

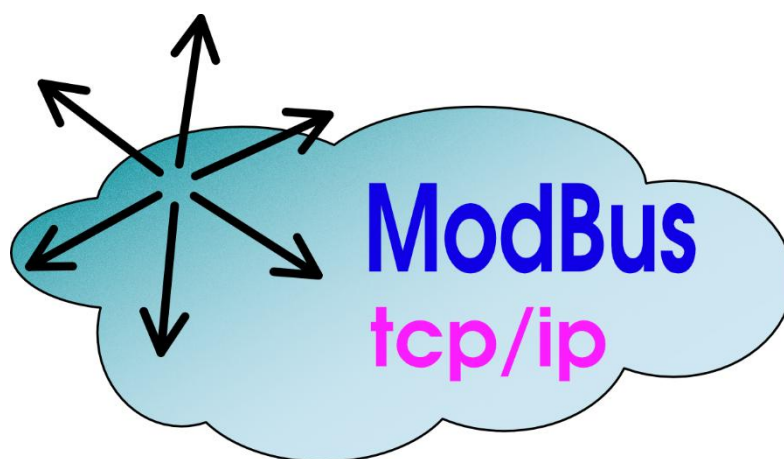


MOBILAN

Configuration documentation

Version: 2.0

July 25, 2026



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Table of Contents

1	Description.....	1
1.1	Function	1
1.2	Relationship between Modbus RTU and TCP	2
1.3	Method of connecting to the internet.....	3
2	Configuration	4
2.1	First startup.....	4
2.2	Meaning of the parameter settings on the Modbus-TCP side.....	5
2.3	Meaning of the parameter settings on the Modbus-RTU side	7
2.4	Meaning of the parameter settings on the Ethernet side	8
2.5	Changing the login password.....	9
2.6	HW device reset	9
	RawetStudio2 and Modbus-TCP communication	10
2.7	Description of the Modbus-TCP application	10
2.8	Configuring Rawet converters via Modbus-TCP	11
2.9	Example of sending a command via Modbus-TCP	12
3	Technical parameters of the MOBILAN converter	13

1 Description

1.1 Function

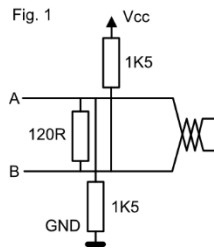
The converter is used for bidirectional communication with Modbus-RTU converters over an Ethernet line. At the point of installation and connection to the Ethernet line, it creates an independent RS485 line and translates commands from Modbus-TCP to Modbus-RTU, and responses in the opposite direction. The device provides Master–Slave communication, where the master can be located on the internet.

From serial number 4608001 onward, the option to switch the communication direction was added, i.e. translation from Modbus-RTU to Modbus-TCP. More detailed information can be found [in section 1.3](#).

The device is powered by a DC voltage of 8..30V DC. The negative supply pole also serves as GND for the RS485 line (defining the reference potential for the differential inputs A, B).

The converter has a fixed line-termination resistor with a value of 120R, and bias resistors defining the idle state of the line with a value of 1K5 (see fig.1).

The termination and biasing resistors are a fixed part of the converter's circuitry and cannot be disconnected. Keep this in mind when designing the network, and do not add another external 120Ω termination resistor if a MOBILAN unit is already at the end of the line.

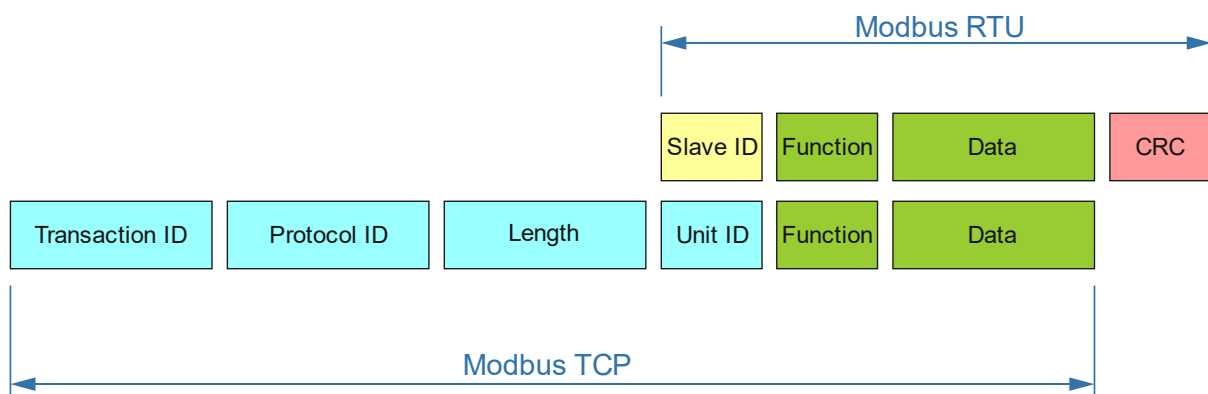


In this way, converters can be operated at a speed of 19,200 Bd for line lengths of up to approximately 500m. More detailed information can be found (John Griffith, 2016).

<https://www.ti.com/document-viewer/lit/html/SSZTBJ6>

1.2 Relationship between Modbus RTU and TCP

Modbus TCP is an extension of Modbus RTU that allows communication over an Ethernet network. This communication can only be initiated from the internet side. Each device on the Ethernet network has its own IP address. Since this is TCP/IP communication, in addition to the address, a TCP port must also be defined. Port 502 was selected for Modbus-TCP. This can in principle be changed, but it is then necessary to consider whether it collides with another service. In practice, this therefore usually does not happen. The Modbus TCP message itself consists of a Modbus RTU command without the CRC (TCP/IP transport security is used instead) and a special header that precedes it.



The header contains the following fields:

Transaction Identifier: The Master device sets 2 bytes to identify the message, and the Slave also uses this identifier in its response, since responses are not always received in the same order in which they were sent.

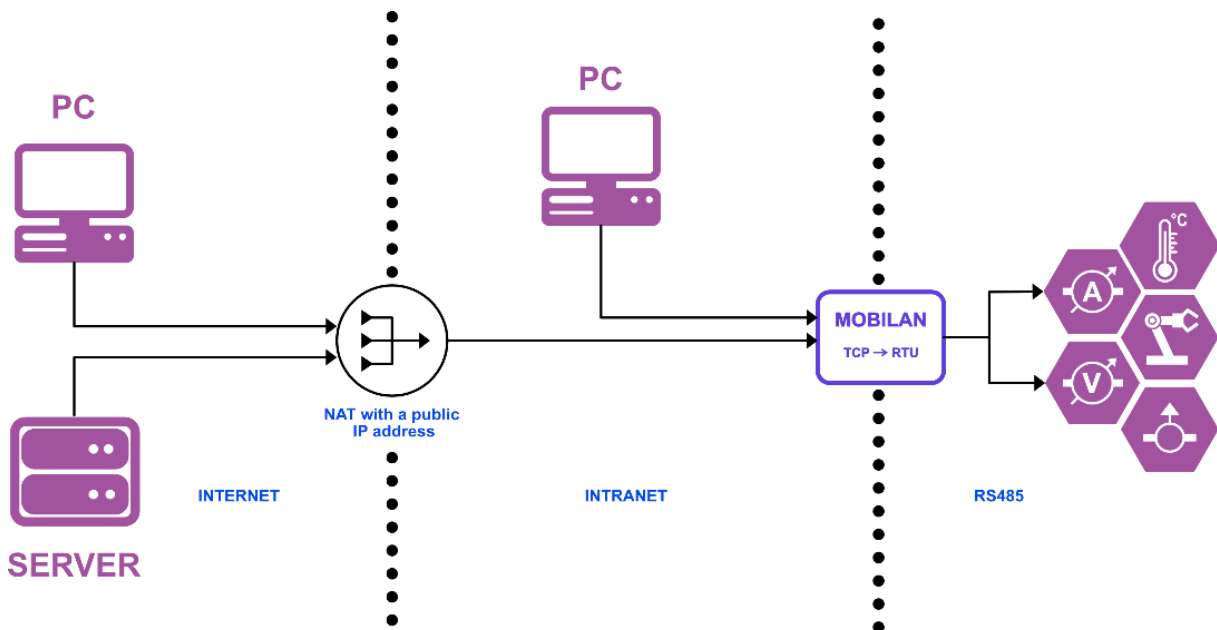
Protocol Identifier: The Master device always sets 2 bytes to the value 0000_h which identifies the Modbus TCP protocol.

Length: The Master device sets 2 bytes specifying the number of bytes in the following message. It is counted from the Unit Identifier to the end of the message.

Unit Identifier (device address): The Master device sets 1 byte in which it repeats the unit identifier. This is used to identify the required Slave device in the Modbus command.

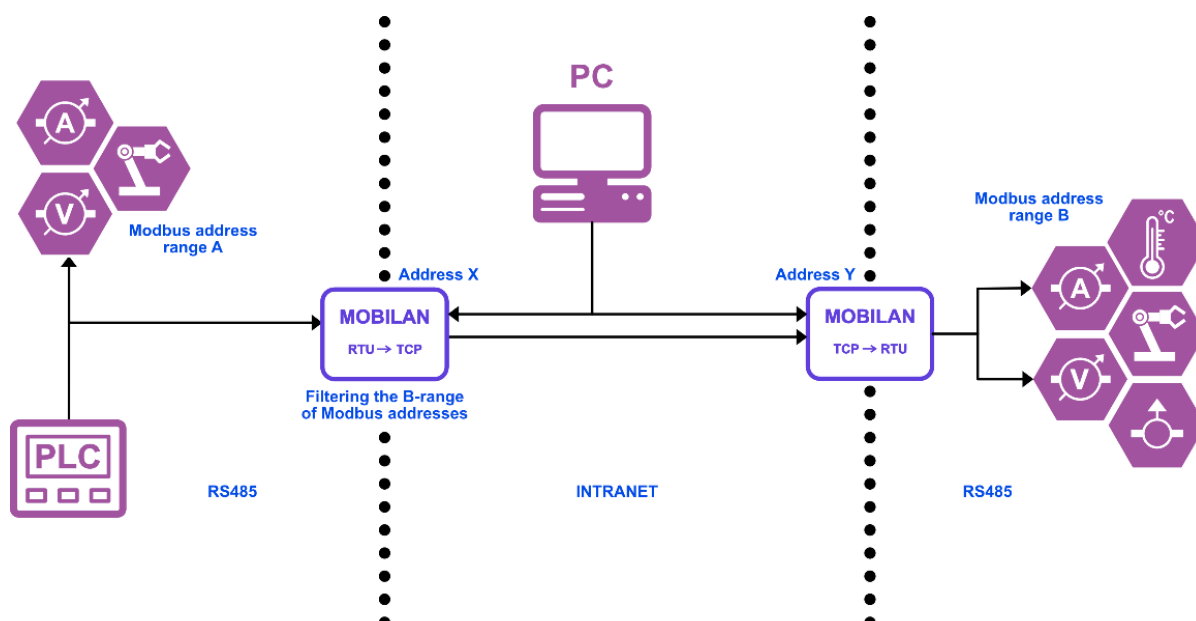
1.3 Method of connecting to the internet

The topology itself and an example of connecting to the internet are shown in the following figure. The unit allows two basic types of installation - local and internet-based. For local communication within an intranet, standard network elements (mainly switches) are used. If remote access is required, it must be possible to address the device from an external network. Due to the shortage of public addresses, the NAT principle is typically used on some external device, where one of the NAT's ports is forwarded to port 502 of the MOBILAN device. Since standard TCP transport is used, it is also possible to use other technologies used in network applications - VPN, SSH tunneling, and similar.



Due to the simplicity of IoT units, the unit provides only basic protection - administration is password-protected, and access is protected by allowed IP addresses. The unit is therefore not suitable for placement on the open internet under a public IP address. Modbus-TCP communication is, by definition, unencrypted, and data spoofing in either direction (man-in-the-middle) cannot be ruled out. Protection must be implemented using restrictive network rules, typically routing, VPN, VLAN, and tunnels (depending on the network scope and the importance of the application).

From serial number 4608001 onward, new functionality was added to the device: reversal of the transfer direction. That is, in this configuration, the device converts packets from Modbus-RTU to Modbus-TCP. A possible use is indicated in the following diagram. For the actual setup, it is then necessary to use two MOBILAN devices with different addresses and different packet routing. This separates part of the Modbus-RTU address space. However, to avoid conflicts, this range must be filtered, as indicated in the diagram.



2 Configuration

2.1 First startup

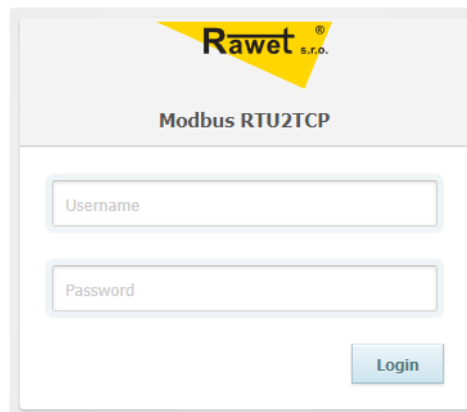
The device is shipped from the factory with the following parameters:

On the Ethernet side	IP address:	192.168.25.102
	Netmask:	255.255.255.0
	Gateway:	192.168.25.1
	Modbus TCP listen port	502
On the MODBUS side	Modbus RTU baudrate	19200 Bd
	Modbus RTU word length	9B
	Modbus RTU parity	EVEN
	Modbus RTU stop bits	1b
	Modbus RTU oversampling	16b
Packet routing	TCP -> RTU	

The mentioned default IP address and Modbus-RTU settings are marked on the converter's housing. In case a DHCP server is used in the future to assign the IP address, the device's MAC address is also indicated there.

For the initial setup, the device must be connected both to the Ethernet line via the RJ45 connector and to the supply voltage. The RS485 line does not need to be connected. The device can be configured via the web interface by entering the corresponding IP address into the browser's address bar (e.g.: <http://192.168.25.102>). It is clear that the device from which this is done must be part of the same address space as the device being configured, so it is necessary to manually change the IP address of your computer, e.g., to 192.168.25.100.

After correctly connecting and entering the address 192.168.25.102, the browser will open showing the following page.

The image shows a web browser window displaying the login page for a device named 'Rawet s.r.o. Modbus RTU2TCP'. The page has a light gray header with the 'Rawet s.r.o.' logo on the left. Below the header, the title 'Modbus RTU2TCP' is centered. The main content area is white and contains two input fields: 'Username' and 'Password', both with placeholder text. A blue 'Login' button is positioned to the right of the password field.

There is one user in the system (Username) **admin** and the username cannot be changed. The default password (Password) is also **admin** and we strongly recommend changing it

After entering the correct login credentials, the configuration web page opens. It has a total of three tabs.

2.2 Meaning of the parameter settings on the Modbus-TCP side

Configuration tab

On this tab, we can change the IP address so that it is part of our required address space. In addition to the IP address and mask (in most smaller networks this will be 255.255.255.0), the gateway must also be set. You can simplify this setup by using DHCP and setting a fixed IP address on the DHCP server (e.g., on the network router)

The first 5 items on the first tab of the configuration website relate to Ethernet. The relationship between the IP address, Netmask, and Gateway probably does not need explanation. However, if we select Enable DHCP, these three parameters are assigned by the server. For correct operation going forward, it is necessary to define them as static on the DHCP server. The MAC address shown on the device's side label can help with identification.

The Modbus TCP listen port is set to 502, and for better traffic identification, it is recommended not to change it. Aside from port 80, which is used for web administration, all valid ports can be used.

Param	Value
Enable DHCP	☐
IP Address	192.168.25.120
Netmask	255.255.255.0
Gateway	192.168.25.1
Modbus TCP listen port	502
Modbus RTU timeout	1000
Modbus RTU baudrate	19200
Modbus RTU word length	9B
Modbus RTU stop bits	1
Modbus RTU parity	Even
Modbus RTU oversampling	16
Gateway Mode	TCP→RTU

Attention!
The parity bit must always be added to the word length. For 8E1 and 8O1 the word length there is 9 bits. For 8N2 there is only 8 bits.

Save

At the end of the table, the transfer direction, Gateway Mode, is defined. By default and most commonly used is the TCP->RTU direction.

After changing to RTU->TCP, additional parameters are added for configuration, namely TCP Server IP = the address of the device to which TCP packets will be routed, and TCP Server Port = the port on which communication will take place. We recommend leaving it at 502.

Gateway Mode	RTU→TCP
TCP Server IP (RTU→TCP)	192.168.25.102
TCP Server Port (RTU→TCP)	502
Remote addresses (behind ETH)	1-5

Only Modbus unit addresses in these ranges (behind ETH) are forwarded from RTU to Ethernet, e.g. 5-12, 20, 33-40. Leave empty to forward all addresses.

Attention!
The parity bit must always be added to the word length. For 8E1 and 8O1 the word length there is 9 bits. For 8N2 there is only 8 bits.

Save

The last parameter is the Modbus address filter. Three ranges are available, entered in the form (27-29, 45-50, 100). Only packets with these addresses will be transferred from RTU to TCP. If nothing is entered in the field, the entire Modbus address range is passed through. This option can be used if there are no devices on the RTU side near the main controller. In that case, conflicts cannot occur. If we were to send a packet to TCP with an address that exists before the RTU->TCP converter, the unit will respond correctly, but an error message will also occur from TCP, because no element with that address exists there.

2.3 Meaning of the parameter settings on the Modbus-RTU side

The Modbus-RTU line parameter settings are located at the bottom of the first tab of the configuration website.

Modbus RTU timeout	1000
Modbus RTU baudrate	19200
Modbus RTU word length	9B
Modbus RTU stop bits	1
Modbus RTU parity	Even
Modbus RTU oversampling	16

Save

The meaning of the individual parameters follows from knowledge of Modbus-RTU communication, so only a few clarifications are given here.

RTU timeout: timeout duration in milliseconds

RTU baudrate: the following values are possible: 2400, 4800, 9600, 19200, 38400, 57600, 115200Bd

For the combination of parity and stop bits, only the combinations 8E1, 8O1, 8N2, and 8N1 are possible

RTU word length: the word length is always 8 bits + parity bit, so it is 9B for 8E1 and 8O1, and 8B for 8N1 and 8N2

RTU oversampling there is no reason to change this parameter; it represents the number of samples used to determine 1 bit in the signal and their processing according to given rules. Considering the speed, it makes sense to reduce this value to 8 for speeds of 57600 and 115200Bd; otherwise, leave it at 16.

Finally, we must write the configured parameters to the device and perform a RESET. Only then can we make a new connection, e.g., with the new IP address.

2.4 Meaning of the parameter settings on the Ethernet side

Access tab

On the second configuration tab, it is necessary to specify the address range and address mask so that the given device and gateway can be accessed. The type xxx.xxx.xxx.0/24 for your entire network is most commonly used. If you want to allow only one specific device, enter the address with a /32 mask (e.g., 192.168.25.100/32)

If Remote IP and Mask are not set, the device allows all ranges of internal IP addresses.

IP: Mask:

192.168.0.0/0 16

10.0.0.0/0 8

172.16.0.0/0 12

For security reasons, we recommend entering your own range and deleting the others.

 **Modbus RTU2TCP**

Configuration

Access

Password

Log out

Delete	Remote IP		Mask
	192.168.25.0	/	24
		/	

Save

Please enter IP address with integer mask where you can access from. For example, if you want to access from addresses 192.168.1.XXX, add 192.168.1.0 / 24. To allow access from all addresses, add 0.0.0.0 / 0 (not recommended for security reasons).

It is also possible to make a strict configuration, see fig.

Delete	Remote IP		Mask
	192.168.25.146	/	32
	192.168.25.120	/	32

Where the first address is the device from which we will perform the configuration, and the second is the address from which Modbus-TCP packets arrive. The device will not respond to any other traffic, so nothing can be spoofed.

After configuration, the parameters must be saved again. A restart is not necessary; the device starts filtering packets immediately after saving.

2.5 Changing the login password

Password tab

The last change we recommend making is changing the Password. This change is made on the third tab.

Note: If information about the IP address setting and Password is lost, it is not possible to communicate with the device, and a HW device reset must be performed ([Device reset 2.6](#))

Rawet Modbus RTU2TCP		Configuration	Access	Password	Log out
New HTTP password					
Repeat new HTTP password					
Save					

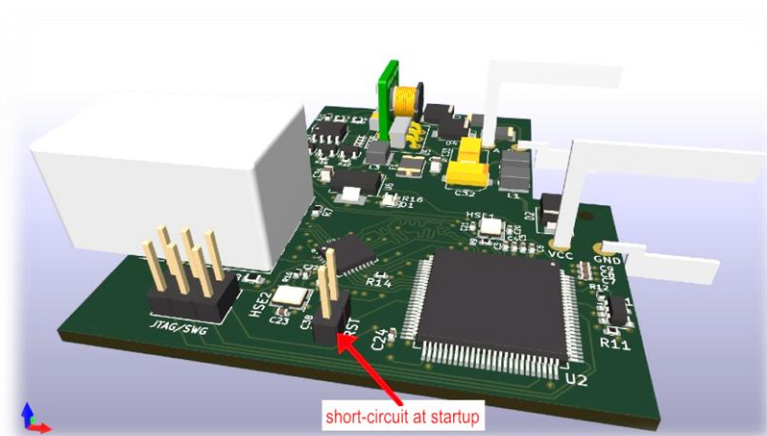
2.6 HW device reset

If you do not know the device's IP address setting or Password, a full device reset can be performed. You can entrust this to the manufacturer, Rawet s.r.o., or, assuming basic manual skill, do it yourself.

Disconnect the device and place it on a table. Using a thin screwdriver, first remove the front label, which is held in place by latches in the side openings. Continue by separating both side panels.

This gives access to the main board, on which the RST SW is marked in the photograph. Short the indicated switch and connect the supply voltage. After approximately 2s, you can remove the shorting jumper. This starts the program with the connection parameters shown on the label and the default PASSWORD.

The next step is to proceed the same way as when connecting for the first time. We enter the required parameters and save them to the device. See [First startup](#).

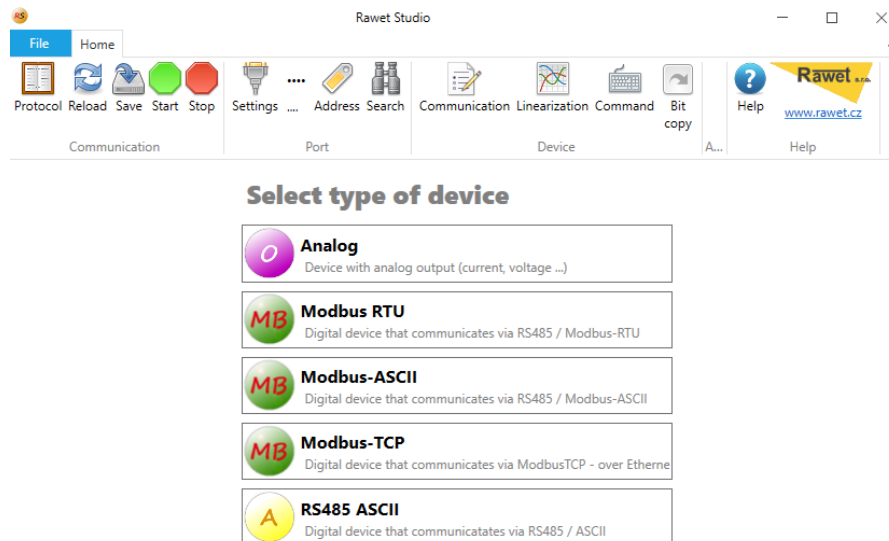


ATTENTION: Until we change the parameters and write them to the EEPROM, the EEPROM memory still contains the old, and therefore unknown, parameters. These will be reloaded on the next startup without shorting the RST SW, and the device will remain unknown to us.

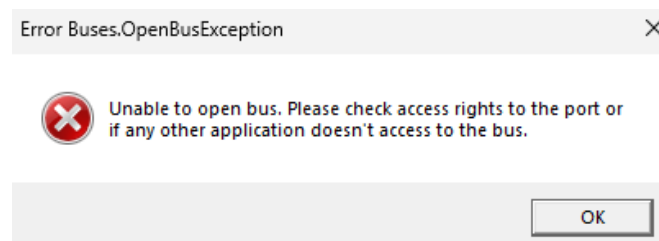
RawetStudio2 and Modbus-TCP communication

2.7 Description of the Modbus-TCP application

The Modbus-TCP protocol was added to Rawet s.r.o.'s RawetStudio program. After starting the program, it is necessary to specify which protocol will be used to communicate with the converters.



Here you can select the desired Modbus-TCP. On the first startup, there is likely no device at the default address supporting this protocol, nor a converter connected to it. This will result in an error message



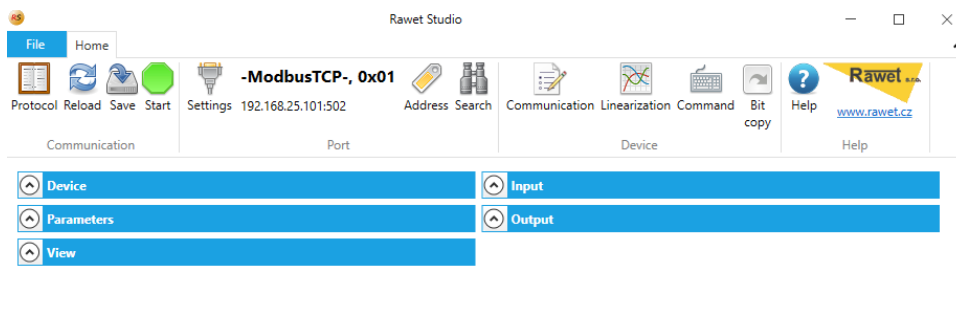
This error is caused either by incorrect Ethernet communication settings or by incorrect access rights settings.

Troubleshooting procedure:

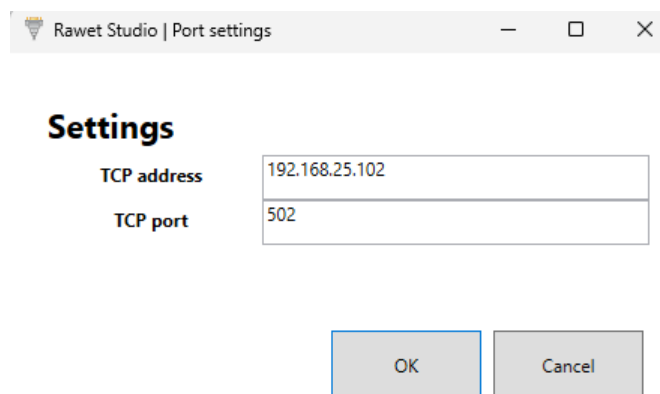
Is it possible to connect to the device via "ping 192.168.25.102" in the command line (or your configured address)? -> if not, the device's IP address is set incorrectly, or there is an issue somewhere in the router

Ping succeeds, but the connection does not? -> Likely an incorrect port or access rights

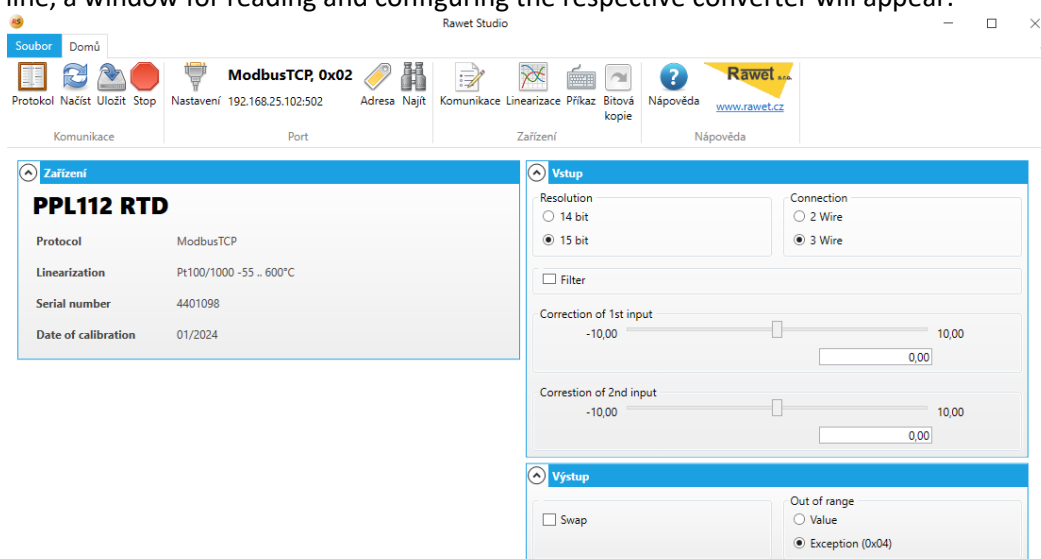
Errors during communication? -> check the Modbus TCP section settings. After troubleshooting and setting the new parameters, confirm with OK and check the highlighted settings



If it does not match reality, use the Settings icon to make a correction.



After entering the correct parameters, including the address and Modbus-RTU communication parameters, press the Start icon. If everything was entered correctly and the correct device is on the RS485 line, a window for reading and configuring the respective converter will appear.



2.8 Configuring Rawet converters via Modbus-TCP

If the internet address and TCP port are correctly configured, all settings behave exactly as if the device were connected to a local RS485 line.

We are not restricted in any setting. It is possible to change linearization, communication parameters, and all other available settings.

Attention!

Changing the communication parameters is somewhat more complicated. It can be changed, but it is necessary to keep in mind that in that case we must also change the communication parameters in the MOBILAN converter (see 2.3). Only then can communication with the converter be re-established.

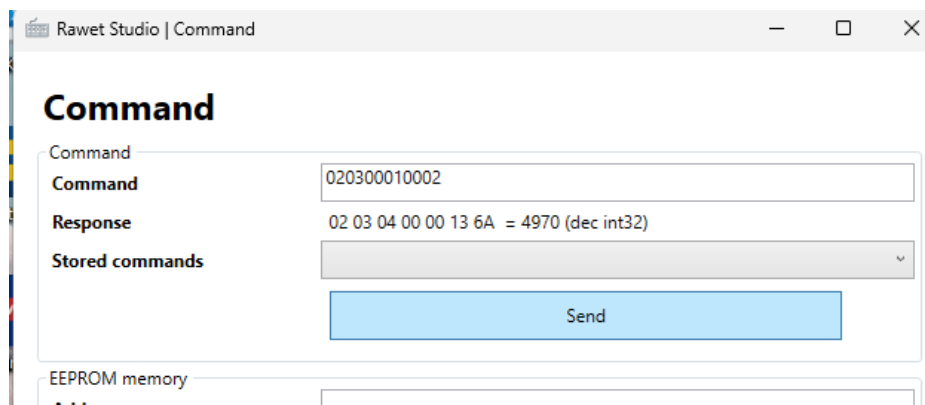
2.9 Example of sending a command via Modbus-TCP

Since RawetStudio2, with the Modbus-TCP protocol configured, fully supports working with the bus, it is also possible to verify communication by entering any command according to the protocol used.

In this example, we will show reading the temperature value from a PPL110 converter with address 2_h.

According to the protocol, this is function 03, reading from registers 0001 and 0002, i.e., we will read two registers.

The command will then have the form <02><03><0001><0002>



After conversion from int32 to a fixed-point decimal number with a resolution of hundredths of a degree, the response is 5136. The resulting temperature is thus 51.36°C.

3 Technical parameters of the MOBILAN converter

- designed for mounting on a DIN 35 rail
- Ethernet input is galvanically isolated at 1500V, in a manner common for internet circuits
- supply voltage range 8 .. 30V DC
- the negative supply pole is galvanically connected to the RS485 line
- converter configuration via web interface



The module is used to create a remote RS485 Modbus/RTU link. It converts the Modbus/TCP signal to Modbus/RTU and back. This allows remote access to the Modbus network via the Ethernet interface.

Device parameters:

- | | |
|---|--|
| - operating temperature range: | -30...+ 70°C |
| - supply voltage | 8 .. 30Vdc |
| - power consumption: | max. 2VA |
| - enclosure/terminal block protection rating: | IP40 / IP10 |
| - weight: | 90g |
| - dimensions: | 85 x 22.5 x 75 mm |
| - signaling on RJ45 | Ethernet connection / Ethernet activity |
| - startup time | 10 – 15 s |
| - number of connected units | up to 63 (unless limited by the connected units) |
| - dielectric strength: | 1500Vrms, 50Hz/1 min – power supply to Ethernet input |
| | ATTENTION - the RS485 output is at the same potential as the power supply! |
| - environment: | pollution degree 2, installation overvoltage category III |
| - storage temperature range | -40..80°C |

Type tests:

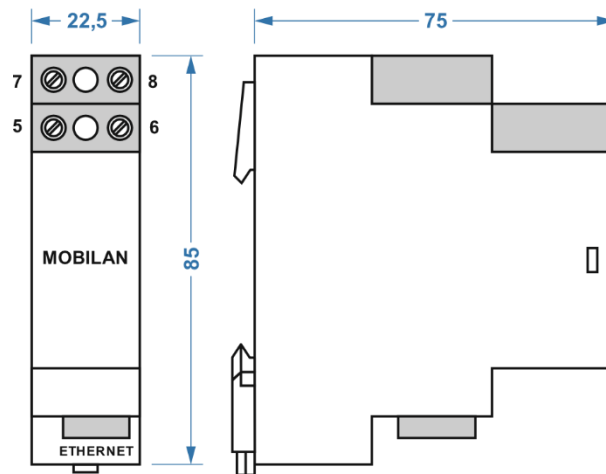
- | | |
|--------|-----------------------------|
| EMC | per ČSN EN IEC 61326-1 ed.3 |
| Safety | per ČSN EN 61010-1 ed.2 |

The converter is supplied with the following default settings:

On the Ethernet side IP address 192.168.25.102
Netmask 255.255.255.0
Gateway 192.168.25.1
Modbus TCP listen port 502

On the MODBUS side Modbus RTU baudrate 19200 Bd
Modbus RTU word length 9B
Modbus RTU parity EVEN
Modbus RTU stop bits 1b
Modbus RTU oversampling 16b

Gateway Mode TCP->RTU

**Terminal wiring:**

5 B (D-) Modbus
6 A (D+) Modbus
7 GND Power supply 8 ..30V dc
8 + Power supply 8 ..30V dc

Converter mounting:

The mounting orientation of the converter is not specified. Vertical mounting on the DIN 35 rail with the latch facing down is recommended. An RJ45 socket is used to connect the Ethernet network. The terminal blocks used allow connection of conductors up to 3.5mm² in cross-section. We recommend using a cable with a conductor cross-section of 1.5 or 2.5mm², depending on the required line resistance. The terminal blocks use M2.5 screws, so only moderate force should be used when tightening the terminal.

Mechanically, the converter is mounted on a 35 mm DIN rail. After placing the upper edge of the mounting notch onto the rail, use a screwdriver to push back the latch and press the lower part of the converter toward the rail. Once the screwdriver is released and the spring mechanism locks into place, the mounting is complete.

Ordering:

The converter is available in only one design variant. To order, simply state the type and quantity.

Example: 2pcs MOBILAN