MBC-24

MBC-24 Modbus RTU-ASCII-TCP Gateway (RS485 / Ethernet)

User guide

MBC-24_3-EN-145737-1.1

Contents

1 Introduction

This manual describes the functions, configuration, operating instructions and troubleshooting of the MBC-24 Modbus gateway (hereinafter referred to as the “device” or “gateway”).
Connection, configuration and maintenance of the device must be performed only by fully qualified personnel after reading this user guide.

1.1 Terms and abbreviations

- **Ethernet** – serial communication interface
- **LAN (Local Area Network)** – local area network based on the Ethernet interface
- **Modbus** – application layer messaging protocol for client/server communication between devices connected on different types of buses or networks, originally published by Modicon (now Schneider Electric), currently supported by an independent organization Modbus-IDA (*www.modbus.org*)
- **USB (Universal Serial Bus)** – serial communication interface
- **PC** – personal computer

1.2 Symbols and key words

WARNING
WARNING indicates a potentially dangerous situation that could result in death or serious injuries.

CAUTION
CAUTION indicates a potentially dangerous situation that could result in minor injuries.

NOTICE
NOTICE indicates a potentially dangerous situation that could result in damage to property.

NOTE
NOTE indicates helpful tips and recommendations, as well as information for efficient and trouble-free operation.

1.3 Intended use

The device has been designed and built solely for the intended use described here, and may only be used accordingly. The technical specifications contained in this document must be observed.
The device may be operated only in properly installed condition.

Improper use

Any other use is considered improper. Especially to note:
- The device may not be used for medical applications.
- The device may not be used in explosive environment.
- The device may not be used in atmosphere in which there are chemically active substances.

1.4 Limitation of liability

Our company does not bear any responsibility with respect to breakdowns or damages caused by using the product in a manner other than described in the Manual or in violation of the current regulations and technical standards.

1.5 Safety

WARNING
Ensure the mains voltage matches the voltage marked on the nameplate. Ensure the device is provided with its own power supply line and electric fuse.

WARNING
The device terminals may be under a dangerous voltage. De-energize the device before working on it. Switch on the power supply only after completing all work on the device.

NOTICE
Supply voltage may not exceed 48 VDC. Higher voltage can damage the device.
If the supply voltage is lower than 10 VDC, the device cannot operate properly but will not be damaged.

NOTICE
If the device is brought from a cold to a warm environment, condensation may form inside the device. To avoid damage to the device, keep the device in the warm environment for at least 1 hour before powering on.
The device should be mounted in a specialized cabinet access to which is limited to qualified personnel.

2 Overview

The MBC-24 Modbus RTU-ASCII-TCP Gateway is designed for bidirectional conversion and routing communication between ModbusRTU / ASCII via RS485 and Modbus TCP via Ethernet interfaces. Master and Slave modes are supported.

3 Specifications

3.1 Specifications

Table 3.1 Specifications

Parameter	Value
Electrical	
Power supply	24 (10…48) V DC
Power consumption, max.	6 W
Appliance class	II
Galvanic isolation	see *Section 3.2*
RS485	
Protocols	Modbus RTU (Master/Slave) Modbus ASCII (Master/Slave)
Baud rate	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200 bps
Cable length, max.	1200 m
Default address	1
Number of Slaves, max.	32
Ethernet	
Protocol	Modbus TCP (Master/Slave)
Baud rate	10/100 Mbps
Type of connector	8P8C (RJ45)
Default address	192.168.1.99
Slave ID (fixed)	1
Number of Slaves, max.	31
USB	
Standard	USB 2.0
Connector type	Micro-USB
Device power supply	yes
Mechanical	
Mounting	DIN rail
Dimensions	55 × 96 × 58 mm
IP code	IP20
Weight	approx. 150 g
Average service life	10 years
Mean time between failures (MTBF)	80000 hours

3.2 Galvanic isolation

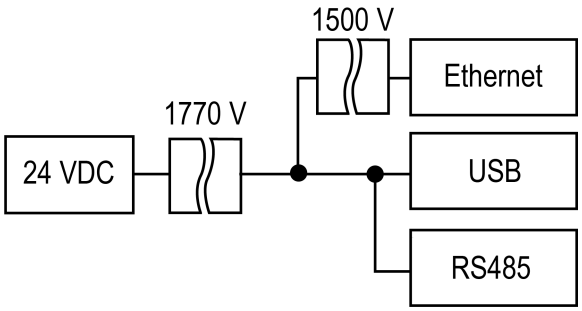


Fig. 3.1 Galvanic isolation

The test voltages shown in the figure correspond to the tests carried out under normal operating conditions with one minute exposure time.

3.3 Environmental conditions

The device is designed for natural convection cooling which should be taken into account when choosing the installation site.
The following environmental conditions must be observed:

– clean, dry and controlled environment, low dust level;
– closed non-hazardous areas, free of corrosive or flammable gases.

Table 3.2 Environmental conditions

Condition	Permissible range
Ambient temperature	-40…+55 °C
Transportation and storage	-25 … +55 °C
Relative humidity	10…95 %(non-condensing)
Altitude	up to 2000 m ASL
Vibration / shock resistance	conforms to IEC 61131-2
EMC emission / immunity	

4 Startup

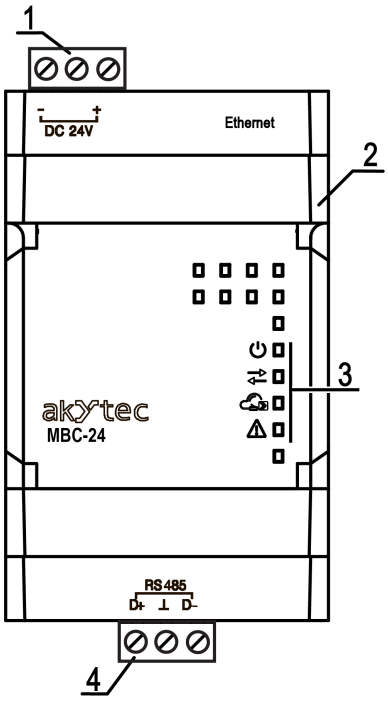
To start the gateway:

1. Mount the gateway (see *Section 6.1*).
2. Connect the gateway to the power supply (see *Section 7.2*).
3. Power the gateway on.
4. Check LEDs on the front panel to make sure that no errors have occurred (see *Section 5.2*).
5. Power off the gateway.
6. Connect devices to the gateway (see *Section 7.3*). Ensure all devices are configured before being connected.
7. Connect the gateway to a PC and configure it using *akYtec Tool Pro* (see *Section 8.1*).
8. Disconnect the gateway from the PC.
9. Power on. The gateway is ready for operation.

5 Design and operation

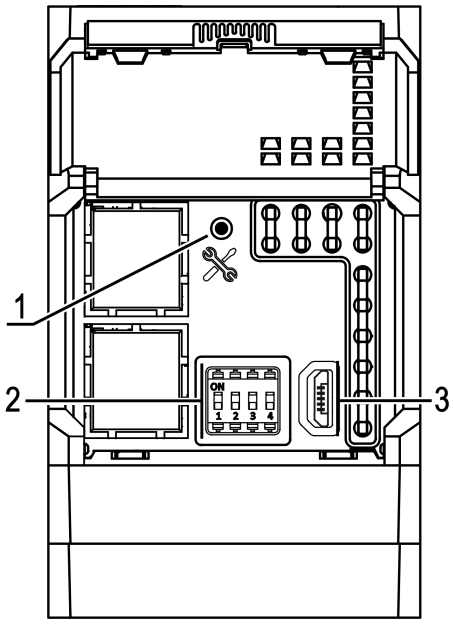
5.1 Design

The gateway is designed in a plastic case for DIN rail mounting. Main components are shown in *Fig. 5.1*. Plug-in terminal blocks enable quick and easy replacement of the device.



1 — Detachable part of power terminal block
2 — Gateway case
3 — Indicators
4 — Detachable part of RS485 terminal block

Fig. 5.1 Front view



1 — Service button (to reset the gateway and restore factory settings)
2 — 4 DIP switches
3 — Micro-USB connector

Fig. 5.2 Under the front cover

5.2 Indication and control

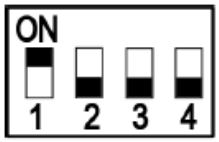
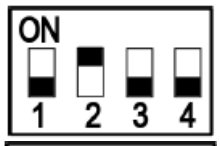
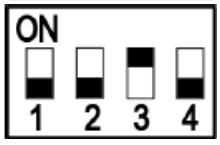
There are 4 LEDs on the front panel of the gateway.

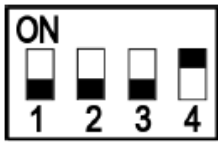
Table 5.1 Indicators

LED	State	Description
⏻	ON	Power is on
	OFF	Power is off
⇄	Flashing	Data transfer over RS485 interface
	OFF	No data transfer over RS485 interface
Ethernet	Flashing	Data transfer over Ethernet interface
	OFF	No data transfer over Ethernet interface
⚠	ON	Hardware / firmware error. Contact akYtec service staff.
	Flashing	Static IP address setup error. Reassign IP address if it was configured using *akYtec Tool Pro*.
	OFF	No errors
⏻ ■ RS ■ Eth □ ⚠ ■	Flashing (three LEDs)	Static IP address setup error
		Cannot establish connection over Ethernet. Check the Ethernet cable and connection.
	ON (three LEDs)	Invalid RS485 configuration
⏻ ■ RS ■ Eth ■ ⚠ ■	ON (All LEDs)	Restart the device. Repeat the firmware update.

NOTE
DIP switch positions are read in ascending order starting from 1.

Table 5.2 DIP switches

DIP switch	Description
	120 Ω terminating resistor is connected
 	Only for akYtec service staff. DIP switches 2, 3 and 4 must be turned **off** during normal operation.

DIP switch	Description
	

6 Installation

6.1 Mounting

The safety measures specified in *Section 1.5* must be observed during the device mounting. The device is to be mounted in enclosures, cabinets, e. t. c. with protection of the device from dust, moisture and foreign objects.

NOTICE
Configure and program the device prior to montage and wiring.

CAUTION
Do not use the device power terminals for powering any other equipment!

To mount the gateway:

1. Ensure the sufficient space for mounting the gateway and the cables.
2. Mount the gateway on the DIN rail using a clip.

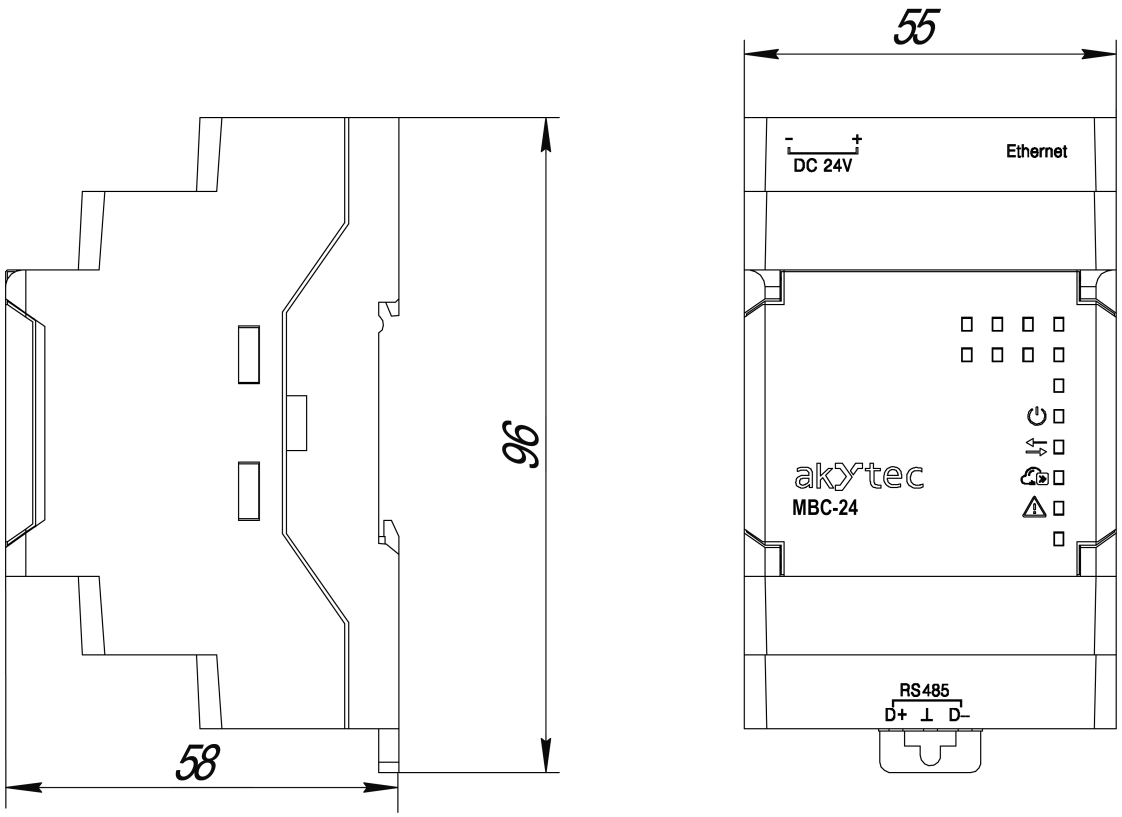


Fig. 6.1 Dimensions

6.2 Quick replacement

The gateway is equipped with plug-in terminal blocks which enable quick replacement of the device without disconnecting the existing wiring.

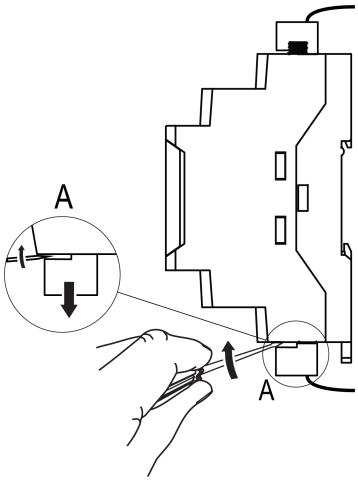


Fig. 6.2 Quick replacement

For the device quick replacement, follow the steps below:

1. Power off all connected lines including power supply.
2. Using a screwdriver or a similar tool, unplug the terminal blocks with existing wiring connected (see *Fig. 6.2*).
3. Remove the device from the DIN rail and mount another gateway of the same modification (with the terminal blocks unplugged).
4. Plug the terminal blocks with existing wiring into mating connectors of the gateway installed.
5. Power on the gateway.

7 Connection

7.1 Terminal assignments

Table 7.1 Terminal assignments

Marking	Description
–	power terminal «–», 24VDC
+	power terminal «+», 24VDC
D+	terminal D+ for RS485 line
⊥	terminal to connect RS485 shield
D-	terminal D– for RS485 line

7.2 Power connection

The following requirements must be observed when connecting the power supply:

– Do not connect more one wire to one terminal.
– The wire cross-section must be within 0.35 — 0.75 mm². Use cable lugs in case of twisted wires.
– Do not use gateway power terminals to power on other devices.

Power the gateway from its power supply of 24 VDC. The cable length should not exceed 30 m.

CAUTION
Do not power the gateway from the distributed 24 VDC power supply line.

7.3 RS485 network

When connecting over the RS485 interface:

– Ensure all devices are configured before being connected.
– Observe the polarity: connect line D+ to terminal D+, line D- to terminal D- .
– Use a shielded twisted-pair cable with the cross-section of at least 0.2 mm ² and a maximum linear capacitance of 60 pF/m.
– The total length of the RS485 line should not exceed 1000 m.
– If the RS485 line is over 10 m, use terminating resistors. The gateway has the in-built terminating resistor which can be connected with the DIP switch (see *Table 5.2*).

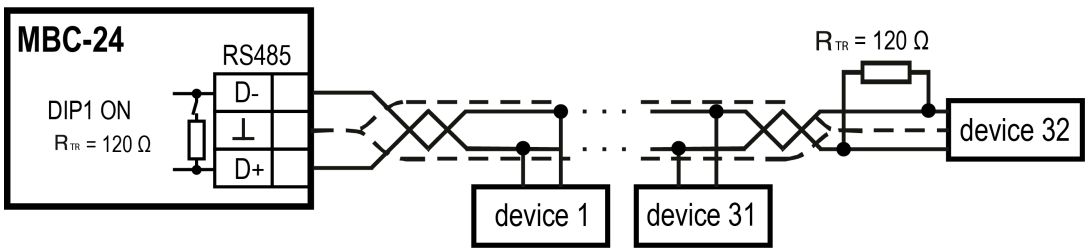


Fig. 7.1 RS485 network

When connecting to a bus with distributed network units, failsafe pull-up resistors R_{FS} are used to guarantee “logical one” at the output. The pull-up resistors are built into the gateway and are enabled when the gateway is configured in *akYtec Tool Pro* (see *Section 8.2.2*).

8 Configuration

To configure the gateway:

1. Download and install *akYtec Tool Pro* on your PC..
2. Connect the gateway to the PC over USB or Ethernet.
3. Add the gateway to a project in akYtec Tool Pro considering the method of gateway connection to the PC.
4. Set up the network parameters of the RS485 and Ethernet interfaces.
5. Configure the gateway operation mode automatically (see *Section 8.2.3.2*) or in the manual mode (see *Section 8.2.3.3*).

8.1 Connection to akYtec Tool Pro

8.1.1 Connection over USB

To add the gateway to an *akYtec Tool Pro* project:

1. Connect the gateway to a PC over USB.
2. Start *akYtec Tool Pro*.
3. In the **Project** tab, click the **Add devices** toolbar item. A window will appear:

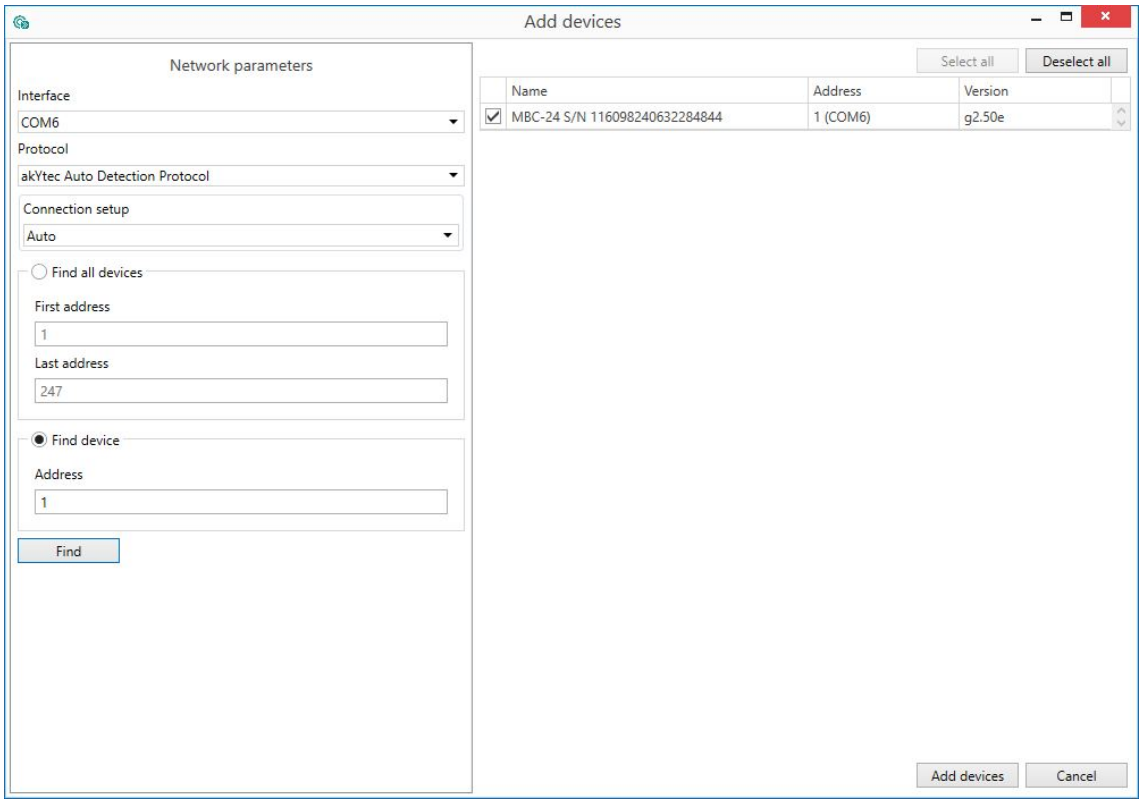


Fig. 8.1 Interface menu

– In the **Interface** field, select the COM port assigned to the gateway You can check the port number and name in Windows Device Manager.
– In the **Protocol** field, select **akYtec Auto Detection Protocol**.
– Select **Find device**.
– Enter the address of the connected device (factory setting — **1**).
– Click the **Find** button. The gateway with the address will be displayed in the right part of the window.

– Select the checkbox next to the gateway and click the **Add devices** button. The device will be added to the project.

8.1.2 Connection over Ethernet

To add the gateway to an *akYtec Tool Pro* project:

1. Power the gateway on.
2. Connect the device to a PC over Ethernet. The gateway and the PC must be in the same network.
3. Start *akYtec Tool Pro*.
4. Click the **Add devices** button in the **Project** tab. A window will appear:

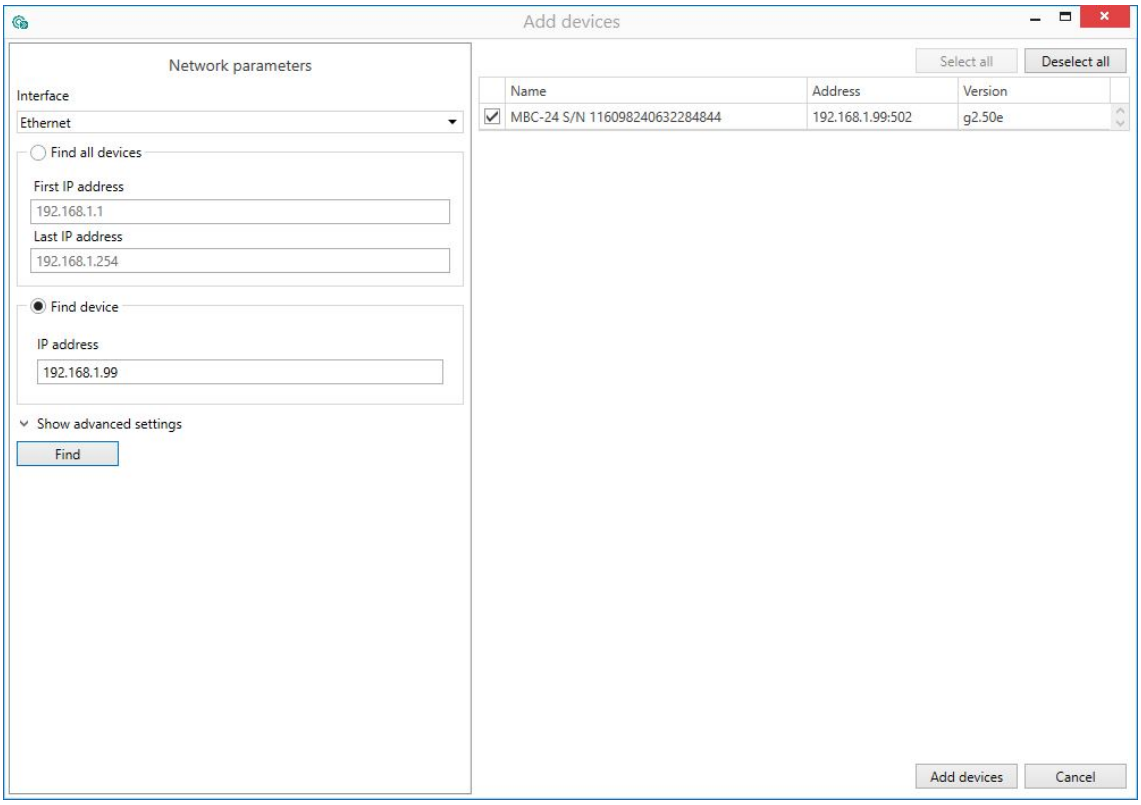


Fig. 8.2 Network settings

– Select **Ethernet** in the **Interface** drop-down menu.
– Select **Find device** and enter **IP address** (factory setting – **192.168.1.99**).

NOTE
If the IP address is unknown, select ***Find all devices*** and enter the supposed address range.

– Click the ***Find*** button. The gateway with the address will be displayed in the right window.
– Select the device by checking the checkbox and click the ***Add devices*** button to add the device to the project.

8.2 Configuration using akYtec Tool Pro

8.2.1 RS485

To configure the RS485 interface, open the **RS485 port settings** node in the parameter tree:

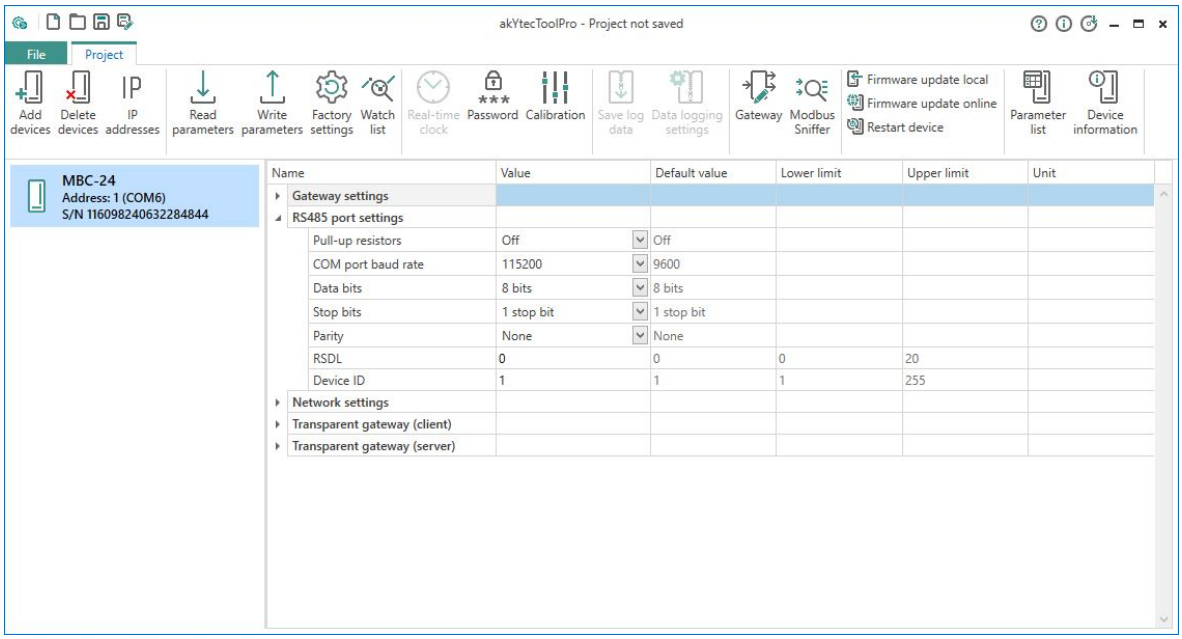


Fig. 8.3 RS485 settings

Set the parameter values in accordance with the table:

Table 8.1 RS485 parameters

Parameter	Description	Default value
Pull-up resistors	Range: **On** – pull-up resistors on; **Off** – pull-up resistors off	Off
Baud rate	Data transfer speed. Range: **1200...115200 bps**	115200
Data bits	Range: **7 bits, 8 bits**	8
Stop bits	Range: **1, 2**	1
Parity	Range: **none, even, odd**	None
RSDL	RS485 response delay. Range: **0...20 ms**	0
Device-ID	Own gateway identifier via the RS485 port when the gateway operates in the Slave mode. Range: **1...255**	1

NOTE
After changing **Parity**, reset the device by briefly (2 s) pressing the service button.

Supported combinations of the parameters ***Data bits***, ***Parity*** and ***Stop bits*** for the RS485 interface are shown in the table:

Table 8.2 Supported parameter combinations

Modbus RTU	Modbus ASCII
8-N-1	8-N-1
8-N-2	8-N-2
8-O-1	8-O-1
8-O-2	8-O-2
8-E-1	8-E-1
8-E-2	8-E-2

Modbus RTU	Modbus ASCII
—	7-O-1
—	7-O-2
—	7-E-1
—	7-E-2

NOTE

– Modbus RTU doesn't support value 7 of the ***Data bits*** parameter.

– Modbus ASCII doesn't support combinations 7-N-1 and 7-N-2. Parameter **Parity** must be set to value **O** or **E**.

8.2.2 Ethernet

To configure the Ethernet interface, open the **Network settings/ Ethernet settings** node in the parameter tree:

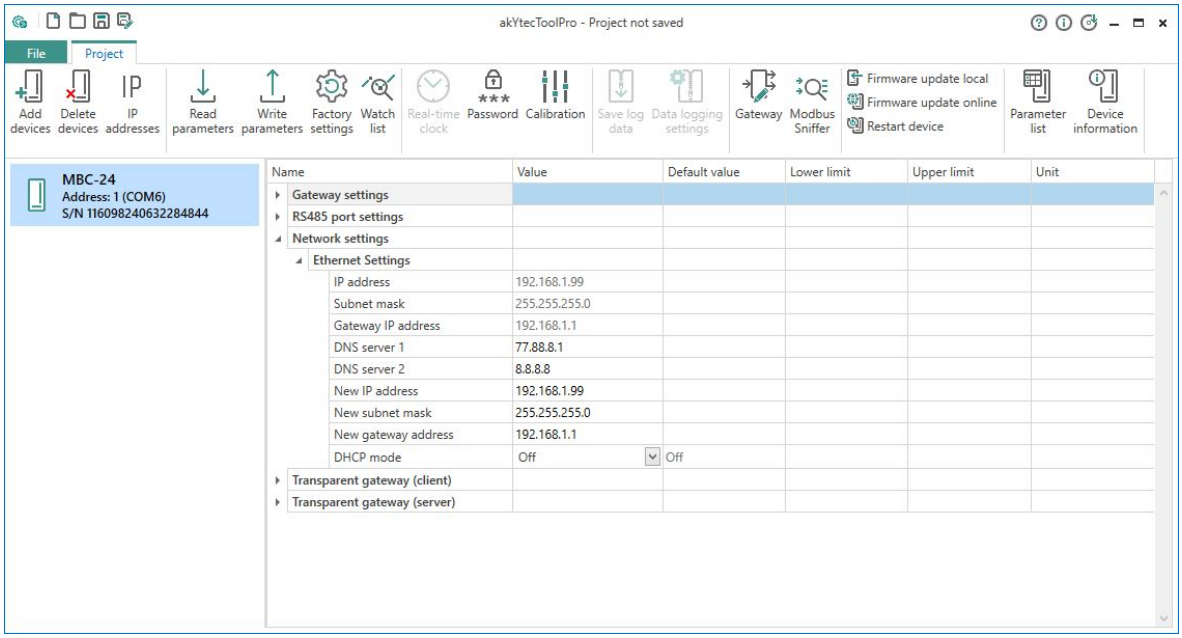


Fig. 8.4 Network settings

If necessary, change the parameter values according to the table:

Table 8.3 Ethernet parameters

Parameter	Description	Factory setting
IP address	IP address of the gateway in the network	192.168.1.99
Subnet mask	IP address recognition area in the subnet	255.255.255.0
Gateway IP address	IP address of the router in the network	192.168.1.1

DNS server 1, 2 — If necessary, change IP addresses of DNS servers. Default values are **77.88.8.1** and **8.8.8.8**.

The dynamic IP address of the device is provided by the DHCP server in the Ethernet network.
To use dynamic IP addresses, ensure ***DHCP* = *On*** (default setting).
To use static IP addresses, ensure ***DHCP* = *Off***, enter values for the parameters ***IP address***, ***Subnet mask*** and ***Gateway IP address***.
To apply the network settings, reset the gateway by briefly (2 s) pressing the button .

NOTE
If the gateway is connected via the USB interface, disconnect the USB cable from the device before reset.

8.2.3 Operation mode configuration

8.2.3.1 Network topology

The gateway supports the following network topologies:
– Daisy
– Star.
The gateway operation mode is configured depending on the network topology.

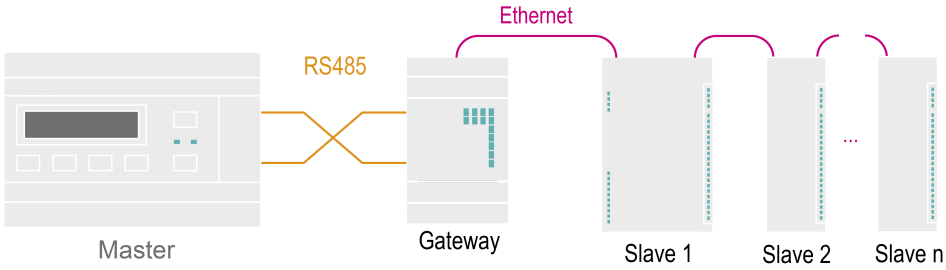


Fig. 8.5 Using the gateway with Master in the RS485 network

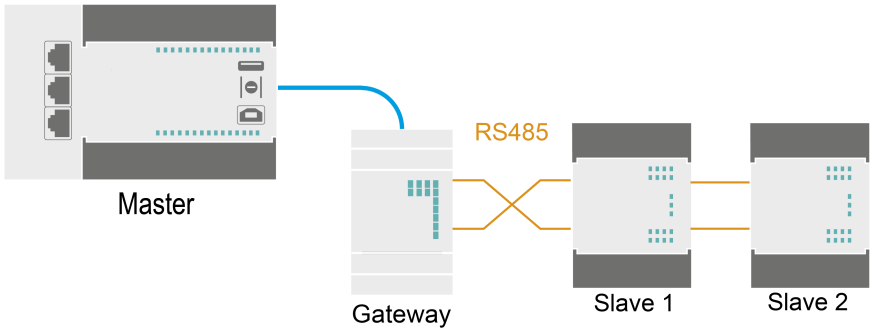


Fig. 8.6 Using the gateway with Master in the Ethernet network

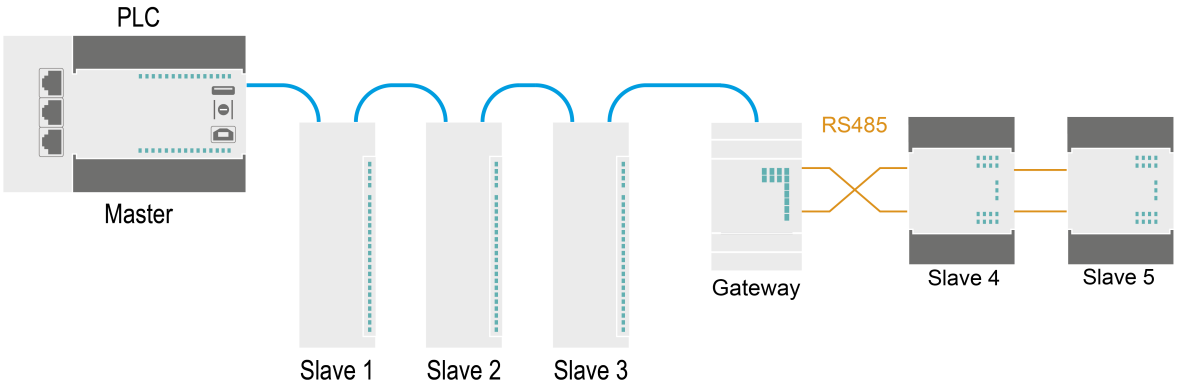


Fig. 8.7 Using the gateway with Master in Ethernet interface

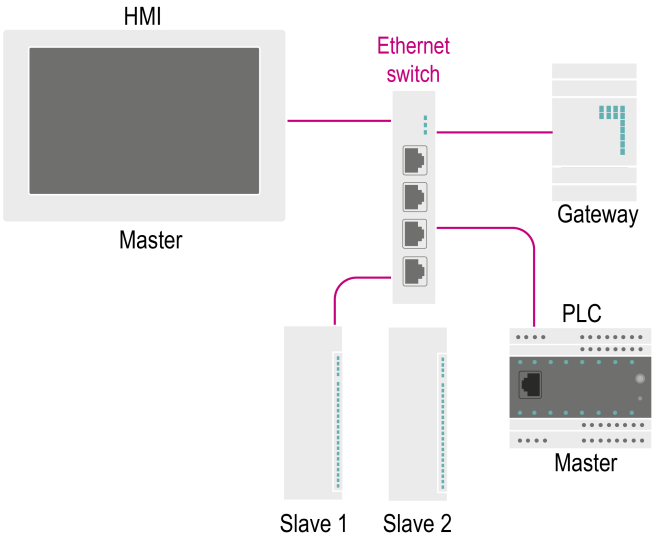


Fig. 8.8 Star topology

8.2.3.2 Automatic gateway configuration

To configure the gateway, click **Gateway**.
A window will appear:

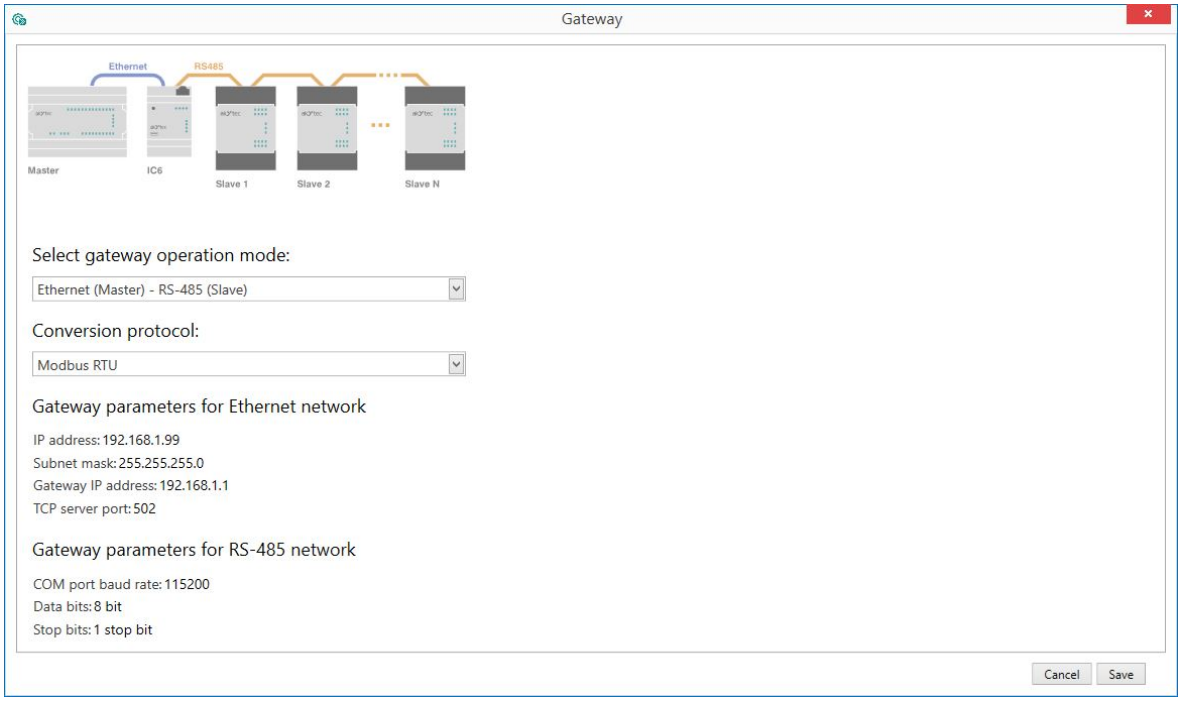


Fig. 8.9 Gateway configuration

Select the gateway operation mode:
– Ethernet (Master) — RS485 (Slave)
– RS485 (Master) — Ethernet (Slave).
The configuration window displays the network interface parameters read from the gateway.

NOTE
Network parameters cannot be changed in the gateway configuration window. Network parameters must be changed in the device settings.

Ethernet (Master) — RS485 (Slave)

The **Ethernet (Master) — RS485 (Slave)** mode assumes that the Master device is in the Ethernet network.

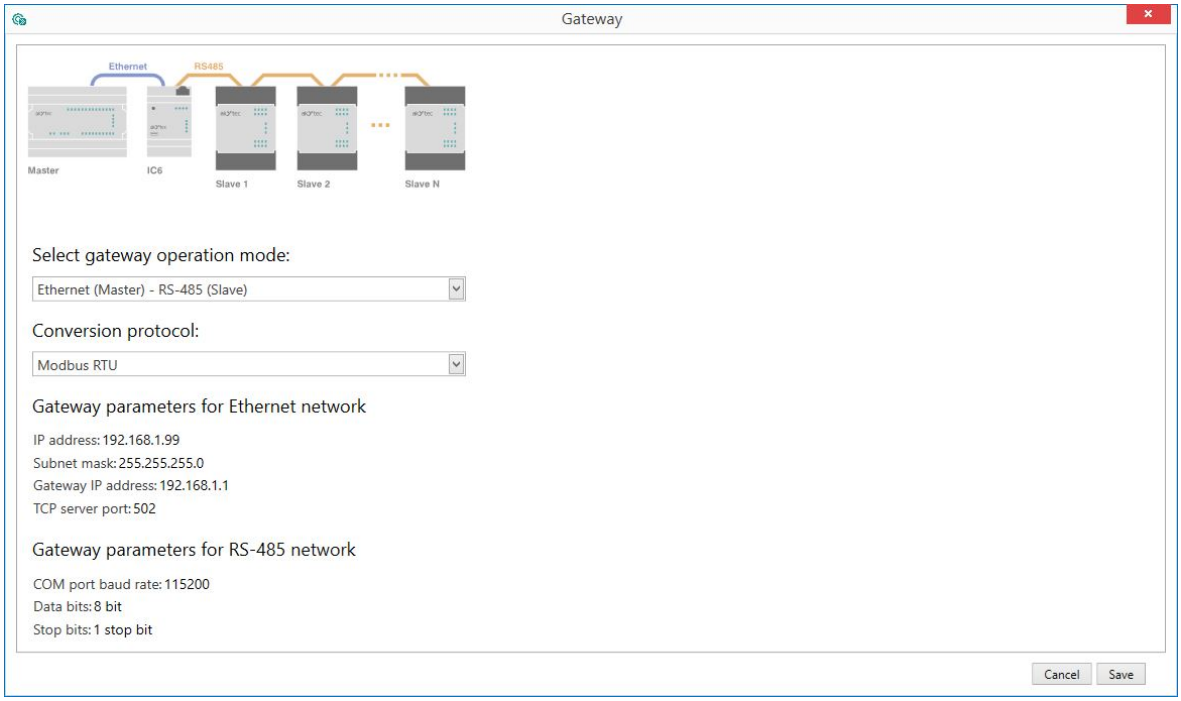


Fig. 8.10 Gateway configuration in the Ethernet (Master) — RS485 (Slave) mode

NOTE
Devices in the RS485 network cannot have addresses equal to 1, as this address is reserved for the gateway. All incoming packets with the Slave ID value equal to 1 will be forwarded to the gateway's own registers according to the routing rule.

Select the conversion protocol:

– Modbus ASCII
– Modbus RTU.

To apply the settings, click the **Save** button.

RS485 (Master) — Ethernet (Slave)

The **RS485 (Master) — Ethernet (Slave)** mode assumes that the Master device is in the RS485 network.

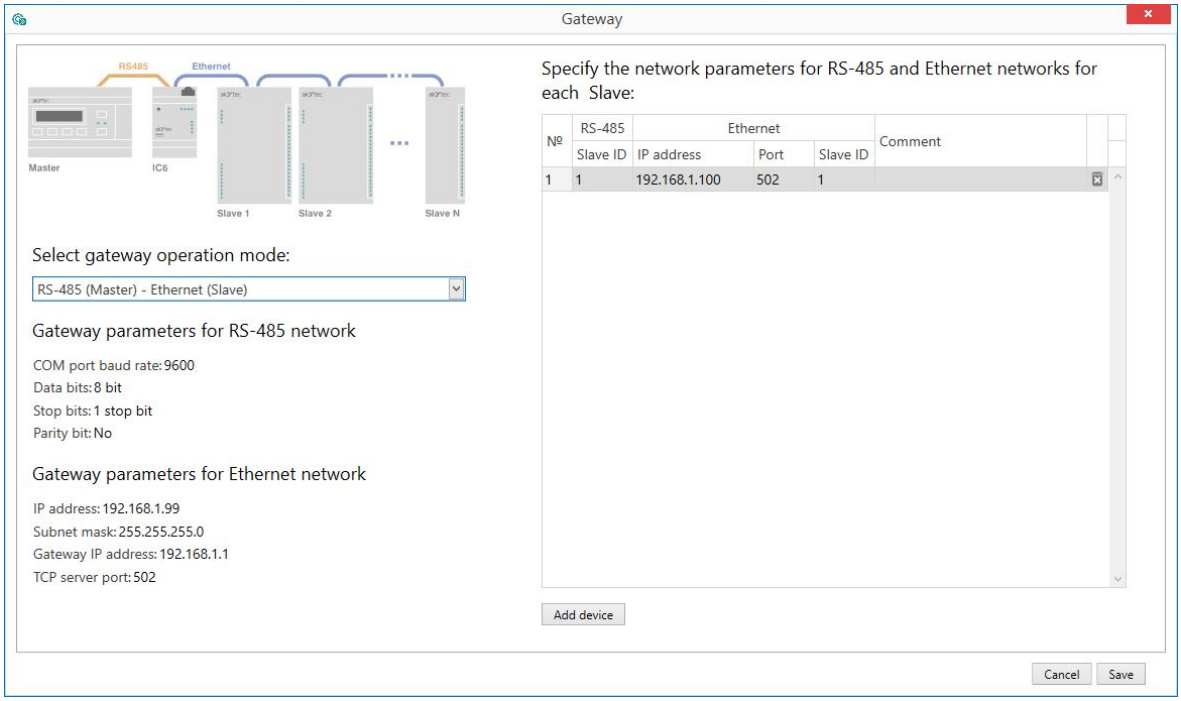


*Fig. 8.11 Gateway configuration in the Master in the **RS485 (Master) — Ethernet (Slave)** mode*

To configure the gateway, set the correspondence of network parameters of devices in the RS485 network (Slave ID) to network parameters in the Ethernet network (IP addresses, ports and Slave ID).

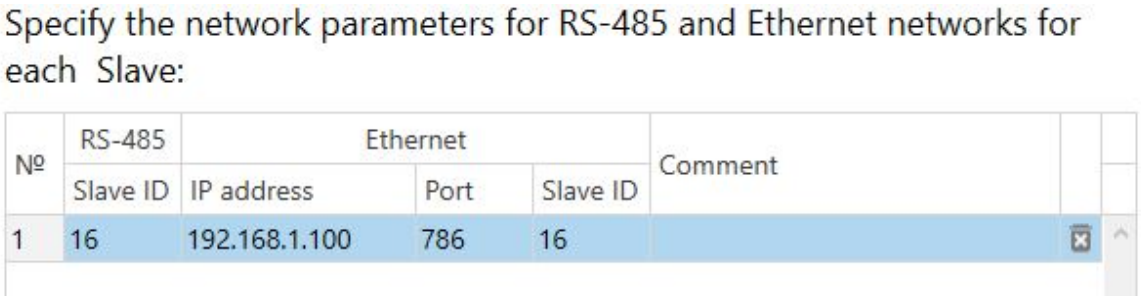


Fig. 8.12 RS485 and Ethernet

NOTE
You can check Slave ID of the device for Modbus TCP protocol in the device documentation.

NOTE
The gateway can simultaneously support two TCP/IP connections in the **RS485 (Master) - (Ethernet) Slave** mode. If the number of Slave devices exceeds two, additional delays related to switching TCP/IP connections occur. The maximum number of Slave devices in the **RS485 (Master) - (Ethernet) Slave** mode is 31.

To add a new device, click the **Add device** button.
To apply the settings, click the **Save** button.

8.2.3.3 Manual gateway configuration

Manual configuration is only required for systems with higher routing requirements, use automatic gateway configuration (see *Section 8.2.3.2*) for standard configuration.
In the *akYtec Tool Pro* window, select the **Gateway settings/Mode settings** node:

Name	Value	Default value	Lower limit	Upper limit	Unit
Gateway settings					
Mode setting					
Delay between packets	5	5	0	255	ms
Mode of RS485 port	Slave	Master			
Response timeout	300	300	50	5000	ms
Routing settings					
R0	27:0:1:0:0:S:P	27:0:1:0:0:S:P			
R1	40:0:1:C0A80164:1F6:3:P				
R2	40:0:2:C0A80165:1F6:6:P				
R3	40:0:3:C0A80166:1F6:9:P				

Fig. 8.13 Gateway settings

Mode settings
If Slave devices need time to prepare for the next exchange, set the time (ms) in the **Delay between packets** field (only for the **Ethernet (Master) - RS485 (Slave)** mode):

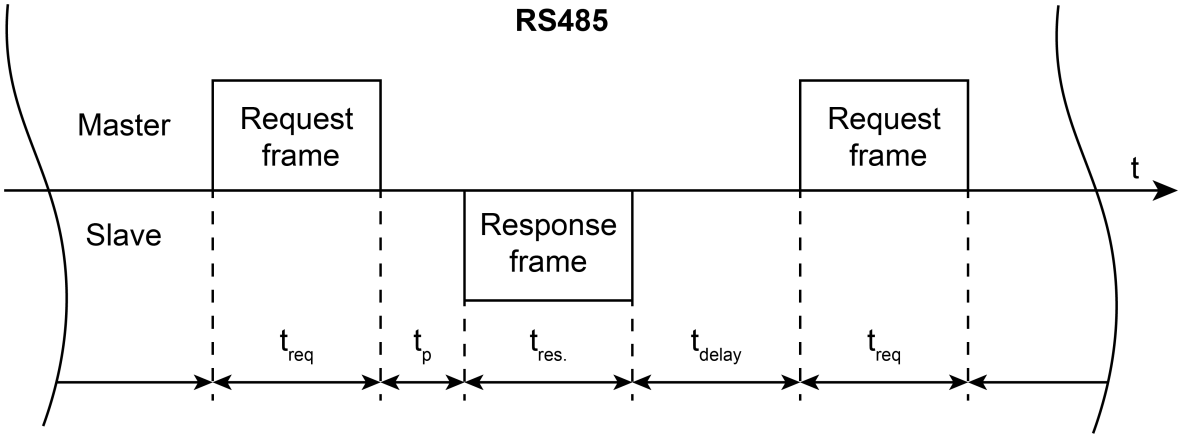


Fig. 8.14 Operation diagram of the "Delay between packets" parameter

where:
– t_{req} – time for which Master transmits the request frame
– t_p – the time of processing a request from Master
– t_{res} – time for which Slave transmits the response frame
– t_{delay} – time of preparation for the next exchange.

In the **Mode of RS485 port** field, select the RS485 port operation mode in relation to the devices of the RS485 network:
Master — for the **Ethernet (Master) - RS485 (Slave)** mode
Slave — for the **RS485 (Master) - Ethernet (Slave)** mode.
In the **Response timeout** field, set the time to wait a response from the Slave device. If it is exceeded, the gateway will send an error message to the Master device. Range: 50...5000 ms.

Routing settings
Set the rules for data conversion taking into account the following conditions:
– The gateway reconciles routing rules from top to bottom (R1 to R31). The maximum number of rules is 31.
– If a packet matches a routing rule, the packet is forwarded according to the routing table.
– The first record *27:0:1:0:0:S:P* is a system record and cannot be changed.

Table 8.4 Routing rule format on the example of a system record

Incoming packet			Outgoing packet			Protocol
Interface code	Port (not used)	Slave ID	Interface code / IP address	Port (optional)	Slave ID	
27	0	1	0	0	S	P

NOTE
For more information about routing rule parameters and registers, see *Appendix B.*

Table 8.5 Values of the Interface code field for an incoming packet

Interface code (Hex)	Value
0x27	Service code for communication with the configurator
0x40	RS485
0x06	Ethernet

Table 8.6 Values of the Interface code field for an outgoing packet

Interface code (Hex) / IP address (Hex)	Value
0x40	RS485
0A0219D2 (an example of the Slave device IP address in the Hex format)	**10.2.25.210**, where **0x0A** – 10; **0x02** – 2; **0x19** – 25; **0xD2** – 210
0x00	Access to gateway registers

Table 8.7 Incoming packet port values

Port (Hex)	Value
0x00	The field is not used (0 by default)

Table 8.8 Outgoing packet port values

Port (Hex)	Value
0x00	Port not used (RS485)
0x01–0xFFF	TCP port number

The **Slave ID** field establishes the relationship between the device ID in the Master and Slave networks and can take the values shown in the table below.

Table 8.9 Value of the Slave ID field of an incoming packet

Slave ID	Value
0x00–0xFF	Device address (ID) (Hex)
G	Process packets with any Slave ID

Table 8.10 Value of the Slave ID field of an outgoing packet

Slave ID	Value
0x00–0xFF	Device address (ID) (Hex)
S	Do not change the Slave ID of the incoming packet

The protocol of the incoming packet is determined automatically by the gateway, the protocol of the outgoing packet is set according to the **Protocol** field.

Table 8.11 Protocol field values

Protocol code	Value
A	Modbus ASCII
P	Modbus TCP
R	Modbus RTU

Examples of conversion from Modbus RTU/ASCII to Modbus TCP and from Modbus TCP to Modbus RTU/ASCII protocols are given in *Appendix A*.

8.2.3.4 Transparent gateway mode

In *akYtec Tool Pro*, configure the gateway depending on the operation mode:

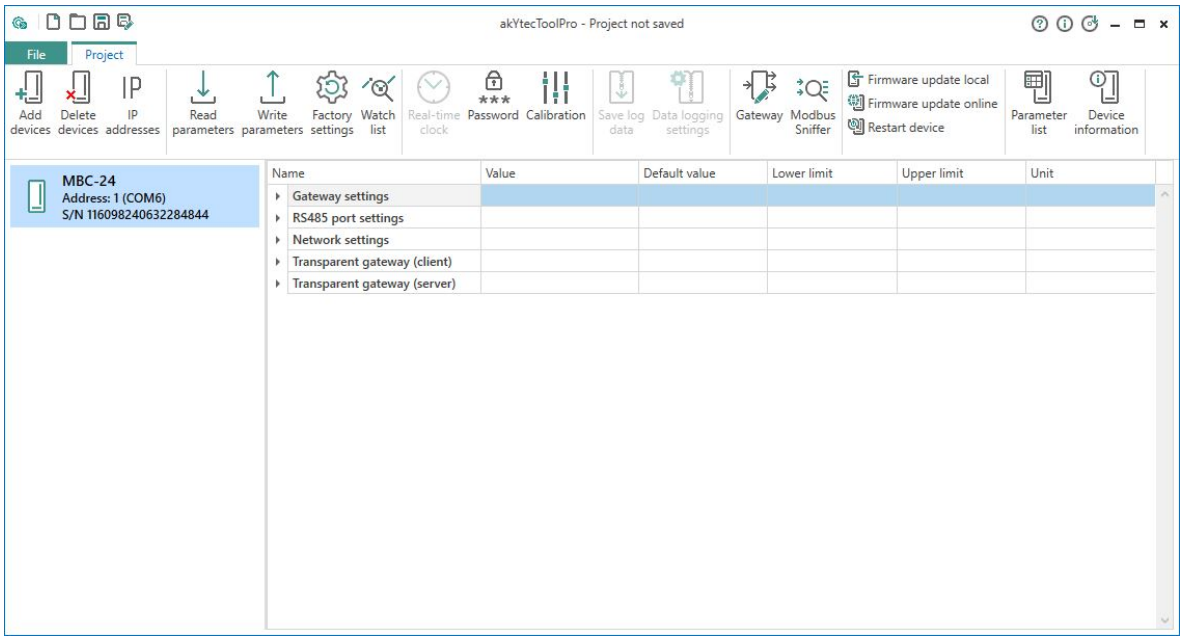


Fig. 8.15 Gateway settings

For the **Ethernet (Master) — RS485 (Slave)** mode, set the following settings:

– In the **Gateway settings** / **Mode settings** node, set the **Mode of RS485 port** to **Master**.
– In the **Gateway settings** / **Mode settings** node, set the routing value to **10:0:G:40:0:S:N** (10 is the MBC-24 Ethernet port in the server mode).

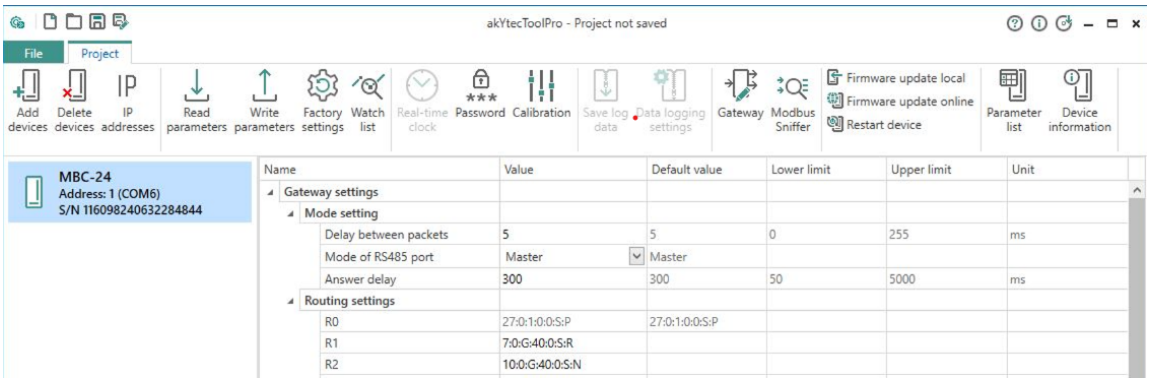


Fig. 8.16 Routing settings

– In the **Network settings**/ **Ethernet settings** node, set the network settings in accordance with *Section 8.2.2*.
– In the **Transparent gateway (server)** node, set the value of the **TCP port** parameter:

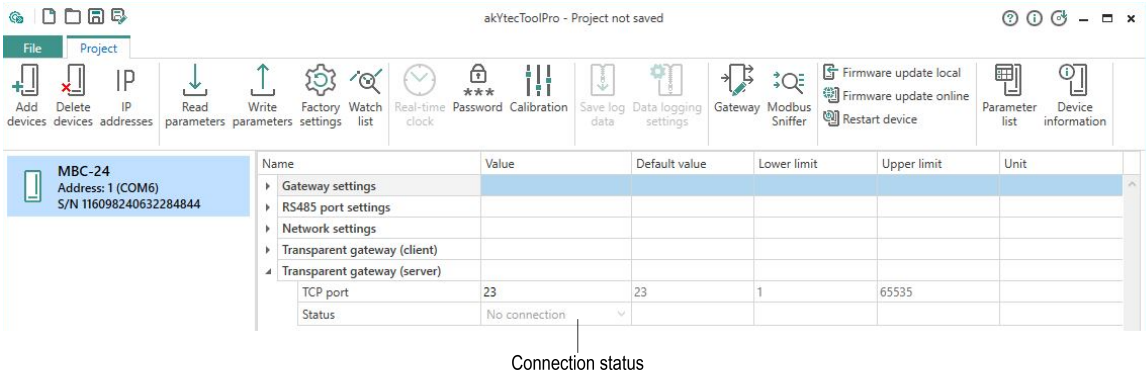


Fig. 8.17 Transparent gateway (server)

– In the **RS485 port settings** node, set the parameter values in accordance with *Section 8.2.1*.
– Set the values in the gateway by clicking  **Write parameters**.
– Reboot the gateway by clicking  **Restart device**.

For the **RS485 (Master) — Ethernet (Slave)** mode, set the following settings:

– In the **Gateway settings** / **Mode settings** node, set the **Mode of RS485 port** to **Slave**.
– In the **Gateway settings**/ **Routing settings** node, set the routing value to **40:0:G:08:0:S:N** (08 — is the MBC-24 Ethernet port in the client mode).
– In the **Transparent gateway (client)** node, set the value of the **Server IP address** and **TCP port** parameters.

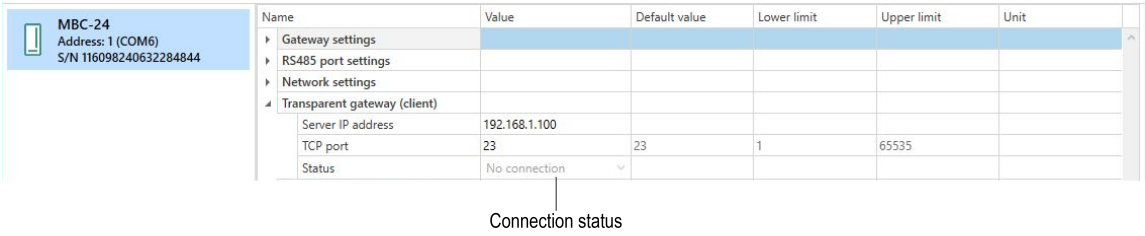


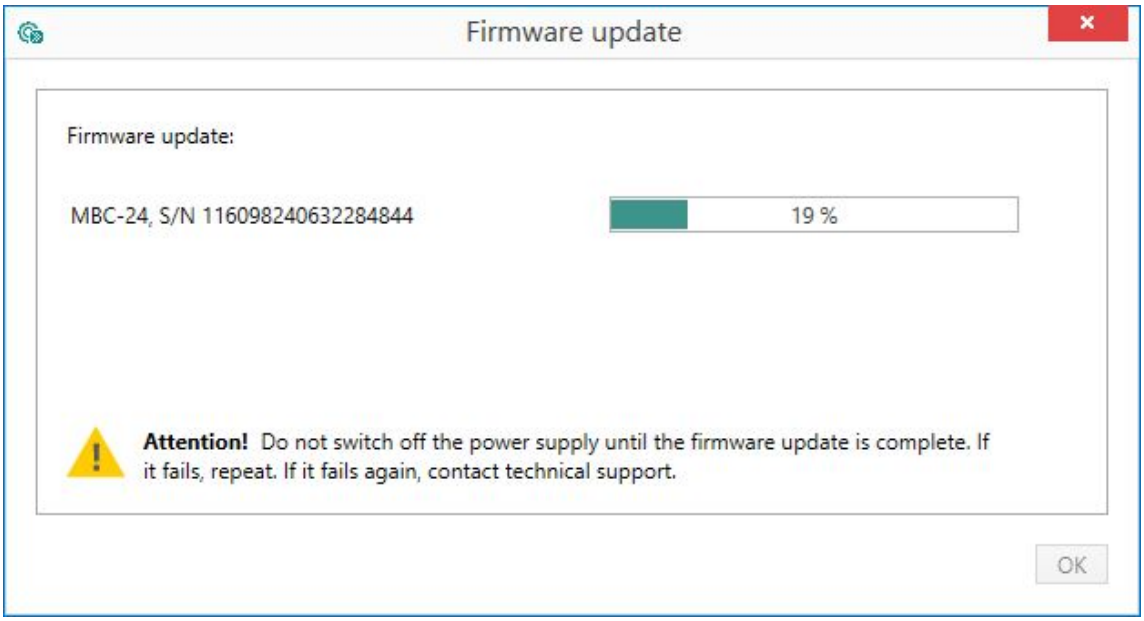
Fig. 8.18 Transparent gateway (client)

– In the **RS485 port settings** node, set the parameter values in accordance with *Section 8.2.1*.
– Set the values in the gateway by clicking  **Write parameters**.
– Reboot the gateway by clicking  **Restart device**.

8.3 Firmware update

You can update the firmware with **akYtec Tool Pro**. Use the firmware file with **.fw.** extension.
To update firmware:

1. Connect the gateway to a PC and add to the *akYtec Tool Pro* project (see *Section 8.1*).
2. Click the button  **Firmware update local**.
3. Select a firmware update file.
4. Wait for the file to upload in the gateway and firmware update to complete.



8.4 Factory settings restoration

To restore the factory settings:

1. Open the front cover.
2. Press and hold the service button for at least 12 s.
3. Power off and then power on the gateway.

The gateway settings and RS485 port settings will be reset to default factory settings. Routing settings and network settings will not be reset to defaults, with the exception of **DHCP mode — OFF**.

9 Maintenance

The safety requirements (see *Section 1.5*) must be observed when the maintenance is carried out.

WARNING
Cut off all power before maintenance.

The maintenance includes:

– cleaning of the housing and terminal blocks from dust, dirt and derbis;
– checking the device fastening;
– checking the wiring (connecting wires, terminal connections, absence of mechanical damages).

NOTICE
The device should be cleaned with a dry or slightly damp cloth only. No abrasives or solvent-containing cleaners may be used.

10 Scope of delivery

— MBC-24 gateway	1 pc.
— Short guide	1 pc.

NOTE
The manufacturer reserves the right to make changes to the scope of delivery.

11 Transportation and storage

Pack the device in such a way as to protect it reliably against impact for storage and transportation. The original packaging provides optimum protection.
If the device is not taken immediately after delivery into operation, it must be carefully stored at a protected location. The device should not be stored in an atmosphere with chemically active substances.
The environmental conditions must be taken into account during transportation and storage.

NOTICE
The device may have been damaged during transportation.
Check the device for transport damage and completeness!
Report the transport damage immediately to the shipper and akYtec GmbH!

Appendix A. Examples of conversion from Modbus RTU/ASCII to Modbus TCP protocols

Example of conversion from Modbus RTU/ASCII to Modbus TCP protocols

The Master device is in the RS485 network, the Slave device is in the Ethernet network.

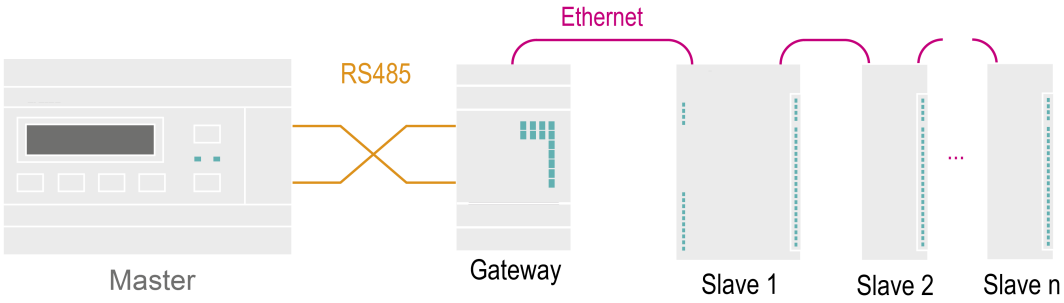


Fig. A.1 Wiring diagram

Table A.1 Network settings of devices connected to the gateway

Master		Slave	
Parameter	**Value**	**Parameter**	**Value**
Interface	RS485	Interface	Ethernet
Protocol	Modbus RTU/ASCII	Protocol	Modbus TCP
Baud rate	9600 kbps	Device address (ID)	1 (Hex – 0x01)
Data bits	8 bits	IP address	10.2.25.210 (Hex – 0A0219D2)
Stop bits	1	TCP port	502 (Hex – 1F6)
Parity	None	Gateway	10.2.1.1
–		Subnet mask	255.255.0.0

Table A.2 Network settings of the gateway

RS485 (interface code– 0x40)		Ethernet	
Parameter	**Value**	**Parameter**	**Value**
Protocol	Autodetection (RTU/ ASCII)	Protocol	Modbus TCP (protocol code – **P**)
Baud rate	9600 kbps	Device address (ID)	1 (Hex – 0x01)
Data bits	8 bits	IP address	10.2.25.211
Stop bits	1	TCP port	502 (Hex – 1F6)
Parity	None	Gateway	10.2.1.1
RS485 port mode	Slave	Subnet mask	255.255.0.0

The routing rule record has the format **40:0:10:0A0219D2:1F6:1:P** and it is explained in the table:

Table A.3 Routing rule record

Incoming packet			Outgoing packet			Proto-col
Interface code / IP address	Port (not used)	Slave ID	Interface code / IP address	Port (optional)	Slave ID	
0x40	0x00 (not used)	0x10	0x0A0219D2	0x1F6	0x01	P

The Slave ID of the incoming packet unambiguously points to a Slave device in the Ethernet network with a specific IP address, TCP port and its own Slave ID. Packets sent by the Master device to address 16 (Hex - 0x10) in the RS485 network will be forwarded to IP address 10.2.25.210 (Hex - 0x0A0219D2), TCP port 502 (Hex - 0x1F6) and Slave ID 1 (Hex - 0x01) of the device in the Ethernet network. The Modbus RTU/ASCII protocol will be converted to the Modbus TCP protocol (protocol code - P).

NOTE
The Hex representation of the IP address is used as the interface code of the outgoing packet, not the Ethernet interface code (Hex is 0x06).

NOTE
To redirect all packets to the specified Slave device, set the Slave ID of the incoming packet to G (any Slave ID can be processed). It should be taken into account that routing rules written below the rule with the code G will not be processed, according to the order of parsing the routing table.

Example of conversion from Modbus TCP to Modbus RTU/ASCII protocol

The Master device is in the Ethernet network, the Slave device is in the RS485 network.

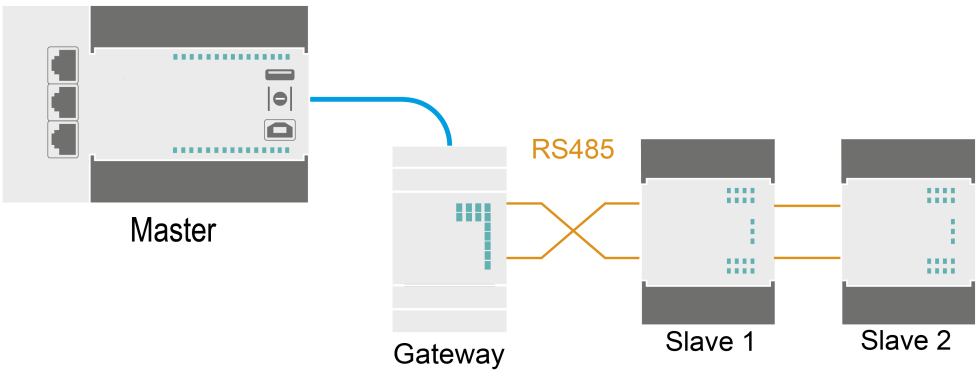


Fig. A.2 Wiring diagram

Table A.4 Network settings of devices connected to the gateway

Master		Slave		
Parameter	Value	Parameter	Value	
Interface	Ethernet	Interface	RS485	
Protocol	Modbus TCP	Protocol	Modbus RTU	
IP address	10.2.25.210 (Hex – 0A0219D2)	Device	Slave 1	Slave 2
Gateway	10.2.1.1	Address	2	3
Subnet	255.255.0.0	Baud rate	9600 kbps	
–		Data bits	8 bits	

Master		Slave	
Parameter	**Value**	**Parameter**	**Value**
		Stop bits	1
		Parity	None

Table A.5 Network settings of the gateway

Ethernet (interface code– 0x06)		RS485 (interface code – 0x40)	
Parameter	**Значение**	**Parameter**	**Value**
Protocol	Modbus TCP	Protocol	Modbus RTU (protocol code – **R**)
Device address (ID)	1*	Baud rate	9600 kbps
IP address	10.2.25.211	Data bits	8 bits
TCP port	502*	Stop bits	1
Gateway	10.2.1.1	Parity	None
Subnet mask	255.255.0.0	RS485 port mode	Master

NOTE
* The value does not change for the Ethernet interface.

The routing rule record has the format **6:0:G:40:0:S:R** and it is explained in the table:

Table A.6 Routing rule record

Incoming packet			Outgoing packet			Proto-col
Interface code / IP address	**Port (not used)**	**Slave ID**	**Interface code / IP address**	**Port (optional)**	**Slave ID**	
0x06	0x00 (not used)	G	0x40	0x00 (not used)	S	R

If the **Slave ID** field of an incoming packet is set to **G**, the gateway forwards all packets from the Ethernet network (Hex - 0x06) to the RS485 network (Hex - 0x40) except for incoming packets with Slave ID equal to 1.

NOTE
Devices in the RS485 network cannot have an address equal to 1 if the Slave ID of the incoming packet is set to **G**, because this address is reserved for the gateway and cannot be changed. Thus, all incoming packets with Slave ID = 1 will match the system routing rule *27:0:1:0:0:S:P*. If you cannot change the address of the Slave device, you can apply the following routing rule: *6:0:DE:40:0:1:R* (packets directed to address 0xDE (Dec - 222) will be redirected to the Slave device with address 1). This routing rule should be put above the rule with the value **G** according to the order of the routing table parsing.

The outgoing packet will have the same Slave ID as the incoming packet because the **Slave ID** field of the outgoing packet has the value of **S**. The Modbus TCP protocol will be converted to the Modbus RTU protocol (protocol code - **R**).

NOTE
To convert the Modbus TCP protocol to the Modbus ASCII protocol, set the **Protocol code** field to **A**.

Appendix B. Modbus register map

To view the gateway parameters in *akYtec Tool Pro*, click **Parameter list**.

Table B.1 Setup parameters

Parameter	Address	Address (hex)	Number of registers	Read function	Write function	Data type
Mode settings						
Delay between packets	1542	0x0606	1	3	16	Unsigned 8
Mode of RS485 port	1540	0x0604	1	3	16	Enum 2
Response timeout	1546	0x060A	1	3	16	Unsigned 16
Routing settings						
R0*	1008	0x03F0	16	3	-	String 256
R1	1024	0x0400	16	3	16	String 256
R2	1040	0x0410	16	3	16	String 256
R3	1056	0x0420	16	3	16	String 256
R4	1072	0x0430	16	3	16	String 256
R5	1088	0x0440	16	3	16	String 256
R6	1104	0x0450	16	3	16	String 256
R7	1120	0x0460	16	3	16	String 256
R8	1136	0x0470	16	3	16	String 256
R9	1152	0x0480	16	3	16	String 256
R10	1168	0x0490	16	3	16	String 256
R11	1184	0x04A0	16	3	16	String 256
R12	1200	0x04B0	16	3	16	String 256
R13	1216	0x04C0	16	3	16	String 256
R14	1232	0x04D0	16	3	16	String 256
R15	1248	0x04E0	16	3	16	String 256
R16	1264	0x04F0	16	3	16	String 256
R17	1280	0x0500	16	3	16	String 256
R18	1296	0x0510	16	3	16	String 256
R19	1312	0x0520	16	3	16	String 256
R20	1328	0x0530	16	3	16	String 256
R21	1344	0x0540	16	3	16	String 256
R22	1360	0x0550	16	3	16	String 256
R23	1376	0x0560	16	3	16	String 256

Parameter	Address	Address (hex)	Number of registers	Read function	Write function	Data type
R24	1392	0x0570	16	3	16	String 256
R25	1408	0x0580	16	3	16	String 256
R26	1424	0x0590	16	3	16	String 256
R27	1440	0x05A0	16	3	16	String 256
R28	1456	0x05B0	16	3	16	String 256
R29	1472	0x05C0	16	3	16	String 256
R30	1488	0x05D0	16	3	16	String 256
R31	1504	0x05E0	16	3	16	String 256
RS485 port settings						
Pull-up resistors	526	0x020E	1	3	16	Enum 2
COM port baud rate	521	0x0209	1	3	16	Enum 14
Data bits	522	0x020A	1	3	16	Enum 2
Stop bits	523	0x020B	1	3	16	Enum 2
Parity	524	0x020C	1	3	16	Enum 3
RSDL	525	0x020D	1	3	16	Unsigned 8
Device ID	527	0x020F	1	3	16	Unsigned 8
Ethernet settings						
IP address*	26	0x001A	2	3	-	Unsigned 32
Subnet mask*	28	0x001C	2	3	-	Unsigned 32
Gateway IP address*	30	0x001E	2	3	-	Unsigned 32
DNS server 1	12	0x000C	2	3	16	Unsigned 32
DNS server 2	14	0x000E	2	3	16	Unsigned 32
New IP address	20	0x0014	2	3	16	Unsigned 32
New subnet mask	22	0x0016	2	3	16	Unsigned 32
New gateway IP address	24	0x0018	2	3	16	Unsigned 32
DHCP	32	0x0020	1	3	16	Enum 3

NOTE
* Unchangeable parameters.