MGate MB3000 Modbus Gateway
User Manual

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www.moxa.com/products

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MGate MB3000 Modbus Gateway User Manual

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1. Introduction

Welcome to the MGate MB3000 line of Modbus gateways. All models feature easy integration of Modbus TCP to Modbus RTU/ASCII and feature RS-232/422/485 ports for Modbus serial communication. One-, two-, and four-port models are available.

This user's manual applies to the following models:

- MGate MB3180
- MGate MB3280
- MGate MB3480
- MGate MB3170/3170I
- MGate MB3270/3270I

Overview

The MGate MB3000 is a line of Modbus protocol gateways that provides users with

- seamless integration of Ethernet and serial Modbus devices
- powerful operation modes to handle almost any Modbus application
- Windows utilities for easy setup and traffic monitoring

Seamless integration of Ethernet and serial Modbus devices

Modbus is one of the most popular automation protocols in the world, supporting traditional RS-232/422/485 devices and newly developed Ethernet devices. Many industrial devices, such as PLCs, DCSs, HMIs, instruments, and meters, use Modbus as their communication standard. However, the Ethernet-based Modbus protocol is so different from the original serial-based protocols that a communication gateway is needed as a bridge for integration.

To integrate Modbus networks, the MGate MB3000 includes an Ethernet port and up to four serial ports that support RS-232, RS-422, and RS-485 communication. It automatically and intelligently translates between Modbus TCP (Ethernet) and Modbus ASCII/RTU (serial) protocols, allowing Ethernet-based PLCs to control instruments over RS-485 without additional programming or effort.

Powerful operation modes to handle almost any Modbus application

With the Modbus protocol, we must clearly define devices as either clients/masters or servers/slaves. Unlike other Modbus gateways, the MGate MB3000's operation modes allow users to select client/master or server/slave operation for each serial port. Not only does the MB3000 allow Ethernet clients/masters to control serial servers/slaves, but it also allows serial clients/masters to control Ethernet servers/slaves. In addition, the advanced models (the MGate MB3170 and MB3270 Series) allow both Ethernet and serial servers/slaves to be controlled by both Ethernet and serial clients/masters. On multiport models, each serial port's operation mode is independent of the other ports, so that one port may be configured for slave mode and another port configured for master mode.

Extra address mapping and exception parameters are provided to ensure that most situations can be handled.

Web console and Windows utilities for easy setup and traffic monitoring

A Windows utility is provided to make configuration and operation of the MGate MB3000 as easy as possible. The utility automatically connects to all available MGate MB3000 units on the LAN for you. Traffic monitoring functions help you troubleshoot Modbus communication problems by tracking items such as connection status and address translation errors. All series provide a web console for configuration.

Package Checklist

All models in the MGate MB3000 line are shipped with the following items:

Standard Accessories

- 1 MGate MB3000 Modbus gateway
- Quick installation guide (printed)
- Power adapter (MB3180, MB3280, and MB3480 only)
- Warranty card

Optional Accessories

- DK-35A: DIN-rail mounting kit (35 mm)
- Mini DB9F-to-TB Adaptor: DB9 female to terminal block adapter
- DR-4524: 45W/2A DIN-rail 24 VDC power supply with universal 85 to 264 VAC input
- DR-75-24: 75W/3.2A DIN-rail 24 VDC power supply with universal 85 to 264 VAC input
- DR-120-24: 120W/5A DIN-rail 24 VDC power supply with 88 to 132 VAC/176 to 264 VAC input by switch

NOTE

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

Product Features

- Integration of Modbus TCP and Modbus RTU/ASCII networks
- Auto device routing
- Up to 31 Modbus RTU/ASCII servers/slaves per serial port
- Allow access to up to 16 (MB3180/MB3280/MB3480) or 32 (MB3170/MB3270) TCP client/master devices, connect up to 32 TCP server/slave devices
- Configuration over Ethernet with easy-to-use Windows utility
- 10/100M Fast Ethernet with automatic IP setting (DHCP)
- Software-selectable RS-232/485/422 communication
- High-speed serial interface supporting 921.6 Kbps
- Serial port routing by IP address and TCP port allow access to up to 4 TCP clients/masters for Modbus gateways with multiple serial ports (MB3280/MB3480/MB3270).
- Serial port routing by slave ID mapping (slave ID table) allows access to up to 16 (MB3180/MB3280/MB3480) or 32 (MB3170/MB3270) TCP clients/masters.
- Extend transmission distance up to 4 km / 20 km through multi-mode/single-mode fiber models.
- ProCOM: Virtual Serial Port for flexible Modbus to Modbus TCP communication (for MB3170/MB3170I/MB3270/MB3270I)
- Supports MXview utility
- Supports SNMP v1, v2c, and v3

2. Getting Started

This chapter provides basic instructions for installing the MGate MB3000.

Connecting Power

The unit can be powered using the AC adaptor or by connecting a power source to the terminal block, depending on the model. The following instructions are for the AC adaptor:

1. Plug the connector of the power adapter into the DC-IN jack on the back of the unit.
2. Plug the power adapter into an electrical outlet.
3. Follow these instructions to connect a power source to the terminal block:
4. Loosen or remove the screws on the terminal block.
5. Connect the 12 to 48 VDC power line to the terminal block.
6. Tighten the connections using the screws on the terminal block.

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 show that the unit is receiving power.

For power terminal block pin assignments, please refer to the hardware reference chapter for your model.

Connecting Serial Devices

The unit's serial port(s) are on the back panel. There are two options for connecting serial devices, depending on the serial interface:

- You may use a DB9-to-DB9 cable to connect a serial device to the unit. Plug one end of the cable into the port on the unit's back panel and plug the other end of the cable into the device's serial port.
- You may make your own customized serial cable to connect a serial device to the unit. For the pin assignments of the unit's serial port, please refer to Chapter 10. This information can then be used to construct your own serial cable.

If you are connecting an RS-485 multidrop network with multiple devices, please note the following:

- All devices that are connected to a single serial port must use the same protocol (i.e., either Modbus RTU or Modbus ASCII).
- Each client/master device must get its own port on the unit. If you are connecting a network with both client/master and server/slave devices, the client/master must be connected to a separate port from the servers/slaves. Furthermore, the client/master will only be able to communicate with Modbus TCP servers/slaves, not to the ASCII or RTU servers/slaves that are connected to a different serial port.

For serial port pin assignments, please refer to the hardware reference chapter for your model.

RS-485 Termination and Pull High/Low Resistors

In some critical RS-485 environments, you may need to add termination resistors to prevent the reflection of serial signals. When using termination resistors, it is important to set the pull high/low resistors correctly so that the electrical signal is not corrupted. For each serial port, DIP switches or jumper settings are used to set the pull high/low resistor values. For all models except the MB3180, a built-in 120-Ω termination resistor can also be enabled.

To change the termination and pull high/low resistor settings, please refer to the hardware reference chapter for your model.

ATTENTION

Do not use the 1 KΩ pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

Connecting to a Host or the Network

A 10/100BaseT Ethernet port is on the unit's front panel. This port is used for the unit's connection to a host or Ethernet network, as follows:

- For normal operation, use a standard straight-through Ethernet cable to connect the unit to your Modbus TCP network.
- For initial configuration or for troubleshooting, you may connect the unit directly to a PC. In this case, use a crossover Ethernet cable to connect the unit to your PC's Ethernet connector.

The unit's Link LED will light up to show a live Ethernet connection.

For advanced models (MB 3170, MB3170I, MB3270, and MB3270I), two Ethernet ports are provided. One port can connect to the network, and the other port can connect to another Ethernet device.

Installing the Software

The Windows management utility is available for download. Please download it from Moxa's website at http://www.moxa.com. For additional details, please refer to Chapter 9.

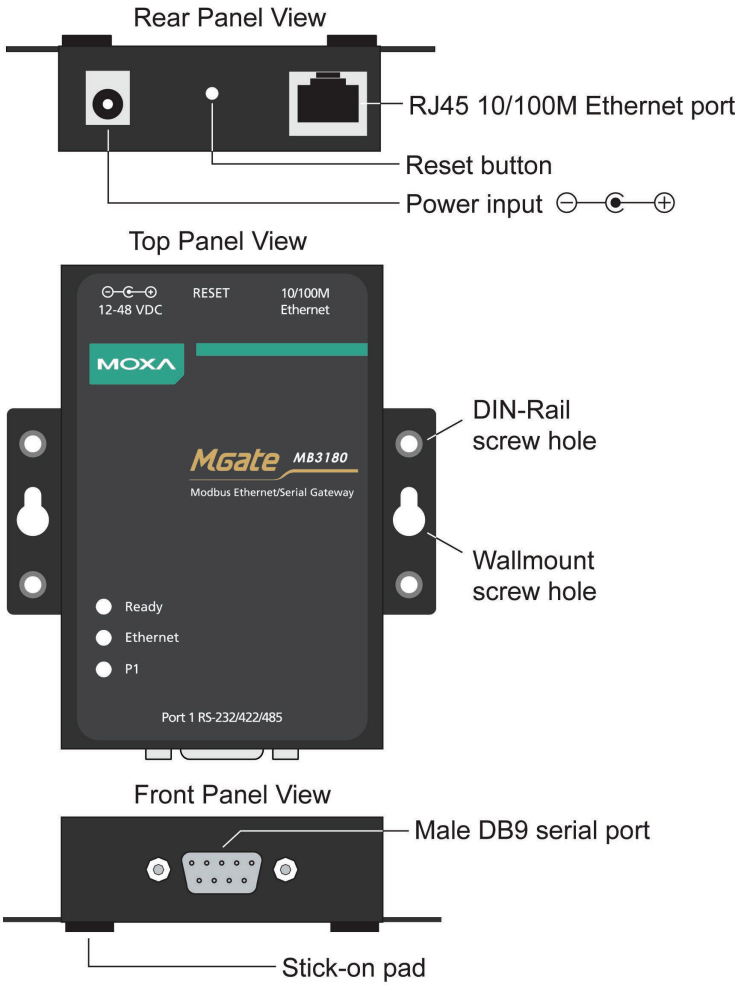
Mounting the Unit

The unit can be placed on a desktop, mounted on the wall, or mounted on a DIN-rail. The MB3180, MB3280, and MB3480 require optional attachments for DIN-rail mounting. For additional details, please refer to the hardware reference chapter for your model.

3. Hardware: MB3180

This chapter provides hardware information for the MGate MB3180.

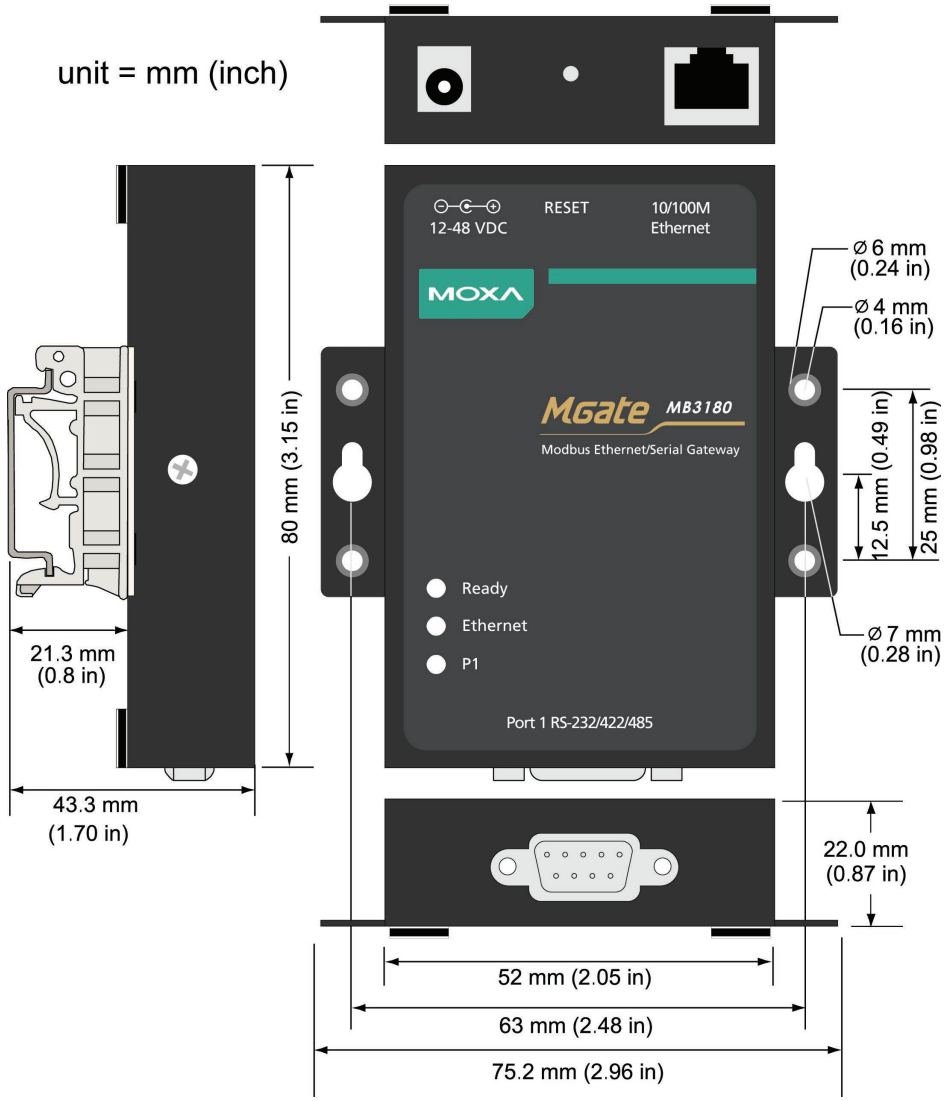
Panel Layout



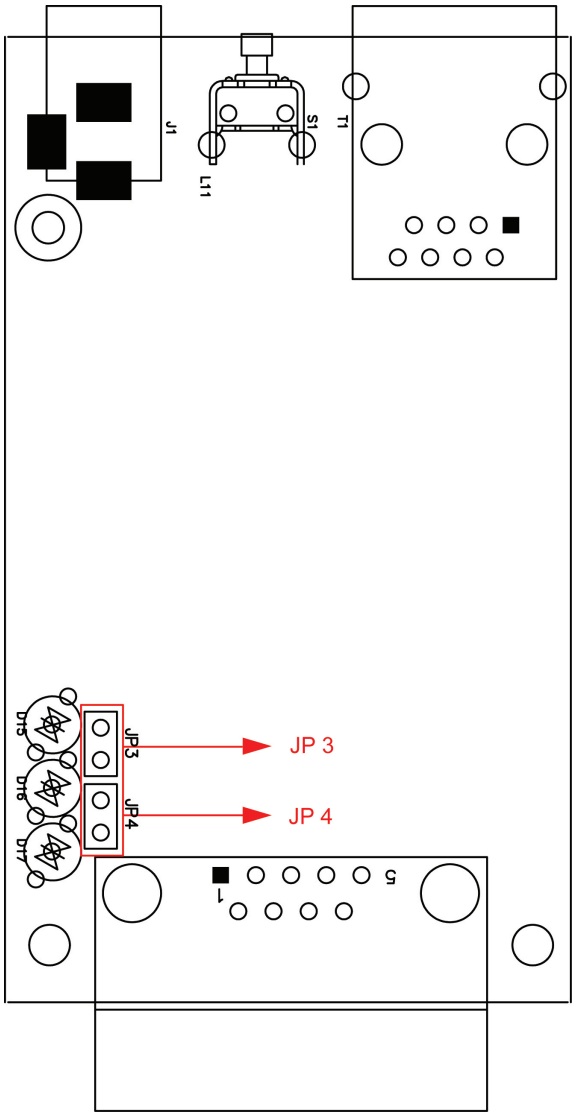
LED Indicators

Name	Color	Function
Ready	Red	Steady on: Power is on, and the unit is booting up. Blinking: Shows an IP conflict, or the DHCP or BOOTP server is not responding properly.
	Green	Steady on: Power is on, and the unit is functioning normally. Blinking: Unit is responding to software Locate function.
	Off	Power is off, or power error condition exists.
Ethernet	Amber	10 Mbps Ethernet connection.
	Green	100 Mbps Ethernet connection.
	Off	Ethernet cable is disconnected or has a short.
P1	Amber	Serial port is receiving data.
	Green	Serial port is transmitting data.
	Off	No data is being transmitted or received through the serial port.

Dimensions



Jumpers



To access these jumpers, loosen the screws on both sides of the device and open the cover.

To set the pull high/low resistors to 150 KΩ, leave jumpers **JP3** and **JP4** open (not shorted). This is the default setting.

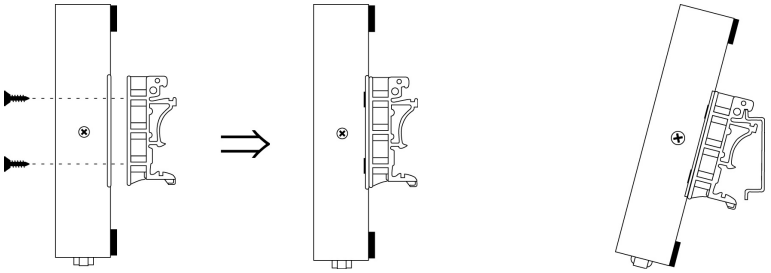
To set the pull high/low resistors to 1 KΩ, short jumpers **JP3** and **JP4** with jumper caps.

ATTENTION

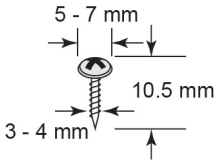
Do not use the 1 KΩ pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

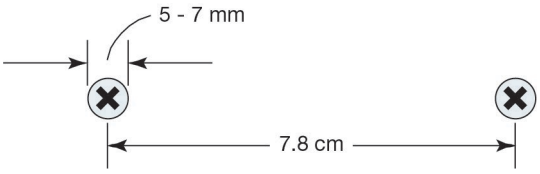
DIN Rail and Wall Mounting

Mounting on a DIN Rail: Attach the DIN-rail accessories and latch the unit onto the DIN Rail as shown. The DIN-rail kit is ordered separately.



Mounting on the wall: Place two screws in the wall and slide the unit onto the screws as shown. The head of the screws should be 5 to 7 mm in diameter, the shaft should be 3 to 4 mm in diameter, and the length of the screws should be at least 10.5 mm. Leave about 2 mm of space between the head and the wall.





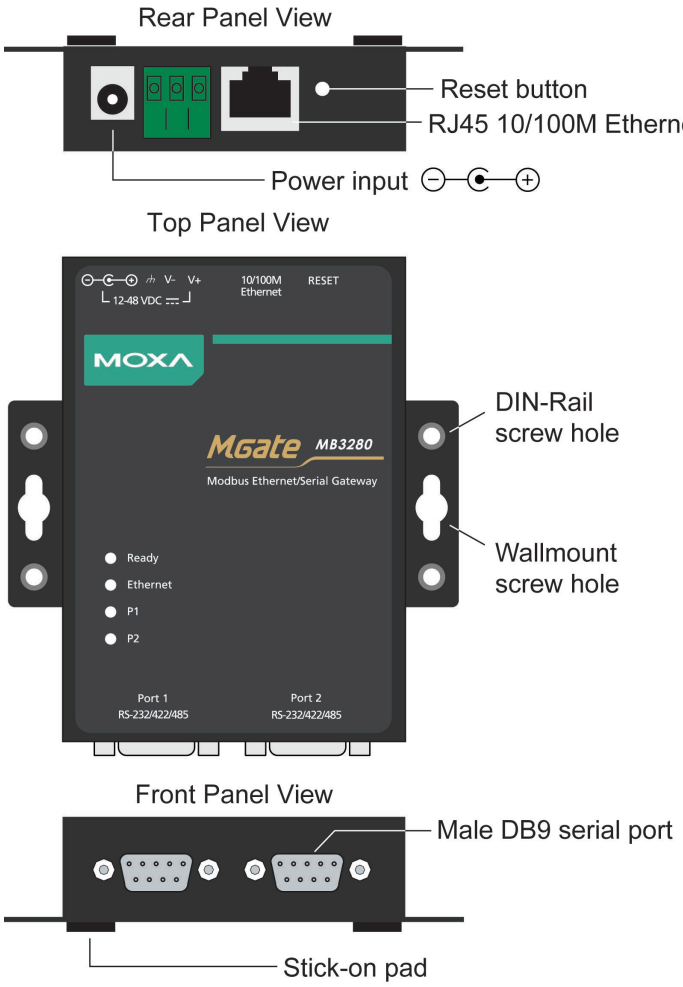
Specifications

> **Note**
>
> The latest specifications for Moxa's products can be found at https://www.moxa.com.

4. Hardware: MB3280

This chapter provides hardware information for the MGate MB3280.

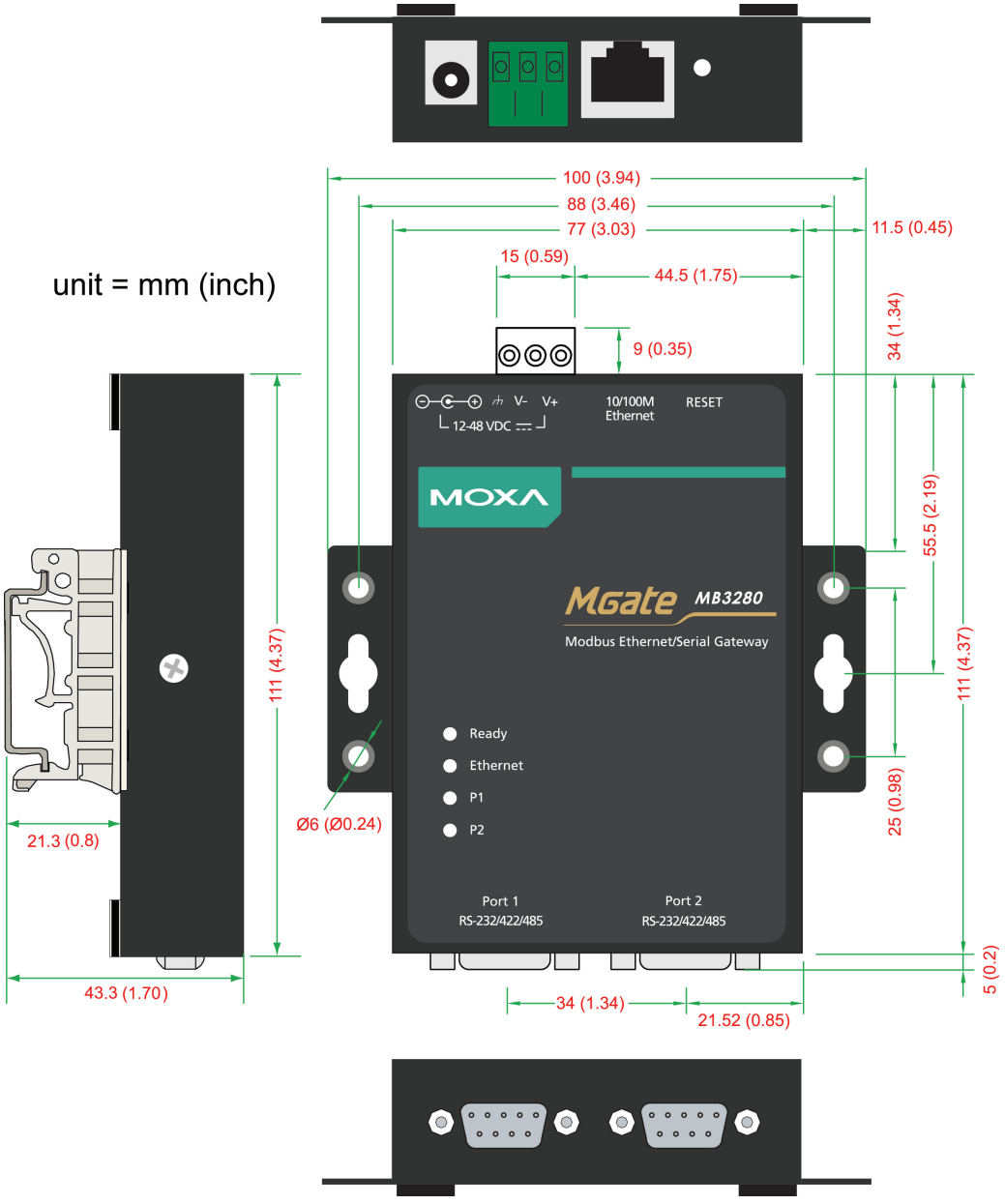
Panel Layout



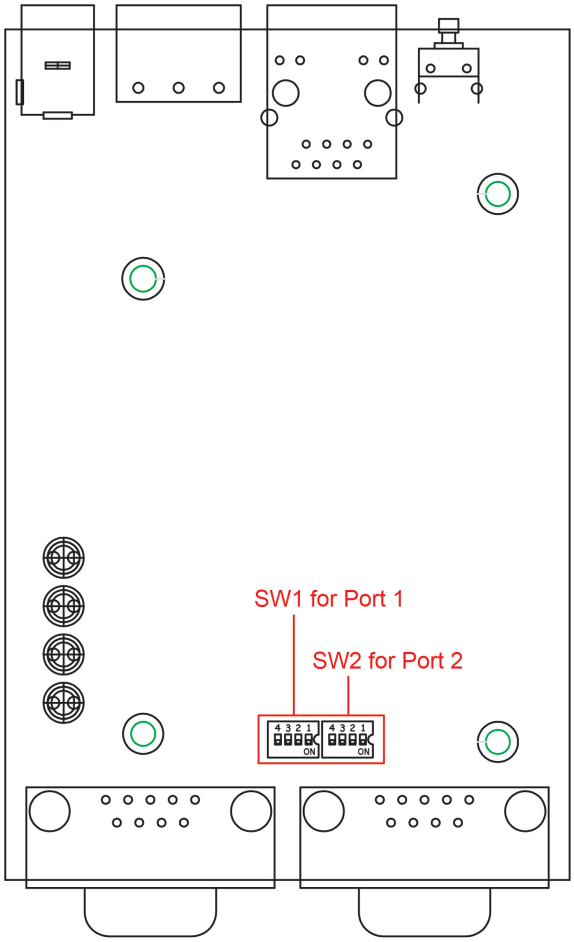
LED Indicators

Name	Color	Function
Ready	Red	Steady on: Power is on, and the unit is booting up. Blinking: Shows an IP conflict, or the DHCP or BOOTP server is not responding properly.
	Green	Steady on: Power is on, and the unit is functioning normally. Blinking: Unit is responding to software Locate function.
	Off	Power is off, or power error condition exists.
Ethernet	Amber	10 Mbps Ethernet connection.
	Green	100 Mbps Ethernet connection.
	Off	Ethernet cable is disconnected or has a short.
P1/P2	Amber	Serial port is receiving data.
	Green	Serial port is transmitting data.
	Off	No data is being transmitted or received through the serial port.

Dimensions



Jumpers



To access these switches, loosen the screws on both sides of the device and open the cover.

To add a 120 Ω termination resistor, set switch 3 on the port's assigned DIP switch to ON; set switch 3 to OFF (the default setting) to disable the termination resistor.

To set the pull high/low resistors to 150 KΩ, set switches 1 and 2 on the port's assigned DIP switch to OFF. This is the default setting.

To set the pull high/low resistors to 1 KΩ, set switches 1 and 2 on the port's assigned DIP switch to ON.

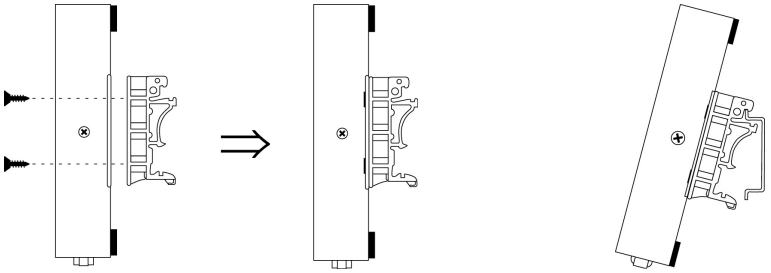
Switch 4 on the port's assigned DIP switch is reserved.

ATTENTION

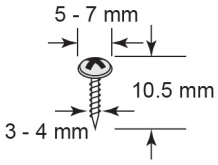
Do not use the 1 KΩ pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

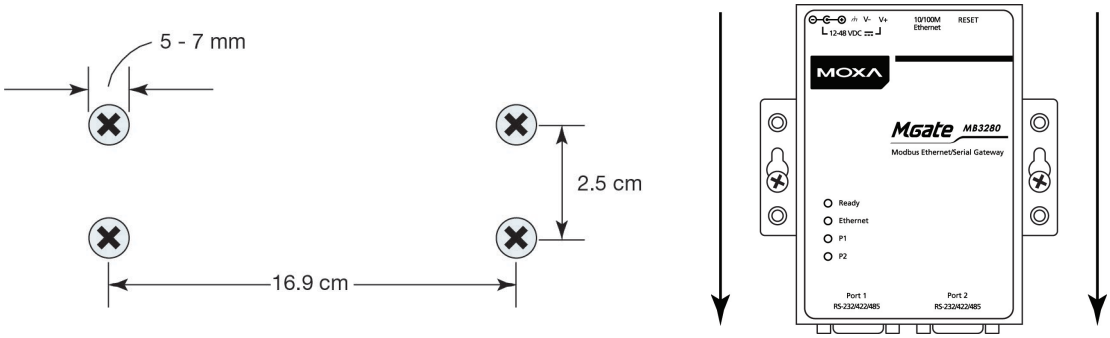
DIN Rail and Wall Mounting

Mounting on a DIN Rail: Attach the DIN-rail accessories and latch the unit onto the DIN Rail as shown. The DIN-rail kit is ordered separately.



Mounting on the wall: Place two screws in the wall and slide the unit onto the screws as shown. The head of the screws should be 5 to 7 mm in diameter, the shaft should be 3 to 4 mm in diameter, and the length of the screws should be at least 10.5 mm. Leave about 2 mm of space between the head and the wall.





Specifications

> **Note**
>
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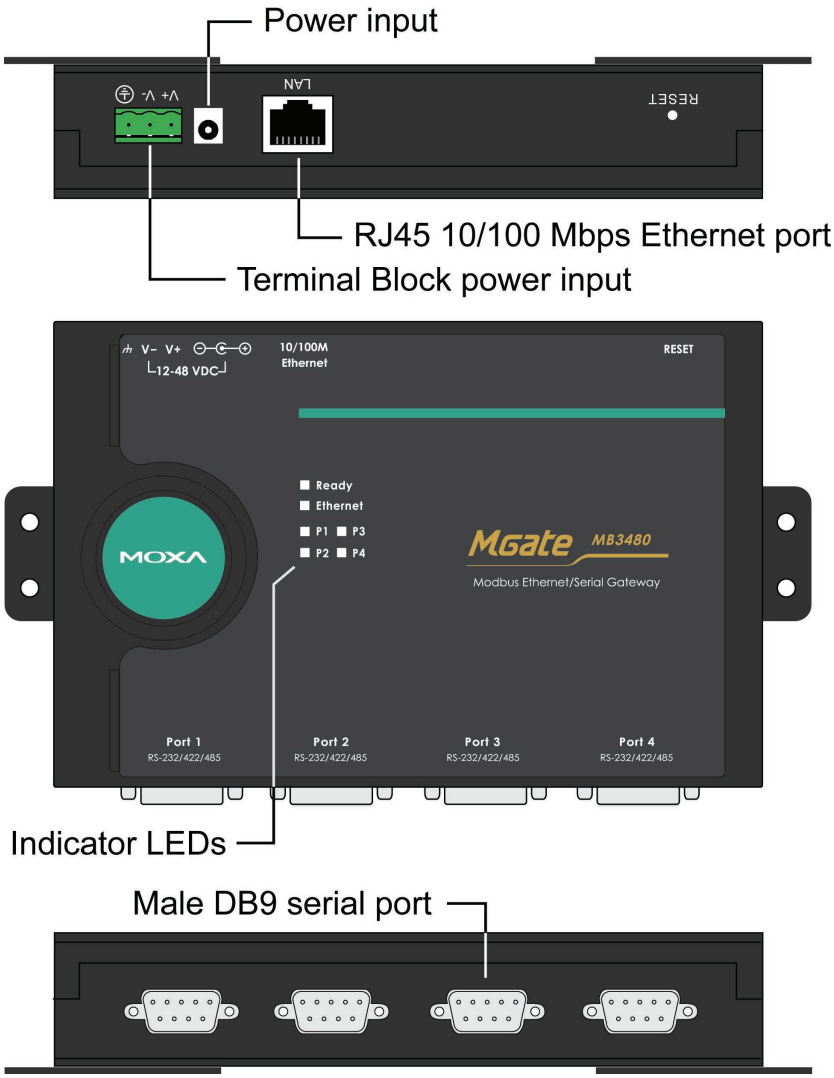
5. Hardware: MB3480

This chapter provides hardware information for the MGate MB3480.

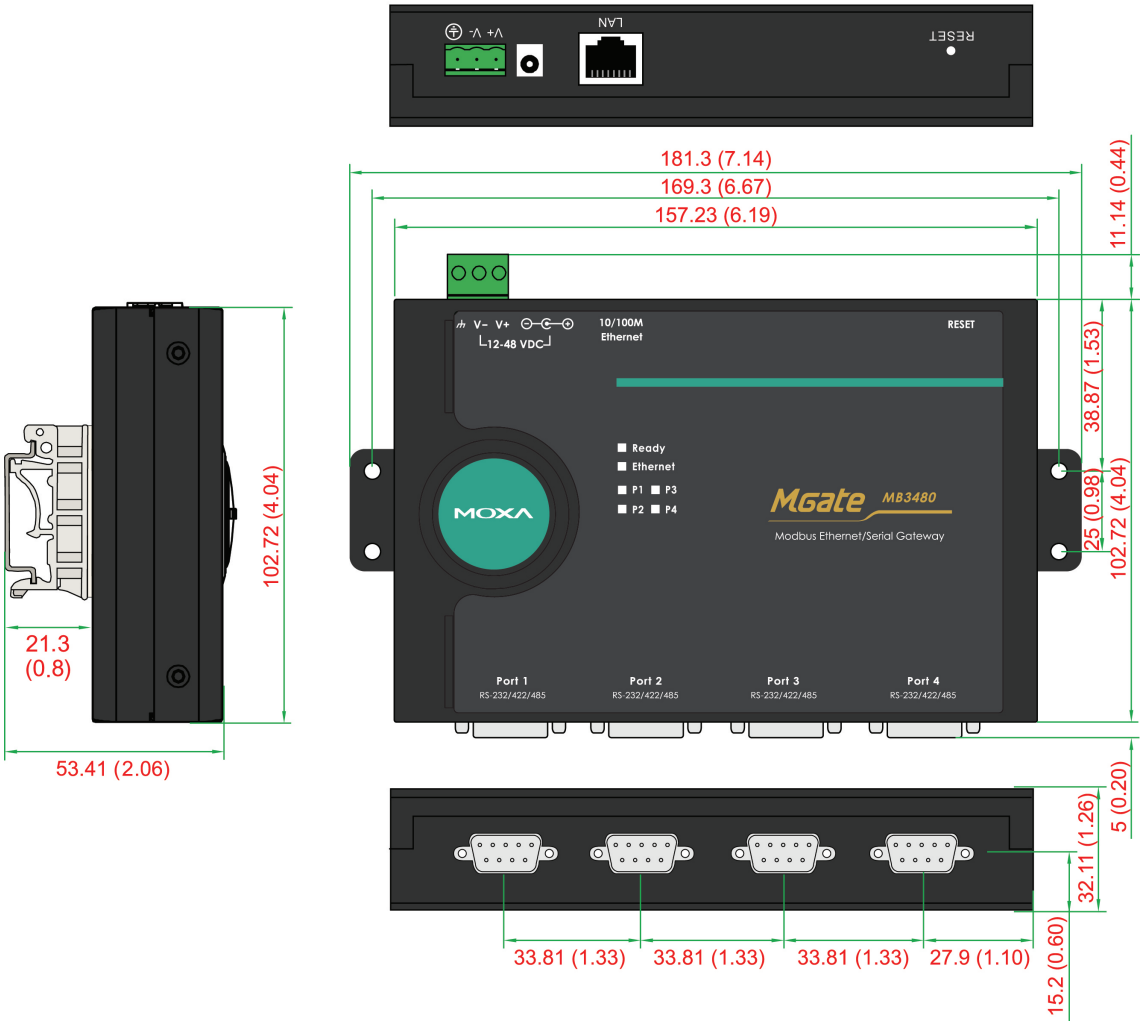
Panel Layout



LED Indicators

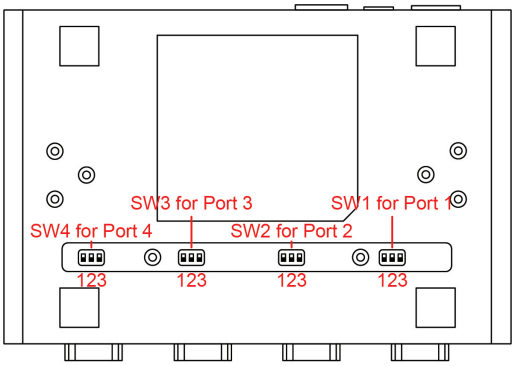
Name	Color	Function
Ready	Red	Steady on: Power is on, and the unit is booting up. Blinking: Shows an IP conflict, or the DHCP or BOOTP server is not responding properly.
	Green	Steady on: Power is on, and the unit is functioning normally. Blinking: Unit is responding to software Locate function.
	Off	Power is off, or a power error condition exists.
Ethernet	Amber	10 Mbps Ethernet connection.
	Green	100 Mbps Ethernet connection.
	Off	Ethernet cable is disconnected or has a short.
P1, P2, P3, P4	Amber	Serial port is receiving data.
	Green	Serial port is transmitting data.
	Off	No data is being transmitted or received through the serial port.

Dimensions

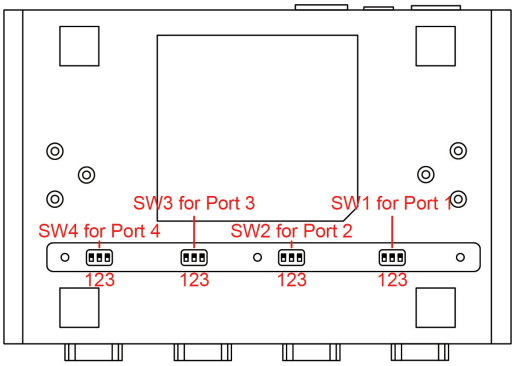


Jumpers

HW version v1.3.3 or earlier



HW version v1.4.0 or later



To access these switches, loosen the screws on both sides of the device and open the cover.

To add a 120 Ω termination resistor, set switch 3 on the port's assigned DIP switch to ON; set switch 3 to OFF (the default setting) to disable the termination resistor.

To set the pull high/low resistors to 150 KΩ, set switches 1 and 2 on the port's assigned DIP switch to OFF. This is the default setting.

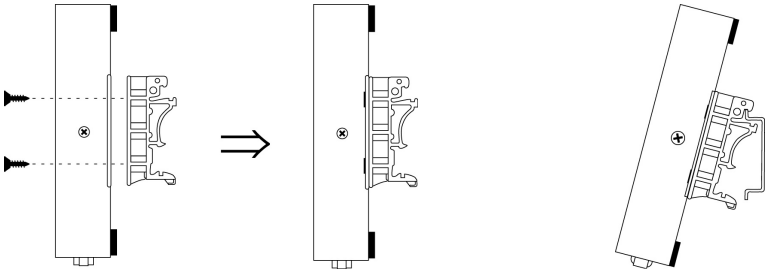
To set the pull high/low resistors to 1 KΩ, set switches 1 and 2 on the port's assigned DIP switch to ON.

ATTENTION

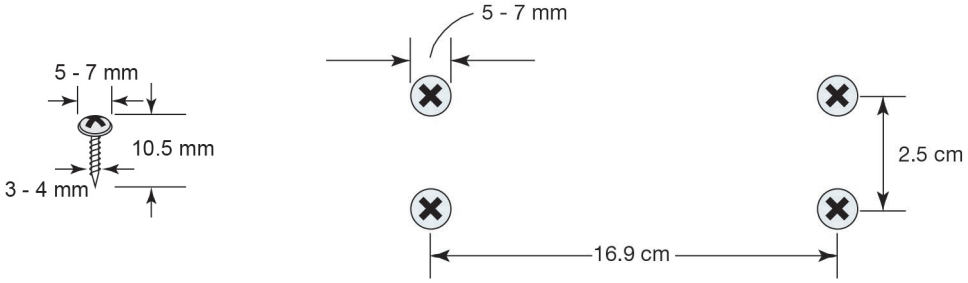
Do not use the 1 KΩ pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

DIN Rail and Wall Mounting

Mounting on a DIN Rail: Attach the DIN-rail accessories and latch the unit onto the DIN Rail as shown. The DIN-rail kit is ordered separately.



Mounting on the wall: You will first need to attach the mounting plates to the unit. Place four screws in the wall and slide the unit onto the screws as shown.



The head of the screws should be 5 to 7 mm in diameter, the shaft should be 3 to 4 mm in diameter, and the length of the screws should be at least 10.5 mm. Leave about 5 mm of space between the head and the wall.

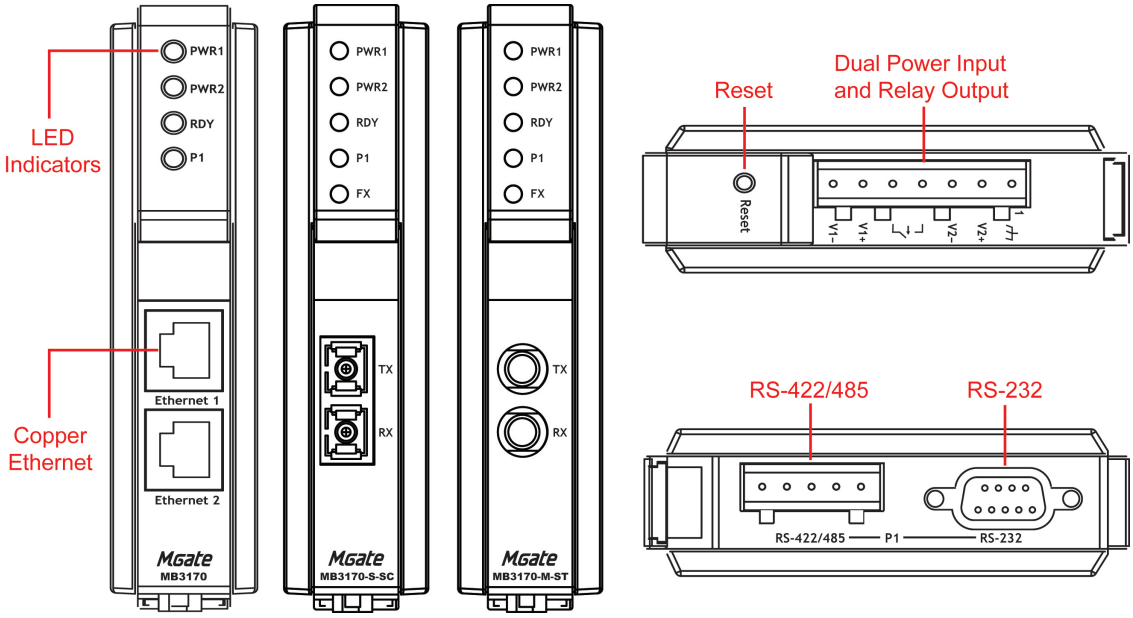
Specifications

> **Note**
>
> The latest specifications for Moxa's products can be found at https://www.moxa.com.

6. Hardware: MB3170, MB3170I

This chapter provides hardware information for the MGate MB3170 and MB3170I.

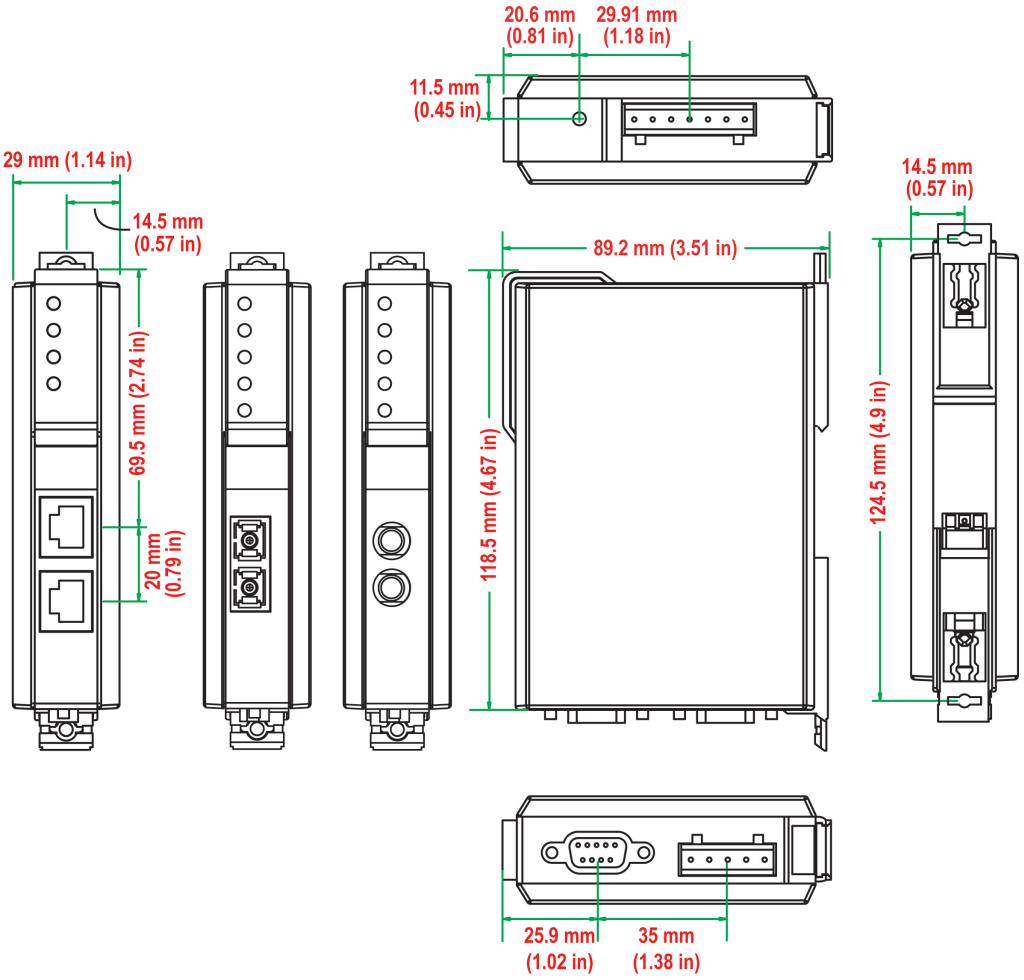
Panel Layout



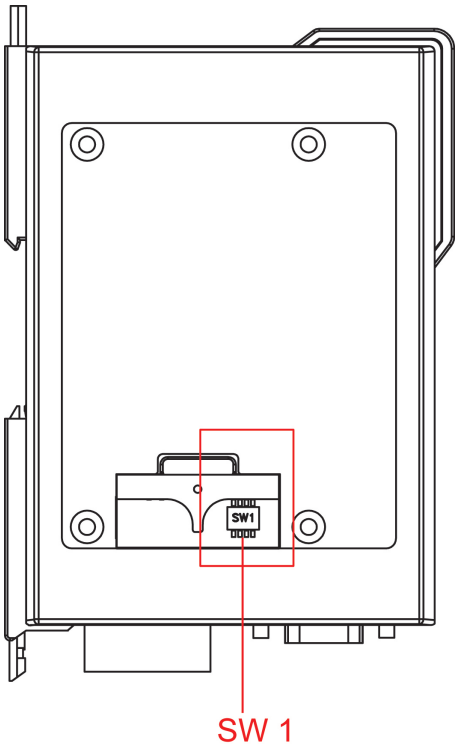
LED Indicators

Name	Color	Function
PWR1	Red	Power is being supplied to the power input.
PWR2	Red	Power is being supplied to the power input.
RDY	Red	Steady on: Power is on, and the unit is booting up. Blinking: IP conflict, the DHCP or BOOTP server did not respond properly, or a relay output occurred.
	Green	Steady on: Power is on, and the unit is functioning normally. Blinking: Unit is responding to software Locate function.
	Off	Power is off, or power error condition exists.
Ethernet	Amber	10 Mbps Ethernet connection.
	Green	100 Mbps Ethernet connection.
	Off	Ethernet cable is disconnected or has a short.
P1	Amber	Serial port is receiving data.
	Green	Serial port is transmitting data.
	Off	No data is being transmitted or received through the serial port.
FX	Amber	Steady on: Ethernet fiber connection, but port is idle.
		Blinking: Fiber port is transmitting or receiving data.
	Off	Fiber port is not transmitting or receiving data.

Dimensions


20.6 mm
(0.81 in)
29.91 mm
(1.18 in)
11.5 mm
(0.45 in)
29 mm (1.14 in)
14.5 mm
(0.57 in)
69.5 mm (2.74 in)
20 mm
(0.79 in)
89.2 mm (3.51 in)
118.5 mm (4.67 in)
14.5 mm
(0.57 in)
124.5 mm (4.9 in)
25.9 mm
(1.02 in)
35 mm
(1.38 in)

Jumpers



The DIP switches are beneath the DIP switch panel on the side of the unit.

To add a 120 Ω termination resistor, set switch 3 to ON; set switch 3 to OFF (the default setting) to disable the termination resistor.

To set the pull high/low resistors to 150 KΩ, set switches 1 and 2 to OFF. This is the default setting.

To set the pull high/low resistors to 1 KΩ, set switches 1 and 2 to ON.

Switch 4 on the port's assigned DIP switch is reserved.

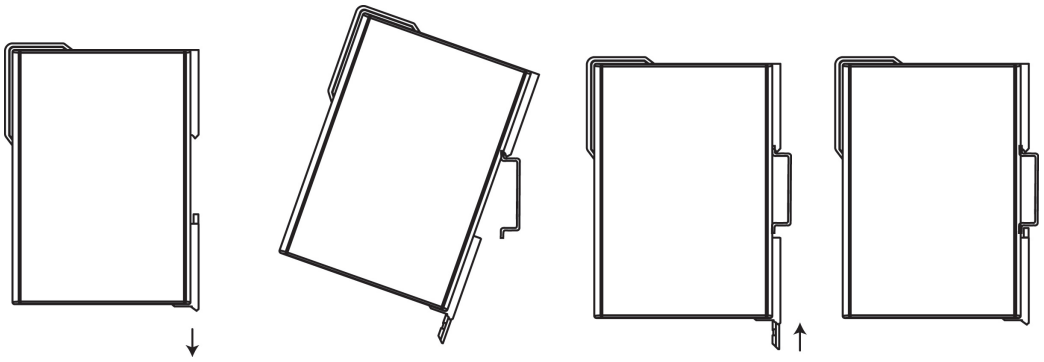
ATTENTION

Do not use the 1 KΩ pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

DIN Rail and Wall Mounting

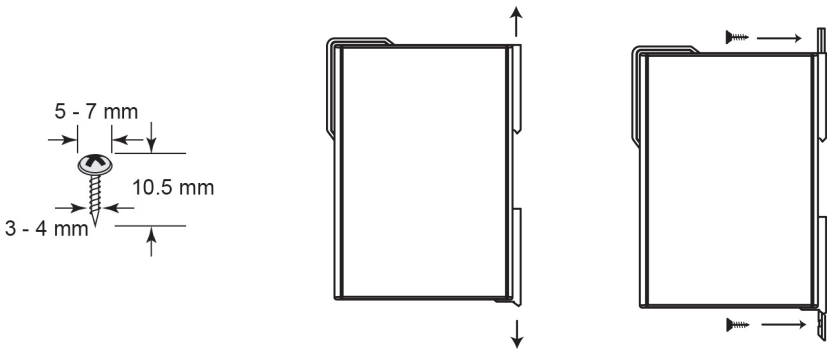
There are two sliders on the back of the unit for DIN Rail and wall mounting.

Mounting on a DIN Rail: Pull out the bottom slider, latch the unit onto the DIN Rail, and push the slider back in.



Mounting on the wall: Pull out both the top and bottom sliders and align the screws accordingly.

Mounting the MGate MB3170 Series on to a wall requires two screws. The heads of the screws should be 5 to 7 mm in diameter, the shafts should be 3 to 4 mm in diameter, and the length of the screws should be more than 10.5 mm.



NOTE

Wall mounting is certified for use in maritime applications. The device must be installed more than 60 cm from the compass.

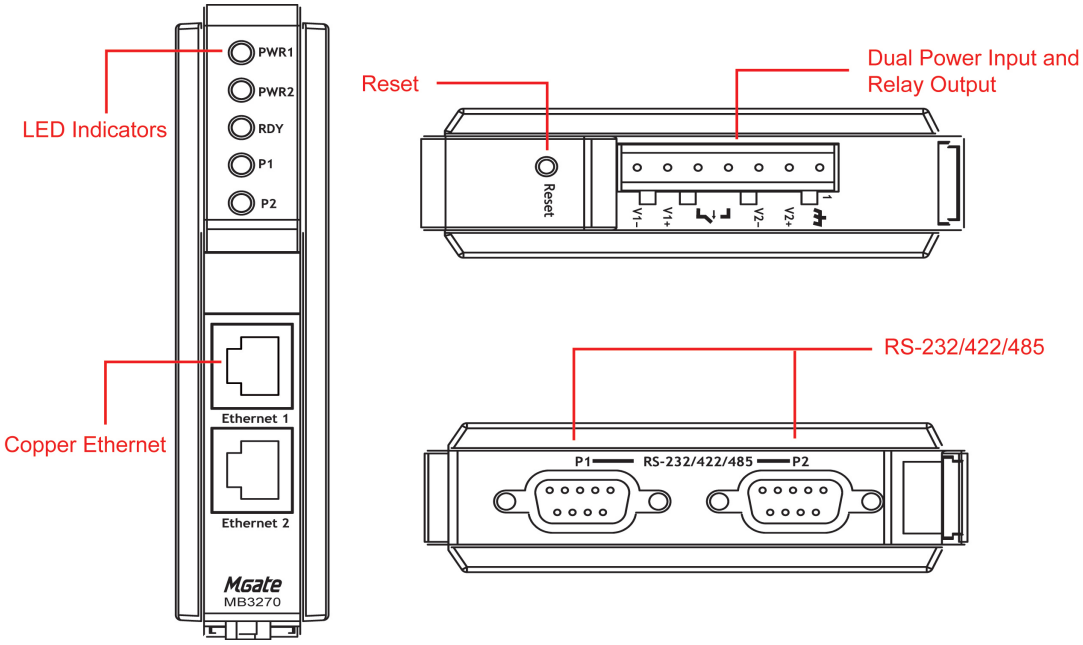
Specifications

> **Note**
>
> The latest specifications for Moxa's products can be found at https://www.moxa.com.

7. Hardware: MB3270, MB3270I

This chapter provides hardware information for the MGate MB3270 and MB3270I.

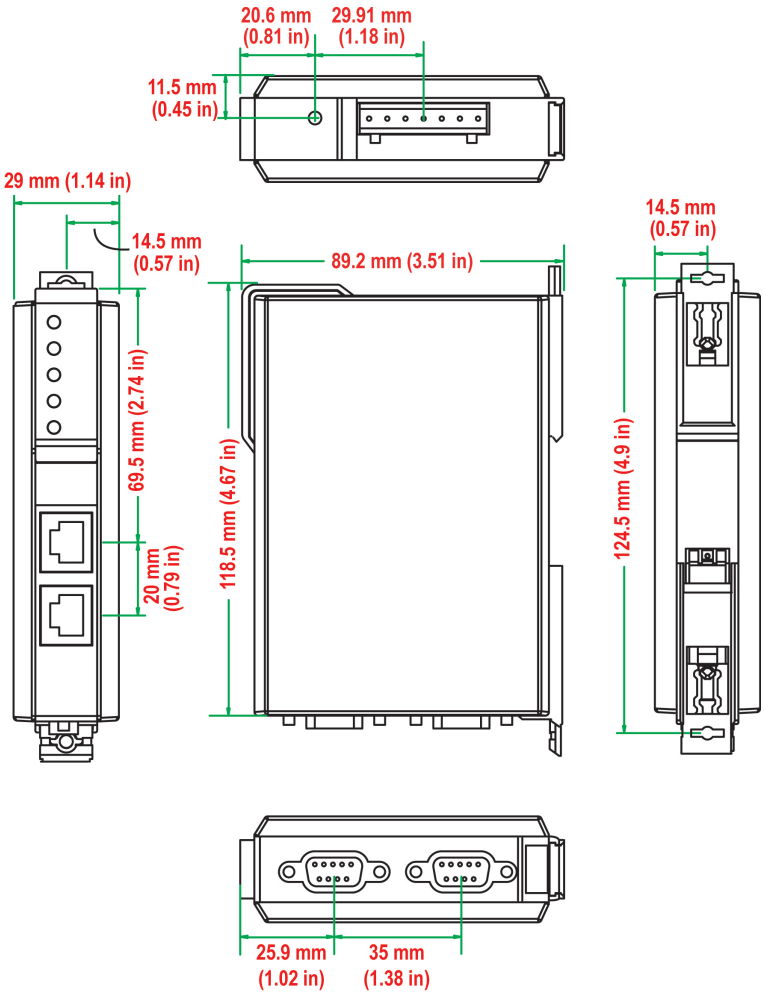
Panel Layout



LED Indicators

Name	Color	Function
PWR1	Red	Power is being supplied to the power input.
PWR2	Red	Power is being supplied to the power input.
RDY	Red	Steady on: Power is on, and the unit is booting up. Blinking: IP conflict, the DHCP or BOOTP server did not respond properly, or a relay output occurred.
	Green	Steady on: Power is on, and the unit is functioning normally. Blinking: Unit is responding to software Locate function.
	Off	Power is off, or power error condition exists.
Ethernet	Amber	10 Mbps Ethernet connection.
	Green	100 Mbps Ethernet connection.
	Off	Ethernet cable is disconnected or has a short.
P1, P2	Amber	Serial port is receiving data.
	Green	Serial port is transmitting data.
	Off	No data is being transmitted or received through the serial port.

Dimensions


20.6 mm
(0.81 in)
29.91 mm
(1.18 in)
11.5 mm
(0.45 in)
29 mm (1.14 in)
14.5 mm
(0.57 in)
89.2 mm (3.51 in)
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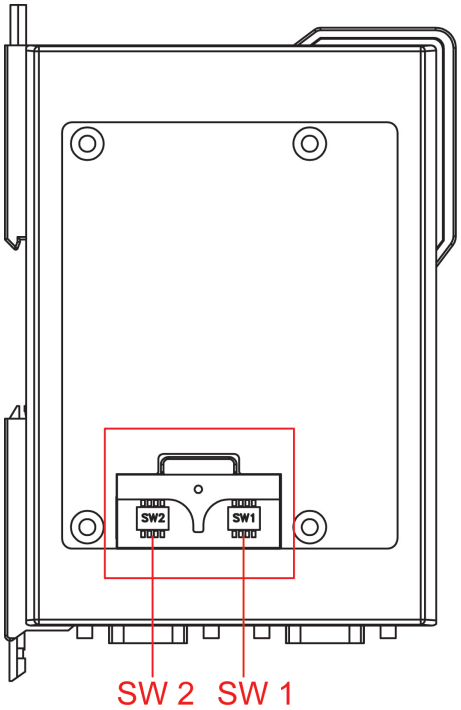
(0.57 in)
69.5 mm (2.74 in)
20 mm
(0.79 in)
118.5 mm (4.67 in)
124.5 mm (4.9 in)
25.9 mm
(1.02 in)
35 mm
(1.38 in)

Jumpers



The DIP switches are beneath the DIP switch panel on the side of the unit.

To add a 120 Ω termination resistor, set switch 3 on the port's assigned DIP switch to ON; set switch 3 to OFF (the default setting) to disable the termination resistor.

To set the pull high/low resistors to 150 KΩ, set switches 1 and 2 on the port's assigned DIP switch to OFF. This is the default setting.

To set the pull high/low resistors to 1 KΩ, set switches 1 and 2 on the port's assigned DIP switch to ON.

Switch 4 on the port's assigned DIP switch is reserved.

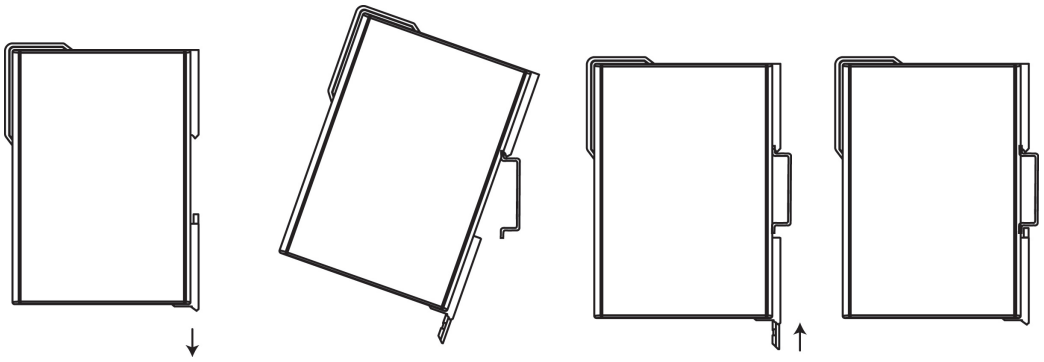
ATTENTION

Do not use the 1 KΩ pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

DIN Rail and Wall Mounting

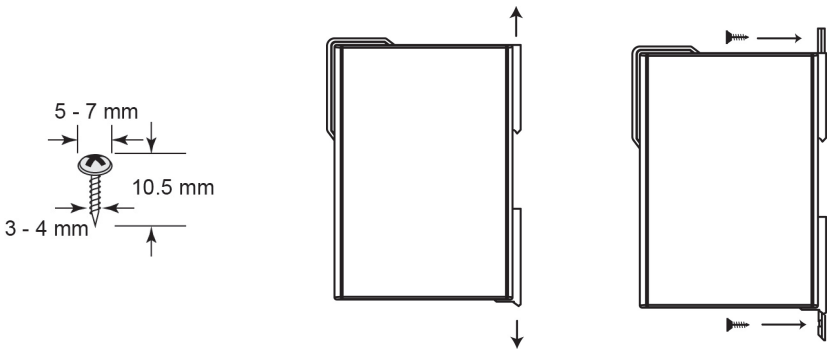
There are two sliders on the back of the unit for DIN Rail and wall mounting.

Mounting on a DIN-rail: Pull out the bottom slider, latch the unit onto the DIN Rail, and push the slider back in.



Mounting on the wall: Pull out both the top and bottom sliders and align the screws accordingly.

Mounting the MGate MB3270 Series on to a wall requires two screws. The heads of the screws should be 5 to 7 mm in diameter, the shafts should be 3 to 4 mm in diameter, and the length of the screws should be more than 10.5 mm.



NOTE

Wall mounting is certified for use in maritime applications. The device must be installed more than 60 cm from the compass.

Specifications

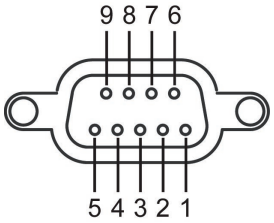
Note

The latest specifications for Moxa's products can be found at https://www.moxa.com.

8. Pin Assignments

DB9 (Male)

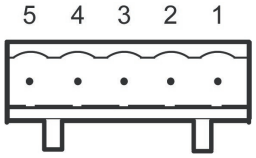
The MGate MB3000 uses DB9 (male) serial ports to connect Modbus RTU or ASCII devices. Each port supports three serial interfaces: RS-232, RS-422, and RS-485 (both 2 and 4-wire).



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

Terminal Block (RS-422, RS-485)

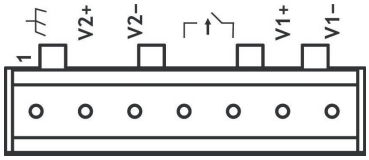
The MB3170 and MB3170I have a terminal block connector for RS-422 and RS-485 signals.



Pin	RS-422/ RS-485 (4W)	RS-485 (2W)
1	TxD+	–
2	TxD-	–
3	RxD+	Data+
4	RxD-	Data-
5	GND	GND

Power Input, Relay Output

The MGate MB3170/MB3270 gateways have dual power inputs for redundancy and a relay output for event warnings.



	V2+	V2-			V1+	V1-
Shielded Ground	DC Power Input 1	DC Power Input 1	Relay Output	Relay Output	DC Power Input 2	DC Power Input 2

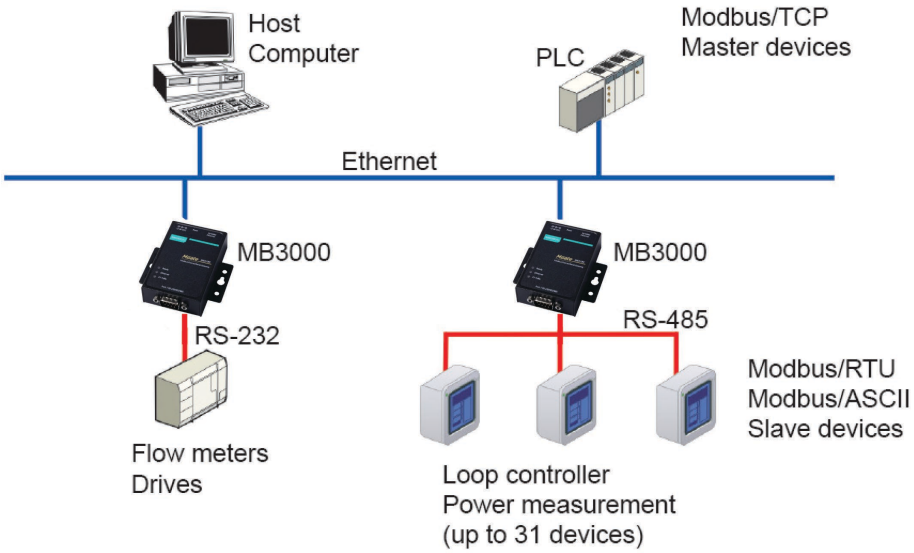
9. Typical Applications

Ethernet Clients/Masters With Multiple Serial Servers/Slaves

Connect all Modbus devices over an Ethernet network

Most modern PLCs and host computers support Modbus TCP over Ethernet. To access discrete Modbus RTU/ASCII devices for data collection and control, they can rely on the MGate MB3000 Modbus gateway.

The MGate MB3000 supports Modbus TCP with up to 16 or 32 simultaneous connections. The serial interface supports both RS-232 and RS-422/485, selectable through software. Each serial port can be connected to one RS-232 or RS-422 serial device, or to 31 RS-485 serial devices.

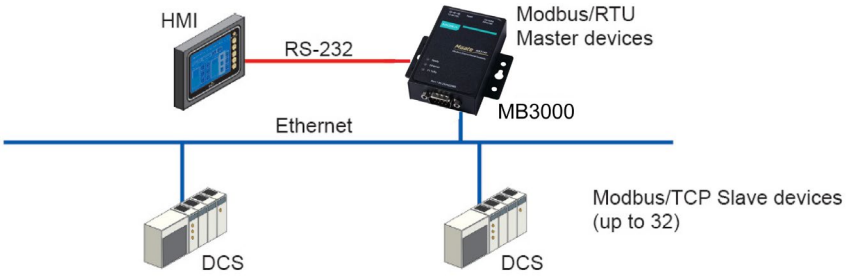


Serial Clients/Masters With Multiple Ethernet Servers/Slaves

Link a serial client/master device with Ethernet server/slave devices

Many Human-machine Interface (HMI) systems use a serial interface to connect to a discrete Data Control System (DCS). However, many DCSs are now Ethernet-based and operate as a Modbus TCP server/slave device.

The MGate MB3000 Modbus gateway can link a serial-based HMI to distributed DCSs over an Ethernet network. Up to 32 Modbus TCP server/slave devices are supported by each MGate MB3000.

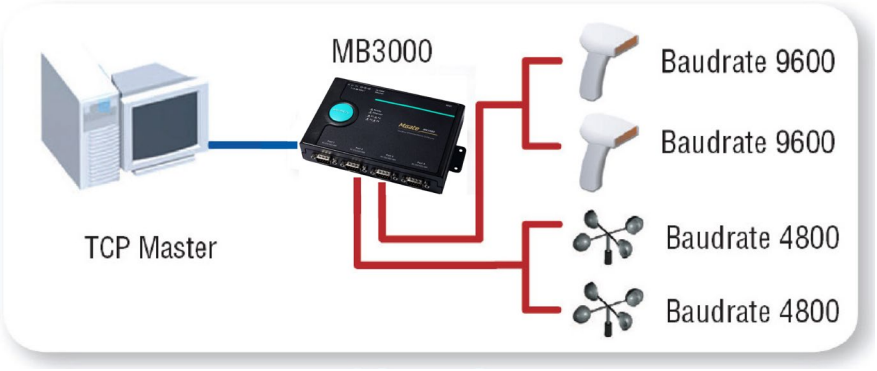


Modbus TCP Clients/Masters With ASCII and RTU Servers/Slaves

Link TCP client/master devices with both ASCII and RTU serial devices simultaneously

When integrating Modbus networks, you may encounter different Modbus serial networks that use different baudrates or a different protocol. Modbus ASCII might be used by some devices, while Modbus RTU is used by other devices.

The two- and four-port MGate models can integrate serial Modbus networks that use different parameters or protocols. You can configure each serial port to a specific Modbus serial environment; set up a slave ID table. After configuration, only the gateway will be visible to Modbus TCP Clients/Masters, and all serial devices will be integrated behind it.

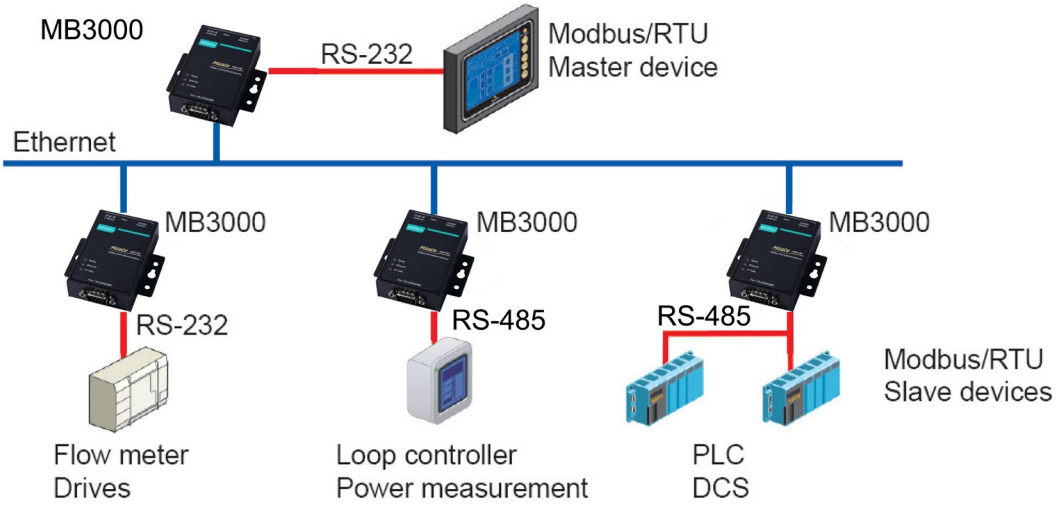


Serial Client/Master With Serial Servers/Slaves over Internet

Let Modbus serial devices communicate over the Internet

Many Modbus devices communicate over RS-485, which limits the number of devices in a network to 32 and the transmission distance to 1.2 km.

With the MGate MB3000 Modbus gateway, you can link all Modbus devices over an Ethernet network. Up to 32 Modbus gateways can be installed in a single control network, so each device can now be accessed from anywhere the TCP/IP network can reach.



10. Configuring the Modbus Gateway

Installing the Software

The following instructions explain how to install MGate Manager, a utility for configuring and monitoring MGate MB3000 units over the network.

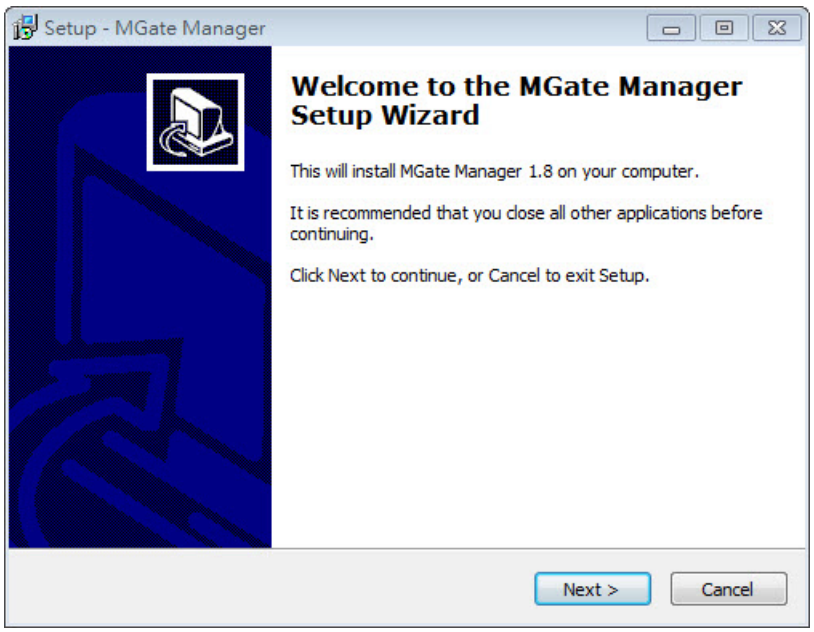
1. To install MGate Manager, please download it from Moxa's website at http://www.moxa.com. Then run the following setup program to begin the installation process:

   moxa-mgate-manager-utility-[version].exe

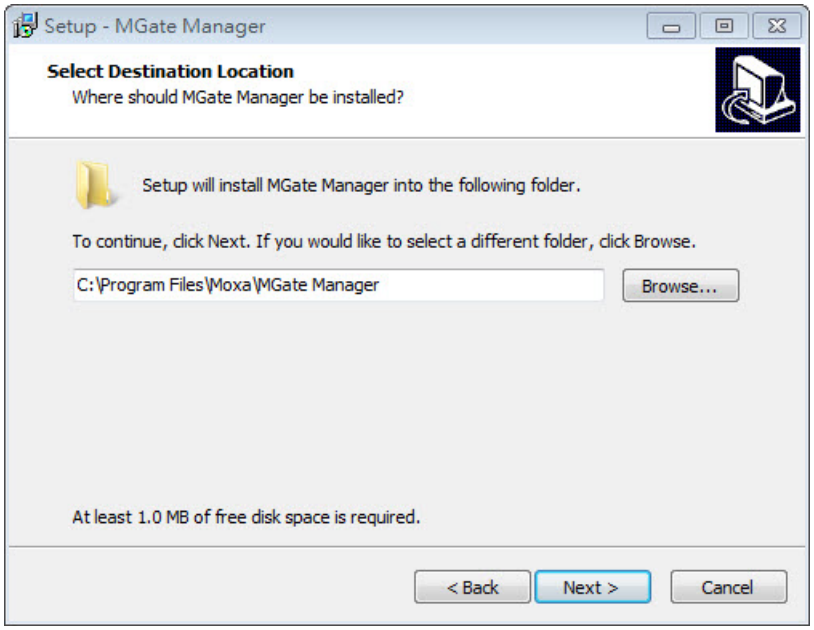
   The filename of the latest version may have the following format:

   moxa-mgate-manager-utility-vx.x.exe, for example:

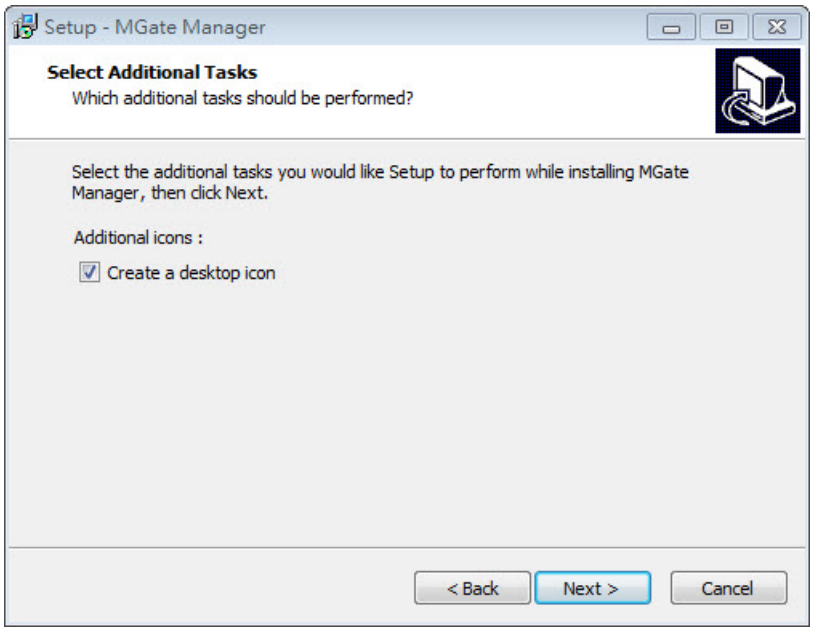
2. You will be greeted by the Welcome window. Click **Next** to continue.

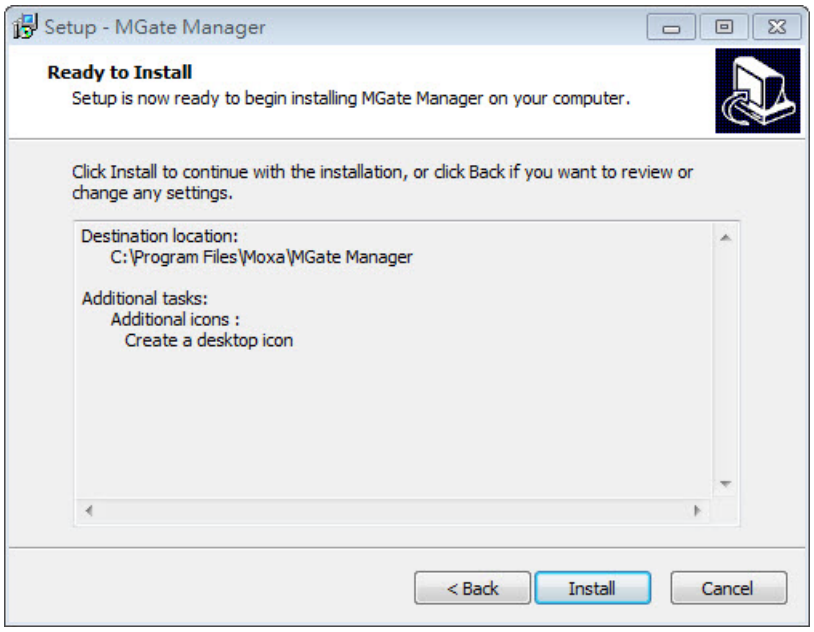
3. When the **Select Destination Location** window appears, click **Next** to continue. You may change the destination directory by first clicking on **Browse...**.



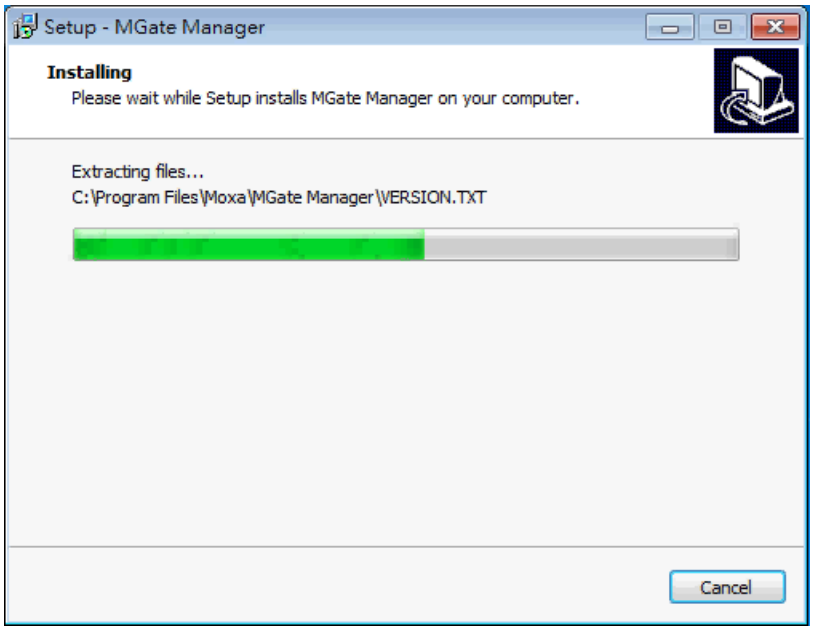
4. When the **Select Additional Tasks** window appears, click **Next** to continue. You may select **Create a desktop icon** if you would like a shortcut to MGate Manager on your desktop.



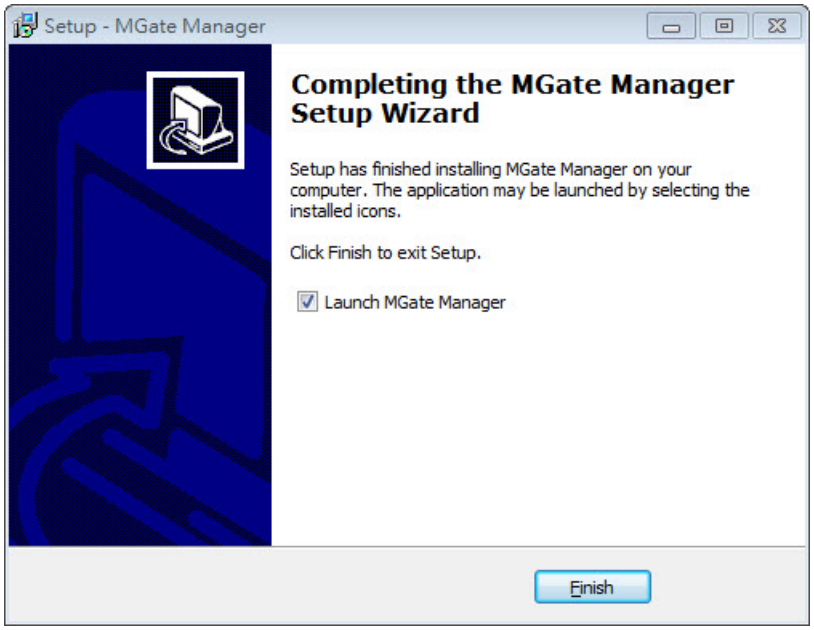
5. Click **Install** to copy the software files.



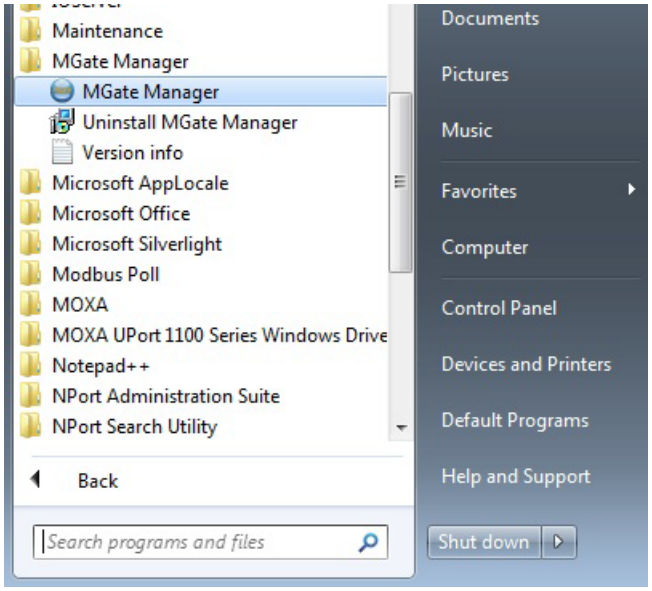
6. A progress bar will appear. The procedure should take only a few seconds to complete.



7. A message will show that MGate Manager is successfully installed. You may choose to run it immediately by selecting **Launch MGate Manager**.



You may also open MGate Manager through **Start > Programs > MGate Manager > MGate Manager**, as shown below.

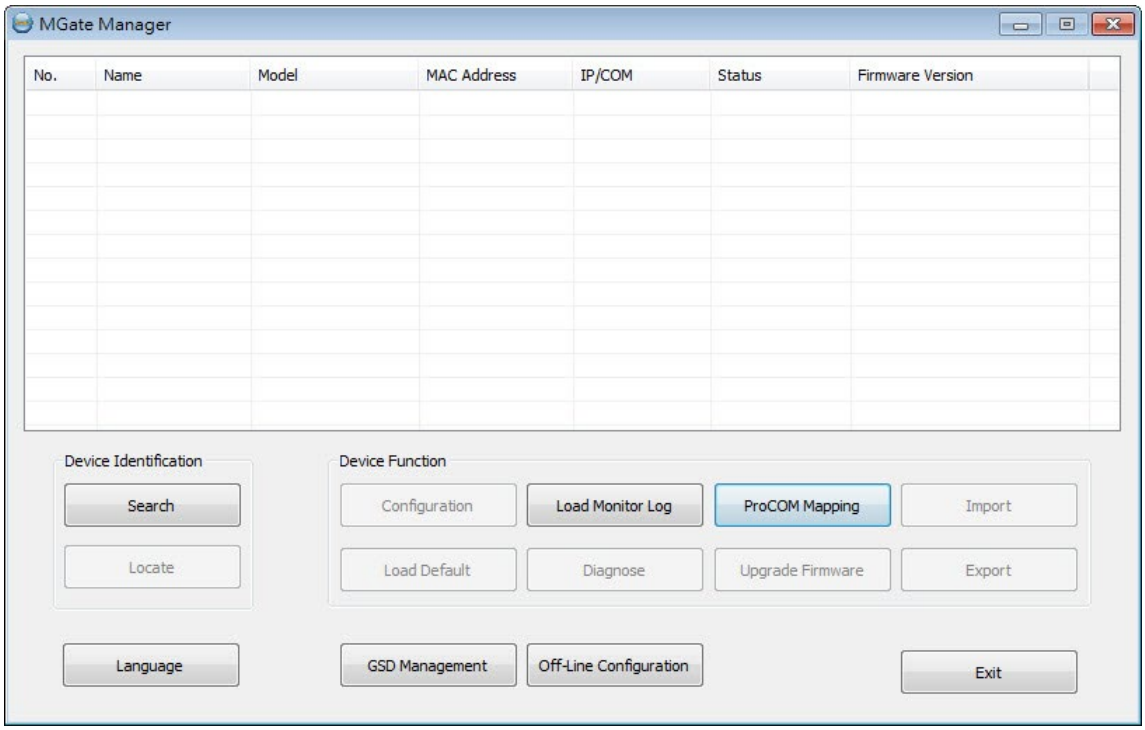


Starting MGate Manager

MGate Manager is a Windows-based utility that is used to configure the MGate MB3000.

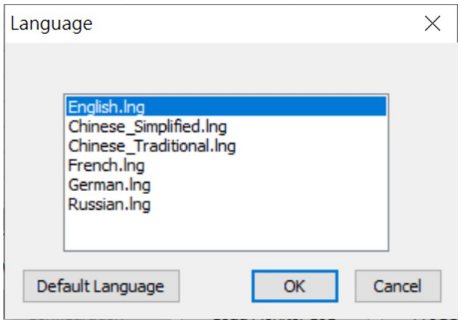
Before running MGate Manager, make sure that your PC and the MGate MB3000 are connected to the same network. Alternatively, the MGate MB3000 may be connected directly to the PC for configuration. Please refer to Chapter 2 for more details.

You may open MGate Manager from the Windows Start menu by clicking **Start > Programs > MGate Manager > MGate Manager**. The MGate Manager window should appear as shown below.

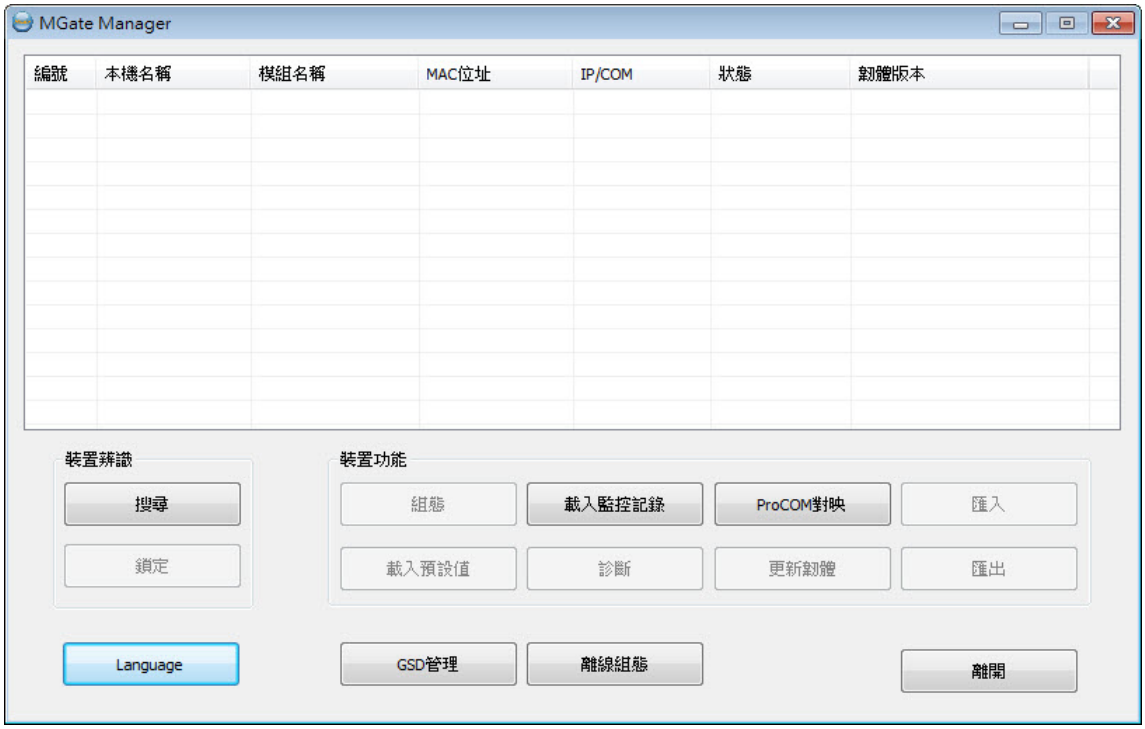


Change Language Setting

If you wish to run MGate Manager in a different language, you may click **Language** to change the language setting. A dialog box showing the languages available should appear as shown below.



When you click **OK**, MGate Manager will immediately switch to your chosen language.



ATTENTION

Use **Default Language** before contacting Moxa Technical Support.

With support for multiple languages, MGate Manager is more user-friendly and accessible. However, if you need help from Moxa Technical Support, please change the language to **Default Language**. This will prevent any misunderstandings or confusion about MGate Manager menu items and commands as our engineers assist you.

The default language is English and will only be active for the current MGate Manager session. When you open MGate Manager again, the language will revert to your original setting.

Connecting to the Unit

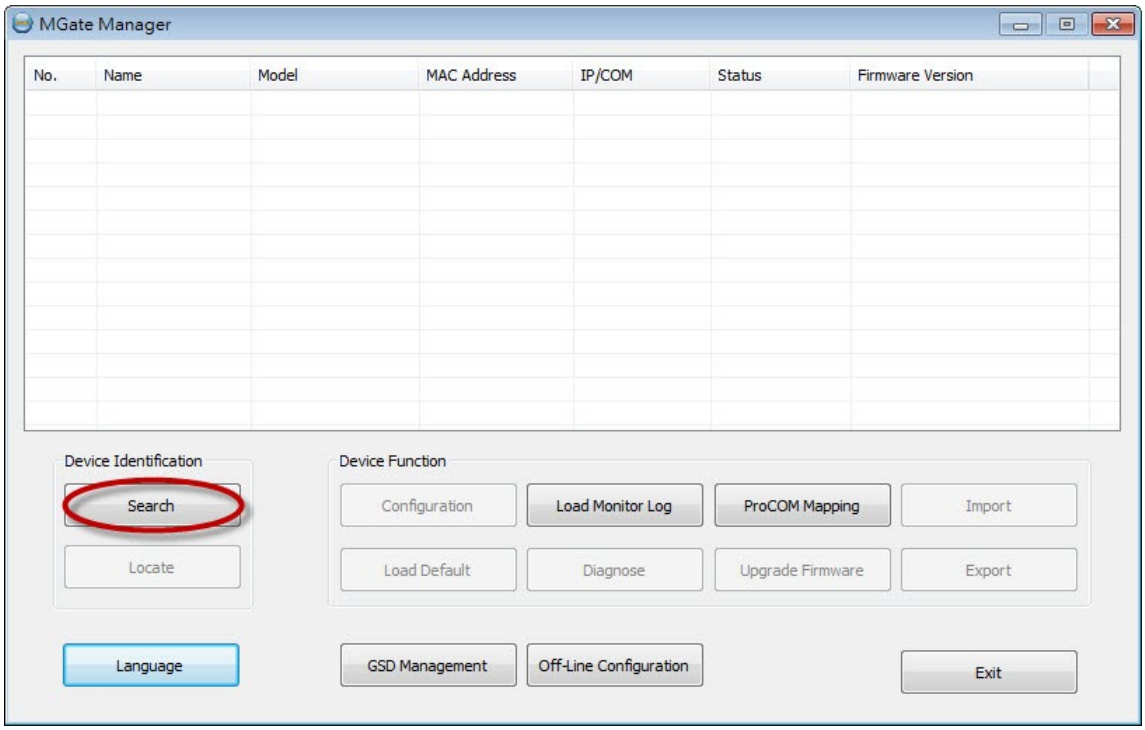
MGate Manager needs to connect to the unit before the unit can be configured. Connecting to the unit can be done in two ways. **Broadcast Search** is used to find every MGate MB3000 on the LAN. **Search by IP** attempts to connect to a specific unit using its IP address, which is useful if the unit is located outside the LAN or can only be accessed by going through a router.

If you do not know the MGate gateway's IP address when setting it up for the first time (the 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.

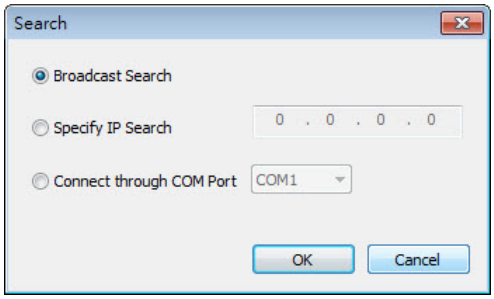
Except for the Broadcast Search feature, you can also use the Device Search Utility (DSU) to detect MGate gateways on your network, which can be downloaded from Moxa's website at http://www.moxa.com. This utility can further support multiple gateways configuration to make your job easier.

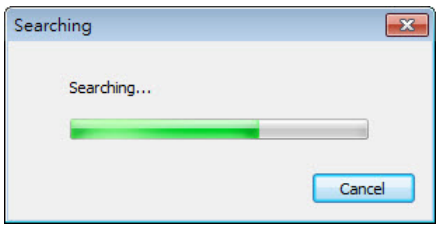
Broadcast Search

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

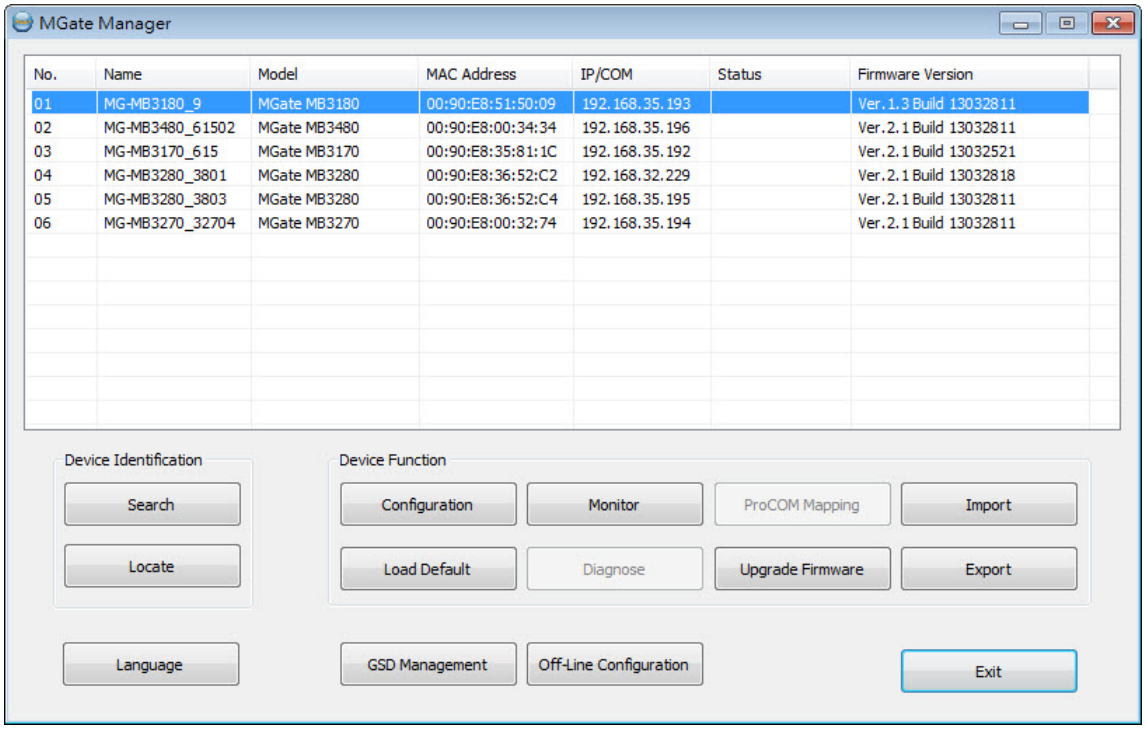


Select **Broadcast Search** and click **OK** to search the LAN for all MGate MB3000 units.





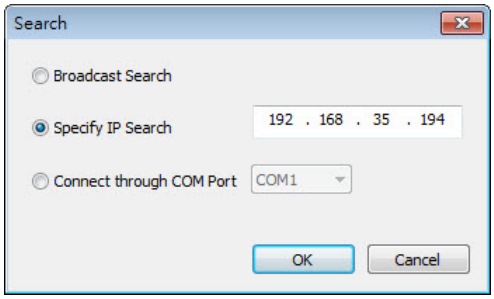
When the search is complete, every MGate MB3000 that is found on the LAN will appear in the window with MAC address and IP address. Select the one that you wish to configure.



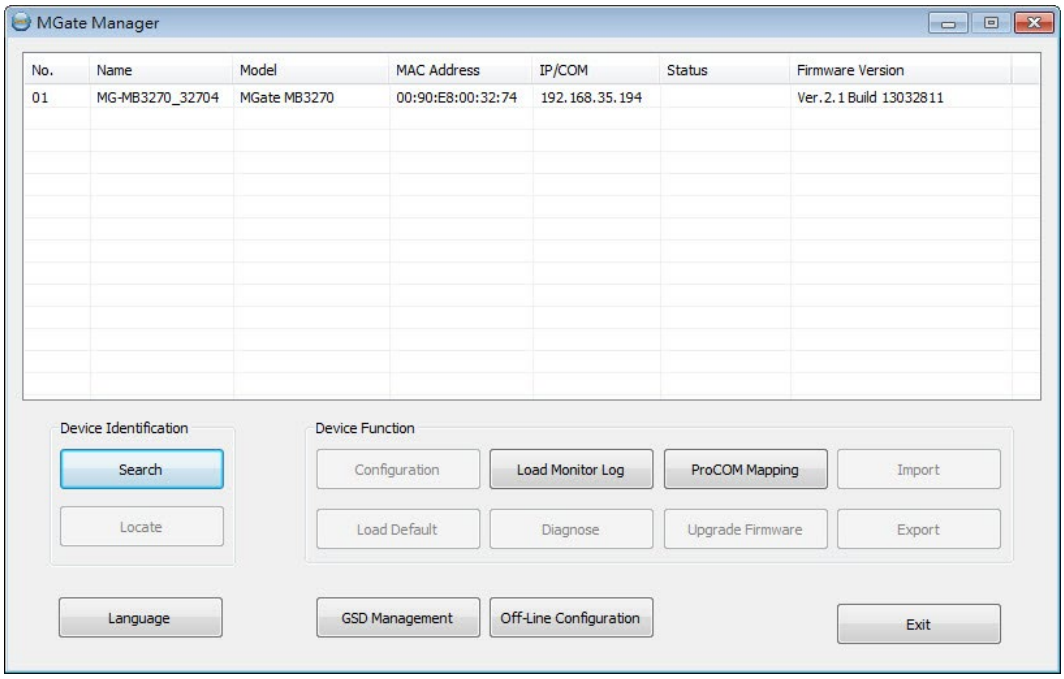
Specify IP Address

Click **Specify IP Search Address** if you know the IP address of the unit and wish to connect to it directly.

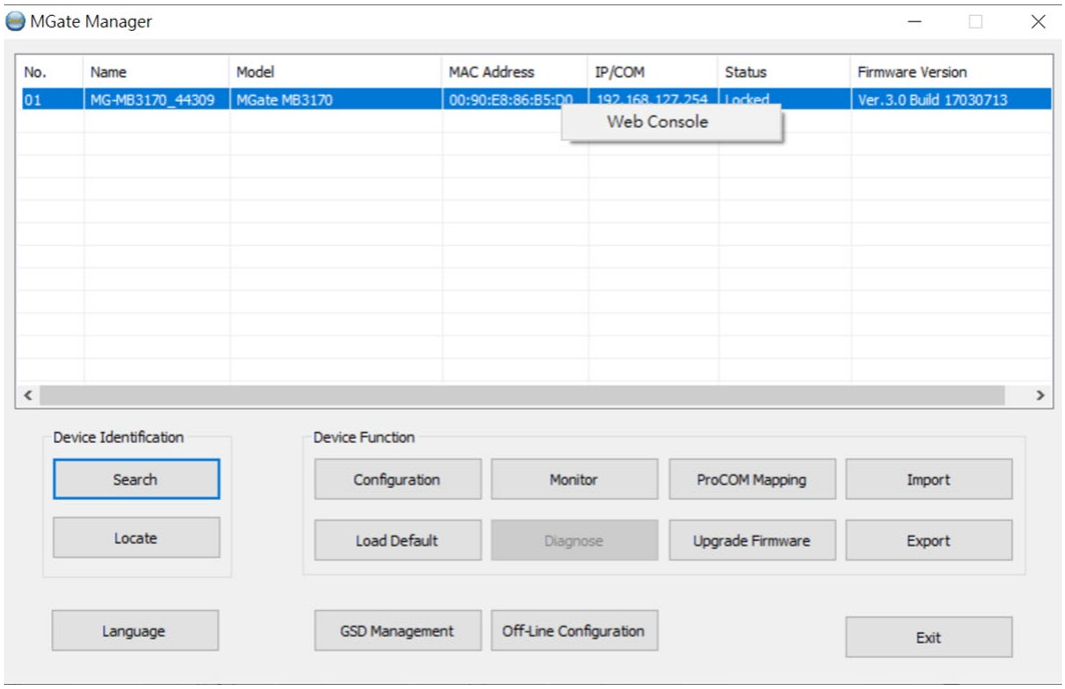
Enter the unit's IP address and click **OK**.



If the search is successful, the model items will be listed in MGate Manager. Configuration can be done in two ways. The first way is to left-click the item to start MGate Manager configuration.



The second way is to right-click the item to begin the web console configuration. You must provide the correct password to log in to the web console.



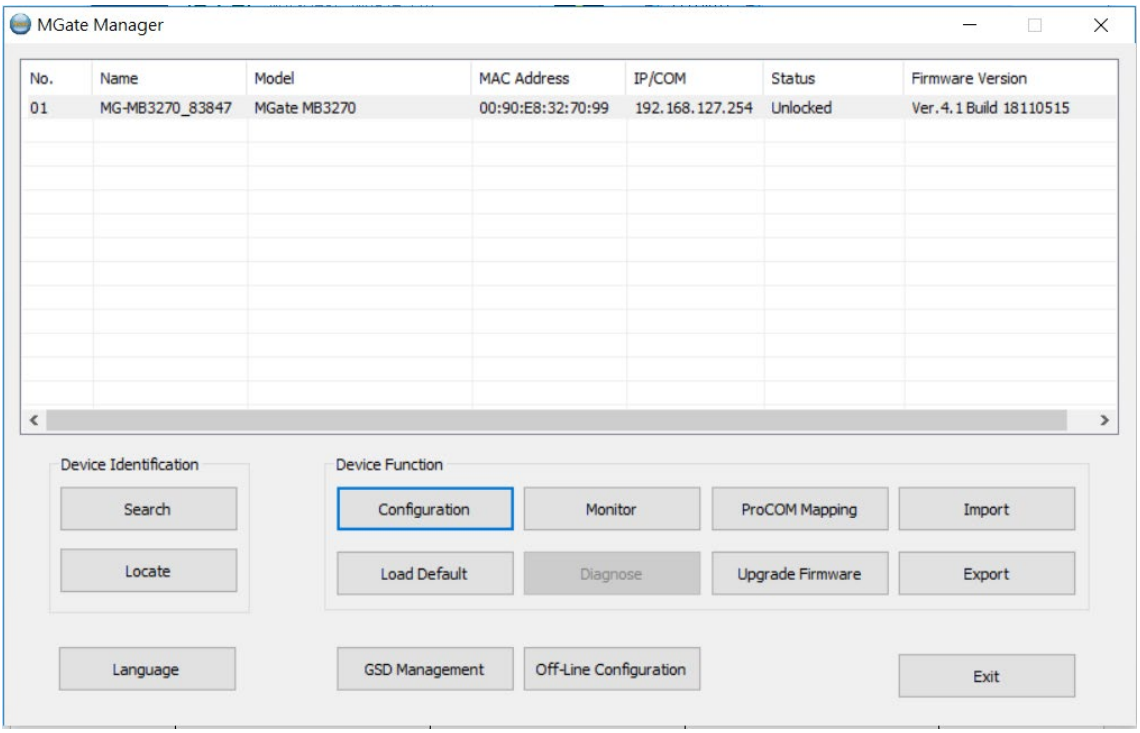
ATTENTION

If Search IP Address cannot locate the MGate MB3000, the IP address you entered might be incorrect. Try doing the search again and re-entering the IP address carefully.

Another possibility is that the MGate MB3000 is on the same LAN as your PC, but on a different subnet. In this case, you can change your PC's IP address and/or netmask so that it is on the same subnet as the MGate MB3000. After your PC and the MGate MB3000 are on the same subnet, MGate Manager should be able to find the unit.

Changing the Configuration

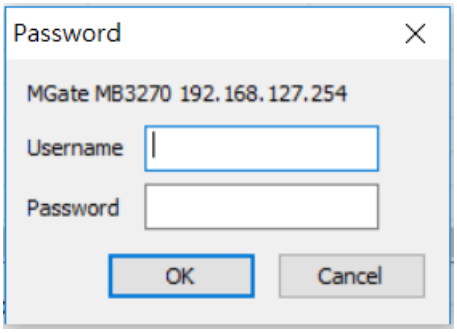
Once your unit is displayed in MGate Manager, click on it to select it. The Configuration button will become available. Click **Configuration** to open the configuration window.



Password Protection

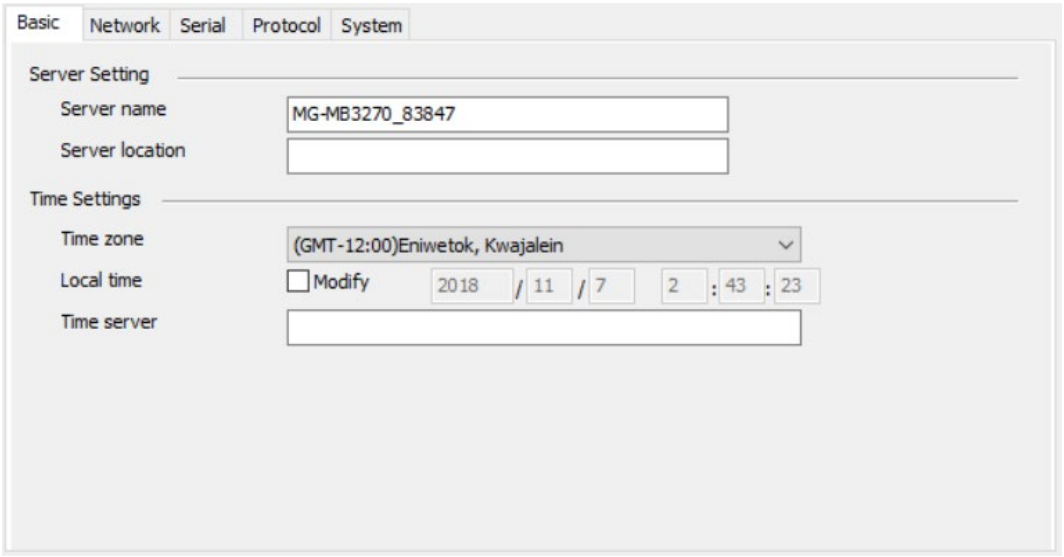
For security reasons, account and password protection is enabled by default, so you must provide the correct password to unlock the device before configuring the device.

Default account: **admin**
Default password: **moxa**



Basic Settings

On the first page, you can change the device name and time zone settings.



Server Setting

Parameter	Value	Notes
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 MB3000 Series 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. You can do time calibration either followed by local time or time server. **Please note that this feature is not supported by the MB3180 gateway**.

ATTENTION

First-time users should select the time zone first. The console will display real time according to the relevant GMT time zone. 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.

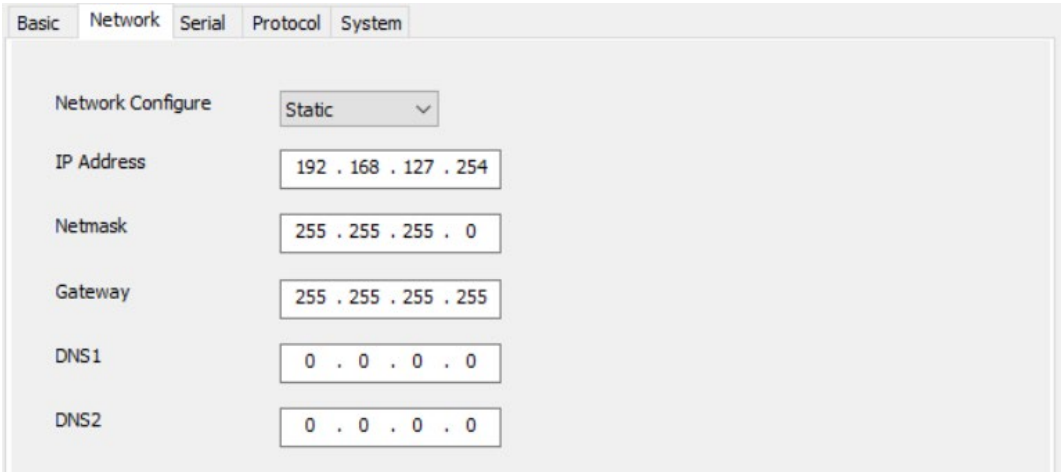
Parameter	Value	Notes
Time Zone	User selectable time zone	This field shows the current selected time zone and allows you to select a different time zone.
Local Time	User adjustable time. (1900/1/1-2037/12/31)	**The Modify** icon needs to be selected to adjust Local Time.
Time Server	IP or Domain address (e.g., 192.168.1.1 or time.stdtime.gov.tw)	If a time server is used on your network, this optional field specifies the IP address or domain name of your time server. 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

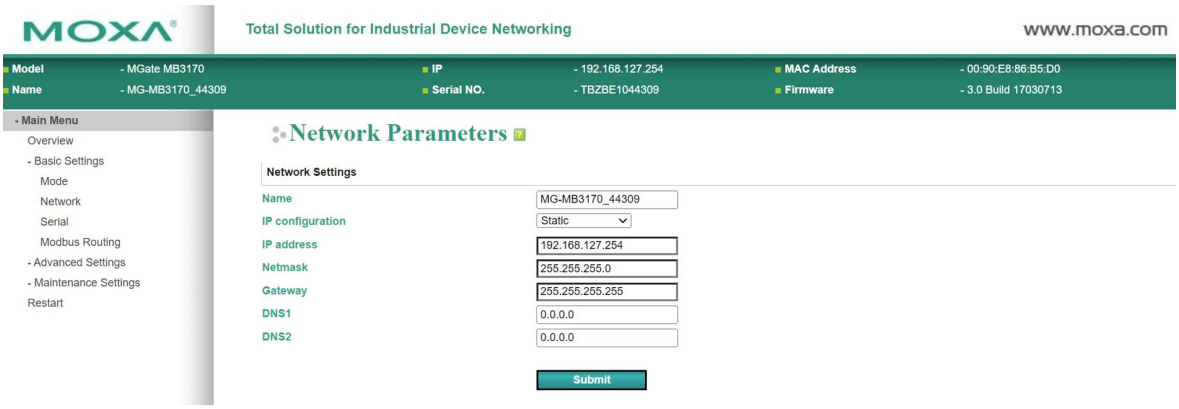
When changing the local time, select the time zone first. The time display will update to reflect the specified time zone.

Network Settings

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



You can also change it on the web console. Click **Basic Settings > Network**. You can change the Name, IP Configuration, IP Address, Netmask, Default Gateway, and DNS. Click **Submit** to continue.



Click **Restart** to reboot the server. Your changes will take effect when the server restarts.

Ethernet Settings

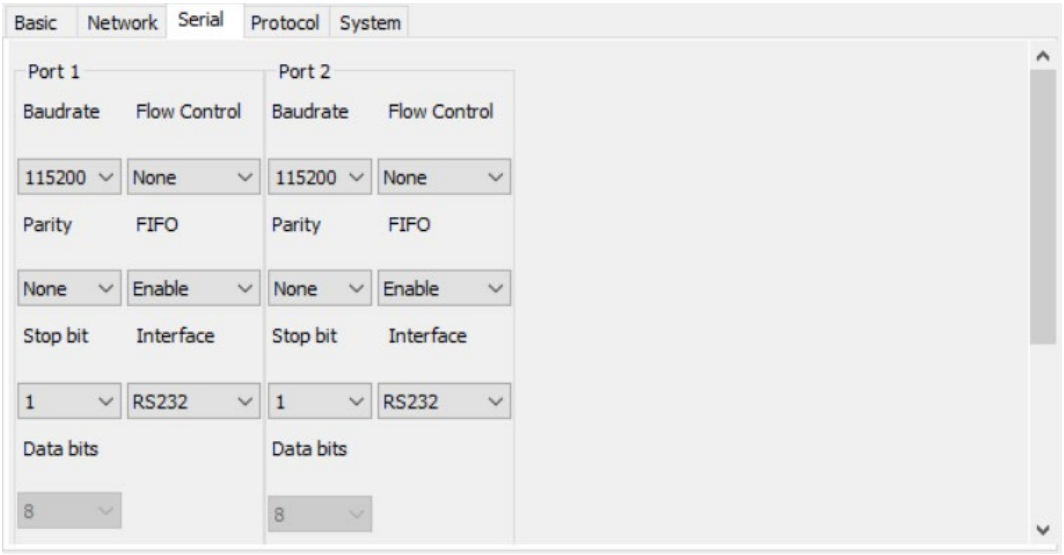
Parameter	Value	Notes
IP Configuration	Static IP, DHCP, BOOTP	Select Static IP if you are using a fixed IP address. Select one of the other options if the IP address is set dynamically.
IP Address	192.168.127.254 (or other 32-bit number)	The IP (Internet Protocol) address identifies the server on the 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

Parameter	Value	Notes
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 MB 3000 Series serial interface supports RS-232, 2-wire RS-485, 4-wire RS-485, and RS-422 interfaces. You must configure baudrate, parity, data bits, and stop bits before using the serial interface with Modbus RTS/ASCII protocol. Incorrect settings will cause communication failures.



Serial settings

Parameter	Value	Notes
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	RTS Toggle will turn off RTS signals when there is no data to be sent. If data needs to be sent, RTS will turn on prior to transmission and turn off once the transmission is finished.
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

Protocol Settings

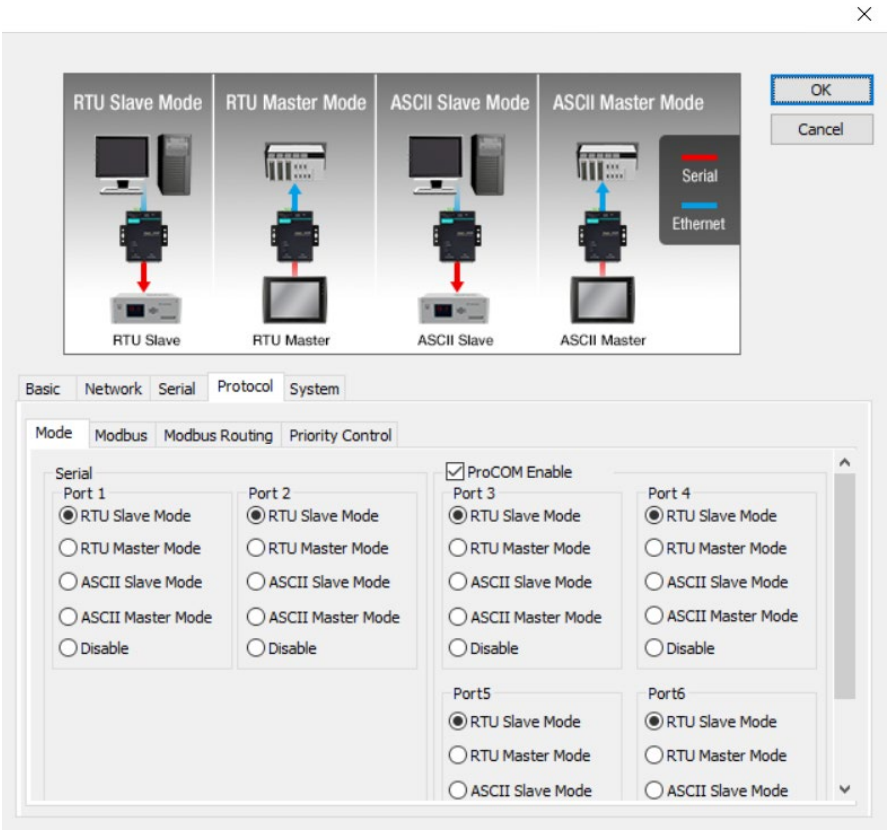
Mode

The MGate gateway supports Modbus RTU/ASCII and Modbus TCP protocols. The operation mode determines whether the device(s) that are connected to the serial port will operate as a client/master or a server/slave and whether the Modbus RTU or Modbus ASCII protocol will be used. Four operation modes are available:

Mode	Description
RTU Slave	Modbus RTU server(s)/slave(s) will be connected to the serial port.
RTU Master	A Modbus RTU client/master will be connected to the serial port.
ASCII Slave	Modbus ASCII server(s)/slave(s) will be connected to the serial port.
ASCII Master	A Modbus ASCII client/master will be connected to the serial port.
Disable	Protocol settings will be disabled in the serial port

- For entry-level models (MB3180, MB3280, and MB3480), Modbus TCP Clients/Masters will control Modbus RTU/ASCII servers/slaves, and Modbus RTU/ASCII clients/masters will control Modbus TCP servers/slaves.
- For advanced models (MB3170, MB3270), both Modbus TCP and Modbus RTU/ASCII clients/masters can control Modbus TCP and Modbus RTU/ASCII servers/slaves.

Use the radio buttons to select the desired operation mode for each serial port on the Modbus gateway. Select the **ProCOM Enable** checkbox in the center of the page to enable ProCOM. For detailed information, refer to the ProCOM function description in this manual.

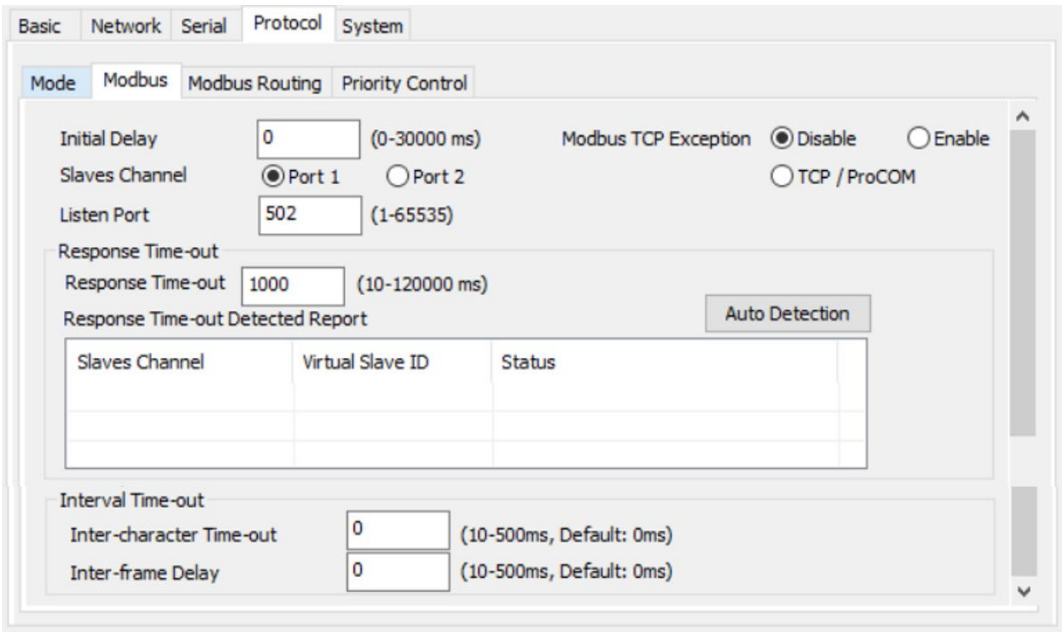


ProCOM

ProCOM is a Moxa proprietary function that creates virtual serial ports on the MGate MB3x70 Series to make fieldbus gateway communications more versatile. This intelligent fieldbus gateway mimics the behavior of a native serial port when transmitting data to the desired destination. PCs can use ProCOM to communicate over the Ethernet with serial devices connected to the MGate MB3x70 as if they were connected to the PC's native COM ports. This advanced feature only works with the MGate MB3x70 Series. For the detailed ProCOM mapping configuration, please check ***ProCOM Mapping***.

Modbus

You can make certain adjustments in the Modbus tab to fine-tune the communication between different Modbus networks. You can configure Initial Delay, Modbus TCP Exception, Slave Channel, and Response Time-out.



Parameter	Value
Initial Delay	Numeric
Modbus TCP Exception	Enable or Disable
Slave Channel	Port 1, Port 2, TCP/ProCOM
Listen Port	1 to 65535
Response Time-out	Numeric
Inter-character Time-out	10 to 500 ms, Default: 0 ms (baudrate < 19200 bps: 1.5 character times; baudrate ≥ 19200 bps: fixed value)
Inter-frame Delay	10 to 500 ms, Default: 0 ms (baudrate < 19200 bps: 3.5 character times; baudrate ≥ 19200 bps: fixed value)

Initial Delay

Some Modbus servers/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. You can force the MGate to wait after booting up before sending the first request with the **Initial Delay** setting.

Modbus TCP Exception

The MGate MB3000 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 Clients/Masters. This is enabled or disabled with the **Modbus TCP Exception** setting. When enabled, the unit can return two types of exceptions:

Exception	Conditions
Time-out	There is no response from the server/slave. Maybe the device is offline or the serial cable is broken. (Exception code = 0x0B, MB_EXC_NORESP)
Request dropped	There are two situations that will cause this exception: The request queue is full, and 32 request queue is for each client/master. (Exception code = 0x06, MB_EXC_BUSY) The destination ID is not included in the slave ID table. (Exception code = 0x0A, MB_EXC_UNAVAILABLE)

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

Modbus TCP Port

Allows you to change the Modbus TCP listen port from the default value (502).

Slave Channel and Response Time-out

According to the Modbus standard, the time that it takes for a server/slave device to respond to a request is defined by the device manufacturer (please refer to Appendix A for details). Based on this response time, a client/master can be configured to wait a certain amount of time for a server/slave's response. If no response is received within the specified time, the client/master will disregard the request and continue operation. This allows the Modbus system to continue operation, even if a server/slave device is disconnected or faulty.

On the MGate MB3000, the **Response Time-out** field is used to configure how long the gateway will wait for a response from a Modbus ASCII or RTU server/slave. This field is set independently for each serial port, which is selected through the **Slave Channel** field. Please refer to your device manufacturer's documentation to manually set the response timeout.

The MGate MB3000 also provides an automatic calibration of the response time-out. 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 for the best performance.

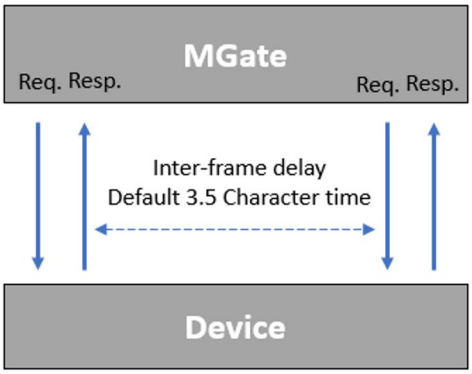
Inter-character Time-out

In Modbus RTU slave mode, use this function to define the time-out interval between characters in one frame. When the serial side of MGate receives one character, and the next one comes after the "inter-character timeout" defined, the frame will be discarded because of time-out. The inter-character timeout can be adjusted within the range of 10 to 500 ms or use the default value. The default value in this field is 0 ms, but the default inter-character timeout varies, depending on the baudrate setting. When the baudrate is configured below 19200 bps, the default inter-character time-out is set to 1.5 character times. When the baudrate is configured equal to or larger than 19200 bps, a predefined fixed value is used.

Inter-frame Delay

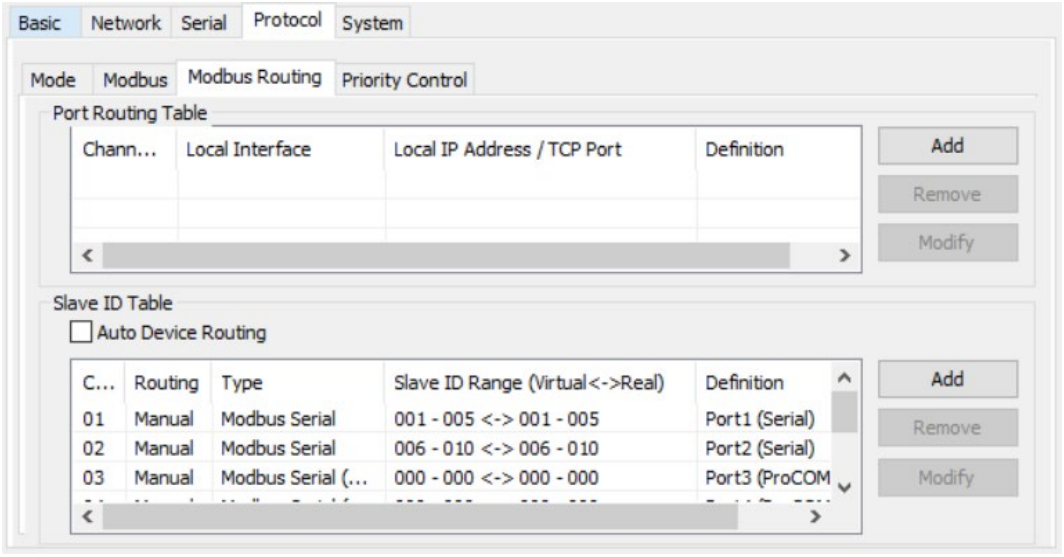
In Modbus RTU slave mode, use this function to define the time interval between a Modbus RTU response and the next Modbus RTU request. The reason for enabling manual configuration of this value is to accommodate certain scenarios where legacy Modbus devices may not process Modbus RTU requests rapidly. By setting a longer interval value, you can increase tolerance for delays in serial reception and transmission. The inter-frame delay can be adjusted within the range of 10 to 500 ms or use the default value. The default value in this field is 0 ms, but the default inter-frame delay varies depending on the baudrate setting. When the baudrate is configured below 19200 bps, the default inter-frame delay is set to 3.5 character times. When the baudrate is configured equal to or larger than 19200 bps, a predefined fixed value is used.

How to calculate Modbus character time? For example, if the baudrate is 9600bps, then 1 character time is about 1ms. In a serial frame (11bits, including start bit, data, parity bit and stop bit), 9,600bps approximately equals to 960 characters/s, so transmitting 1 character needs about 1/960=1ms.



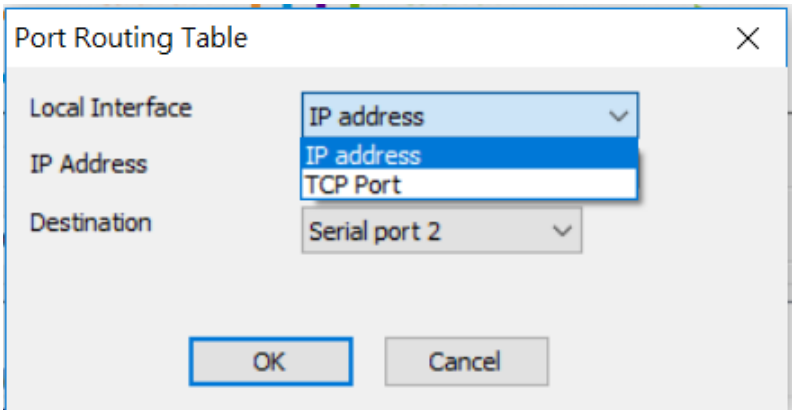
Modbus Routing

The **Modbus Routing** tab is where the Modbus slave IDs are managed. The definitions on this tab determine how Modbus requests will be routed to the serial ports by the gateway.



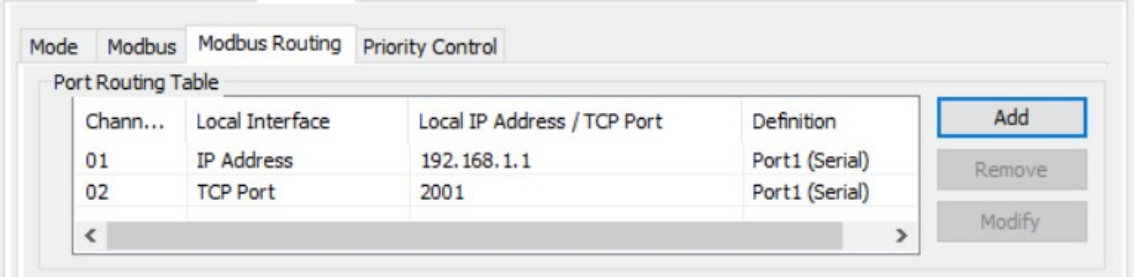
Port Routing Table

The MGate MB3000 gateways support two kinds of port routing mechanism: by **IP address** and by **TCP port**. The Modbus client/master can communicate with the Modbus server/slave devices connected to a specific serial port on the gateway by assigning an IP address or TCP port to the specified serial port. Under these two kinds of port routing mechanisms, each serial port can be accessed by up to four Modbus clients/masters.

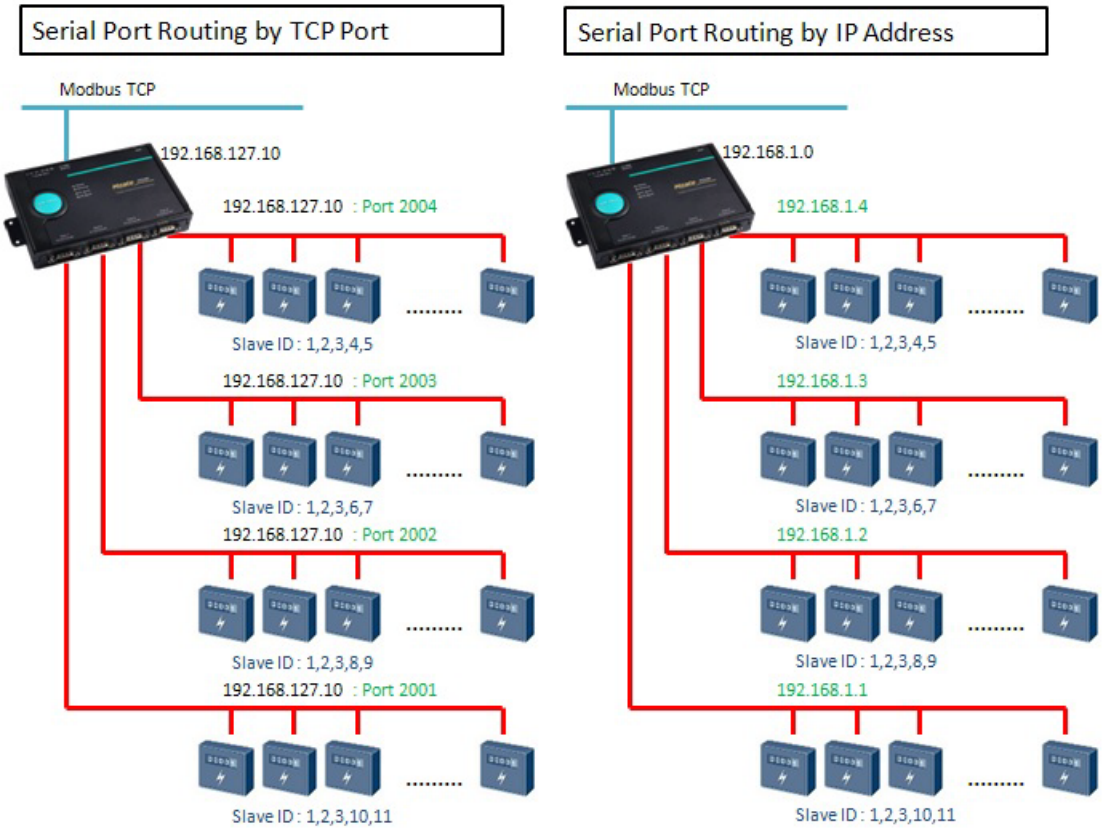


For example, you could assign TCP ports 2001 to 2004 to serial ports 1 to 4, respectively. When the gateway receives a Modbus request designated for TCP port 2001, it will forward the Modbus request to serial port 1 directly. Similarly, if it receives a Modbus request designated for TCP port 2004, it will forward the Modbus request to the serial port 4 directly.

The MGate MB3000 gateways can forward the Modbus requests from different IP addresses to a specific serial port. For example, if IP address 192.168.1.1 is assigned to serial port 1, and when the gateway receives a Modbus request sent to 192.168.1.1, the gateway will forward the Modbus request to serial port 1 directly.



With port routing mechanisms, Modbus slave ID routing can be simpler and more effective by giving users the flexibility to define a multirouting mechanism.



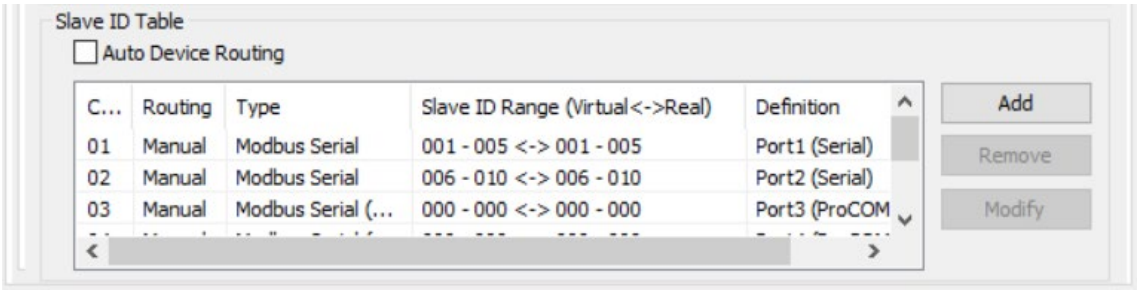
Slave ID Table

With the slave ID table, a routing mechanism is achieved for gateways with two or more serial ports. Since the Modbus devices (all with different slave IDs) are connected to different serial ports on a gateway, the Modbus requests should be routed to the specific serial port that connects the targeted Modbus server/slave device.

This keeps communication efficient and prevents devices from other ports from receiving an unrelated Modbus request, resulting in slowing down the entire system. The slave ID table is used to handle the routing mechanism.

Traditionally, there is a factory default routing. For example, the Modbus requests with slave ID 001 to 005 will be routed to serial port1; the Modbus requests with slave ID 006 to 010 will be routed to serial port2.

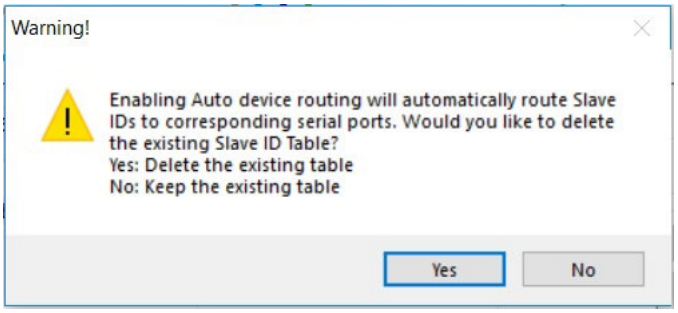
Users have to set their own customized routing. Select the one you want to set and click **Add/Remove/ Modify** buttons to change the existing routing. Set each port one by one.



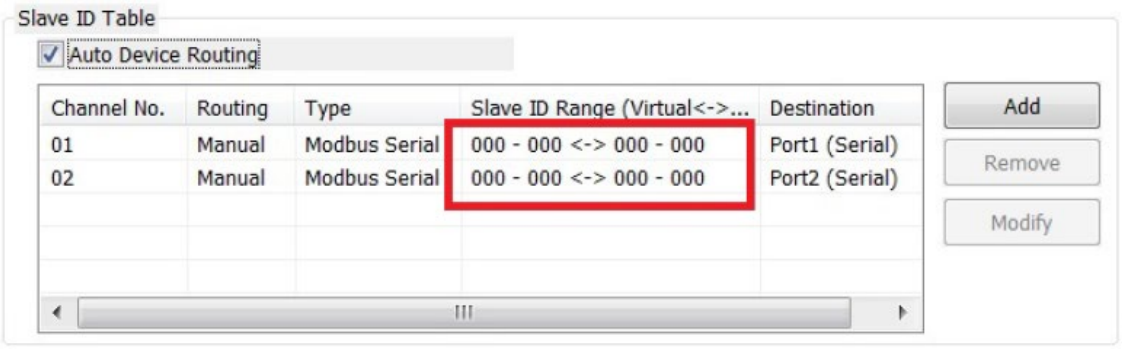
Auto Device Routing

The Moxa Modbus gateways provide an auto routing mechanism that eliminates the burdensome task of setting the slave ID table manually. Now, users no longer need to set the bothersome routing table. The Moxa Modbus gateways will help you detect and route correctly.

Click the checkbox for **Auto Device Routing**, and a message window will pop up.



Click **Yes** to delete the existing (factory default or user-set) routing table; the auto-routing mechanism will automatically find the correct serial port that connects the target Modbus device. Moreover, if a device is added to the gateway later, the gateway can also route it correctly. Note that the routing table will be cleared as the warning message. The Slave ID table is then shown as in the figure below.



Users can only check the result of an auto-detect routing table through the web console.

This snapshot shows the routing mechanism is in Auto mode, and the gateway detects that slave ID 1 and 2 are connected in port 1 and slave ID 3 is connected in port 2.

If a conflict exists, the table will show the error in red.

For example, two Modbus devices with the same slave ID are connected in serial port 1 and port 2.

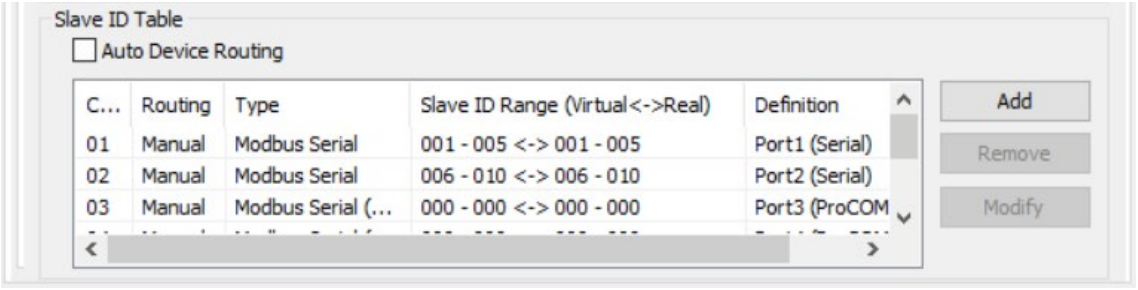
On the other hand, if you have manually set the routing table already, and you would like to enable the auto-routing mechanism for the newly added devices, click No to keep the existing routing table. The gateway will remain the existing user-set routing table and automatically route the new devices. Note that if a newly added device cannot be polled by the Modbus client/master correctly, the slave ID of this newly added device might be set in the existing user-set table. Users must modify the existing user-set table.

Another scenario is when legacy Modbus devices cannot set slave ID arbitrarily. It has a fixed slave ID or a short range of slave IDs. Then, the slave IDs of the Modbus devices connecting to different serial ports will be in conflict. The virtual-to-real slave ID function can help you to connect the same slave ID devices to different serial ports of a gateway.

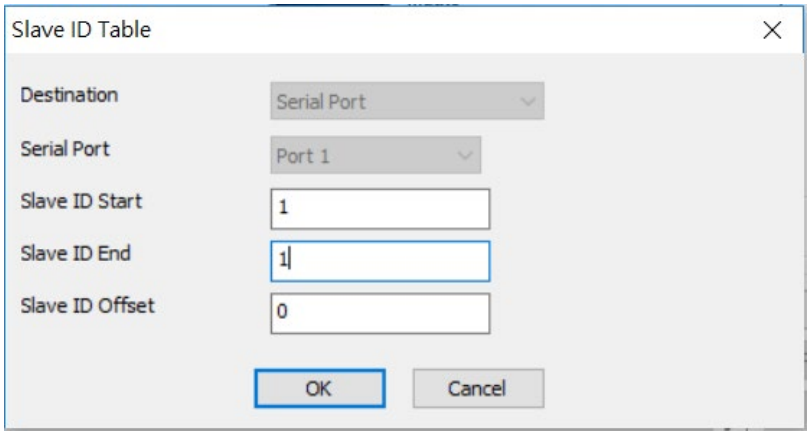
Let's assume there are two legacy Modbus devices (named Device A, and Device B) with the same slave ID 1. Device A is connected to serial port 1 and Device B is connected to serial port 2. On the Modbus Client/Master side, the Modbus request for Device A is recognized by slave ID 1 and the request for Device B is recognized by slave ID 2. You have to set the offset for the duplicate slave ID.

	Real Device ID	Virtual ID (Device ID recognized by Modbus Master)	Offset
Device A	1	1	0
Device B	1	2	-1

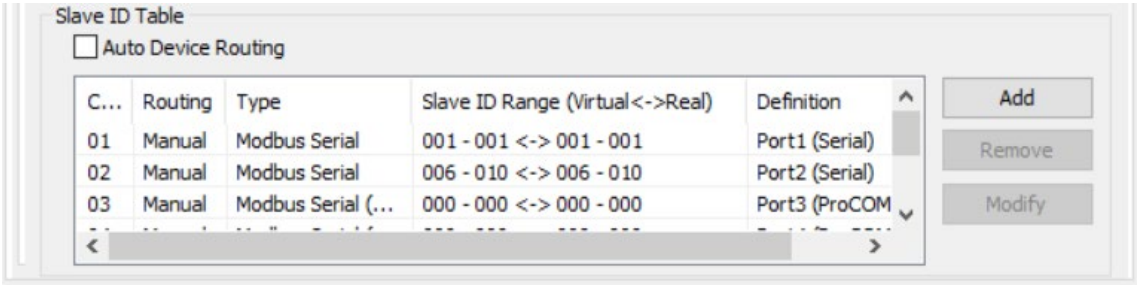
Original Setting



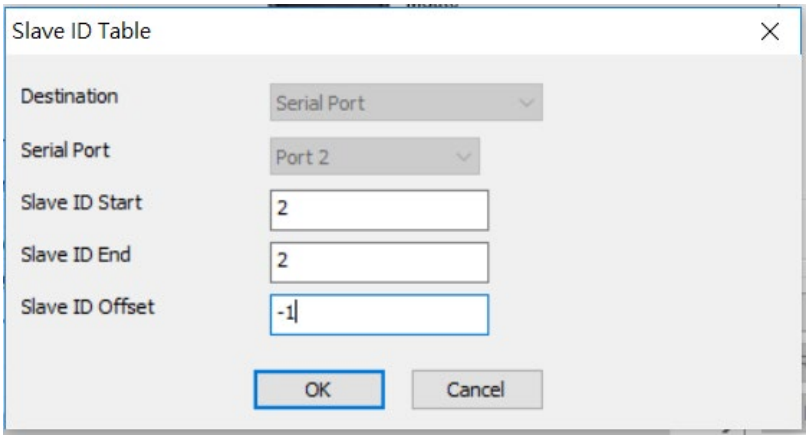
Select the first channel and click **Modify**. The Slave ID represents the Virtual ID recognized by the Modbus client/master.



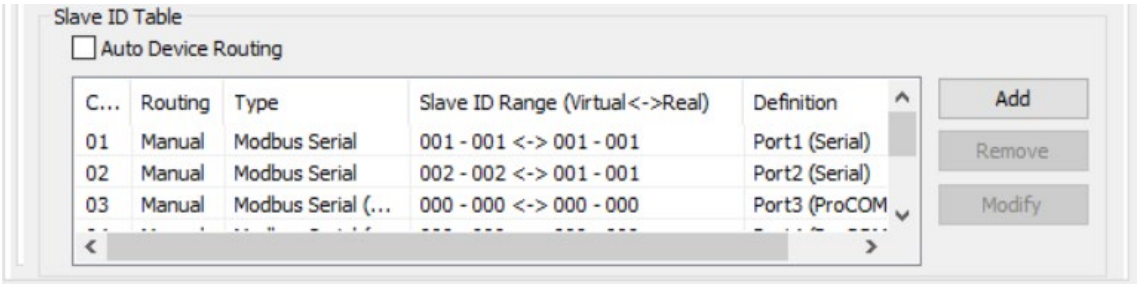
The routing table will show up as follows:



Select the second channel and click **Modify**. Since the virtual ID recognized by the Modbus client/master is 2, and the real slave ID of the device B is ID 1, the offset should be set as -1.



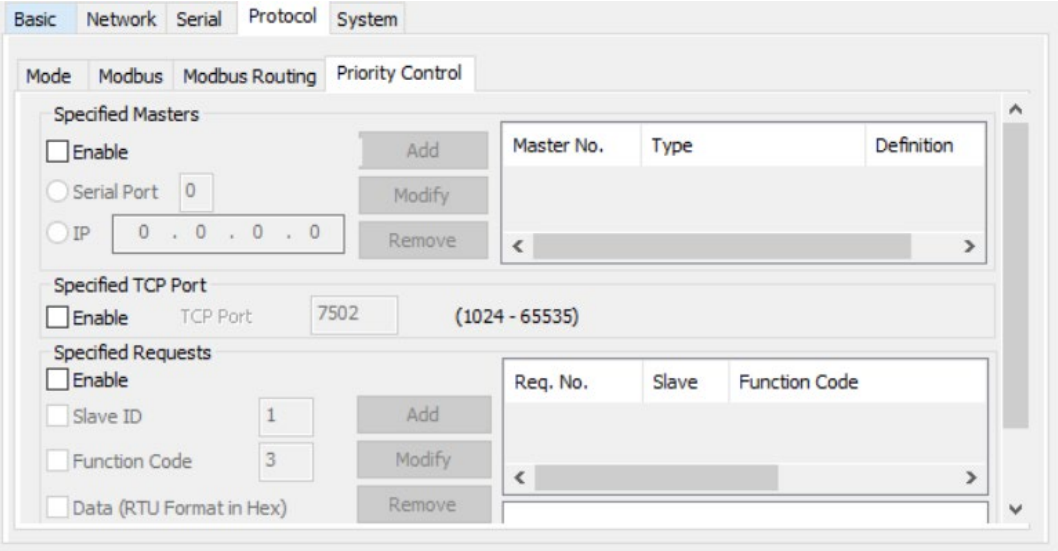
The routing table will show up as follows:



Now, the Modbus client/master can send a request with slave ID 1 to Modbus device A connected to serial port 1 as well as send a request with slave ID 2 to the Modbus device B connected in serial port 2.

Priority Control

The Priority Control tab is where emergency requests are enabled and configured. This is available for advanced models only (MB3170, MB3170I, MB3270 and MB3270I).



Priority control is designed for requests that are sent to Modbus RTU/ASCII servers/slaves. Since Modbus RTU/ASCII servers/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 client/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 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 unnecessary for **Specified TCP Port**.)

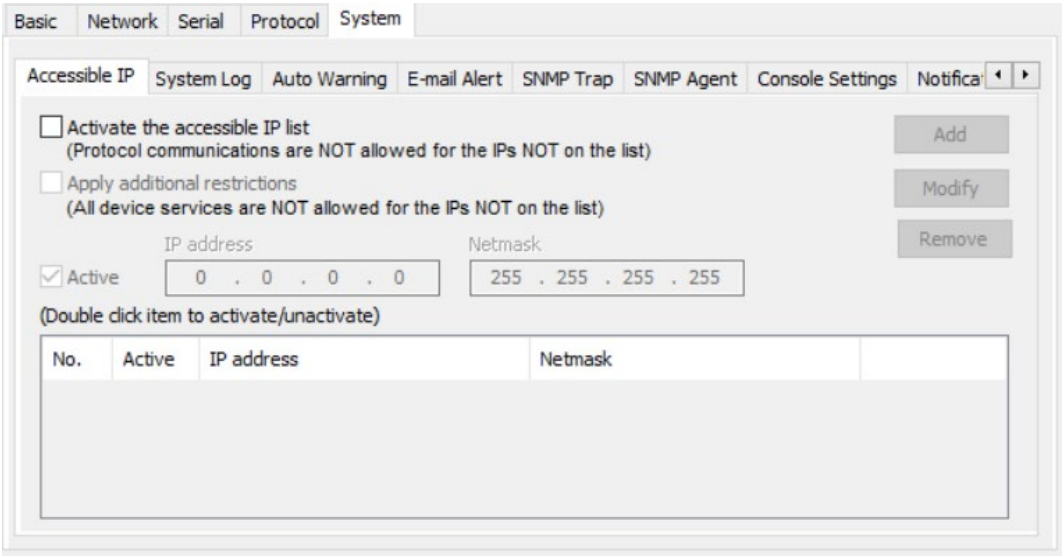
For example, if you want all requests from 192.168.32.161 to be considered a priority request, do the following:

1. Enable **Specified Masters**.
2. Enter 192.168.32.161 as the **IP**.
3. Click **Add/Modify**.

System Settings

Accessible IP

The MGate MB3000 uses an IP address-based filtering method to control access to itself.



The Accessible IP List function allows you to add or block remote host IP addresses to prevent unauthorized access. Access to the MGate MB3000 is controlled by IP address. That is, if a host's IP address is in the accessible IP table, then the host will be allowed to access the MGate MB3000. The different restrictions are listed in the table below. The checkbox "Apply additional restrictions" can only be activated if the checkbox "Activate the accessible IP list" is activated.

Activate the accessible IP list	Apply additional restrictions	Ips on the list (Active checked)	Ips NOT on the list (Active NOT checked)
✓	–	All protocol communication and services* are allowed.	Protocol communication is not allowed, but services* are still allowed.
✓	✓	All protocol communication and services* are allowed.	All services* are not allowed.

*Services show HTTP, HTTPS, TELNET, SSL, SNMP, SMTP, DNS, NTP, DSU

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").

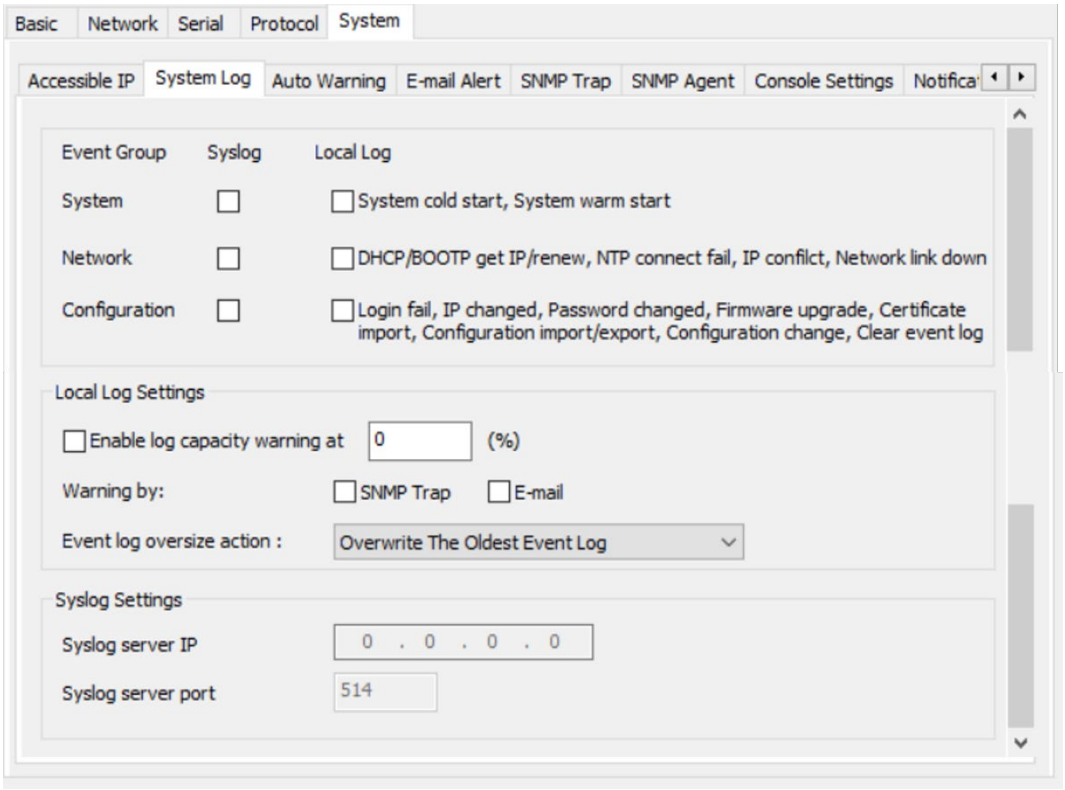
To allow access to all IP addresses: Make sure that **Enable** the accessible IP list is not checked.

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
192.168.0.1 to 192.168.255.254	192.168.0.0	255.255.0.0
192.168.1.1 to 192.168.1.126	192.168.1.0	255.255.255.128
192.168.1.129 to 192.168.1.254	192.168.1.128	255.255.255.128

System Log

These settings enable the MGate firmware to record important events for future verification. The recorded information can only be displayed in the web console. **Please note that this feature is not supported on MB3180 gateway**.



The 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

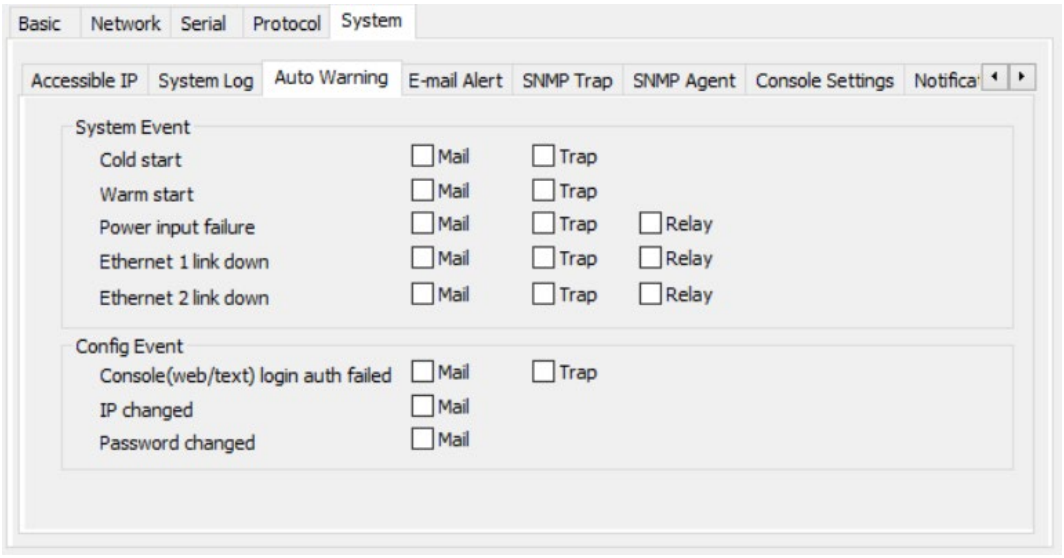
Local Log Settings	Description
Enable Log Capacity Warning (%)	The maximum number of log capacity is 1,000. When the log amount exceeds the warning percentage, it will trigger an event to SNMP Trap or Email
Warning by	SNMP Trap Email
Event log oversize action	Overwrites the oldest event log Stops recording event log

Syslog Settings	Description
Syslog server IP	IP address of the server that will record the log data
Syslog server Port	514

Users can view the recorded information from the web console or the text mode console.

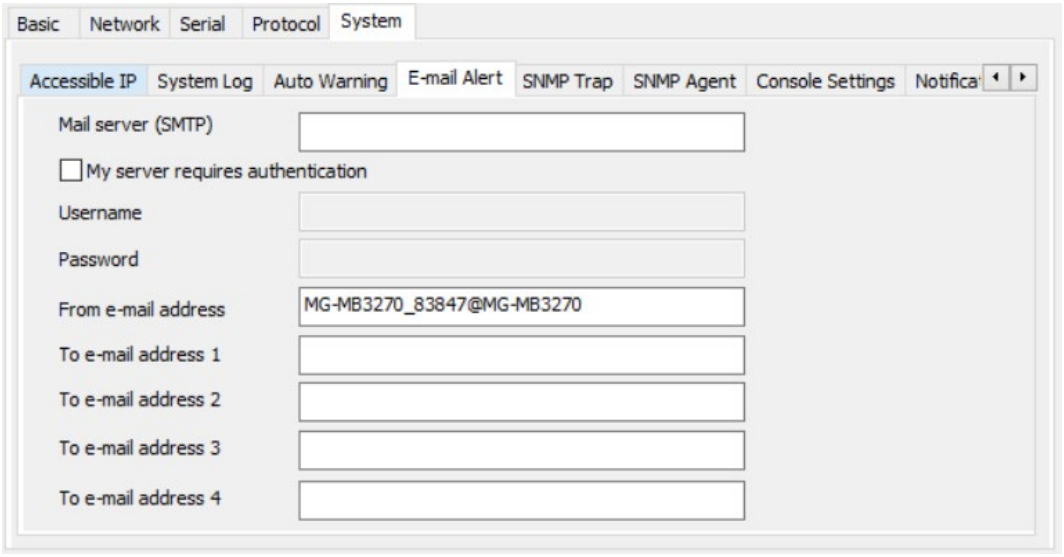
Auto Warning Settings

Auto Warning is triggered by different events. When a checked trigger condition occurs, the MGate can send e-mail alters, SNMP Trap messages, or open/close the circuit of the relay output and trigger the Fault LED to blink. To enable an e-mail alert, configure the e-mail address on the **E-mail Alert** page. Likewise, to enable SNMP Trap alerts, configure the SNMP trap server on the SNMP Trap page. **Please note that this feature is not supported on MB3180 gateway.**



E-mail Alert

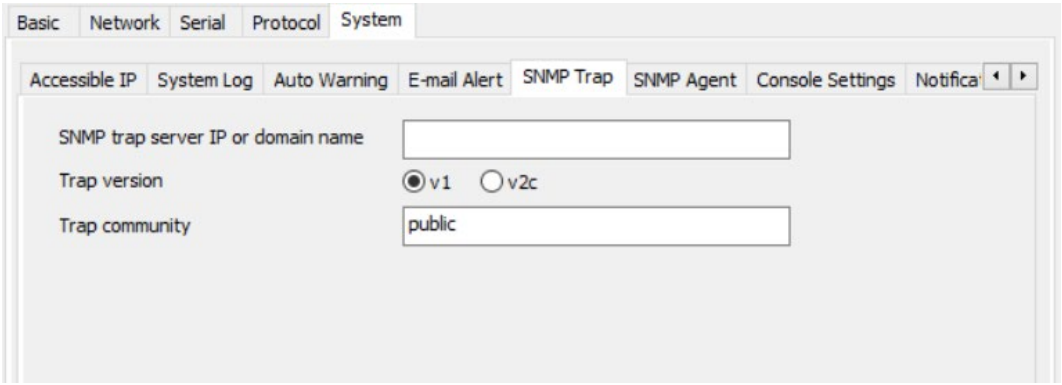
Along with activating "Mail" function from events on **Auto Warning Settings** page, the E-mail alert should be setup then. **Please note that this feature is not supported on MB3180 gateway.**



Parameters	Description
Mail server	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 e-mail address	This is the e-mail address from which automatic e-mail warnings will be sent.
To e-mail address 1 to 4	This is the e-mail address or addresses

SNMP Trap

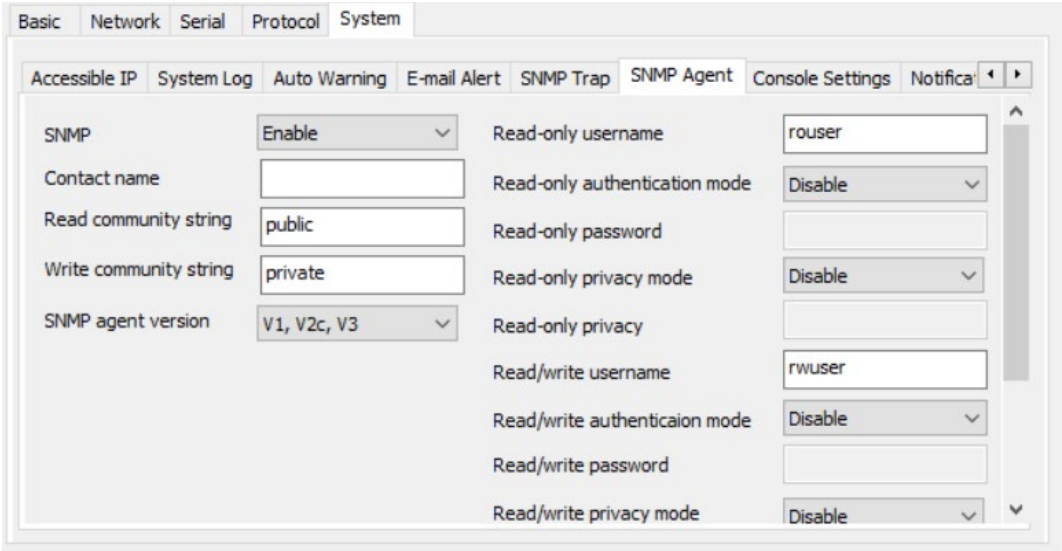
Along with activating the **Trap** function from events on the **Auto Warning Settings** page, the SNMP Trap should be set up. **Please note that this feature is not supported by the MB3180 gateway.**



Parameters	Description
SNMP trap server IP	Use this field to show the IP address to use 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.

SNMP Agent

The SNMP Agent is a network-management for collecting and organizing information about managed devices on IP network and for modifying the information on the device.



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 MB3000 Series supports SNMP V1, V2c, and V3.

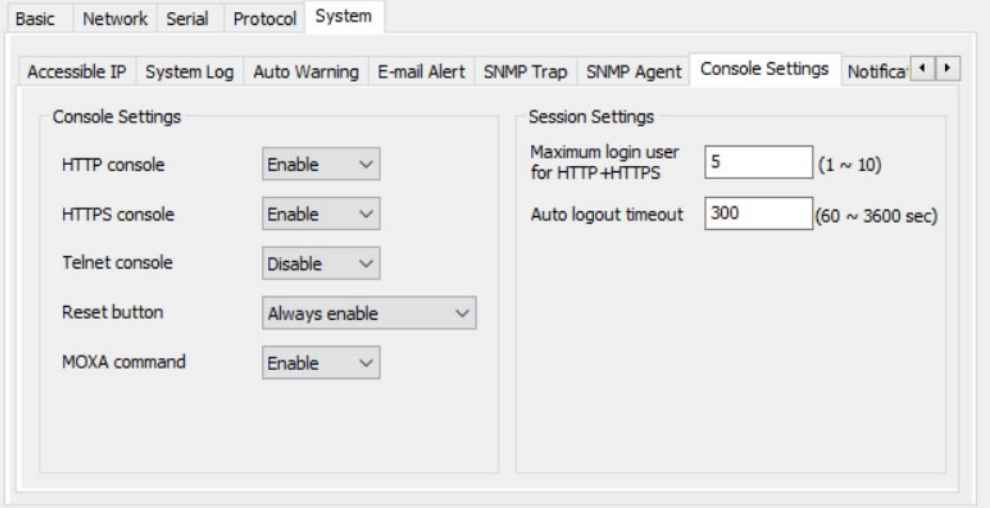
Read-only and Read/write access control

While selecting SNMP agent version V3, it is needed to configure read-only and read/write access control parameters. 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 indicate 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.

Console Settings

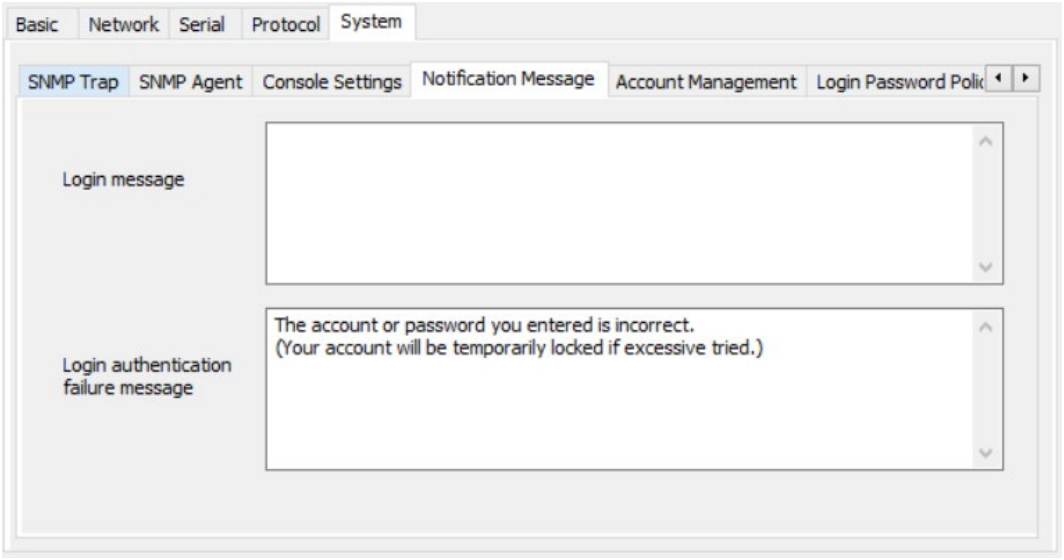
To support various security levels, the console and session can be further configured.



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	Enable/Disable	The MGate Telnet function can be enabled or disabled.
Reset button protect	Disable after 60 sec, Always enable	The MGate provides the reset button to clear the password and 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, in case users actually need to reset this function.
Moxa command	Enable/Disable	The DSU can search the MGate. If you have any security concerns, you can choose Disable to deny the DSU right to access.

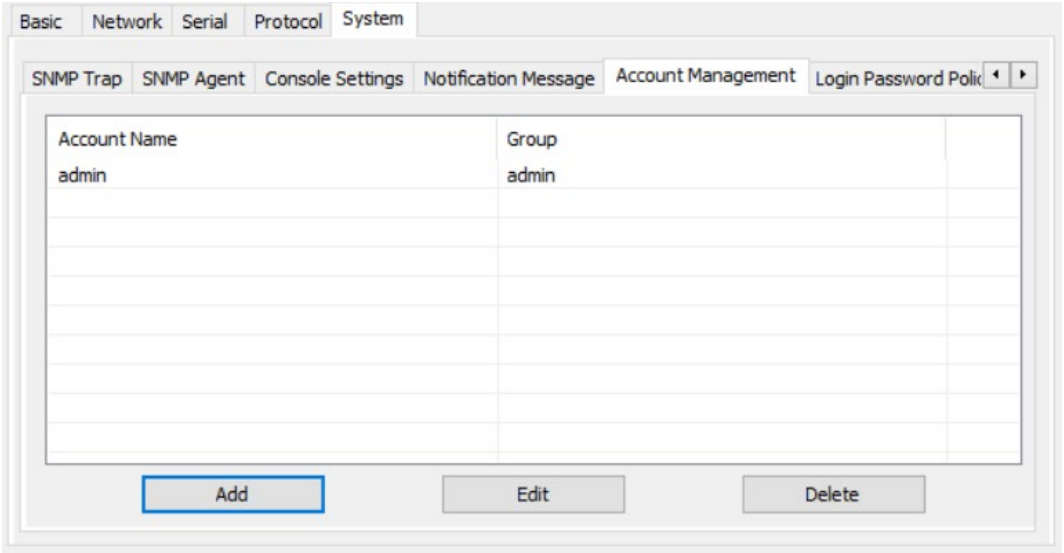
Notification Message

The login message and login authentication failure message can be configured.



Account Management

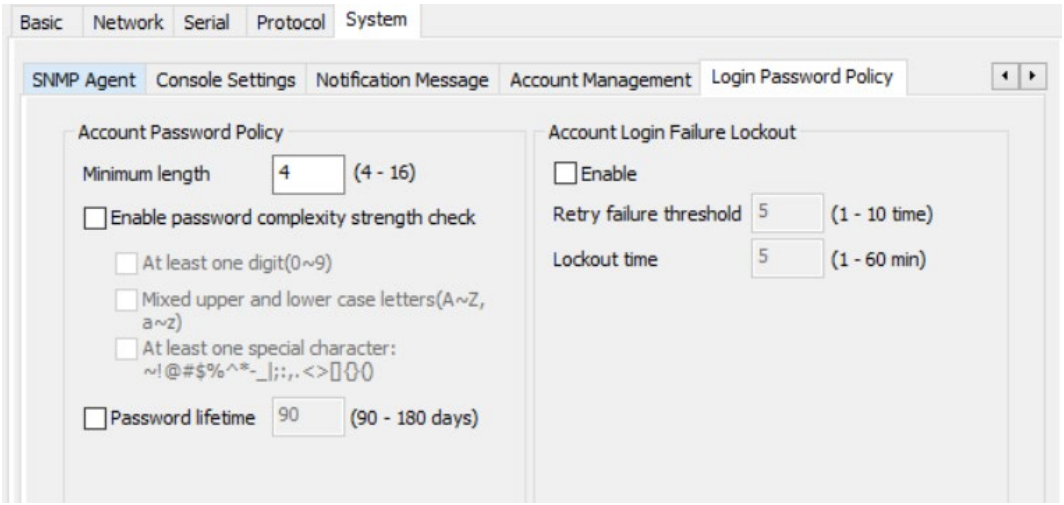
A group of accessible accounts with two different user levels can be managed.



Parameters	Value	Description
Account Name		Users can set up the account name for login purpose.
Group	Admin, user	Users can change the password for different accounts. The MGate provides two different user levels: **admin** and **user** with maximum 16 accounts. The admin account can access and change all the settings through the web console. The user account can only view the settings and cannot change anything.

Login Password Policy

Considering security level, the login password policy and failure lockout can be configured.



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

Account Login Failure Logout	Value	Description
Retry failure threshold	1 to 10 time(s)	
Lockout time	1 to 60 min	

Certificate

For the MGate self-signed certificate:

When we encounter the valid date of the certificate expired, we can regenerate the "MGate self-signed" certificate through the following steps.

Step 1: Users should delete the SSL certificate file originating from the MGate device.

Step 2: Then, enable the NTP server by setting up the time zone and local time.

Step 3: After restarting the device, the "MGate self-signed" certificate will be regenerated with the updated valid time.

For importing the third-party trusted SSL certificate:

By importing the third-party trusted SSL certificate, the security level can be enhanced. A snapshot of the GUI for the web console is shown below. To generate the SSL certificate through the third party, here are the steps:

Step 1: Step1: Create a certification authority (Root CA), such as Microsoft AD Certificate Service (https://mizitechinfo.wordpress.com/2014/07/19/step-by-step-installing-certificate-authority-on-windows-server-2012-r2/)

Step 2: Step 2: Find a tool to issue a "Certificate Signing Requests" file, where you can find it from third-party CA companies, such as DigiCert (https://www.digicert.com/easy-csr/openssl.htm).

Step 3: Step3: Submit it to a public certification authority for signing the certificate.

Step 4: Step4. Import the certificate to the MGate Series. Please note that the MGate Series only accepts "xxxx.pem" format.

NOTE

The maximum key length of the MGate devices supports 2,048 bits.

Some well-known third-party CA (Certificate Authority) companies are listed below for your reference: (https://en.wikipedia.org/wiki/Certificate_authority):

IdenTrust (https://www.identrust.com/)

DigiCert (https://www.digicert.com/)

Comodo Cybersecurity (https://www.comodo.com/)

GoDaddy (https://www.godaddy.com/)

Verisign (https://www.verisign.com/)

Serial Redirector Settings

An advanced multiport MGate model (MB3270/MB3270I) supports the serial redirector function, which integrates Modbus RTU/ASCII and Modbus TCP devices simultaneously. Many serial control systems in the field and local control devices, such as HMI, are connected to serial field devices. Using Ethernet-based equipment for remote access and monitoring has become a trend. By setting up the MGate, you will keep the original serial control system and add Modbus TCP client/master (e.g., SCADA) or/and Modbus TCP server/slave (e.g., PLC) into the system. Both Modbus TCP and Modbus RTU/ASCII clients/masters can control Modbus TCP and Modbus RTU/ASCII servers/slaves. MGate can act as a "Serial Redirector" by configuring the **Protocol Settings**.

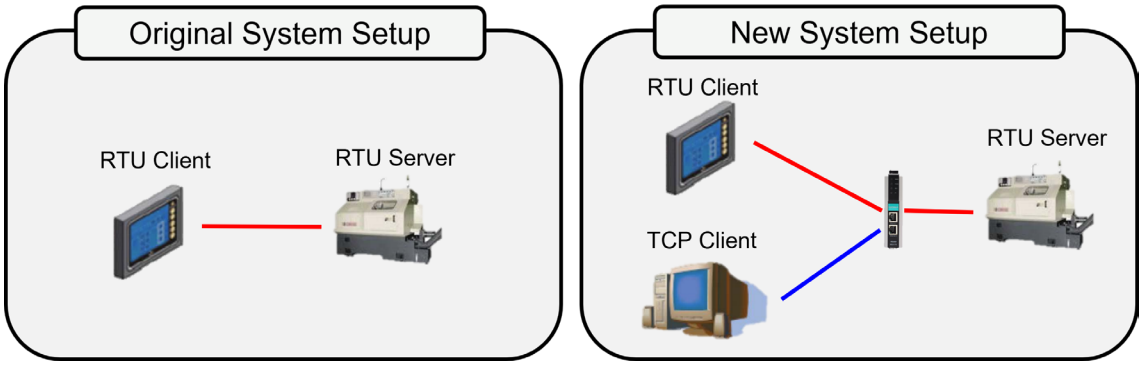
Configuring Serial Redirector

Serial Redirector can be set up by Protocol Settings—**Mode** and **Modbus Routing**. For detailed information, refer to the following scenario and steps.

Scenario 1: Adding Modbus TCP Client/Master (SCADA) to an existing Modbus serial system

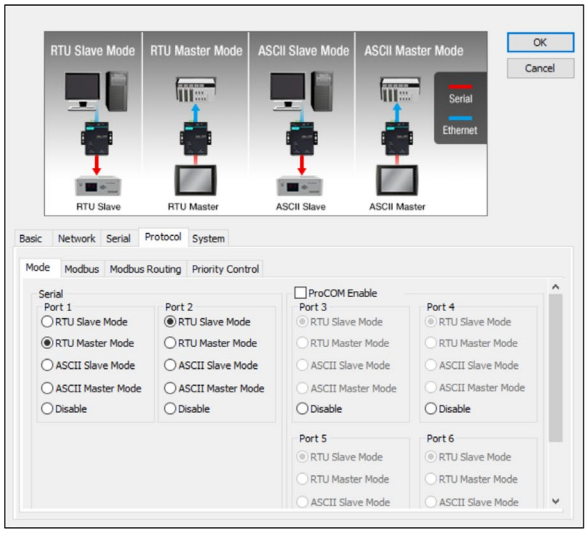
A Modbus RTU client/master, such as HMI, controls the Modbus RTU server/slave in the original system. Now you want to add a Modbus TCP client/master such as SCADA into the system and keep the serial Modbus RTU system.

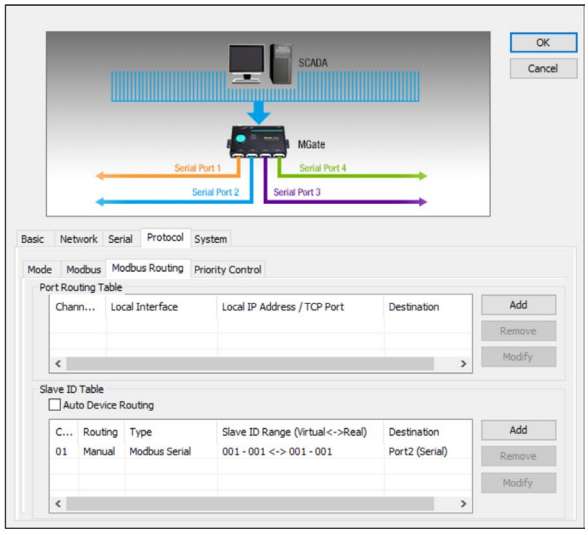
Set up the serial redirector using an advanced Modbus gateway (MB3270/MB3270I). Configuring it using the following steps allows the serial client/master to continue controlling the serial servers/slaves even when implementing a new TCP network.



Under **Mode** settings, use the radio button to set up the operation mode for each serial port. If the Modbus RTU client/master is connected to the serial port 1, select "RTU Master Mode" under port 1. If a Modbus RTU server/slave is connected to the serial port 2, select "RTU Slave Mode" under port 2.

Next, go to the **Modbus Routing** tab to configure how the gateway routes Modbus requests. If the slave ID of the Modbus RTU server/slave is 1 and it is connected to serial port 2, click the "Add/Remove/Modify" button to change the default slave ID table. Set the serial port 2 to be the destination for slave ID 1, so Modbus RTU requests sent to slave ID 1 will be routed to serial port 2.

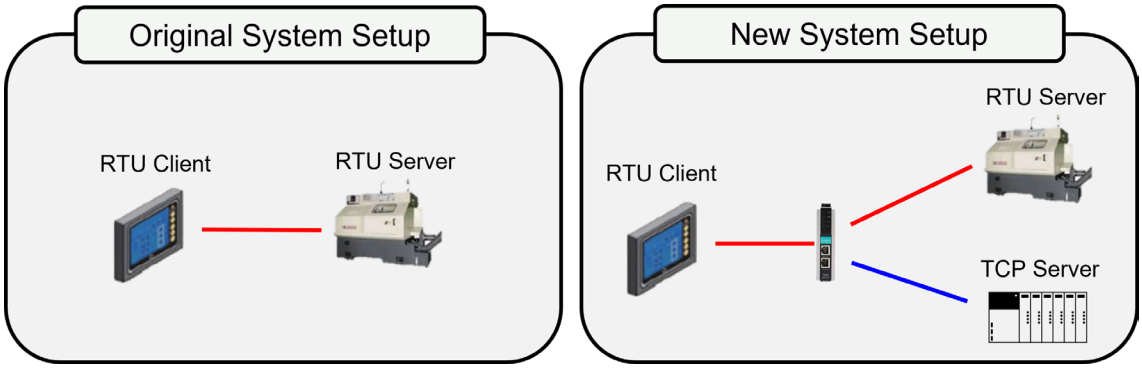




Scenario 2: Adding Modbus TCP Server/Slave to an existing Modbus serial system

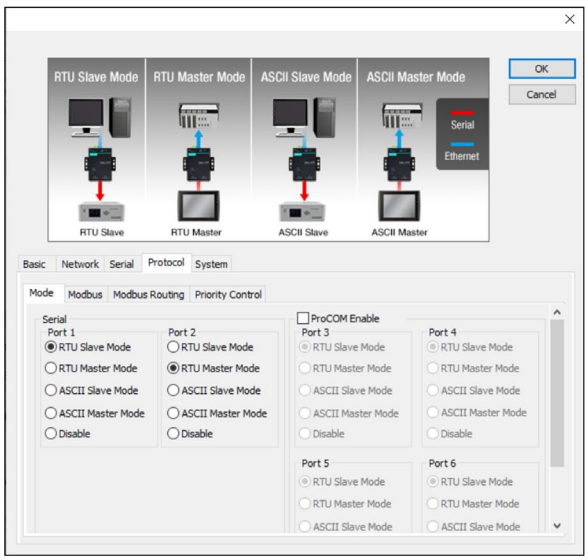
There is a Modbus RTU client/master such as HMI that controls the Modbus RTU server/slave in the original system. Now you want to add the Modbus TCP server/slave such as PLC into the system and keep the serial Modbus RTU system.

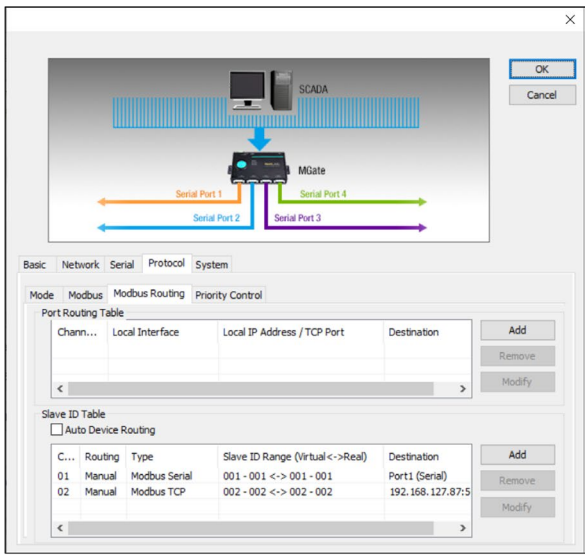
Set up the serial redirector using an advanced Modbus gateway (MB3270/MB3270I). Configuring it using the following steps allows the serial client/master to continue controlling the serial servers/slaves even when implementing a new TCP network.



Under **Mode** settings, use the radio button to set up the operation mode for each serial port. If the Modbus RTU server/slave is connected to serial port 1, select "RTU Slave Mode" under port 1. If a Modbus RTU client/master is connected to serial port 2, select "RTU Master Mode" under port 2.

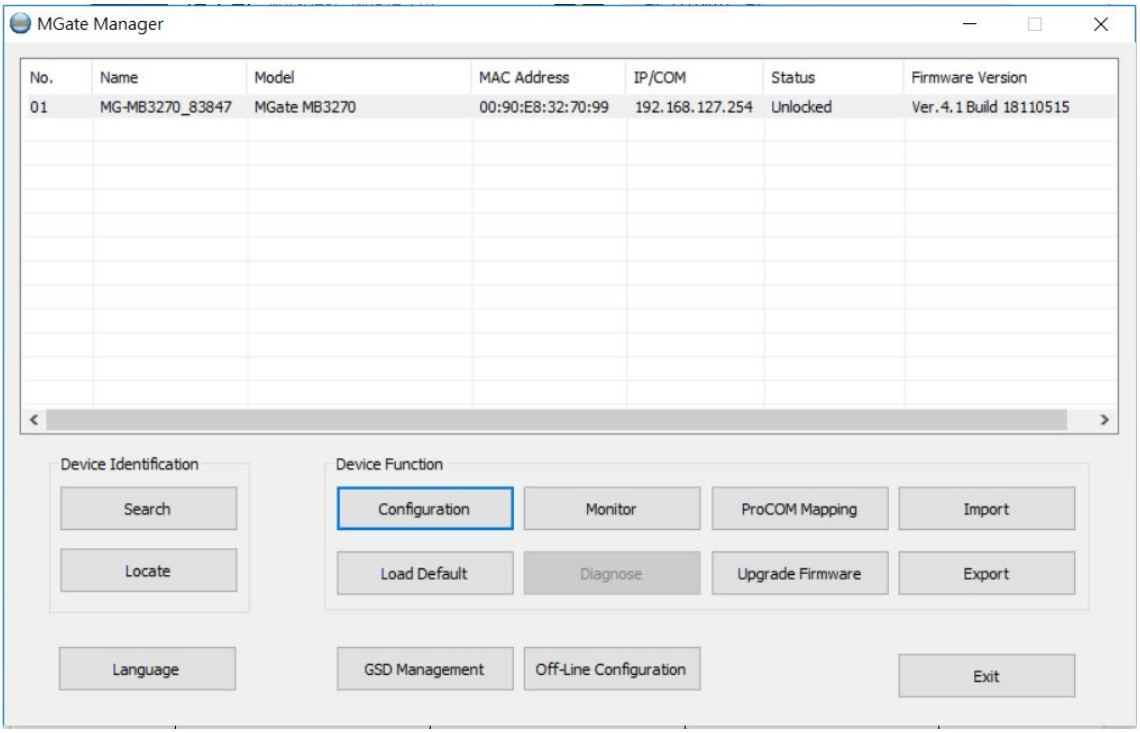
Next, go to the **Modbus Routing** tab to configure how the gateway routes Modbus requests. If the slave ID of the Modbus RTU server/slave is 1 and it is connected to serial port 1, and the slave ID of the Modbus TCP server/slave is 2 with an IP address of 192.168.127.87:502, click the "Add/Remove/Modify" button to modify an existing route. Set up two routing rules. Set the serial port 1 to be the destination for slave ID 1, so Modbus RTU requests sent to slave ID 1 will be routed to serial port 1. Set the IP address 192.168.127.87:502 to be the destination for slave ID 2, then Modbus RTU requests sent to slave ID 2 will be routed to 192.168.127.87:502.





Verifying the Location of the Unit

If you are managing multiple MGate units, you may wonder if you are configuring the correct unit in MGate Manager. You can select a unit in MGate Manager and click **Locate** to make the unit's **Ready** LED blink for a few seconds. This will tell you which physical unit corresponds with the unit that you have selected.

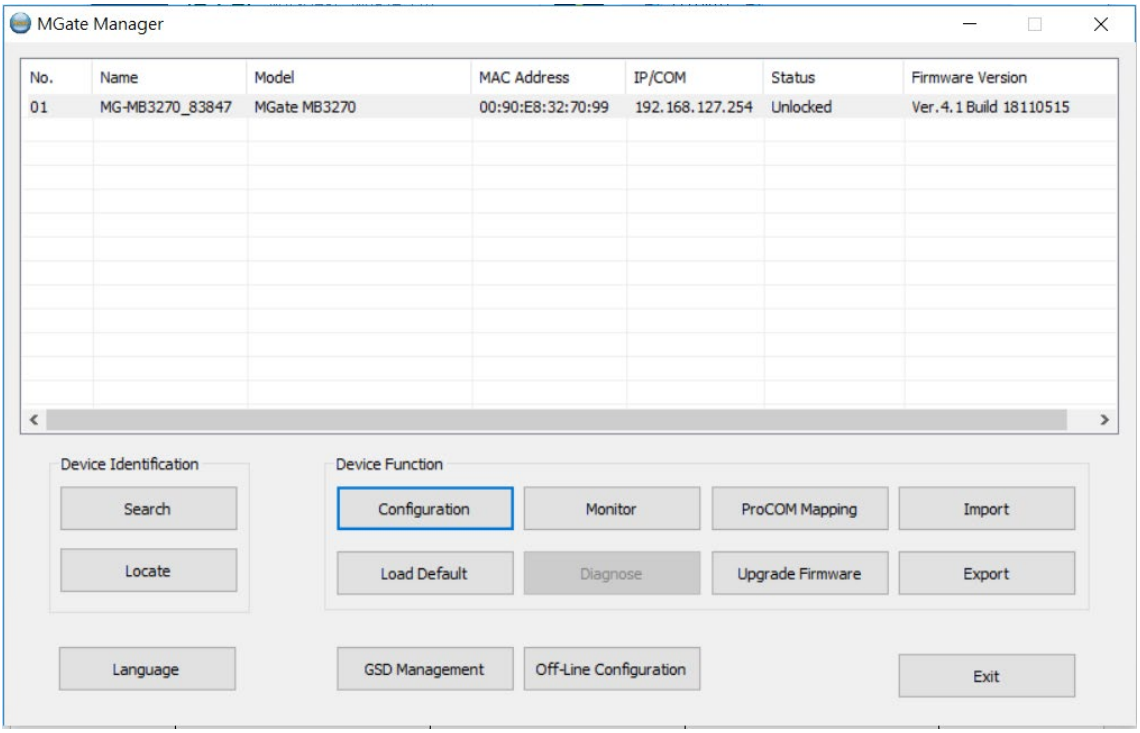


Monitoring Modbus Activity

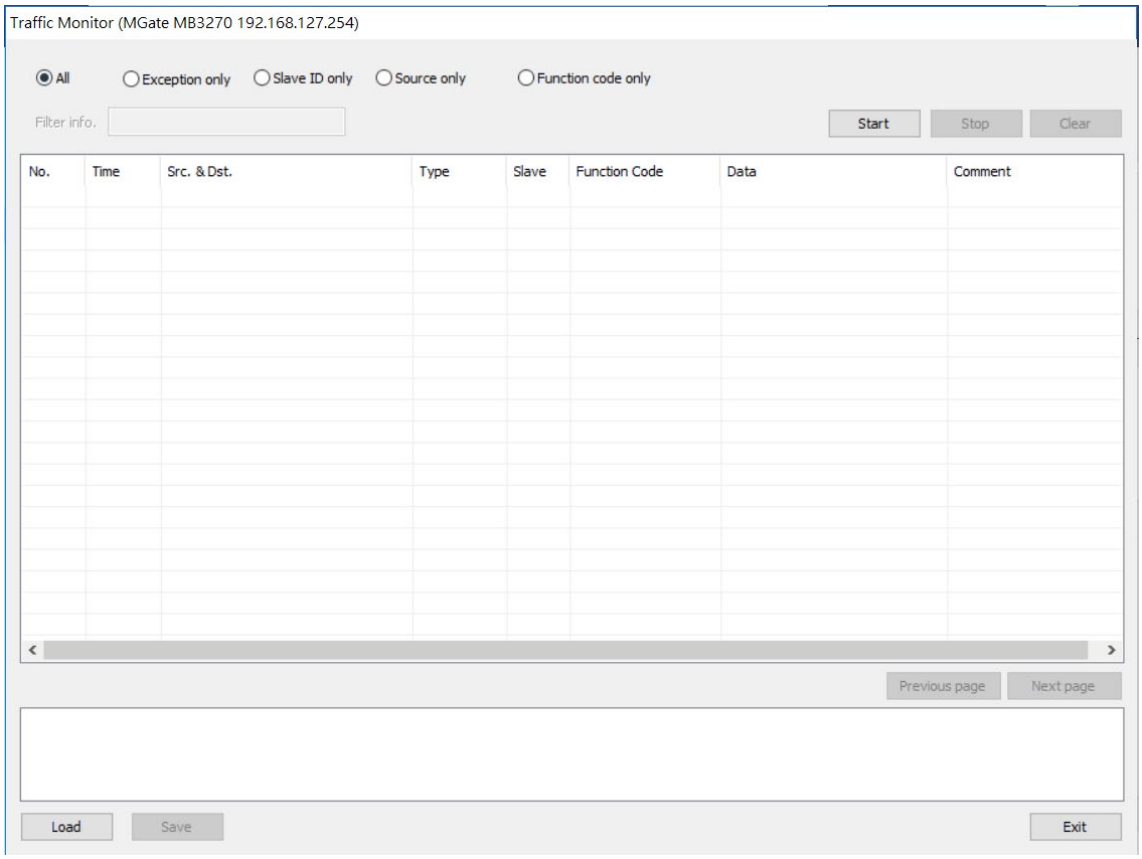
For troubleshooting or management purposes, you can monitor the data passing through any MGate MB3000 on the network. The gateway will log data events as they pass through it. Rather than simply echoing the data, MGate Manager presents the data in an intelligent, easily understood format, with clearly designated fields including source, type, destination, contents, and more. Users can filter events in different ways and save the complete log to a file for later analysis.

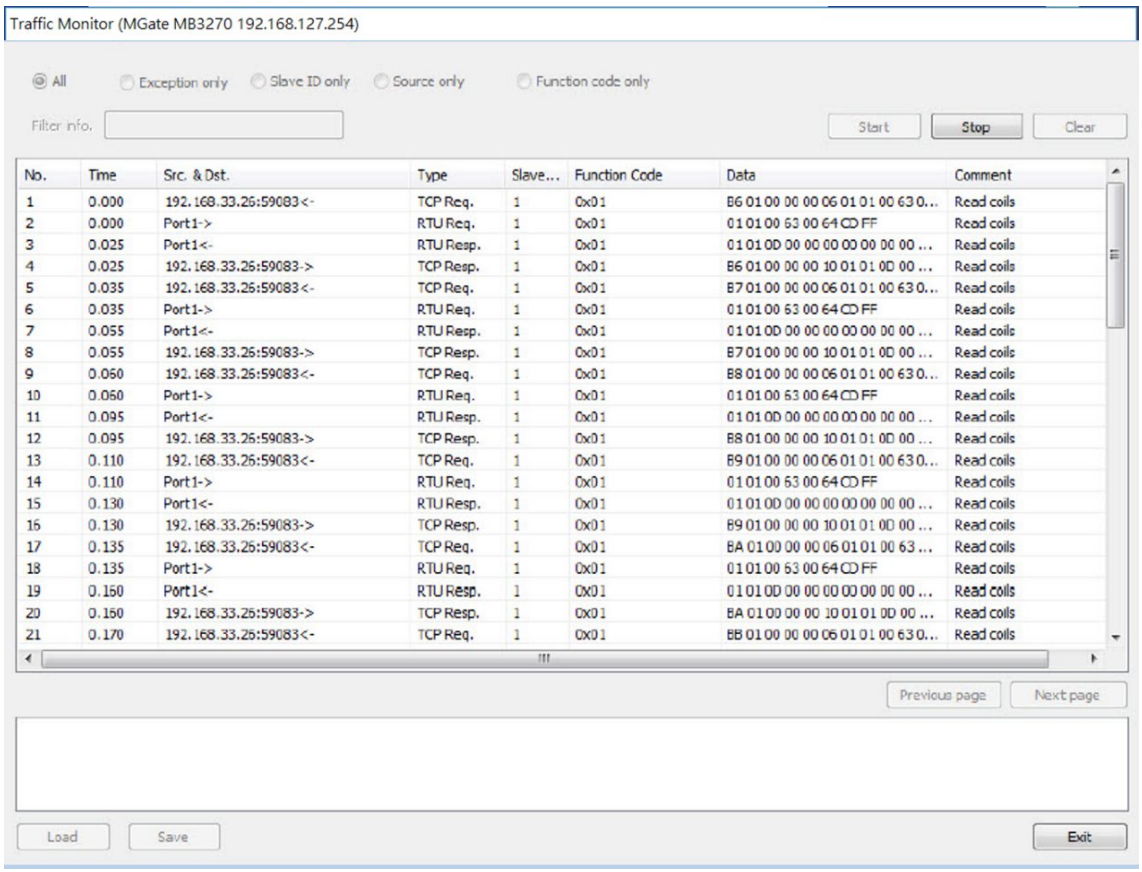
Open Traffic Monitor Window

Select the unit that you wish to monitor and click **Monitor** to open the Traffic Monitor window.

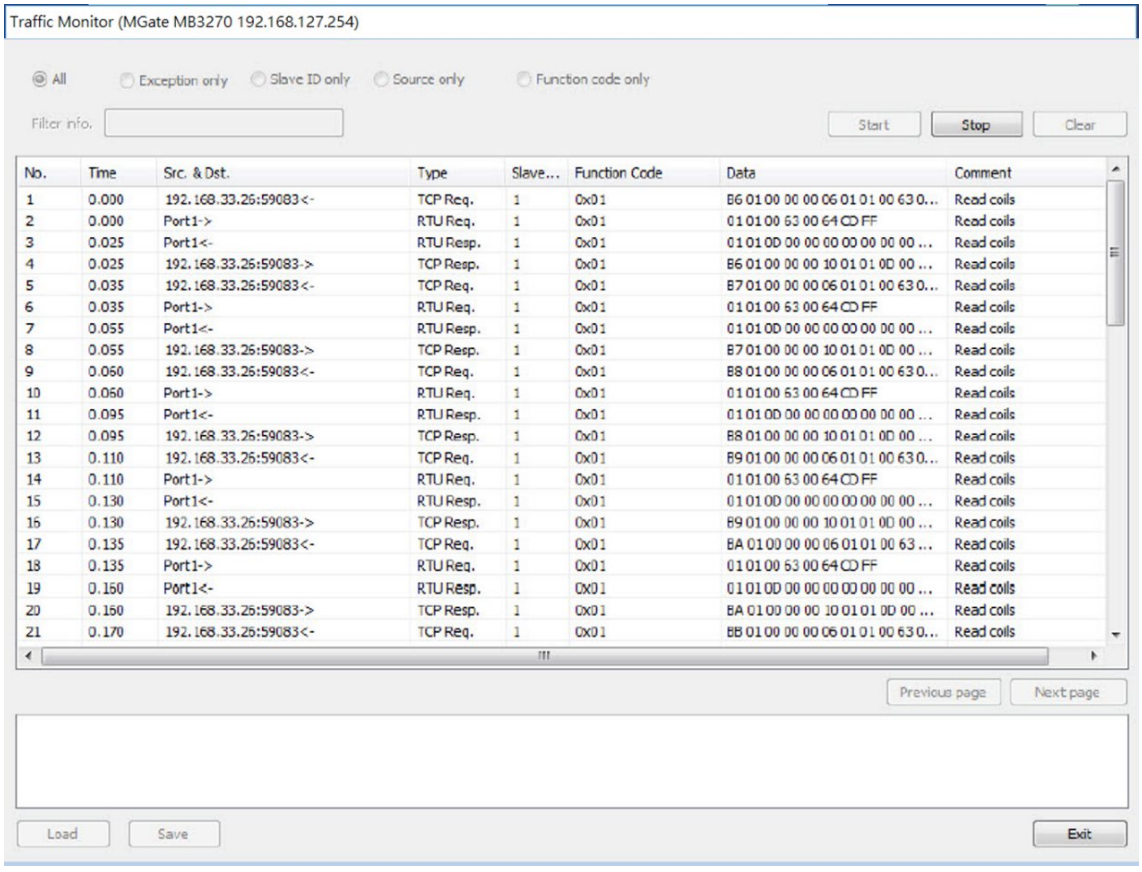


In the Traffic Monitor window, click **Start** to begin live monitoring of the data passing through the selected MGate MB3000 unit.





To stop capturing the log, press the **Stop** button.



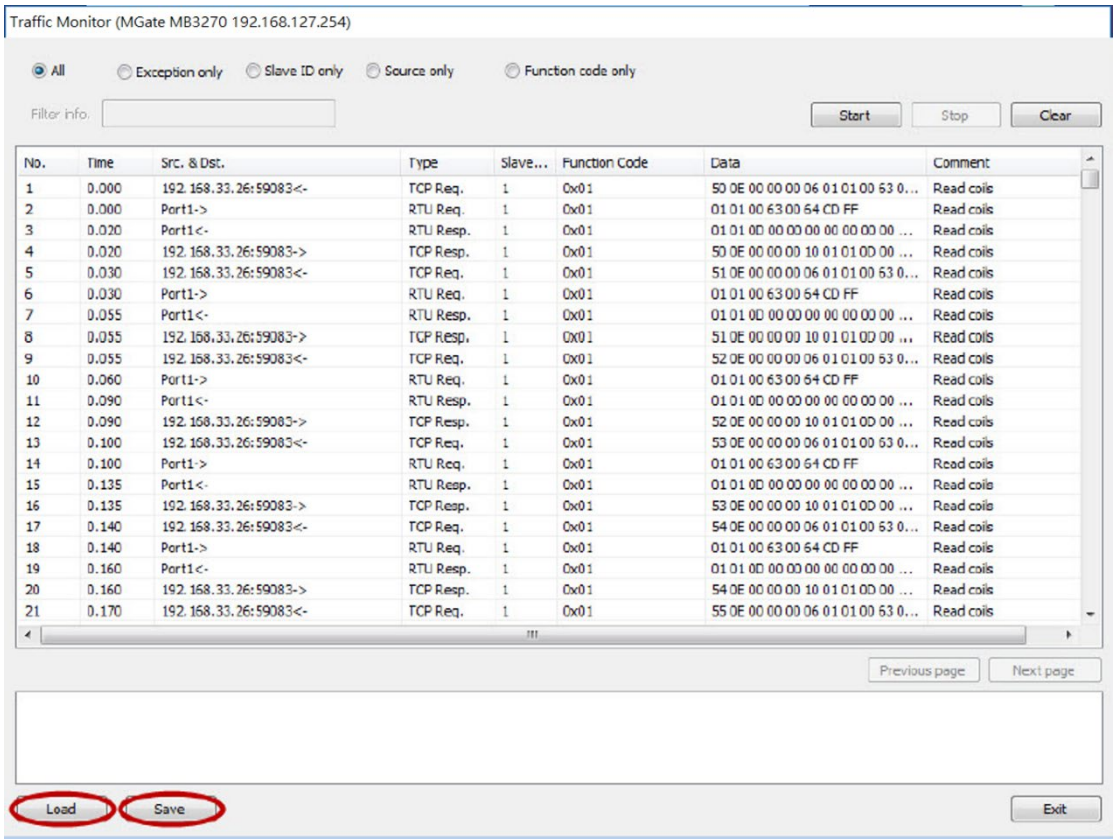
Filter Traffic Information

The traffic monitor window displays all events by default. MGate Manager also allows the data to be filtered so only the relevant information is displayed. The filter is selected, using the radio buttons, and customized, using the **Filter info** field, as follows:

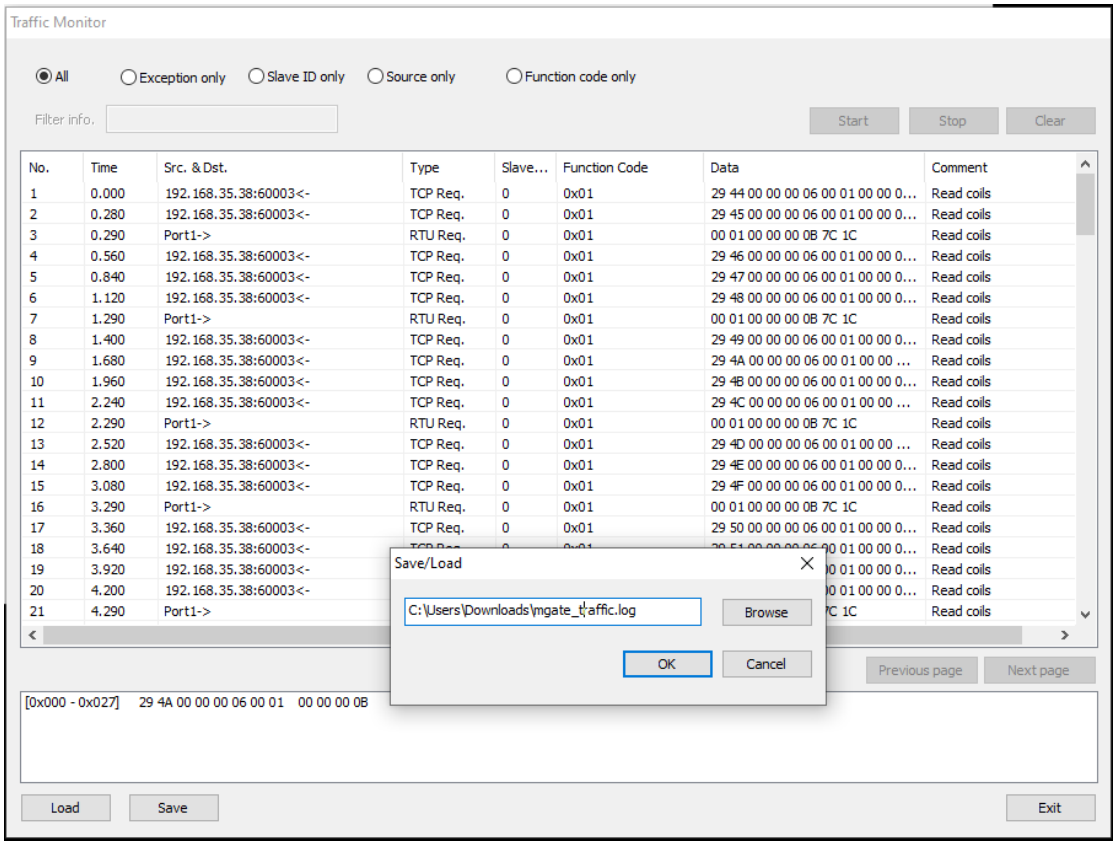
Filter	Customization	Description
All	–	Show all traffic
Exception only	–	Show only exceptions
SID only	VSID=< virtual slave ID> (e.g., "VSID=1")	Show only traffic to and from the specified "virtual" slave ID (as assigned in the MGate's slave ID table)
	RSID=< actual slave ID> (e.g., "RSID=1")	Show only traffic to and from the specified "actual" slave ID (as assigned on the device itself)
Source only	IP=<IP address> (e.g., "IP=192.168.1.2")	Show only traffic sent from the specified IP address
	PORT=< MGate serial port number> (e.g., "PORT=1")	Show only traffic sent from the specific serial port on the MGate
Function code only	FCODE=<Modbus function code> (e.g., "FCODE=3")	Show only traffic for a specific function code

Save Log to File

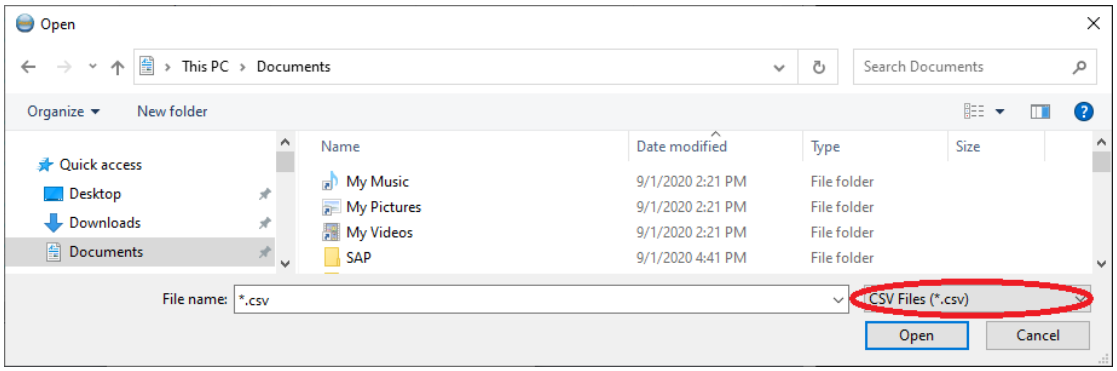
To save the data log to a file, click **Save**. You may retrieve a saved log by clicking **Load**. You can select the location to save the data log and the file format, such as .log or .csv file.



After clicking **Save**, a window pops up where you can select the location to save the log file.



To save the file to .csv format, click **Browse** and select the drop-down menu to choose .csv format.



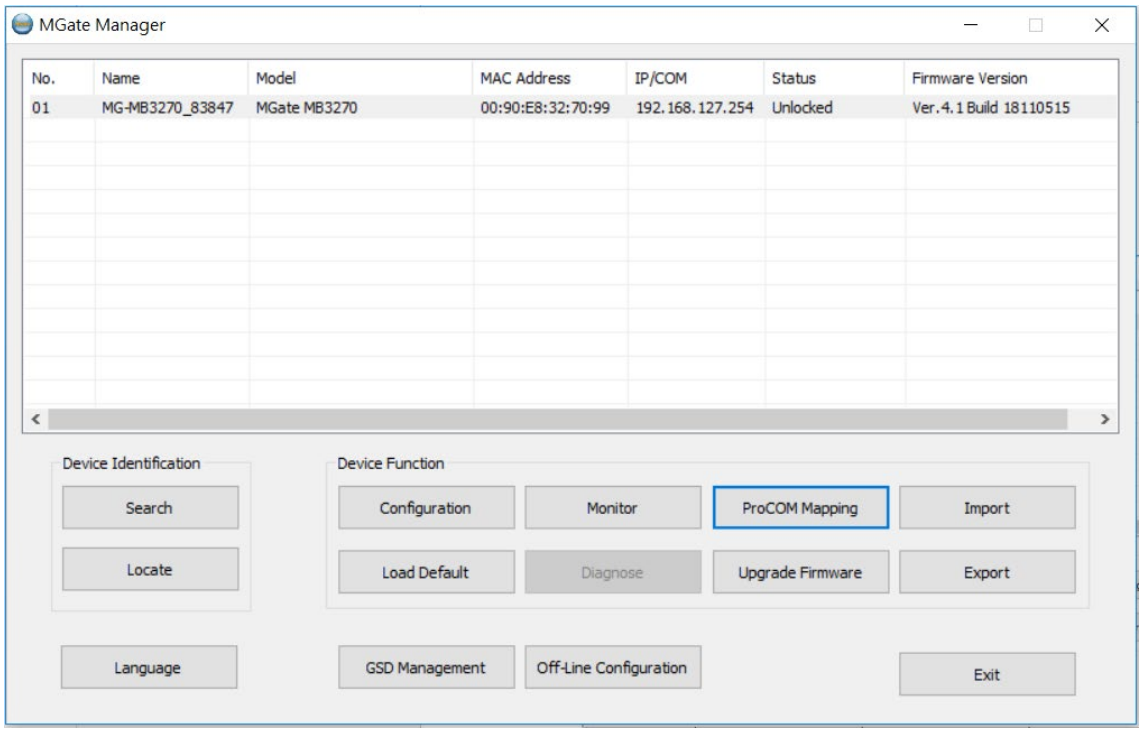
ProCOM Mapping

If your system uses remote PCs that only support COM port behavior to control remote Modbus devices, then ProCOM is the best solution for your system. Before using ProCOM, your PC needs to create virtual COM ports that connect to a specific ProCOM over an Ethernet network. By using ProCOM, the MGate MB3x70 will treat your PC's COM port as if it were an additional serial port on the MGate MB3x70.

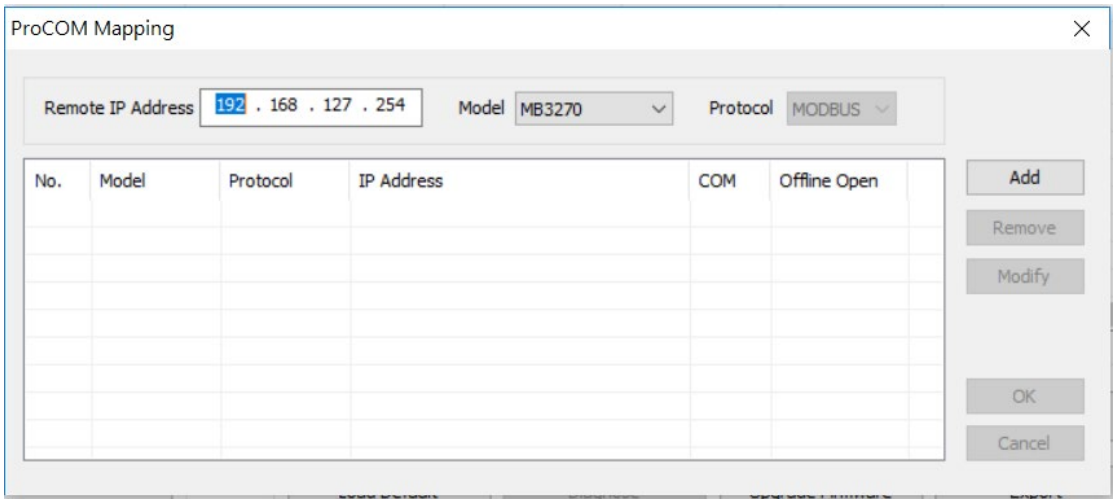
Configuring ProCOM

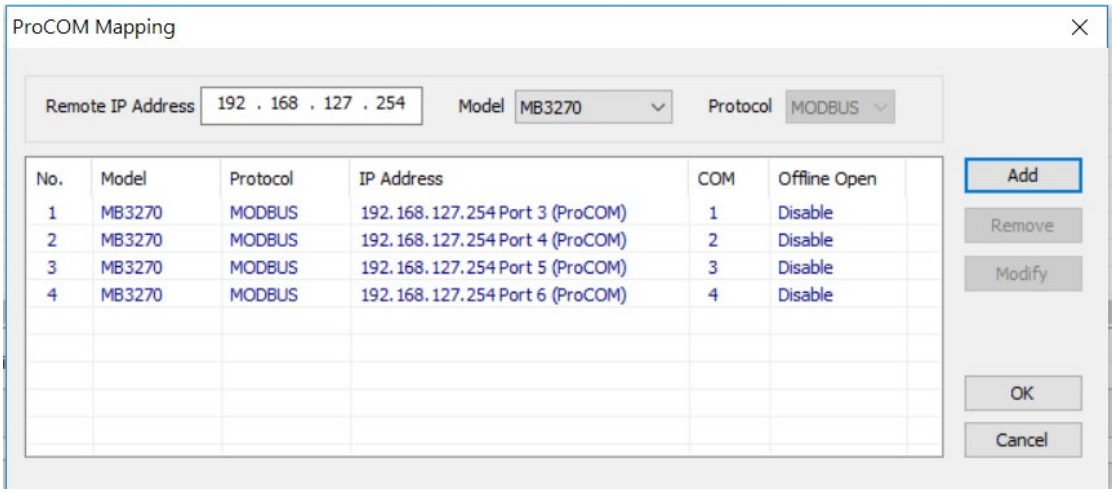
To enable this function, ProCOM mapping must be completed as follows:

Locate the MGate MB3x70 with the search function. Select the MGate MB3x70 device that you want to set ProCOM for and then click **ProCOM Mapping** to enter the mapping dialog box, as illustrated by the following figures.

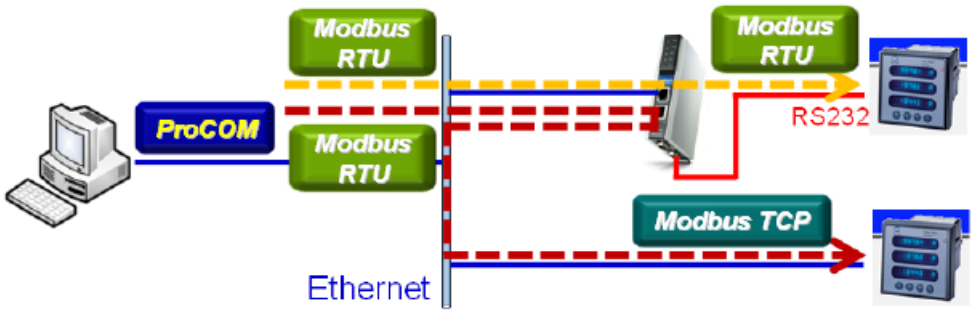


On the ProCOM mapping dialog box, you can map up to four ProCOM functions for each Modbus gateway to your PC's COM ports. The driver will generate virtual COM ports on your PC to connect to the selected MGate MB3x70 over the network.

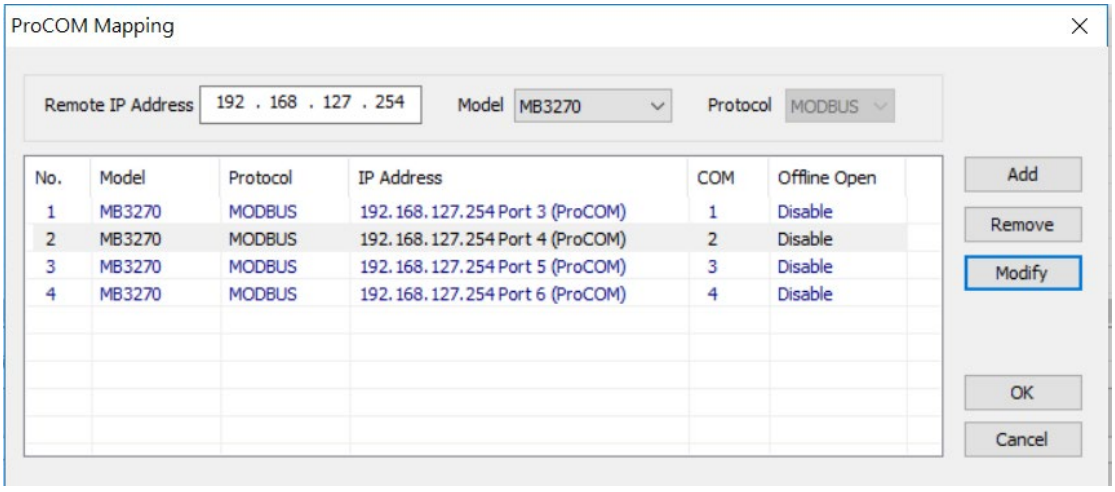


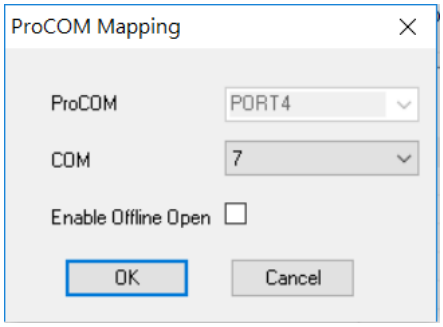


This way, when you send a Modbus request to ProCOM, the driver will forward your request to the MGate MB3x70 and the MGate MB3x70 will forward the request to the target Modbus device using the preset Modbus device mode and Slave ID. For example, the Modbus request from ProCOM can be redirected to a Modbus RTU/ASCII device that is behind the MGate MB3x70's serial interface or to a Modbus TCP device through the MGate MB3x70's Ethernet port. In addition, it can be redirected to another ProCOM port on the MGate MB3x70.

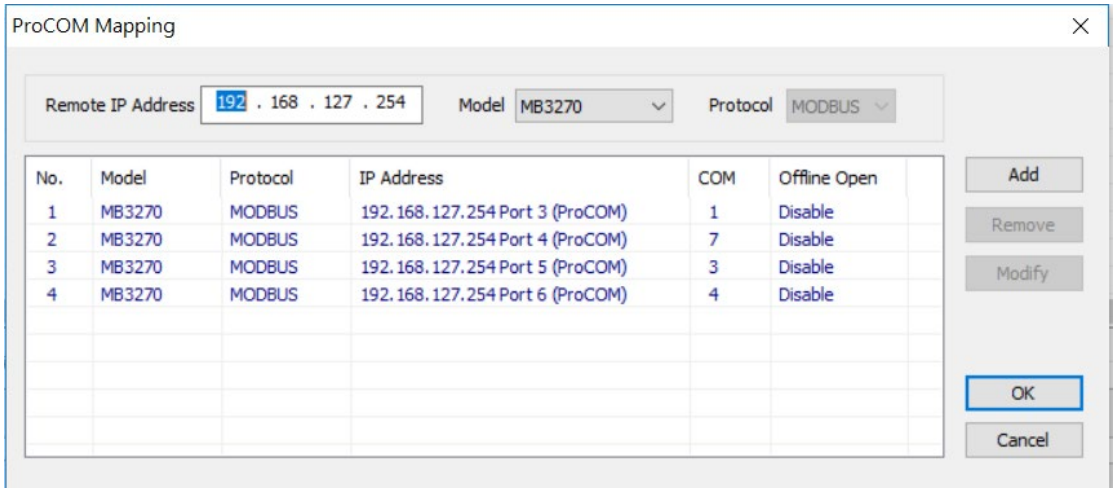


If you would like to change the COM port numbers, double-click on the items as follows:





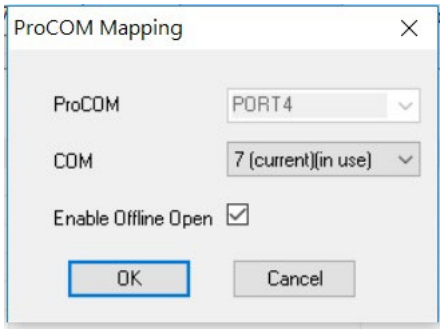
Once finishing configuring the COM port, click **OK** and check if the COM port is changed successfully.



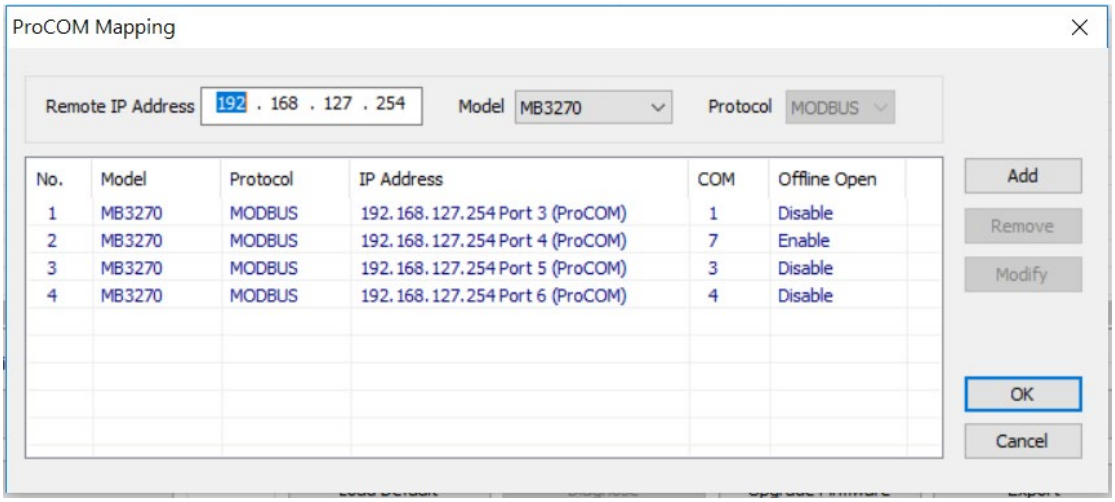
Offline Open

This function enables users to open ProCOM port(s) before the device is connected. Here, the data transmitted to ProCOM port(s) will be stored temporarily and will be sent out once the ProCOM port(s) are ready for access.

Select the **Enable Offline Open** checkbox and click **OK** to enable this function.

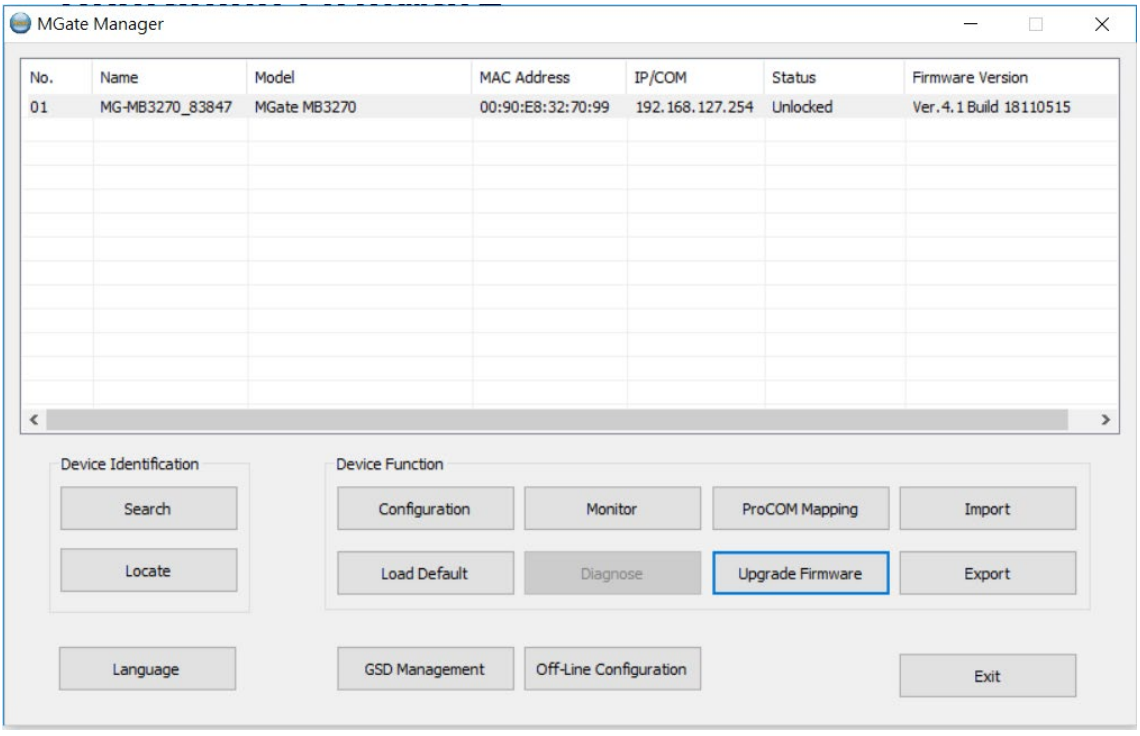


The Offline Open function is changed successfully from the mapping table.

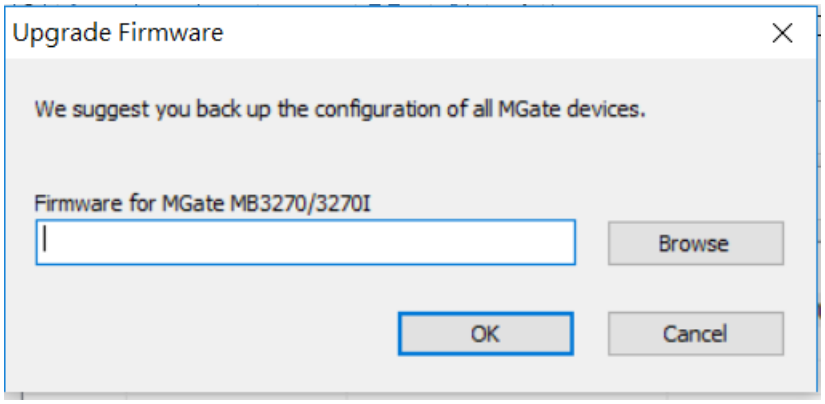


Upgrading Firmware

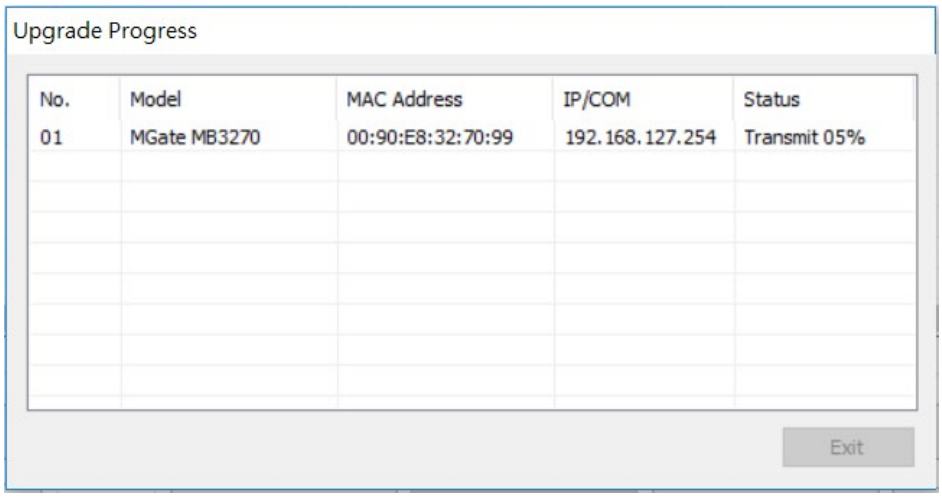
The updated MGate MB3000 Series firmware is at http://www.moxa.com. After you have downloaded the new firmware onto your PC, you can use MGate Manager to write it onto your MGate MB3000 gateway. Select the desired unit from the list in MGate Manager and click **Upgrade Firmware** to begin the process.



The dialog boxes will guide you through the process. You will need to browse your PC for the firmware file. Make sure that it matches your model.



As the firmware is written to the unit, progress is displayed in the window.



ATTENTION

DO NOT turn off the MGate's 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 cannot boot. If this happens, call Moxa RMA services.

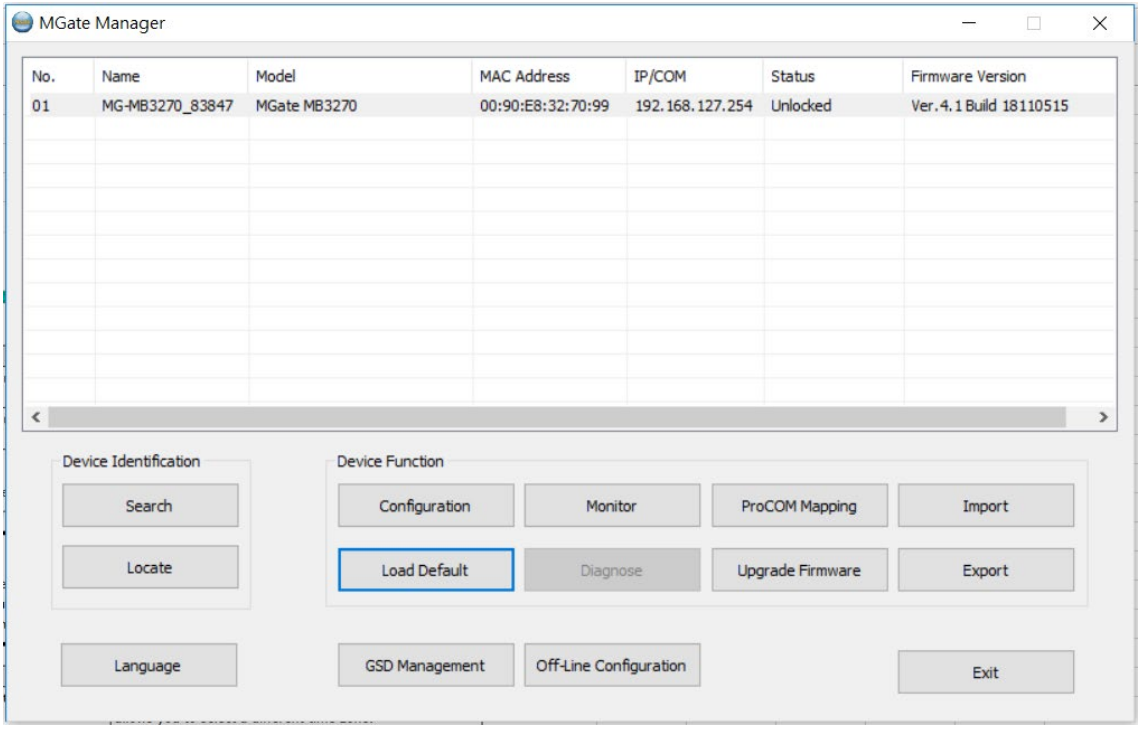
Once the firmware has been successfully written onto the unit where the status is shown as **OK**, then click **Exit** to close the Upgrade Firmware window. MGate Manager will automatically execute a Broadcast Search for all MGate MB3000 units on the LAN. Your MGate should reappear in the list of units.

ATTENTION

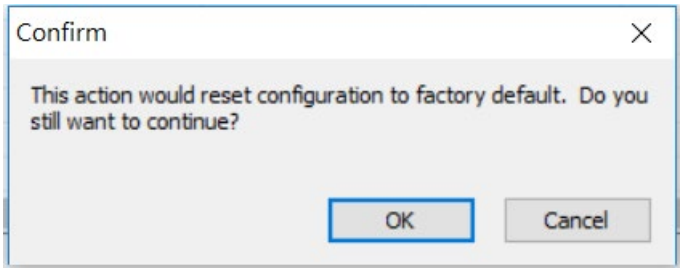
While executing firmware upgrade, it is recommended to back up the configuration file by using **Export** function. Once the latest firmware is successfully written onto the unit, it is recommended to reset the device to default by using **Load Default** function.

Load Default

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



Click **Load Default** and review the confirmation message. If you are sure you would like to reset the configuration to factory defaults, click the **OK** button. If not, click **Cancel**.



After the MGate Manager resets completely, MGate Manager will automatically execute a Broadcast Search for all MGate units on the LAN. Your MGate should reappear in the list of units.

ATTENTION

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

Export/Import

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**

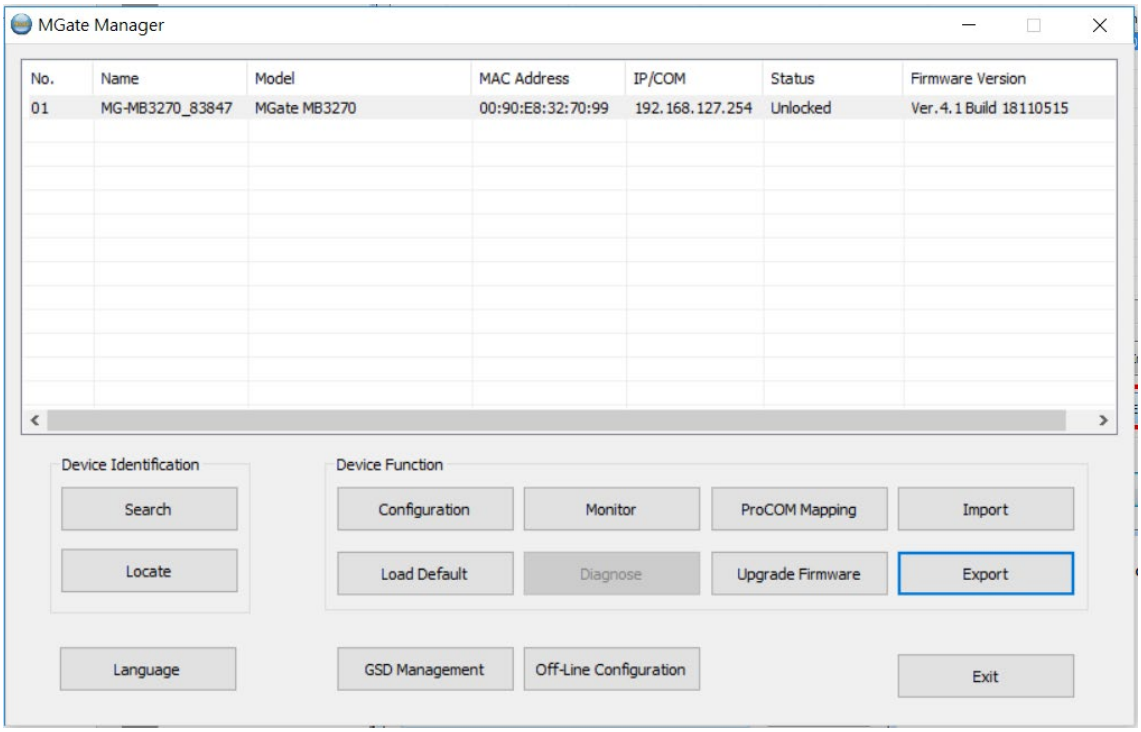
  The export function allows you to export configuration files that can be imported onto other gateways to restore malfunctioning systems within minutes.

- **Troubleshooting**

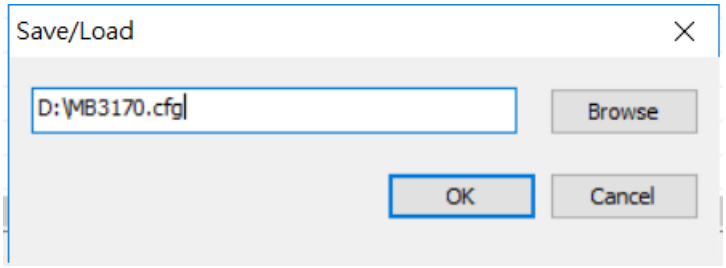
  Exported configuration files can help administrators to identify system problems that provide useful information for Moxa's Technical Service Team when maintenance visits are requested.

Export Function

The export function saves all the configuration settings and parameters of the MGate MB3000 Series in a ***.cfg** file. To begin, click the **Export** button.



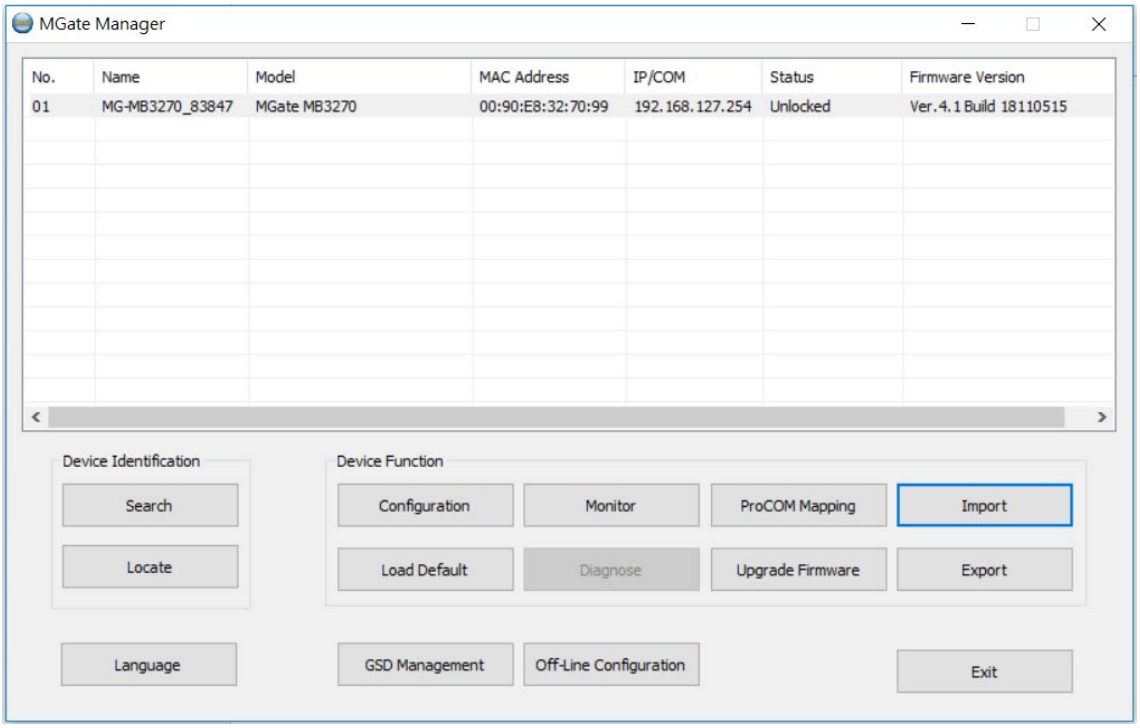
Enter a file name and use the **Browse** button to save the file to a specific path. Then, click the **OK** button.



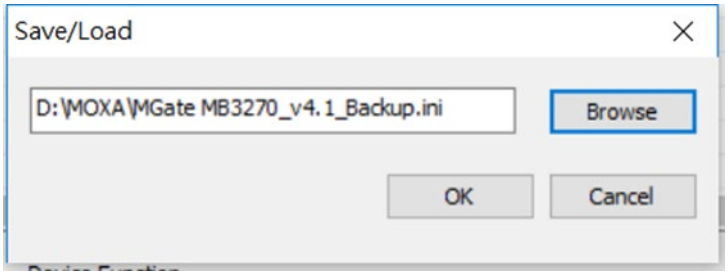
If you export the configuration file successfully, a confirmation message will pop up and the configuration file will be saved as a ***.cfg** file

Import Function

Once the file is saved, it can be imported into your target unit to duplicate the same settings. Select the target unit first and click the **Import** button to import.



Select the file you want to import, and then click the **OK** button



Wait for the MGate Manager to finish configuring the target device. If you import the configuration file successfully, a confirmation message will pop up. After closing the message dialog, the MGate Manager will automatically execute a Broadcast Search for all MGate units on the LAN. Your MGate should reappear in the list of units.

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 process, all settings will disappear, and the MGate gateway will revert to factory defaults. If this happens, import the settings from the file again.

Network Management Tool (MXstudio)

For the software and related detailed information regarding MXview and MXconfig, as well as the supported product firmware versions, please refer to the Moxa website at https://www.moxa.com/en/products/industrial-network-infrastructure/network-management-software.

When you discover a Moxa product that has not been integrated into MXview or MXconfig, you may not be able to retrieve the product information from MXview or MXconfig. To solve this, you can download the plugin file from the Moxa MGate product website and then import/install the plugin into MXview or MXconfig. After importing/installing the plugin files, the MGate products can be supported by MXview/MXconfig. Please refer to the Moxa MGate product website to download plugin files: http://www.moxa.com. For more detailed functions such as supported functions on MXview/MXconfig, please refer to the Tech Note: Configuring and Monitoring with MXview One/MXview and MXconfig.

11. Case Studies

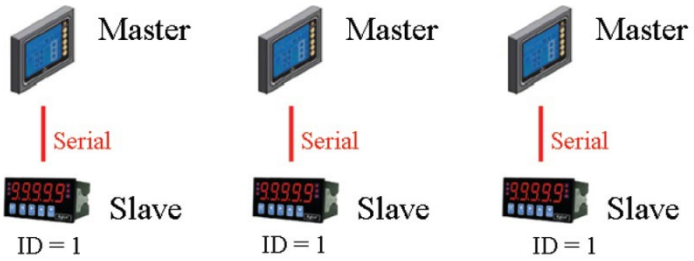
Introduction

There are many reasons a Modbus gateway might be used to integrate Modbus networks. However, every situation has its own requirements and difficulties. Users may wonder how the gateway can help, or even if the gateway is suitable for the system.

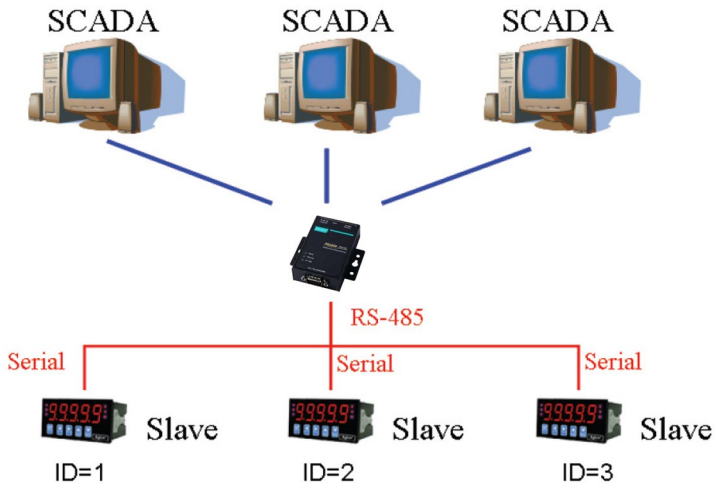
This chapter presents some case studies to guide you. If you cannot find a case like yours, it does not mean the MGate MB3000 is not suitable for you. Please contact Moxa, and we will work it out with you.

Replace Serial Clients/Masters With Ethernet Client(s)/Master(s), Slave IDs are Configurable

In this scenario, the original control system comprises several serial-based systems. In each system, a serial client/master directly controls serial server/slave devices, as follows:

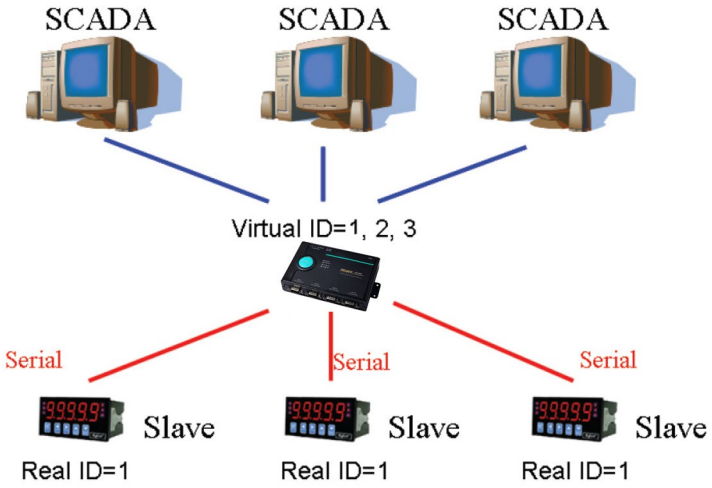


The MGate MB3000 can connect to each serial server/slave, so Ethernet SCADA clients/masters will be able to control them. However, since slave IDs cannot be repeated in a system, we will need to change the IDs of some of the servers/slaves to integrate them into a single network, as follows:



Replace Serial Clients/Masters With Ethernet Client(s)/Master(s), Slave IDs Are Fixed

Some legacy Modbus server/slave devices have fixed IDs that cannot be changed. In order to integrate the devices into a Modbus TCP network, a multiport MGate model (MB3280, MB3270, or MB3480) can be used to assign virtual slave IDs. For more information about virtual slave IDs, please refer to Chapter 9.

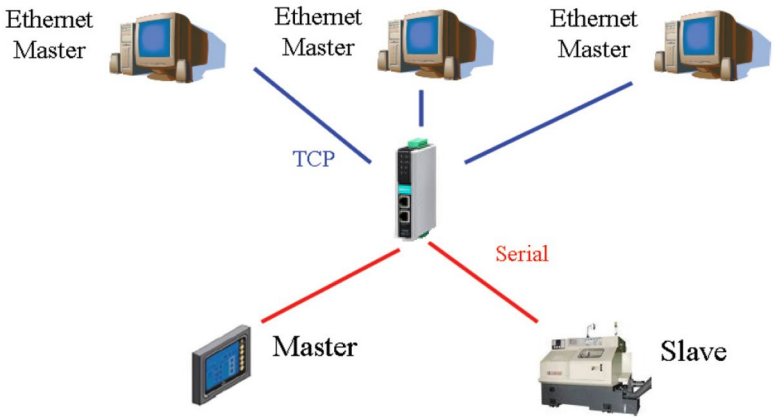


Keep Serial Client/Master and Add Ethernet Client(s)/Master(s)

In this scenario, the serial control system is a direct, low-latency system. The serial client/master must not be replaced, but Ethernet clients/masters will need to have access to the serial servers/slaves for monitoring or supervision.

Serial Redirector

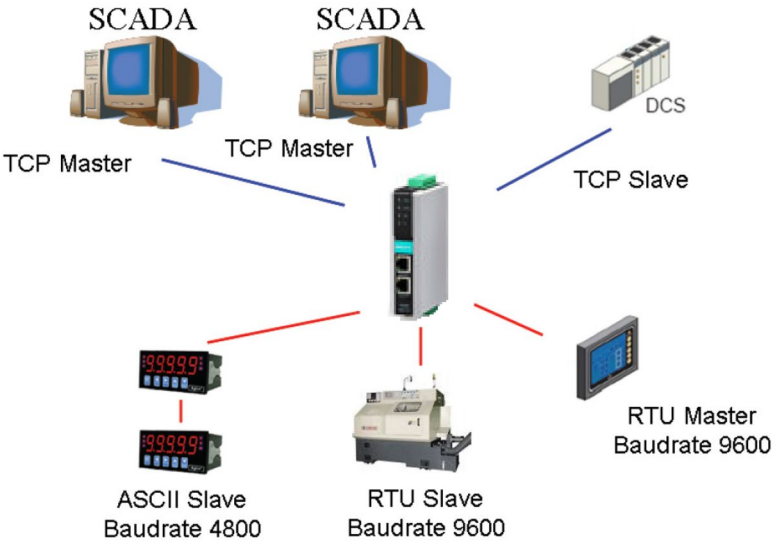
An advanced multiport MGate model (MB3270/MB3270I) supports the serial redirector function, which integrates Modbus RTU/ASCII and Modbus TCP devices simultaneously. Many serial control systems in the field and local control devices, such as HMI, are connected to serial field devices. Using Ethernet-based equipment for remote access and monitoring has become a trend. By setting up the MGate, you will keep the original serial control system and add Modbus TCP client/master (e.g., SCADA) or/and Modbus TCP server/slave (e.g., PLC) into the system. Both Modbus TCP and Modbus RTU/ASCII clients/masters can control Modbus TCP and Modbus RTU/ASCII servers/slaves. MGate can act as a "Serial Redirector" by configuring the Protocol Settings. For more information about how to set up the serial redirector function, please refer to the Serial Redirector Settings in this manual.



Integrate Modbus RTU, ASCII, and TCP at the Same Time

There can be a wide range in number, type, and sophistication of devices on the factory floor. The most common devices are simple serial-based meters, which report certain information relating to factory environment or equipment. However, other Modbus serial servers/slaves may be as complex as a manufacturing machine or a PLC controller.

When integrating these devices, there may be issues if different serial environments are used for different devices. One system may use a different baudrate than another or may use Modbus ASCII instead of Modbus RTU. The MGate MB3000 allows the different Modbus systems to be integrated into one network, regardless of the protocol or communication parameters.



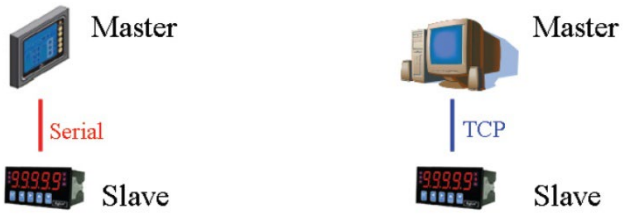
A. Modbus Overview

Introduction

Modbus is one of the most popular automation protocols in the world. It supports both serial and Ethernet devices. Many industrial devices, such as PLCs, DCSs, HMIs, instruments, meters, motors, and drivers, use Modbus as their communication standard.

Devices Are Either Clients/Masters or Servers/Slaves

All Modbus devices are classified as either a client/master or a server/slave. Clients/Masters initiate all communication with servers/slaves and do not communicate to other clients/masters. Servers/Slaves are completely passive and communicate only by sending a response to a client's/master's request.



Server/Slaves Are Identified by ID

Each Modbus slave in a system is assigned a unique ID between 1 and 247. Whenever a client/master makes a request, the request must include the ID of the intended recipient. Client/Master devices themselves have no ID.

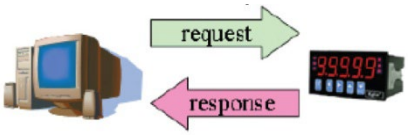
0	1 to 247	248 to 255
Broadcast address	Slave individual address	Reserved

Communication Is by Request and Response

All Modbus communication is by request and response. A client/master sends a request, and a server/slave sends a response. The client/master will wait for the server/slave's response before sending the next request. For broadcast commands, no response is expected. This three scenarios are explained below:

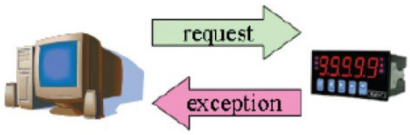
Normal

The client/master sends a request to the server/slave. The server/slave sends a response with the requested information.



Exception

The client/master sends a request to the server/slave. The server/slave may not support the command, or an error is detected, so it sends an exception to the client/master.



Broadcast

The client/master sends a broadcast command, such as a reset command. Every server/slave on the network complies with the command, and no response is sent to the client/master.

Requests Need a Time Limit

The original Modbus protocol was not designed for simultaneous requests or simultaneous clients/masters, so only one request on the network can be handled at a time. When a client/master sends a request to a server/slave, no other communication may be started until after the server/slave responds. The Modbus protocol specifies that clients/masters use a response time-out function to identify when a server/slave is nonresponsive because of device or line failure. This function allows a client/master to give up on a request if no response is received within a certain amount of time. This is illustrated as follows:

Response Timeout

The client/master sends a request. The server/slave is unresponsive for time specified by the response timeout function. The client/master gives up on the request and resumes operation, allowing another request to be initiated.

To allow for a wide range of devices, baudrates, and line conditions, actual response timeout values are left open for manufacturers to determine. This allows the Modbus protocol to accommodate a wide range of devices and systems. However, this also makes it difficult for system integrators to know what response timeout value to use during configuration, especially with older or proprietary devices.

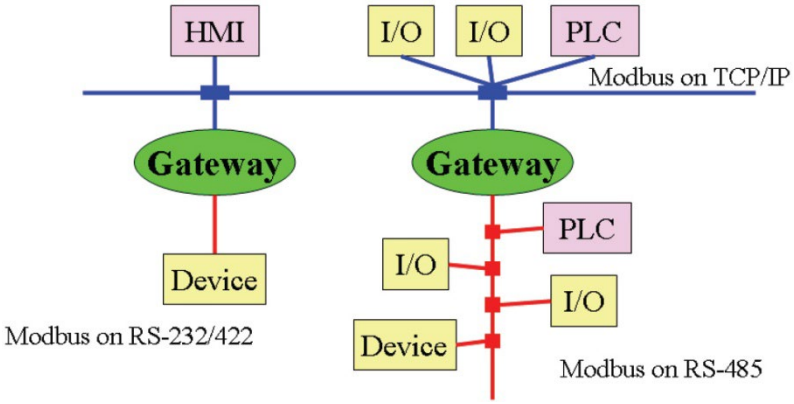
The MGate MB3000 provides an auto-detection function that tests all attached devices and recommends a response timeout value. This function saves considerable time and effort for system integrators, and it results in more accurate timeout settings.

Modbus Ethernet vs. Modbus Serial

Although Modbus is intended as an application-layer messaging protocol, the data format and communication rules for Ethernet-based Modbus TCP differ from serial-based Modbus ASCII and RTU.

The major difference between the Ethernet and serial Modbus protocols is the behavior of the communication model. Modbus ASCII and RTU allow only one request on the network at a time. Once a request is sent, no other communication on the bus is allowed until the server/slave sends a response, or until the request times out. However, Modbus TCP allows simultaneous requests on the network, from multiple clients/masters to multiple servers/slaves. TCP clients/masters cannot send more than one request at a time to a server/slave, but they can send requests to other servers/slaves before a response is received. The Modbus TCP standard recommends that servers/slaves be able to queue up to 16 requests at a time. The MGate MB3000 will queue up to 32 requests from each TCP client/master, for up to 16 or 32 TCP clients/masters.

Integrate Modbus Serial and Ethernet With Gateways



Ordinarily, Modbus TCP and Modbus ASCII/RTU cannot communicate with each other. However, with a Modbus gateway in between the Modbus serial network and the Modbus Ethernet network, TCP clients/masters can communicate with serial servers/slaves, and serial clients/masters can communicate with TCP servers/slaves.

B. SNMP Agents With MIB II and RS-232-Like Groups

The MGate MB3000 Series has built-in Simple Network Management Protocol (SNMP) agent software that supports SNMP Trap, RFC1317 and RS-232-like groups, and RFC 1213 MIB-II.

RFC1213 MIB-II Supported SNMP Variables

System MIB	Interfaces MIB	IP MIB	ICMP MIB
sysDescr	ifNumber	ipForwarding	icmpInMsgs
sysObjectID	ifIndex	ipDefaultTTL	icmpInErrors
sysUpTime	ifDescr	ipInReceives	icmpInDestUnreachs
sysContact	ifType	ipInHdrErrors	icmpInTimeExcds
sysName	ifMtu	ipInAddrErrors	icmpInParmProbs
sysLocation	ifSpeed	ipForwDatagrams	icmpInSrcQuenchs
sysServices	ifPhysAddress	ipInUnknownProtos	icmpInRedirects
	ifAdminStatus	ipInDiscards	icmpInEchos
	ifOperStatus	ipInDelivers	icmpInEchoReps
	ifLastChange	ipOutRequests	icmpInTimestamps
	ifInOctets	ipOutDiscards	icmpTimestampReps
	ifInUcastPkts	ipOutNoRoutes	icmpInAddrMasks
	ifInNUcastPkts	ipReasmTimeout	icmpInAddrMaskReps
	ifInDiscards	ipReasmReqds	icmpOutMsgs
	ifInErrors	ipReasmOKs	icmpOutErrors
	ifInUnknownProtos	ipReasmFails	icmpOutDestUnreachs
	ifOutOctets	ipFragOKs	icmpOutTimeExcds
	ifOutUcastPkts	ipFragFails	icmpOutParmProbs
	ifOutNUcastPkts	ipFragCreates	icmpOutSrcQuenchs
	ifOutDiscards	ipAdEntAddr	icmpOutRedirects
	ifOutErrors	ipAdEntIfIndex	icmpOutEchos
	ifOutQLen	ipAdEntNetMask	icmpOutEchoReps
	ifSpecific	ipAdEntBcastAddr	icmpOutTimestamps
		ipAdEntReasmMaxSize	icmpOutTimestampReps
		ipRouteDest	icmpOutAddrMasks
		ipRouteIfIndex	icmpOutAddrMaskReps
		ipRouteMetric1	
		ipRouteMetric2	
		ipRouteMetric3	
		ipRouteMetric4	
		ipRouteNextHop	
		ipRouteType	
		ipRouteProto	
		ipRouteAge	
		ipRouteMask	
		ipRouteMetric5	
		ipRouteInfo	
		ipNetToMediaIfIndex	
		ipNetToMediaPhysAddress	
		ipNetToMediaNetAddress	
		ipNetToMediaType	
		ipRoutingDiscards	

Address Translation MIB	TCP MIB	UDP MIB	SNMP MIB
atIfIndex	tcpRtoAlgorithm	udpInDatagrams	snmpInPkts
atPhysAddress	tcpRtoMin	udpNoPorts	snmpOutPkts
atNetAddress	tcpRtoMax	udpInErrors	snmpInBadVersions
	tcpMaxConn	udpOutDatagrams	snmpInBadCommunityNames
	tcpActiveOpens	udpLocalAddress	snmpInBadCommunityUses
	tcpPassiveOpens	udpLocalPort	snmpInASNParseErrs
	tcpAttemptFails		snmpInTooBigs
	tcpEstabResets		snmpInNoSuchNames
	tcpCurrEstab		snmpInBadValues
	tcpInSegs		snmpInReadOnlys
	tcpOutSegs		snmpInGenErrs
	tcpRetransSegs		snmpInTotalReqVars
	tcpConnState		snmpInTotalSetVars
	tcpConnLocalAddress		snmpInGetRequests
	tcpConnLocalPort		snmpInGetNexts
	tcpConnRemAddress		snmpInSetRequests
	tcpConnRemPort		snmpInGetResponses
	tcpInErrs		snmpInTraps
	tcpOutRsts		snmpOutTooBigs
			snmpOutNoSuchNames
			snmpOutBadValues
			snmpOutGenErrs
			snmpOutGetRequests
			snmpOutGetNexts
			snmpOutSetRequests
			snmpOutGetResponses
			snmpOutTraps
			snmpEnableAuthenTraps
			snmpSilentDrops
			snmpProxyDrops

RFC1317 RS-232-like Groups

RS-232 MIB	Async Port MIB
rs232Number	rs232AsyncPortIndex
rs232PortIndex	rs232AsyncPortBits
rs232PortType	rs232AsyncPortStopBits
rs232PortInSigNumber	rs232AsyncPortParity
rs232PortOutSigNumber	
rs232PortInSpeed	
rs232PortOutSpeed	

Input Signal MIB	Output Signal MIB
rs232InSigPortIndex	rs232OutSigPortIndex
rs232InSigName	rs232OutSigName
rs232InSigState	rs232OutSigState