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User Manual
ModGate Plus

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1. Overview

The ModGate Plus devices are designed to connect serial connection lines running Modbus protocol to networks running Modbus/TCP. The network interface of ModGate Plus is implemented as Fast Ethernet 10/100 Mbit/s. The ModGate Plus Gateways are also available with a second network interface as WLAN (802.11b/g/n), this will be used in parallel with the standard Ethernet.

The network transport is implemented via TCP/IP protocol. Therefore control is available via WLAN, Ethernet, Intranet and Internet. The serial data transmission uses Modbus/RTU and Modbus/ASCII, physical on RS232 and RS485 connection lines. As an extension to the standard RS422 is also available.

2. Introduction

This manual covers several models of ModGate Plus devices, in particular the ModGate Plus 113. In general the operation is the same on all models, except where explicitly noted otherwise.

The devices come with a steel case well suited for industrial environments. The models provide one, two, four and eight serial ports. Power-over-Ethernet may be ordered on the four and eight port models.

The ModGate Plus Gateways support serial speed up to 115200 bps, which is a restriction of Modbus. In RS232 mode the technical limit is 1000 kbps, used as RS485 the serial port can operate up to 3 Mbps. In RS485 mode the serial ports use the Automatic Receive Transmit (ART) control logic to follow the RS485 specifications for transmitting data.

2.1. Features

- Single power supply
  DC 9-54V, 300-500 mA@12V
- Wireless LAN 802.11b/g/n (optional with integrated module or USB expansion)
- Ethernet 10/100BaseT/Auto-MDI(X) for auto-configuration
- Serial port interfaces: RS232, RS422 and RS485
- Max. 115.200 bps, half- and full-duplex
- TCP/IP configuration fixed or by DHCP
- Easy remote configuration via HTTP (browser)

2.2. Product Specifications

Most of the hardware characteristics are common for all ModGate Plus models. However some must differ from model to model, they are shown in dedicated sections.

2.2.1. Common Characteristics

Processor	Modern RISC processor	
WLAN antenna	SMA-reverse	
Ethernet connector	RJ45 10BaseT/100BaseTx	
Serial connector	DB9 male (similar to PC)	
Serial Speed	180 bps up to 3 Mbps	
Parity	None, Even, Odd	
Data bits	7, 8	
Stop bits	1, 2	
Serial signals	RS232	TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND
	RS485	Data+/Data−, GND
	RS422	Tx+/Tx−, Rx+/Rx−, GND
	RS485 4 wire	Tx+/Tx−, Rx+/Rx−, GND
Protocols	TCP/IP, UDP, DHCP, ICMP, ARP, HTTP, SSDP/UPnP	
Serial operation	RS232 to RS485, configured by software	
Management	Web browser	
Operating temp.	-20° to 65°C	
LED	Power	Red	Blinks once when ready
	WLAN	Blue	Only when WLAN installed
	Ready	Green	Lights when Firmware is operating
	Serial Tx	Green	One for each serial port
	Serial Rx	Yellow	One for each serial port
Approval	CE, FCC		

Table 1: Specifications, common

2.2.2. Device specific Characteristics

The characteristics of certain ModGate Plus models are shown as a short overview for comparison.

ModGate Plus 113

Power requirement	DC 9V to 54V, 300 mA@12V
Dimensions	115×73×25 mm³ (W×D×H)
Weight	400 g
Mounting	DIN Rail, Wall mount

Table 2: Characteristics of ModGate Plus 113

(a) Front, Top and Left Side

(b) Rear Side

Figure 1: ModGate Plus 113 on DIN Rail

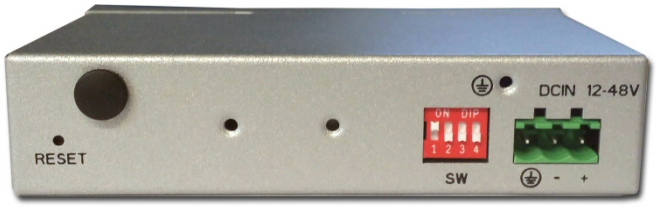
This is the ModGate Plus 113 with the serial connector, Ethernet port and USB for optional WLAN expansion. The configuration switches, power connector and Reset hole are on the rear side. Also visible are two positions for a WLAN antenna, when the internal module is installed.

ModGate Plus 213

Power requirement	DC 9V to 54V, 300 mA@12V
Dimensions	115×73×25 mm³ (W×D×H)
Weight	400 g
Mounting	DIN Rail, Wall mount

Table 3: Characteristics of ModGate Plus 213

(a) Top, Front and Left Side



(b) Back Side

Figure 2: ModGate Plus 213 Top, Front, Left and Back Side

This is the ModGate Plus 213 with the serial connectors, Ethernet port and USB for optional WLAN expansion. The configuration switches, power connector and Reset hole are on the back side (same as ModGate Plus 113). Visible on the left is the position for a WLAN antenna if the integrated module is installed. There is another positon for this antenna on the back side.

ModGate Plus 413

Power requirement	DC 9V to 54V, 500 mA@12V
Dimensions	196×147×44 mm³ (W×D×H)
Weight	900 g
Mounting	19 inch Rack, Wall mount
POE	Optional supply by Power over Ethernet 802.3af

Table 4: Characteristics of ModGate Plus 413

(a) Front Side

(b) Rear Side

Figure 3: ModGate Plus 413

This is the ModGate Plus 413. The front side presents the four serial ports, Ethernet connector and the position for WLAN antenna with the integrated module. The rear side shows the Reset hole, the USB port for WLAN extension, configuration switches and the power supply.

ModGate Plus 813

Power requirement	DC 9V to 54V, 500 mA@12V
Dimensions	196×147×44 mm³ (W×D×H)
Weight	900 g
Mounting	19 inch Rack, Wall mount
POE	Optional supply by Power over Ethernet 802.3af

Table 5: Characteristics of ModGate Plus 813

(a) Front Side

(b) Rear Side

Figure 4: ModGate Plus 813

This is the ModGate Plus 813. The front side presents the eight serial ports, Ethernet connector and the position for WLAN antenna with the integrated module. The rear side is the same as on

ModGate Plus 413 and shows the Reset hole, the USB port for WLAN extension, configuration switches and the power supply.

2.3. Packing List

- ModGate Plus Modbus Gateway
- WLAN Antenna for Models with integrated module

Warning

The packages of ModGate Plus 19-inch models include a Wall Mount Kit. There are two sets of screws in the package, long screws and short screws. The short screws are designed to fix the Wall Mount Kit. The long screws are intended to fix the 19-inch mounting brackets to the case. These long screws *must not* be used on the Wall Mount Kit, otherwise this may result in damage of the device.

2.4. About this Manual

This manual covers many configuration options of the ModGate Plus Modbus Gateways. The vast majority of these are set by software, sometimes in alternative methods. To emphasize these in the text, special character styles are used.

Bold Face is used for the names of configuration options or buttons, as they are displayed in menus or dialogs.

Slanted denotes text as displayed by the software. These are the names of parameter options, as well as special values for multiple-choice parameters. Such values may appear in drop-down lists, as radio buttons or just as clickable words.

`Typewriter` is used for sample User Input.

The version of the firmware described in this manual is 2.1.2.

3. Hardware Description

This section focuses on the options provided by the hardware of ModGate Plus Modbus Gateways.

3.1. Configuration by DIP Switch

The ModGate Plus are configured using a webbrowser with JavaScript enabled. The DIP switches on the ModGate Plus Gateways control special configuration options.

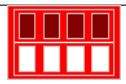
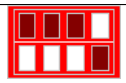
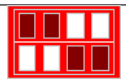
Function	S1	S2	S3	S4	Switch Positions
Configuration IP 192.168.254.254	Off	Off	Off	Off	
Factory settings	Off	Off	Off	On	
Standard Operation	Off	Off	On	On	

Table 6: Switch Configurations

By default the ModGate Plus Gateway uses DHCP to get a valid IP Address. When the Gateway is configured for a static but now unknown address, one can switch to **Configuration IP** temporarily setting it to 192.168.254.254. Then access via webbrowser is possible for final configuration. If DHCP fails it will also respond on 192.168.254.254.

For Factory Settings the DIP switch is first set to the defined configuration. The parameters are then restored on Power-Up/Reset of the ModGate Plus Gateway. Wait until the Power LED blinks once. Then change the DIP switch to **Standard Operation** and reboot the Gateway.

Standard Operation is the configuration to use for operating in Gateway mode.

3.2. Signal Assignment

It is very important to know the exact location of the serial signals in the configured mode. Here is the table for the DB9 male connector.

Pin	RS232	RS422/RS485 4-wire	RS485 2-wire
1	DCD	Tx− (A)	Data− (A)
2	RxD	Tx+ (B)	Data+ (B)
3	TxD	Rx+ (B)	
4	DTR	Rx− (A)	
5	GND	GND	GND
6	DSR		
7	RTS		
8	CTS		

Table 7: Signal Assignment DB9 male

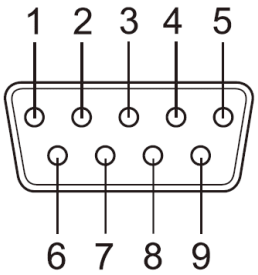


Figure 5: Connector DB9 male

For RS232 the assignment is the same as on any PC (Com1/2). This is required by RS232.

Please note the GND signal in RS485 modes (and RS422). This signal must also be connected between the serial devices. So in reality there is not a 2-wire connection. With the exception of very special configurations, a serial cable without GND violates the specifications for RS485.

Also notice that the pins in the 4-wire modes are in symetric order in respect to its polarity having the positive signals on 2 & 3 and the negative signals on 1 & 4 .

3.3. RS485 Electrical Configuration

In typical RS485 installations certain electric conditions have to be configured. Simply connecting cables is not enough to fulfill the specifications of RS485. For ease of installations the ModGate Plus Gateways provide these functions for often used parameters. They are activated by software.

3.3.1. Termination Resistors

The use of long communication lines in RS485 mode requires the installation of termination resistors. These must match the impedance of the cable. Typical cables in Twisted-Pair configuration have an impedance of about 120Ω. In RS485 the typical configuration requires one resistor at each end of the cable. This resistor is activated via the webbrowser.

3.3.2. BIAS Function

RS485 requires a BIAS option for the communication lines. This will guarantee stable electrical levels on the cables, even at times when no station is transmitting data. Without BIAS there will be noise on the cable, and sometimes receivers can not detect the first characters of a beginning communication.

The serial ports of the ModGate Plus Gateways do not require adding BIAS. This function can be added to the cable for other hardware on the RS485 bus.

3.4. Network

The ModGate Plus connects to Ethernet, and with WLAN option it may use Wireless LAN or Ethernet at customers choice. Both interfaces are enabled and configured, a ModGate Plus with WLAN accepts connections in parallel.

3.4.1. WLAN Configuration

The pre-defined operation mode is as Access Point, providing an open wireless network. Any computer with WLAN equipment may contact the ModGate Plus with WLAN. This operation mode is implemented to assist modern Windows and other operating systems, where the Ad-hoc Mode is removed.

However the AP-Mode is not encrypted by default. As one result any station can read the data transferred to the ModGate Plus with WLAN. This also includes the passwords. Therefore the recommended method is to use the Ethernet connector for the first configuration.

The configuration of the WLAN parameters should follow in a later step. This is especially the case, if encryption or certain other parameters require special configuration.

3.4.2. WLAN Antenna

The connector used for the WLAN Antenna is known as SMA-Reverse. This is a standard type to allow for simple connection of different equipment. Just fit the supplied antenna by carefully screwing it to the connector. You are free to connect a cable and a different antenna of your choice, as long as it is designed for WLAN. When a ModGate Plus with WLAN detects an operational WLAN it can connect to, the Blue LED lights.

3.4.3. Ethernet

The connector for Ethernet is the usual RJ45. Simply connect it to your (switching) Hub. Because the Ethernet has Auto-MDI(X) function, a direct cable or a cross-over cable may both be used.

When the connect is done the Link LED on ModGate Plus (yellow) will light. When data traffic occurs on the network, this LED will blink. It depends on your network whether a 100 Mbit or a 10 Mbit connect will be established. A 100 Mbit net causes the Speed LED on ModGate Plus (green) to light, otherwise it will remain dark.

Yellow LED	Green LED	Status
Off	Off	No connection
On	Off	10 Mbit connection established
Blink	Off	10 Mbit data transfer (traffic)
On	On	100 Mbit connection established
Blink	On	100 Mbit data transfer (traffic)

Table 8: Ethernet LED Function

3.5. LEDs

Besides the LEDs on the Ethernet port the ModGate Plus has three LEDs to indicate the state of the device.

The red LED (PWR) lights when the device has power.

Red LED	Status
Off	Power is off
On	Power is on

Table 9: Red LED Function

If the device has Wifi functionality the blue LED (WiFi) will be on.

Blue LED	Status
Off	No Wifi is present in the device
On	Wifi can be enabled and used

Table 10: Blue LED Function

The green LED (RDY) shows wether the ModGate Plus is fully usable. When the device or the ModbusGateway application is restarted the RDY LED may be off until all is functional again.

Green LED	Status
Off	The device is not functional. See Troubleshooting.
Blink	Configuration is necessary to be usable.
On	The device is fully functional.

Table 11: Green LED Function

3.6. Power Supply

The ModGate Plus device is powered by a single 9-54V power supply. It requires 300 mA up to 600 mA of current, depending on the device type and voltage supplied. A suitable power supply adapter is available as optional accessory. Connect the cable to the power jack (Terminal Block) at the rear side of ModGate Plus, and put the adapter into the socket.
You may connect a power supply of your choice, providing the technical requirements are met.

4. Setup

The ModGate Plus can interconnect arbitrary sets of Modbus/TCP, Modbus/RTU as well as Modbus/ASCII devices. The Figure 6 shows some possible setups using the ModGate Plus:

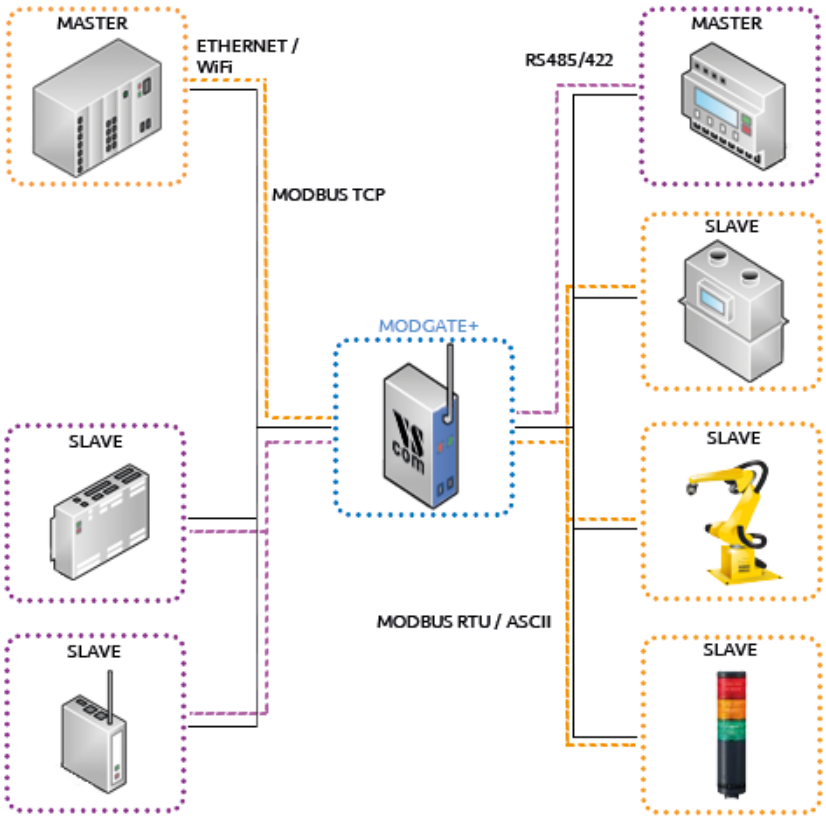


Figure 6: Possible Modbus Setups

- You may want to reach serial Modbus Slave devices from a modern Modbus Master i.e. a PLC that uses Modbus/TCP. The ModGate Plus translates between these worlds (Orange connections). Consider the example configuration 8.1.
- A legacy Modbus/RTU controller has to access newer Modbus hardware that can only be accessed via a TCP/IP link (Purple connections). See 8.2.
- An existing serial Modbus network needs a modern web presentation of certain register values i.e. power use or temperature out of the Modbus devices. Example 8.3 may be of interest.
- Two ModGate Plus may also solve the problem of distance between serial Master and Slave with a tunnel using available TCP/IP infrastructure. See 8.4.

To guide you through the configuration we propose the following order of configuration:

1. Start with the configuration of the serial port(s) as shown under Configuration of Serial Ports.

   a) You have to know which serial parameters do your devices use, i.e. Modbus/RTU or Modbus/ASCII, Baudrate, RS232 or RS485.

2. Do you want to restrict the access to the ModGate Plus?
   a) If yes, uncheck Allow unknown clients under Modbus Gateway Settings. Continue with 3.
   b) If no, check Allow unknown clients if unchecked. Skip to 4.
3. Configure allowed Inbound TCP connections under Configuration of TCP Connections.
   a) Gather IP addresses or Hostnames which should have access to the ModGate Plus.
   b) Write these into the TCP conections table as Inbound connections.
4. Does your setup include Modbus/TCP Slaves?
   a) If yes, you would use the DirectMappingMode selected under Modbus Gateway Settings. Continue at 5.
   b) If no, skip to 7.
5. Add all TCP Slaves to the TCP connections table under Configuration of TCP Connections as Outbound connections.
6. Configure the Direct Mapping table as described under Edit Direct Mappings. After this the configuration is done.
7. Does each TCP connection use a single serial port? Do all connections use a single serial which is the case for one port devices?
   a) If at least one answer is yes, you should consider LineMappingMode and select it under Modbus Gateway Settings. Continue with 8.
   b) If both are answered no, you need to use DirectMappingMode. Select it under Modbus Gateway Settings. Continue at 6.
8. Add missing TCP connections that use specific serial ports. See Configuration of TCP Connections.
9. Configure the Line Mapping table shown under Serial to TCP (Line Mapping). After this the configuration is done.
   a) Single port ModGates do not need any entry when Allow unknown clients is selected; because the serial port to use is obvious.

5. Configuration

The ModGate Plus provides a webinterface for configuration. The IP Address of ModGate Plus is used as the location to open by the web browser. Typically the IP Address is known to the user, so this is an easy step. But this is not always the situation.

The ModGate Plus may use DHCP, which is also the default configuration. If a DHCP server is available, it will assign an IP Address from a configured pool. At first this address is not known to the user, since he can not access the DHCP servers log file. To solve this problem the ModGate Plus uses UPnP. This mechanism announces the existence of the ModGate Plus, so it will appear in the **Network Places** of Windows.

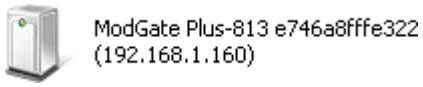


Figure 7: UPnP Device Display

Next to the icon the detected model is shown. The Ethernet MAC address (without colons) is shown as well, so users can identify the device they wish to configure. The text displays the IP Address in parentheses, to make access possible. More easy, a double-click will open the browser with the configuration.

If no DHCP server provides an IP address to the device and no fixed IP Address is configured the ModGate Plus uses the temporary configuration address *192.168.254.254*. To reach the ModGate Plus in any circumstance you can switch the ModGate Plus to the temporary configuration address *192.168.254.254* using the DIP switches (see section 6 on page 14). You could follow the instructions under Troubleshooting.

Accessing the configuration requires username and password, by default they are `admin` and `vscom`.

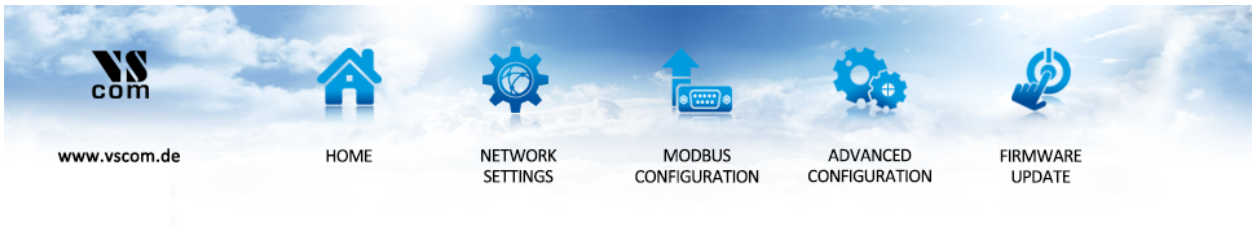


Figure 8: Navigation Bar

The navigation is done in the line on top of the parameters. Select the **Home** page, the **Network Settings** or the **Modbus Configuration**. The option of **Advanced Configuration** is reserved for special purposes, and not a supported user configuration so far. It is documented below (6.4). Finally **Firmware Update** is the access to update the Firmware on the ModGate Plus.

5.1. Home

The **Home** page provides some **Status** information about the ModGate Plus to configure, as well as some **Actions** the user can perform.

5.1.1. Status

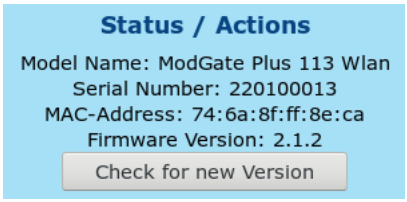


Figure 9: Status information

The type of ModGate Plus is shown as the **Model Name**. For identification the **Serial Number** and **MAC-Address** are also given. Since such an address must be unique for all devices on the world, this is suitable to check if the configuration starts on the correct device. And last the **Firmware Version** is presented. The button **Check for new Version** allows you to check whether a new firmware is available. See 5.4 for details.

5.1.2. Actions

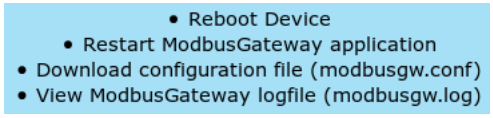


Figure 10: Possible Actions

These Actions are required later, so they will be referenced in below sections. Here is only basic information.

- *Reboot* Device
  This will restart the complete ModGate Plus, thus cancelling all current operations and connections.
- *Restart* application
  The application is the Gateway part of the software being restarted.
- *Download* configuration file
  The file is shown in a separate browser window. The download is performed by just saving the 'page'. For service requests it is useful to send this saved configuration.
- *View* logfile
  The log displays the operations performed recently. It is also shown in a separate window, and can be saved in the same way as the configuration. Also useful for service requests.

5.2. Network Settings

5.2.1. Access Control

Figure 11: Access Control

It is recommended to change the password to the webinterface for security reasons. The username is fixed as *admin*. The factory password is `vscom`. Note: You have to reboot the device for the changes to take effect.

5.2.2. Universal Plug and Play (UPnP)

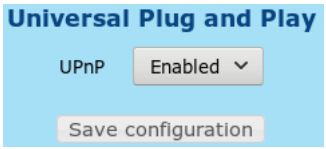


Figure 12: Universal Plug and Play

UPnP can be disabled if needed. Note that the ModGate Plus will not appear automatically in the Network view in Windows when it is disabled.

5.2.3. Ethernet (IP) Settings

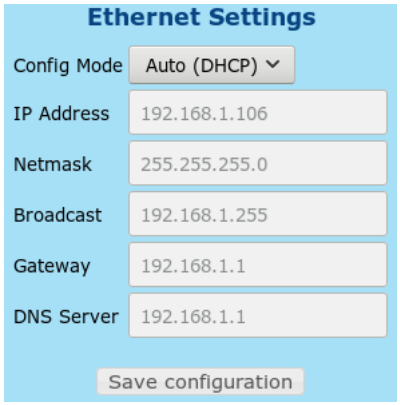


Figure 13: Ethernet Settings

Ethernet is considered the most often used network connection of ModGate Plus. Therefore the default configuration is created for automatic acquisition of suitable parameters.

Config Mode provides the choice between *Auto (DHCP)* and *Manual*. DHCP acquires the configuration from a certain server in the network, no need to define the other parameters. Selecting *Manual* requires to configure all following parameters, except of **Gateway** and **DNS Server**, if they are not known. Ask your Network Administrator for proper parameters.

IP Address is the fixed IP Address as given.

Netmask is the required Netmask.

Broadcast is the target address to use for sending out IP Broadcasts packages. Ask your Administrator.

Gateway This is the address of a Router, giving access to other networks (e.g. the Internet).

DNS Server This server translates Domain names like vscom.de to IP Addresses.

Note: You have to reboot (see 5.1.2) the device for the changes to take effect.

5.2.4. WLAN Settings

Models ModGate Plus with WLAN provide Wireless LAN as of IEEE 802.11b/g/n. This network can operate in parallel to the Ethernet.

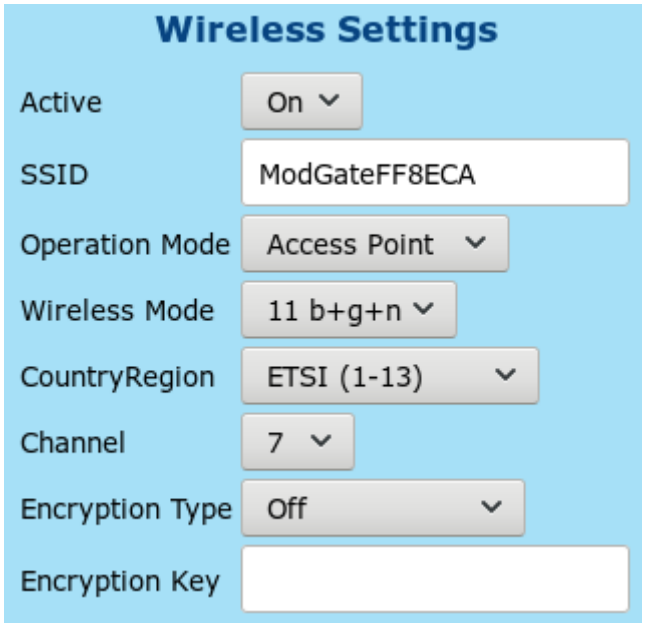


Figure 14: WLAN Radio Cell Settings

WLAN Radio Cell Parameters These are the parameters to configure the radio operation, so ModGate Plus will operate on WLAN.

SSID is the name selected for the Radio Cell. The SSID has to be the same for devices to communicate with each other. It is initialized with a unique string, generated from the last characters of the Ethernet MAC Address.

Operation Mode provides the choice between *Access Point* and *Infrastructure*. The Ad-hoc mode used in the past is no longer available in modern versions of Windows and other operating systems. Therefore it is replaced by the mode of *Access Point* here, which also allows a PC to establish a direct connection to the ModGate Plus. In Infrastructure Mode all communication is sent via an Access Point on-site, which operates as the central hub of the Radio Cell. In general this also enhances signal quality, security and bandwidth.

Wireless Mode may be selected as *11b* for 11 Mbit/s or *11b+g+n* for up to 150 Mbit/s.

CountryRegion WLAN is a Radio technique, so local regulations apply. These are selected by country. *FCC(1-11)* is valid in North America, and *ETSI(1-13)* generally in Europe. *SPAIN(10-11)* and *FRANCE(10-13)* are special European configurations, finally *MKK(14)* is required for Japan. Please check local restrictions on allowed radio channels.

Channel selects the frequency the cell shall operate on. The previous parameter of *CountryRegion* may restrict the possible configurations.

Encryption Type is used to restrict access to the radio cell. The possible selections *Off*, *WEP*, *WPA-PSK TKIP* and *WPA2-PSK AES*, where WPA2 is the most secure variant.

Encryption Key This is the secret key which provides access to the radio cell. Without this key no station can join the Wireless network. The length of the string defines the strength of the key.

- WEP with 5 characters: WEP-40/64 with 40 bit text key
- WEP with 10 characters: WEP-40/64 with 40 bit binary key (hexadecimal)
- WEP with 13 characters: WEP-114/128 with 114 bit text key
- WEP with 26 characters: WEP-114/128 with 114 bit binary key (hexadecimal)
- WPA/WPA2 with 8 to 63 characters: The 256 bit key is generated from this text and the SSID
- WPA/WPA2 with 64 characters: The 256 bit binary key (hexadecimal) is directly given

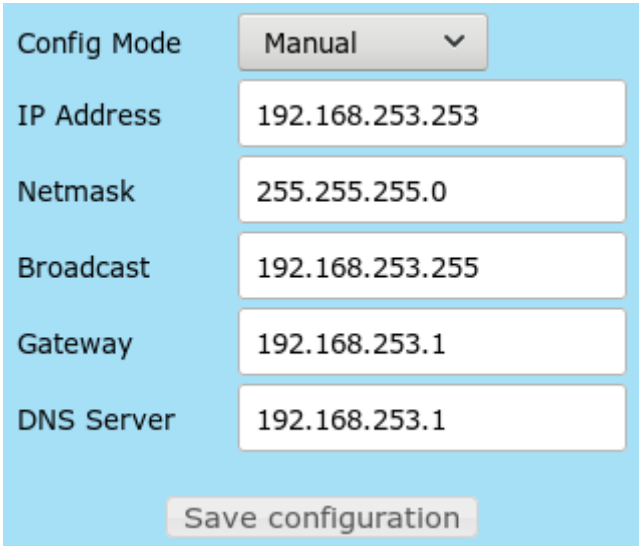


Figure 15: WLAN IP Settings

WLAN IP Settings As a general rule of thumb when *Access Point* is selected the WLAN IP address should be *Manual*. If *Infrastructure* is chosen it is very likely *Auto (DHCP)* has to be used.

When ModGate Plus has access to the WLAN radio cell, this network interface operates similar to Ethernet. Meaning all IP traffic operates exactly the same on Ethernet or WLAN. This results in a configuration parallel to Ethernet. Please ask your Network Administrator for a correct configuration, and compare the parameter meanings with Ethernet (see 5.2.3 on page 22).

Note: You have to reboot (see 5.1.2) the device for the changes to take effect.

5.3. Firmware Update

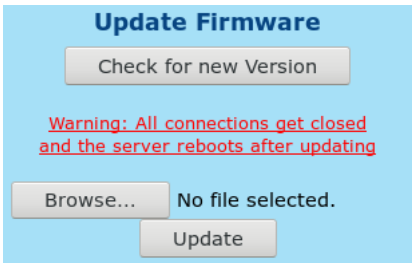


Figure 16: Update Firmware

By clicking the top button will check online for a new firmware. See 5.4 for details.

To install an update manually click on the button named **Browse**. Select the file of the new firmware (type *.b64). When the file is displayed here click on the button for **Update**. This will upload the new firmware to the device, and then install it. Naturally this process must cancel all currently operating connections, and it will reboot the device.

5.4. Online Firmware Update

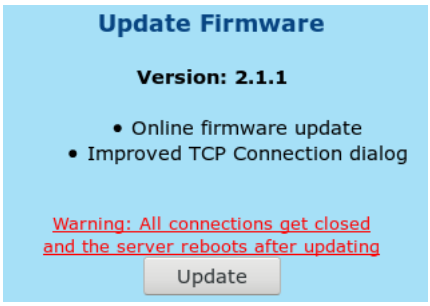


Figure 17: Update Firmware

To install a new firmware click on the button **Update**. This will download and install the new firmware to the device. Naturally this process must cancel all currently operating connections, and it will reboot the device. If the newest firmware is already running, it will inform you of that. If the Internet is not accessible by the ModGate Plus or fails for other reasons, it shows “Getting new version info failed. Please check for a new version manually.” .

6. Modbus Configuration

The ModGate Plus uses a versatile but powerful concept of mapping target interfaces for incoming Modbus frames. The decision where an incoming frame has to be transferred to is chosen on few bits of information, so the configuration stays quite simple.

Modbus uses a Master/Slave concept of communication. Each slave device has an address, which is unique on the line where it is connected to. The Master sends commands and requests, which contain this address in the frame header. ModGate Plus knows which communication line (serial port, TCP connection) the address is connected to. So it is easy to send the received frame to that interface. Of course responses are identified and sent to the Master which requested them. This is the way the *DirectMappingMode* operates.

However in many installations there is a ModGate Plus with a single serial port only. This Gateway is contacted by only one Master via TCP. Naturally all data coming from TCP must be sent to the serial port, and vice versa. It is not necessary to define all the Modbus addresses for just this simple task. Use the *LineMappingMode* in this setup.

Note: Changes in this section do not need a complete reboot of the device, its sufficient to restart the ModbusGateway application (see section 5.1.2 on page 21) once the configuration is finished.

The subsections of this chapter do not follow the presentation on the screen, but are sorted to follow the guide as proposed in chapter 4.

6.1. Configuration of Serial Ports

First the configuration of the serial port(s) must match the requirements of the connected devices.

Configuration of serial ports

Serial Port ID	Device	Modbus	RSMode	Baudrate	Databits	Parity	Stopbits	Devs	Action
1	COM1	rtu	rs232	115200	8	even	1	1	
2	COM2	rtu	rs485	115200	8	even	1		
3	COM3	rtu	rs485+T	115200	8	even	1	127	
4	COM4	rtu	rs422+T	115200	8	even	1		
5	COM5	rtu	rs485_4w	115200	8	even	1		
6	COM6	rtu	rs422	115200	8	even	1		
7	COM7	rtu	rs485_4w+T	115200	8	even	1		
8	COM8	rtu	rs232	115200	8	even	1		

Save configuration

Figure 18: Serial Settings

The table in Figure 18 shows all available serial ports of the ModGate Plus with their current settings. To help you configure the device still unused ports are highlighted red while used ports are displayed on green according to the current configuration. Blue signifies a master on a line. Additionally the next to last column named **Devs** contains a drop-down list with all Modbus IDs

assigned to the serial port when *DirectMappingMode* it selected. When *LineMappingMode* is in use this column is titled **TCPs** and lists the TCP Connections using a serial port. The '+T' in RSMode signals an active Termination resistor of 120Ω. The wrench on the right open the menu to edit the specific serial port shown in Figure 19. By default the parameters are set to the values specified in the Modbus standard.

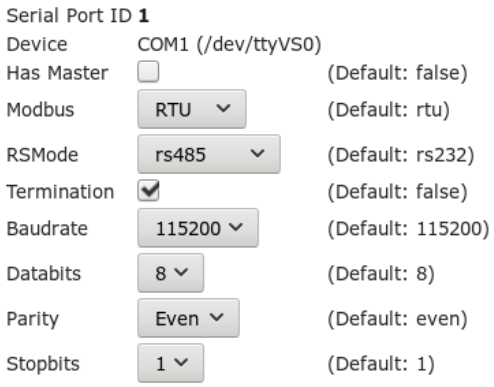


Figure 19: Edit Serial Parameters

Device specifies the port about to be configured. The parentheses contain the internal name of the port.

Has Master lets you note a Serial Master on this serial line. This will highlight the port in blue in the port table. It has no influence on the ModGate Plus function itself.

Modbus You have the choice between the *Modbus/ASCII* and the *Modbus/RTU* protocol.

RSMode The serial interface can be set to RS232 (standard) or RS485 (Automatic Receive Transmit control, 2-wire). RS485 4-wire and RS422 are other options.

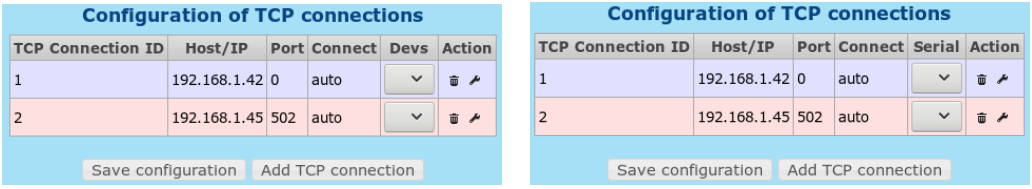
Termination If the serial connection in RS485 mode requires **Termination**, place a checkmark in the box. This activates an internal resistor of 120Ω.

Baudrate, Databits, Parity and Stopbits need to be set appropriately for the attached Slave devices on this port.

6.2. Configuration of TCP Connections

Defined TCP connections can fulfill two separate functions:

1. They can be used to restrict the access from which IP addresses the ModGate Plus can be used. One would uncheck **Allow unknown clients** (See 6.3) and define all *Inbound* TCP connections allowed access.
2. When Slaves or other Gateways need to be connected via Modbus/TCP they are also defined as *Outbound* TCP connections.



(a) with Direct Mapping (b) with Line Mapping

Figure 20: TCP Connections

You can add, edit and delete TCP connections here. Like with serial ports the highlighting shows whether a TCP Connection is used (green), unused (red) or a master (blue). Likewise the next to last column called **Devs** shows the associated Modbus IDs when in *DirectMappingMode*; while the *LineMappingMode* shows the **Serial** column with mapped Serial Port IDs in that place. *Inbound* connections are shown with 0 as port number.

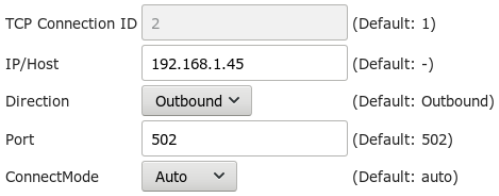


Figure 21: Edit TCP Connections

Unless you allowed unknown clients it is necessary to add a new connection for each Modbus/TCP device you want to communicate with. Otherwise Modbus/TCP packets from unknown sources are dropped. Please note that each entry needs a unique number called **TCP Connection ID**. The **IP/Host** field can be either a numeric IP Address or a hostname. The **Direction** defines who initiates the connection. *Outbound* is used when the ModGate Plus starts a connection; likely for Modbus/TCP Slaves (Server). *Inbound* expects a connection to the ModGate Plus on its **ListenPort** what a Modbus/TCP Master (Client) would do. The **Port** can be set for outbound connections; otherwise it will show the TCP Port on which the ModGate Plus listens. There are two types of **ConnectMode** available:

- *Startup*: establishes the TCP connection to the remote host when the Modbus gateway application starts.
- *Auto*: does not connect to the remote host until the first packet for that destination shall be delivered.

6.3. Modbus Gateway Settings

As explained above (6) you have to select the mode of packet forwarding, i.e. the Mapping scheme. On single port models Line Mapping is preselected.

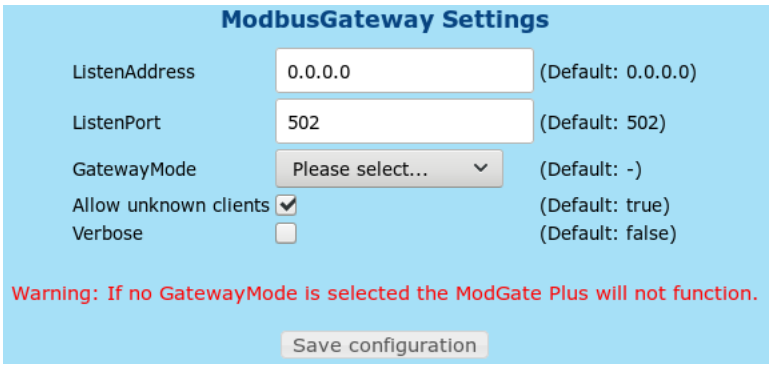


Figure 22: Gateway Settings

ListenAddress Specifies the IP Address the modbus gateway application listens on. The default value is `0.0.0.0`, which means ModGate Plus accepts connections on all interfaces (Ethernet and WLAN) in parallel. Enter the IP Address of either Ethernet or WLAN to restrict the Gateway function to this interface.

ListenPort Specifies the TCP port number the Modbus gateway application listens on. The default value is `502`, which is the reserved port for Modbus/TCP protocol.

GatewayMode You have to specify the mode which the gateway operates in. *DirectMappingMode* (Mapping of Modbus devices to serial ports or TCP connections) or *LineMappingMode* (Mapping of serial ports to TCP connections).

Allow unknown clients Enables all stations to connect to ModGate Plus without prior configuration as an allowed source for data.

Verbose When enabled the Modbus gateway application writes more debug output in the logfile (/var/log/modbusgw.log). Don't enable this, unless you want to resolve problems!

The combination of *LineMappingMode* with **Allow unknown clients** is most useful for single port models. All requests from unknown masters on TCP is directed to the single or first serial port.

LineMappingMode on multi-port models requires the definition of **TCP connections**. This allows the assignment of certain clients (Modbus Master) on TCP to a distinct serial port.

The *DirectMappingMode* routes Modbus requests to the targets based on the Modbus ID from the defined TCP Connections or Serial Ports. If **Allow unknown clients** is enabled the requests may originate from any source, including unknown clients.

6.3.1. Devices to Serial or TCP (Direct Mapping)

In this mode Modbus data is forwarded based on the Modbus ID included in Modbus packets.

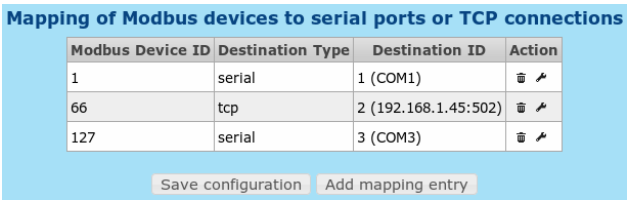


Figure 23: Direct Mapping Table

The mapping table is the main part of the gateway. It specifies where the Modbus packets should be delivered to. The type of the mapping table depends on the mapping mode specified under "Modbus Gateway Settings" (see 6.3); figure 23 shows the Direct Mapping version. The mapping table is sortable by clicking on the column title.

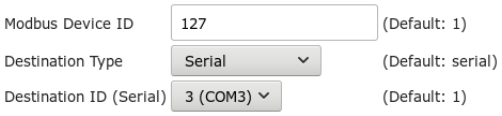


Figure 24: Edit Direct Mappings

In *DirectMappingMode* each mapping entry consists of three fields:

- **Modbus Device ID**: The (unique) Modbus ID of the device. Ranges like `1-12` and `1,3,5` are allowed for creating multiple entries at once.
- **Destination Type**: The destination can either be a Modbus device on a serial port (*Serial*) or a remote Modbus device connected via TCP (*TCP* or *TCP (Gateway)*).
  - *TCP* expects only one device on the TCP Connection. It replaces the Modbus Device ID with FF (hex) in outgoing Modbus/TCP packets to honor the standard Modbus/TCP protocol.
  - *TCP (Gateway)* allows to have multiple Modbus devices on one TCP Connection because the Modbus Device ID is sent in outgoing Modbus/TCP packets. This supports TCP to serial gateways like ModGate Plus.
- **Destination ID**: Depending on the **Destination Type** this is either a **Serial Port ID** or a **TCP Connection ID**.

Every time a valid Modbus packet is received (over TCP or serial line) the application checks if the mapping table contains an entry where the destination Modbus device ID of the packet matches the **Modbus Device ID** specified in the table. If there is such an entry the packet will be forwarded to the destination specified, otherwise the packet will be dropped. The main advantage of this mode is that you can specify an individual mapping for each Modbus device ID.

6.3.2. Serial to TCP (Line Mapping)

In this mode Modbus data is forwarded based on the network source the request originated from, i.e. a certain TCP connection.

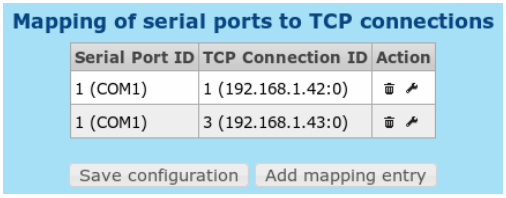


Figure 25: Line Mapping Table

The mapping table determines where Modbus packets should be delivered to. In Figure 25 the Line Mapping table is shown.

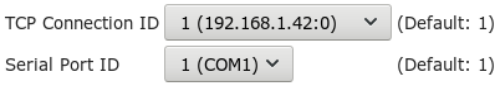


Figure 26: Edit Line Mappings

In *LineMappingMode* each mapping entry only consists of two fields, the **Serial Port ID** and the **TCP Connection ID**. Every valid Modbus packet received on the serial port is forwarded to the TCP connection and vice versa. This mode has the advantage that it is very basic and easy to set up, but it does not allow a complex mapping depending on the destination devices. Its only possible to define mappings where the destination is unique which means for instance that two serial ports cannot be mapped to one TCP connection being the Master.

If **Allow unknown clients** is enabled (6.3) on a single port device, there is no need to configure a mapping. On a multi-port model all traffic from unknown clients is forwared to serial port 1.

6.4. Advanced Configuration

In this section it is possible to upload a previously used '*modbusgw.conf*' file (via copying and pasting the old file into the text-box). You may also edit the configuration file manually here. The configuration file consists of key-value pairs. There are also flags like "*line*" and "*verbose*" which are off by default if they are not specified in the config file. In the sections "*Serial Ports*", "*TCP Connections*" and "*Mappings*" *ALL* available options have to be specified for each entry. The valid mapping table is selected depending on the *line* flag, the settings belonging to the currently inactive mode are ignored (e.g. when in *LineMappingMode* all mappings that were specified for *DirectMappingMode* are ignored). ModGate Plus treats lines as comments when they start with the hash character "#".

Any change of configuration via this interface is not encouraged. There is no support for establishing a certain configuration using this method. Also note, different text editors may use deviating ways of character representation. This also may result in problems when uploading a modified configuration.

6.4.1. General Options (general options for Gateway operation)

```
#
# General settings
#
listenaddr "0.0.0.0"
listenport 502
```

Figure 27: Manual Edit - General Options

listenaddr IP to listen on (default="`0.0.0.0`")

listenport Port to listen on (default=`502`)

line Line mapping mode (default=`off`)

promisc equivalent to Line mapping mode. This flag is obsolete.

select No mode selected: "Please select..." (default=`on` after Factory Reset)

verbose Verbose output (default=`off`)

response-timeout Modbus response timeout (in milliseconds, default=`1000` for 1 second)

allow-unknown-clients Allow connections of IPs which have not been specified (default=`off`)

log-file Log file (default=`/var/log/modbusgw.log`)

tcp-queue-size size of Modbus/TCP input queue (default=`16`)

6.4.2. Serial Ports (configuration of serial ports)

```
#
# Configuration of serial ports
#
serial 1
device "/dev/ttyVS0"
modbus "rtu"
rsmode "rs232"
term 0
baudrate 115200
databits 8
parity "even"
stopbits 1
```

Figure 28: Advanced Configuration - Configuration of Serial Ports

serial Unique Identifier, numeric, sequentially (`1, 2, ...`)

device Serial Port (e.g. "`/dev/ttyVS0`")

rsmode Physical serial line configuration (e.g. "`rs232`")

term Termination (e.g. `0`)

baudrate Baudrate (e.g. `115200`)

databits Databits (e.g. `8`)

parity Parity ("`none, even or odd`")

stopbits Stopbits (`1 or 2`)

master Has master (`0 or 1`)

6.4.3. TCP Connections (configuration of allowed TCP connections)

```
#
# Configuration of TCP connections
#
tcp 1
ip "192.168.1.146"
port 502
connect "auto"
```

Figure 29: Manual Edit - Configuration of TCP Connections

tcp Unique Identifier, numeric, sequentially (`1, 2, ...`)

ip IP Address or hostname of the remote Modbus TCP device (e.g. "`192.168.1.50`")

port Port of the remote Modbus TCP device (e.g. `502`)

connect ConnectType ("`auto`" or "`startup`")

6.4.4. Mappings - DirectMappingMode

```
#
# Mapping of Modbus devices to
#         serial ports or TCP connections
#
devid 1
type "tcpgateway"
destid 1
```

Figure 30: Manual Edit - DirectMappingMode

Mapping of Modbus devices to either serial ports or TCP connections

devid Modbus device ID

type Destination type (`tcp`, `serial` or `tcpgateway`)

destid Identifier of the destination

6.4.5. Mappings - LineMappingMode

```
#
# Mapping of serial ports to TCP connections
#
tcpid 1
serialid 1
```

Figure 31: Manual Edit - LineMappingMode

Mapping of TCP connections to serial ports

tcpid Identifier of the TCP connection

serialid Identifier of the serial port

7. Special Implementation Features

7.1. Modbus/TCP Request Queueing

A master on Modbus/TCP may send multiple requests at the same time, i.e. without waiting for the response on each. This is not possible on serial lines, so the requests are placed in a queue and served one by one. Serial ports are served from this queue independently.

As a side effect of this implementation variant multiple masters on Modbus/TCP may connect to the same serial line. Their requests are placed into the queue in a first come - first served manner. Multiple serial masters on Modbus/RTU may forward their requests using an extra ModGate Plus to go to Modbus/TCP as intermediate. Then these requests use the target queue as well.

7.2. Conversion of Serial Line Parameters

On ModGate Plus models with multiple serial lines a master on a serial port can address slaves on the other serial ports. The DirectMappingMode allows for that configuration. The involved serial lines do not need to share the configuration parameters. The requests and their responses are transferred from one serial line to the other by getting the logical content. This enables to change the complete serial line configuration, including the Modbus operation mode.

So one port configured for Modbus/ASCII by 9600 bps and 7 bits on RS232 may connect to another port operating Modbus/RTU by 115200 bps and 8 bits on RS485.
Note: the transfer from one serial port to another does not share the queue function of section 7.1.

7.3. Redirect of Modbus/TCP

Using the Direct Mapping, a ModGate Plus can receive requests via Modbus/TCP and forward them to other TCP connections. The masters on Modbus/TCP then only need to know about the one ModGate Plus Gateway, and not the individual target devices. However for this the masters need to send a dedicated Modbus ID, not the default 255/0xFF.

This option is also useful, if all or many of the masters use Wireless LAN for communication, and the target devices are on Ethernet. And of course vice versa.

8. Example Configurations

The ModGate Plus are intended to convert from Modbus on serial lines (RTU or ASCII) to Modbus/TCP, and vice versa. This chapter will show some fairly often used installation variants. The requirements of the application are given first, then the suggested configuration of ModGate Plus with an explanation on why these parameters are selected. These configurations are for transport and conversion of Modbus data, so configuration of IP Addresses is not covered here.

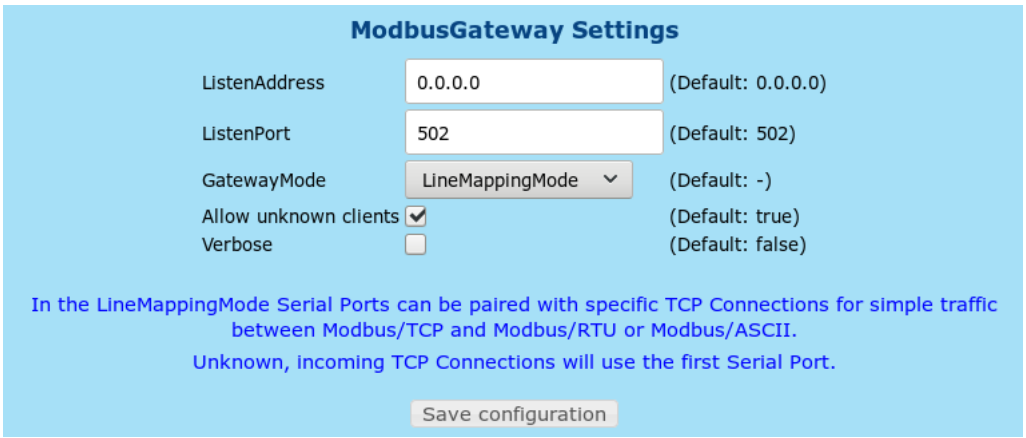
In general the ModGate Plus operate more similar to a Router than to a Gateway. The normal configuration includes a list of Modbus IDs and the connections they are available with. These connections are either serial or a TCP connection. In many applications those details are not necessary, so more simple configurations are listed here.

To distinguish Master and Slave devices by its physical interfaces the devices using Modbus/TCP will be prepended by TCP- while devices with a serial interface will carry the attribute serial. Masters might be SCADA-Controllers, PCs with control software or other systems monitoring via Modbus.

8.1. Access one serial line from multiple TCP-Masters in a Network

The serial line has one (RS232) or many (RS485) devices connected to it. There is no Modbus master on the serial line. Instead different TCP-Masters on the network shall send requests to specific devices, and the ModGate Plus shall enable this.

The configuratition is done as in section Modbus Gateway Settings.



Special Values to observe are

GatewayMode as `LineMappingMode` sends all requests from a TCP connection to the first serial port. This is done without checking the Modbus ID in the request, so a configuration of IDs for the serial port is not necessary.

Allow unknown clients assures the ModGate Plus accepts TCP connections from all stations, without prior configuration of clients to accept connections.

This configuration is the default set of options for single port devices like the ModGate Plus 113. Multi port devices need at least configuration of the *GatewayMode* as seen in figure 22.

How this works: When any TCP-Master opens a TCP connection to the ModGate Plus, all requests from this TCP connection are forwarded to the serial line and the responses are returned. Several simultaneous connections are supported, they are served sequentially to the serial line. The figure 32 shows this simple setup. If the serial line is operated with RS485, it can handle multiple serial Slaves where as RS232 and RS422 are restricted to one Slave device signified in green.

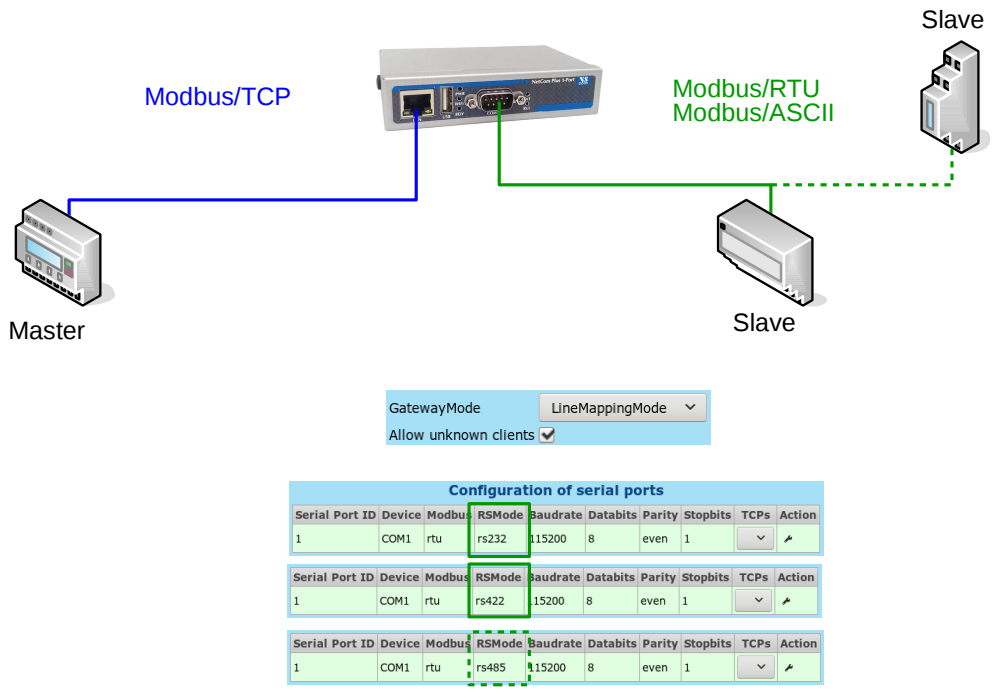
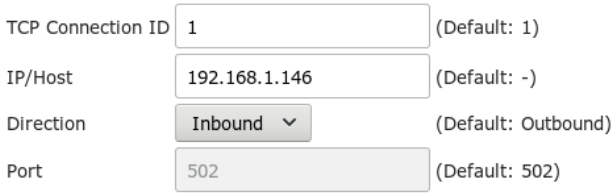


Figure 32: One serial line setup

8.1.1. Variation: Access several serial lines from selected TCP-Masters in a Network

The configuration above sends all requests coming from any TCP-Master to the first serial port. On a single port ModGate Plus this is not a problem. A multi-port device only allows to use the first serial port in this way because the information how to forward arriving requests is not specified.

The other serial ports on a multi-port ModGate Plus are accessible, if certain TCP-Masters are defined to connect to those ports. At first for each TCP-Master using a certain serial port a TCP connection has to be configured, see section Configuration of TCP Connections and figure 21.



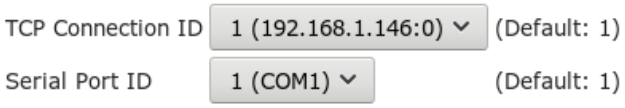
TCP Connection ID must be a unique number, using just 1, 2, 3, ... is fine.

IP/Host is the definition of the TCP-Master to get access to a serial line.

Direction is *Inbound* because the TCP-Master initiates the connection.

Port shows 502 as the TCP port on which the ModGate Plus listens.

Once such definitions exist for all planned TCP-Masters, the Line Mapping is to be defined. See section Serial to TCP (Line Mapping) and figure 26.



Each *TCP Connection ID* is paired with one *Serial Port ID*, to establish the connection.

How this works: The TCP-Masters from the network establish a connection to the ModGate Plus. Once this is done the source address is compared with the existing definitions. If it exits in the configuration, all requests from this TCP connection are forwarded to the specified serial line and the responses are returned. If it does not exist, the requests are either forwarded to port one, or the connection is cancelled if *Allow unknown clients* is not enabled. The figure 33 depicts a setup with two TCP-Masters each talking to a designated line and a serial Slave attached.

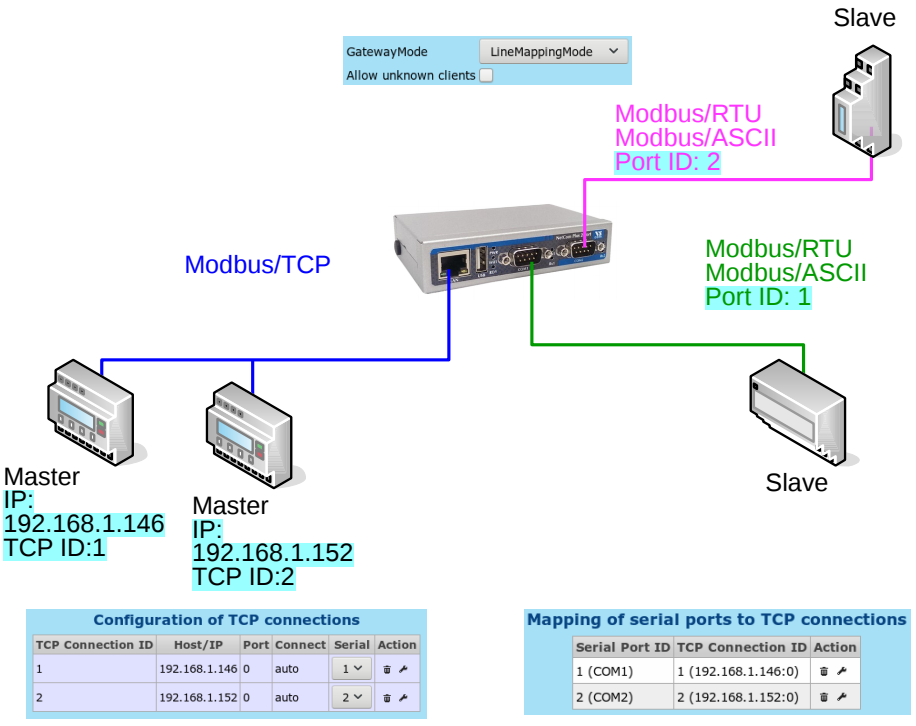
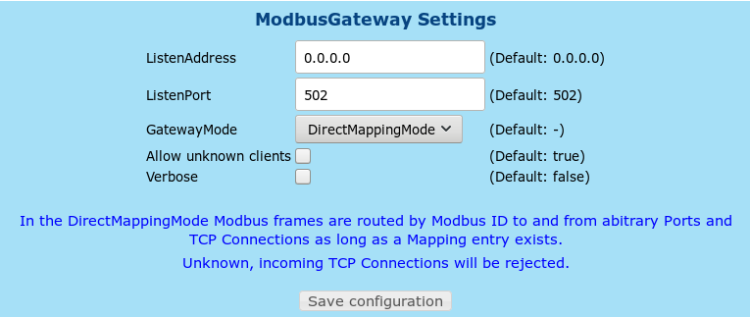


Figure 33: Line mapping for TCP-Masters

8.2. Access one or more Modbus/TCP Devices from a serial Master

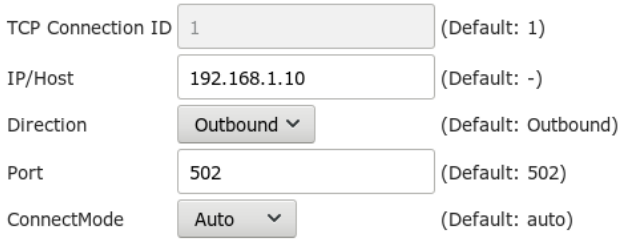
A serial Master for Modbus/RTU is already operating on a serial line. On this line there may also exist serial Slave devices operating Modbus/RTU. Such is a typical installation as many exist. The new demand is for the serial Master to also get data from new devices via Modbus/TCP. Since the Master does not know about a network, a ModGate Plus is required.

The `LineMappingMode` is not usable here, so this must be disabled. See section Modbus Gateway Settings in figure 22.



Select the `DirectMappingMode`.

As the next steps for each device on Modbus/TCP the ModGate Plus needs a TCP connection defined. This is done as defined in section Configuration of TCP Connections and figure 21.



TCP Connection ID must be a unique number, using just `1`, `2`, `3`, ... is fine.

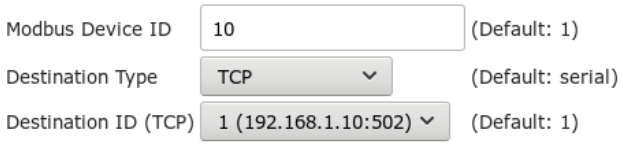
IP/Host is the IP address of the TCP-Slave to access via Modbus/TCP.

Direction is *Outbound* because the ModGate Plus initiates the connection to the TCP-Slave.

Port usually is `502`, the standard value for Modbus/TCP.

ConnectMode is `Auto`, to establish the connection when it is necessary.

Finally for each of the defined TCP connections at least one Modbus ID is required for identification. This is done as the Devices to Serial or TCP (Direct Mapping), seen in figure 24.



Modbus Device ID The (unique) Modbus ID of the device. This defined ID is used by the Master on the serial line to address the Modbus/TCP device, usually there is only one ID per device.

Destination Type This is either *TCP* or *TCP (Gateway)*. this depends on the particular device, see the note below.

Destination ID The *TCP Connection ID* for the target device.

How this works: The serial Master sends requests on the serial line. The ModGate Plus receives those requests, and extracts the Modbus ID from them. If this ID is not among the configured **Modbus Device ID**s, the request is considered targeted to a device on the serial line. In that case it is ignored.
But if the ID is found among the configuration, the ModGate Plus opens a TCP connection to the Modbus/TCP device if the connection does not exist yet (This is controlled by the `Auto` configuration). The request from the serial line is then forwarded via the connection to the Modbus/TCP device, and the response from the device is sent to the Master on the serial line.

Note: The definitions of Modbus/TCP specify to address a device by its IP Address (and the TCP port number). So there is no need for a unique Modbus ID, and targeted devices shall ignore the ID in the requests. Masters shall send the ID set to the value of 255/0xFF. The ModGate Plus operates conforming to this when the **Destination Type** is configured as *TCP*. When returning the response to the Master the original ID is restored for obvious reasons.
But not all Modbus/TCP devices follow the given definition, some need to be addressed also by their specific ID. To support those kinds of devices the configuration as *TCP (Gateway)* is available. The Modbus ID is not replaced by 255, instead it is preserved in the forwarded request. In figure 34 a setup with two TCP-Slaves, a serial Master and additional serial Slave is shown.

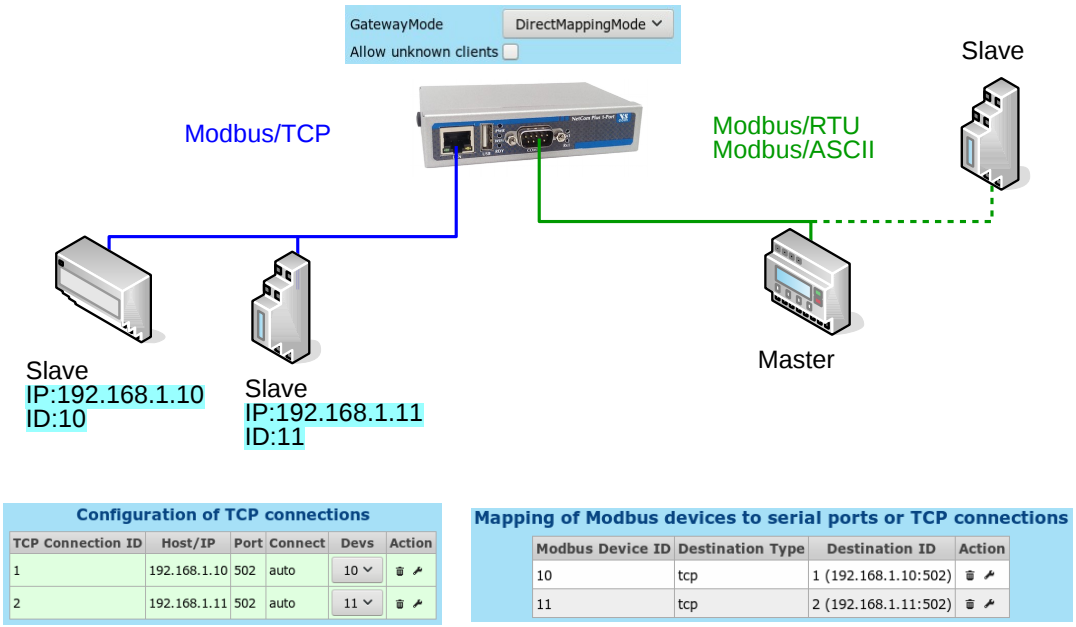


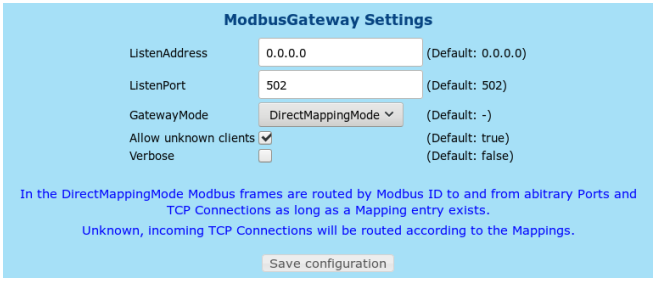
Figure 34: Serial Master using TCP-Slaves

8.3. Using Modbus/TCP to monitor a serial Modbus Line

A classic configuration of Modbus is a Master on a serial line, connected to one or more Slave devices. The Master continuously retrieves data from the Slaves, and displays some status information. In modern times users are interested to also get information from the Slave devices, but from a remote location. A network shall connect to the serial line.

Such is not possible in a simple way. The remote station may use some network connected hardware to just receive all data on the serial line, i.e. eavesdropping on the protocol. For that it needs special software to distinguish requests from responses, to get the required data.
A better solution is to have the remote station use Modbus/TCP as the protocol to connect to the serial line. However a direct connection would cause a conflict by concurrently accessing the serial line. A ModGate Plus with two ports can solve this problem.
The existing serial line is cut between the Master and the Slave devices. The Master connects to serial port one of the ModGate Plus, while the remaining line with the Slaves is connected to the second serial port. The ModGate Plus will then forward the requests from the Master to the second serial port, returning the responses in the opposite direction. This allows a different Master via Modbus/TCP to also access the serial Slave devices.

The `DirectMappingMode` is necessary. Configure this in section Modbus Gateway Settings in figure 22.



And also enable *Allow unknown clients* for simplicity.

For each serial Slave device this system requires a Mapping entry. This is to inform the ModGate Plus about the Modbus IDs existing on the second serial port. Open section Devices to Serial or TCP (Direct Mapping) in figure 24.

Configure

Modbus Device ID The ID of one Slave device, a value of 1 to 247.

Destination Type This must be *Serial* to access the serial port.

Destination ID This is 2 for the second serial port.

How this works: The serial Master sends requests on the serial line on port 1 to the Slave devices. These do no longer connect to this cable, but the requests are received by the ModGate Plus. It extracts the Modbus ID from the request, and as per configuration this Destination ID is defined. So the ModGate Plus forwards the request to the serial port 2, where the Slave devices receive the data. The device with this Modbus ID sends the response, which in turn is forwarded back to port 1. Finally the Master receives the response from the Slave, and the communication cycle is completed. This is just as before without the ModGate Plus.
While this communication is performed, any other TCP-Master can send a request via Modbus/TCP to the ModGate Plus. If this request carries one of the configured Modbus IDs for a Slave device, this will be forwarded to the second serial port. But only if there is no current communication between Master and Slave. Otherwise the request is placed in a queue and sent to the Slave when the current communication is finished. The new response from the Slave is then returned via the TCP connection, and *not to* serial port 1. The setup as shown in figure 35 illustrates how a TCP-Master can be integrated to a serial Modbus installation.

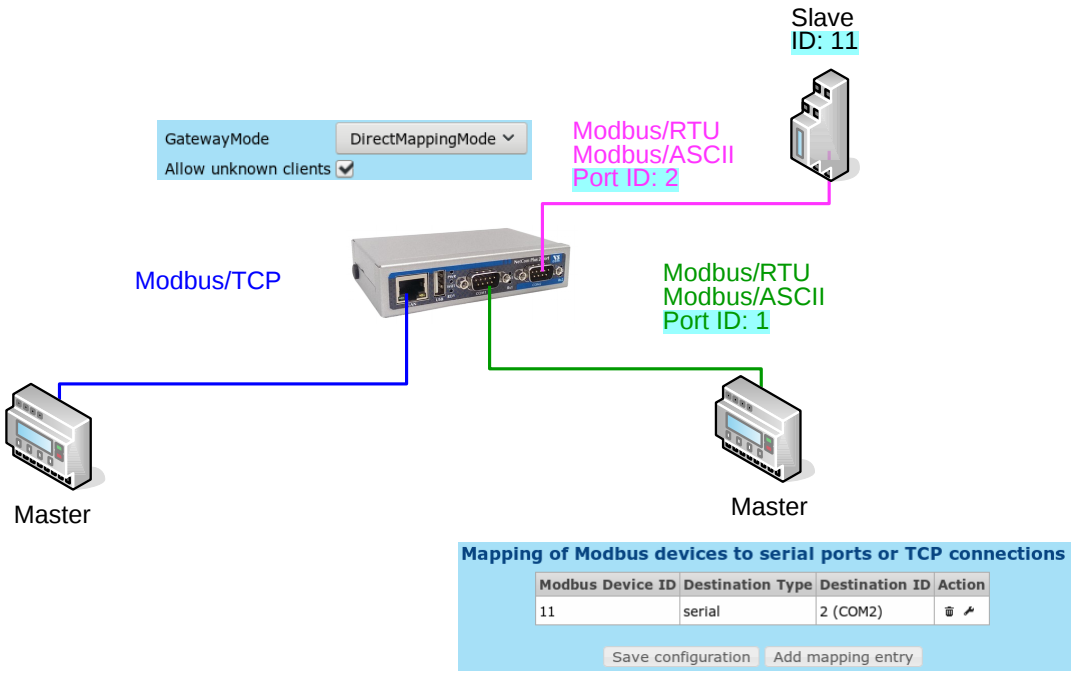


Figure 35: Dual Master

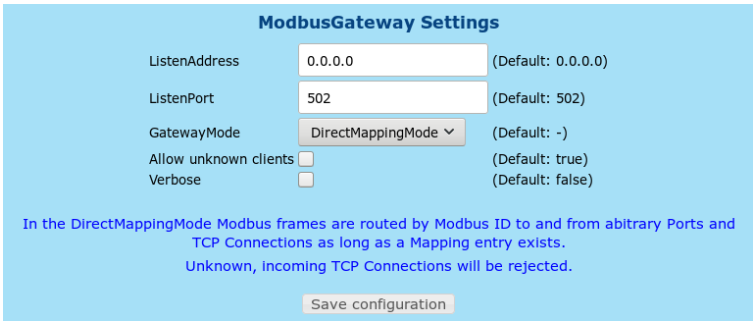
Alternatives: The desired function may also be achieved by replacing the multi-port ModGate Plus by two single-port ModGate Plus Gateways in a configuration as in Extend serial Modbus Protocol via a Network below.

8.4. Extend serial Modbus Protocol via a Network

An existing serial Modbus/RTU configuration needs extension to more and remote devices. But these are too far away for a convenient serial connection, or this may not be possible at all. Then the serial Modbus line can be tunneled via an existing TCP/IP network, or via Internet. In the latter case the use of VPNs for security is highly recommended.

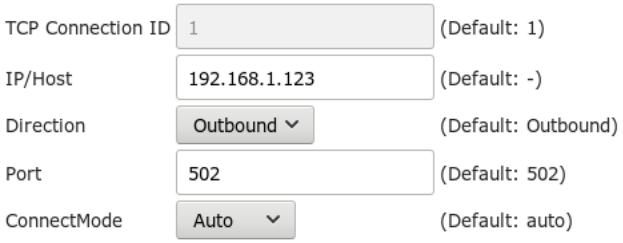
One ModGate Plus is connected to the existing serial communication line. This ModGate Plus is referenced here as Gateway L for Local. Other ModGate Plus are referenced as Gateway R (R2, R3, ...) for Remote, and these are connected to the new remote devices. The ModGate Plus Gateway L is configured for Direct Mapping, and has defined TCP connections to the Gateways referenced as R.

The start of configuration is similar to section 8.2 on page 40. See section Modbus Gateway Settings in figure 22.



The ModGate Plus Gateway L is configured for the `DirectMappingMode`.

Next for each of the remote ModGate Plus Gateway R it needs a TCP connection defined. This is done as defined in section Configuration of TCP Connections and figure 21.



TCP Connection ID must be a unique number, using just `1`, `2`, `3`, ... is fine.

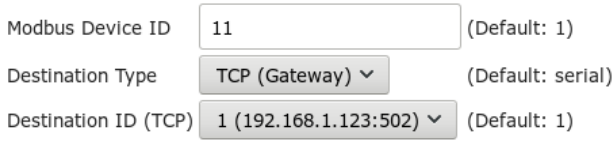
IP/Host is the definition of the ModGate Plus Gateway referenced as R (R2, R3, ...).

Direction is *Outbound* because the ModGate Plus initiates the connection to the secondary Gateways R.

Port usually is `502`, the standard value for Modbus/TCP.

ConnectMode is `Auto`, to establish the connection when it is necessary.

Finally for each of the defined TCP connections all of the remote Modbus IDs is required. This is done as the Devices to Serial or TCP (Direct Mapping), seen in figure 24.

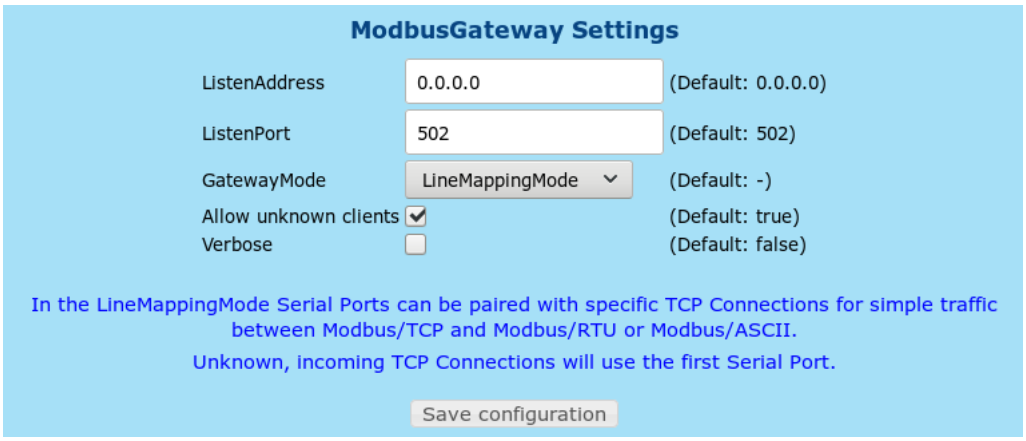


Modbus Device ID The (unique) Modbus ID of the remote device. This ID is used by the Master on the serial line to address the remote Modbus/RTU device.

Destination Type This is *TCP (Gateway)*.

Destination ID The *TCP Connection ID* for the remote ModGate Plus Gateway.

The remote ModGate Plus Gateways R (R2, R3, ...) are in default configuration for simplicity.



Here *Allow unknown clients* is enabled, otherwise a TCP connection to the ModGate Plus Gateway L would be required.

How this works: The serial Master on the existing serial line now connects to the ModGate Plus Gateway L also; the Master sends requests to many Modbus IDs. When such an ID is not configured in Gateway L, the ModGate Plus simply drops the request. The target is on the serial line, and will eventually send the response.

But when this ID is configured in Gateway L, it forwards the request to the responsible Gateway R. Since the TCP connection is configured as *TCP (Gateway)*, the target Modbus ID is retained (not replaced by 255/0xFF). Now Gateway R forwards this request to its own serial line, where the remote Modbus/RTU device gets it. The response is sent on the serial line, forwarded back from Gateway R to Gateway L, and then to the original serial line and to the Master. The communication cycle is finished with this final forward. The figure 36 shows such a setup.

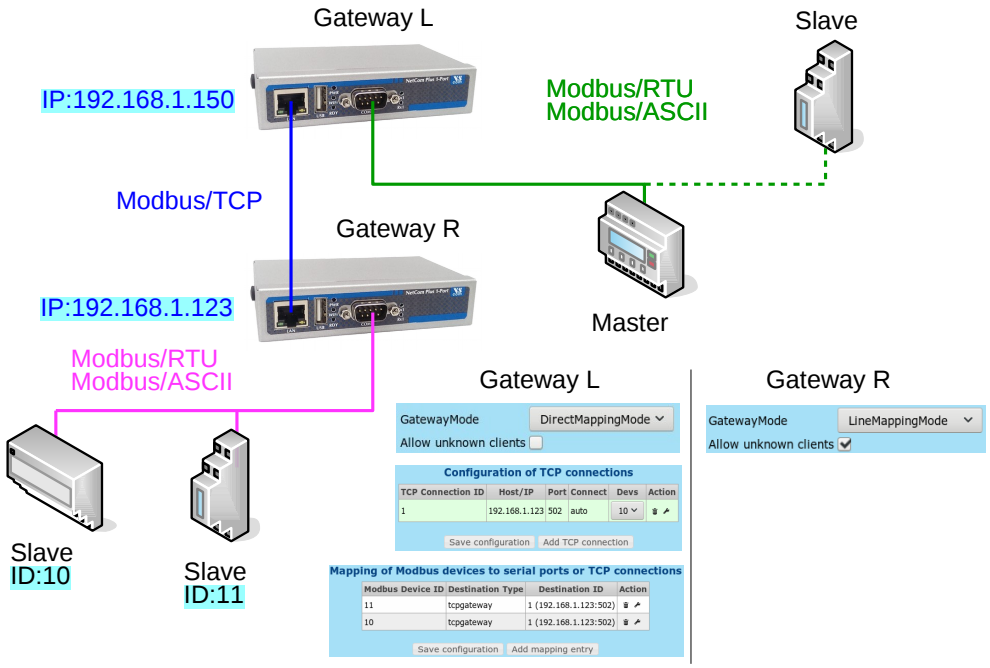


Figure 36: Tunnel setup

Alternatives: It's possible to have the remote Gateway R as a multi-port ModGate Plus. This is especially required to attach Modbus devices communicating via RS232; in such a situation only a single device per serial port is possible. For example a ModGate Plus 413 can connect to four devices RS232, or fewer plus several other devices via RS485 on one port.

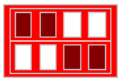
9. Troubleshooting

9.1. Cannot find the ModGate Plus in the network

Follow the listed instructions to solve the problem:

When in doubt or missing options in Windows consult the local network administrator.

1. Do the DIP switches show OFF OFF ON ON for normal operation? If yes, continue. If no, switch to this setting and restart the device.



2. Click on the folder symbol or press Win-Key + E, and click on Network. Can you find the ModGate Plus under Other Devices? This may look like Figure 37. If yes, you have found the device. If no, continue.

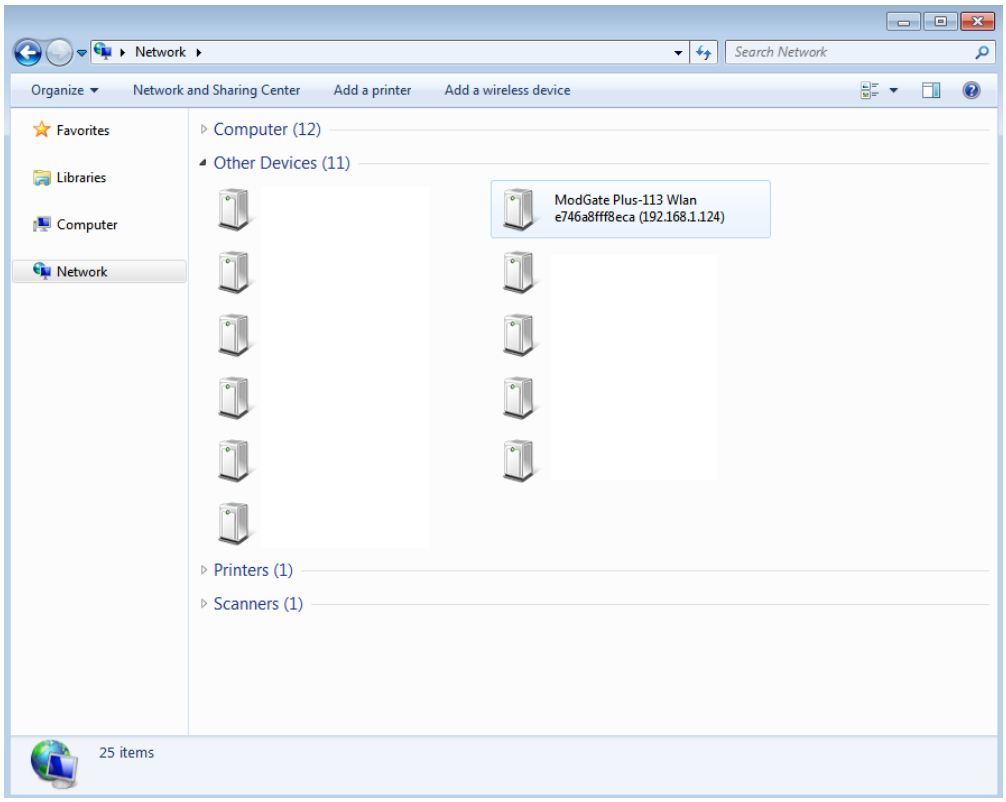


Figure 37: Network View (Windows 7)

3. Set the DIP switches to OFF OFF OFF OFF. Connect the PC directly to the ModGate Plus using a single ehternet cable. And configure the PC to the static IP address 192.168.254.1/24. For that you can use the following instructions:

   a) Click on the folder symbol or press Win-Key + E and click on Network again. Click on “Network and Sharing Center” in the menu bar. This will show Figure 38.

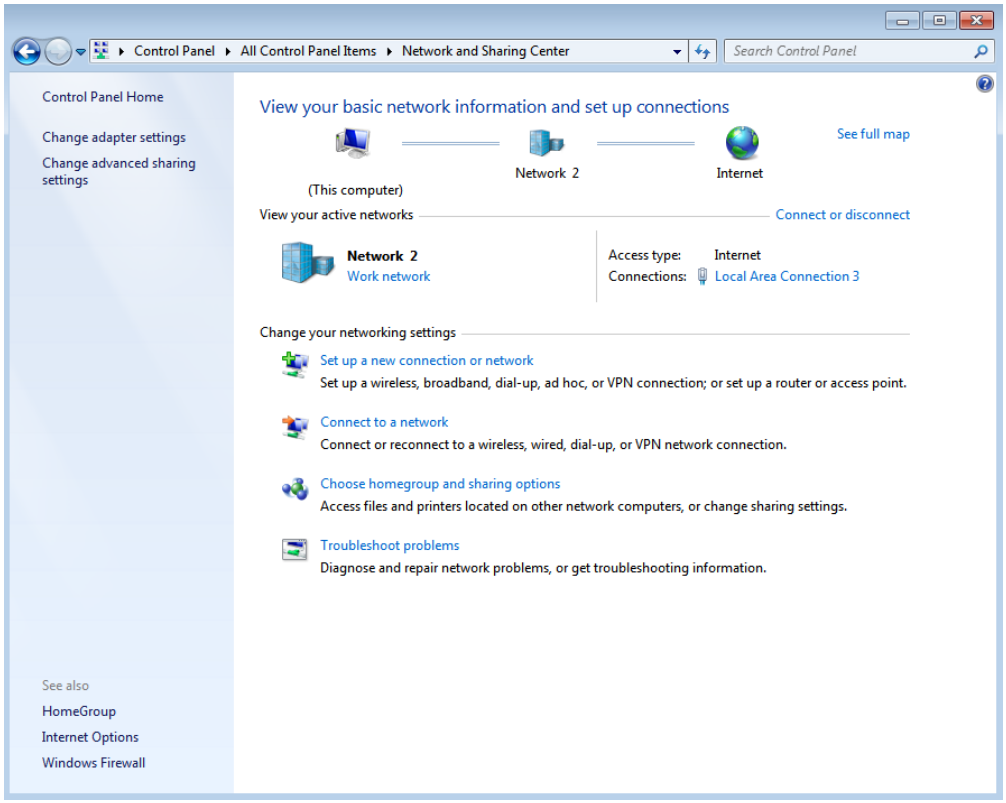


Figure 38: Network and Sharing Center

b) Click on Connections: Local Area Connection 3 to open the Network Adapter Settings as shown in Figure 39. If multiple networks are shown, select the one corresponding to the ethernet port you like to use. When in doubt ask the local network administrator.

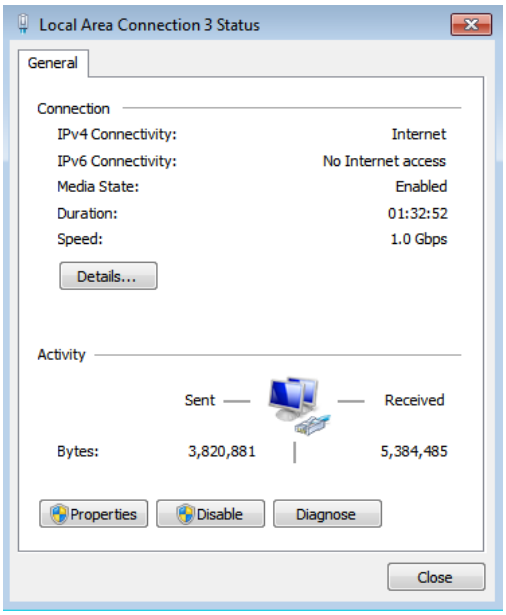


Figure 39: Local Area Connection Status

c) Click on Properties opening 40

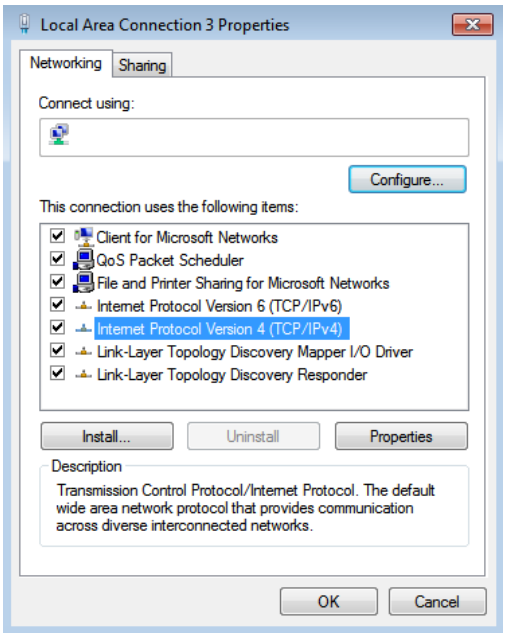


Figure 40: Local Area Connection Properties

d) Double-clicking on “Internet Protocol Version 4 (TCP/IPv4)” will open the dialog 41 where the IP address can be set. Select “Use the following IP address”, enter 192.168.254.1 as “IP address”, 255.255.255.0 as “Subnet mask” and 192.168.254.254 as “Default gateway”.

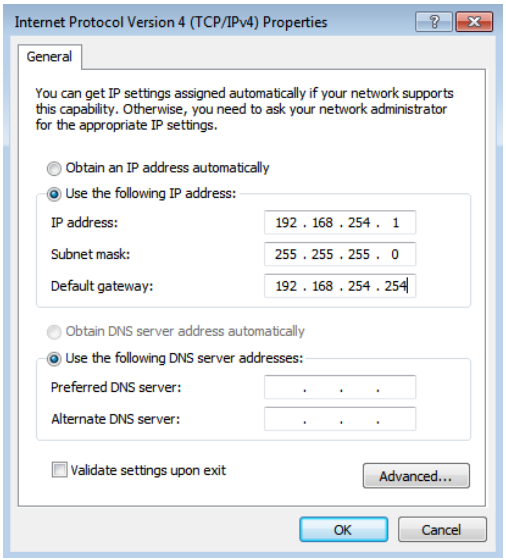


Figure 41: IPv4 Properties

4. Restart the ModGate Plus. The configuration webinterface is now reachable under http://192.168.254.254.
5. Now some questions have to be answered. You may need to ask the local network administrator.

a) Does the network have a DHCP server?

b) Are any restictions / policies at play that prohibit that the ModGate Plus to get an IP address?

c) Was the device used in another network with a static IP?

d) Was Universal Plug and Play disabled in the device? See Universal Plug and Play (UPnP).

6. Dealing with the answers to 5.

a) If the answer to a) is no, ask the network administrator for the IP address to use. Look at Section 5.2.3 to set the static IP. If yes, look at b).

b) If yes, discuss this with the local network administrator to solve it. If no, check c) and d).

c) You now have access to the device to apply the settings for normal operation.

d) Universal Plug and Play makes it easier to find the device as shown in 2.

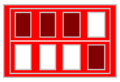
9.2. The green RDY LED blinks

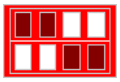
You need to decide how the device should operate, because the ModGate Plus can work in several mutual exclusive ways. Look at Section 8 for examples similar to your scenario. See also 6.

9.3. The green RDY LED is off

This indicates that the device is not fully functional. This may be caused by a corrupted configuration. Please follow the listed instructions:

1. At first we will try a factory reset. This will delete all settings. Set the DIP switches to OFF OFF OFF ON and restart the device. Wait until the red PWR LED was off once. Then restart the ModGate Plus with normal DIP settings and reconfigure the device. If the RDY LED is now on or blinking, the device work. Else continue.


Factory reset


Normal operation

2. This looks like a serious problem. Attach an empty USB-Stick to the USB-Port on the ModGate Plus and restart the device and let it run for a few minutes. Can you reach the webinterface of the device? Please contact us at service@vscom.de with the files now on the stick.

9.4. The serial Slave does not response

1. Check the cabling to the Modbus/RTU or Modbus/ASCII Slave. Refer to Signal Assignment
   a) If RS232 is used, do the signals of TxD, RxD, GND on the ModGate Plus connect to RxD, TxD, GND on the Slave side (Strait vs Nullmodem cables)?
   b) If a RS485 bus is used, do Data+ and Data- signals line up? Is GND connected to the ModGate Plus? Is the bus terminated at both ends?
   c) If RS422 or RS485 4-wire is used, do Tx+/- and Rx+/- connect to the corresponding Rx+/- and Tx+/- at the Slave? Does the polarity of signals match? Is the bus terminated?
2. Check that the serial parameter in the ModGate Plus (See Configuration of Serial Ports) match the Slave's settings/requirements.
3. Visually check if the Tx and Rx LEDs flicker when communication is attempted.
4. Enable logging on the ModGate Plus by checking Verbose in the Modbus Configuration (See Modbus Configuration). This will create thourough logs on every Modbus communication. Download these after a few communication attempts on the Home page by clicking on View ModbusGateway logfile. The following Figure 42 is an annotated example of such a log.

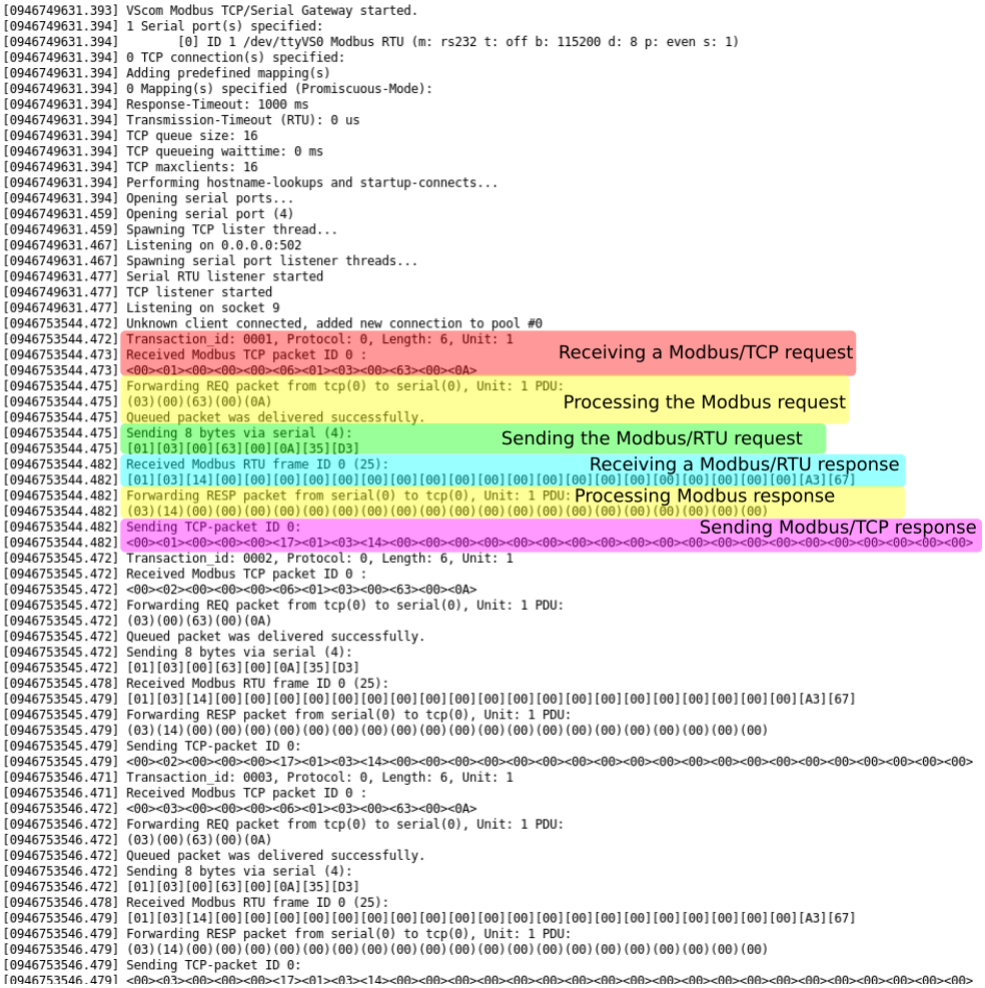


Figure 42: ModGate logfile

The colored log entries show a complete request and response from a Modbus/TCP Master to a Modbus/RTU Slave. If steps are missing, this log may help to narrow down the problem.

9.5. Will my configuration work in practice?

There are tools that can simulate Master and Slave on a normal PC:

- Modpoll is a command line tool simulating a Master: https://www.modbusdriver.com/modpoll.html
- Diagslave is a command line tool to simulate a Slave: https://www.modbusdriver.com/diagslave.html
- QModBus is a graphical Master: http://qmodbus.sourceforge.net/

As a short example analog to the scenario 8.1 with one PC acting as Slave on a COM port and acting as TCP-Master on the network:

- Command for Diagslave: `diagslave.exe -b 115200 -p even -m rtu COM1` - simulate a Slave on COM1 with 115200 baud and even parity acting on any Modbus ID.

```
diagslave 2.12 - FieldTalk(tm) Modbus(R) Diagnostic Slave Simulator
Copyright (c) 2002-2012 proconX Pty Ltd
Visit http://www.modbusdriver.com for Modbus libraries and tools.
Protocol configuration: Modbus RTU
Slave configuration: address = -1, master activity t/o = 3.00
Serial port configuration: COM1, 115200, 8, 1, even

Server started up successfully.
Listening to network (Ctrl-C to stop)
Slave   1: readHoldingRegisters from 100, 5 references
Slave   1: readHoldingRegisters from 100, 5 references
Slave   1: readHoldingRegisters from 100, 5 references
Slave   1: readHoldingRegisters from 100, 5 references
Slave   1: readHoldingRegisters from 100, 5 references
Slave   1: readHoldingRegisters from 100, 5 references
Slave   1: readHoldingRegisters from 100, 5 references
.......................
```

- Command for Modpoll: `modpoll.exe -m tcp -r 100 -c 5 192.168.1.97` - continuously request registers 100 to 104 of Slave with the Modbus ID 1 via a ModGate Plus with the IP address 192.168.1.97.

```
modpoll 3.4 - FieldTalk(tm) Modbus(R) Master Simulator
Copyright (c) 2002-2013 proconX Pty Ltd
Visit http://www.modbusdriver.com for Modbus libraries and tools.
Protocol configuration: MODBUS/TCP
Slave configuration...: address = 1, start reference = 100, count = 5
Communication.........: 192.168.1.97, port 502, t/o 1.00 s, poll rate 1000 ms
Data type.............: 16-bit register, output (holding) register table

-- Polling slave... (Ctrl-C to stop)
[100]: 0
[101]: 0
[102]: 0
[103]: 0
[104]: 0
-- Polling slave... (Ctrl-C to stop)
[100]: 0
[101]: 0
[102]: 0
[103]: 0
[104]: 0
-- Polling slave... (Ctrl-C to stop)
[100]: 0
[101]: 0
[102]: 0
[103]: 0
[104]: 0
-- Polling slave... (Ctrl-C to stop)
```

A. History

August 2015 Manual for ModGate Plus models

April 2017 Update Firmware 2.0.7 (TCP (Gateway) mode)
Added Configuration Examples

January 2018 Add ModGate Mini, update menu bar, improved examples. Improved Front-End, CC license

June 2018 FrontEnd updates (FW 2.1.2), Troubleshooting Section

May 2019 License References

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Version 2.1, February 1999

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