MGate 5109 Series User Manual

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1. Introduction

Welcome to the MGate 5109 line of Modbus-to-DNP3 gateways. All models feature easy protocol conversion between Modbus RTU/ASCII, Modbus TCP, and DNP3 protocols. This chapter is an introduction to the MGate 5109.

Overview

The MGate 5109 is an industrial Ethernet gateway for Modbus RTU/ASCII/TCP and DNP3 serial/TCP/UDP protocol conversion. All models are protected with a rugged metallic casing, DIN-rail mountable, and offer built-in serial isolation. The rugged design is suitable for industrial applications such as oil/gas, power, process automation, and factory automation.

Package Checklist

All models of the MGate 5109 Series are shipped with the following items:

Standard Accessories:

- 1 MGate 5109 gateway
- 1 serial cable: DBL-RJ45F9-150
- Quick installation guide (printed)
- Warranty card

NOTE

Please notify your sales representative if any of the above items are missing or damaged.

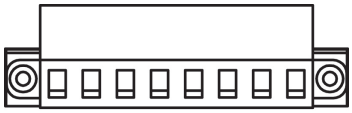
Optional Accessories (can be purchased separately)

- CBL-F9M9-150: DB9-female-to-DB9-male serial cable, 150 cm
- CBL-F9M9-20: DB9-female-to-DB9-male serial cable, 20 cm
- CBL-RJ45SF9-150: RJ45-to-DB9-female shielded serial cable, 150 cm
- ADP-RJ458P-DB9F: DB9-female-to-RJ45 connector
- ADP-RJ458P-DB9F-ABC01: DB9-female-to-RJ45 connector
- Mini DB9F-to-TB: DB9-female-to-terminal-block connector

Product Features

- Gateway function to transfer data between Modbus RTU/ASCII/TCP and DNP3 serial/TCP/UDP
- Support for both DNP3 master and outstation
- Up to 31 Modbus serial slaves or DNP3 serial outstations
- Up to 32 Modbus TCP slaves or DNP3 TCP/UDP outstations
- Support DNP 3.0 subset level 2
- DNP3 master mode support up to 18800 points
- Effortless configuration via Web console
- Complete packet analysis and diagnosis information for maintenance
- Redundant dual DC power inputs and relay output supported
- MicroSD card supported for configuration backup
- -40 to 75°C wide operating temperature range models available
- Serial port with 2 kV built-in isolation protection
- Built-in Ethernet cascading for easy wiring

Power Input and Relay Output Pinouts



	V2+	V2-				V1+	V1-
Shielded Ground	DC Power Input 2	DC Power Input 2	N.O.	Common	N.C.	DC Power Input 1	DC Power Input 1

LED Indicators

Agent Mode:

LED	Color	Description
Ready	Off	Power is off or a fault condition exists
	Green	Steady: Power is on, and the MGate is functioning normally
	Red	Steady: Power is on, and the MGate is booting up
		Blinking slowly: Indicates an IP conflict, or the DHCP or BOOTP server is not responding properly
		Flashing quickly: microSD card failed
MB*	Off	No serial communication with Modbus device
	Green	Normal Modbus serial communication in progress
	Red	Serial communication error When MGate 5109 acts as Modbus Master: 1. Slave device returned an error (exception) 2. Received frame error (parity error, checksum error) 3. Timeout (slave device no response) When MGate 5109 acts as Modbus Slave: 1. Received invalid function code 2. Master accessed invalid register addresses or coil addresses 3. Received frame error (parity error, checksum error)
DNP3*	Off	No serial communication with DNP3 device
	Green	Normal DNP3 serial communication in progress
	Red	Serial communication error When MGate 5109 acts as DNP3 Master: 1. Received outstation exception (format error, checksum error, invalid data, outstation responds not support) 2. Timeout (outstation no response) When MGate 5109 acts as DNP3 outstation: 1. Received master exception (format error, checksum error, invalid data) 2. Timeout (master no response)

*Only indicates serial communication status; for Ethernet status, refer to the LED indicator on the Ethernet port.

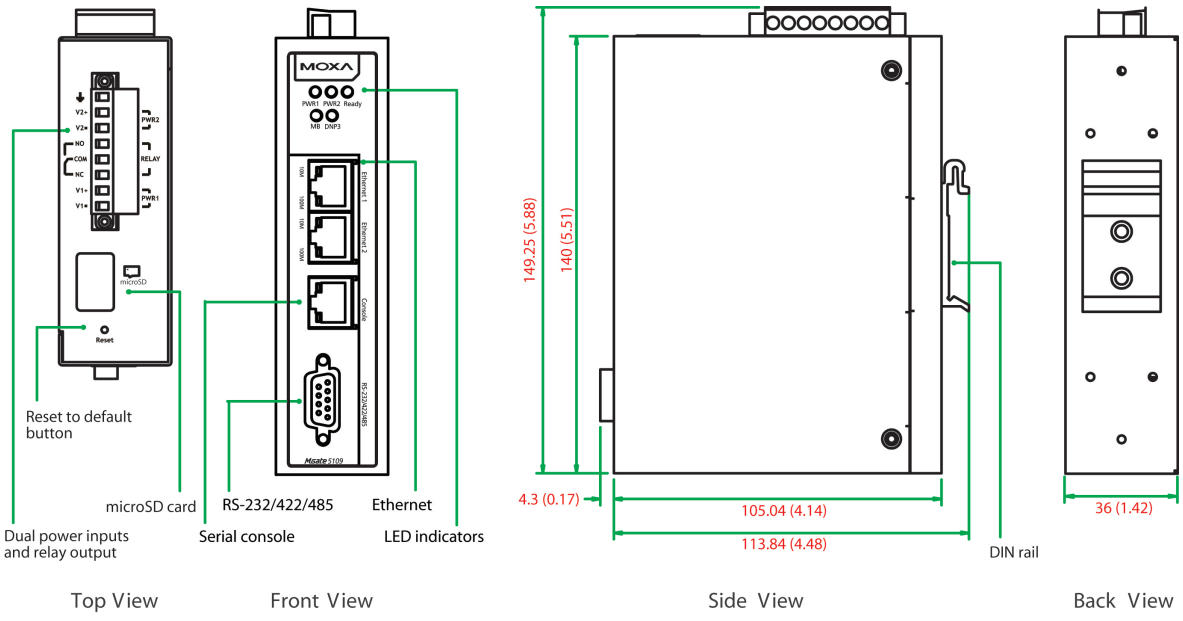
Transparent Mode:

LED	Color	Description
Ready	Off	Power is off, or a fault condition exists
	Green	Steady: Power is on, and the MGate is functioning normally
	Red	Steady: Power is on, and the MGate is booting up
		Blinking slowly: Indicates an IP conflict, or the DHCP or BOOTP server is not responding properly
		Flashing quickly: microSD card failed
MB	Off	No communication with Modbus device
	Green	Modbus communication in progress**
DNP3	Off	No communication with DNP3 device
	Green	DNP3 communication in progress**

**The LED will light up (green) only when the MGate is receiving data on a serial port (Rx); this does not include transmitted data (Tx).

Dimensions

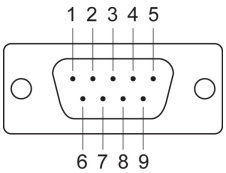
Unit: mm (inch)



Pin Assignments

Serial Port (Male DB9)

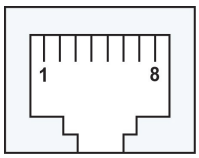
Pin	RS-232	RS-422/RS-485 (4W)	RS-485 (2W)
1	DCD	TxD-(A)	–
2	RXD	TxD+(B)	–
3	TXD	RxD+(B)	Data+(B)
4	DTR	RxD-(A)	Data-(A)
5*	GND	GND	GND
6	DSR	–	–
7	RTS	–	–
8	CTS	–	–
9	–	–	–



*Signal ground

Ethernet Port (RJ45)

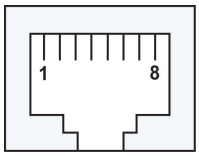
Pin	Signal
1	Tx+
2	Tx-
3	Rx+
6	Rx-



Console Port (RS-232)

The MGate 5109 Series can use an RJ45 serial port to connect to a PC for device configuration.

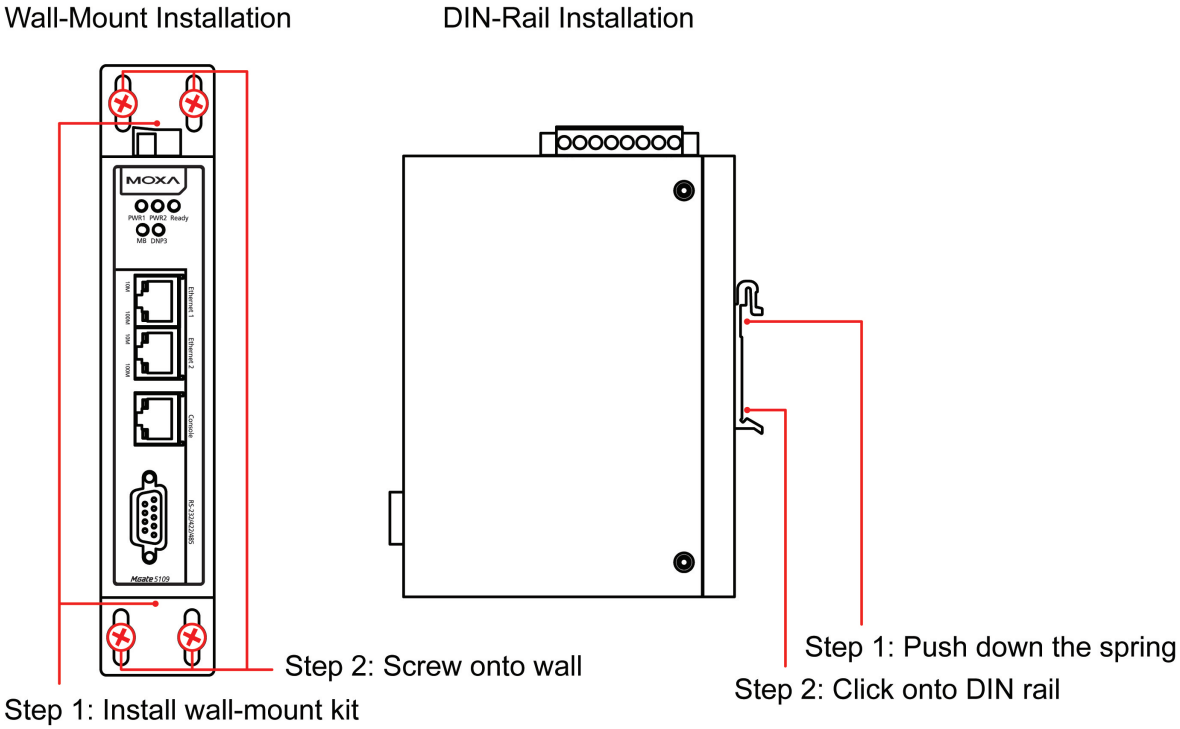
Pin	RS-232
1	DSR
2	RTS
3	GND
4	TXD
5	RXD
6	DCD
7	CTS
8	DTR



Mounting the Unit

1. Connect the power adapter. Connect the 12-48 VDC power line or DIN-rail power supply to the MGate 5109's terminal block.
2. Use a serial cable to connect the MGate to the Modbus or DNP3 device.
3. Use an Ethernet cable to connect the MGate to the Modbus or DNP3 device.
4. The MGate 5109 is designed to be attached to a DIN rail or mounted on a wall. For DIN-rail mounting, push down the spring and properly attach it to the DIN rail until it snaps into place. For wall mounting, install the wall-mounting kit (optional) first and then screw the device onto the wall.

The following figure illustrates the two mounting options:



Specifications

Ethernet Interface

Protocols: Modbus TCP client/server, DNP 3.0 TCP/UDP master/outstation
Number of Ports: 2 (1 IP, Ethernet cascade)
Speed: 10/100 Mbps, Auto MDI/MDIX
Connector: 8-pin RJ45
Magnetic Isolation Protection: 1.5 kV (built-in)

Serial Interface

Protocols: Modbus RTU/ASCII master/slave, DNP 3.0 serial master/outstation
Number of Ports: 1
Serial Standards: RS-232/422/485, software selectable
Connectors: DB9 male
RS-485 Data Direction Control: ADDC® (automatic data direction control)
Pull High/Low Resistor for RS-485: 1 kΩ, 150 kΩ
Terminator for RS-485: 120 Ω
Isolation: 2 kV (built-in)

Serial Communication Parameters

Data Bits: 7, 8
Stop Bits: 1, 2
Parity: None, Even, Odd, Space, Mark
Flow Control: RTS/CTS, RTS Toggle (RS-232 only)
Baudrate: 50 bps to 921.6 kbps

Serial Signals

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

Modbus

Functions Supported: 1, 2, 3, 4, 5, 6, 15, 16, 23
Max. No. of Commands: 100
Max. No. of Connections:
MGate as Modbus TCP Master: 32 slave connections
MGate as Modbus TCP slave: 16 master connections

DNP3

Max. No. of Connections:
- Transparent mode:
  16 DNP3 TCP master connections or 32 DNP3 TCP outstation connections
- Agent mode:
  The MGate as DNP3 TCP/UDP master: 32 outstation connections
  The MGate as DNP3 TCP/UDP outstation: 1 master connection

DNP3 Internal Database:
- For each outstation:
  Binary Inputs: 256 points
  Analog Inputs: 64 points
  Counters: 64 points
  Binary Outputs: 256 points
  Analog Outputs: 64 points
- When the MGate 5109 is configured as a DNP3 outstation
  Binary Inputs: 8192 points
  Counters: 2048 points
  Binary Outputs: 8192 points
  Analog Outputs: 2048 points
  Binary Input Events: 1024
  Analog Input Events: 1024
  Counter Events: 1024

Software

Configuration Options: Web Console, Serial Console Utility

Configuration: MXconfig, MXview, SNMP (v1, v2c, v3), Private MIB

Physical Characteristics

Housing: Metal, IP30

Weight: 507 g (1.12 lb)

Dimensions: 36 x 105 x 140 mm (1.42 x 4.14 x 5.51 in)

Storage Card Slot: 1 microSD (SDHC) card slot supports up to 32 GB

Relay Alarm Circuit: 3-pin circuit with current carrying capacity of 2 A @ 30 VDC

Environmental Limits

Operating Temperature:

Standard Models: 0 to 60°C (32 to 140°F)

Wide Temp. Models: -40 to 75°C (-40 to 167°F)

Storage Temperature: -40 to 85°C (-40 to 185°F)

Ambient Relative Humidity: 5 to 95% (non-condensing)

Vibration: IEC 60068-2-6, IEC 60068-2-64

Shock: IEC 60068-2-27

Drop: IEC 60068-2-32

Power Requirements

Input Voltage: 12 to 48 VDC

Input Current: 455 mA max., Class 2

Power Connector: Terminal block

Standards and Certifications

Safety: UL 508, EN 60950-1

Hazardous Location: Class 1 Division 2, ATEX, IECEx

EMC: EN 55022/24

EMI: CISPR 22, FCC Part 15B Class B

EMS:

IEC 61000-4-2 ESD: Contact: 8 kV; Air: 15 kV
IEC 61000-4-3 RS: 80 MHz to 1 GHz: 10 V/m
IEC 61000-4-4 EFT: Power: 4 kV; Signal: 2 kV
IEC 61000-4-5 Surge: Power: 2 kV; Signal: 2 kV
IEC 61000-4-6 CS: 150 kHz to 80 MHz: 10 V/m
IEC 61000-4-8 PFMF

MTBF (mean time between failures)

Time: 859,422 hrs

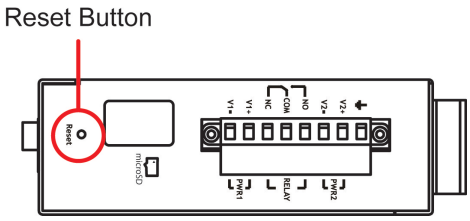
Standard: Telcordia SR332

Warranty

Warranty Period: 5 years

Details: See www.moxa.com/warranty

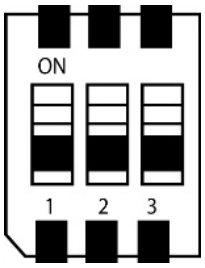
Reset Button



Restore the MGate to factory default settings by using a pointed object (such as a straightened paper clip) to hold the reset button down until the Ready LED stops blinking (approx. five seconds).

Pull-high, Pull-low, and Terminator for RS-485

Remove the MGate 5109's top cover, and you will find DIP switches to adjust each serial port's pull-high resistor, pull-low resistor, and terminator.



SW	1	2	3
	Pull-high resistor	Pull-low resistor	Terminator
ON	1 kΩ	1 kΩ	120 Ω
OFF	150 kΩ*	150 kΩ*	–*

*Default

MicroSD

The MGate 5109 provides users with an easy way to backup, copy, replace, or deploy. The MGate is equipped with a microSD card slot. Users can plug in a microSD card to backup data, including the system configuration setting, and system data log.

First time using the MGate gateway with a new microSD card

1. Format the microSD card as FAT file system through a PC.
2. Power off the MGate and insert the microSD card (ensure that the microSD card is empty).
3. Power on the MGate. The default settings will be copied to the microSD card.
4. Manually configure the MGate via web console, and all the stored changes will copy to the microSD card for synchronization.

First time using the MGate with a microSD card containing a configuration file

1. Power off the MGate and insert the microSD card.
2. Power on the MGate.
3. The configuration file stored in the microSD card will automatically copy to the MGate.

Duplicating current configurations to another MGate gateway

1. Power off the MGate and insert a new microSD card.
2. Power on the MGate.
3. The configuration will be copied from the MGate to the microSD card.
4. Power off the MGate and insert the microSD card into the other MGate.
5. Power on the second MGate.
6. The configuration file stored in the microSD card will automatically copy to the MGate.

Malfunctioning MGate replacement

1. Replace the malfunctioning MGate with a new MGate.
2. Insert the microSD card into the new MGate.
3. Power on the MGate.
4. The configuration file stored on the microSD card will automatically copy to the MGate.

MicroSD card writing failure

The following circumstances may cause the microSD card to experience a writing failure:

1. The microSD card has less than 20 Mbytes of free space remaining.
2. The microSD card is write-protected.
3. The file system is corrupted.
4. The microSD card is damaged.

The MGate will stop working in case of the above events, accompanied by a flashing Ready LED and beeping alarm. When you replace the MGate gateway's microSD card, the microSD card will synchronize the configurations stored on the MGate gateway. Note that the replacement microSD card should not contain any configuration files on it; otherwise, the out-of-date configuration will copy to the MGate device.

3. Getting Started

Connecting the Power

The unit can be powered by connecting a power source to the terminal block:

1. Loosen or remove the screws on the terminal block.
2. Turn off the power source and then connect a 12–48 VDC power line to the terminal block.
3. Tighten the connections, using the screws on the terminal block.
4. Turn on the power source.

Note that the unit does not have an on/off switch. It automatically turns on when it receives power. The PWR LED on the top panel will glow to indicate that the unit is receiving power. For power terminal block pin assignments, refer to the Power Input and Relay Output Pinouts section in *chapter 2*.

Connecting Serial Devices

The MGate 5supportsport Modbus serial and DNP3 serial devices. Before connecting or removing the serial connection, first make sure the power is turned off. For the serial port pin assignments, see the Pin Assignments section in *chapter 2*.

Connecting to a Network

Connect one end of the Ethernet cable to the MGate's 10/100M Ethernet port and the other end of the cable to the Ethernet network. The MGate will indicate a valid connection to the Ethernet in the following ways:

- The Ethernet LED maintains a solid green color when connected to a 100 Mbps Ethernet network.
- The Ethernet LED maintains a solid orange color when connected to a 10 Mbps Ethernet network.
- The Ethernet LED will flash when Ethernet packets are being transmitted or received.

Installing DSU Software

If you do not know the MGate gateway's IP address when setting it up for the first time (default IP is *192.168.127.254*); use an Ethernet cable to connect the host PC and MGate gateway directly. If you connect the gateway and host PC through the same Ethernet switch, make sure there is no router between them. You can then use Device Search Utility to detect the MGate gateways on your network.

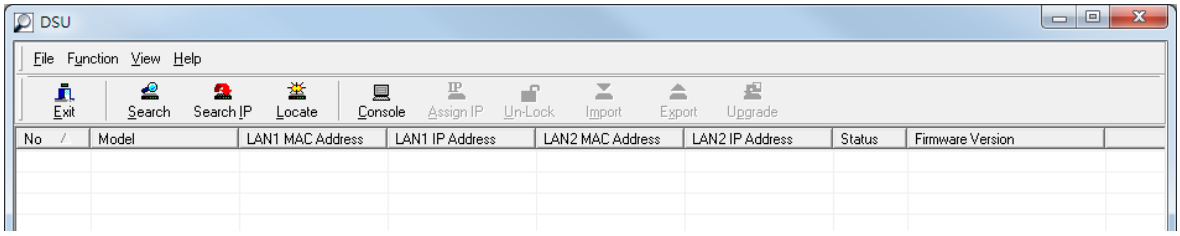
The following instructions explain how to install the Device Search Utility (**DSU**), a utility to search for MGate 5109 units on a network.

1. Insert the Document and Software CD into the CD-ROM drive. Locate and run the following setup program to begin the installation process:

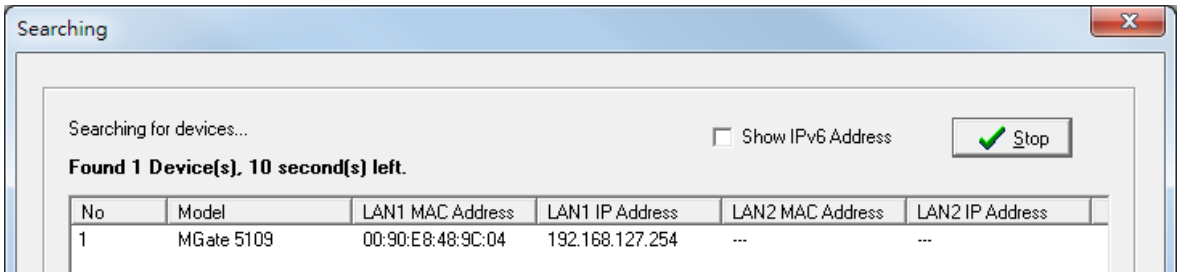
   dsu_setup_[*Version*]**_Build_**[*DateTime*]**.exe**

   The latest version might be named **dsu_setup_Ver2.0_Build_xxxxxxxx.exe**, for example:
2. You will be greeted by the Welcome window. Click **Next** to continue.
3. When the **Select Destination Location** window appears, click **Next** to continue. You may change the destination directory by first clicking on **Browse...**.
4. When the **Select Additional Tasks** window appears, click **Next** to continue. You may select **Create a desktop icon** if you would like a shortcut to the DSU on your desktop.
5. Click **Install** to start copying the software files.
6. A progress bar will appear. The procedure should take only a few seconds to complete.
7. A message will indicate that the DSU is successfully installed. You may choose to run it immediately by selecting **Launch DSU**.
8. You may also open the DSU through **Start > Programs > MOXA > DSU**.

The DSU window should appear as shown below.



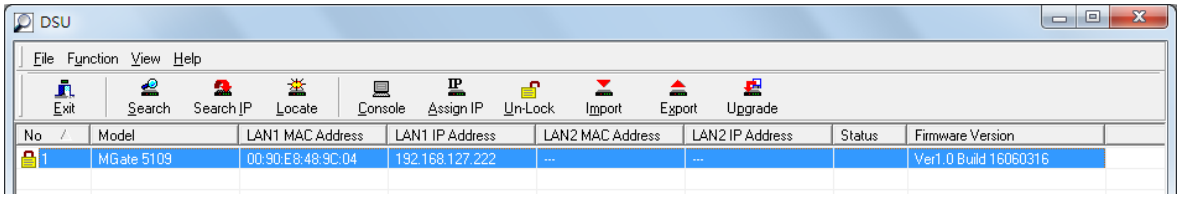
Click **Search** and a new Search window will pop up.



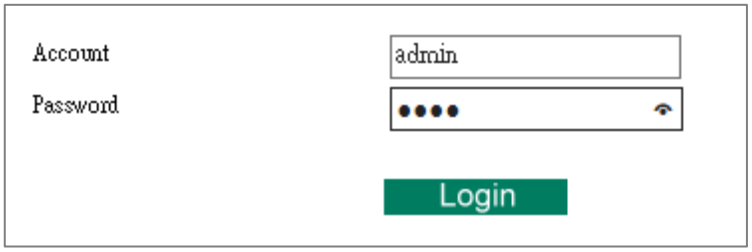
Logging in to the Web Console

Use the Web console to configure the MGate through Ethernet or verify the MGate's status. Use a web browser, such as Microsoft Internet Explorer or Google Chrome to connect to the MGate, using the HTTP/HTTPS protocol.

When the MGate gateway appears on the DSU device list, select the gateway and use the right-click the mouse button to open a web console to configure the gateway.

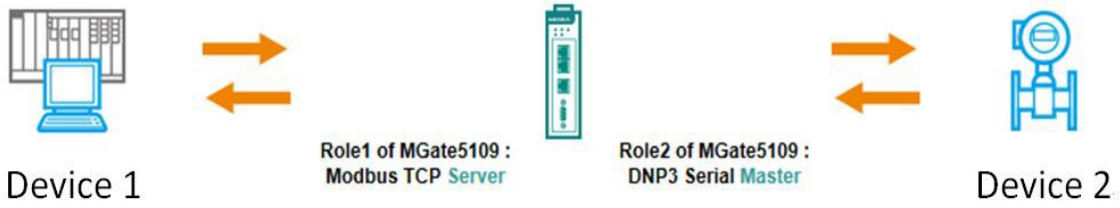


On the first page of the web console, enter the **admin** for the default Account name and **moxa** for the default Password.



Quick Setup

The MGate Series now provides a Quick Setup wizard, an illustrated guide specifically designed to make the configuration process easy. The Quick Setup wizard takes you through the configuration process from start to finish so that you do not miss any step. The following agent modes are supported in the Quick Setup:

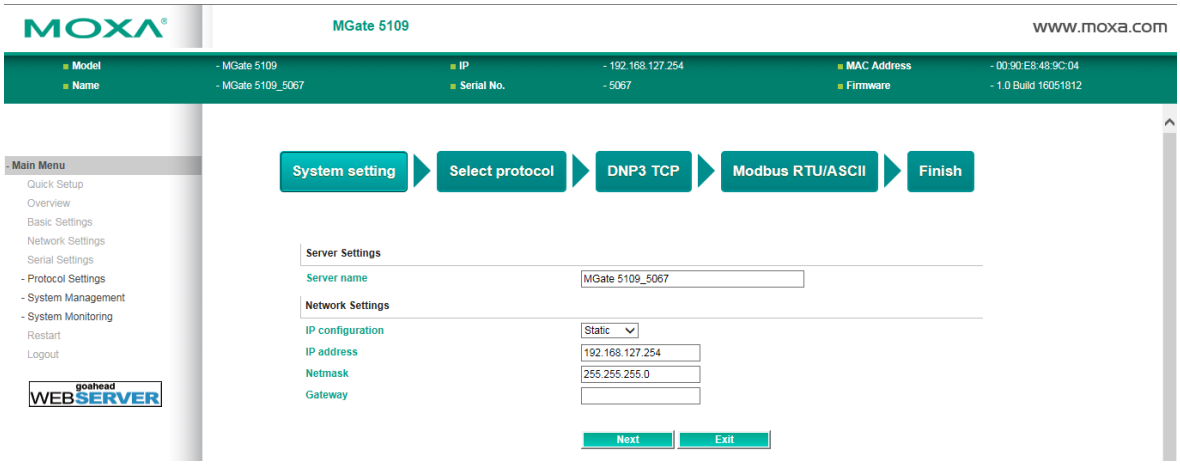


Device 1	Device 2
MB RTU/ASCII Master	DNP3 TCP Outstation
MB TCP Client	DNP3 serial Outstation
MB TCP Client	DNP3 TCP/UDP Outstation
DNP3 serial Master	MB TCP server
DNP3 TCP/UDP Master	MB RTU/ASCII slave
DNP3 TCP/UDP Master	MB TCP slave

Except for the above agent modes, other combinations can be configured in **Protocol Settings > Protocol Conversion.** For more information, refer to *chapter 4*.

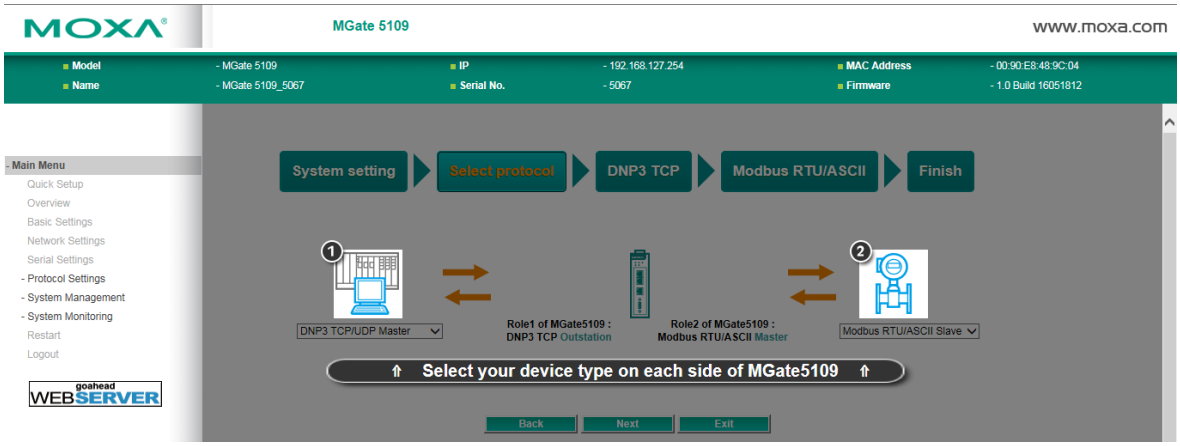
Quick Setup—System Setting

First, configure the **Server Settings** to identify the units and **Network Settings** of the MGate.



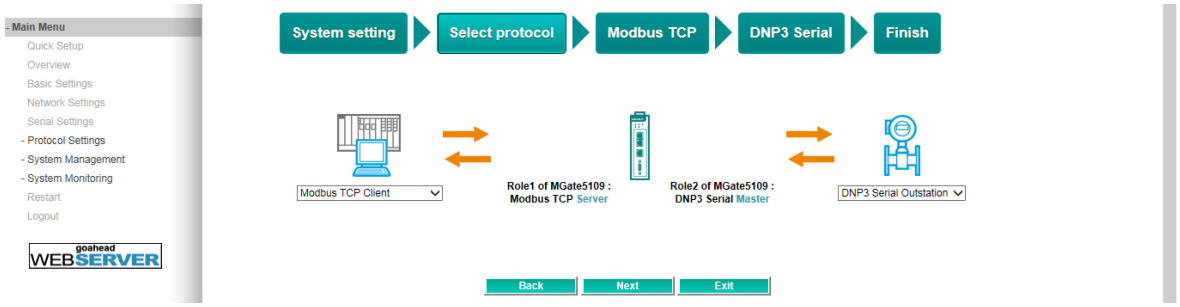
Quick Setup—Select Protocol

Then, you should select your devices' protocols on each side. After selection, the MGate will change its role to the correct one. For example, if the device is set as a DNP3 TCP/UDP Master, the MGate will then automatically configure as a DNP3 TCP/UDP Outstation by itself. Regarding protocol configuration, refer to *chapter 4*.

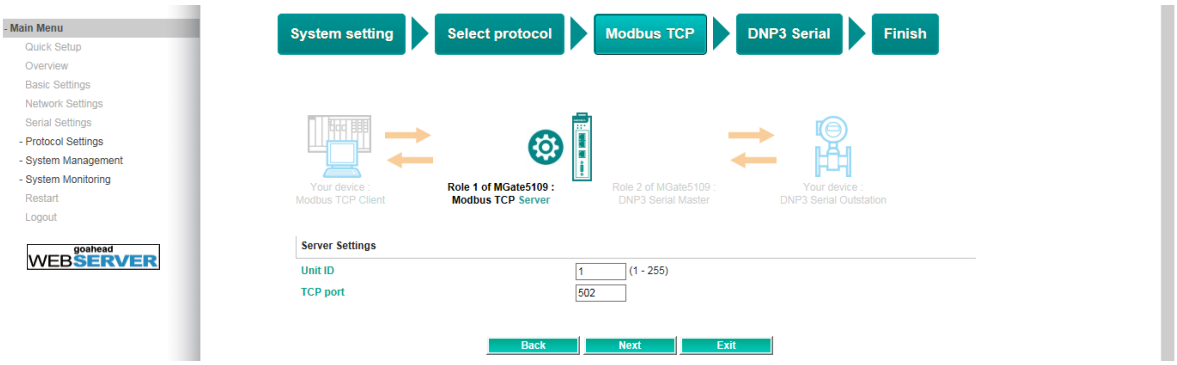


Quick Setup—Role 1 and Role 2 of the MGate 5109 (Example 1)

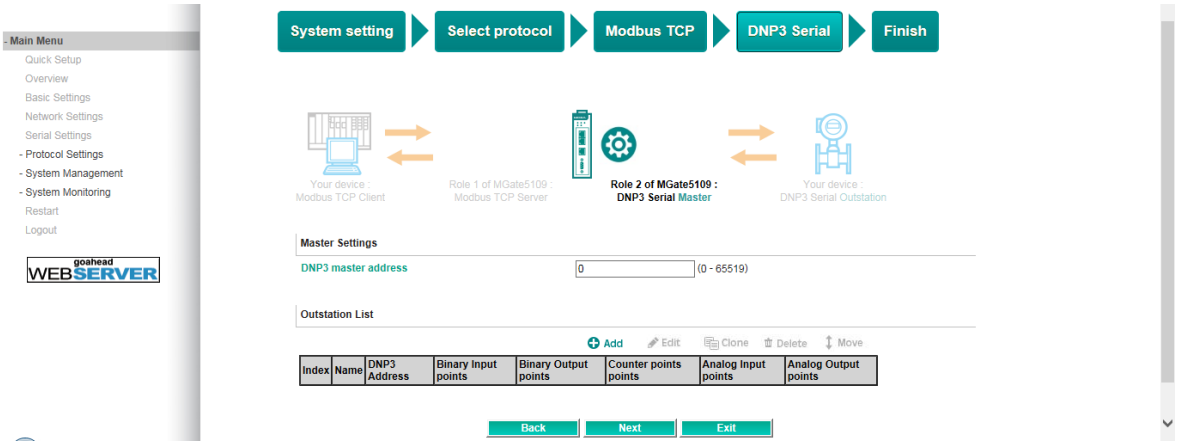
After finishing the device protocol selection, Role 1 and Role 2 of the MGate will be confirmed. You will need to configure the roles on each side by the following steps. Here is an example of Role 1 as a Modbus TCP Server, and Role 2 as a DNP3 Serial Master.



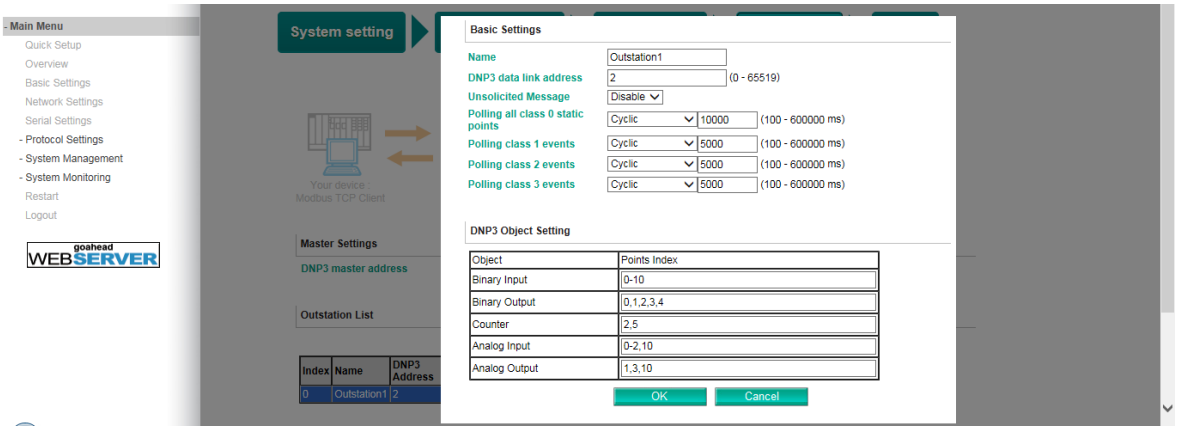
Modbus TCP settings: Set MGate Unit ID and TCP port.



DNP3 serial settings: Set MGate DNP3 Master ID address.

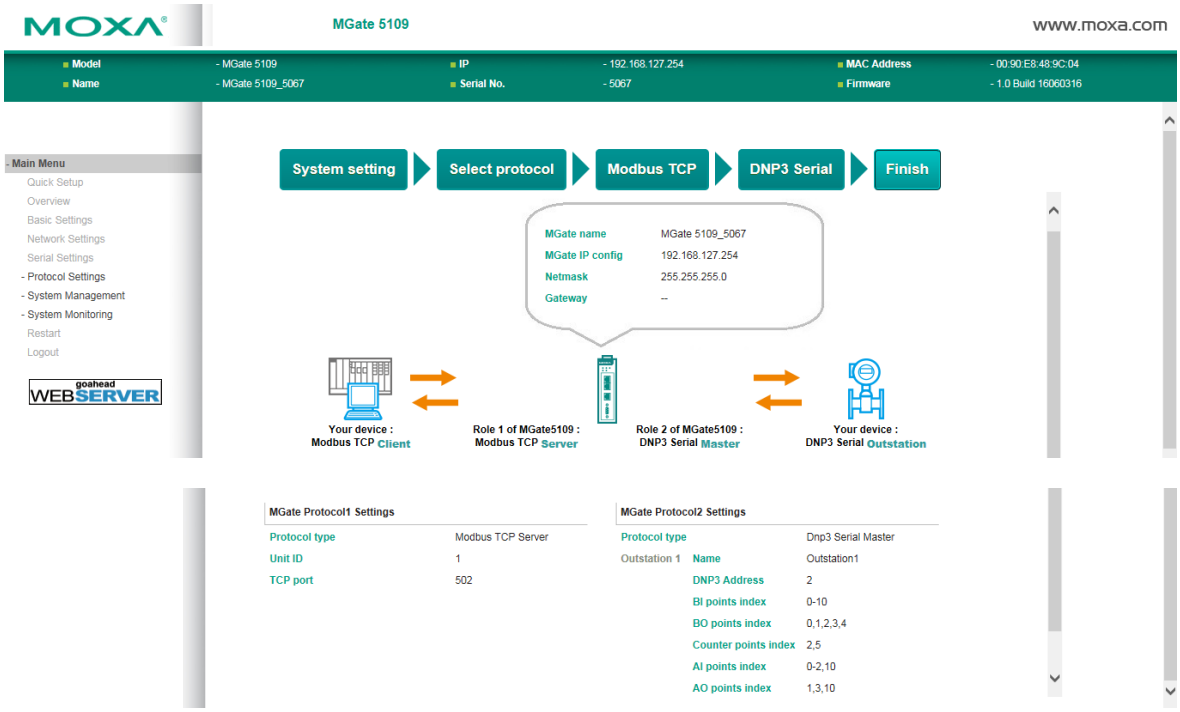


DNP3 serial settings: Add DNP3 Outstation List. For configuration details, refer to *Chapter 4*.



Quick Setup—Finish (Example 1)

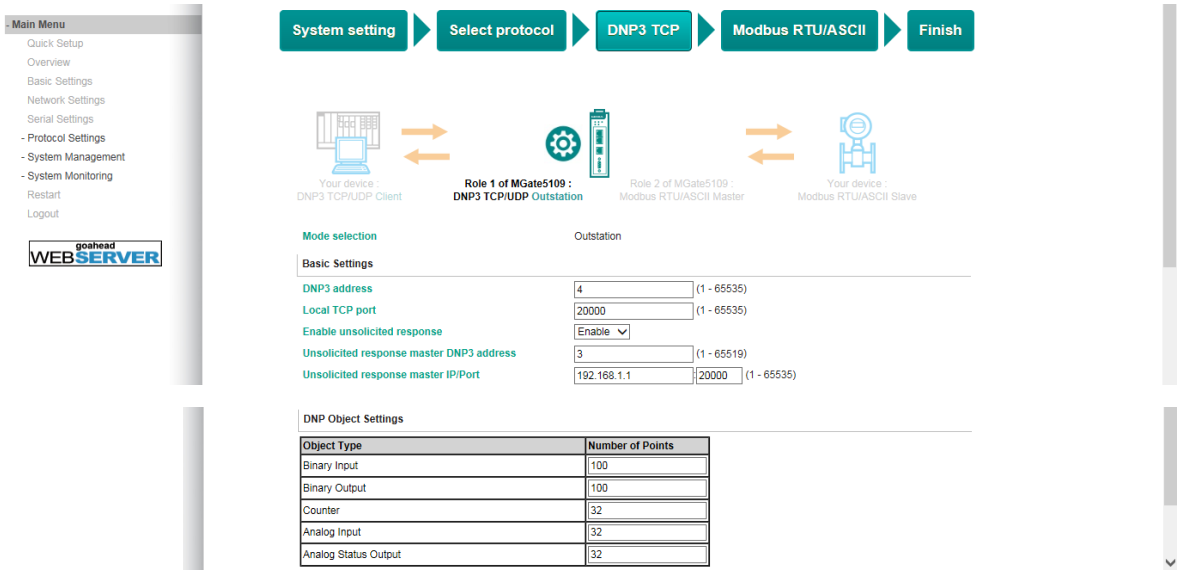
Once all the configurations are done, you can check if the parameters are correct on this webpage. Click **Save** to make the parameters effective. To view DNP3 mapping data, go to the **Protocol Settings** > **I/O Data Mapping** page. For additional details, refer to *chapter 4,* Protocol Settings—I/O Data Mapping.



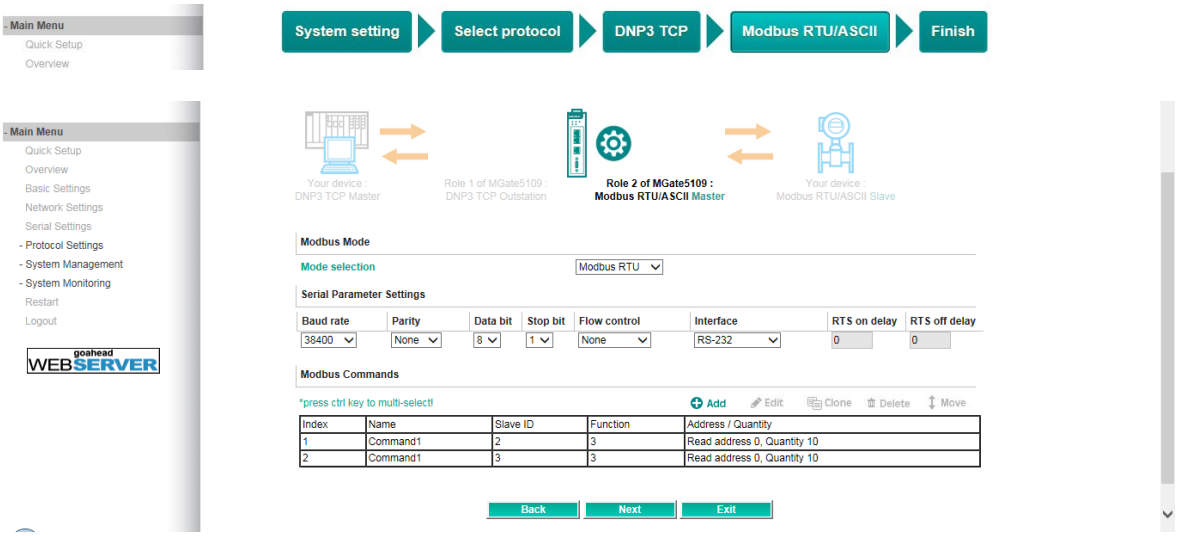
Quick Setup—Role 1 and Role 2 of the MGate 5109 (Example 2)

Here is an example of Role 1 as a DNP3 TCP/UDP Outstation, and Role 2 as a Modbus RTU/ASCII Master.

DNP3 TCP settings: For configuration details, refer to *chapter 4*.

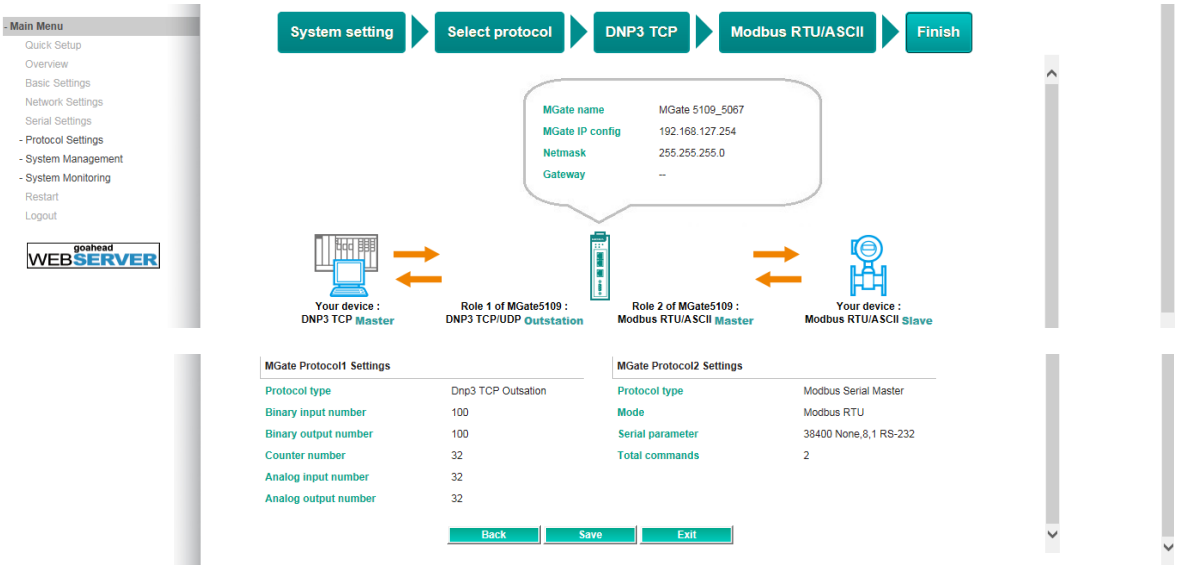


Modbus RTU/ASCII settings: For configuration details, refer to *Chapter 4*.



Quick Setup—Finish (Example 2)

Once all the configurations are done, you can check if all the parameters are correct on this webpage. Moreover, if you want to determine the data mapping status, you can click the **View I/O data mapping** to know more details. If all of them are correct, press **Save** to make the parameters effective.

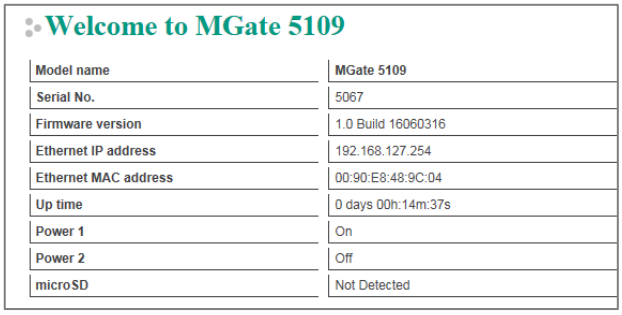


4. Web Console Configuration and Troubleshooting

This chapter provides a quick overview of how to configure the MGate 5109 by web console.

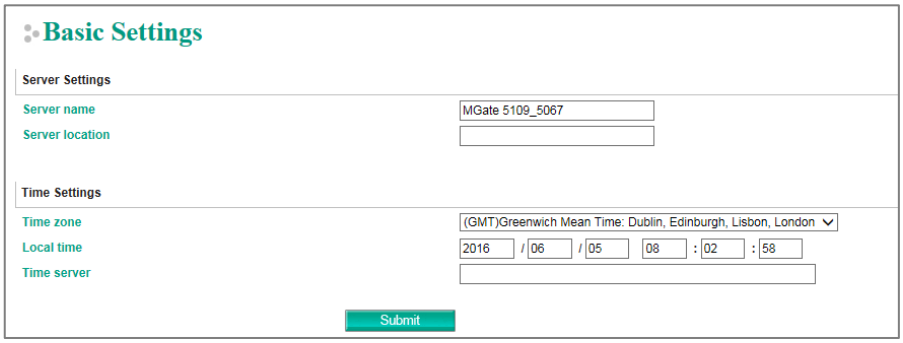
Overview

This section gives an overview of the MGate 5109 hardware.



Basic Settings

On this webpage, you can change the name of the device and time zone settings.



Server Setting

Parameter	Value	Description
Server Name	(an alphanumeric string)	You can enter a name to help you identify the unit, such as the function, etc.
Server Location	(an alphanumeric string)	You can enter a name to help you identify the unit location. Such as "Cabinet A001."

Time Settings

The MGate 5109 has a built-in Real-Time Clock for time calibration functions. Functions such as the log function can add real-time information to the message.

ATTENTION

First-time users should select the time zone first. The console will display the "real time" according to the time zone relative to GMT. If you would like to change the real-time clock, select **Local time**. The MGate's firmware will change the GMT time according to the Time Zone.

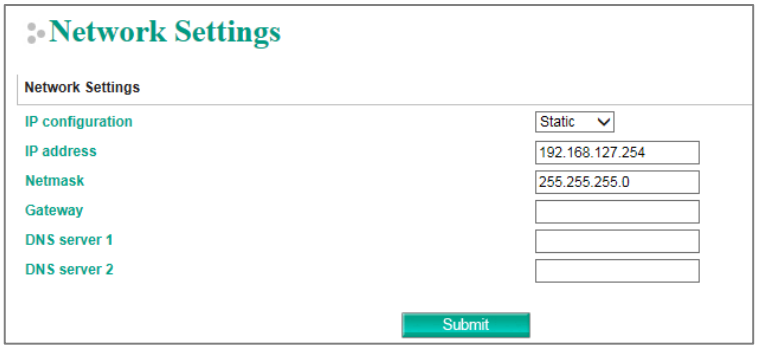
Parameter	Value	Description
Time Zone	User's selectable time zone	This field shows the currently selected time zone and allows you to select a different time zone.
Local Time	User's adjustable time.	(1900/1/1-2037/12/31)
Time Server	IP or Domain address (e.g., 192.168.1.1 or time.stdtime.gov.tw)	This optional field specifies your time server's IP address or domain name if a time server is used on your network. The module supports SNTP (RFC-1769) for automatic time calibration. The MGate will request time information from the specified time server every 10 minutes.

ATTENTION

If the dispersion of the time server is higher than the client (the MGate), the client will not accept NTP messages from the time server. The MGate's dispersion is 1 second. You must configure your time server with a dispersion value lower than 1 sec for the NTP process to complete.

Network Settings

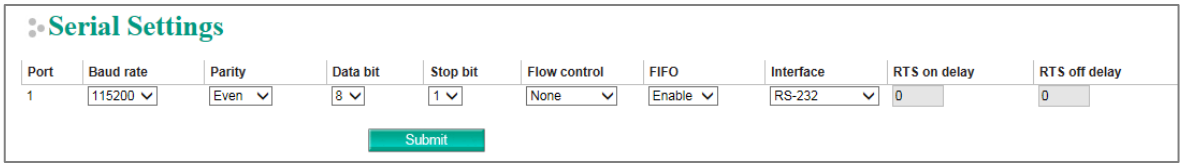
The Network Settings is where the unit's network settings are configured. You can change the IP Configuration, IP Address, Netmask, Default Gateway, and DNS.



Parameter	Value	Description
IP Configuration	Static IP, DHCP, BOOTP	Select Static IP if you are using a fixed IP address. Select one of the other options if the IP address is set dynamically.
IP Address	192.168.127.254 (or other 32-bit number)	The IP (Internet Protocol) address identifies the server on the TCP/IP network.
Netmask	255.255.255.0 (or other 32-bit number)	This identifies the server as belonging to a Class A, B, or C network.
Gateway	0.0.0.0 (or other 32-bit number)	This is the IP address of the router that provides network access outside the server's LAN.
DNS Server 1	0.0.0.0 (or other 32-bit number)	This is the IP address of the primary domain name server.
DNS Server 2	0.0.0.0 (or other 32-bit number)	This is the IP address of the secondary domain name server.

Serial Settings

The MGate 5109 serial interface supports RS-232, 2-wire RS-485, 4-wire RS-485, and RS-422 interfaces. You must configure the baudrate, parity, data bits, and stop bits before using the serial interface with Modbus RTU/ASCII protocol. Incorrect settings will cause communication failures.



Parameter	Value	Description
Baudrate	Supports standard baudrates (bps): 50/ 75/ 110/ 134/ 150/ 300/ 600/ 1200 1800/ 2400/ 4800/ 7200/ 9600/ 19200/ 38400/ 57600/ 115200/ 230.4k/ 460.8k/ 921.6k	
Parity	None, Odd, Even, Mark, Space	
Data bits	8	
Stop bits	1, 2	
Flow control	None, RTS/CTS, RTS Toggle	The RTS Toggle will turn off RTS signal when there is no data to be sent. If there is data to be sent, the RTS toggle will turn on the RTS signal before a data transmission and off after the transmission is completed.
FIFO	Enable, Disable	The internal buffer of UART. Disabling FIFO can reduce the latency time when receiving data from serial communications, but this will also slow down the throughput.
Interface	RS-232, RS-422, RS-485 2 wire, RS-485 4 wire	
RTS on delay	0 to 100 ms	Only available for RTS Toggle
RTS off delay	0 to 100 ms	Only available for RTS Toggle

RTS Toggle

The RTS Toggle function is used for **RS-232** mode only. This flow-control mechanism is achieved by toggling the RTS pin in the transmission direction. When activated, data will be sent after the RTS pin is toggled ON for the specified time interval. After the data transmission is finished, the RTS pin will toggle OFF for the specified time interval.

Protocol Settings (Agent Mode)

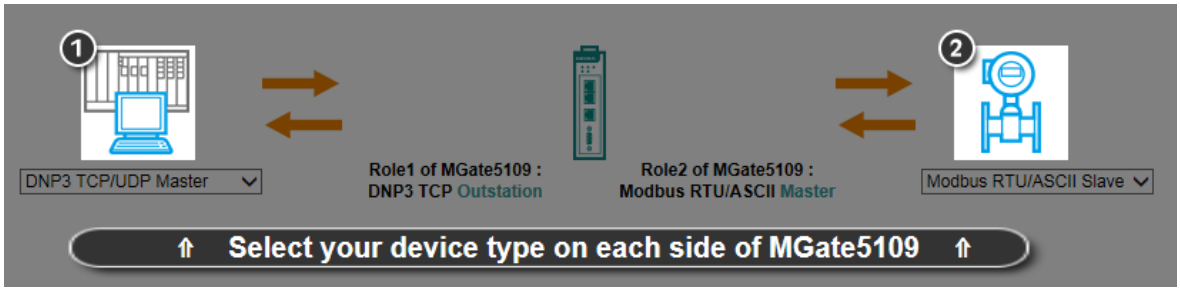
A typical MGate 5109 application comprises SCADA/PLC as client/master and RTU/IED as server/slave. Both these components use different protocols and hence need a gateway in between to exchange data. The MGate can do the role of a gateway by acting as the server/slave when it is connected to SCADA/PLC and the client/master when it is connecting to RTU/IED. Therefore, to configure an MGate, you must:

1. Select the correct protocols in the **Protocol Conversion** setting after which the details of both *sides* of the MGate's role is shown below the selection.
2. Configure the MGate's roles for both sides. Configure the master side first followed by the slave side.
3. After the MGate configuration is completed, click **I/O data mapping** to view details on exchanging data with the SCADA/PLC.

The following sections contain detailed MGate configuration instructions organized as per the above outline.

Protocol Settings—Protocol Conversion

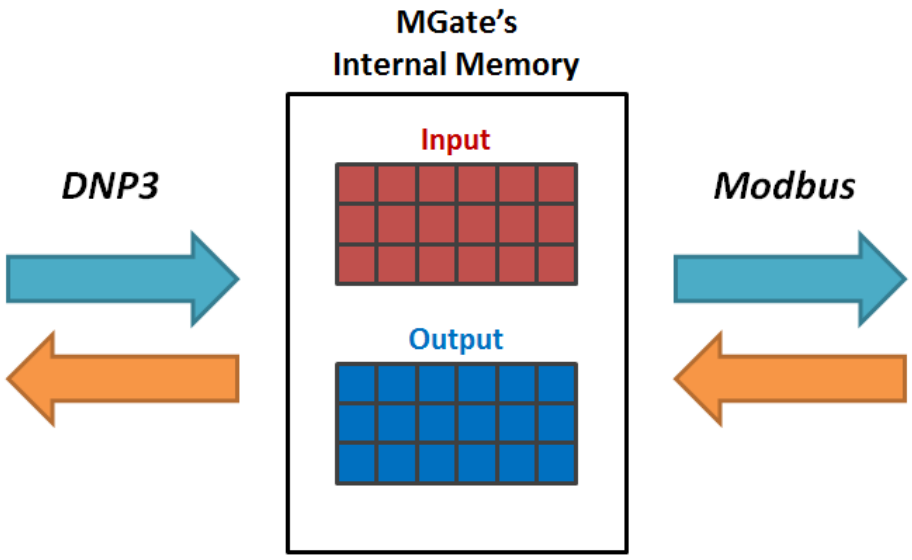
The MGate 5109 supports Modbus RTU/ASCII, Modbus TCP, and DNP3 serial/TCP/UDP protocols. The MGate fulfills a different role on each of its sides. Each role is determined by your device's settings. Therefore, set the role of each of your devices correctly. DNP3 serial master/outstation, DNP3 TCP master/outstation, Modbus TCP Client/Server, Modbus RTU/ASCII Master/Slave can be selected. Below is the selection table of the MGate 5109.



Device 1 / Device 2	Modbus RTU Master	Modbus RTU Slave	Modbus TCP Client	Modbus TCP Server	DNP3 Serial Master	DNP3 Serial Outstation	DNP3 TCP/UDP Master	DNP3 TCP/UDP Outstation
Modbus RTU Master								
Modbus RTU Slave								
Modbus TCP Client	Agent	Transparent Agent	Agent					
Modbus TCP Server	Transparent Agent							
DNP3 Serial Master			Agent	Agent				
DNP3 Serial Outstation			Agent					
DNP3 TCP/UDP Master	Agent	Agent	Agent	Agent		Transparent Agent		
DNP3 TCP/UDP Outstation	Agent		Agent		Transparent Agent			

When using the MGate 5109 for different protocol conversions, it should be set to *agent* mode. In agent mode, the MGate 5109 uses an internal memory to exchange data between Modbus and DNP3.

The MGate's internal memory is divided into two parts—one for input and the other for output as shown in the illustration below. The internal memory concept is shown in the figure below:



To learn more about MGate's internal memory, refer to Protocol Settings—I/O Data Mapping.

Protocol Settings—Configure MGate's Role 1 and Role 2

After protocol selection, we have to configure each side of the MGate's role. In a typical application, one side of the MGate will be set as a server/slave and the other side will be set as a client/master. The following configuration settings are possible:

A1. Modbus TCP Client (Master) Settings

A2. Modbus RTU/ASCII Master Settings

A3. DNP3 TCP/UDP Master Settings

A4. DNP3 Serial Master Settings

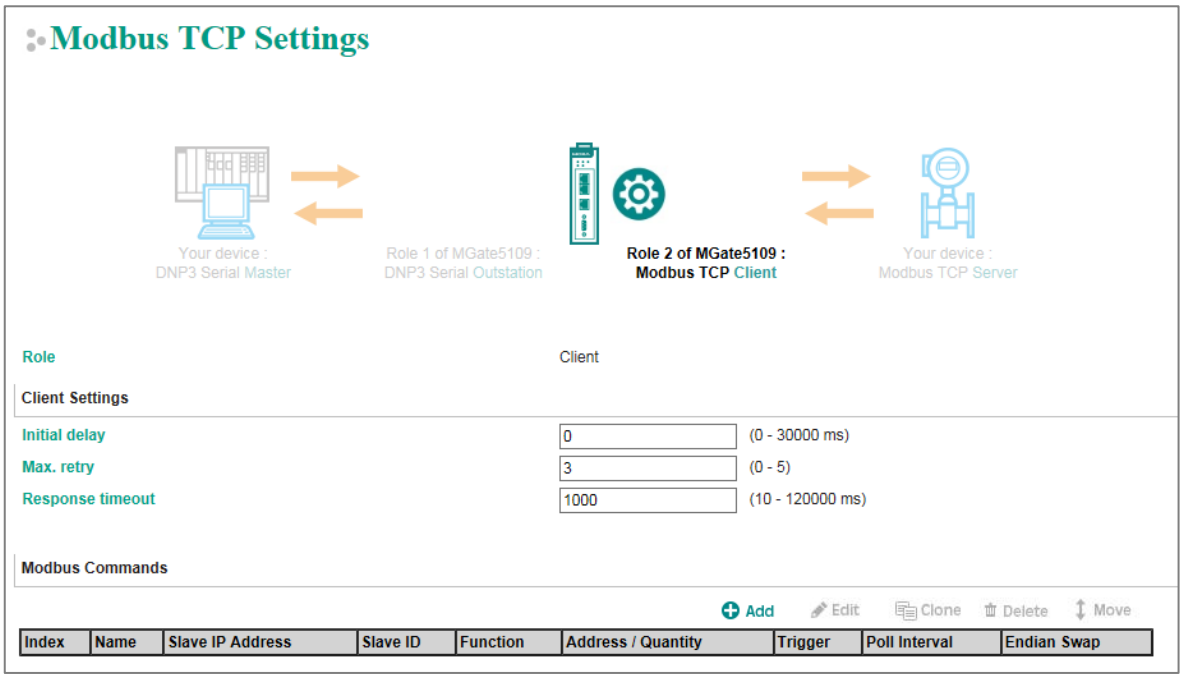
A5. Modbus TCP Server (Slave) Settings

A6. Modbus RTU/ASCII Slave Settings

A7. DNP3 TCP/UDP Outstation Settings

A8. DNP3 Serial Outstation Settings

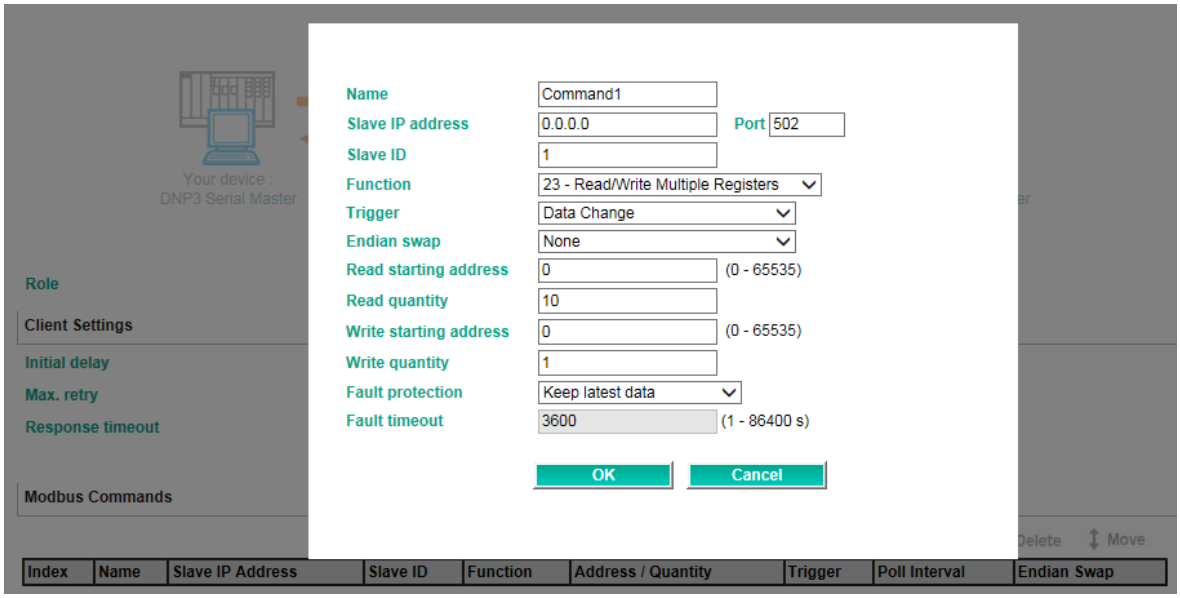
A1. Modbus TCP Client (Master) Settings



Client Settings

Parameter	Value	Default	Description
Initial delay	0 to 30000 ms	0	Some Modbus slaves may take more time to boot up than other devices. In some environments, this may cause the entire system to suffer from repeated exceptions during the initial boot-up. After booting up, you can force the MGate to wait before sending the first request with the **Initial Delay** setting.
Max. retry	0 to 5	3	This is used to configure how many times the MGate will try to communicate with the Modbus slave.
Response timeout	10 to 120000 ms	1000	The time taken by a slave device to respond to a request is defined by the device manufacturer based on the Modbus standard. A Modbus master can be configured to wait a certain amount of time for a slave's response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue the operation even if a slave device is disconnected or faulty. On the MGate 5109, the **Response timeout** field is used to configure how long the gateway will wait for a response from a Modbus slave. Refer to your device manufacturer's documentation to manually set the response timeout

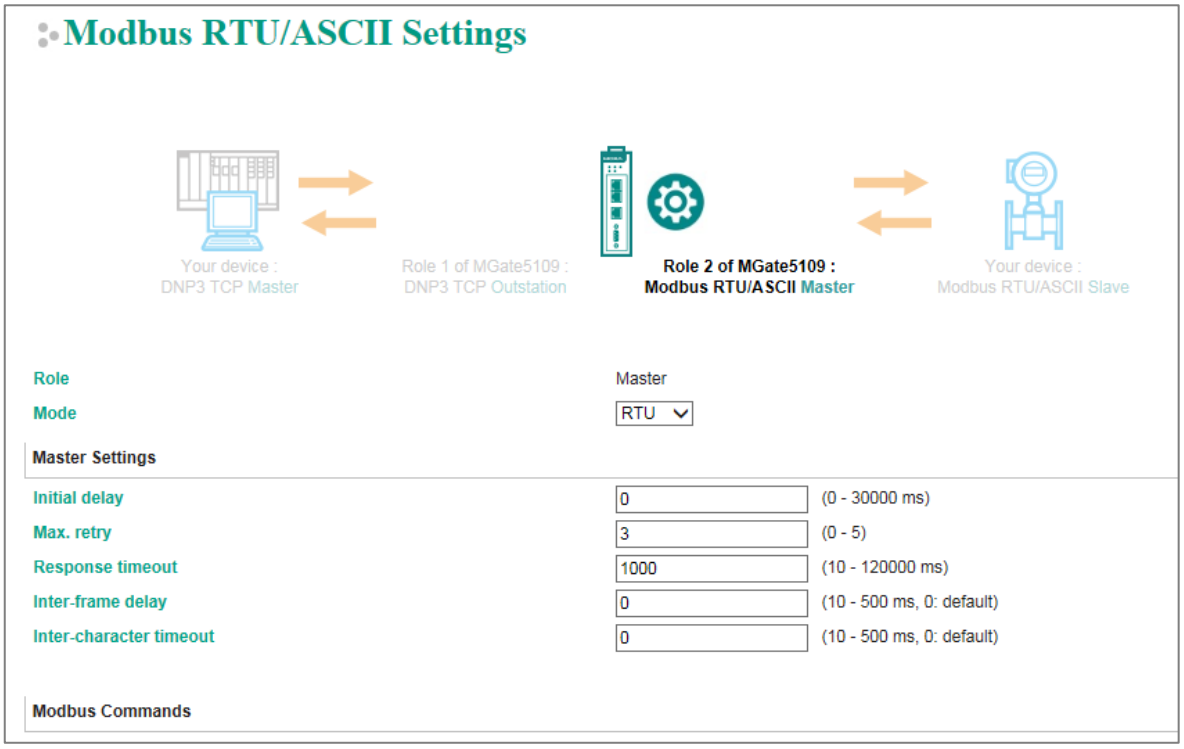
Add Modbus Commands



Parameter	Value	Default	Description
Name	(an alphanumeric string)	Command1	Max. 32 characters
Slave IP address	0.0.0.0 to 255.255.255.255	0.0.0.0	The IP address of a remote slave device.
Port	1 to 65535	502	The TCP port number of a remote slave device.
Slave ID	1 to 255	1	The Modbus slave ID
Function	1 – Read Coils 2 – Read Discrete Inputs 3 – Read Holding Registers 4 – Read Input Registers 5 – Write Single Coil 6 – Write Single Register 15 – Write Multiple Coils 16 – Write Multiple Registers 23 – Read/Write Multiple Registers		When a message is sent from a Client to a Server device, the function code field tells the server what kind of action to perform.
Trigger	Cyclic Data Change Disable		Disable: The command is never sent Cyclic: The command is sent cyclically at the interval specified in the Poll Interval parameter. Data change: The data area is polled for changes at the time interval defined by Poll Interval. A command is issued when a change in data is detected.
Poll interval	100 to 1200000 ms	1000	Polling intervals are in milliseconds. Since the module sends all requests in turns, the actual polling interval also depends on the number of requests in the queue and their parameters. The range is from 100 to 1,200,000 ms.

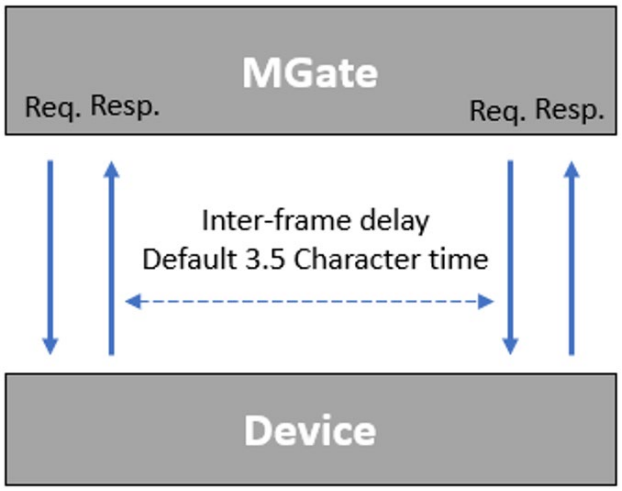
Parameter	Value	Default	Description
Endian swap	None Byte Word Byte and Word	None	Data Byte Swapping **None:** Don't need to swap **Byte:** 0x0A, 0x0B, 0x0C, 0x0D becomes 0x0D, 0x0C, 0x0B, 0x0A. **Word:** 0x0A, 0x0B, 0x0C, 0x0D becomes 0x0C, 0x0D, 0x0A, 0x0B. **ByteWord:** 0x0A, 0x0B, 0x0C, 0x0D becomes 0x0D, 0x0C, 0x0B, 0x0A. There are two phases in changing **ByteWord:** 1) 0x0A, 0x0B, 0x0C, 0x0D becomes 0x0B, 0x0A, 0x0D, 0x0C 2) 0x0B, 0x0A, 0x0D, 0x0C becomes 0x0D, 0x0C, 0x0B, 0x0A
Read starting address	0 to 65535	0	Modbus register address.
Read quantity		10	Specifying how many items to read.
Write starting address	0 to 65535	0	Modbus register address.
Write quantity		1	Specifying how many items to write into.
Fault protection	Keep latest data Clear all data bits to 0 Set to user defined value		If the MGate's connection to the other side (server/slave) fails, the gateway will not be able to receive data, but the gateway will continuously send output data to the Modbus TCP server device. To avoid problems in this case, the MGate 5109 can be configured to react in one the following three ways: Keep latest data, clear data to zero, set the data bits to user-defined values.
Fault value		00 00	The user-defined values to write into the data bits when the **Set to user defined value** option is selected.
Fault timeout	1 to 86400 s	3600	Defines the communication timeout for the opposite side.

A2. Modbus RTU/ASCII Master Settings



Master Settings

Parameter	Value	Default	Description
Mode	RTU or ASCII	RTU	The Modbus protocol type
Initial delay	0 to 30000 ms	0	Some Modbus slaves may take more time to boot up than other devices. In some environments, this may cause the entire system to suffer from repeated exceptions during the initial boot-up. After booting up, you can force the MGate to wait before sending the first request with the **Initial Delay** setting.
Max. retry	0 to 5	3	The number of times the master will retry the same request when the response times out.
Response timeout	10 to 120000 ms	1000	According to the Modbus standard, the time it takes for a slave device to respond to a request is defined by the device manufacturer. Based on this response time, a master can be configured to wait a certain amount of time for a slave's response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue operations even if a slave device is disconnected or faulty. On the MGate 5109, the **Response timeout** field is used to configure how long the gateway will wait for a response from a Modbus ASCII or RTU slave. Refer to your device manufacturer's documentation to manually set the response time.

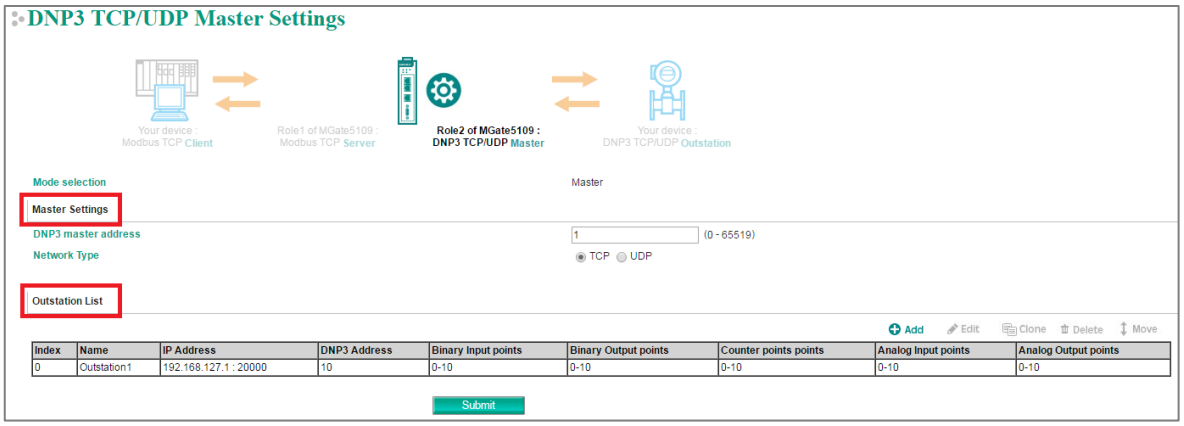
Parameter	Value	Default	Description
Inter-frame delay (only for Modbus RTU)	10 to 500 ms	0	Defines the time interval between an RTU response and the next RTU request. When the baudrate is lower than 19200 bps, the default value is 0, which is 3.5 character time. When the baudrate is larger than 19200 bps, the MGate uses a predefined fixed value that is not user-configurable. This function solves the issue that some devices can't handle the RTU requests that quickly, so the MGate opens to user-defined values. How to calculate Modbus character time? E.g., if the baudrate is 9600 bps, 1 character time is about 1 ms. In a serial frame (11 bits, including start bit, data, parity bit, and stop bit), 9600 bps approximately equals to 960 characters/s, so transmitting 1 character needs about 1/960 = 1 ms. 
Inter-character timeout (only for Modbus RTU)	10 to 500 ms	0	The time interval between characters in one frame. When the baudrate is lower than 19200 bps, the default value is 0, which is 1.5 character time. When the baudrate is larger than 19200 bps, MGate uses a predefined fixed value that is not user-configurable. When the serial side of the MGate receives one character, and the next one comes after the "inter-character timeout" defined, the frame will be discarded because of timeout.

Add Modbus Commands

Refer to *A1. Modbus TCP Client (Master) Settings.*

A3. DNP3 TCP/UDP Master Settings

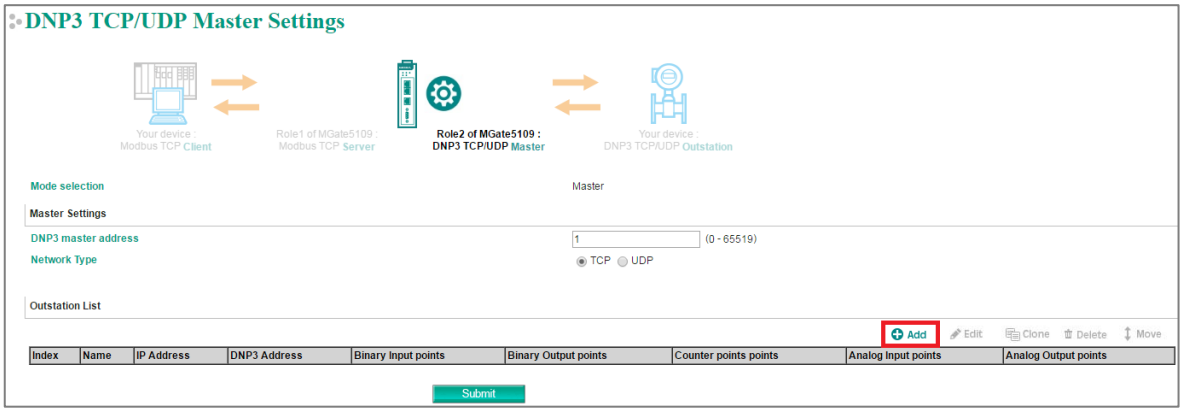
Configuration of a DNP3 TCP/UDP master comprises two parts: **Master settings** and **Outstation List**. The **Master settings** specify the MGate's Master address and connection type with outstation. The **Outstation List** is a list of all the outstations that the MGate connects to.



Master Settings

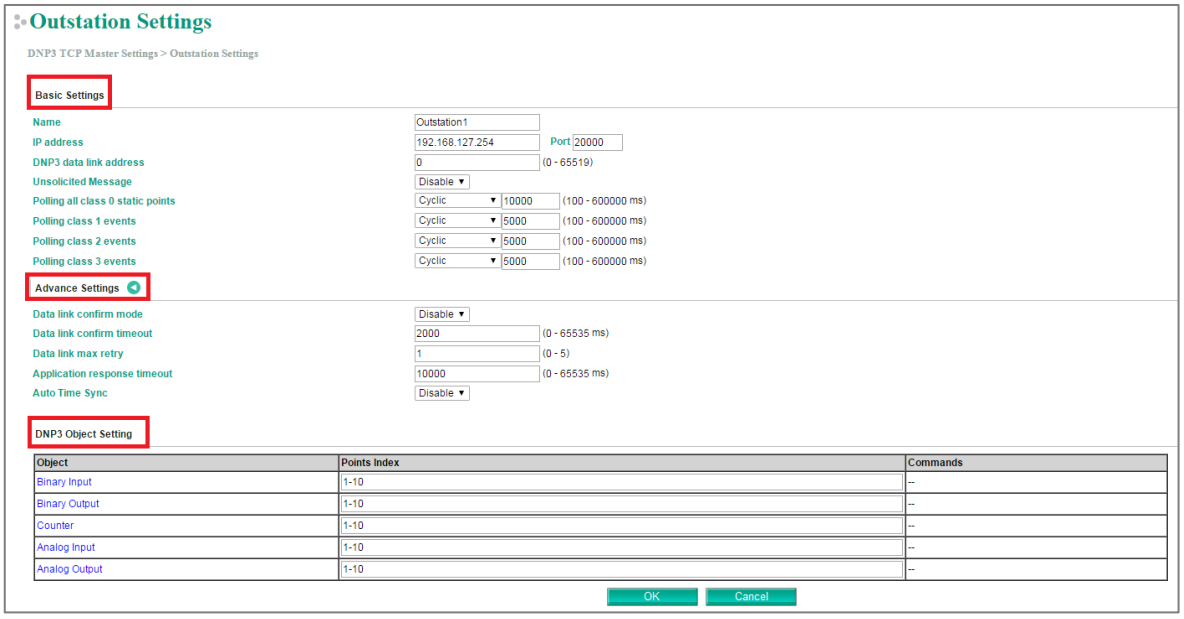
Parameter	Value	Default	Description
DNP3 master address	0 to 65519	1	DNP3 master address
Network Type	TCP UDP	TCP	Network Type

After configuring the **Master Settings**, click on **Add** in the **Outstation List** section.

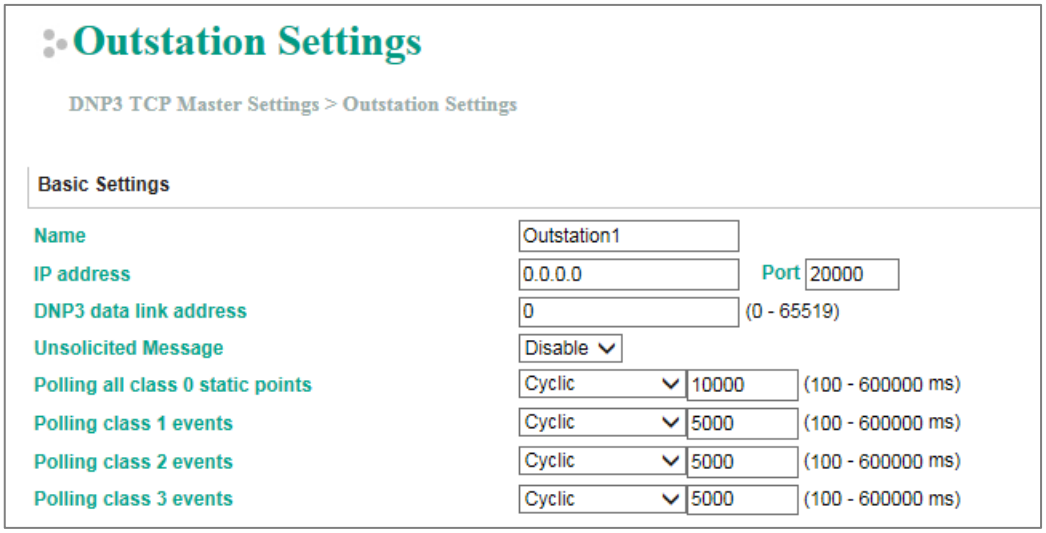


Adding an Entry to the Outstation List (Outstation Settings)

Click on **Add** option to open the **Outstation Settings** page, which comprises three sections: **Basic Settings**, **Advanced Settings,** and **DNP3 Object Setting.**



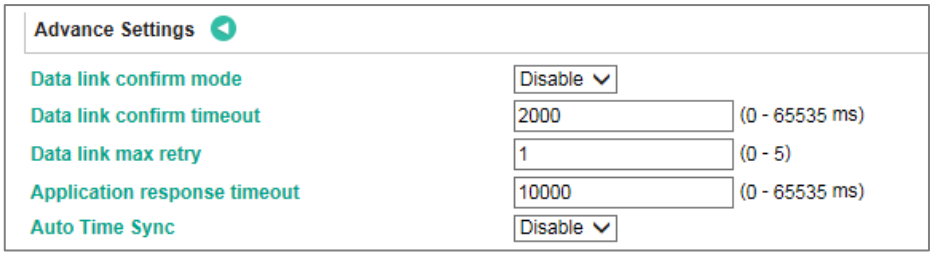
Basic Settings



Parameter	Value	Default	Description
Name	an alphanumeric string	Outstation1	Max. 32 characters
IP address	0.0.0.0 to 255.255.255.255	0.0.0.0	The IP addresses of a remote slave device.
Port	1 to 65535	20000	The TCP port number of a remote slave device.
DNP3 data link address	0 to 65519	0	DNP3 ID / Outstation address
Unsolicited Message	Enable Disable	Disable	Enables to accept outstation's unsolicited responses.
Polling all class 0 static points	None At start up only Cyclic (100 to 600000 ms)	Cyclic (10000 ms)	The method to poll point's current value.

Parameter	Value	Default	Description
Polling class 1 events	None At start up only Cyclic (100 to 600000 ms)	Cyclic (5000 ms)	The method to poll class-1 events.
Polling class 2 events	None At start up only Cyclic (100 to 600000 ms)	Cyclic (5000 ms)	The method to poll class-2 events.
Polling class 3 events	None At start up only Cyclic (100 to 600000 ms)	Cyclic (5000 ms)	The method to poll class-3 events.

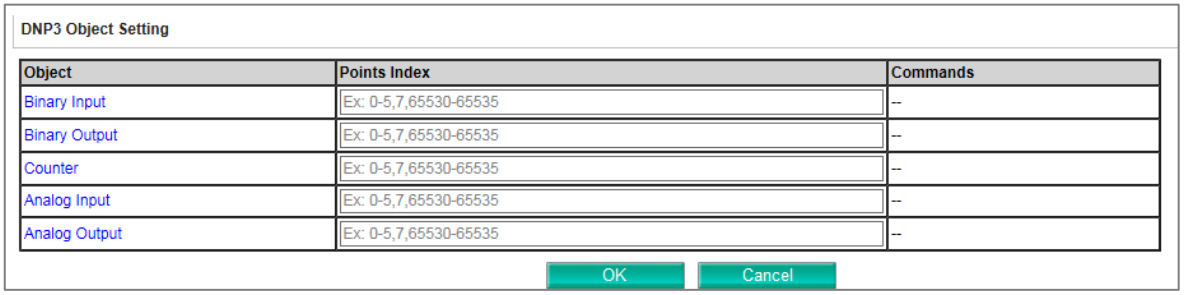
Advanced Settings



Parameter	Value	Default	Description
Data link confirm mode	Enable Disable	Disable	This value specifies whether data link frames sent to the remote device require a data link confirmation. This parameter should be set to **Disable** for almost all applications.
Data link confirm timeout	0 to 65535 ms	2000	This parameter specifies the required time fora data link confirmation from the remote device before a retry is attempted
Data link max retry	0 to 5	1	The maximum number of retries at the Data Link level to get a confirmation. If this value is set to 0, retries are disabled at the data link level of the protocol. This parameter is only used if the frame is sent when a confirmation is requested.
Application response timeout	0 to 65535 ms	10000	During the timeout period, the master will wait for each response message If **Data link confirm mode** is enabled, make sure the timeout period is set long enough to permit data link retries.
Auto Time Sync	Enable Disable	Enable	When an outstation anticipates that its timing reference (such as a crystal oscillator) will drift beyond the required accuracy, it should set the IIN1.4 [NEED_TIME] bit in responses. The master must send the time promptly after receiving a response with this bit set when enabling Auto Time Sync. Outstations that set the IIN1.4 [NEED_TIME] bit at unreasonably short intervals will adversely impact system operation by dedicating a disproportionate amount of processing to non-data collection activities.

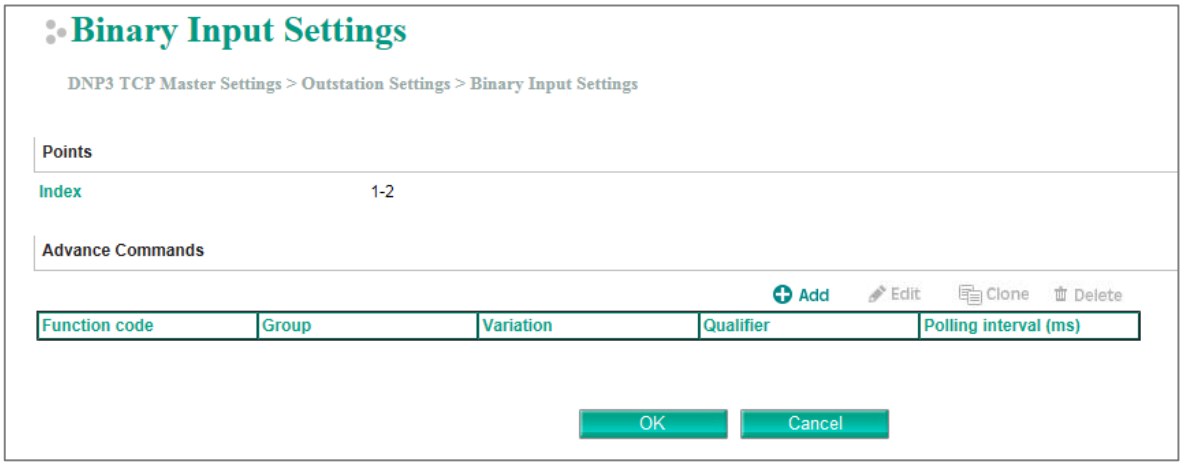
DNP3 Object Setting

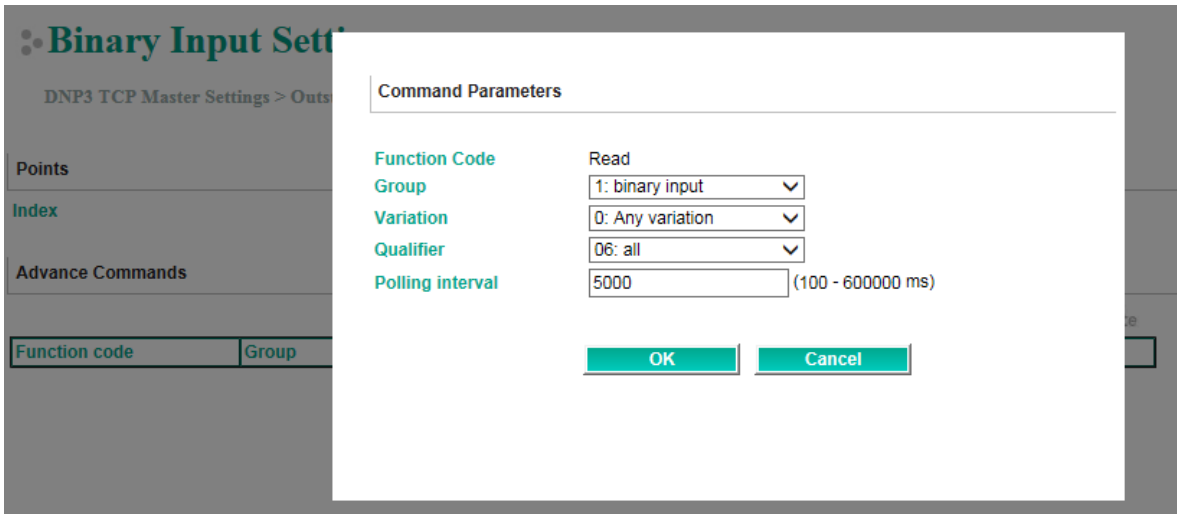
In this section, you can configure **Points Index** for each DNP3 object. Be sure to include a reference to your DNP3 outstation device here. The MGate uses the information in this section to determine how to exchange data with a DNP3 outstation.



The general DNP3 settings can be found just above the DNP3 Master configuration. In addition to polling all **Class Static Points** and **Class Events** in the outstation, you can create commands to trigger specific actions such as Binary Input, Binary Output, Counter, Analog Input, and Analog Output.

Binary Input

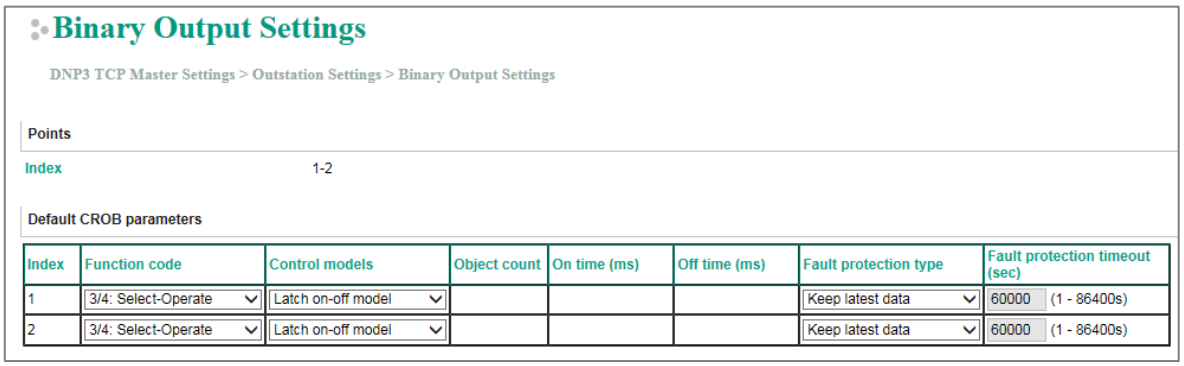




Command Parameters	Group	Variation	Qualifier
Select Read Binary Input method	1: binary input	0: Any variation	06: all
	2: binary input event	0: Any variation 1: Without time 2: With absolute time 3: With relative time	06: all 07/08: limited quantity (1-65535)

Binary Output

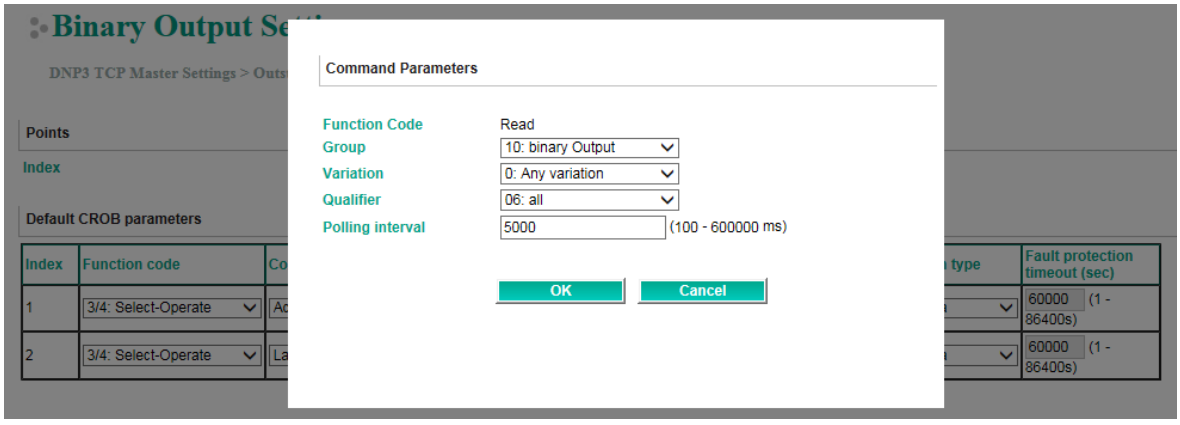
Default CROB Parameters



Parameter	Value	Default	Description
Function code	3/4: Select-Operate 5: Direct Operate 6: Direct Operate, No Ack		The method of CROB (Control Relay Output Blocks) control request
Control models	Latch on-off model Close-trip model Activation model		Regarding control models, refer to DNP3 device attributes.
Object count	0 to 65535	1	The count number of pulse on/off with on time and off time for close-trip model and activation model.
On time (ms)	0 to 4294967295	100	Pulse on time
Off time (ms)	0 to 4294967295	100	Pulse off time
Fault protection type	Keep latest data On Off Close Trip	Keep latest data	When the communication on the opposite side stops, users can select a protection method to write a CROB request to the end device.
Fault protection timeout (sec)	1 to 86400 seconds	60000	Available for ON-OFF (latch on-off model), Close-trip (close-trip model)

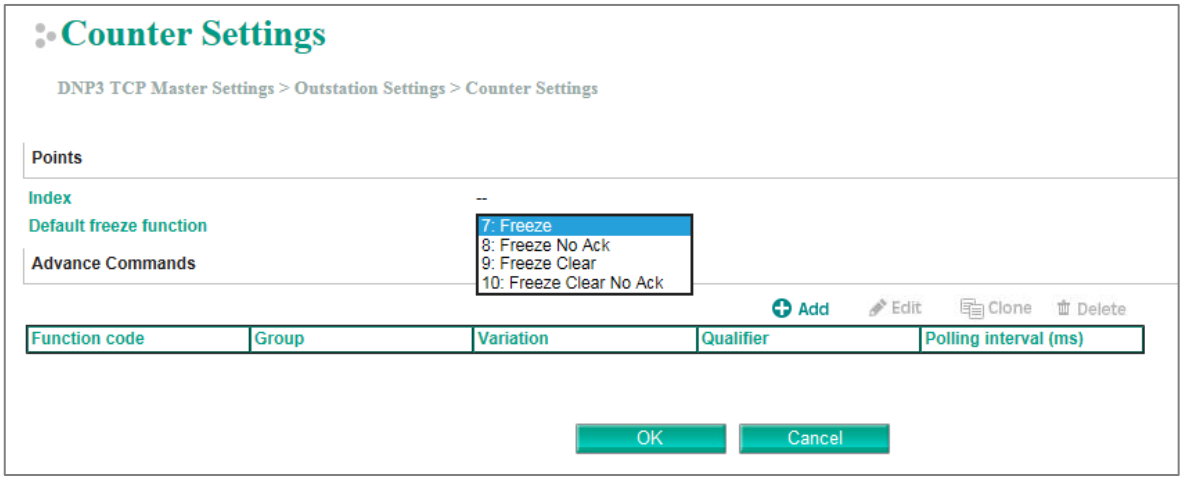
Advance Commands

Read current Binary Output value.



Command Parameters	Group	Variation	Qualifier
Select Read Binary Output method	10: Binary Output	0: Any variation	06: all

Counter Settings



Default freeze function (options 7, 8, 9, and 10)

The purpose of this function is to copy the value of the current point of an outstation counter to a second and separate memory location associated with the same point. The copied value is referred to as the frozen value and remains constant until the next freeze operation for the same point of the outstation counter is performed.

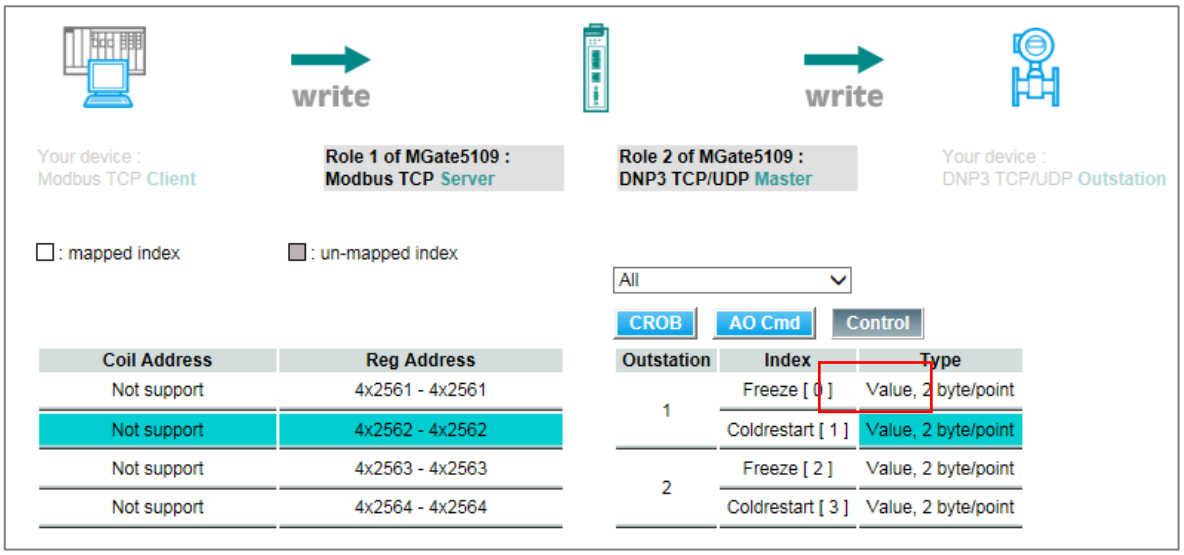
Parameters	Value	Description
Default freeze function	7: Freeze (Default)	Sends the IMMED_FREEZE function code to the outstation. Result: A null response from the outstation.
	8: Freeze No Ack	Sends the IMMED_FREEZE_NR function code to the outstation. This function code is recommended for broadcast freezing. Result: No response from the outstation.
	9: Freeze Clear	Sends the IMMED_FREEZE function code to the outstation. Result: The current value of the outstation counter is immediately reset to 0 and a null response is received from the outstation.
	10: Freeze Clear No Ack	Sends IMMED_FREEZE_NR function code to the outstation. Result: The current value of the outstation counter is immediately set to 0 and no response is received from the outstation.

Advanced Commands

Command used to read the current data in the Counter.

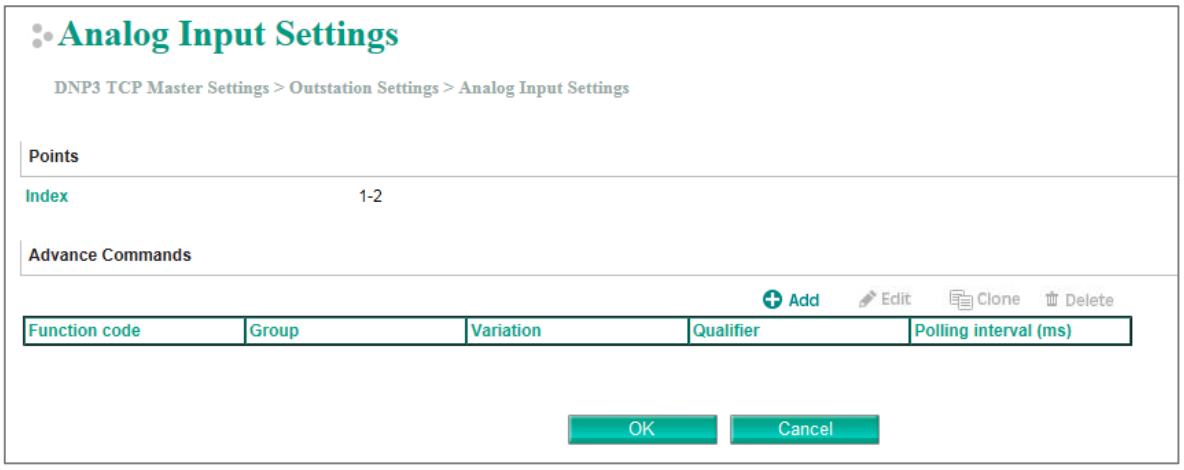
Command Parameters	Group	Variation	Qualifier
Select Read Counter method	20: counter	0: Any variation	06: all
	21: frozen counter	0: Any variation	06: all
	22: counter event	0: Any variation	06: all 07/08: limited quantity (1-65535)

To send a freeze request, press the **Control** button on the I/O mapping page as shown below:

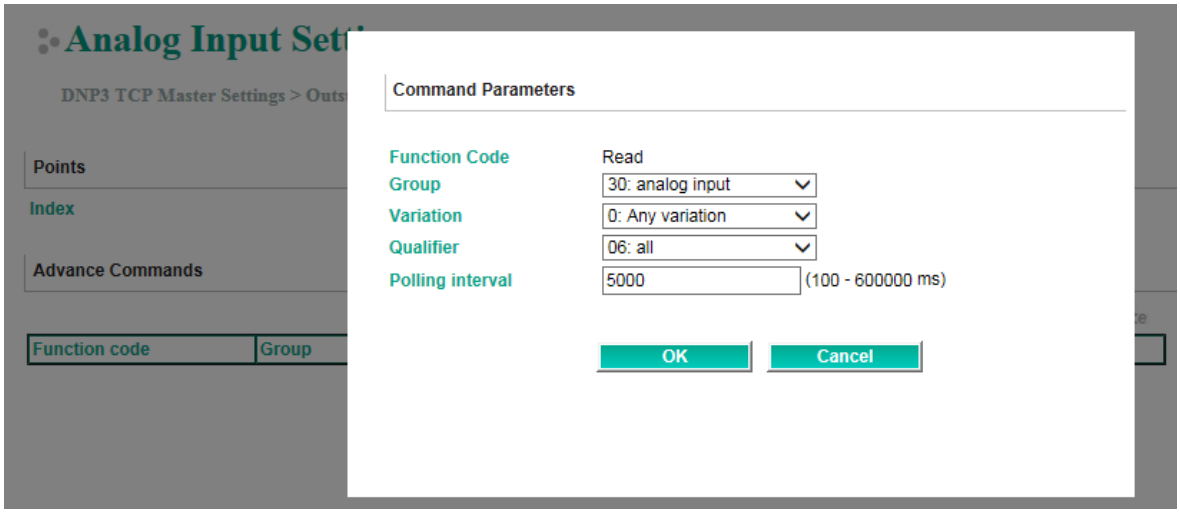


Modbus master writes a value of 256 to a relative Register Address (40000 based); the MGate will trigger a freeze request to the outstation according to the configuration. After sending out the command, the MGate will reset the relative Modbus address value to 0.

Analog Input

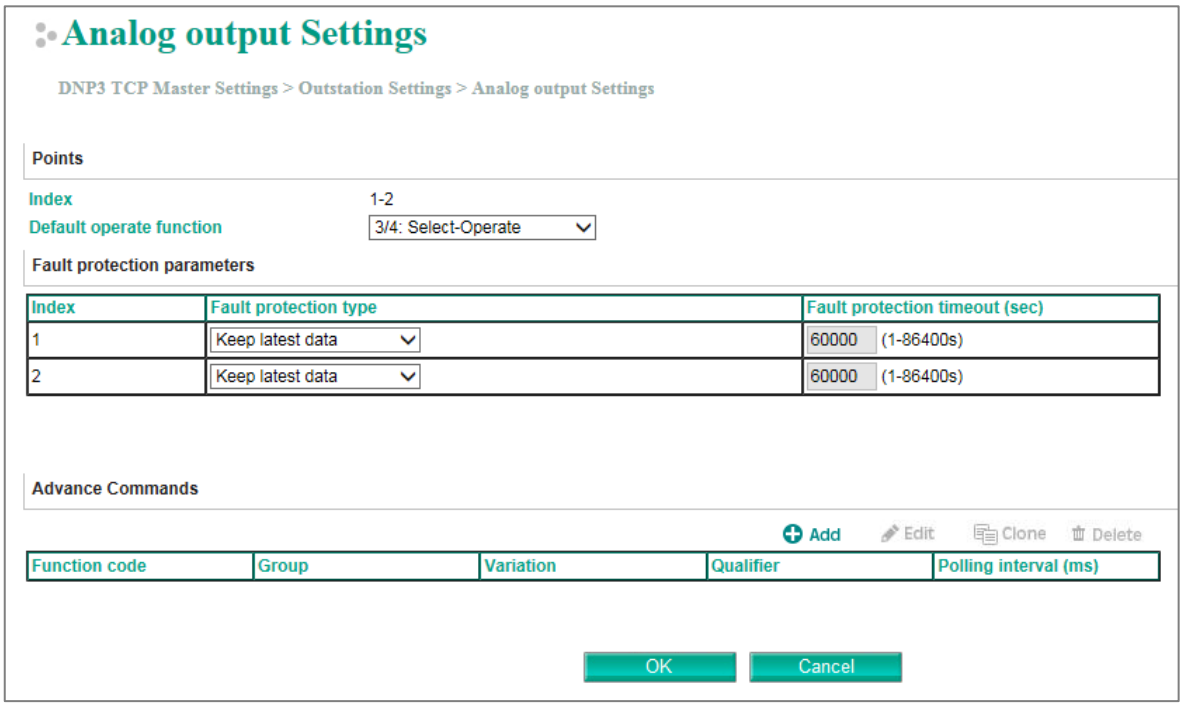


Advanced Commands:



Command Parameters	Group	Variation	Qualifier
Select Read Analog Input method	30: analog input	0: Any variation	06: all
	32: analog input event	0: Any variation	06: all 07/08: limited quantity (1-65535)

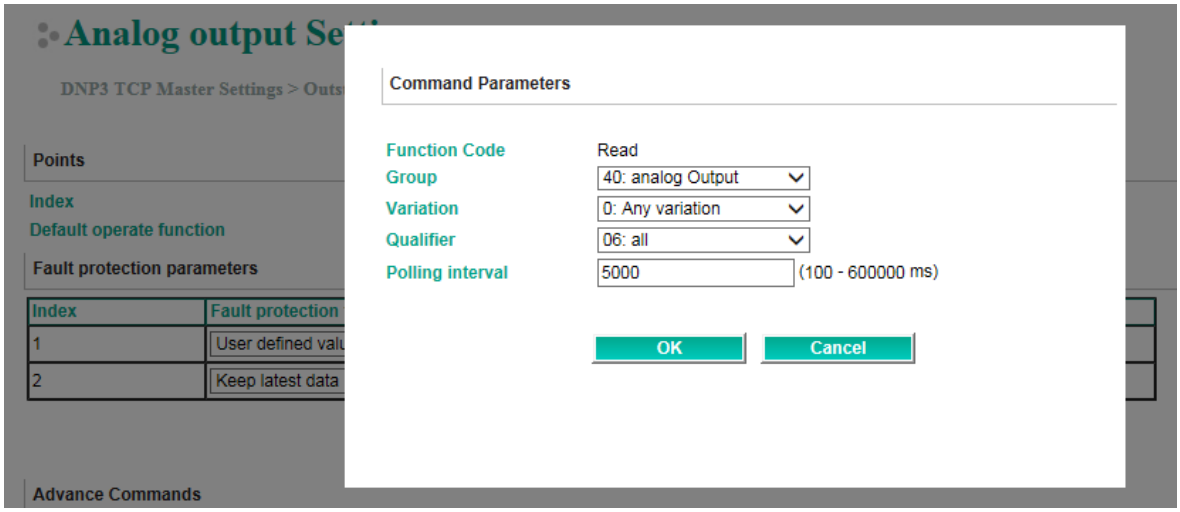
Analog Output



Fault protection parameters	Fault protection type	Fault protection timeout (sec)
When communication on the opposite side stops, users can select a protection method to write a request to the end device.	Keep latest data	-
	Clear data to zero	60000, (1-86400 second)
	User-defined value	(-32768 to32767)

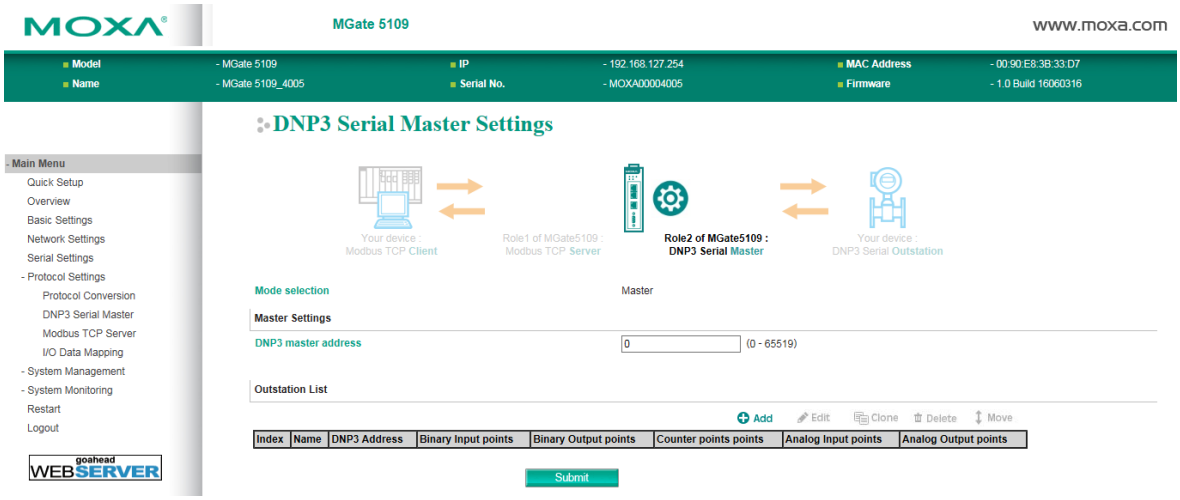
Advanced Commands:

Read the current analog output value.



Command Parameters	Group	Variation	Qualifier
Select Read Analog Input method	40: analog output	0: Any variation	06: all

A4. DNP3 Serial Master Settings



Master Settings

Parameter	Value	Default	Description
DNP3 master address	0 to 65519	1	DNP3 master address

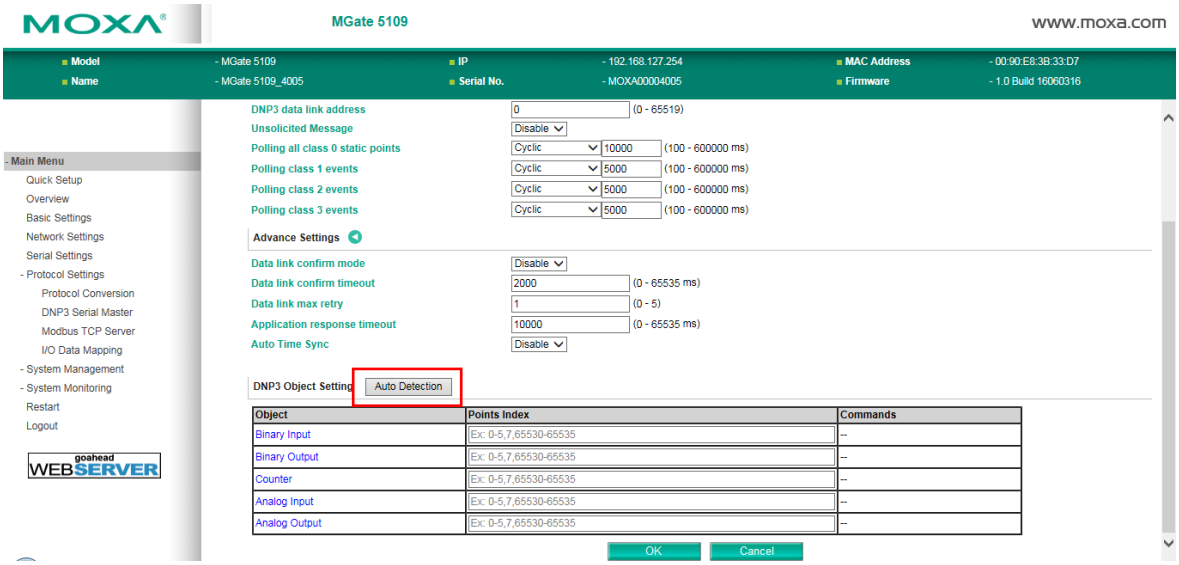
Outstation List

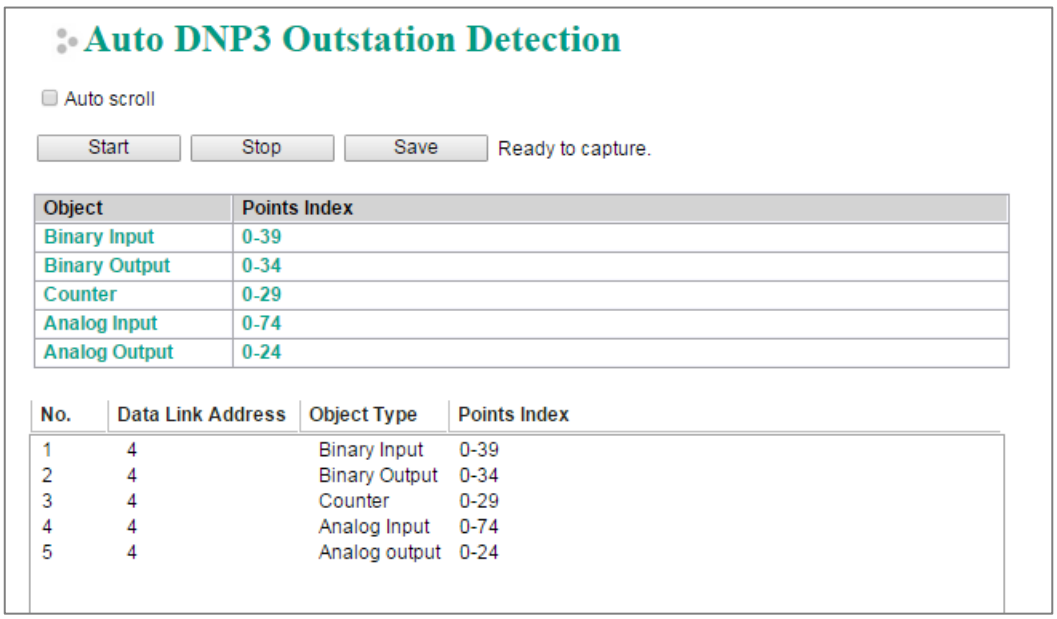
Refer to *A3. DNP3 TCP/UDP Master Settings*

DNP3 Object Setting

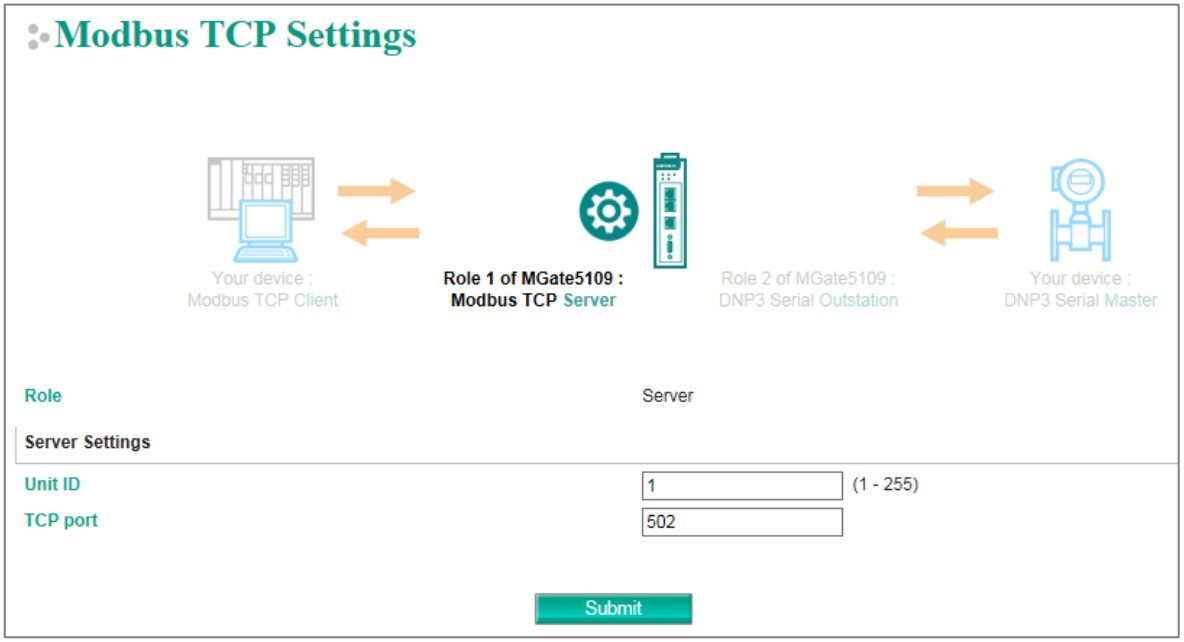
Refer to *A3. DNP3.TCP/UDP Master Settings.*

DNP3 serial Master supports an auto detection function, which can automatically detect DNP3 serial outstation attributes, such as quantity of BI, BO, and so on.





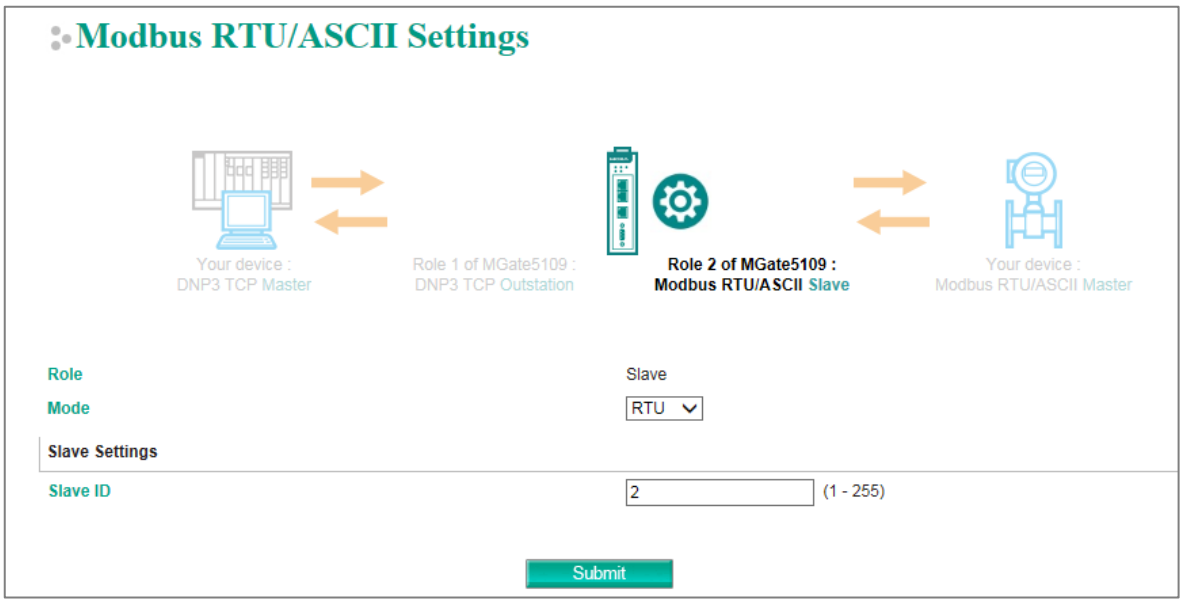
A5. Modbus TCP Server (Slave) Settings



Server Settings

Parameter	Value	Default	Description
Unit ID	1 to 255	1	The Modbus slave ID that this slave module will accept.
TCP port	1 to 65535	502	The TCP port number.

A6. Modbus RTU/ASCII Slave Settings



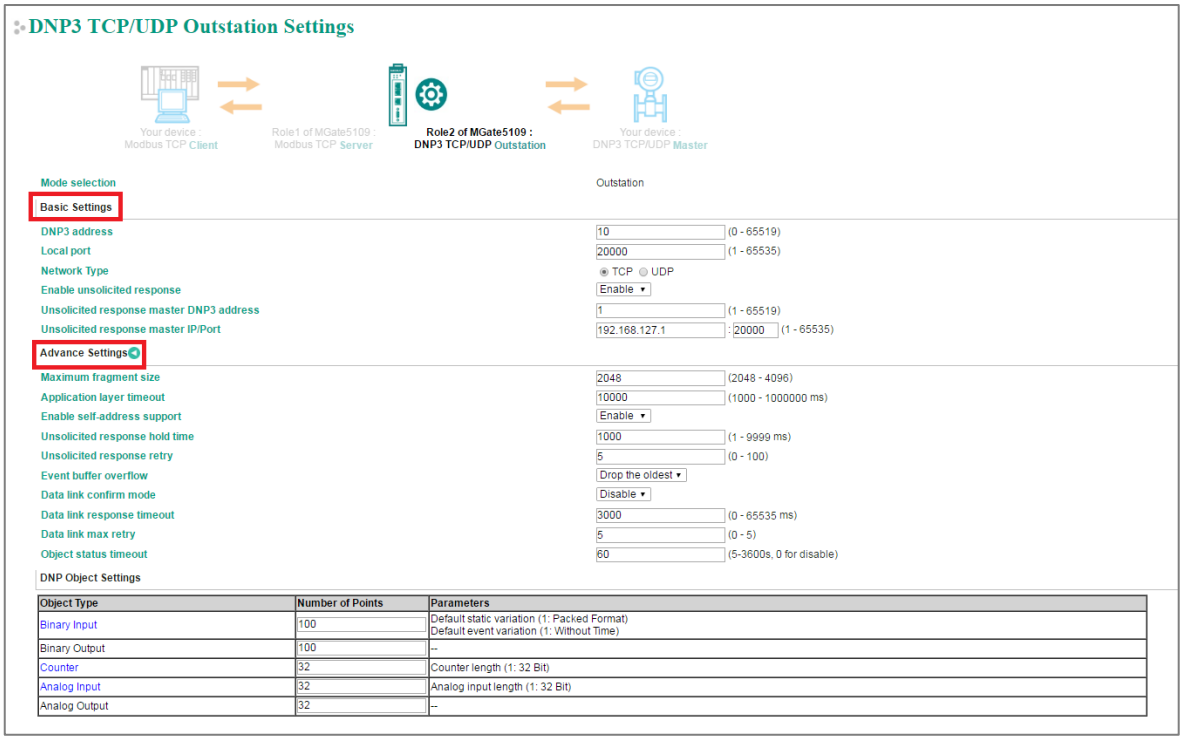
Slave Settings

Parameter	Value	Default	Description
Mode	RTU or ASCII	RTU	The Modbus protocol type
Slave ID	1 to 255	2	The Modbus slave ID that this slave module will accept.

A7. DNP3 TCP/UDP Outstation Settings

The DNP3 TCP/UDP outstation configuration consists of three parts: **Basic Settings**, **Advanced Settings,** and **DNP3 Object Settings**. The basic settings section is used to specify the outstation information for the MGate.

The advanced settings section is for setting additional parameters, while the last section is for DNP3 object related settings.

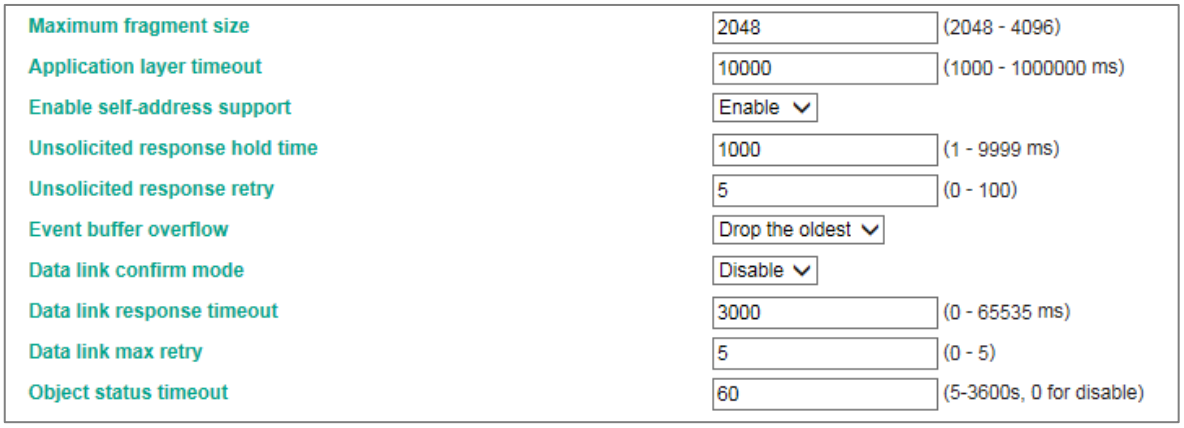


Basic Settings

Parameter	Value	Default	Description
DNP3 address	0 to 65519	4	Outstation address (MGate 5109)
Local port	1 to 65535	20000	The TCP port number
Network Type	TCP UDP	TCP	Network Type
Enable unsolicited response	Enable Disable	Enable	Enables the MGate to initiate unsolicited responses.
Unsolicited response master DNP3 address	1 to 65519	3	DNP3 master address to which the MGate 5109 unsolicited response is send to.
Unsolicited response master IP/Port (for TCP mode)	192.168.1.1: (1-65535)	192.168.1.1: 20000	DNP3 master IP address/Port to which the MGate 5109 unsolicited response is send to.
Remote master IP/Port (for UDP mode)	192.168.1.1: (1-65535)	192.168.1.1: 20000	DNP3 master IP address/Port to which the MGate 5109 unsolicited response is send to.

After configuring the **Basic Settings**, you may need to configure some advanced parameters, which you can find in the **Advanced Settings** section.

Advanced Settings



Parameter	Value	Default	Description
Maximum fragment size	2048 to 4096	2048	A fragment is a block of octets containing request or response information transported between a master and an outstation. DNP3 limits the amount of memory devices employed to send and receive messages. It achieves this by specifying the maximum length of each fragment and allowing response messages to be divided into one or multiple fragments. Small messages, requiring only a few octets, can fit into a single fragment, whereas larger messages may require multiple fragments.
Application layer timeout	1000 to 1000000 ms	10000	DNP3 application layer timeout.
Enable self-address support	Enable Disable	Enable	Devices that support this address, and have the self-address feature enabled, must process frames with destination address 0xFFFC as if the message has used the device's unique individual address. This feature can simplify the commissioning, troubleshooting, and maintenance of devices because it is not necessary to know the receiving device's address ahead of time. Only enable a single device at a time for processing messages with the self-address destination so that multiple devices do not respond.
Unsolicited response hold time	1 to 9999 ms	1000	The outstation keeps the unsolicited message with a hold time before DNP3 master requests a confirmation message.
Unsolicited response retry	0 to 100	5	Retry count
Event buffer overflow	Drop the oldest Drop the latest	Drop the oldest	Behavior when MGate event buffer overflows.
Data link confirm mode	Enable Disable	Disable	This value specifies whether data link frames sent to the remote device require a data link confirmation This parameter should be set to **Disable** for almost all applications.
Data link response timeout	0 to 65535 ms	3000	This parameter specifies the required time for a data link confirmed to be from the remote device before a retry is attempted
Data link max retry	0 to 5	5	The maximum number of retries at the Data Link level to get a confirmation. If this value is set to 0, retries are disabled at the data link level of the protocol. This parameter is only used if the frame is sent when a confirmation is requested.
Object status timeout	5 to 3600 second 0: Disable	60	

DNP3 Object Settings

You must configure the **Number of Points** for each object in the **DNP3 Object Setting** section of the **DNP3 TCP/UDP Outstation Setting**. The number of points that you must configure for an object depends on the volume of data generated by a corresponding object on the other side of the MGate. Refer to *chapter 4,* Protocol Settings—I/O Data Mapping section for additional information.

DNP Object Settings

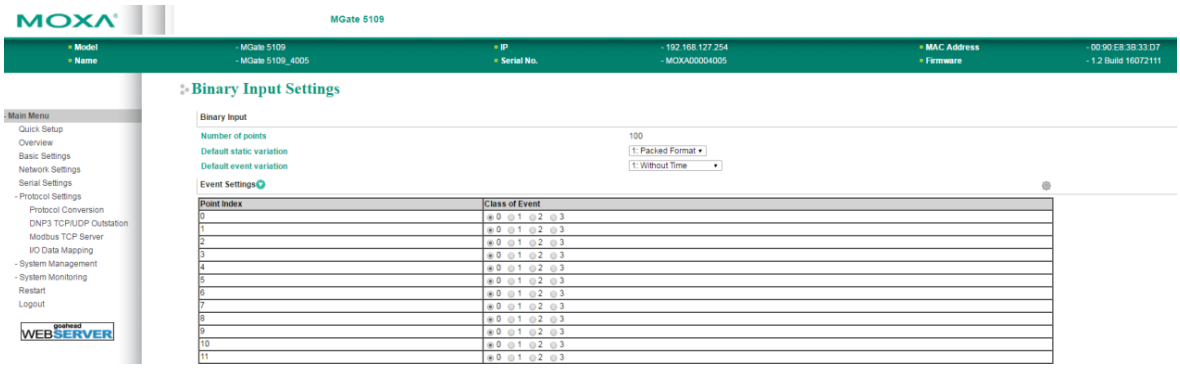
Object Type	Number of Points	Parameters
Binary Input	100	Default static variation (1: Packed Format) Default event variation (1: Without Time)
Binary Output	100	--
Counter	32	Counter length (1: 32 Bit)
Analog Input	32	Analog input length (1: 32 Bit)
Analog Output	32	--

Besides the **Number of Points** for an object, you can configure the **Binary Input**, **Counter**, and **Analog Input** for an event class. Click on the corresponding links to configure these settings.

DNP Object Settings

Object Type	Number of Points	Parameters
Binary Input	100	Default static variation (1: Packed Format) Default event variation (1: Without Time)
Binary Output	100	--
Counter	32	Counter length (1: 32 Bit)
Analog Input	32	Analog input length (1: 32 Bit)
Analog Output	32	--

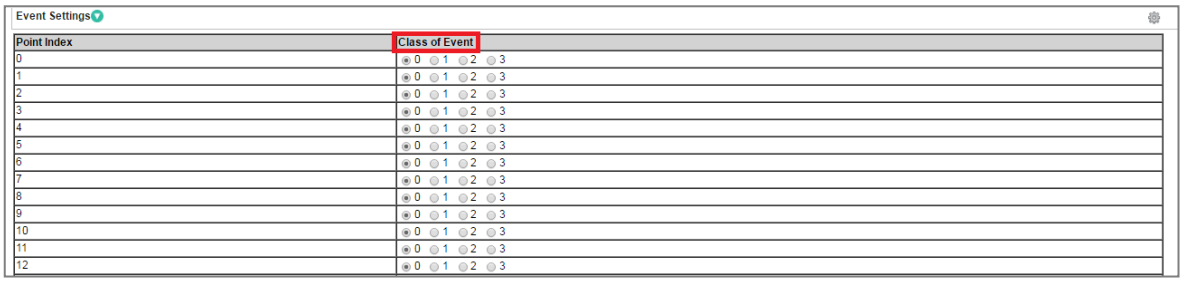
Binary Input



The **Binary Input** parameters define the format of outstation's response to DNP3 commands from the DNP3 Master.

Binary Input Setting	Value	Description
Default Static Variation	1: Packet Format 2: With Flags	**1: Packet Format—**Reports only the state of the inputs **2: With Flag—**Reports the state of the inputs and the status flags.
Default Event Variation	1: Without Time 2: With Absolute Time 3: With Relative Time	

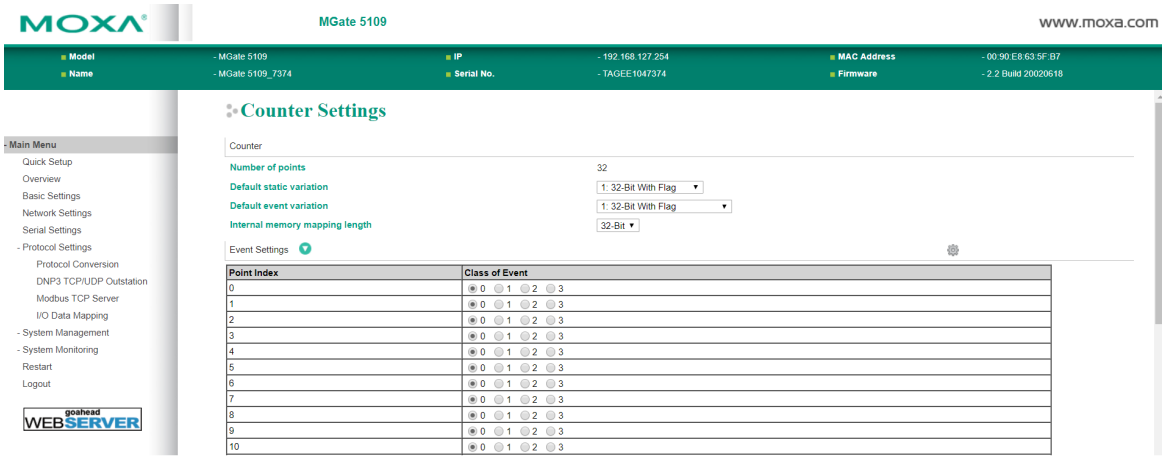
In **Event Settings**, you can set the value of each point index to Class 0/1/2/3 (Default: Class 0).



Counter Settings

The outstation monitors predefined data points and generates events. These events are each placed in one of three classes—Class 1, 2, or 3. In addition, Class 0 is defined as the "static" state or the status of the monitored data. Counters are used to track the data points defined for the monitored data. This model of event-oriented data reporting using a class improves bandwidth efficiency.

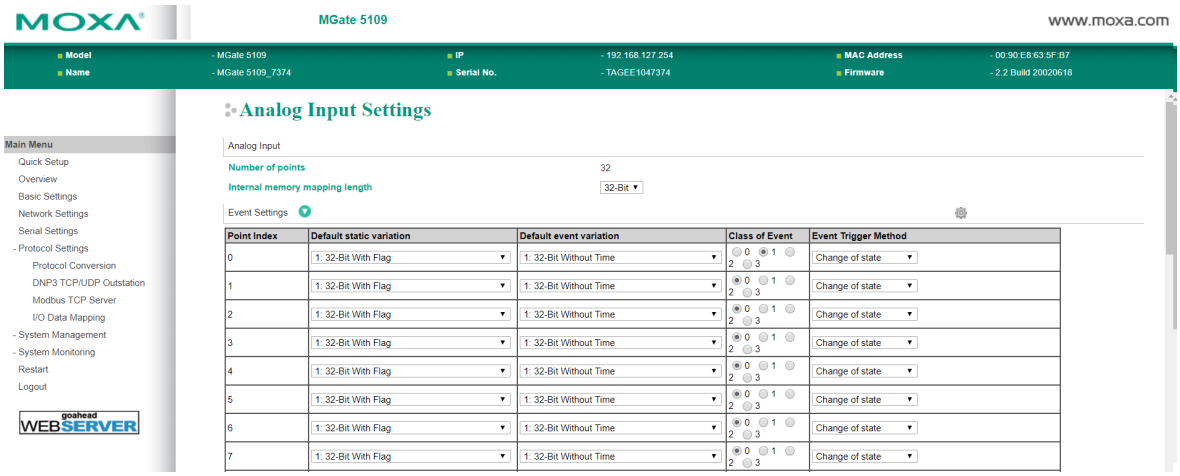
You can set the value of each point index to Class 0/1/2/3 (Default: Class 0) in the **Event Settings** section of the **Counter Settings** page**.**



Counter Settings	Value	Description
Default Static Variation	1: 32-Bit With Flag 2: 16-Bit With Flag 3: 32-Bit Without Flag 4: 16-Bit Without Flag	With Flag—reports the value of the counter and the status flag. Without Flag—Reports the value of the counter only.
Default Event Variation	1: 32-Bit With Flag 2: 16-Bit With Flag 5: 32-Bit With Flag and Time 6: 16-Bit With Flag and Time	With Flag—reports the value of the counter event and the status flag. With Flag and Time—Reports the value of the counter event with status flag and time tag.
Internal Memory Mapping Length	32-Bit, 16-Bit	Unit length of counter value for data mapping

Analog Input Settings

For analog inputs, in addition to setting the value of each point index to Class 0/1/2/3 (Default: Class 0), you can also configure an event trigger method in the **Event Settings** section of the **Analog Input Settings** page**.**



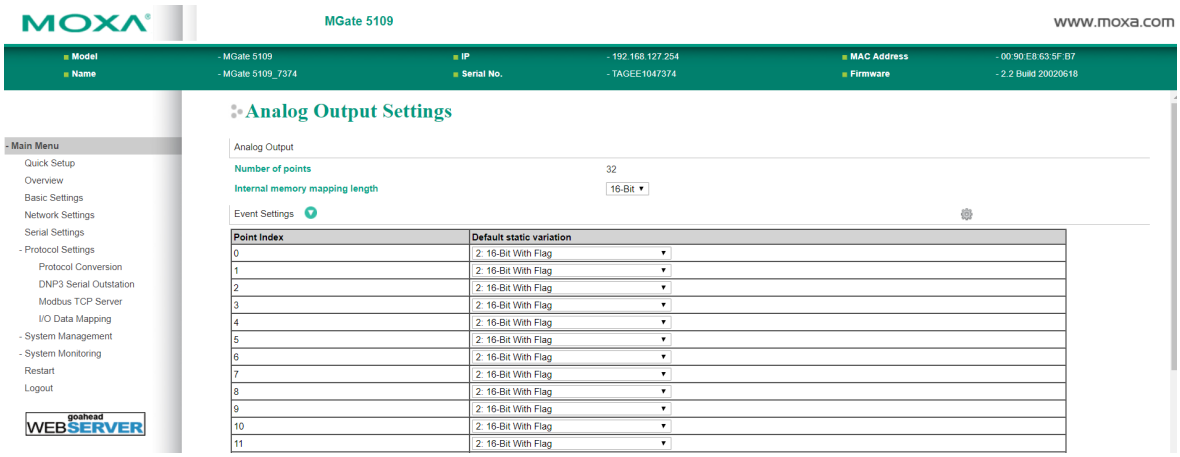
Each point of Analog Input can define its own "static variation" and "event variation".

Analog Input Settings	Value	Description
Default Static Variation	1: 32-Bit With Flag 2: 16-Bit With Flag 3: 32-Bit Without Flag 4: 16-Bit Without Flag 5: Single-Precision, Floating –Point With Flag	With Flag—reports the value of the analog input and the status flag. Without Flag—reports the value of the analog input only.
Default Event Variation	1: 32-Bit Without Time 2: 16-Bit Without Time 3: 32-Bit With Time 4: 16-Bit With Time 5: Single-Precision, Floating –Point Without Time 7: Single-Precision, Floating –Point With Time	Without Time—reports the value of the event analog input only. With Time—reports the value of the analog input event with time tag.
Internal Memory Mapping Length	32-Bit, 16-Bit	Unit length of counter value for data mapping

When you classify a point as event class **1, 2,** or **3**, two event trigger methods can be selected as follows:

Event Trigger Method	Value/Range	Description
Change of state	N/A	An event is triggered when there is a change in value
Deadband	0 to 65535	An event is triggered when a value goes over the deadband range.

Analog Output Settings

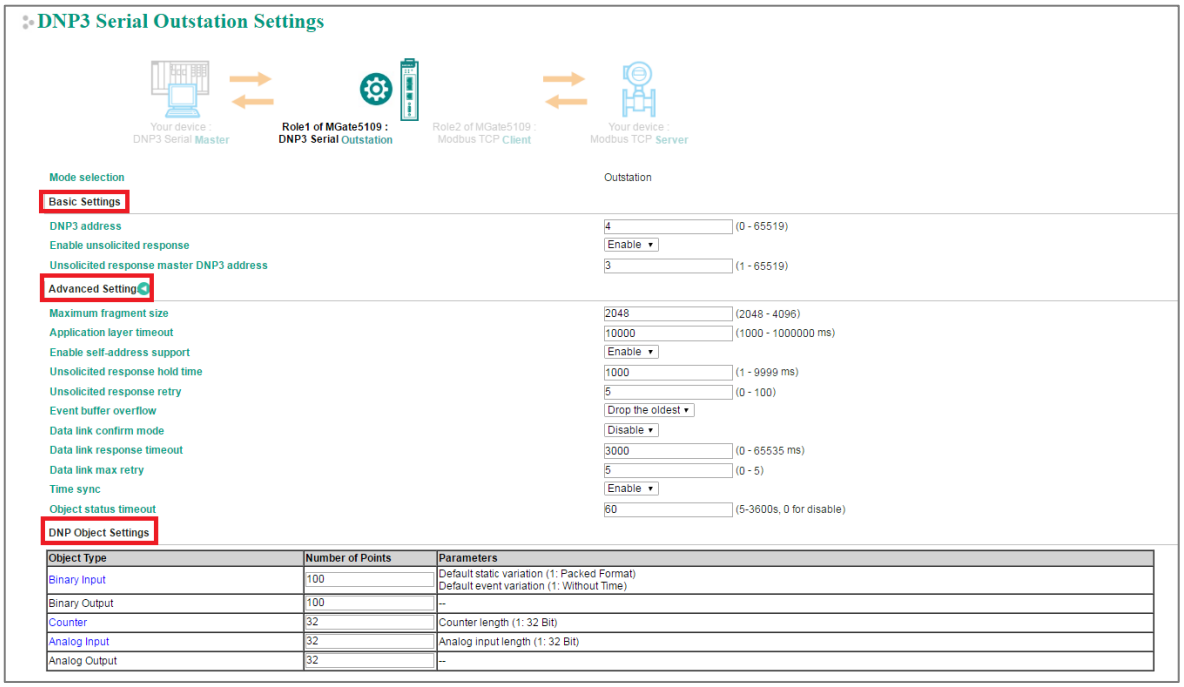


Each point of Analog Output can define its own "static variation".

Analog Output Settings	Value	Description
Default Static Variation	1: 32-Bit With Flag 2: 16-Bit With Flag 3 Single-Precision, Floating –Point With Flag	With Flag—reports the value of the analog output with flag.
Internal Memory Mapping Length	32-Bit, 16-Bit	Unit length of counter value for data mapping

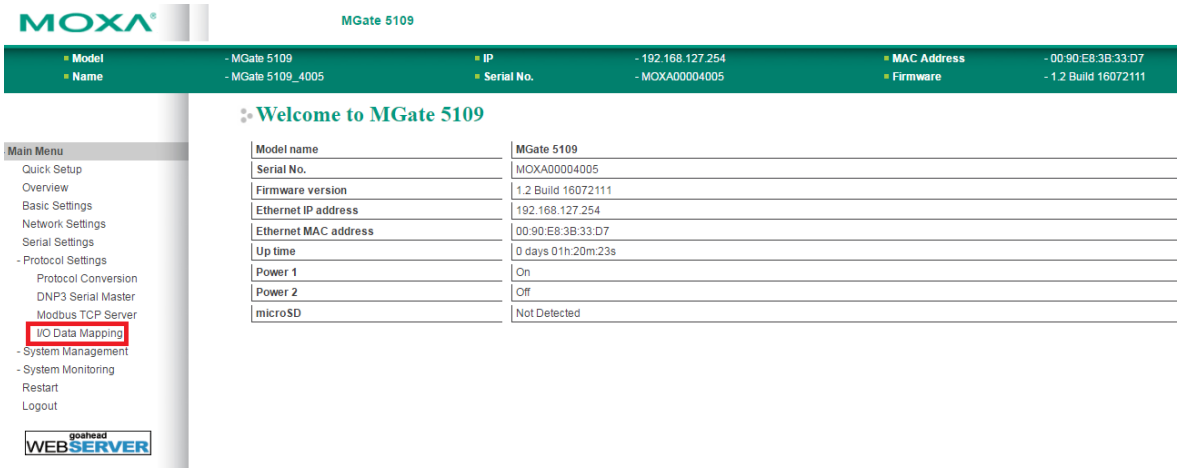
A8. DNP3 Serial Outstation Settings

The DNP3 TCP/UDP outstation configuration consists of three parts: Basic Settings, Advanced Settings, and DNP3 Object Settings. The basic settings section is used to specify the outstation information for MGate. The advanced settings section is for setting additional parameters, while the last section is for configuring the DNP3 object related settings. For additional details, refer to section *A7. DNP3 TCP/UDP Outstation Settings*.



Protocol Settings—I/O Data Mapping

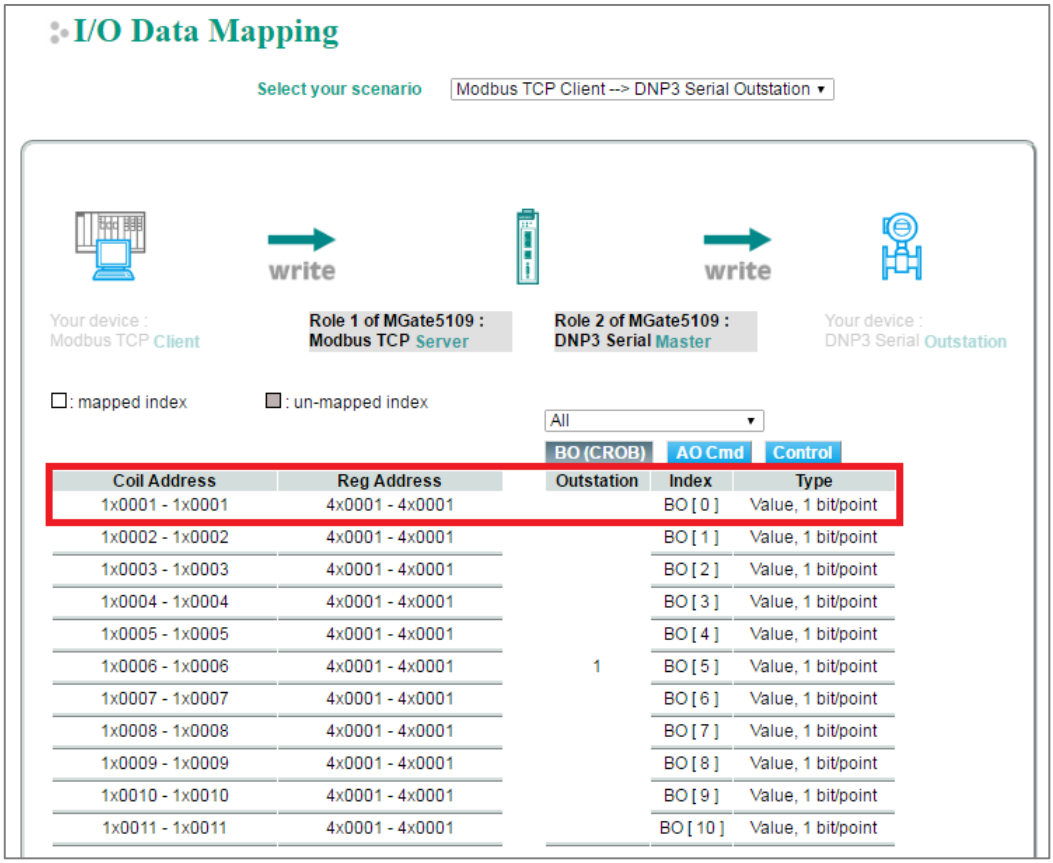
After you have configured Role 1 and Role 2 (client/master and server/slave) of the MGate settings, the PLC/SCADA in the master role will start monitoring and controlling the remote slave device. The MGate uses its internal memory to facilitate data exchange. The **I/O Data Mapping** page shows the complete mapping status.



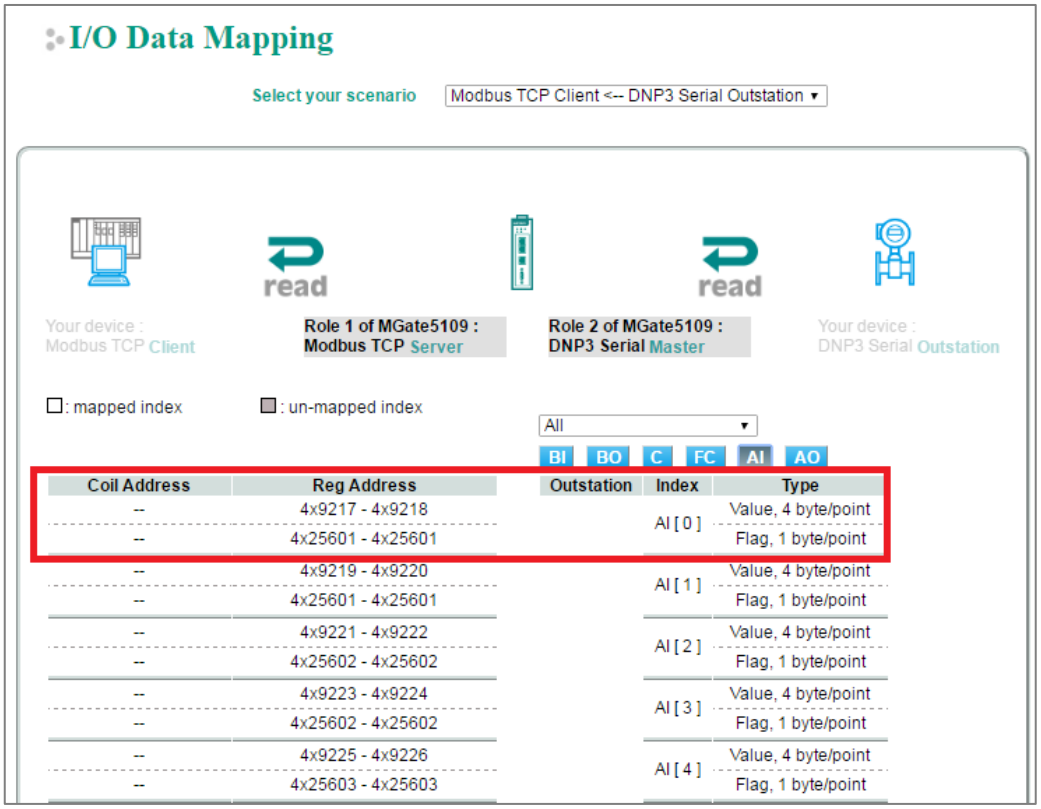
The following examples illustrate Role 1 and Role 2 configurations of the MGate:

Example 1—The MGate 5109 as Modbus TCP Server (Role 1) and DNP3 Serial Master (Role 2)

The Modbus master must write the value 1 to the corresponding **Coil Address,** `1x0001` if the Modbus master wants to set the DNP3 outstation value BO [0] to `1`. The MGate will then trigger a BO [0] write request to the outstation.

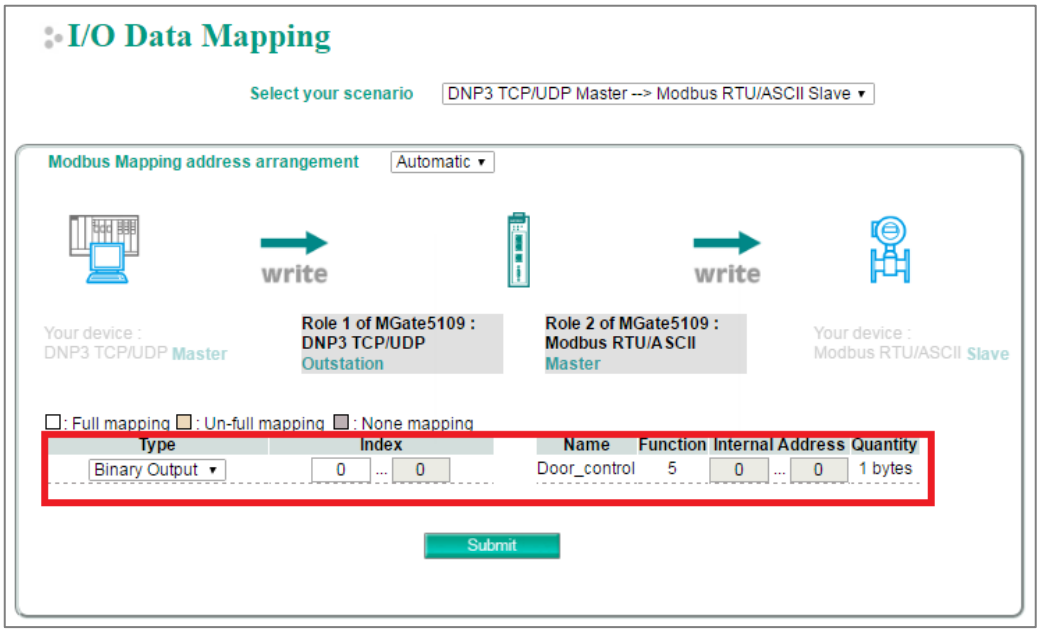


Likewise, if the Modbus master wants to read the value in DNP3 outstation index AI [0], the Modbus master must send a request to read the Modbus addresses 4x9217 and 4x9218, whose value will be periodically updated because of cyclic polling to the outstation on the other side.

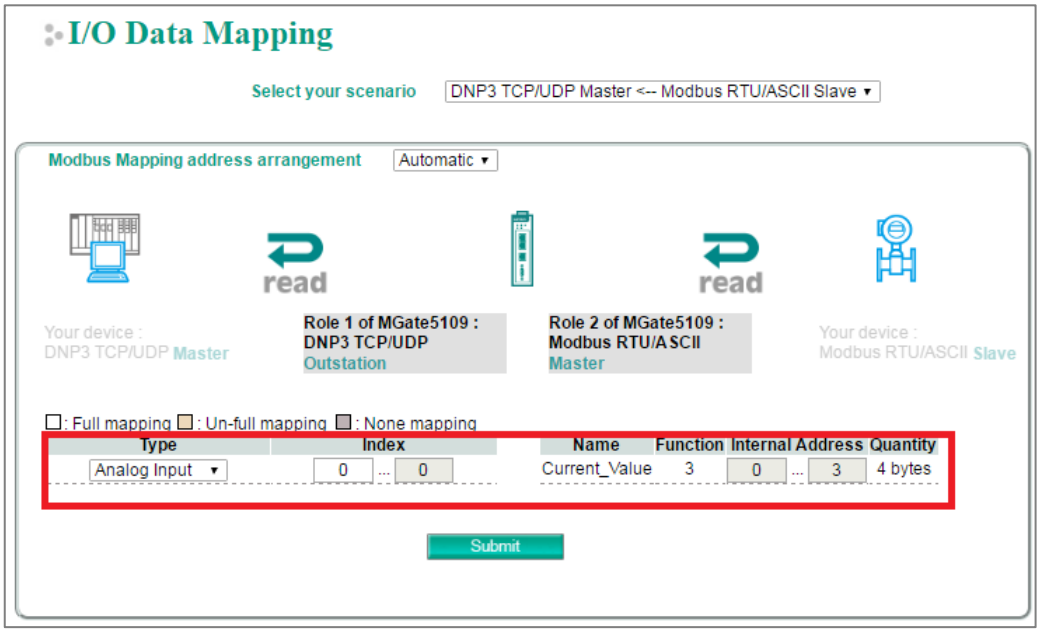


Example 2—The MGate 5109 as DNP3 TCP Outstation (Role 1) and Modbus RTU Master (Role 2)

For the DNP3 master to control the Modbus coil command, we have created a command called `Door_control`. The DNP3 type of the `Door_control` command is set as Binary Output. BO [0] should be mapped to the `Door_control` command, as shown in the I/O Data Mapping table below. When the DNP3 TCP master sends a write command to BO [0], MGate will trigger a `Door_control` request to the Modbus slave.



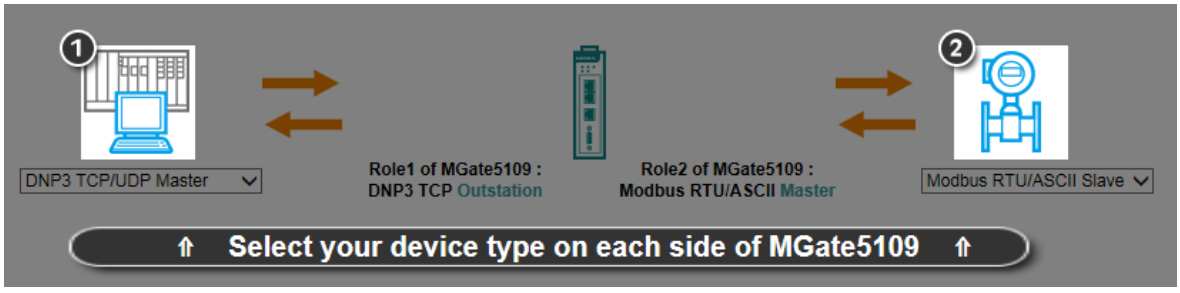
Likewise, if DNP3 TCP master wants to read the Modbus register command named `Current_Value`, the DNP3 type must first be set to Analog Input. The I/O Data Mapping table shows that AI [0] is mapped to the `Current_Value` command. The DNP3 TCP master can read AI [0] of the outstation whose value will be periodically updated because of the cyclic polling to the Modbus slave on the other side of the MGate.



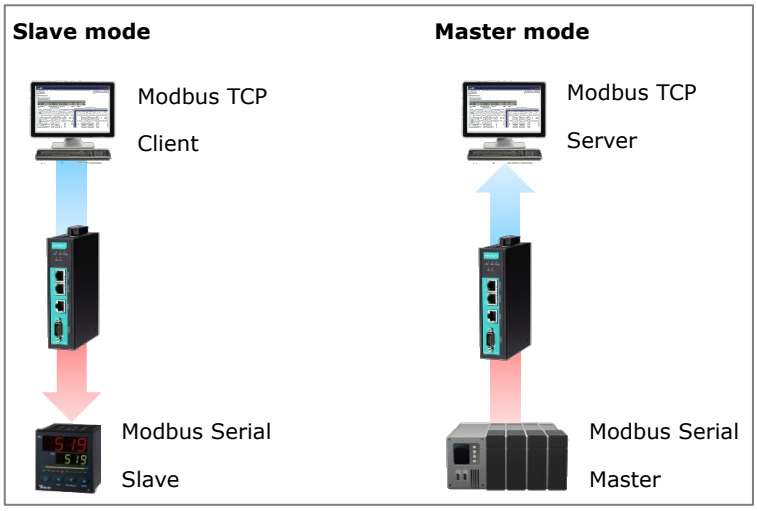
Protocol Settings (Transparent Mode)

Modbus Transparent

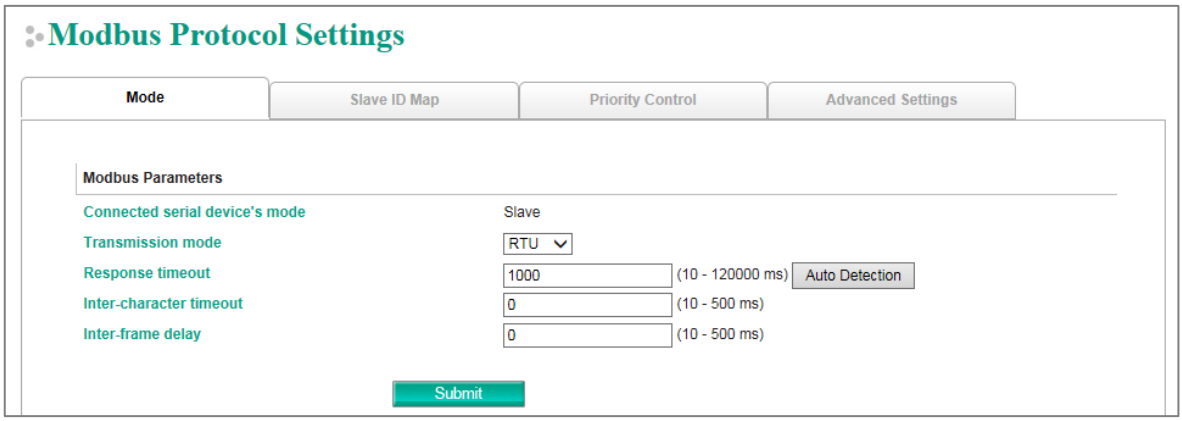
Only the following combination can select transparent mode.



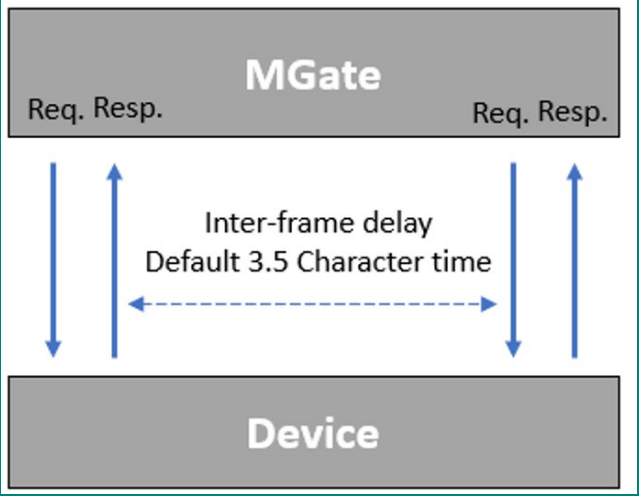
Connected serial device's mode	Device 1	Device 2
Master mode	MB RTU/ASCII Master	MB TCP Server
Slave mode	MB TCP Client	MB RTU/ASCII Slave



Protocol Settings—Modbus Transparent—Mode

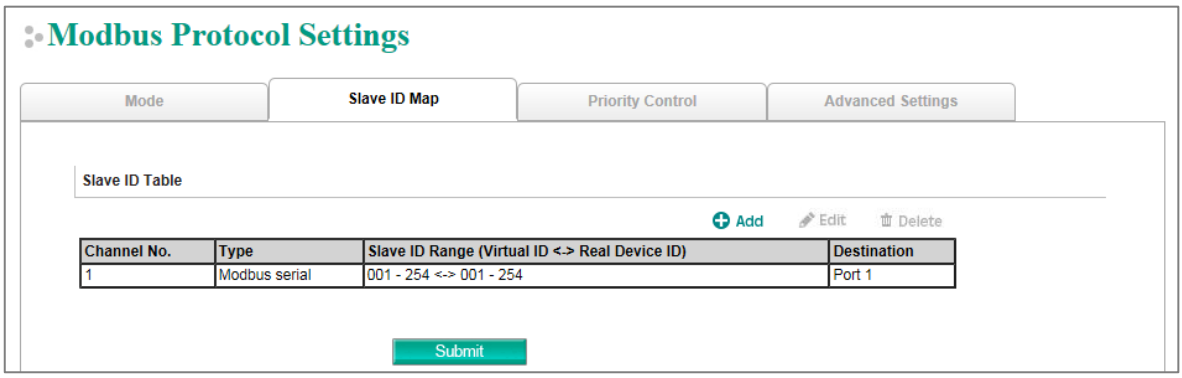


Parameter	Value	Default	Description
Transmission mode	RTU ASCII	RTU	Modbus transmission mode
Response timeout	10 to 120000 ms	1000	According to the Modbus standard, the time it takes for a slave device to respond to a request is defined by the device manufacturer. Based on this response time, a master can be configured to wait a certain amount of time for a slave's response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue operation even if a slave device is disconnected or faulty. On the MGate 5109, the Response timeout field is used to configure how long the gateway will wait for a response from a Modbus ASCII or RTU slave. Refer to your device manufacturer's documentation to manually set the response time. The MGate 5109 can also auto-detect the response timeout. Instead of manually figuring out the appropriate setting, you can click **Auto Detection** to have the MGate figure out the setting for you. Once a value has been recommended, you can fine-tune it to get the best performance. You can specify the Modbus function and starting address in the Auto Detection screen for different devices. This function is only available when the MGate 5109 connects to Modbus RTU/ASCII slaves.

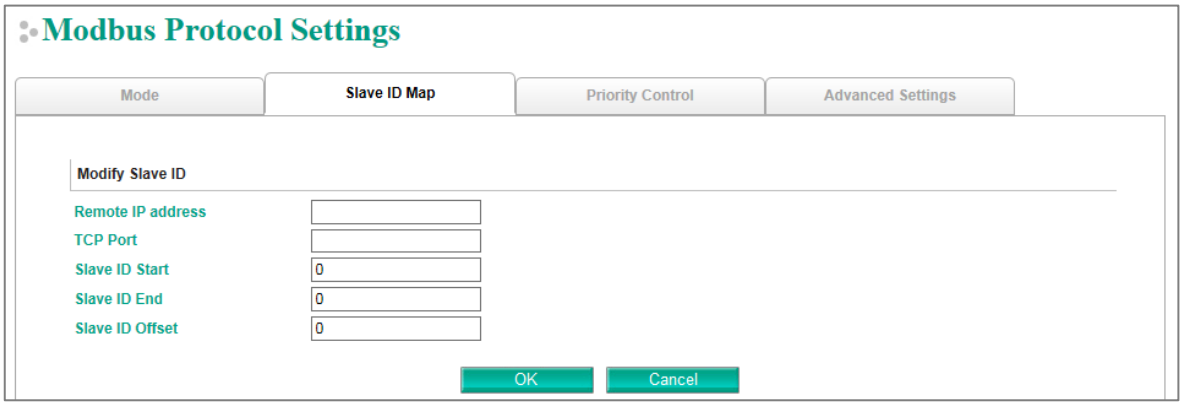
Parameter	Value	Default	Description
Inter-character timeout (only for Modbus RTU)	10 to 500 ms	0	The time interval between characters in one frame. When the baudrate is lower than 19200 bps, the default value is 0, which is 1.5 character time. When the baudrate is larger than 19200 bps, the MGate uses a predefined fixed value that is not user-configurable. When the serial side of the MGate receives one character, and the next one comes after the "inter-character timeout" defined, the frame will be discarded because of timeout.
Inter-frame delay (only for Modbus RTU)	10 to 500 ms	0	Defines the time interval between an RTU response and the next RTU request. When the baudrate is lower than 19200 bps, the default value is 0, which is 3.5 character time. When the baudrate is larger than 19200 bps, the MGate uses a predefined fixed value that is not user-configurable. This function solves the issue that some devices can't handle the RTU requests quickly enough, so the MGate opens to user-defined values. How to calculate Modbus character time? E.g., if the baudrate is 9,600 bps, 1 character time is about 1 ms. In a serial frame (11 bits, including start bit, data, parity bit, and stop bit), 9,600 bps approximately equals to 960 characters/s, so transmitting 1 character needs about 1/960 = 1 ms 

Protocol Settings—Modbus Transparent—Slave ID Map

In slave mode, the default slave ID mapping will define all Modbus IDs to serial port since the MGate 5109 only has one serial port. In master mode, you have to add all the Modbus IDs manually.



You can add or modify the slave ID mapping via the Add or Edit button.



Parameter	Value	Default	Description
Remote IP address	0.0.0.0 to 255. 255. 255.255		For Modbus TCP: the IP address of a remote slave device.
TCP Port	1 to 65535		For Modbus TCP: the TCP port number of a remote slave device.
Slave ID Start	1 to 254	0	This specifies the range of IDs that will be routed to the selected set of slave devices.
Slave ID End	1 to 254	0	
Slave ID Offset	-253 to 253	0	This specifies the difference between the virtual slave ID and the actual slave ID. If a slave's virtual ID is 16 and the actual ID is 5, you would set the offset to -11. This offset is applied to the entire range of virtual slave IDs.

How Slave IDs are Mapped on the MGate 5109

With the slave ID table, smart routing is achieved for units with multiple serial ports. Since each virtual slave ID is routed to a specific Modbus network, requests are not broadcast over all serial ports. This keeps communication efficient and prevents devices on one port from slowing down the entire system.

When a Modbus master requests information from a Modbus slave device, the request is addressed to the desired slave's ID, which must be unique on the network. When Modbus networks are integrated by a Modbus gateway, complications can arise if the same slave ID is being used on different networks. If this is not properly addressed, a request sent to that slave ID would receive more than one response, causing communication problems.

With the MGate 5109, this situation is addressed by using a slave ID map. While configuring the MGate, users set up a range of "virtual" slave IDs that are mapped to slave devices on a specific Modbus network. To send a request to a slave device that is on a different Modbus network, a Modbus master would address the request to the appropriate (virtual) slave ID. The MGate then routes that request as specified by the slave ID map.

For example, if a TCP master needs information from an ASCII slave, it addresses the request to the corresponding virtual slave ID as defined on the MGate's slave ID map. The MGate identifies the request as within its virtual slave ID range and forwards the request to the Modbus ASCII by the device's actual slave ID.

Virtual slave IDs must not conflict with each other or with other TCP slave IDs.

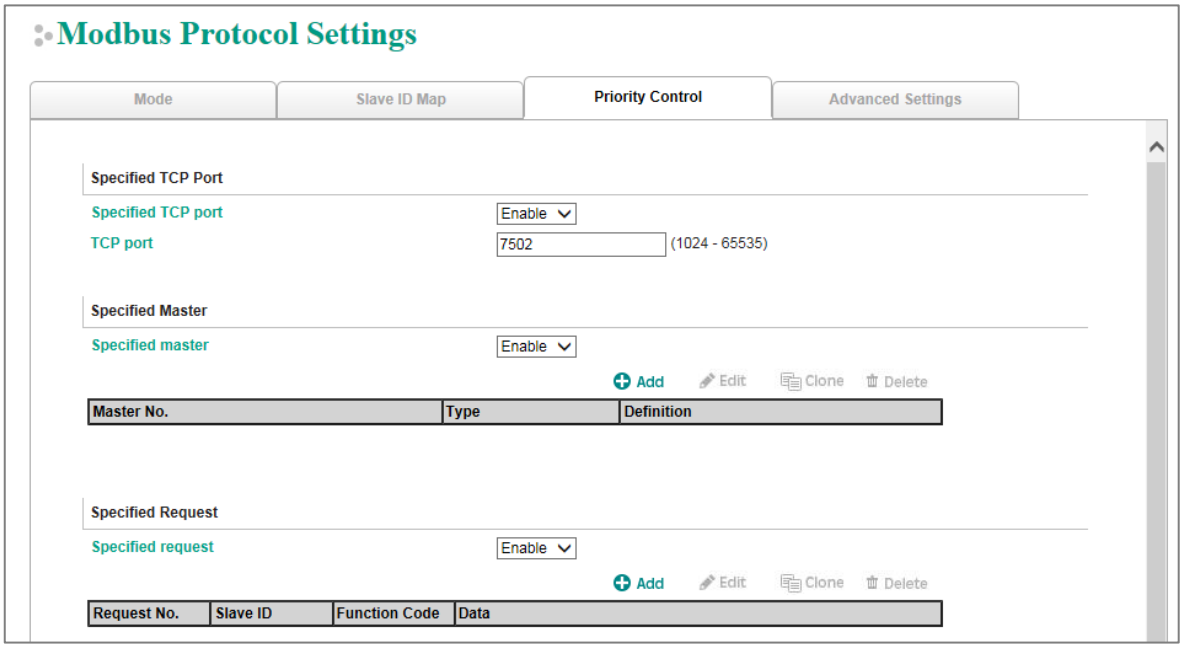
When a serial port is set to RTU slave or ASCII slave mode, a virtual ID range will already be created for you. Select the entry in the table and change the range and offset as needed. For TCP slaves, you can add an entry that assigns a range of virtual IDs to a specific IP address, using the **Remote TCP Slave IP setting**.

ATTENTION

The MGate 5109 will disregard any request that is not addressed to a virtual slave ID on its slave ID map. If a device has not been assigned a virtual slave ID, it will not be accessible by masters on the other side of the Modbus gateway.

Protocol Settings—Modbus Transparent—Priority Control

The Priority Control tab is where emergency requests are enabled and configured.



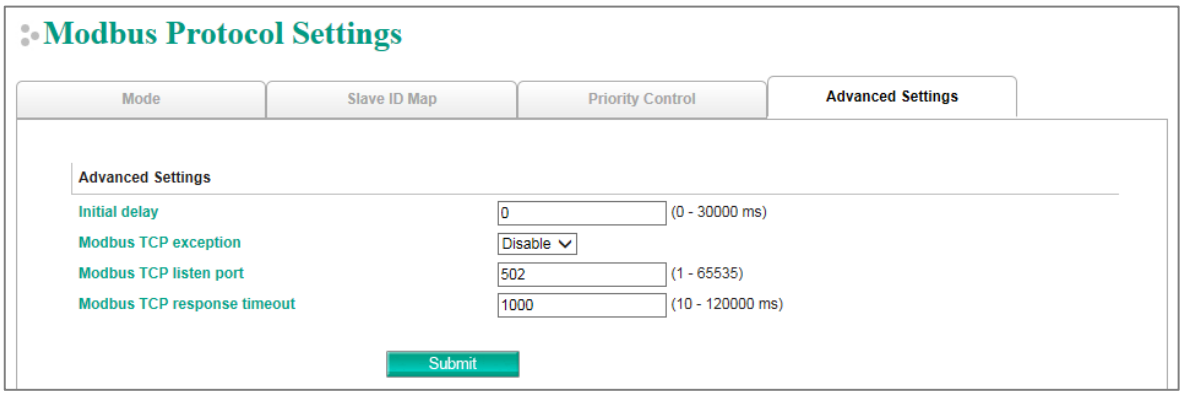
Priority control is designed for requests that are sent to Modbus RTU/ASCII slaves. Since Modbus RTU/ASCII slaves cannot handle multiple requests, the Modbus gateway must send each request individually and wait for the response before sending the next request. As requests stack up, the response time can suffer. This can cause problems for certain critical requests that require an immediate response.

With priority control, you can specify that certain requests are sent to the front of the queue for more immediate response times. Priority requests can be specified by the master (IP address or serial port), TCP port, or command type (slave ID, function code, or data). When the Modbus gateway identifies a priority request, the request will immediately be placed at the front of the queue.

To define a priority request, enable the appropriate priority scheme (i.e., **Specified Masters, Specified TCP Port,** or **Specified Requests**). Then, specify the parameter(s) that will indicate a priority request. Finally, click **Add/Modify** to apply this definition. (This last step is not necessary for **Specified TCP Port**.)

Protocol Settings—Modbus Transparent—Advanced Settings

The Advanced Settings tab is where certain adjustments can be made to fine-tune the communication between different Modbus networks. You can configure Initial Delay, Modbus TCP Exception, Modbus TCP listen port, Modbus TCP Response Time-out, and Self-Slave ID for digital I/O control.



Parameter	Value	Default	Description
Initial delay	0 to 3000ms	0	Some Modbus slaves may take more time to boot up than other devices. For certain environments, this may cause the entire system to suffer from repeated exceptions during the initial boot-up. After booting up, you can force the MGate to wait before sending the first request with the **Initial Delay** setting.
Modbus TCP exception	Disable Enable	Disable	The MGate 5109 is a protocol gateway that transparently passes requests and responses between the Ethernet and serial interfaces. In some situations, it may be necessary for the gateway to return an exception in response to a request from a Modbus TCP master. This is enabled or disabled with the **Modbus TCP Exception** setting. When enabled, the unit can return two types of exception:
Modbus TCP listen port	1 to 65535	502	Allow you to change Modbus TCP listen port from the default value (502).
Modbus TCP response timeout	10 to 120000	1000	According to the Modbus standard, the time that it takes for a slave device to respond to a request is defined by the device manufacturer. Based on this response time, a master can be configured to wait a certain amount of time for a slave's response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue operation even if a slave device is disconnected or faulty. On the MGate 5109, the **Modbus TCP response timeout** field is used to configure how long the gateway will wait for a response from a Modbus ASCII or RTU slave. Refer to your device manufacturer's documentation to manually set the response timeout.

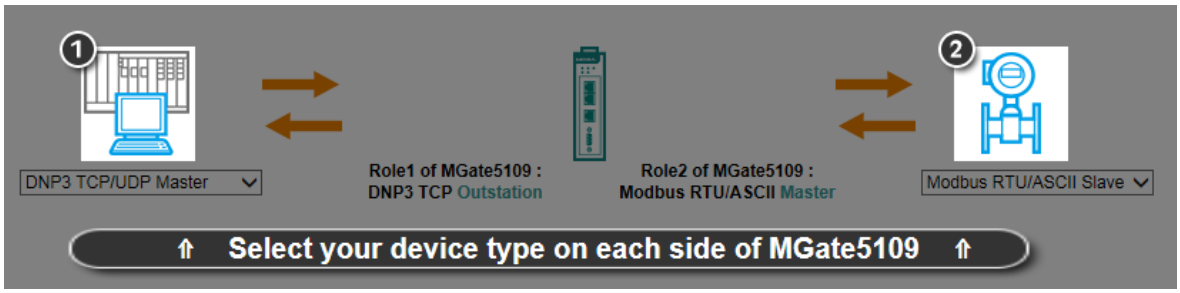
Modbus TCP exception

Exception	Conditions
Timeout	There was no response from the slave. Maybe the device is offline or the serial cable is broken.
Request dropped	There are two situations that will cause this exception: The request queue is full (32 request queue for each master) The destination ID is not included in the slave ID map.

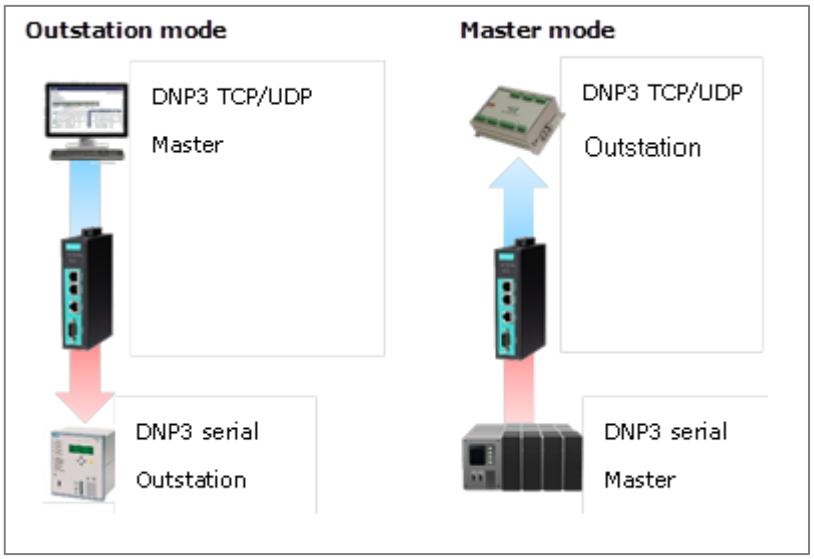
Not all Modbus TCP masters require this exception, so it is up to you to determine if this setting should be enabled.

DNP3 Transparent

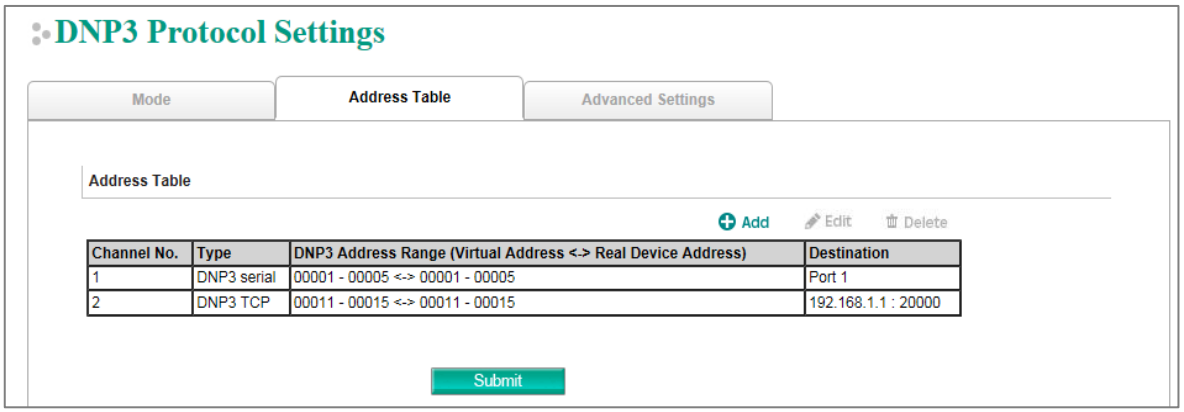
The MGate 5109 Series supports DNP3 transparent mode. Only the following combination can select transparent mode:

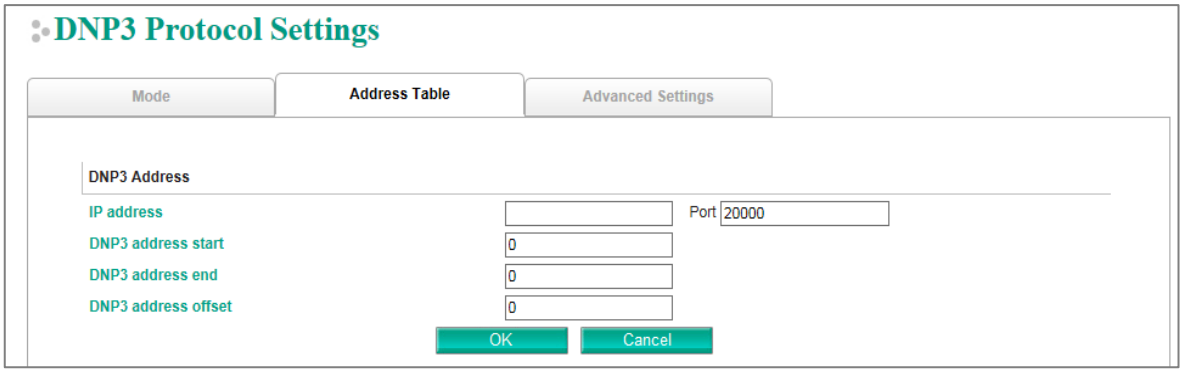


Connected serial device's mode	Device 1	Device 2
Master mode	DNP3 serial Master	DNP3 TCP/UDP Outstation
Outstation mode	DNP3 TCP/UDP Master	DNP3 Serial Outstation



Add all DNP3 devices into the table, including master and all outstations.



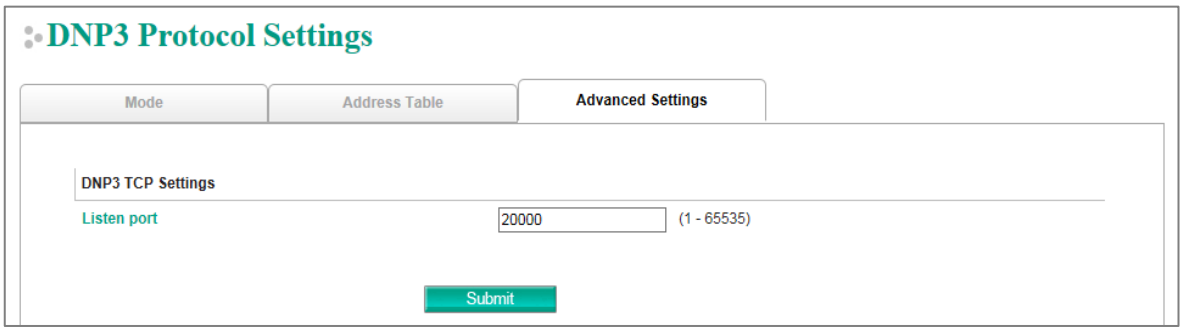


Parameter	Value	Default	Description
IP address	0.0.0.0 to 255.255.255.255		The IP address of remote DNP3 device.
Port	1 to 65535	20000	DNP3 default using port 20000.
DNP3 address Start	0 to 65519	0	This specifies the range of IDs that will be routed to the selected set of slave devices.
DNP3 address End	0 to 65519	0	
DNP3 address Offset	0 to 65519	0	This specifies the difference between the virtual slave ID and the actual slave ID. If a slave's virtual ID is 16 and the actual ID is 5, you would set the offset to -11. This offset is applied to the entire range of virtual slave IDs.

For DNP3 packet frames from Ethernet side, you need to assign a serial port along with related ranges of DNP3 addresses to receive these DNP3 data packets. Similarly, for DNP3 packet frames coming from the serial side, you need to assign the DNP3 device's address and IP address. The default IP address is 192.168.1.1; change the IP address based on your DNP3 equipment settings. If there are multiple outstation devices on the Ethernet side, you will need to add these devices' IP addresses and DNP3 addresses to the routing table. The gateway will drop a DNP3 packet frame if the destination DNP3 device address or IP address is not defined in the gateway.

Protocol Settings—DNP3 Transparent—Advanced Settings

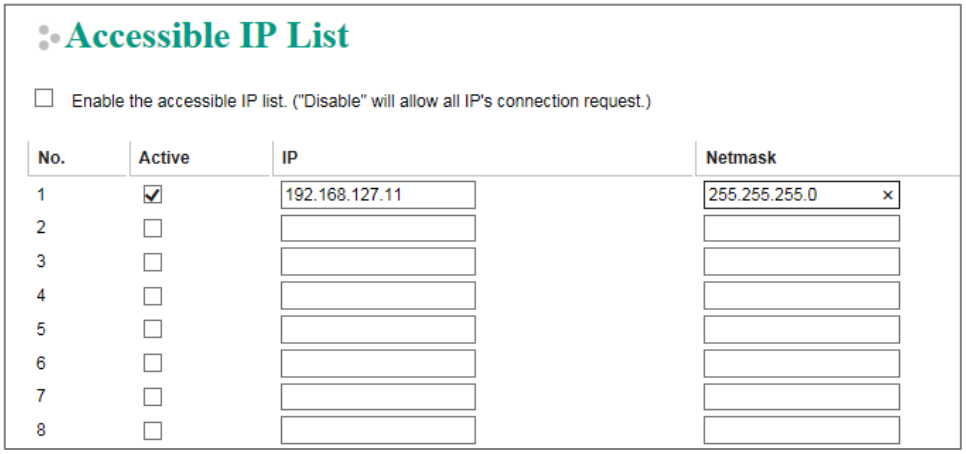
Allows you to change the default value (20000) of the DNP3 TCP listen port.



Parameter	Value	Default	Description
Listen port	1 to 65535	20000	The default DNP3 TCP listen port is 20000; you can change it to any number between 1 and 65535.

System Management

System Management—Accessible IP List



These settings are used to restrict access to the module by the IP address. Only IP addresses on the list will be allowed access to the device. You may add a specific address or range of addresses by using a combination of an IP address and a netmask as follows:

To allow access to a specific IP address: Enter the IP address in the corresponding field; enter 255.255.255.255 for the netmask.

To allow access to hosts on a specific subnet: For both the IP address and netmask, use 0 for the last digit (e.g., "192.168.1.0" and "255.255.255.0").

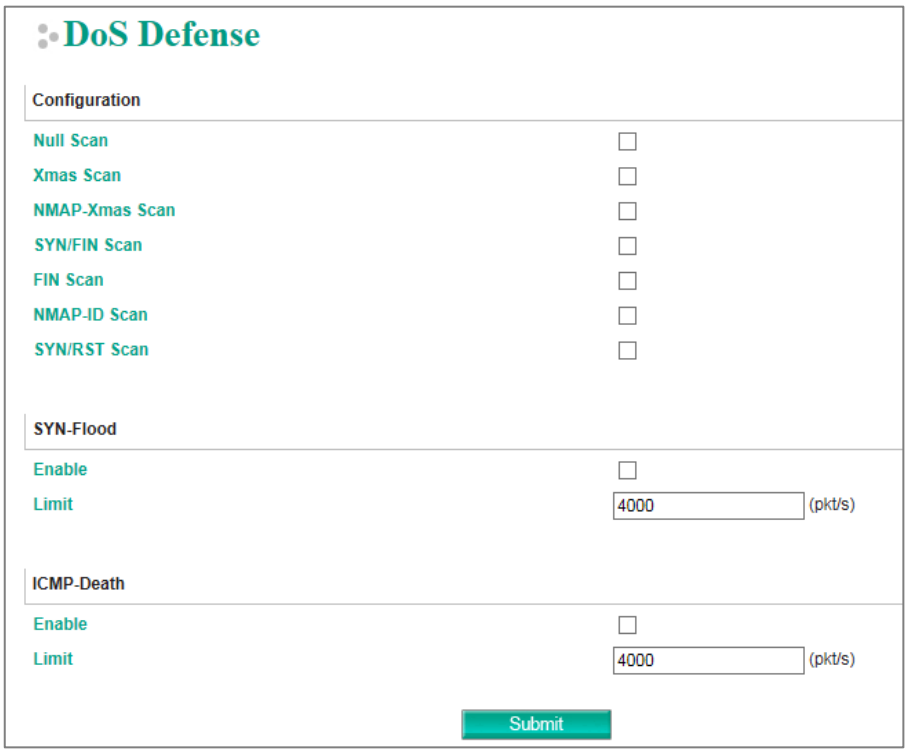
To allow access to all IP addresses: Make sure that **Enable** the accessible IP list is not checked.

Additional configuration examples are shown in the following table:

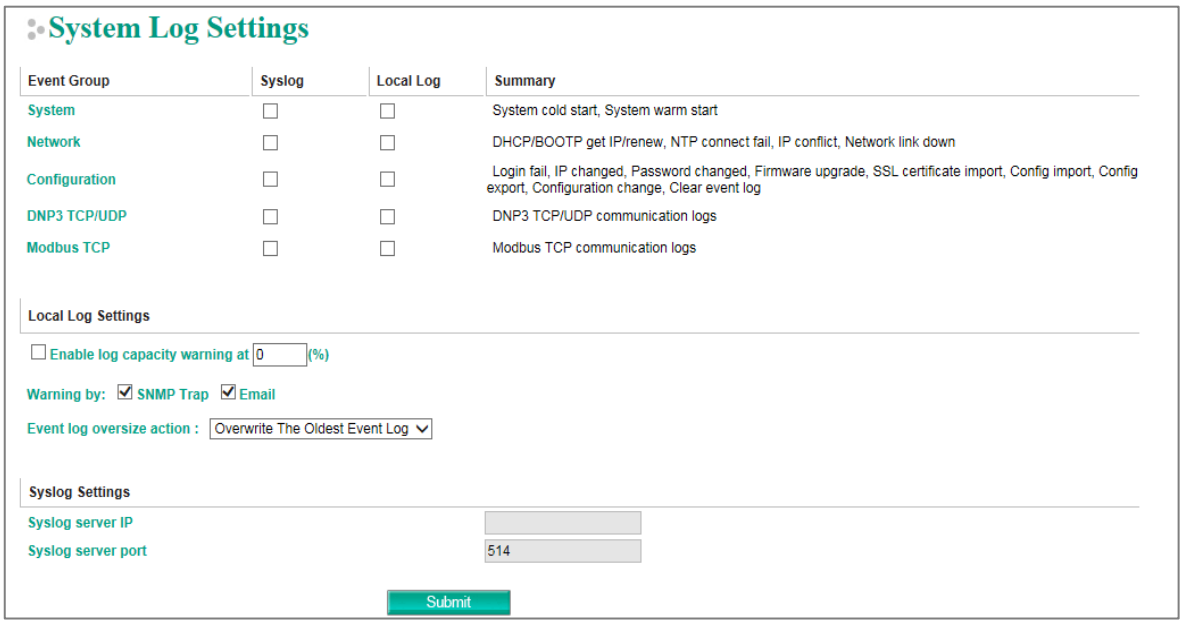
Desired IP Range	IP Address Field	Netmask Field
Any host	Disable	Enable
192.168.1.120	192.168.1.120	255.255.255.255
192.168.1.1 to 192.168.1.254	192.168.1.0	255.255.255.0
192.168.1.1 to 192.168.255.254	192.168.0.0	255.255.0.0
192.168.1.1 to 192.168.1.126	192.168.1.0	255.255.255.128
192.168.1.129 to 192.168.1.254	192.168.1.128	255.255.255.128

System Management—DoS Defense

Users can select from several options to enable DoS Defense to fend off cybersecurity attacks. A denial-of-service (DoS) attack is an attempt to make a machine or a network resource unavailable. Users can select from the following options to counter DoS attacks.



System Management—System Log Settings



The system log settings enable the MGate firmware to record important events for future verification. The recorded information can only be displayed on the web console.

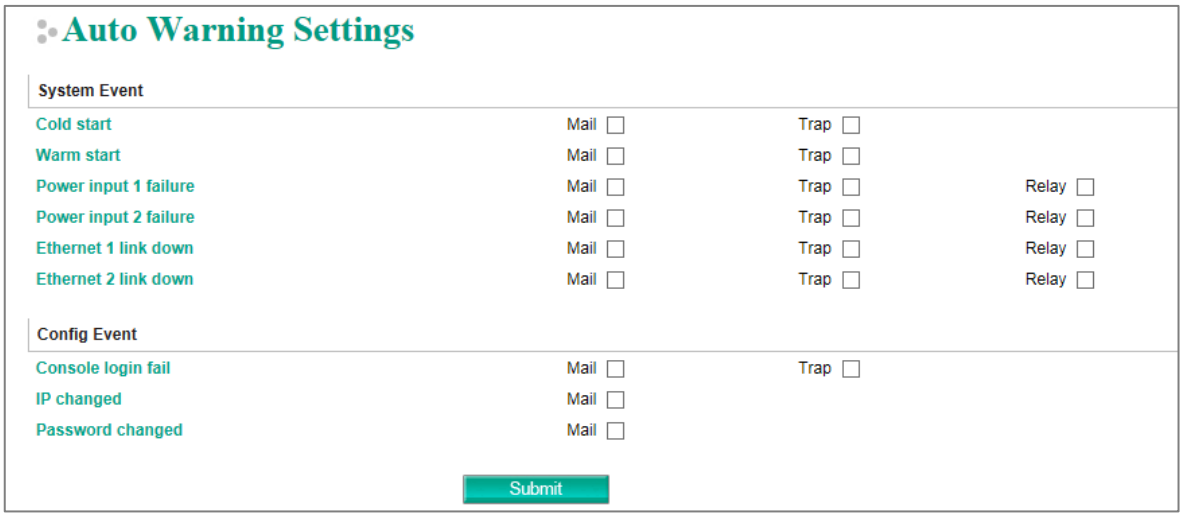
The available information that can be recorded includes the following events:

Event Group	Description
System	System Cold Start, System Warm Start
Network	DHCP/BOOTP Get IP/Renew, NTP Connect Fail, IP Conflict, Network Link Down
Configuration	Login Fail, IP Changed, Password Changed, Firmware Upgrade, SSL Certificate Import, Configuration Import/Export
DNP3 TCP/UDP	DNP3 TCP/UDP Communication logs
Modbus TCP	Modbus TCP Communication logs

Local Log Settings	Description
Enable log capacity warning (%)	When the log amount exceeds the warning percentage, it will trigger an event to SNMP Trap or Email.
Warning by	SNMP Trap Email
Event log oversize action	Overwrites the oldest event log Stops recording event log

Syslog Settings	Description
Syslog server IP	IP address of a server which will record the log data.
Syslog server port	514

System Management—Auto Warning Settings

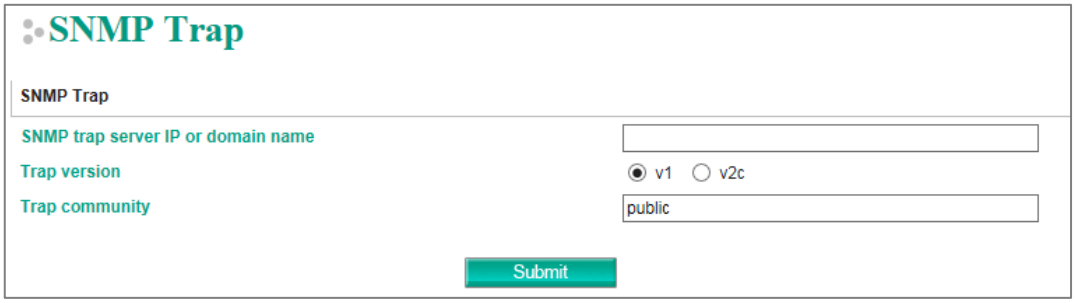


Auto Warning is triggered by different events. When a checked trigger condition occurs, the MGate can send email alerts, SNMP Trap messages, or open/close the circuit of the relay output and trigger the Fault LED to start blinking. To enable an email alert, configure the email address on the **Email Alert** page. Likewise, to enable SNMP trap alerts, configure SNMP trap server on the **SNMP Trap** page.

System Management—Email Alert

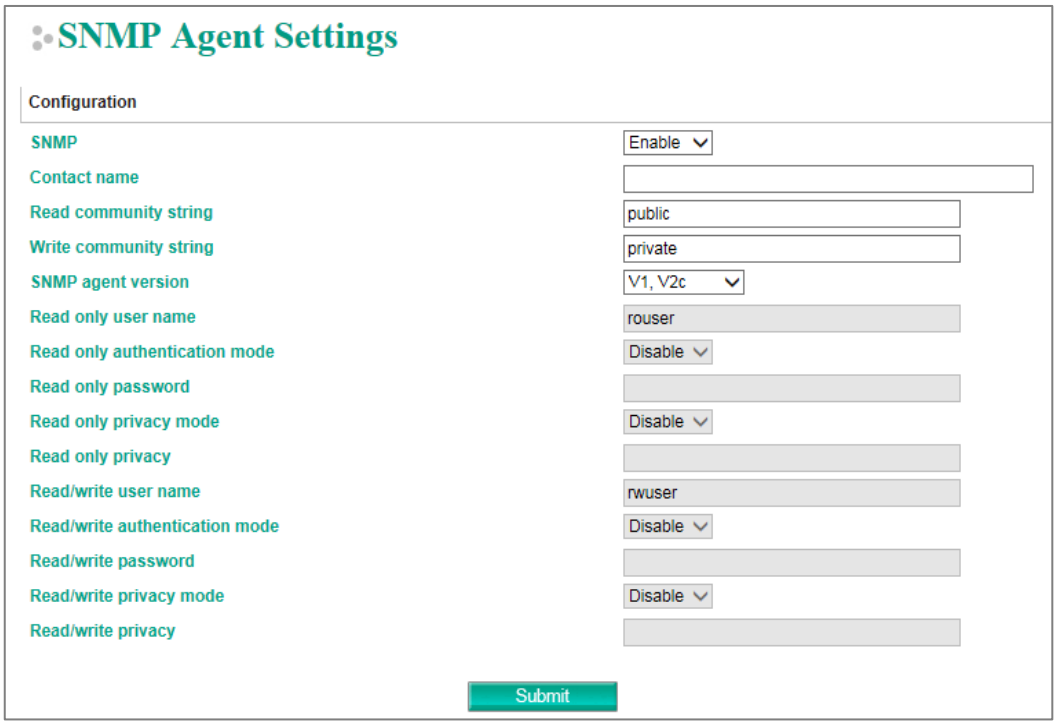
Parameters	Description
Mail server (SMTP)	The mail server's domain name or IP address.
Username	This field is for your mail server's username, if required.
Password	This field is for your mail server's password, if required.
From email address	This is the email address from which automatic email warnings will be sent.
To email address 1 to 4	Email addresses to which automatic email warnings will be sent.

System Management—SNMP Trap



Parameters	Description
SNMP trap server IP	Use this field to show the IP address for receiving SNMP traps.
Trap version	Use this field to select the SNMP trap version.
Trap community	Use this field to designate the SNMP trap community.

System Management—SNMP Agent



Parameters	Description
SNMP	To enable the SNMP Agent function, select the **Enable** option, and enter a community name (e.g., public).
Contact name	The optional SNMP contact information usually includes an emergency contact name and telephone number.
Read community string	This is a text password mechanism that is used to weakly authenticate queries to agents of managed network devices.
Write community string	This is a text password mechanism that is used to weakly authenticate changes to agents of managed network devices.
SNMP agent version	The MGate 5109 supports SNMP V1, V2c, and V3.

Read-only and Read/write access control

The following fields allow you to define usernames, passwords, and authentication parameters for two levels of access: read-only and read/write. The name of the field will show which level of access it refers to. For example, **Read-only** authentication mode allows you to configure the authentication mode for read-only access, whereas **Read/write** authentication mode allows you to configure the authentication mode for read/write access. For each level of access, you may configure the following:

Parameters	Description
Username	Use this optional field to identify the username for the specified level of access.
Authentication mode	Use this field to select MD5 or SHA as the method of password encryption for the specified level of access, or to disable authentication.
Privacy mode	Use this field to enable or disable DES_CBC data encryption for the specified level of access.
Password	Use this field to set the password for the specified level of access.
Privacy	Use this field to define the encryption key for the specified level of access.

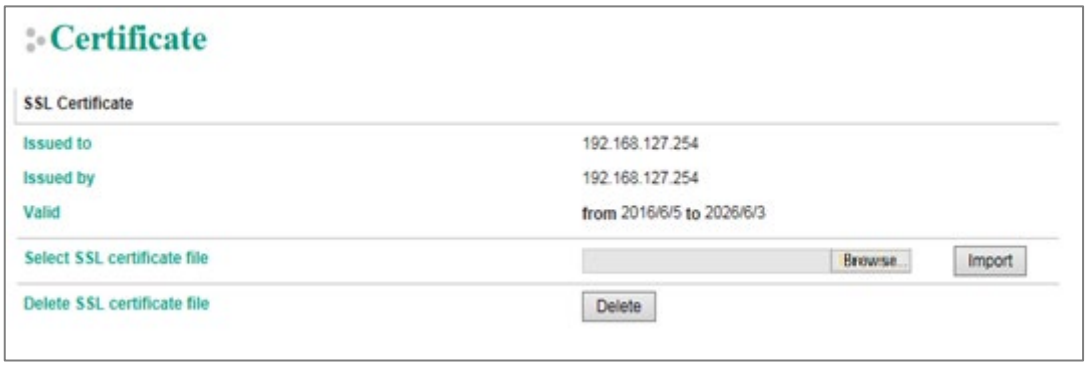
System Management—LLDP Settings

The Link Layer Discovery Protocol (LLDP) standardizes the method that devices on a network use to periodically send information on their configuration and status. This self-identification method keeps all LLDP devices on a network informed of each other's status and configuration. You can use SNMP protocol to then send the LLDP information on the network devices to Moxa's MXview to create auto network topology and for network visualization.

The MGate web interface lets you enable or disable LLDP and set the LLDP transmit interval. In addition, you can go to **System Monitoring–System Status–LLDP Table** to view the MGate's neighbor-list, which is created based on the information reported by neighboring devices on the network.

Parameters	Values	Description
Message transmit interval	5 to 16383 secs (Default:30 secs)	The MGate will send information on the configuration and status of devices in a network at regular intervals based on the value configured here.

System Management—Certificate

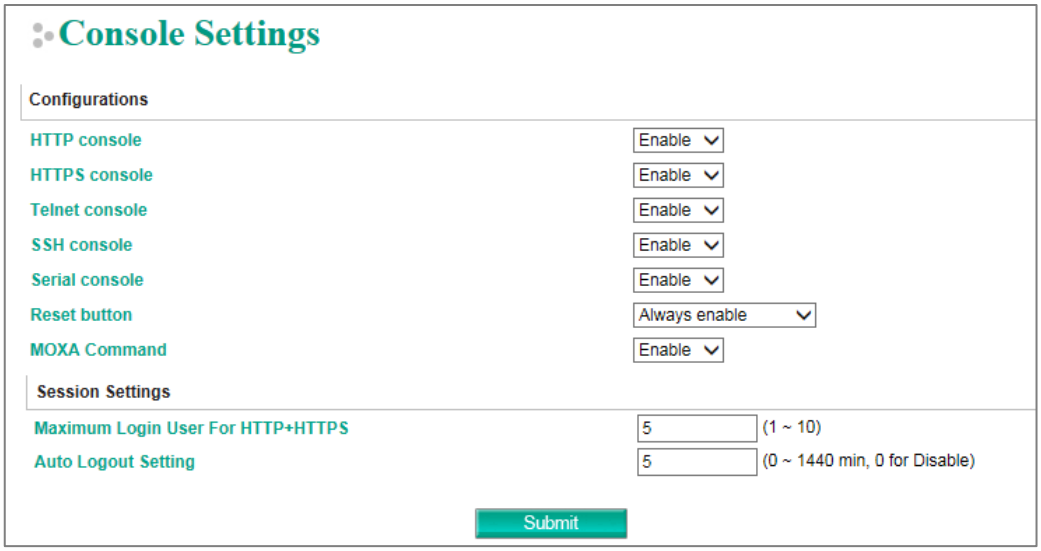


Use this function to load the Ethernet SSL certificate. Select or browse for the certificate file in the Select SSL certificate/key file field. This function is only available on the web console.

System Management—Misc. Settings

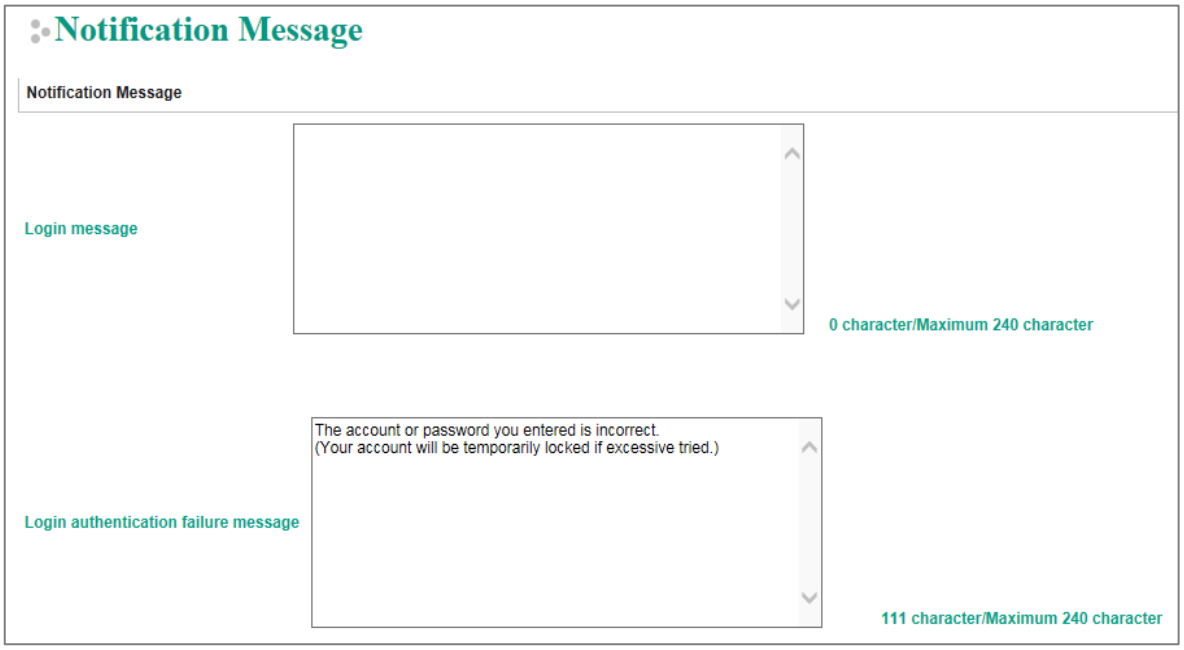
This page includes console settings, password and relay output.

System Management—Misc. Settings—Console Settings



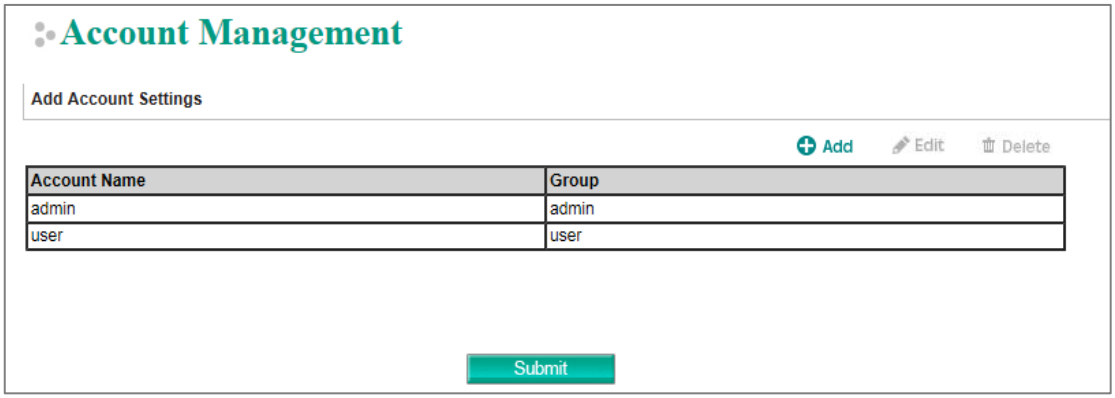
Configuration	Value	Description
HTTP/HTTPS	Enable/Disable	This setting is to enable/disable the web console. For security issues, users can only enable the HTTPS or just disable all settings.
Telnet/SSH	Enable/Disable	
Serial console	Enable/Disable	
Reset button protect	Disable after 60 sec, Always enable	The MGate provides the reset button to clear password or load factory default settings. But for security issues, users can disable this function. In disabled mode, the MGate will still enable this function within 60 seconds after boot-up, just in case users really need to reset this function.
MOXA command	Enable/Disable	
Session Settings	Value	Description
Maximum Login User for HTTP+HTTPS	1 to 10	
Auto Logout Setting	0 to 1440 min.	Sets the auto logout time.

System Management—Misc. Settings—Notification Message



Users can input a message for Login or for Login authentication failure message.

System Management—Misc. Settings—Account Management



Parameters	Value	Description
Account	admin, user	Users can change the password for different accounts. The MGate provides two different level accounts: **admin** and **user**. Admin account can access and change all the settings through the web console. User account can only view the setting and can't change anything.

System Management—Misc. Settings—Login Password Policy

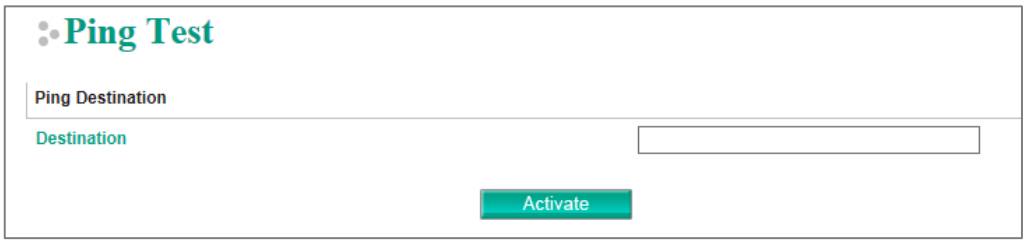
Account Password Policy	Value	Description
Minimum length	4 to 16	
Enable password complexity strength check		Select how the MGate checks the password's strength
Password lifetime	90 to 180 days	Set the password's lifetime period.

Account Login Failure Lockout	Value	Description
Retry failure threshold	1 to 10 times	
Lockout time	1 to 60 min.	

System Management—Maintenance

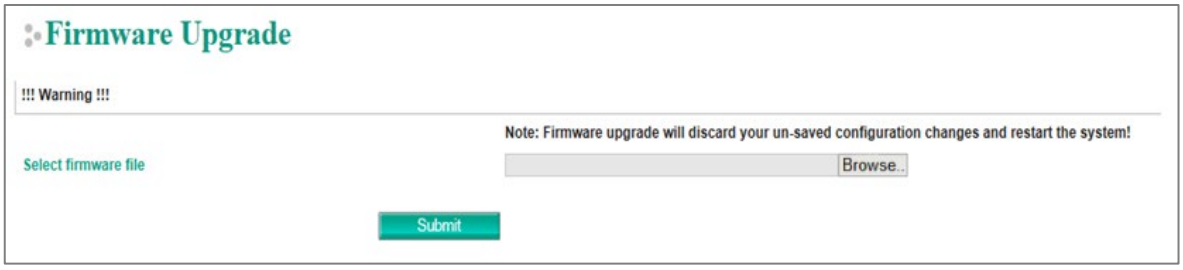
System Management—Maintenance—Ping

This network testing function is available only on the web console. The MGate gateway will send an ICMP packet through the network to a specified host, and the result can be viewed on the web console immediately.



System Management—Maintenance—Firmware Upgrade

Firmware updates for the MGate 5109 are at www.moxa.com. After you have downloaded the new firmware onto your PC, you can use the web console to write it on your MGate 5109. Select the desired unit from the list in the web console and click **Submit** to begin the process.



ATTENTION

DO NOT turn off the MGate power before the firmware upgrade process is completed. The MGate will erase the old firmware to make room for the new firmware to flash memory. If you power off the MGate and terminate the progress, the flash memory will contain corrupted firmware and the MGate will fail to boot. If this happens, call Moxa RMA services.

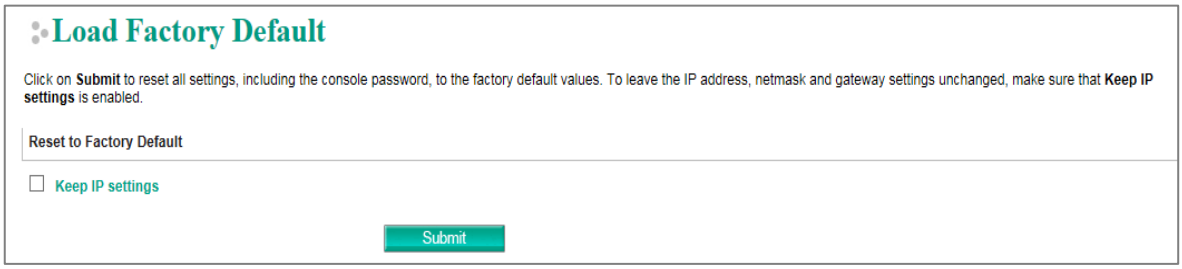
System Management—Maintenance—Configuration Import/Export

There are three main reasons for using the Import and Export functions:

- **Applying the same configuration to multiple units.** The Import/Export configuration function is a convenient way to apply the same settings to units in different sites. You can export the configuration as a file and then import the configuration file onto other units at any time.
- **Backing up configurations for system recovery.** The export function allows you to export configuration files that can be imported onto other gateways to restore malfunctioning systems within minutes.
- **Troubleshooting.** Exported configuration files can help administrators to identify system problems that provide useful information for Moxa's Technical Service Team when maintenance visits are requested.

System Management—Maintenance—Load Factory Default

To clear all the settings on the unit, use the Load Factory Default to reset the unit to its initial factory default values.



ATTENTION

Load Default will completely reset the configuration of the unit, and all the parameters you have saved will be discarded. Do not use this function unless you are sure you want to completely reset your unit.

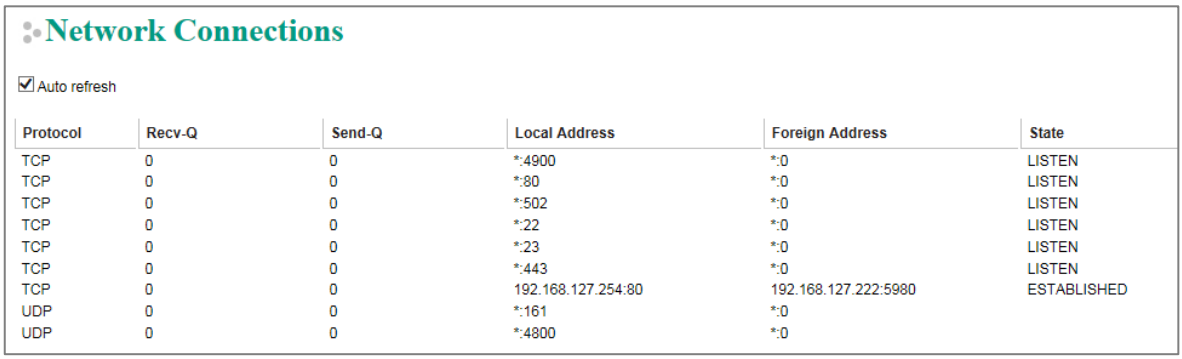
System Monitoring (Troubleshooting)

MGate 5109 provides easy-to-use and useful troubleshooting tools. If a communication issue occurs, we suggest that you first check the **Protocol Status** > **Diagnosis** page for the status of the protocol. To analyze the Modbus/DNP serial traffic, view the network logs available at **Protocol Status** > **Traffic**.

System Monitoring—System Status

System Monitoring—System Status—Network Connections

Go to **Network Connections** under **System Status** to view network connection information.



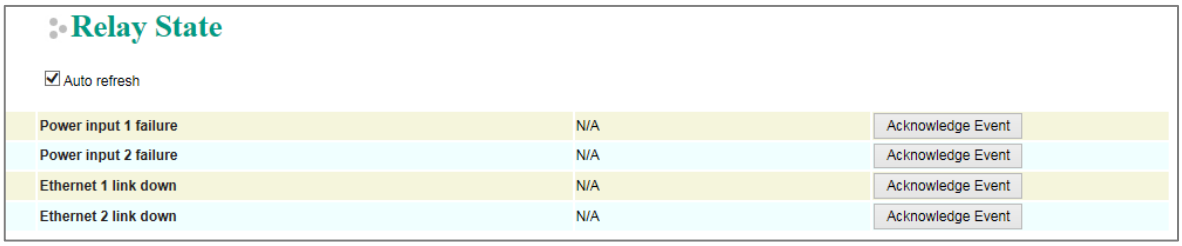
Protocol	Recv-Q	Send-Q	Local Address	Foreign Address	State
TCP	0	0	*:4900	*:0	LISTEN
TCP	0	0	*:80	*:0	LISTEN
TCP	0	0	*:502	*:0	LISTEN
TCP	0	0	*:22	*:0	LISTEN
TCP	0	0	*:23	*:0	LISTEN
TCP	0	0	*:443	*:0	LISTEN
TCP	0	0	192.168.127.254:80	192.168.127.222:5980	ESTABLISHED
UDP	0	0	*:161	*:0	
UDP	0	0	*:4800	*:0	

System Monitoring—System Status—System Log

Go to Network Connections under System Status to view network connection information.

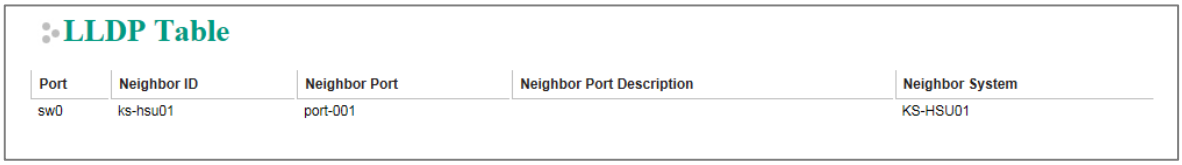
System Monitoring—System Status—Relay State

The MGate gateway includes a built-in relay circuit that is triggered in the event of a power failure or if the Ethernet link is down. You can view the relay status on this page.



System Monitoring—System Status—LLDP Table

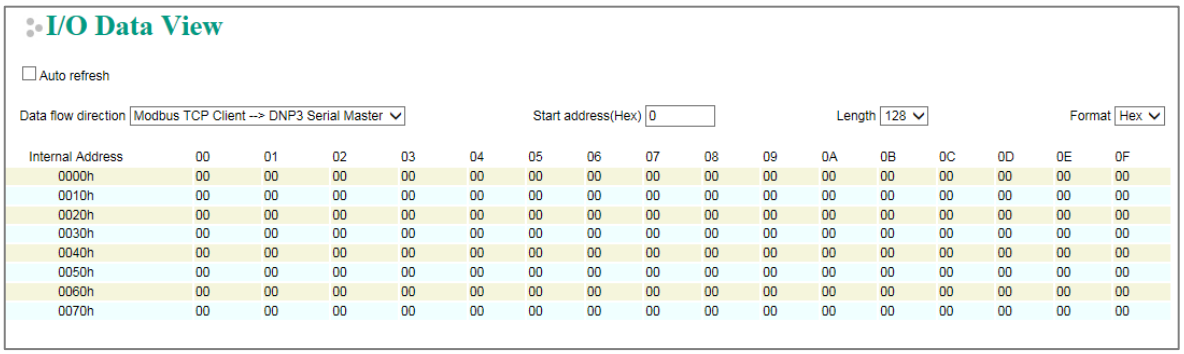
You can see LLDP related information, including Port, Neighbor ID, Neighbor Port, Neighbor Port Description, and Neighbor System.



System Monitoring—Protocol Status

System Monitoring—Protocol Status—I/O Data View

This page displays the internal memory information for input and output data transfers. View updated values for communication verification here. This function is only available on the web console.

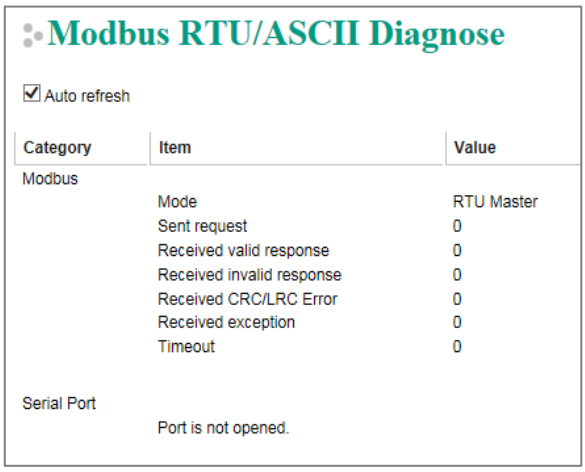


Internal Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0000h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0010h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0020h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0030h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0040h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0050h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0060h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0070h	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

System Monitoring—Protocol Status—Diagnose

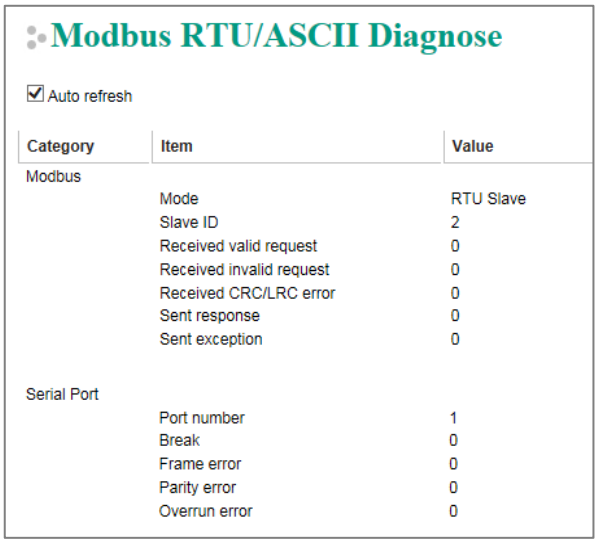
The MGate provides status information for DNP3, Modbus RUB/ASCII, and Modbus TCP troubleshooting. Verify data or packet counters to make sure the communications are running smoothly.

Modbus RTU/ASCII Diagnose (Master)



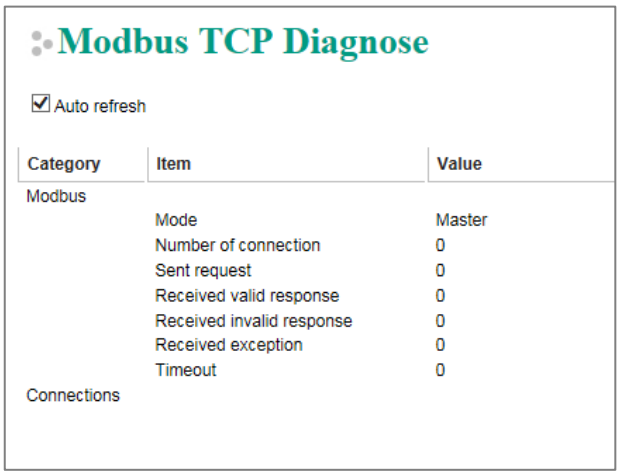
Category	Item	Value
Modbus		
	Mode	RTU Master
	Sent request	0
	Received valid response	0
	Received invalid response	0
	Received CRC/LRC Error	0
	Received exception	0
	Timeout	0
Serial Port		
	Port is not opened.	

Modbus RTU/ASCII Diagnose (Slave)

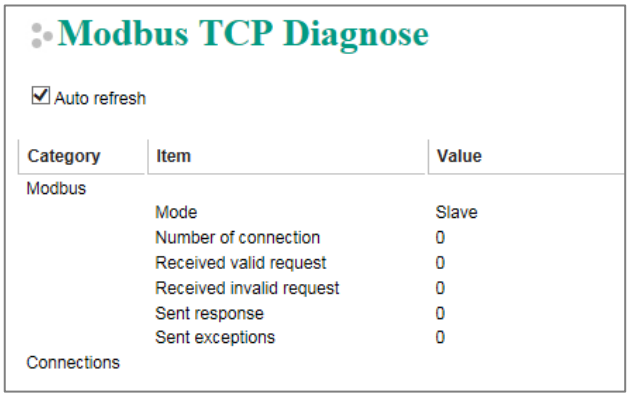


Category	Item	Value
Modbus		
	Mode	RTU Slave
	Slave ID	2
	Received valid request	0
	Received invalid request	0
	Received CRC/LRC error	0
	Sent response	0
	Sent exception	0
Serial Port		
	Port number	1
	Break	0
	Frame error	0
	Parity error	0
	Overrun error	0

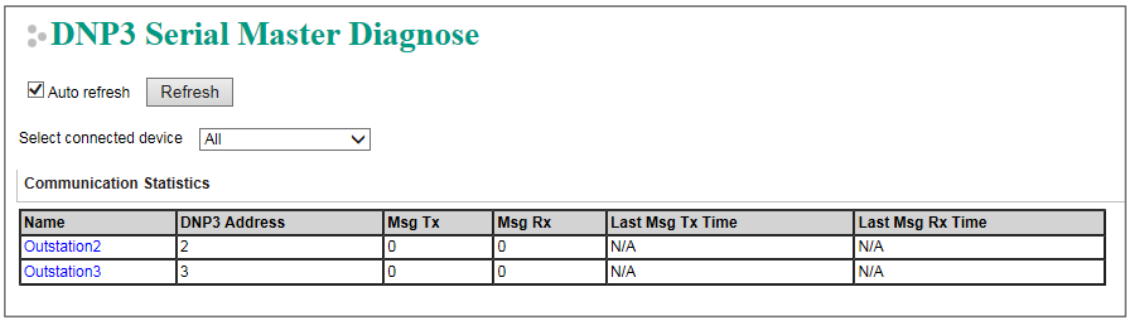
Modbus TCP Diagnose (Client/Master)



Modbus TCP Diagnose (Slave/Server)



DNP3 Serial Master Diagnose



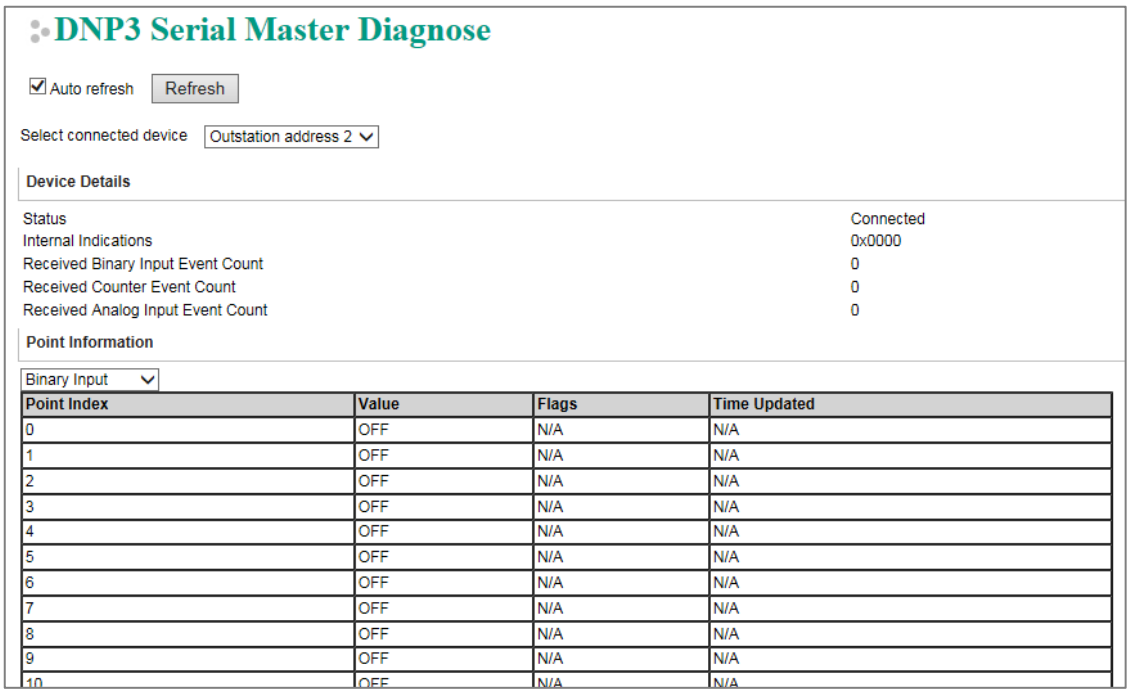
DNP3 Serial Master Diagnose

Auto refresh Refresh

Select connected device All

Communication Statistics

Name	DNP3 Address	Msg Tx	Msg Rx	Last Msg Tx Time	Last Msg Rx Time
Outstation2	2	0	0	N/A	N/A
Outstation3	3	0	0	N/A	N/A



DNP3 Serial Master Diagnose

Auto refresh Refresh

Select connected device Outstation address 2

Device Details

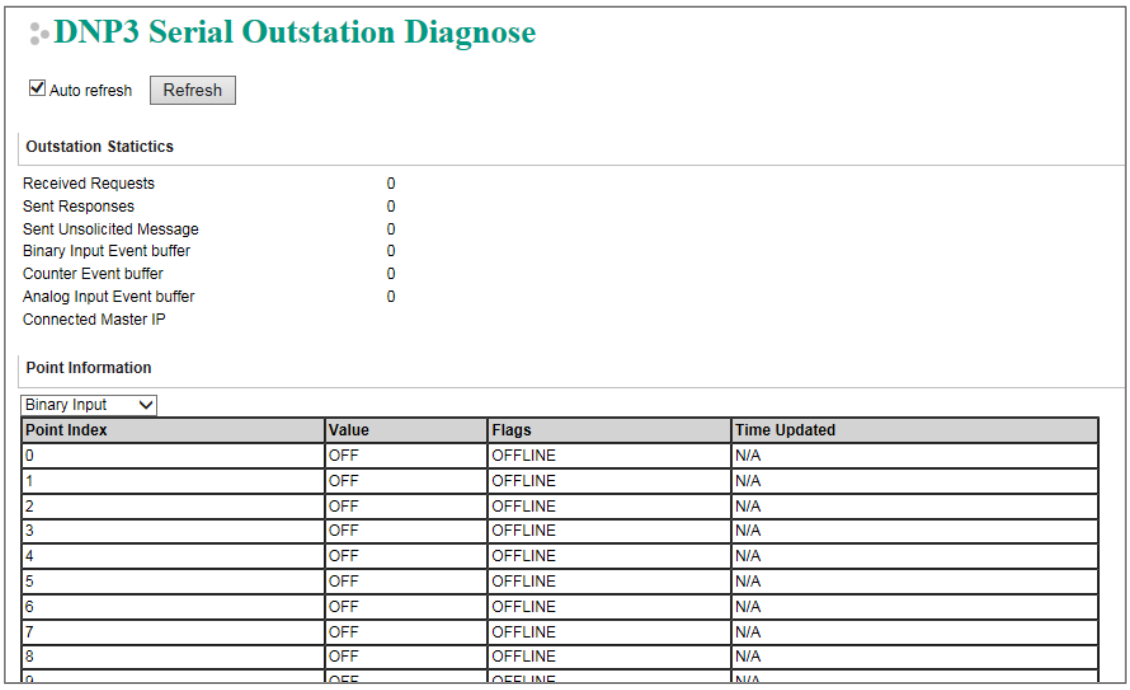
Status	Connected
Internal Indications	0x0000
Received Binary Input Event Count	0
Received Counter Event Count	0
Received Analog Input Event Count	0

Point Information

Binary Input

Point Index	Value	Flags	Time Updated
0	OFF	N/A	N/A
1	OFF	N/A	N/A
2	OFF	N/A	N/A
3	OFF	N/A	N/A
4	OFF	N/A	N/A
5	OFF	N/A	N/A
6	OFF	N/A	N/A
7	OFF	N/A	N/A
8	OFF	N/A	N/A
9	OFF	N/A	N/A
10	OFF	N/A	N/A

DNP3 Serial Outstation Diagnose



DNP3 Serial Outstation Diagnose

Auto refresh Refresh

Outstation Statictics

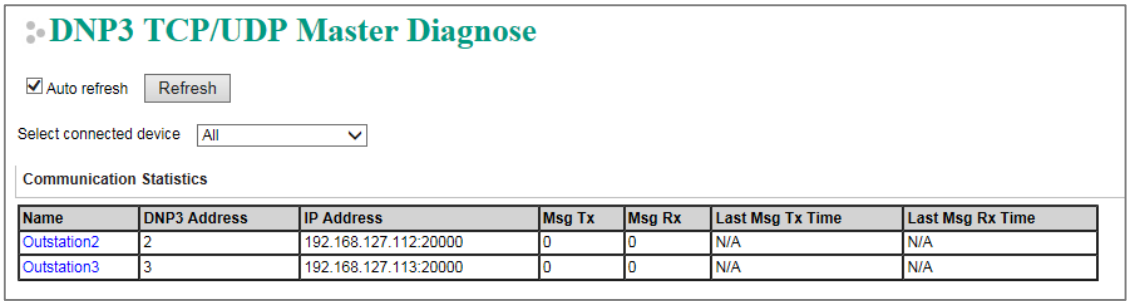
Received Requests	0
Sent Responses	0
Sent Unsolicited Message	0
Binary Input Event buffer	0
Counter Event buffer	0
Analog Input Event buffer	0
Connected Master IP	

Point Information

Binary Input

Point Index	Value	Flags	Time Updated
0	OFF	OFFLINE	N/A
1	OFF	OFFLINE	N/A
2	OFF	OFFLINE	N/A
3	OFF	OFFLINE	N/A
4	OFF	OFFLINE	N/A
5	OFF	OFFLINE	N/A
6	OFF	OFFLINE	N/A
7	OFF	OFFLINE	N/A
8	OFF	OFFLINE	N/A
9	OFF	OFFLINE	N/A

DNP3 TCP/UDP Master Diagnose



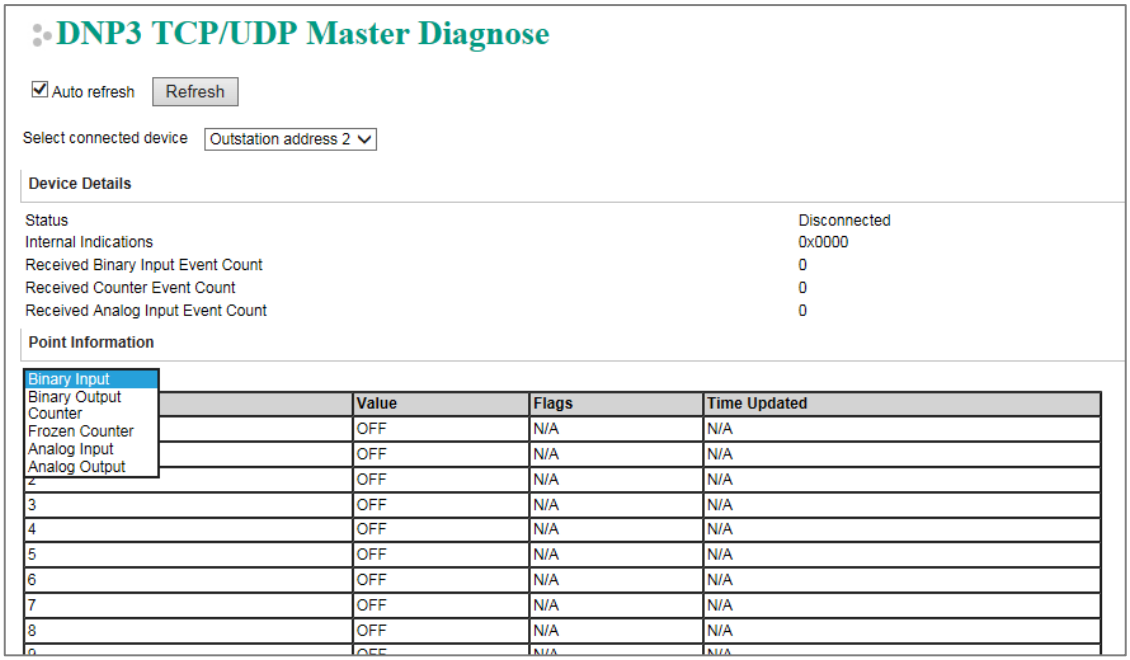
DNP3 TCP/UDP Master Diagnose

Auto refresh Refresh

Select connected device All

Communication Statistics

Name	DNP3 Address	IP Address	Msg Tx	Msg Rx	Last Msg Tx Time	Last Msg Rx Time
Outstation2	2	192.168.127.112:20000	0	0	N/A	N/A
Outstation3	3	192.168.127.113:20000	0	0	N/A	N/A



DNP3 TCP/UDP Master Diagnose

Auto refresh Refresh

Select connected device Outstation address 2

Device Details

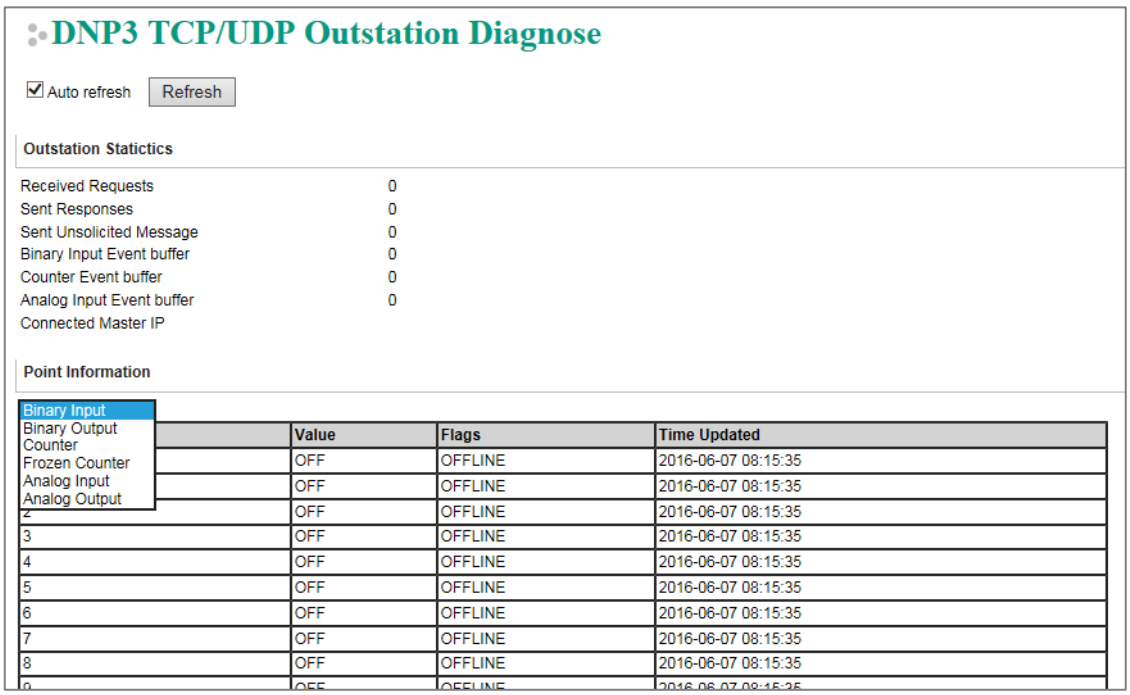
Status	Disconnected
Internal Indications	0x0000
Received Binary Input Event Count	0
Received Counter Event Count	0
Received Analog Input Event Count	0

Point Information

Binary Input
Binary Output
Counter
Frozen Counter
Analog Input
Analog Output

	Value	Flags	Time Updated
	OFF	N/A	N/A
	OFF	N/A	N/A
2	OFF	N/A	N/A
3	OFF	N/A	N/A
4	OFF	N/A	N/A
5	OFF	N/A	N/A
6	OFF	N/A	N/A
7	OFF	N/A	N/A
8	OFF	N/A	N/A

DNP3 TCP/UDP Outstation Diagnose



DNP3 TCP/UDP Outstation Diagnose

Auto refresh Refresh

Outstation Statictics

Received Requests	0
Sent Responses	0
Sent Unsolicited Message	0
Binary Input Event buffer	0
Counter Event buffer	0
Analog Input Event buffer	0
Connected Master IP	

Point Information

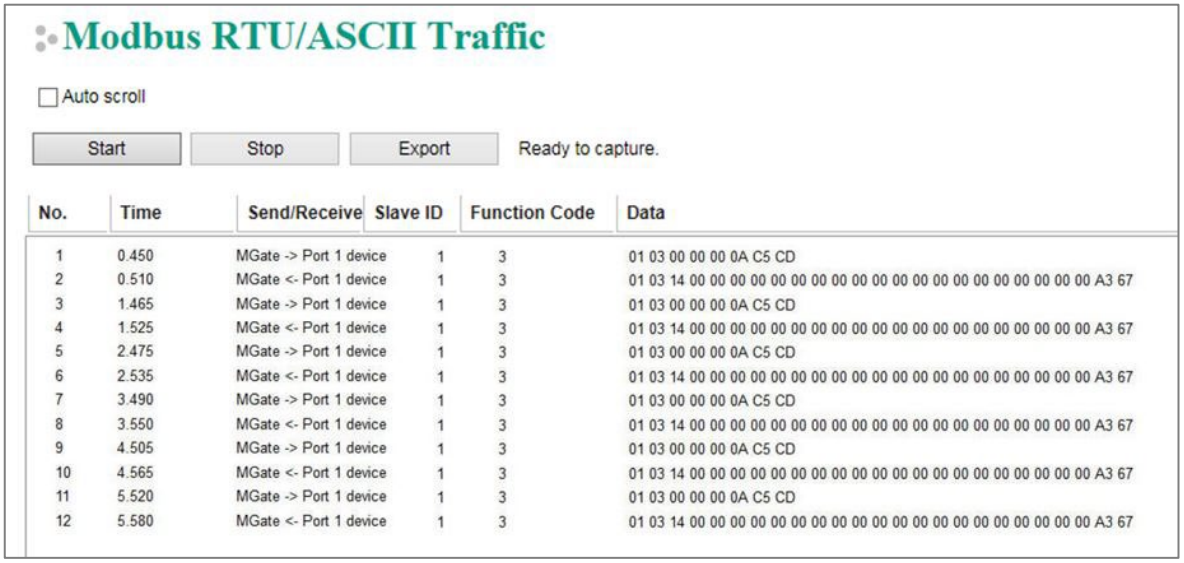
Binary Input
Binary Output
Counter
Frozen Counter
Analog Input
Analog Output

	Value	Flags	Time Updated
	OFF	OFFLINE	2016-06-07 08:15:35
	OFF	OFFLINE	2016-06-07 08:15:35
2	OFF	OFFLINE	2016-06-07 08:15:35
3	OFF	OFFLINE	2016-06-07 08:15:35
4	OFF	OFFLINE	2016-06-07 08:15:35
5	OFF	OFFLINE	2016-06-07 08:15:35
6	OFF	OFFLINE	2016-06-07 08:15:35
7	OFF	OFFLINE	2016-06-07 08:15:35
8	OFF	OFFLINE	2016-06-07 08:15:35

System Monitoring—Protocol Status—Traffic

Modbus RTU/ASCII Traffic

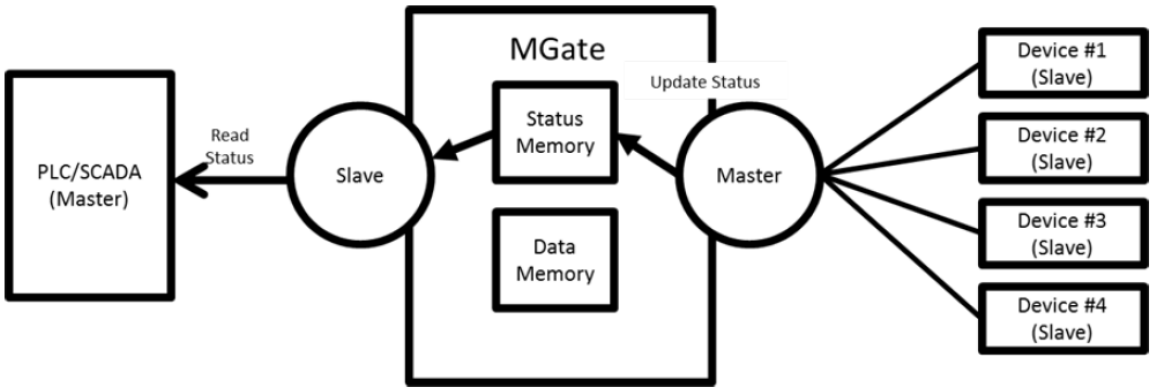
For troubleshooting or management purposes, you can monitor the Modbus RTU/ASCII data passing through the MGate 5109 on the network. Rather than simply echoing the data, MGate Manager presents the data in an intelligent, easy-to-understand format with clearly designated fields, including source, type, destination, contents, and more. Events can be filtered in different ways, and the complete log can be saved to a file for later analysis.



DNP3 Serial Traffic

Status Monitoring

Status Monitoring helps users monitor slave device communication status by PLC/SCADA master. (See schematic diagram below.) Status monitoring only works when the MGate acts as the "Master". This function always works in the background while the MGate is operating. If there are no issues, the MGate will not list any monitored information. But when an error occurs, the MGate will list the status into the specified memory, which can be retrieved by PLC/SCADA via Ethernet/IP or Modbus protocol. Once the issue has been solved, the MGate will eliminate the error status.



Format:

The maximum number of entries for Status Monitoring lists is 30. Each entry frame has eight bytes, which contains the information of device ID, information group, and protocol information content. The format is:

4 bytes	1 byte	3 bytes
Device ID	Information Group Type	Protocol Information

Device ID:

The first four bytes of the status monitoring data represent the device ID, which could be an IPv4 address or a Modbus slave ID (for example: Modbus slave ID).

Information Group Type:

The 5th byte is the information group, which is defined below:

0x00: Reserved, currently not use.
0x01: Connection info group, which represents for the connection drop or other error related to connection step.
0x02: Protocol related status information, which will be defined by each protocol.
0x03: Moxa defined status.
0x04: Vendor specified.

Protocol Information:

The Protocol Information will be influenced by the Information Group.

If the value in the **Information Group** is 0x01, the three protocol information bytes will take the value 0x00, 0x00, 0xFF. This means a slave device was disconnected or unable to connect successfully.

Information Group	Protocol Information		
1 byte	1 byte	1 byte	1 byte
0x01	0x00	0x00	0xFF

If the Information Group is 0x02, different protocols of the format will be different.

Modbus Master Error:

Information Group	Protocol Information		
1 byte	1 byte	1 byte	1 byte
0x02	**Reserved** (should be all 0)	**Modbus** Function code	**Modbus** Exception code

For details regarding the Modbus function code and exception code, refer to the Modbus protocol specification.

A slave device was disconnected or unable to connect success:

1st & 2nd bytes: Should be all **0**.

3rd byte: Should be **0xFF**.

After the slave device was connected:

1st byte: Reserved, should be all 0.

2nd byte: The function code of the Modbus command when an error occurs.

3rd byte: The Modbus exception code that the slave device responds to (refer to the specification of the corresponding slave device). When the device disconnects or the connection times out, the exception code will be 0xFF.

DNP3 Master Error:

Information Group	Protocol Information		
1 byte	1 byte	1 byte	1 byte
0x02	**Reserved** (Should be all 0)	**DNP3** IIN2.X (MSB)	**DNP3** IIN1.X (LSB)

The Slave device was disconnected or unable to connect success:

1st & 2nd bytes: should be all 0.
3rd byte: should be 0xFF.

After the slave device was connected:

1st byte: reserved, should be all 0.
2nd byte: the IIN2.X (MSB) from outstation response fragment.
3rd byte: the IIN1.X (LSB) from outstation response fragment.

When the IIN occurs below, field device status monitoring data will be generated:

IIN1.6 device trouble
IIN2.0 function code not supported
IIN2.1 object unknown
IIN2.2 parameter error
IIN2.3 event buffer overflow
IIN2.5 configuration corrupt

Access method:

Modbus:

If user's device is Modbus master (client), and the MGate acts as a Modbus slave (server), the user can get the status monitoring information through function code 0x03, with protocol register address 60000 (in PLC view, the address is 60001); Quantity 1 to 120 (total 240 bytes).

5. Configuration (Text Mode Console)

The MGate 5109 supports a text-mode console with a serial interface, Telnet, and SSH protocol. The user interface is the same in all text mode consoles. Note that the text mode console does not support all configuration items. Some parameters must be configured through the web console.

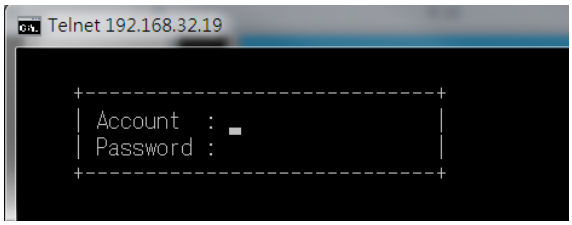
You must use a DB9-to-RJ45 cable to connect the serial console port on the MGate gateway's front panel to the serial port on the host. The serial console parameters are 115.2 kbps; parity: none; 8 data bits; and one stop bit.

For telnet and SSH, use HyperTerminal or PuTTY to connect to the MGate. Note that the Telnet protocol will transfer the account and password information over the Internet using plain text, so Telnet is essentially obsolete and should be replaced by the SSH protocol.

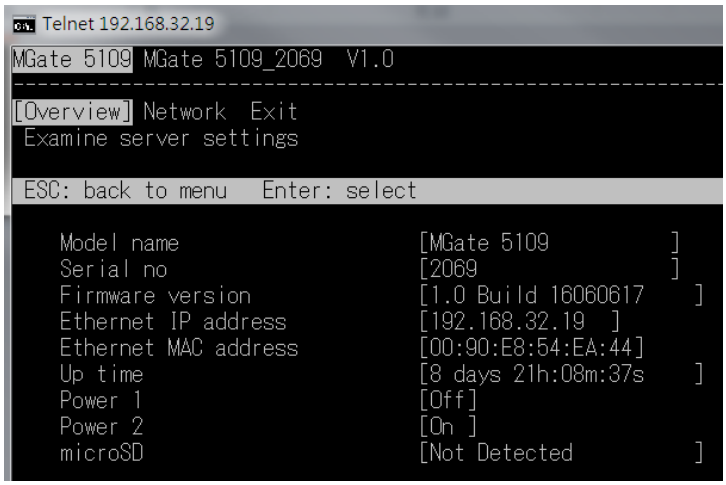
To connect to the MGate Telnet/SSH console, load the Telnet/SSH program and connect to the MGate IP address.

For the serial interface, use a null modem (crossover) cable to connect the serial port on the host to the serial console port on the MGate's front of panel. The serial console parameters are 115.2kbps, none for parity, 8 data bits, and one stop bit. You can use a terminal program such as PComm Terminal Emulator or PuTTY to connect to the MGate serial console.

On the first page, input the account and password. The account supports two types of users: **admin** and **user**. An "admin" account can change all the settings, but a "user" account can only review the settings. A "user" account cannot change the configuration. The default password for **admin** is **moxa**.



The text mode console will display the menu-driven interface. Users can use the arrow key to move the menu bar. To select the option, press the "Enter" key to go next level menu. To go to the previous level menu, press the "Esc" key to quit. If necessary, the MGate will need to restart to activate the setting.



6. Network Management Tool (MXstudio)

This chapter provides an overview of Moxa's MXstudio industrial network management suite.

Overview

Moxa's MXstudio industrial network management suite includes tools that you might need throughout your industrial network life cycle such as MXconfig industrial network configuration tool, MXview industrial management software, and N-Snap industrial network snapshot tool. The MXstudio suite in the MGate 5109 includes MXconfig and MXview, which are used for mass configuration of network devices and monitoring network topology, respectively. The following functions are supported:

Tool	Function Support
MXconfig	1. System name and login password modification 2. Network settings 3. Configuration import/export 4. Firmware upgrade
MXview	1. Configuration import/export 2. LLDP for topology analysis 3. Security View**

** Security features based on IEC-62443 standard.