority for data transmission will go first.

### Weighted Round Robin

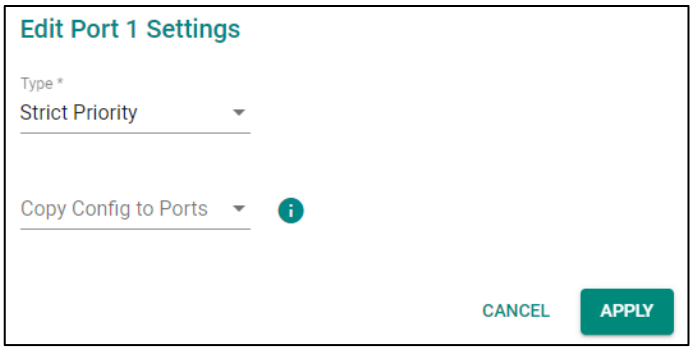
The **Weighted Round Robin** type allows tou to give priority to specific packets in the higher weighted queue to ensure those packets will be sent first. Switch modules now have eight queues, and the weights from highest to lowest are 8:8:4:4:2:2:1:1.

### Scheduler Settings

Select **Scheduler** in the menu and then select the edit icon on the port you want to configure.




Configure the following settings.




***Type***

| Setting | Description | Factory Default |
|---|---|---|
| Strict Priority | Set scheduler algorithm as Strict Priority. | Strict Priority |
| Weighted Round Robin | Set the scheduler algorithm as Weighted Round Robin: The queued packet will be forwarded by its associated weight. | |

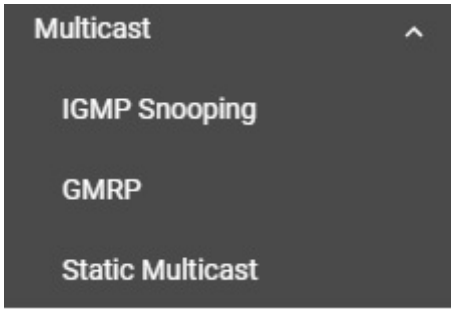
***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list | Copy the same settings to other ports. | None |

When finished, select **APPLY** to save your changes.

# Multicast

Multicast filtering improves the performance of networks that carry multicast traffic. This section will explain the Layer 2 multicast settings, such as IGMP Snooping, GMRP, and Static Multicast.




## IGMP Snooping

### IGMP Snooping Overview

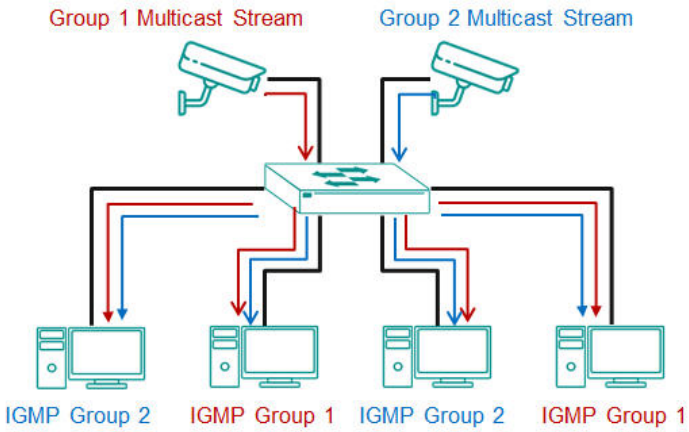
IGMP stands for **Internet Group Management Protocol**, which is a network communication protocol that hosts nearby routers on networks to construct multicast group memberships.

IGMP snooping allows a network switch to listen in on the IGMP conversation between hosts and routers. By listening to these conversations, the switch maintains an association mapping table between port(s) and multicast group.

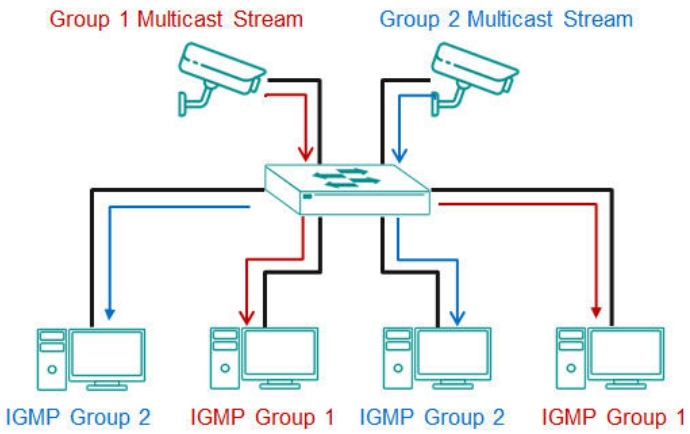
### How IGMP Snooping Works

A switch will, by default, flood multicast traffic to all the other ports, aside ingress, in a broadcast domain (or the VLAN equivalent). Multicast can cause unnecessary loading for host devices by requiring them to process packets they have not solicited. IGMP snooping prevents hosts on a local network from receiving traffic for a multicast group they have not joined. It provides switches with a mechanism to forward multicast traffic to specific ports that receive IGMP hosts. Hence, IGMP snooping can use the network bandwidth more efficiently.

**Without IGMP Snooping**



**With IGMP Snooping**



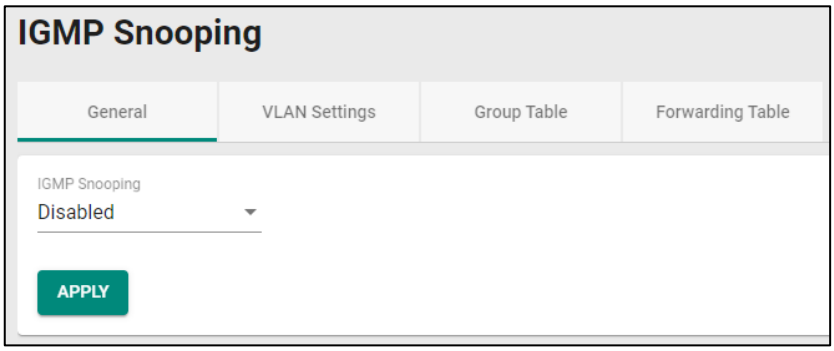

## Differences Between IGMP Snooping V1, V2, and V3

IGMP protocols regulate the communication mechanism between querier and listener. IGMP Snooping has three different versions. Refer to the following table for the detailed differences.

| IGMP Version | Main Features | Reference |
|---|---|---|
| V1 | The IGMPv1 querier will periodically send out a "query". Listeners can solicit a "report" of their interested group. However, IGMPv1 does not have a "leave group" message, and the querier might need to implement a timeout mechanism for each registered group. | RFC-1112 |
| V2 | Compatible with V1 and the following functions:<br>a. Group-specific query<br>b. Leave group messages<br>c. Resends specific queries to verify leave message was the last one in the group<br>d. Querier election if multiple capable queries are present. | RFC-2236 |
| V3 | Compatible with V1, V2, and the following functions:<br>Source filtering enables hosts to specify:<br>- the multicast traffic from a specified source<br>- the multicast traffic from any source except a specified source | RFC-3376 |

## IGMP Snooping Settings

First, select **IGMP Snooping** on the menu and then the **General** tab on the configuration page.

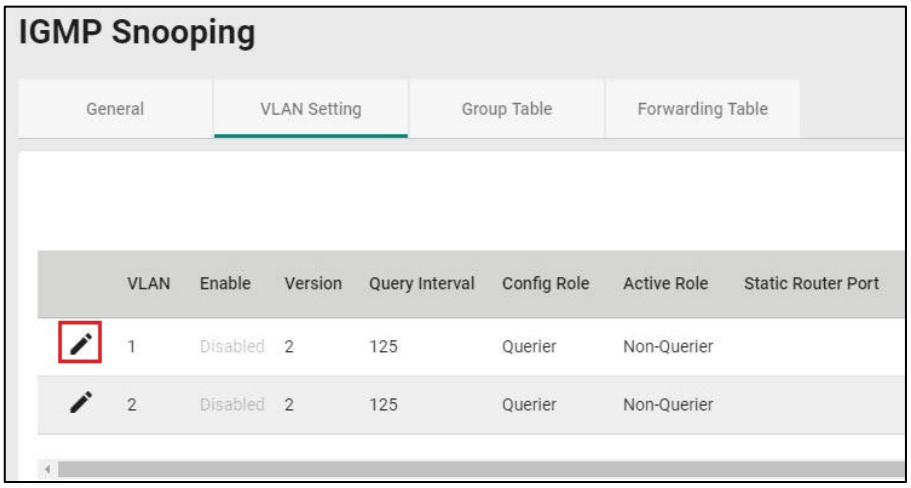


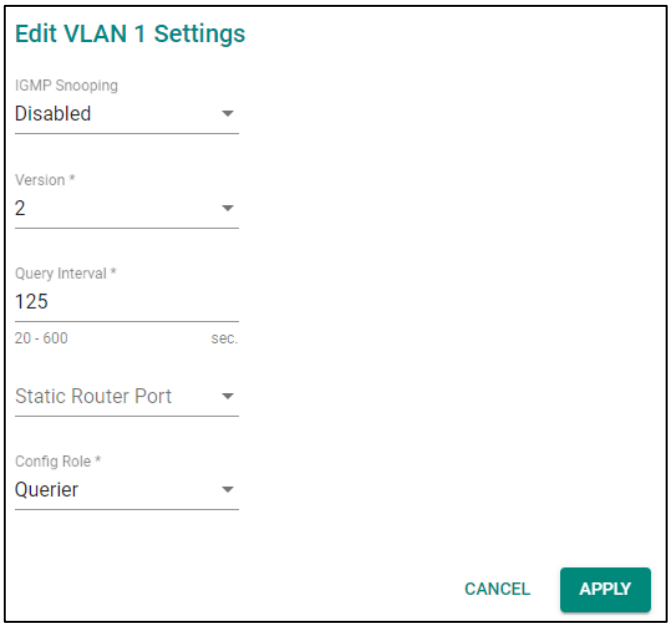

***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable IGMP Snooping on a specific VLAN. | Disabled |
| Disabled | Disable IGMP Snooping on a specific VLAN. | |

## Configuring VLAN Setting

Select the **VLAN Setting** tab, and then select the edit icon to configure the VLAN settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable IGMP Snooping on a switch. | Disabled |
| Disabled | Disable IGMP Snooping on a switch. | |

***Version***

| Setting | Description | Factory Default |
|---|---|---|
| 1, 2, 3 | Specify the IGMP version of the packets that the switch listens to and sends queries for. | 2 |

***Query Interval (sec)***

| Setting | Description | Factory Default |
|---|---|---|
| 20 to 600 | Specify the query interval for the Querier function globally (Querier must be enabled.) | 125 |

***Static Router Port***

| Setting | Description | Factory Default |
|---|---|---|
| Check the port from the drop-down list | The router port is the port that connects to the upper-level router (or IGMP querier), or to the upper-level router of downstream multicast streams. All of the received IGMP signaling packets or multicast streams will be forwarded to those static router ports. | None |

***Config Role***

| Setting | Description | Factory Default |
|---|---|---|
| Querier | The switch will act as the Querier role. | Querier |
| Non-querier | The switch will not act as the Querier role. | |

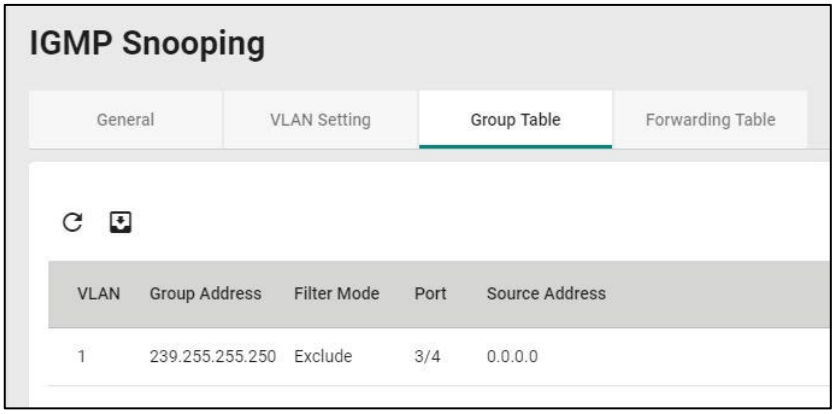
When finished, select **APPLY** to save your changes.

## NOTE

To ensure stable multicast stream transmission during topology changes with redundant protocols, it is recommended to configure a static router port.

### Viewing the Group Table

Select the **Group Table** tab, which allows you to view the current Group Table status.

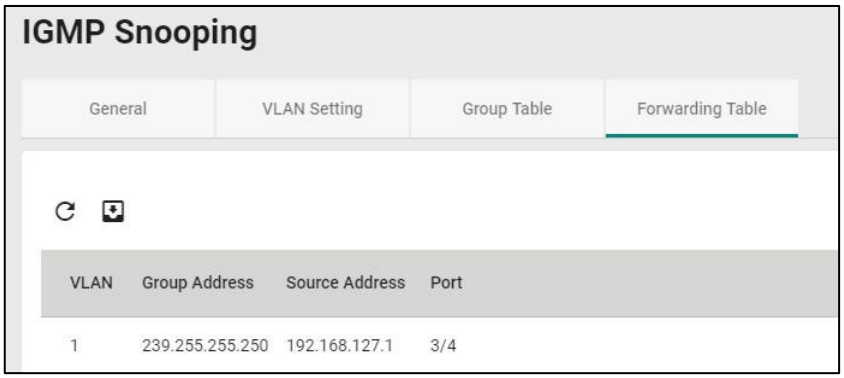



Refer to the following table for the detailed description for each item.

| Item | Description |
|---|---|
| VLAN | The VLAN ID. |
| Group Address | The registered multicast group. |
| Filter Mode | Only applicable to IGMPv3. (v1 and v2 will display "N/A")<br>Include: source-specific multicast address group<br>Exclude: source-specific exclusive multicast address group |
| Port | The forwarded port. |
| Source Address | Only applicable to IGMPv3. (v1 and v2 will display N/A) |

### Viewing the Forwarding Table

Select the **Forwarding Table** tab to view the current forwarding table.




Refer to the following table for a description of each item.

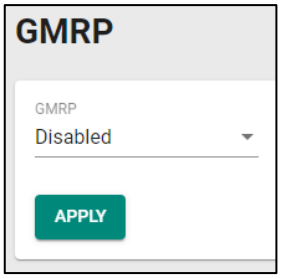
| Item | Description |
|---|---|
| VLAN | The VLAN ID. |
| Group Address | The associated multicast group address of the streaming data. |
| Source Address | The source address of the streaming data. |
| Port | The forwarded port. |

## GMRP

GMRP stands for GARP Multicast Registration Protocol, which is a Generic Attribute Registration Protocol (GARP) application that can be used to prevent multicast from data flooding. Both GMRP and GARP are defined by the IEEE 802.1P, and widely used as a standard protocol in various industrial-related applications. GMRP allows bridges and the devices at the edge of the network to perform a dynamic group membership information registration with the MAC bridges connected to the same LAN section. The information can be transmitted among all bridges in the Bridge LAN that is implemented with extended filtering features. To operate GMRP, the GARP service must be established first.

### Configuring GMRP Setting

To configure the GMRP settings, select **GMRP** on the menu.




Configure the following settings.

***Enable***

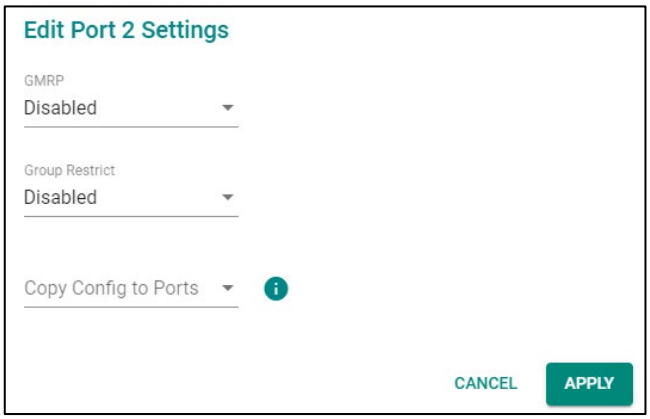
| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable GMRP. | Disabled |
| Disabled | Disable GMRP. | |

When finished, select **APPLY** to save your changes.

## Configuring GMRP Settings for Each Port

Next, select the edit icon on the port you want to configure.


Configure the following settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable GMRP for this port. | Disabled |
| Disabled | Disable GMRP for this port. | |

***Group Restrict***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Group Restrict on the port. This specific port will not process any GMRP control packets. | Disabled |
| Disabled | Disable Group Restrict on the port. The specific port will receive and process incoming GMRP control packets. | |

***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Allows you to copy the configurations to other port(s). | None |

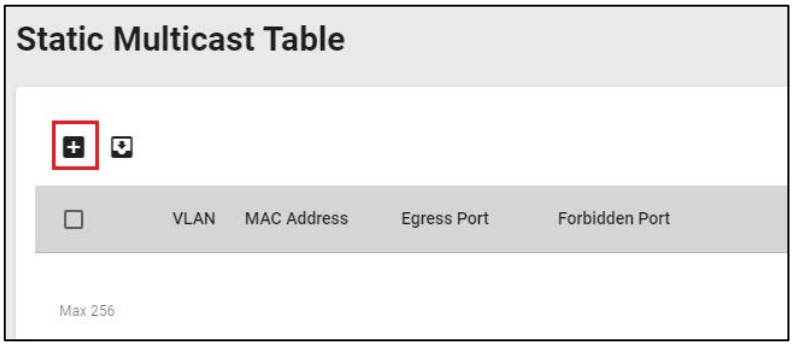
When finished, select **APPLY** to save your changes.

## Static Multicast

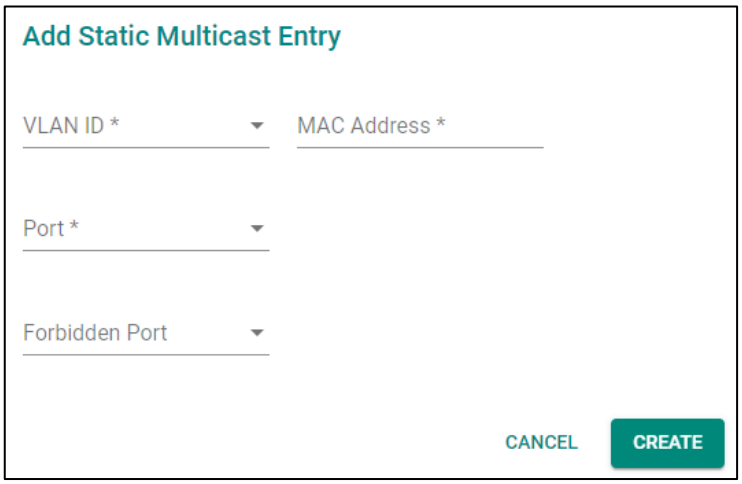
Select Static Multicast on the menu to view the current multicast table.

### Adding Static Multicast Entry

To add more tables, select the **+** icon.




Configure the following settings.




***VID (VLAN ID)***

| Setting | Description | Factory Default |
|---|---|---|
| Input the VID | Specify the multicast group's associated VLAN ID. | None |

***MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the MAC address | Specify the multicast MAC address. | None |

***Egress Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port from the drop-down list | Set the port(s) as an egress port(s) so that multicast streams can be forwarded to this port. | None |

***Forbidden Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port from the drop-down list | Set the port as forbidden so that packets cannot be forwarded to this port. | None |

When finished, select **CREATE**.

# Network Redundancy

Setting up the Redundancy Protocol on your network helps protect critical links against failure, protects against network loops, and keeps network downtime to a minimum.

The Redundancy Protocol allows you to set up redundant paths on the network to provide a backup data transmission route if a cable or one of the switches is inadvertently disconnected or damaged. This is a particularly important feature for industrial applications, since it can take several minutes to address the link down port or failed switch. For example, if a switch module is used as a key communications device for a production line, several minutes of downtime can cause a big loss in production and revenue. Switch modules support the following Redundancy Protocol functions:

- **Spanning Tree**
- **Turbo Ring V2**
- **Turbo Chain**
- **Dual Homing**

## Layer 2 Redundancy

First select **Network Redundanc**y on the menu and then select **Layer 2 Redundancy**.


### Spanning Tree

#### Spanning Tree Overview

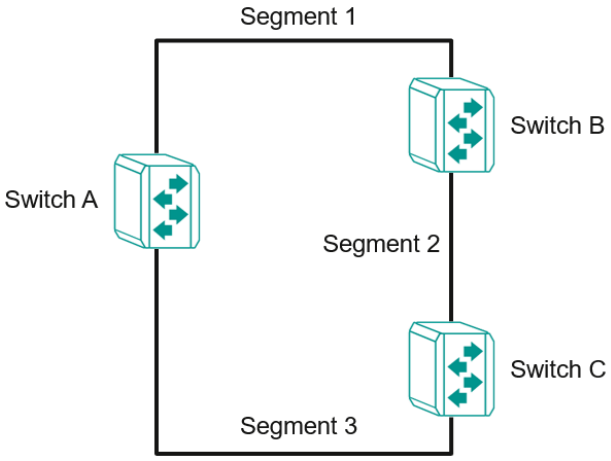
Spanning Tree Protocol (STP) helps construct a loop-free logical typology on an Ethernet network and provides an automatic means of avoiding any network loops. This is particularly important for networks that have a complicated architecture, since unintended loops in the network can cause broadcast storms. Switch modules' STP feature is disabled by default. To be completely effective, enable STP/RSTP on every switch module connected to your network.

STP (802.1D) is a bridge-based system that is used to implement parallel paths for network traffic. STP uses a loop-detection process to:

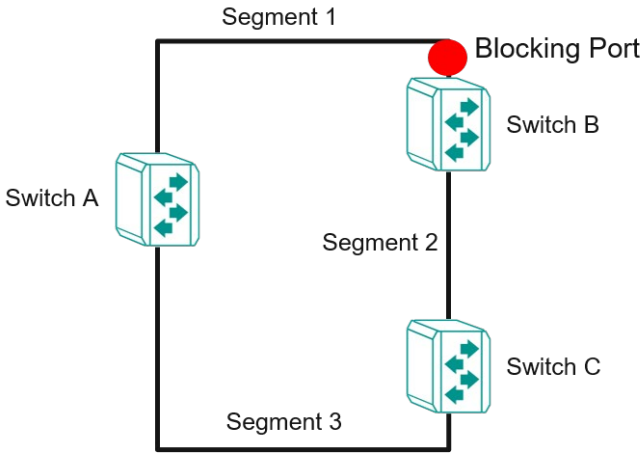
- Locate and then disable less efficient paths (e.g., paths that have lower bandwidth).
- Enable one of the less efficient paths if a more efficient path fails.

## How STP Works

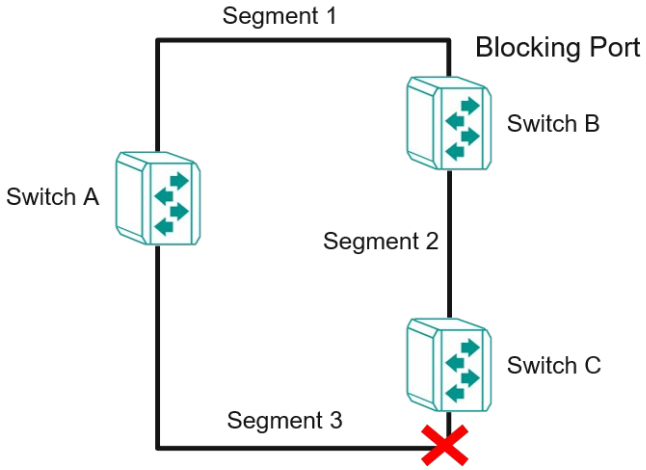
The figure below shows a network made up of three LANs separated by three bridges. Each segment uses at most two paths to communicate with the other segments. Since this configuration can give rise to loops, the network will overload if STP is not enabled.




If STP is enabled, it will detect duplicate paths or block one of the paths from forwarding traffic. In the following example, STP determined that traffic from segment 2 to segment 1 flows through switches C and A since this path is in a forwarding state and is processing BPDUs. However, switch B on segment 1 is in a blocking state.




What happens if a link failure is detected? As shown in the figure below, the STP will change the blocking state to a forwarding state so that traffic from segment 2 flows through switch B to segment 1 through a redundant path.



STP will determine which path between each segment is most efficient and then assign a specific reference point on the network. When the most efficient path has been identified, the other paths are blocked. In the previous three figures, STP first determined that the path through switch C was the most efficient, and as a result, blocked the path through switch B. After the failure of switch C, STP re-evaluated the situation and opened the path through switch B.

## Difference Between STP and RSTP

RSTP is like STP but includes additional information in the BPDUs that allows each bridge to confirm that it has taken action to prevent loops from forming when it decides to enable a link to a neighboring bridge. Adjacent bridges connected via point-to-point links will enable a link without waiting to ensure that all other bridges in the network have had time to react to the change. The main benefit of RSTP is that the configuration decision is made locally rather than network-wide, allowing RSTP to carry out automatic configuration and restore a link faster than STP.

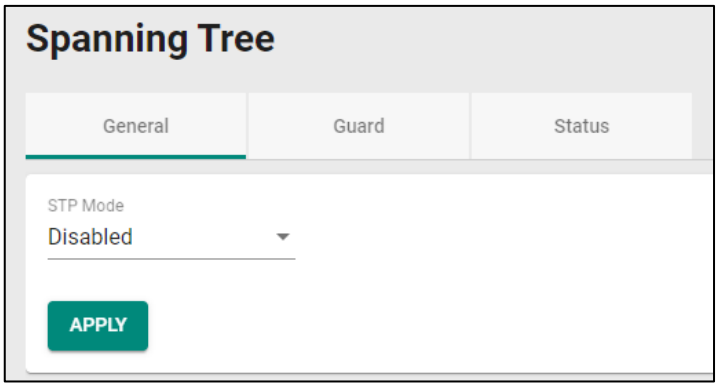
STP and RSTP spanning tree protocols operate without regard to a network's VLAN configuration and maintain one common spanning tree throughout a bridged network. Thus, these protocols map one loop-free, logical topology on a given physical topology.

## STP/RSTP Settings and Status

This section describes how to configure **Spanning Tree** settings.

## General

Select Spanning Tree on the menu and then the **General** tab.

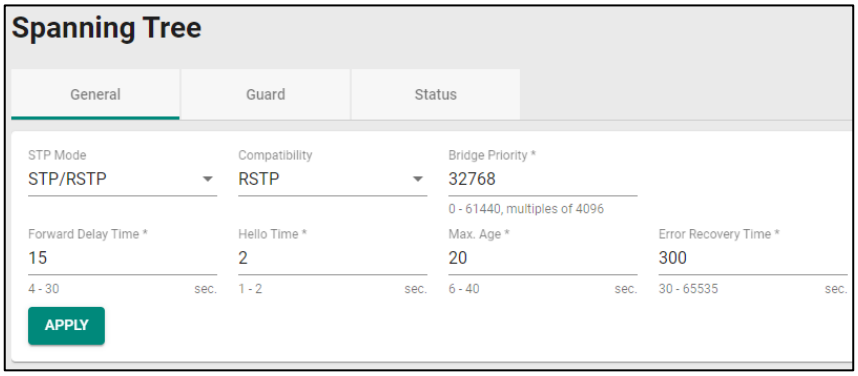



Configure the following settings.

***STP Mode***

| Setting | Description | Factory Default |
|---|---|---|
| Disabled | Disable Spanning Tree. | Disabled |
| STP/RSTP | Specify STP/RSTP as the STP mode. | |
| MSTP | Specify MSTP as the STP mode. | |

Select **APPLY** to save your changes. When **STP/RSTP** has been selected, configure the following settings.



***STP Mode***

| Setting | Description | Factory Default |
|---|---|---|
| STP/RSTP | Use the STP/RSTP mode as the Spanning Tree protocol. | STP/RSTP |

***Compatibility***

| Setting | Description | Factory Default |
|---|---|---|
| STP | To be compatible with STP mode only | RSTP |
| RSTP | To be compatible with RSTP and STP modes | |

***Bridge Priority***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 61440 | Increase this device's bridge priority by selecting a lower number. A device with a higher bridge priority has a greater chance of being established as the root of the Spanning Tree topology. | 32768 |

***Forwarding Delay Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 4 to 30 | The time the device waits before checking to see if it should change to a different state. | 15 |

***Hello Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 or 2 | The root of the Spanning Tree topology periodically sends out a "hello" message to other devices on the network to check if the topology is healthy. The "hello time" is the time the root waits between sending hello messages. | 2 |

***Max Age (sec.)***

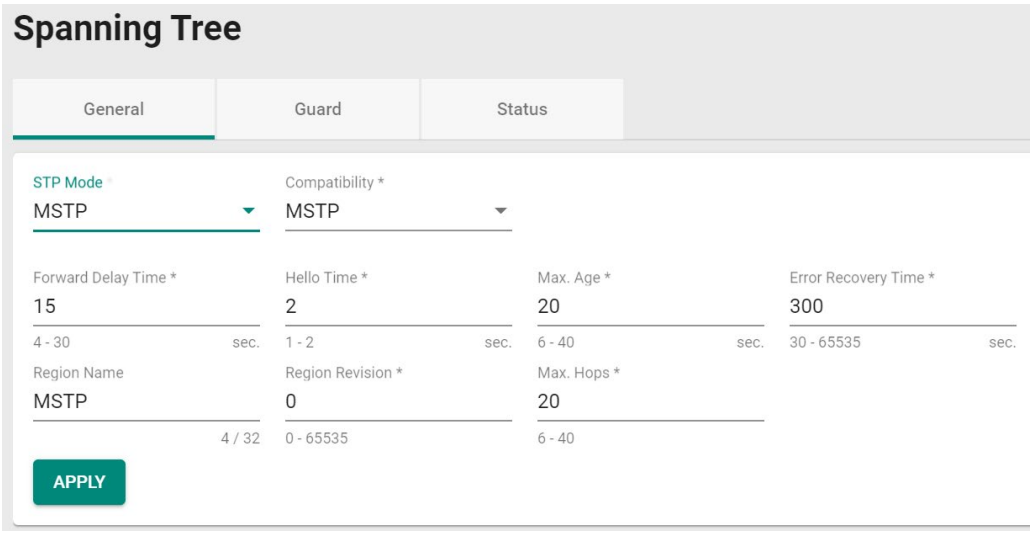
| Setting | Description | Factory Default |
|---|---|---|
| 6 to 40 | If this device is not the root, and it has not received a hello message from the root in the time equal to "Max. Age," then this device will reconfigure itself as a root. Once two or more devices on the network are recognized as a root, the devices will renegotiate a new Spanning Tree topology. | 20 |

***Error Recovery Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 30 to 65535 | If the BPDU guard is triggered on a port, it will automatically recover to the normal state after the Error Recovery Time. | 300 |

When finished, select **APPLY** to save your changes.

If you select **MSTP** as the STP mode, configure the following settings.



***STP Mode***

| Setting | Description | Factory Default |
|---|---|---|
| MSTP | Use the MSTP mode as the Spanning Tree protocol. | MSTP |

***Compatibility***

| Setting | Description | Factory Default |
|---|---|---|
| MSTP | Only compatible with MTP mode. | MSTP |
| STP | Only compatible with STP mode. | |
| RSTP | Compatible with RSTP and STP modes. | |

***Forwarding Delay Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 4 to 30 | The amount of time the device waits before checking to see if it should change to a different state. | 15 |

***Hello Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 or 2 | The root of the Spanning Tree topology periodically sends out a "hello" message to other devices on the network to check if the topology is healthy. The "hello time" is the amount of time the root waits between sending hello messages. | 2 |

***Max Age (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 6 to 40 | If this device is not the root, and it has not received a hello message from the root in the amount of time equal to "Max. Age," then this device will reconfigure itself as a root. Once two or more devices on the network are recognized as a root, the devices will renegotiate a new Spanning Tree topology. | 20 |

***Error Recovery Time (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 30 to 65535 | If the BPDU guard is triggered on a port, it will automatically recover to the normal state after the Error Recovery Time. | 300 |

***Region Name***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 32 characters | Provides the region's name. | MSTP |

***Region Revision***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 65535 (characters) | Provides the regional revision. | 0 |

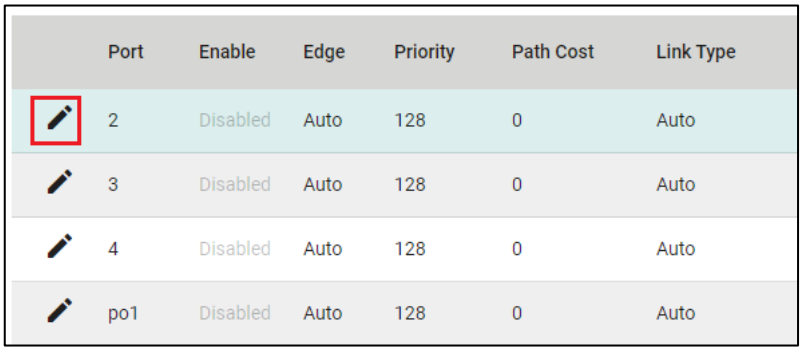
***Max. Hops***

| Setting | Description | Factory Default |
|---|---|---|
| 6 to 40 | Provides the maximum hops value. | 20 |

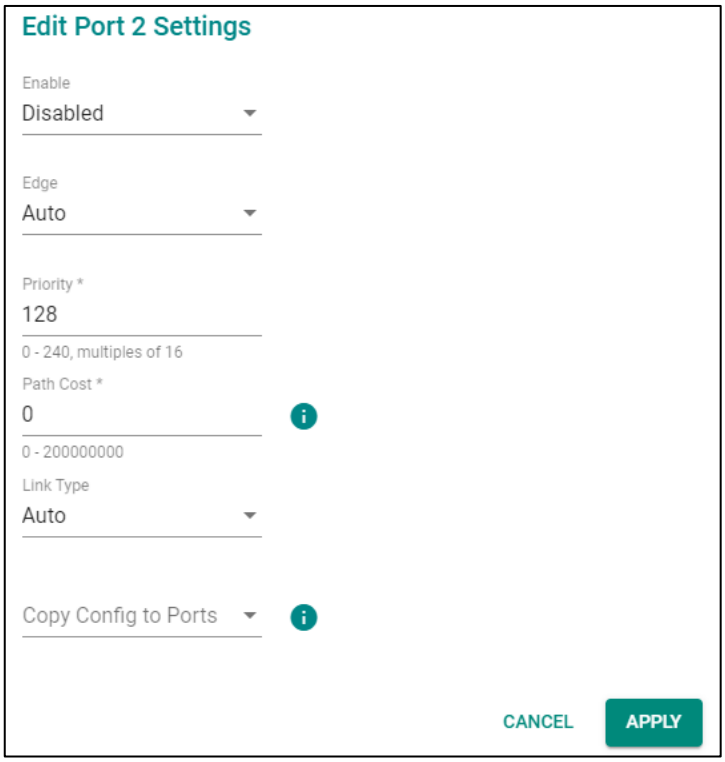
When finished, select **APPLY** to save your changes.

## Editing Spanning Tree for a Port

To edit the spanning tree settings for a specific port, select the edit icon on the port you want to configure.



Configure the following settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Spanning Tree. | Disabled |
| Disabled | Disables Spanning Tree. | |

***Edge***

| Setting | Description | Factory Default |
|---|---|---|
| Auto | Automatically detects to be the edge port. | Auto |
| Yes | Set as an edge port. | |
| No | Does not set as an edge port. | |

***Priority***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 255 (multiples of 16) | Increases the priority of a port by selecting a lower number. A port with a higher priority has a greater chance of being a root port. | 128 |

***Path Cost***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 20000000 | The path cost value will be automatically assigned according to the different port speed if the value is set to zero. | 0 |

***Link Type***

| Setting | Description | Factory Default |
|---|---|---|
| Force True | Set to Force True when port operating in full-duplex mode, such as a switch. | Auto |
| Force False | Set to Force False when port operating in half-duplex mode, such as a hub. | |
| Auto | Automatically select Force True or Force False mode. | |

***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Copy the configurations to other port(s). | None |

Select **APPLY** to finish.

## BPDU Overview

BDPUs (Bridge Protocol Data Units) are the network communication frames used in the STP (Spanning Tree Protocol). When two switches exchange messages, BDPUs are used to calculate the STP topology and determine the network communication route. A BDPU filter is often used to screen sending or receiving BPDUs on a specific port of the switch.

### BPDU Guard

BDPU Guard is a protection mechanism that prevents a port from receiving BPDUs. When an RSTP-enabled port receives BPDUs, it will automatically be in the error-disable state, which means the port will in turn switch to Block state. When STP is enabled, all ports are involved in the STP domain, sending and receiving BPDUs. However, when BPDU Guard is enabled, all ports will not receive or send any BPDUs, as all computers and unmanaged switches do not support STP. When BPDU Guard is enabled, all communications will be treated as error-disabled, and the related ports will be blocked, therefore no more data will be sent or received, protecting the network from a loop chain.

### Root Guard

**Root Guard** prevents a designated port role in changing to a root port role on reception of superior information.

### Loop Guard

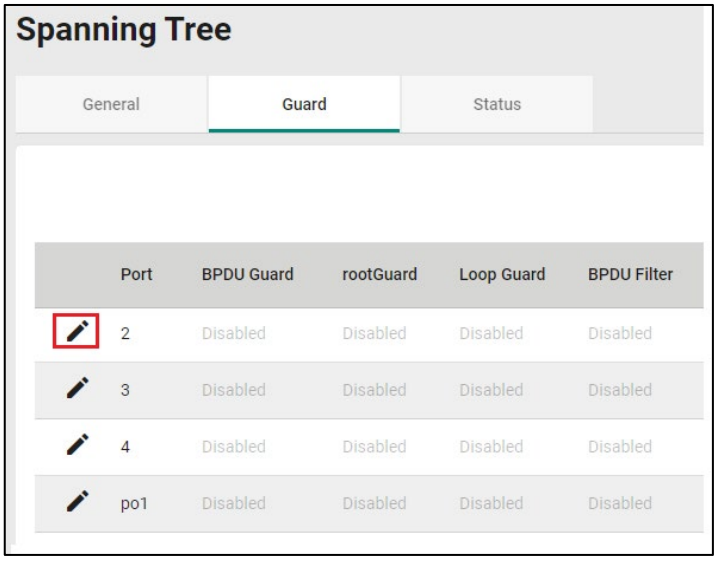
**Loop Guard** prevents temporary loops in a network caused by **non-designated ports** changing to the spanning-tree **forwarding** state because of a link failure in the topology.

### BPDU Filter

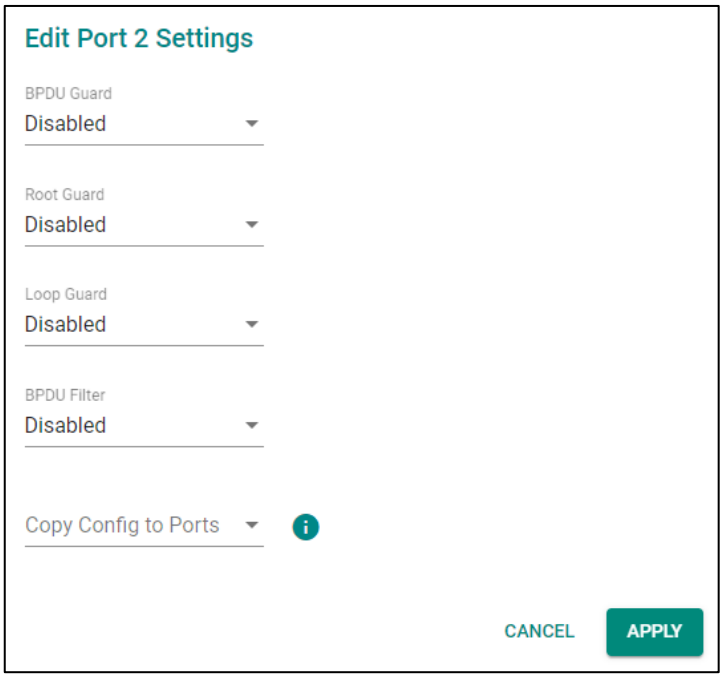
**BPDU Filter** prevents a port from sending and processing BPDUs. A BPDU filter enabled port cannot transmit any BPDUs and drop all received BPDUs.

### Configuring BPDU Filter, BPDU/Root/Loop Guard Settings

First select **Spanning Tree** on the menu and then the **Guard** tab. Next, select the edit icon on the port you want to configure.



Configure the following settings.




***BDPU Guard***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables BDPU Guard. | Disabled |
| Disabled | Disables BDPU Guard. | |

## NOTE

To establish a redundant port, e.g., it is highly recommended that you do not enable the BPDU filter.

***Root Guard***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Root Guard. | Disabled |
| Disabled | Disables Root Guard. | |

***Loop Guard***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Loop Guard. | Disabled |
| Disabled | Disables Loop Guard. | |

***BDPU Filter***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables BDPU Filter. | Disabled |
| Disabled | Disables BDPU Filter. | |

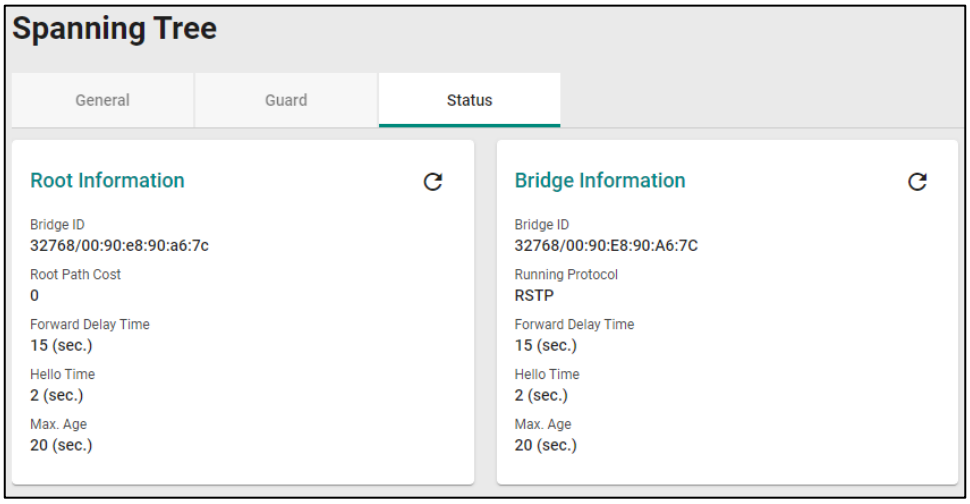
***Copy Config to Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Copies the same settings as other port(s). | None |

When finished, select **APPLY** to save your changes.

## Viewing Current Spanning Tree Status

Select the Status tab to view the current Spanning Tree status.




In addition, the status for each port will also be shown below.

| Port | Edge | Port Role | Port State | Root Path Cost | Path Cost | Link Type | BPDU Inconsistency | Root Inconsistency | Loop Inconsistency |
|---|---|---|---|---|---|---|---|---|---|
| 2 | No | Disabled | Discarding | 0 | 200000 | Shared-LAN | No | No | No |
| 3 | No | Disabled | Discarding | 0 | 200000 | Shared-LAN | No | No | No |
| 4 | No | Disabled | Discarding | 0 | 200000 | Shared-LAN | No | No | No |
| po1 | No | Disabled | Forwarding | 0 | 199900 | Point-to-Point | No | No | No |

Refer to the following table for a detailed description of each item.

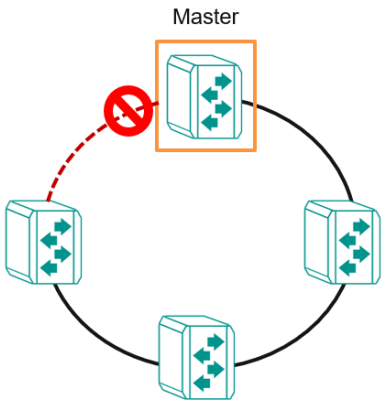
| Item | Description |
|---|---|
| Port | The port number on this device. |
| Edge | Shows if this port is connected to an edge device. |
| Port Rule | Root: The port is connected directly or indirectly to the root device.<br>Designated: The port is designated if it can send the best BPDU on the segment to which it is connected.<br>Alternate: The alternate port receives more useful BPDU from another bridge and is a blocked port.<br>Backup: The backup port receives more useful BPDU from the same bridge and is the blocked port.<br>Disabled: The function is disabled. |
| Port State | Forwarding: The traffic can be forwarded through this port.<br>Blocked: The traffic will be blocked.<br>Disabled: The function is disabled. |
| Root Path Cost | The total path cost to the root bridge. |
| Path Cost | The path cost on this link. |
| Link Type | Edge Port: The port is connected to an edge device.<br>Point-to-Point Non-edge Port: The port is connected to another bridge and is full duplex.<br>Shared Non-edge Port: The port is connected to another bridge and is half duplex. |
| BPDU Inconsistency | BPDU is received in a port enabled by a BPDU guard. |
| Root Inconsistency | A port is changed to a root port when enabled by a loop guard. |
| Loop Inconsistency | A loop is detected on this port by a loop guard. |

# Turbo Ring v2

## Turbo Ring v2 Overview

Moxa Turbo Ring is a proprietary self-healing technology that enables fast fault recovery of under 20 ms for Fast Ethernet, and 50 ms for Gigabit Ethernet. Turbo Ring supports two topology expansions—ring coupling and dual-ring—to reduce redundant network cabling and network planning costs and to ensure high reliability of your industrial network applications.

The Turbo Ring v2 protocols identify one switch as the client of the network, and then automatically block one port beside the client on the ring (red line) to avoid network's redundant loops. If one branch of the ring gets disconnected from the rest of the network, the protocol automatically readjusts the ring so that the part of the network that was disconnected can reestablish contact with the rest of the network.

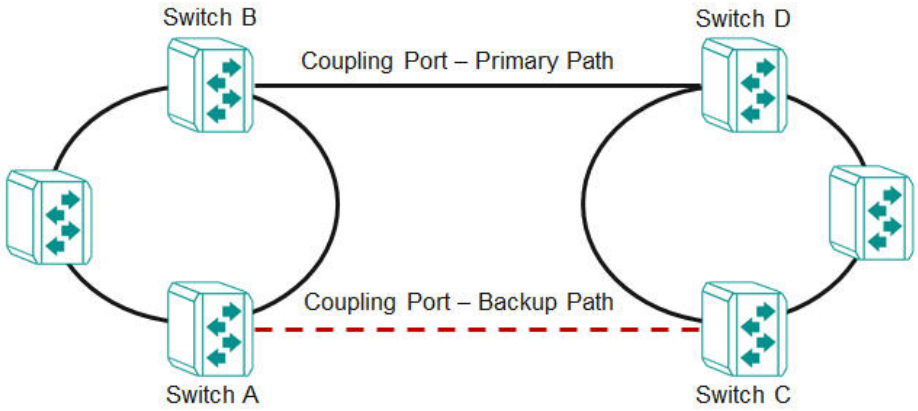



## How Turbo Ring v2 Works

Turbo Ring v2 is an advanced technology for network redundancy, which ensures recovery times of less than 20 ms for Fast Ethernet, and 50 ms for Gigabit Ethernet when the network is down. In addition, it allows more switches within the network rings. You can select different network typologies for Turbo Ring redundancy to allow more network reliability and reduce cabling costs. Below are three examples of how Turbo Ring v2 works.

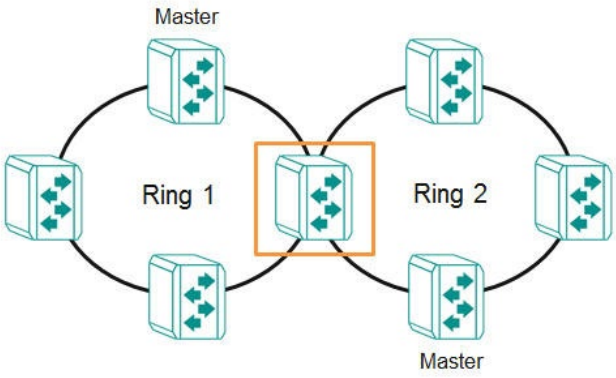
## Ring Coupling

Ring Coupling helps you separate distributed devices into different smaller redundant rings, but in such a way that the smaller rings at different remote sites will be able to communicate with each other. This is useful for applications where some devices are at remote sites.



## Dual-Ring

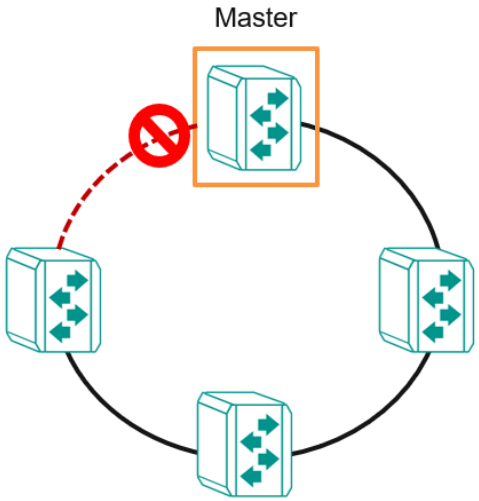
Dual-ring adds reliability by using a single switch module to connect two separate rings for applications that present cabling difficulties. It provides another ring coupling configuration where two adjacent rings can share one switch. This typology is an ideal solution for applications that have inherent cabling difficulties.



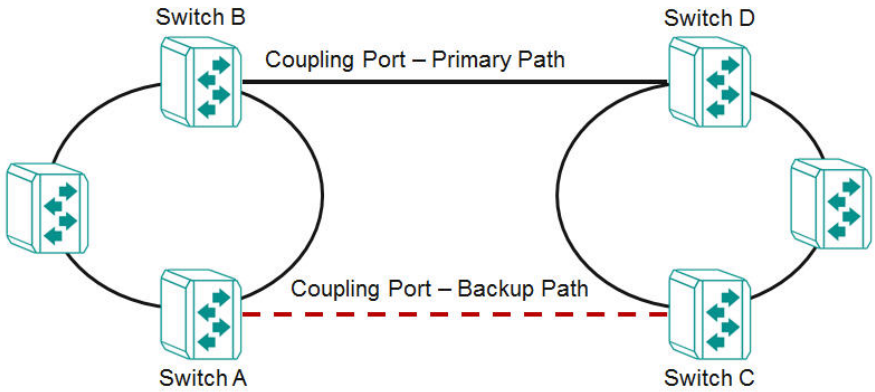

## How to Determine the Redundant Path

For Turbo Ring v2, the client is determined by two methods: one is a system MAC address election, the smallest MAC address will play the client role; the other is user manual configuration to enable the client role on the switch.

The redundant path is determined by "Ring Port 2", which means the port set on "Ring Port 2" will become the blocking port.




## Ring Coupling for a "Turbo Ring V2" Ring



For Turbo Ring V2, Ring Coupling is enabled by configuring the **Coupling Port (Primary)** on Switch B, and the **Coupling Port (Backup)** on Switch A only.

The **Coupling Port (Backup)** on Switch A is used for the backup path, and connects directly to an extra network port on Switch C. The **Coupling Port (Primary)** on Switch B monitors the status of the main path, and connects directly to an extra network port on Switch D. With ring coupling established, Switch A can activate the backup path as soon as it detects a problem with the main path.

## ATTENTION

Ring Coupling needs to be enabled on one coupling primary switch and one coupling backup switch as the Ring Coupler. The Coupler must designate different ports, such as the two Turbo Ring ports and the coupling port.

## NOTE

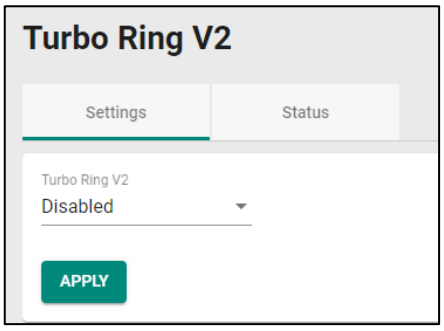
1. You do not need to use the same switch for both Ring Coupling and Ring Master.
2. To achieve optimal redundancy performance, it is recommended to use 1G fiber for Turbo Ring.

### Turbo Ring V2 Settings and Status

## NOTE

If you connect the EDR-G9010 Series in your topology, ensure it is not set as the client.

Select **Turbo Ring V2** on the menu, and then select the **Setting** tab.




Configure the following setting.

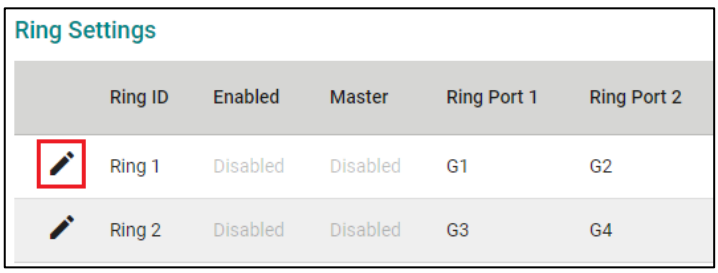
***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Turbo Ring V2. | Disabled |
| Disabled | Disable Turbo Ring V2. | |

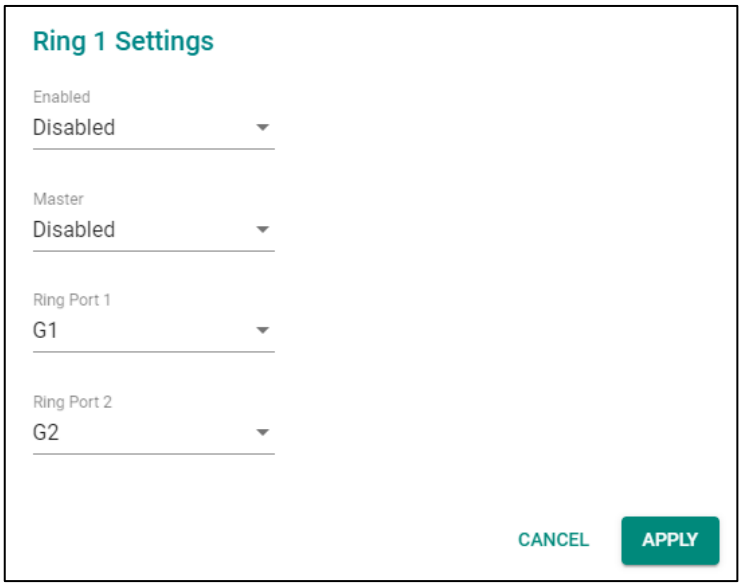
When finished, select **APPLY** to save your changes.

### Ring Settings

In **Ring Setting**, select the edit icon.



Configure the following settings. When finished, select **Apply** to save your changes.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Ring Setting. | Disabled |
| Disabled | Disables Ring Setting. | |

***Master***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables this Ring as the client. | Disabled |
| Disabled | Disables this Ring as the client. | |

***Ring Port 1***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Specifies this port as the first redundant port. | 1/1 |

***Ring Port 2***

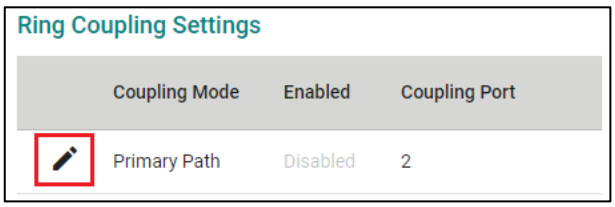
| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Specifies this port as the second redundant port. | 1/2 |

## Ring Coupling Overview

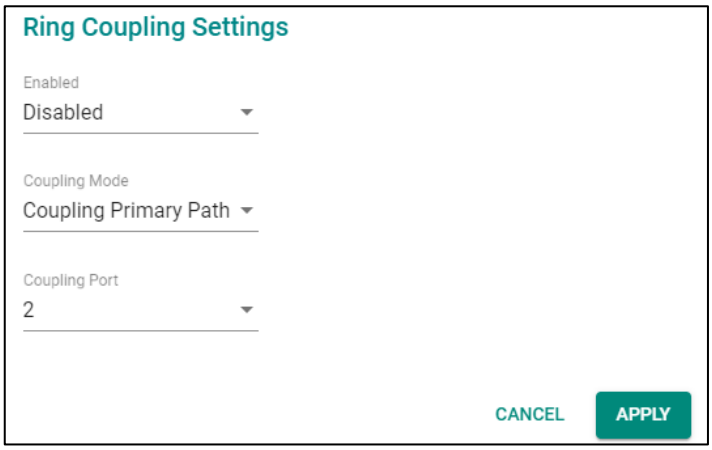
Ring Coupling helps you separate distributed devices into different smaller redundant rings, but in such a way that the smaller rings at different remote sites will be able to communicate with each other. This is useful for applications where some devices are at remote sites.

### Ring Coupling Settings and Status

In the **Ring Coupling Setting**, select the edit icon.



Configure the following settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Ring Coupling. | Disabled |
| Disabled | Disables Ring Coupling. | |

***Coupling Mode***

| Setting | Description | Factory Default |
|---|---|---|
| Coupling Backup Path | Selects Coupling Mode to assign the coupling port as the backup path. | Coupling Primary Path |
| Coupling Primary Path | Selects Coupling Mode to assign the coupling port as the primary path. | |

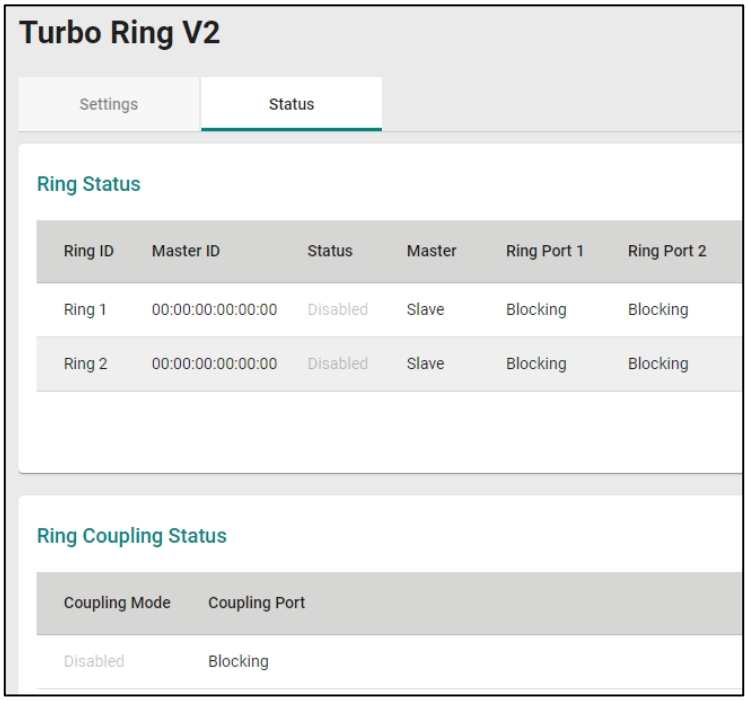
***Coupling Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Selects the port as the coupling port. | 2/1 |

When finished, select **APPLY** to save your changes.

## Ring Settings and Ring Coupling Setting Status

Select **Status** in the Turbo Ring V2 menu to view the current Ring settings and the Ring Coupling Status.



Refer to the following table for a detailed description of each item of the Ring status.

| Item | Description |
|---|---|
| Ring ID | The ID number of the Ring. |
| Master ID | The MAC address of the Ring client. |
| Status | Healthy: The Ring and the ports are working properly.<br>Break: One or more rings has been broken. |
| Master | The device is a client/server on this ring. |
| Ring Port 1 | The port of the first ring port. |
| Ring Port 2 | The port of the second ring port. |

Refer to the following table for a detailed description of the status of Coupling Mode and Coupling Port.

| Item | Description |
|---|---|
| Coupling Mode | Primary: The main path of Ring Coupling.<br>Backup: The backup path of Ring Coupling. |
| Coupling Port | The port of the Ring Coupling. |

# Turbo Chain

## Turbo Chain Overview

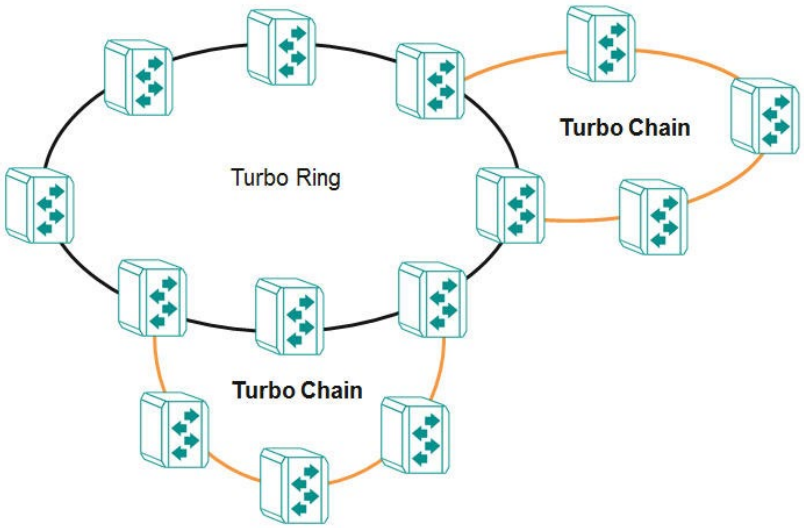
Moxa's Turbo Chain is an advanced software technology that gives network administrators the flexibility of constructing any type of redundant network topology. In addition, it offers system recovery time under 20 ms for Fast Ethernet, and 50 ms for Gigabit Ethernet for member port link environments. When using the "chain" concept, you first connect the Ethernet switches in a chain and then simply link the two ends of the chain to an Ethernet network.

Turbo Chain can be used on industrial networks that have a complex topology. If the industrial network uses multi-ring architecture, Turbo Chain can be used to create flexible and scalable topologies with a fast media-recovery time.

## How Turbo Chain Works

Moxa's Turbo Chain outperforms traditional ring topologies by providing great flexibility, unrestricted expansion, and cost-effective configurations when connecting separate redundant rings together—in a simplified manner. With Turbo Chain, you can create any complex redundant network that corresponds to your needs, while still ensuring great reliability and availability for your industrial Ethernet network applications.

With Moxa's Turbo Chain, network engineers have the flexibility to construct any type of redundant topology with minimum effort by simply linking Turbo Chain to the Ethernet Network. Turbo Chain allows for unrestricted network expansion. Network engineers no longer need to go through the hassle of reconfiguring the existing network and can simply use Turbo Chain to scale up their redundant networks.

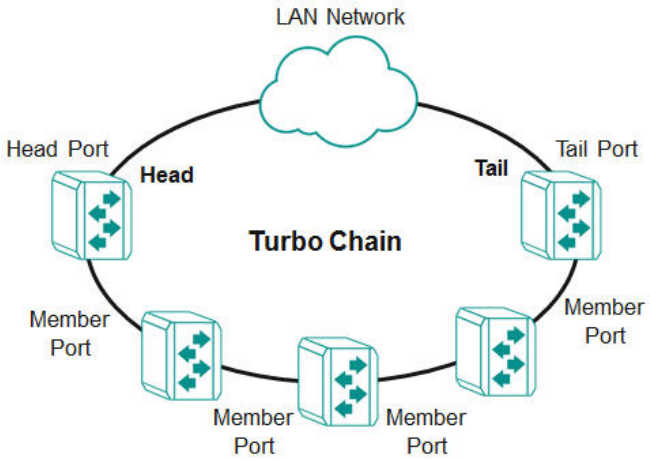


## How to Determine the Redundant Path

Here is an example of how to set up Turbo Chain and determine the redundant path.

1. Select the head switch, tail switch, and member switches.
2. Configure one port as the head port and one port as the member port in the head switch, configure one port as the tail port and one port as the member port in the tail switch, and configure two ports as Member ports in each of the member switches.
3. Connect the head switch, tail switch, and member switches, as shown in the diagram below.

The path connecting to the head port is the main path, and the path connecting to the tail port is the backup path of Turbo Chain. Under normal conditions, packets are transmitted through the head port to the LAN network. If any Turbo Chain path is disconnected, the Tail Port will be activated so that packet transmission can continue.

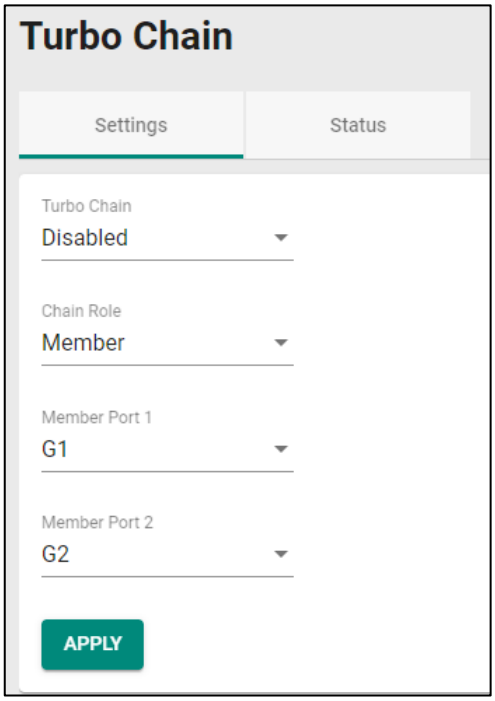



There are two points to note:

1. Two chain ports must have the same PVID.
2. Chain ports must join the untagged members of PVID VLAN before being assigned to be a chain port.

## Turbo Chain V2 Settings and Status

First select **Turbo Chain** on the menu and then **Setting**.



Configure the following settings.

***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Turbo Chain. | Disabled |
| Disabled | Disables Turbo Chain. | |

***Chain Role***

| Setting | Description | Factory Default |
|---|---|---|
| Head | Enables chain role as the head. | Member |
| Member | Enables chain role as a member. | |
| Tail | Enables chain role as the tail. | |

***Head/Member/Tail Port***

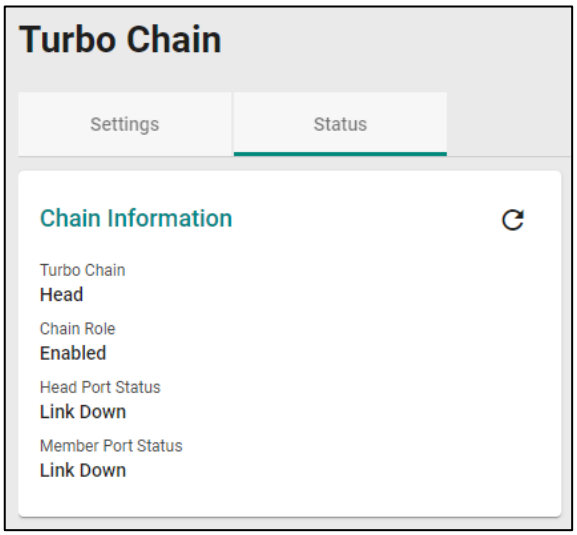
| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Specifies the port as the head/member/tail port. | 1/1 |

***Member Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Specifies the port as the member port. | 1/2 |

When finished, select **APPLY** to save your changes.

Select **Turbo Chain** on the menu and then **Status** to view the current Turbo Chain status.




Refer to the following table for a detailed description of each item.

| Item | Description |
|---|---|
| Turbo Chain | Head: The device is the head of this chain.<br>Member: The device is a member of this chain.<br>Tail: The device is the tail of this chain. |
| Chain Role | Healthy: The Chain and the ports are working properly.<br>Break: The chain or the ports are broken. |
| Head/Member/Tail 1 Port Status | The status of the first Head/Member/Tail port. |
| Head/Member/Tail 2 Port Status | The status of the second Head/Member/Tail port. |

# Dual Homing

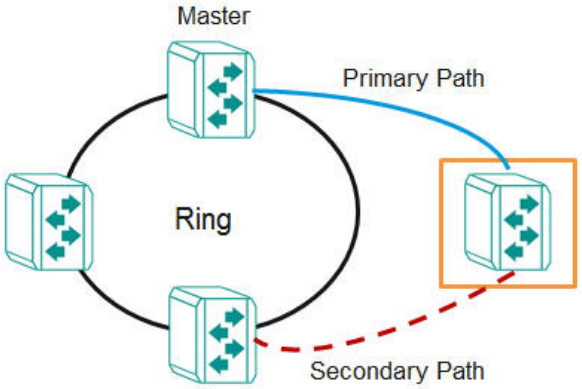
## Dual Homing Overview

Dual Homing is a layer 2 function, which uses a single Ethernet switch to connect two network topologies, both of which can run any redundancy protocols. It involves coupling two separate devices or even coupling to two separate rings with a single switch connecting to two independent connection points. The secondary path will be activated if the primary path fails.

## How Dual Homing Works

Dual Homing is a redundant path technology that allows a single switch to connect to any topology.

The primary and secondary paths require manual configuration: Select a primary port as the primary path and the secondary port as the secondary path. The default path switching mode is "primary path always first", which means when failover occurs, the primary path will switch to the secondary path, but if the primary path recovers, the path will switch back to the primary path again even if the secondary path is healthy.




## Path Switching Mode

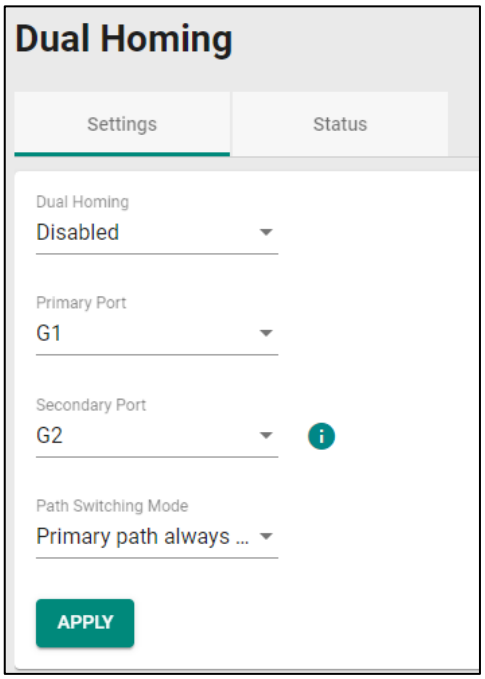
There are two path switch modes that you can configure:

**Primary path always first:** Always select the path switching mode as the primary path first. When path switching occurs, the primary path will always be the first path for data communication.

**Maintain current path:** Select the path switching mode to maintain the current path. When path switching occurs, maintain the current path to keep the network stable and do not change paths for data communication.

## Dual Homing Settings and Status

Select **Dual Homing** in the menu and then **Setting**.



Configure the following settings.

***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Dual Homing. | Disabled |
| Disabled | Disables Dual Homing. | |

***Primary Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Specifies the port as the primary port. | 1/1 |

***Secondary Port***

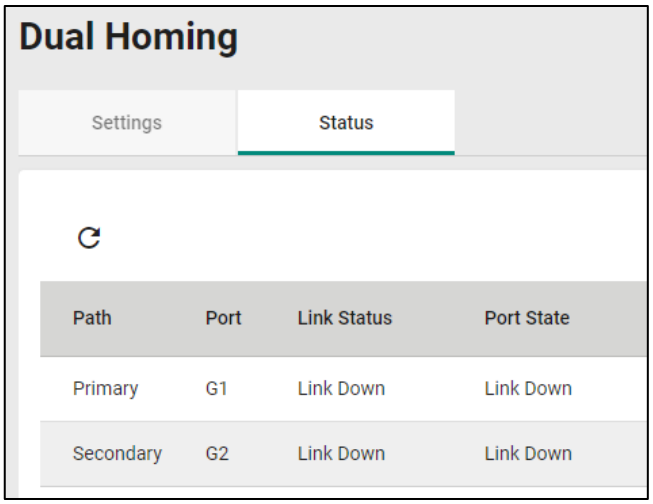
| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Specifies the port as the secondary port. | 1/1 |

***Path Switching Mode***

| Setting | Description | Factory Default |
|---|---|---|
| Primary path always first | Always select path switching mode as the primary path first. | Primary path always first |
| Maintain current path | Always select the path switching mode to maintain the current path. | |

When finished, select **APPLY** to save your changes.

First, select **Dual Homing** in the menu and then **Status** to view the current Dual Homing Settings.




Refer to the following table for a detailed description of each item.

| Item | Description |
|---|---|
| Path | Primary: The primary path of dual homing.<br>Secondary: The secondary path of dual homing. |
| Port | The port that is used as the primary/secondary path. |
| Link Status | Link Up: The port is connected.<br>Link Down: The port is disconnected. |
| Port State | Forwarding: The port is forwarding traffic.<br>Blocking: The port is blocking traffic. |

# Management

This section describes how to configure **Network Management** including SNMP and **SNMP Trap/Inform**.


## Network Management

This section demonstrates how to configure **SNMP** and **SNMP Trap/Inform** settings.

### SNMP

The ioPAC 6500 Layer 2 Managed Ethernet Switch Module support SNMP V1, V2c, and V3. SNMP V1 and SNMP V2c use a community string match for authentication, so SNMP servers access all objects with read-only or read/write permission using the community strings public and private by default. SNMP V3 requires that you select an authentication level of MD5 or SHA. You can also enable data encryption to enhance data security.

Supported SNMP security modes and levels are shown in the table below. Select the security mode and level that will communicate between the SNMP agent and manager.

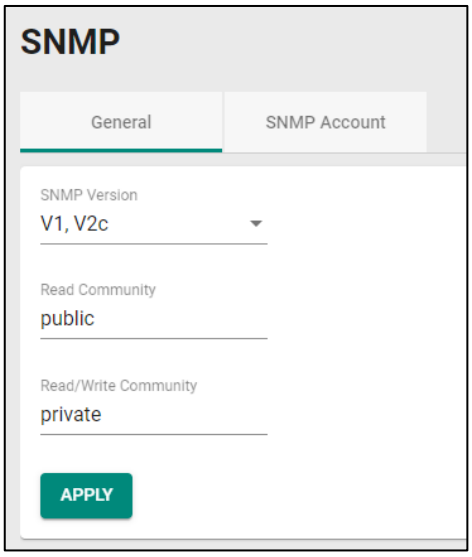
| Protocol Version | UI Setting | Authentication | Encryption | Method |
|---|---|---|---|---|
| SNMP V1, V2c | V1, V2c Read Community | Community string | No | Uses a community string match for authentication. |
| | V1, V2c Write/Read Community | Community string | No | Uses a community string match for authentication. |
| SNMP V3 | None | No | No | Uses an account with admin or user to access objects. |
| | MD5 or SHA | Authentication based on MD5 or SHA | Disabled | Uses authentication based on HMAC-MD5, or HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication. |
| | MD5 or SHA | Authentication based on MD5 or SHA | Data encryption key: DES, AES | Uses authentication based on HMAC-MD5 or HMAC-SHA algorithms, and data encryption key. 8-character passwords and a data encryption key are the minimum requirements for authentication .and encryption. |

**NOTE**

SNMPv3 enhances security, as it includes authentication and data privacy. If you require a higher level of security, it is recommended to install additional security mechanisms, such as a firewall, to protect critical infrastructure.

## General Settings

First select **SNMP** on the menu and then **General**.




Configure the following settings.

***SNMP Version***

| Setting | Description | Factory Default |
|---|---|---|
| V1, V2c, V3 | Specify V1, V2c, and V3 as the SNMP version. | V1, V2c |
| V1, V2c | Specify V1 and V2c as the SNMP version. | |
| V3 only | Specify V3 as the SNMP version. | |

***Read Community***

| Setting | Description | Factory Default |
|---|---|---|
| Max. 30 characters | Specifies the community string to authenticate the SNMP agent for read-only access. The SNMP agent will access all objects with read-only permissions using this community string. | Public |

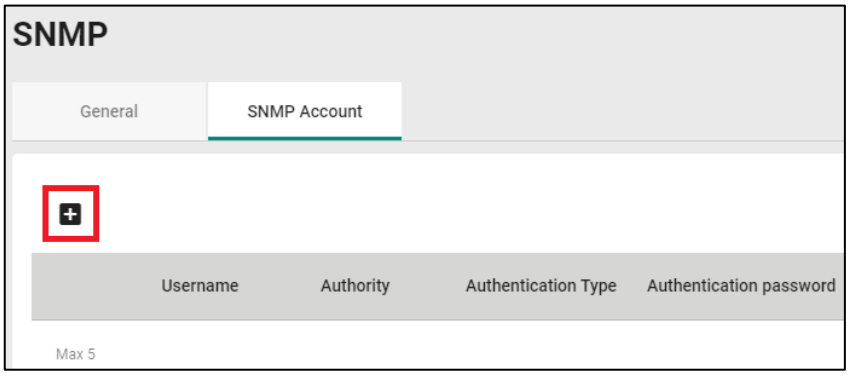
***Read/Write Community***

| Setting | Description | Factory Default |
|---|---|---|
| Max. 30 characters | Specifies the community string to authenticate the SNMP agent for read/write access. The SNMP server will access all objects with read/write permissions using this community string. | Private |

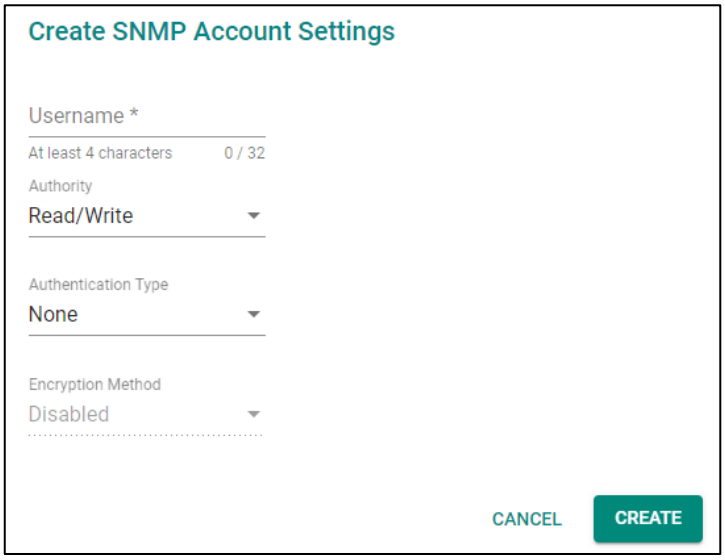
When finished, select **Apply** to save your changes.

## Creating an SNMP Account

Select **SNMP** on the menu and then **SNMP Account**. Next, select the **+** icon on the page.



Configure the following settings.




***Username***

| Setting | Description | Factory Default |
|---|---|---|
| At least 4 characters, (max. 32 characters) | Input a username. | None |

***Authority***

| Setting | Description | Factory Default |
|---|---|---|
| Read Write | The user has read/write access. | None |
| Read Only | The user only has read access. | |

***Authentication type***

| Setting | Description | Factory Default |
|---|---|---|
| None | No authentication will be used. | None |
| MD5 | MD5 is the authentication type. | |
| SHA | SHA is the authentication type. | |

***Authentication password***

| Setting | Description | Factory Default |
|---|---|---|
| 8 to 64 characters | Input the authentication password. | None |

***Encryption Method***

| Setting | Description | Factory Default |
|---|---|---|
| Disabled | Disables the encryption method. | None |
| DES | DES is the encryption method. | |
| AES | AES is the encryption method. | |

***Encryption Key***

| Setting | Description | Factory Default |
|---|---|---|
| 8 to 30 characters | Enables data encryption. | None |

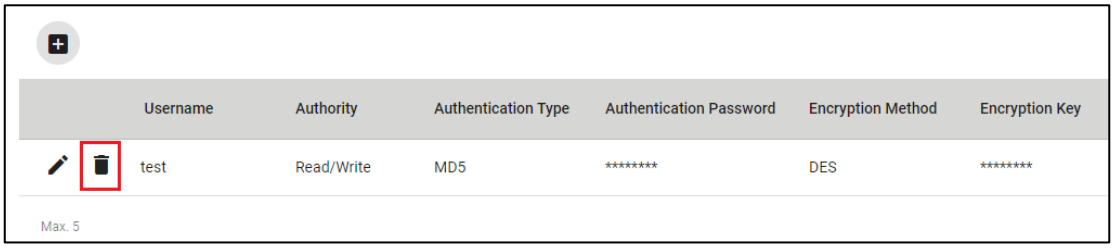
When finished, select **CREATE**.

## NOTE

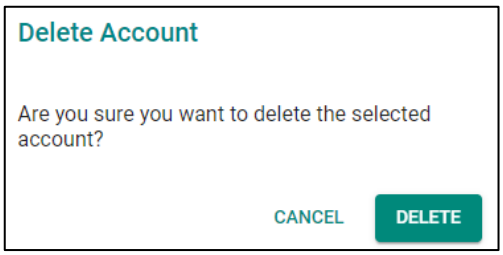
SNMPv3 enhances security management by using authentication and ensuring data privacy. If you intend to pursue a higher level of security, it is recommended to install additional security mechanisms, such as a firewall, to protect critical infrastructure.

### Deleting an Existing SNMP Account

To delete an existing SNMP account, select the delete icon on the account.



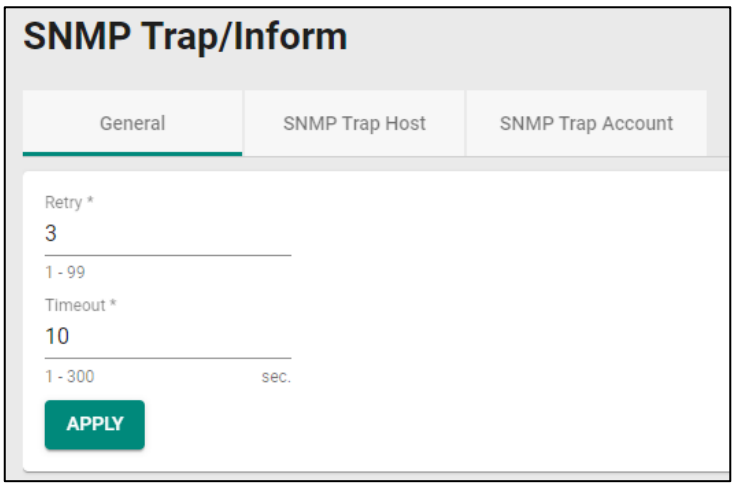

Select **DELETE** to delete the SNMP account.




## SNMP Trap/Inform

### General Settings

First select **SNMP Trap/Inform** on the menu and then **General**.




Configure the following settings.

***Retry***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 99 | Input the retry value. | 3 |

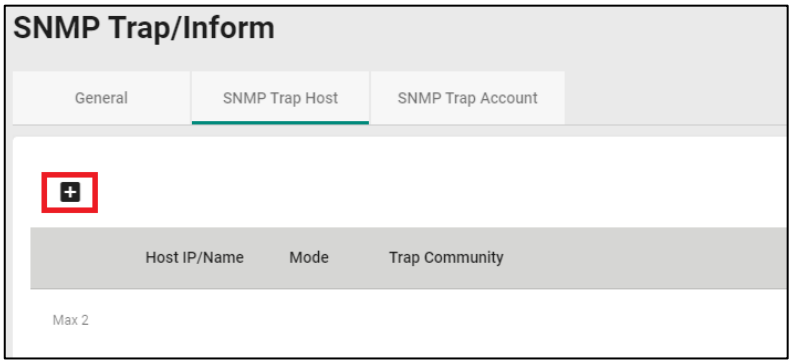
***Timeout***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 300 | Input the timeout value. | 10 |

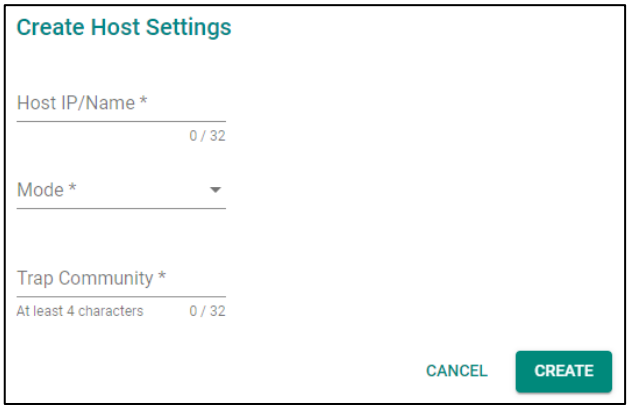
When finished, select **APPLY** to save your changes.

## SNMP Trap Host Settings

SNMP Trap allows an SNMP agent to notify the NMS of a significant event. The switch supports two SNMP modes: **Trap** mode and **Inform** mode. Select **SNMP Trap/Inform** on the menu and then **SNMP Trap Host**. Then select the **+** icon on the page.




Configure the following settings.




***Host IP/Name***

| Setting | Description | Factory Default |
|---|---|---|
| Input a host IP or name, (max. 32 characters) | Specify the name of the primary trap server used by your network. | None |

***Mode***

| Setting | Description | Factory Default |
|---|---|---|
| Trap V1 | Set the trap version to Trap V1. | None |
| Trap V2c | Set the trap version to Trap v2c. | |
| Inform V2c | Set the inform version to Inform V2c. | |
| Trap V3 | Set the trap version to Trap V3. | |
| Inform V3 | Set the inform version to Inform V3. | |

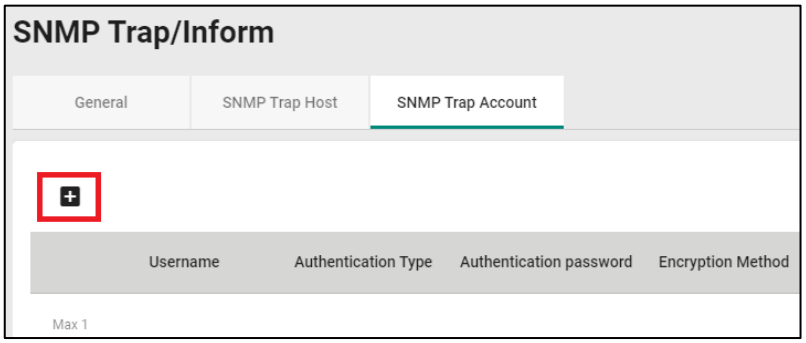
***Trap Community***

| Setting | Description | Factory Default |
|---|---|---|
| At least 4 characters, (max. 30 characters) | Specify the community string that will be used for authentication. | None |

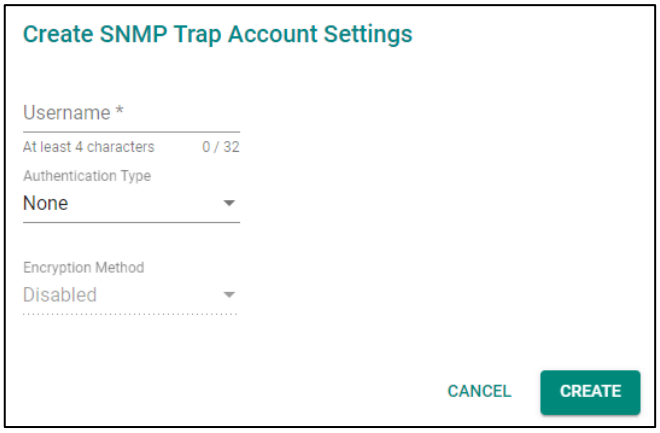
When finished, select **CREATE**.

## SNMP Trap Account Settings

Select **SNMP Trap/Inform** on the menu and then **SNMP Trap Account**. Next, select the + icon on the page.




Configure the following settings:




***Username***

| Setting | Description | Factory Default |
|---|---|---|
| At least 4 characters, (max. 30 characters) | Input a username. | None |

***Authentication type***

| Setting | Description | Factory Default |
|---|---|---|
| None | No authentication type will be used. | None |
| MD5 | MD5 is the authentication type. | |
| SHA | SHA is the authentication type. | |

***Authentication Password***

| Setting | Description | Factory Default |
|---|---|---|
| 8 to 64 characters | Input the authentication password. | None |

***Encryption Method***

| Setting | Description | Factory Default |
|---|---|---|
| Disabled | Disable the encryption method. | None |
| DES | DES is the encryption method. | |
| AES | AES is the encryption method. | |

***Encryption Key***

| Setting | Description | Factory Default |
|---|---|---|
| 8 to 64 characters | Enable data encryption. | None |

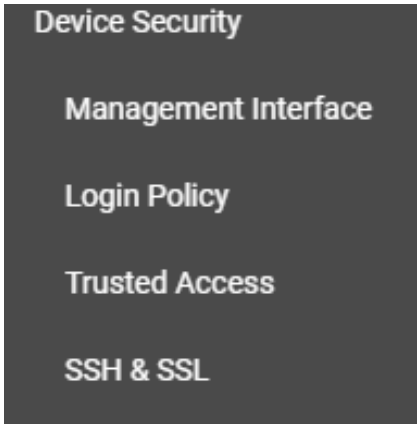
When finished, select **CREATE**.

# Security

This section describes how to configure **Device Security, Network Security,** and **Authentication**.

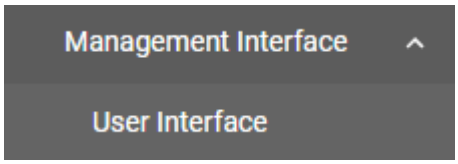

## Device Security

This section includes information about the **Management Interface, Login Policy, Trusted Access,** and **SSH and SSL** configurations.

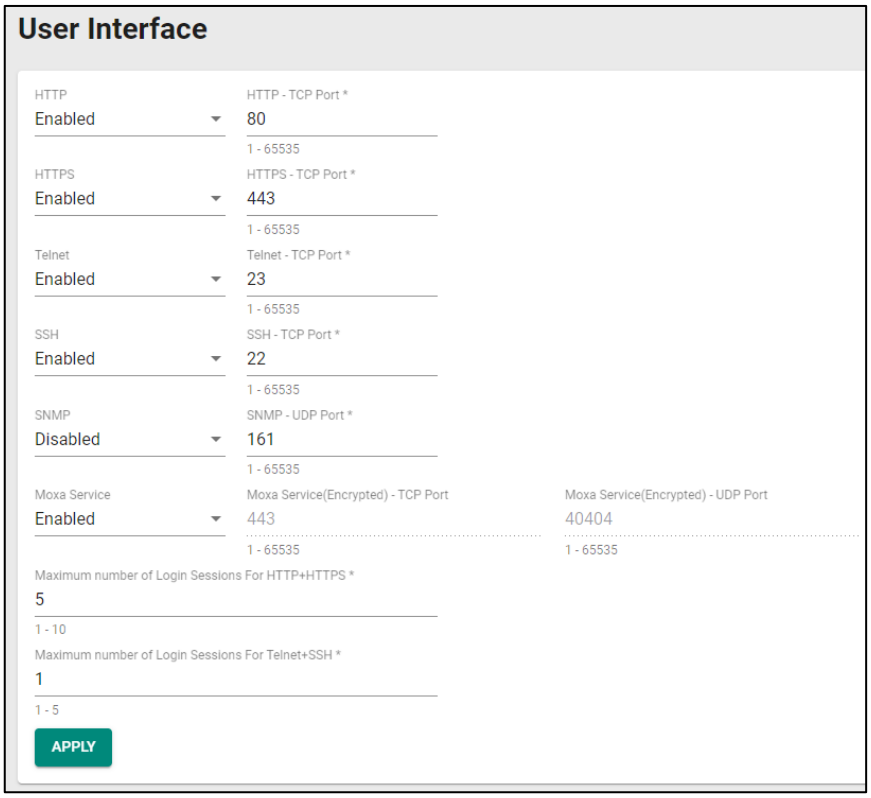



### Management Interface

Select **Management Interface** to configure the settings for **User Interface**.



## User Interface




Configure the following settings.

***HTTP***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the HTTP connection. | Enabled |
| Disabled | Disable the HTTP connection. | |

**NOTE**

An HTTP session will be redirected to HTTPs if both HTTP and HTTPs are enabled.

***HTTP – TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 47808 | Specify the HTTP connection port number. | 80 |

***HTTPS***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the HTTPS connection. | Enabled |
| Disabled | Disable the HTTPS connection. | |

***HTTPS – TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Specify the HTTP connection port number. | 443 |

***Telnet***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable a Telnet connection. | Disabled |
| Disabled | Disable a Telnet connection. | |

***Telnet – TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Specify the Telnet connection port number. | 23 |

***SSH***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the SSH connection. | Enabled |
| Disabled | Disable the SSH connection. | |

***SSH – TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the SSH connection port number. | 22 |

***SNMP***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the SNMP connection. | Disabled |
| Disabled | Disable the SNMP connection. | |

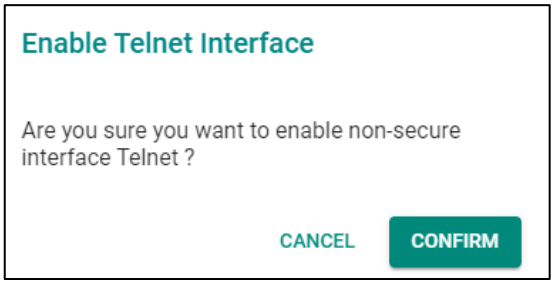
***SNMP – Port***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 47808 | Input the SNMP connection port number. | 161 |

***Moxa Service***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Moxa Service. | Enabled |
| Disabled | Disable Moxa Service. | |

When you enable a non-secure protocol, such as Telnet, a warning screen will appear. Select **CONFIRM** to make sure you want to enable the protocol.




## NOTE

Moxa Service is only for Moxa network management software suite.

***Moxa Service (Encrypted)—TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 443 (read only) | Enable a Moxa Service TCP port. | 443 |

***Moxa Service (Encrypted)—UDP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 40404 (read only) | Enable a Moxa Service UDP port. | 40404 |

***Maximum number of Login Sessions for HTTP+HTTPS***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 10 | Specify the maximum amount of HTTP and HTTPS login sessions that can happen simultaneously. | 5 |

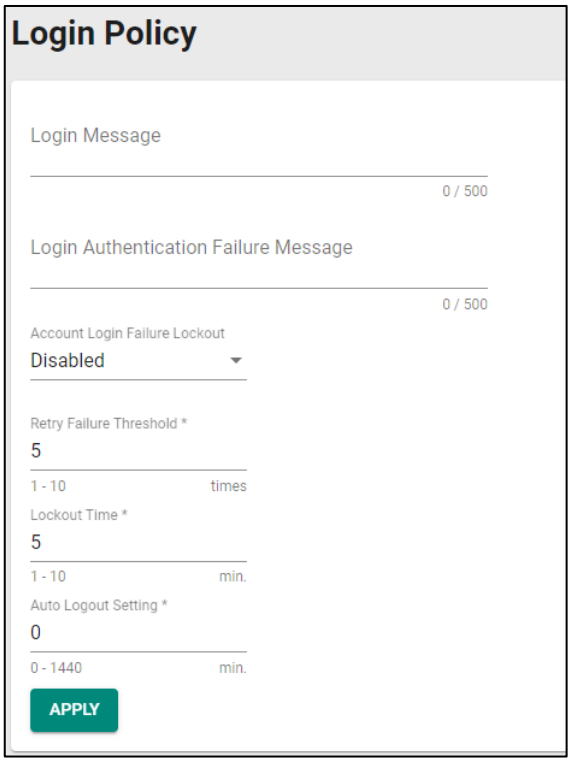
***Maximum number of Login Sessions for Telnet+SSH***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 5 | Specify the maximum amount of Telnet and SSH login sessions that can happen simultaneously. | 1 |

When finished, select **APPLY** to save your changes.

## Login Policy

Select **Login Policy** on the menu.




Configure the following settings.

***Login Message***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 500 characters | Input the message that will be displayed to users when they log in. | None |

***Login Authentication Failure Message***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 500 characters | Input the message that will be displayed when users cannot log in. | None |

***Account Login Failure Lockout***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables the lockout function when a user cannot log in. Note that this will work on web, command-line interface, and SNMP V3 protocols. | Disabled |
| Disabled | Disables the lockout function when a user cannot log in. | |

***Retry Failure Threshold (times)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 10 | Input the maximum number of retry failure times. | 5 |

***Lockout Time (min.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 60 | Specifies the time (in minutes) that a user cannot log in after the retry failure threshold is achieved. | 5 |

***Auto Logout Setting (min.)***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 1440 | Specify how long a user must be inactive before getting logged out. | 5 |

When finished, select **APPLY** to save your changes.

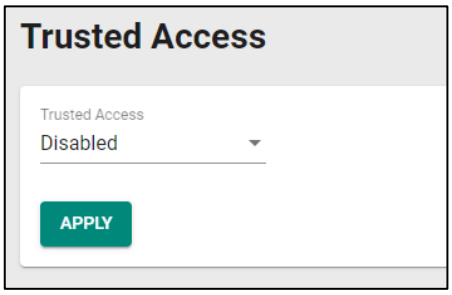
# Trusted Access

## Trusted Access Overview

Trusted Access is a mechanism that provides a secure connection to the switch module. Use this method to allow the connection from the assigned IP address to ensure safe data transmission.

## Trusted Access Settings and Status

Select **Trusted Access** on the menu.




Configure the following settings.

***Enable***

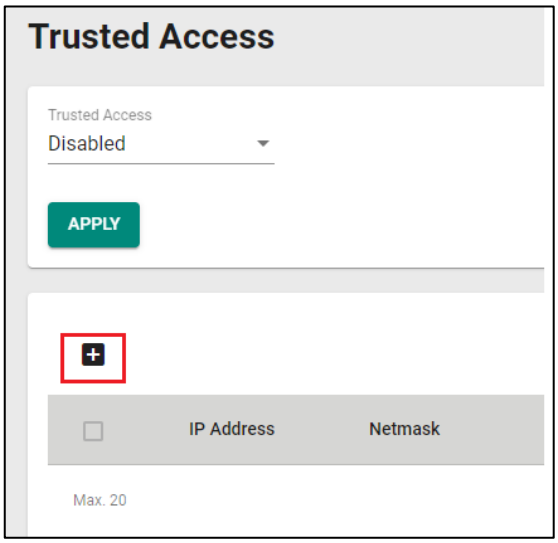
| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Trusted Access. | Disabled |
| Disabled | Disables Trusted Access. | |

### NOTE

1. Trusted Access must be added before it can be enabled.
2. To avoid being disconnected after you enable Trusted Access, you must first add the current IP subnet to Trusted Access. To use this function, you should use an RS-232 console to log in or set the device to factory default.

When finished, select **APPLY** to save your changes.

Next, select the **+** icon.



Configure the following settings.


***IP Address***

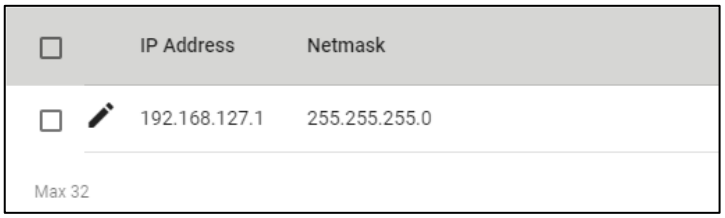
| Setting | Description | Factory Default |
|---|---|---|
| Input IP address | Specifies the IP address that is allowed to connect to switch module. | None |

***Netmask***

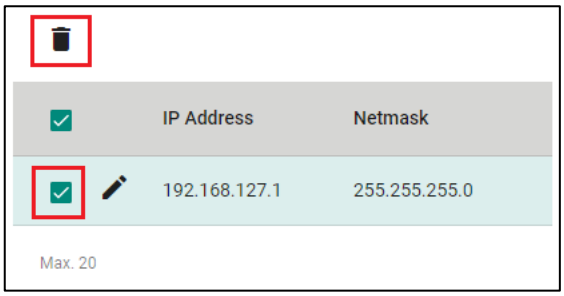
| Setting | Description | Factory Default |
|---|---|---|
| Input Netmask | Specifies the Netmask that is allowed to connect to switch module. | None |

When finished, select **CREATE**.

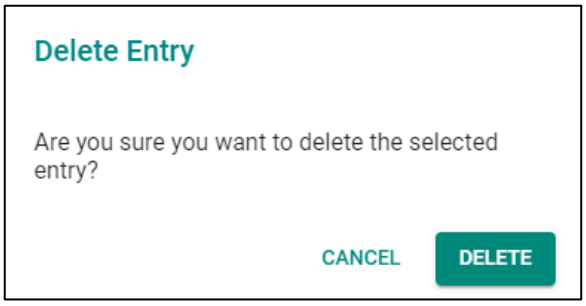
View the Trusted Access status in the figure below.




To delete the trusted access source, select the item and then delete the icon on the top of the page.



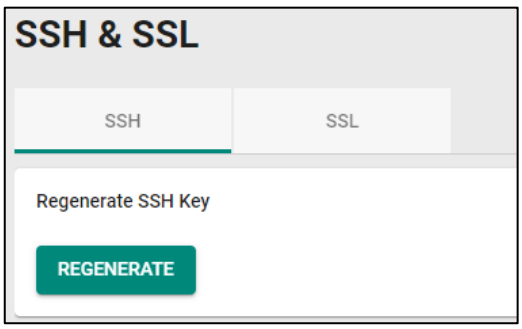

Select **DELETE** to delete the item.



# SSH & SSL

## SSH Key Regeneration

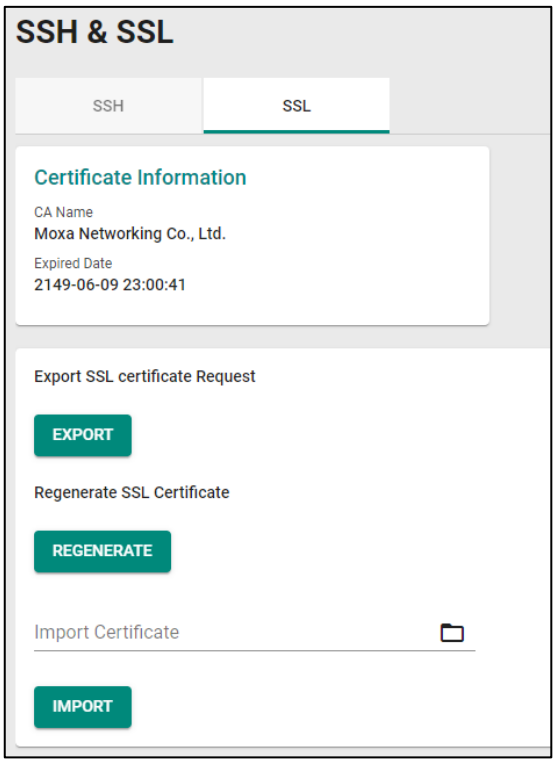
Select **SSH & SSL** on the menu and then the **SSH** tab.




Select **REGENERATE** to regenerate the key.

## SSL Certification Regeneration

Select **SSH & SSL** on the menu and the **SSL** tab. The Certificate Information is shown on this screen.




We recommend using a certificate that is signed by the certification authority to enhance security. Configure the following settings and use the steps below to import the certificate.

1. Export the CSR file from the switch and provide it to the certification authority to generate the certificate.
2. Import the certificate signed by the certification authority to the switch.

***Export SSL Certificate Request***

| Setting | Description | Factory Default |
|---|---|---|
| Export | Export the SSL certificate to your local computer. | None |

***Regenerate SSL Certificate***

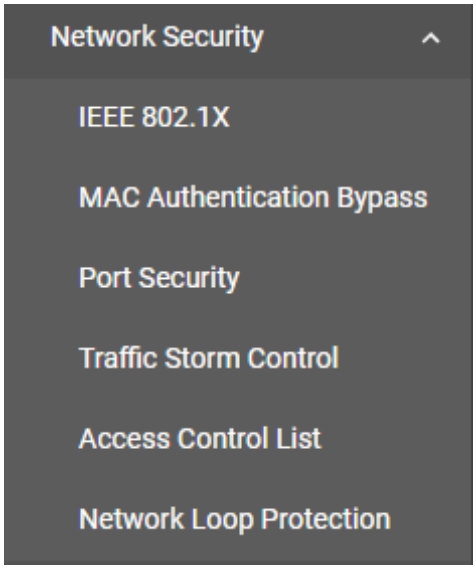
| Setting | Description | Factory Default |
|---|---|---|
| Regenerate | Regenerates the SSL certificate. | None |

***Import Certificate***

| Setting | Description | Factory Default |
|---|---|---|
| Select the file | Imports the SSL certificate from the location where the SSL certificate is located. | None |

# Network Security

This section shows how to configure network security settings, including **IEEE802.1X, MAC Authentication Bypass, Port Security, Traffic Storm Control, Access Control List, and Loop Protection**.




## IEEE 802.1X

### Port-based IEEE 802.1X Overview

The IEEE 802.1X standard defines a protocol for client/server-based access control and authentication. The protocol restricts unauthorized clients from connecting to a LAN through ports that are open to the Internet, and which otherwise would be readily accessible. The purpose of the authentication server is to check each client that requests access to the port. The client is only allowed access to the port if the client's permission is authenticated.

Three components are used to create an authentication mechanism based on 802.1X standards: Client/Supplicant, Authentication Server, and Authenticator.

**Client/Supplicant:** The end station that requests access to the LAN and switch services and responds to the requests from the switch.

**Authentication Server:** The server that performs the actual authentication of the supplicant.

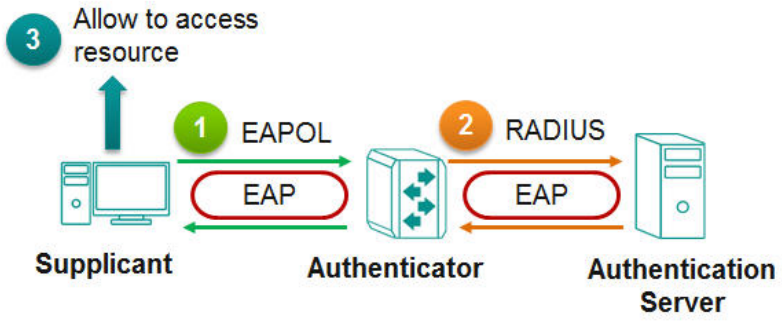
**Authenticator:** Edge switch or wireless access point that acts as a proxy between the supplicant and the authentication server, requesting identity information from the supplicant, verifying the information with the authentication server, and relaying a response to the supplicant.

The switch module acts as an authenticator in the 802.1X environment. A supplicant and an authenticator exchange EAPOL (Extensible Authentication Protocol over LAN) frames with each other. We can either use an external RADIUS server as the authentication server or implement the authentication server in the switch module by using a Local User Database as the authentication look-up table. When we use an external RADIUS server as the authentication server, the authenticator and the authentication server exchange EAP frames.

Authentication can be initiated either by the supplicant or the authenticator. When the supplicant starts the authentication process, it sends an **EAPOL-Start** frame to the authenticator. When the authenticator starts the authentication process or when it receives an **EAPOL Start** frame, it sends an **EAP Request/Identity** frame to ask for the username of the supplicant.

## How IEEE 802.1X Works

802.1X authentication requires three parties: a supplicant, an authenticator, and an authentication server. The supplicant is a client device that wishes to connect to the LAN or WLAN. The supplicant can also use the software to run on the client that offers credentials to the authenticator. Network administrators usually use an Ethernet switch or wireless access point as the authenticator and running software supporting RADIUS and EAP protocols in the authentication server.



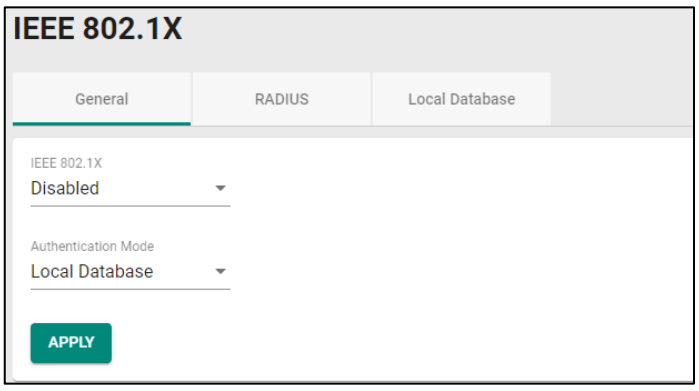

The authenticator serves as a security guard to a protected network. The supplicant is not allowed access through the authenticator to the protected side of the network unless the supplicant's identity has been validated and authorized. With 802.1X port-based authentication, the supplicant provides credentials, such as username/password or digital certificate, to the authenticator, and the authenticator transmits the credentials to the authentication server for verification. If the authentication server approves the credentials as valid, the supplicant (client device) is allowed to access resources located on the protected side of the network.

### IEEE 802.1X Settings

Select **IEEE802.1X** on the menu and then the **General** tab.

**NOTE**

Only ports 1 to 10 support 802.1X setting. SW1, SW2, CPU1, CPU2 are internal communication ports. This function cannot be edited in these ports.




Configure the following settings.

***IEEE 802.1X***

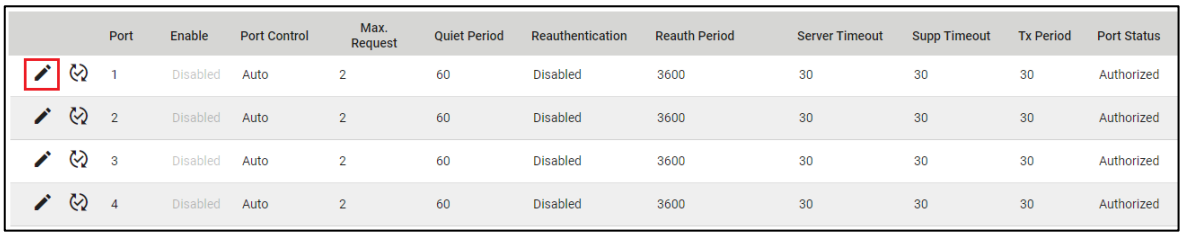
| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables IEEE 802.1X. | Disabled |
| Disabled | Disables IEEE 802.1X. | |

***Authentication Mode***

| Setting | Description | Factory Default |
|---|---|---|
| Local Database | Uses the local database as the authentication mode. | Local Database |
| RADIUS | Uses the RADIUS as the authentication mode. | |

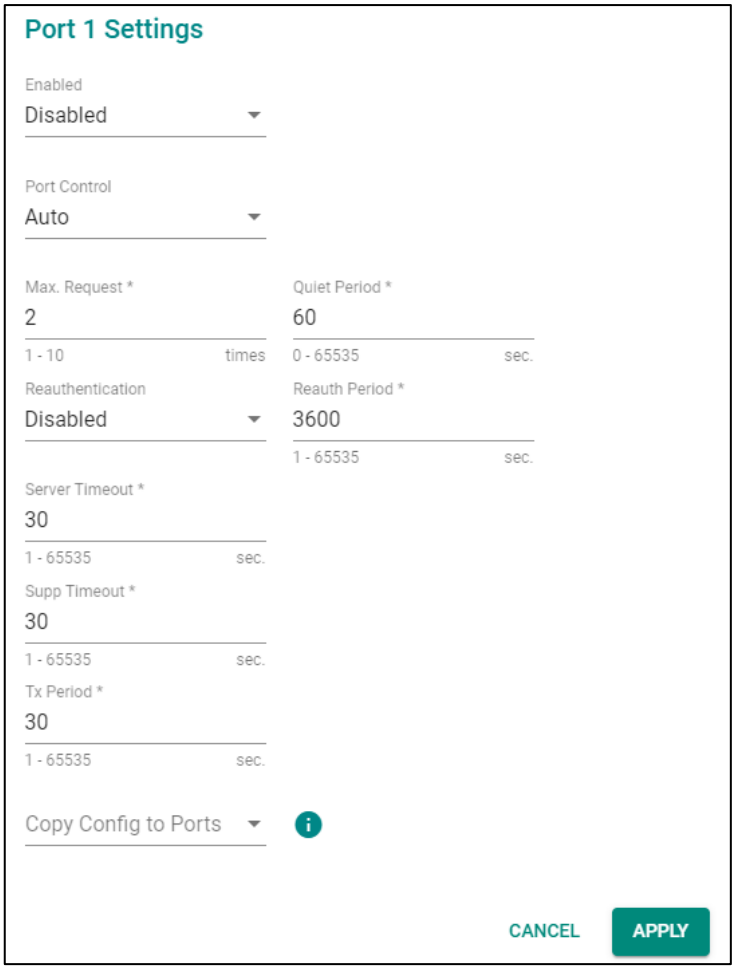
When finished, select **APPLY** to save your changes.

To configure the IEEE 802.1X settings for the specific port, select the edit icon on the port.



| | Port | Enable | Port Control | Max. Request | Quiet Period | Reauthentication | Reauth Period | Server Timeout | Supp Timeout | Tx Period | Port Status |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | Disabled | Auto | 2 | 60 | Disabled | 3600 | 30 | 30 | 30 | Authorized |
| | 2 | Disabled | Auto | 2 | 60 | Disabled | 3600 | 30 | 30 | 30 | Authorized |
| | 3 | Disabled | Auto | 2 | 60 | Disabled | 3600 | 30 | 30 | 30 | Authorized |
| | 4 | Disabled | Auto | 2 | 60 | Disabled | 3600 | 30 | 30 | 30 | Authorized |

Configure the following settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables IEEE 802.1X. | Disabled |
| Disabled | Disables IEEE 802.1X. | |

***Port Control***

| Setting | Description | Factory Default |
|---|---|---|
| Force Unauthorized | The controlled port must be held in the Unauthorized state. | Auto |
| Auto | The controlled port is set to the authorized or unauthorized state in accordance with the outcome of an authentication exchange between the Supplicant and the Authentication Server. | |
| Force Authorized | The controlled port is required to be held in the authorized state. | |

***Max Request (times)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 10 | Enables re-authentication request time. | 2 |

***Quiet Period (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 65535 | Specifies the duration of time that the switch remains in the muted state following a failed authentication exchange with the client. | 60 |

***Reauthentication***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables re-authentication. | Disabled |
| Disabled | Disables re-authentication. | |

***Reauth Period (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the duration of time between re-authentication attempts. | 3600 |

***Server Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the duration of time that the switch will re-transmit the packets from the switch to the authentication server. | 30 |

***Supp (Supplicant, such as Client PC) Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the duration of time that the switch will re-transmit the packets from the switch to the client. | 30 |

***Tx Period (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the duration of time that the switch will re-transmit the data to the client. | 30 |

***Copy Config to Ports***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Allows users to copy configurations to other port(s). | None |

When finished, select **APPLY** to save your changes.

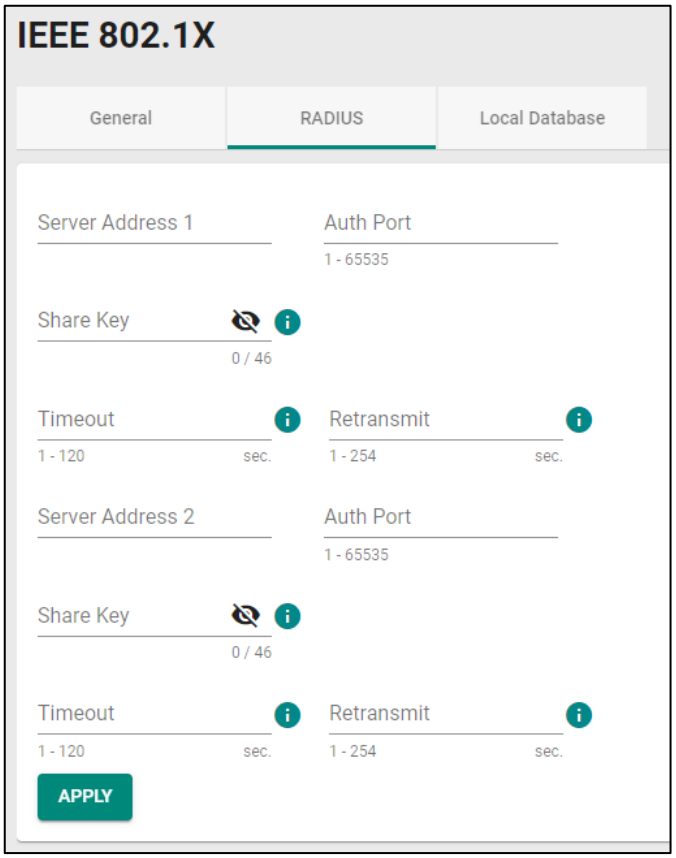
# IEEE 802.1X Database

## RADIUS

RADIUS **Remote Authentication Dial in User Service** is a protocol that involves three services in one network protocol: Authentication, Authorization, and Accounting (AAA). The protocol operates in port 1812, and the AAA management for users connecting to a network service.

RADIUS is based on a client/server protocol that runs in the application layer and can use either TCP or UDP as the mode of transport. The network access servers that contain the RADIUS protocol can allow the client to communicate with the RADIUS server. Through Authentication, Authorization, and Accounting, RADIUS is used to monitor access to the network.

To configure RADIUS settings, select the **RADIUS** tab.




Configure the following settings.

***Server Address 1***

| Setting | Description | Factory Default |
|---|---|---|
| To input server address 1 | Specifies the first server address. | None |

***Auth Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Specifies the authentication port number for the first server address. | None |

***Share Key***

| Setting | Description | Factory Default |
|---|---|---|
| Input the share key for the first server, (0 to 46) | Specifies the share key for the first server. | None |

***Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 120 | Specifies the duration of time before a device is logged out. | None |

***Retransmit (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 254 | Specifies the time for data retransmission. | None |

***Server Address 2***

| Setting | Description | Factory Default |
|---|---|---|
| To input server address 2 | Specify the second server address. | None |

***Auth Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Specifies the authentication port number for the first server address. | None |

***Share Key***

| Setting | Description | Factory Default |
|---|---|---|
| Input the share key for the second server (0 to 46) | Specifies the share key for the second server. | None |

***Timeout***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 120 | Specifies the duration of time before the device is timed out. | None |

***Retransmit (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 254 | Specifies the time for data re-transmission. | None |

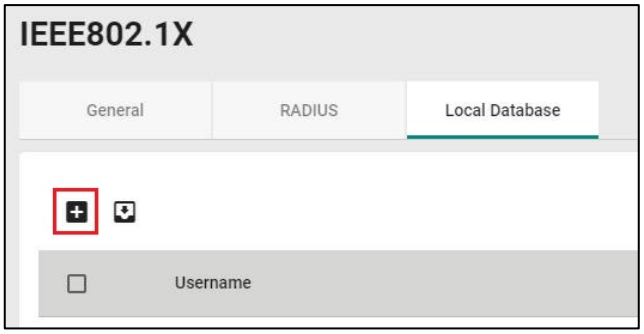
When finished, select **APPLY** to save your changes.

## NOTE

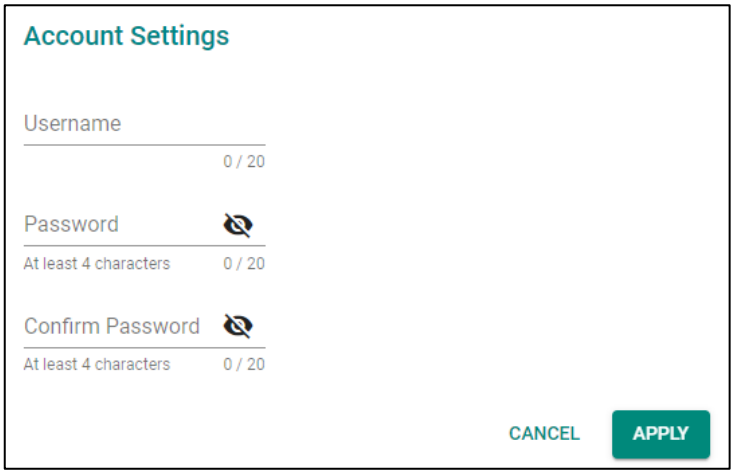
The RADIUS service will be operated via the first server first; if it fails, it will be run on the second server.

### Local Database

First, select the **Local Database** tab and then the + icon.



Configure the following settings.




***Username***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 20 characters | Specifies the username for the local database. | None |

***Password***

| Setting | Description | Factory Default |
|---|---|---|
| At least 4 characters, (max. 64 characters) | Specifies the password for the local database user. | None |

***Confirm Password***

| Setting | Description | Factory Default |
|---|---|---|
| At least 4 characters, (max. 64 characters) | Confirms the password for the local database user. | None |

When finished, select **APPLY** to save your changes.

## MAC Authentication Bypass

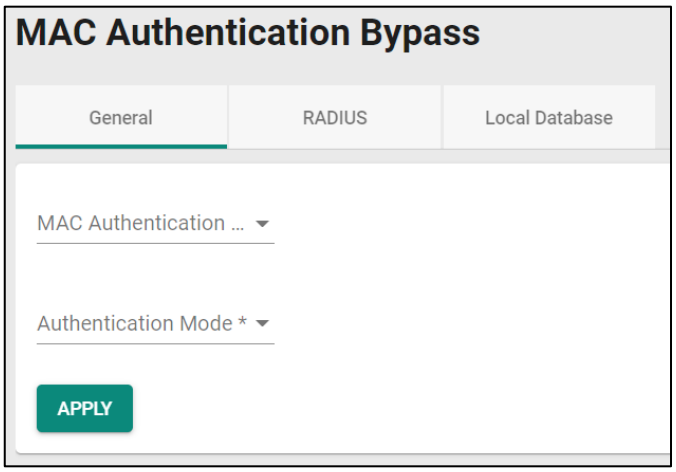
Select **MAC Authentication Bypass** on the function menu.

**NOTE**

Only ports 1 to 10 support MAC Authentication Bypass setting. SW1, SW2, CPU1, and CPU2 are internal communication ports. This function cannot be edited in these ports.

### General

Select the **General** tab for general settings.



***MAC Authentication Bypass***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables the MAC authentication bypass function. | None |
| Disabled | Disables the MAC authentication bypass function. | |

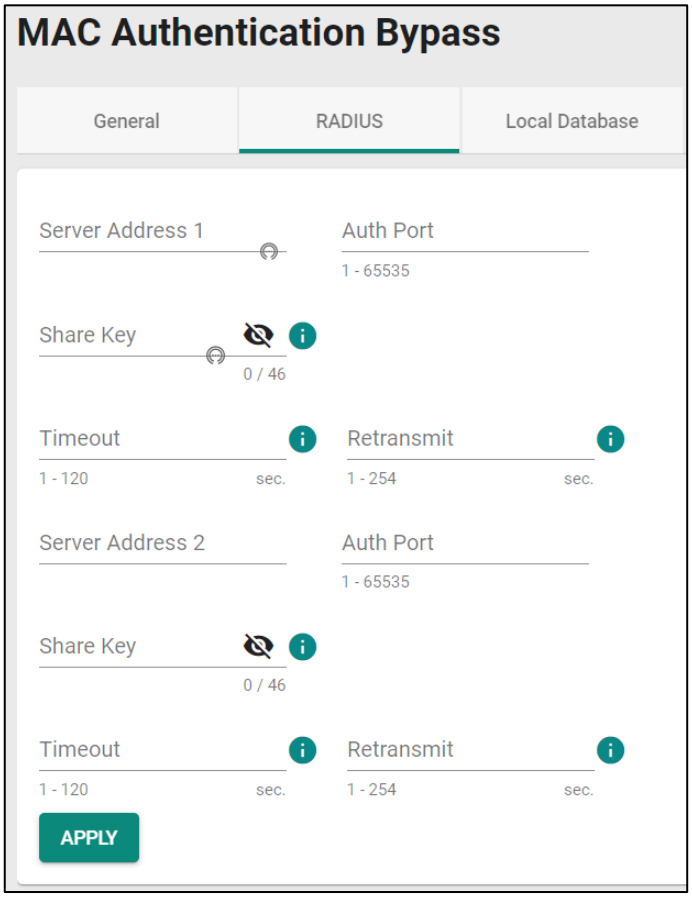
***Authentication Mode***

| Setting | Description | Factory Default |
|---|---|---|
| RADIUS | Selects RADIUS as the authentication mode. | None |
| Local Database | Selects local database as the authentication mode. | |

When finished, select **APPLY** to save your changes.

## RADIUS

Select the **RADIUS** tab to perform further configurations.




Configure the following settings.

***Server Address 1***

| Setting | Description | Factory Default |
|---|---|---|
| To input server address 1 | Specifies the first server address. | None |

***Auth Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Specifies the authentication port number for the first server address. | None |

***Share Key***

| Setting | Description | Factory Default |
|---|---|---|
| Input the share key for the first server, (0 to 46) | Specifies the share key for the first server. | None |

***Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 120 | Specifies the duration of time before a device is logged out. | None |

***Retransmit (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 254 | Specifies the time for data retransmission. | None |

***Server Address 2***

| Setting | Description | Factory Default |
|---|---|---|
| To input server address 2 | Specifies the second server address. | None |

***Auth Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Specifies the authentication port number for the first server address. | None |

***Share Key***

| Setting | Description | Factory Default |
|---|---|---|
| Input the share key for the second server (0 to 46) | Specifies the share key for the second server. | None |

***Timeout***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 120 | Specifies the duration of time before the device is timed out. | None |

***Retransmit (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 254 | Specifies the time for data retransmission. | None |

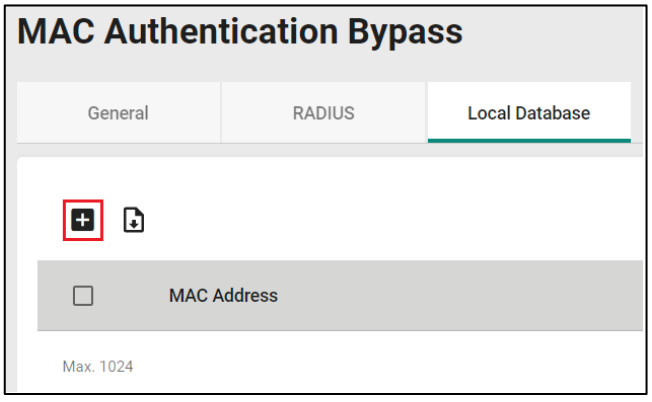
When finished, select **APPLY** to save your changes.

**NOTE**

The RADIUS service will be operated via the first server first. If it fails, it will be run on the second server.

## Local Database

Select **Local Database** tab and then select ⊞ icon for further configurations.



Configure the following setting.


***MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| MAC Address | Specifies the MAC address used for MAC authentication bypass. | None |

When finished, select **CREATE** to complete.

## Port Security

> **NOTE**
>
> Only port 1 to 10 support Port Security setting. SW1, SW2, CPU1, CPU2 are internal communication ports. This function cannot be edited in these ports.

### MAC Sticky Overview

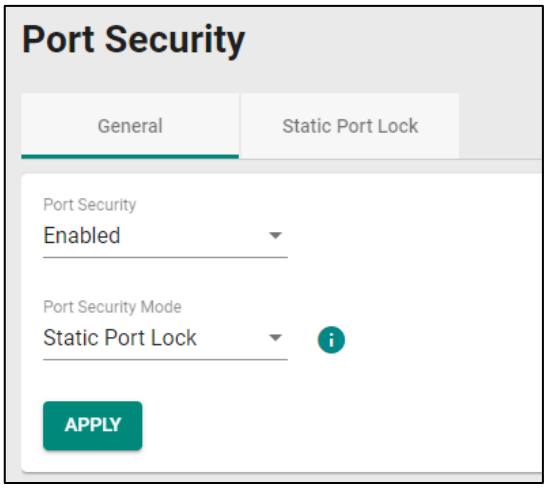
MAC Sticky is a function that allows users to configure the maximum number of MAC addresses (the Limit) that a port can "learn". Users can configure what action should be taken (under Secure Action) when a new MAC address tries to access a port after the maximum number of MAC addresses have already been learned. The total number of allowed MAC addresses cannot exceed 1024.

### How MAC Sticky Works

In MAC Sticky mode, administrators can set a proper limit number and then configure trust devices manually, or let the system configure trust devices automatically. Except for dropping packets as a response to any violations, administrators can set 'port shutdown' on a port and achieve a strict security guarantee. When a violation is registered on a port, the port will shut down and an administrator will receive a notification to perform a check.

## MAC Sticky Settings and Status

To configure the MAC Sticky settings, select the **General** tab in **Port Security**.



Configure the following settings.

***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables port security. | Enabled |
| Disabled | Disables port security. | |

***Port Security Mode***

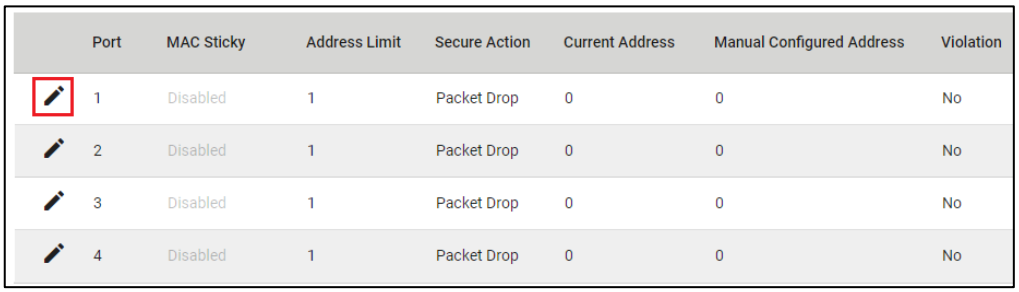
| Setting | Description | Factory Default |
|---|---|---|
| MAC Sticky | Specifies MAC Sticky as the port security mode. | Static Port Lock |
| Static Port Lock | Specifies Static Port Lock as the port security mode. | |

Select **MAC Sticky** and then **APPLY**.

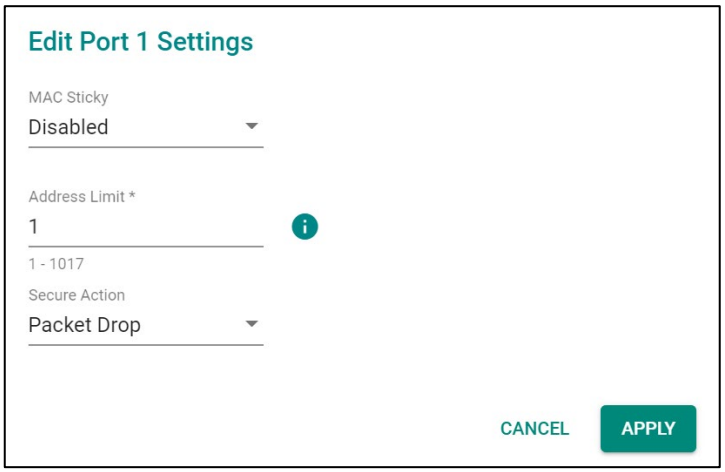
## NOTE

When you change the Port Security Mode, the settings in the table will be deleted.

Select the edit icon on the port you want to edit.




Configure the following settings.




***MAC Sticky***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Static Port Lock for this port. | Disabled |
| Disabled | Disables Static Port Lock for this port. | |

***Address Limit***

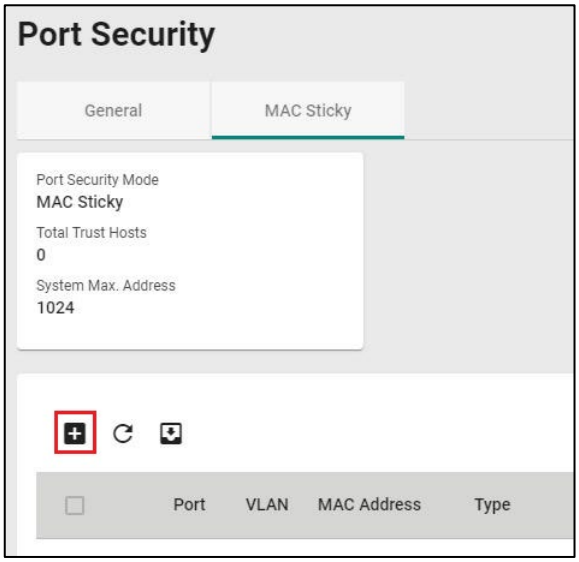
| Setting | Description | Factory Default |
|---|---|---|
| 1 to 1017 | Specifies the maximum numbers of the learned MAC address. | 1 |

***Secure Action***

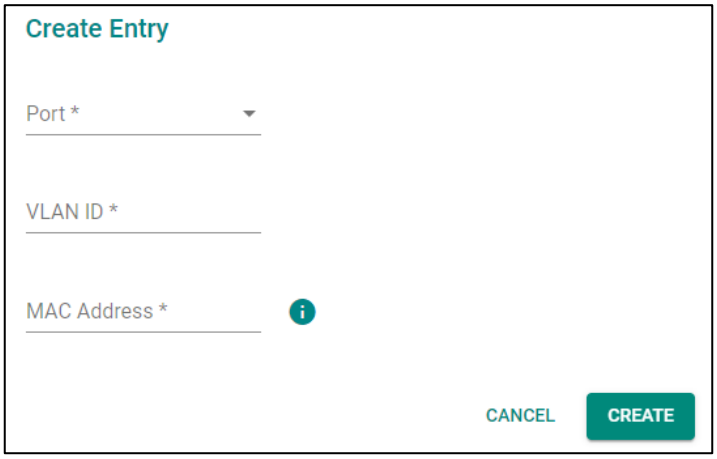
| Setting | Description | Factory Default |
|---|---|---|
| Port Shutdown | Enables port shutdown when a violation occurs. | Packet Drop |
| Packet Drop | Drops the packets when a violation occurs. | |

When finished, select **APPLY** to save your changes.

Next, select the **MAC Sticky** tab and then the + icon to add the MAC Sticky entries.




Configure the following settings.




***Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list | Selects the port(s) that will be used with the MAC Sticky function. | None |

***VLAN ID***

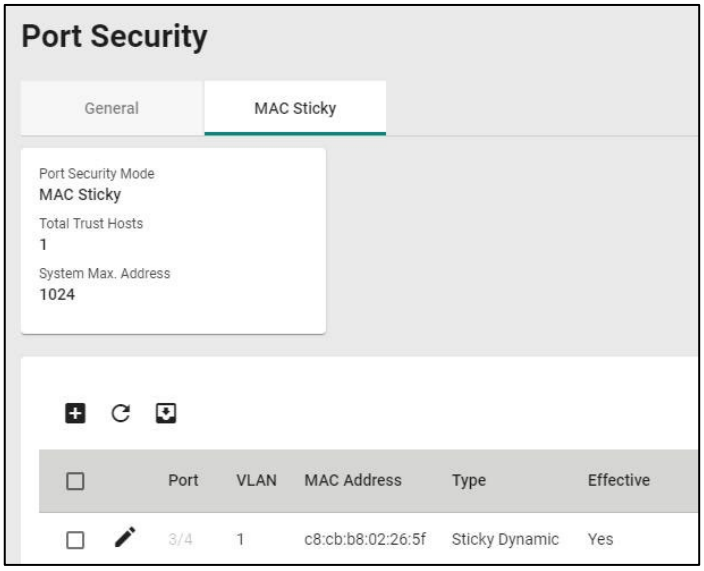
| Setting | Description | Factory Default |
|---|---|---|
| Input the VLAN ID | Specifies the VLAN ID that will be used with MAC Sticky. | None |

***MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the MAC address that will be used | Specifies the MAC Address of the device that will be used as the reliable source for network access. | None |

When finished, select **CREATE**.

You can view the MAC Sticky settings in the figure below.

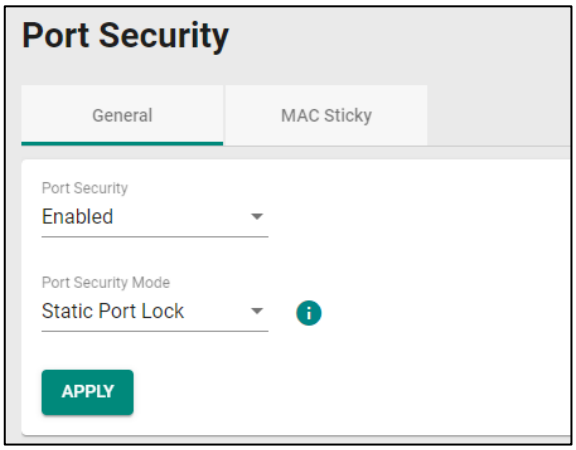



## Static Port Lock Overview

To provide a port-based security function, switch modules have implemented Static Port Lock function; the main idea is to allow configured devices, 128 at most, to access the network through a specific port. Packets sent from unknown devices or from configured devices with mismatching ports will be dropped. In other words, only the packets from the devices pre-configured with the specific MAC addresses can be sent to the specific port to ensure a secure network data transmission scenario.

## Static Port Lock Settings and Status

To configure these settings, first select the **Port Security** tab and then **General**.




Configure the following settings.

***Enable***

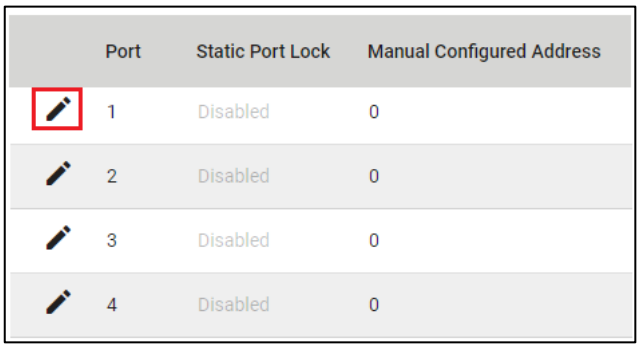
| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables port security. | Enabled |
| Disabled | Disables port security. | |

***Port Security Mode***

| Setting | Description | Factory Default |
|---|---|---|
| MAC Sticky | Selects MAC Sticky as the port security mode. | Static Port Lock |
| Static Port Lock | Selects Static Port Lock as the port security mode. | |

Select **Static Port Lock** and then **APPLY**.

Select the edit icon on the port you want to edit.



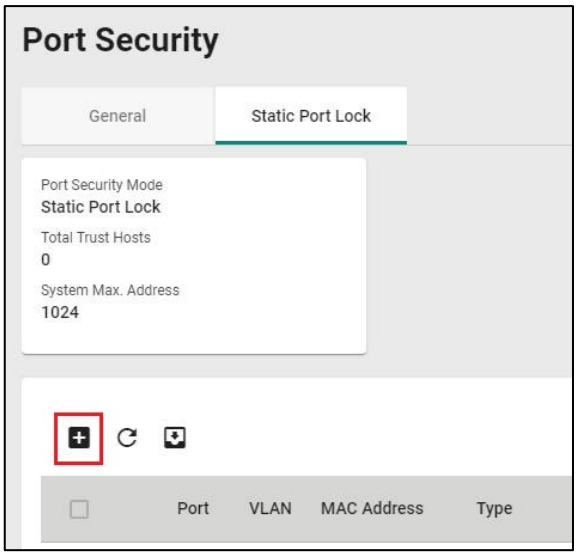

Configure the following settings.


***Enable***

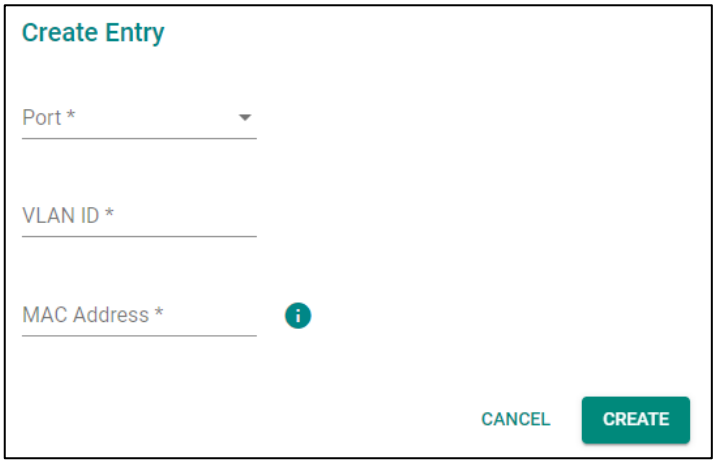
| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Static Port Lock. | Disabled |
| Disabled | Disables Static Port Lock. | |

When finished, select **APPLY** to save your changes.

Next, select the **Static Port Lock** tab and then the + icon to perform further settings.



Configure the following settings.




***Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the drop-down list | Specifies the port(s) that will be used with Static Port Lock. | None |

***VLAN ID***

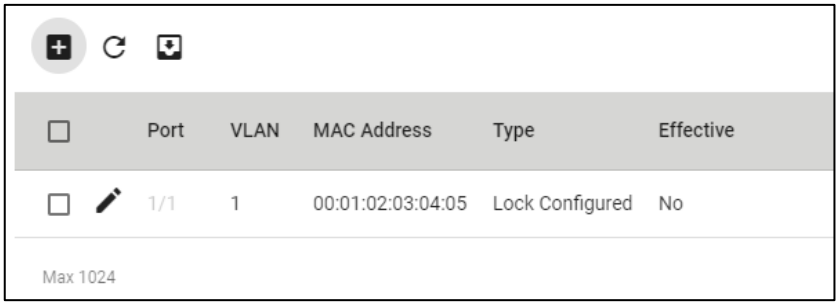
| Setting | Description | Factory Default |
|---|---|---|
| Input the VLAN ID | Specifies the VLAN ID that will use Static Port Lock. | None |

***MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| Input the MAC address that will be used | Specifies the MAC Address of the device that will be used as the reliable source for network access. | None |

When finished, select **CREATE**.

View the Static Port Lock setting status from the following figure.



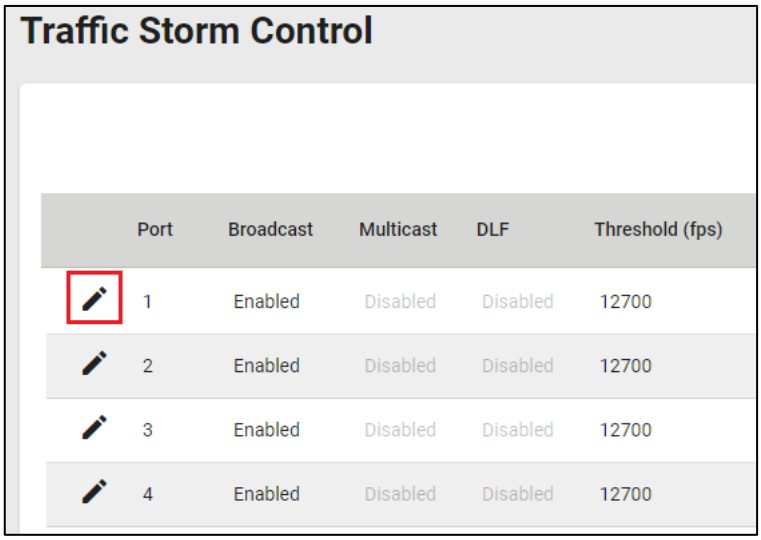

## Traffic Storm Control

A traffic storm can happen when packets flood the network; this causes excessive traffic and slows down the network performance. To counter this, Traffic Storm Control provides an efficient design to prevent the network from flooding caused by a broadcast, multicast, or unicast traffic storm on a physical network layer. The feature can handle packets from both ingress and egress data.

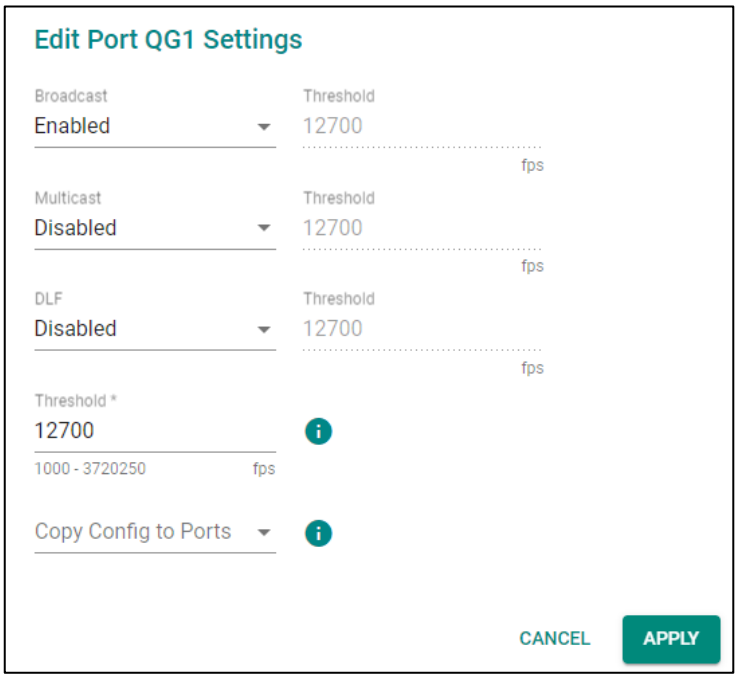
First select **Traffic Storm Control** on the menu and then the edit icon on the specific port you want to configure.

### NOTE

Only ports 1 to 10 support Traffic Storm Control setting. SW1, SW2, CPU1, CPU2 are internal communication ports. This function cannot be edited in these ports.




Configure the following settings.




Three methods that can be used for traffic storm control: Broadcast, Multicast, and Destination Lookup Failure (DLF).

***Broadcast***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables Broadcast when a traffic storm occurs. | Disabled |
| Disabled | Disables Broadcast when a traffic storm occurs. | |

***Multicast***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables multicast when a traffic storm occurs. | Disabled |
| Disabled | Disables multicast when a traffic storm occurs. | |

***DLF***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enables DLF when a traffic storm occurs. | Disabled |
| Disabled | Disables DLF when a traffic storm occurs. | |

***Threshold (fps)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 1488100 | Define the threshold for a traffic storm. | 12700 |

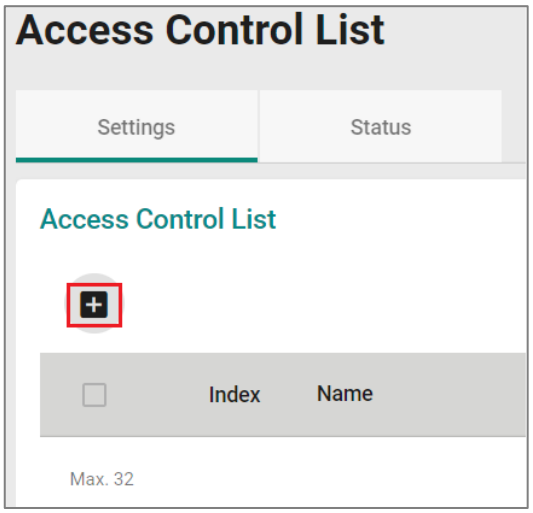
***Copy Config to Ports***

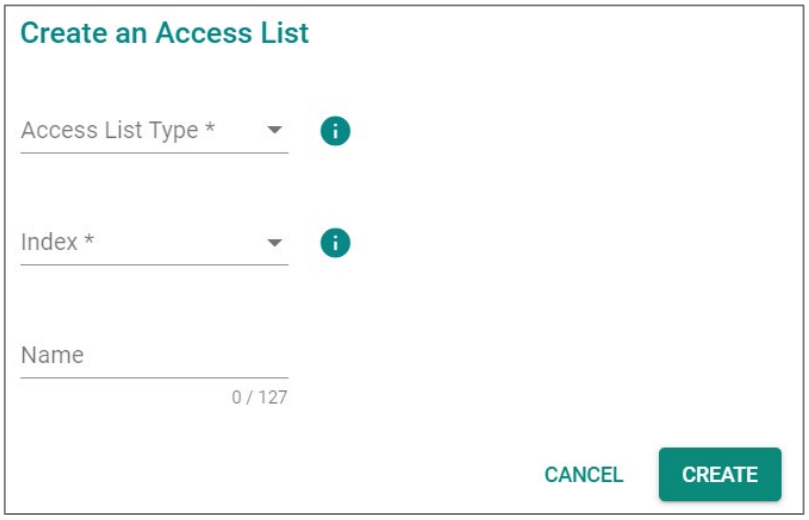
| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the port(s) you want to have the same configurations for. | None |

When finished, select **APPLY** to save your changes.

## Access Control List

Select **Access Control List** on the function menu and then ⊞ to perform further configurations.




Configure the following settings.

***Access List Type***

| Setting | Description | Factory Default |
|---|---|---|
| IP-based | Specify IP-based as the access list type. | None |
| MAC-based | Specify MAC-based as the access list type. | |

***Index (For IP-based type)***

| Setting | Description | Factory Default |
|---|---|---|
| Select from IP-1 to IP-16 | Select from the drop-down list for index. | None |

***Index (For MAC-based type)***

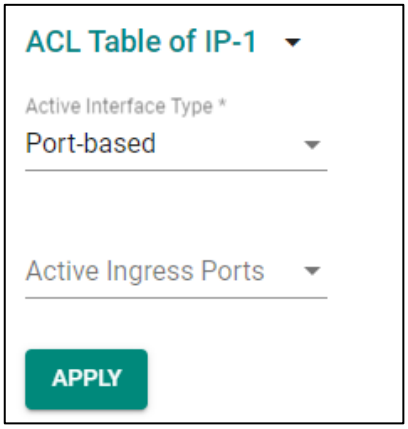
| Setting | Description | Factory Default |
|---|---|---|
| Select from MAC-1 to MAC-16 | Select from the drop-down list for index. | None |

***Name***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 127 characters | Provide a name for this access list. | None |

## IP-based ACL Table Configurations

Configure the following settings for the IP-based access list.




***Active Interface Type***

| Setting | Description | Factory Default |
|---|---|---|
| Port-based | Specify Port-based as the active interface type. | None |
| VLAN-based | Specify VLAN-based as the active interface type. | |

***Active Ingress Ports (For Port-based type)***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the port(s) as the active ingress port(s). | None |

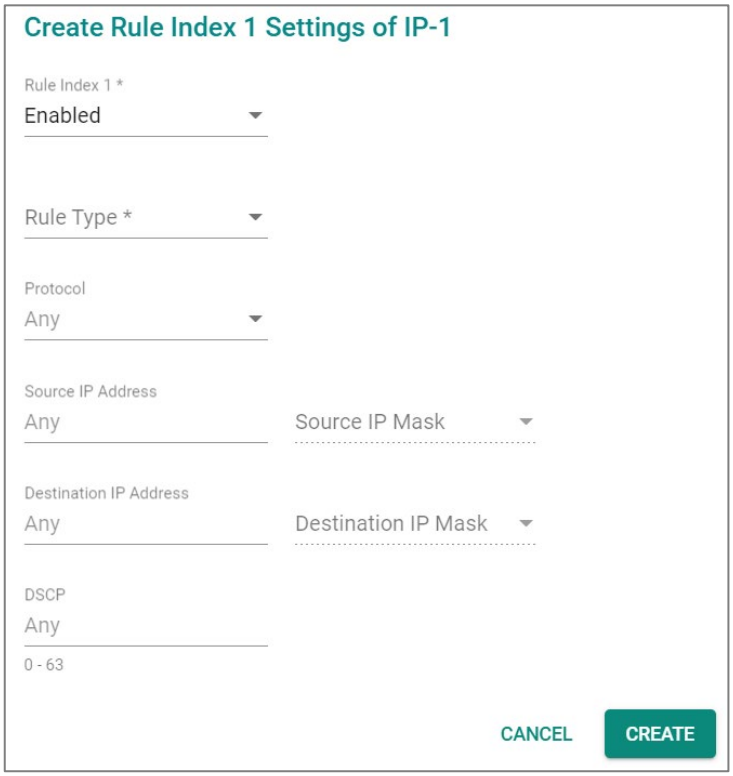
***Active Ingress VLAN (For VLAN-based type)***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the port(s) as the active ingress VLAN. | None |

When finished, select **APPLY** to save your changes.

## IP-based Rule Index Settings

Select the ⊞ icon for Rule Index settings.




Configure the following settings.

***Rule Index 1***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Rule Index 1 settings. | Enabled |
| Disabled | Disable Rule Index 1 settings. | |

***Rule Type***

| Setting | Description | Factory Default |
|---|---|---|
| Permit | Permit the rule type. | None |
| Deny | Deny the rule type. | |

***Protocol***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the protocol used for this rule index. | Any |

***Source IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| IP address | Provide the IP address as the source IP address. | Any |

***Source IP Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the source IP mask from the list. | None |

***Destination IP Address***

| Setting | Description | Factory Default |
|---|---|---|
| IP address | Provide the IP address as the destination IP address. | Any |

***Destination IP Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the destination IP mask from the list. | None |

***DSCP***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 63 | Specify the DSCP value. | Any |

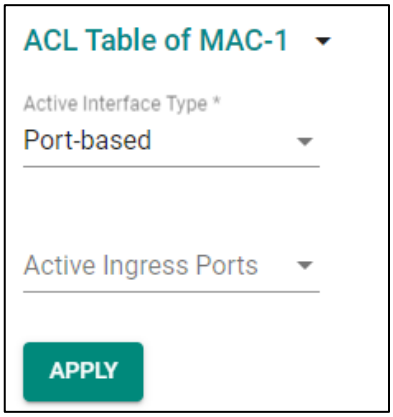
When finished, select **CREATE** to complete.

Note that the following system packets are not included in the ACL operation.

| Item | Destination/Source Port Number |
|---|---|
| DHCP Server | 67 |
| DHCP Client | 68 |
| Moxa Service | 40404 |

## MAC-based ACL Table Configurations

Configure the following settings for MAC-based access list.




***Active Interface Type***

| Setting | Description | Factory Default |
|---|---|---|
| Port-based | Specify Port-based as the active interface type. | None |
| VLAN-based | Specify VLAN-based as the active interface type. | |

***Active Ingress Ports (For Port-based type)***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the port(s) as the active ingress port(s). | None |

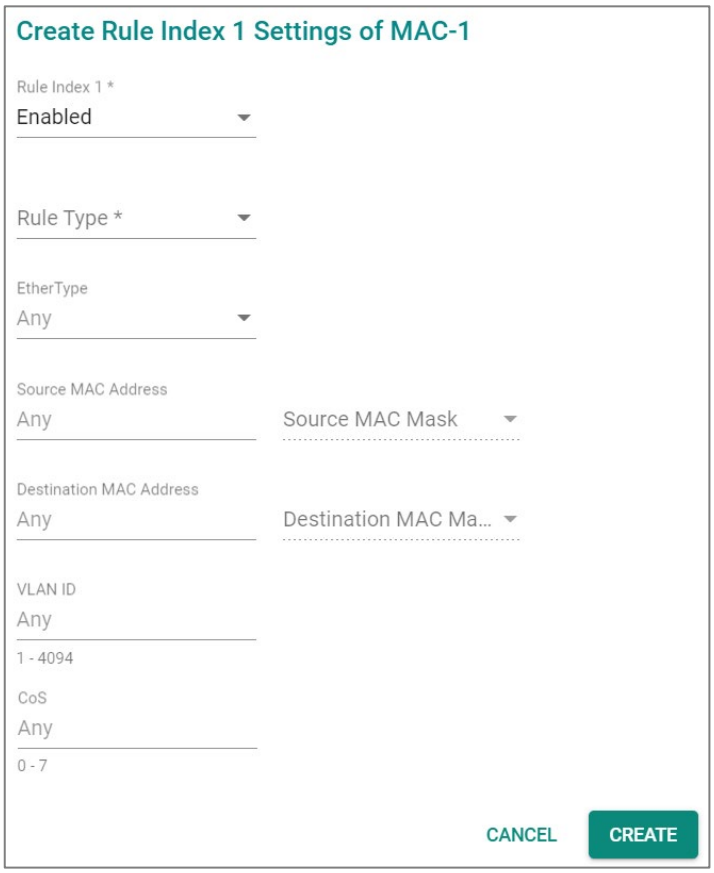
***Active Ingress VLAN (For VLAN-based type)***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the port(s) as the active ingress VLAN. | None |

When finished, select **APPLY** to save your changes.

### MAC-based Rule Index Settings

Select the ⊞ icon for Rule Index settings.




Configure the following settings.

***Rule Index 1***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Rule Index 1 settings. | Enabled |
| Disabled | Disable Rule Index 1 settings. | |

***Rule Type***

| Setting | Description | Factory Default |
|---|---|---|
| Permit | Permit the rule type. | None |
| Deny | Deny the rule type. | |

***EtherType***

| Setting | Description | Factory Default |
|---|---|---|
| User defined | Select User defined as the Ethernet type. | Any |

***EtherType Value (For User defined type only)***

| Setting | Description | Factory Default |
|---|---|---|
| In hex digit | Provide the Ethernet type value for the user defined type. | 0x |

***Source MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| MAC address | Provide the MAC address as the source MAC address. | Any |

***Source MAC Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the source MAC mask from the list. | None |

***Destination MAC Address***

| Setting | Description | Factory Default |
|---|---|---|
| MAC address | Provide the MAC address as the destination MAC address. | Any |

***Destination MAC Mask***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port(s) from the drop-down list | Select the destination MAC mask from the list. | None |

***VLAN ID***

| Setting | Description | Factory Default |
|---|---|---|
| Select the VLAN ID by using the up/down arrows | Select the VLAN ID. | Any |

***CoS***

| Setting | Description | Factory Default |
|---|---|---|
| Select the CoS value by using the up/down arrows | Specify the DSCP value. | Any |

When finished, select **CREATE** to complete.

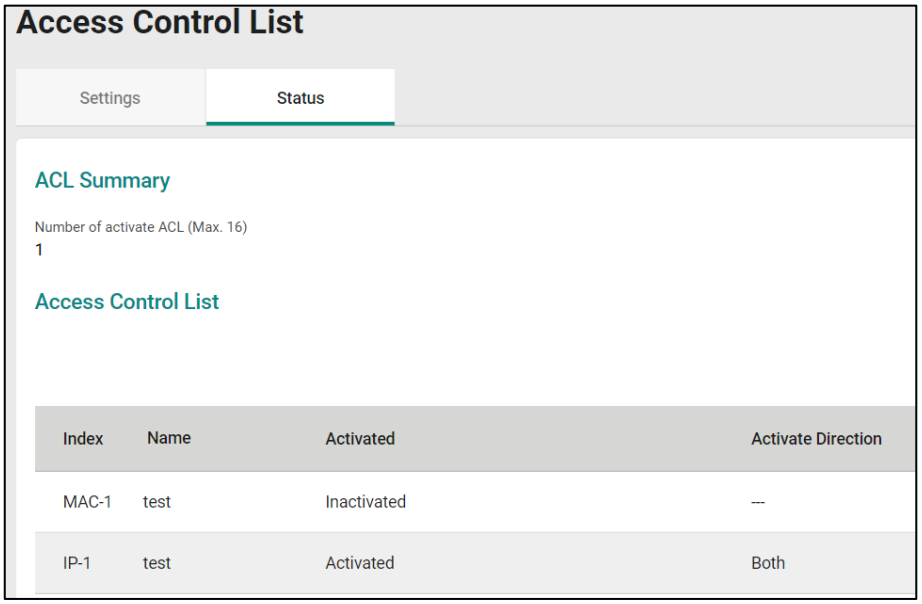
Note that the following system packets are not included in the ACL operation.

| Item | MAC Address |
|---|---|
| IEEE reserved Multicast MAC address | 01:80:C2:XX:XX:XX |
| IP Multicast MAC address | 01:00:5E:XX:XX:XX |
| Broadcast MAC address | FF:FF:FF:FF:FF:FF |
| L2 Multicast MAC address | 01:XX:XX:XX:XX |

| Item | Ether Type |
|---|---|
| LLDP | 0x88CC |
| EAPOL | 0x888E |
| LACP | 0x8809 |
| LLC Jumbo Frame | 0x8870 |
| ARP | 0x0806 |
| MRP | 0x88E3 |
| PROFINET | 0x8892 |
| PTP | 0x88B5 |
| PTP | 0x88F7 |
| GOOSE | 0x88B8 |
| SMV | 0x88BA |
| Ethernet Configuration Testing Protocol | 0x9000 |

### Access Control List Status

Select **Status** to view the Access Control List status.

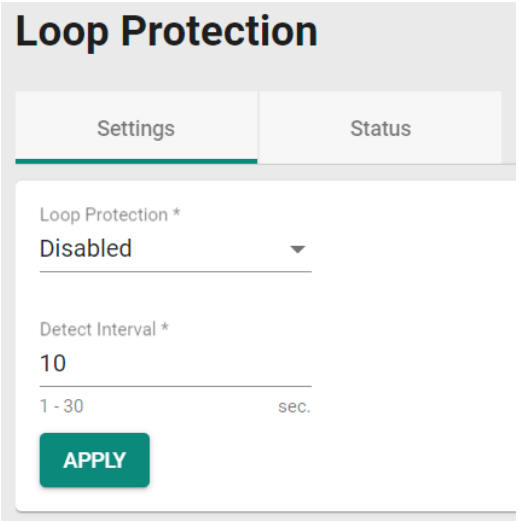



## Loop Protection

Select **Loop Protection** on the function menu.

### Settings

Select **Settings** for further configurations.




Configure the following settings.

***Loop Protection***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the Loop Protection function. | Disabled |
| Disabled | Disable the Loop Protection function. | |

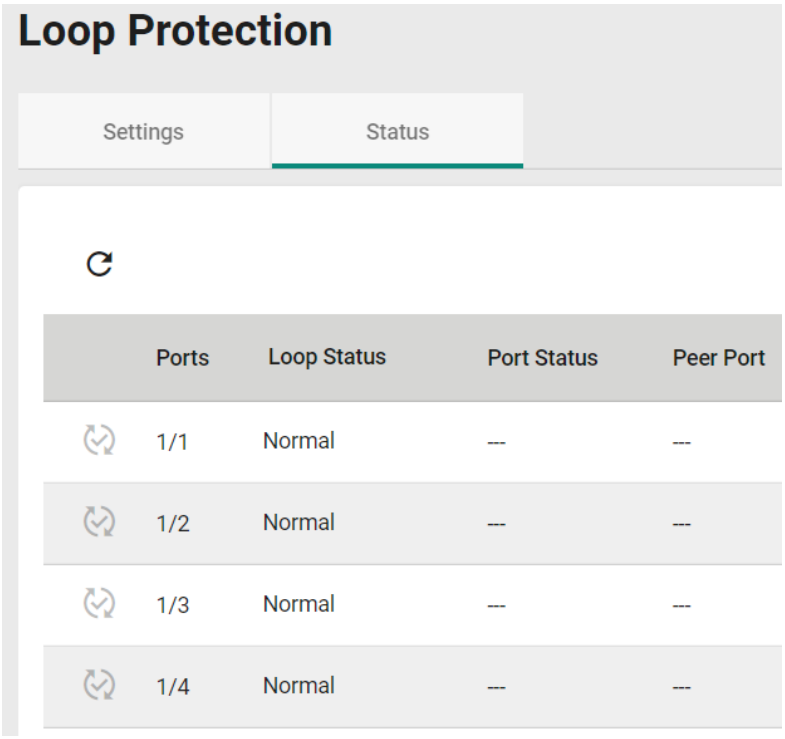
***Detect Interval***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 30 | Specify the detect interval value. | 10 |

When finished, select **APPLY** to complete.

### Status

Select **Status** tab to view the Loop Protection status.



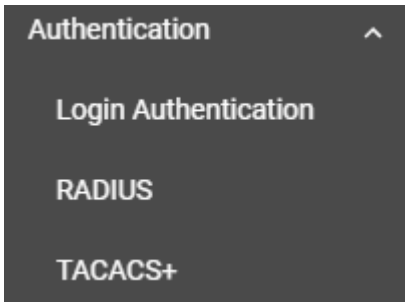

## Authentication

This section describes how to configure system authentication including RADIUS and TACACS+. Switch modules have three different user login authentications: TACACS+ (Terminal Access Controller Access-Control System Plus), RADIUS (Remote Authentication Dial In User Service), and Local. The TACACS+ and RADIUS mechanisms are centralized "AAA" (Authentication, Authorization, and Accounting) systems for connecting to network services. The fundamental purpose of both TACACS+ and RADIUS is to provide an efficient and secure mechanism for user account management.

Five combinations are available to choose from.

1. **TACACS+, Local:** Check the TACACS+ database first. If checking the TACACS+ database fails, then check the Local database.
2. **RADIUS, Local:** Check the RADIUS database first. If checking the RADIUS database fails, then check the Local database.
3. **TACACS+:** Only check TACACS+ database.
4. **RADIUS:** Only check the RADIUS database.
5. **Local:** Only check the Local database.

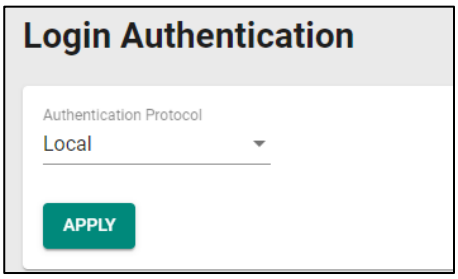
This section includes the configurations for Login Authentication, RADIUS, and TACACS+.



## Login Authentication

This section allows you to select the login authentication protocol.

Select **Login Authentication**.




Configure the following settings.

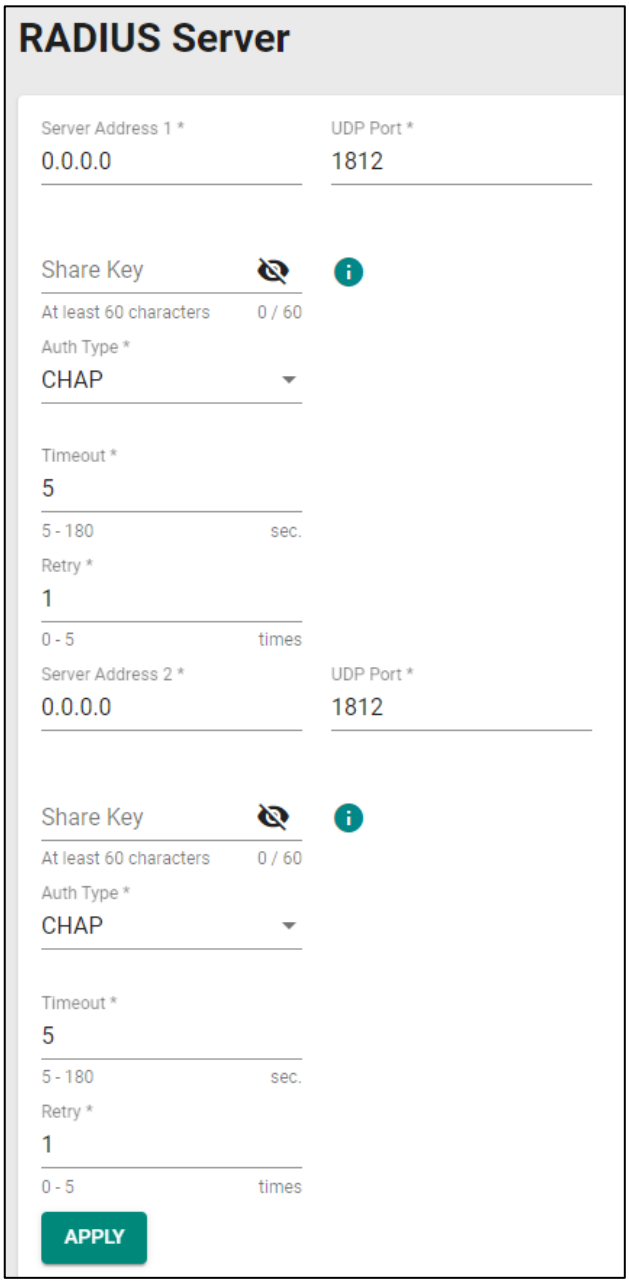
***Authentication Protocol***

| Setting | Description | Factory Default |
|---|---|---|
| Local | Select Local as the authentication protocol. | Local |
| RADIUS | Select RADIUS as the authentication protocol. | |
| TACACS+ | Select TACACS+ as the authentication protocol. | |
| RADIUS, Local | Select RADIUS and Local as the authentication protocol. | |
| TACACS+, Local | Select TACACS+ and Local as the authentication protocol. | |

When finished, select **APPLY** to save your changes.

## RADIUS

Select RADIUS on the menu and configure the following settings.




***Server Address 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the server address | Specify the first server address as the authentication database. | 0.0.0.0 |

***UDP Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port number | Specify the UDP port. | 1812 |

***Share Key***

| Setting | Description | Factory Default |
|---|---|---|
| Input the key | Input the share key for first server authentication verification. | None |

***Authentication Type***

| Setting | Description | Factory Default |
|---|---|---|
| PAP | PAP is the authentication type. | CHAP |
| CHAP | CHAP is the authentication type. | |
| MS-CHAPv1 | MS-CHAPv1 is the authentication type. | |

***Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 5 to 180 | When waiting for a response from the server, set the time before timeout. | 5 |

***Retry (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 5 | Define the retry interval when reconnecting to a server. | 1 |

***Server Address 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the server address | Specify the second server address as the authentication database. | 0.0.0.0 |

***UDP Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port number | Specify the UDP port. | 1812 |

***Share Key***

| Setting | Description | Factory Default |
|---|---|---|
| Input the key | Specify the share key for second server authentication verification. | None |

***Authentication Type***

| Setting | Description | Factory Default |
|---|---|---|
| PAP | PAP is the authentication type. | CHAP |
| CHAP | CHAP is the authentication type. | |
| MS-CHAPv1 | MS-CHAPv1 is the authentication type. | |

***Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 5 to 180 | When waiting for a response from the server, set the time before the device is timed out. | 5 |

***Retry (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 5 | Set the retry interval when reconnecting to a server. | 1 |

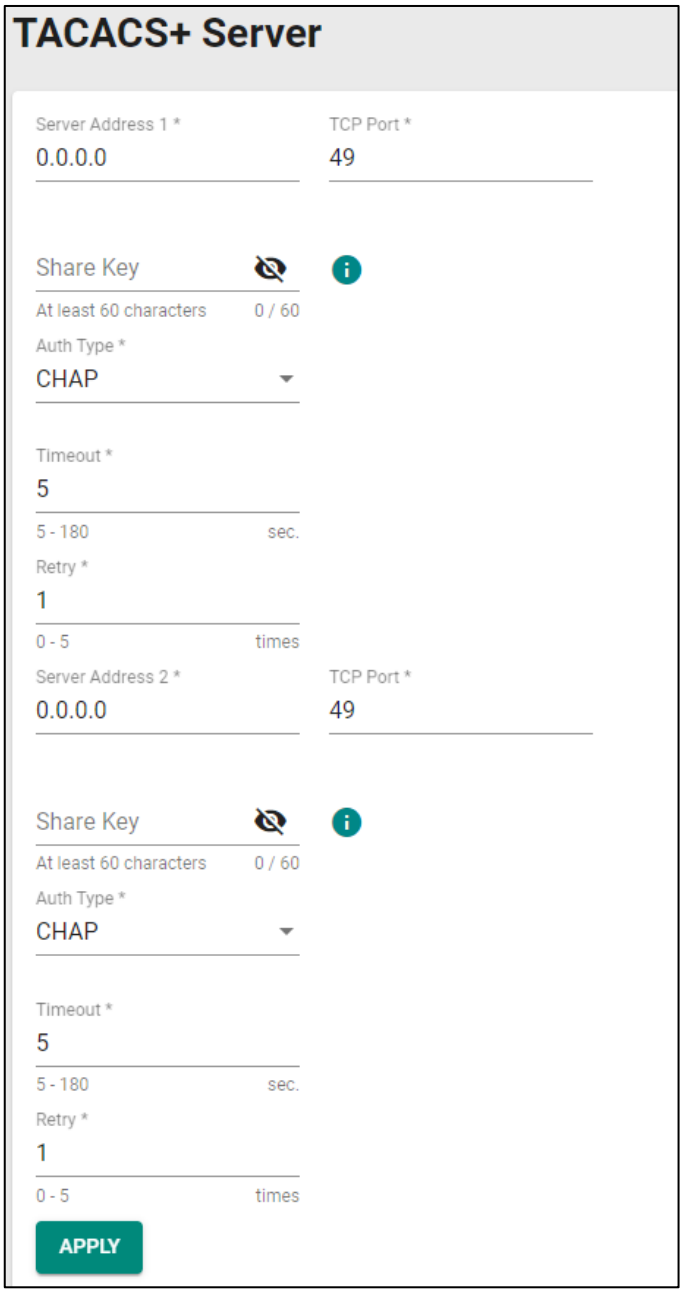
When finished, select **APPLY** to save your changes.

## NOTE

The RADIUS service will be operated via the first server; if it fails, it will run on the second server.

## TACACS+

Select **TACACS+** on the menu and then configure the following settings.




***Server Address 1***

| Setting | Description | Factory Default |
|---|---|---|
| Input the server address | Specify the first server address as the authentication database. | 0.0.0.0 |

***TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port number | Specify the UDP port. | 49 |

***Share Key***

| Setting | Description first | Factory Default |
|---|---|---|
| Input the key | Specify the share key for first server authentication verification. | None |

***Authentication Type***

| Setting | Description | Factory Default |
|---|---|---|
| ASCII | ASCII is the authentication type. | CHAP |
| PAP | PAP is the authentication type. | |
| CHAP | CHAP is the authentication type. | |

***Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| Input the value | When waiting for a response from the server, set the time before the device is timed out. | 5 |

***Retry***

| Setting | Description | Factory Default |
|---|---|---|
| Input the value | Set the retry interval when reconnecting to a server. | 1 |

***Server Address 2***

| Setting | Description | Factory Default |
|---|---|---|
| Input the server address | Specify the second server address as the authentication database. | 0.0.0.0 |

***TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| Input the port number | Specify the UDP port. | 49 |

***Share Key***

| Setting | Description | Factory Default |
|---|---|---|
| Input the key | Specify the share key for second server authentication verification. | None |

***Authentication Type***

| Setting | Description | Factory Default |
|---|---|---|
| ASCII | ASCII is the authentication type. | CHAP |
| PAP | PAP is the authentication type. | |
| CHAP | CHAP is the authentication type. | |

***Timeout (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| Input the value | When waiting for a response from the server, set the time before the device is timed out. | 5 |

***Retry***

| Setting | Description | Factory Default |
|---|---|---|
| Input the value | Set the retry interval when reconnecting to a server. | 1 |

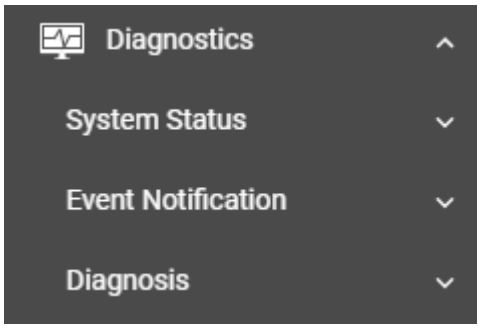
When finished, select **APPLY** to save your changes.

## NOTE

The TACACS+ service will be operated via the first server; if it fails, it will run on the second server.

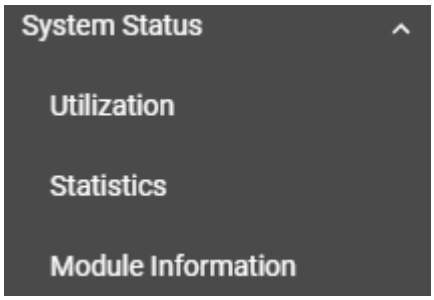
# Diagnostics

This section describes the diagnostics functions of the switch module. Select **Diagnostics** from the function menu.



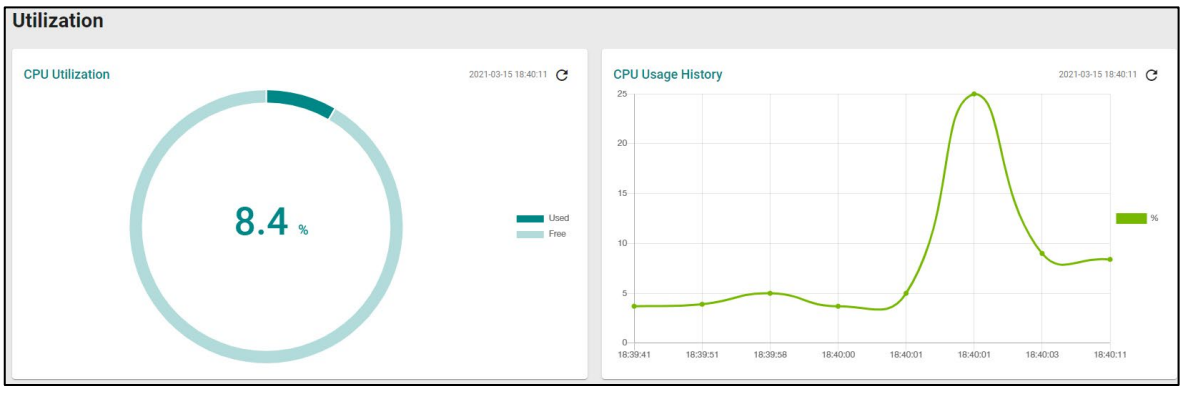

## System Status

This section allows you to view the current system status, including **Utilization**, **Statistics**, and **Module Information**.




### Utilization

Select **Utilization** on the function menu to view the current utilization status, including CPU utilization, memory history, power consumption, and power history. All the information is displayed via graphics, making it easier for you to view the system's status. In addition, a refresh icon is available on the upper right corner of each figure, which allows you to view the latest status for each function.

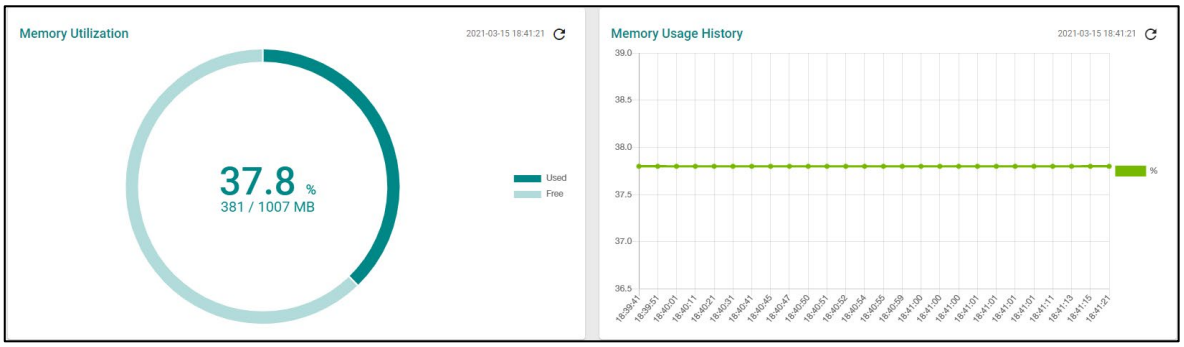



***CPU Utilization***

| Setting | Description | Factory Default |
|---|---|---|
| Read-only | Displays the current utilization of the CPU. | None |

***CPU Usage History***

| Setting | Description | Factory Default |
|---|---|---|
| Read-only | Displays the CPU usage history trend in a chart. | None |

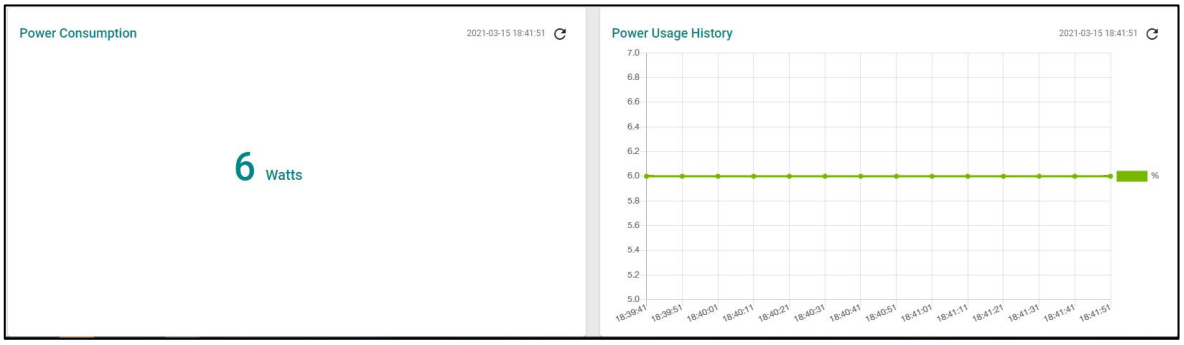



***Memory Utilization***

| Setting | Description | Factory Default |
|---|---|---|
| Read-only | Displays the memory status. | None |

***Memory Usage History***

| Setting | Description | Factory Default |
|---|---|---|
| Read-only | Displays the history of memory usage. | None |




***Power Consumption (watt)***

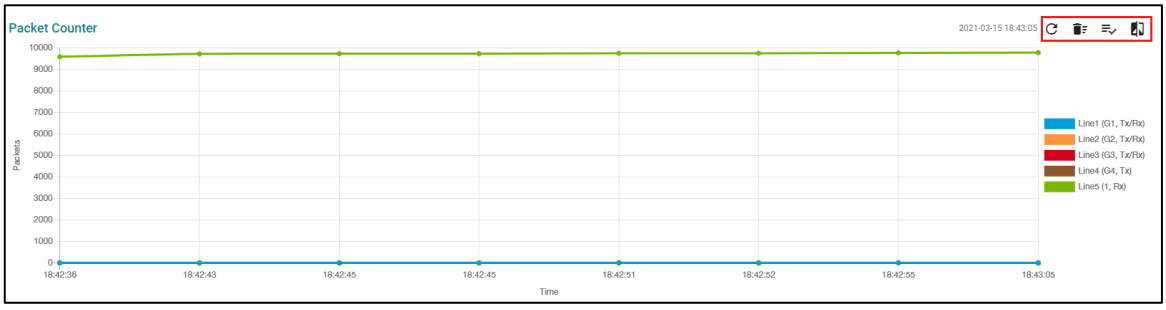
| Setting | Description | Factory Default |
|---|---|---|
| Read-only | Displays the power consumption status. | None |

***Power Usage History***

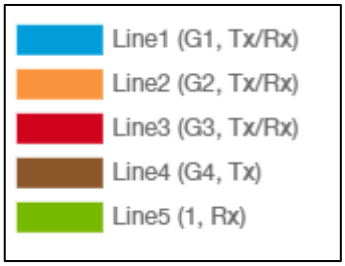
| Setting | Description | Factory Default |
|---|---|---|
| Read-only | Displays the history of power usage. | None |

## Statistics

Select **Statistics** on the function menu. The first figure shows the packet counter status.



The status of the different ports will be shown in different colors. A maximum of five ports will have their information displayed.




There are four icons on the right upper corner of the page. The table below describes each one.

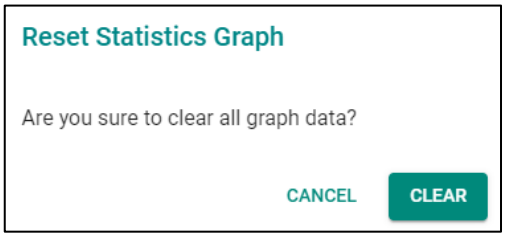
| Item | Name | Description |
|---|---|---|
| | Refresh | All statistical data will be refreshed. |
| | Reset Statistics Graph | The packet counter will be cleared, and the graphs will be reset. |
| | Display Setting | All selected setting items will be shown here. |
| | Data Comparison | Select the data you want to compare. |

## Refreshing the Statistics

Select the **Refresh** button and all statistical data will be refreshed immediately.

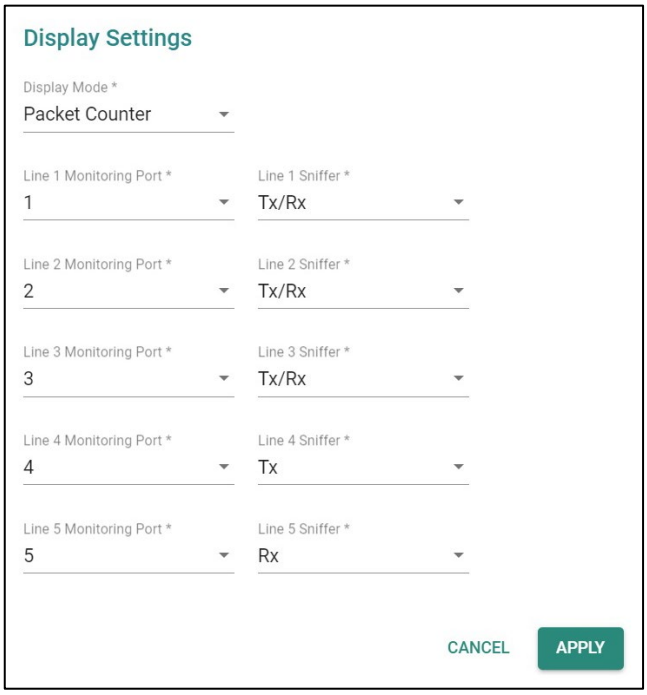
## Resetting Statistics Graph

Select the **Reset** button and then **CLEAR** to clear the packet counter and reset the graph.



## Display Setting

Select the **Display Setting** icon and all settings will be displayed. Select the display mode from the drop-down list.




The Monitoring Port is the port you want to view or monitor. The sniffer port is the port you can choose to view its receiving or transmission status, or both.

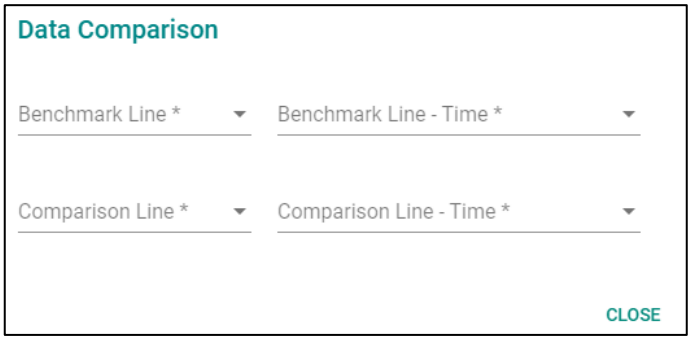
***Display Mode***

| Setting | Description | Factory Default |
|---|---|---|
| Packet Counter | The packet statistics will be displayed. | Packet Counter |
| Bandwidth Utilization | The bandwidth statistics will be displayed. | |

Select **APPLY** to complete.

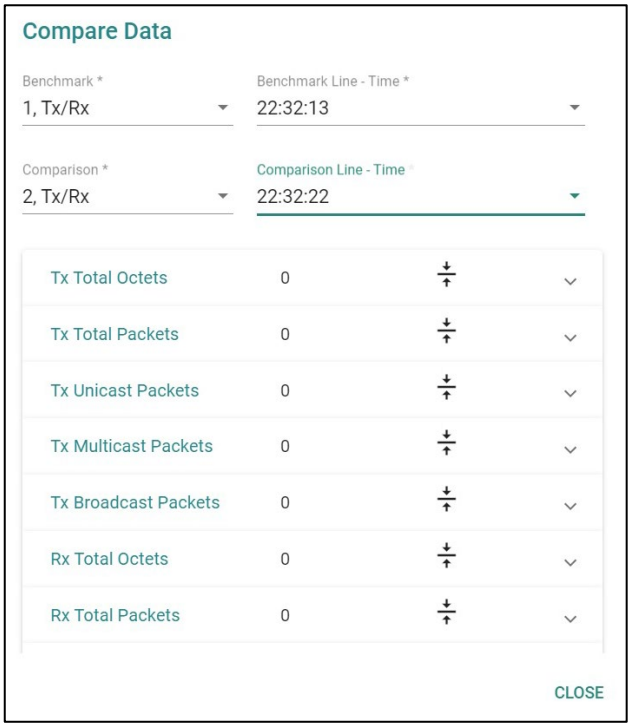
## Comparing Data

Select the **Data Comparison** icon and then select the items from the relevant fields.




Select **CLOSE** to complete.

The data comparison figure will be shown. Select **Close** to finish.




The detailed packet transmission activity for each port can be seen in the table below.

| Port | Tx Total Octets | Tx Total Packets | Tx Unicast Packets | Tx Multicast Packets | Tx Broadcast Packets | Rx Total Octets | Rx Total Packets | Rx Unicast Packets | Rx Multicast Packets | Rx Broadcast Packets |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11843056 | 15111 | 13375 | 1736 | 0 | 1974621 | 10329 | 10041 | 282 | 6 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| po1 | 11843056 | 15111 | 13375 | 1736 | 0 | 1974621 | 10329 | 10041 | 282 | 6 |

| Rx Pause Packets | Collision Packets | Late Collision Packets | Excessive Collision Packets | CRC Align Error Packets | Drop Packets | Undersize | Oversize Packets | Fragment Packets | Jabber Packets |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Port:** port number

**Tx Total Octets:** Number of octets transmitted, including bad packets and FCS octets. Framing bits are not included.

**Tx Total Packets:** Number of packets transmitted.

**Tx Unicast Packets:** Number of Unicast packets transmitted.

**Tx Broadcast Packets:** Number of good Broadcast packets transmitted. Multicast packets are not included.

**Rx Total Octets:** Number of octets received, including bad packets and FCS octets. Framing bits are not included.

**Rx Unicast Packets:** Number of Unicast packets received.

**Rx Multicast Packets:** Number of Multicast packets received.

**Rx Broadcast Packets:** Number of good Broadcast packets received. Multicast packets are not included.

**Rx Pause Packets:** Number of pause packets received.

**Collision Packets:** Number of collisions received. If Jumbo Frames are enabled, the threshold of Jabber Frames is raised to the maximum size of Jumbo Frames.

**Late Collision Packets:** Number of late collision packets.

**Excessive Collision Packets:** Number of excessive collision packets.

**CRC Align Error Packets:** Number of CRC and Align errors that have occurred.

**Drop Packets:** Number of packets that were dropped.

**Undersize:** Number of undersized packets (less than 64 octets) received.

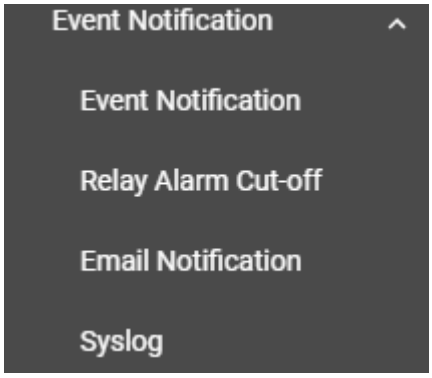
**Oversize Packets:** Number of oversized packets (over 1518 octets) received.

**Fragment Packets:** Number of fragments (packets with less than 64 octets, excluding framing bits, but including FCS octets) received.

**Jabber Packets:** Number of received packets that were longer than 1632 octets. This number excludes frame bits but includes FCS octets that had either a bad FCS (Frame Check Sequence) with an integral number of octets (FCS Error) or a bad FCS with a non-integral octet (Alignment Error) number.

## Event Notification

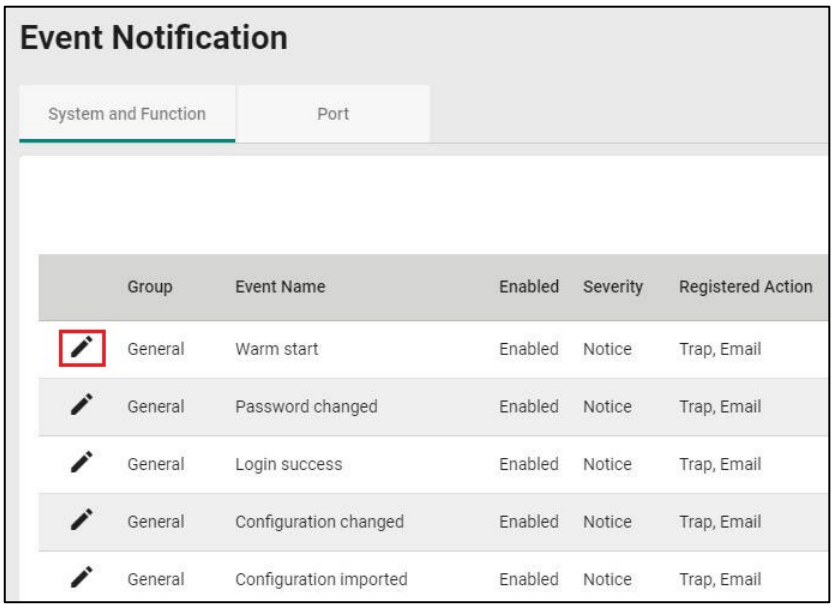
This section includes the information regarding **Event Notification, Email Notification**, and **Syslog**.



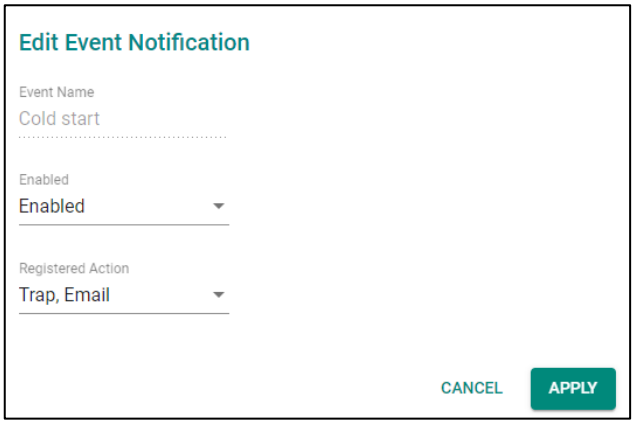
## Event Notification

Event Notification includes two functions: System and Function, and Port.

In the **Event Notification** menu, select the **System and Function** tab and then the edit icon on the specific event you want to configure. For example, select the edit icon for warm start when the switch reboots.




Configure the following settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Event Notification for this event. | Enabled |
| Disabled | Disable Event Notification for this event. | |

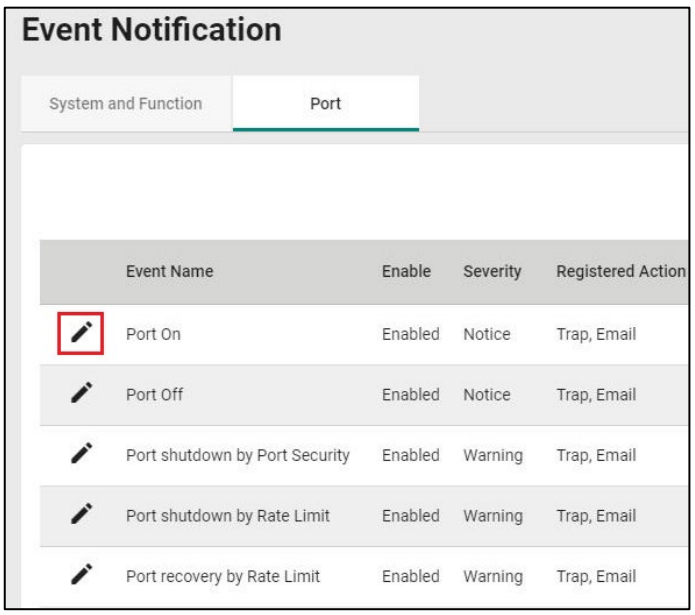
***Registered Action***

| Setting | Description | Factory Default |
|---|---|---|
| Trap | Send SNMP Trap for event notifications. | Trap/Email |
| Email | Send an email for event notifications. | |

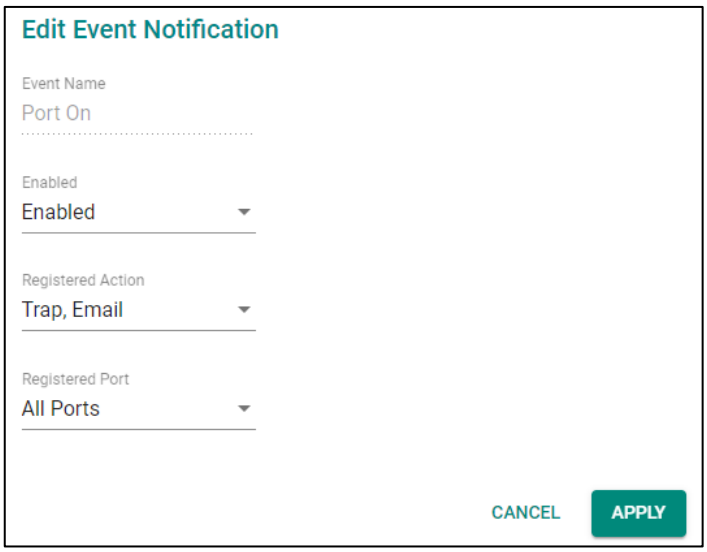
When finished, select **APPLY** to save your changes.

In addition, use the same method to edit other events, such as login lockout, warm start, password changed, etc.

Next, in the **Event Notification** menu, select the **Port** tab, and then select the edit icon on the specific port status on **Event Name**. For example, select the edit icon for event notifications when the port status is on.




Configure the following settings.




***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Event Notification for this event. | Enabled |
| Disabled | Disable Event Notification for this event. | |

***Registered Action***

| Setting | Description | Factory Default |
|---|---|---|
| Trap | Send SNMP Trap for event notifications. | Trap/Email |
| Email | Send an email for event notifications. | |

***Registered Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select port(s) from the drop-down list | Specify the port(s) that use the registered action. | All Ports |

When finished, select **APPLY** to save your changes.

In addition, use the same method to edit other events such as, port status is off, port shutdown by port security, and port recovery by rate limit, etc.

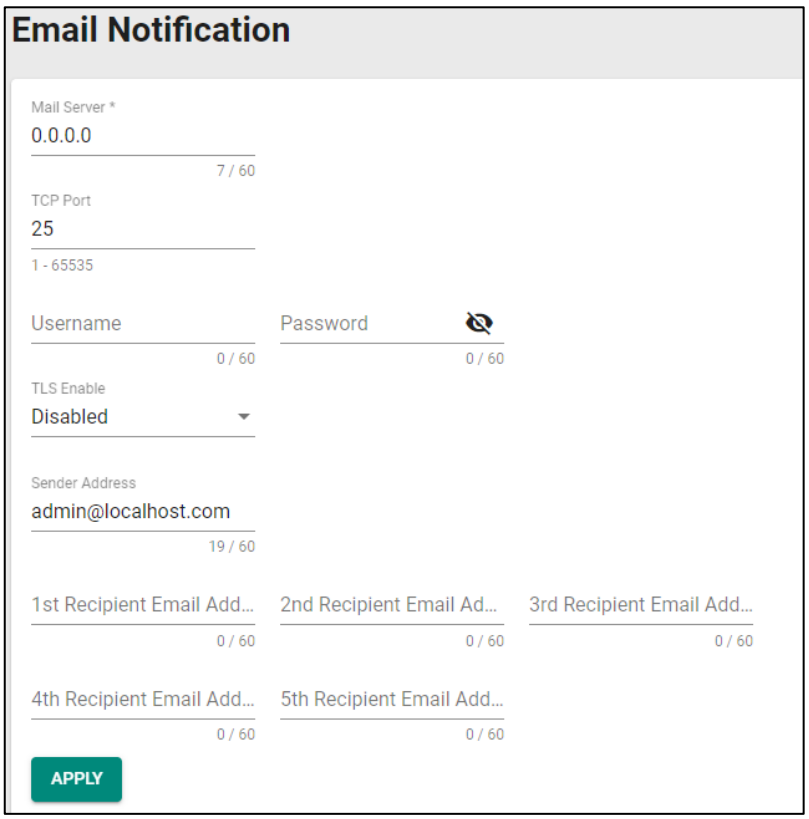
Check the following table for the severity degree of each event.

| System & Function | |
|---|---|
| **Event Name** | **Severity** |
| Cold start | Critical |
| Warm start | Notice |
| Configuration changed | Notice |
| Login success | Notice |
| Login fail | Warning |
| Login lockout | Warning |
| Account setting changed | Notice |
| Configuration imported | Notice |
| SSL certification changed | Notice |
| Log capacity threshold | Warning |
| Password changed | Notice |
| PWR Off->On | Notice |
| PWR On->Off | Notice |
| Topology changed | Warning |
| Coupling changed | Warning |
| Master changed | Warning |
| Master mismatch | Warning |
| RSTP topology changed | Warning |
| RSTP root changed | Warning |
| RSTP migration | Warning |
| RSTP invalid BPDU | Warning |
| RSTP new port role | Warning |
| Redundant port health check fail | Error |
| Dual homing path changed | Warning |
| Dot1X auth fail | Warning |
| LLDP table changed | Information |
| RMON raising alarm | Warning |
| RMON failing alarm | Warning |

| Port | |
|---|---|
| **Event Name** | **Severity** |
| Port On | Notice |
| Port Off | Notice |
| Port shutdown by Port Security | Warning |
| Port shutdown by Rate Limit | Warning |
| Port recovery by Rate Limit | Warning |

## Email Notification

Select **Email Notification** on the function menu and configure the following settings.




***Mail Server***

| Setting | Description | Factory Default |
|---|---|---|
| IP address or URL | The IP Address or URL of the email server. | 0.0.0.0 |

***TCP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | The TCP port number of your email server. | 25 |

***User Name***

| Setting | Description | Factory Default |
|---|---|---|
| Max. of 60 characters | Your email account name. | None |

***Password***

| Setting | Description | Factory Default |
|---|---|---|
| Max. of 60 characters | Your email account password. | None |

***TLS Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable TLS (Transport Layer Security). | Disabled |
| Disabled | Disable TLS (Transport Layer Security). | |

***Sender Address***

| Setting | Description | Factory Default |
|---|---|---|
| Max. 60 characters | The sender's email address. | admin@localhost |

***First to Fifth Email Addresses***

| Setting | Description | Factory Default |
|---|---|---|
| Max. of 60 characters | Set up maximum five email addresses to receive alert emails from the switch module. | None |

When finished, select **APPLY** to save your changes.

## Syslog Settings

Select the **General** tab on the function menu and configure the following settings.


***Logging Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable logging. | Disabled |
| Disabled | Disable logging. | |

***Syslog Server 1***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the first log server. | Disabled |
| Disabled | Disable the first log server. | |

***Address 1***

| Setting | Description | Factory Default |
|---|---|---|
| IP Address | Input the IP address of the Syslog first server that is used by your network. | None |

***UDP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the UDP port number. | 514 |

***Syslog Server 2***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the second syslog server. | Disabled |
| Disabled | Disable the second syslog server. | |

***Address 2***

| Setting | Description | Factory Default |
|---|---|---|
| IP Address | Input the IP address of Syslog second server that is used by your network. | None |

***UDP Port***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the UDP port number. | 514 |

***Syslog Server 3***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the third syslog server. | Disabled |
| Disabled | Disable the third syslog server. | |

***Address 3***

| Setting | Description | Factory Default |
|---|---|---|
| IP Address | Input the IP address of the Syslog third server that is used by your network. | None |

***UDP Port***

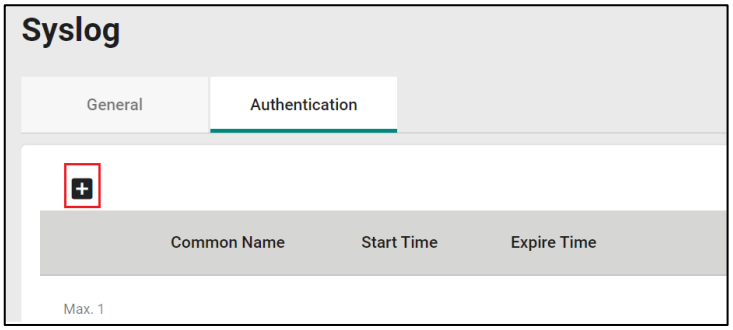
| Setting | Description | Factory Default |
|---|---|---|
| 1 to 65535 | Input the UDP port number. | 514 |

When finished, select **APPLY** to save your changes.

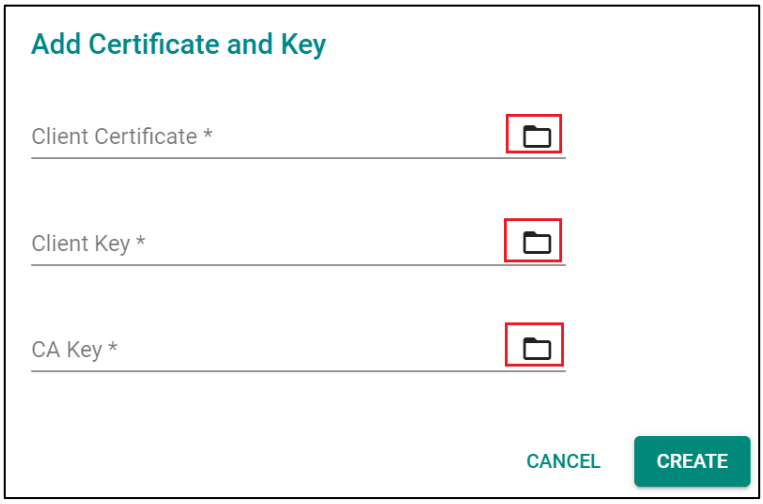
## NOTE

If the syslog server cannot receive the previous logs, it is possible that the receiving port of the syslog server is not ready. We suggest you enable the Linkup Delay function to delay the log delivery time.

Select **Authentication** tab and add the icon in the function menu.



Configure the following settings.




***Client Certificate***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import icon and then the file from your computer. | Import the client certificate file. | None |

***Client Key***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import icon and then the file from your computer. | Import the client key file. | None |

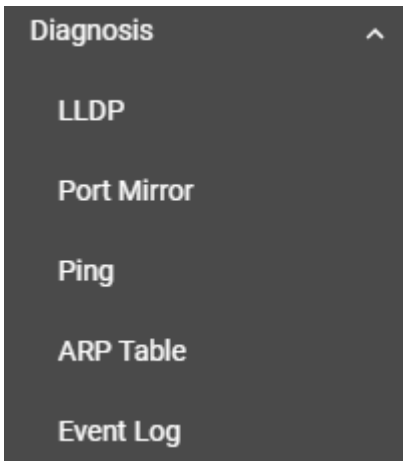
***CA Key***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import icon and then select the file from your computer. | Import the CA key file. | None |

When finished, select **CREATE** to save your changes.

# Diagnosis

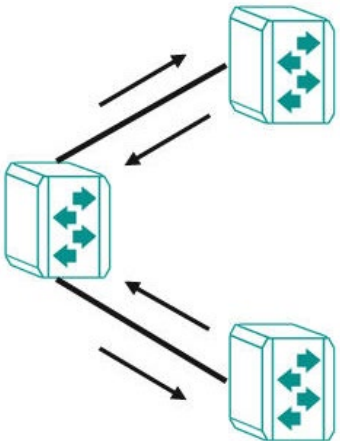
This section explains the configurations for system diagnoses, such as **LLDP**, **Port Mirror**, **Ping**, **ARP Table**, and **Event Log**.



## LLDP Overview

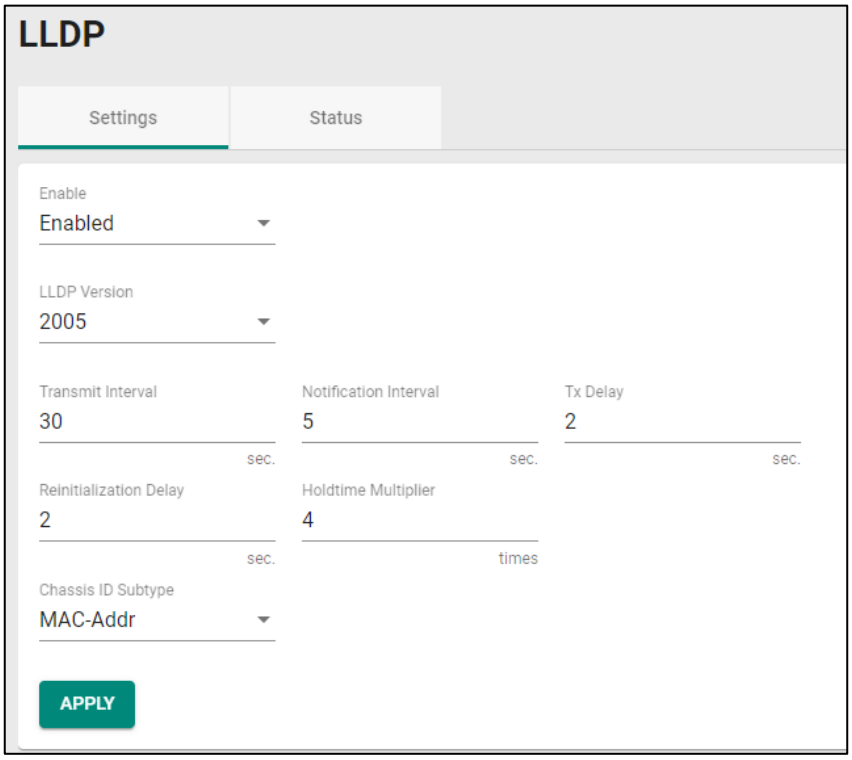
LLDP is an OSI Layer 2 protocol defined by IEEE 802.11AB. LLDP standardizes the self-identification advertisement method, and allows each networking device, such as a Moxa managed switch, to periodically send its system and configuration information to its neighbors. Because of this, all LLDP devices are kept informed of each other's status and configurations. With SNMP, this information can be transferred to Moxa's MXview for auto-topology and network visualization.

From the switch's web interface, enable or disable LLDP, and set the LLDP transmit interval. In addition, you can view each switch's neighbor-list, which is reported by its network neighbors. Most importantly, enabling the LLDP function allows Moxa's MXview to automatically display the network's topology and system setup details, such as VLAN and trunking for the entire network.



## LLDP Settings and Status

Select **LLDP** on the menu and then the **Setting** tab to configure the following settings.



***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable LLDP. | Disabled |
| Disabled | Disable LLDP. | |

***LLDP Version***

| Setting | Description | Factory Default |
|---|---|---|
| Show the LLDP version | Show the LLDP version automatically. | 2005 |

***Transmit Interval (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 5 to 32768 | Set the transmit interval of LLDP messages | 30 |

***Notification Interval (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 5 to 3600 | Specify the notification interval. | 5 |

***Tx Delay (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 8192 | Specify the Tx delay interval. | 2 |

***Reinitialization Delay (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 10 | Specify the LLDP reinitialization delay interval. | 2 |

***Holdtime Multiplier***

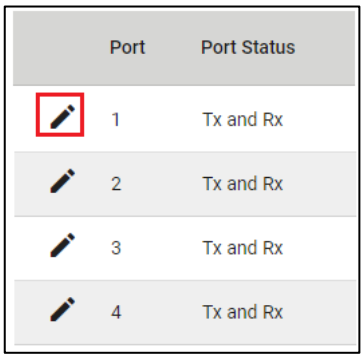
| Setting | Description | Factory Default |
|---|---|---|
| 2 to 10 | Specify the holdtime multiplier value. | 4 |

***Chassis ID Subtype***

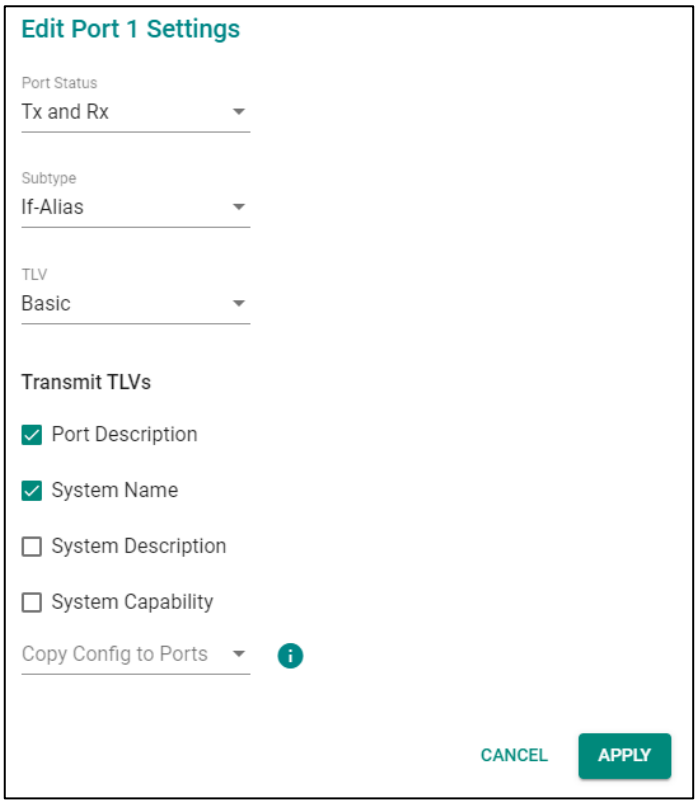
| Setting | Description | Factory Default |
|---|---|---|
| Chassis-Component | Select Chassis-Component as Chassis ID subtype. | Mac-Addr |
| If-Alias | Select If-Alias as Chassis ID subtype. | |
| Port-Component | Select Port-Component as Chassis ID subtype. | |
| MAC-Addr | Select MAC-Address as Chassis ID subtype. | |
| Network Address | Select Network Address as Chassis ID subtype. | |
| If-Name | Select If-Name as Chassis ID subtype. | |
| Local | Select Local as Chassis ID subtype. | |

When finished, select **APPLY** to save your changes.

Each port for the LLDP settings can also be configured. Select the edit icon for the port you want to configure.



Configure the following settings.




***Port Status***

| Setting | Description | Factory Default |
|---|---|---|
| Tx Only | Set Tx as the port status. | Tx and Rx |
| Rx Only | Set Rx as the port status. | |
| Tx and Rx | Set both Tx and Rx as the port status. | |

***Subtype***

| Setting | Description | Factory Default |
|---|---|---|
| If-Alias | Select If-Alias as the subtype. | If-Alias |
| Port-Component | Select Port-Component as the subtype. | |
| MAC-Addr | Select MAC-Address as the subtype. | |
| If-Name | Select If-Name as the subtype. | |
| Local | Select Local as the subtype. | |

***TLV***

| Setting | Description | Factory Default |
|---|---|---|
| Basic | Set TLV as Basic. | Basic |
| 802.1 | Set TLV as 802.1. | |
| 802.3 | Set TLV as 802.3. | |

***Transmit TLVs***

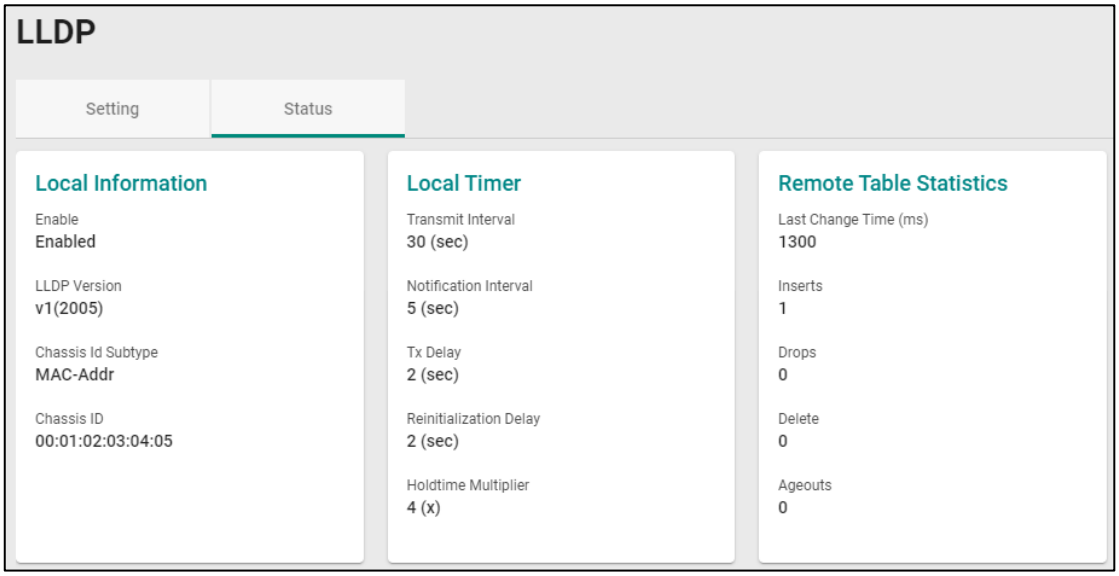
| Setting | Description | Factory Default |
|---|---|---|
| Port Description | Add a port description for the TLV. | Port Description<br>System Name |
| System Name | Add a system name for the TLV. | |
| System Description | Add a system description for the TLV. | |
| System Capability | Add a system capability for the TLV. | |

***Copy Config to Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Copy the same configurations to other port(s). | None |

When finished, select **APPLY** to save your changes.

To view the LLDP status, select the **Status** tab on the LLDP page, and the status of all LLDP will be shown on the page.



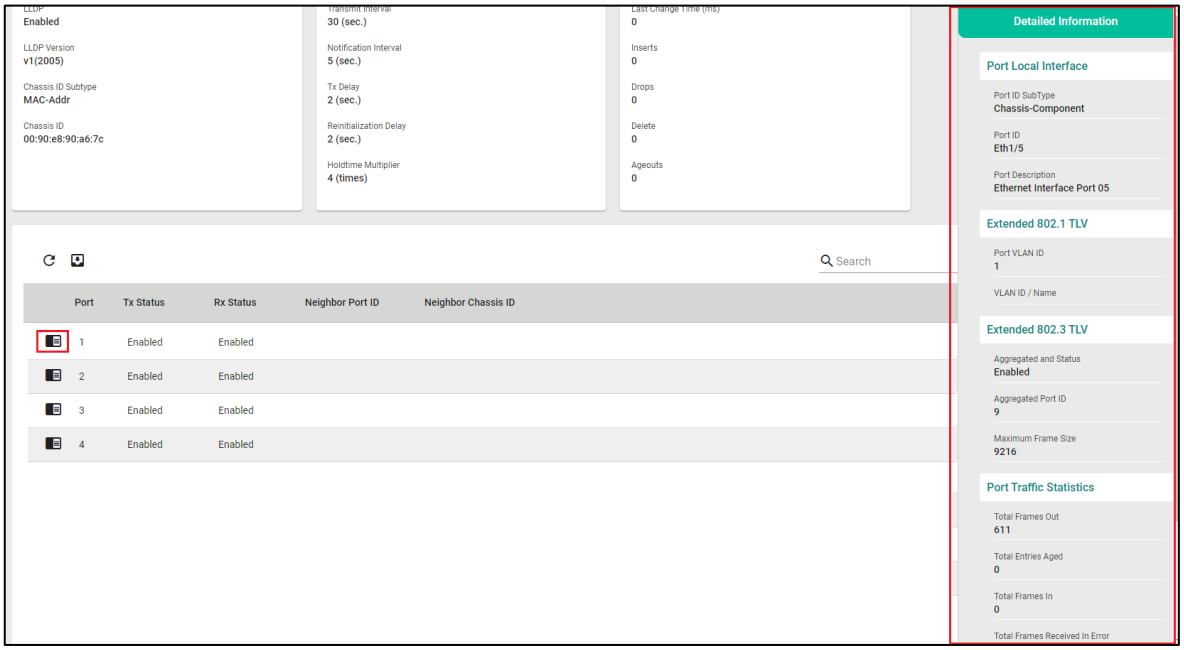

Refer to the following table for the detailed description of each item.

| **Local Information** | |
|---|---|
| Enable | Show if LLDP has been enabled or disabled. |
| LLDP Version | Show the LLDP version. |
| Chassis ID Subtype | Show the chassis ID subtype. |
| Chassis ID | Show the chassis ID. |

| **Local Timer** | |
|---|---|
| Transmit Interval (sec.) | The interval between regular LLDP packet transmissions. |
| Notification Interval (sec.) | The interval that notifications will be sent. |
| Tx Delay (sec.) | The delay period between successive LLDP frame transmissions initiated by changes. |
| Reinitialization Delay (sec.) | The interval of an LLDP port waits before re-initializing an LLDP packet transmission. |
| Holdtime Multiplier | The time that the receiving device holds an LLDP packet before discarding it. |

| **Remote Table Statistics** | |
|---|---|
| Last Change Time (ms.) | The last time the remote table changed. |
| Inserts | How many inserts have occurred. |
| Drop | How many drops have occurred. |
| Delete | How many deletes have occurred. |
| Age-outs | How many age-outs have occurred. |

To view the LLDP status for a specific port, select the detailed information icon on the port. All information will be shown on the right side of the page.



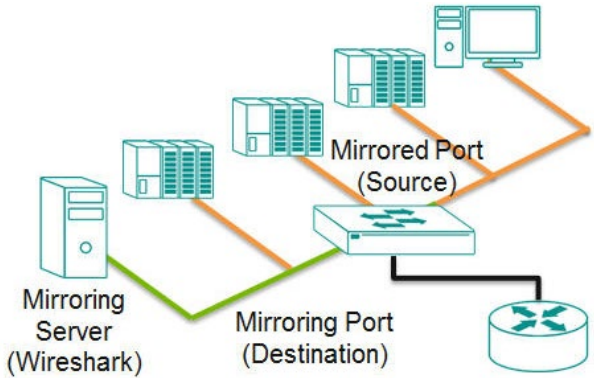

# Port Mirroring

## Port Mirroring Overview

The Port Mirroring function can be used to monitor data being transmitted through a specific port. This is done by setting up another port (the mirror port) to receive the same data being transmitted from, or both to and from, the port under observation. Using a mirror port allows the network administrator to sniff the observed port to keep tabs on network activity.

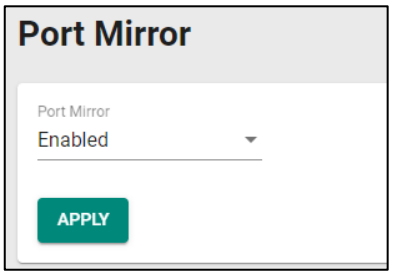
# How Port Mirror Works

Port Mirroring can configure to copy one or more packets from various ports to a single port, so that you can check if there are problems occurring in these ports. For example, the following figure demonstrates how the packets transmitted in the four mirrored ports (marked in orange) are copied (mirrored) to a single mirroring port (marked in green). These packets will be sent to a monitoring computer and then software is used to check if there is something wrong with these packets. It is a useful function to troubleshoot or debug a network data transmission issue.



## Port Mirror Settings and Status

Select Port Mirror on the menu and then configure the settings.

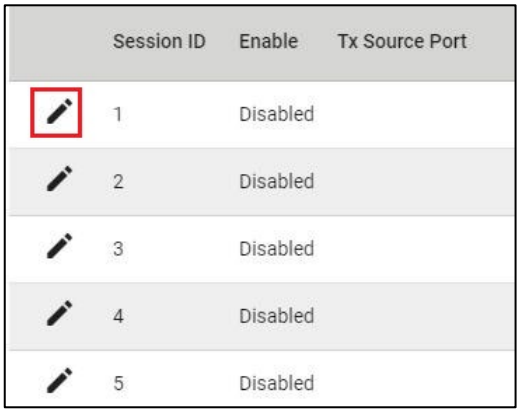



***Enable***

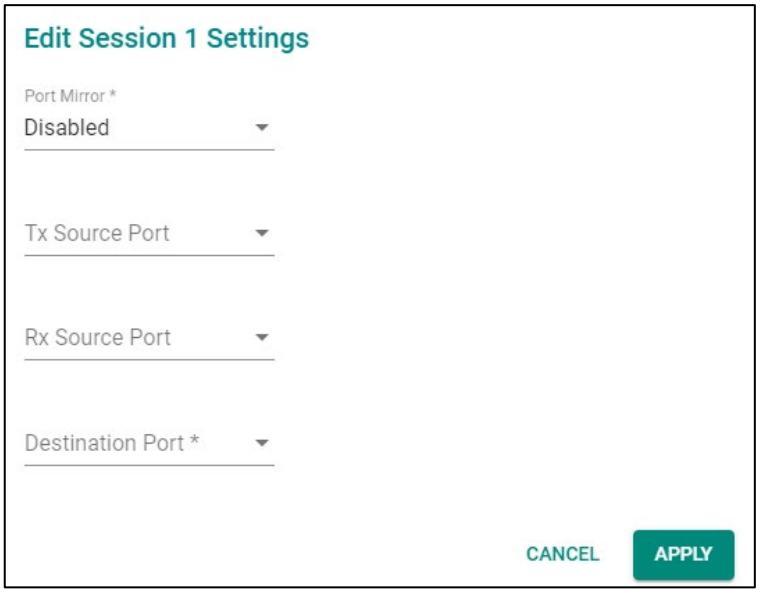
| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Port Mirror. | Enabled |
| Disabled | Disable Port Mirror. | |

When finished, select **APPLY** to save your changes.

To configure the specific port, select the edit icon next to the port.




Configure the following settings.



***Enable***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable Port Mirror for this session. | Disabled |
| Disabled | Disable Port Mirror for this session. | |

***Tx Source Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Select this option to monitor only those data packets being sent out through the switch's port. | None |

***Rx Source Port***

| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Select this option to monitor only those data packets coming into the switch's port. | None |

***Destination Port***

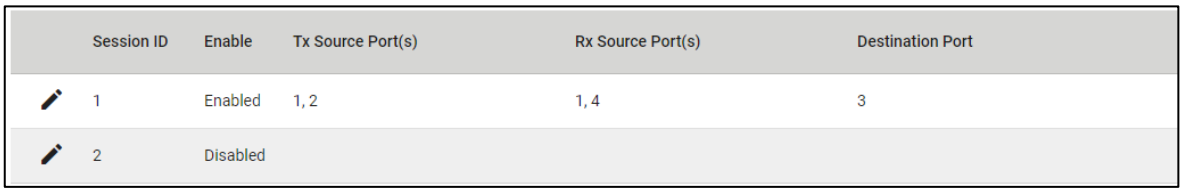
| Setting | Description | Factory Default |
|---|---|---|
| Select the port from the list | Specify this port as the destination port. | None |

When finished, select **APPLY** to save your changes.

**NOTE**

The RSTP ports and Port Mirror destination port cannot be enabled on the same port.

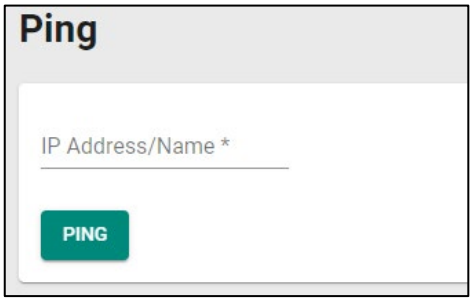
The Port Mirror status can be seen in the figure below.




## Ping

The **Ping** function uses the ping command to give you a simple but powerful tool for troubleshooting network problems. The unique feature of the function is that even though the ping command is entered from the your PC, the actual ping command originates from the switch module itself. This allows you to essentially sit on top of the switch module and send ping commands out through its ports.

To use the Ping function, select **Ping** on the menu, and enter the IP address or domain name you want to ping. After selecting **Ping**, the result will be shown.

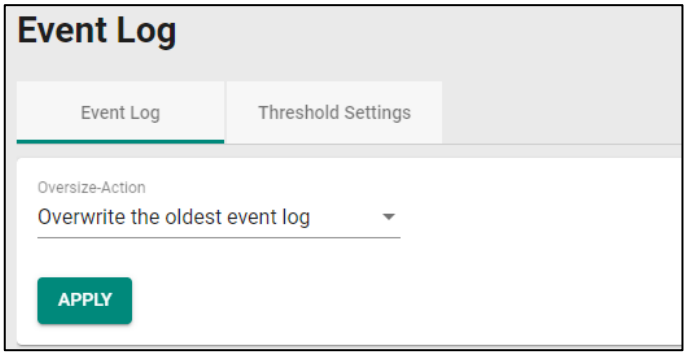


## ARP Table

To view the ARP Table, select **ARP Table** and the information will be displayed.


## Event Log

To edit the event log oversize-action, select **Event Log** on the menu and then **Event Log** on the page.




Configure the following settings when the event log file is full.

***Oversize-action***

| Setting | Description | Factory Default |
|---|---|---|
| Overwrite the oldest event log | Overwrite the oldest event log. | Overwrite the oldest event log |
| Stop recording event log | Disable Port Mirror for this port. | |

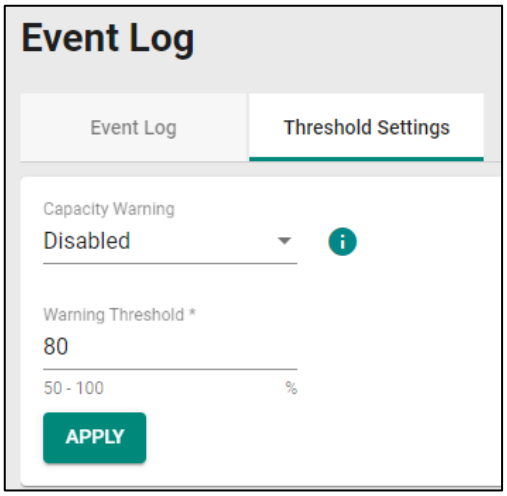
Select **APPLY** to finish.

To view all the event formation, check the lower part of the event log page.

| Index | Bootup Number | Severity | Timestamp | Uptime | Message |
|---|---|---|---|---|---|
| 1 | 16 | Notice | 2018-12-27 21:47:10 | 0d4h52m3s | Configuration ['Account'] changed by admin. |
| 2 | 16 | Notice | 2018-12-27 21:41:20 | 0d4h46m13s | Configuration ['Port Security'] changed by admin. |
| 3 | 16 | Notice | 2018-12-27 21:36:48 | 0d4h41m41s | Configuration ['Port Security'] changed by admin. |
| 4 | 16 | Notice | 2018-12-27 21:21:34 | 0d4h26m27s | Configuration ['Trusted Access'] changed by admin. |
| 5 | 16 | Notice | 2018-12-27 21:12:24 | 0d4h17m17s | Configuration ['Mgmt Interface'] changed by admin. |
| 6 | 16 | Notice | 2018-12-27 21:05:41 | 0d4h10m34s | Configuration ['SNMP'] changed by admin. |
| 7 | 16 | Notice | 2018-12-27 21:04:13 | 0d4h9m6s | Configuration ['SNMP'] changed by admin. |
| 8 | 16 | Notice | 2018-12-27 20:57:08 | 0d4h2m1s | Configuration ['L2 Redundancy'] changed by admin. |
| 9 | 16 | Notice | 2018-12-27 20:56:09 | 0d4h1m2s | Port 1/2 has restarted by Turbo Chain. |
| 10 | 16 | Notice | 2018-12-27 20:56:08 | 0d4h1m1s | Port 1/1 has restarted by Turbo Chain. |
| 11 | 16 | Notice | 2018-12-27 20:56:06 | 0d4h0m59s | Configuration ['L2 Redundancy'] changed by admin. |
| 12 | 16 | Warning | 2018-12-27 20:55:11 | 0d4h0m4s | Topology has been changed by Turbo Chain. |
| 13 | 16 | Notice | 2018-12-27 20:55:11 | 0d4h0m4s | Port 1/2 has restarted by Turbo Chain. |
| 14 | 16 | Notice | 2018-12-27 20:55:11 | 0d4h0m4s | Port 1/1 has restarted by Turbo Chain. |
| 15 | 16 | Notice | 2018-12-27 20:55:08 | 0d4h0m1s | Configuration ['Turbo Chain'] changed by admin. |
| 16 | 16 | Notice | 2018-12-27 20:54:54 | 0d3h59m47s | Configuration ['L2 Redundancy'] changed by admin. |

## Threshold Settings

To configure the event log threshold, select the **Threshold Setting** tab on the Event Log Page. The event log threshold can be set up to send an early warning when the event log entries have reached the percentage of the threshold. The maximum recorded event log entries are 10,000.



Configure the following settings.

***Capacity Warning***

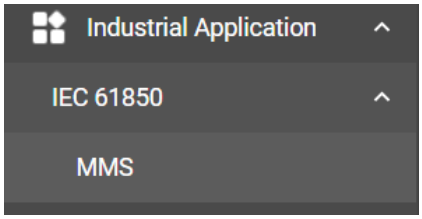
| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable capacity warning event log. | Disabled |
| Disabled | Disable capacity warning event log. | |

***Warning Threshold (%)***

| Setting | Description | Factory Default |
|---|---|---|
| 50 to 100 | Set the warning threshold as a percentage. | 80 |

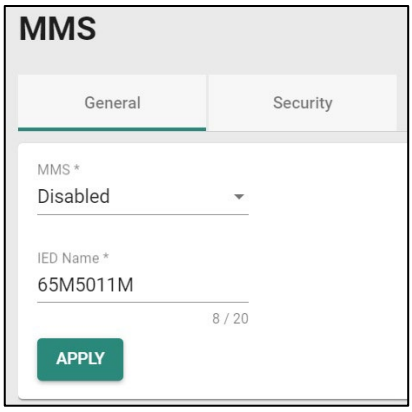
# Industrial Applications

This section introduces the settings for the MMS of the IEC 61850 standard. Select **MMS** in the function menu under **Industrial Application** and **IEC 61850**.




## General Settings

Select the **General** tab for further configurations.




Configure the following settings.

***MMS***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the MMS function on the switch. | Disabled |
| Disabled | Disable the MMS function on the switch. | |

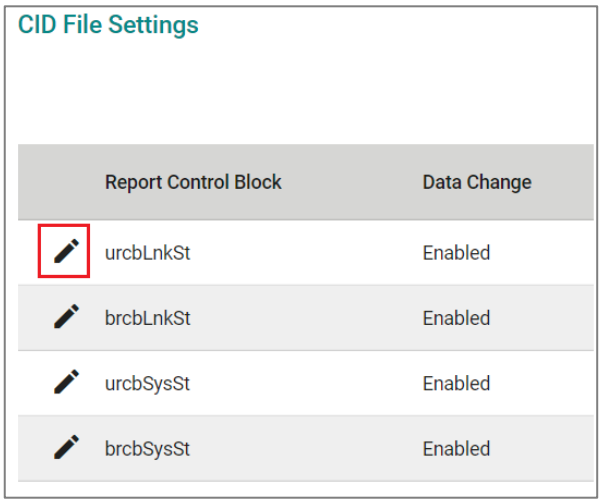
***IED Name***

| Setting | Description | Factory Default |
|---|---|---|
| 0 to 20 characters | Provide the IED name for your switch. | RKS-G4000 (Will vary depending on the switch models) |

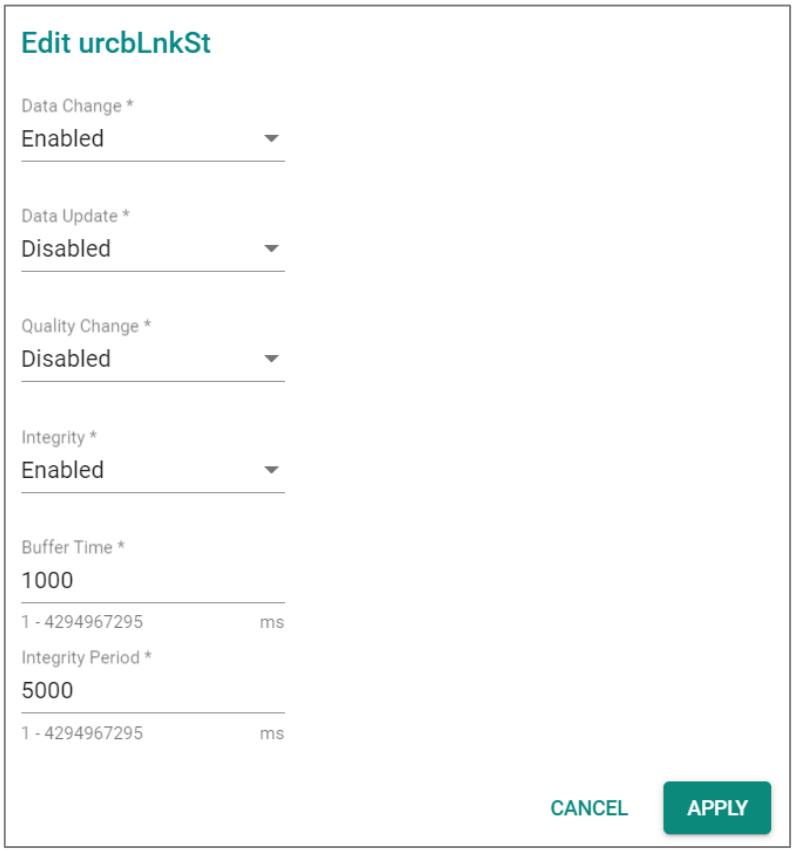
When finished, select **APPLY** to save your changes.

## CID File Settings

Select the edit icon on the page.




Configure the following settings.




***Data Change***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the Data Change function. | Enabled |
| Disabled | Disable the Data Change function. | |

***Data Update***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the Data Update function. | Disabled |
| Disabled | Disable the Data Update function. | |

***Quality Change***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the Quality Change function. | Disabled |
| Disabled | Disable the Quality Change function. | |

***Integrity***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable the Integrity function. | Enabled |
| Disabled | Disable the Integrity function. | |

***Buffer Time***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 4294967295 (ms) | Provide the buffer time value. | 1000 |

***Integrity Period***

| Setting | Description | Factory Default |
|---|---|---|
| 1 to 4294967295 (ms) | Provide the integrity period value. | 5000 |

When finished, select **APPLY** to save your changes.

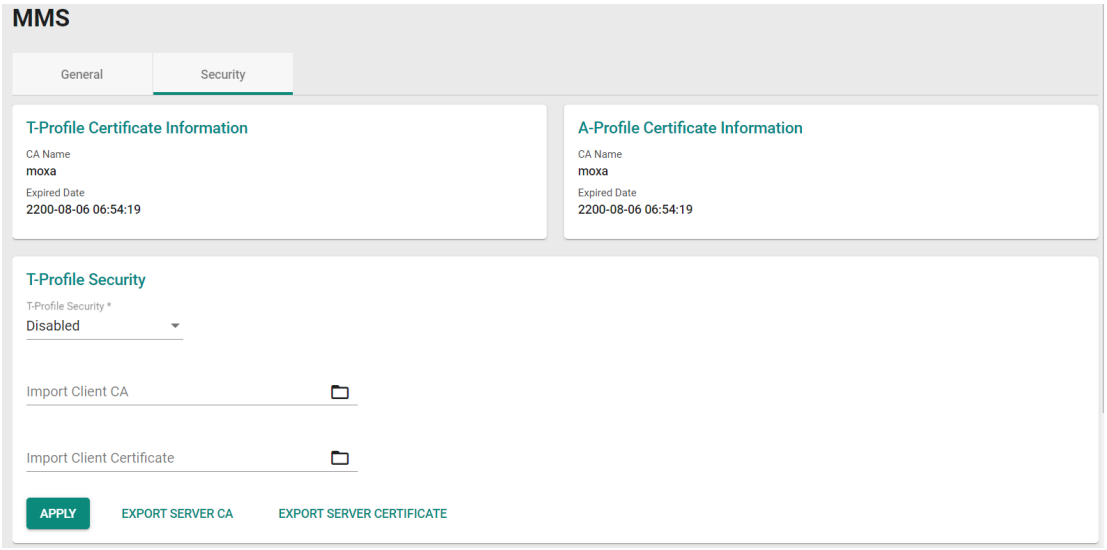
## Exporting CID File

To export the CID file, select **EXPORT CID FILE**.


The file will be downloaded to your local computer.

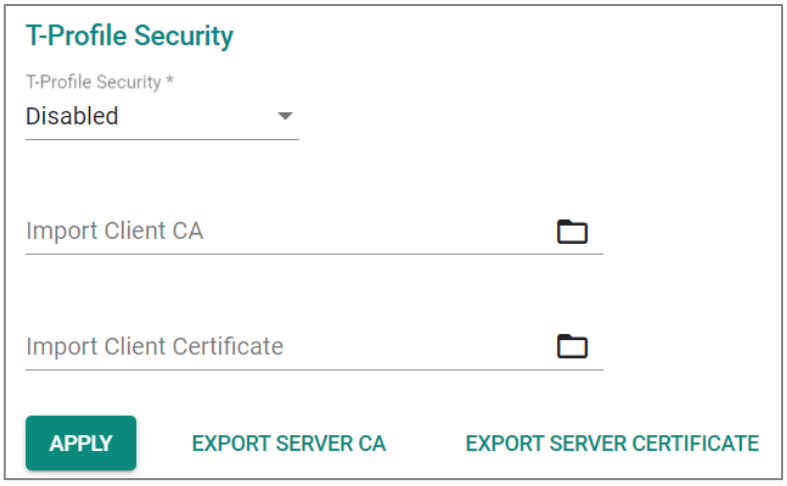
# Security Settings

Select the **Security** tab, where you can view the information for **T-Profile** and **A-Profile** Certificates.



## T-Profile Security Settings

Configure the following settings for T-Profile Security.




***T-Profile Security***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable T-Profile Security. | Disabled |
| Disabled | Disable T-Profile Security. | |

***Import Client CA***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import icon on the right. | Import Client CA file from your local computer | None |

***Import Client Certificate***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import icon on the right. | Import Client Certificate file from your local computer | None |

When finished, select **APPLY** to complete.

### Export Server CA

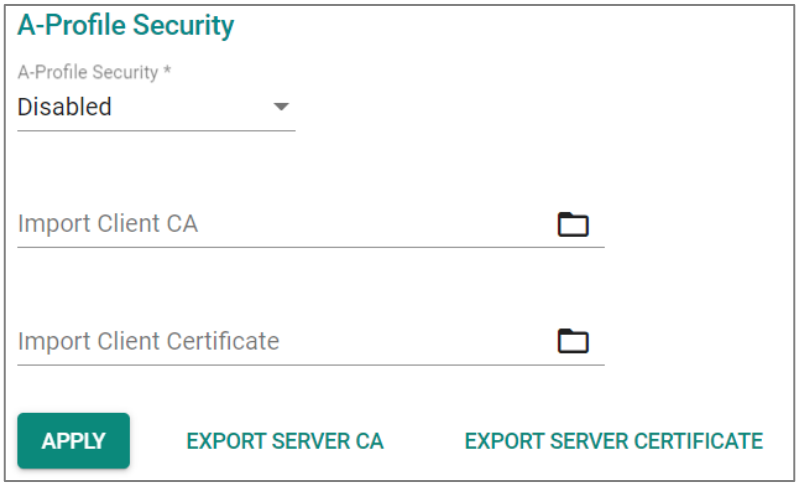
To export the Server CA, select **EXPORT SERVER CA**, the file will be downloaded to your local computer.


### Export Server Certificate

To export the Server Certificate, select **EXPORT SERVER CERTIFICATE**, the file will be downloaded to your local computer.

## A-Profile Security Settings

Configure the following settings for A-Profile Security.




***A-Profile Security***

| Setting | Description | Factory Default |
|---|---|---|
| Enabled | Enable A-Profile Security | Disabled |
| Disabled | Disable A-Profile Security | |

***Import Client CA***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import icon on the right | Import Client CA file from your local computer | None |

***Import Client Certificate***

| Setting | Description | Factory Default |
|---|---|---|
| Select the import icon on the right | Import Client Certificate file from your local computer | None |

When finished, select **APPLY** to complete.

### Exporting Server CA

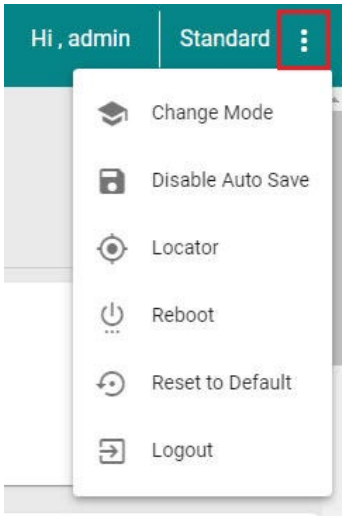
To export Server CA, select **EXPORT SERVER CA**. The file will be downloaded to your local computer.


### Exporting Server Certificate

To export Server Certificate, select **EXPORT SERVER CERTIFICATE**. The file will be downloaded to your local computer.

# Maintenance and Tool

This section explains how to maintain the switch module and the tools that help you operate the switch. Select the icon on the upper right corner of the page.

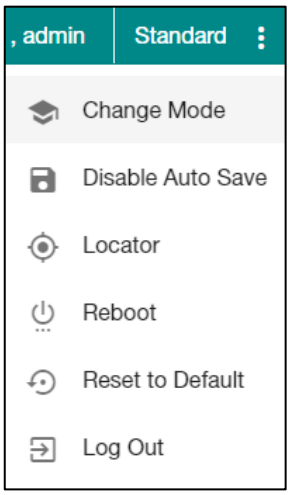



## Standard/Advanced Mode

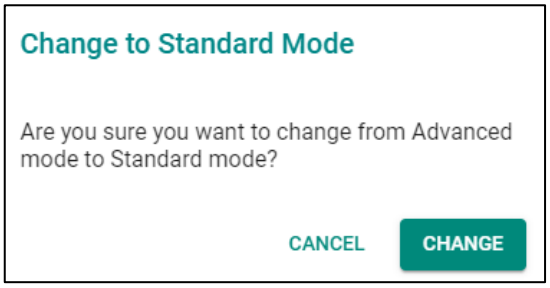
Two configuration modes are available: **Standard Mode** and **Advanced Mode**.

1. In **Standard Mode**, some of the features/parameters will be hidden to make it easier to perform configurations (this is the default setting).
2. In **Advanced Mode**, some advanced features/parameters will be available for you to adjust these settings.

To switch to Advanced Mode, select the change mode icon on the upper right corner of the page and then **Change Mode**.



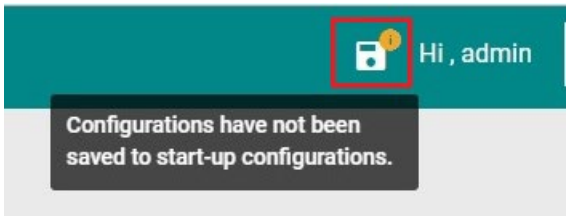
Select **CHANGE** to change to **Advanced Mode**.




Advanced Mode offers more detailed system configurations for specific functions. Use the same process if you want to return to Standard Mode.

## Disable Auto Save

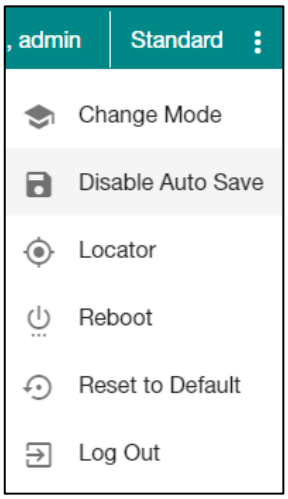
Auto Save allows you to save the settings to the start-up configurations; all parameters will be effective when applied immediately, even when the switch has restarted. When you select **Disable Auto Save**, all parameters will be temporarily stored in the running config (memory), and a disk icon will appear on the upper right corner of the page. You need to save the running-configuration to the startup-configuration when changing any parameters or function after selecting **Apply**.



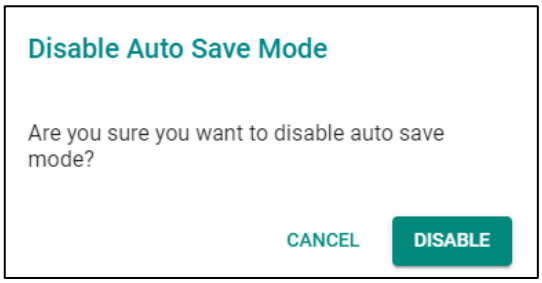

It is highly recommended that you always manually save all configurations by selecting the Save Disk icon when **Disable Auto Save** is applied, or all information will have disappeared after the switch has restarted.

When **Disable Auto Save** is applied, only the configurations that are running will be saved; you can unplug the power or perform a warm recovery to the network before manually saving the configurations. When Auto Save is enabled, the start-up configurations will be saved in the switch.

To disable the **Auto Save** function, select **Disable Auto Save** in the menu.

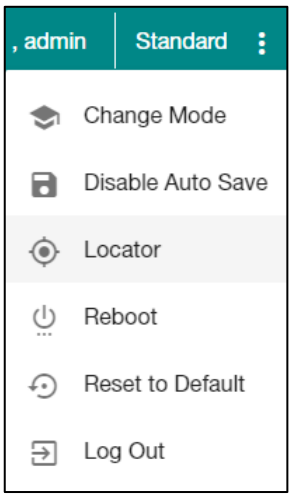


Select **DISABLE**.

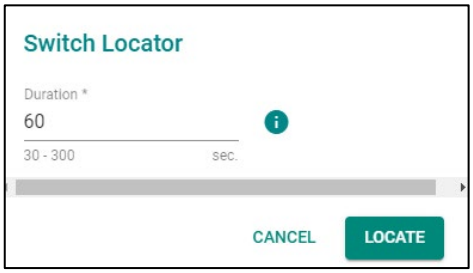



## Locator

You can trigger the device locator by selecting this icon. This will cause the LED indicators on the switch to flash for one minute. This helps you easily find the location of the switch on a field site.




Select **LOCATE**.

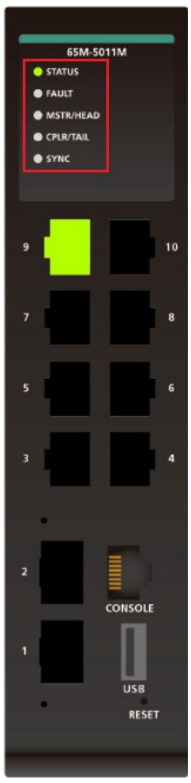



***Duration (sec.)***

| Setting | Description | Factory Default |
|---|---|---|
| 30 to 300 | Specify the time the indicators will remain flashing. | 60 |

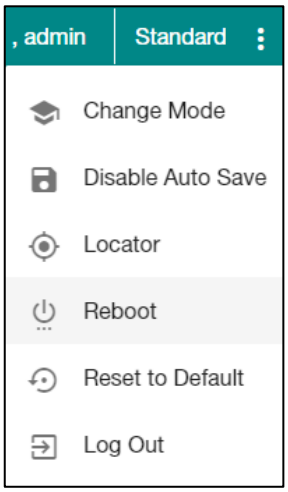
Select **LOCATE** to activate the switch locator.

The LED indicators are on the top of the front panel of the switch, as shown in the following figure.

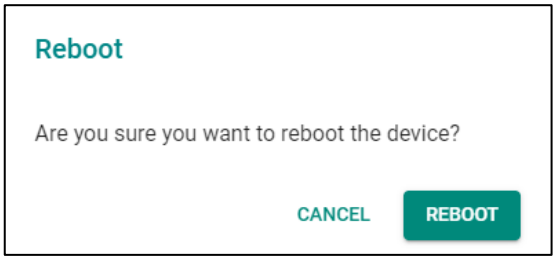



## Reboot

To reboot the device, select **Reboot**.

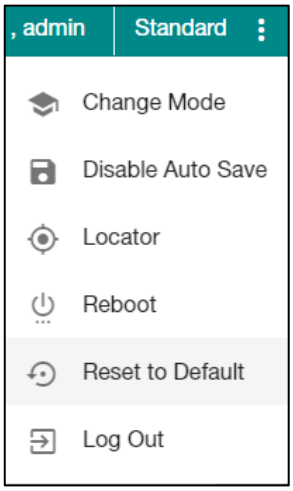



Select **REBOOT** to reboot the device.

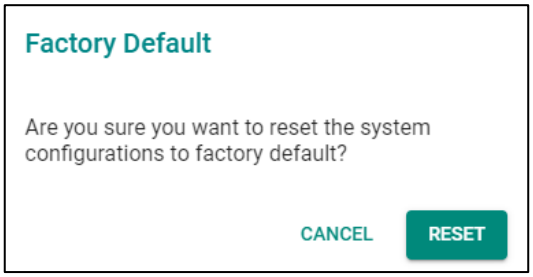


## Reset to Default

To reset the switch to the default status, select **Reset to Default**.

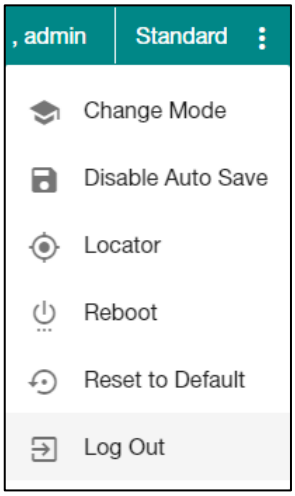



To return the switch to factory default settings, select **Reset**.

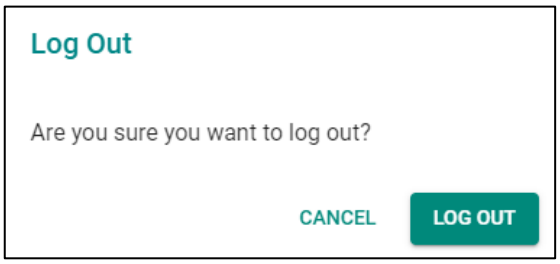



## Log Out of the Switch

To log out of the switch, select **Log Out**.



Select **LOG OUT** to log out of the switch.



# A. Activate and Transfer the IINxpress

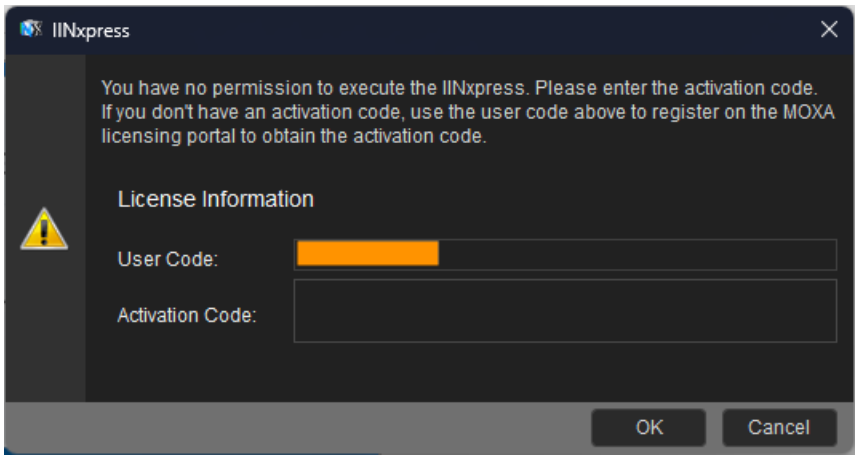
In this appendix, we demonstrate how to activate the IINxpress and transfer the activation code between the IINxpress.

## Activate the IINxpress

The activation code is needed to activate the IINxpress. Follow the steps to complete the activation in your computer.

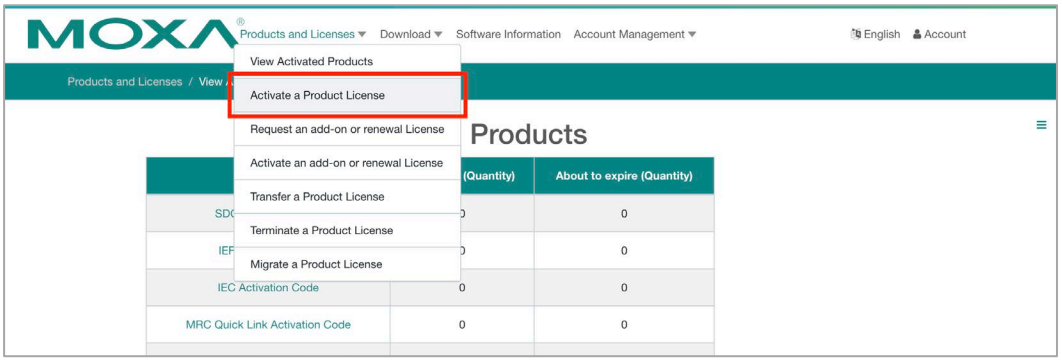
**Step 1:** Contact Moxa sales representatives or Moxa official distributors to purchase the license of IINxpress. One computer is required for one license. Once the license procurement is complete, the **Registration Code** will be mailed to you.

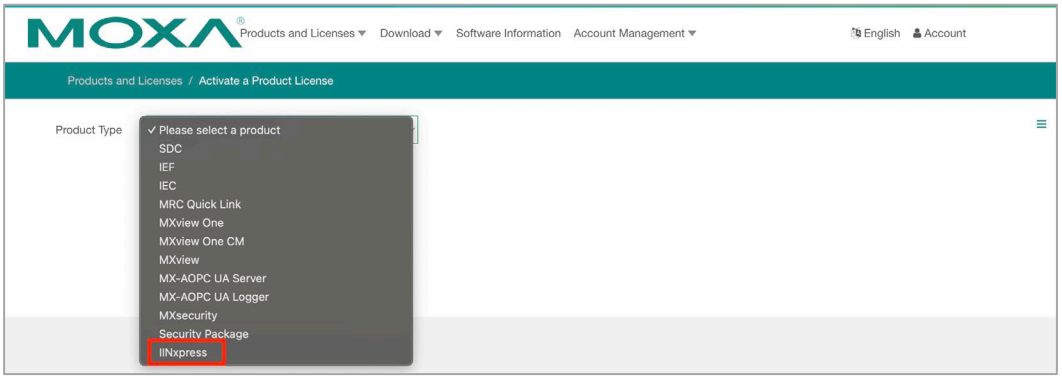
**Step 2:** Download the IINxpress from the Moxa website (https://www.moxa.com/) and install in the computer. When a first-time user opens IINxpress, the user can find the **User Code** in the pop-up window.



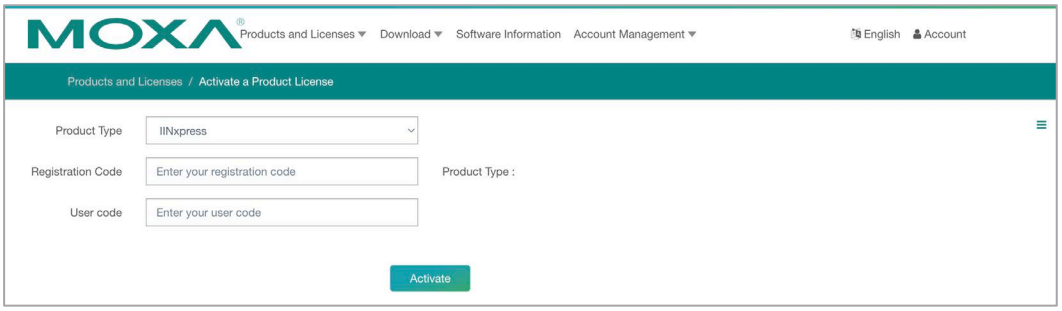

**Step 3:** Create an account on Moxa Software Licensing System. (https://netsecuritylicense.moxa.com/Account/Login)

**Step 4:** Go to **Products and Licenses > Activate a Product License** and select the **IINxpress**.




**Step 5:** Enter the Registration Code and User Code. Select the **Activate**.




**Step 6:** If activated successfully, you will receive a mail notice with the **Activation Code**.

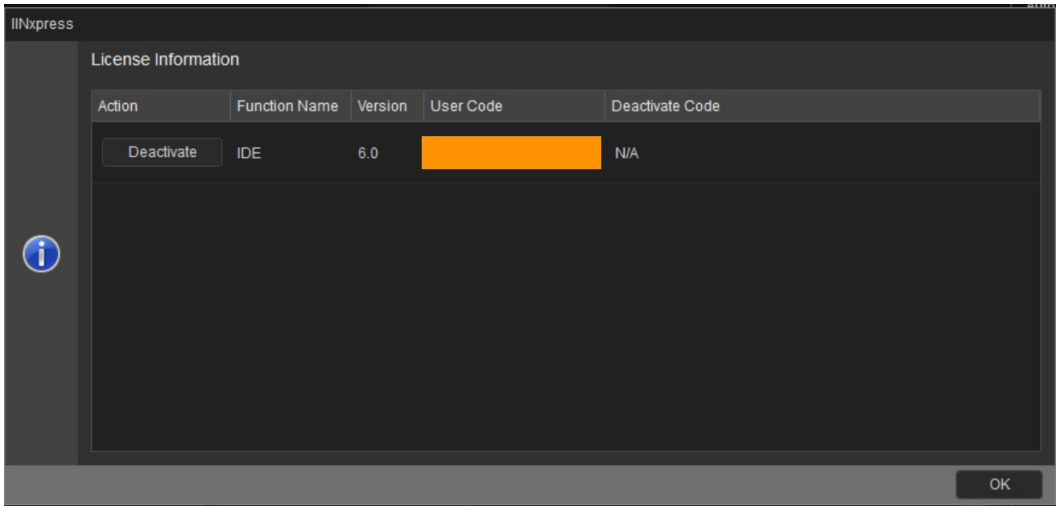
**Step 7:** Activate the IINxpress with the Activation Code.

# Transfer the Activation Code Between IINxpress

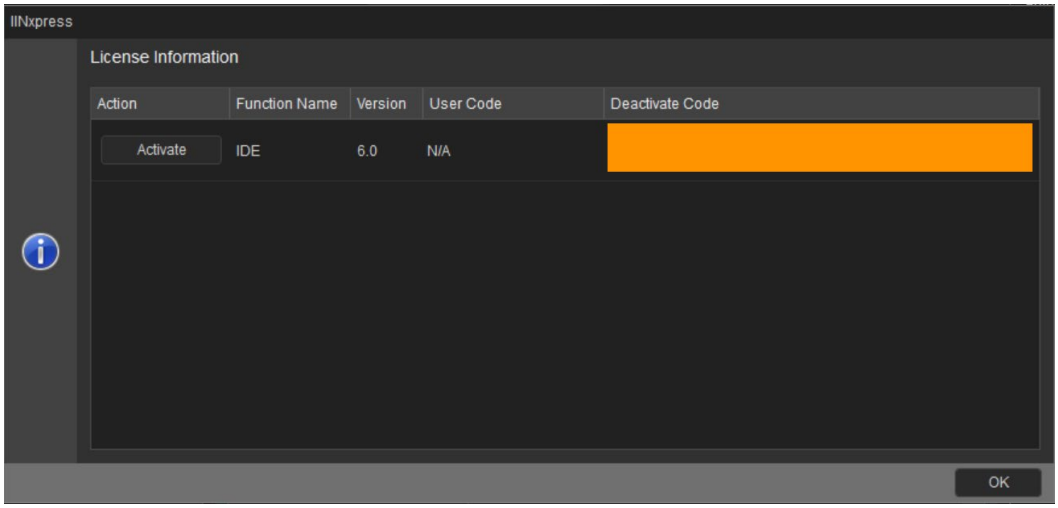
When you want to change the development environment to a new computer, the IINxpress can transfer to a new computer accordingly. Follow the steps to complete the transfer between the IINxpress.

**Step 1:** Download the IINxpress and complete the installation on the new computer. Get the new **User Code** from the IINxpress on the new computer.

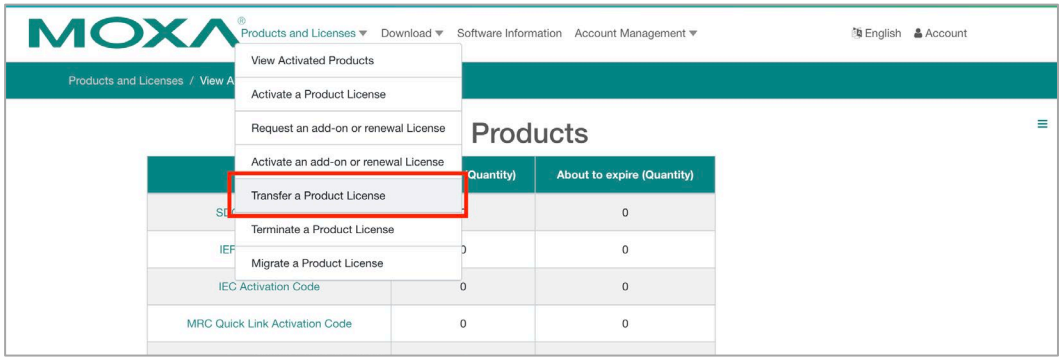
**Step 2:** Open the IINxpress on the old computer, go to **Help > License Information,** and launch the license management tool.



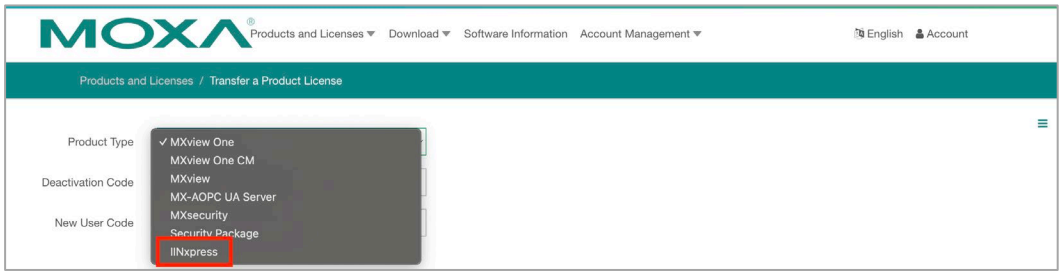

**Step 3:** Select the **Deactivate** button, the IINxpress will ask you to reconfirm again. Select OK and the IINxpress will provide a **Deactivation Code**.



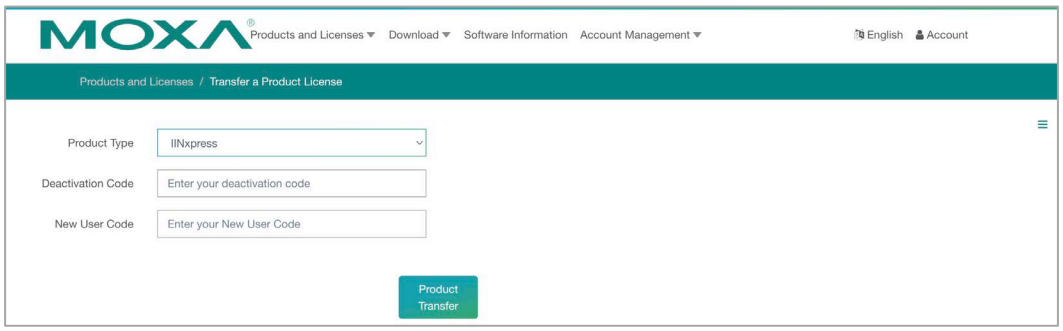
**Step 4:** Go to Moxa Software Licensing System and find the Transfer page via **Products and Licenses > Transfer a Product License**.




**Step 5:** Select the IINxpress.




**Step 6:** Enter the Deactivation Code and New User Code. Then, select the **Product Transfer**.




**Step 7:** If the transfer is successful, you will receive a mail notice with new **Activation Code**.

**Step 8:** Activate the IINxpress on a new computer with the new Activation Code.

# B. Account Privileges List of 65M-5011M (Managed Switch Module)

This appendix describes the read/write access privileges for different accounts on the ioPAC 6500 Layer 2 Managed Ethernet Switch Module.

## Account Privileges List

This appendix lists the privileges for different account roles.

Note, **R** stands for **Read** and **W** stands for **Write**.

| Function | Account Privilege | | |
|---|---|---|---|
| **System** | **Admin** | **Supervisor** | **User** |
| Information Setting | R/W | R/W | R/W |
| Firmware Upgrade | Execute | No Access | No Access |
| Configuration Backup and Restore (including File Signature) | Execute | No Access | No Access |
| Event log backup | Execute | Execute | Execute |
| User Account | R/W | No Access | No Access |
| Password Policy | R/W | No Access | No Access |
| Online Accounts | R/w | No Access | No Access |
| IP Configuration | R/W | R/W | R |
| DHCP Server | R/W | R/W | R |
| Time Zone | R/W | R/W | R |
| System Time | R/W | R/W | R |
| **Port** | | | |
| Port Setting | R/W | R/W | R |
| Linkup Delay | R/W | R/W | R |
| Link Aggregation (Port Channel) | R/W | R/W | R |
| **VLAN** | | | |
| IEEE 802.1Q | R/W | R/W | R |
| GARP | R/W | R/W | R |
| MAC | | | |
| Static Unicast | R/W | R/W | R |
| MAC Address Table | R/W | R/W | R |
| **QoS** | | | |
| Classification | R/W | R/W | R |
| Ingress Rate Limit (port shutdown only) | R/W | R/W | R |
| Scheduler | R/W | R/W | R |
| **Multicast** | | | |
| IGMP Snooping | R/W | R/W | R |
| Static Multicast | R/W | R/W | R |
| GMRP | R/W | R/W | R |
| **Layer 2 Redundancy** | | | |
| Spanning Tree | R/W | R/W | R |
| Turbo Ring v2 | R/W | R/W | R |
| Turbo Chain | R/W | R/W | R |
| Dual Homing | R/W | R/W | R |
| **Network Management** | | | |
| SNMP | R/W | No Access | No Access |
| SNMP Trap/Inform | R/W | No Access | No Access |

| Function | Account Privilege | | |
|---|---|---|---|
| **Security** | **Admin** | **Supervisor** | **User** |
| Management Interface | R/W | R/W | R |
| Login Policy | R/W | R | R |
| Trusted Access | R/W | R/W | R |
| SSH & SSL | Execute | Execute | No Access |
| IEEE802.1X | R/W | R/W | R |
| Port Security | R/W | R/W | R |
| Traffic Storm Control | R/W | R/W | R |
| **Authentication** | | | |
| RADIUS | R/W | No Access | No Access |
| TACACS+ | R/W | No Access | No Access |
| Login Authentication | R/W | No Access | No Access |
| **Diagnostics** | | | |
| Event Notification | R/W | R/W | R |
| Email Notification | R/W | R | R |
| Syslog (including authentication) | R/W | R | R |
| Event Log | R/W | R/W | R |
| LLDP | R/W | R/W | R |
| Port Mirror | R/W | R/W | R |
| Ping | Execute | Execute | Execute |
| ARP Table | R | R | R |
| Utilization | R | R | R |
| Statistics | R/W | R/W | R |
| **Maintenance and Tool** | | | |
| Standard/Advance Mode | Execute | Execute | Execute |
| Disable Auto Save | R/W | R/W | R |
| Locator | R/W | R/W | Execute |
| Reboot | Execute | Execute | No Access |
| Reset to Default | Execute | Execute | No Access |
| Logout | Execute | Execute | Execute |

# C. Event Log Description of 65M-5011M (Managed Switch Module)

This appendix describes all the information for the event logs. When an event occurs, it will be recorded in the event log files. Check the event log name and its event log description.

## Event Log Description

| Event Name | Severity | Event Description |
|---|---|---|
| 802.1X Auth Failed | Warning | 802.1x authentication failed on port {{index}}/{{number}} with {{buffer}} |
| ABC-02 is inserted or unplugged | Notice | ABC-02 is {{inserted/unplugged}}. |
| Account log out | Notice | [Account:{{user_name}}] logged out. |
| Account removed | Notice | [Account:{{user_name}}] has been removed by admin. |
| Account settings changed | Notice | Account settings of [Account:{{user_name}}] has been updated.<br>Account settings of [Account:{{user_name}}] has been deleted.<br>Account settings of [Account:{{user_name}}] has been created. |
| Announce message with different interval | Warning | An Announce message with a different interval has been received from port {{index}}/{{number}} |
| Check if hardware revision is valid | Notice | The hardware revision of Power Module {{index}} is not allowed. |
| Cold start | Critical | System has performed a cold start. |
| Configuration changed | Notice | Configuration {{modules}} changed by {{username}}. |
| Configuration exported | Notice | Configurations exported {{successful /failed}} by {{username}} via {{method}}. |
| Configuration imported | Notice | Configuration import {{successful /failed}} by {{username}} via {{method}}. |
| Coupling changed | Warning | Turbo Ring v2 coupling path status has changed. |
| dhcpsnp untrust mac discards | Warning | VLAN {{Vlan Id}} dropped packets due to violation of DHCP Snooping rule. Total mac discards: {{number}}. |
| dhcpsnp untrust server discards | Warning | VLAN {{Vlan Id}} dropped packets due to a violation of the DHCP Snooping rule. Total server discards: {{number}}. |
| Dual homing path changed | Warning | Dual Homing path has switched. |
| Event log export | Notice | Event Log export {{successful /failed}} by {{username}} via {{method}}. |
| Firmware upgrade failed | Warning | Firmware failed to upgrade. |
| Firmware upgrade successful | Notice | Firmware successfully upgraded |
| Hardware revision is not allowed | Error | The hardware revision of Line Module %d is not allowed. |
| Interface link down | Notice | Interface{{number}} down. |
| Interface link up | Notice | Interface {{number}} up. |
| LLDP table changed | Info | LLDP remote table has changed. |
| Log capacity threshold | Warning | Number of event log entries {{logEntryNum}} has reached the threshold. |

| Event Name | Severity | Event Description |
|---|---|---|
| Log Turbo Chain Port Restart | Notice | Port-Channel {{channel id}} has restarted by Turbo Chain.<br>Port {{index}}/{{number}} has restarted by Turbo Chain. |
| Login failed | Warning | [Account {{user_name}}] log in failed via {{interface}}. |
| Login lockout | Warning | [Account {{user_name}}] locked due to {{failed_times}} failed login attempts. |
| Login successful | Notice | [Account {{user_name}}] successfully logged in via {{interface}}. |
| Master changed | Warning | Ring {{Index}} client has changed. |
| Master mismatch | Warning | Ring {{Index}} client setting does not match. |
| MSTP new port role | Warning | MSTP (MST{{Index}}) port {{number}} role changed from {{role}} to {{role}}. |
| MSTP root changed | Warning | MSTP (MST{{Index}}) new root has been elected in topology. |
| MSTP topology changed | Warning | Topology (MST{{Index}}) has been changed by MSTP. |
| Packet dropped by Port Security | Warning | Port {{index}}/{{number}} dropped packets due to violation of Port Security rule. |
| Password changed | Notice | Password of [Account: {{user_name}}] has been changed. |
| Port Link Down | Notice | Port {{index}}/{{number}} link down.<br>Port-channel {{Channel id}} link down. |
| Port Link Up | Notice | Port {{index}}/{{number}} link up.<br>Port-channel {{Channel id}} link up. |
| Port recovery by Rate Limit | Warning | Port {{index}}/{{number}} has recovered by rate limit. |
| Port shutdown by Loop | Critical | Port {{index}}/{{number}} looping and shutdown. |
| Port shutdown by Port Security | Warning | Port {{index}}/{{number}} has shut down due to a violation of the Port Security rule. |
| Port shutdown by Rate Limit | Warning | Port {{index}}/{{number}} has excessive traffic and shutdown. |
| Power Off->On | Notice | Power {{index}} has turned off. |
| Power On->Off | Notice | Power {{index}} has turned on. |
| Redundant port health check failed | Error | Redundant port {{index}}/{{number}} health check fail. |
| RMON failing alarm | Warning | {{user defined}}. |
| RMON raising alarm | Warning | {{user defined}}. |
| RSTP invalid BPDU | Warning | RSTP Port-Channel {{channel id}} received an invalid BPDU (type: {{type}}, value: {{value}}).<br>RSTP port {{index}}/{{number}} received an invalid BPDU (type: {{type}}, value: {{value}}). |
| RSTP migration | Warning | Port-Channel {{channel id}} changed to {{rstp/stp}}.<br>Port {{index}}/{{number}} changed to {{rstp/stp}}. |
| RSTP new port role | Warning | RSTP Port-Channel {{channel id}} role changed from {{role}} to {{role}}.<br>RSTP port {{index}}/{{number}} role changed from {{role}} to {{role}}. |
| RSTP root changed | Warning | RSTP new root has been elected in topology. |
| RSTP topology changed | Warning | Topology has been changed by RSTP. |
| SSH Key generated | Notice | SSH key has been regenerated. |
| SSL certification changed | Notice | SSL certificate has been changed.<br>SSL certificate has been regenerated. |
| Topology changed (RSTP) | Warning | Topology has been changed by RSTP. |
| Topology changed (Turbo Chain) | Warning | Topology has been changed by Turbo Chain. |

| Event Name | Severity | Event Description |
|---|---|---|
| Topology changed (Turbo Ring) | Warning | Topology change has been detected on Ring {{RingIndex}} of Turbo Ring v2. |
| Topology changed (MSTP) | Warning | Topology (MST{{Index}}) has been changed by MSTP. |
| Warm start | Notice | System has performed a warm start. |
| When the trust host moves, it will send a log to Moxa log handler. | Warning | A trust host, MAC is {{mac address}} with VLAN {{Vlan Id}}, moved from port {{index}}/{{number}} to port {{index}}/{{number}}. |

# D. SNMP MIB File of 65M-5011M (Managed Switch Module)

This appendix contains the SNMP MIB file for the managed switch.

## Standard MIB Installation Order

If you need to import the MIB one-by-one, install the MIBs in the following order.

1. RFC1213-MIB.mib
2. SNMP-FRAMEWORK-MIB.mib
3. SNMPv2-SMI.mib
4. SNMPv2-TC.mib
5. SNMPv2-CONF.mib
6. SNMPv2-MIB.mib
7. IANAifType-MIB.mib
8. IEEE8023-LAG-MIB.mib
9. IF-MIB.mib
10. EtherLike-MIB.mib
11. IEEE8021-PAE-MIB.mib
12. BRIDGE-MIB.mib
13. P-BRIDGE-MIB.mib
14. RFC1271-MIB.mib
15. RMON-MIB.mib
16. TOKEN-RING-RMON-MIB.mib
17. RMON2-MIB.mib
18. Q-BRIDGE-MIB.mib
19. INET-ADDRESS-MIB.mib
20. IEEE8021-TC-MIB.mib
21. IEEE8021-SPANNING-TREE-MIB.mib
22. IANA-ADDRESS-FAMILY-NUMBERS-MIB.mib
23. LLDP-MIB.mib
24. LLDP-EXT-DOT1-MIB.mib
25. LLDP-EXT-DOT3-MIB.mib

# MIB Tree

Refer to the following content for the MIB Tree structure.

iso(1)

|-std(0)-iso8802(8802)-ieee802dot1(1)-ieee802dot1mibs(1)

|-ieee8021paeMIB(1): IEEE8021-PAE-MIB.mib

|-ieee8021SpanningTreeMib(3): IEEE8021-SPANNING-TREE-MIB.mib

|-org(3)

|-dod(6)-internet(1)

|-mgmt(2)-mib-2(1): SNMPv2-MIB.mib

|-system(1): RFC1213-MIB.mib

|-interface(2): RFC1213-MIB.mib

|-at(3): RFC1213-MIB.mib

|-snmp(11): RFC1213-MIB.mib

|-rmon(16): RMON-MIB.mib

|-dot1dBridge(17): BRIDGE-MIB.mib, P-BRIDGE-MIB.mib, Q-BRIDGE-MIB.mib

|-ifMIB(31): IF-MIB.mib

|-etherMIB(35): EtherLike-MIB.mib

|-private(4)-moxa(8691)

|-product(600): mxGeneralInfo.mib, mxProductInfo.mib,

|-general(602): mxGeneral.mib, mxDeviceIo.mib, mxDhcpSvr.mib, mxEmailC.mib,

mxEventLog.mib,

: mxGene.mib, mxLocator.mib, mxManagementIp.mib, mxPorte.mib,

: mxSnmp.mib, mxSwe.mib, mxSysLoginPolicySvr.mib,

: mxSyslogSvr.mib, mxSysPasswordPolicySvr.mib, mxSystemInfo.mib,

: mxSysTrustAccessSvr.mib, mxSysUtilSvr.mib, mxTimeSetting.mib,

: mxTimeZone.mib, mxTrapC.mib, mxUiServiceMgmt.mib

|-switching(603): mxSwitching.mib

|- portInterfacce : mxPort.mib, mxLa.mib

|- basicLayer2: mxLhc.mib, mxQos, mxVlan.mib

|- layer2Redundancy: mxRstp.mib, mxTrv2.mib, mxTurboChain.mib,

mxDualHoming.mib

|- layer2Security: mxStcl.mib, mxRlps.mib, mxPssp.mib, mxPsms.mib, mxDot1x.mib,

mxRadius.mib

|- layer2Diagnosic: mxLldp.mib, mxTcst.mib, mxPortMirror.mib, mxRmon.mib

|- layer2Multicast: mxIgmpSnp.mib

|-snmpV2(6)-snmpModules(3)

|-snmpFrameworkMIB(10): SNMP-FRAMEWORK.mib

|-ieee(111)-standards-association-numbers-series-standards(2)-lan-man-stds(802)-ieee802dot1(1)-ieee802dot1mibs(1)-ieee8021SpanningTreeMib(3): IEEE8021-SPANNING-TREE-MIB.mib

# E. Security Guidelines of 65M-5011M (Managed Switch Module)

This appendix explains security practices for installing, operating, maintaining, and decommissioning the device. We strongly recommend that our customers follow these guidelines to enhance network and equipment security.

# Installation

## Physical Installation

1. The device MUST be installed in an access-controlled area, where only the necessary personnel have physical access to the device.
2. The device MUST NOT be directly connected to the Internet, which means switches MUST be installed within a security perimeter, which can be implemented by a firewall at the border since the device is not classified as zone/boundary equipment.
3. Follow the instructions in the Quick Installation Guide, which is included in the package, to ensure you install the device correctly in your environment.
4. The device has anti-tamper labels on the enclosures. This allows an administrator to tell whether the device has been tampered with.
5. The ports that are not in use should be deactivated. Refer to **Port Interface** section for detailed instructions.

## Account Management

Follow these best practices when setting up an account.

1. Each account should be assigned the correct privileges: Only allow the minimum number of people to have admin privilege so they can perform device configuration or modifications, while other users should only have read access privilege. The device supports both local account authentication and remote centralized mechanism, including Radius and TACACS+.
2. Change the default password, and strengthen the account password complexity by:
   a. Enabling the "Password Policy" function.
   b. Increasing the minimum password length to at least eight characters.
   c. Defining a password policy to ensure that it contains at least an uppercase and lowercase letter, a digit, and a special character.
   d. Setting user passwords to expire after a certain period.
3. Enforce regulations that ensure that only a trusted host can access the device. Refer to the **Trusted Access** section for detailed instructions.

## Vulnerable Network Ports

1. For network security concerns, we strongly recommend that you change the port numbers, such as TCP port numbers for HTTP, HTTPS, Telnet, and SSH, for the protocols that are in use; ports that are not in use but are still reachable pose an unacceptable security risk and should be disabled. Refer to the **Management Interface** section for detailed instructions.
2. To avoid eavesdropping from snooping confidential information, you should adopt encryption-based communication protocols, such as HTTPS instead of HTTP, SSH instead of Telnet, SFTP instead of TFTP, SNMPv3 instead of SNMPv1/v2c, etc. In addition, the maximum number of sessions should be kept to an absolute minimum. Refer to **Management Interface** section for detailed instructions.
3. Generate the SSL certificate for the device before commissioning HTTPS or SSH applications. Refer to **SSH & SSL** section for detailed instructions.

# Operation

1. To ensure that communications are properly protected, use a strong cryptographic algorithm for key exchange or encryption protocols for HTTPS/SSH applications. The device follows the NIST SP800-52 and SP800-131 standards and supports TLS v1.2 and v1.3 with the following cipher suites:

| TLS V1.2 | | | | |
|---|---|---|---|---|
| **Cipher suite name** | **Key exchange** | **Authentication** | **Encryption** | **Hash function** |
| TLS_ECDHE_RSA_WITH_CHACHA20_POLY1305_SHA256 | ECDHE | RSA | CHACHA20-POLY1305 | SHA256 |
| TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 | ECDHE | ECDSA | AES128 | SHA256 |
| TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 | ECDHE | RSA | AES128 | SHA256 |
| TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 | ECDHE | RSA | AES256 | SHA384 |
| TLS_DHE_RSA_WITH_AES_128_GCM_SHA256 | Ephemeral DH | RSA | AES128 | SHA256 |
| TLS_DHE_RSA_WITH_AES_256_GCM_SHA384 | Ephemeral DH | RSA | AES256 | SHA384 |
| TLS_DHE_RSA_WITH_CHACHA20_POLY1305_SHA256 | Ephemeral DH | RSA | CHACHA20-POLY1305 | SHA256 |
| TLS_ECDHE-RSA_WITH_AES256-SHA384 | ECDHE | RSA | AES256 | SHA384 |
| TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 | ECDHE | RSA | AES128 | SHA256 |
| TLS_ECDHE_ECDSA_WITH_CHACHA20_POLY1305_SHA256 | ECDHE | ECDSA | CHACHA20-POLY1305 | SHA256 |
| TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA384 | ECDHE | RSA | AES256 | SHA384 |
| TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA384 | ECDHE | ECDSA | AES256 | SHA384 |
| TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 | ECDHE | ECDSA | AES128 | SHA256 |

| TLS V1.3 | | | | |
|---|---|---|---|---|
| **Cipher suite name** | **Key exchange** | **Encryption** | **Mode** | **Hash function** |
| TLS_AES_256_GCM_SHA384 | any | AES256 | GCM | SHA384 |
| TLS_CHACHA20_POLY1305_SHA256 | any | CHACHA20-POLY1305 | N/A | SHA256 |
| TLS_AES_128_GCM_SHA256 | any | AES128 | GCM | SHA256 |

2. Below is a list of the recommended secure browsers that support TLS v1.2 or above:

| Browser | Version |
|---|---|
| Microsoft Edge | All |
| Microsoft Internet Explorer | v11 or above |
| Mozilla Firefox | v27 or above |
| Google Chrome | v38 or above |
| Apple Safari | v7 or above |

Reference: https://support.globalsign.com/ssl/general-ssl/tls-protocol-compatibility#Browsers

3. The device supports event logs and syslog for SIEM integration:
   a. Event log: Because of limited storage capacity, the event log can only accommodate a maximum of 10,000 entries. Administrators can set a warning for a pre-defined threshold. We recommend that youregularly back up system event logs. Refer to **Event Log** section for detailed instructions.
   b. Syslog: the device supports syslog, and advanced secure TLS-based syslog for centralized SIEM integration. Refer to **Syslog Settings** section for detailed instructions.
4. The device can provide information for control system inventory:
   a. SNMPv1, v2c, v3: We recommend administrators use SNMPv3 with authentication and encryption to manage the network. Refer to the **MIB File** for detailed instructions.
   b. Telnet/SSH: We recommend that administrators use SSH with authentication and encryption to retrieve device properties.
   c. HTTP/HTTPS: We recommend that administrators use HTTPS with a certificate that has been granted by a Certificate Authority to configure the device.
5. Denial of Service protection: To avoid disruption of normal operation of the switch, administrators should configure the QoS function. The device supports the ingress rate limit and egress shaped. Administrators can decide how to deal with excess data flow and configure the device accordingly. This process will regulate the resulting data rate per port. Refer to **QoS** section for detailed instructions.
6. Time synchronization with authentication: Time synchronization is crucial for process control. To prevent malicious attacks, whereby the settings are changed without permission, authentication must be in place between the NTP server and client. The device supports NTP with a pre-shared key. Refer to **NTP** section for detailed instructions.
7. Periodically regenerate the SSH and SSL certificates: Even though the device supports RSA 2048-bit and SHA-256 to ensure sufficient complexity, we strongly recommend that you frequently renew their SSH key and SSL certificate in case the key is compromised. Refer to **SSH & SSL** section for detailed instructions.
8. Below is the list of the protocol port numbers used for all external interfaces.

| Protocol | Service Type | Port Number |
|---|---|---|
| TCP | SSH | 22 |
| | Telnet | 23 |
| | HTTP | 80 |
| | HTTPS | 443 |
| UDP | DHCP | 67 |
| | NTP | 123 |
| | SNMP | 161 |
| | Moxa Service | 40404 |

# Maintenance

1. Perform firmware upgrades frequently to enhance features, deploy security patches, or fix bugs.
2. Frequently back up the system configurations: In order to properly protect the system configuration files from being tampered with, the device supports password encryption and signature authentication for backup files.
3. Examine event logs frequently to detect any anomalies.
4. To report vulnerabilities of Moxa products, submit your findings on the following web page: https://www.moxa.com/en/support/product-support/security-advisory/report-a-vulnerability.

# Decommission

To avoid any sensitive information such as your account password or certificate from being disclosed, always reset the system settings to factory default before decommissioning the device.

# F. SFP Module List of 65M-5011M (Managed Switch Module)

This appendix lists the supported SFP module for the managed switch module

| Model | Description |
|---|---|
| SFP-1GLHLC-T | SFP module with 1 1000BaseLH port with LC connector for 30 km transmission, -40 to 85°C operating temperature |
| SFP-1GLSXLC-T | SFP module with 1 1000BaseLSX port with LC connector for 1km/2km transmission, -40 to 85°C operating temperature |
| SFP-1GLXLC-T | SFP module with 1 1000BaseLX port with LC connector for 10 km transmission, -40 to 85°C operating temperature |
| SFP-1GSXLC-T | SFP module with 1 1000BaseSX port with LC connector for 300m/550m transmission, -40 to 85°C operating temperature |
| SFP-1GZXLC-T | SFP module with 1 1000BaseZX port with LC connector for 80 km transmission, -40 to 85°C operating temperature |
| SFP-1G10ALC-T | WDM-type (BiDi) SFP module with 1 1000BaseSFP port with LC connector for 10 km transmission; TX 1310 nm, RX 1550 nm, -40 to 85°C operating temperature |
| SFP-1G10BLC-T | WDM-type (BiDi) SFP module with 1 1000BaseSFP port with LC connector for 10 km transmission; TX 1550 nm, RX 1310 nm, -40 to 85°C operating temperature |
| SFP-1G20ALC-T | WDM-type (BiDi) SFP module with 1 1000BaseSFP port with LC connector for 20 km transmission; TX 1310 nm, RX 1550 nm, -40 to 85°C operating temperature |
| SFP-1G20BLC-T | WDM-type (BiDi) SFP module with 1 1000BaseSFP port with LC connector for 20 km transmission; TX 1550 nm, RX 1310 nm, -40 to 85°C operating temperature |
| SFP-1G40ALC-T | WDM-type (BiDi) SFP module with 1 1000BaseSFP port with LC connector for 40 km transmission; TX 1310 nm, RX 1550 nm, -40 to 85°C operating temperature |
| SFP-1G40BLC-T | WDM-type (BiDi) SFP module with 1 1000BaseSFP port with LC connector for 40 km transmission; TX 1550 nm, RX 1310 nm, -40 to 85°C operating temperature |
| SFP-1FELLC-T | SFP module with 1 100Base single-mode with LC connector for 80 km transmission, -40 to 85°C operating temperature |
| SFP-1FEMLC-T | SFP module with 1 100Base multi-mode with LC connector for 2/4 km transmission, -40 to 85°C operating temperature |
| SFP-1FESLC-T | SFP module with 1 100Base single-mode with LC connector for 40 km transmission, -40 to 85°C operating temperature |