

MGate MB3000 Modbus Gateway User's Manual

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MGate MB3000 Modbus Gateway

User's Manual

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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

The following topics are covered in this chapter:

- **Overview**
- **Package Checklist**
- **Product Features**

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 recently 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.

In order 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, devices must be clearly defined as either masters or slaves. Unlike other Modbus gateways, the MGate MB3000's operation modes allow users to select master or slave operation for each serial port. Not only does the MB3000 allow Ethernet masters to control serial slaves, it also allows serial masters to control Ethernet slaves. In addition, the advanced models (the MGate MB3170 and MB3270 Series) allow both Ethernet and serial slaves to be controlled by both Ethernet and serial 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
- Document & software CD
- Quick installation guide (printed)
- Power adaptor (MB3180 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

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

Product Features

- Integration of Modbus TCP and Modbus RTU/ASCII networks
- Auto device routing (patent pending)
- Up to 31 Modbus RTU/ASCII slaves per serial port
- Allow access to up to 16 (MB3180/MB3280/MB3480) or 32 (MB3170/MB3270) TCP master/client devices, connect up to 32 TCP slave/server 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, TCP port, or ID mapping
- Extend transmission distance up to 4 km / 20 km through multimode/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.

2

Getting Started

This chapter provides basic instructions for installing the MGate MB3000.

The following topics are covered in this chapter:

▣ **Connecting Power**

▣ **Connecting Serial Devices**

- RS-485 Termination and Pull High/Low Resistors
- Connecting to a Host or the Network
- Installing the Software
- Mounting the Unit

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 12~48 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 indicate 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 located 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 a 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 master device must get its own port on the unit. If you are connecting a network with both master and slave devices, the master must be connected to a separate port from the slaves. Furthermore, the master will only be able to communicate to Modbus TCP slaves, not to the ASCII or RTU 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 modify the termination and pull high/low resistor settings, please refer to the hardware reference chapter for your model.



ATTENTION

Do not use the 1 K Ω 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 located 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 purposes, 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 indicate a live Ethernet connection.

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

Installing the Software

The Windows management utility is installed from the Document and Software CD. Follow the onscreen instructions after inserting the CD. 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.

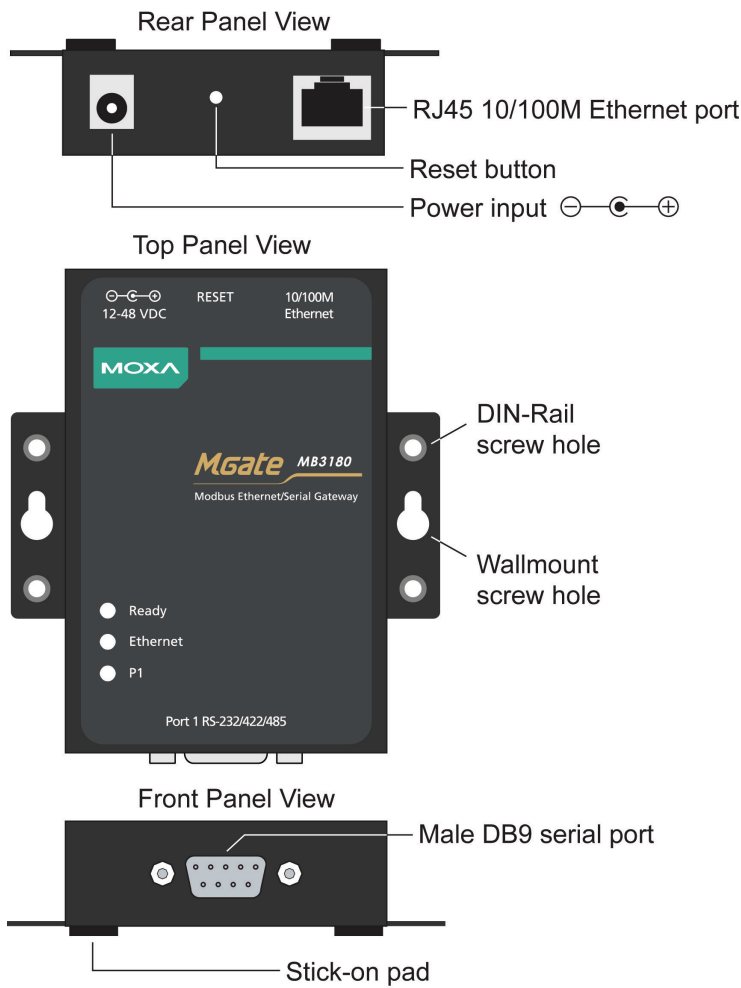
Hardware: MB3180

This chapter provides hardware information for the MGate MB3180.

The following topics are covered in this chapter:

- **Panel Layout**
- **LED Indicators**
- **Dimensions**
- **Jumpers**
- **DIN-Rail and Wall Mounting**
- **Specifications**

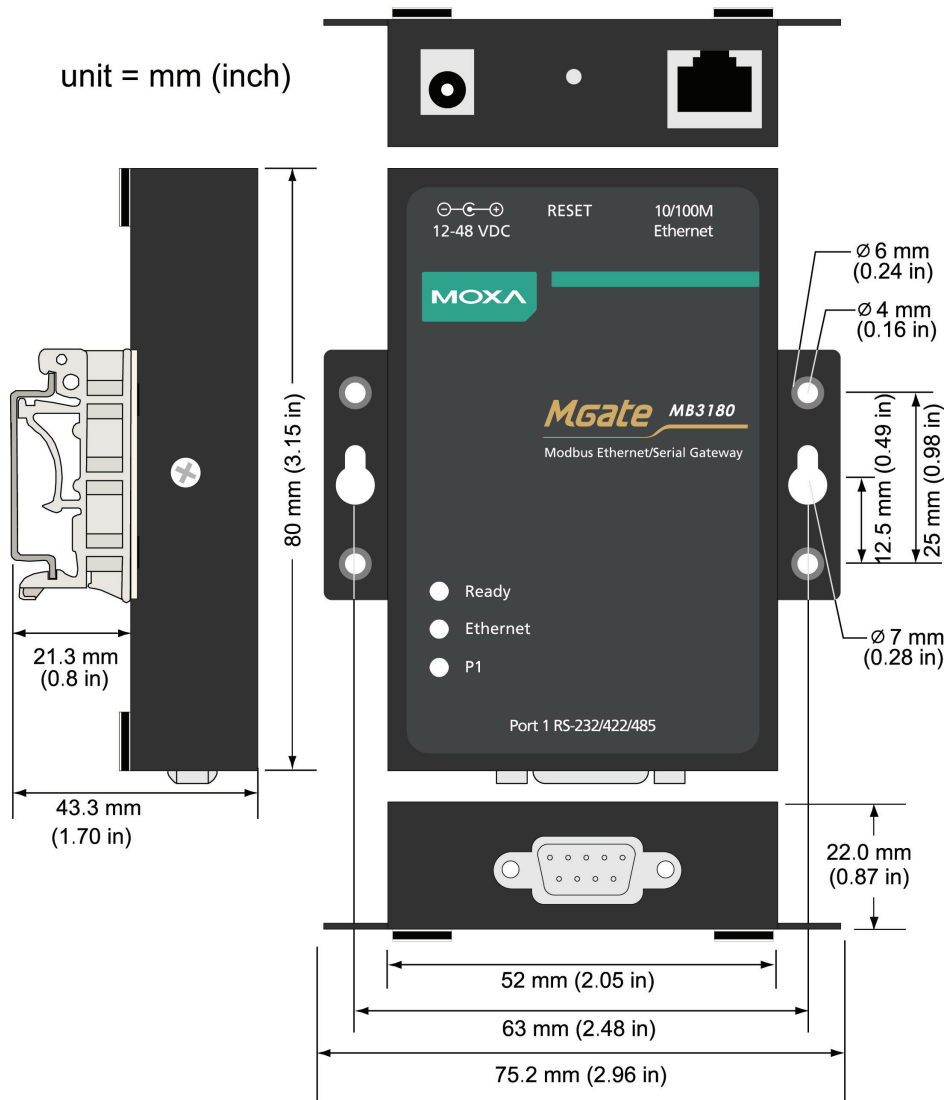
Panel Layout



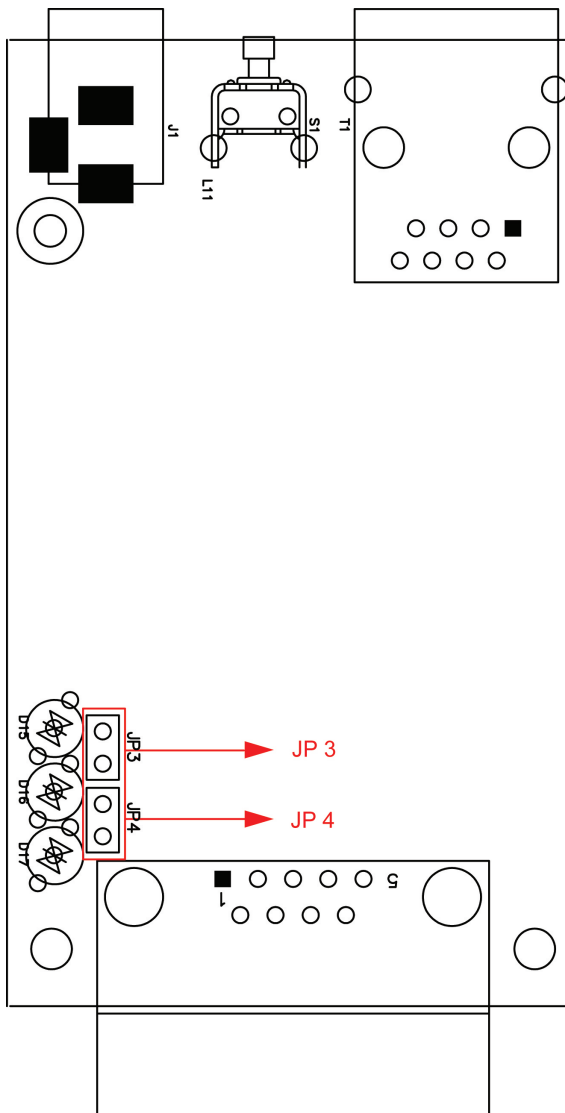
LED Indicators

Name	Color	Function
Ready	Red	Steady on: Power is on and unit is booting up. Blinking: Indicates an IP conflict, or the DHCP or BOOTP server is not responding properly.
	Green	Steady on: Power is on and 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 set the pull high/low resistors to **150 K Ω** , leave jumpers **JP3** and **JP4** open (not shorted). This is the default setting.

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

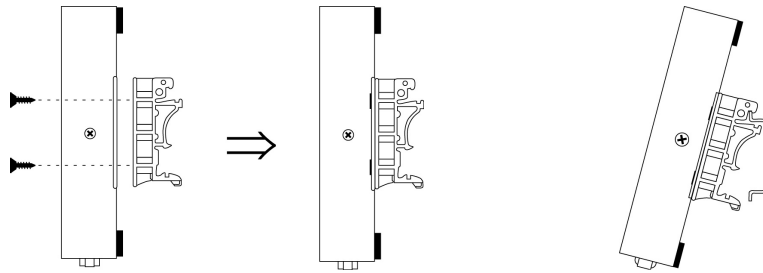


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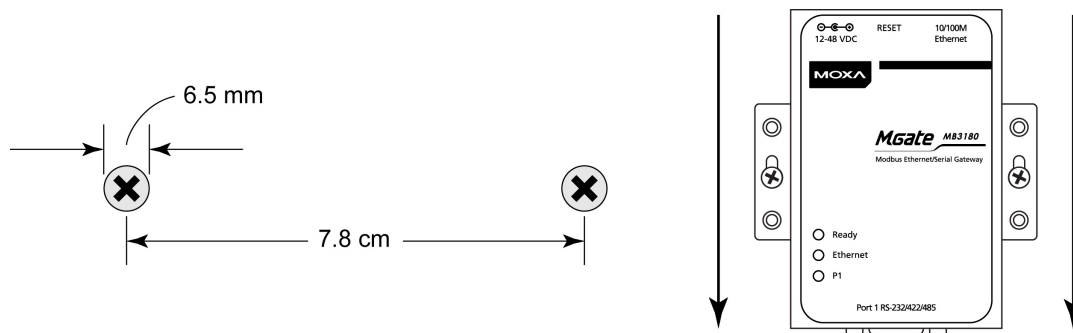
Do not use the 1 K Ω pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

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 each screw 6.5 mm or less in diameter, and the shaft should be 3 mm or less in diameter. Make sure to leave about 2 mm of space between the head and the wall.



Specifications

LAN

Ethernet 10/100 Mbps, RJ45, Auto MDI/MDIX
 Protection Built-in 1.5 kV magnetic isolation

Serial Interface

Interface RS-232/422/485
 No. of Ports 1 port
 Connector Type DB9 (male)
 Signals
 RS-232: TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
 RS-422: Tx+, Tx-, Rx+, Rx-, GND
 RS-485 (2-wire): Data+, Data-, GND
 RS-485 (4-wire) Tx+, Tx-, Rx+, Rx-, GND

Serial Line Protection 15 kV ESD for all signals
 RS-485 Data Direction Patented ADDC™

Serial Communication Parameters

Parity None, Even, Odd, Space, Mark
 Data Bits 7, 8
 Stop Bits 1, 2
 Flow Control RTS/CTS
 Transmission Speed 50 bps to 921.6 Kbps

Software Features

Operation Mode RTU Slave, RTU Master, ASCII Slave, ASCII Master
 Utilities MGate Manager
 Multi-Masters and Multi-Request 16 simultaneous TCP masters, 32 simultaneous requests for each TCP master

Power Requirements

Power Input	12 to 48 VDC
Power Connector	Power jack
Power Consumption	200 mA@12 VDC, 60 mA@48 VDC

Environmental Limits

Operating Temperature	0 to 60°C (32 to 140°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Ambient Relative Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 2000 m (795 hPa); higher altitudes on demand

Note: Please contact Moxa if you require products guaranteed to function properly at higher altitudes.

Standards and Certifications

Safety:	UL 60950-1, EN 60950-1
EMC:	CE, FCC
EMI:	EN 55032 Class A, FCC Part 15 Subpart B Class A
EMS:	EN 55024, EN 61000-4-2 (ESD) Level 2, EN 61000-4-3 (RS) Level 2, EN 61000-4-4 (EFT) Level 2, EN 61000-4-5 (Surge) Level 2, EN 61000-4-6 (CS) Level 2, EN 61000-4-8 (PFMF) Level 1, EN 61000-4-11

Reliability

MTBF (mean time between failures):	MGate M3180: 628,376 hrs
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Warranty

Period	5 years
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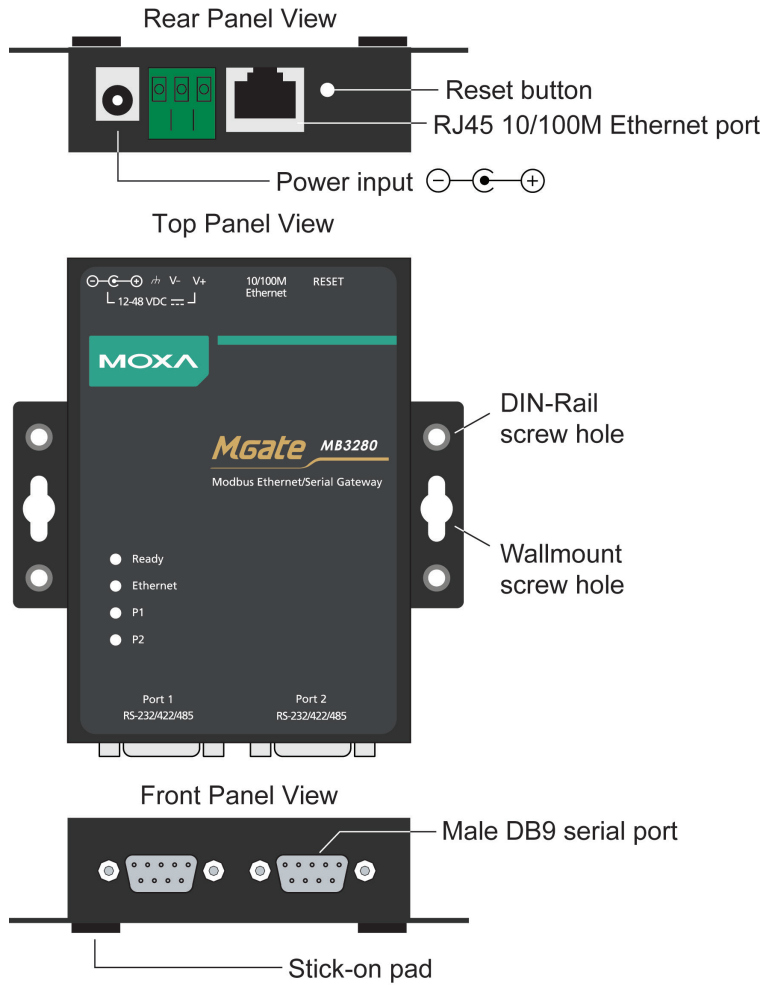
Hardware: MB3280

This chapter provides hardware information for the MGate MB3280.

The following topics are covered in this chapter:

- **Panel Layout**
- **LED Indicators**
- **Dimensions**
- **Jumpers**
- **DIN-Rail and Wall Mounting**
- **Specifications**

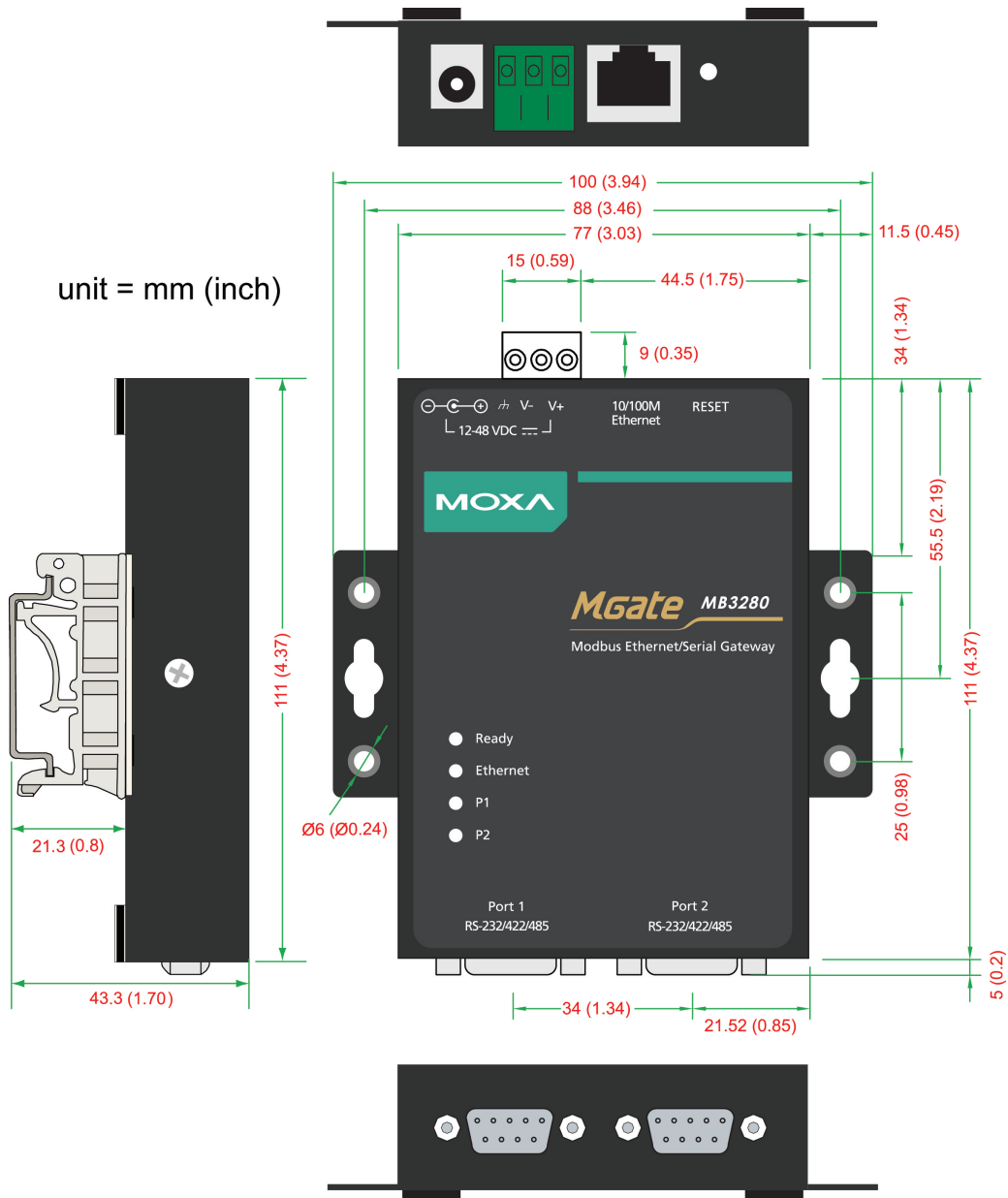
Panel Layout



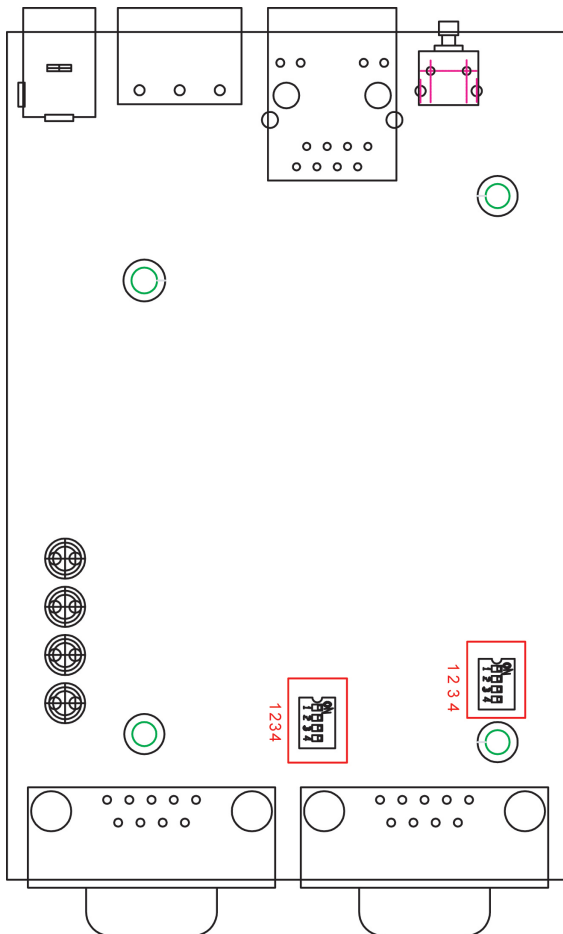
LED Indicators

Name	Color	Function
Ready	Red	Steady on: Power is on and unit is booting up. Blinking: Indicates an IP conflict, or the DHCP or BOOTP server is not responding properly.
	Green	Steady on: Power is on and 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 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.

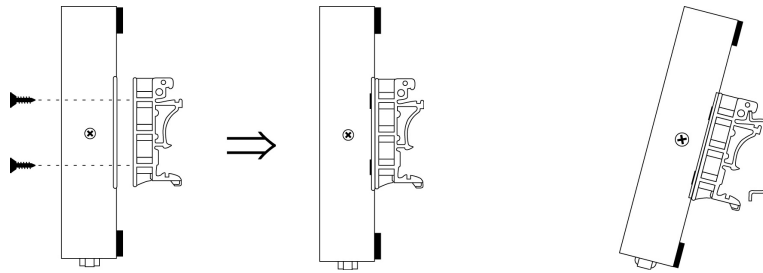


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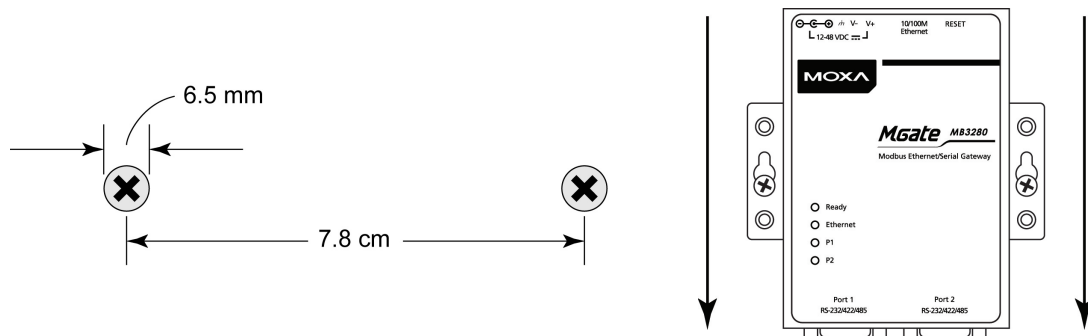
Do not use the 1 KΩ pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

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 each screw 6.5 mm or less in diameter, and the shaft should be 3 mm or less in diameter. Make sure to leave about 2 mm of space between the head and the wall.



Specifications

LAN

Ethernet 10/100 Mbps, RJ45, Auto MDI/MDIX
Protection Built-in 1.5 kV magnetic isolation

Serial Interface

Interface RS-232/422/485
No. of Ports 2 ports
Connector Type DB9 (male)
Signals
RS-232: TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
RS-422: Tx+, Tx-, Rx+, Rx-, GND
RS-485 (2-wire): Data+, Data-, GND
RS-485 (4-wire): Tx+, Tx-, Rx+, Rx-, GND

Serial Line Protection 15 kV ESD for all signals
RS-485 Data Direction Patented ADDC™

Serial Communication Parameters

Parity None, Even, Odd, Space, Mark
Data Bits 7, 8
Stop Bits 1, 2
Flow Control RTS/CTS
Transmission Speed 50 bps to 921.6 Kbps

Software Features

Operation Mode RTU Slave, RTU Master, ASCII Slave, ASCII Master
Utilities MGate Manager
Multi-Masters and Multi-Request 16 simultaneous TCP masters, 32 simultaneous requests for each TCP master

Power Requirements

Power Input	12 to 48 VDC
Power Socket	Power jack and terminal block
Power Consumption	250 mA@12 VDC, 90 mA@48 VDC

Environmental Limits

Operating Temperature	0 to 60°C (32 to 140°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Ambient Relative Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 2000 m (795 hPa); higher altitudes on demand

Note: Please contact Moxa if you require products guaranteed to function properly at higher altitudes.

Standards and Certifications

Safety:	UL 60950-1, EN 60950-1
EMC:	CE, FCC
EMI:	EN 55032 Class A, FCC Part 15 Subpart B Class A
EMS:	EN 55024, EN 61000-4-2 (ESD) Level 2, EN 61000-4-3 (RS) Level 2, EN 61000-4-4 (EFT) Level 2, EN 61000-4-5 (Surge) Level 2, EN 61000-4-6 (CS) Level 2, EN 61000-4-8 (PFMF) Level 1, EN 61000-4-11

Reliability

MTBF (mean time between failures):	MGate M3280: 503,029 hrs
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Warranty

Period	5 years
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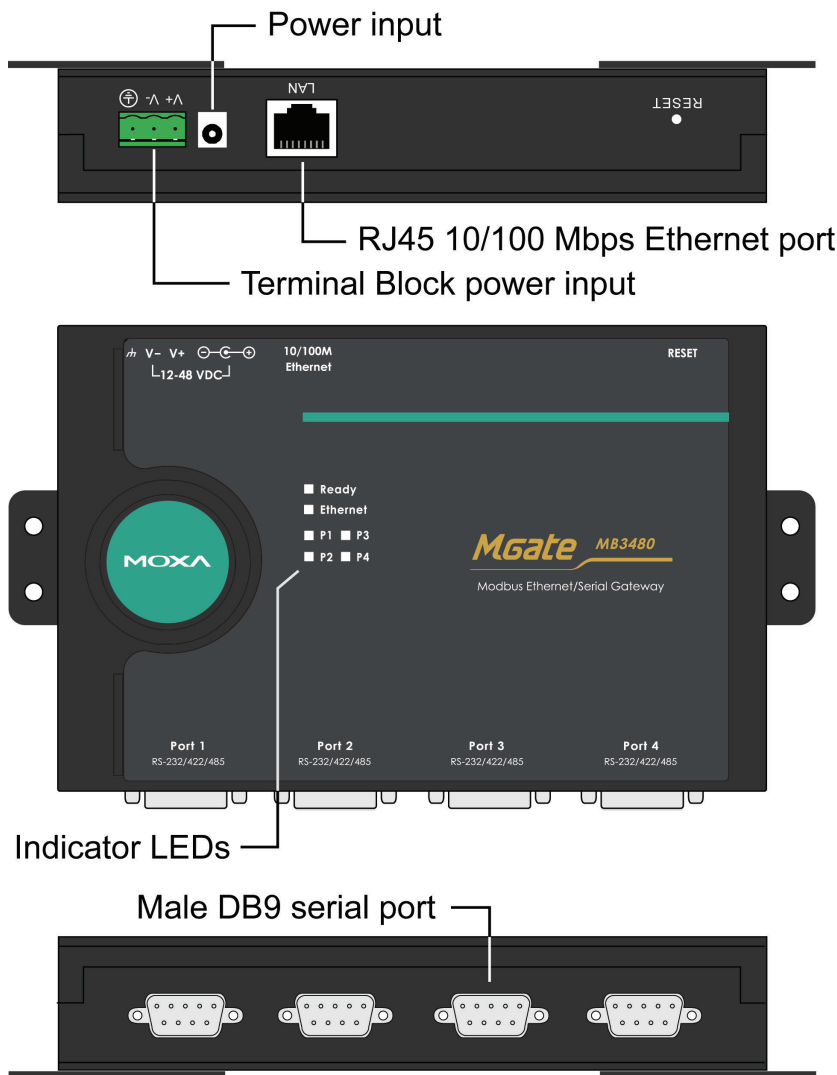
Hardware: MB3480

This chapter provides hardware information for the MGate MB3480.

The following topics are covered in this chapter:

- ❑ **Panel Layout**
- ❑ **LED Indicators**
- ❑ **Dimensions**
- ❑ **Jumpers**
- ❑ **DIN-Rail and Wall Mounting**
- ❑ **Specifications**

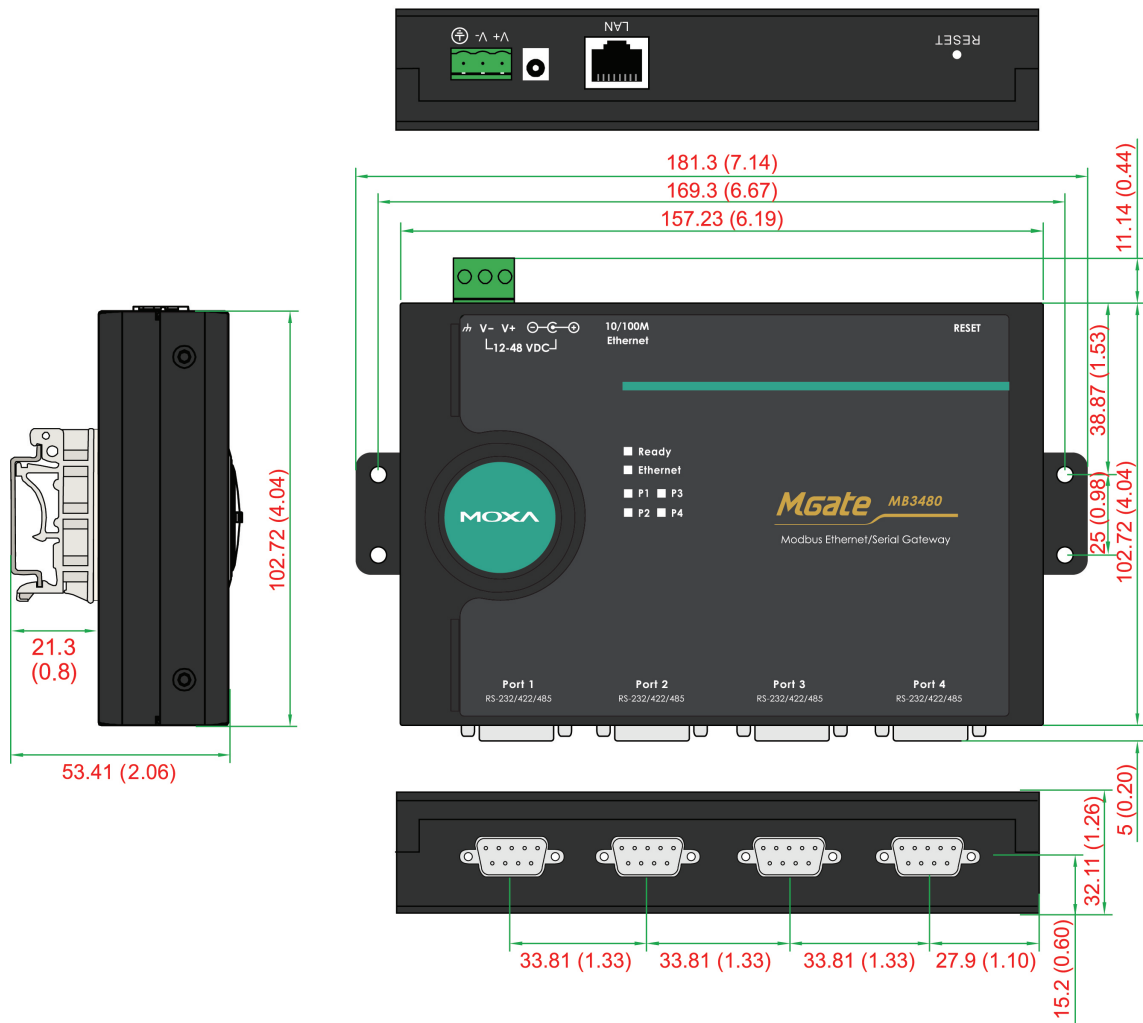
Panel Layout



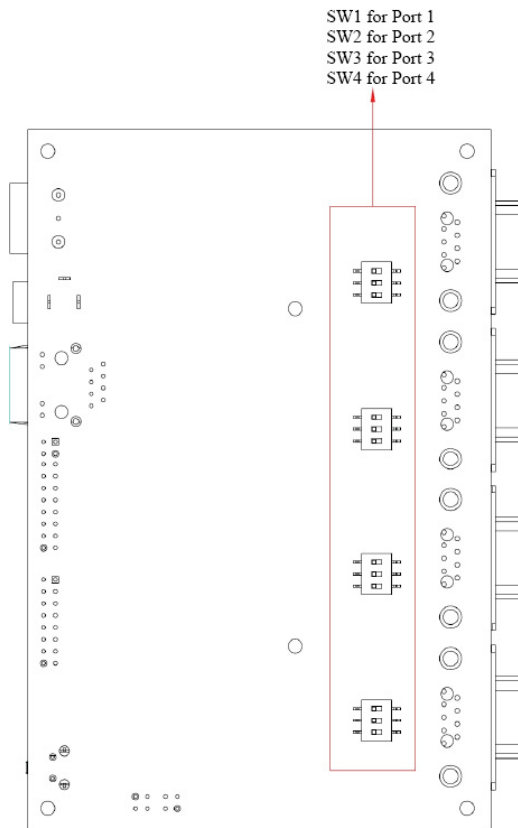
LED Indicators

Name	Color	Function
Ready	Red	Steady on: Power is on and unit is booting up. Blinking: Indicates an IP conflict, or the DHCP or BOOTP server is not responding properly.
	Green	Steady on: Power is on and 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 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



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 K Ω , 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 K Ω , set switches 1 and 2 on the port's assigned DIP switch to ON.

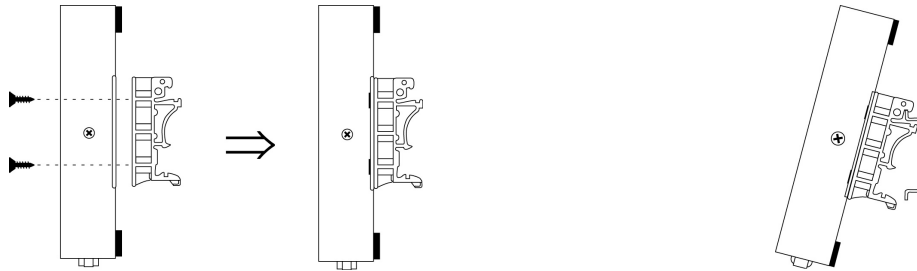


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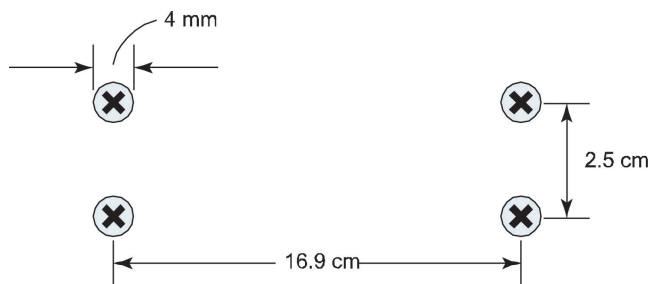
Do not use the 1 K Ω pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

DIN-Rail and Wall Mounting

Mounting on a DIN-rail: You will first need to attach the mounting plates (included) to the unit. Attach the DIN-rail accessories to the mounting plates 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 each screw should be 6 mm or less in diameter, and the shaft should be 3 mm or less in diameter. Make sure to leave about 5 mm of space between the head and the wall.

Specifications

LAN

Ethernet 10/100 Mbps, RJ45, Auto MDI/MDIX
 Protection Built-in 1.5 kV magnetic isolation

Serial Interface

Interface RS-232/422/485
 No. of Ports 4 ports
 Connector Type DB9 (male)
 Signals
 RS-232: TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
 RS-422: Tx+, Tx-, Rx+, Rx-, GND
 RS-485 (2-wire): Data+, Data-, GND
 RS-485 (4-wire) Tx+, Tx-, Rx+, Rx-, GND

Serial Line Protection 15 kV ESD for all signals
 RS-485 Data Direction Patented ADDC™

Serial Communication Parameters

Parity None, Even, Odd, Space, Mark
 Data Bits 7, 8
 Stop Bits 1, 2
 Flow Control RTS/CTS
 Transmission Speed 50 bps to 921.6 Kbps

Software Features

Operation Mode RTU Slave, RTU Master, ASCII Slave, ASCII Master
 Utilities MGate Manager
 Multi-Masters and Multi-Request 16 simultaneous TCP masters, 32 simultaneous requests for each TCP master

Power Requirements

Power Input	12 to 48 VDC
Power Socket	Power jack and terminal block
Power Consumption	385 mA@12 VDC, 110 mA@48 VDC

Environmental Limits

Operating Temperature	0 to 60°C (32 to 140°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Ambient Relative Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 2000 m (795 hPa); higher altitudes on demand

Note: Please contact Moxa if you require products guaranteed to function properly at higher altitudes.

Standards and Certifications

Safety:	UL 60950-1, EN 60950-1
EMC:	CE, FCC
EMI:	EN 55032 Class A, FCC Part 15 Subpart B Class A
EMS:	EN 55024, EN 61000-4-2 (ESD) Level 2, EN 61000-4-3 (RS) Level 2, EN 61000-4-4 (EFT) Level 2, EN 61000-4-5 (Surge) Level 2, EN 61000-4-6 (CS) Level 2, EN 61000-4-8 (PFMF) Level 1, EN 61000-4-11

Reliability

MTBF (mean time between failures):	MGate M3480: 295,812 hrs
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Warranty

Period	5 years
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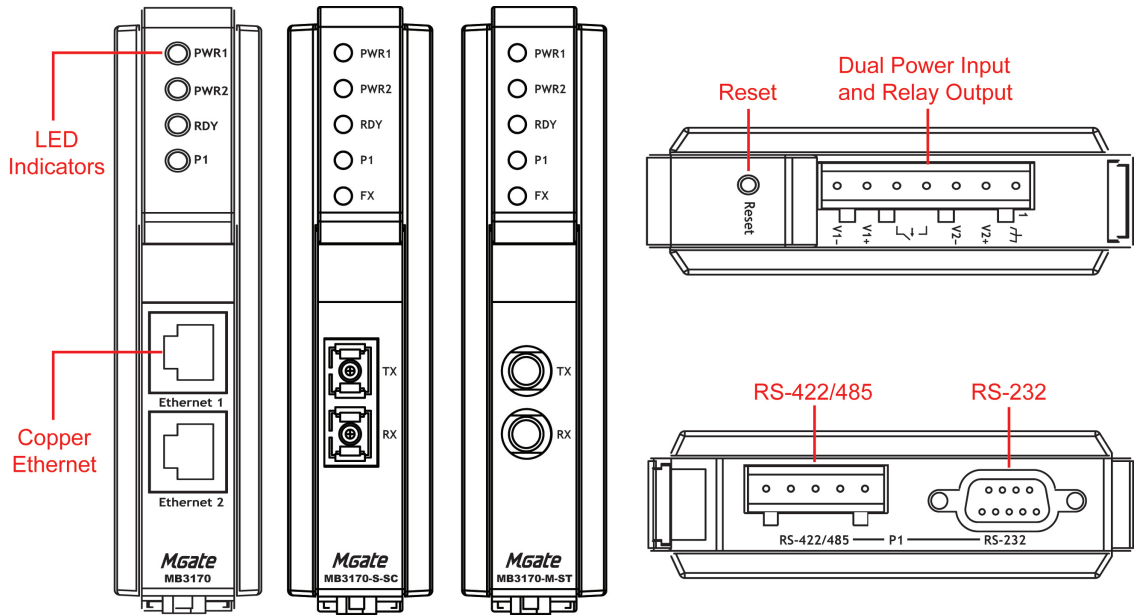
Hardware: MB3170, MB3170I

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

The following topics are covered in this chapter:

- **Panel Layout**
- **LED Indicators**
- **Dimensions**
- **Jumpers**
- **DIN-Rail and Wall Mounting**
- **Specifications**

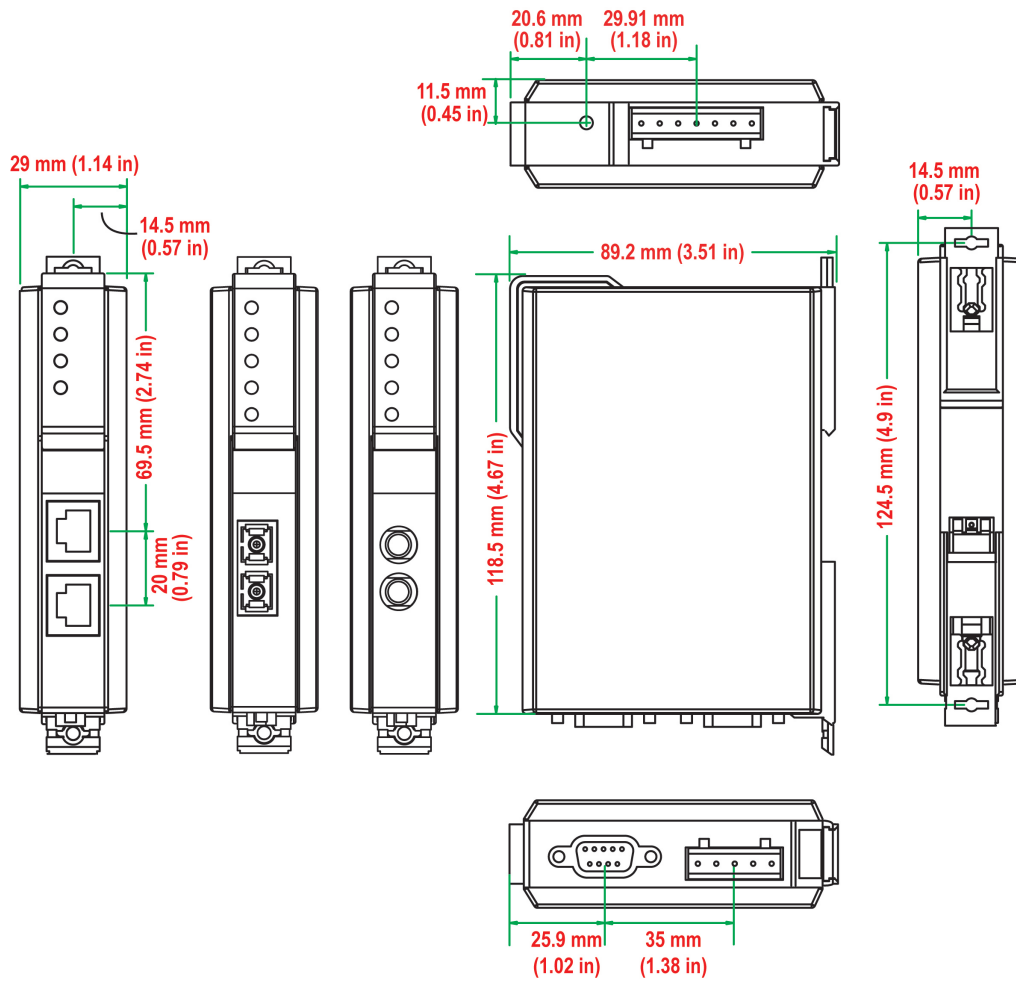
Panel Layout



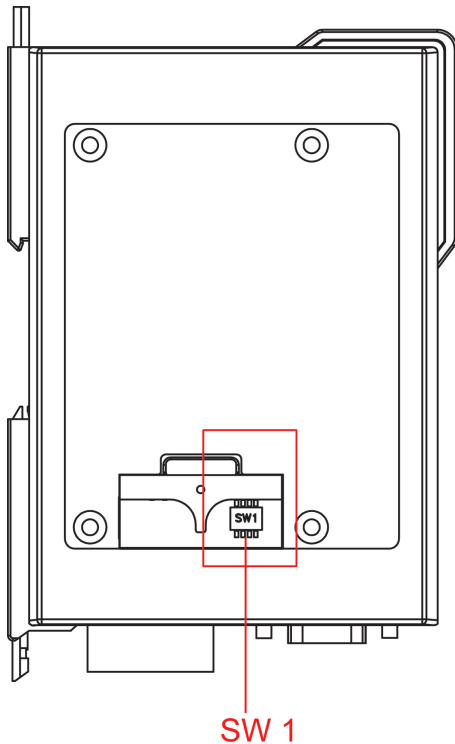
LED Indicators

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 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 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



Jumpers



The DIP switches are located 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 K Ω , set switches 1 and 2 to OFF. This is the default setting.

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

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



ATTENTION

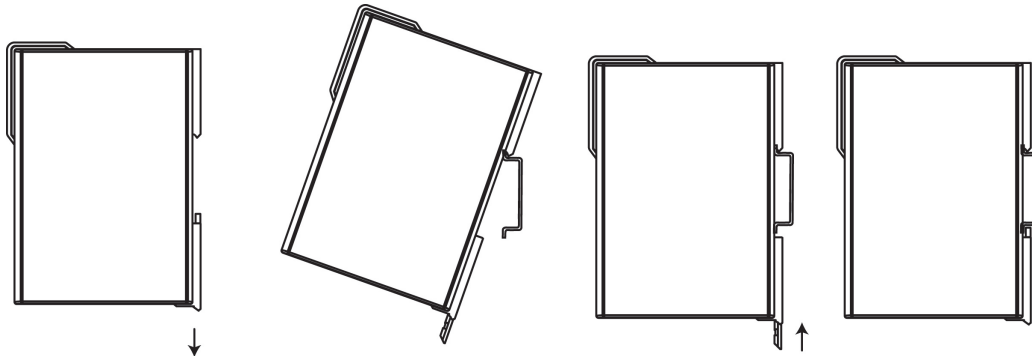
Do not use the 1 K Ω pull high/low setting on the MGate MB3000 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

DIN-Rail and Wall Mounting

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

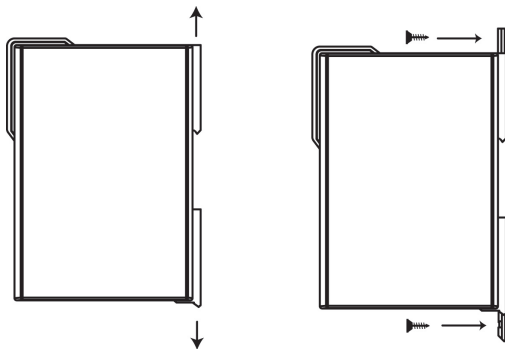
Mounting on a DIN-rail:

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.



Specifications

LAN

Ethernet	10/100 Mbps, RJ45, Auto MDI/MDIX
Number of Ports	2 (1 IP, Ethernet cascade)
Connector	8-pin RJ45
Protection	Built-in 1.5 kV magnetic isolation

Optical Fiber Interface

		100BaseFX		
		Multimode		Single-mode
Fiber Cable Type		OM1	50/125 μm	G.652
			800 MHz*km	
Typical Distance		4 km	5 km	40 km
Wavelength	Typical (nm)	1300		1310
	TX Range (nm)	1260 to 1360		1280 to 1340
	RX Range (nm)	1100 to 1600		1100 to 1600
Optical Power	TX Range (dBm)	-10 to -20		0 to -5
	RX Range (dBm)	-3 to -32		-3 to -34
	Link Budget (dB)	12		29
	Dispersion Penalty (dB)	3		1

Note: When connecting a single-mode fiber transceiver, we recommend using an attenuator to prevent damage caused by excessive optical power.

Note: Compute the "typical distance" of a specific fiber transceiver as follows: Link budget (dB) > dispersion penalty (dB) + total link loss (dB).

Serial Interface

Interface	RS-232/422/485
No. of Ports	1 port
Connector Type	DB9 (male) for RS-232, terminal block for RS-422/485
Signals	RS-232: TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
	RS-422: Tx+, Tx-, Rx+, Rx-, GND
	RS-485 (2-wire): Data+, Data-, GND
	RS-485 (4-wire): Tx+, Tx-, Rx+, Rx-, GND
Serial Line Protection	15 kV ESD for all signals
Magnetic Isolation Protection	2 kV (for -I model)
RS-485 Data Direction	Patented ADDC™

Serial Communication Parameters

Parity	None, Even, Odd, Space, Mark
Data Bits	7, 8
Stop Bits	1, 2
Flow Control	RTS/CTS
Transmission Speed	50 bps to 921.6 Kbps

Software Features

Operation Mode	RTU Slave, RTU Master, ASCII Slave, ASCII Master
Utilities	MGate Manager
Multi-Masters and Multi-Request	32 simultaneous TCP masters, 32 simultaneous requests for each TCP master

Power Requirements

Power Input	12 to 48 VDC
Power Socket	Terminal block
Power Consumption	MB3170: 435 mA @ 12 V, 218 mA @ 24 V, 109 mA @ 48 V
	MB3170I: 555 mA @ 12 V, 278 mA @ 24 V, 138 mA @ 48 V
Relay Output	1 digital relay output to alarm (normal close): Current-carrying capacity 1 A @ 30 VDC

Environmental Limits

Operating Temperature	0 to 60°C (32 to 140°F) -40 to 75°C (-40 to 167°F) for “-T” models
Storage Temperature	-40 to 85°C (-40 to 185°F)
Ambient Relative Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 2000 m (795 hPa); higher altitudes on demand

Note: Please contact Moxa if you require products guaranteed to function properly at higher altitudes.

Standards and Certifications

Safety:	UL 508, EN 60950-1
Hazardous Location	UL/cUL Class 1 Division 2 Groups A/B/C/D, ATEX Zone 2 Ex nA IIC T3 Gc, IECEX (-IEX model only)
EMC:	CE, FCC
EMI:	EN 55032 Class A, FCC Part 15 Subpart B Class A
EMS:	EN 55024, EN 61000-4-2 (ESD) Level 3, EN 61000-4-3 (RS) Level 3, EN 61000-4-4 (EFT) Level 4, EN 61000-4-5 (Surge) Level 3, EN 61000-4-6 (CS) Level 3, EN 61000-4-8 (PFMF) Level 1, EN 61000-4-11
Marine:	DNV
Shock:	IEC 60068-2-27
Freefall:	IEC 60068-2-32
Vibration:	IEC 60068-2-6

Reliability

MTBF (mean time between failures):	MGate MB3170: 210,794 hrs.
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Warranty

Period	5 years
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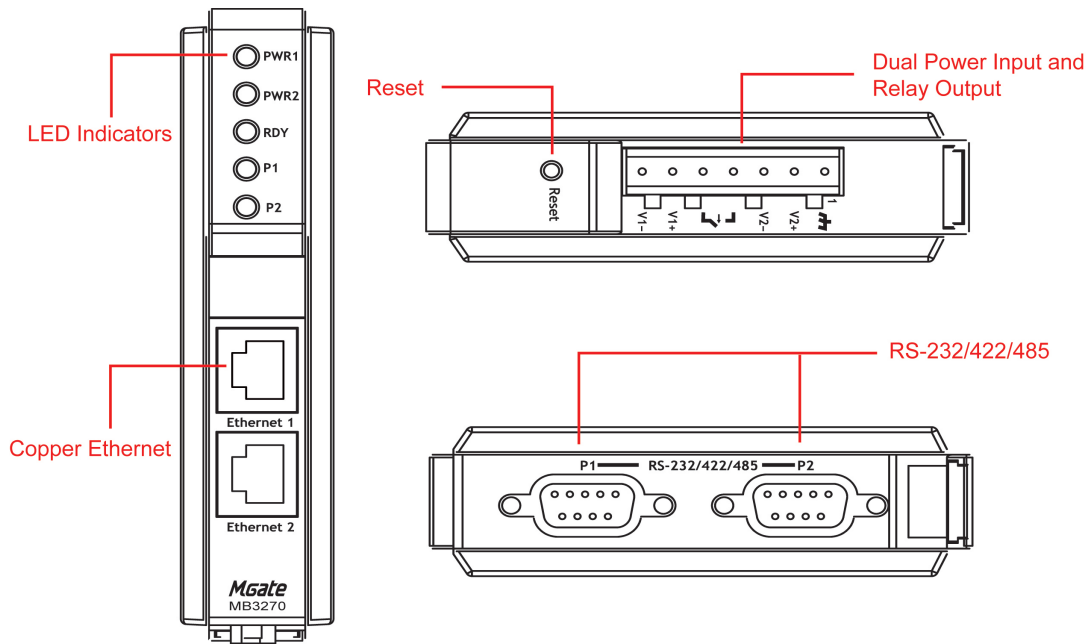
Hardware: MB3270, MB3270I

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

The following topics are covered in this chapter:

- **Panel Layout**
- **LED Indicators**
- **Dimensions**
- **Jumpers**
- **DIN-Rail and Wall Mounting**
- **Specifications**

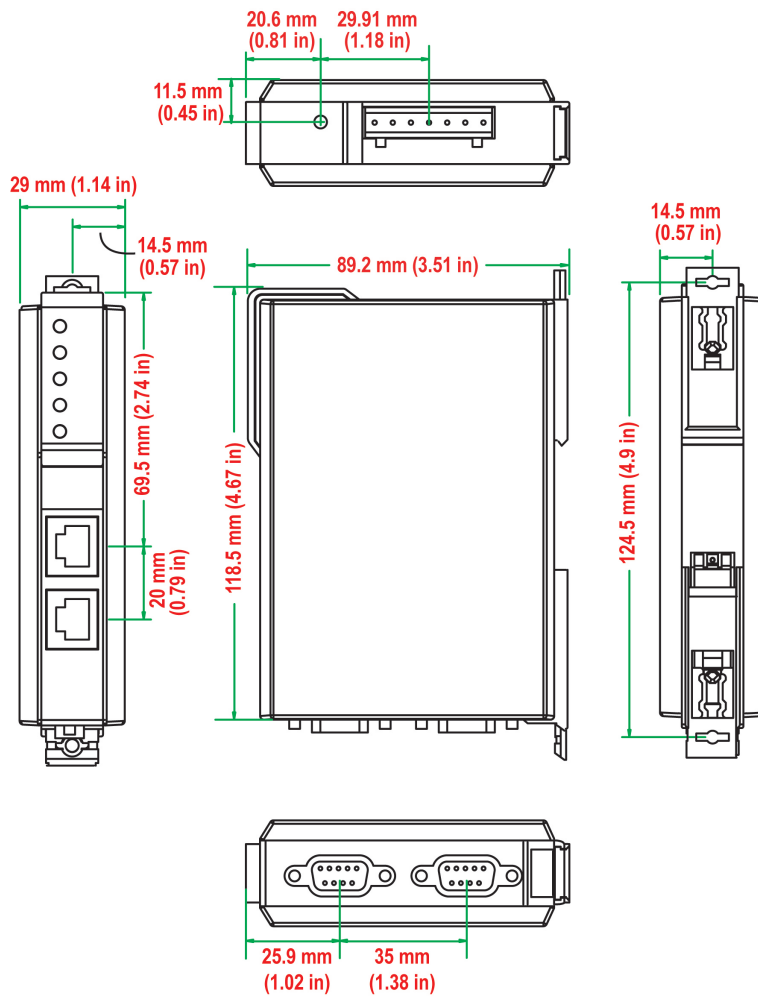
Panel Layout



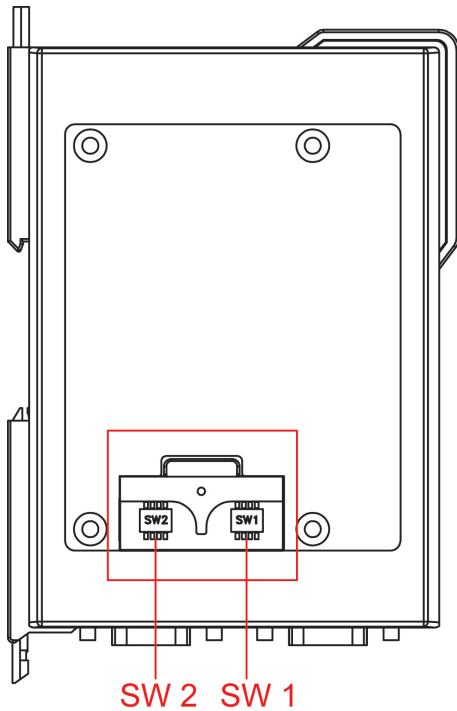
LED Indicators

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 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 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 connections.
	Green	100 Mbps Ethernet connections.
	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



The DIP switches are located 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 K Ω , 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 K Ω , 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.



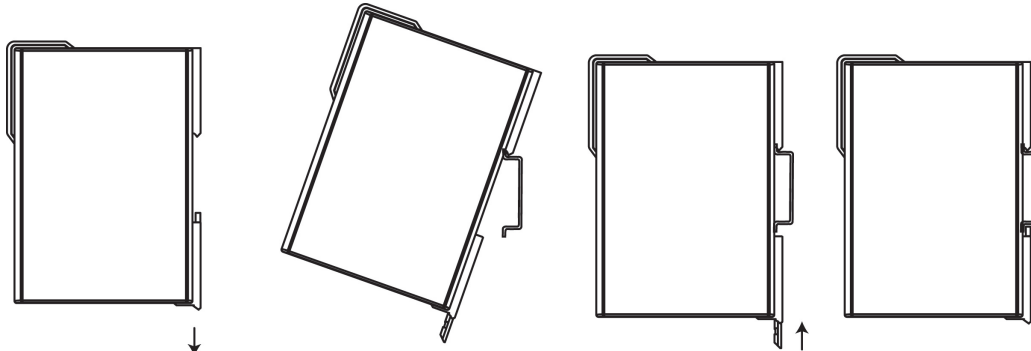
ATTENTION

Do not use the 1 K Ω 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.

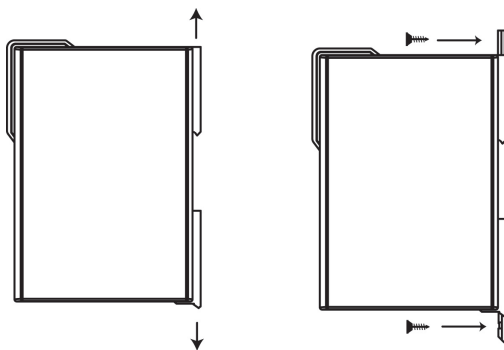
DIN-Rail and Wall Mounting

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.



Specifications

LAN

Ethernet 10/100 Mbps, RJ45, Auto MDI/MDIX
 Protection Built-in 1.5 kV magnetic isolation

Serial Interface

Interface RS-232/422/485
 No. of Ports 2 ports
 Connector Type DB9 (male)
 Signals
 RS-232: TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
 RS-422: Tx+, Tx-, Rx+, Rx-, GND
 RS-485 (2-wire): Data+, Data-, GND
 RS-485 (4-wire): Tx+, Tx-, Rx+, Rx-, GND
 Serial Line Protection 15 kV ESD for all signals
 Magnetic Isolation Protection 2 kV (for -I model)
 RS-485 Data Direction Patented ADDC™

Serial Communication Parameters

Parity None, Even, Odd, Space, Mark
 Data Bits 7, 8
 Stop Bits 1, 2
 Flow Control RTS/CTS
 Transmission Speed 50 bps to 921.6 Kbps

Software Features

Operation Mode	RTU Slave, RTU Master, ASCII Slave, ASCII Master
Utilities	MGate Manager
Multi-Masters and Multi-Request	32 simultaneous TCP masters, 32 simultaneous requests for each TCP master

Power Requirements

Power Input	12 to 48 VDC
Power Socket	Terminal block
Power Consumption	MB3270: 435 mA @ 12 V, 218 mA @ 24 V, 109 mA @ 48 V MB3270I: 510 mA @ 12 V, 255 mA @ 24 V, 128 mA @ 48 V
Relay Output	1 digital relay output to alarm (normal close): Current-carrying capacity 1 A @ 30 VDC

Environmental Limits

Operating Temperature	0 to 60°C (32 to 140°F) -40 to 75°C (-40 to 167°F) for "-T" models
Storage Temperature	-40 to 85°C (-40 to 185°F)
Ambient Relative Humidity:	5 to 95% (non-condensing)
Altitude:	Up to 2000 m (795 hPa); higher altitudes on demand

Note: Please contact Moxa if you require products guaranteed to function properly at higher altitudes.

Standards and Certifications

Safety:	UL 508, EN 60950-1
Hazardous Location	UL/cUL Class 1 Division 2 Groups A/B/C/D, ATEX Zone 2 Ex nA IIC T3 Gc, IECEx (-IEX model only)
EMC:	CE, FCC
EMI:	EN 55032 Class A, FCC Part 15 Subpart B Class A
EMS:	EN 55024, EN 61000-4-2 (ESD) Level 3, EN 61000-4-3 (RS) Level 3, EN 61000-4-4 (EFT) Level 4, EN 61000-4-5 (Surge) Level 3, EN 61000-4-6 (CS) Level 3, EN 61000-4-8 (PFMF) Level 1, EN 61000-4-11
Marine:	DNV
Shock:	IEC 60068-2-27
Freefall:	IEC 60068-2-32
Vibration:	IEC 60068-2-6

Reliability

MTBF (mean time between failures):	MGate MB3270: 125,234 hrs
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Warranty

Period	5 years
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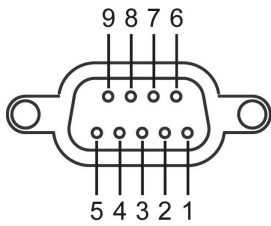
Pin Assignments

The following topics are covered in this chapter:

- **DB9 (Male)**
- **Terminal Block (RS-422, RS-485)**
- **Power Input, Relay Output**

DB9 (Male)

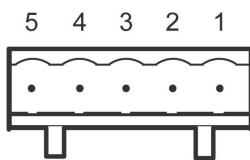
The MGate MB3000 uses DB9 (male) serial ports to connect Modbus RTU or ASCII devices. Each port supports three serial interfaces: RS-232, RS-422, and RS-485 (both 2 and 4-wire).



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)

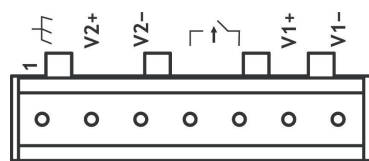
The MB3170 and MB3170I have a terminal block connector for RS-422 and RS-485 signals.





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

Typical Applications

The following topics are covered in this chapter:

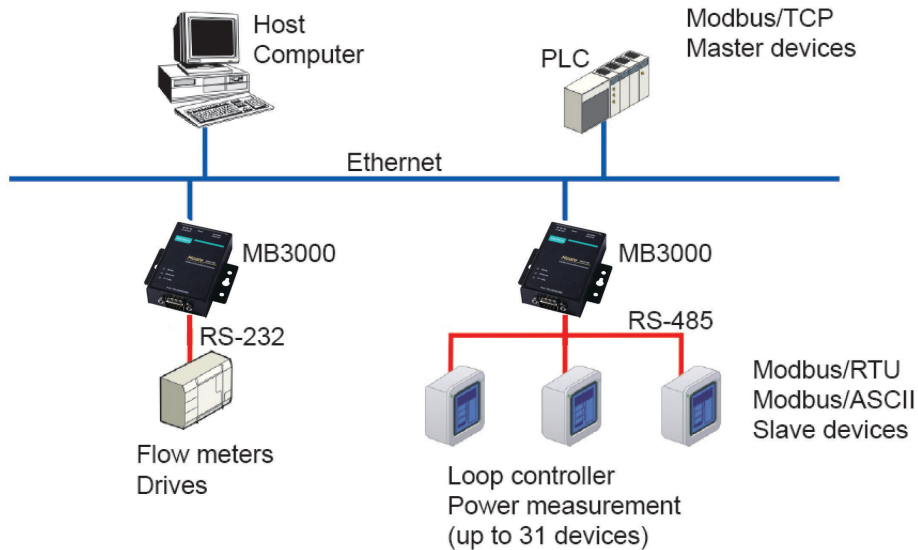
- ❑ **Ethernet Masters with Multiple Serial Slaves**
- ❑ **Serial Masters with Multiple Ethernet Slaves**
- ❑ **Modbus TCP Masters with ASCII and RTU Slaves**
- ❑ **Serial Master with Serial Slaves over Internet**

Ethernet Masters with Multiple Serial Slaves

Connect all Modbus devices over an Ethernet network

Most modern PLCs and host computers support Modbus TCP over Ethernet. In order 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.

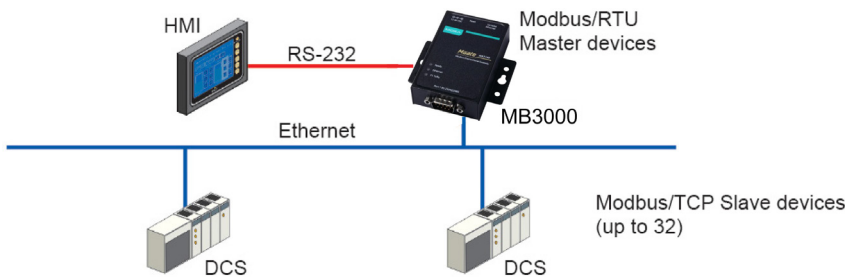


Serial Masters with Multiple Ethernet Slaves

Link a serial master device with Ethernet slave devices

Many HMI (Human Machine Interface) systems use a serial interface to connect to a discrete DCS (Data Control System). However, many DCSs are now Ethernet-based and operate as a Modbus TCP 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 slave devices are supported by each MGate MB3000.



Modbus TCP Masters with ASCII and RTU Slaves

Link TCP 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 masters, and all serial devices will be integrated behind it.

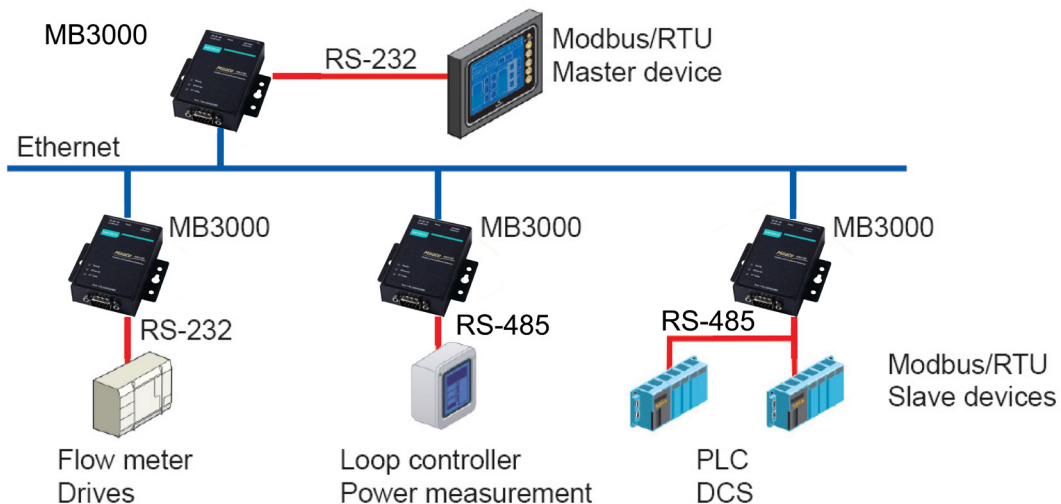


Serial Master with Serial Slaves over Internet

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.



Configuring the Modbus Gateway

The following topics are covered in this chapter:

- ❑ **Installing the Software**
- ❑ **Starting MGate Manager**
 - Change Language Setting
- ❑ **Connecting to the Unit**
 - Broadcast Search
 - Specify IP Address
- ❑ **Modifying the Configuration**
 - Configure Serial Port for RTU or ASCII, Master or Slave
 - What is ProCOM?
 - How to Configure ProCOM for the MGate MB3000
 - Offline Open
 - Configure IP Address and Other Network Settings
 - Configure Serial Communication Parameters
 - RTS Toggle
 - Set Up Modbus Routing
 - Customize Modbus Settings
 - Set Up Priority Control
 - Accessible IP
 - SNMP
 - Miscellaneous Setup
- ❑ **Verifying the Location of the Unit**
- ❑ **Monitoring Modbus Activity**
 - Open Traffic Monitor Window
 - Filter Traffic Information
 - Save Log to File
- ❑ **Upgrading Firmware**
- ❑ **MXview**
 - MXview for the MGate MB3000 Series

Installing the Software

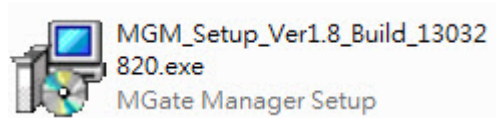
The following instructions explain how to install MGate Manager, a utility for configuring and monitoring MGate MB3000 units over the network.

1. To install MGate Manager, insert the MGate Documentation and Software CD into your PC's CD-ROM drive, and then run the following setup program to begin the installation process from the "Software" directory:

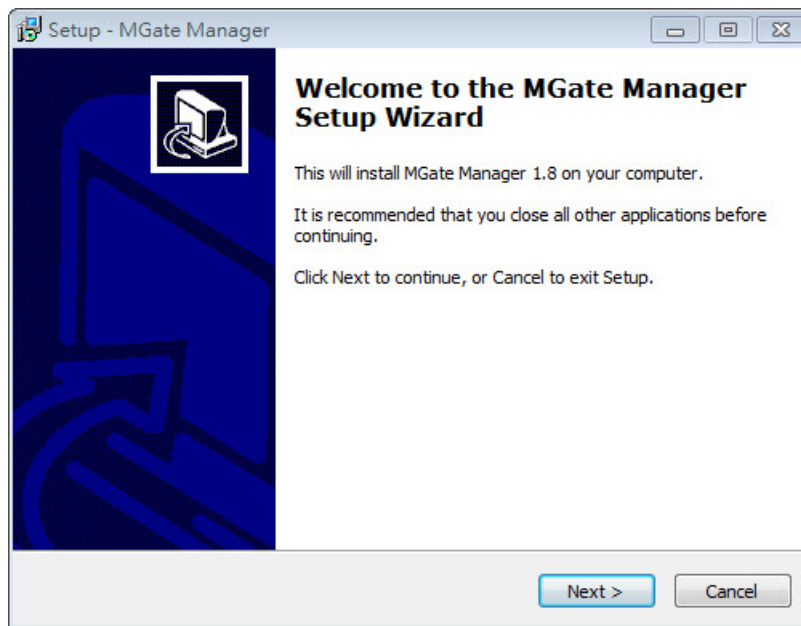
MGM_Setup_[Version]_Build_[DateTime].exe

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

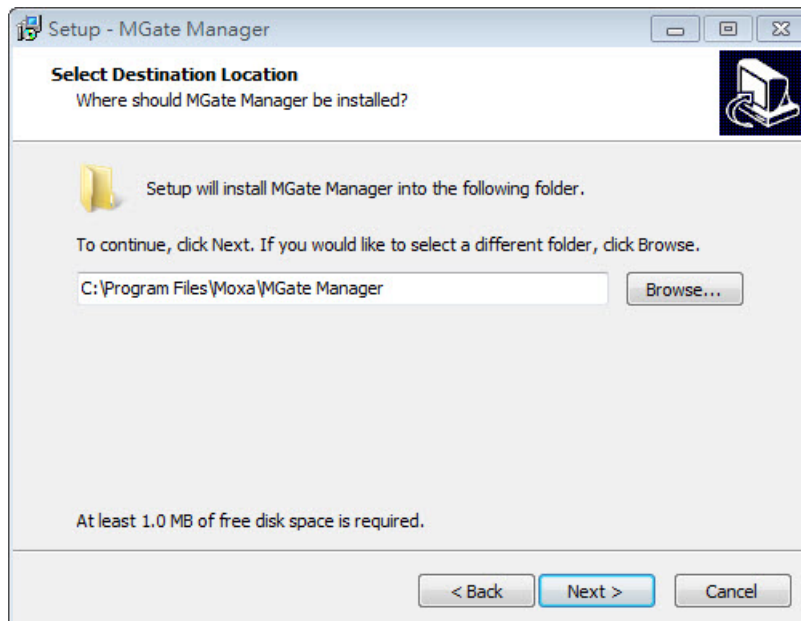
MGM_Setup_Verx.x.x_Build_xxxxxxx.exe, for example:



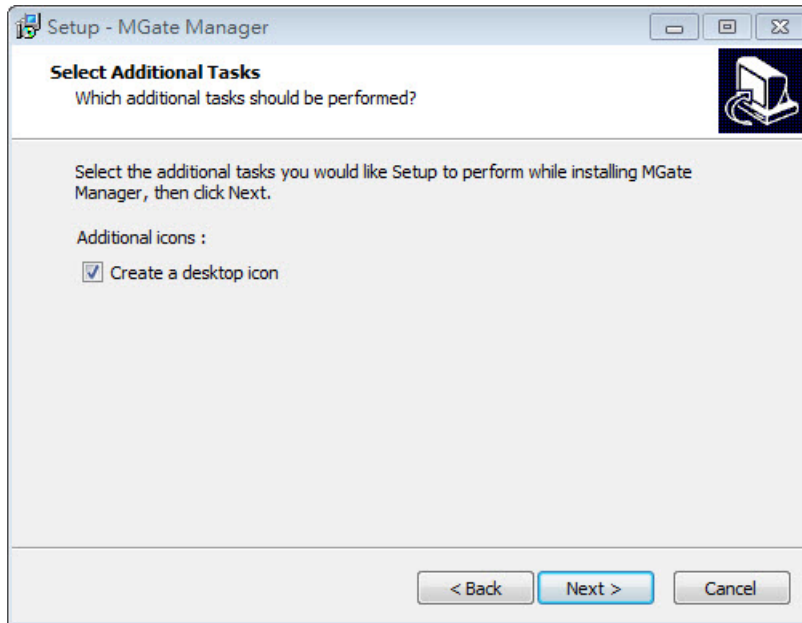
2. You will be greeted by the Welcome window. Click **Next** to continue.



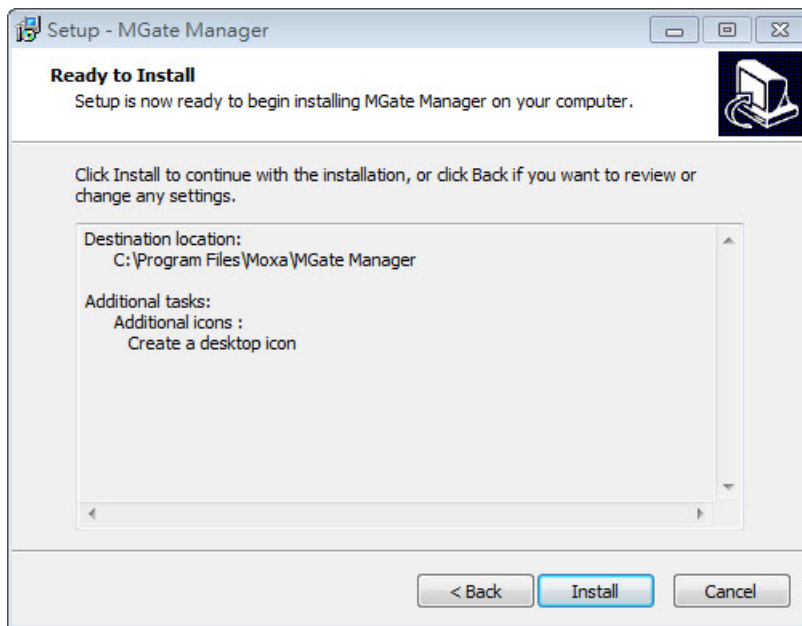
3. When the **Select Destination Location** window appears, click **Next** to continue. You may change the destination directory by first clicking on **Browse....**



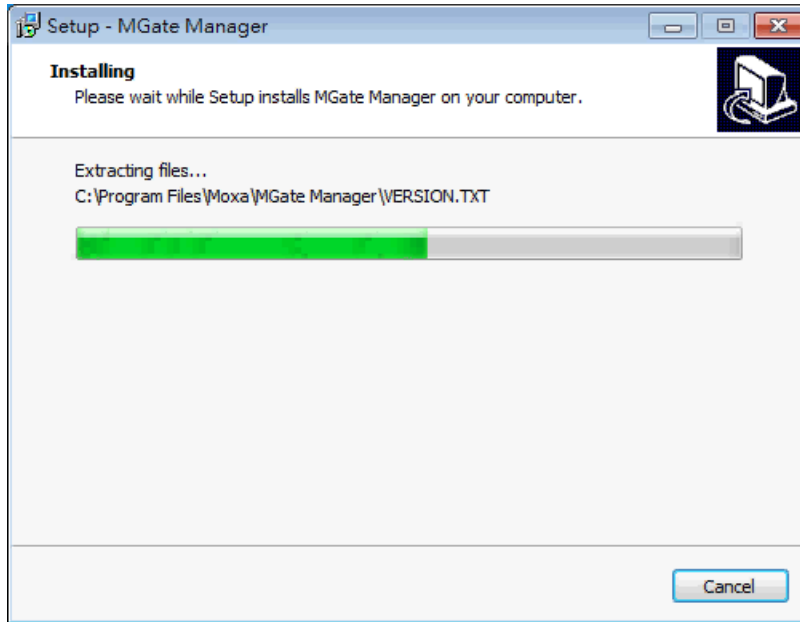
- When the **Select Additional Tasks** window appears, click **Next** to continue. You may select **Create a desktop icon** if you would like a shortcut to MGate Manager on your desktop.



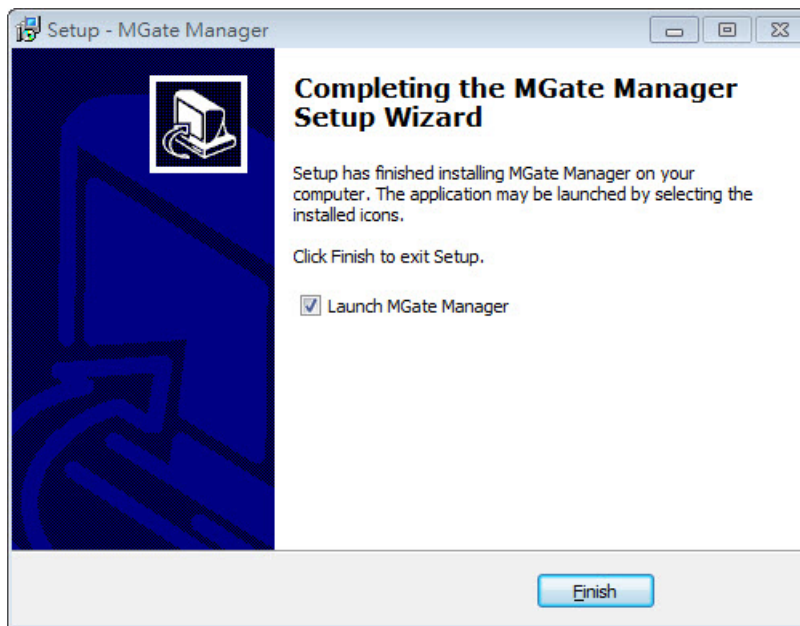
- Click **Install** to start copying the software files.



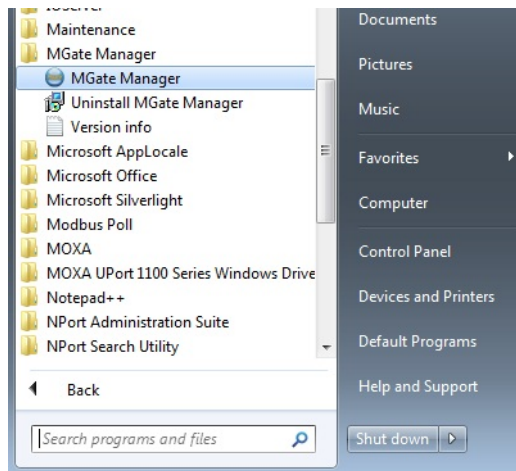
- 6. A progress bar will appear. The procedure should take only a few seconds to complete.



- 7. A message will indicate that 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.

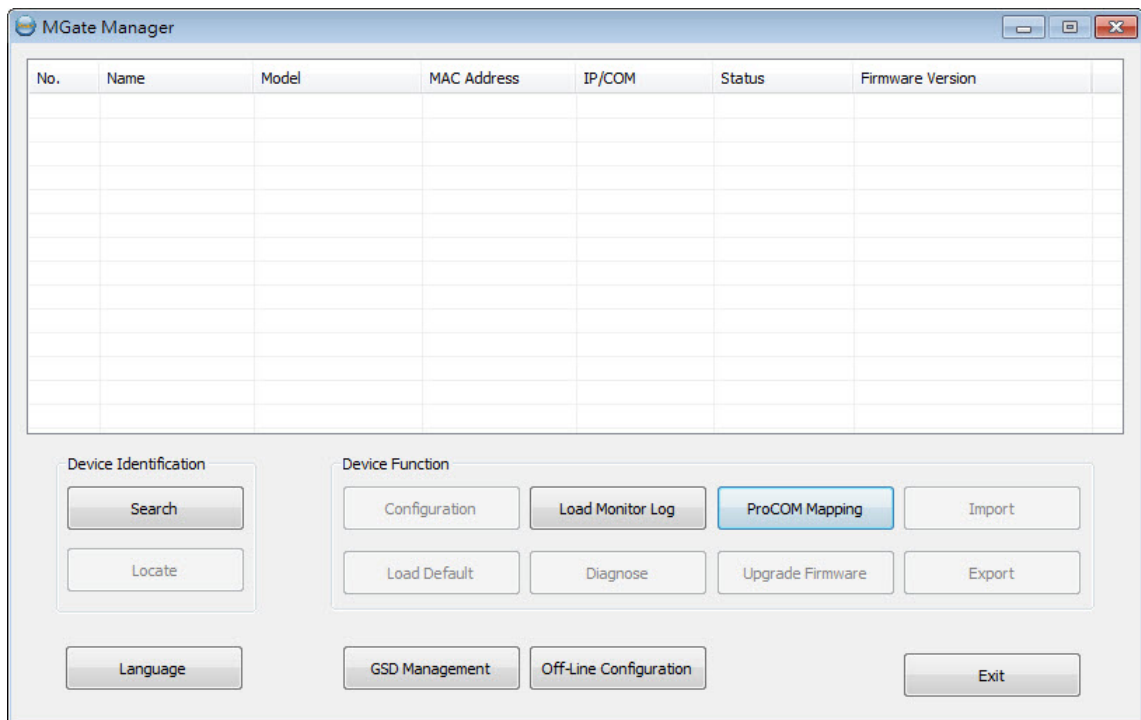


Starting MGate Manager

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

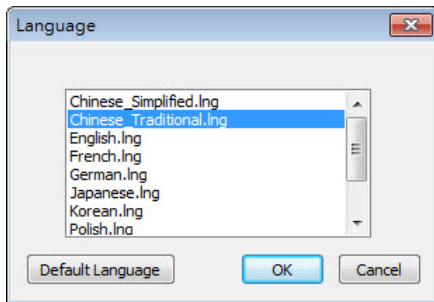
Before running MGate Manager, make sure that your PC and the MGate MB3000 are connected to the same network. Alternatively, the MGate MB3000 may be connected directly to the PC for configuration purposes. Please refer to Chapter 2 for more details.

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 available languages should appear as shown below.



When you click **OK**, MGate Manager will immediately reflect 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 assistance 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.

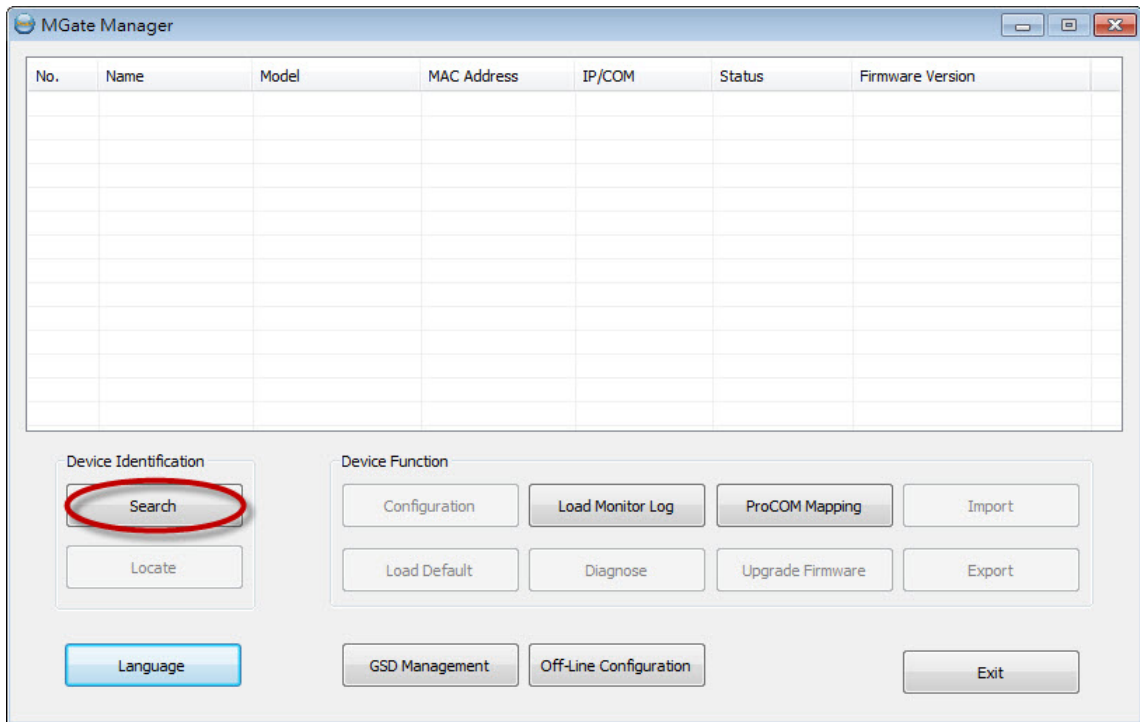
The default language is English and will only be active for the current MGate Manager session. When you open MGate Manager again, the language will revert to your original setting.

Connecting to the Unit

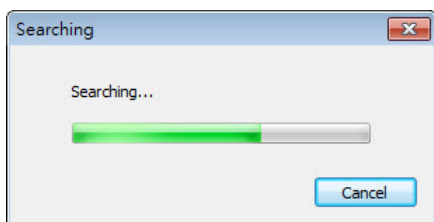
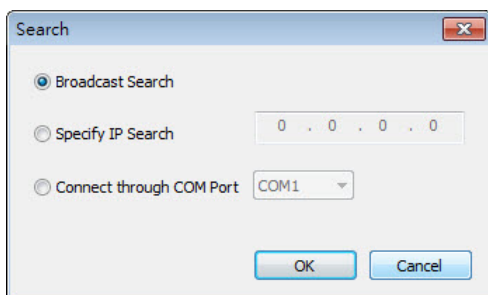
MGate Manager needs to connect to the unit before the unit can be configured. There are two methods to connect to the unit. **Broadcast Search** is used to find every MGate MB3000 on the LAN. **Search by IP** attempts to connect to a specific unit by IP address, which is useful if the unit is located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

Broadcast Search

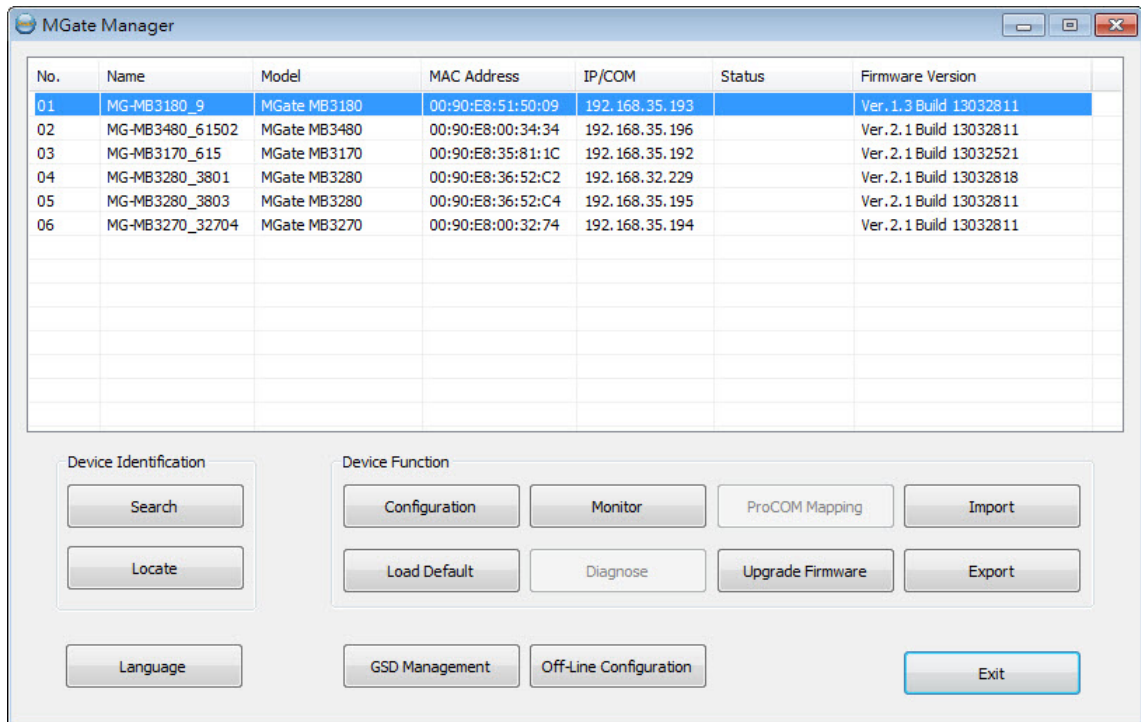
Click **Search** and a new Search window will pop up.



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



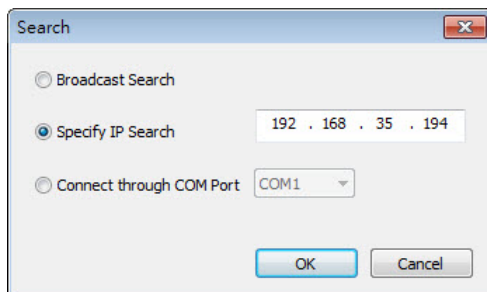
When the search is complete, every MGate MB3000 that is found on the LAN will appear in the window with MAC address and IP address. Simply select the one that you wish to configure.



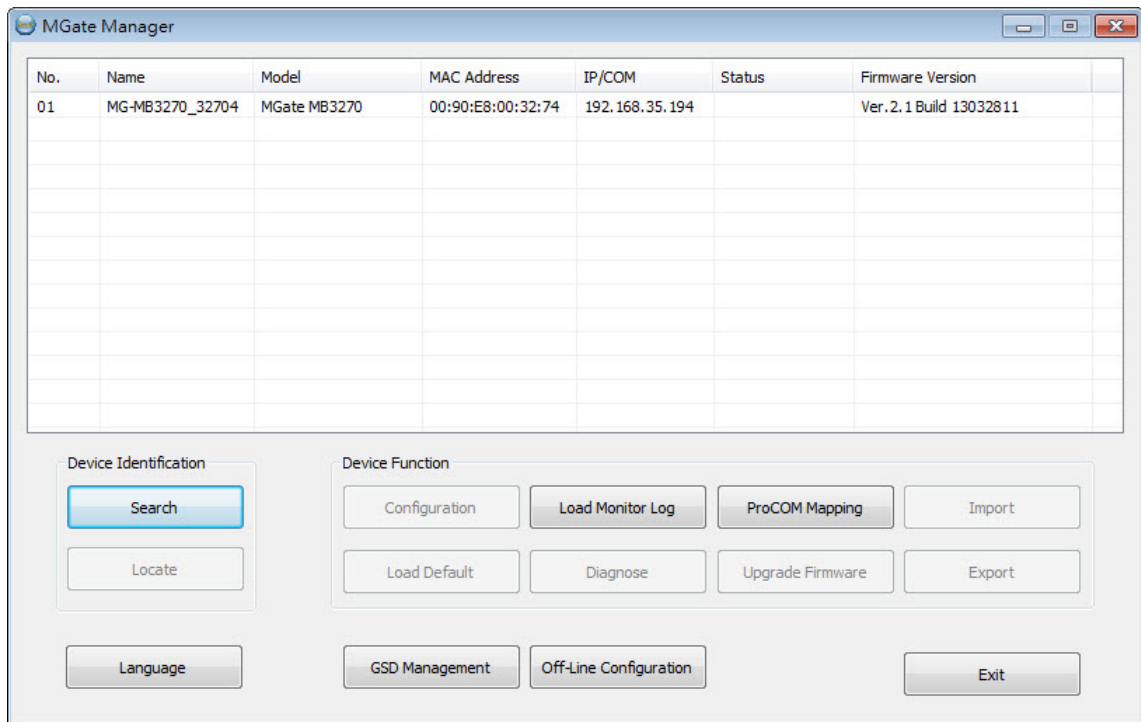
Specify IP Address

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 unit will be listed in MGate Manager. Configuration can be done in two ways: left click the unit to begin the MGate Manager configuration; right click the unit to begin the Web Console configuration.



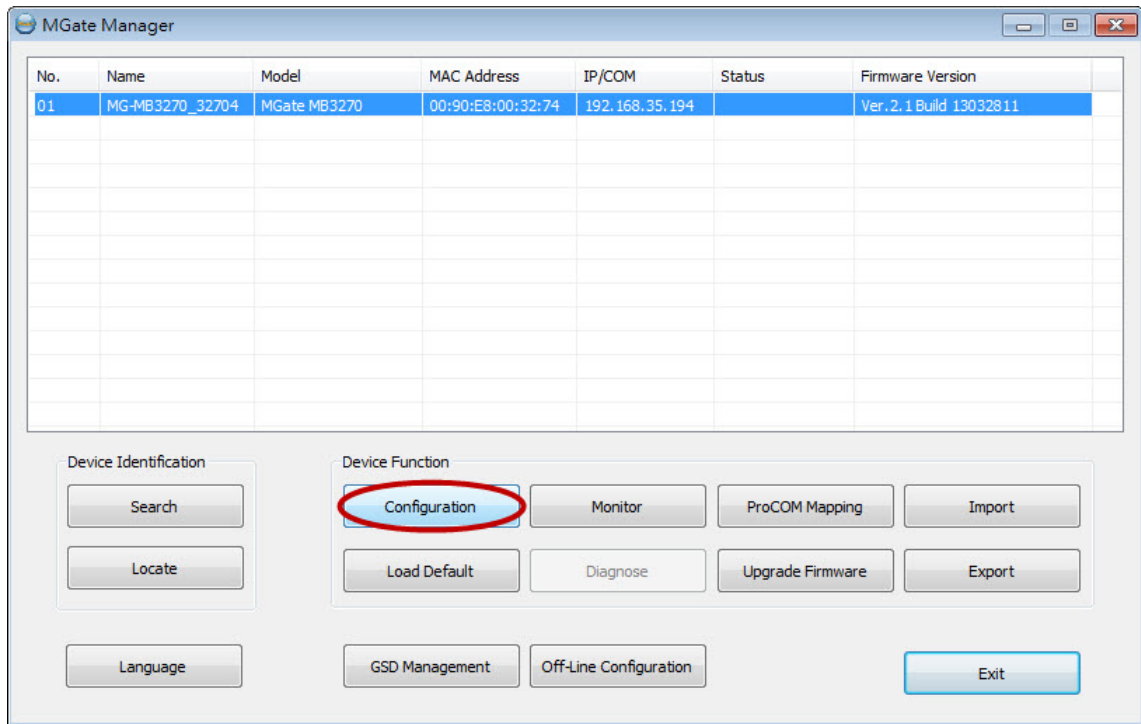
ATTENTION

If Search IP Address fails to locate the MGate MB3000, the IP address that 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 located on the same LAN as your PC, but on a different subnet. In this case, you can modify 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.

Modifying the Configuration

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



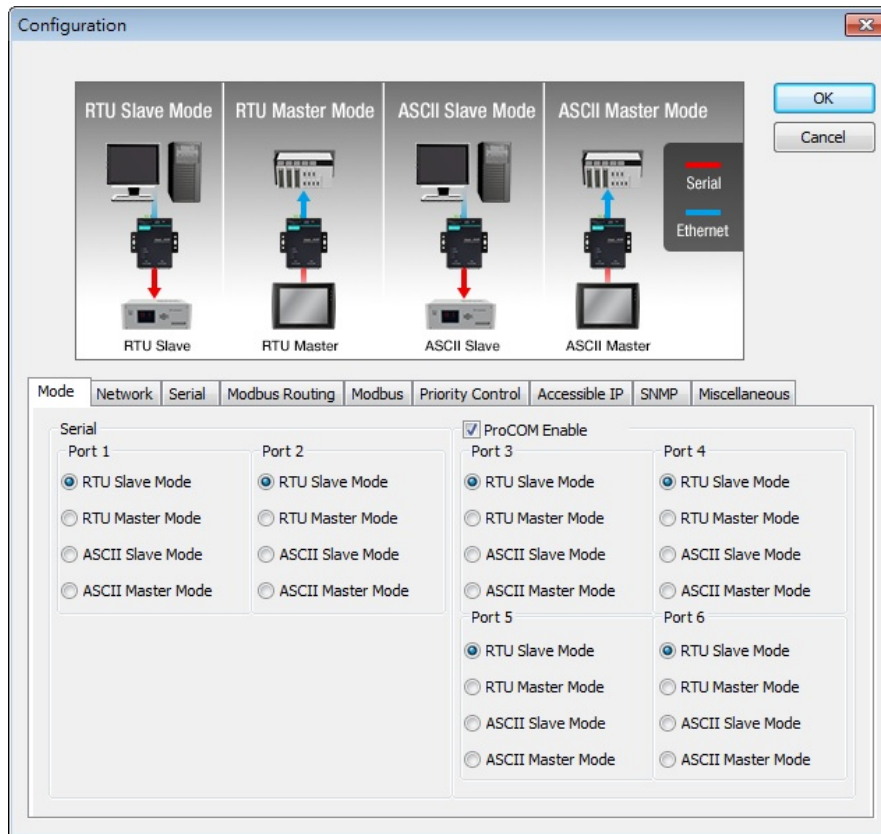
Configure Serial Port for RTU or ASCII, Master or Slave

The **Mode** tab is where each serial port’s operation mode is configured. The operation mode determines whether the device(s) that are connected to the serial port will operate as a master or a slave and whether the Modbus RTU or Modbus ASCII protocol will be used. There are four operation modes as follows:

Mode	Description
RTU Slave	Modbus RTU slave(s) will be connected to the serial port.
RTU Master	A Modbus RTU master will be connected to the serial port.
ASCII Slave	Modbus ASCII slave(s) will be connected to the serial port.
ASCII Master	A Modbus ASCII master will be connected to the serial port.

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

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



What is ProCOM?

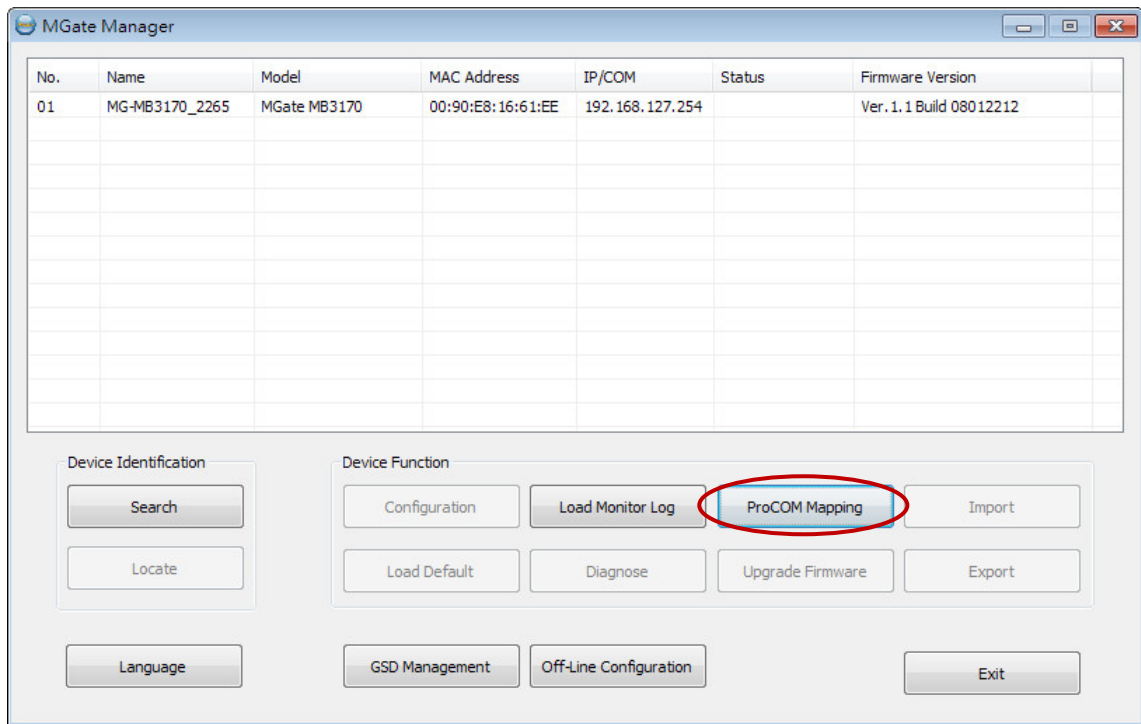
ProCOM is a Moxa proprietary function that creates virtual serial ports on the MGate MB3000 Series to make fieldbus gateway communications more versatile. This intelligent fieldbus gateway mimics the behavior of a native serial port when transmitting data to the desired destination. PCs can use ProCOM to communicate over the Ethernet with serial devices connected to the MGate MB3000 as if they were connected to the PC's native COM ports. This advanced feature only works with the MGate MB3x70 Series.

How to Configure ProCOM for the MGate MB3000

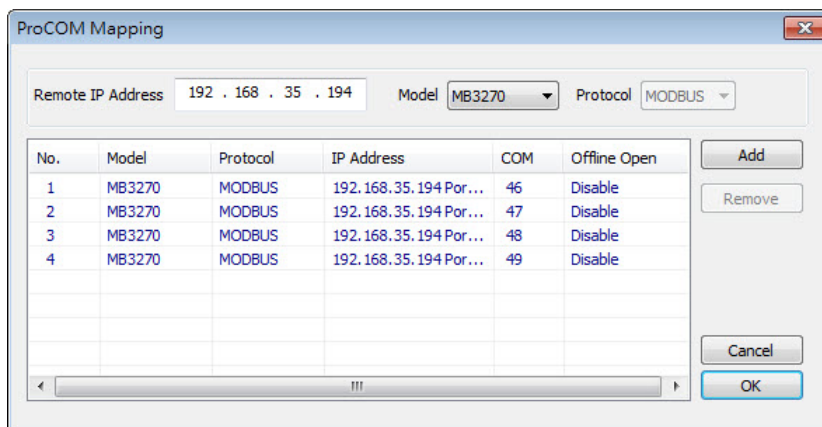
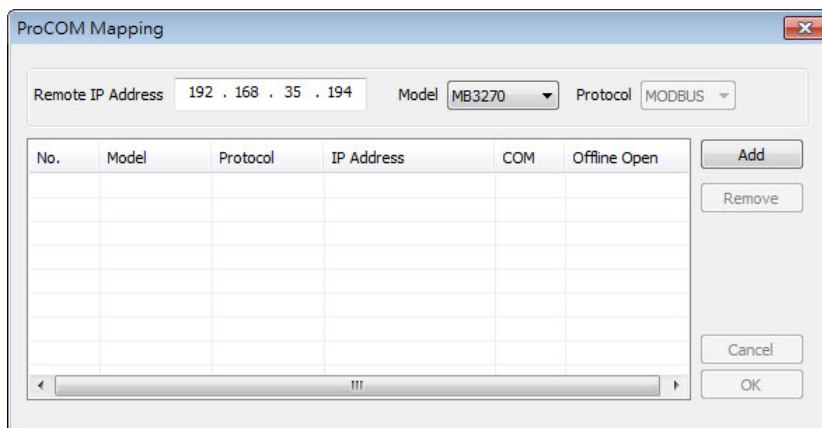
If your system uses remote PCs that only support COM port behavior to control remote Modbus devices, then ProCOM is the best solution for your system. Before using ProCOM, your PC needs to create virtual COM ports that connect to a specific ProCOM over an Ethernet network. By using ProCOM, the MGate MB3000 will treat your PC's COM port as if it were an additional serial port on the MGate MB3000.

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

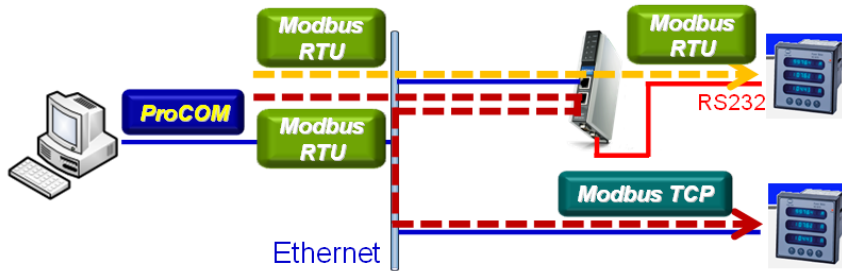
Locate the MGate MB3000 with the search function, select the MGate MB3000 device that you want to set ProCOM for, and then click **ProCOM Mapping** to enter the mapping dialog box, as illustrated by the following figures.



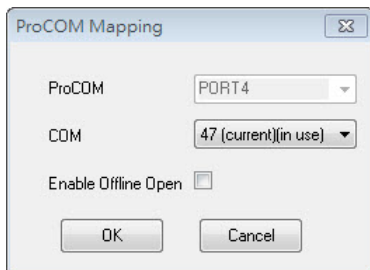
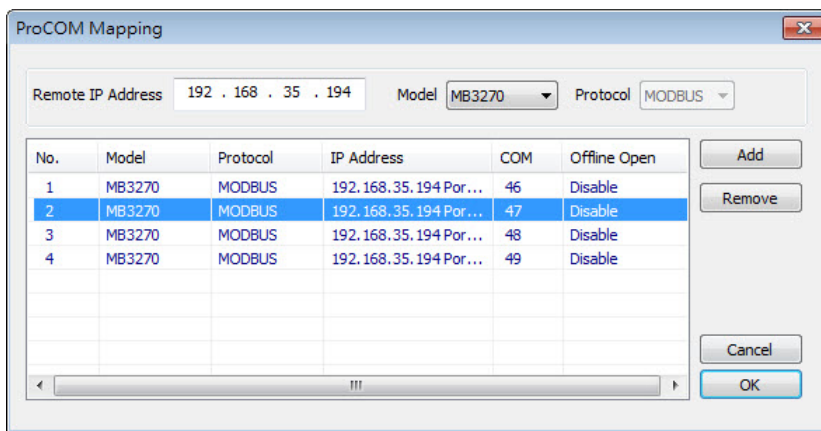
On the ProCOM mapping dialog box, you can map up to four ProCOM functions for each Modbus gateway to your PC's COM ports. The driver will generate virtual COM ports on your PC to connect to the selected MGate MB3000s over the network.



This way, when you send a Modbus request to ProCOM, the driver will forward your request to the MGate MB3000 and the MGate MB3000 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 MB3000's serial interface or to a Modbus TCP device through the MGate MB3000's Ethernet port. In addition, it can be redirected to another ProCOM port on the MGate MB3000.



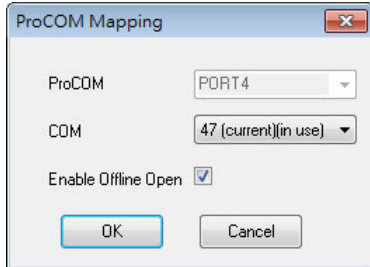
If you would like to change the COM port numbers, double click on the items as follows:



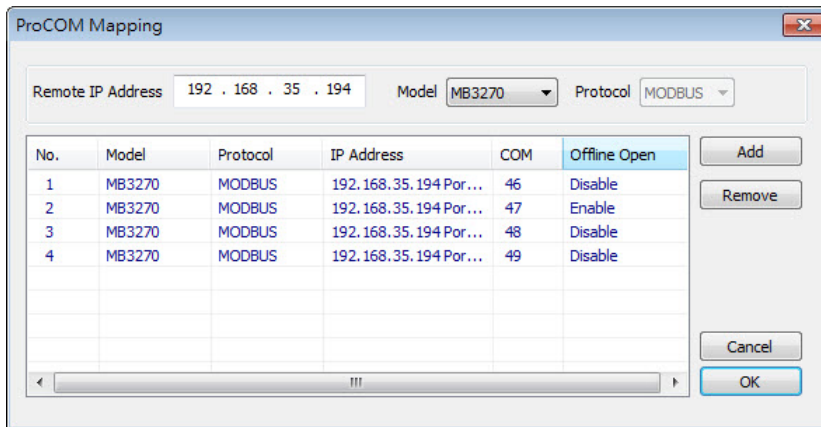
Offline Open

This function enables users to open ProCOM port(s) before the device is connected. In this case, the data transmitted to ProCOM port(s) will be kept 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.

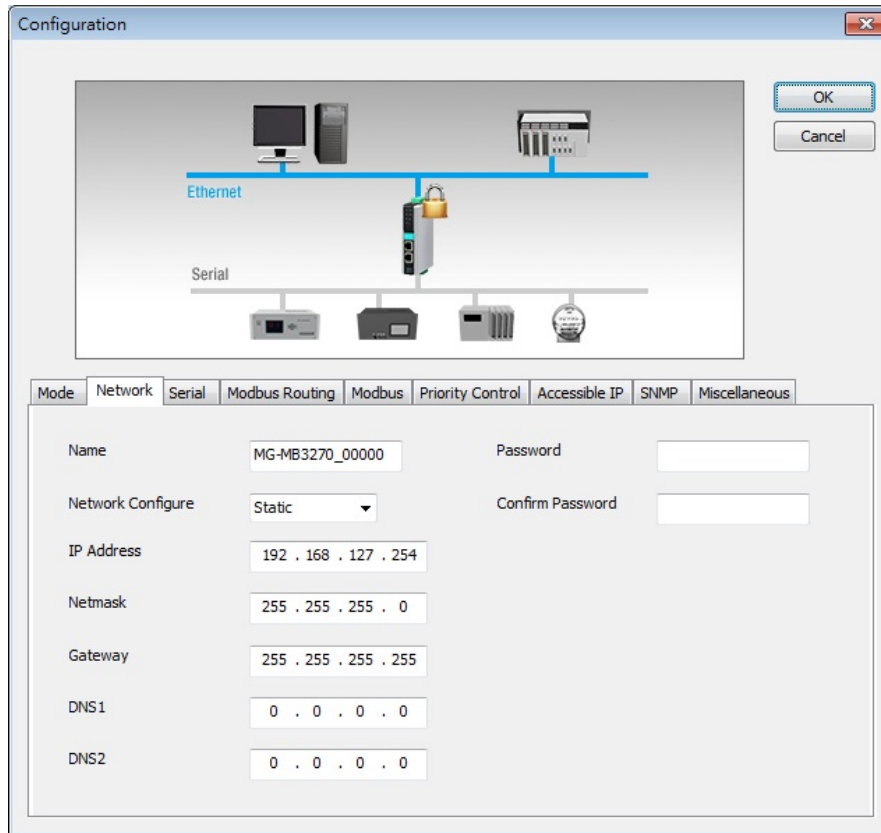


You can check the **Enable Offline Open** status from the **Offline Open** column.



Configure IP Address and Other 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 may also select a **Password** to protect the unit from unauthorized access.



Parameter	Value	Notes
Name	(an alphanumeric string)	You can enter a name to help you identify the unit, such as the location, function, etc.
Network Configuration	Static IP, DHCP, BootP, or 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.
DNS1	0.0.0.0 (or other 32-bit number)	This is the IP address of the primary domain name server.
DNS2	0.0.0.0 (or other 32-bit number)	This is the IP address of the secondary domain name server.
Password	(an alphanumeric string)	You can set a password to prevent unauthorized users from configuring the unit. The password will be required when anyone attempts to configure the unit over the network. Modbus operation is not affected by the password.
Confirm password	(an alphanumeric string)	Re-type the password again for confirmation.

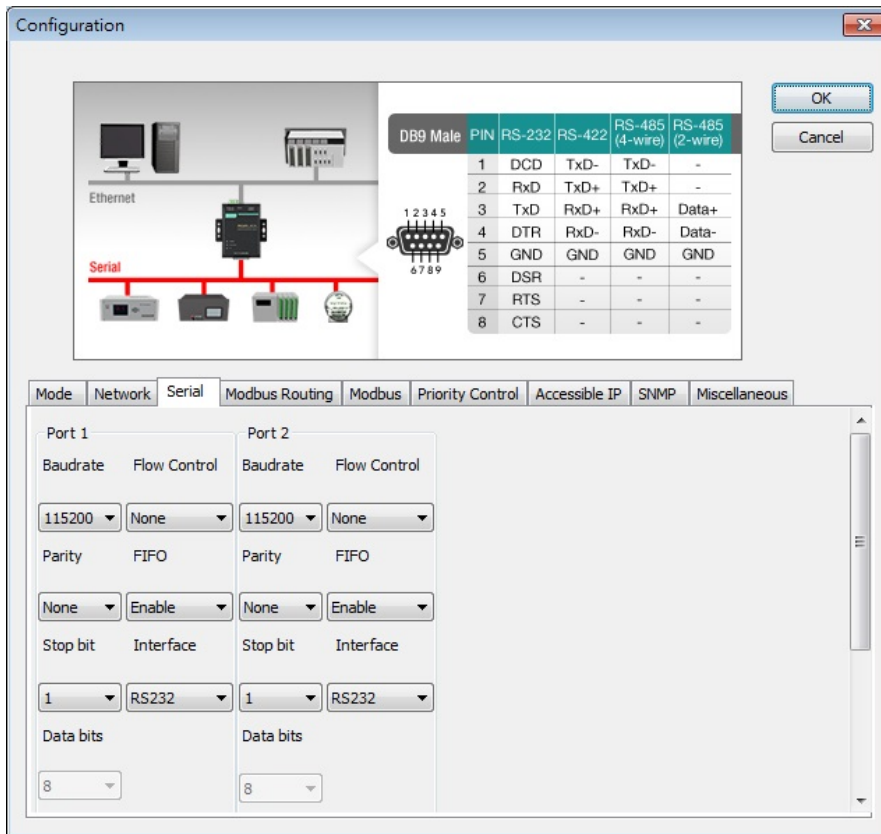


ATTENTION

To erase an existing password, leave both the **New Password** and **Confirm Password** text input boxes blank. The password will be erased when you click **OK** in the bottom right corner.

Configure Serial Communication Parameters

The **Serial** tab is where each serial port’s communication parameters are configured. You can configure **Baud Rate, Parity, Stop Bit, Flow Control, FIFO, and Interface Mode.**



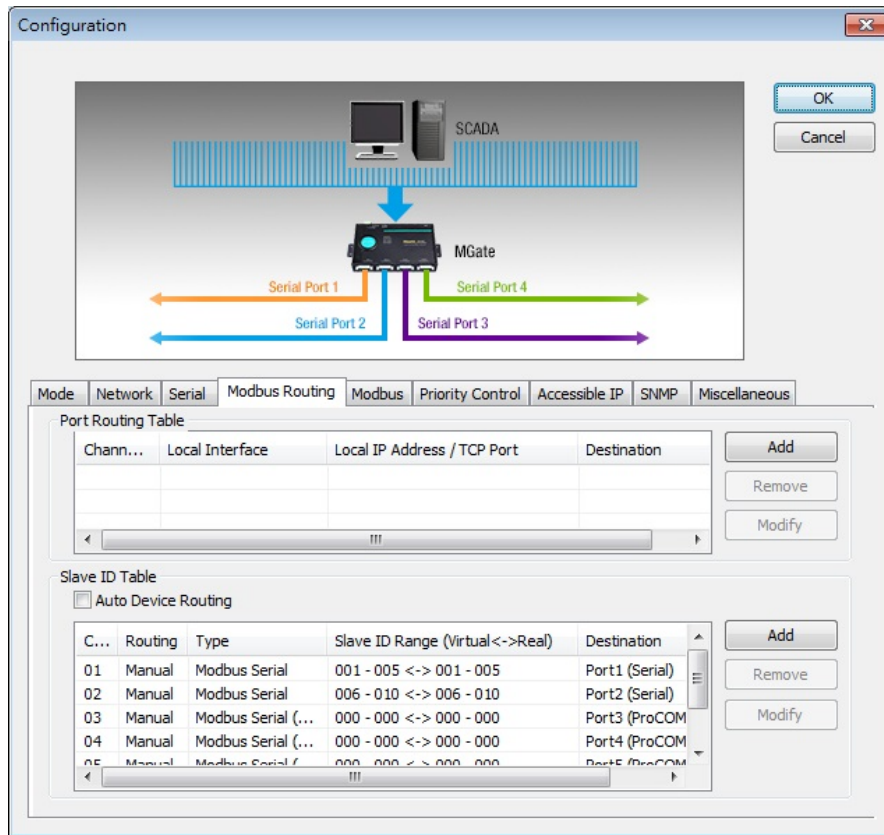
Parameter	Value
Interface Mode	RS-232
	RS-422
	RS-485, 2W
	RS-485, 4W
Baud Rate	50 bps to 961200 bps
Parity	None, Odd, Even, Space, Mark
Stop Bits	1, 2
Flow Control	None, RTS/CTS, RTS Toggle
UART FIFO	Enable, Disable
RTS On Delay	0 to 100 ms
RTS Off Delay	0 to 100 ms

RTS Toggle

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

Set Up 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.

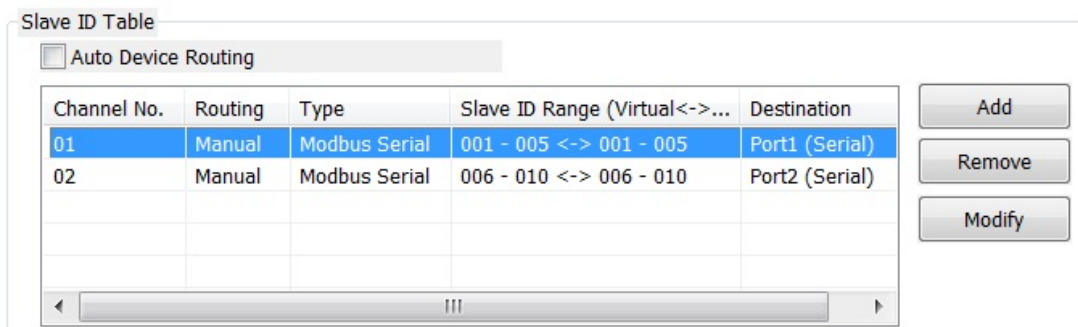


Slave ID Table

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 slave device.

This keeps communication efficient and prevents devices on other ports to receive an unrelated Modbus request, resulting in slowing down the whole 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 001~005 will be routed to serial port1; the Modbus requests with slave ID 006~010 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.



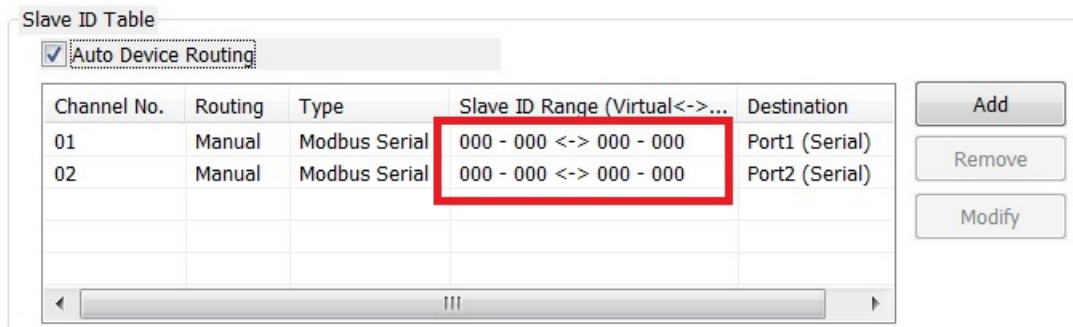
Auto Device Routing (patent pending)

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

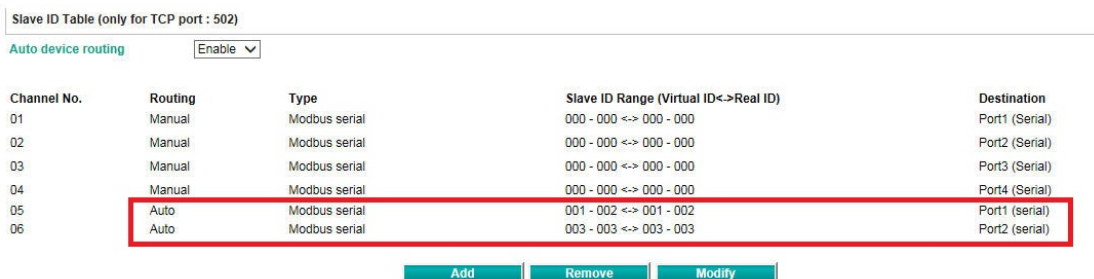
Click the checkbox for **Auto Device Routing**, and a message window will pop up.



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 clear as illustrated below.



Users can check the result of 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 you the error in red.

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

Slave ID Table (only for TCP port : 502)

Auto device routing

Channel No.	Routing	Type	Slave ID Range (Virtual ID<->Real ID)	Destination
01	Manual	Modbus serial	000 - 000 <-> 000 - 000	Port1 (Serial)
02	Manual	Modbus serial	000 - 000 <-> 000 - 000	Port2 (Serial)
03	Manual	Modbus serial	000 - 000 <-> 000 - 000	Port3 (Serial)
04	Manual	Modbus serial	000 - 000 <-> 000 - 000	Port4 (Serial)
05	Conflict	Modbus serial	001 - 001 <-> 001 - 001	Port1 (serial)
06	Conflict	Modbus serial	001 - 001 <-> 001 - 001	Port2 (serial)

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 newly devices. Note that if a newly added device cannot be polled by the Modbus master correctly, the slave ID of this newly added device might be set in the existing user-set table. Users have to modify the existing user-set table.

How to connect legacy Modbus devices with same slave ID

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 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

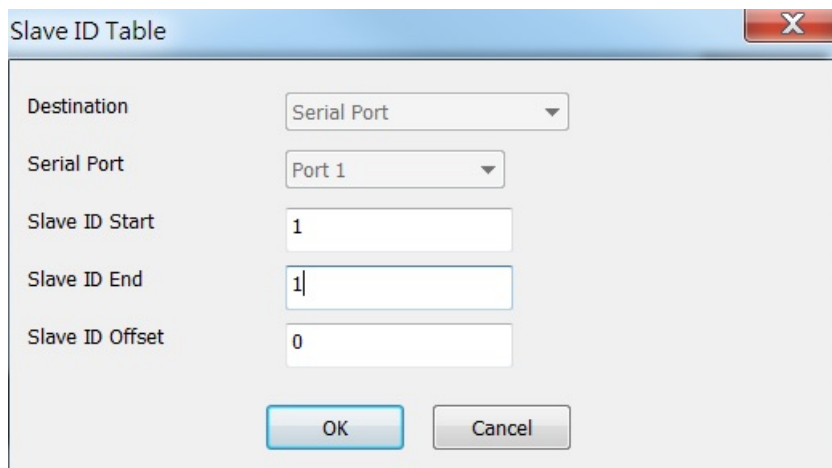
Original setting

Slave ID Table

Auto Device Routing

Channel...	Rout...	Type	Slave ID Range (Virtual<->Real)	Destination
01	Man...	Modbus Serial	001 - 005 <-> 001 - 005	Port1 (Serial)
02	Man...	Modbus Serial	006 - 010 <-> 006 - 010	Port2 (Serial)

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

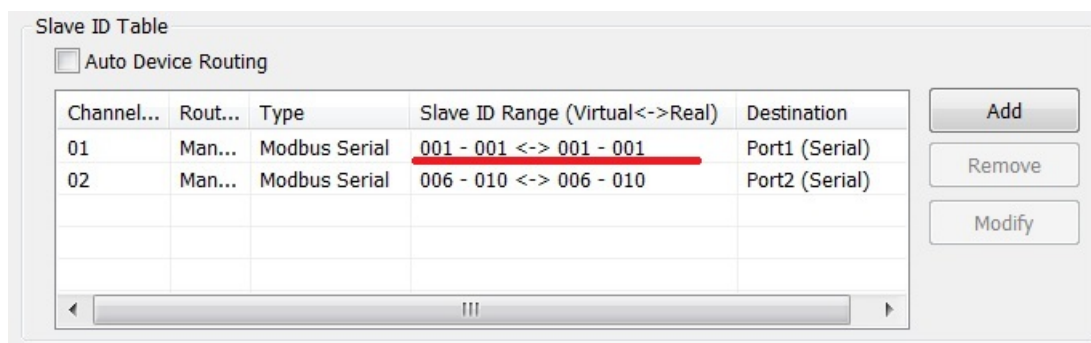


The dialog box 'Slave ID Table' has the following fields:

- Destination: Serial Port
- Serial Port: Port 1
- Slave ID Start: 1
- Slave ID End: 1
- Slave ID Offset: 0

Buttons: OK, Cancel

The routing table will show up as follows:

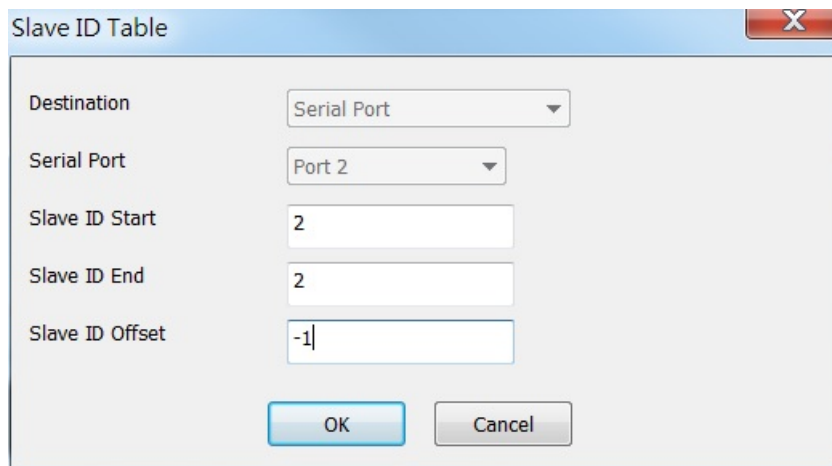


The dialog box 'Slave ID Table' includes an 'Auto Device Routing' checkbox and a table with the following data:

Channel...	Rout...	Type	Slave ID Range (Virtual<->Real)	Destination
01	Man...	Modbus Serial	001 - 001 <-> 001 - 001	Port1 (Serial)
02	Man...	Modbus Serial	006 - 010 <-> 006 - 010	Port2 (Serial)

Buttons: Add, Remove, Modify

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

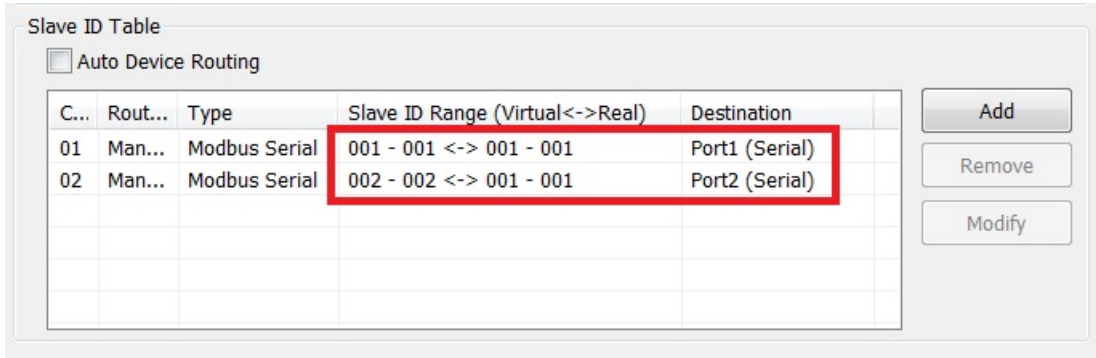


The dialog box 'Slave ID Table' has the following fields:

- Destination: Serial Port
- Serial Port: Port 2
- Slave ID Start: 2
- Slave ID End: 2
- Slave ID Offset: -1

Buttons: OK, Cancel

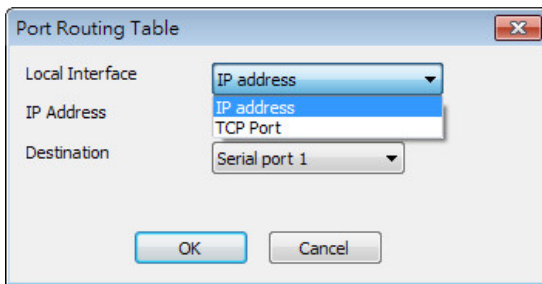
The routing table will show up as follows:



Now, the Modbus 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.

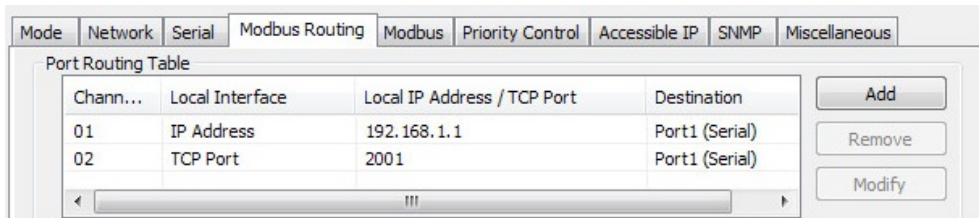
Port Routing Table

The MGate MB3000 gateways support two kinds of port routing mechanism: by **IP address** and by **TCP port**. The Modbus master can communicate with the Modbus 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 4 Modbus masters.

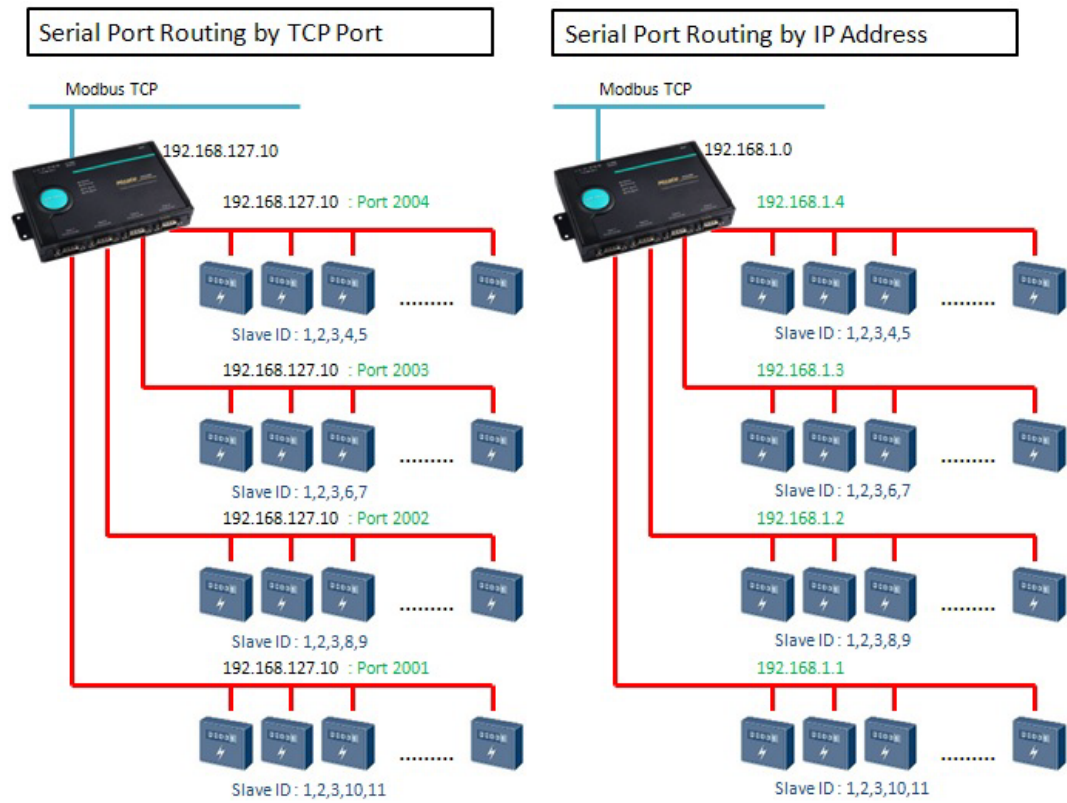


For example, you could assign TCP ports 2001 to 2004 to serial ports 1 to 4, respectively. When the gateway receives a Modbus request designated for TCP port 2001, it will forward the Modbus request to serial port 1 directly. Similarly, if it receives a Modbus request designated for TCP port 2004, it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

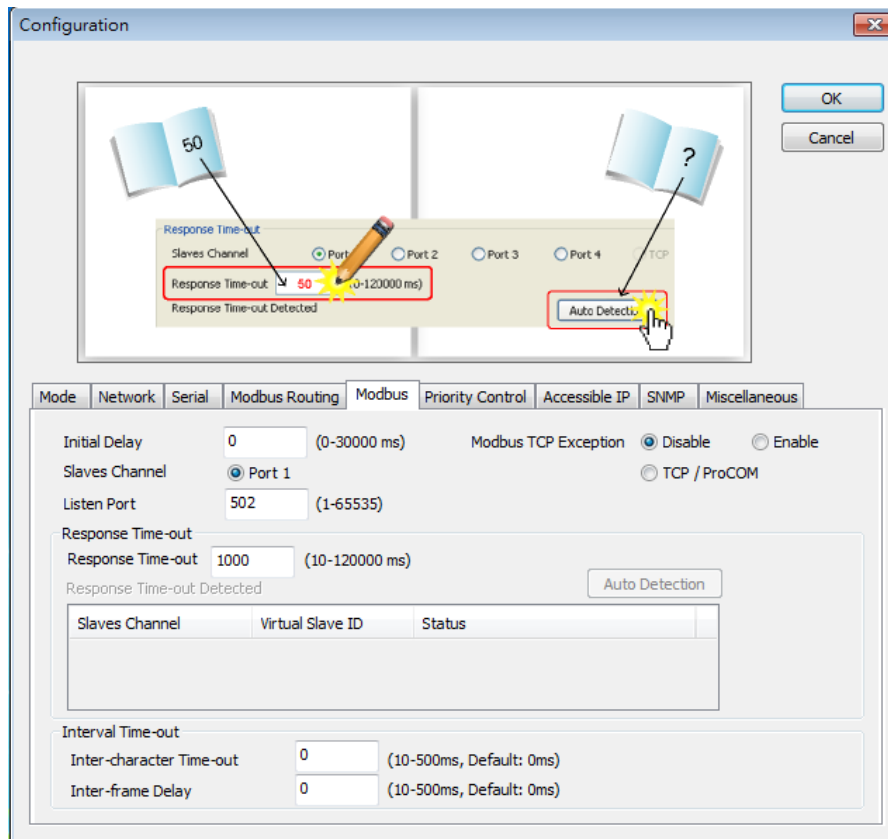


With port routing mechanisms, Modbus slave ID routing can be simpler and more effective by giving users the flexibility to define a multirouting mechanism.



Customize Modbus Settings

The **Modbus** tab is where certain adjustments can be made to fine-tune the communication between different Modbus networks. You can configure **Initial Delay**, **Modbus TCP Exception**, **Slave Channel**, and **Response Time-out**.



Parameter	Value
Initial Delay	Numeric
Modbus TCP Exception	Enable or Disable
Slave Channel	Radio button
Listen Port	1-65535
Response Time-out	Numeric
Inter-character Time-out	10–500 ms, Default: 0 ms
Inter-frame Delay	10–500 ms, Default: 0 ms

Initial Delay

Some Modbus slaves may take more time to boot up than other devices. For certain environments, this may cause the entire system to suffer from repeated exceptions during the initial boot-up. 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 master. 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 slave. Maybe the device is offline or the serial cable is broken.
Request dropped	There are two situations that will result in this exception: The request queue is full (32 request queue for each master) The destination ID is not included in the slave ID table.

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

Modbus TCP Listen 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 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 master can be configured to wait a certain amount of time for a slave’s response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue operation even if a slave device is disconnected or faulty.

On the MGate 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 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 time-out.

The MGate MB3000 also provides 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 best performance.

Inter-Character Time-Out

Use this function to determine the time-out interval between characters for Modbus devices that cannot receive Rx signals within an expected time interval. If the response is timed out, all received data will be discarded. Note that this time-out mechanism only works in RTU slave mode. The MGate MB3000 will automatically determine the time-out interval if the time-out value is set to 0.

Inter-Frame Delay

In Modbus RTU slave mode, user can determine the time-delay to transmit the data frame received from the slave device to the upstream. The MGate MB3000 will automatically determine the time interval if it is set to 0.



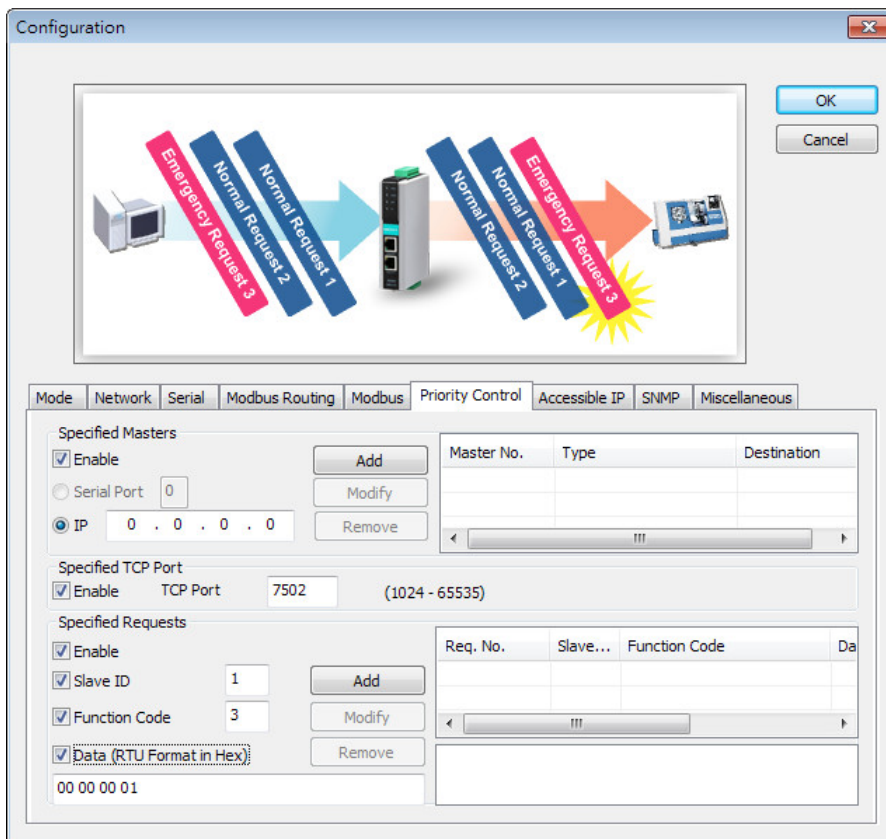
ATTENTION

Please note the following regarding automatic calibration of response time-outs:
 When automatically detecting the response time-out, the MGate will use the slave ID table to determine which ports and which IDs to search. Make sure that you have defined the slave ID table for your system before clicking **Auto Detection**.

The automatic calibration will take some time to complete. We recommend that you save this step for last and take a break as the MGate does its work.

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

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

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

For example, if you want all requests from 192.168.32.161 to be considered a priority request, you would follow these steps:

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

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 following descriptions illustrate how to configure the accessibility parameters:

- **Only one host with a specific IP address can access the MGate MB3000**

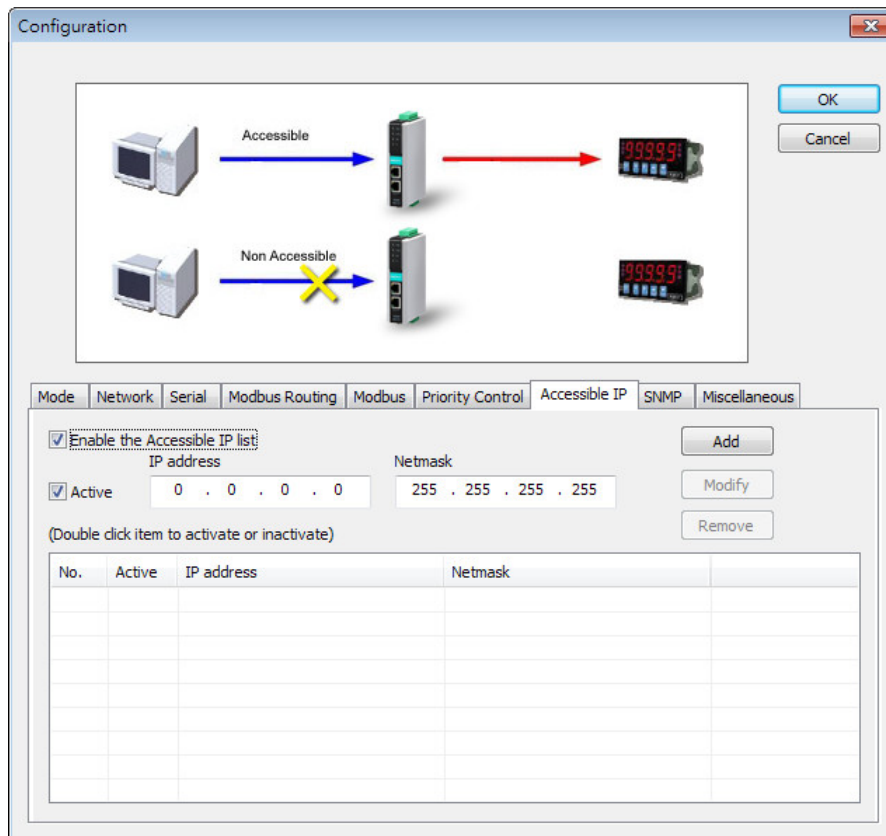
Enter **IP address/255.255.255.255** (e.g., "192.168.1.1/255.255.255.255") and activate the item by selecting the checkbox.

- **Hosts on a specific subnet can access the MGate MB3000**

Enter **IP address/255.255.255.0** (e.g., "192.168.1.0/255.255.255.0") and activate the item by selecting the checkbox.

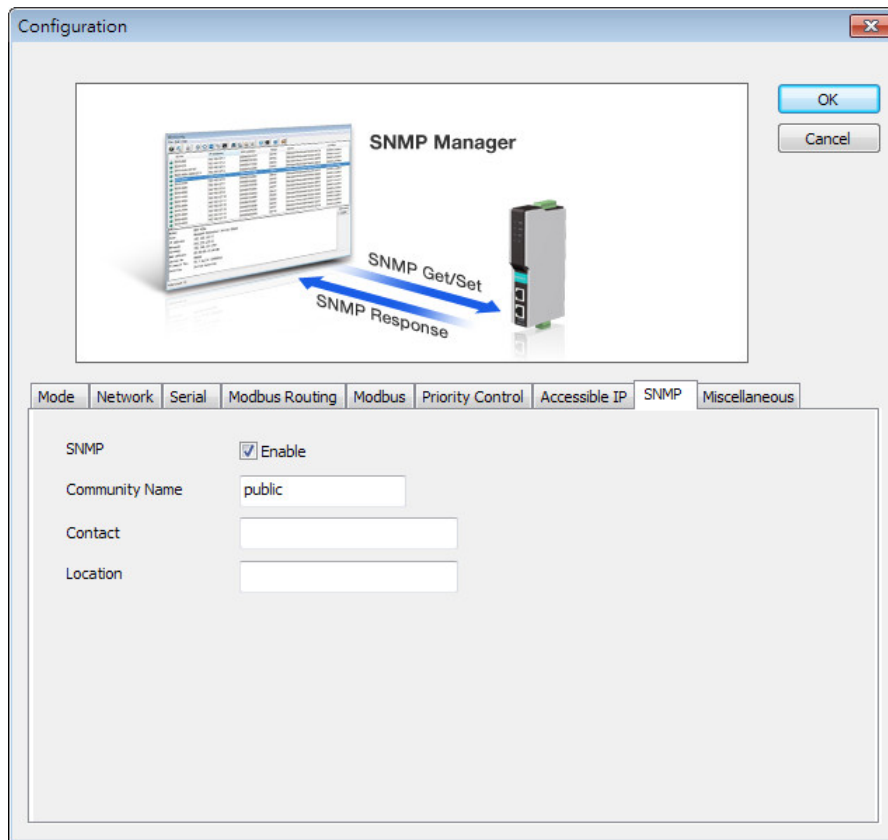
- **Any host can access the MGate MB3000**

Disable this function by clearing the **Enable the accessible IP list** checkbox.



SNMP

The **SNMP** function allows users to adjust SNMP related settings.



To enable the **SNMP** function, select the **Enable** checkbox.

Community Name: This field specifies the read/write community string used for the SNMP Agent. This is a text password mechanism that is used to weakly authenticate queries to agents of managed network devices.

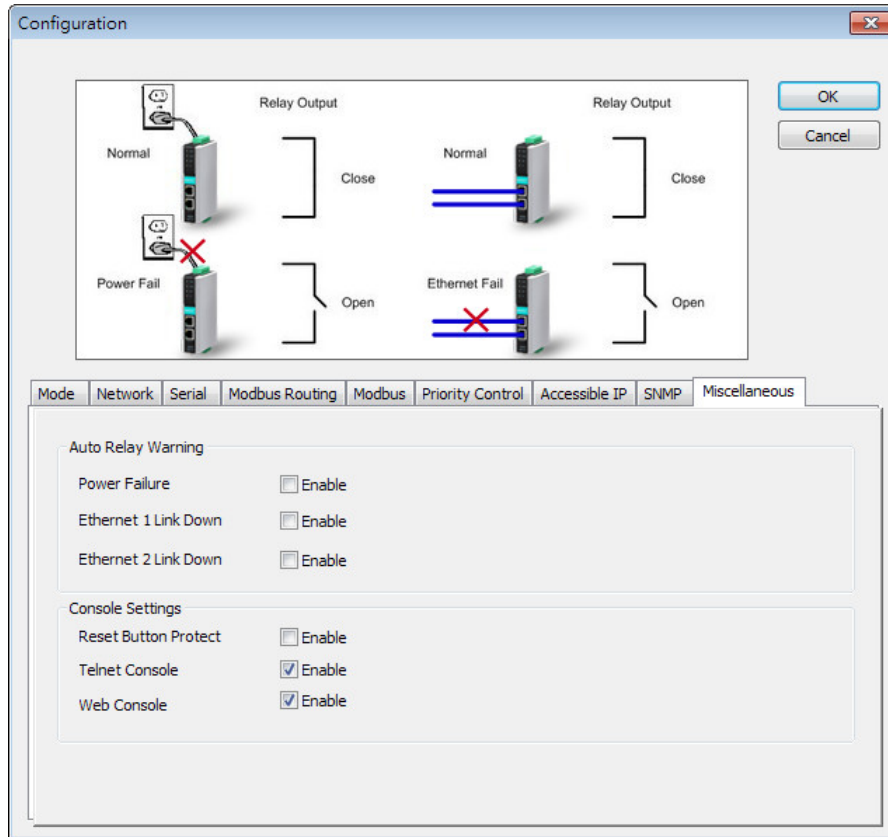
Contact: This is an optional free text field that can be used to specify the SNMP emergency contact name, telephone, or pager number.

Location: This is an optional free text field that can be used to specify the location for SNMP agents such as the MGate.

Miscellaneous Setup

This page identifies options that were not mentioned previously: **Auto Relay Warning**, **Reset Button Protect**, **Web Console**, and **Telnet Console**.

Auto Relay Warning will be triggered in the event of a power failure or when Ethernet links are disconnected. When a checked trigger condition occurs, the MB3000 will open the circuit of the relay output and trigger the Fault LED to start blinking. Otherwise, the MB3000 will short-circuit the relay output.

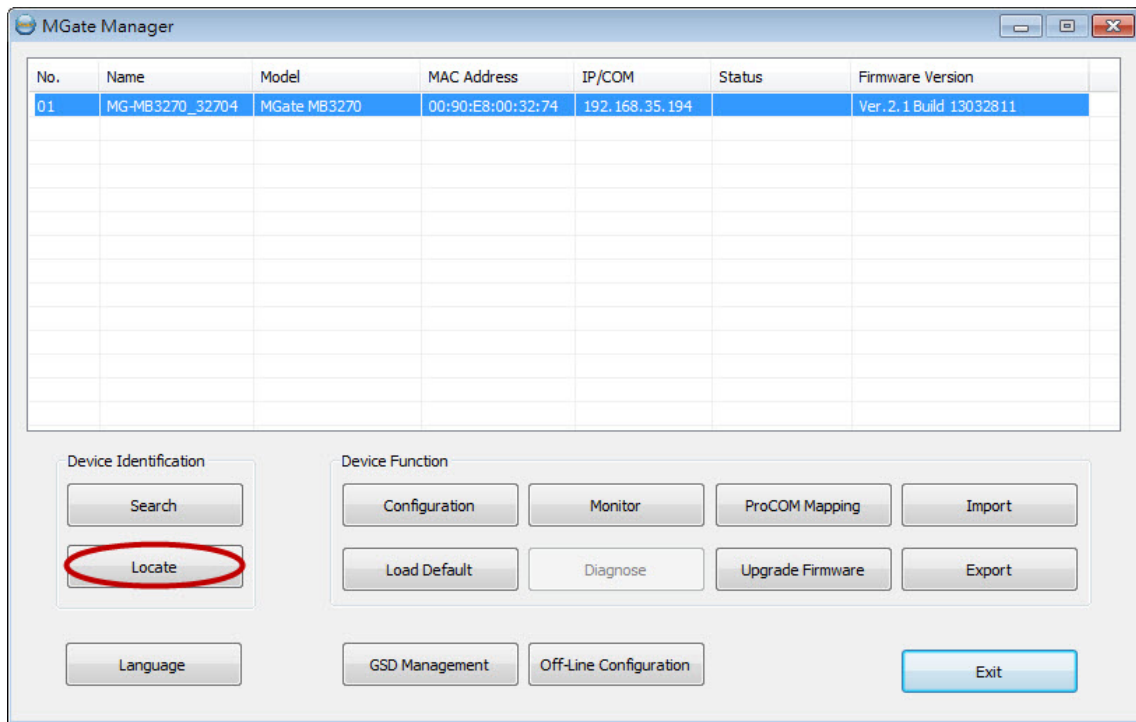


ATTENTION

The MGate MB3180/3280/3480 do not have relay outputs and consequently do not support **Auto Relay Warning**.

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 that unit's **Ready** LED blink for a few seconds. This will tell you which physical unit corresponds with the unit that you selected.

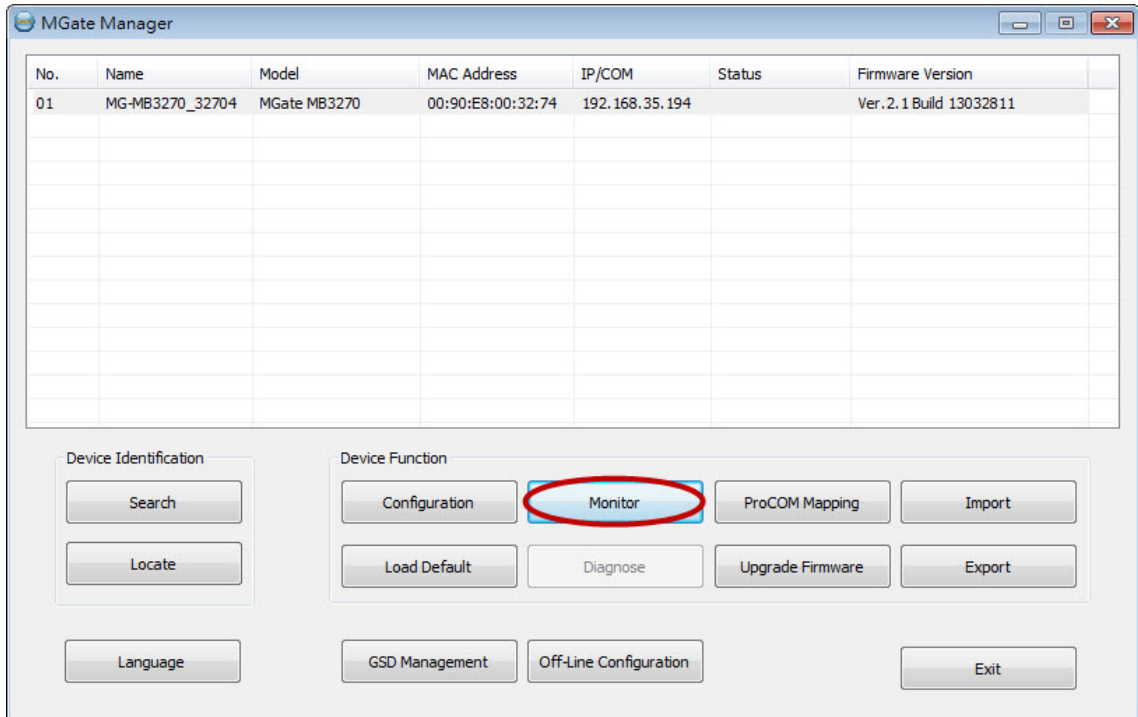


Monitoring Modbus Activity

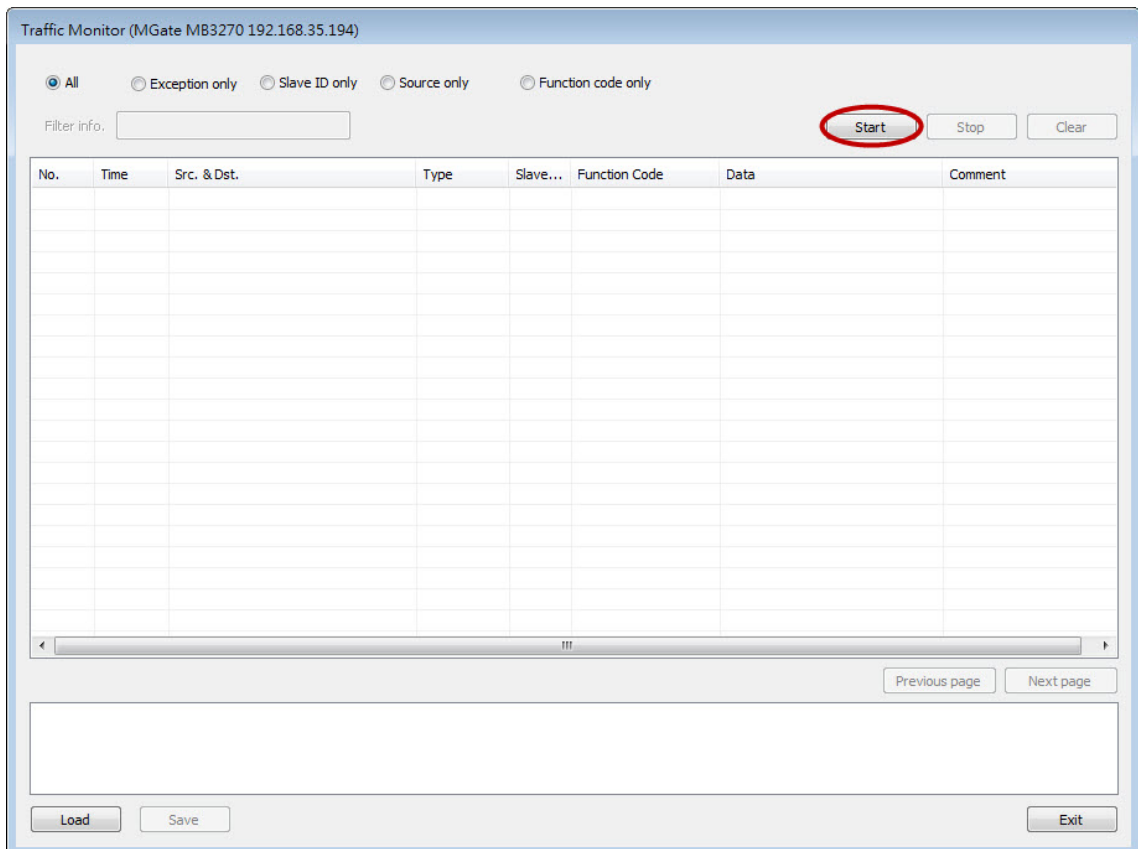
For troubleshooting or management purposes, you can monitor the data passing through any MGate MB3000 on the network. Data events will be logged as they pass through the gateway. Rather than simply echoing the data, MGate Manager presents the data in an intelligent, easily-understood format, with clearly designated fields including source, type, destination, contents, and more. Events can be filtered in different ways, and the complete log can be saved 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.



Traffic Monitor (MGate MB3270 192.168.35.194)

All
 Exception only
 Slave ID only
 Source only
 Function code only

Filter info:

Start Stop Clear

No.	Time	Src. & Dst.	Type	Slave...	Function Code	Data	Comment
1	0.000	192.168.33.26:59083<-	TCP Req.	1	0x01	B6 01 00 00 00 06 01 01 00 63 0...	Read coils
2	0.000	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
3	0.025	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
4	0.025	192.168.33.26:59083->	TCP Resp.	1	0x01	B6 01 00 00 00 10 01 01 0D 00 ...	Read coils
5	0.035	192.168.33.26:59083<-	TCP Req.	1	0x01	B7 01 00 00 00 06 01 01 00 63 0...	Read coils
6	0.035	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
7	0.055	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
8	0.055	192.168.33.26:59083->	TCP Resp.	1	0x01	B7 01 00 00 00 10 01 01 0D 00 ...	Read coils
9	0.060	192.168.33.26:59083<-	TCP Req.	1	0x01	B8 01 00 00 00 06 01 01 00 63 0...	Read coils
10	0.060	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
11	0.095	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
12	0.095	192.168.33.26:59083->	TCP Resp.	1	0x01	B8 01 00 00 00 10 01 01 0D 00 ...	Read coils
13	0.110	192.168.33.26:59083<-	TCP Req.	1	0x01	B9 01 00 00 00 06 01 01 00 63 0...	Read coils
14	0.110	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
15	0.130	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
16	0.130	192.168.33.26:59083->	TCP Resp.	1	0x01	B9 01 00 00 00 10 01 01 0D 00 ...	Read coils
17	0.135	192.168.33.26:59083<-	TCP Req.	1	0x01	BA 01 00 00 00 06 01 01 00 63 ...	Read coils
18	0.135	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
19	0.160	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
20	0.160	192.168.33.26:59083->	TCP Resp.	1	0x01	BA 01 00 00 00 10 01 01 0D 00 ...	Read coils
21	0.170	192.168.33.26:59083<-	TCP Req.	1	0x01	BB 01 00 00 00 06 01 01 00 63 0...	Read coils

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Load Save Exit

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

Traffic Monitor (MGate MB3270 192.168.35.194)

All
 Exception only
 Slave ID only
 Source only
 Function code only

Filter info:

Start **Stop** Clear

No.	Time	Src. & Dst.	Type	Slave...	Function Code	Data	Comment
1	0.000	192.168.33.26:59083<-	TCP Req.	1	0x01	50 0E 00 00 00 06 01 01 00 63 0...	Read coils
2	0.000	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
3	0.020	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
4	0.020	192.168.33.26:59083->	TCP Resp.	1	0x01	50 0E 00 00 00 10 01 01 0D 00 ...	Read coils
5	0.030	192.168.33.26:59083<-	TCP Req.	1	0x01	51 0E 00 00 00 06 01 01 00 63 0...	Read coils
6	0.030	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
7	0.055	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
8	0.055	192.168.33.26:59083->	TCP Resp.	1	0x01	51 0E 00 00 00 10 01 01 0D 00 ...	Read coils
9	0.055	192.168.33.26:59083<-	TCP Req.	1	0x01	52 0E 00 00 00 06 01 01 00 63 0...	Read coils
10	0.060	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
11	0.090	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
12	0.090	192.168.33.26:59083->	TCP Resp.	1	0x01	52 0E 00 00 00 10 01 01 0D 00 ...	Read coils
13	0.100	192.168.33.26:59083<-	TCP Req.	1	0x01	53 0E 00 00 00 06 01 01 00 63 0...	Read coils
14	0.100	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
15	0.135	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
16	0.135	192.168.33.26:59083->	TCP Resp.	1	0x01	53 0E 00 00 00 10 01 01 0D 00 ...	Read coils
17	0.140	192.168.33.26:59083<-	TCP Req.	1	0x01	54 0E 00 00 00 06 01 01 00 63 0...	Read coils
18	0.140	Port1->	RTU Req.	1	0x01	01 01 00 63 00 64 CD FF	Read coils
19	0.160	Port1<-	RTU Resp.	1	0x01	01 01 0D 00 00 00 00 00 00 00 ...	Read coils
20	0.160	192.168.33.26:59083->	TCP Resp.	1	0x01	54 0E 00 00 00 10 01 01 0D 00 ...	Read coils
21	0.170	192.168.33.26:59083<-	TCP Req.	1	0x01	55 0E 00 00 00 06 01 01 00 63 0...	Read coils

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Load Save Exit

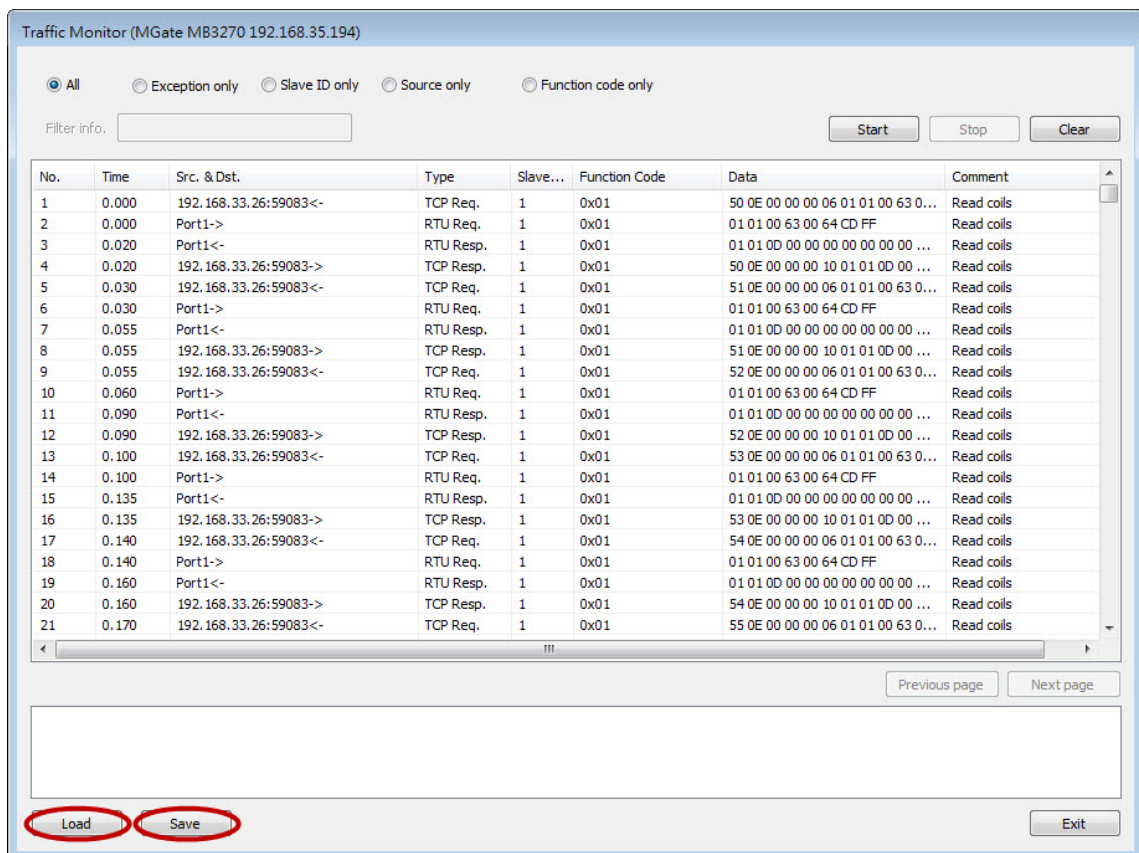
Filter Traffic Information

By default, all events are displayed in the traffic monitor window. 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

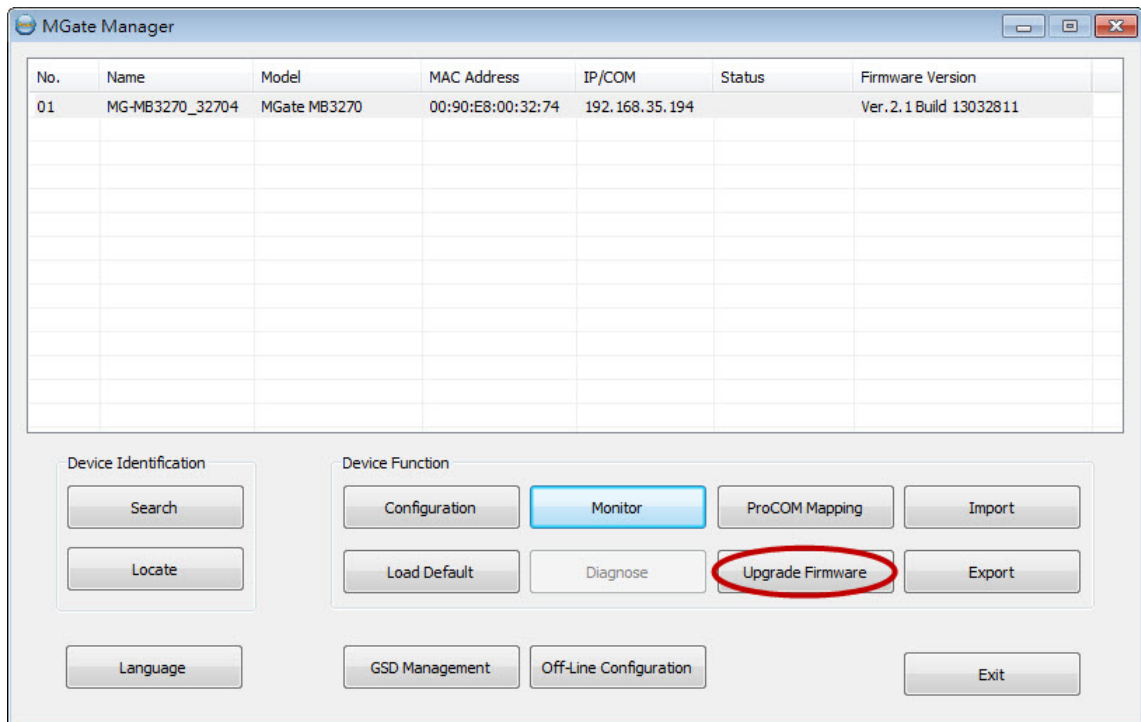
Save Log to File

To save the data log to a file, click **Save**. You may retrieve a saved log by clicking **Load**.

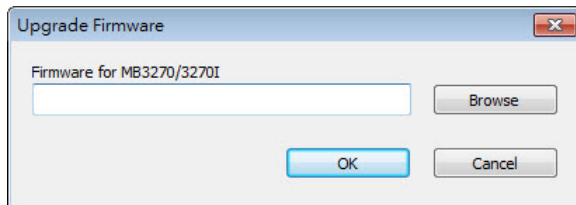


Upgrading Firmware

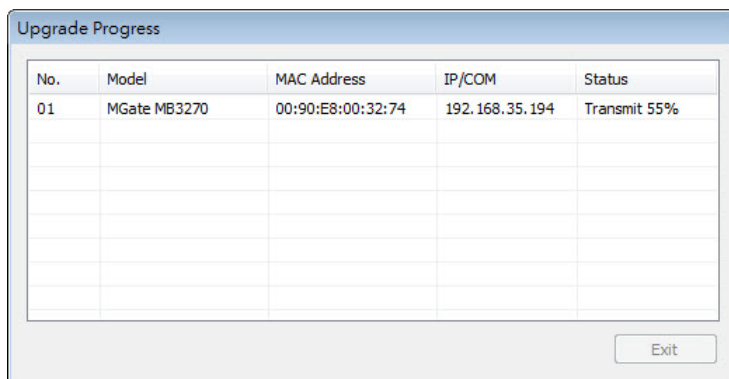
Firmware updates for the MGate MB3000 are located at <http://www.moxa.com>. After you have downloaded the new firmware onto your PC, you can use MGate Manager to write it onto your MGate MB3000. Select the desired unit from the list in MGate Manager and click **Upgrade Firmware** to begin the process.



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.



Once the firmware has been successfully written onto the unit, 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.

MXview

The Moxa MXview network management software gives you a convenient graphical representation of your Ethernet network and allows you to configure, monitor, and diagnose Moxa networking devices. MXview provides an integrated management platform that can manage the Moxa MGate MB3000 Series as well as Ethernet switches and wireless APs, and SNMP-enabled and ICMP-enabled devices installed on subnets. MXview includes an integrated MIB complier that supports any third-party MIB. It also allows you to monitor third-party OIDs and Traps. Network and Trap components that have been located by MXview can be managed via web browsers from both local and remote sites—anytime, anywhere.

MXview for the MGate MB3000 Series

Through MXview, users can access the MGate MB3000 devices and take advantage of additional functions, such as searching for MGate MB3000 devices, setting network configurations, changing passwords, upgrading firmware, and importing/exporting configurations.

All MGate MB3000 devices can be recognized by MXview. However, be sure your MGate device has the proper firmware version installed, as listed in the following table:

Model type	Firmware version
MGate MB3170/3170I	2.1 or higher
MGate MB3270/3270I	2.1 or higher
MGate MB3180	1.3 or higher
MGate MB3280	2.1 or higher
MGate MB3480	2.1 or higher

Before adding MGate MB3000 devices to the MXview utility, you must add the MB3000 plug-in package to MXview via *Plug-in Manager*. The *Plug-in Manager* is automatically installed when setting up MXview. You can download the plug-in package at <http://www.moxa.com>. For more detailed information regarding MXview, download the MXview user's manual from Moxa's website.

11

Case Studies

The following topics are covered in this chapter:

- ❑ **Introduction**
- ❑ **Replace Serial Masters with Ethernet Master(s), Slave IDs are Configurable**
- ❑ **Replace Serial Masters with Ethernet Master(s), Slave IDs are Fixed**
- ❑ **Keep Serial Master and Add Ethernet Master(s)**
- ❑ **Integrate Modbus RTU, ASCII, and TCP at the Same Time**

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.

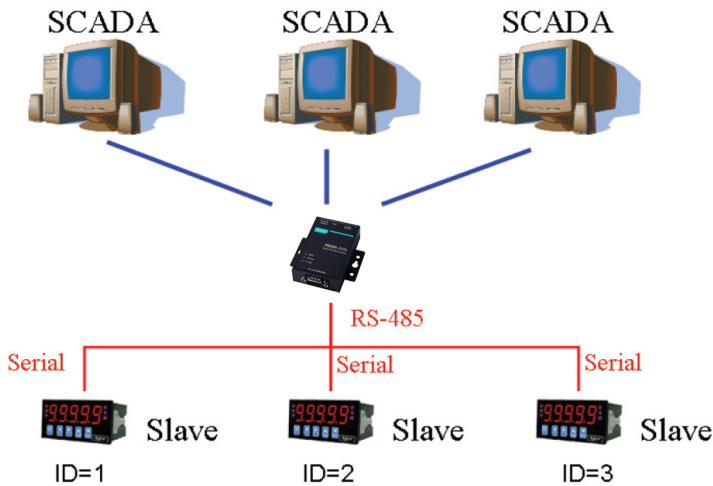
This chapter presents some case studies to guide you. If you can not find a case similar to yours, it does not mean the MGate MB3000 is not suitable for you. Please contact Moxa, and we will work it out with you.

Replace Serial Masters with Ethernet Master(s), Slave IDs are Configurable

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

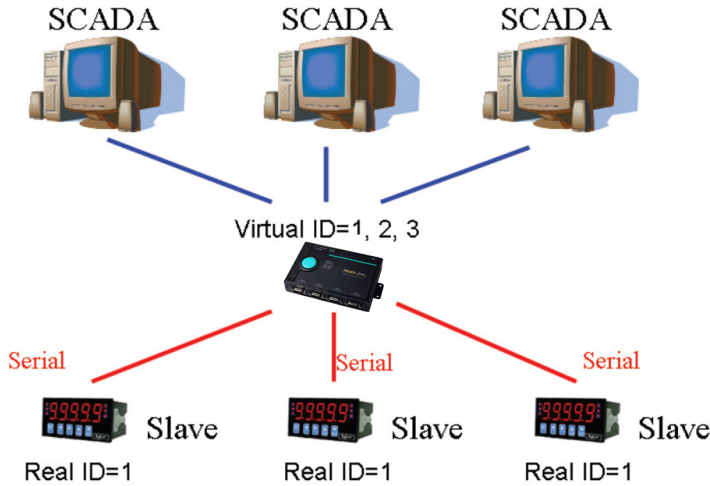


The MGate MB3000 can connect to each serial slave, so Ethernet SCADA masters will be able to control them. However, since slave IDs cannot be repeated in a system, we will need to change the IDs of some of the slaves in order to integrate them into a single network, as follows:



Replace Serial Masters with Ethernet Master(s), Slave IDs are Fixed

Some legacy Modbus 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.

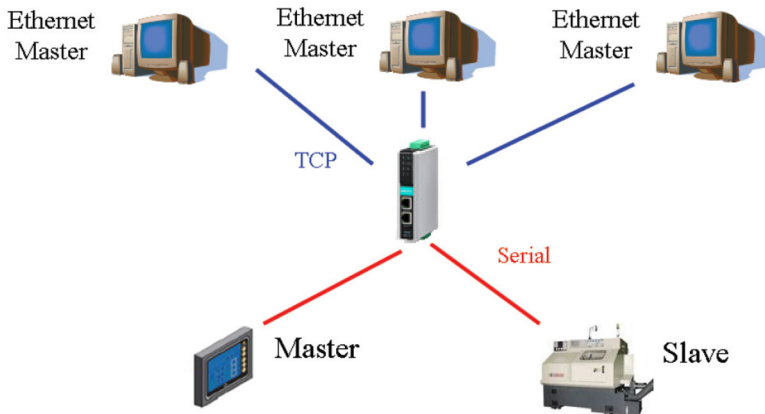


Keep Serial Master and Add Ethernet Master(s)

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



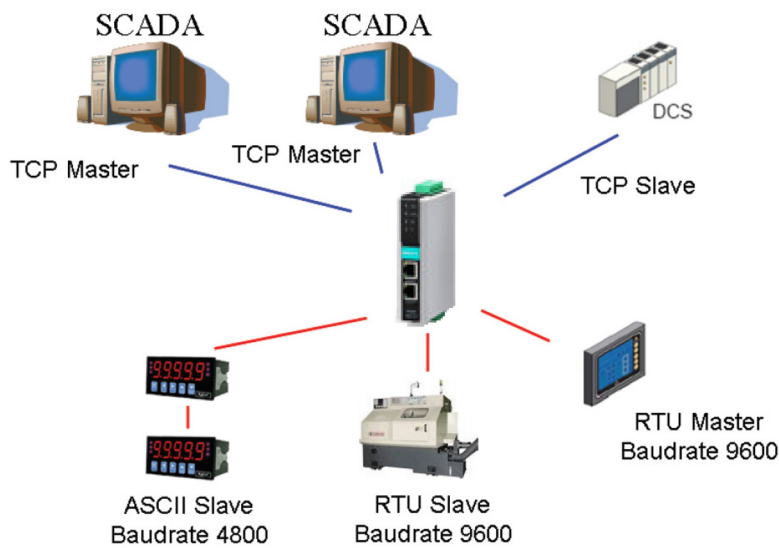
An advanced multiport MGate model (MB3270) can be inserted into the serial system, with the slaves connected to one serial port and the master to another serial port. The advanced gateway allows Ethernet masters to communicate with the serial slaves, and it also provides a serial redirector function that simultaneously allows the serial master to continue controlling the slaves.



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 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.



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 Masters or Slaves

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



Slaves are Identified by ID

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

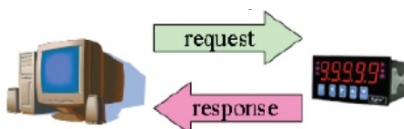
0	1~247	248~255
Broadcast address	Slave individual address	Reserved

Communication is by Request and Response

All Modbus communication is by request and response. A master sends a request and a slave sends a response. The master will wait for the slave's response before sending the next request. For broadcast commands, no response is expected. This is illustrated by three scenarios as follows:

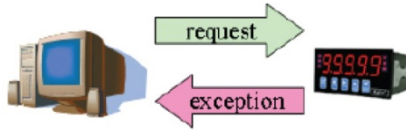
Normal

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



Exception

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



Broadcast

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



Requests Need a Time Limit

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

Response Time-Out

The master sends a request. The slave is unresponsive for the amount of time specified by the response time-out function. The 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 time-out 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 time-out value to use during configuration, especially with older or proprietary devices.

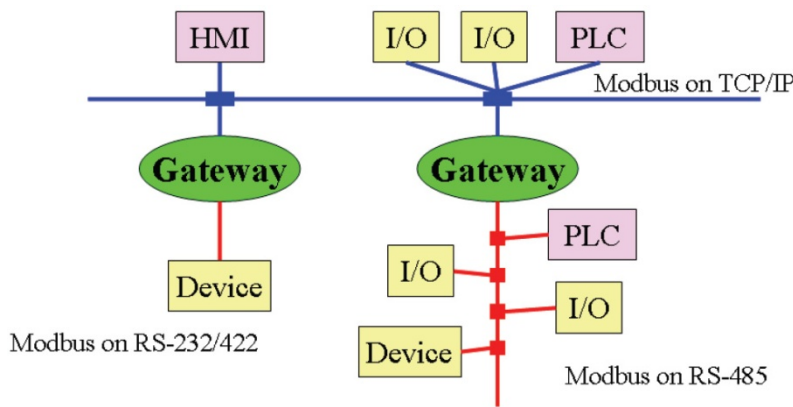
The MGate MB3000 provides a patent-protected function that tests all attached devices and recommends a response time-out value. This function saves considerable time and effort for system integrators, and it results in more accurate time-out settings.

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 are different 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 slave sends a response, or until the request times out. However, Modbus TCP allows simultaneous requests on the network, from multiple masters to multiple slaves. TCP masters cannot send more than one request at a time to a slave, but they can send requests to other slaves before a response is received. The Modbus TCP standard recommends that slaves be able to queue up to 16 requests at a time. The MGate MB3000 will queue up to 32 requests from each TCP master, for up to 16 or 32 TCP masters.

Integrate Modbus Serial and Ethernet with Gateways



Ordinarily, Modbus TCP and Modbus ASCII/RTU are unable to communicate with each other. However, with a Modbus gateway in between the Modbus serial network and the Modbus Ethernet network, TCP masters are able to communicate with serial slaves, and serial masters are able to communicate with TCP slaves.