

MBRG-300

Modbus Router/ Gateway

User manual

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Important user information

This manual explains how to install, operate and configure a MBRG-300. This device may only be used for the applications described in this document.

This manual is to be used with a MBRG-300 with firmware version 2.12.

These instructions are intended for use by trained specialists in electrical installation and control and automation engineering, who are familiar with the applicable national standards and safety procedures.

Safety Precautions



ELECTRICAL HAZARD

- This equipment must be installed and serviced only by qualified personnel. Such work should be performed only after reading this entire set of instructions.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Apply appropriate personal protective equipment and follow safe electrical practices.
- Turn off all power supplying the equipment in which the MBRG-300 is to be installed before installing, wiring or removing the MBRG-300.
- Always use a properly rated voltage sensing device to confirm that power is off.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.

Failure to follow these instructions could result in death or serious injury!

Document conventions

Throughout this manual we use the following symbols and typefaces to make you aware of safety or other important considerations:



Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation that, if not avoided, could result in damage to equipment.



Indicates information that is critical for successful application and understanding of the product.



Provides other helpful user information that does not fall in above categories.



Provides supplemental user information.

Acronym

This typeface is used to introduce acronyms or product names.

`Command`

This typeface is used to represent commands, prompts, input fields and filenames. In the context of programming it is used for functions, variable names, constants or class names.

Placeholder

This typeface is used to represent replaceable text. Replaceable text is a placeholder for data you have to provide, like filenames or command line arguments.

User input

This typeface is used to represent data entered by the user or buttons.

`Screen output`

Screen output or program listing

Chapter 1. Introduction

The MBRG-300 is a Modbus/TCP to Modbus Serial Line gateway.

The gateway features an Ethernet port and two serial ports which can be configured as either RS-232 or RS-485 or combined to form one RS-422 port.

It can be mounted on a DIN rail.

Usage and configuration of the gateway is simple and conveniently performed using a web browser which connects to the embedded web server.



Possible areas of application are:

- PLC connection
- Operator panel interfacing
- HMIs
- SCADA integration
- Remote control & monitoring
- Data logging

Features

The MBRG-300 gateway provides the following key features:

- Two serial ports
- Modbus/TCP protocol (Ethernet)
- Modbus RTU and ASCII protocols
- RS-232, RS-485 or RS-422, software configurable
- Embedded web server for easy configuration and commissioning using a web browser
- Firmware upgradeable via Ethernet
- DIN rail mountable
- 24 V DC (10-30 V) power supply
- Status LEDs for power, Ethernet link, device status and communication status

Quick start checklist

- Read this set of instructions properly and in its entirety.
- Mount the unit.
- Connect the power. Do not connect yet serial ports.
- Configure the Ethernet communications settings with a web browser (using an Ethernet crossover cable) or with a terminal program like *HyperTerminal* (using a null modem cable)
- Configure the serial line communication settings.
- Configure the operational aspects of the device.
- Wire serial line interfaces.

Chapter 2. Description

The power and RS-485/RS-422 terminals are placed on the top side of the unit. The RS-232 and Ethernet connectors are placed on the bottom side of the unit as shown in the following illustration:

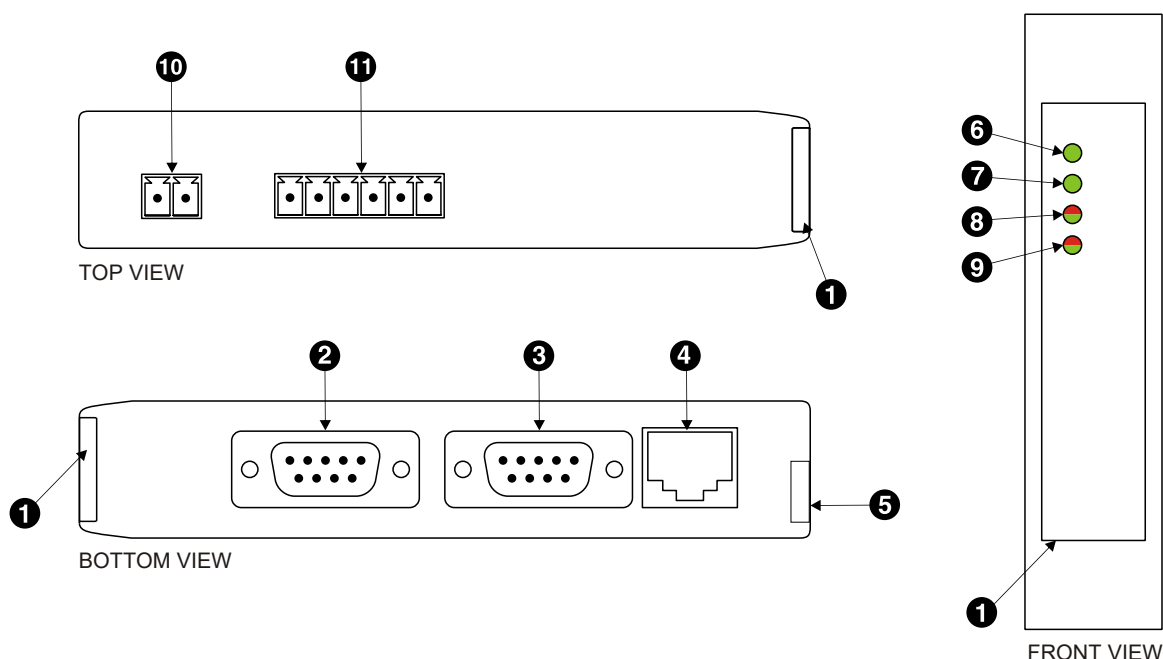


Figure 2.1: Location of connectors

- ❶ Clear front cover
- ❷ Serial port 1 RS-232 connector
- ❸ Serial port 2 RS-232 connector
- ❹ Ethernet connector
- ❺ DIN rail clip
- ❻ Power LED
- ❼ Ethernet link LED
- ❽ Device status LED
- ❾ Communication status LED
- ❿ Power terminals
- ⓫ Serial port 1 and 2 RS-485 or serial port 1 RS-422 terminals

LED indicators

Four LEDs located at the front panel indicate the status of the device. The LEDs assist maintenance personnel in quickly identifying wiring or communication errors.

A LED test is exercised at power-up, cycling each LED off, green and then red for approximately 0.25 seconds. At the same time the power-on self test of the device is performed.

The following table outlines the indicator condition and the corresponding status after the power-on self test has been completed:

LED	Function	Condition	Indication
Power	Power	Off	No power applied to the device.
		Green	Power supply OK
Link	Ethernet link	Off	No Ethernet link
		Green	Ethernet link OK
Status1	Device status	Off	The device has an unrecoverable fault; may need replacing.
		Flashing green 1 s rate	Device operational but needs commissioning due to configuration missing, incomplete or incorrect.
		Green	The device is operating in normal condition.
		Flashing red 1 s rate	Device operational but has a fault listed which requires acknowledgment.
		Red	The device has an unrecoverable fault; may need replacing. Flashing sequence and rate of Status2 LED indicates fault class.
Status2	Communication status	Off	No Modbus/TCP connection.
		Green	Modbus/TCP connection established.

Table 2.1: LED diagnostic codes

Chapter 3. Installation

Regulatory notes



1. The MBRG-300 is suitable for use in non-hazardous locations only.
2. The MBRG-300 is not authorized for use in life support devices or systems.
3. Wiring and installation must be in accordance with applicable electrical codes in accordance with the authority having jurisdiction.
4. This is a Class A device and intended for commercial or industrial use. This equipment may cause radio interference if used in a residential area; in this case it is the operator's responsibility to take appropriate measures.
5. The precondition for compliance with EMC limit values is strict adherence to the guidelines specified in this set of instructions. This applies in particular to the area of grounding and shielding of cables.

FCC Notice (USA only)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada Notice (Canada only)

This Class A digital apparatus complies with Canadian ICES-003.

Unpacking, handling and storage



1. Please read this set of instructions. carefully before fitting it into your system.
2. Keep all original packaging material for future storage or warranty shipments of the unit.
3. Do not exceed the specified temperatures.

Before connecting anything

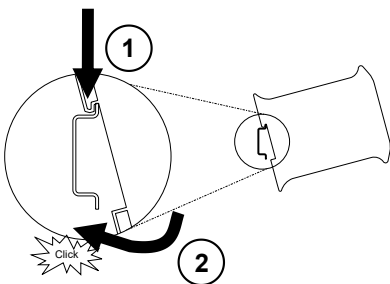


1. Before installing or removing the unit or any connector, ensure that the system power and external supplies have been turned off.
2. Check the system supply voltage with a multimeter for correct voltage range and polarity.

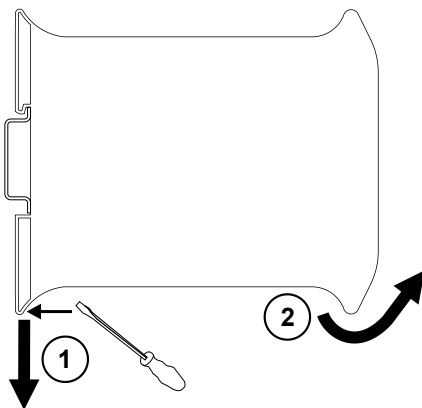
3. Connect the power supply cable and switch on the system power. Check if the Power LED is lit.
4. Turn off system power.
5. Connect all I/O cables.
6. Once you are certain that all connections have been made properly, restore the power.

DIN rail mounting and removal

The MBRG-300 gateway is designed to be mounted on a 35 mm DIN rail according to DIN/EN 50022. The enclosure features a 35 mm profile at the back which snaps into the DIN rail. No tools are required for mounting. Please observe the rules outlined in the section called "Mounting rules".



To mount the unit on a DIN rail, slot the top part of the MBRG-300 into the upper guide of the rail and lower the enclosure until the bottom of the red hook clicks into place.



To remove the MBRG-300 from the DIN rail, use a screw driver as a lever by inserting it in the small slot of the red hook and push the red hook downwards. Then remove the unit from the rail by raising the bottom front edge of the enclosure.

Mounting rules

The enclosure provides protection against solid objects according to IP 20 / NEMA Type 1 protection rating. When mounting the unit observe the following rules:



- No water splash and water drops
- No aggressive gas, steam or liquids
- Avoid dusty environments.
- Avoid shock or vibration

- Do not exceed the specified operational temperatures and humidity range.
- Mount inside an electrical switchboard or control cabinet.
- Make sure there is sufficient air ventilation and clearance to other devices mounted next to the unit.
- Observe applicable local regulations like EN60204 / VDE0113.

Powering the MBRG-300



Before connecting power please follow the rules in the section called “Safety Precautions” and the section called “Before connecting anything”.

Power is supplied via a 3.81 mm 2-pin pluggable terminal block located at the top side of the mounted unit (refer to Figure 2.1, “Location of connectors”). The following table and picture shows the power terminal socket pinout:



Pin	Signal	Function
1	V+	Positive voltage supply (10 - 30 V DC)
2	V-	Negative voltage supply, DC power return

Table 3.1: Power supply connector pinout

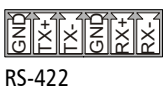
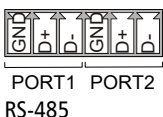


Make sure that the polarity of the supply voltage is correct before connecting any device to the serial ports! A wrong polarity can cause high currents on the ground plane between the V- power supply pin and the serial port ground pins, which can cause damage to the device.

Wiring the RS-485/422 interface

The RS-485/422 port is used for integrating the MBRG-300 into a two-wire or four-wire Modbus over Serial Line network. The use of either the RS-485 or RS-422 interface must be configured using the web interface (See the section called “Configuring Modbus network”). The MBRG-300 is a Modbus Master device on this interface.

The RS-485 and RS-422 signals are located at the 3.81 mm 6-pin pluggable terminal block on the top side of the mounted unit (refer to Figure 2.1, “Location of connectors”). The following table and picture shows the pinout:



Pin	RS-485 signal	RS-422 signal	Description
3	GND	GND	Modbus Common
4	D+ port 1	TX+	Modbus D1 or TXD1
5	D- port 1	TX-	Modbus D0 or TXD0
6	GND	GND	Modbus Common
7	D+ port 2	RX+	Modbus D1 or RXD1
8	D- port 2	RX-	Modbus D0 or RXD0

Table 3.2: RS-485/RS-422 connector pinout

- Line termination is required and is typically done with a 120 Ohm 1/4 W resistor. For RS-485 operation the bus must be terminated at both ends. For RS-422 operation a termination resistor must be inserted between the RX+/RX- signals.
- Maximum number of RS-485 nodes without repeater is 32.
- Stub connections off the main line should be avoided if possible or at least be kept as short as possible. Stub connections must not have terminating resistors.
- Maximum cable length to 1200 m (4000 ft).
- To assure a high degree of electromagnetic compatibility and surge protection the cable should be twisted pairs and shielded. An additional cable conductor or pair may be used for the GND reference.

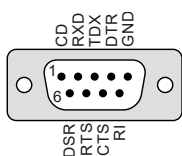


Do *not* connect the cable shield to the GND pins! Use an external chassis ground connection to terminate the shield.

Wiring the RS-232 interface

The RS-232 port can alternatively be used for serial communication to a Modbus Slave device instead of RS-485. The use of the RS-232 interface must be configured using the web interface (See the section called “Configuring Modbus network”). The MBRG-300 is a Modbus Master device on this interface.

The Modbus RS-232 connector is a male 9-pin D-sub type located at the bottom side of the mounted unit (refer to Figure 2.1, “Location of connectors”). It has industry standard EIA-574 data terminal equipment (DTE) pinout as shown in the following table and picture:



Pin	Signal	Function	Direction
1	DCD	(unused)	in
2	RXD	Receive data	in
3	TXD	Transmit data	out
4	DTR	(unused)	out
5	GND	Signal ground	
6	DSR	(unused)	in
7	RTS	(unused)	out
8	CTS	(unused)	in
9	RI	(unused)	in

Table 3.3: Modbus RS-232 connector pinout

- Maximum cable length is 15 m (50 ft) or a length equal to a line capacitance of 2500 pF, both at the maximum standard bit rate of 20 kbps. If operating at higher bit rates the maximum cable length drops to 3 m (10 ft) at a bit rate of 57.6 kbps.
- To assure a high degree of electromagnetic compatibility and surge protection the RS-232 cable should be shielded. The shield shall be connected to an external chassis ground at the either or both ends, depending on the application.

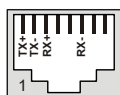
- The shield must *not* be connected to the GND pin.



To connect the MBRG-300 to a PC (Personal Computer) or any other device with data terminal equipment (DTE) pinout you need a null-modem or cross-over cable.

Connecting Ethernet

The following table describes the 10BASE-T Ethernet RJ-45 connector pinout:



Pin	Signal	Function
1	TX+	Non-inverting transmit signal
2	TX-	Inverting transmit signal
3	RX+	Non-inverting receive signal
4		Internal termination network
5		Internal termination network
6	RX-	Inverting receive signal
7		Internal termination network
8		Internal termination network

Table 3.4: Ethernet connector pinout

- We recommend to use Category 5 UTP network cable.
- Maximum cable length is 100 m (3000 ft).

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Chapter 4. Ethernet & IP configuration

Before configuring the MBRG-300, obtain a unique static IP address, subnet mask, and default gateway address from your network administrator.

The factory default IP address of the MBRG-300 is 169.254.0.10 which is in the Automatic Private IP Addressing (APIPA) address range.

There are several methods of configuring the unit's IP address:

1. Removing your PC from your corporate network and using a cross-over network cable (see the section called "IP setup using a web browser and a cross-over network cable").
2. Via the Serial Port 1 and a terminal program like *HyperTerminal* (see the section called "IP setup using a terminal program like HyperTerminal").
3. Leaving your PC connected to your corporate network and temporarily changing the IP settings on your PC to match the subnet of the MBRG-300 (see the section called "Temporarily changing the IP settings on your PC").



In order to connect to the MBRG-300 via TCP/IP, your PC must be on same IP subnet as the gateway. In most situations this means that the first three numbers of the IP address have to be identical.

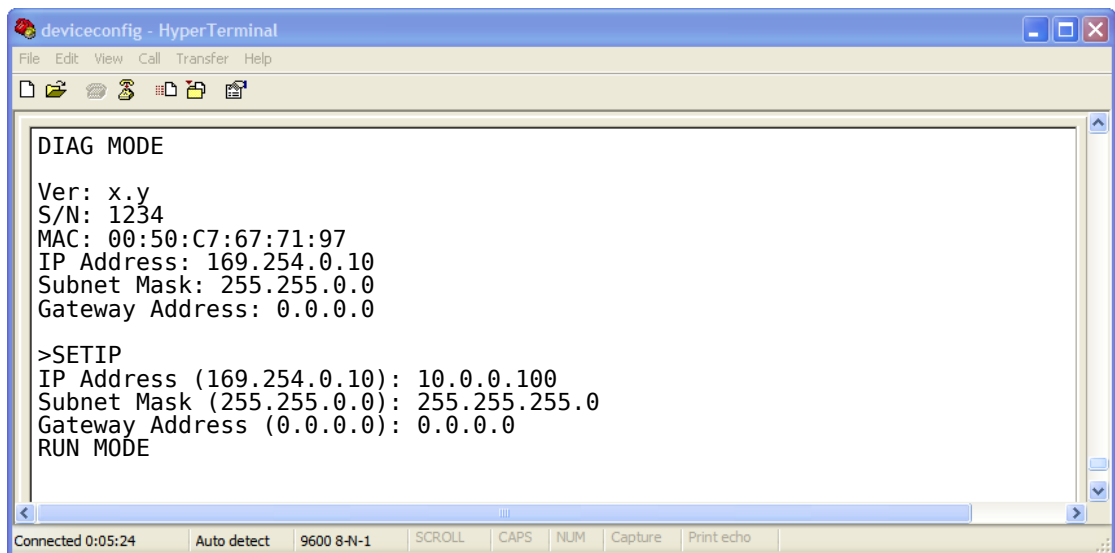
IP setup using a web browser and a cross-over network cable

This method applies only to operating systems like Windows, which support APIPA (Automatic Private IP Addressing). It also requires your PC to be configured for DHCP. If your computer is configured with a static IP address, follow the procedure in the section called "Temporarily changing the IP settings on your PC".

1. Disconnect your PC from your corporate network. If your computer is configured for DHCP it should now automatically fall back to use a default IP address from the APIPA range 169.254.x.x (Windows PCs only).
2. Connect an Ethernet crossover cable from the MBRG-300 to the computer.
3. Start *Internet Explorer*.
4. In the address box, type **169.254.0.10** and then press **Enter**.
5. Click **Configuration...** and then **Ethernet & IP** in the menu on the left side of the page.
6. Enter the IP address, subnet mask, and gateway address assigned to your MBRG-300, then click **save**.
7. Reconnect your computer to your corporate network.

IP setup using a terminal program like HyperTerminal

1. Connect a null modem RS-232 cable between your PC and the MBRG-300's Serial Port 1.
2. In Windows XP, click **Start**, point to **All Programs**, point to **Accessories**, point to **Communications**, and then click **HyperTerminal**.
3. When *HyperTerminal* starts, it opens a dialog box and asks for a name for the new connection. Enter a name (for example, `deviceconfig`) then click **OK**.
4. The **Connect to** dialog opens. Select the COM port you will be using in the **Connect using** drop-down list box, then click **OK**.
5. Select **9600**, **8**, **None**, **1**, **None** in the **COM Properties** dialog, then click **OK**.
6. *HyperTerminal* is now connected to the serial line.
7. Keep the **space** bar pressed in *HyperTerminal* and power-cycle your device at the same time.
8. A menu should appear after one or two seconds showing device information, the current IP configuration and a **>** prompt.
9. Type **SETIP**, then press **Enter** within 10 seconds after the prompt is shown:

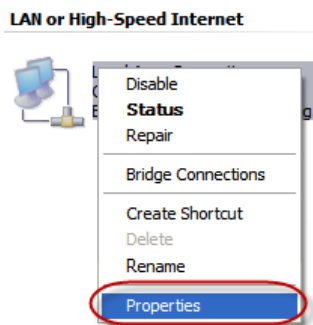


10. The device will show current values and prompt for new values for IP address, net mask and gateway address. Enter the new values and press **Enter**. A key press must be received at least every 10 seconds otherwise the device will go back to *RUN MODE* and resume normal operation.
11. The gateway will return to the main prompt. Type **x** and press **Enter** to leave *DIAG MODE* and resume normal operation indicated with *RUN MODE*.

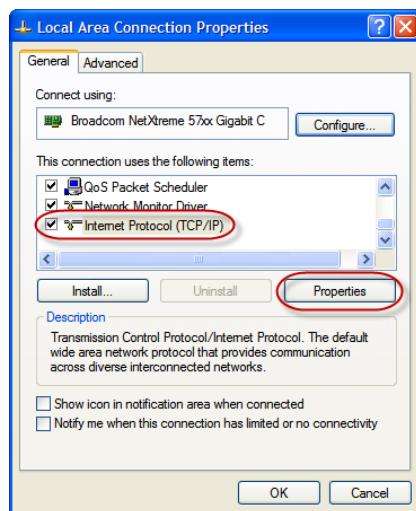
Temporarily changing the IP settings on your PC

This method involves manually assigning an IP address to your PC in the same subnet as the gateway. The default subnet of the gateway is 169.254.0.0/16.

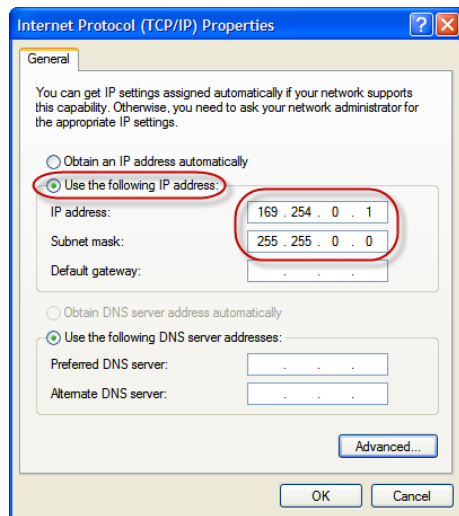
1. Connect the MBRG-300 to your Ethernet network.
2. On a Windows PC, open the Control Panel and double-click on **Network Connections**. Right-click on the Network Connection associated with your network adapter and select **Properties**:



This will show the Local Area Connection Properties Dialog:



3. Select the **Internet Protocol (TCP/IP)** entry and click on **Properties** to open the TCP/IP Properties dialog as shown below:



4. Write down your current settings so they can be restored later.
5. Select **Use the following IP address** and configure a static IP address in the same subnet as the device, for example 169.254.0.1 and the subnet mask 255.255.0.0. Click **OK** to save the changes.
6. Start *Internet Explorer*.
7. In the address box, type 169.254.0.10 and then press **Enter**.
8. Click **Configuration...** and then **Ethernet & IP** in the menu on the left side of the page.
9. Enter the IP address, subnet mask, and gateway address assigned to your MBRG-300, then click **Save**.
10. Restore your computer's original settings.

Chapter 5. Web browser based management

The MBRG-300 incorporates an embedded web server. This allows you to connect to the device and monitor and configure it using a web browser. Most browsers should work, provided they support JavaScript. We recommend *Internet Explorer 6.0* or higher.

Connecting to the MBRG-300

Once you made sure that your PC is configured to be on the same subnet as the MBRG-300, start your web browser. In the address box, type the IP address of your device (169.254.0.10 is the default), and then press **Enter**. (See Chapter 4, *Ethernet & IP configuration*)

The web browser will establish communication with the embedded web server and an overview page similar to the following picture will appear:

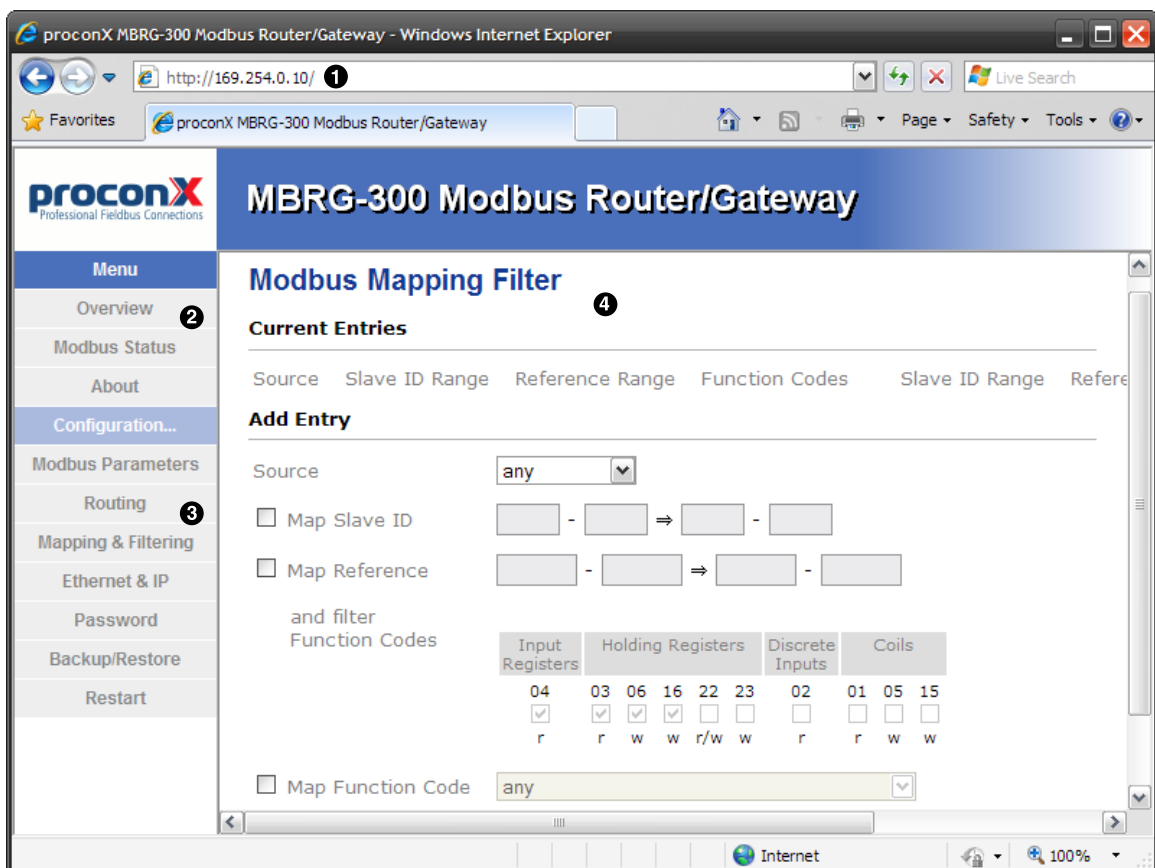


Figure 5.1: Device management and configuration via the web browser

- ❶ Gateway IP address
- ❷ Main menu
- ❸ Configuration sub-menu
- ❹ Information area

Use the menu bar shown on the left side to navigate the different pages.



In order to connect to the MBRG-300 via TCP/IP, your PC must be on same IP subnet as the gateway. In most situations this means that the first three numbers of the IP address have to be identical.

Monitoring and diagnostic

The MBRG-300 offers several web pages which allow monitoring of the status of the different communication networks and the device performance.

Device status

The `Overview` page shows the principal device status as shown in the following picture:



Figure 5.2: Overview page

The value shown in the `Device` row represents the device status register which keeps track of run-time faults. All run-time faults are latched and must be reset by the user. The following faults can be listed here:

OK

The device is fault free.

Watchdog reset

This warning indicates that the device was reset by it's internal watchdog supervision circuit.

Brown out reset

This warning indicates that the device was reset by it's internal supply voltage monitoring circuit. This fault occurs when the supply voltage drops below the lower limit.

Device out of memory

This warning indicates that the internal dynamic memory has been exhausted and due to this a certain function could not be completed.

Device configuration data write failure

This alarm indicates that the configuration data could not be written to the non-volatile memory. Configuration data changes will be lost once the device is power-cycled or reset.

Reset to factory defaults

This alarm indicates that the device's configuration data was reset to factory defaults. The device requires re-commissioning.

Modbus connection status

The **Modbus Status** page shows status and statistics about the Modbus traffic. These values provide valuable information used to troubleshoot Modbus network problems. This page is automatically updated every 5 seconds.

Modbus Status

Serial Line

Port	Requests	Replies	Broadcasts	Exceptions	Total Rx	Rx Err	Rx Overruns	Reply T/o
1	18	0	0	0	0	0	0	17
2	0	0	0	0	0	0	0	0

Ethernet

Socket	TCP Status	Total Cx	Requests	Replies	Exceptions	Rx Err	Tx Err	Cx Err	Reply T/o	Closed
1	CLOSEWAIT	9	8	0	0	0	7	0	0	0
2	CLOSEWAIT	8	8	0	0	0	7	0	0	0
3	LISTEN	3	3	0	0	0	3	0	0	0
4	✓ 169.254.0.11	1	1	0	0	0	0	0	0	0
5	CLOSED	0	0	0	0	0	0	0	0	0
6	CLOSED	0	0	0	0	0	0	0	0	0
7	CLOSED	0	0	0	0	0	0	0	0	0
8	CLOSED	0	0	0	0	0	0	0	0	0

Clear Counter

Figure 5.3: Modbus status page



This page shows accumulated readings since the MBRG-300 was last activated or reset. If power to the MBRG-300 is lost, all cumulative values are reset to zero.

The following statistics are maintained:

TCP status

Status of the Modbus/TCP connection as per TCP finite state machine (refer to RFC 793). If a peer is connected the status indicates `LISTEN`. If a peer is connected, it's IP address is shown.

Total Cx

A counter that increments each time a new Modbus/TCP connection is established.

Requests

Number of request messages processed including broadcast messages. Value represents the standard Modbus *Return Slave Message Count* diagnostic counter.

Replies

A counter that is incremented each time a response message is processed. This value includes exception responses.

Broadcasts

Number of broadcast messages processed. Value represents the standard Modbus *Return Slave No Response Count* diagnostic counter.

Exceptions

Number of exception responses processed. Also includes exception errors detected in broadcast messages even no reply is transmitted in that case. Value represents the standard Modbus *Return Slave Exception Error Count* diagnostic counter.

Total Rx

Number of valid messages the device has detected regardless whether they are addressed to it or not. Value represents the standard Modbus *Return Bus Message Count* diagnostic counter.

Rx Err (Modbus serial line)

A counter that increments each time a message is received with an invalid CRC or otherwise invalid frame or characters. Messages with this error are discarded and not replied to. Typically the result of wiring issues or wrong serial line parameters like baud rate. Value represents the standard Modbus *Return Bus Communication Error Count* diagnostic counter.

Rx Err (Modbus/TCP)

Number of messages received with incorrect MBAP header, incorrect length or a invalid frame structure. The connection is closed after such an error has occurred.

Tx Err

Number time-outs occurred while attempting to send a message. The connection is closed after such an error has occurred.

Rx Overruns

Number of character overrun conditions detected. This error is caused if more characters are received than a Modbus frame can hold. Malformed and incompatible Modbus frames or reflections on the serial line can cause this error condition. Value represents the standard Modbus *Return Bus Character Overrun Count* diagnostic counter.

Reply T/o

Number of time-outs occurred while waiting for or receiving a response. In case of Modbus/TCP the connection is closed after such an error has occurred.

Cx Err

Number of failed connection attempts.

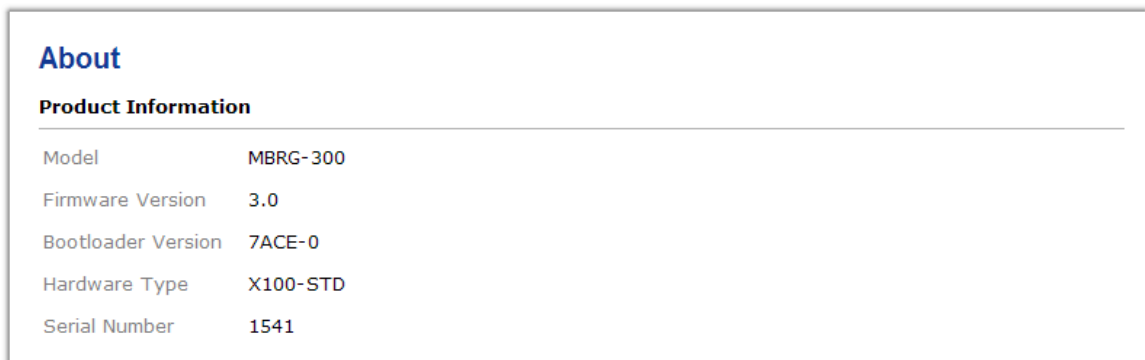
Closed

Number disconnections initiated by a remote client.

The cumulative diagnostic data is reset when the device is power cycled or reset. The data is also reset by pressing the **Clear Counter** button.

Finding the firmware version and serial number

Click on the **About** menu entry on the menu bar to show the product information as shown below:



The screenshot shows a web interface with a title 'About' and a section 'Product Information'. Below this section is a table with five rows of product details.

Product Information	
Model	MBRG-300
Firmware Version	3.0
Bootloader Version	7ACE-0
Hardware Type	X100-STD
Serial Number	1541

Figure 5.4: About page

This product information is important for service and support inquiries. The following product information is provided:

Model

The model name of the product. The Model defines the functionality of the product.

Firmware Version

The firmware version that is installed.

Bootloader Version

The version of the Ethernet bootloader. This is relevant for firmware upgrades.

Hardware Type

Type of hardware the MBRG-300 is based on. The Type is relevant to identify the device for regulatory compliance.

Serial Number

The serial number of the MBRG-300. The serial number is specific to your device.

Configuring and commissioning

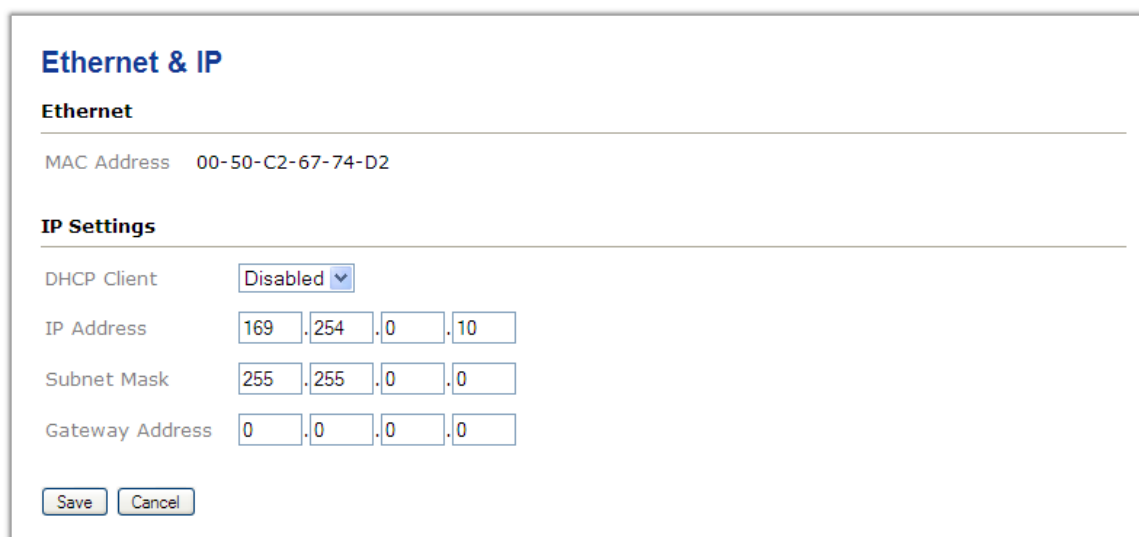
The configuration pages are accessed by clicking on the **Configuration...** menu entry on the menu bar which then expands a configuration sub-menu. All configuration settings are kept in the device' non-volatile memory.



If you make changes to any settings, remember to save each page before changing to a different page!

Configuring Ethernet and IP

Select the **Configuration**→**Ethernet & IP** sub-menu from the menu bar to open the Ethernet and IP settings which are shown below:



Ethernet & IP

Ethernet

MAC Address 00-50-C2-67-74-D2

IP Settings

DHCP Client Disabled ▼

IP Address 169 . 254 . 0 . 10

Subnet Mask 255 . 255 . 0 . 0

Gateway Address 0 . 0 . 0 . 0

Save Cancel

Figure 5.5: Ethernet and IP settings page

The following Ethernet parameters are shown:

MAC Address

The device's unique MAC address. This number is hard coded and cannot be changed.

The following Internet protocol (IP) settings can be entered:

DHCP Client

Select **Enabled** to have the IP address assigned via DHCP. When enabling this option it is important to have a reliable DHCP server available in the network at all times. The MBRG-300 will not communicate without an IP address. A missing IP address is indicated with a distinct LED diagnostic code.

IP Address

The static IP address assigned to this device if DHCP is not used. This IP address is different to the IP address assigned through DHCP.

Subnet Mask (also known as network mask)

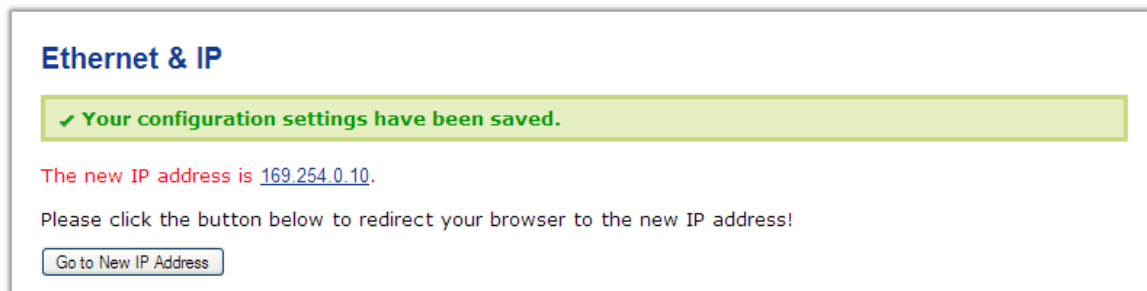
If you have a router, enter the subnet mask for the segment to which this device is attached.

Gateway Address

If your network segment has a router, enter its IP address here. Otherwise leave the address as 0.0.0.0.

Once you click **save** the new settings are stored and applied instantly. Existing TCP/IP connections to the device are terminated and must be re-established using the new IP address.

The new settings are confirmed with the following page:



Ethernet & IP

✓ Your configuration settings have been saved.

The new IP address is [169.254.0.10](#).

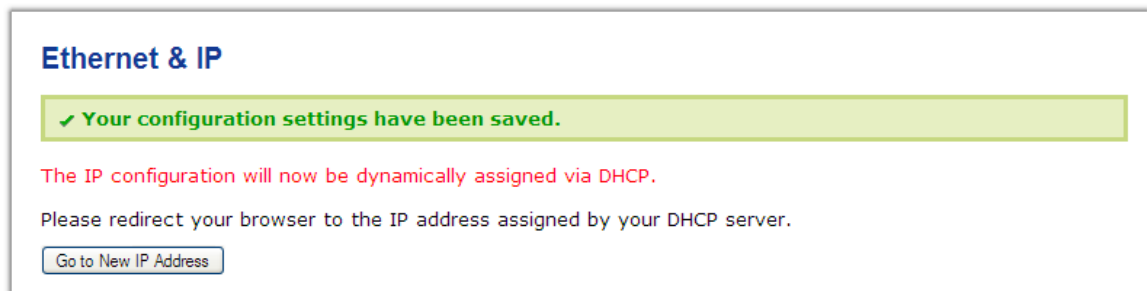
Please click the button below to redirect your browser to the new IP address!

[Go to New IP Address](#)

Figure 5.6: IP settings changed to static IP confirmation



Please write down the new IP address so you are able to communicate with the device in the future!



Ethernet & IP

✓ Your configuration settings have been saved.

The IP configuration will now be dynamically assigned via DHCP.

Please redirect your browser to the IP address assigned by your DHCP server.

[Go to New IP Address](#)

Figure 5.7: IP settings changed to DHCP confirmation

Configuring Modbus network

The Modbus parameters for the serial line can be configured to match the serial line configuration of the other Modbus network nodes.

Select the **Configuration→Modbus Parameters** sub-menu from the menu bar to open the Modbus parameter settings which are shown below:

Modbus Parameters									
Serial Port 1									
Physical Layer	Protocol	Baud Rate	Data Bits	Stop Bits	Parity	Rx Tolerance	Tx Delay	Reply t/o	
RS-485 2-wire	RTU	19200	8	1	even	strict	minimum	1000 ms	

Serial Port 2									
Physical Layer	Protocol	Baud Rate	Data Bits	Stop Bits	Parity	Rx Tolerance	Tx Delay	Reply t/o	
RS-485 2-wire	RTU	115200	8	1	odd	+ 0.25 ms	+ 2 ms	500 ms	

Ethernet	
TCP Port	502
Time-out	1000 ms

Save Cancel

Figure 5.8: Modbus parameters page

The following Modbus parameters can be entered:

Physical Layer

A serial port can utilise the RS-485 (two-wire) , RS-422 (4-wire) or RS-232 interface. The RS-485 interface is selected as default. If the RS-422 interface must be used then serial port 1 is combined with port 2 for 4-wire operation and only one serial port can be used. In this case the second serial port will be disabled. Depending on the physical layer either the D-sub (RS-232) connector or the terminal block connector (RS-485/RS-422) of the MBRG-300 is utilized.

Protocol

Modbus RTU or ASCII transmission mode can be selected. Modbus RTU is the most commonly used protocol and the default setting.

Baud rate

9600 and 19200 are the most common baud rates for Modbus. 19200 is the default setting.

Data bits

Can be configured to be 7 or 8. Must be set to 8 data bits for Modbus RTU.

Stop bits

Can be configured to be 1 or 2. The Modbus Specification mandates that 2 stop bits are configured when using no parity.

Parity

Changes parity mode to either none, even or odd. The default parity mode for Modbus is even parity.

Rx Tolerance

If precise and Modbus conform detection of the silence interval is desired, then this should be set to `strict` which is the default. The timing for the silence detection can be relaxed with this setting by adding small increments. This enables the MBRG-300 to communicate with Modbus devices which may not be fully compliant to the Modbus specification in that respect.

Tx Delay

Modbus defines a minimum spacing between two Modbus messages. This setting enforces additional time to pass before a new message is transmitted by the MBRG-300 unit. Such additional delay may be required in circumstance where a Modbus device requires additional processing time before they can receive the next message.

Reply t/o

The time in milliseconds the MBRG-300 waits for a response before the transaction is aborted and an error is raised. Default is 1000 ms which is recommended in the Modbus Specification for a bitrate of 9600 bps. It is important that the time-out time is sufficiently larger than the time required to transmit, process and receive a message over the serial line.

TCP Port

TCP port number to be used by the Modbus/TCP protocol. Usually the port number remains unchanged and defaults to 502 as per Modbus Specification.

Time-out

The time in milliseconds the MBRG-300 waits for a response on Ethernet before the transaction is aborted and an error is raised. Default is 1000 ms.

Once you click **save** the new settings are stored and applied instantly. A confirmation message is shown.



It is of great importance to ensure that there is not two devices with the same Modbus address. In such a case, an abnormal behavior of the whole serial bus can occur, the master being then in the impossibility to communicate with all present slaves on the bus.



The protocol (RTU or ASCII) and serial port parameters must be the same for all devices on a Modbus serial line.

Remote restarting the device

You can perform a remote restart of the device from the web interface. A remote restart is similar to power cycling the device. Possibly connected clients are disconnected and communication is interrupted until the device has rebooted.

To perform a remote restart, click on the **Configuration** sub-menu and then click on the **Restart** menu entry. This will open the device restart page as shown below:

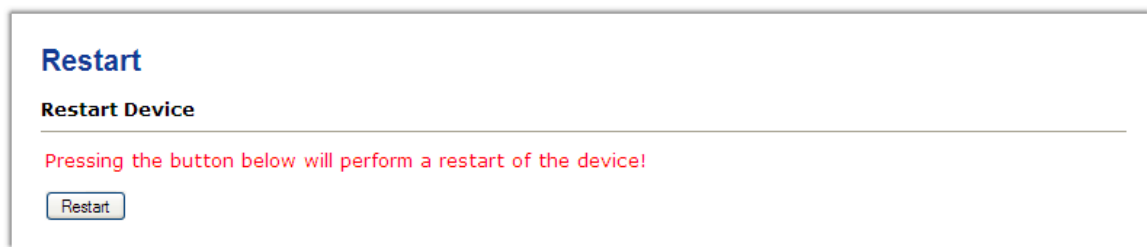


Figure 5.9: Restart device page

Click on the **Restart** button to perform a restart of the device. The restart is confirmed with the following notification:

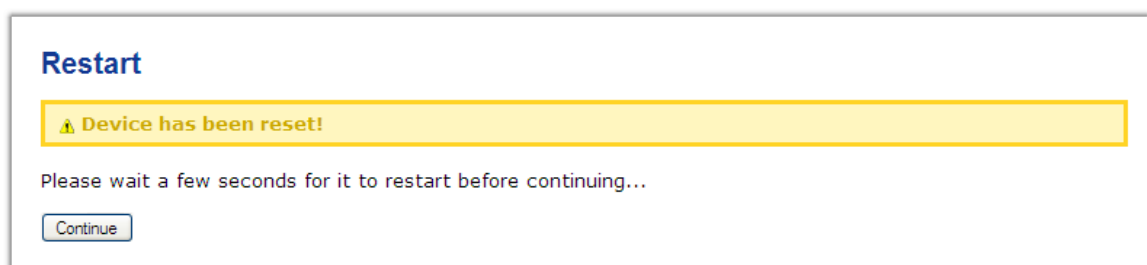


Figure 5.10: Restart confirmation page

Please allow a few seconds before continuing working with the device as it has to fully start-up first, before being able to respond to further web browser requests.

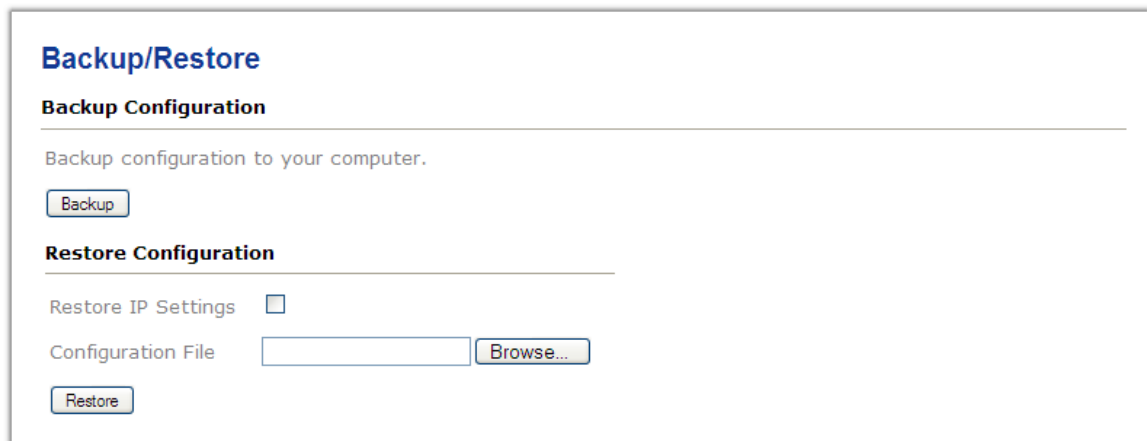


After a remote restart a *Watchdog reset* alarm is shown on the device' home page. This is a side-effect of the remote restart procedure and the alarm shall be ignored and cleared.

Backup and restoring of configuration settings

The MBRG-300 allows configuration settings to be uploaded onto a PC.

This is a beneficial for archiving purposes but also allows easy deployment of similar devices by the means of loading settings from a previously stored reference device.



Backup/Restore

Backup Configuration

Backup configuration to your computer.

Restore Configuration

Restore IP Settings ☐

Configuration File

Figure 5.11: Backup/Restore page

To store the configuration settings on your PC, click on the **Configuration** sub-menu and then click on the **Backup/Restore** menu entry. Then click on **Backup**. Your web browser will open a file download dialog which allows you to save the configuration file on your PC. The file name of the configuration file reflects the model name and the serial number and has the `.config` extension.



In case the configuration is password protected, the username and password will not be stored in the configuration file!

To restore the settings from a configuration file, click on the **Browse** button and select a `.config` file matching the model of your device. Then click on **Restore**.

There are two options to restore a previously saved configuration set:

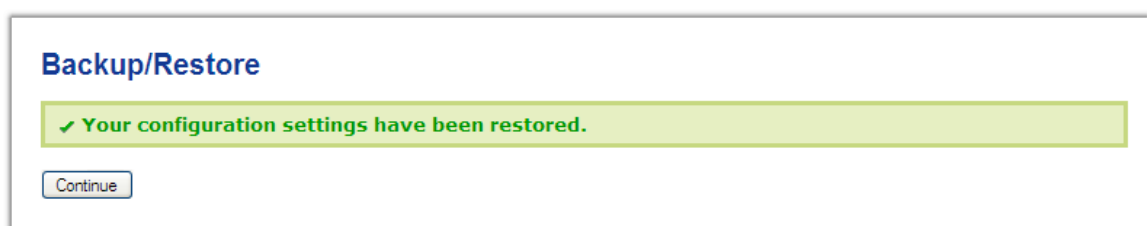
Restore IP Settings un-checked

Default. All but the IP settings are restored. This option is useful when device settings shall be duplicated onto another device which will operate on the same network and hence requires its own distinct IP settings.

Restore IP Settings checked

The complete settings are restored. This option is useful if a device is replaced with a new device and the new device should inherit the previously set IP address.

The successful restoration of configuration settings is confirmed with the following message:



Backup/Restore

✓ Your configuration settings have been restored.

In case of an error message, the settings may have only been partially restored and it is important to review all the settings for correctness.

Password protection

Access to the configuration pages can be protected with a password. To configure a password, click on the **Configuration** sub-menu and then click on the **Password** menu entry.

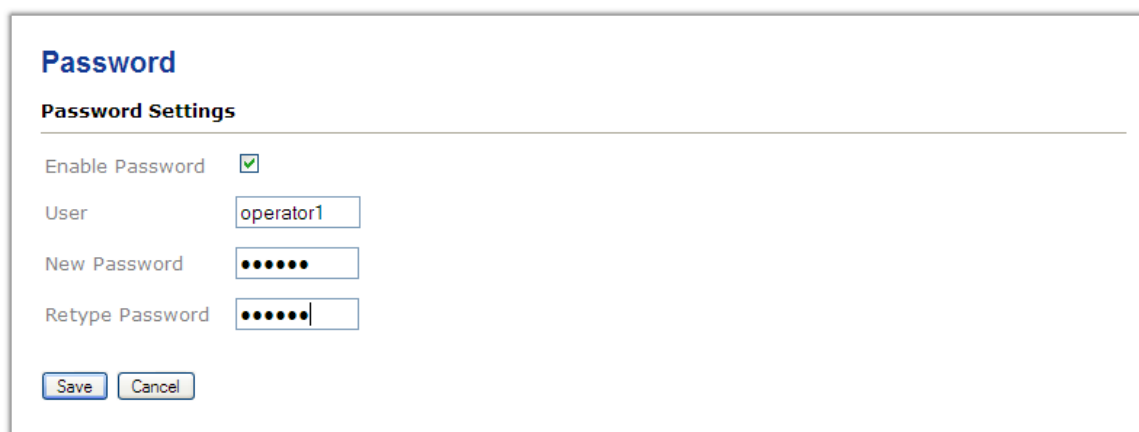


Figure 5.12: Password page

To enable a password, check the **Enable Password** checkbox and enter a user name and a password in the form. The password must be entered twice to make sure it is typed correctly. Click **save** to confirm the password.

Only one password protected user can be configured. If a new user and password is entered the previous user name is deleted.



Make sure you record or memorize the username and password before you press the **save** button! The only way to recover from a lost password is by resetting the device to factory defaults which requires physical access to the device.

To log on to password protected configuration pages, click on a configuration menu entry. The web browser will open a password dialog similar to the one shown below:

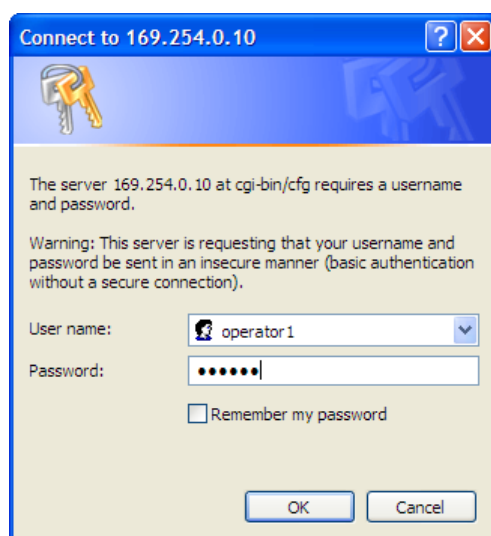


Figure 5.13: Authentication dialog

To remove password protection, log on, uncheck the **Enable Password** checkbox and click **save** to confirm.

Firmware upgrade

The unit's firmware can be upgraded via Ethernet.

Please contact us for an *Application note* describing the upgrade procedure and for required software tools.

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Chapter 6. Decommissioning

Before disconnecting the MBRG-300 unit please follow the rules in the section called "Safety Precautions".

Disconnecting



1. Ensure that the system power and external supplies have been turned off.
2. Disconnect power supply plug.
3. Disconnect all I/O cables.
4. Remove the MBRG-300 from the DIN rail following the procedure described in the section called "DIN rail mounting and removal".

Disposal



This product must be disposed of at a specialized electronic waste recycling facility. Do not dispose of in domestic waste.

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Appendix A.Specifications

Product name	MBRG-300
Interfaces	
Ethernet	1
Serial ports	2, software configurable as either 2 x RS-232 or 2 x RS-485 or 1 x RS-232 + 1 x RS-485 or 1 x RS-422
User interface	
LED indicators	Power (green), Ethernet link (green), 2 status (bi-color red/green)
Monitoring & configuration	Web browser based
Diagnostic	
High availability features	Watchdog supervision, brown-out detection
Serial Port 1 RS-232 interface	
Connector	male 9-pin D-sub, DTE, EIA-574 pin-out
Physical layer	EIA-232-F
Isolation	non-isolated
Signals	RXD, TXD, RTS, CTS, DTR, DSR, DCD, RI
Speed	300, 600, 1200, 2400, 4800, 9600, 19200, 57600, 115200 bps
Protocols	Modbus RTU (master), Modbus ASCII (master)
Serial Port 1 RS-485/RS-422 interface	
Connector	3.81 mm 6-pin pluggable terminal block header
Physical layer	EIA-485-A, 2-wire or 4-wire
Isolation	non-isolated
Speed	300, 600, 1200, 2400, 4800, 9600, 19200, 57600, 115200 bps
Max. number of nodes	32
Protocols	Modbus RTU (master), Modbus ASCII (master)
Serial Port 2 RS-232 interface	
Connector	male 9-pin D-sub, DTE, EIA-574 pin-out
Physical layer	EIA-232-F
Isolation	non-isolated
Signals	RXD, TXD
Speed	9600 bps
Protocols	Modbus RTU (master), Modbus ASCII (master)
Serial Port 2 RS-485 interface	
Connector	3.81 mm 6-pin pluggable terminal block header
Physical layer	EIA-485-A, 2-wire
Isolation	non-isolated
Speed	300, 600, 1200, 2400, 4800, 9600, 19200, 57600, 115200 bps
Max. number of nodes	32
Protocols	Modbus RTU (master), Modbus ASCII (master)
Ethernet port	
Connector	8-pin RJ-45 socket for Cat 5 UTP
Physical & Data Link Layer Layer	IEEE 802.3i 10BASE-T
Isolation	1.5 kV galvanic

Speed	10 Mbit/s
Max. cable length	100 m (328 ft)
Ethernet frame types	802.3
Protocols	Modbus/TCP slave, HTTP, IP, TCP, DHCP, NBNS, ARP
Concurrent connections	4 Modbus/TCP slave, 2 HTTP
Power supply	
Connector	3.81 mm 2-pin pluggable terminal block header
Voltage	10-30 V DC
Current	30 mA typical @ 24 V DC
Intrinsic consumption	750 mW
Electromagnetic compatibility	
Emissions (radiated and conducted)	AS/NZS CISPR 22 / EN 55022 (Class A)
Immunity	EN 55024
Electrostatic discharge	EN 61000-4-2
Radiated RF	EN 61000-4-3
Fast transients	EN 61000-4-4
Conducted RF	EN 61000-4-6
Enclosure	
Material	Self-extinguishing PC/ABS blend (UL 94-V0)
Mounting	35 mm DIN rail (EN 60715)
Classification / Type rating	IP 20 / NEMA Type 1
Cooling	Convection
Environmental	
Operating temperature	0 to 60 °C / 32 to 140 °F
Storage temperature	-25 to 85 °C / -13 to 185 °F
Humidity rating	10 to 95% relative humidity, non condensing
Operating ambience	Free from corrosive gas, minimal dust
Physical	
Dimensions	101 x 22.5 x 120 mm / 3.98 x 0.886 x 4.72 in
Weight	0.12 kg / 0.265 lb
Compliance	
Australia	C-Tick
Europe	CE, RoHS
USA	FCC Part 15 (Class A)
Canada	ICES-003 (Class A)

Dimensions

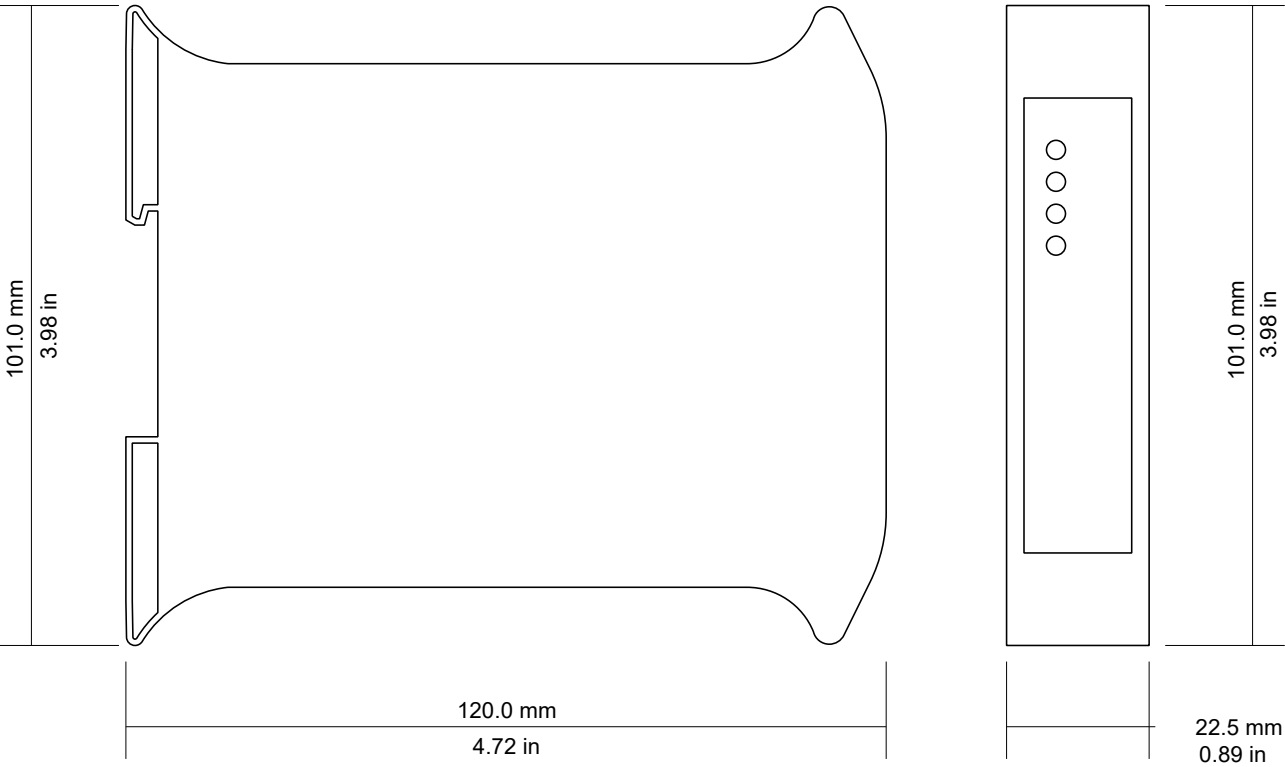


Figure A.1: Enclosure dimensions

Glossary

RTU

Remote terminal unit. Also used to designate a protocol variant of Modbus.

Modbus

Fieldbus protocol used in the process automation industry. It uses a master and slave structure. Originally developed by Modicon, now part of Schneider Automation.

Master

Active communication device, controls the bus access.

Slave , slave

Passive communication device, answers to the master

10BASE-T

10 Mbit/s twisted pair Ethernet standard. Standardized in IEEE 802.3i.

APIPA

Automatic Private IP Addressing

Class A

Class A equipment is that used in commercial or light industrial environments.

DIN

German Institute for Standardization

DIN rail

35 mm wide mounting bracket standardized in DIN/EN 50022.

DTE

Data terminal equipment. DTE and DCE devices have different pinouts for RS-232 connectors. A PC for example is a DTE.

EIA

Electronic Industries Alliance. Standard organisation for serial communication.

EIA-232

Standard for serial transmission of data between two devices, also known as RS-232 and V.24.

EIA-422

ANSI/TIA/EIA-422 standard for serial transmission of data between two devices, also known as RS-422 and V.11.

EIA-485

ANSI/TIA/EIA-485 standard for serial transmission of data between multiple devices, also known as RS-485.

EIA-574

Standard for the pinout of serial D-sub connectors.

EMC

Electromagnetic compatibility

EMI

Electromagnetic interference

EN

European standard

ESD

Electrostatic discharge

Ethernet

The standard for local area networks developed jointly by Digital Equipment Corp., Xerox, and Intel. Ethernet is used as the underlying transport vehicle by several upper-level protocols, including TCP/IP.

Fieldbus

Digital communication network used to connect process instrumentation and control systems.

Frame

A single block of data transmission from a device.

Gateway

A network device that passes data between different networks or fieldbuses. It is different to a Bridge in that protocol conversion occurs above the application layer rather than in the datalink layer.

Gateway address

The IP address of the gateway or router used to access the Internet from the local are network.

HMI Human-Machine Interface	RS-232 See <i>EIA-232</i> .
IEEE Institute of Electrical and Electronics Engineers	RS-422 See <i>EIA-422</i> .
IP Internet Protocol	RS-485 See <i>EIA-485</i> .
IP Ingress Protection Rating according IEC 60529. Standard for various grades of electrical enclosures.	SCADA Supervisory Control and Data Acquisition
IP address A numeric address used by computer hosts to transmit and receive information over the Internet.	Subnet mask A numeric address used in conjunction with an IP address to segment network traffic; used to restrict transmissions to certain subnets.
ISO International Standards Organisation	Switch A device that facilitates transmissions between nodes in a star-formed network
KiB, KiByte 1024 bytes. The SI standard recommends the usage of the binary unit prefix <i>Ki</i> for 1024.	TCP/IP Transport Control Protocol/Internet Protocol. Connection-orientated transfer protocol.
MAC address Every piece of Ethernet hardware has a unique number assigned to it called it's MAC address. MAC addresses are administered and assigned by the IEEE organization.	TIA Telecommunications Industry Association. US trade association and standardization committee.
NEMA National Electrical Manufacturers Association. NEMA defines standards for various grades of electrical enclosures.	UL 94 Plastics flammability standard released by Underwriters Laboratories of the USA.
Node A communications device on the network.	Watchdog A fail-safe mechanism which resets a device if it becomes unresponsive.
PC/ABS Polycarbonate-ABS. Widely used thermoplastic material.	
Physical Layer This layer defines everything required to make a physical connection to the network or fieldbus.	
PLC Programmable Logic Controller	

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