Protocol converter for Modbus RTU/ASCII to Modbus TCP

User manual

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User manual

Protocol converter for Modbus RTU/ASCII to Modbus TCP

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Revision: B

This user manual is valid for:

Designation	Order No.
GW MODBUS TCP/RTU 1E/1DB9	2702764
GW MODBUS TCP/RTU 1E/2DB9	2702765
GW MODBUS TCP/RTU 2E/2DB9	2702766
GW MODBUS TCP/RTU 2E/4DB9	2702767

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to qualified application programmers and software engineers, who are familiar with the safety concepts of automation technology and applicable standards.

Explanation of symbols used and signal words

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.

There are three different categories of personal injury that are indicated with a signal word.

DANGER This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.

This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

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1 Description

The GW MODBUS TCP/RTU... devices provide enhanced connectivity from a wide variety of Modbus® masters to a wide variety of Modbus slaves, advanced master-to-master connectivity, and connectivity from legacy Modbus serial networks to Modbus TCP networks. Supported Modbus masters include:

– Modbus TCP
– Modbus RTU
– Modbus ASCII

Supported Modbus slaves include:

– Modbus TCP
– Modbus RTU serial
– Modbus ASCII serial

Connectivity is achieved between any master(s) and any slave(s) anywhere on an Ethernet network. Combined with a GW MODBUS TCP/RTU... device, both serial and Ethernet raw/ASCII devices can be accessed anywhere on a network from any Modbus master. GW MODBUS TCP/RTU... devices are designed to greatly enhance system maintenance capabilities, including comprehensive device and port-specific diagnostic web pages that display status, message response timing, timeouts, other error counts, and overall message statistics. A serial log provides message level diagnosis for serial devices.

The family consists of universal RS232/422/485 1-, 2-, and 4-port serial versions, with one or two Ethernet ports to fit any application.

This user manual is valid for:

Table 1-1 GW MODBUS TCP/RTU... types

Type Description	Order No.
GW MODBUS TCP/RTU 1E/1DB9	2702764
GW MODBUS TCP/RTU 1E/2DB9	2702765
GW MODBUS TCP/RTU 2E/2DB9	2702766
GW MODBUS TCP/RTU 2E/4DB9	2702767

1.1 Structure

GW MODBUS TCP/RTU 1E/1DB9

The GW MODBUS TCP/RTU 1E/1DB9 features one Ethernet port and one RS-232/422/485 serial port with a D-SUB 9 connector.

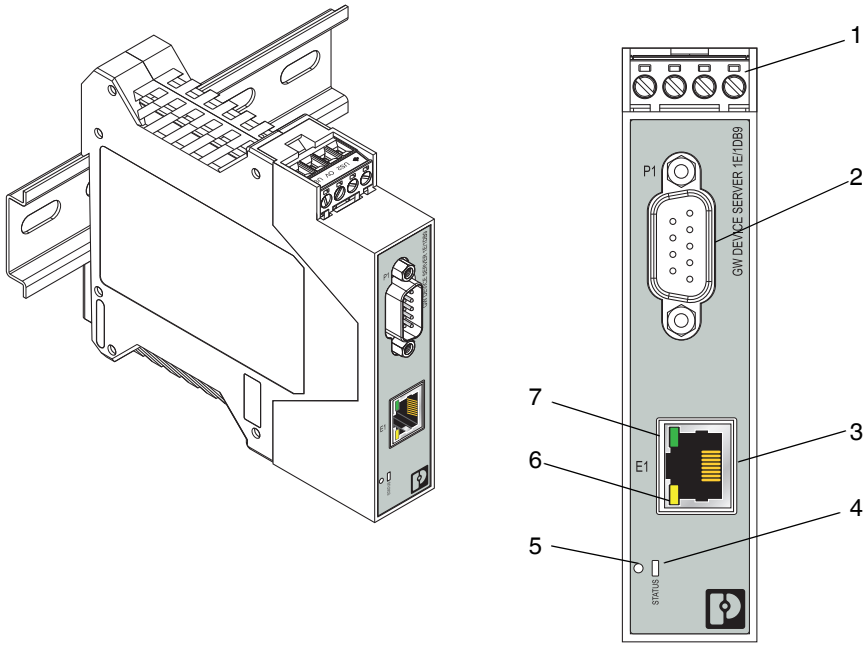


Figure 1-1 GW MODBUS TCP/RTU 1E/1DB9

Table 1-2 GW MODBUS TCP/RTU 1E/1DB9 structure

Item	Description
1	Power connector
2	P1 D-SUB 9 connector
3	Ethernet port (RJ45)
4	Status LED
5	Reset button
6	Ethernet activity status LED
7	Ethernet link status LED

GW MODBUS TCP/RTU 1E/2DB9

The GW MODBUS TCP/RTU 1E/2DB9 features one Ethernet port and two RS-232/422/485 serial ports with D-SUB 9 connectors.

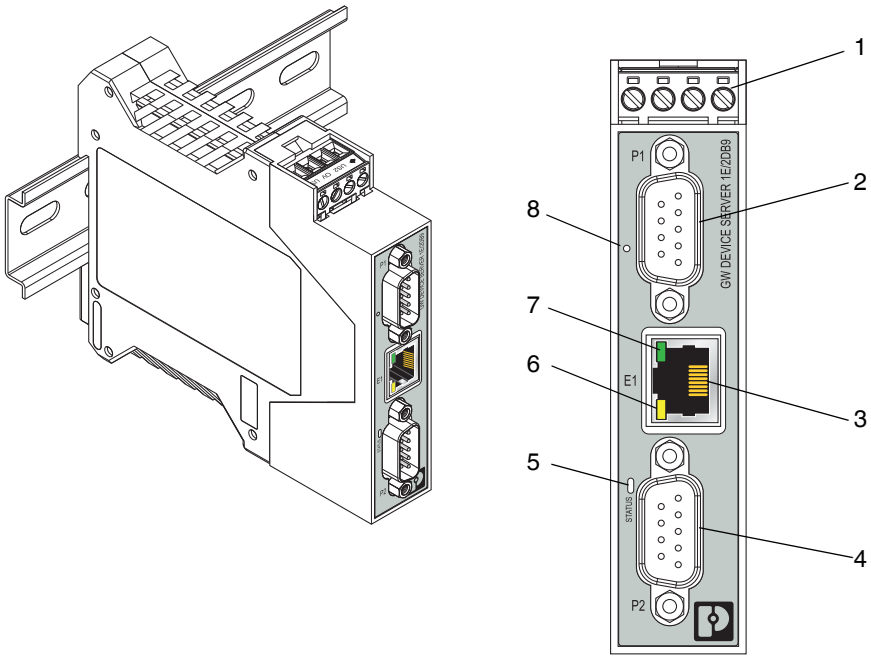


Figure 1-2 GW MODBUS TCP/RTU 1E/2DB9

Table 1-3 GW MODBUS TCP/RTU 1E/2DB9 structure

Item	Description
1	Power connector
2	P1 D-SUB 9 connector
3	Ethernet port (RJ45)
4	P2 D-SUB 9 connector
5	Status LED
6	Ethernet activity status LED
7	Ethernet link status LED
8	Reset button

GW MODBUS TCP/RTU 2E/2DB9

The GW MODBUS TCP/RTU 2E/2DB9 features two Ethernet ports with integrated switch functionality and two RS-232/422/485 serial ports with D-SUB 9 connectors.

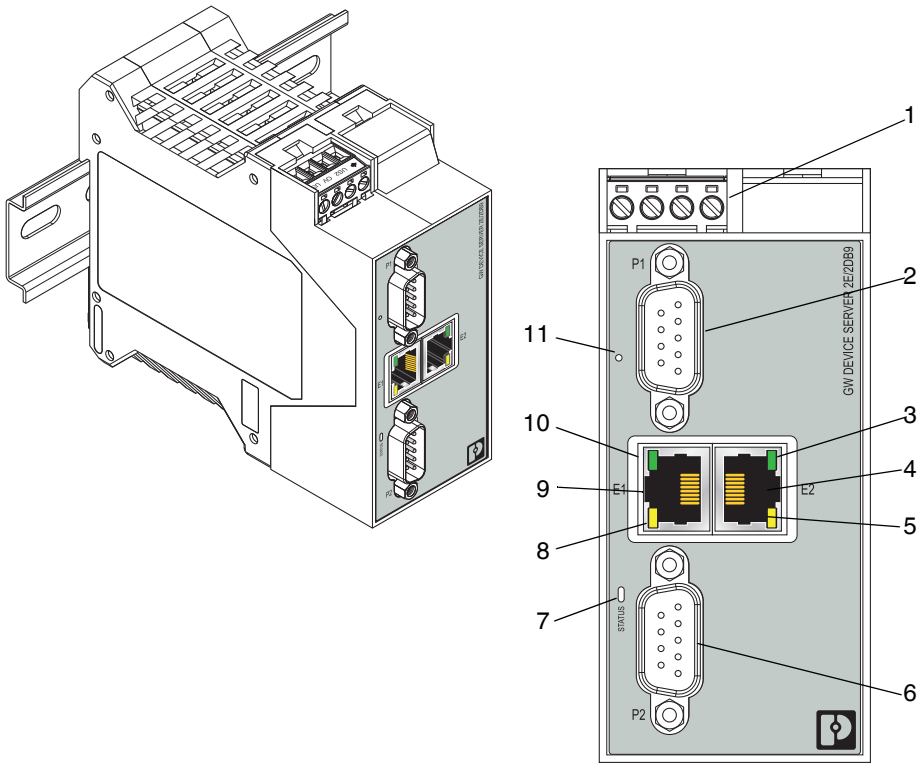


Figure 1-3 GW MODBUS TCP/RTU 2E/2DB9

Table 1-4 GW MODBUS TCP/RTU 2E/2DB9 structure

Item	Description
1	Power connector
2	P1 D-SUB 9 connector
3	Ethernet link status LED
4	E2 Ethernet port (RJ45)
5	Ethernet activity status LED
6	P2 D-SUB 9 connector
7	Status LED
8	Ethernet activity status LED
9	E1 Ethernet port (RJ45)
10	Ethernet link status LED
11	Reset button

GW MODBUS TCP/RTU 2E/4DB9

The GW MODBUS TCP/RTU 2E/4DB9 features two Ethernet ports with integrated switch functionality and four RS-232/422/485 serial ports with D-SUB 9 connectors.

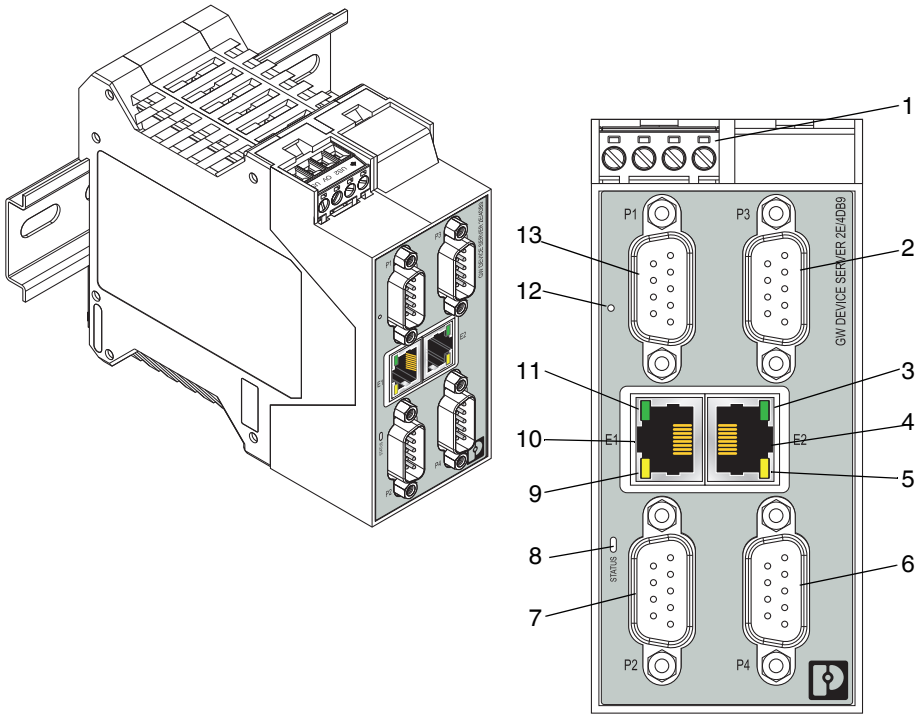


Figure 1-4 GW MODBUS TCP/RTU 2E/4DB9

Table 1-5 GW MODBUS TCP/RTU 2E/4DB9 structure

Item	Description
1	Power connector
2	P3 D-SUB 9 connector
3	Ethernet link status LED
4	E2 Ethernet port (RJ45)
5	Ethernet activity status LED
6	P4 D-SUB 9 connector
7	P2 D-SUB 9 connector
8	Status LED
9	Ethernet activity status LED
10	E1 Ethernet port (RJ45)
11	Ethernet link status LED
12	Reset button
13	P1 D-SUB 9 connector

2 Installation

2.1 Safety regulations and installation notes

Installation, operation, and maintenance may be carried out only by qualified electricians. Follow the specified installation instructions. The applicable specifications and safety directives (including the national safety directives), as well as the general technical regulations, must be observed during installation and operation. The technical data should be taken from the packaging instructions and the certificates (conformity assessment, other possible approvals).

Opening the device or making changes to it is not permitted. Do not repair the device yourself, but replace it with an equivalent device. Repairs may be carried out only by the manufacturer. The manufacturer is not liable for any damage caused by violation of the prescribed regulations.

The IP20 degree of protection (EN 60529) of the device is intended for a clean and dry environment.

Do not subject the device to any load that exceeds the prescribed limits.

The device is not designed for use in environments with danger of dust explosions.

2.2 Mounting

To mount on the DIN rail:

1. Place the device onto the DIN rail from above (A), so that the upper housing keyway hooks onto the top edge of the DIN rail.
2. Hold the device by the housing cover and carefully push the device toward the mounting surface (B).
3. After the foot is snapped onto the DIN rail, verify that it is attached securely.

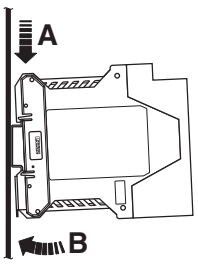


Figure 2-1 DIN rail mounting

To remove:

1. Use a suitable screwdriver to release the locking mechanism (A) on the snap-on foot of the device.
2. Hold on to the device by the housing cover and carefully tilt it upward (B).
3. Remove the device from the DIN rail (C).

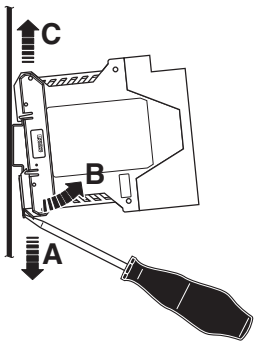


Figure 2-2 DIN rail removal

2.3 Data interfaces

2.3.1 Connecting the V.24 (RS-232) cable

The D-SUB 9 connector may function as an RS-232, RS-422, or RS-485 interface. The RS-232 interface is a data terminal equipment (DTE) device that behaves like a personal computer (PC). A null modem cable or adapter is required to connect to a PC.

The V.24 (RS-232) interface of the GW MODBUS TCP/RTU... is a DTE assignment.

Connect the GW MODBUS TCP/RTU... to the V.24 (RS-232) device to be connected (for example, a PC) by way of the PSM-KA-9SUB 9/BB/2 METER V.24 (RS-232) cable (Order No. 2799474). The cable is an interface cable with 1:1 connected contacts.

Table 2-1 D-SUB 9 to RS-232 pin out

GW MODBUS TCP/RTU...		End device			
	RS-232	D-SUB 9 (DCE)	D-SUB 9 (DTE)	D-SUB 25 (DCE)	D-SUB 25 (DTE)
1	DCD	1	4	8	20
2	RxD	2	3	3	2
3	TxD	3	2	2	3
4	DTR	4	1, 6	20	6, 8
5	GND	5	5	7	7
6	DSR	6	4	6	20
7	RTS	7	8	4	5
8	CTS	8	7	5	4
9	RI	9	-	22	-

2.3.2 Connecting the RS-422 cable

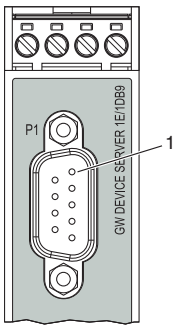


Figure 2-3 Pin 1 location

In RS-422 mode, a point-to-point connection can be established. Use a twisted-pair, common shielded bus cable to connect the I/O device.

To connect the RS-422 cable:

1. Connect the individual conductors of the data cable to the GW MODBUS TCP/RTU... using a SUBCON 9/F SH (Order No. 2761499).
2. Make sure the signal assignment is correct.
   This operating mode supports full duplex transmission mode.

Table 2-2 D-SUB 9 to RS-422 and RS-485 pin out

GW MODBUS TCP/RTU...			End device	
	RS-422	**RS-485**	**RS-422**	**RS-485**
2	T(A)	–	D(A)	–
3	D(A)	D(A)	T(A)	D(A)
5	GND	GND	GND	GND
7	D(B)	D(B)	T(B)	D(B)
8	T(B)	–	D(B)	–

2.3.3 Connecting the RS-485 cable

In RS-485 mode, an RS-485 network with several I/O devices can be created. Use a twisted-pair, common shielded bus cable to connect the I/O devices.

Connect the individual conductors of the data cable to the GW MODBUS TCP/RTU... using a SUBCON 9/F SH (Order No. 2761499) (see Table 2-2).

NOTE:

Observe the polarity of the RS-485 cable.

Fit this bus cable with a termination network at the two furthest points of the RS-485 network.

The termination resistors are integrated in the GW MODBUS TCP/RTU... and can be switched on through the web-based management interface.

2.3.4 Connecting the Ethernet cable

The GW MODBUS TCP/RTU... has an Ethernet interface on the front in RJ45 format, to which only twisted-pair cables with an impedance of 100 Ω can be connected. The data transmission rate is either 10 or 100 Mbps. The GW MODBUS TCP/RTU... supports the auto negotiation function for automatic selection of the transmission speed, as well as an automatic crossover feature for the selection of line or crossover cabling.

Push the Ethernet cable with the crimped RJ45 connector into the GW MODBUS TCP/RTU... until it engages with a click.

2.3.4.1 Models with two Ethernet ports

When using two Ethernet ports, the GW MODBUS TCP/RTU... is classified as a switch. When using only one port, it is a simple end node device. The maximum number of daisy-chained GW MODBUS TCP/RTU... units, and the maximum distance between units, is based on the Ethernet standards, and is determined by the environment and conformity of the network to these standards. There may be some performance degradation on the devices at the end of the chain, so it is recommended to overload and test for performance in the environment. The application may also limit the total number of ports that may be installed. Some basic guidelines are listed below.

- Ethernet 10BASE-T rules
  - The maximum number of repeater segments is four.
  - Use Category 3 or 5 twisted-pair 10BASE-T cables. The maximum length of each cable is 100 m (328 ft.).
- Fast Ethernet 100BASE-TX rules
  - The maximum number of repeater segments is two (for a Class II hub). A Class II hub can be connected directly to one other Class II Fast Ethernet hub. A Class I hub cannot be connected directly to another Fast Ethernet hub.
  - Category 5 twisted-pair cable must be used. The maximum length of each twisted-pair cable is 100 m (328 ft.).
  - The total length of twisted-pair cabling (across directly connected hubs) must not exceed 205 m (672 ft.).
- IEEE 802.3 specification: A network using repeaters between communicating stations (PCs) is subject to the 5-4-3 rule of repeater placement on the network:
  - The maximum number of segments connected on a network is five.
  - Four repeaters is the maximum that can be applied to a network.
  - Only three segments can have user connections. The other two segments must act as repeaters with no user connections.

2.4 Connecting the power supply

CAUTION:

Incorrect connection may result in damage to equipment and/or serious personal injury.

Only qualified personnel may connect the power, start up, and operate this device. According to the safety instructions in this text, qualified personnel are persons who are authorized to start up, to ground, and to mark devices, systems, and equipment according to the standards of safety technology. In addition, these persons must be familiar with all warning instructions and maintenance measures in this text.

Disregarding this warning may result in damage to equipment and/or serious personal injury.

The device can be connected to a single power source or two power sources for redundancy. The GW MODBUS TCP/RTU... is powered using a +24 V DC SELV power supply. The power supply is connected by way of COMBICON plug-in screw terminal blocks (24 V and 0 V).

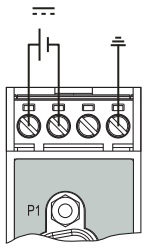


Figure 2-4 Single power supply connection

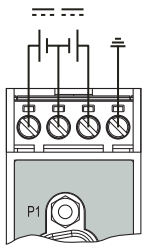


Figure 2-5 Redundant power supply connection

3 Configuration and startup

3.1 Default settings

The default network settings of the GW MODBUS TCP/RTU... are:

IP address: 192.168.254.254
Subnet mask: 255.255.255.0
Gateway: 0.0.0.0

The default settings are invoked whenever the system is reset.

3.2 Web-based management

The user-friendly, web-based management interface, a graphical user interface (GUI), can be used to manage the GW MODBUS TCP/RTU... from anywhere in the network using a standard browser. Comprehensive configuration and diagnostic functions, including a wide range of information about the device itself, the current parameters, and the operating state, are clearly displayed.

3.3 Login

To log in:

1. Set the IP address of the connected PC to the subnetwork of the GW MODBUS TCP/RTU...: for example, IP = 192.168.254.10, subnetwork = 255.255.255.0.
2. Open a web browser and enter the IP address of the GW MODBUS TCP/RTU... in the “Address” field (default = 192.168.254.254).

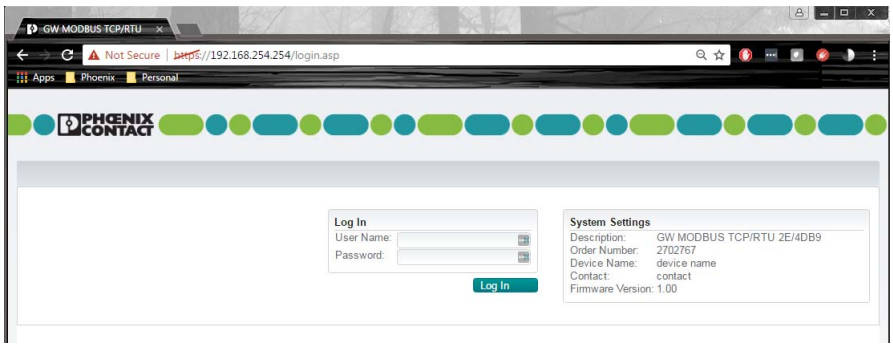


Figure 3-1 “Login” screen

The web server responds immediately.

If the web server does not load, first check the IP parameters of the PC. If everything is set correctly, check to see if there are any proxy settings loaded in the web browser. The proxy setting must be set to “Load automatically” or “Deactivated” to properly establish communication.

3. Enter the credentials to access the web server configuration pages. The default credentials are:

   User name: Admin

   Default password: admin

Powering multiple devices with factory default IP addresses causes a network conflict, and incorrect parameters may be set in the GW MODBUS TCP/RTU... modules. When programming modules for the first time, it is important to apply power to only one at a time, and change the IP address of each module to a unique IP address. Once all devices have a unique IP address, they can be powered on together while on the same network.

3.4 Home screen

Immediately after login, the “Home” screen is displayed. From the “Home” screen, the basic settings of the GW MODBUS TCP/RTU... can be immediately configured by clicking on the appropriate Ethernet port or serial port in the diagram of the module.

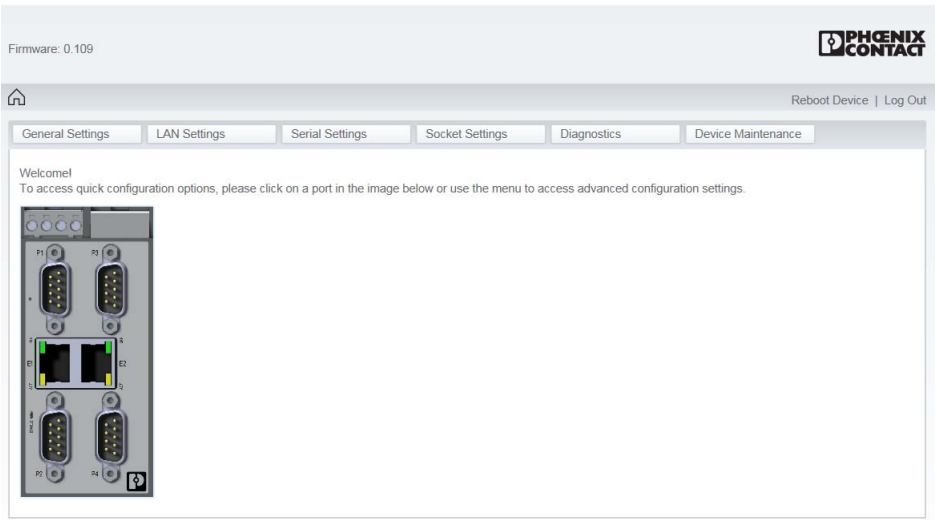


Figure 3-2 “Home” screen

Advanced settings can be accessed through the menu at the top of the screen. The “Home” screen can be accessed at any time by clicking the “Home” button in the upper-left corner of the web-based management interface.

3.5 General settings

To view and edit general settings:

1. Click the “General Settings” tab to view and edit general information about the GW MODBUS TCP/RTU....

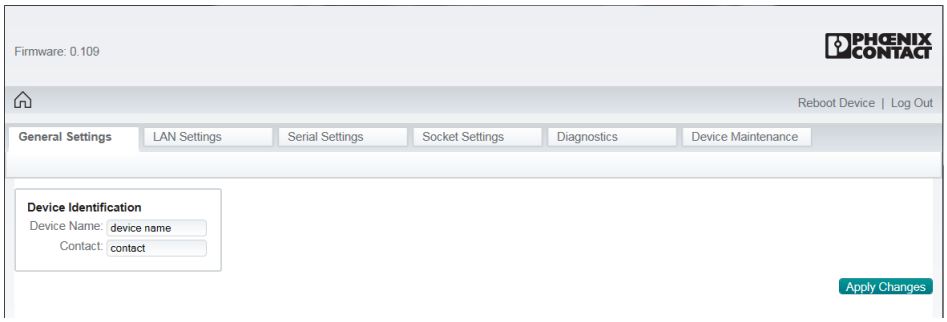


Figure 3-3 “General Settings” page

2. View the listed information.
3. If desired, change the listed information.

   The “Device Identification” group provides fields for entering descriptive information about individual devices.

   Device Name: Enter a name for the device. The field accepts up to 16 characters.

   Contact: Enter the name of a contact person, group, or department responsible for this device. The field accepts up to 16 characters.
4. Click the “Apply Changes” button to save the configuration.

3.6 LAN settings

3.6.1 IP address

To enter the IP address:

1. From the “LAN Settings” page, click the “IP Address” tab to access the “IP Address” page.

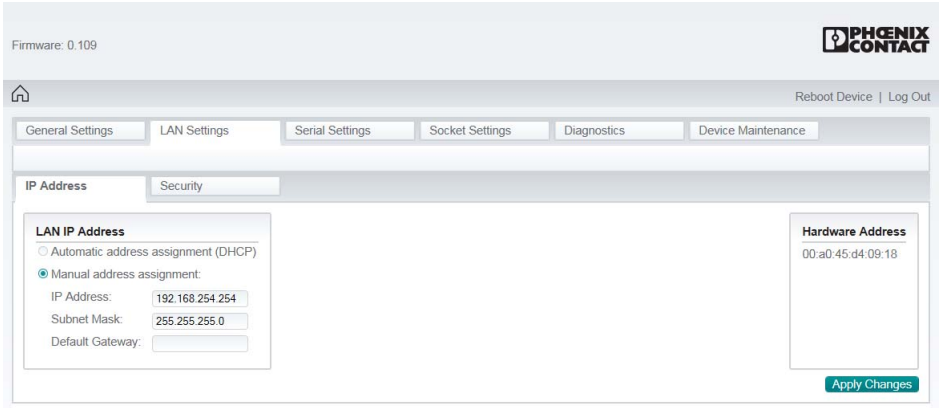


Figure 3-4 “LAN Settings/IP Address” page

2. Select the method for assigning the LAN IP address.
   If a DHCP server assigns IP addresses, click the “Automatic address assignment (DHCP)” button.
   If using static IP addresses, click the “Manual address assignment” button and enter the appropriate information in the various fields.
   MAC Address: The MAC address of the GW MODBUS TCP/RTU... is displayed.
3. Click the “Apply Changes” button to save the configuration.

3.6.2 Security

The GW MODBUS TCP/RTU... includes several security options for data encryption and device authentication. It is possible to configure the GW MODBUS TCP/RTU.... so that only authorized client applications can connect using SSL/TLS. For secure operation, the GW MODBUS TCP/RTU... uses a set of four keys and certificates. These keys and certificates are configurable.

To configure security settings:

1. From the “LAN Settings” page, click the “Security” tab.

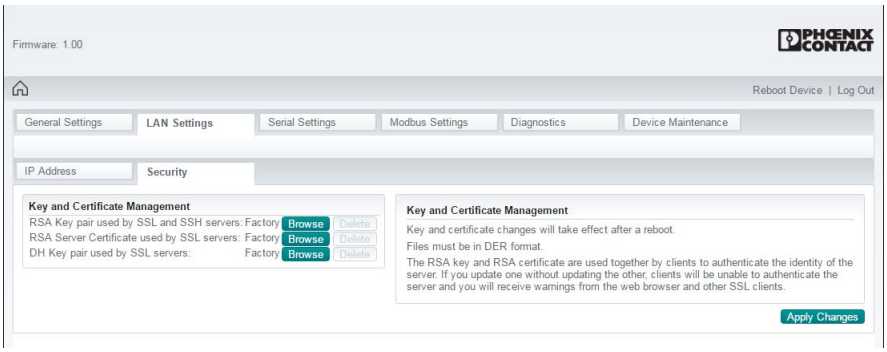


Figure 3-5 “LAN Settings/Security” page

2. Configure the GW MODBUS TCP/RTU... so that only authorized client applications can connect using SSL/TLS.

   For secure operation, the GW MODBUS TCP/RTU... uses a set of four keys and certificates. These keys and certificates may be configured.

   RSA Key pair used by SSL and SSH servers: This is a private/public key pair that is used for two purposes:

   – It is used by some cipher suites to encrypt the SSL/TLS handshaking messages. Possession of the private portion of this key pair allows an eavesdropper to decrypt traffic on SSL/TLS connections that use RSA encryption during handshaking.
   – It is used to sign the RSA server certificate in order to verify that the GW MODBUS TCP/RTU... is authorized to use the RSA server identity certificate.

Possession of the private portion of this key pair allows others to pose as the GW MODBUS TCP/RTU....

   If the RSA server key is to be replaced, a corresponding RSA identity certificate must also be generated and uploaded, or clients cannot verify the identity certificate.

   RSA Server Certificate used by SSL servers: This is the RSA identity certificate that the GW MODBUS TCP/RTU... uses during SSL/TLS handshaking to identify itself. It is used most frequently by SSL server code in the GW MODBUS TCP/RTU... when clients open connections to the GW MODBUS TCP/RTU... secure web server or other secure TCP ports. If a GW MODBUS TCP/RTU... serial port configuration is set up to open (as a client) a TCP connection to another server device, the GW MODBUS TCP/RTU... also uses this certificate to identify itself as an SSL client if requested by the server.

   In order to function properly, this certificate must be signed using the RSA server key. This means that the RSA server certificate and RSA server key must be replaced as a pair.

DH Key pair used by SSL servers: This is a private/public key pair that is used by some cipher suites to encrypt the SSL/TLS handshaking messages.

Possession of the private portion of the key pair allows an eavesdropper to decrypt traffic on SSL/TLS connections that use DH encryption during handshaking.

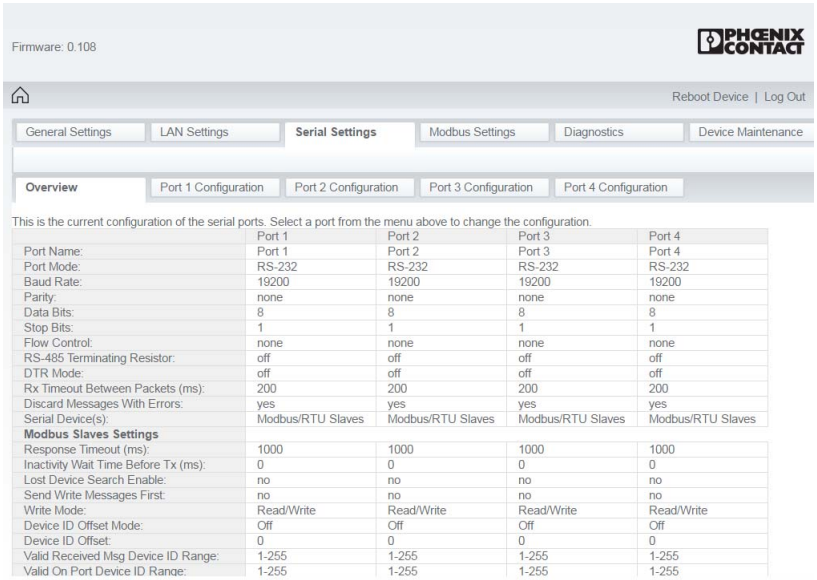
The key or certificate notation changes from **factory** or **none** to **user** when the GW MODBUS TCP/RTU... is secure.

Certificates and keys to be uploaded to the GW MODBUS TCP/RTU... must be in the .DER binary file format, not in the .PEM ASCII file format. (The openssl tools can create files in either format and can convert files back and forth between the two formats.)

3.7 Serial settings

To configure serial settings:

1. Click the “Serial Settings” tab to configure the serial port(s).
   The “Overview” page provides a quick summary of the current configuration of the serial port(s).
2. Click the appropriate configuration tab to edit the configuration of that port.



	Port 1	Port 2	Port 3	Port 4
Port Name:	Port 1	Port 2	Port 3	Port 4
Port Mode:	RS-232	RS-232	RS-232	RS-232
Baud Rate:	19200	19200	19200	19200
Parity:	none	none	none	none
Data Bits:	8	8	8	8
Stop Bits:	1	1	1	1
Flow Control:	none	none	none	none
RS-485 Terminating Resistor:	off	off	off	off
DTR Mode:	off	off	off	off
Rx Timeout Between Packets (ms):	200	200	200	200
Discard Messages With Errors:	yes	yes	yes	yes
Serial Device(s):	Modbus/RTU Slaves	Modbus/RTU Slaves	Modbus/RTU Slaves	Modbus/RTU Slaves
Modbus Slaves Settings				
Response Timeout (ms):	1000	1000	1000	1000
Inactivity Wait Time Before Tx (ms):	0	0	0	0
Lost Device Search Enable:	no	no	no	no
Send Write Messages First:	no	no	no	no
Write Mode:	Read/Write	Read/Write	Read/Write	Read/Write
Device ID Offset Mode:	Off	Off	Off	Off
Device ID Offset:	0	0	0	0
Valid Received Msg Device ID Range:	1-255	1-255	1-255	1-255
Valid On Port Device ID Range:	1-255	1-255	1-255	1-255

Figure 3-6 “Serial Settings/Overview” page

3.7.1 Port configuration

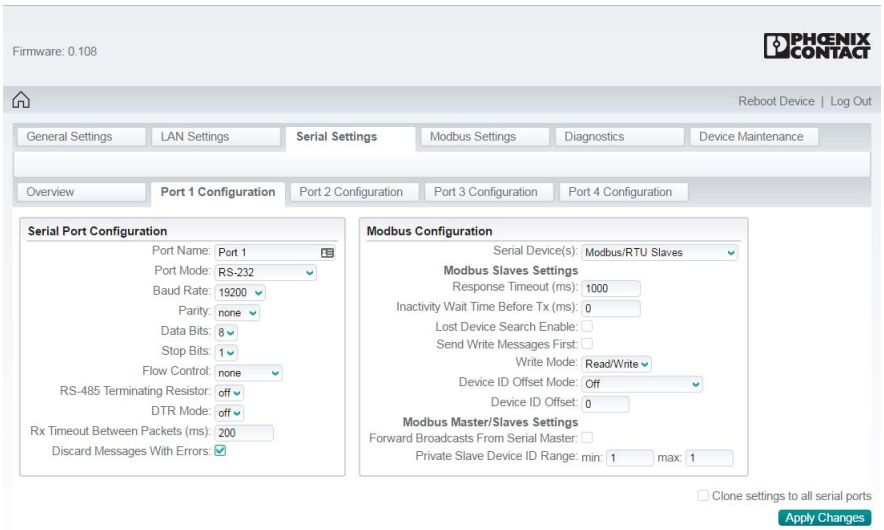


Figure 3-7 “Serial Settings/Port 1 Configuration” page

3.7.1.1 Serial port configuration

To configure serial ports:

1. From the “Serial Settings” page, click the “Port Configuration” tab.
2. In the “Serial Port Configuration” group, specify the settings of each serial port to match the connected serial device.

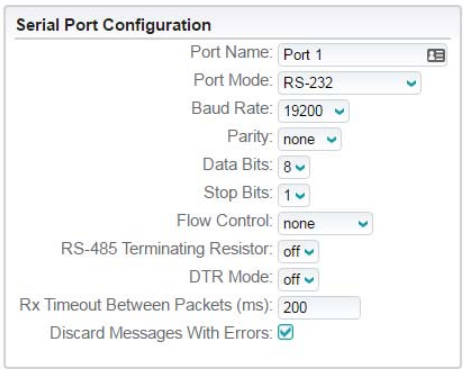


Figure 3-8 “Serial Port Configuration” page

Port Name: Enter a label for the port. This could correspond to the connected device, “Shipping Label” for example, for easy identification.

Port Mode: Select the port operating mode. Available settings are **RS-232**, **RS-422**, **RS-485 2-wire**, **RS-485 4-wire (M)**, and **RS-485 4-wire (S)**, where “M” indicates master and “S” indicates slave. When **RS-485 4-wire (M)** is selected, the RS-485 transmitter is always enabled on the GW MODBUS TCP/RTU.... When **RS-485 4-wire (S)** is selected, the RS-485 transmitter is enabled only when the GW MODBUS TCP/RTU... has data to send. This is important when a four-wire RS-485 multidrop network is installed.

Baud rate: Select the baud rate of the serial port; **300**, **600**, **1200**, **2400**, **4800**, **9600**, **19200**, **38400**, **57600**, **115200**, and **230400** bps are supported.
Parity: Select **odd**, **even**, **mark**, **space**, or **none**.
Data Bits: Select **5**, **6**, **7**, or **8** data bits.
Stop Bits: Select **1** or **2** stop bits.
Flow Control: Available options for RS-232 flow control are hardware **RTS/CTS**, software **Xon/Xoff**, **half duplex,** and **none**.
RS-485 Terminating Resistor: The terminating resistor is used only in RS-485 networks. If the GW MODBUS TCP/RTU... is the last device in the RS-485 network, enable the terminating resistor.
DTR Mode: Select **on** all the time or **off** all the time when a connection is established on this port.
Rx timeout between packets: This is the maximum spacing between received bytes allowed before the received Modbus serial message is expected to be complete. The default value is **200 ms**.
Discard packets with errors: If enabled, all packets with parity, framing, or overrun errors are dropped.

3.7.2 Modbus Configuration

To configure serial ports:

1. From the “Serial Settings” page, click the “Port Configuration” tab.
2. In the “Modbus Configuration” group, specify Modbus settings.

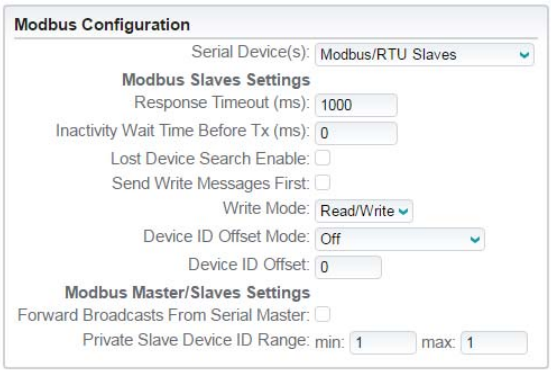


Figure 3-9 “Modbus Configuration” page

Serial Device: Select the type of serial Modbus device(s) that is connected to this port.

- **Modbus RTU Slaves** configures the serial port to communicate to Modbus RTU slaves.
- **Modbus ASCII Slaves** configures the serial port to communicate to Modbus ASCII slaves.
- **Modbus RTU Master** configures the serial port to communicate to a Modbus RTU master.
- **Modbus ASCII Master** configures the serial port to communicate to a Modbus ASCII master.
- **Modbus RTU Master/Slaves** configures the serial port to communicate to a serial bus with a Modbus RTU master and Modbus RTU slave(s).
- **Modbus ASCII Master/Slaves** configures the serial port to communicate to a serial bus with a Modbus ASCII master and Modbus ASCII slaves.

Response timeout: This is to maximum allowable time for a slave device to respond to a message before the message is considered timed out. The default is **1000 ms**.
Inactivity wait time before Tx: This is the minimum time that the GW MODBUS TCP/RTU… waits after receiving a response or transmitting a Modbus request before transmitting the next request. The default is **0 ms**.
Lost device search enable: If multiple routes are available and a Modbus slave times out, the GW MODBUS TCP/RTU... will search ports with this feature enabled in an effort to find communication from the slave device.

Timeout delays can be caused when the “Lost device” search feature is enabled.

Send write messages first: When enabled, any write messages are sent before transmitting any read messages that may have already been queued for transmission.
Write mode: When read/write is selected, both Modbus read and write messages are transmitted. If read is selected, all Modbus write messages are disabled.
Write Mode: This configures the ability to write messages on the slave. Select **Read Only** to prevent devices from writing messages and select **Read/Write** to allow all Modbus messages to be sent to the slave.
Device ID offset mode: The “Device ID Offset” functionality allows modification of device IDs when messages are transmitted to serial Modbus slave devices. When configured, the “Device ID Offset” functionality modifies the device ID received in the message to match the actual device ID range of the serial device(s). The device ID range is effectively either increased or decreased depending on the serial port device ID offset configuration. Select **Add to message ID** to add the device offset to the message device ID. Select **Subtract from message ID** to subtract the device ID offset from the message device ID. Select **Off** to disable this functionality.
Device ID offset: Enter a value from **0** to **254**. This value is added to, or subtracted from, the device ID of the Modbus message before it is transmitted out of the serial port.
The following table demonstrates several device ID offset examples:

Table 3-1 Device ID offset examples

Device ID offset mode	Device ID offset	Valid device ID range	Offset ID range	Description
Off	0	1…255	1…255	Default mode. Device IDs are unchanged.
Add to message ID	50	1…205	51…255	Increase device ID range by 50. Examples: Device ID 1 is converted to 51; Device ID 10 is converted to 60; Device ID 120 is converted to 170.
Subtract from message ID	100	101…255	1…155	Decrease device ID range by 100. Examples: Device ID 101 is converted to 1; Device ID 150 is converted to 50; Device ID 225 is converted to 125.

Use caution when configuring the “Device ID Offset” functionality. Verify the following when configuring the device ID offset:

– Check for device ID overlaps. Be certain that no two devices have same device ID.
– Check for conflicts with the alias device ID configuration. The device ID offset configuration must coincide with any alias device ID configurations.
– Verify that the valid device ID ranges are sufficient to address all serial devices.

Forward broadcasts from serial master: When enabled, all broadcast messages from the serial master are forwarded to the Modbus TCP network.

Private slave device ID range: On a serial port configured to **Modbus RTU Master/Slaves**, only the master on the private serial bus has access to the serial slaves on that serial bus. However, the master can also communicate to public devices and shared memory anywhere on the Modbus network. This range defines the expected slave device ID range on the serial bus. Modbus request messages received on this port within this device ID range are not forwarded to the Modbus network, and all communication to device(s) in that range must occur between the Modbus master and slave(s) on that serial bus.

Using this feature, a serial Modbus master can communicate to slaves on its own private serial bus as well as public slaves on a Modbus network. The Modbus slaves on the serial bus are private to the master on that serial bus, and the slave device(s) are effectively protected from all other Modbus masters on the Modbus network.

Enter a value from **1** to **255** in the “min” and “max” fields.

The GW MODBUS TCP/RTU... has a built-in auto-detect algorithm for detecting private slave device(s) with ID(s) not defined within the private device ID range.

3.8 Modbus settings

To configure Modbus settings:

1. Click the “Modbus Settings” tab to configure the Modbus settings.
   The “Overview” page provides a quick summary of the current configuration of the serial port(s).
2. Click the appropriate configuration tab to edit the Modbus configuration.

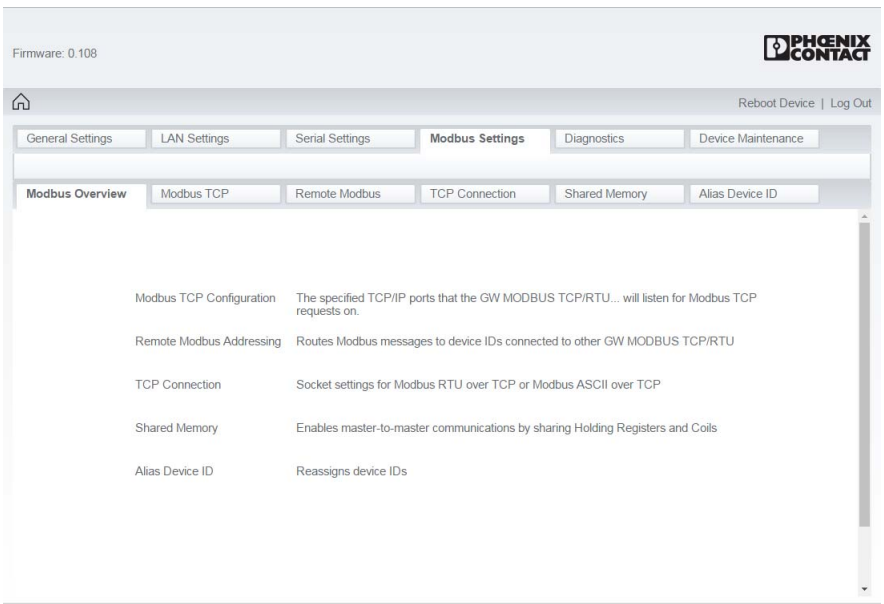


Figure 3-10 “Modbus Settings” page

The “Modbus Overview” page provides a brief explanation of each configuration page.

3.8.1 Modbus TCP configuration

The “Modbus TCP Configuration” page allows specification of TCP port numbers that the GW MODBUS TCP/RTU... uses for Modbus TCP communication.

To enter Modbus TCP configuration information:

1. From the “Modbus Settings” page, click the “Modbus TCP” tab.
2. In the “Modbus TCP Configuration” group, specify Modbus TCP settings.

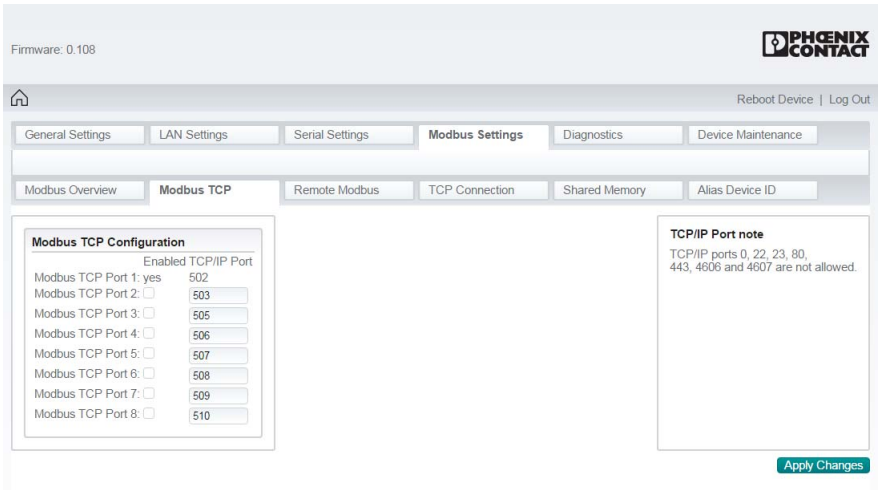


Figure 3-11 “Modbus TCP” page

3. Enter a TCP Port number.
4. Check the box to enable listening on that port.
   The default TCP Port for the Modbus TCP protocol is 502.

3.8.2 Remote Modbus addressing

The “Remote Modbus addressing” feature allows the GW MODBUS TCP/RTU... to connect a serial Modbus RTU/ASCII master to Modbus TCP slaves, or to Modbus RTU/ASCII slaves connected to other GW MODBUS TCP/RTU... devices.

To add a remote Modbus device to the table:

1. From the “Modbus Settings” page, click the “Remote Modbus” tab.
2. In the “Remote Modbus Addressing” group, specify settings.

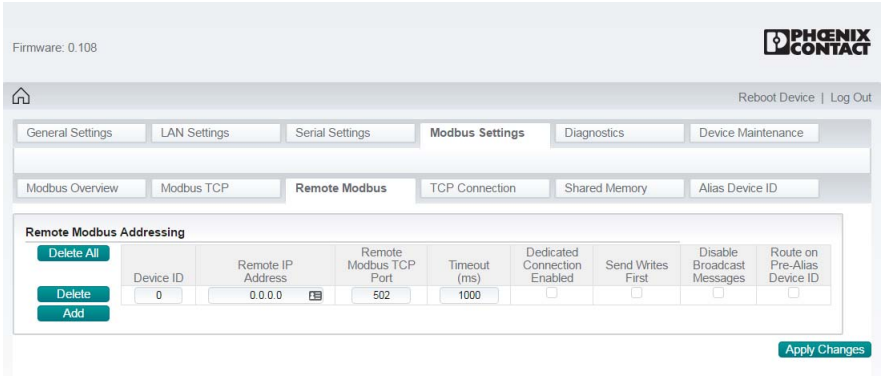


Figure 3-12 “Remote Modbus” page

3. Click the “Add” button. A new row is added to the table.
4. Enter information in the fields provided.

   Device ID: Enter the Device ID of the remote Modbus device, the range is **1** to **255**.

   Remote IP Address: Enter the IP address of the remote Modbus TCP device in standard AAA.BBB.CCC.DDD format.

   Remote TCP Port: Enter the TCP port to connect to on the remote device. The default Modbus TCP port is **502**.

   Timeout: Enter the maximum time period from **1** to **65535 ms** that a remote device should respond to a message. The default value is **1000 ms**.

   Dedicated Connection: If selected, a dedicated Modbus TCP connection is used to connect to this remote device.

This is most commonly used when connecting to another gateway, multiple devices are being accessed, and maximum bandwidth is desired.

   Send Writes First: If selected, the GW MODBUS TCP/RTU... forward writes messages before forwarding any pending read messages.

This is most commonly used when multiple messages may be queued for the remote device(s) and low latency for write messages is desired.

   Disable broadcast messages: If selected, the GW MODBUS TCP/RTU... disables broadcasts to this remote device.

   Route on pre-alias device ID: This setting only applies to a Modbus message if the Modbus message device ID has been aliased, or changed, as a result of a corresponding device ID alias configuration (see Section 3.8.5, “Device ID aliasing”), and a remote Modbus addressing configuration exists for the pre-aliased, or original, device ID. In this case, the remote Modbus addressing configuration for the pre-aliased device ID is applied to the Modbus message.

5. After entering the parameters, click the “Apply Changes” button to save the configuration.
   The fields may be edited at any time. Be sure to click the “Apply Changes” button to save the modifications.
6. To delete an entry, click the “Delete Entry” check box next to the row to remove, and then click the “Apply Changes” button.
7. To delete the entire table, check the “Delete all entries” box, and then click the “Apply Changes” button.

3.8.3 TCP/IP connection

The “TCP/IP Connection” feature is for applications that require Modbus ASCII or RTU protocols to be encapsulated in an Ethernet TCP/IP frame, but not converted to Modbus TCP. For example, this can be used with the “COM port redirector” software to create a virtual COM port for a Modbus application on a PC.

The number of Ethernet TCP/IP connections supported by the GW MODBUS TCP/RTU... is equal to the number of serial ports on the device, but the TCP/IP connections are not directly linked to a particular serial port. Each TCP/IP connection provides connectivity to either Modbus RTU or Modbus ASCII masters. Messages received on all Ethernet TCP/IP configurations are routed to all local and remote Modbus slave devices.

To add a remote Modbus device to the table:

1. From the “Modbus Settings” page, click the “TCP/IP Connection” tab.
2. In the “TCP Interface Connection” group, specify the Modbus TCP settings.

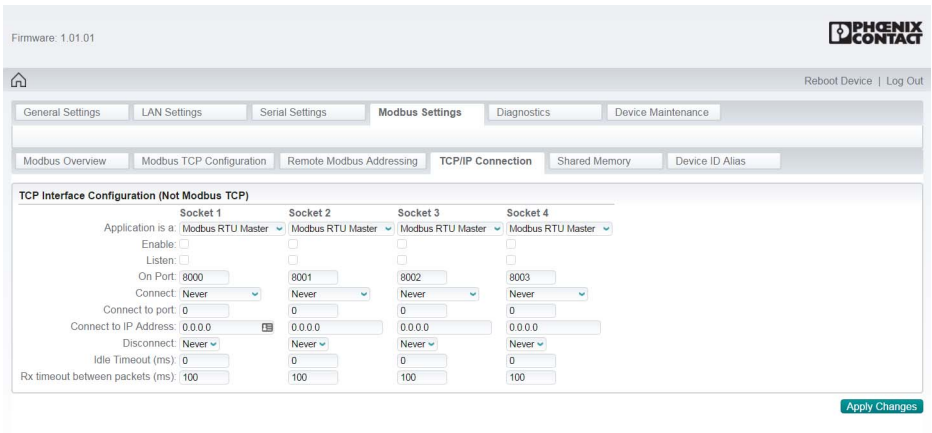


Figure 3-13 “TCP/IP Connection” page

3. Enter information in the fields provided.
   Enable: This must be enabled to use the port as a socket connection.
   Application is a: This selection configures the TCP/IP connection to communicate with a Modbus RTU or a Modbus ASCII master.
   Listen: Check the “Listen” check box so that the GW MODBUS TCP/RTU... listens for incoming TCP/IP socket connections on the port number specified in the “Listen Port” field.

On port: Enter the TCP port number on which the GW MODBUS TCP/RTU... listens for connections. Up to six connections from external applications are supported.

The Modbus TCP port 502 cannot be used.

Connect: Determines how to connect to an application. If **Never** is selected, the GW MODBUS TCP/RTU... does not attempt to make a connection. If **Always** is selected, the GW MODBUS TCP/RTU... maintains a permanent connection to the device specified by the “Connected to IP address” and “Connect to port” fields.

Connect to port: Enter a TCP port number to which the GW MODBUS TCP/RTU... initiates a connection.

Connect to IP address: Enter an IP address to which the GW MODBUS TCP/RTU... initiates a connection. Use the standard AAA.BBB.CCC.DDD format.

Disconnect: This field determines how the GW MODBUS TCP/RTU... should disconnect from the application. Select **Never** to maintain the connection when there is no data. Select **Idle** to close the connection after a period of inactivity specified by the “Idle timeout” field.

Idle timeout: The **Idle Timeout** is the number of milliseconds before a disconnect occurs if the **Disconnect Idle** option is selected.

Rx timeout between packets: This determines the receive timeout between packets, in msec. This is the maximum spacing between received bytes allowed before the received Modbus message is expected to be complete. The range is **0** to **65565 ms**.

4. After entering the parameters, click the “Apply Changes” button to save the configuration.

   The fields may be edited at any time. Be sure to click the “Apply Changes” button to save the modifications.

3.8.4 Shared memory

The “Shared Memory” feature provides a simple and robust method for Modbus master-to-master communication. In this case, the GW MODBUS TCP/RTU... emulates a Modbus slave, and each Modbus master can read or write to the “shared” memory in order to exchange data. Any Modbus master (Modbus TCP, serial Modbus RTU/ASCII, and Modbus RTU/ASCII over Ethernet TCP/IP) can access the shared memory.

The “Shared Memory” interface contains eight blocks of 200 holding registers and eight blocks of 160 coils. Write access can be controlled to each holding register block and coil block. Each block can be configured to provide all masters write access or be restricted to a port-specific serial master, a Modbus TCP master, or an Ethernet TCP/IP master.

The “Shared Memory” contents can be displayed and cleared by way of the GW MODBUS TCP/RTU... web server, and diagnostics for each block include read, write, and blocked write message counts. Blocked write messages are recorded in the “Write Violation” log.

The following Modbus function codes are supported:

Table 3-2 Modbus function codes

Function code	Description
01	Read coils
03	Read holding registers
05	Write single coil
06	Write single register
15	Write multiple coils
16	Write multiple registers
22	Write mask register
23	Read write registers

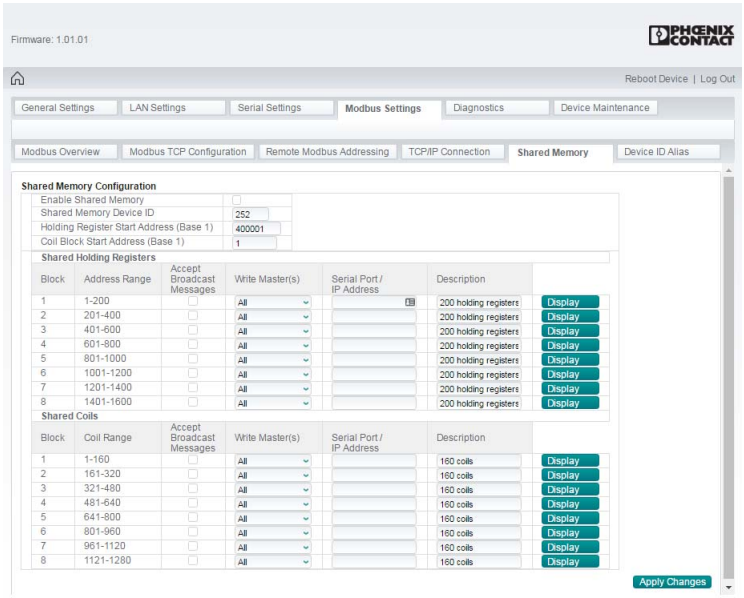


Figure 3-14 “Shared Memory Configuration” page

To add a remote Modbus device to the table:

1. From the “Modbus Settings” page, click the “Shared memory” tab.
2. In the “Shared Memory Configuration” group, specify settings.
3. Enter information in the fields provided.

   Enable Shared Memory: If selected, enables the “Shared Memory” functionality.

   Shared Memory Device ID: Enter a Modbus device ID for the GW MODBUS TCP/RTU.... The device ID must be unique within the Modbus network. The valid range of values is **1** to **255**.

   Holding Register Start Address (Base 1): Enter the starting address of the GW MODBUS TCP/RTU... holding registers. The valid range is **400001** to **463935**.

   Coil Block Start Address (Base 1): Enter the starting address of the GW MODBUS TCP/RTU... coils. The valid range is **1** to **64255**.

The holding registers are broken up into eight blocks of 200 holding registers in the memory of the GW MODBUS TCP/RTU.... The Modbus register address range for each block is listed next to the block number.

Accept Broadcast Messages: If selected, the Shared Memory block(s) accepts broadcast messages addressed to their memory block(s).

Write Master(s): This selection determines which Modbus masters have write access to the shared memory block. Select **All** to allow all masters to have write access to the block. Select a **Serial Port** to allow only serial Modbus masters connected to the specific serial port to have write access. Select **Modbus TCP** or **Ethernet TCP/IP** to allow masters at a specific IP address to have write access. The IP address of the master must be entered in the “Select Port/IP Address” field.

Serial Port/IP Address: If write access is limited to a specific Modbus master, enter the serial port or the IP address of the Modbus master.

Description: Each block may be labeled with a description, for example, ‘Compressor Station #1’ for simple identification of the registers.

4. Click the “Display” button next to each “Shared Holding Registers” block to view the contents of the Modbus registers.

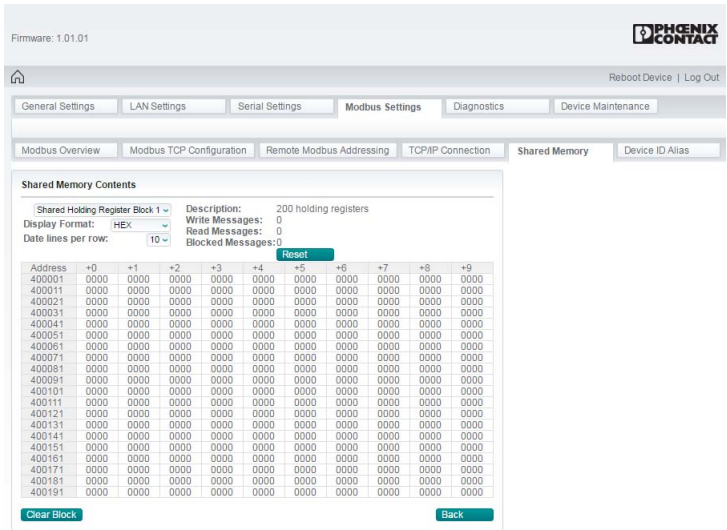


Figure 3-15 “Holding Registers” page

The “Shared Coils” table provides a simple overview and configuration of the coils. The coils are broken up into eight blocks of 160 coils in the memory of the GW MODBUS TCP/RTU....

Each block may be labeled with a description, such as ‘Compressor Station #1’ for simple identification of the coils. The Modbus coil address range for each block is listed next to the block number.

Accept broadcast messages: If selected, the shared memory block(s) accept broadcast messages addressed to their memory block(s).

Write masters: This selection determines which Modbus masters have write access to the shared memory block. Select **All** to allow all masters to have write access to the block. Select a **Serial Port** to allow only serial Modbus masters connected to the specific serial port to have write access. Select **Modbus TCP** or **Ethernet TCP/IP** to allow masters at a specific IP address to have write access. The IP address of the master must be entered in the “Serial Port/IP Address” field.

Serial Port/IP Address: If write access is limited to a specific Modbus master, enter the serial port or the IP address of the Modbus master.

Description: Each block may be labeled with a description, for example, ‘Compressor Station #1’ for simple identification of the registers.

5. Click the “Display” button next to each block to view the contents of the Modbus coils.

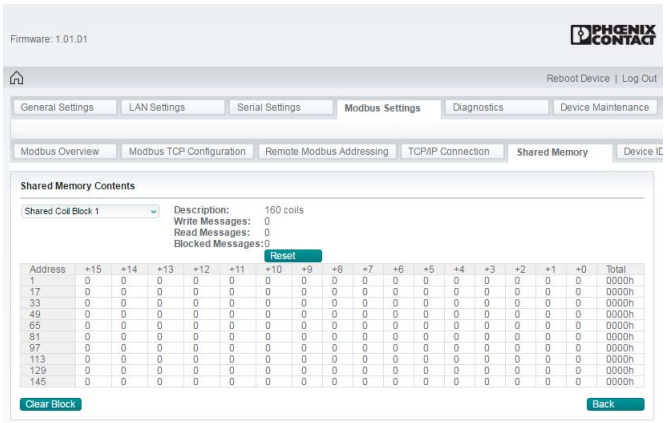


Figure 3-16 “Shared Coils” page

6. After entering the parameters, click the “Apply Changes” button to save the configuration.

   The fields may be edited at any time. Be sure to click the “Apply Changes” button to save the modifications.

3.8.5 Device ID aliasing

Many Modbus devices have fixed device IDs that can cause problems when multiple devices are connected to a single network. The “Device ID Alias” functionality allows masking Modbus device IDs to simulate unique devices on the network.

When configured, a Modbus master sends a command and receives responses using the Rx Device ID. Internally, the command is routed to the device ID alias using the “Device ID Alias” table. The following table demonstrates several device ID aliasing examples:

Table 3-3 Device ID alias examples

Rx device ID	Device ID alias	Routed message device ID	Description
1	10	10	Convert messages with received device ID 1 to 10. Route message with device ID 10.
50	5	5	Convert messages with received device ID 50 to 5. Route message with device ID 5.
100	254	254	Convert messages with received device ID 100 to 254. Route message with device ID 254.
10	10	10	Invalid configuration attempt. No change to device ID is performed.

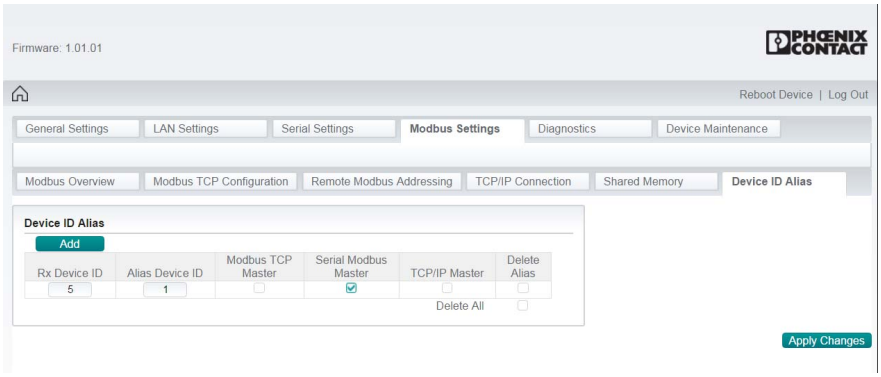


Figure 3-17 “Device ID Alias” page

To add a device ID aliasing rule to the table:

1. From the “Modbus Settings” page, click the “Devices Alias ID” tab.
2. In the “Device ID Alias” group, specify settings the settings.

   Rx Device ID: Enter the device ID received from the Modbus master.

   Alias Device ID: Enter the device ID that the GW MODBUS TCP/RTU... addresses. This is the “artificial” ID of the Modbus slave.

   Modbus TCP Master: If selected, this applies the alias configuration to messages received from Modbus TCP masters.

   Serial Modbus Master: If selected, this applies the alias configuration to messages received from serial Modbus masters.

TCP/IP Master: If selected, this applies the alias configuration to messages received from Modbus RTU/ASCII over Ethernet TCP/IP masters.
The number of alias conversions performed by the GW MODBUS TCP/RTU… is available for each rule, and indicates which type of master originated the Modbus message.
After entering the parameters, click the “Apply Changes” button to save the configuration.

3. To delete an entry, check the “Delete Entry” box next to the rule to remove it, and then click the “Apply Changes” button.
4. To delete the entire table, check the “Delete all” box, and then click the “Apply Changes” button.

3.9 Diagnostics

A variety of packet statistics can be used to diagnose a configuration or application problem.

To view any diagnostics data:

1. Click the “Diagnostics” tab to view a variety of packet statistics that can be used to diagnose a configuration or application problem.

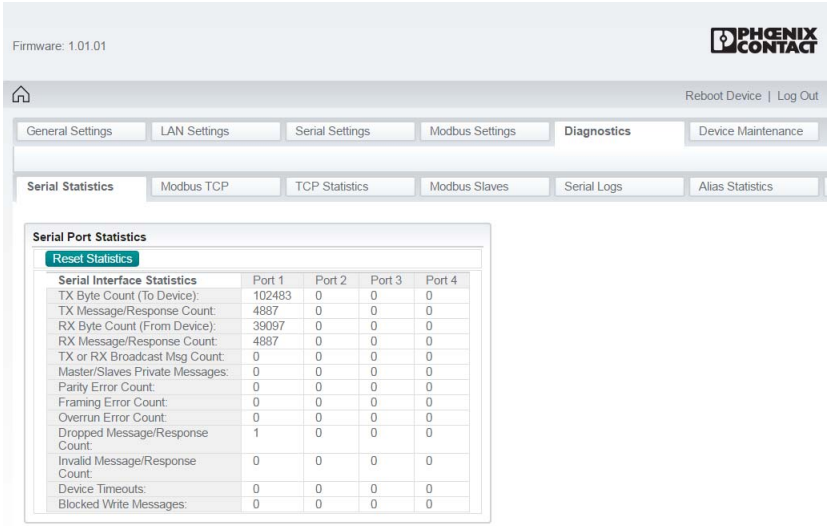


Figure 3-18 “Diagnostics Serial Statistics” page

2. Click the “Serial Statistics” tab.
   The “Communication Statistics” page provides an overview of the activity on each serial port and TCP socket connection. The values can be reset to zero at any time by clicking the “Reset Statistics” button.
3. View the “Serial Port Statistics” group.
   TX Byte Count (To Device): This displays the number of bytes transmitted out the serial port.
   TX Message/Response Count: This displays the number of messages or responses transmitted out the serial port.
   RX Byte Count (From Device): This displays the number of bytes received on the serial port.

RX Message/Response Count: This displays the number of messages or responses received on the serial port.

TX or RX Broadcast Msg Count: This displays the number of broadcast messages transmitted out the serial port.

Master/Slaves Private Messages: This displays the number of private messages detected, those between a master and private slave(s), on a serial port configured in Master/Slaves mode.

Parity Error Count: This displays the number of parity errors received on the serial port. Typically occurs due to an incorrect parity setting.

Framing Error Count: This displays the number of framing errors received on the serial port. Typically occurs due to an incorrect baud rate or stop bit setting.

Overrun Error Count: This displays the number of overrun errors received on the serial port. This typically occurs due to one of the following events: incorrect flow control, incorrect baud rate, incorrect data size, or incorrect stop bit setting.

Dropped Message/Response Count: This displays the number of messages or responses dropped due to either an incomplete message or response, or if the GW MODBUS TCP/RTU... did not receive valid start and/or end characters (Modbus/ASCII only).

Invalid Message/Response Count: This displays the number of invalid messages or responses received because either the message was received after the timeout period (this may require increasing the device response timeout), an incorrect device ID was detected in the response message, or there was an incorrect function code in the response message.

Device Timeouts: This displays the number of device timeouts that occurred when there was no response for a Modbus message.

Blocked Write Messages: This displays the number of Modbus write messages that were not transmitted as a result of the “Write Mode” option being set to **Read Only** (see “Modbus Configuration” on page 22).

4. If desired, click the “Reset Statistics” button to refresh the statistics shown.

3.9.1 Modbus TCP

The “Modbus TCP Statistics” page displays information specific to the Modbus TCP communication on TCP port 502.

To view Modbus TCP statistics:

1. Click the “Diagnostics” tab.
2. Click the “Modbus TCP” tab.

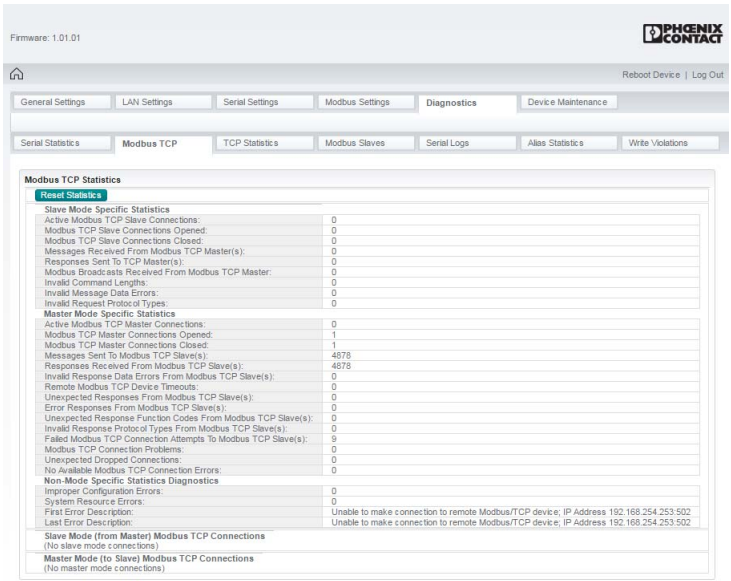


Figure 3-19 “Modbus TCP” page

Slave Mode Specific Statistics

Active Modbus TCP Slave Connections: This displays the current number of active Modbus TCP slave connections initiated by a controller.

Modbus TCP Slave Connections Opened: This displays the total number of Modbus TCP slave connections that have been opened.

Modbus TCP Slave Connections Closed: This displays the total number of Modbus TCP slave connections that have been closed.

Messages Received From Modbus TCP Master(s): This displays the total number of Modbus TCP messages received from Modbus TCP master(s).

Responses Sent To TCP Master(s): This displays the total number of Modbus TCP responses sent to Modbus TCP master(s).

Modbus Broadcasts Received From Modbus TCP Master: This displays the number of Modbus broadcast messages received from Modbus TCP masters.

Invalid Command Lengths: This displays the number of messages received with invalid command lengths.

Invalid Message Data Errors: This displays the number of messages received with invalid message data errors. These errors occur when the GW MODBUS TCP/RTU... receives a message that cannot be processed due to improper message data.

Invalid Request Protocol Types: This displays the number of messages received with invalid protocol errors. This occurs when a message is received with a protocol other than the Modbus TCP protocol value of zero.

Master Mode Specific Statistics

Active Modbus TCP Master Connections: This displays the current number of active Modbus TCP master connections initiated by the GW MODBUS TCP/RTU... to a Modbus TCP slave.

Modbus TCP Master Connections Opened: This displays the total number of Modbus TCP master connections that have been opened.

Modbus TCP Master Connections Closed: This displays the total number of Modbus TCP master connections that have been closed.

Messages Sent To Modbus TCP Slave(s): This displays the total number of Modbus messages sent to remote Modbus TCP slaves.

Responses Received From Modbus TCP Slave(s): This displays the total number of Modbus responses received from the Modbus TCP slaves.

Invalid Response Data Errors From Modbus TCP Slave(s): This displays the number of response data errors to polling requests returned from the Modbus TCP slaves. Possible causes include an incorrect transaction ID, message command length, or device ID in response.

Remote Modbus TCP Device Timeouts: This displays the number of messages to remote devices that were determined to have timed out by the GW MODBUS TCP/RTU...

Unexpected Responses From Modbus TCP Slave(s): This displays the number of responses received when no response was expected.

Error Responses From Modbus TCP Slave(s): This displays the number of responses received from Modbus TCP slaves with errors indicated. This may be caused by device timeouts detected by a slave Modbus TCP device, an invalid device address, device ID, or message data.

Unexpected Response Function Codes From Modbus TCP Slave(s): This displays the number of unexpected response function codes from Modbus TCP slaves. This occurs when a response was received with a different function code than what was sent.

Invalid Response Protocol Types From Modbus TCP Slave(s): This displays the number of responses with invalid protocol errors. This occurs when a response is returned with a protocol other than the Modbus TCP protocol value of zero.

Failed Modbus TCP Connection Attempts To Modbus TCP Slave(s): This displays the number of failed Modbus TCP connection attempts to the specified PLC IP address.

Modbus TCP Connection Problems: This displays the number of Modbus TCP connection attempt problems. This occurs when the device responds and the connection is made, but there are problems setting up the connection.

Unexpected Dropped Connections: This displays the number of Modbus TCP connections that were unexpectedly dropped.

No Available Modbus TCP Connection Errors: This displays the number of connections aborted when there are no available Modbus TCP connections. This error occurs when the maximum number of Modbus TCP connections has been reached and the GW MODBUS TCP/RTU... is attempting to form another Modbus TCP connection.

Non-mode Specific Statistics Diagnostics

Improper Configuration Errors: This displays the number of errors that were caused by improper configuration.

System Resource Errors: This displays the numbers of system resource errors. These errors are typically caused by congestion and/or non-responding devices.

First Error Description: This displays the first error detected.

Last Error Description: This displays the last or most recent error detected.

Slave Mode (from Master) Modbus TCP Connections (only displayed if active connections)

Remote Connection: This displays the Modbus/TCP master connection in “IP Address: Port Number” format.

Local IP Port: The local TCP port on the GW MODBUS TCP/RTU.... The standard Modbus TCP port of 502 is always enabled. Optionally, up to seven additional Modbus TCP ports may also be enabled.

Rx Requests: This displays the number of Modbus requests that have been received since the connection was opened.

Tx Responses: This displays the number of Modbus responses that have been transmitted since the connection was opened.

Time Since Open: This is the time that has elapsed since the connection was opened.

Master Mode (To Slave) Modbus/TCP Connections (only displayed if active connections).

Remote Connection: This displays the Modbus/TCP master connection in “IP Address: Port Number” format.

Tx Requests: This displays the number of Modbus requests that have been transmitted since the connection was opened.

Rx Responses: This displays the number of Modbus responses that have been received since the connection was opened.

Dedicated: This indicates if the connection is dedicated for a specified Modbus device ID.

Device ID: This displays the device ID of the associated device. If device ID offset or alias device ID is enabled, the device ID used to communicate with the device is displayed.

Time Since Open: This is the time that has elapsed since the connection was opened.

3. If desired, click the “Reset Statistics” button to refresh the statistics shown.

3.9.2 TCP Statistics

To view TCP statistics:

1. Click the “Diagnostics” tab.
2. Click the “TCP Statistics” tab.

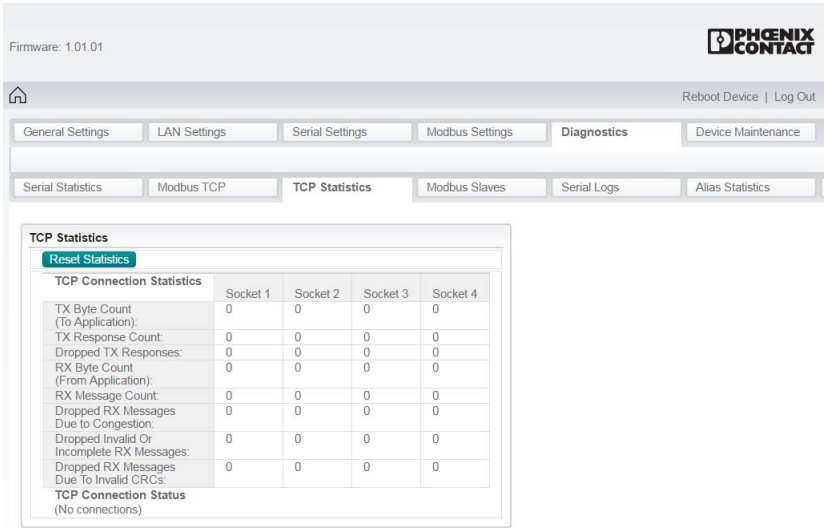


Figure 3-20 “TCP Statistics” page

TX Byte Count (To Application): This displays the number of bytes transmitted out of the TCP/IP connection(s).

TX Response Count: This displays the number of responses transmitted out of the TCP/IP connection(s).

Dropped TX Responses: This displays the number of responses that were intended to be transmitted over the TCP/IP connection(s) but were dropped. This typically occurs when one or more connections close unexpectedly.

RX Byte Count (From Application): This displays the number of bytes received on the TCP/IP connection(s).

RX Message Count: This displays the number of messages received on the TCP/IP connection(s).

Dropped RX Messages Due to Congestion: This displays the number of messages that were dropped because the GW MODBUS TCP/RTU… was overloaded. This typically occurs when the application(s) send messages faster than the slave device(s) can respond.

Dropped Invalid Or Incomplete RX Messages: This displays the number of messages from the application(s) that were dropped due to an invalid Modbus message format or an incomplete Modbus message.

Dropped RX Messages Due To Invalid CRCs: This displays the number of messages from the application(s) that were dropped due to an invalid Modbus/RTU CRC or Modbus/ASCII LRC.

3. If desired, click the “Reset Statistics” button to refresh the statistics shown.

3.9.3 Modbus slave devices

The “Modbus Slaves” page provides device-specific status and statistics for each device connected locally to one or more of the serial ports, or remotely through a remote Modbus TCP device configuration.

To view Modbus slave statistics:

1. Click the “Diagnostics” tab.
2. Click the “Modbus Slaves” tab.

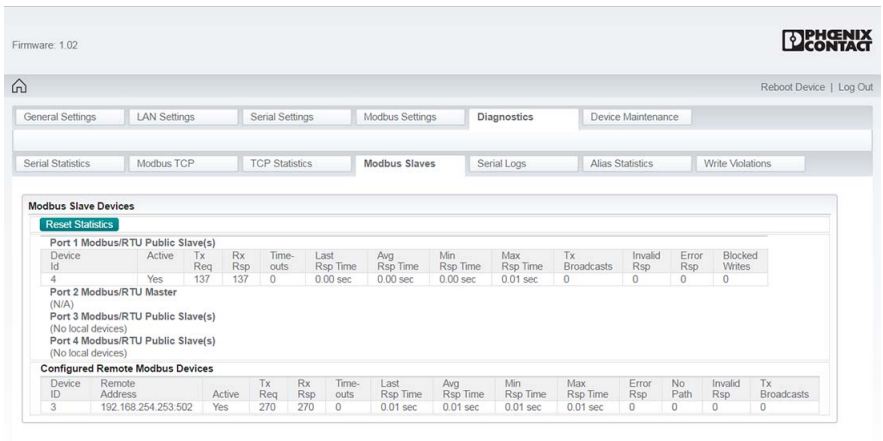


Figure 3-21 “Modbus Slaves” page

Device ID: Displays the device ID associated with this device.

If Device ID Offset Mode is enabled, the actual device ID transmitted out the serial port displays as (SP=xxx).

Active: Displays the status of device: **Yes** indicates that the last request received a valid response and did not time out. **No** indicates that the last request timed out or the device has not yet received a message.

IP Address: Displays the IP address and port in “IP Address: Port Number” format of remote Modbus devices.

Tx Req: Displays the number of Modbus messages transmitted to this device.

Rx Rsp: Displays the number of Modbus responses received from this device.

Timeouts: Displays the number of response timeouts associated with this device.

Last Rsp Time: Displays the last response time from the Modbus device.

Avg Rsp Time: Displays the average response time from the Modbus device.

Min Rsp Time: Displays the minimum response time from the Modbus device.

Max Rsp Time: Displays the maximum response time from the Modbus device.

Error Rsp: Displays the number of responses with Modbus errors.

No Path: This displays the number of times the network path could not be connected. This could be a result of a Modbus TCP device not responding, an incorrect IP address, or a lack of remaining Modbus TCP connections.

Invalid Responses: Displays the number of invalid messages or responses received because either a message was received after the timeout period (this may require increasing the device response timeout), an incorrect device ID was received in the response message, or an incorrect function code was received in the response message.

Blocked Writes: Displays the number of Modbus write messages that were not transmitted for this device. This only occurs when the “Write Mode” option is set to **Read Only** (see “Modbus Configuration” on page 22)

Tx Broadcasts: Displays the number of Modbus broadcast messages transmitted to this device.

3. If desired, click the “Reset Statistics” button to refresh the statistics shown.

3.9.4 Serial logs

This page displays the serial messages transmitted and received during normal operation.

To view serial log statistics:

1. Click the “Diagnostics” tab.
2. Click the “Serial Log” tab.

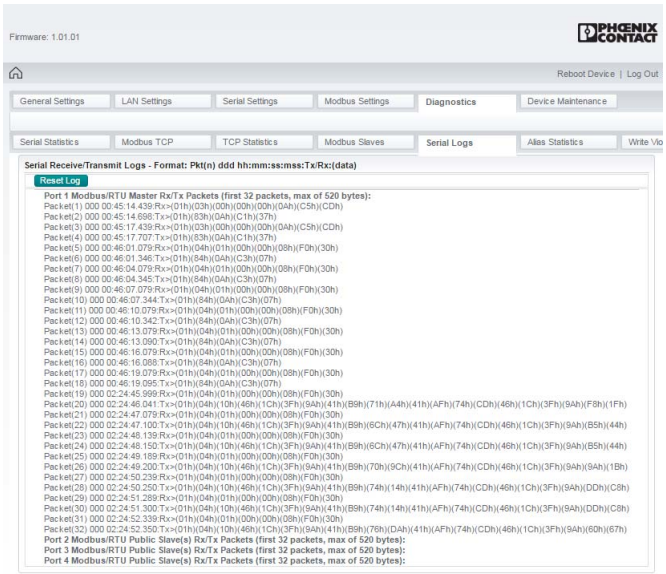


Figure 3-22 “Serial Log” page

The log format is as follows: **Pkt(N): ddd:hh:mm:ss.mss Rx/Tx>(data)**

ddd: days since last system restart
hh: hours since last system restart
mm: minutes since last system restart
ss: seconds since last system restart
mss: milliseconds since last system restart
(**data**): Modbus/RTU or Modbus/ASCII message data

Private messages between the master and slaves on the master/slave ports are indicated as **(Private)**. All other messages are those routed through the Modbus gateway to the Modbus network or shared memory.

3. Click the “Reset Log” button to clear the log.

3.9.5 Alias statistics

To view miscellaneous statistics:

1. Click the “Diagnostics” tab.
2. Click the “Alias Statistics” tab.

Figure 3-23 “Alias Statistics” page

3. If desired, click the “Reset Statistics” button to refresh the statistics shown.

3.9.6 Write violations

To view miscellaneous statistics:

1. Click the “Diagnostics” tab.
2. Click the “Write Violations” tab.

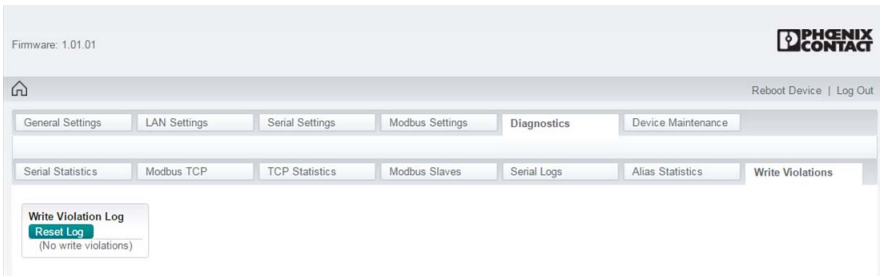


Figure 3-24 “Write Violations” page

Entry: The log entry number.

Time Since Startup: The time since the GW MODBUS TCP/RTU… was started due to a power on/cycle or a system reset. The format displays in the ddd:hh:mm:ss:mss format.

Source: The source or sender of the Modbus write message. The IP address is displayed for all Modbus TCP and Modbus over Ethernet TCP/IP masters. The serial port number is displayed (SP=<port number>) for serial Modbus masters.

Protocol: The protocol of the received Modbus message. Possible values are Modbus TCP, Modbus RTU (serial or Ethernet), Modbus/ASCII (serial or Ethernet).

Device ID: Displays the device ID associated with the received write message.

If this message underwent a device ID alias operation, the originally received device ID is displayed as (Rx=xxx).

Function Code: Displays the Modbus write function code.

Address: Displays the address of the intended write message.

If this message was addressed to shared memory, the shared memory address is displayed followed by **(Shared memory)**.

Count: The number of items the write message intended to modify. For write register messages, this is the number of 16-bit registers. For write coil messages, this is the number of coils. For write file record messages, this is the number of records.

Data: The data the write message intended to write to the specified address. For write register messages, the data is displayed in 16-bit hex word format. For all other write messages, the data is displayed in 8-bit, or byte, hex format.

3.10 Maintenance

Click the “Device Maintenance” tab to access the available maintenance functions of the GW MODBUS TCP/RTU....

3.10.1 Passwords

To change passwords:

1. Click the “Device Maintenance” page.
2. Click the “Passwords” tab to change the password used to access the web server.

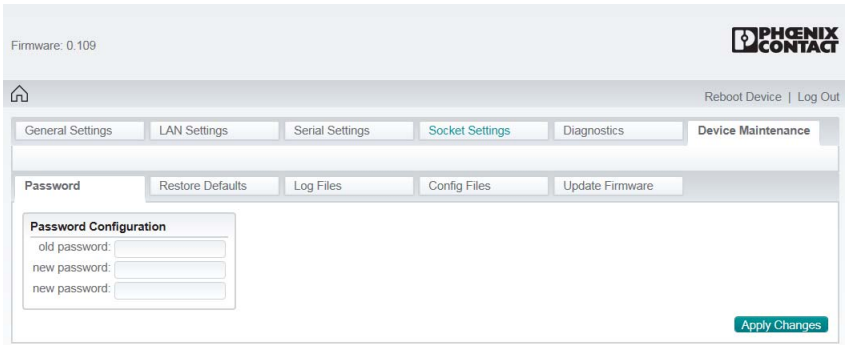


Figure 3-25 “Password” page

The GW MODBUS TCP/RTU... has administrator-level passwords. The administrator-level user may make changes to the configuration.

The default user name and password are:

User name: Admin

Password: admin

The “Password” field is case sensitive. The user name is fixed and cannot be modified.

3. Enter the current password and the new password (twice) in the appropriate fields.
4. Click the “Apply Changes” button to save changes.

3.10.2 Restore defaults

To restore defaults:

1. From the “Device Maintenance” page, click the “Restore Defaults” tab to return the GW MODBUS TCP/RTU... to the original factory defaults, including the IP address.

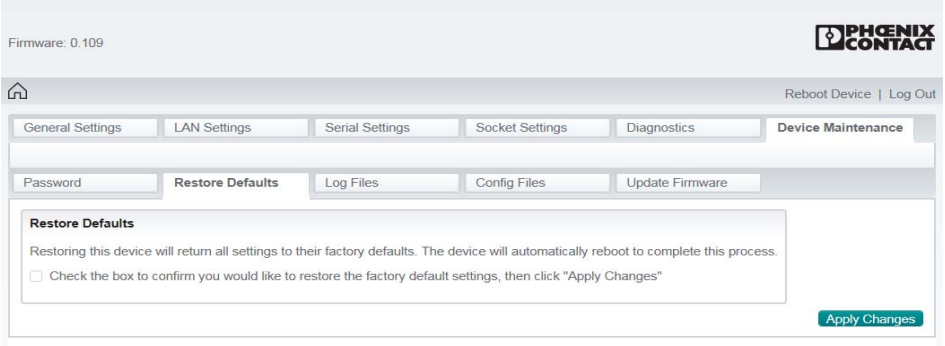


Figure 3-26 “Restore Defaults” page

2. Check the “Check the box to confirm...” box.
3. Click the “Apply Changes” button.

Note that the IP address returns to the factory defaults and may require modification to prevent multiple devices on the network from trying to use the same address.

3.10.3 Log files

To view log files:

1. From the “Device Maintenance” page, click the “Log Files” tab to review the log files of the device, which can be used for advanced troubleshooting.

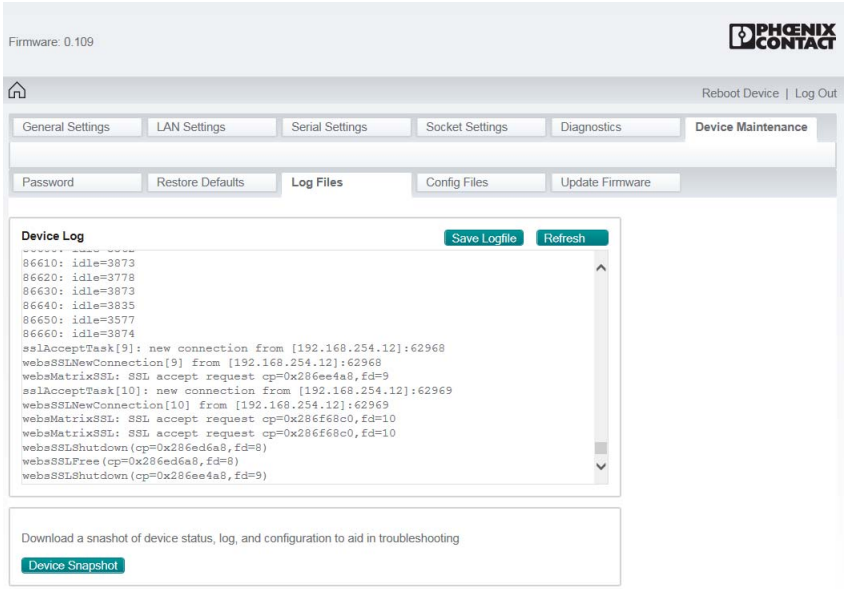


Figure 3-27 “Log Files” page

2. Click the “Save Logfile” button to save the log as a text file for future use, or review the log in the web browser.

   The log displays information about the device, such as when a PC created or broke a connection to the GW MODBUS TCP/RTU....

   The “Device Snapshot” feature allows a user to capture the system log, configuration data, and other information that can be used for advanced troubleshooting or for “As Configured” record keeping as a single text file.

3.10.4 Configuration files

For fast and easy commissioning of a replacement unit, or in the event that many devices need the same configuration, it is possible to create and load a configuration file into the GW MODBUS TCP/RTU....

To save and load configuration files:

1. From the “Device Maintenance” page, click the “Config Files” tab.

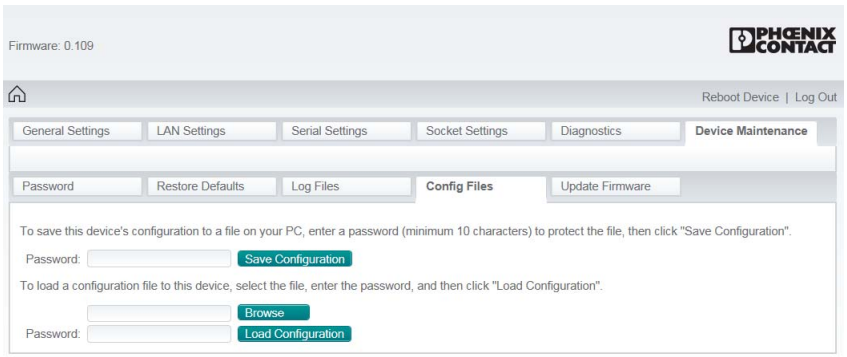


Figure 3-28 “Config Files” page

2. Enter a password that is used to protect the file.
   The password prevents unauthorized users from applying the system configuration file to an unapproved node to gain access to the network.
3. Click the “Save Configuration” button to open a dialog box where the file name and storage location on the PC are selected.
4. To load a configuration file to a GW MODBUS TCP/RTU..., click the “Browse” button to open a dialog box and browse to the configuration file location on the PC.
5. After selecting the appropriate configuration file, enter the password for the file and click the “Load Configuration” button.

3.10.5 Update firmware

To update firmware:

1. From the “Device Maintenance” page, click the “Update Firmware” tab to install a new version of the firmware.

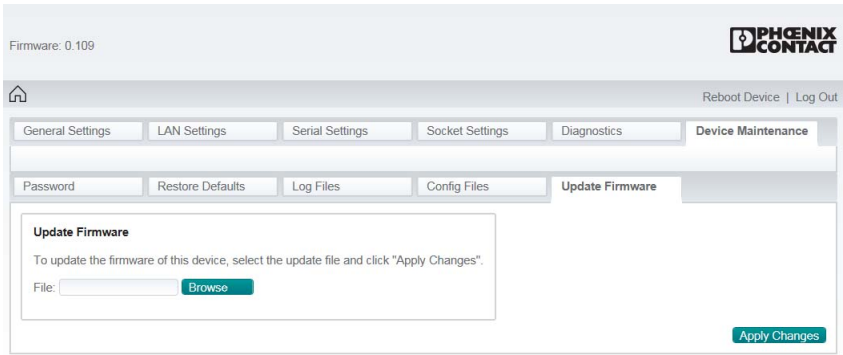


Figure 3-29 “Update Firmware” page

Occasionally, a new version of firmware may be provided to enhance operation of the GW MODBUS TCP/RTU....

2. Download the firmware to a local drive on the connected computer.
3. Click the “Browse” button and navigate to the file in the “Browse” dialog box.
4. Highlight the file to select it, and then click the “Close” button.
5. Click the “Apply Changes” button to install the firmware.

NOTE:

Ensure that a reliable power connection is available during the firmware update. Do not restart the module or disconnect the Ethernet cable during this process.

When firmware is updated, the device configuration is maintained.

4 Application examples

4.1 Serial Modbus RTU/ASCII slave to Modbus TCP master

Serial Modbus devices can be integrated into a Modbus TCP network. For flexibility, Modbus TCP connections are configured on multiple TCP ports. Refer to “Modbus TCP configuration” on page 25 for configuration details.

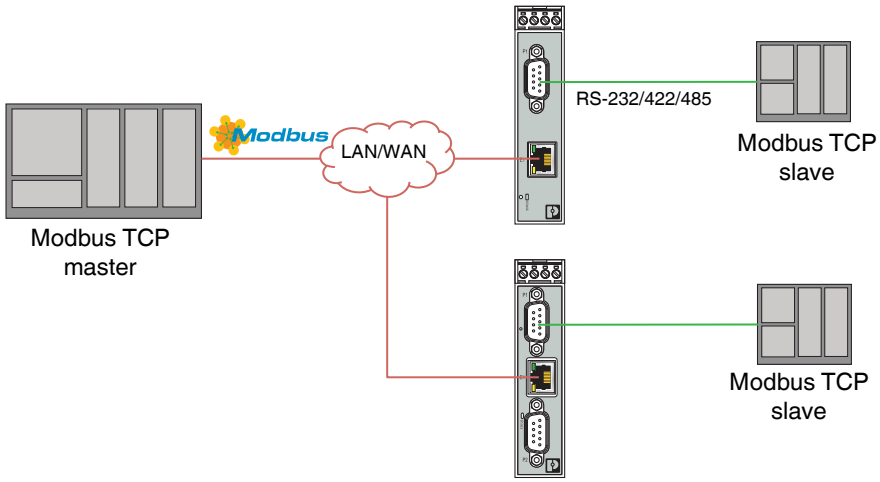


Figure 4-1 Serial Modbus RTU/ASCII slave to Modbus TCP master

4.2 Modbus TCP slave to serial Modbus RTU/ASCII master

The “Remote Modbus Addressing” feature configures the GW MODBUS TCP/RTU... to connect a serial Modbus RTU/ASCII master to Modbus TCP slaves, or to Modbus RTU/ASCII slaves connected to other GW MODBUS TCP/RTU... devices.

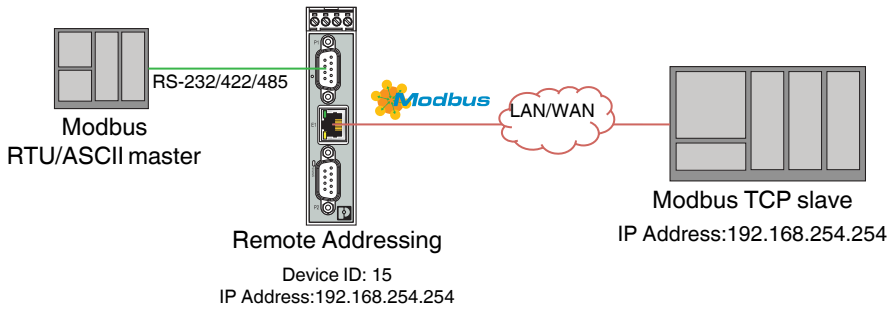


Figure 4-2 Modbus TCP slave to serial Modbus RTU/ASCII master

Refer to section “Remote Modbus addressing” on page 26 for configuration details.

4.3 Modbus RTU/ASCII over TCP/IP using virtual COM port

Most modern PCs no longer have serial ports, yet there are still a large number of installed Modbus devices. By creating a virtual COM port on the PC, the GW MODBUS TCP/RTU... can be used to connect serial Modbus devices over TCP/IP.

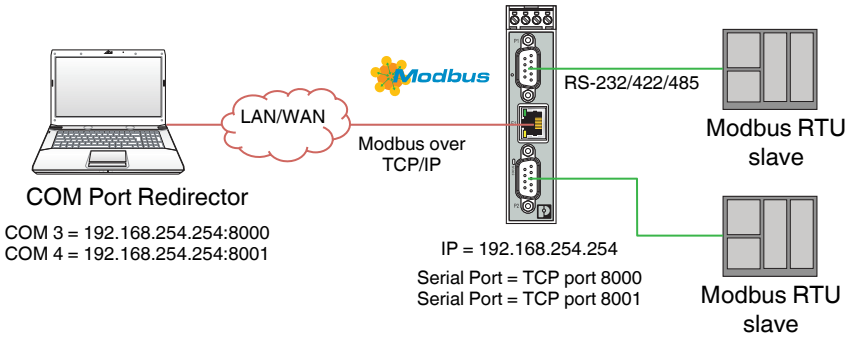


Figure 4-3 Modbus RTU/ASCII over TCP/IP using virtual COM port

4.3.1 COM port redirector software

The redirector application is a special peer-to-peer connection. It runs as an application on the PC and allows up to eight virtual COM ports to be set up.

4.3.1.1 Configure the GW MODBUS TCP/RTU...

Configure the TCP connection settings for the serial port in the following manner.

Table 4-1 TCP connection settings

Parameter	GW DEVICE SERVER (A)	Explanation
Enable TCP connection	Enabled	Use the TCP/IP protocol
Listen	Enabled	The COM port redirector initiates the connection
On Port	8000	Connect on TCP port 3001
Connect to IP address	–	The COM port redirector initiates the connection
Target port	–	
Source port	–	
Connect	Data	The connection is started when the COM port redirector sends data
Disconnect	Idle	If no data is received for the period set by the Idle Timer field, disconnect

4.3.1.2 Install the COM port redirector software

Download the COM port redirector software from phoenixcontact.com. Double-click the icon to start the installation process and follow the on-screen prompts.

4.3.1.3 Configure the COM port redirector software

To use virtual COM ports:

1. Double-click the desktop icon to launch the software. Click the “New Port” button on the upper left corner.

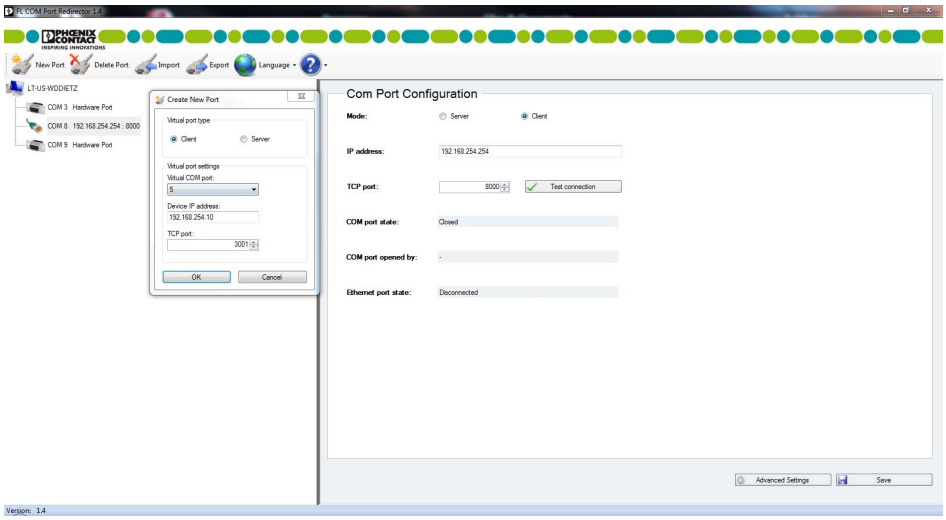


Figure 4-4 “Create New Port” dialog box

2. Click the “Client” button to select the virtual port type.
3. Enter a port number from the “Virtual COM port” drop-down menu.
4. Enter the IP address of the GW MODBUS TCP/RTU... in the “Device IP address” field.
5. Enter **8000** in the “TCP port” field.
6. Click the “OK” button to close the dialog box.
7. Click “Test Connection” button to verify communication to the GW MODBUS TCP/RTU....

4.4 Addressing Modbus RTU/ASCII devices with fixed IDs using device aliasing

Many Modbus devices have fixed device IDs, which can cause problems when multiple devices are connected to a single network. The “Device ID Aliasing” functionality allows modification of Modbus device IDs to simulate unique devices on the network.

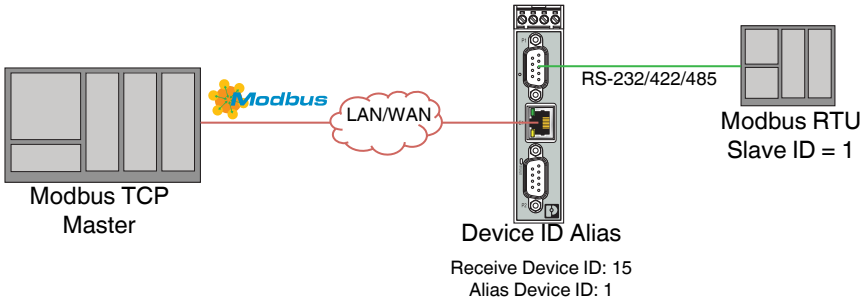


Figure 4-5 Addressing Modbus RTU/ASCII devices with fixed IDs using device ID aliasing

When configured, a Modbus message from a master with the specified device ID alias is converted to the device ID alias, the message is then routed internally using the alias device ID. All responses are returned to the master with the original received message device ID. Table 3-3 “Device ID alias examples” demonstrates several device ID aliasing examples.

Alternately, use the device ID offset functionality shown in Table 3-1 “Device ID offset examples”, which modifies the device ID contained in a Modbus request sent to a serial Modbus slave by adding or subtracting a user specified value.

4.5 Modbus master-to-master communication using shared memory

The “Shared Memory” feature provides a simple and robust method for Modbus master-to-master communication. In this case, the GW MODBUS TCP/RTU... emulates a Modbus slave, and each Modbus master can read or write to the “shared” memory in order to exchange data. Any Modbus master (Modbus TCP, serial Modbus RTU/ASCII, and Modbus RTU/ASCII over Ethernet TCP/IP) can access the shared memory.

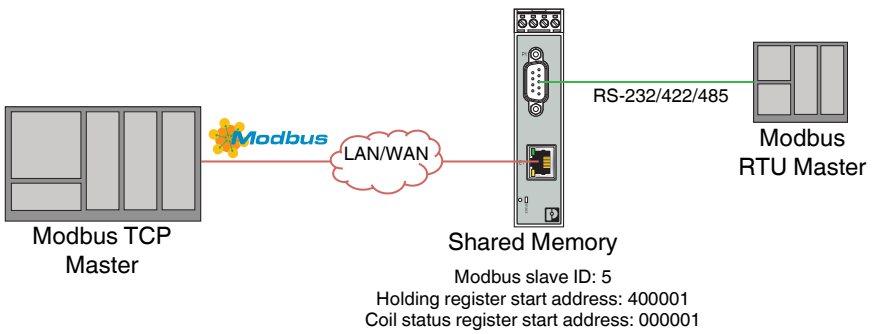


Figure 4-6 Modbus master-to-master communication using shared memory

The shared memory interface contains eight blocks of 200 holding registers and eight blocks of 160 coils. Write access is controlled to each holding register block and coil block. Each block is configured to provide all masters write access or be restricted to a port-specific serial master, a Modbus TCP master, or an Ethernet TCP/IP master (see Table 3-2 on page 29).

4.6 Serial Modbus devices with the same device ID on a multiport GW MODBUS TCP/RTU...

When multiple serial Modbus devices with fixed device IDs are connected to multiple serial ports on the GW MODBUS TCP/RTU..., it is possible to address them separately using the device ID offset functionality.

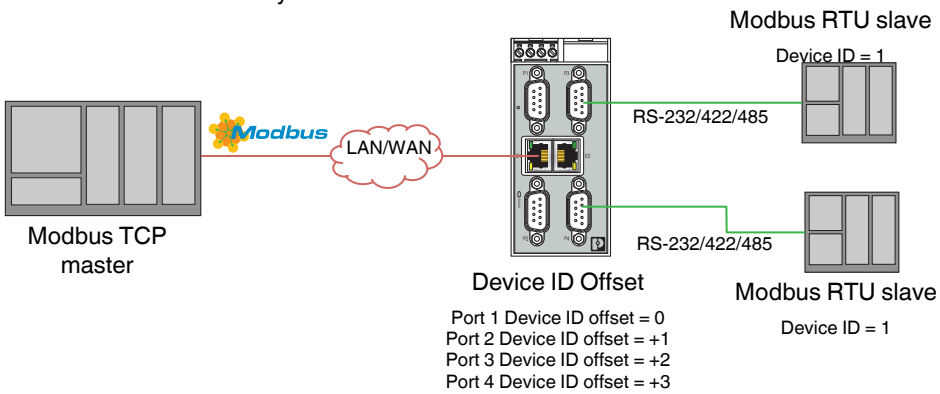


Figure 4-7 Serial Modbus devices with the same device ID on a multiport GW MODBUS TCP/RTU...

Refer to Table 3-1 “Device ID offset examples” for details.

For example, if a GW MODBUS TCP/RTU 4P/2E has a serial Modbus device connected to each port with Device ID 1, configure the device ID offset for each serial port according to the following table:

Table 4-2 GW MODBUS TCP/RTU 4P/2E to serial Modbus example

Serial port	Original device ID	Device ID offset mode	Device ID offset value	Resulting device ID
1	1	Off	–	1
2	1	Add to message ID	1	2
3	1	Add to message ID	2	3
4	1	Add to message ID	3	4

The result is that each device may be addressed with a unique device ID by the Modbus master.

4.7 Limiting access to Modbus devices using private networks

The GW MODBUS TCP/RTU... supports the connection of both Modbus masters and slaves on the same serial port. This allows a serial Modbus master to communicate to slaves on its own “private” serial bus as well as “public” slaves on a Modbus TCP network. In this configuration, a serial master can communicate to:

– Modbus RTU/ASCII slave(s) on its own serial bus.
– Public Modbus RTU/ASCII serial slave(s) connected to the same GW MODBUS TCP/RTU....
– Modbus TCP slaves, remote public Modbus RTU/ASCII serial slave(s) by way of another GW MODBUS TCP/RTU....
– Other Modbus master(s) on the Modbus network by way of the Shared Memory functionality.

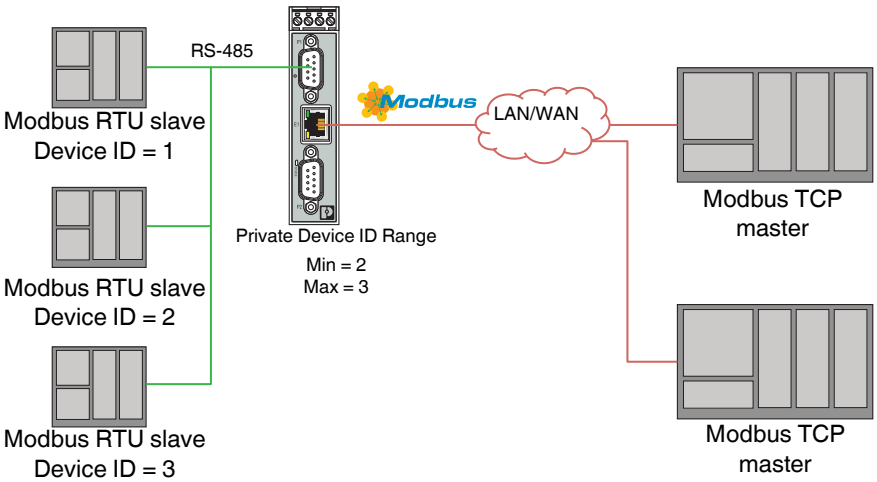


Figure 4-8 Limiting access to Modbus devices using private networks

Additionally, the Modbus slaves on the serial bus are private to the master on that serial bus, so the slave device(s) cannot be accessed by Modbus masters on the Modbus TCP network. In the event the GW MODBUS TCP/RTU... is powered off, the master and slaves on the serial bus can still communicate.

Specify the range of device IDs that should be considered private on the serial bus. Refer to “Modbus Configuration” on page 22 for configuration details.

5 Troubleshooting

5.1 Resetting the device

If, for some reason, the module needs to be reset to factory settings, there are two methods available: hardware reset and software reset.

5.1.1 Hardware reset

The reset button allows resetting the device without the use of a PC.

To force a hardware reset:

1. With the device powered off, press and hold the reset button. Apply power and hold the reset button for at least five seconds. Reinitializing the module and firmware reset may take some time. Do not disconnect from power (see Section 1.1, “Structure” for the location of the reset button on the GW MODBUS TCP/RTU...).
2. After a successful reset, the module returns to the factory default address (192.168.254.254).

5.1.2 Software reset

To force a software reset:

1. Start the web server and navigate to the “Device Maintenance/Restore Defaults” page.
2. Click the check box on the page.
3. Click the “Apply Changes” button.
4. After a successful reset, the module returns to the factory default address (192.168.254.254).

5.2 LEDs

Table 5-1 LEDs

LED	Color	Meaning
STATUS	Green	The STATUS LED flashes while the device is booting (approximately 15 seconds). After booting, the LED blinks approximately every ten seconds. An internal error is indicated by three flashes every five seconds.
	Green	Link LED. On indicates Ethernet network is connected.[1]
	Yellow	Activity LED. Flashing indicates data transfer activity.[1]

[1] LEDs on Ethernet ports are not labeled. See Section 1.1, “Structure” for LED location.

A Appendixes

A 1 List of figures

Section 1

Section 2

Section 3

Section 4

B 2 List of tables

Section 1

Section 2

Section 3

Section 4

Section 5