MGate MB3660 Modbus Gateway User's Manual

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MGate MB3660 Modbus Gateway User's Manual

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Technical Support Contact Information

www.moxa.com/support

Moxa Americas
Toll-free: 1-888-669-2872
Tel: +1-714-528-6777
Fax: +1-714-528-6778

Moxa China (Shanghai office)
Toll-free: 800-820-5036
Tel: +86-21-5258-9955
Fax: +86-21-5258-5505

Moxa Europe
Tel: +49-89-3 70 03 99-0
Fax: +49-89-3 70 03 99-99

Moxa Asia-Pacific
Tel: +886-2-8919-1230
Fax: +886-2-8919-1231

Moxa India
Tel: +91-80-4172-9088
Fax: +91-80-4132-1045

Table of Contents

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Introduction

Welcome to the MGate MB3660 Series of 8 or 16-port Modbus gateways that convert between Modbus TCP and Modbus RTU/ASCII protocols.

All MB3660 gateways (MB3660-8, MB3660-16) have dual AC/DC power inputs and dual IP addresses built in for redundancy. Magnetic serial port isolation is also provided for "-I" models.

In this chapter, we give an introduction to the MGate MB3660. The following topics are covered:

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

Overview

The MGate MB3660 (MB3660-8 and MB3660-16) Series comprises redundant Modbus gateways that convert between Modbus TCP and Modbus RTU/ASCII protocols. They can be accessed by up to 256 Modbus TCP client (master) devices, or connect to 128 Modbus TCP server (slave) devices. The MGate MB3660 isolation model provides 2 kV isolation protection suitable for power substation applications. The MGate MB3660 gateways are designed to easily integrate Modbus TCP and RTU/ASCII networks. The MGate MB3660 gateways offer features that make network integration easy, customizable, and compatible with almost any Modbus network.

For large-scale Modbus deployments, MGate MB3660 gateways can effectively connect a large number of Modbus nodes to the same network. The MB3660 Series can physically manage up to 248 serial slave nodes for 8-port models or 496 serial slave nodes for 16-port models (the Modbus standard only defines Modbus IDs from 1 to 247). Each RS-232/422/485 serial port can be configured individually for Modbus RTU or Modbus ASCII operation and for different baudrates, allowing both types of networks to be integrated with Modbus TCP through one Modbus gateway.

High Performance with Innovative Command Learning

The MGate MB3660 gateways support two communication modes: transparent mode and agent mode. For transparent mode, the gateway converts Modbus commands from Modbus TCP to Modbus RTU/ASCII, and vice versa, or from serial Master to serial Slave. However, since only one Modbus protocol request-response action can be executed at any given time, each Modbus device has to wait its turn, resulting in poorer performance. Agent mode is designed to overcome this performance weakness. By allowing users to manually key in Modbus commands, the gateway can send Modbus commands to multiple Modbus devices at the same time. Since the gateway actively and continuously retrieves data from Modbus devices simultaneously through the different serial ports, users will see a dramatic reduction in the amount of time a Modbus device needs to wait to be accessed. SCADA systems can retrieve Modbus device data directly from the gateway's memory, instead of waiting for the gateway to pass commands to the serial ports, enhancing the Modbus gateway's communication performance.

Transparent mode helps users adopt existing SCADA programs, but with reduced communication performance, whereas agent mode is characterized by high performance, but it requires users to go through the trouble of keying in Modbus commands. In order to provide better performance, without requiring users to key in a lot of Modbus commands, the MGate MB3660 gateways are designed with an innovative Command Learning function, which can be activated with a single mouse click. Once activated, the gateway will learn and memorize the Modbus commands it receives, and once a command has been learned, the gateway will act as though it were in agent mode and actively send Modbus requests to the relevant Modbus devices. Since the data is saved in a different memory space that can be accessed by the SCADA system, the SCADA system can retrieve Modbus response data directly from the gateway's memory, instead of waiting for the data to pass through the Modbus devices, dramatically increasing communication performance.

Windows-Based Utility and Web Console for Easy Setup

A Windows-based utility (refer to Chapter 3) is provided to make it easy to search for and locate devices, assign IP addresses, import/export configuration files, and upgrade the the MGate MB3660's firmware. The utility automatically connects to all available MGate MB3660 units on the LAN. A user-friendly web console (refer to Chapter 4) is provided to configure the device from a web browser.

Package Checklist

All models in the MGate MB3660 Series are shipped with the following items:

Standard Accessories

- MGate MB3660 Modbus gateway
- 8-pin RJ45-to-DB9 female serial cable for console setting
- Two L-shaped brackets for wall mounting
- Two AC power cord (for AC models); two terminal blocks (for DC models)
- Documentation & software CD
- Quick installation guide (printed)
- Warranty card

Optional Accessories

- **Mini DB9F-to-TB Adapter:** DB9 female to terminal block adapter for RS-422/485 applications
- **CBL-RJ45M9-150:** 8-pin RJ45 to DB9 male cable, 150 cm
- **CBL-RJ45F9-150:** 8-pin RJ45 to DB9 female cable, 150 cm

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

Product Features

- Innovative Command Learning eliminates the need to key-in SCADA Modbus commands (acts as an agent gateway)
- Auto device routing (patent pending)
- High performance through active and parallel polling of serial devices
- Supports serial (Master) to serial (Slave) communication
- 2 Ethernet ports with the same IP or dual IP addresses
- SD card for configuration backup
- Access by up to 256 Modbus TCP client (master) devices, or connect to 128 Modbus TCP server (slave) devices
- Dual VDC or VAC power inputs with wide power input range
- 3-pin fault relay circuit for event alarms
- 2 kV isolation protection (for "-I" models)

2

Getting Started

This chapter provides basic instructions for installing the MGate MB3660.

The following topics are covered in this chapter:

- **Connecting the Power**
- **Connecting Serial Devices**
- **Connecting to a Host or the Network**
- **Wiring Requirements**
- **LED Indicators**
- **Dimensions**
- **Adjustable Pull High/Low Resistors for the RS-485 Port**
- **Pin Assignments**
- **Power Input**
- **Relay Output**
- **Rackmount**
- **Specifications**

Connecting the Power

The unit can be powered by connecting a power source to the terminal block for DC models or power connector for AC models.

For DC power input models:

1. Loosen or remove the screws on the terminal block.
2. Connect the 20-60 VDC power line to the terminal block.
3. Tighten the connections using the screws on the terminal block.

For AC power input models:

- Connect the 100-240 VAC power line to the AC connector.

Note that the unit does not have an on/off switch. It automatically turns on when it receives power. The PWR LED on the front panel will glow to indicate that the unit is receiving power. There are two DC power inputs for redundancy.

Connecting Serial Devices

The unit's serial port(s) are located on the back panel. If you are connecting an RS-485 multidrop network with multiple devices, 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 connect to its own port on the unit. If you are connecting to a network with both master and slave devices, the master must be connected to a separate port from the slaves.

For serial port pin assignments, refer to the **Pin Assignments** section.

Connecting to a Host or the Network

Two 10/100BaseT Ethernet ports are located on the gateway's back panel. These ports are used to connect the unit 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.

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

The MGate MB3660 has two Ethernet ports with two MAC addresses. Hence, the unit can be connected by two different IP addresses.

Wiring Requirements

ATTENTION

Safety First!

Be sure to disconnect the power cord before installing and/or wiring your MGate MB3660.

Wiring Caution!

Calculate the maximum possible current in each power wire and common wire. Observe all electrical codes dictating the maximum allowed current for each wire size.

If the current goes over the allowed maximum, the wiring could overheat, causing serious damage to your equipment.

Temperature Caution!

Be careful when handling the MGate MB3660. When plugged in, the MGate MB3660's internal components generate heat, and consequently the board may feel too hot to touch.

You should also observe the following common wiring rules:

- Use separate paths to route wiring for power and devices. If power wiring and device wiring paths must cross, make sure the wires are perpendicular at the point of intersection.

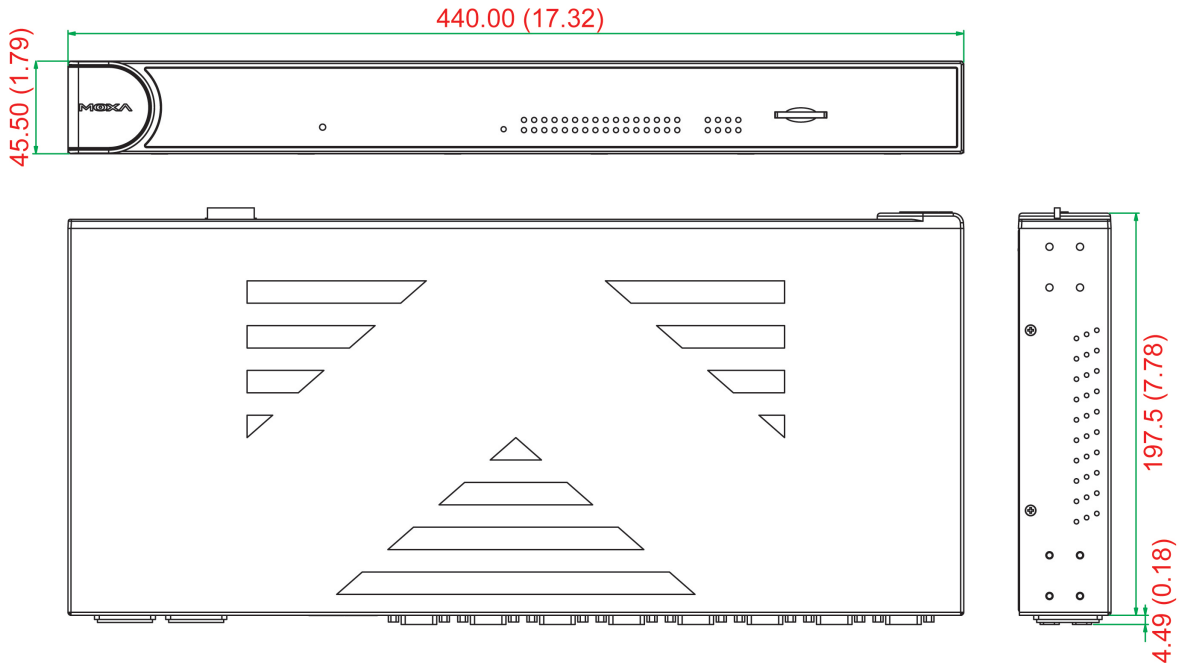
NOTE Do not run signal or communication wiring and power wiring in the same wire conduit. To avoid interference, wires with different signal characteristics should be routed separately.

- You can use the type of signal transmitted through a wire to determine which wires should be kept separate. The rule of thumb is that wiring that shares similar electrical characteristics can be bundled together.
- Keep input wiring and output wiring separate.
- When necessary, we strongly advise labeling wiring to all devices in the system.

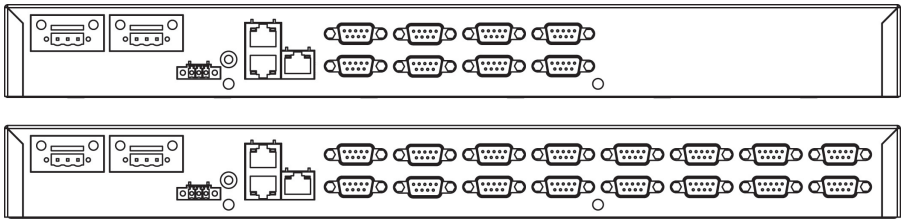
LED Indicators

Item	Description	
Reset Button	Press the Reset button for five seconds to load factory defaults. The MGate MB3660 will beep twice when the configuration has been reset.	
(LEDs)		
PWR 1, PWR 2	Red	Power connection
	Off	Power cable is not connected
Ready	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 **locate** function
	Off	Power is off, or power error condition exists
Tx 1–8 (16)	Green	Serial port is transmitting data
Rx 1–8 (16)	Amber	Serial port is receiving data
LAN 1, LAN 2	Green	Indicates 100 Mbps Ethernet connection
	Amber	Indicates 10 Mbps Ethernet connection
	Off	Ethernet cable is disconnected

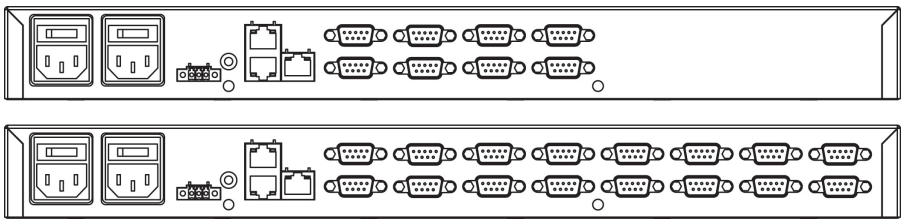
Dimensions



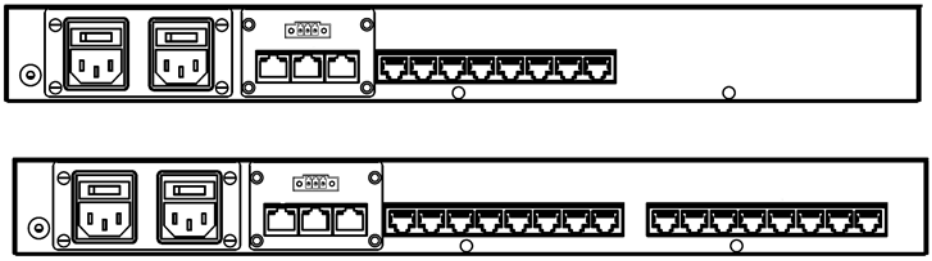
DC-DB9 Models



AC-DB9 Models



AC-RJ45 Models



Adjustable Pull High/Low Resistors for the RS-485 Port

In some critical 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. The MGate MB3660 uses DIP switches to set the pull high/low resistor values for each serial port. Tear open the screws and find the DIP switches located at the back side of the PCB.

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

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

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

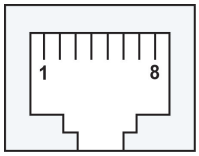
ATTENTION

Do not use the 1 KΩ pull high/low setting on the MGate MB3660 when using the RS-232 interface. Doing so will degrade the RS-232 signals and reduce the effective communication distance.

Pin Assignments

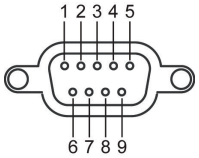
The MGate MB3660 uses DB9 serial ports to connect to Modbus RTU or ASCII devices. Each port supports three serial interfaces that select by software: RS-232, RS-422, and RS-485 (both 2 and 4-wire).

RJ45 (Ethernet, Console)



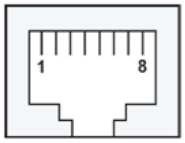
Pin	Ethernet	Console (RS-232)
1	Tx+	DSR
2	Tx-	RTS
3	Rx+	GND
4	–	TxD
5	–	RxD
6	Rx-	DCD
7	–	CTS
8	–	DTR

Male DB9 (Serial Ports)



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

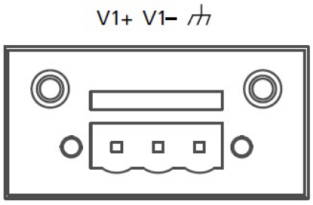
RJ45 (Serial Ports)



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

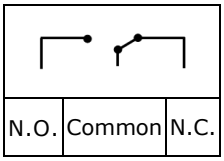
Power Input

DC Model (20 to 60 VDC)



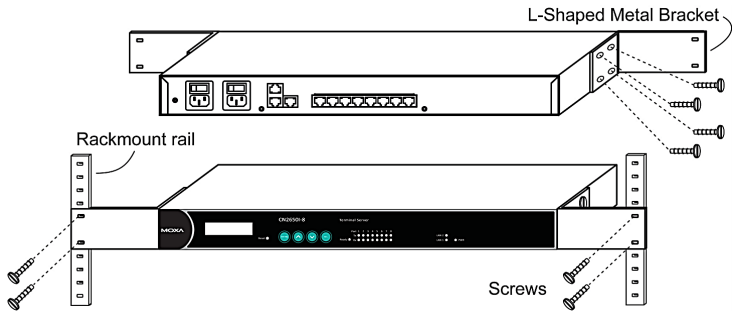
AC Model (100 to 240 VAC)

Relay Output



Rackmount

The MGate MB3660 is designed to be mounted on a standard 19-inch rack. Use the enclosed pair of L-shaped metal brackets and screws to fasten your MGate MB3660 to the rack cabinet. Each L-shaped bracket has six holes, leaving two outer or inner holes available for other uses. You have two options. You can lock either the front or rear panel of the MGate MB3660 to the front of the rack. Locking the front panel is shown in the following figure.



Specifications

Ethernet Interface

Number of Ports: 2 ports (2 IP addresses)
Speed: 10/100 Mbps, Auto MDI/MDIX
Connector: RJ45 x 2
Protocols: Modbus TCP Client/Server

Serial Interface

Number of Ports:
MGate MB3660-8: 8 ports
MGate MB3660-16: 16 ports
MGate MB3660I-8: 8 ports
MGate MB3660I-16: 16 ports
Serial Standards: RS-232/422/485, software selectable
Connector: DB9 male or RJ45
RS-485 Data Direction Control: ADDC® (automatic data direction control)
Isolation Protection: 2 kV (for "-I" model)
Protocols: Modbus RTU/ASCII Master/Slave

Serial Communication Parameters

Data Bits: 8
Stop Bits: 1, 2
Parity: None, Even, Odd, Space, Mark
Flow Control: RTS/CTS, DTR/DSR, RTS Toggle (RS-232 only)
Transmission Speed: 50 bps to 921.6 Kbps

Serial Signals

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

Software

Configuration Options: Web console, Serial console, Telnet console
Utilities: Device Search Utility (DSU) for Windows 95, 98, ME, NT, 2000, Windows XP, Server 2003, Vista, Server 2008 (x86/x64), Windows Server 2008 R2, Windows 7/8/8.1/10 (x86/x64), Windows Server 2012 (x64), Windows 2012 R2
Network protocols: TCP/IP, UDP, HTTP, SMTP, NTP, DNS, DHCP Client, SNMPv1 (read only), ARP, Telnet, Radius
Multimaster and Multidrop: Master mode: 128 Modbus TCP servers; Slave mode: 256 Modbus TCP clients

Physical Characteristics

Fault Relay Circuit: 3-pin circuit with current carrying capacity of 2 A @ 30 VDC
External Storage Drive: SD card for configuration backup
Housing: Metal, IP30 protection
Dimensions:
Without ears: 440 x 45 x 198 mm (17.32 x 1.77 x 7.80 in)
With ears: 480 x 45 x 198 mm (18.90 x 1.77 x 7.80 in)

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)

Power Requirements

Input Voltage:
For DC models: Dual 20 to 60 VDC (1.5 kV isolation)
For AC models: Dual 100 to 240 VAC, 47 to 63 Hz
Power Connector: Terminal block (for DC models)

Power Consumption:

MGate MB3660-8-2AC: 144mA/110V, 101mA/220V
MGate MB3660-8-2DC: 312mA/24V, 156mA/48V
MGate MB3660I-8-2AC: 244mA/110V, 159mA/220V
MGate MB3660-8-J-2AC: 111mA/110VAC, 81mA/220VAC
MGate MB3660-16-2AC:178mA/110V,120mA/220V
MGate MB3660-16-2DC: 390mA/24V, 195mA/48V
MGate MB3660-16-J-2AC: 133mA/110VAC, 92mA/220VAC
MGate MB3660I-16-2AC: 351mA/110VAC, 221mA/220VAC

Standards and Certifications

Safety: UL 60950-1, EN 60950-1 (LVD)
EMC: CE, FCC
EMS:
EN 55032/24
EN 61000-4-2 (ESD) Level 3 for power side, Level 4 for serial side (Contact: 8 kV, Air: 15 kV)
EN 61000-4-3 (RS) Level 2
EN 61000-4-4 (EFT) Level 2
EN 61000-4-5 (Surge) Level 3
EN 61000-4-6 (CS), Level 3
EN 61000-4-8 (PFMF) Level 3
Shock: IEC 60068-2-27, IEC 60870
Freefall: IEC 60068-2-32
Vibration: IEC 60068-2-64, IEC 61373

Warranty

Warranty Period: 5 years
Details: See www.moxa.com/warranty

3

Device Search Utility

The following topics are covered in this chapter:

- **Installing the Software**
- **Starting Device Search Utility (DSU)**
- **Connecting to the Unit**
  - Broadcast Search
  - Search IP
  - Locate
- **Upgrading the Firmware**

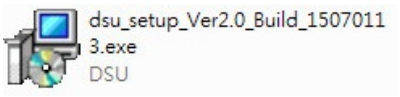
Installing the Software

The following instructions explain how to install the Device Search Utility (abbreviated **DSU**), a utility for configuring and monitoring MGate MB3660 units over the network.

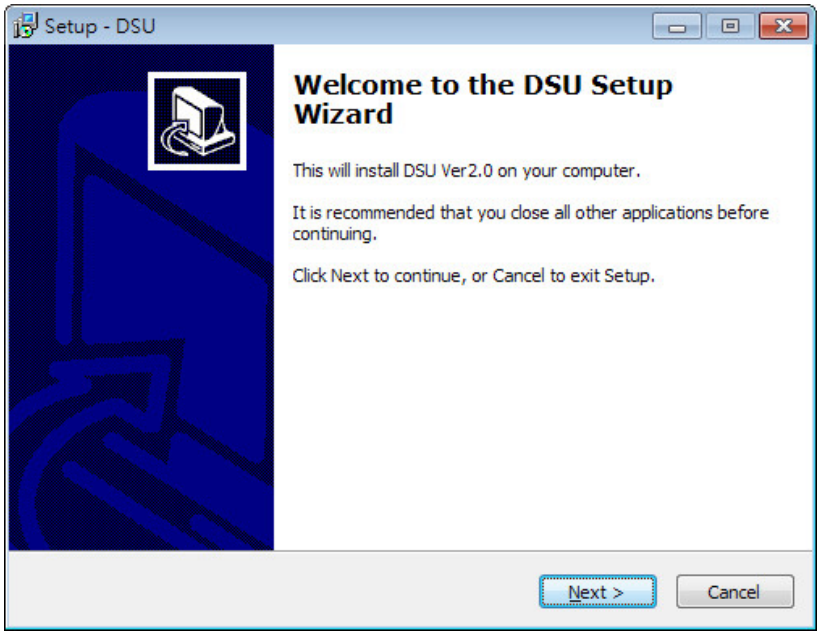
1. Insert the Document and Software CD into the CD-ROM drive. Locate and run the following setup program to begin the installation process:

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

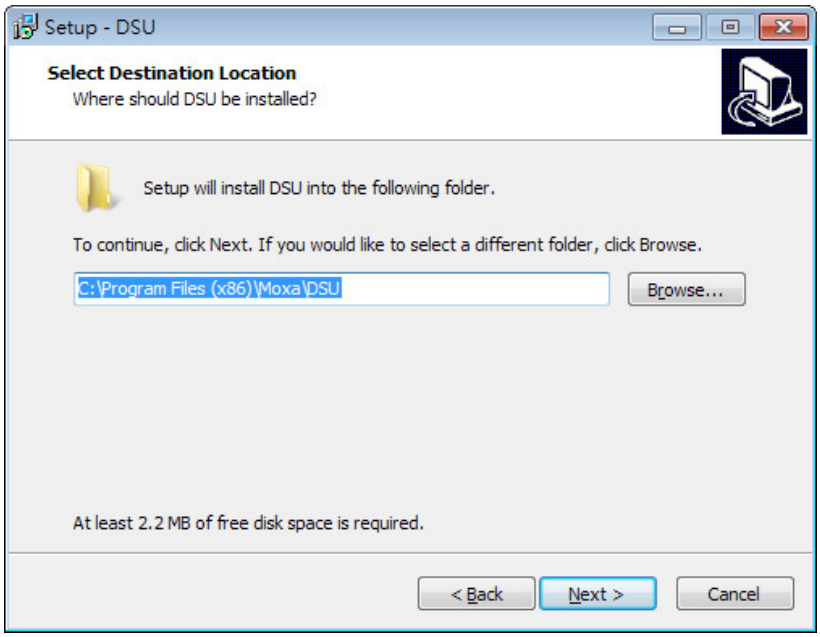
   The version might be named **dsu_setup_Ver2.x_Build_xxxxxxxx.exe**, for example:

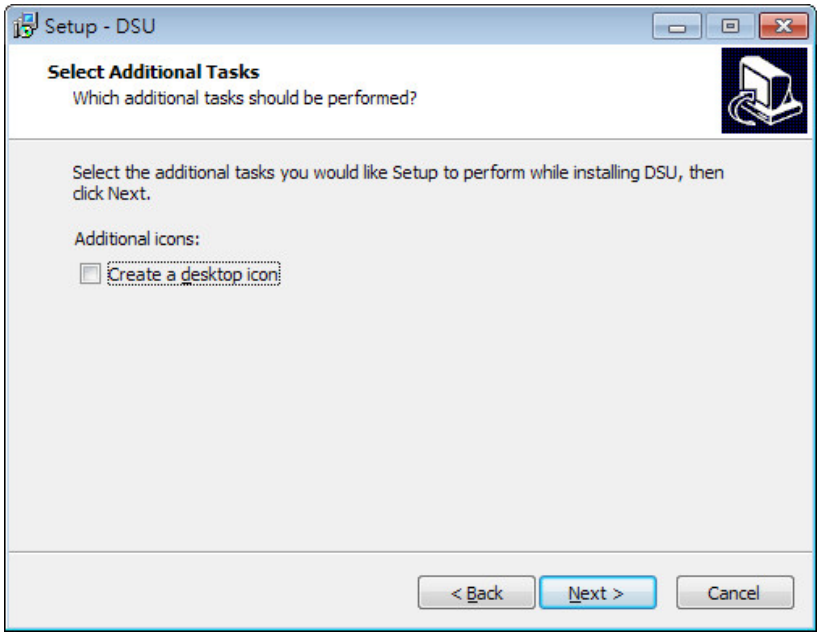
2. You will be greeted by the Welcome window. Click **Next** to continue.

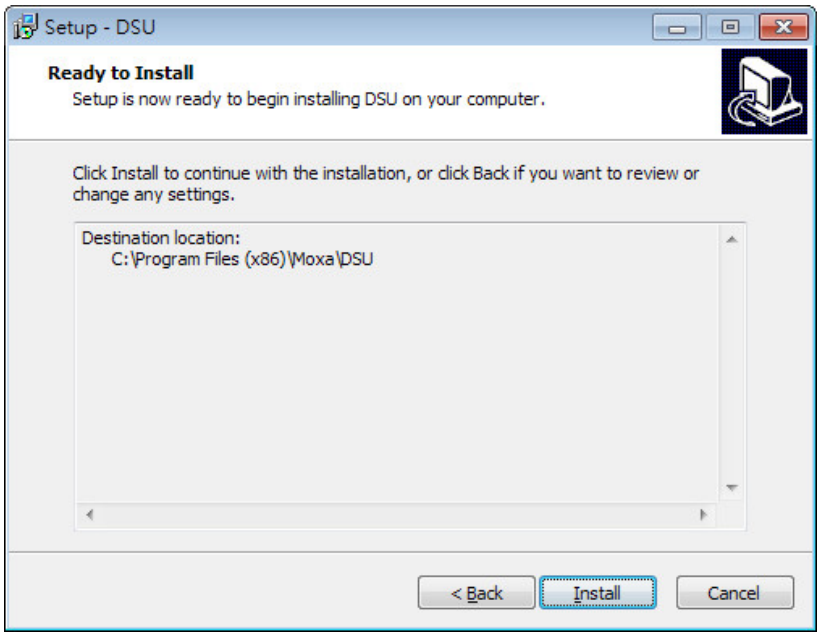
3. When the **Select Destination Location** window appears, click **Next** to continue. You may change the destination directory by first clicking on **Browse...**.

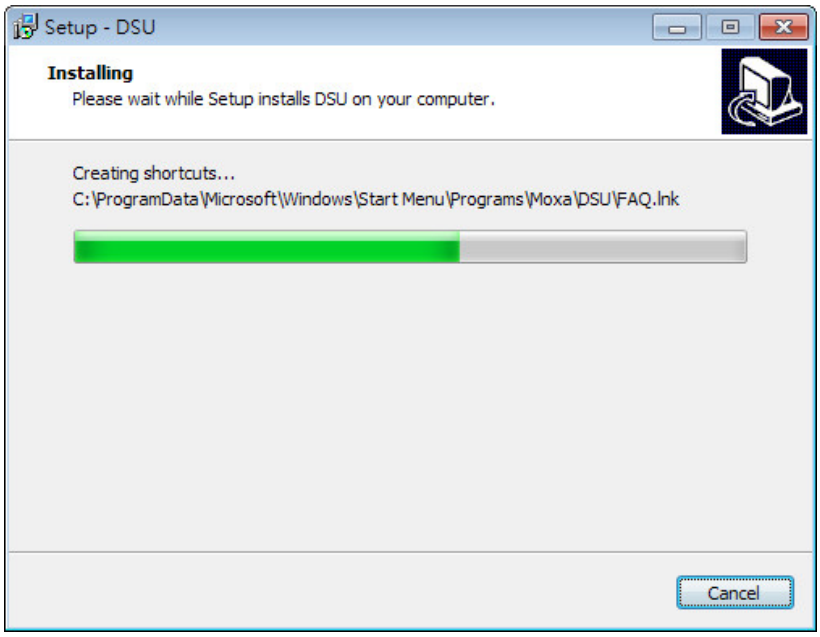
4. When the **Select Additional Tasks** window appears, click **Next** to continue. You may select **Create a desktop icon** if you would like a shortcut to DSU on your desktop.



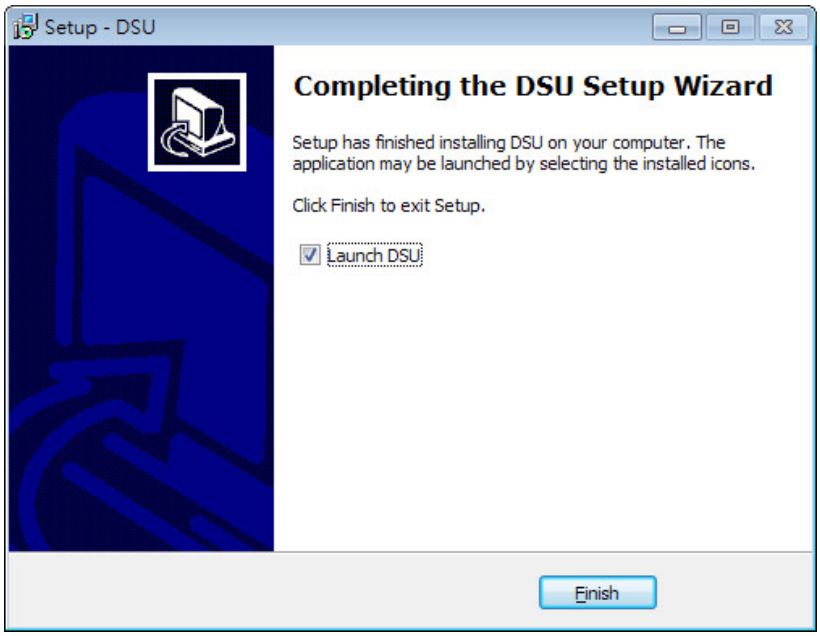
5. Click **Install** to start copying the software files.



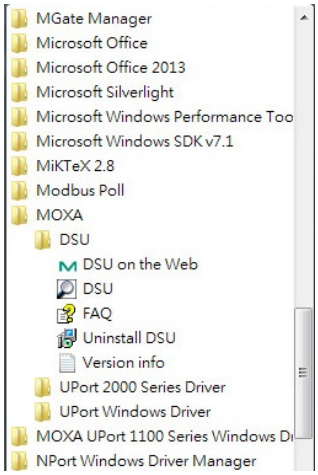
6. A progress bar will appear. The procedure should take only a few seconds to complete.



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



8. You may also open DSU through **Start → Programs → MOXA → DSU**, as shown below.

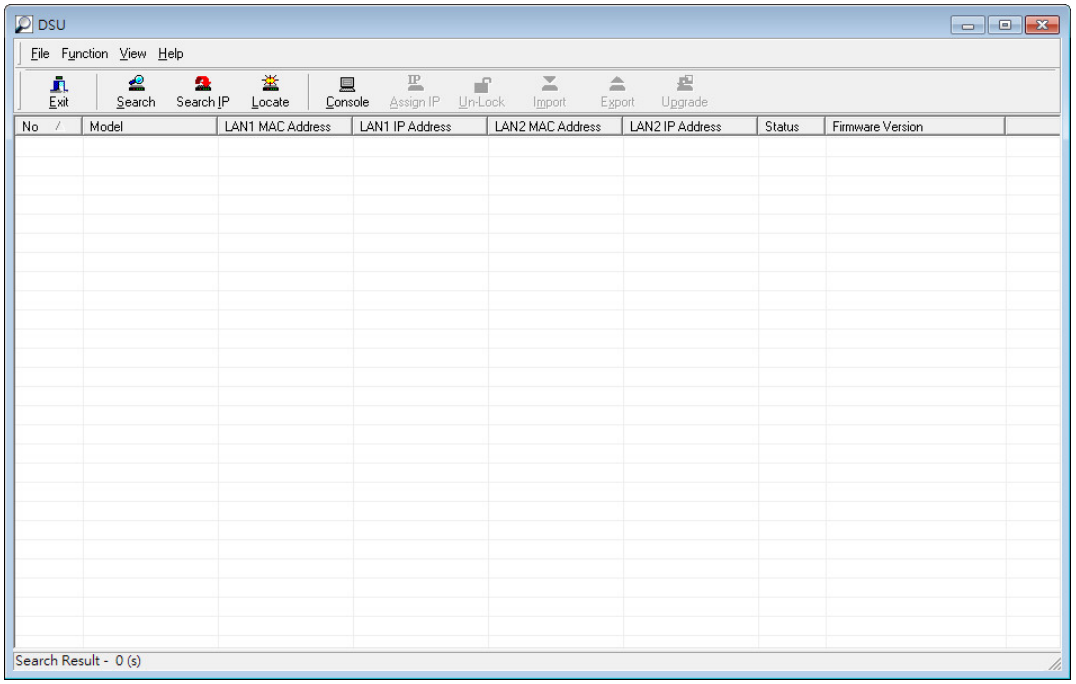


Starting Device Search Utility (DSU)

DSU is a Windows-based utility that is used to configure the MGate MB3660 Series.

Before running DSU, make sure that your PC and the MGate MB3660 are connected to the same network. Alternatively, the MGate MB3660 Series may be connected directly to the PC for configuration purposes. Refer to Chapter 2 for more details.

You may open DSU from the Windows Start menu by clicking **Start → Programs → MOXA → DSU.** The DSU window should appear as shown below.

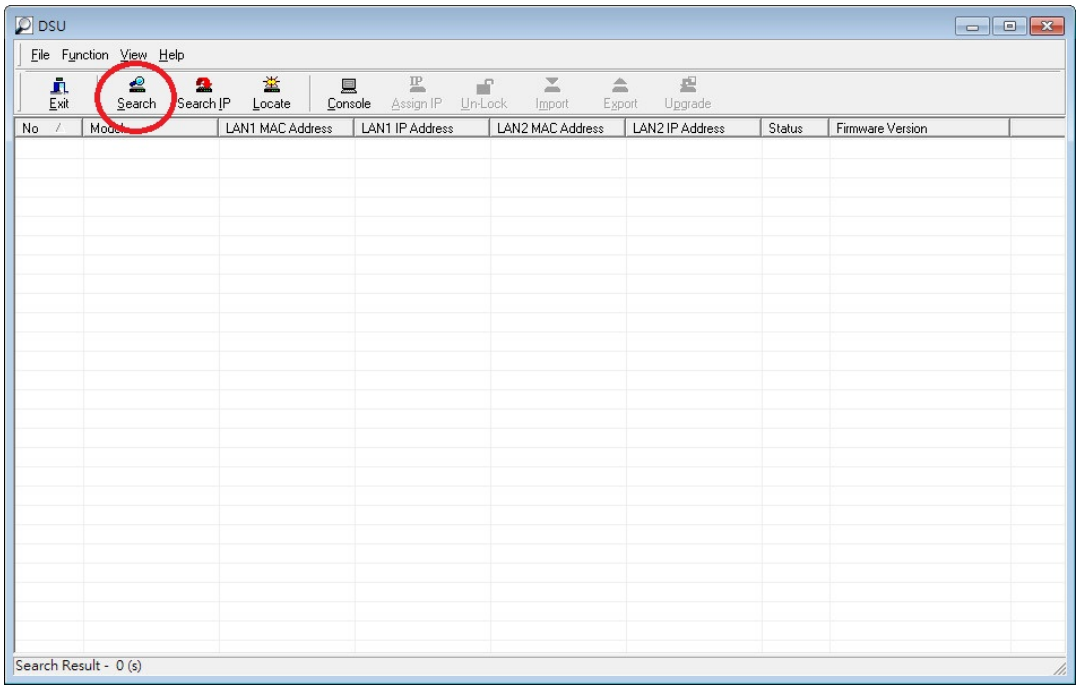


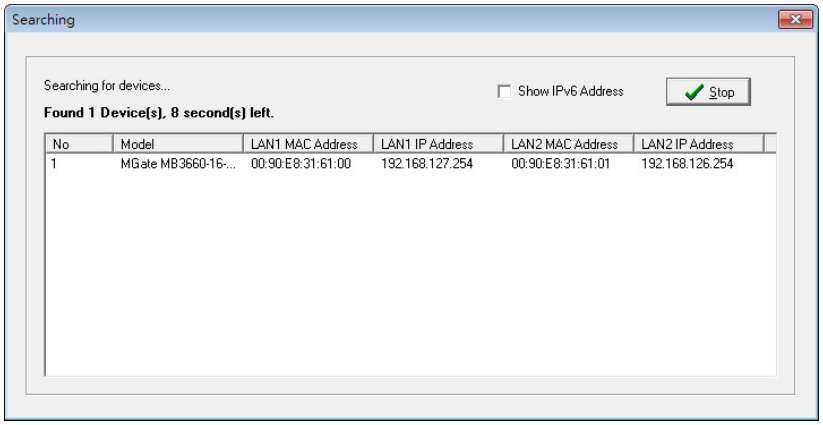
Connecting to the Unit

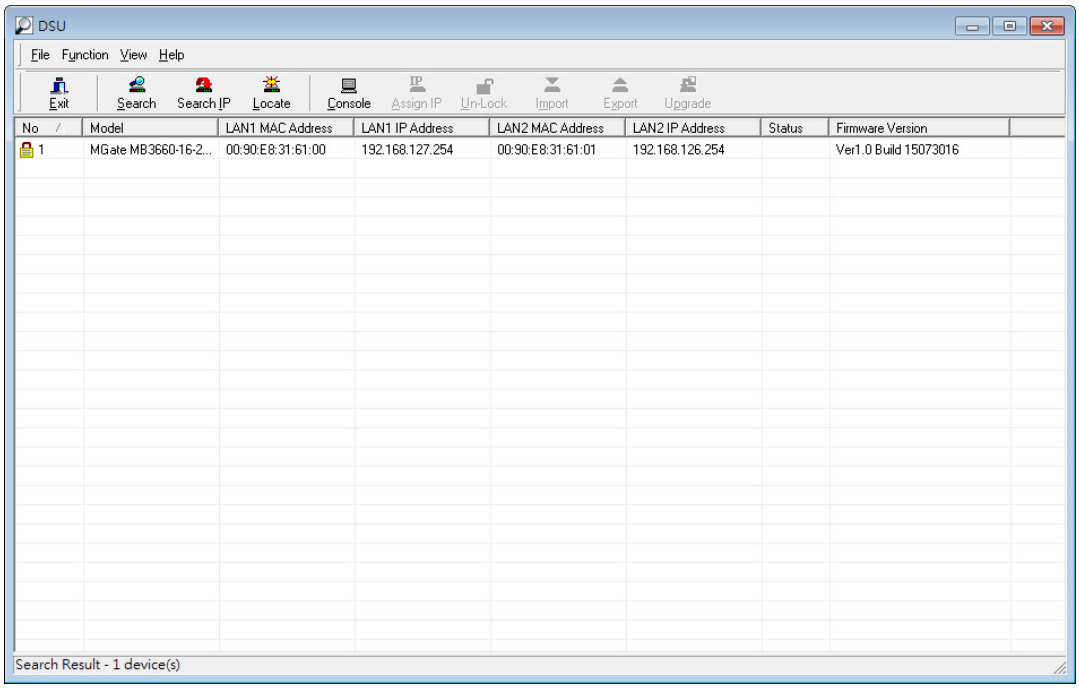
The DSU needs to connect to the unit before the unit can be configured. There are two methods to connect to the unit. **Broadcast Search** is used to find all MGate MB3660 units on the LAN. **Search IP** attempts to connect to a specific unit by IP address, which is useful if the unit is located outside the LAN or can only be accessed by going through a router.

Broadcast Search

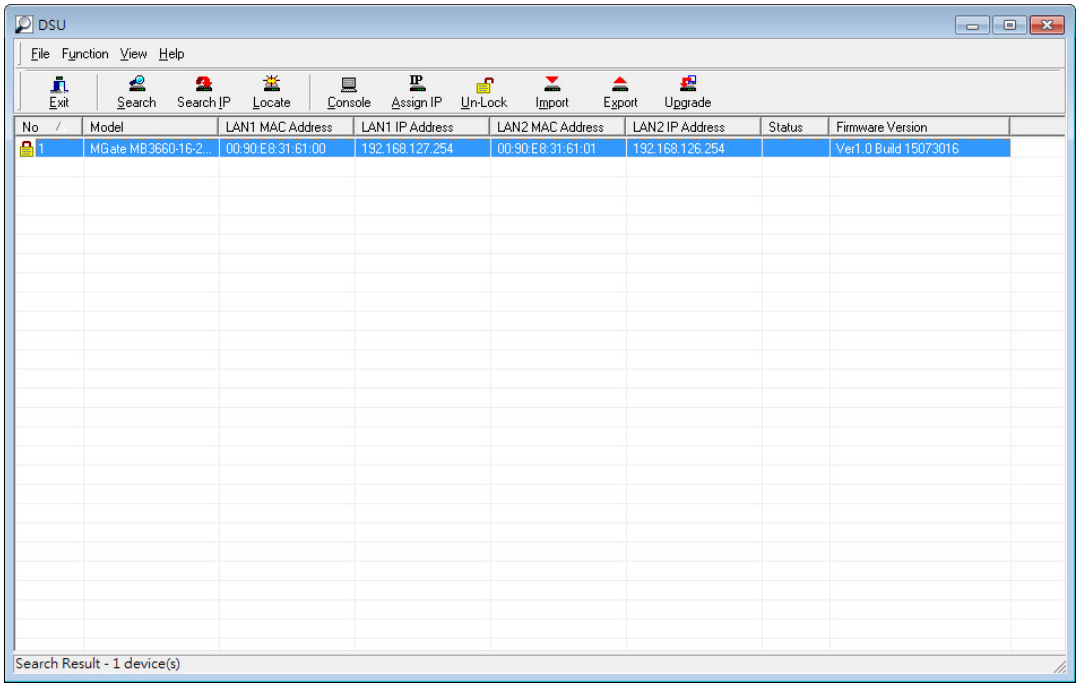
Click **Search** and a new Search window will pop up.







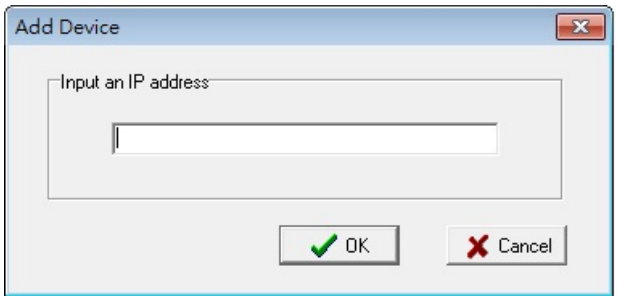
When the search is complete, every MGate MB3660 found on the LAN will appear in the DSU window. The MAC address, IP address, and Firmware version of each unit will be shown. Select the one you would like to configure.



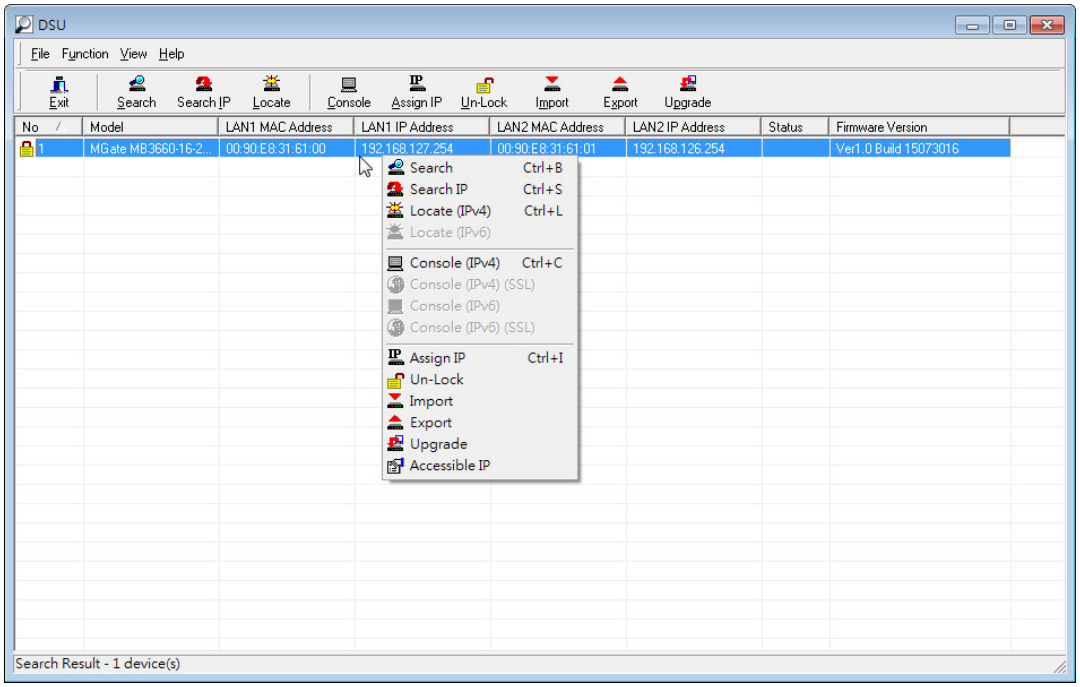
Search IP

Click **Search IP** 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**.

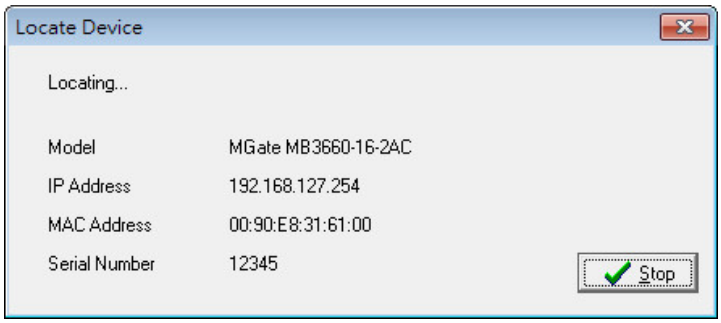


If the search is successful, the unit will be listed in the DSU window. Right click the unit to open a pop-up list of possible actions, or double click a unit to open the web console.



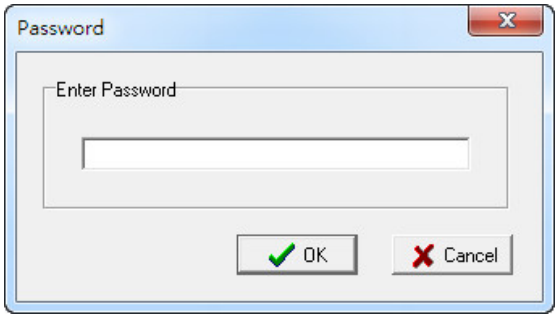
Locate

The **Locate** function will cause the unit to beep, so you can determine which unit is the target.



The **Assign IP** function allows you to change the unit's IP addresses.

Use the **Un-Lock** function to execute Import, Export, and Upgrade actions. The default password is **moxa**.



To **Import** or **Export** the configuration file, click the icons to import the configuration file from a laptop or export the currently used unit's configuration file to a laptop.

ATTENTION

If Search IP fails to locate the MGate MB3660, 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 MB3660 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 MB3660. After your PC and the MGate MB3660 are on the same subnet, DSU should be able to find the unit.

Upgrading the Firmware

You can obtain the latest firmware for the MGate MB3660 from www.moxa.com. After downloading the new firmware file to your PC, you can use the DSU to write it to your MGate MB3660. Select the desired unit from the DSU list and then click **Upgrade** to begin the process.

4

Web Console Configuration

The MGate MB3660 provides a web console for easy configuration through a web browser such as Microsoft Internet Explorer or Google Chrome.

The following topics are covered in this chapter:

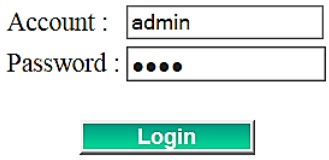
- **Logging into the Web Console**
- **Basic Settings**
- **Network Settings**
- **Serial Settings**
  - RTS Delay
- **Protocol Settings**
  - Transparent Mode
  - Agent mode
  - System Management
  - System Monitoring
- **Save/Restart**
- **Logout**
- **MXView**
- **MXconfig**

Logging into the Web Console

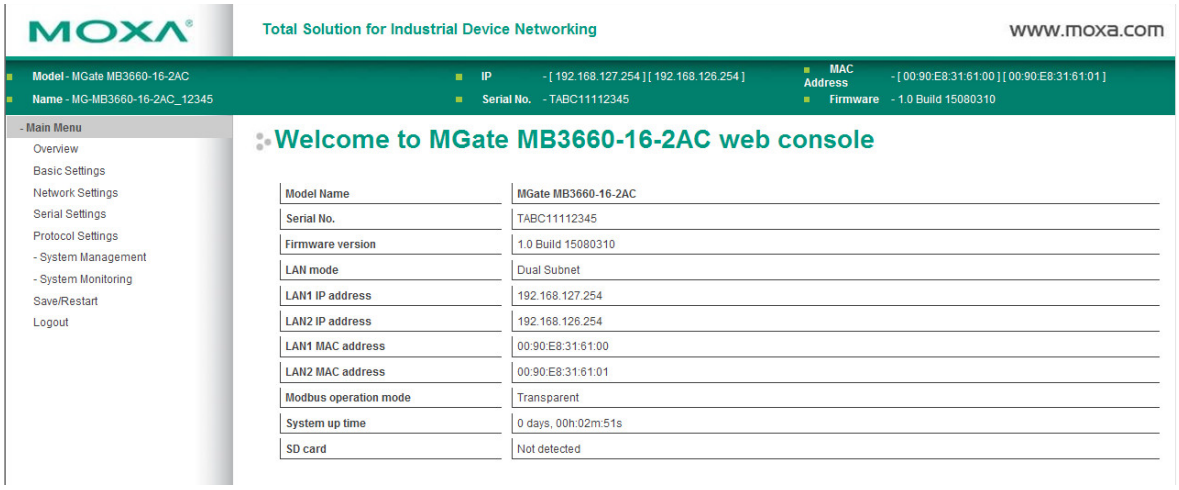
To connect to the MGate web console, open a web browser and enter the MGate gateway's IP address.

http://<MGate IP address>

The default IP addresses of LAN1 and LAN2 are 192.168.127.254 and 192.168.126.254, respectively. If you are unable to log in to the unit, you can use the DSU to first search for the unit. Refer to the **Device Search Utility.** On the first page of the web console, enter **admin** for the default Account name and **moxa** for the default password.

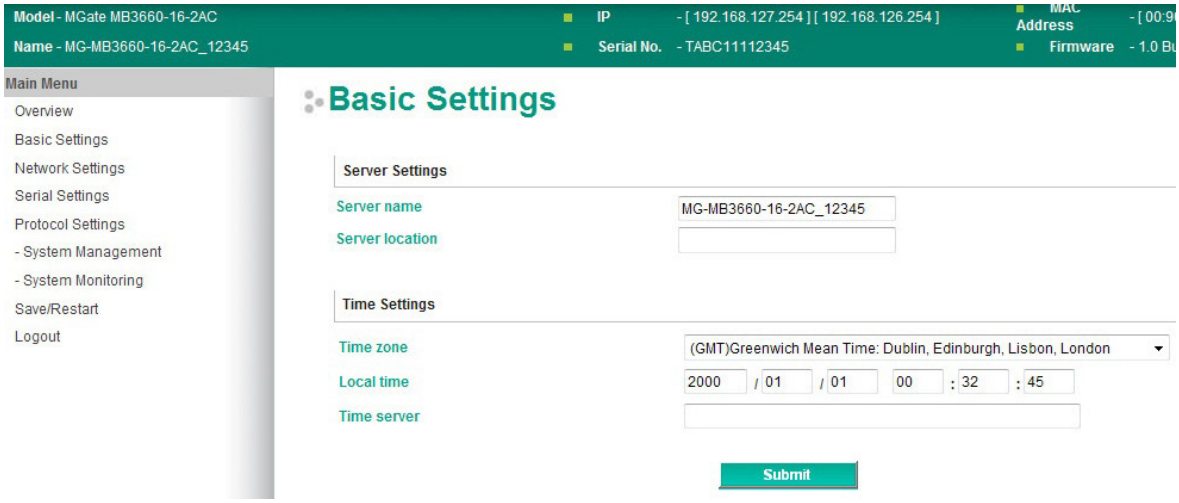


The welcome page shows information relevant to the MGate MB3660.



Basic Settings

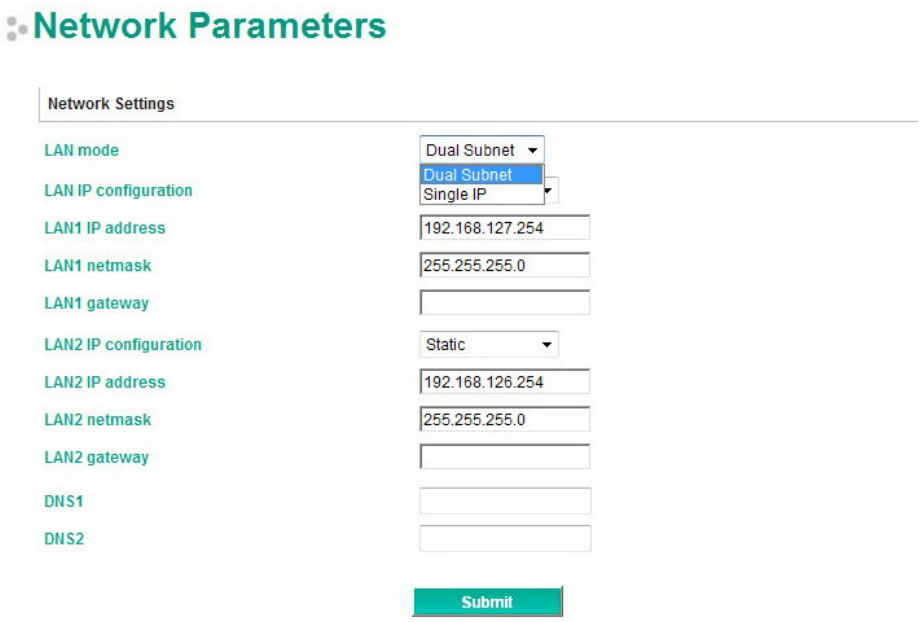
Server Settings and **Time Settings** are shown on the **Basic Settings** page. Click **Submit** to save the current changes to the unit and click **Save/Restart** once all the settings have been changed. The unit will reboot immediately to use the new settings.



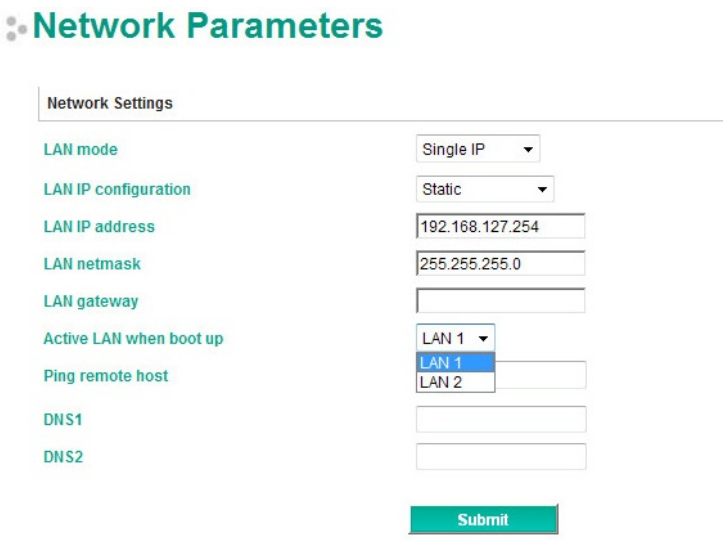
Network Settings

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

The MGate MB3660 gateways have dual Ethernet ports with dual MACs. There are two LAN modes: **Dual Subnet** and **Single IP**.



Dual Subnet mode allows the gateway to have two different IP addresses, each with distinct netmask and gateway settings. **Single IP** mode allows users to use the same IP address on both Ethernet ports.



You need to choose which LAN port will be active when the device boots up. The MGate MB3660 will continuously send PING requests to the assigned host to determine the network status. If the active LAN fails to respond, the unit will automatically hand over to the backup LAN. This mechanism not only detects a physical link down situation, but also the actual network status via the PING function. Consequently, you can plug in both Ethernet cables into the two Ethernet ports using the same IP address. The MGate MB3660 gateway will detect and hand over to the active/backup LAN automatically

.

Parameter	Value (Default)	Notes
LAN mode	Dual Subnet	**Dual Subnet:** Use two different IP addresses for the two Ethernet ports. **Single IP:** Use one IP address for both ports.
LAN IP configuration	Static IP	Select **Static IP** if you are using a fixed IP address. Select **DHCP, BootP, or DHCP/BootP** if the IP address is set dynamically.
LAN IP address	LAN1:192.168.127.254 or LAN2:192.168.126.254	The IP (Internet Protocol) address identifies the server on the TCP/IP network.
LAN netmask	255.255.255.0	Identifies the server as belonging to a Class A, B, or C network.
LAN gateway	0.0.0.0	The IP address of the router that provides network access outside the server's LAN.
Ping remote host	0.0.0.0	Remote server for ping test
DNS1	0.0.0.0	This is the IP address of the primary domain name server.
DNS2	0.0.0.0	This is the IP address of the secondary domain name server.

Serial Settings

The **Serial** tab is where each serial port's communication parameters are configured. You can configure **Baudrate**, **Parity**, **Stop Bit**, **Flow Control**, **FIFO**, **Interface**, **RTS on delay**, and **RTS off delay**.

Parameter	Value
Baudrate	50 bps to 921600 bps
Parity	None, Odd, Even, Space, Mark
Stop Bits	1, 2
Data Bits	7, 8 (Data bits 7 can be selected under Modbus ASCII mode)
Flow Control	None, RTS/CTS, DTR/DSR, RTS Toggle
UART FIFO	Enable, Disable
Interface	RS-232
	RS-422
	RS-485, 2W
	RS-485, 4W
RTS On Delay	0 to 100 ms. (The function will be active when Flow Control is set to RTS Toggle)
RTS Off Delay	0 to 100 ms. (The function will be active when Flow Control is set to RTS Toggle)

Serial Settings

Port	Baud rate	Parity	Data bit	Stop bit	Flow control	FIFO	Interface	RTS on delay	RTS off delay
1	115200	Even	8	1	None	Enable	RS-232	0	0
2	115200	Even	8	1	None	Enable	RS-232	0	0
3	115200	Even	8	1	None	Enable	RS-232	0	0
4	115200	Even	8	1	None	Enable	RS-232	0	0
5	115200	Even	8	1	None	Enable	RS-232	0	0
6	115200	Even	8	1	None	Enable	RS-232	0	0
7	115200	Even	8	1	None	Enable	RS-232	0	0
8	115200	Even	8	1	None	Enable	RS-232	0	0
9	115200	Even	8	1	None	Enable	RS-232	0	0
10	115200	Even	8	1	None	Enable	RS-232	0	0
11	115200	Even	8	1	None	Enable	RS-232	0	0
12	115200	Even	8	1	None	Enable	RS-232	0	0
13	115200	Even	8	1	None	Enable	RS-232	0	0
14	115200	Even	8	1	None	Enable	RS-232	0	0
15	115200	Even	8	1	None	Enable	RS-232	0	0
16	115200	Even	8	1	None	Enable	RS-232	0	0

Activate

RTS Delay

The **RTS Toggle** function in flow control 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.

Protocol Settings

The MGate MB3660 provides two operation modes for Modbus communication: **Transparent mode** and **Agent Mode**.

In **Transparent mode**, the gateway will bypass and translate Modbus commands between Modbus TCP/RTU/ASCII. In **Agent mode**, the gateway will actively poll the Modbus slave devices and store the data in the gateway's memory. The Modbus master can retrieve Modbus slave devices' data via the gateway's memory.

Protocol Settings

Operation Mode: Transparent / Agent

Mode | Slave ID Map | Priority Control | Advanced Settings | Intelligent Commands

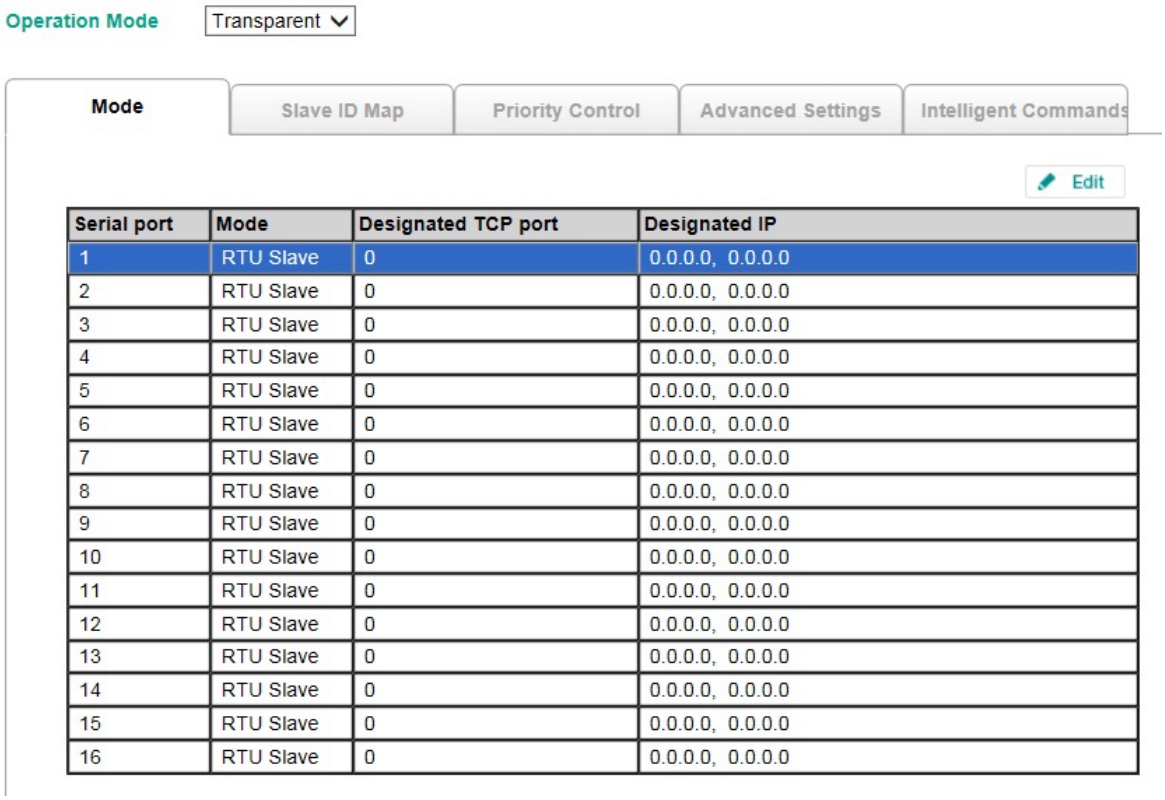
Edit

Serial port	Mode	Designated TCP port	Designated IP
1	RTU Slave	0	0.0.0.0, 0.0.0.0
2	RTU Slave	0	0.0.0.0, 0.0.0.0
3	RTU Slave	0	0.0.0.0, 0.0.0.0
4	RTU Slave	0	0.0.0.0, 0.0.0.0
5	RTU Slave	0	0.0.0.0, 0.0.0.0
6	RTU Slave	0	0.0.0.0, 0.0.0.0
7	RTU Slave	0	0.0.0.0, 0.0.0.0
8	RTU Slave	0	0.0.0.0, 0.0.0.0
9	RTU Slave	0	0.0.0.0, 0.0.0.0
10	RTU Slave	0	0.0.0.0, 0.0.0.0
11	RTU Slave	0	0.0.0.0, 0.0.0.0
12	RTU Slave	0	0.0.0.0, 0.0.0.0
13	RTU Slave	0	0.0.0.0, 0.0.0.0
14	RTU Slave	0	0.0.0.0, 0.0.0.0
15	RTU Slave	0	0.0.0.0, 0.0.0.0
16	RTU Slave	0	0.0.0.0, 0.0.0.0

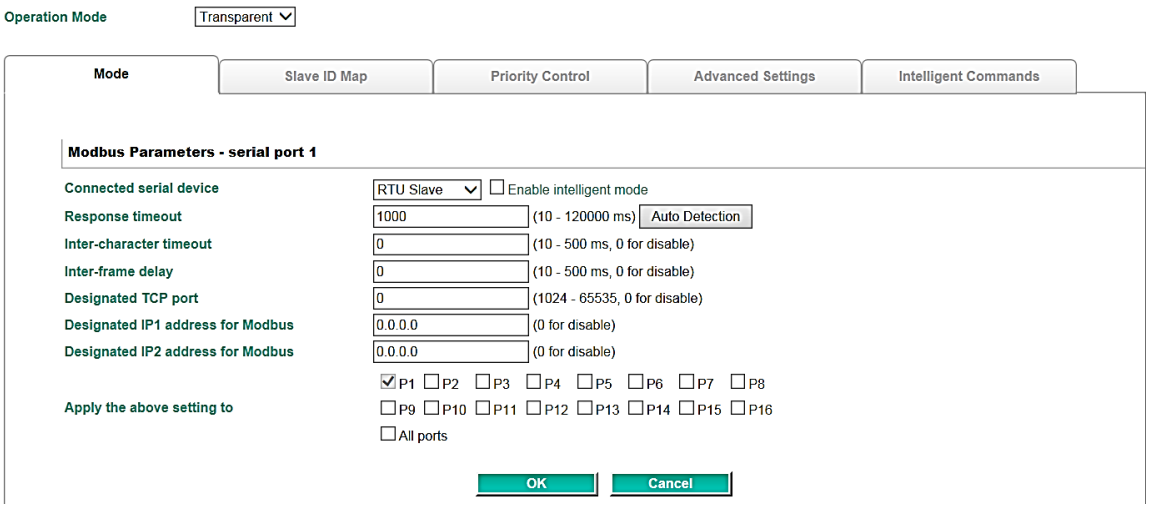
Transparent Mode

Mode

Double click the intended serial port column to set detailed Modbus parameters, or click **Edit** to enter the settings page.



Serial port	Mode	Designated TCP port	Designated IP
1	RTU Slave	0	0.0.0.0, 0.0.0.0
2	RTU Slave	0	0.0.0.0, 0.0.0.0
3	RTU Slave	0	0.0.0.0, 0.0.0.0
4	RTU Slave	0	0.0.0.0, 0.0.0.0
5	RTU Slave	0	0.0.0.0, 0.0.0.0
6	RTU Slave	0	0.0.0.0, 0.0.0.0
7	RTU Slave	0	0.0.0.0, 0.0.0.0
8	RTU Slave	0	0.0.0.0, 0.0.0.0
9	RTU Slave	0	0.0.0.0, 0.0.0.0
10	RTU Slave	0	0.0.0.0, 0.0.0.0
11	RTU Slave	0	0.0.0.0, 0.0.0.0
12	RTU Slave	0	0.0.0.0, 0.0.0.0
13	RTU Slave	0	0.0.0.0, 0.0.0.0
14	RTU Slave	0	0.0.0.0, 0.0.0.0
15	RTU Slave	0	0.0.0.0, 0.0.0.0
16	RTU Slave	0	0.0.0.0, 0.0.0.0



Parameters	Description
Connected serial device	Select the role of the device that is connected to the serial port.
Response timeout	According to the Modbus standard, the time it takes for a slave device to respond to a request is defined by the device manufacturer. Based on this response time, a master can be configured to wait a certain amount of time for a slave's response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue operation even if a slave device is disconnected or faulty. The MGate MB3660 can also auto-detect the response timeout. Instead of manually figuring out the appropriate setting, you can click **Auto Detection** to have the MGate figure out the setting for you. Once a value has been recommended, you can fine-tune it to get the best performance.
Inter-character timeout (only for Modbus RTU)	Use this function to determine the timeout 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. The MGate MB3660 will automatically determine the timeout interval if the timeout value is set to 0.
Inter-frame delay (only for Modbus RTU)	The users can determine the time-delay to transmit the data frame received from the slave device to the upstream. The MGate MB3660 will automatically determine the time interval if it is set to 0.
Designated TCP port	In RTU/ASCII slave mode, a Modbus command from a specified TCP port can be routed to a specified serial port.
Designated IP 1/2 address for Modbus	In RTU/ASCII slave mode, a Modbus command sent to a specified IP address can be routed to a specified serial port. If the command will come from LAN1 and LAN2 respectively, set different IP addresses accordingly.

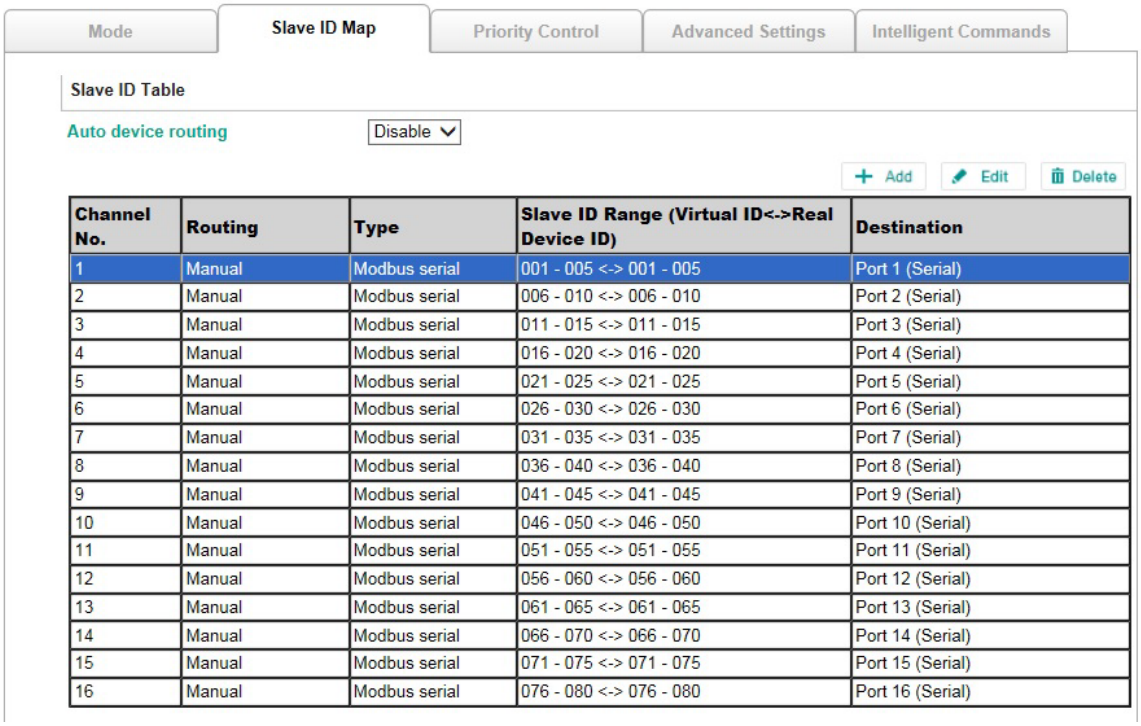
For convenience, you can apply the setting to other serial ports by checking the desired ports or to all ports by selecting the **All ports** checkbox. This feature can dramatically reduce the time needed to configure Modbus gateways that service a large number of serial ports.

Slave ID Map

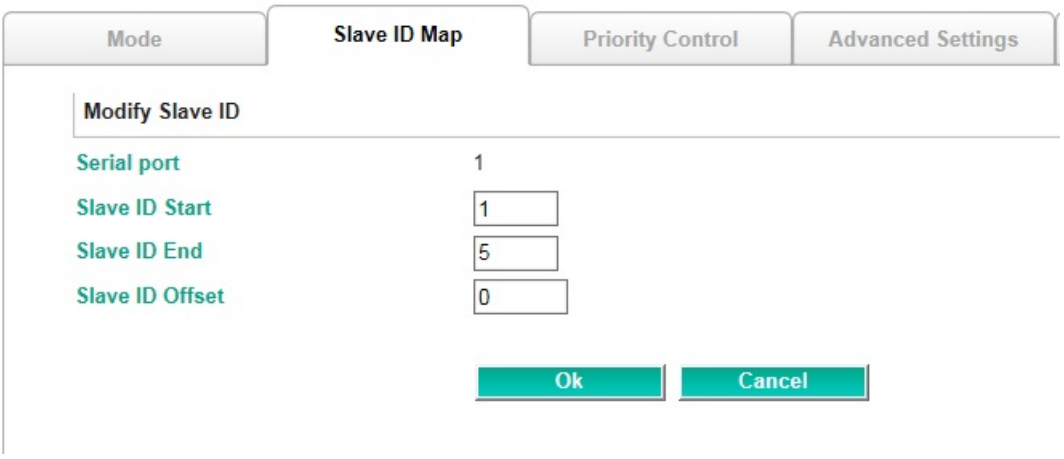
The **Slave ID Map** tab is where slave IDs are managed. The definitions on this tab determine how requests will be routed by the unit. With the slave ID table, a routing mechanism is achieved for gateways with two or more serial ports. Since the Modbus devices (all with different slave IDs) are connected to the different serial ports of a gateway, the Modbus requests should be routed to the specific serial port that is connected to 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, and 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 / Edit / Delete** buttons to change the existing routing. Set each port one by one.



Channel No.	Routing	Type	Slave ID Range (Virtual ID<->Real Device ID)	Destination
1	Manual	Modbus serial	001 - 005 <-> 001 - 005	Port 1 (Serial)
2	Manual	Modbus serial	006 - 010 <-> 006 - 010	Port 2 (Serial)
3	Manual	Modbus serial	011 - 015 <-> 011 - 015	Port 3 (Serial)
4	Manual	Modbus serial	016 - 020 <-> 016 - 020	Port 4 (Serial)
5	Manual	Modbus serial	021 - 025 <-> 021 - 025	Port 5 (Serial)
6	Manual	Modbus serial	026 - 030 <-> 026 - 030	Port 6 (Serial)
7	Manual	Modbus serial	031 - 035 <-> 031 - 035	Port 7 (Serial)
8	Manual	Modbus serial	036 - 040 <-> 036 - 040	Port 8 (Serial)
9	Manual	Modbus serial	041 - 045 <-> 041 - 045	Port 9 (Serial)
10	Manual	Modbus serial	046 - 050 <-> 046 - 050	Port 10 (Serial)
11	Manual	Modbus serial	051 - 055 <-> 051 - 055	Port 11 (Serial)
12	Manual	Modbus serial	056 - 060 <-> 056 - 060	Port 12 (Serial)
13	Manual	Modbus serial	061 - 065 <-> 061 - 065	Port 13 (Serial)
14	Manual	Modbus serial	066 - 070 <-> 066 - 070	Port 14 (Serial)
15	Manual	Modbus serial	071 - 075 <-> 071 - 075	Port 15 (Serial)
16	Manual	Modbus serial	076 - 080 <-> 076 - 080	Port 16 (Serial)

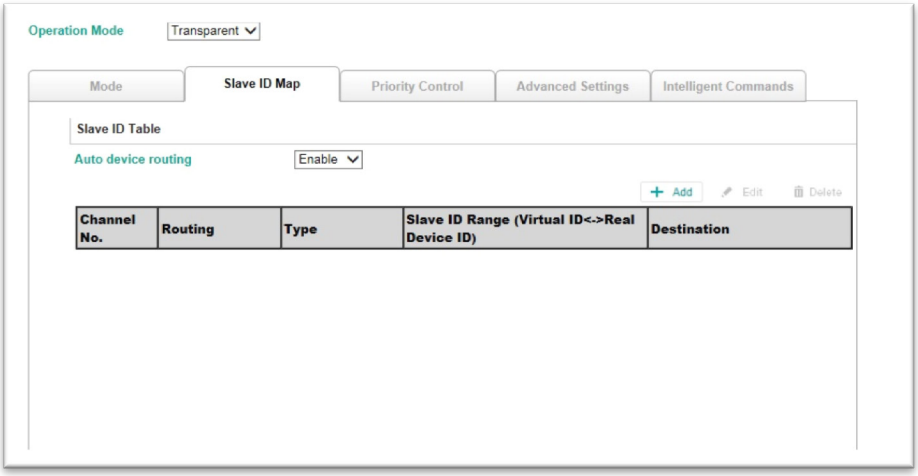


Auto Device Routing (patent pending)

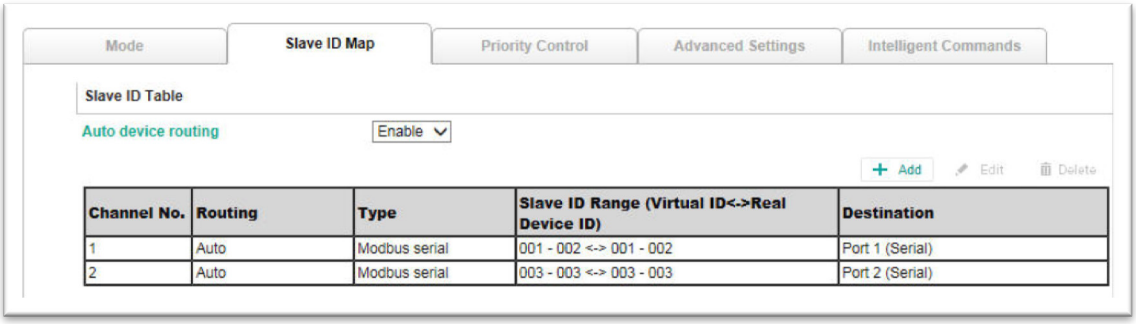
The Moxa Modbus gateways provide an auto routing mechanism that eliminates the burdensome task of setting the slave ID table manually. Now, users no longer need to set the routing table. The Moxa Modbus gateways will help detect and route correctly.

Enable **Auto Device Routing**, and a message window will pop up.

Click **OK** to delete the existing (factory default or user-set) routing table; the auto routing mechanism will automatically find the correct serial port that connects to 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.



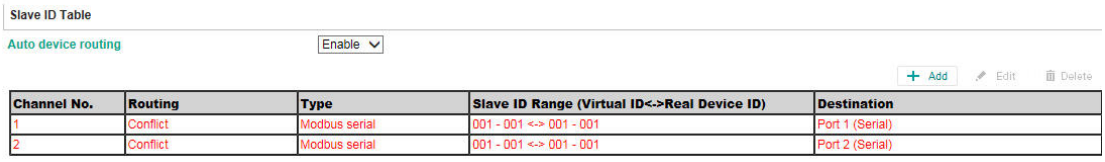
Once the Modbus Master starts to send Modbus requests, the gateway will auto-detect the routing and show results in the web console.



This snapshot shows the routing mechanism is in *Auto* mode, and the gateway detects that slave ID 1 and 2 are connected to port 1 and slave ID 3 is connected to port2.

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

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



On the other hand, if you have manually set routing table already and would like to enable the auto routing mechanism for the newly added devices, click **No** to keep the existing routing table. The gateway will keep 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.

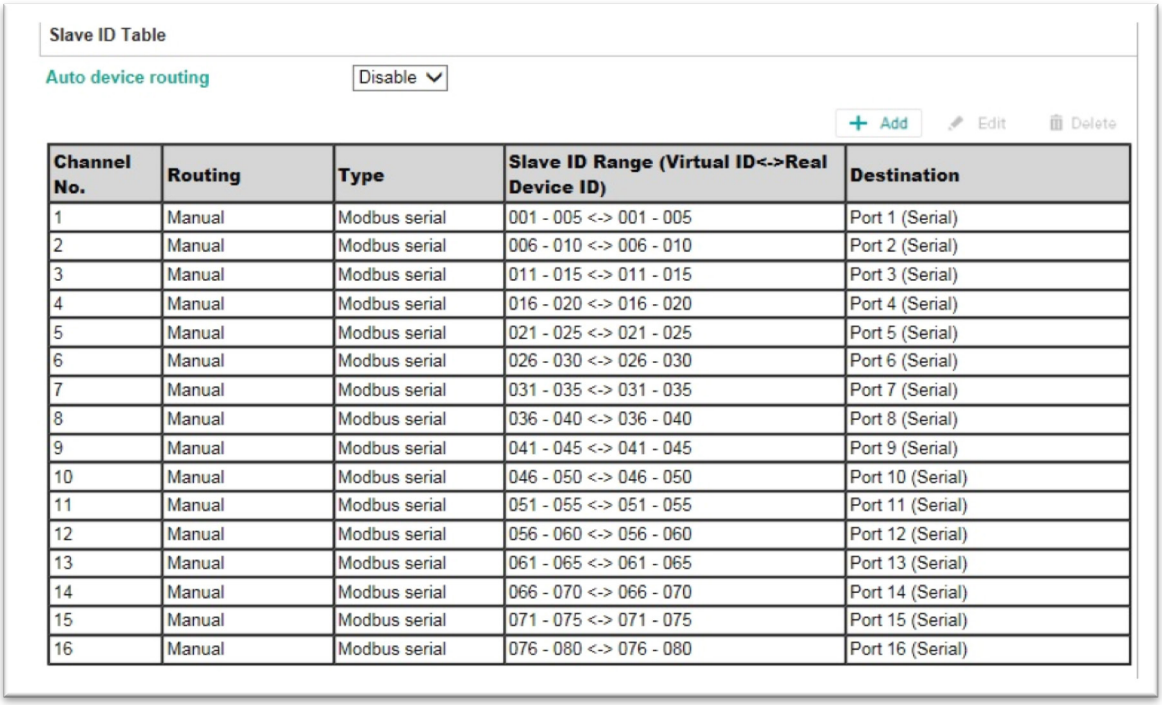
How to connect legacy Modbus devices with same slave ID

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 connected 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 the 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 Modbus 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

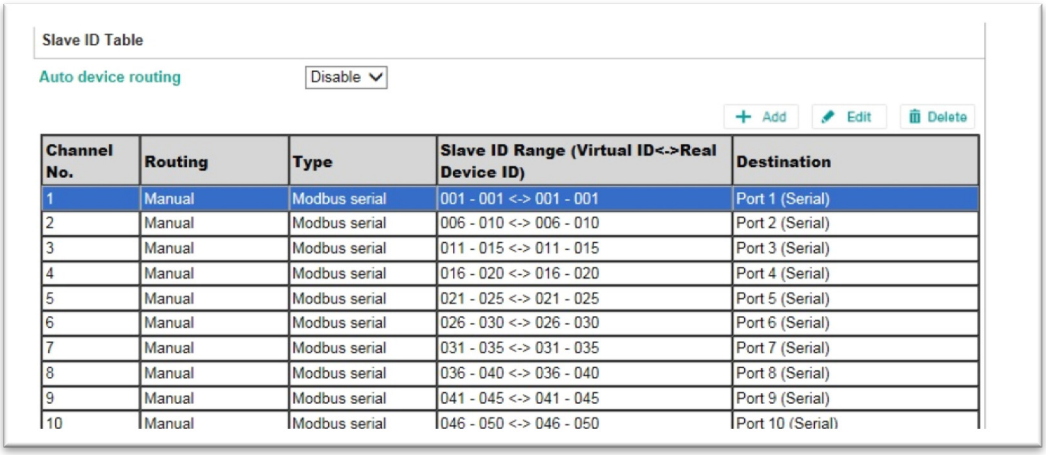
Original setting



Channel No.	Routing	Type	Slave ID Range (Virtual ID<->Real Device ID)	Destination
1	Manual	Modbus serial	001 - 005 <-> 001 - 005	Port 1 (Serial)
2	Manual	Modbus serial	006 - 010 <-> 006 - 010	Port 2 (Serial)
3	Manual	Modbus serial	011 - 015 <-> 011 - 015	Port 3 (Serial)
4	Manual	Modbus serial	016 - 020 <-> 016 - 020	Port 4 (Serial)
5	Manual	Modbus serial	021 - 025 <-> 021 - 025	Port 5 (Serial)
6	Manual	Modbus serial	026 - 030 <-> 026 - 030	Port 6 (Serial)
7	Manual	Modbus serial	031 - 035 <-> 031 - 035	Port 7 (Serial)
8	Manual	Modbus serial	036 - 040 <-> 036 - 040	Port 8 (Serial)
9	Manual	Modbus serial	041 - 045 <-> 041 - 045	Port 9 (Serial)
10	Manual	Modbus serial	046 - 050 <-> 046 - 050	Port 10 (Serial)
11	Manual	Modbus serial	051 - 055 <-> 051 - 055	Port 11 (Serial)
12	Manual	Modbus serial	056 - 060 <-> 056 - 060	Port 12 (Serial)
13	Manual	Modbus serial	061 - 065 <-> 061 - 065	Port 13 (Serial)
14	Manual	Modbus serial	066 - 070 <-> 066 - 070	Port 14 (Serial)
15	Manual	Modbus serial	071 - 075 <-> 071 - 075	Port 15 (Serial)
16	Manual	Modbus serial	076 - 080 <-> 076 - 080	Port 16 (Serial)

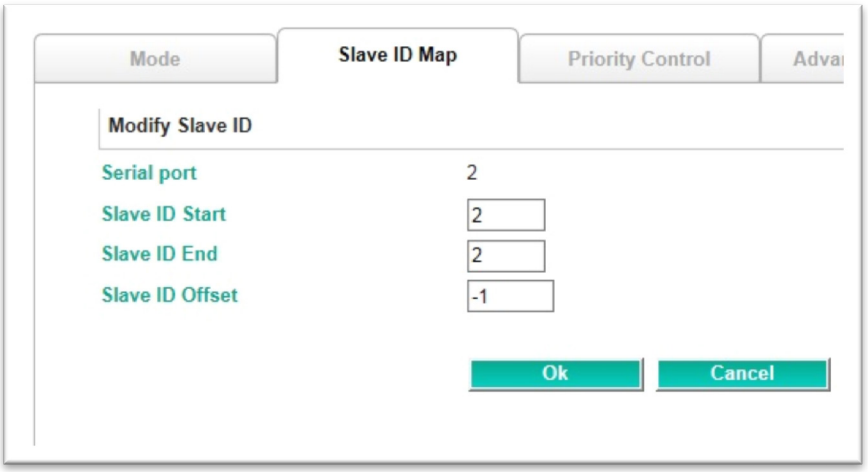
Select the first channel and click **Edit**. The *Slave ID* here represents the Virtual ID recognized by the Modbus master.

The routing table will be as follows:

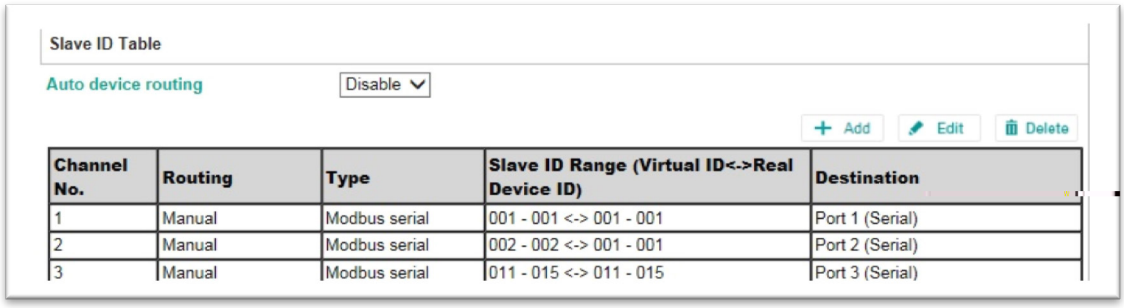


Channel No.	Routing	Type	Slave ID Range (Virtual ID<->Real Device ID)	Destination
1	Manual	Modbus serial	001 - 001 <-> 001 - 001	Port 1 (Serial)
2	Manual	Modbus serial	006 - 010 <-> 006 - 010	Port 2 (Serial)
3	Manual	Modbus serial	011 - 015 <-> 011 - 015	Port 3 (Serial)
4	Manual	Modbus serial	016 - 020 <-> 016 - 020	Port 4 (Serial)
5	Manual	Modbus serial	021 - 025 <-> 021 - 025	Port 5 (Serial)
6	Manual	Modbus serial	026 - 030 <-> 026 - 030	Port 6 (Serial)
7	Manual	Modbus serial	031 - 035 <-> 031 - 035	Port 7 (Serial)
8	Manual	Modbus serial	036 - 040 <-> 036 - 040	Port 8 (Serial)
9	Manual	Modbus serial	041 - 045 <-> 041 - 045	Port 9 (Serial)
10	Manual	Modbus serial	046 - 050 <-> 046 - 050	Port 10 (Serial)

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



The routing table will be as follows:

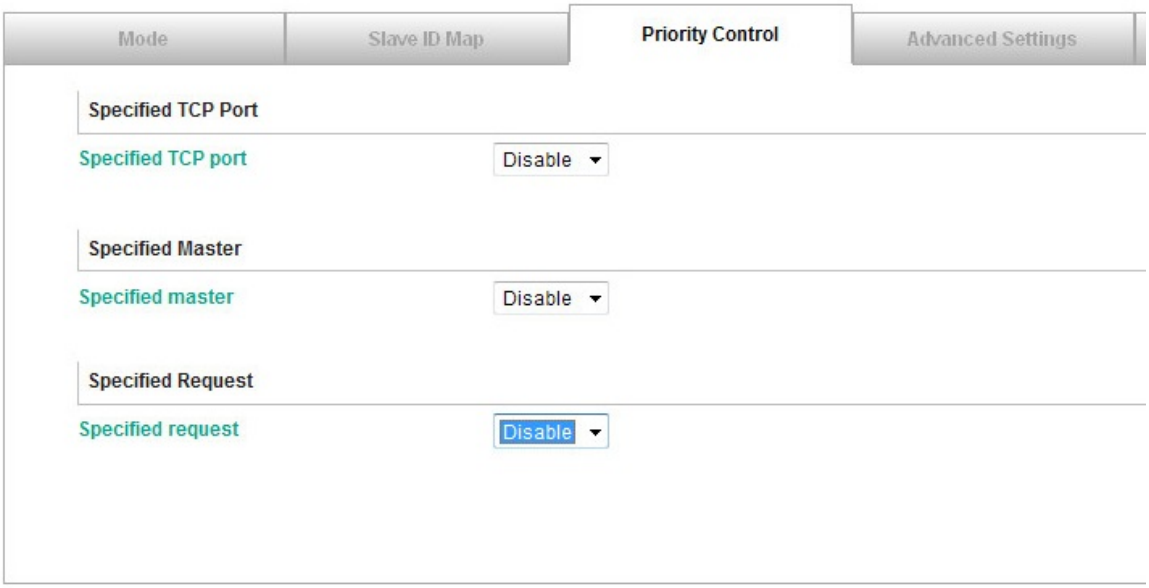


Channel No.	Routing	Type	Slave ID Range (Virtual ID<->Real Device ID)	Destination
1	Manual	Modbus serial	001 - 001 <-> 001 - 001	Port 1 (Serial)
2	Manual	Modbus serial	002 - 002 <-> 001 - 001	Port 2 (Serial)
3	Manual	Modbus serial	011 - 015 <-> 011 - 015	Port 3 (Serial)

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

Priority Control

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



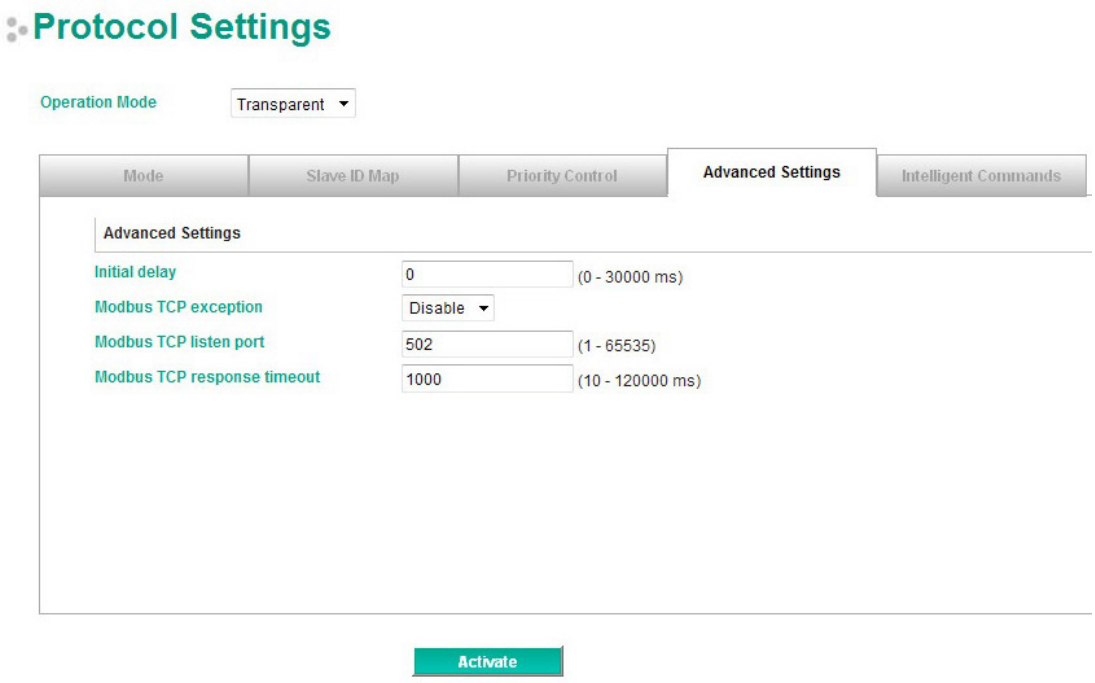
Priority control is designed for requests that are sent to Modbus RTU/ASCII slaves. Since Modbus RTU/ASCII slaves cannot handle multiple requests, the Modbus gateway must send each request individually and wait for the response before sending the next request. As requests stack up, the response time 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**.)

Advanced Settings

The **Advanced 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, Modbus TCP listen port,** and **Modbus TCP Response Time-out.**



Parameter	Value
Initial delay	0-30000 ms
Modbus TCP exception	Enable or Disable
Modbus TCP listen port	1-65535
Modbus TCP response timeout	10-120000 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 MB3660 is a protocol gateway that transparently passes requests and responses between the Ethernet and serial interfaces. In some situations, it may be necessary for the gateway to return an exception in response to a request from a Modbus TCP master. This is enabled or disabled with the **Modbus TCP Exception** setting. When enabled, the unit can return two types of exception:

Exception	Conditions
Timeout	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 map.

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

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

Modbus TCP Response Timeout

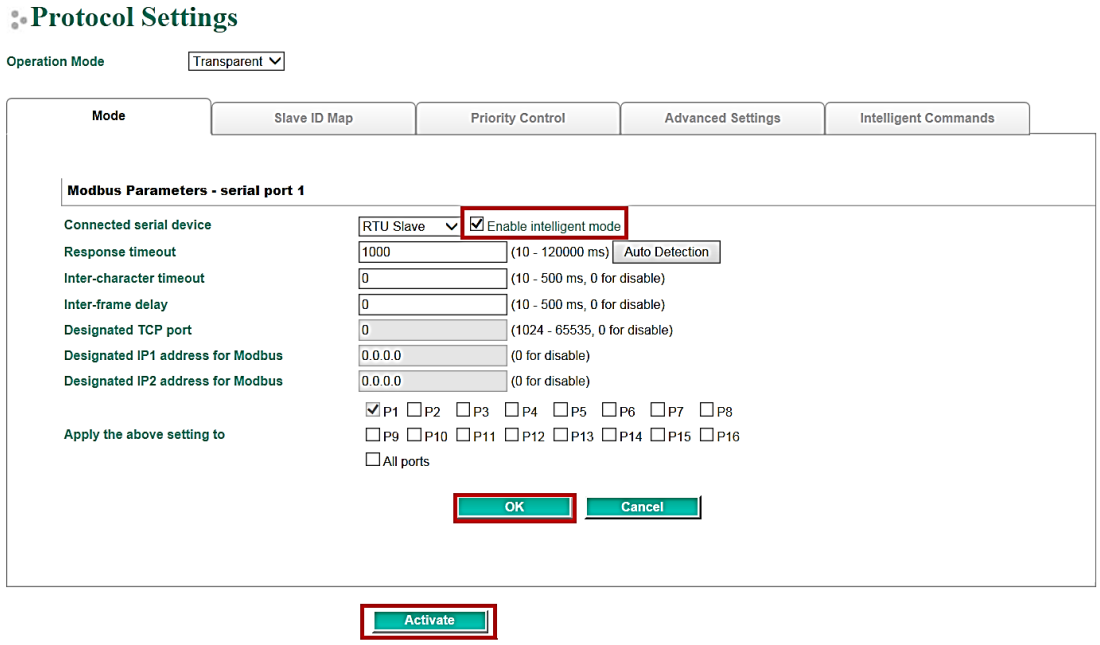
According to the Modbus standard, the time that it takes for a slave device to respond to a request is defined by the device manufacturer (refer to Appendix A for details). Based on this response time, a master can be configured to wait a certain amount of time for a slave's response. If no response 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 MB3660, the **Modbus TCP response timeout** field is used to configure how long the gateway will wait for a response from a Modbus ASCII or RTU slave. Refer to your device manufacturer's documentation to manually set the response timeout.

Intelligent Mode

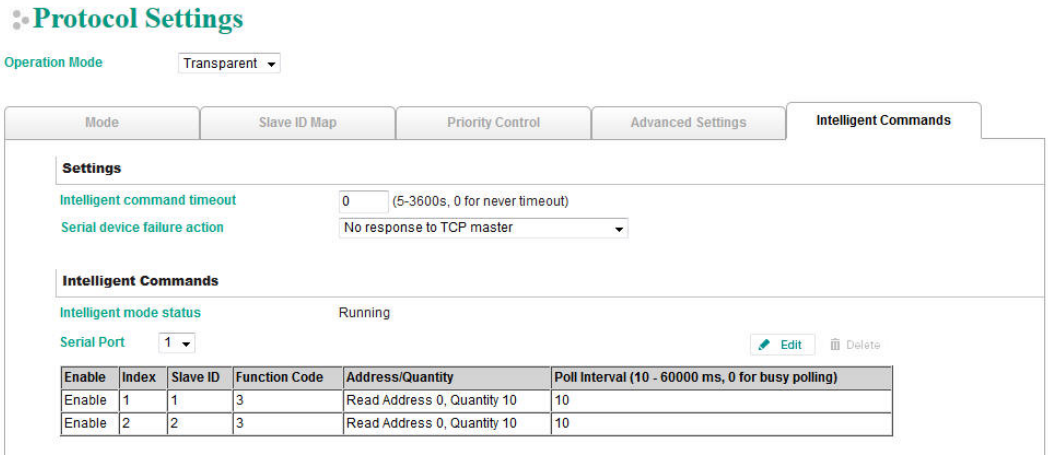
When the MGate MB3660 runs under transparent mode with the serial device as a Modbus slave, you do not need to type Modbus commands (copied from the SCADA system) into the gateway. However, transparent mode uses a traditional round-robin polling mechanism, which supports only one request-response action at a time, resulting in poor performance. For applications that use large numbers of Modbus devices, the inherent latency is unacceptable from the SCADA system's point of view. Agent mode provides better performance since the gateway actively polls the devices to retrieve data from the remote site. SCADA systems can retrieve Modbus device data directly from the gateway's memory, instead of waiting for the gateway to pass commands to the serial ports.

In order to provide better performance as an agent gateway, but without requiring users to key in a lot of Modbus commands, the MGate MB3660 series of gateways are designed with an innovative command learning function, which can be enabled with a single mouse click. Then, press **OK** and **Activate**, and the function will be activated.

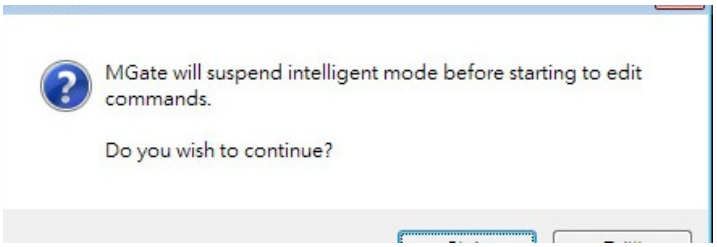


Once activated, the gateway will learn and memorize the Modbus commands it receives. Once a command has been learned, the gateway will act as though it were in agent mode and actively send Modbus requests to the relevant Modbus devices. Since the data is saved in a different memory space that can be accessed by the SCADA system, the SCADA system can retrieve Modbus response data directly from the gateway's memory,

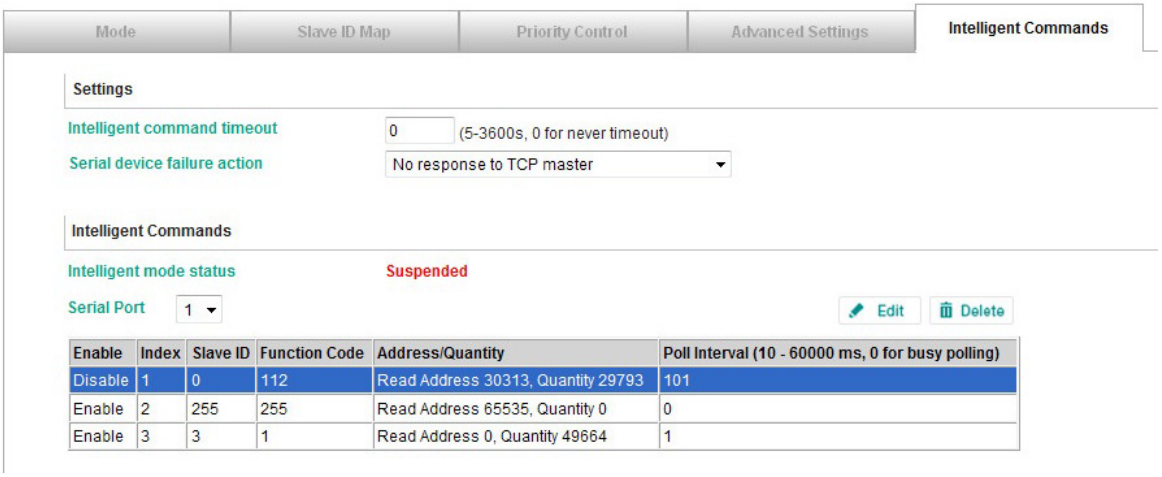
instead of waiting for the data to pass through the Modbus devices, dramatically increasing communication performance.



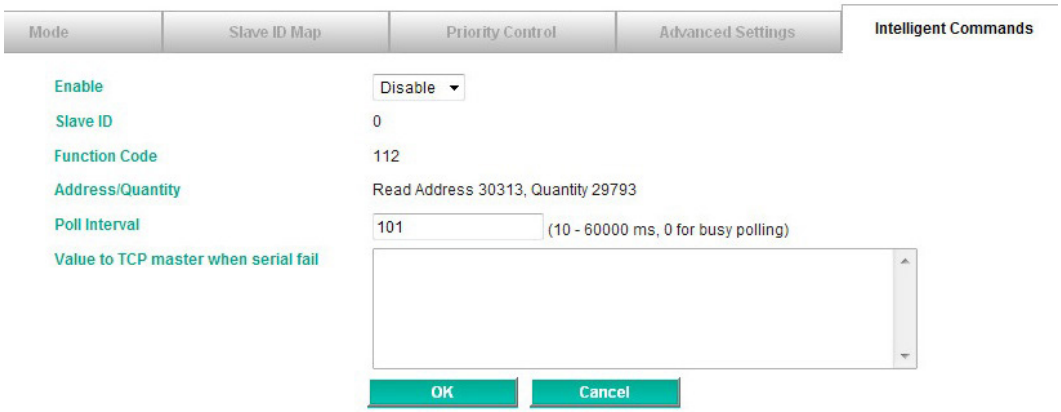
The learned Modbus commands will be shown on the **Intelligent Commands** tab. The gateway will act as in agent mode when intelligent mode is activated. Once the Modbus command is learned, the gateway will start to actively poll the Modbus device according to the command learned from the SCADA system. You can edit the learned Modbus commands received from the Modbus master by clicking the **Edit** button. Since the gateway is actively polling the devices, if you would like to edit commands manually, you first need to deactivate active polling.



The status of intelligent mode will change to **Suspended**.



Click **Edit** to open the edit page, or click the **delete button** to delete the command. You may also disable the Modbus command, and then reactivate it when needed.



The gateway now acts as though it were in agent mode and actively polls the Modbus slave devices. The Modbus Master will retrieve the Modbus device's data directly from the gateway's memory. If the serial device fails, the Modbus master will not be aware of the failure since it is still getting the Modbus slave's data from the gateway's memory. The gateway is designed with a fail report mechanism to inform the Modbus Master. You may set a pre-defined value for the serial port abnormality warning in the **Value to TCP master when serial fail** text box. When the serial device fails, the gateway will automatically write this predefined value to memory. The Modbus master will be aware of the serial device failure when it receives this predefined value.

Agent mode

When running in agent mode, two Modbus roles must be set. One is the Ethernet side (Modbus TCP), and the other is the serial side (Modbus RTU/ASCII).

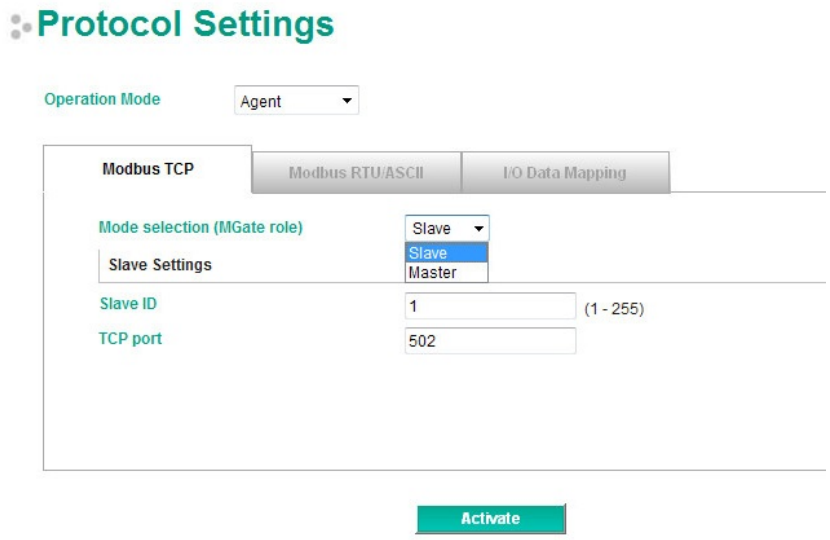
Modbus TCP Settings

The MGate MB3660 supports a Modbus TCP function with Master (Client) and Slave (Server) modes. For slave mode, the MGate works as a server and waits for incoming connections from the Modbus TCP client. In master mode, the MGate works as a client and tries to build a TCP connection with the remote Modbus TCP slave device.

NOTE Under Modbus TCP server mode, the recommended polling interval of each Modbus request is 2000 ms when establishing 256 Modbus TCP connections. For a requirement that needs a shorter polling interval than 2000 ms, the number of connections should be adjusted accordingly.

Slave Mode Settings

The MGate MB3660 supports Modbus slave mode, which means the MGate will work as a server and wait for incoming connection requests. The default TCP listen port is 502. In this mode, the MGate will wait for incoming Modbus TCP requests and use the internal memory as the slave register to respond.

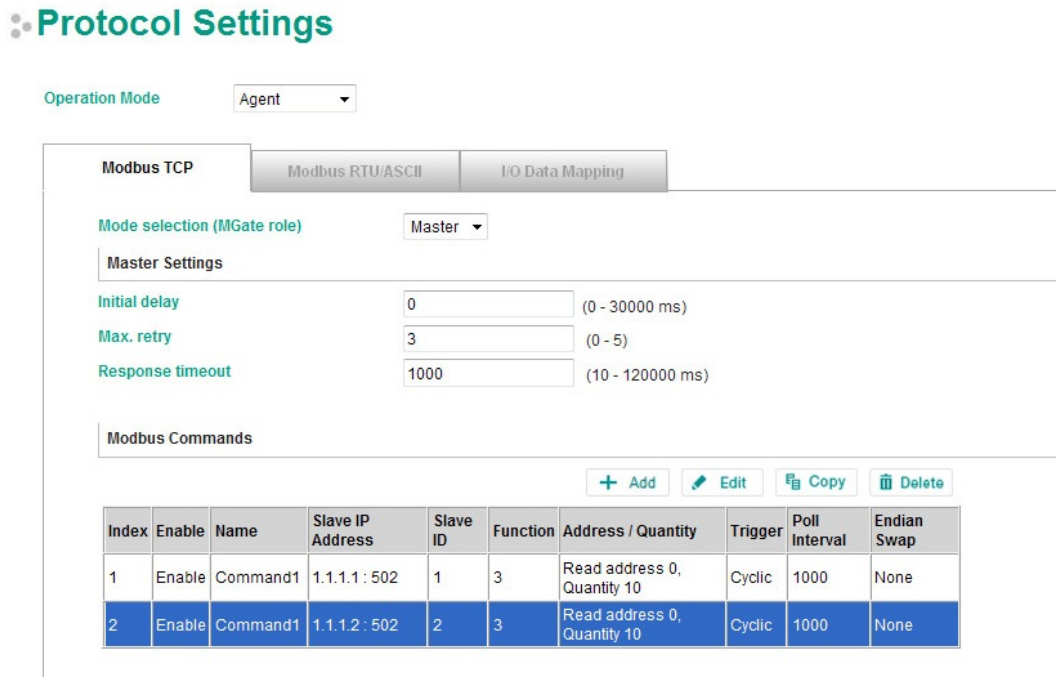


Modify the Slave ID settings to match the system requirements. The default TCP port for Modbus TCP is 502, so you may need to modify if there is a firewall in place.

Parameters	Value	Description
Slave ID	1-255	The Modbus address of the MGate.
TCP port	1-65535	The local TCP port for the MGate.

Master Mode Settings

The MGate MB3660 supports Modbus TCP master mode, which means the MGate will work as a client and send the Modbus command request to the slave device actively. You will need to configure each Modbus command manually. On this page, users can see all the commands listed in the table.

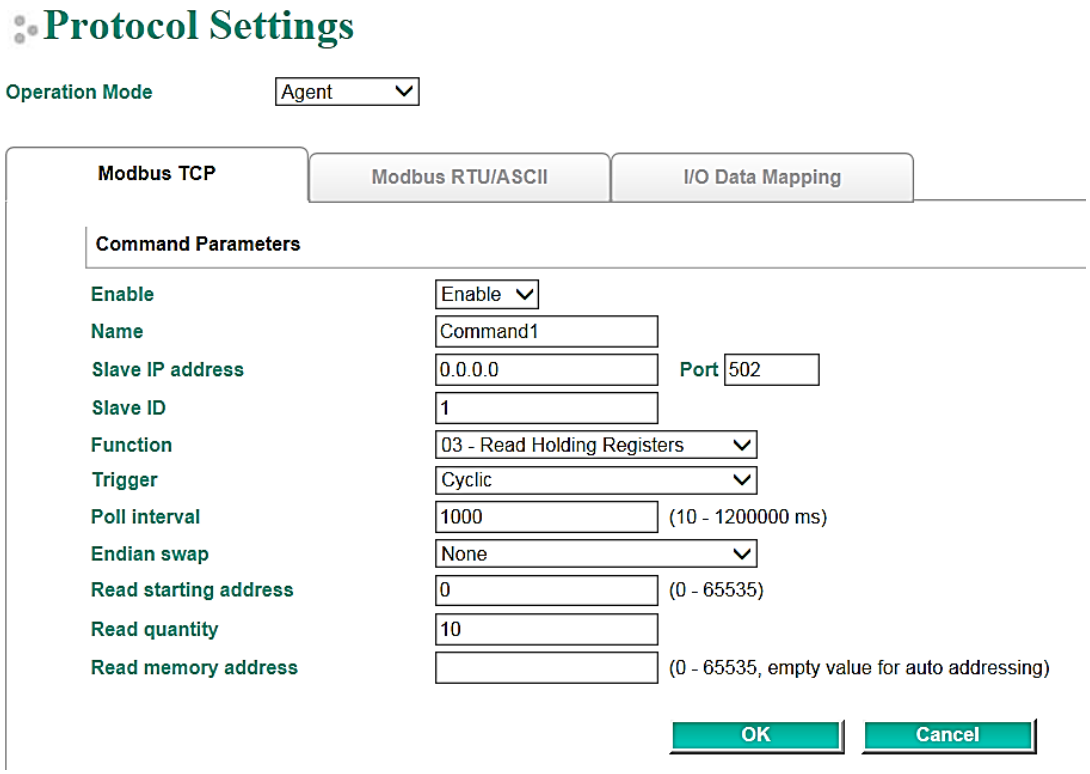


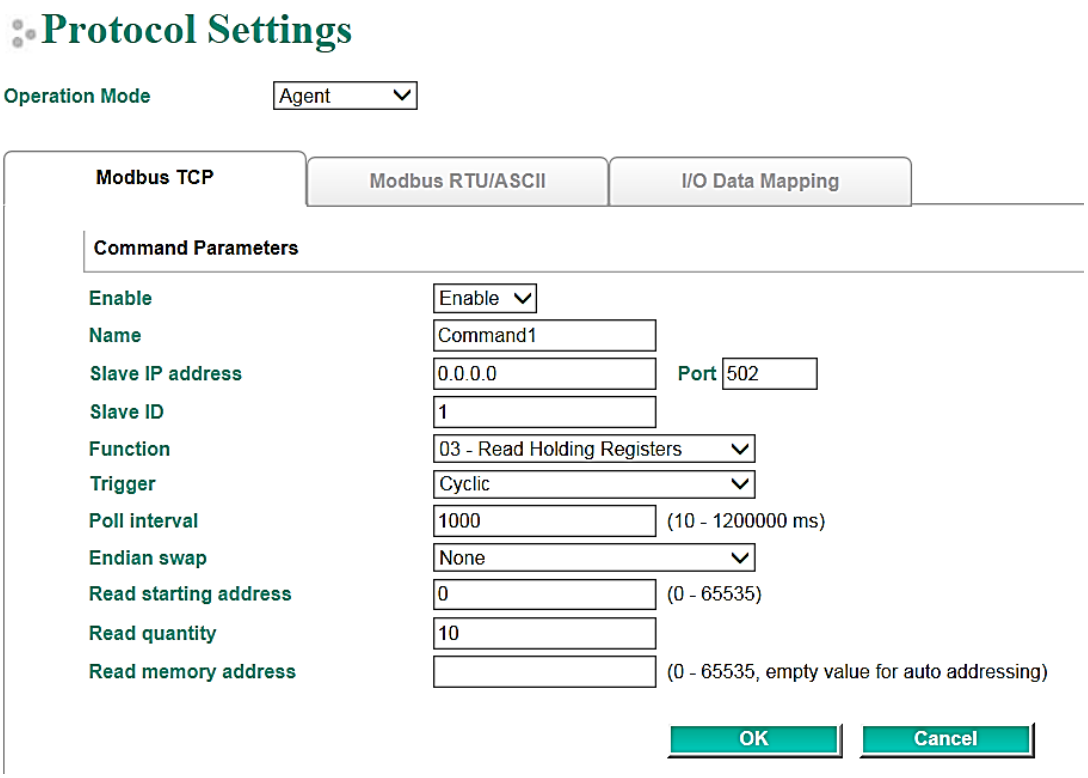
Parameters	Value	Description
Initial delay	0-30000 ms	Some Modbus slaves may take more time to boot up than other devices. In some environments, this may cause the entire system to suffer from repeated exceptions during the initial boot-up. You can force the MGate to wait after booting up before sending the first request with the Initial Delay setting.
Max. retry	0-5	This is used to configure how many times the MGate will try to communicate with the Modbus slave.
Response timeout	10-12000 ms	This is used to configure how long the MGate will wait for a response from a Modbus slave.

To add a new command or modify the existing one, click the **Add** button or **Modify** button and a new dialog box will appear. To remove Modbus commands, select the specific command and then click the **Remove** button.

To communicate with remote Modbus TCP slave devices, specify the Modbus command for each device. For each Modbus read/write command, specify the internal memory address for data exchange. For the read command, the information received from remote devices will be updated to the specified internal memory address. For the write command, the data in the specified internal memory address will be sent to the remote device. The data will be used to update the remote device register.

Each remote device may need more than one command for communication, so you will need to input all the commands manually.





Parameters	Description
Enable	To enable/disable this Modbus command
Name	Enter a name to help identify the command, such as the location, function, etc.
Slave IP address	The IP address of remote slave device.
Port	The TCP port number of remote slave devices. 1 to 65535
Slave ID	The Modbus slave ID that this slave module will accept. 0: Broadcasting 1–255: Device specific.
Function	When a message is sent from a Client to a Server device the function code field tells the server what kind of action to perform. We support the following function codes so far: 01: Read coils 02: Read discrete inputs 03: Read holding registers 04: Read input register 05: Write single coil 06: Write single register 15: Write multiple coils 16: Write multiple registers 23: Read/Write multiple registers
Trigger	Disable: The command is never sent Cyclic: The command is sent cyclically at the interval specified in the **Poll Interval** parameter. Data change: The data area is polled for changes at the time interval defined by Poll Interval. A command is issued when a change in data is detected.
Poll interval	Polling intervals are in milliseconds; since the module sends all requests in turns, the actual polling interval also depends on the number of requests in the queue and their parameters. The range is from 10 to 1,200,000 ms.
Endian swap	Data Byte Swapping **None**: Don't need to swap **Byte**: 0x0A, 0x0B, 0x0C, 0x0D becomes 0x0B, 0x0A, 0x0D, 0x0C.

Parameters	Description
	Word: 0x0A, 0x0B, 0x0C, 0x0D becomes 0x0C, 0x0D, 0x0A, 0x0B. **ByteWord**: 0x0A, 0x0B, 0x0C, 0x0D becomes 0x0D, 0x0C, 0x0B, 0x0A.
Read starting address	Station Address. The range is from 0 to 65535
Read quantity	Specifying how many quantities to write. There are two kinds of quantity units, bit and 16bits, which are associated with function field. The range is from 1 to 125.
Write starting address	Station Address. The range is from 0 to 65535
Write quantity	Specifying how many quantities to write. There are two kinds of quantity units, bit and 16bits, which are associated with function field. The range is from 1 to 123.
Read/Write memory address	Manually decide the read or write starting address in the gateway's memory. The range is from 0 to 65535. Set this value as empty for auto addressing by the system.
Opposite side's command fault	For Modbus TCP master mode, the opposite side refers to the serial port side. The Modbus writer command is sent from the serial port to the TCP side. Once the serial connection fails, the gateway will not be able to receive the serial Master's write command, but the gateway will continuously send Modbus write commands to the Modbus TCP slave device. To avoid problems when the serial side fails, the MB3660 can be configured to react in one of three ways: keep latest data, clear data to zero, and user-defined value.
Timeout for opposite side's data update	Defines the timeout for the serial side. The range is from 0 to 65535 ms.

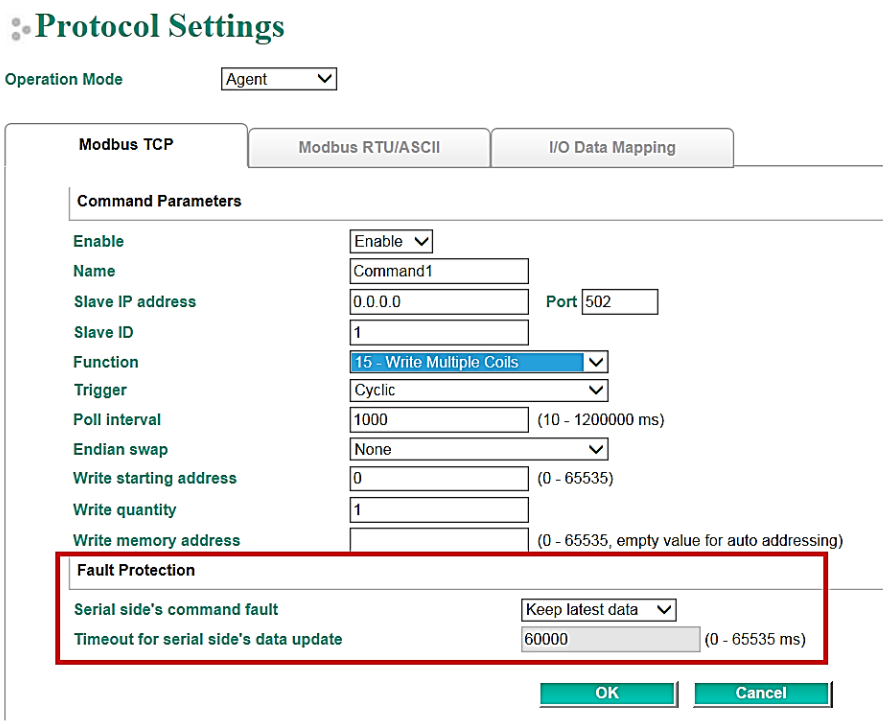
Fault Protection and Status Monitoring

Fault Protection

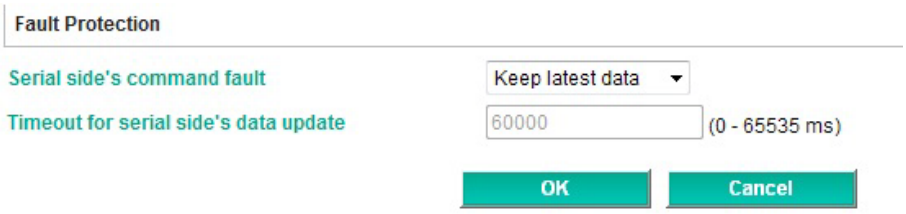
The Fault Protection function sends a predefined setting to field devices to prevent incorrect actions when the upstream connection is lost.

The MB3660 supports a Fault Protection function when in agent mode. You can configure the criteria used to determine what to do when the write command is no longer received from the master side. For example, when a cable comes loose accidentally, the most up-to-date write command from the master side will not be received by the gateway. Hence, the slave device will use the latest command from the gateway, which is now out-of-date, creating an inconsistency between the master and slave devices. To avoid this problem, the MB3660 supports options to determine which actions should be taken when the master's side is disconnected from the gateway.

Options	Description
Keep latest data	The gateway will write the same data to the slave device.
Clear data to zero	The gateway will write zero values to the slave device.
User-define value	A user-defined value will be written to the slave device.



Use the **Timeout for serial side's data update** item to set how long the gateway will wait to activate this function.



Status Monitoring

The Status Monitoring function provides status information of field devices when the MGate is being used as a master/client; information includes alive list, counter, the result of commands issued, etc.

For Modbus gateways in agent mode, if a slave device fails or a cable comes loose, generally the gateway won't be able to receive up-to-date data from the slave device. The out-of-date data will be stored in gateway's memory and will be retrieved by the Modbus master, which will not be aware that the slave device is not providing up-to-date data. The MB3660 supports the Status Monitoring function, which provides a warning mechanism to report the list of slave devices that are still "alive."

In agent mode, each serial port supports 32 Modbus commands. Hence, there are at most 512 Modbus commands for all serial devices. The MB3660 allocates 1 bit of the gateway's specified memory address to indicate the status of each Modbus command as being normal or abnormal. In other words, the MB3660 allocates 512 bits of memory to indicate the status of all Modbus commands. If a command has run successfully, the status value will continuously be 0. On the contrary, if a command has failed, the status will be set to 1. In this case, the Modbus TCP master will be aware of the failure status of the slave device in relation to the Modbus command.

In agent mode, when the Modbus TCP master queries Modbus serial slave devices, the MB3660 plays the role of TCP slave on the Ethernet side, and consequently is assigned a Modbus TCP slave ID. The Modbus TCP master can retrieve the Modbus slave devices' status via Modbus command with the following information.

Slave ID	[MB3660's Modbus TCP slave ID]
Function	0x03 or 0x04
Address	40001~
Quantity	32 words for MB3660-16, 16 words for MB3660-8

When a Modbus serial master queries the Modbus TCP slave devices, the MB3660 plays the role of serial slave on the serial side, and consequently is assigned a Modbus serial slave ID. The Modbus serial master can retrieve the Modbus TCP slave devices' status via Modbus command with the following information.

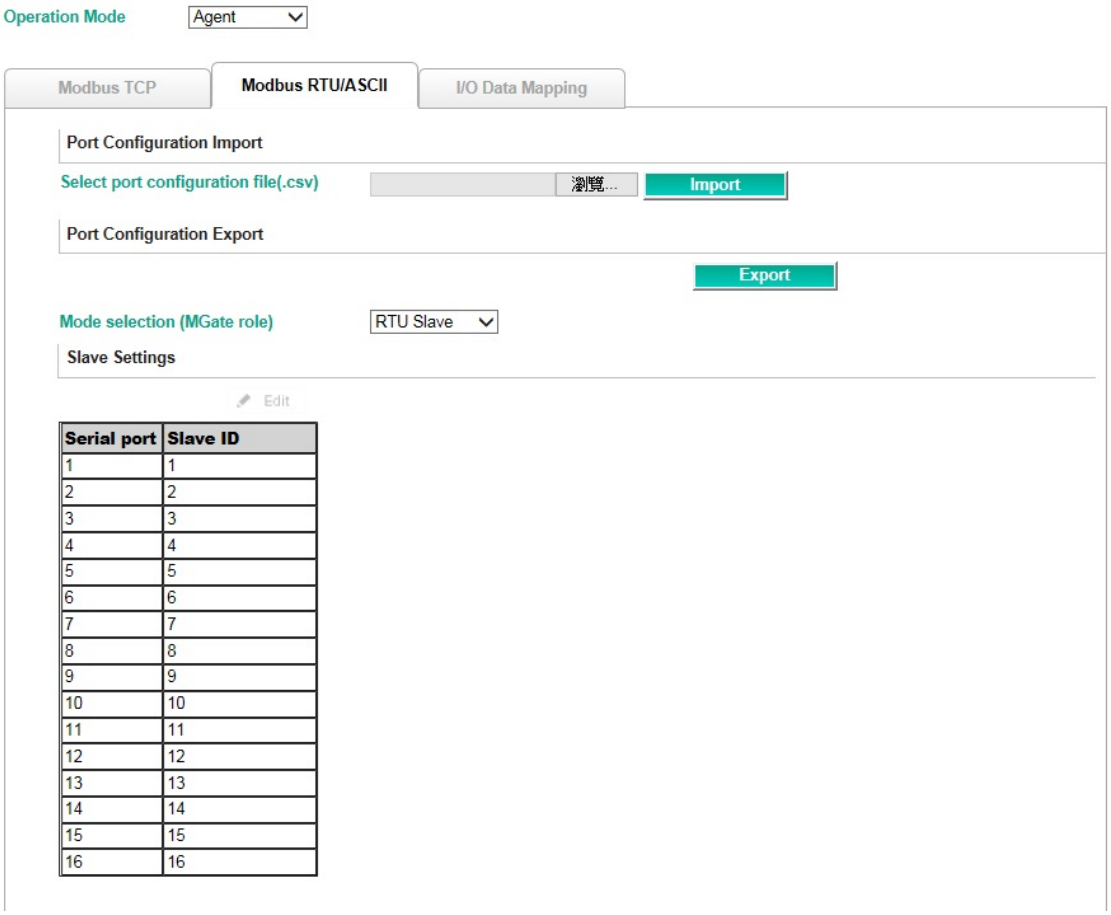
Slave ID	[MB3660's Modbus RTU/ASCII slave ID]
Function	0x03 or 0x04
Address	41001~
Quantity	16 words

Modbus RTU/ASCII Settings

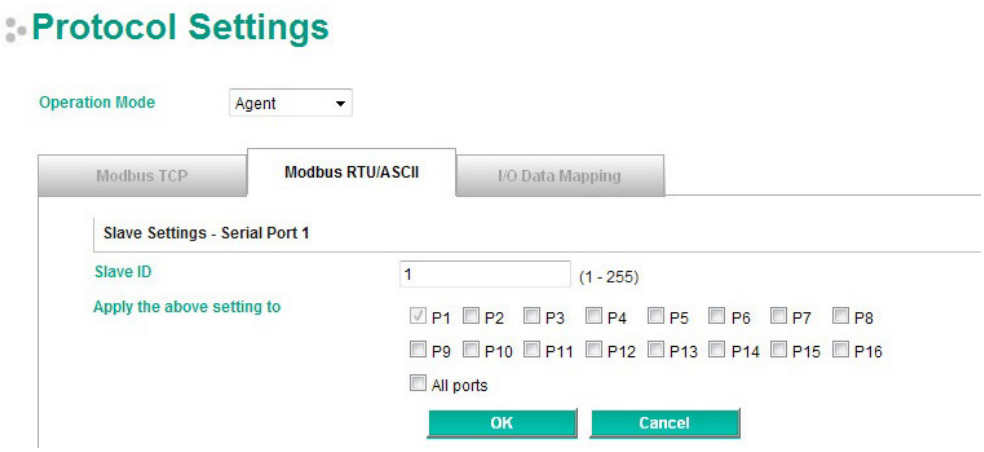
According to the Modbus RTU/ASCII settings, the MGate MB3660 will act as a Modbus master or Modbus slave in order to communicate with your Modbus RTU/ASCII devices. For Slave mode, the MGate acts as a slave and waits for the incoming connection from the Modbus master. In this mode, you only need to specify the slave ID for the MGate gateway. For Master mode, the MGate works as a master and will try to send Modbus commands to the Modbus slave devices, so you will need to specify the slave device IDs and the relative Modbus commands.

Slave Mode Settings

You will need to specify which Modbus protocols will run in Slave mode. The MGate MB3660 supports Modbus RTU and Modbus ASCII protocols in Slave mode.



Double click a serial port for additional settings, or click the intended serial port and then click **Edit**.

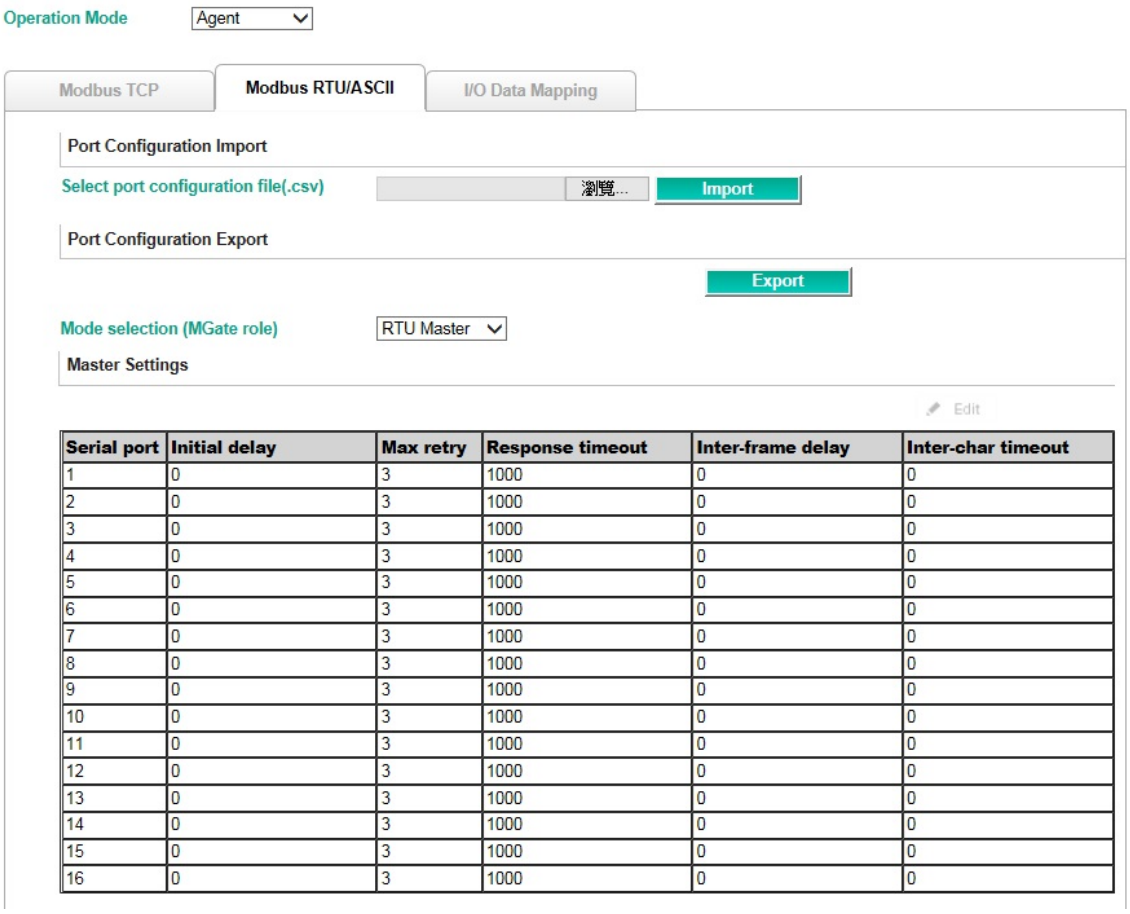


Parameters	Value	Description
Slave ID	1-255	The Modbus Slave ID that this slave module will accept. 1–255: Device specific.

You can change the Modbus slave ID on this page. If two or more serial ports use the same slave ID, you can check to see if they use the same setting. If two or more slave devices are using the same slave ID connected to different serial ports, you can click the intended serial ports for the same slave ID setting.

Master Mode Settings

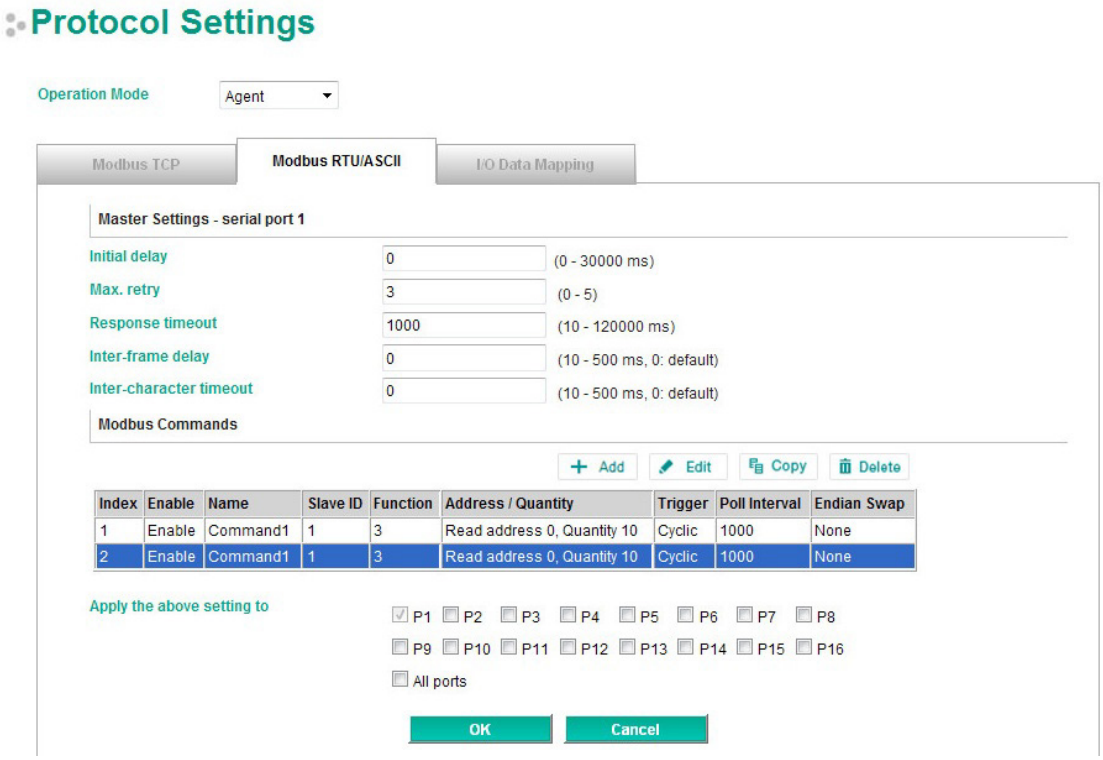
You will need to specify which Modbus protocols will run in Master mode. The MGate MB3660 supports Modbus RTU and Modbus ASCII protocols in Master mode.



Serial port	Initial delay	Max retry	Response timeout	Inter-frame delay	Inter-char timeout
1	0	3	1000	0	0
2	0	3	1000	0	0
3	0	3	1000	0	0
4	0	3	1000	0	0
5	0	3	1000	0	0
6	0	3	1000	0	0
7	0	3	1000	0	0
8	0	3	1000	0	0
9	0	3	1000	0	0
10	0	3	1000	0	0
11	0	3	1000	0	0
12	0	3	1000	0	0
13	0	3	1000	0	0
14	0	3	1000	0	0
15	0	3	1000	0	0
16	0	3	1000	0	0

The MGate MB3660 also provides several advanced settings for specific application requirements. The following settings are optional for most applications. It is suggested to use the default settings to test the MGate MB3660.

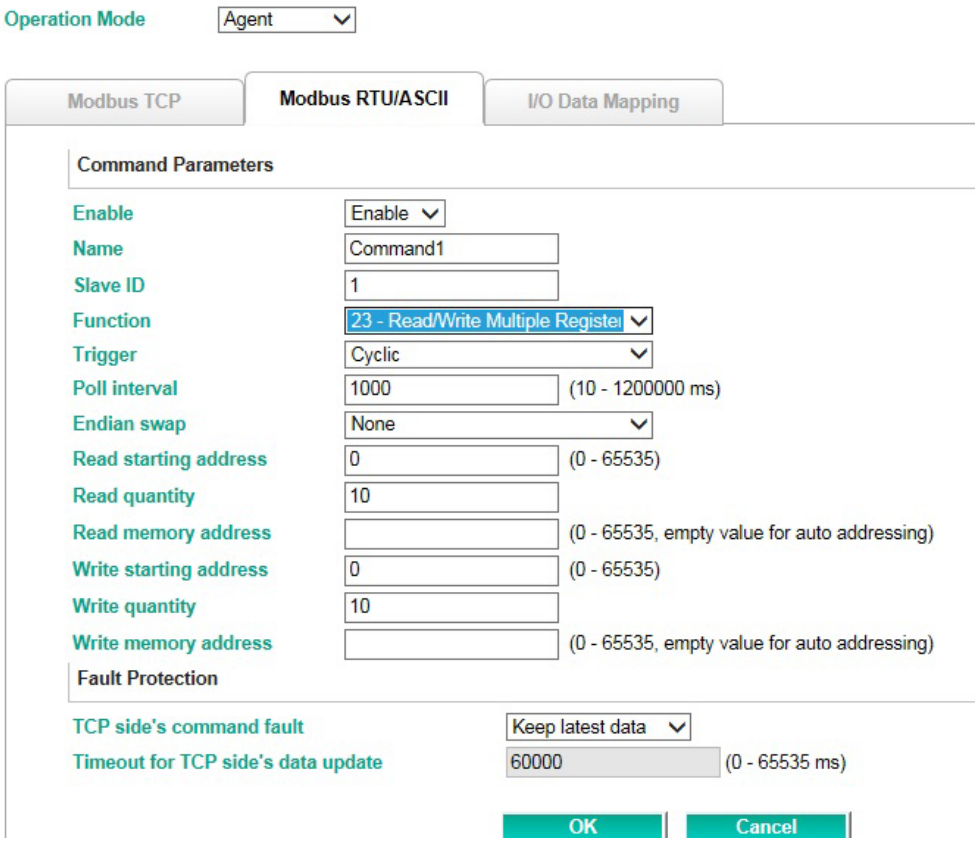
Double click the intended serial port to configure additional settings.



Parameters	Description
Initial delay	Some Modbus slaves may take more time to boot up than other devices. In some environments, this may cause the entire system to suffer from repeated exceptions during the initial boot-up. You can force the MGate to wait after booting up before sending the first request with the **Initial Delay** setting.
Max. retry	The number of times the master will retry the same request when the response times out.
Response timeout	According to the Modbus standard, the time it takes for a slave device to respond to a request is defined by the device manufacturer. Based on this response time, a master can be configured to wait a certain amount of time for a slave's response. If no response is received within the specified time, the master will disregard the request and continue operation. This allows the Modbus system to continue operation even if a slave device is disconnected or faulty. On the MGate 5101-MB-EIP, the **Response timeout** field is used to configure how long the gateway will wait for a response from a Modbus ASCII or RTU slave. Refer to your device manufacturer's documentation to manually set the response time.
Inter-frame delay	The users can determine the time-delay to transmit the data frame received from the slave device to the upstream. The MGate MB3660 will automatically determine the time interval if it is set to 0.
Inter-character timeout	Use this function to determine the timeout 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. The MGate MB3660 will automatically determine the timeout interval if the timeout value is set to 0.

For Master mode, you must identify which Modbus requests need to be sent to Modbus slave devices through serial interface. The data will be exchanged between slave devices and the MGate gateway's internal memory. To do this, manually add all Modbus commands that will handle the data exchange.

The **Add**, **Edit**, **Copy**, and **Delete** buttons support the Modbus command arrangement. When you click on the **Add** and **Edit** buttons, the following dialog box will be displayed.

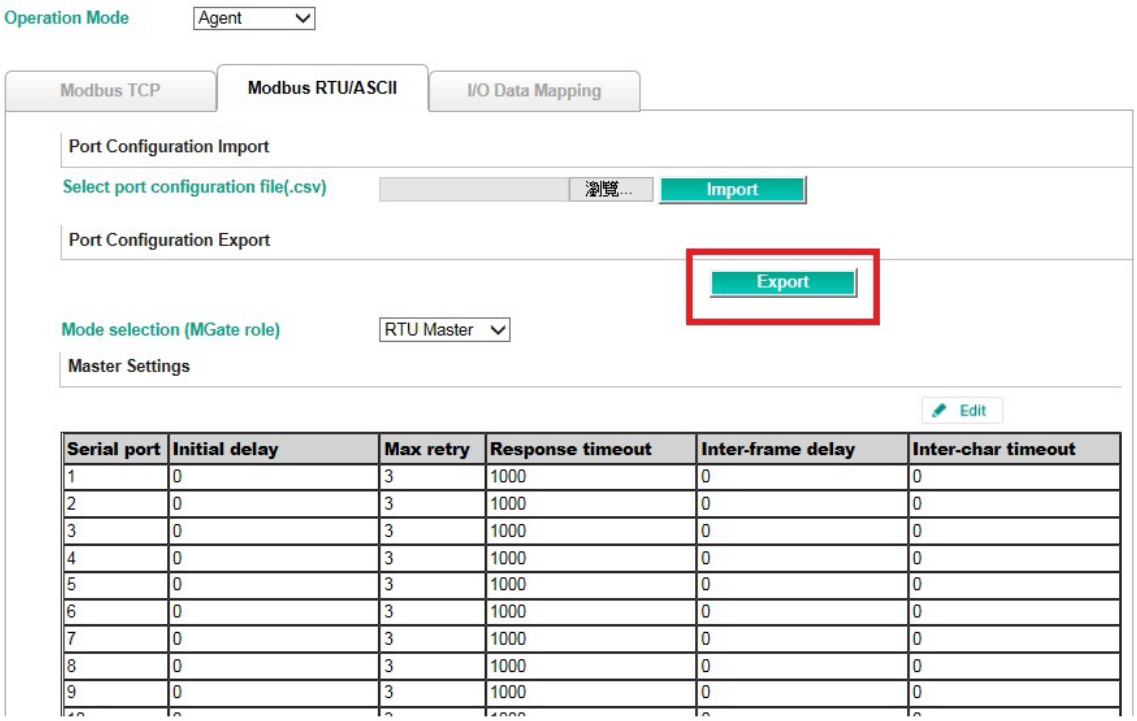


The description of all the fields can refer to Agent mode---**Master Mode Settings**.

Port Configuration

A Modus RTU/ASCII master may set several commands that are sent to slave devices. Some users are familiar with CSV file format to edit these commands. Therefore, MGate MB3660 supports the import or export functions for CSV files.

First, click **Export** to generate the template file.



Serial port	Initial delay	Max retry	Response timeout	Inter-frame delay	Inter-char timeout
1	0	3	1000	0	0
2	0	3	1000	0	0
3	0	3	1000	0	0
4	0	3	1000	0	0
5	0	3	1000	0	0
6	0	3	1000	0	0
7	0	3	1000	0	0
8	0	3	1000	0	0
9	0	3	1000	0	0

Then open the exported CSV file to further configure.

	A	B	C	D	E	F	G	H	I	J
1	#modeType									
2	[mode_type]									
3	1									
4	#PortIndex	InitDelay	MaxRetry	RespTout	InterFrameDelay	InterCharDelay				
5	[basic_setting]									
6	1	0	3	1000	0	0				
7	2	0	3	1000	0	0				
8	3	0	3	1000	0	0				
9	4	0	3	1000	0	0				
10	5	0	3	1000	0	0				
11	6	0	3	1000	0	0				
12	7	0	3	1000	0	0				
13	8	0	3	1000	0	0				
14	9	0	3	1000	0	0				
15	10	0	3	1000	0	0				
16	11	0	3	1000	0	0				
17	12	0	3	1000	0	0				
18	13	0	3	1000	0	0				
19	14	0	3	1000	0	0				
20	15	0	3	1000	0	0				
21	16	0	3	1000	0	0				
22	#PortIndex	cmdIndex	cmdEnable	cmdName	cmdSlaveId	cmdFunc	cmdTrigger	cmdPollinterval	cmdEndianSwap	cmdReadStartAddr
23	[cmd_setting]									
24	14	1	1	Command1	1	1	1	1000	0	0

Make sure to follow the format or an error will occur when the file is imported. The detail description of the format is shown below.

Port Configuration Format

Item		Value	Note
mode_type		0, 1, 2, 3	0: RTU Slave 1: RTU Master 2: ASCII Slave 3: ASCII Master
basic_setting (RTU/ASCII Slave mode only)	PortIndex	1 to 8 (the MGate MB3660-8 Series) 1 to 16 1 to 8 (the MGate MB3660-16 Series)	Serial port number

Item		Value	Note
	SlaveID (Slave ID)	1 to 255	
basic_setting (Master mode only)	PortIndex	1 to 8	Serial port number
	InitDelay (Initial delay)	0 to 30000 ms	
	MaxRetry (Max. retry)	0 to 5	
	RespTout (Response timeout)	10 to 120000 ms	
	InterFrameDelay (Inter-frame delay)	10 to 500 ms,(0 for disable)	
	InterCharDelay (Inter-character timeout)	10 to 500, (0 for disable)	
cmd_setting (Master mode)	PortIndex	1 to 8 (the MGate MB3660-8 Series) 1 to 16 1 to 8 (the MGate MB3660-16 Series)	Serial port number
	cmdIndex (Command index)	1 to 32	Max. up to 32 commands per port
	cmdEnable (Enable)	0, 1	0: disable 1: enable
	cmdName (Name)	Name	Max. up to 40 characters
	cmdSlaveId (Slave ID)	1 to 255	
	cmdFunc (Function)	1-6,15,16,23	
	cmdTrigger (Trigger)	1, 2	1:Cyclic 2:Data Change
	cmdPollinterval (Poll interval)	10 to 1200000 ms	
	cmdEndianSwap (Endian swap)	0, 1, ,2, 3	0:None 1:Byte 2:Word 3:Byte and Word
	cmdReadStartAddr (Read starting address)	0 to 65535	
	cmdReadQuan (Read quantity)	1 to 123	
	cmdReadMemAddr (Read memory address)	0 to 65535	
	cmdWriteStartAddr (Write starting address)	0 to 65535	
	cmdWriteQuan (Write quantity)	1 to 123	
	cmdWriteMemAddr (Write memory address)	0 to 65535	
	cmdFaultProtType (Opposite side's command fault)	0, 1, 2	0:keep latest data 1:clear data to zero 2:user-defined value
	cmdFaultProtValue (Fault protection value)	00 to FF	
	cmdFaultProtTout	0 to 65535 ms	Timeout for opposite side's

Item		Value	Note
	(Timeout for opposite side's data update)		data update

NOTE In [basic_setting], the value of "portIndex" must be bigger than the previous row.

In [cmd_setting], the value of "portIndex" must be equal or bigger than the previous row.

In [cmd_setting], the value of "cmdIndex" must be bigger than the previous row.

Content that appears after the "#" character will be ignored. It is used to write notes on the CSV file.

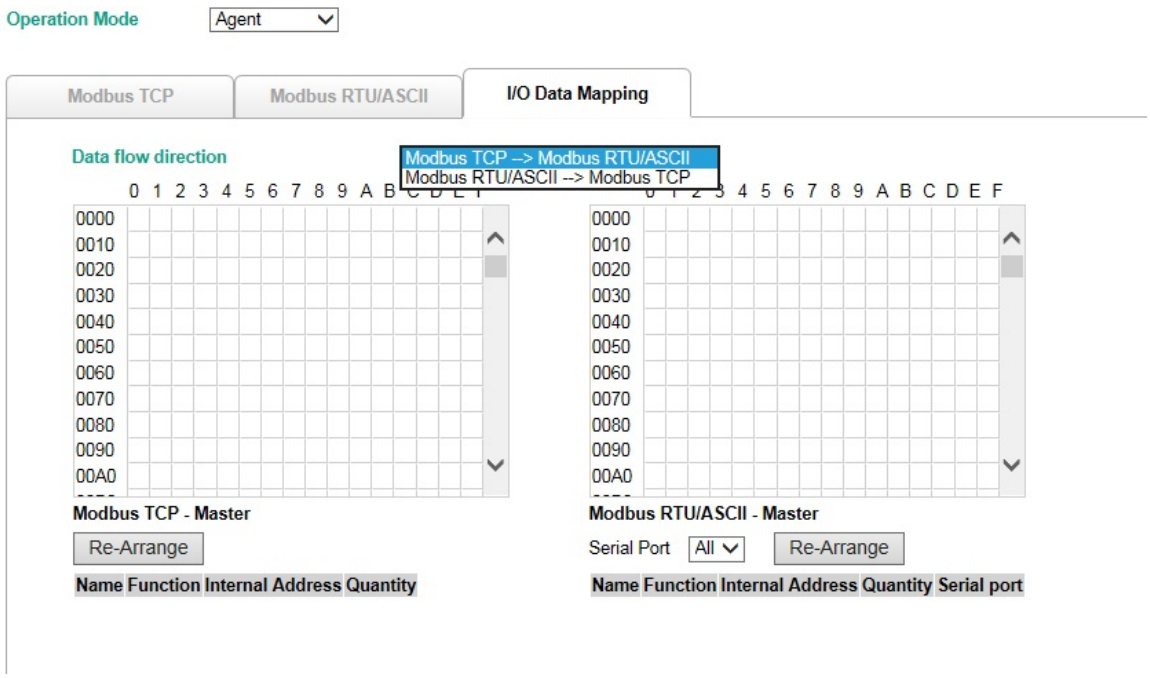
Error Message

If you import an invalid format of a configuration file, a notification message will pop up to show which columns and rows are incorrect on the web console. Two types of errors should be avoided.

Format Error	invalid character, absent/additional columns/rows below data block.
Data Range Error	value is out of range.(Ref Port Configuration Format)

I/O Data Mapping

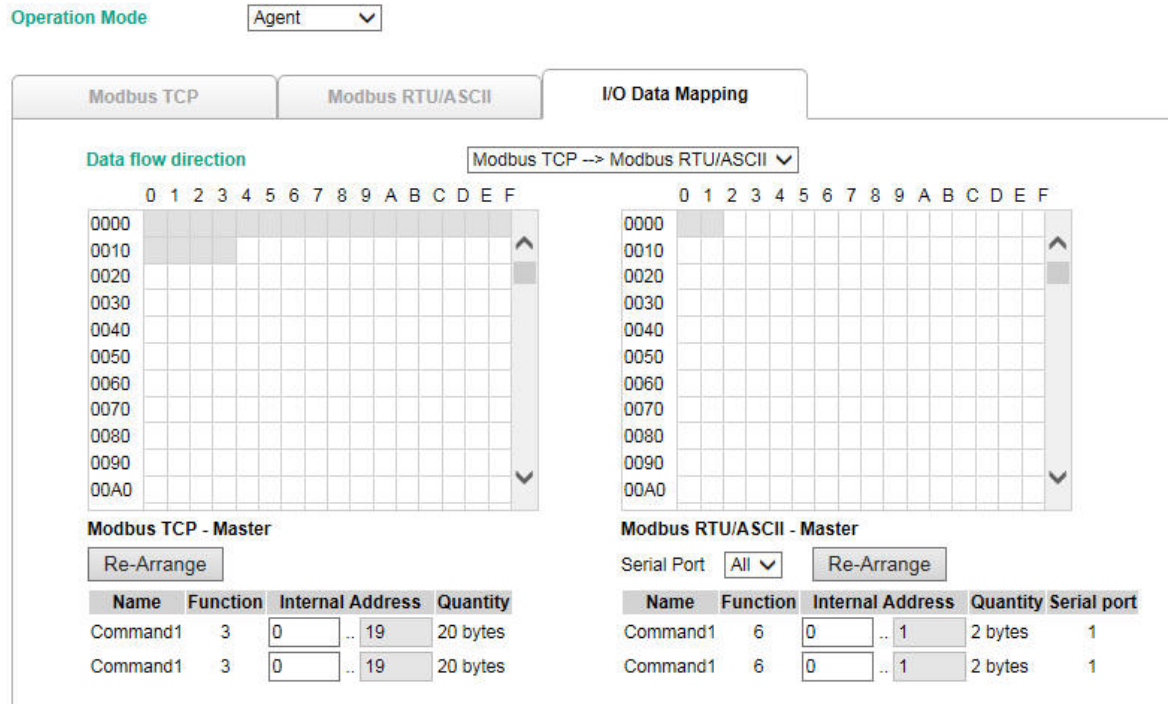
You can verify the gateway's memory allocation on the **I/O Data Mapping** page. First select the Modbus data flow you want to see.



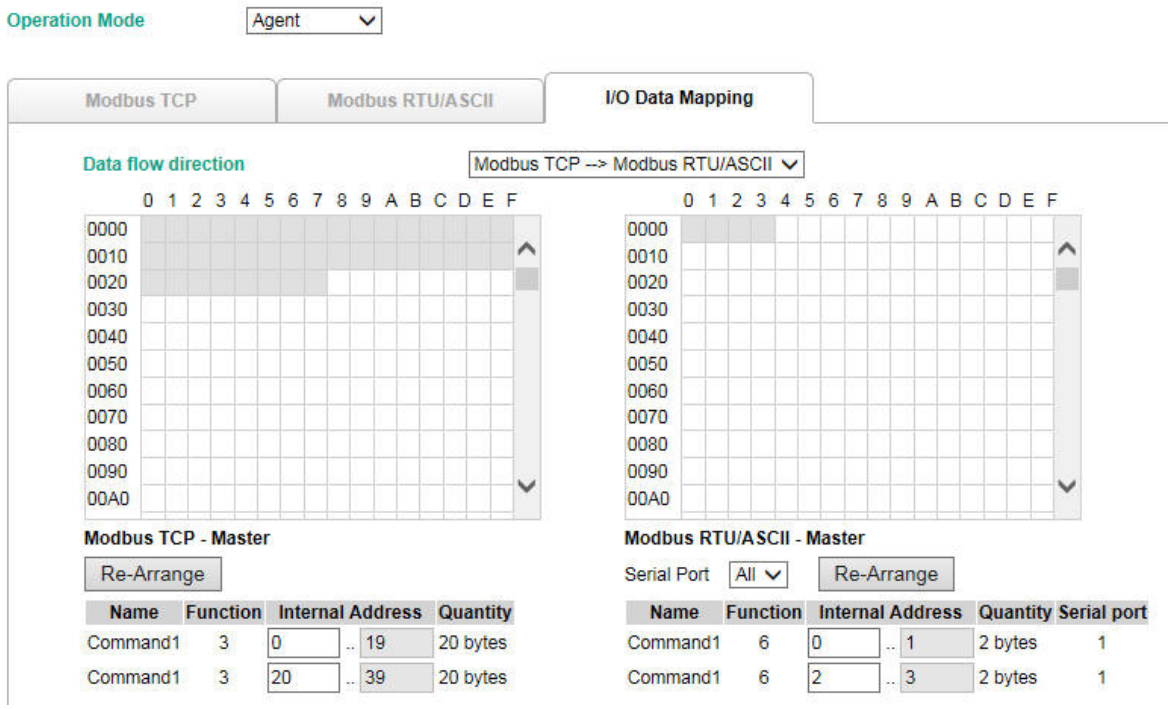
In agent mode, you need to manually set Modbus commands one-by-one and assign a gateway memory address for storing this data. We recommend using **I/O Data Mapping** to check the memory address of each command.

Example 1

If there are two commands with the same internal address as shown in the figure below.

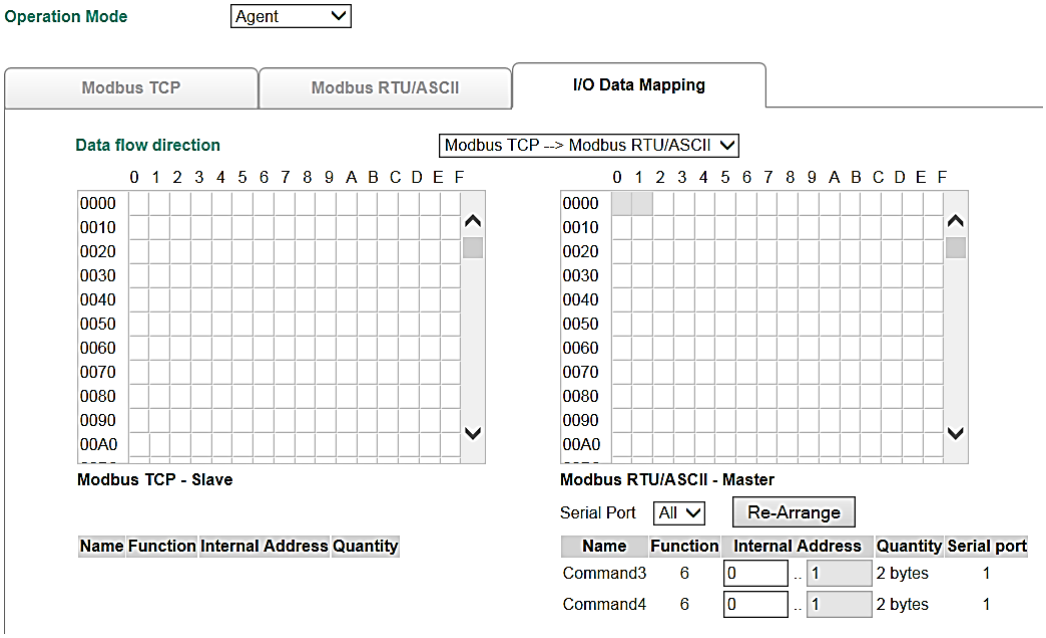


You can click on the **Re-Arrange** button to automatically address the internal address. The update internal address will become as follows:

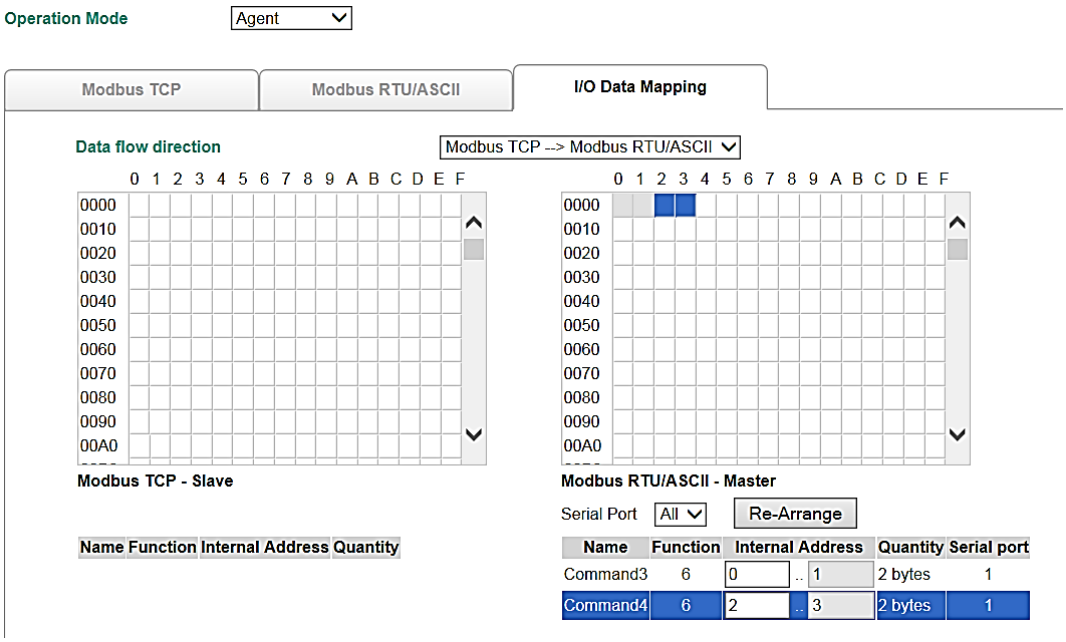


Example 2

On the contrary, you can also set the internal address manually. For example, if you add two Modbus commands that Command3 uses addresses 0 to 1, whereas Command4 uses addresses 2 to 3, then obviously a memory overlap exists.



To rectify the error, click **Command4** to change its starting address from 2 to 3.

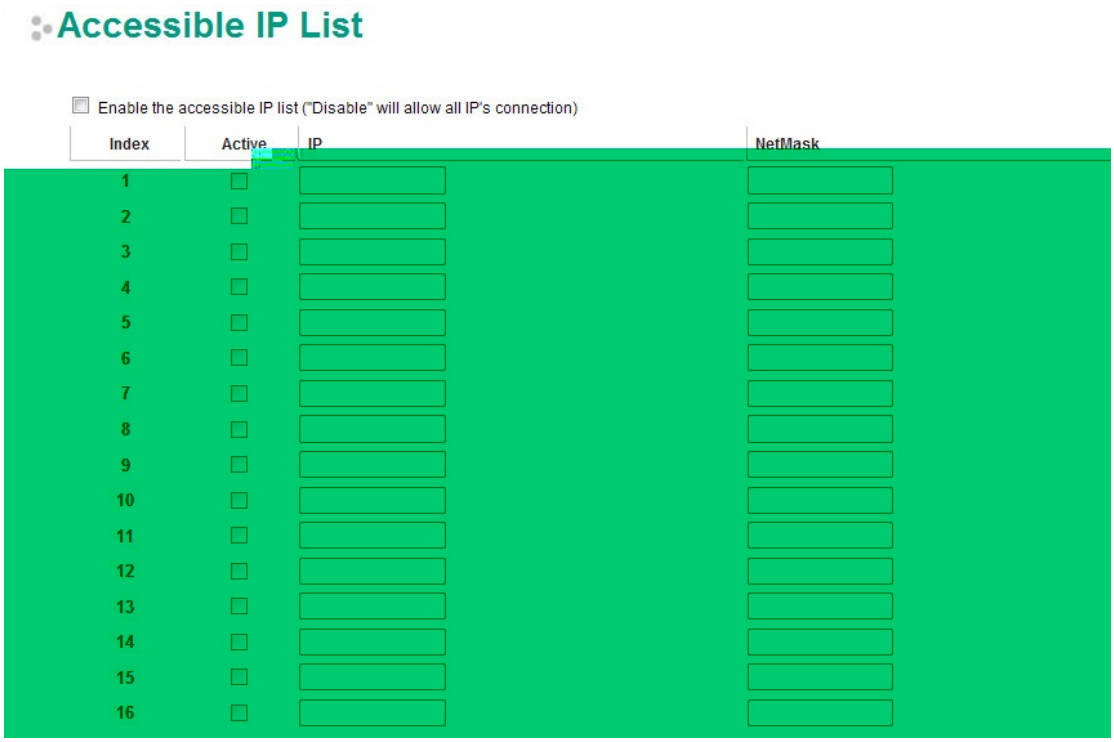


Once the change has been made, each of the two commands will be allocated to unique address ranges in the gateway's memory. That is, the address for command 3 will be in the range 0 to 1, whereas command 4 will be in the range 2 to 3.

System Management

This configuration tab includes several system level settings. Most of these settings are optional.

Accessible IP Settings



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

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

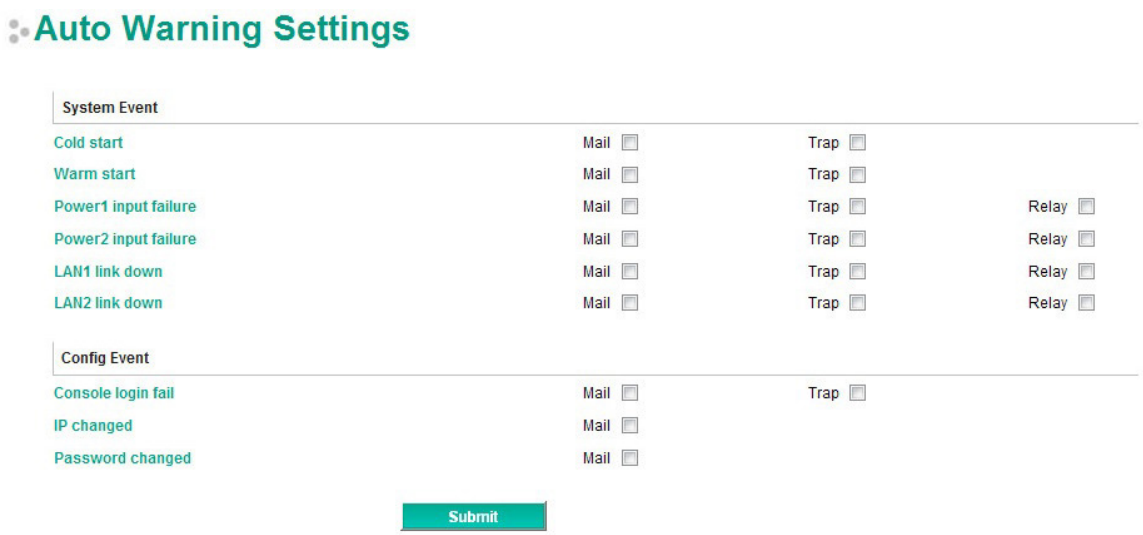
To allow access to hosts on a specific subnet
For both the IP address and netmask, use 0 for the last digit (e.g., "192.168.1.0" and "255.255.255.0").

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

Additional configuration examples are shown in the following table:

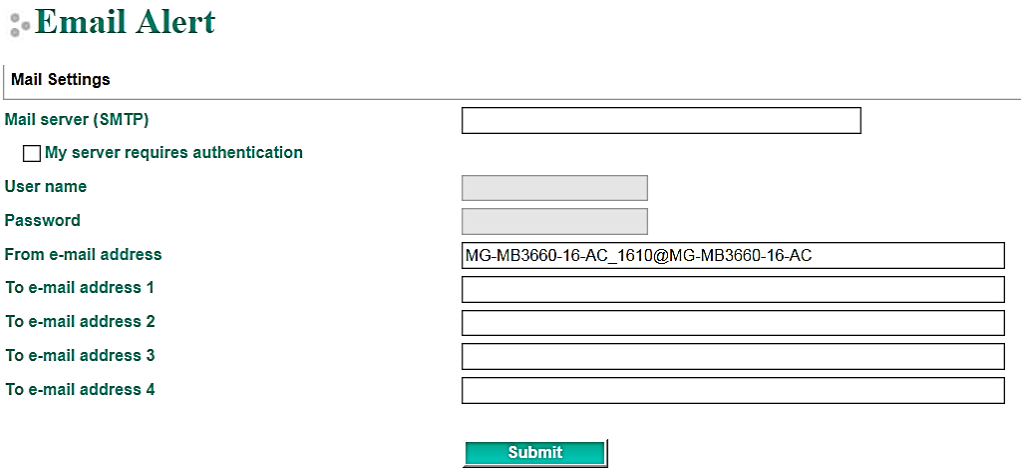
Allowed hosts	Entered IP address/Netmask
Any host	Disable
192.168.1.120	192.168.1.120 / 255.255.255.255
192.168.1.1 to 192.168.1.254	192.168.1.0 / 255.255.255.0
192.168.0.1 to 192.168.255.254	192.168.0.0 / 255.255.0.0
192.168.1.1 to 192.168.1.126	192.168.1.0 / 255.255.255.128
192.168.1.129 to 192.168.1.254	192.168.1.128 / 255.255.255.128

Auto Warning Settings



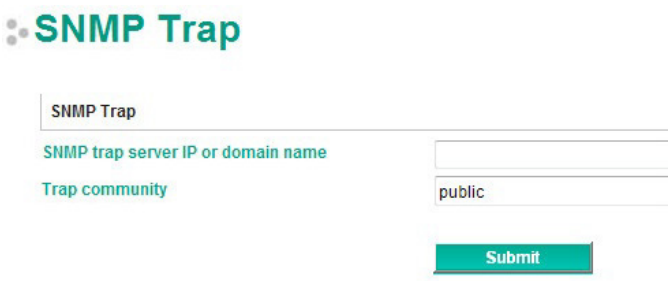
Auto Warning is triggered by different events. When a checked trigger condition occurs, the MGate can send e-mail alters, SNMP Trap messages, or open/close the circuit of the relay output and trigger the Fault LED to start blinking. To enable an e-mail alert, configure the e-mail address on the E-mail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

Email Alert Settings



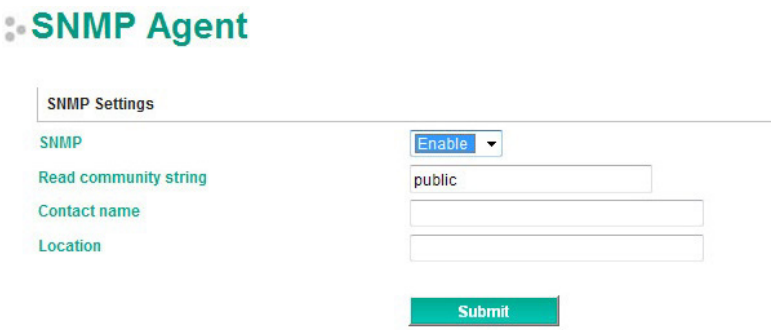
Parameters	Description
Mail server	The mail server's domain name or IP address.
User name	This field is for your mail server's user name, if required.
Password	This field is for your mail server's password, if required.
From e-mail address	This is the e-mail address from which automatic e-mail warnings will be sent.
To e-mail address 1 to 4	This is the e-mail address or addresses to which the automatic e-mail warnings will be sent.

SNMP Trap Settings



Parameters	Description
SNMP trap server IP	Use this field to indicate the IP address to use for receiving SNMP traps.
Trap community	Use this field to designate the SNMP trap community.

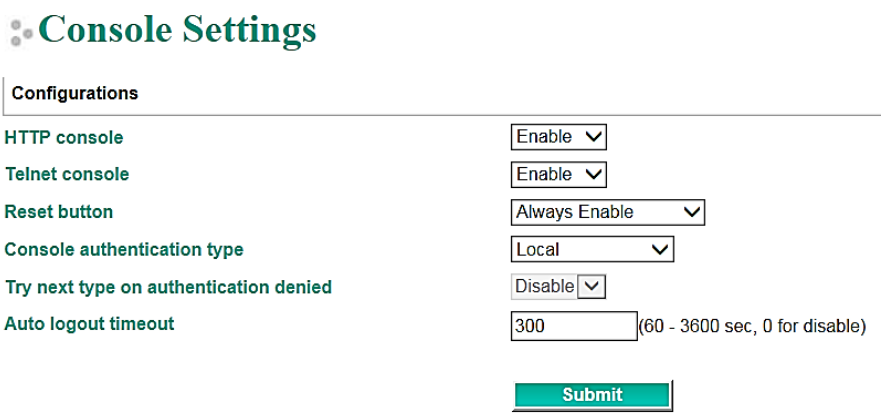
SNMP Agent Settings



Parameters	Description
SNMP	To enable the SNMP Agent function, select the Enable option, and enter a community name (e.g., public).
Read community string	This is a text password mechanism that is used to weakly authenticate queries to agents of managed network devices.
Contact name	The optional SNMP contact information usually includes an emergency contact name and telephone or pager number.
Location	For storing the SNMP's location information.

Misc. Settings

This page includes **console settings**, **password**, **RADIUS Server**, and **User Table**.

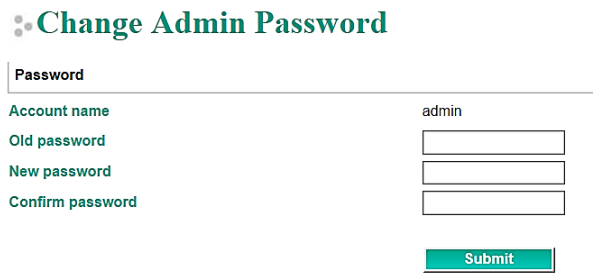


Console Settings

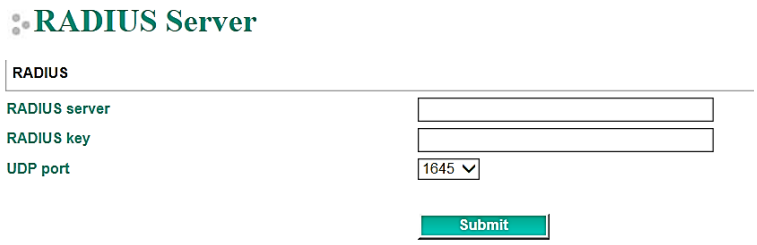
Parameters	Value	Description
HTTP	Enable/Disable	This setting is to enable/disable the web console.
Telnet console	Enable/Disable	This setting is to enable/disable the telnet console.
Reset button	Disable after 60 sec, Always enable	The MGate provides a reset button to clear the password or load factory default settings. For security reasons, you can disable this function. In disabled mode, the MGate will still enable this function within 60 seconds after power-up; 60 seconds later, the function will be disabled.
Console authentication type	Local/RADIUS/RADIUS-Local, Local-RADIUS	Determines the RADIUS authentication type.
Try next type on authentication denied	Disable/Enable	When the above multitype authentication fails, enable/disable to try next type of authentication automatically.
Auto logout time	60-3600 sec	Set the auto logout time period.

Change Admin Password

You can modify the password for the account **admin**. The default password is moxa. To change the password, type the existing password and then type the new password twice. Click **Submit** to activate the new password.



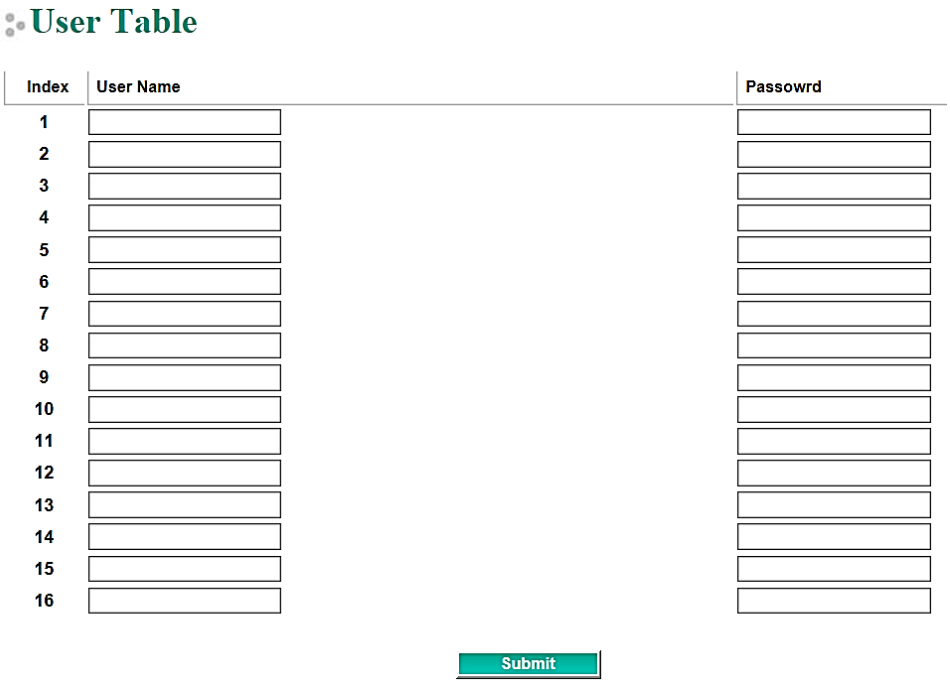
RADIUS Server



Parameters	Description
RADIUS Server	The name of the RADIUS server.
RADIUS key	The key for RADIUS authentication (be sure to type in the correct key)
UDP port	Support UDP port: 1645 (default)/1812.

User Table

The administrator can create a list of user names with passwords for logging in to the MGate MB3660.



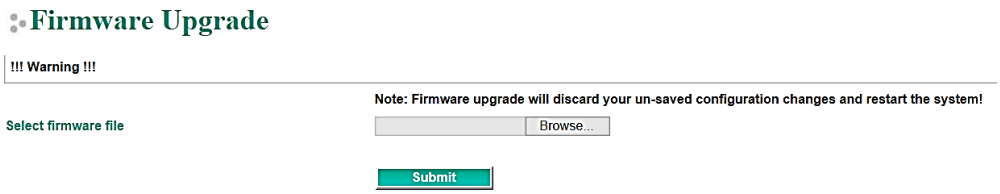
Maintenance

Other gateway maintenance settings.

Ping

To test the network status with the PING function, enter the PING server IP address, click **Start**, and wait for a response.

Firmware Upgrade



Firmware updates for the MGate MB3660 are located at www.moxa.com. After you have downloaded the new firmware onto your PC, you can use DSU to write it onto your MGate MB3660. Select the desired unit from the list and click to begin the process. Choose the correct file and click **Submit** to upgrade the firmware.

ATTENTION

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

Configuration Import/Export

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

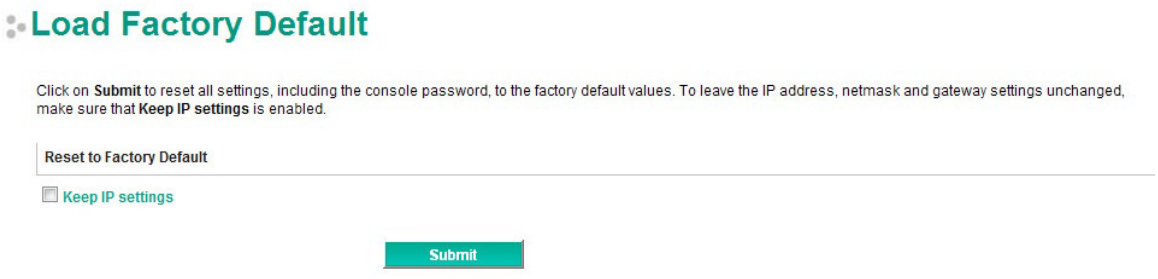
- **Applying the same configuration to multiple units**
  The Import/Export configuration function is a convenient way to apply the same settings to units located in different sites. You can export the configuration as a file and then import the configuration file onto other units at any time.
- **Backing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

The import or export function saves all the configuration settings and parameters of the MGate MB3660 in a ***.ini** file. To begin, click the **Import** or **Export** button.

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

Load Factory Default

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



Click **Submit** to restore the unit to factory default values.

ATTENTION

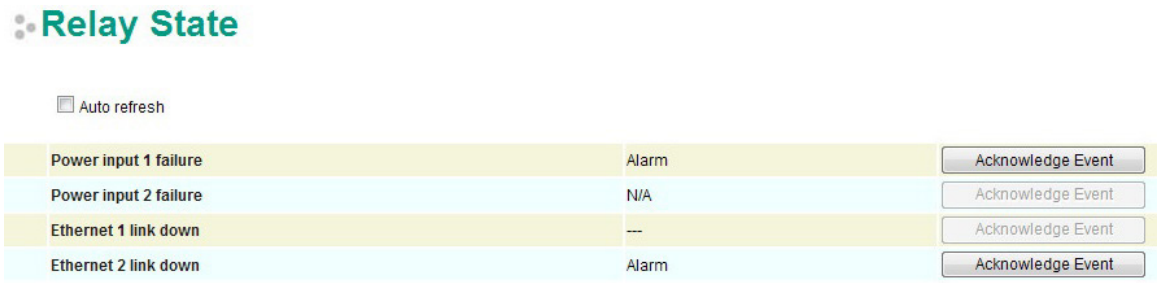
Load Default will completely reset the configuration of the unit, and all of the parameters you have saved will be discarded. Do not use this function unless you are sure you want to completely reset your unit.

System Monitoring

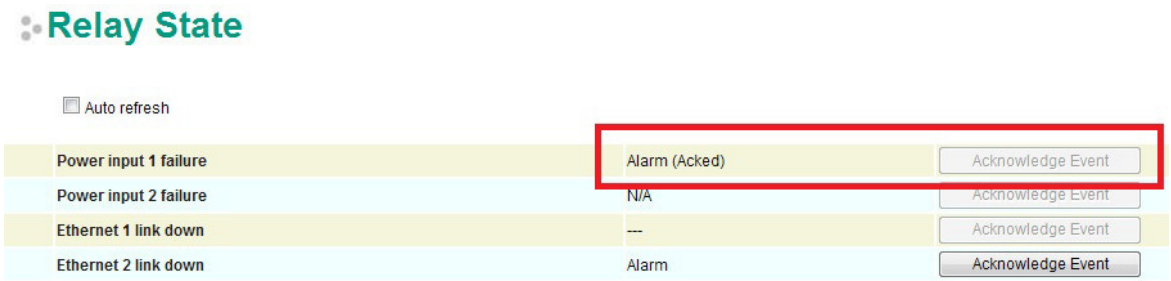
The MGate MB3660 provides two system monitoring functions: **Relay status** and **Protocol status**.

Relay Status

The MGate MB3660 has a built-in 3-pin relay output. It can be triggered by power input failure and LAN link down. Enable the relay output functions by clicking the relay check box in the **Auto Warning Settings**.



When a warning event occurs, the relay circuit will activate to enable the warning device, such as a beeper. The field engineer can click the **Acknowledge Event** button to temporarily deactivate the relay circuit and then take some time to troubleshoot the problem.

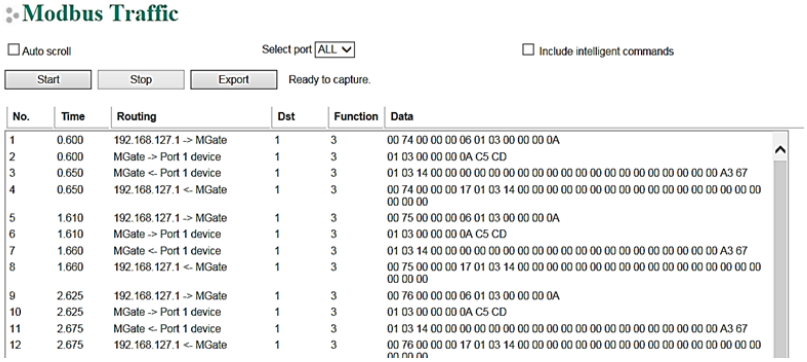


Once the abnormality has been resolved, the relay will return to normal status.

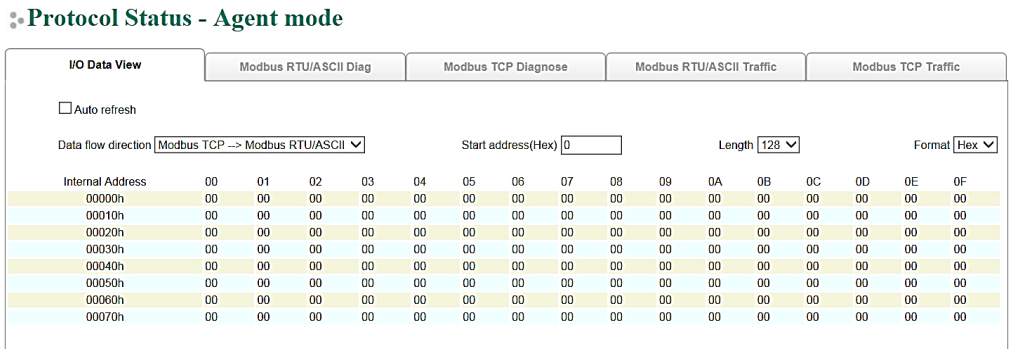
Protocol Status

The MGate MB3660 has a built-in Modbus diagnosis/traffic monitor function. For troubleshooting or management purposes, you can diagnose the Modbus protocol communication status and monitor Modbus RTU/ASCII/TCP data passing through the MGate MB3660.

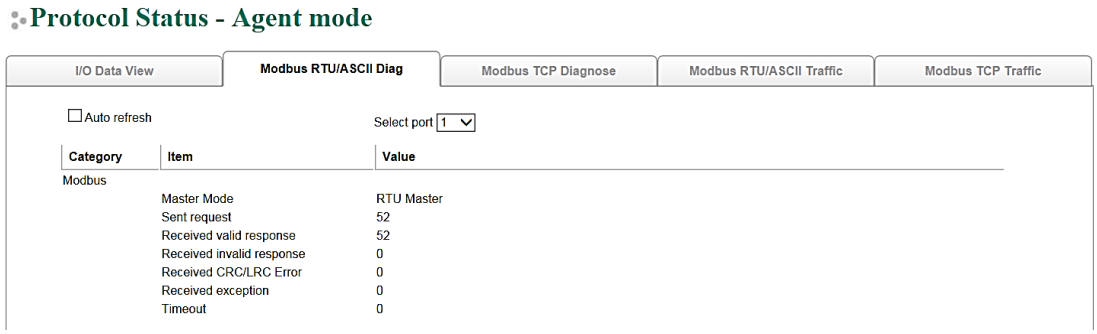
For **transparent mode**, it presents the data in an intelligent, easy-to-understand format with clearly designated fields, including source, destination, function code, and data. Events can be filtered in different ways, and the complete log can be saved to a file for later analysis.

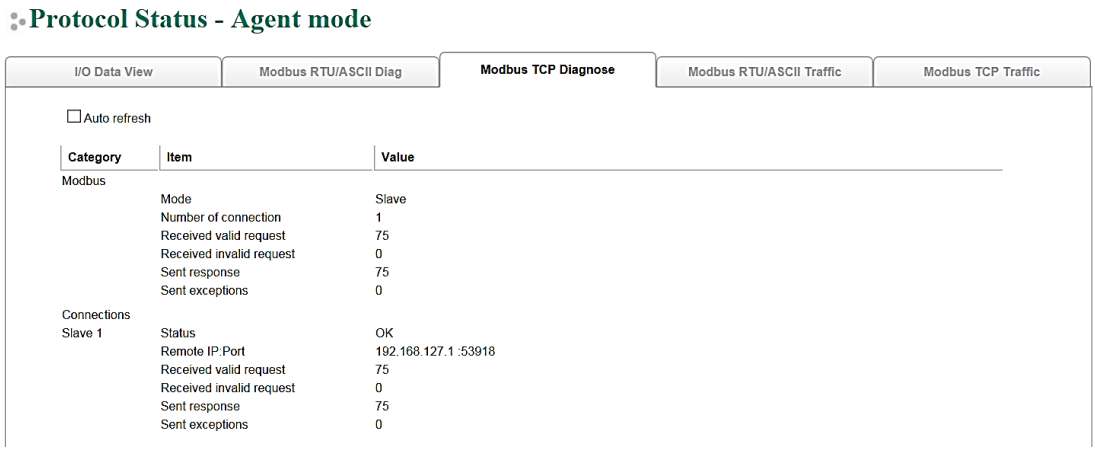


For **agent mode**, it includes I/O Data View, Modbus RTU/ASCII/TCP Diagnose, and Modbus RTU/ASCII/TCP Traffic. The I/O Data view page displays the internal memory information for input and output data transfers.

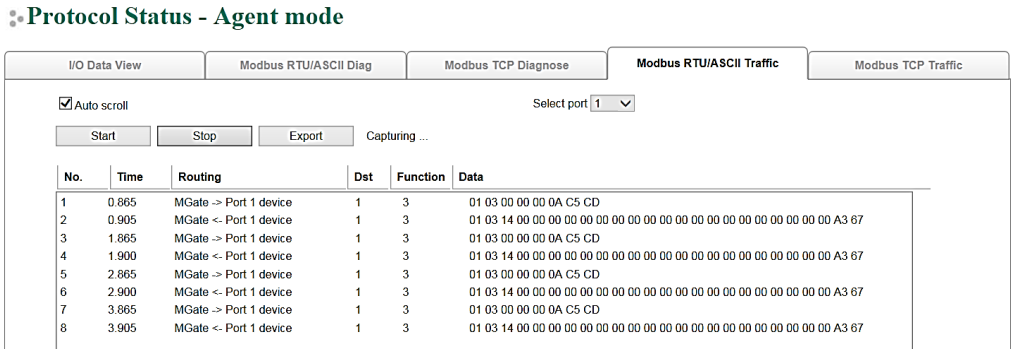


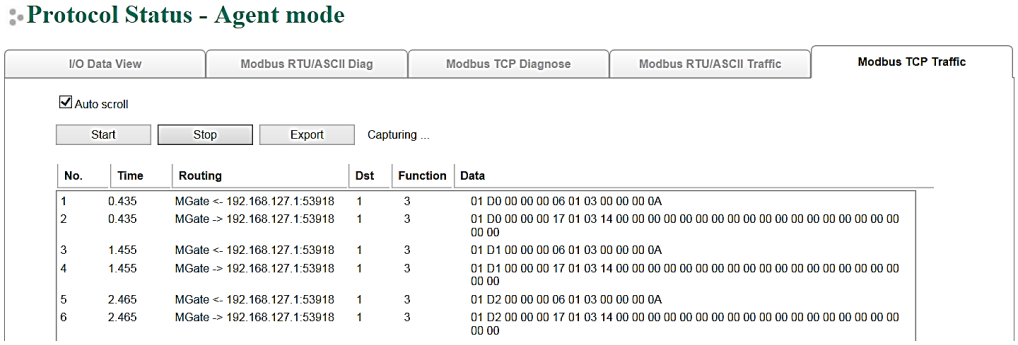
For **agent mode**, it includes Diagnose function, which provides status information for Modbus RTU/ASCII/TCP troubleshooting. Verify the connection status or packet counters to make sure communications are running smoothly.





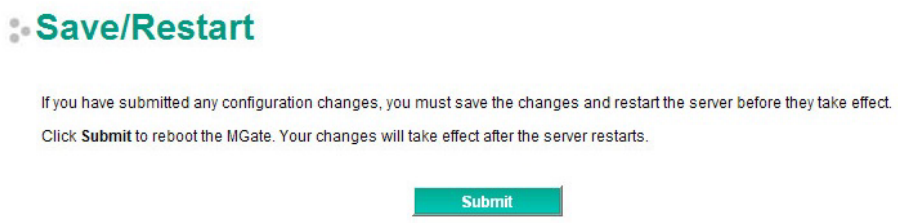
For **agent mode**, the traffic monitoring function can capture both Modbus RTU/ASCII and Modbus TCP communication logs, respectively, which present the data in an intelligent, easy-to-understand format with clearly designated fields including source, destination, function code, and data. Events can be filtered in different ways, and the complete log can be saved to a file for later analysis.





Save/Restart

All changes will be activated by clicking the **Submit** button first and then restarting the gateway. If a lot of settings need to be changed, you can click **Submit** for each setting and then click **Save/Restart** to activate all the changes.



Logout

For safety reasons, remember to log out of the web utility to prevent people who do not have the proper authorization from accessing the gateway.

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 Series of products 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.

MXconfig

Moxa's MXconfig is a comprehensive Windows-based utility that is used to install, configure, and maintain multiple Moxa devices in industrial networks. This suite of useful tools helps users set the IP addresses of multiple devices with one click, configure the redundant protocols and VLAN settings, modify multiple network configurations of multiple Moxa devices, upload firmware to multiple devices, export/import configuration files, copy configuration settings across devices, easily link to web and telnet consoles, and test device connectivity. MXconfig gives device installers and control engineers a powerful and easy way to mass configure devices, and effectively reduces the setup and maintenance cost.

For more detailed information regarding MXview, download the MXview user's manual from Moxa's website at http://www.moxa.com

5

Typical Applications

The following topics are covered in this chapter:

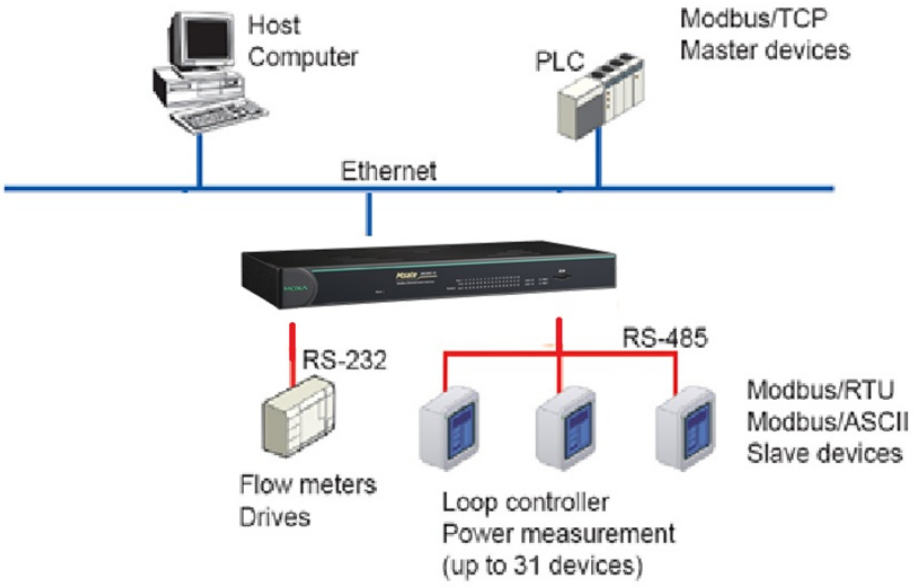
- **Ethernet Masters with Multiple Serial Slaves**
- **Serial Masters with Multiple Ethernet Slaves**
- **Modbus TCP Masters with ASCII and RTU Slaves**
- **Serial Master with Serial Slaves over Internet**

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 MB3660 Modbus gateway.

The MGate MB3660 supports Modbus TCP with up to 256 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.

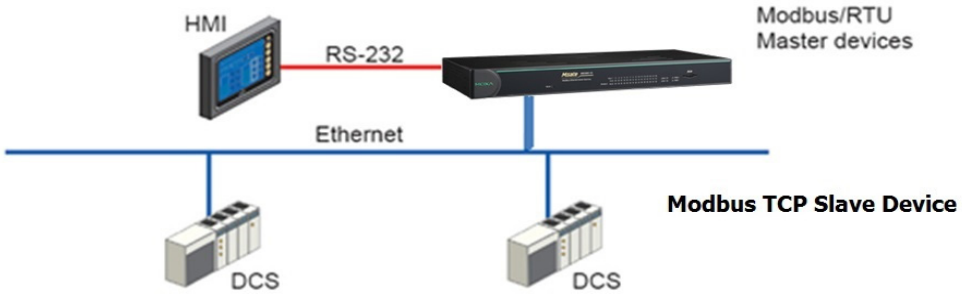


Serial Masters with Multiple Ethernet Slaves

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 MB3660 Modbus gateway can link a serial-based HMI to distributed DCSs over an Ethernet network. Up to 128 Modbus TCP slave devices are supported by each MGate MB3660.



Modbus TCP Masters with ASCII and RTU Slaves

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

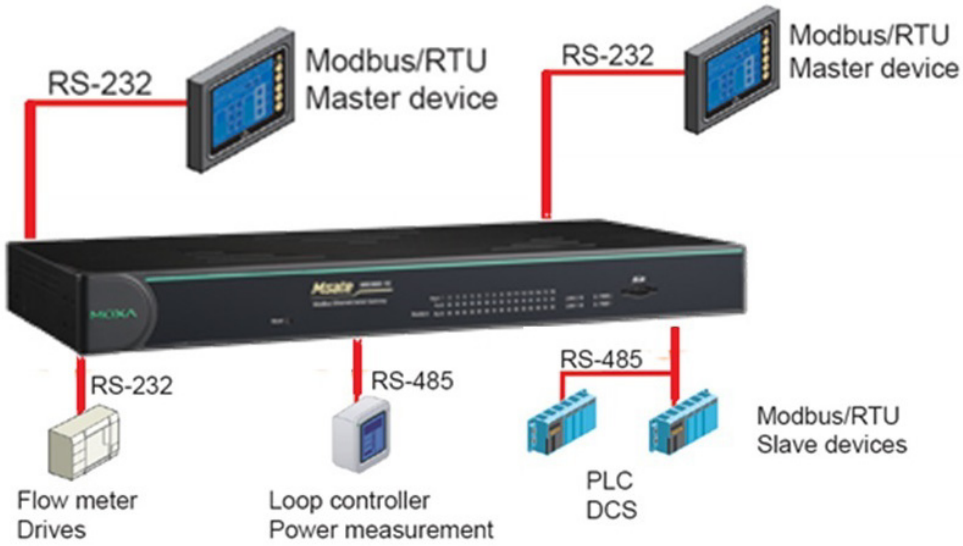
When integrating Modbus networks, you may encounter different Modbus serial networks that use different baudrates or a different protocol. Modbus ASCII might be used by some devices, while Modbus RTU is used by other devices.

The MGate models with two or more ports can integrate serial Modbus networks that use different parameters or protocols. You can configure each serial port to a specific Modbus serial environment to set up a slave ID map. After configuration, only the gateway will be visible to Modbus TCP masters, and all serial devices will be integrated behind it.

Serial Master(s) with Serial Slaves

Let Modbus serial devices communicate

The MGate MB3660 provides a feature for connecting serial master(s) with serial slave devices by using transparent mode. You only need to set up the slave ID routing mechanism.



6

Case Studies

The following topics are covered in this chapter:

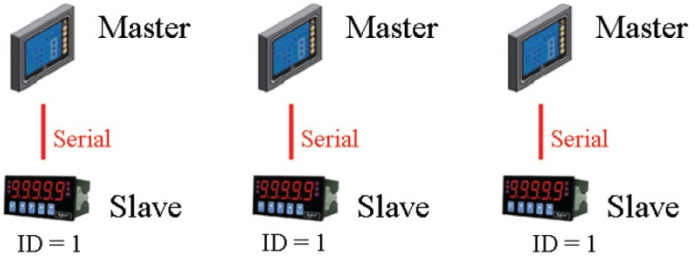
- **Introduction**
- **Replace Serial Masters with Ethernet Master(s), Configurable Slave IDs**
- **Replace Serial Masters with Ethernet Master(s), Fixed Slave IDs**
- **Keep Serial Master and Add Ethernet Master(s)**
- **Integrate Modbus RTU, ASCII, and TCP at the Same Time**

Introduction

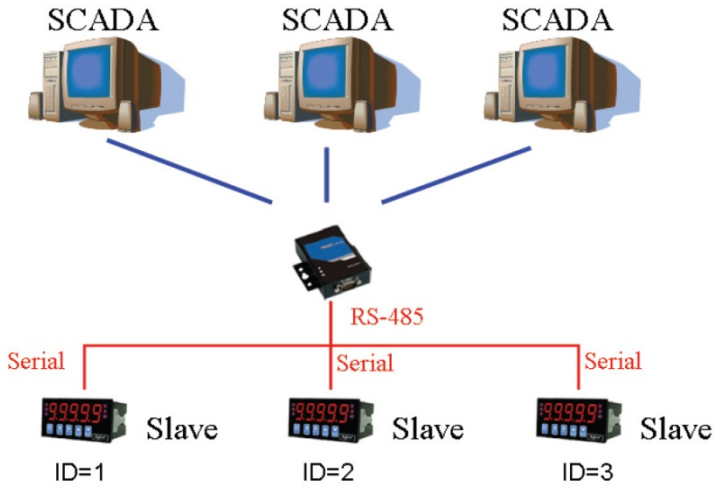
For many reasons, a Modbus gateway might be used to integrate Modbus networks. However, every situation has its own requirements and difficulties. Users may wonder how the gateway can help or even if the gateway is suitable for the system.

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

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:

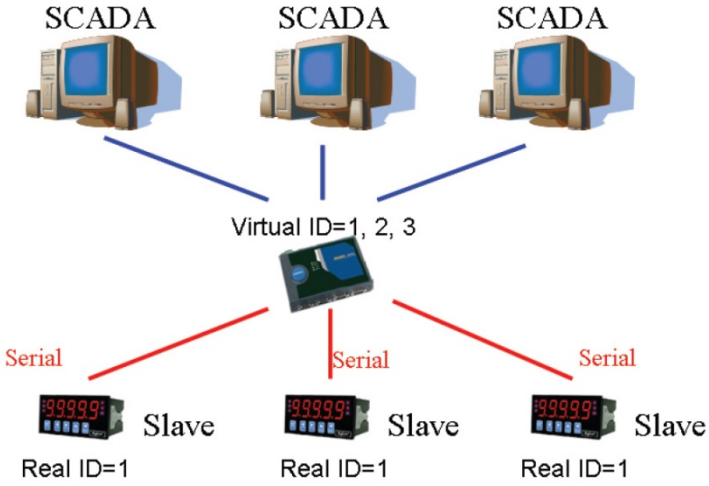


The MGate MB3660 can connect to each serial slave so Ethernet SCADA masters will be able to control them. However, since slave IDs cannot be repeated in a system, we will need to change the IDs of some of the slaves in order to integrate them into a single network, as follows:



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

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 can be used to assign virtual slave IDs. For more information about virtual slave IDs, refer to **Set Up Slave ID Mapping**, chapter 4.



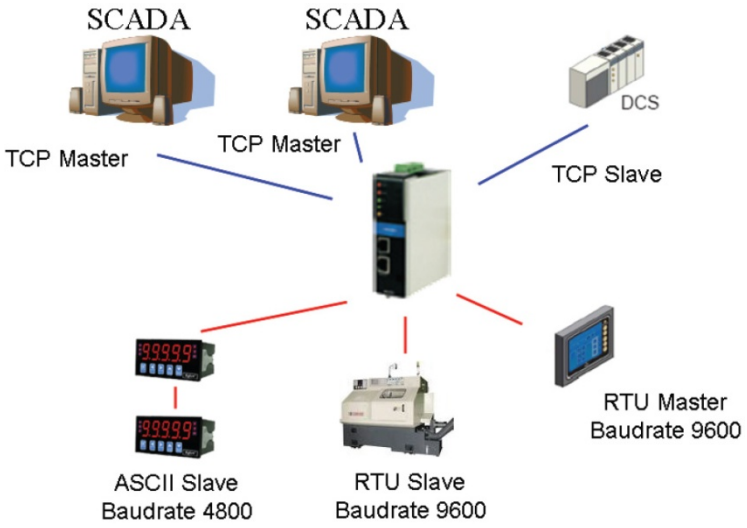
Keep Serial Master and Add Ethernet Master(s)

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.

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 MB3660 allows the different Modbus systems to be integrated into one network, regardless of the protocol or communication parameters.



A

Modbus Overview

Introduction

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

Devices are Either 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.

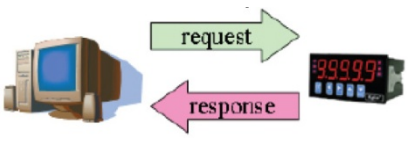
0	1~247	248~255
Broadcast address	Slave individual address	Reserved

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:

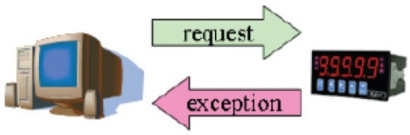
Normal

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 timeout 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 Timeout

The master sends a request. The slave is unresponsive for the amount of time specified by the response timeout 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 timeout values are left open for manufacturers to determine. This allows the Modbus protocol to accommodate a wide range of devices and systems. However, this also makes it difficult for system integrators to know what response timeout value to use during configuration, especially with older or proprietary devices.

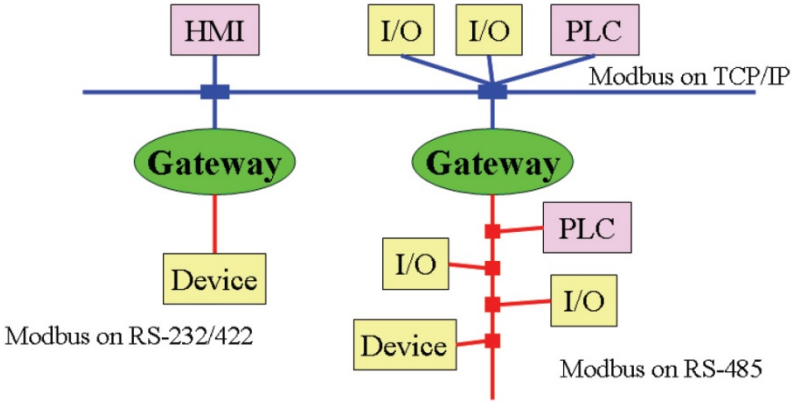
The MGate MB3660 provides a patent-pending function that tests all attached devices and recommends a response timeout value. This function saves considerable time and effort for system integrators and results in more accurate timeout settings.

Modbus Ethernet vs. Modbus Serial

Although Modbus is intended as an application-layer messaging protocol, the data format and communication rules for Ethernet-based Modbus TCP 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 MB3660 will queue up to 32 requests from each TCP master, for up to 16 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.