

MBC-24.Wi-Fi

Modbus RTU-ASCII-TCP Gateway (RS485 / Wi-Fi)

User guide

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MBC-24.Wi-Fi_3-EN-149178-1.1
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1 Introduction

This manual describes the functions, configuration, operating instructions and troubleshooting of the MBC-24.Wi-Fi Modbus RTU-ASCII-TCP 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*)
– **Wi-Fi** – Wireless local network protocol based on IEEE 802.11 standard
– **akYtec Tool Pro** – Configuration interface
– **USB (Universal Serial Bus)** – Serial communication interface
– **PC** – Personal computer
– **MTBF** – Mean Time Between Failures

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.

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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.

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2 Overview

The MBC-24.Wi-Fi network gateway is designed for bidirectional conversion and routing communication between ModbusRTU / ASCII via RS485 and Modbus TCP via the Wi-Fi interface. Master and Slave modes are supported.
To operate, the gateway should be configured on PC using *akYtec Tool Pro*.

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3 Specifications

3.1 Specifications

Table 3.1 Specifications

Parameter	Value
Electrical	
Power supply	24 (10…48) V DC
Power consumption, max.	6 W
Galvanic isolation	see *Section 3.2*
Appliance class	II
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
Wi-Fi	
Standard	802.1 b/g/n
Protocol	Modbus TCP (Master/Slave)
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 (without antenna)	55 × 96 × 58 mm
IP code	IP20
Weight	approx. 150 g
Average service life	10 years
Mean time between failures (MTBF)	80000 hours

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3.2 Galvanic isolation

For the diagram of galvanically isolated components and galvanic isolation, see *Fig. 3.1*.

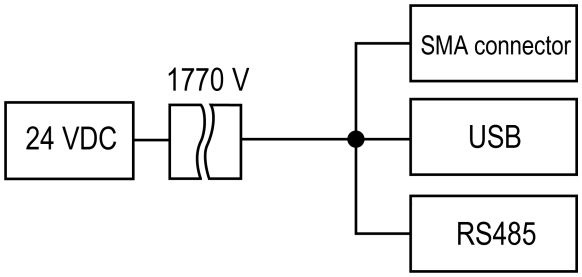


Fig. 3.1 Galvanic isolation

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	

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4 Startup

To start the gateway:

1. Mount the gateway (see *Section 5.1*).
2. Connect the gateway to the power supply (see *Section 6.1*).
3. Power on the gateway.
4. Check LEDs on the front panel to make sure that no errors have occurred (see *Table 7.3*).
5. Connect devices to the gateway (see *Section 6.3*). Ensure all devices are configured before being connected.
6. Configure the gateway using akYtec Tool Pro (see *Section 8.1*).

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5 Installation

5.1 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, etc. 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, antenna and cables.
2. Mount the gateway on the DIN rail.

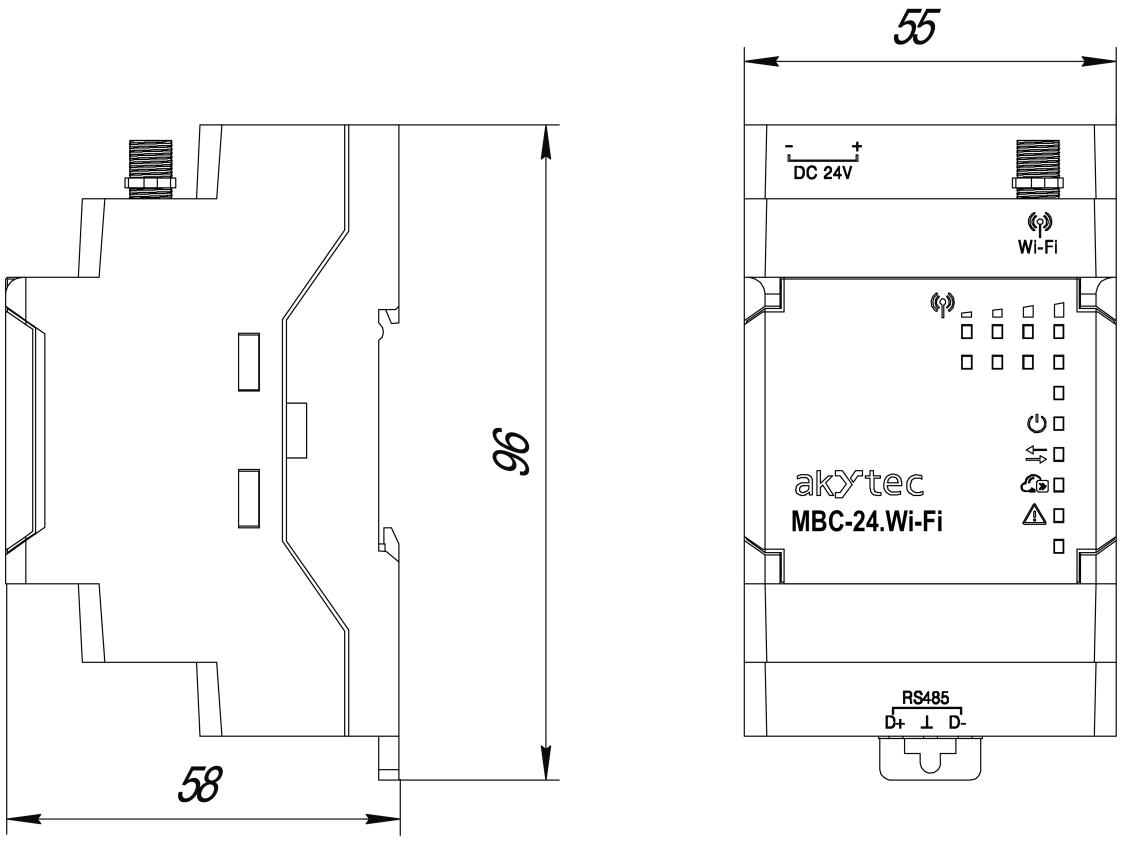


Fig. 5.1 Dimensions

After mounting, connect the antenna to the appropriate connector. Dimensions of the gateway with the supplied antenna are shown in the figure below.

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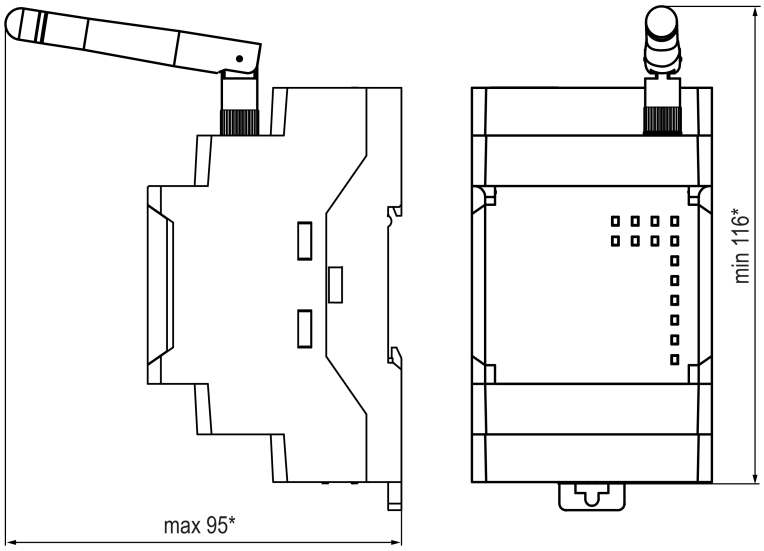


Fig. 5.2 Dimensions with the antenna connected

5.2 Quick replacement

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

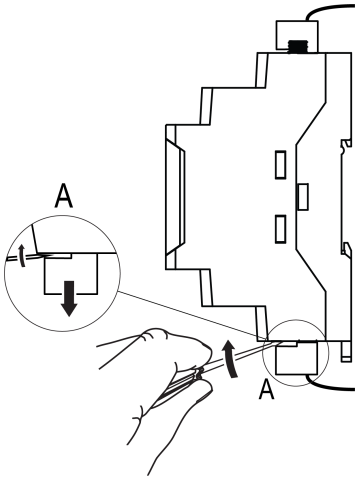


Fig. 5.3 Quick replacement

For the device quick replacement, follow the steps below:

1. Power off all connected lines including power supply.
2. Disconnect the antenna.
3. Using a screwdriver or a similar tool, unplug the terminal blocks with existing wiring connected (see *Fig. 5.3*).
4. Remove the gateway from the DIN rail and mount another gateway of the same modification (with the terminal blocks unplugged).
5. Plug the terminal blocks with existing wiring into mating connectors of the gateway installed.
6. Power on the gateway.

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6 Connection

6.1 General information

CAUTION
Do not use gateway power terminals to power on other devices.

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

CAUTION
De-energize the gateway and connected devices before connection and maintenance.

The wire cross-section must be within 0.35 – 0.75 mm². Use cable ferrules in case of twisted wires.

NOTE
Do not connect more one wire to a one terminal.

To connect the gateway to a Wi-Fi network, use an access point that supports the IEEE 802.11 standard. Attach the antenna to connect the gateway to the Wi-Fi network.

6.2 Terminal assignments

Table 6.1 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

6.3 RS485 network

When connecting over the RS485 interface:

– 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 mm² 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 7.4*).

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 pull link D+ to power supply, link D- to ground. 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*).

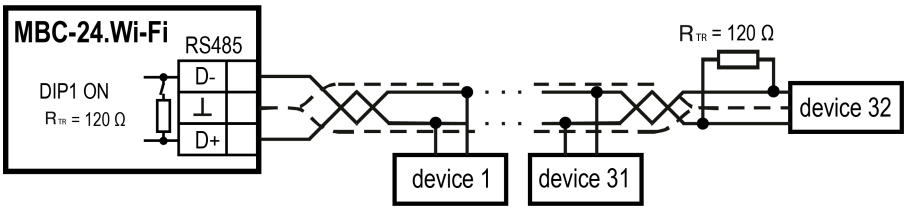


Fig. 6.1 RS485 network

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7 Design and operation

7.1 Design

The gateway is designed in a plastic case for DIN rail mounting. Main components are shown in *Fig. 7.1*:

1. Antenna
2. Detachable part of power terminal block
3. Gateway case
4. Indicators
5. Detachable part of RS485 terminal block
6. Wi-Fi signal indicators

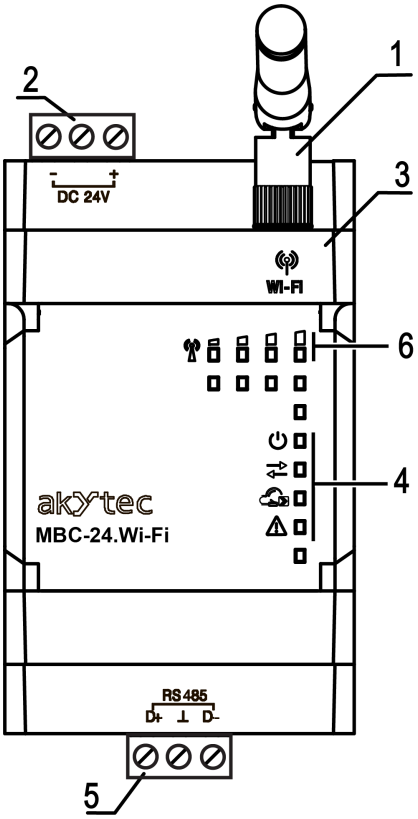


Fig. 7.1 Front view

Under the front cover (see *Fig. 7.2*):

1. Service button
2. 4 DIP switches
3. Micro-USB connector

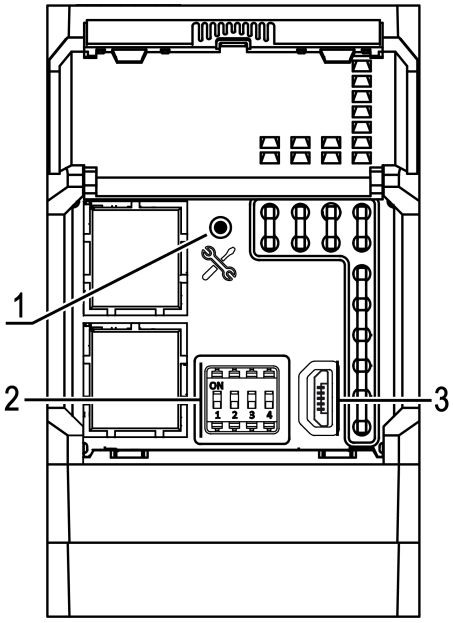


Fig. 7.2 Under the front cover

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7.2 Indication and control

There are 8 LEDs on the front panel of the gateway:

Table 7.1 Indicators

LED	State	Description
	ON (Wi-Fi 1...4)	Wi-Fi signal level
	ON one after the other ("ticker") (Wi-Fi 1...4)	Connection to Wi-Fi access point not configured
		The device has created its own access point for configuration
	ON	Power is on
RS	Flashing	Data transfer over RS485 interface
	Flashing	Data transfer over Wi- Fi interface
	OFF	No errors
	ON	Error (see *Table 7.3*)

Table 7.2 Firmware update indication

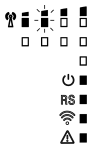
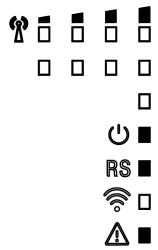
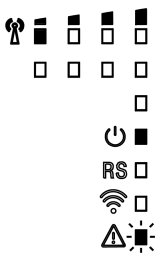
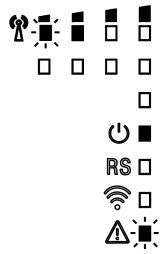
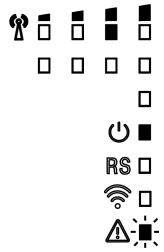
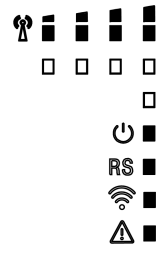
LED	State	Description
	ON (⚠, **RS**, , ⏻), Wi-Fi LEDs flash and turn on one by one	Firmware update is in progress

Table 7.3 Error indication and remedy

LED	State	Description	Remedy
	ON (⏻, **RS**, ⚠)	Invalid RS485 configuration: 7-N-1 (data bits - 7 bits, stop bits - 1, pariry - none)	Select a valid combination of parameters (see *Table 8.2*)
	⚠ Flashing (short ON, long OFF) and ON (Wi-Fi 1 and ⏻)	Wi-Fi module does not respond	Contact akYtec service staff
		Wi-Fi module is not powered	

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LED	State	Description	Remedy
	⚠, Wi- Fi 1 flashing (short ON, long OFF) and ON (Wi- Fi 2 and ⏻)	Incorrect configuration for connection to the access point	Ensure the correctness of configuration for connection to the access point. Check if there is a Wi-Fi signal in the place where the device is installed. Check antenna connection
		Access point rejects connection requests	
	⚠ Flashing and ON (Wi- Fi 3 and ⏻)	Static IP address setup error	Reassign IP address, if it was configured with *akYtec Tool Pro.* Ensure the correctness of Wi-Fi network settings
	ON (⏻, **RS**, ⚠, Wi-Fi 1..4)	Firmware startup error	Restart the device. Repeat the firmware update if necessary

Under the cover:

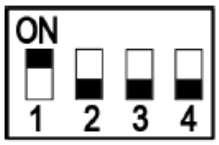
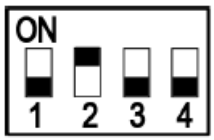
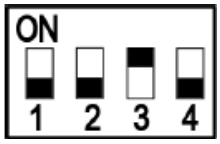
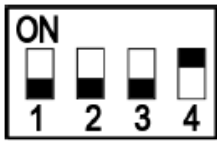
1. Service button
2. 4 DIP switches
3. Micro-USB connector

The service button can be used for the following functions:

– Factory settings restoration (long press up to 12 s (see *Section 8.5*))
– Device reset (up to 2 s)

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Table 7.4 DIP switches

DIP switch	Description
 DIP1 = ON	120 Ω terminating resistor is connected
 DIP2 = ON	Firmware update mode is enabled (see *Section 8.4.1*)
 DIP3 = ON  DIP4 = ON	Only for akYtec service staff. DIP switches 3 and 4 must be turned **off** during normal operation

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

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8 Configuration

8.1 Configuration sequence

To configure the gateway in *akYtec Tool Pro*:

1. Add the gateway to a project in *akYtec Tool Pro* (see *Section 8.2.1*).
2. Configure the Wi-Fi interface (see *Section 8.2.2*).
3. Configure the gateway operation mode (see *Section 8.2.4.2*).

8.2 Configuration using akYtec Tool Pro

8.2.1 Connection to akYtec Tool Pro

To configure the gateway, install *akYtec Tool Pro*.
You can connect the gateway to *akYtec Tool Pro* over:

– USB (Micro-USB connector)
– Wi-Fi

8.2.1.1 Connection over USB

To add the gateway to a *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:

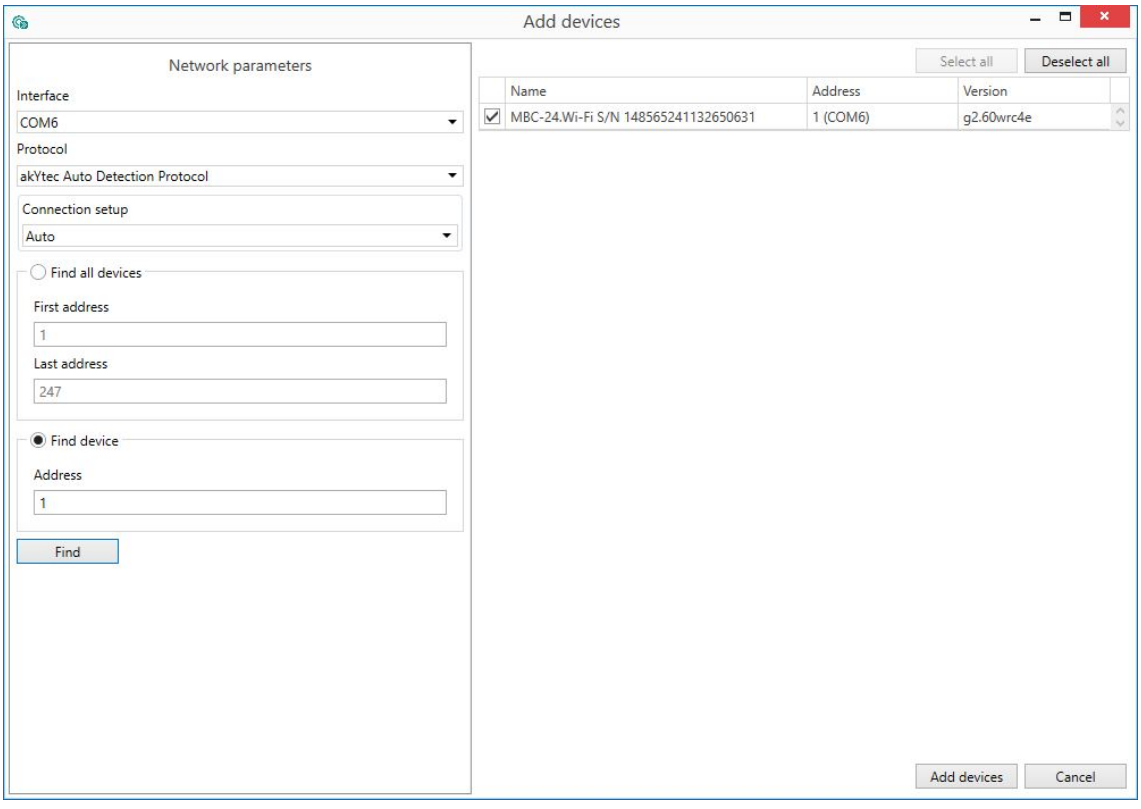


Fig. 8.1 Interface menu

– 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**.

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– Enter the address of the connected device (factory setting - **1**).
– Click the **Find** button. The gateway with the address will be displayed in the field on the right.
– Select the checkbox next to the gateway and click the **Add devices** button. The device will be added to the project.

8.2.1.2 Connection over Wi-Fi

NOTE
Before connecting over Wi-Fi, ensure the gateway is connected to a power supply.

You can connect the gateway to a PC over Wi-Fi using:
– gateway's access point
– external Wi-Fi network

If no settings for connecting to the Wi-Fi network are saved in the gateway, the gateway creates its own access point.
To find and add the gateway connected via its own access point to a project in *akYtec Tool Pro*:

1. In Windows settings on the PC, go to **Network & internet** settings, select the gateway's access point.

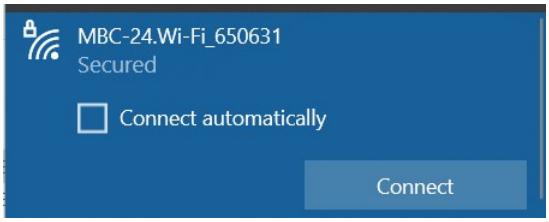


Fig. 8.2 Access point

NOTE
By default, the gateway's access point is named «**MBC-24.Wi-Fi_xxxxxx**», where **xxxxxx** are 6 last digits of the gateway's serial number.
The default password is 12345678.
You can change the SSID and password of the access point in the gateway network settings (see *Section 8.2.2*).

2. Start *akYtec Tool Pro*.
3. On the **Project** tab, click the **Add devices** button. You will see the window to select the interface and search devices.
4. Select the wireless network (could be "Wi-Fi", "Wireless 80211", or otherwise) from the **Interface** drop-down menu.



Fig. 8.3 Menu to select Wi-Fi interface

5. Select **Find device** and enter **IP address** of the connected device.

NOTE
The default IP address (factory setting) is 192.168.1.99.
If you do not know the IP address of the gateway, select **Find all devices** and enter the range of possible IP addresses in fields **First IP address** and **Last IP address** (see *Fig. 8.4*).

6. Click the **Find** button, the gateway with this address will be displayed.

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7. Select checkbox next to the gateway's name and click the **Add devices** button. The gateway will be added in the project.

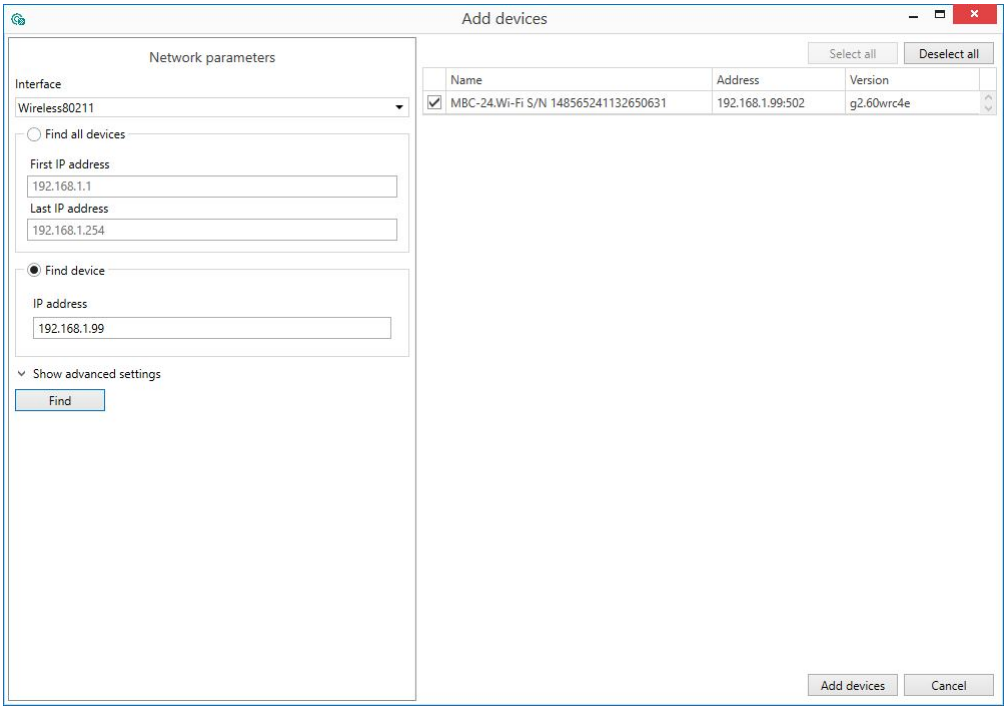


Fig. 8.4 Adding the device

To connect to an external Wi-Fi network:

1. Connect the gateway to *akYtec Tool Pro* using its own access point as described above or over USB (see *Section 8.2.1.1*).
2. In the **Network settings** menu, select the **Wi-Fi settngs** tab.

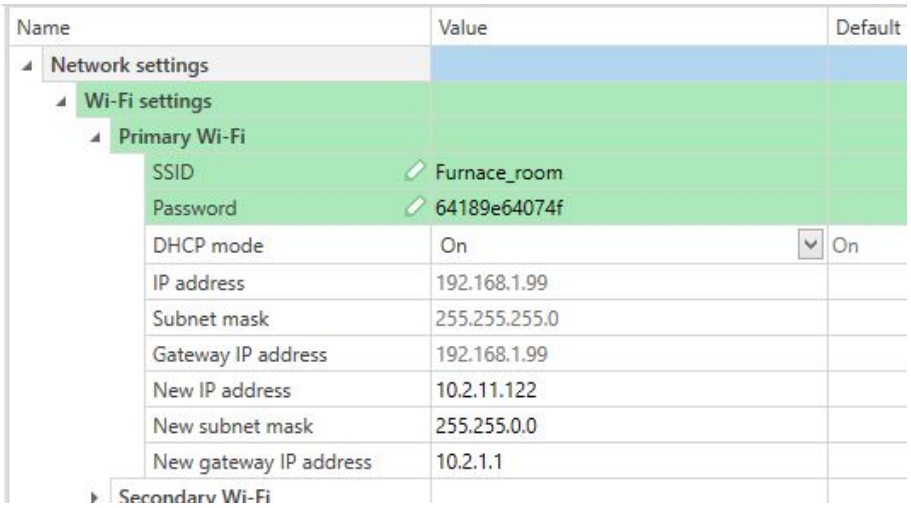


Fig. 8.5 Network settings

3. In the **SSID** field, enter the name of the access point.
4. In the **Password** field, enter the password for the access point.
5. In the **Project** menu, click **Write parameters**.

After saving the access point parameters, you can connect the gateway to your PC using the external Wi-Fi. The device and PC with *akYtec Tool Pro* installed must be in the same Wi-Fi network. Further connection is carried out in the same way as via the gateway's own access point (Cl. 2-7).

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8.2.2 Network settings

You can set the gateway network settings in the *akYtec Tool Pro* setting tree.

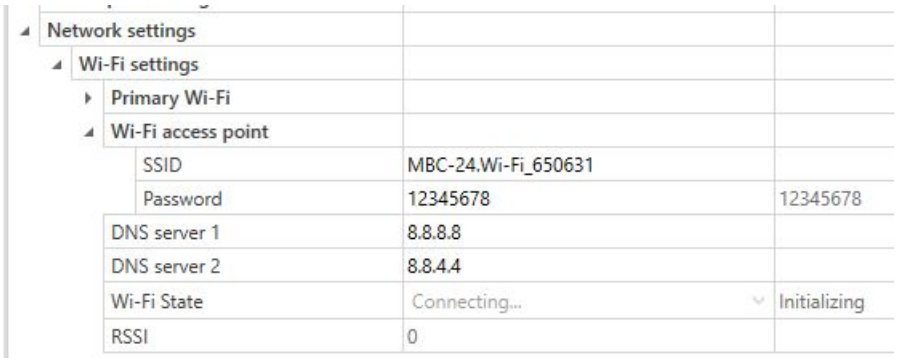


Fig. 8.6 Network settings

To apply the new network settings, reset the gateway.

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

NOTE
Press and hold the service button for 12 s, to restore the factory settings.

RS485 parameters

Table 8.1 RS485 parameters

Parameter	Description	Default value
Pull-up resistors	It is set by switching on the DIP-switch (see *Table 7.4*): – **On** – pull-up resistors on – **Off** – pull-up resistors off	Off
Baud rate	Data transfer speed can be selected from the drop-down list of **1200...115200** bps	115200
Data bits	It can be selected from the drop-down list of **7 bits, 8 bits**	8
Stop bits	It can be selected from the drop-down list of **1, 2**	1
Parity	It can be selected from the drop-down list of **none, even, odd**	None
RSDL	RS485 response delay **(0...20 ms)**	0
Device-ID	Own gateway identifier via the RS-485 port when the gateway operates in the Slave mode. Range: **1...255**	1

NOTE
After changing **Parity**, reset the device.

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

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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
—	7-O-1
—	7-O-2
—	7-E-1
—	7-E-2

NOTE
Some combinations are not supported:
– 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**.

"Primary Wi-Fi" parameters

To transfer data in a Wi-Fi network, set the following parameters:

Table 8.3 Network settings

Parameter	Description	Factory setting
SSID and Password	Access point and password to connect to the Wi-Fi network	-
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

NOTE
The gateway MAC address is set by the manufacturer and is not changed.

The dynamic IP address of the device is provided by a DHCP server of the local network. Ask the system administrator whether there is a DHCP server in the network area to which the device is connected. To use dynamic IP addresses, set ***DHCP*** to ***On***.
If there is a DHCP server in the network, setup of network parameters is not required. The mode of address acquisition via DHCP is enabled in the device by default.

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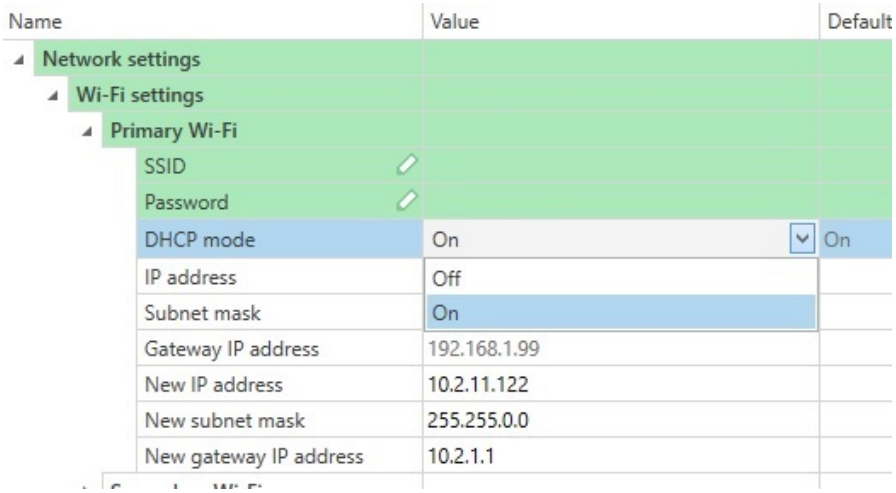


Fig. 8.7 DHCP

To use the static IP address, set ***DHCP*** to ***off*** in the gateway via *akYtec Tool Pro*:

– **Off** - Static IP address
– **On** (by default) - Dynamic IP address from DHCP server

To set the static IP address manually (**DHCP = Off**) in *akYtec Tool Pro*, enter the following parameters:

– IP address
– Subnet mask
– Gateway IP address

“Wi-Fi access point” parameters

Upon the first power-on the gateway creates its own access point.
The default SSID is «**MBC-24.Wi-Fi_xxxxxx**», where **xxxxxx** is the last 6 digits of the gateway’s serial number. The default password is not set. After connection it is recommended to set the password to ensure security.



Fig. 8.8 Access point settings

DNS server

By default, the device uses standard DNS servers **8.8.8.8** and **8.8.4.4**. If necessary, the server addresses can be changed using the parameters:

– DNS server 1
– DNS server 2

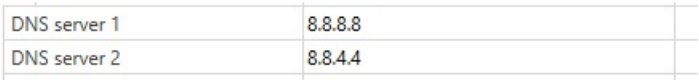


Fig. 8.9 DNS servers

8.2.3 Network delay setup

“Delay between packets” parameter

The **Delay between packets** parameter works only in the **Wi-Fi (Master) - RS485 (Slave)** mode. Use this parameter if Slave devices need additional time to prepare for the next exchange. The

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Delay between packets is set in milliseconds (ms). The range is 50...5000 ms, the default value is 300 ms.
Response timeout is the maximum time for the Slave device to respond to a request. If after this time the gateway has not received a response to the request, it means that a failure or accident has occurred. In this case the gateway will generate error 0B (GATEWAY TARGET DEVICE FAILED TO RESPOND) according to the Modbus protocol specification.
The time diagram explaining the principle of operation of the **Delay Between Packets** parameter is shown in the figure below

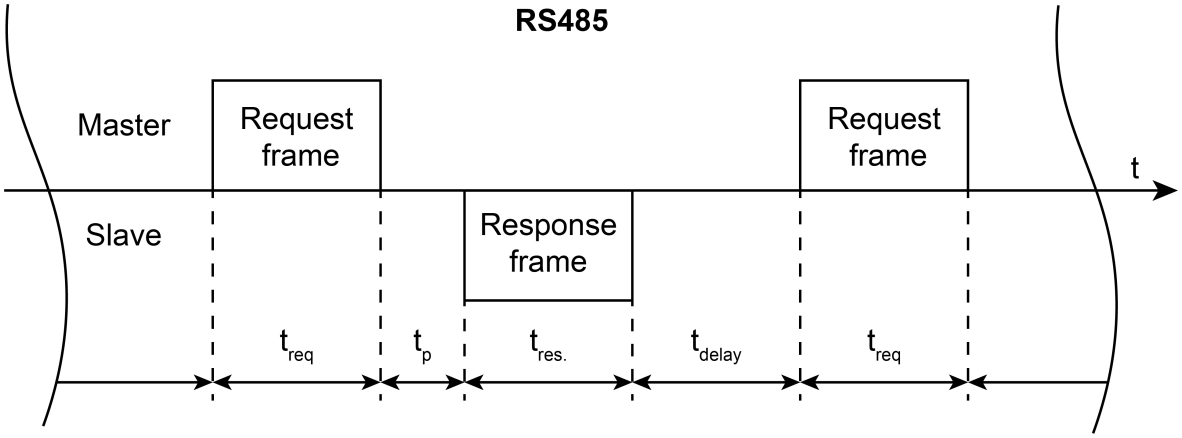


Fig. 8.10 Operation diagram of "Delay between packets" parameter

where:
– t_{req} – time for which Master transmits the request frame
– t_p – 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

"Response timeout" parameter

The parameter defines the waiting time for a response from the Slave device. If the waiting time exceeds the specified time, the gateway will send an error message to the Master. The range is 50...5000 ms
In the **RS485 (Master) - Wi-Fi (Slave)** mode, the value of the **Response timeout** parameter should be set according to the maximum PING to Slave devices in the used Wi-Fi network (select the value with margin).
In the **Wi-Fi (Master) - RS485 (Slave)** mode, the response waiting time is determined by the maximum response delay of Slave devices in the used RS485 network (select the value with margin).

NOTE
Master in the Wi-Fi or RS485 network must have a larger timeout than the **Response timeout** at the gateway.
To estimate the minimum timeout set on Master, you can use the formula:
$T_{time\ out} = T_{RT} + T_{Max.\ delay}$, where
T_{RT} – Response timeout parameter
$T_{Max.\ delay}$ – Maximum delay of data transmission over the used channel

8.2.4 Operation mode configuration

8.2.4.1 Network topology

The gateway supports the following network topologies:
– daisy (see the figures below)
– star with several gateways

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NOTE
It is recommended to use not more than five gateways for star topology.

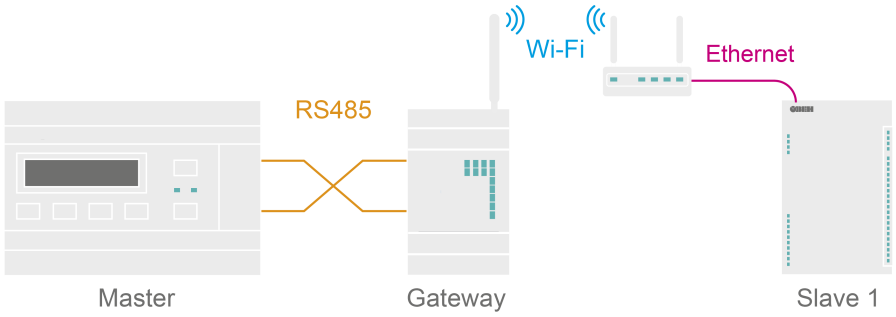


Fig. 8.11 Using the gateway with Master in the RS485 interface

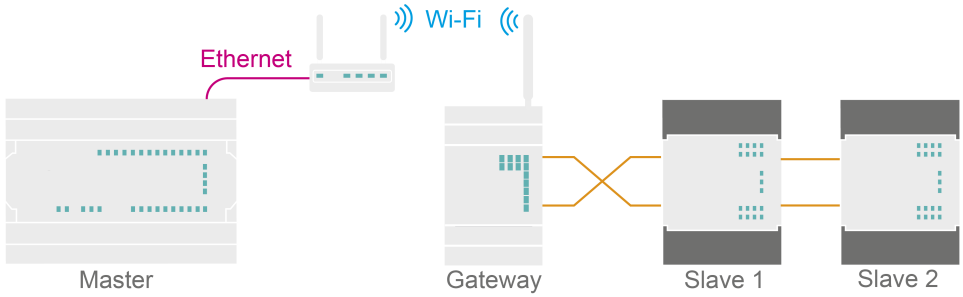


Fig. 8.12 Using the gateway with Slave devices in the RS485 interface

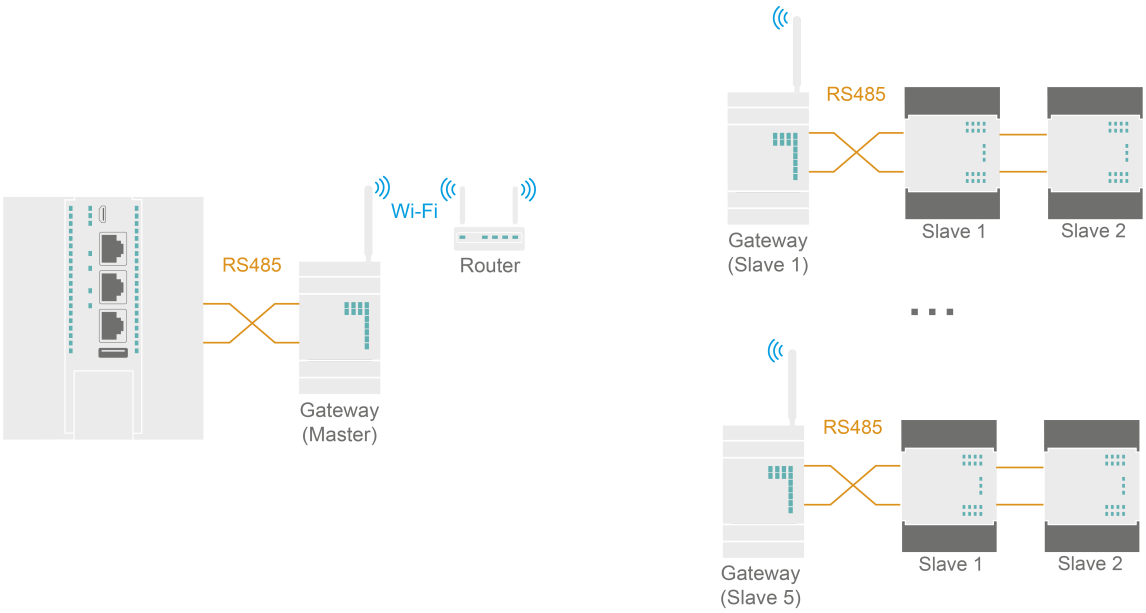


Fig. 8.13 Star topology using an external router

8.2.4.2 Standard gateway configuration

After adding the gateway to the akYtec Tool Pro project, you can select the operation mode using the **Gateway** function.

To configure the gateway, click **Gateway** in the gateway context menu in the device field or in the **Project** tab in the main menu.
Operating modes are available for the gateway:

– Wi-Fi (Master) - RS485 (Slave)

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– RS485 (Master) - Wi-Fi (Slave)

NOTE
The operating modes are labeled the same for the MBC-24 gateway with Ethernet and MBC-24 gateway with Wi-Fi. in *akYtec Tool Pro* in the **Gateway** window.
For MBC-24 gateway with Wi-Fi:
– **Wi-Fi (Master) - RS485 (Slave)** corresponds to **Wi-Fi (Ethernet) - RS485 (Slave)**
– **RS485 (Master) - Wi-Fi (Slave)** corresponds to **RS485 (Master) - Ethernet (Slave)**

Depending on the selected operating mode, a reference connection diagram is displayed in the upper left part of the window.
The network parameters of the interfaces, which are read from the gateway, are also displayed in the parameter settings area.

NOTE
Network parameters cannot be changed in the **Gateway** window. To change the network parameters, make changes in the settings tree and write the parameters to the gateway. When reopening the gateway settings, the changed parameters will be read out.

Wi-Fi (Master) - RS485 (Slave)

The **Wi-Fi (Master) - RS485 (Slave)** operation mode implies that the gateway is connected to the Master via the Wi-Fi interface and connected to the slave devices via the RS485 interface (see *Fig. 8.14*).

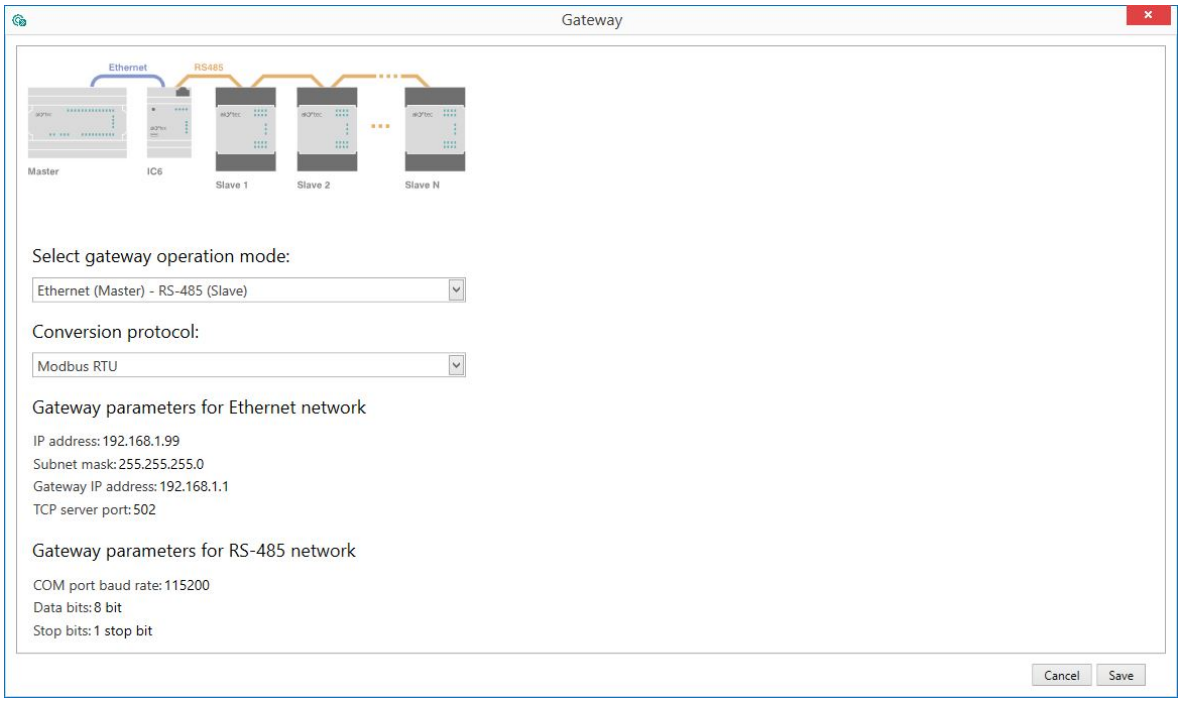


Fig. 8.14 Gateway settings in Wi-Fi (Master) - RS485 (Slave)

NOTE
Devices in the RS485 network cannot have the address equal to 1, as this address is reserved for the gateway and cannot be changed. All incoming packets with the Slave ID value equal to 1 match the system routing rule and will be redirected to the gateway's own registers, see *Appendix A.* for details.

You can select the select the conversion protocol for the gateway in the **Wi-Fi (Master) - RS485 (Slave)** operation mode:
– Modbus ASCII
– Modbus RTU

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RS485 (Master) - Wi-Fi (Slave)

The **RS485 (Master) - Wi-Fi (Slave)** operation mode implies that the network Master is in the RS485 network (see *Fig. 8.15*).

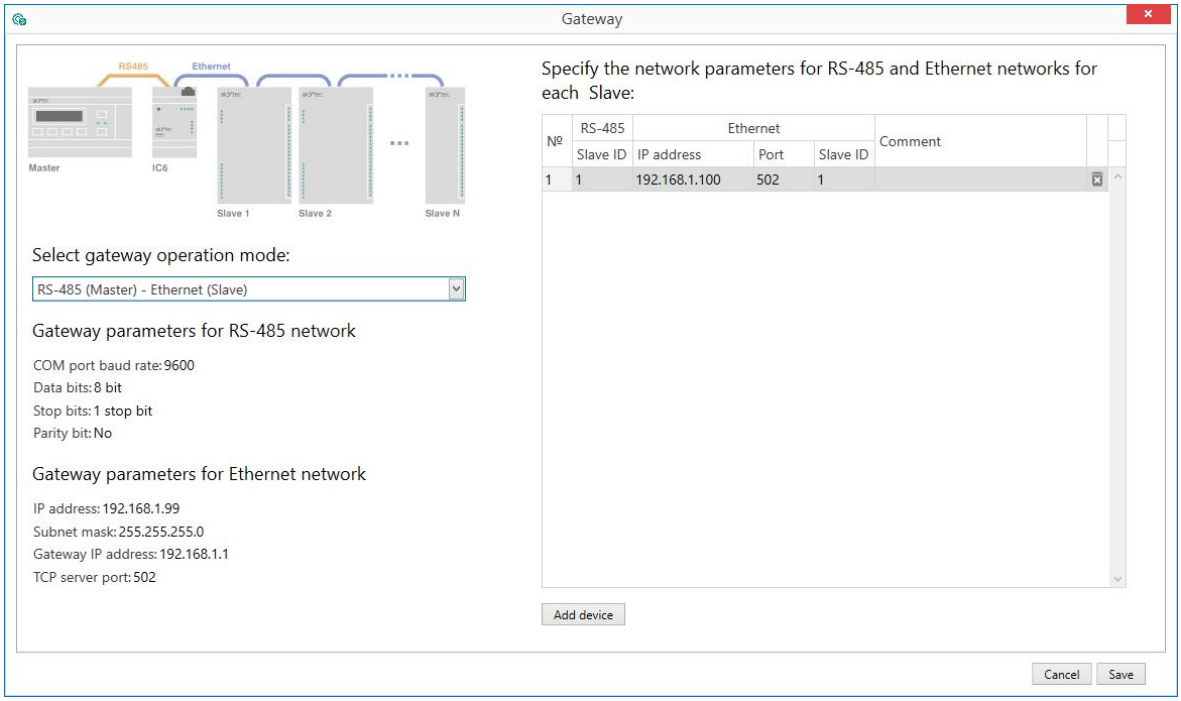


Fig. 8.15 Gateway settings in Master in RS-485 - Slave in Wi-Fi

If the mode with the network Master in the RS485 interface is selected, then in the right area of the window you should set the correspondences between network parameters of the devices in the RS485 network (Slave ID) for IP addresses and ports, as well as the Slave ID of the device in the Wi-Fi network. For convenience, you can add a comment to each device.

№	RS-485	Ethernet			Comment
	Slave ID	IP address	Port	Slave ID	
1	1	192.168.1.100	502	3	MV210-101 #1
2	2	192.168.1.101	502	6	MU210-502 #1
3	3	192.168.1.102	502	9	MU210-502 #2

Fig. 8.16 Matching device addresses

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

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

To add a new device into the table, click the **Add device** button.

To remove a device from the table, click **Remove device** in the device row.

NOTE
The maximum number of Slave devices in the **RS485 (Master) - Wi-Fi (Slave)** operation mode is 31.

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Example:
The slave device in the local network is located at IP-address *10.2.1.1:502* and has a built-in Slave ID - *1*. To poll the slave device by the Master in the RS485 network, set the **RS485 (Master) - Wi-Fi (Slave)** conversion mode using *akYtec Tool Pro* and match the network parameters of the slave device to address 1 in the RS485 network. Then, when the Master polls the device at address 1 of the RS485 interface, a request will be sent through the gateway to the specified slave device in the local network.

8.2.4.3 Manual gateway configuration

To configure the gateway manually, use the **Gateway settings** node in the *akYtec Tool Pro* parameter field.

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	Master	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	7:0:G:40:0:S:R				
R2	10:0:G:40:0:S:N				

Fig. 8.17 Gateway settings

Manual setting is only required for systems with higher routing requirements, for standard setting it is recommended to use the **Gateway** (see *Section 8.2.4.2*).
A detailed description of the manual setting is given in *Appendix A.1*.

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8.3 Configuration in Web interface

You can set the following parameters on the web interface page:

– External access point
– Primary access point
– Addresses of additional DNS servers (independent of the addresses received from the router)
– Name and password of the access point created by the gateway

To configure the gateway in the web interface, connect to an access point as described in *Section 8.2.1.2*.

When connecting to the access point created by the gateway, the setting page will open automatically. If the page does not open automatically, enter the default IP address of the access point - **192.168.1.99** - in the browser address bar to access the setting page.

When connecting via an external access point, enter the IP address of the gateway assigned to it by the access point in the browser address bar.

You can view or download brief documentation for the gateway on the Web-interface page. To do this, use the **Short guide** link at the top of the page.

There are links to perform service operations with the gateway at the bottom of the page:

– Restore to the factory settings
– Firmware update (see *Section 8.4.2*)
– Reboot
– Switching to the light web-page

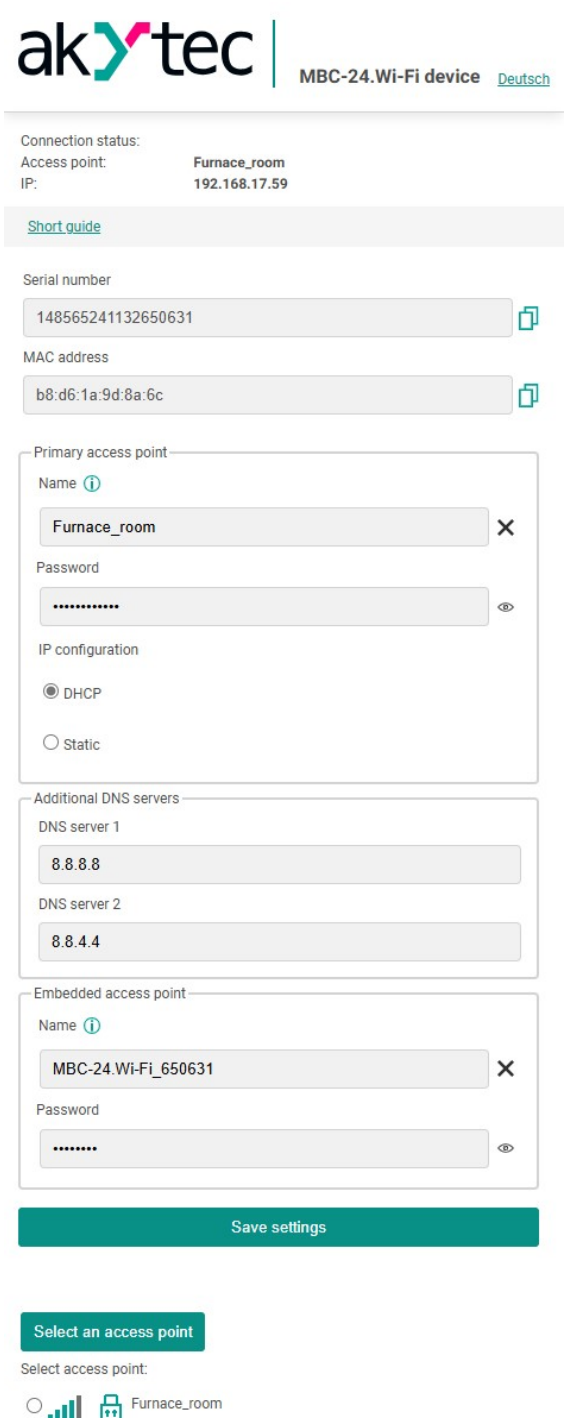


Fig. 8.18 Gateway configuration page

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8.4 Firmware update

8.4.1 Firmware update using akYtec Tool Pro

To update firmware using *akYtec Tool Pro:*

1. Connect the gateway to a PC.
2. Click  in the context menu of the device or on the control panel.
3. Select a firmware update file (.fw). Wait for the file is uploaded in the gateway and firmware update is complete (during update, signal level LEDs indicate update progress).

8.4.2 Firmware update using Web interface

To update firmware using web interface:

1. Open the gateway's web interface page in your browser (see *Section 8.3*).
2. Go to the **Firmware update** page.
3. Select a firmware update file (.fw). Wait for the file is uploaded in the gateway and firmware update is complete (during update, signal level LEDs indicate update progress).

8.5 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.

After powering on the gateway will work with default settings.

NOTE
After powering on the gateway will reset all network settings and create its own access point.

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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.

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10 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!

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11 Scope of delivery

- MBC-24.Wi-Fi network gateway	1 pc.
- External Wi-Fi antenna with RP-SMA connector	1 pc.
- Short guide	1 pc.
- 2EGTK-5-03P-11 terminal block	2 pc.

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

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Appendix A. Manual configuration

Manual setting is only required for systems with higher routing requirements, for standard setting it is recommended to use the **Gateway** function (see *Section 8.2.4.3*).
To configure manually, use the following nodes in *akYtec Tool Pro* parameter field:

– mode setting
– routing setting

A.1 Routing setting

The **Routing Settings** node allows you to set your own rules for data conversion. The gateway parses routing rule records from top to bottom (R1 to R31), checking to see if the packet being parsed matches the current rule. If the packet matches a routing rule, the record lookup is completed and the packet is forwarded according to the routing table. By default, the first record *27:0:1:0:0:S:P* is the system entry and cannot be changed. The gateway allows you to create up to 31 routing rules. A routing rule is written as a string with each field separated by a colon ":".

Table A.1 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 A.2 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	Wi-Fi

Table A.3 Values of the Interface code field for an outgoing packet

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

Table A.4 Values of incoming packet port

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

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Table A.5 Values of outgoing packet port

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 A.6 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 A.7 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 A.8 Values of protocol field

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

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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 Wi-Fi network.

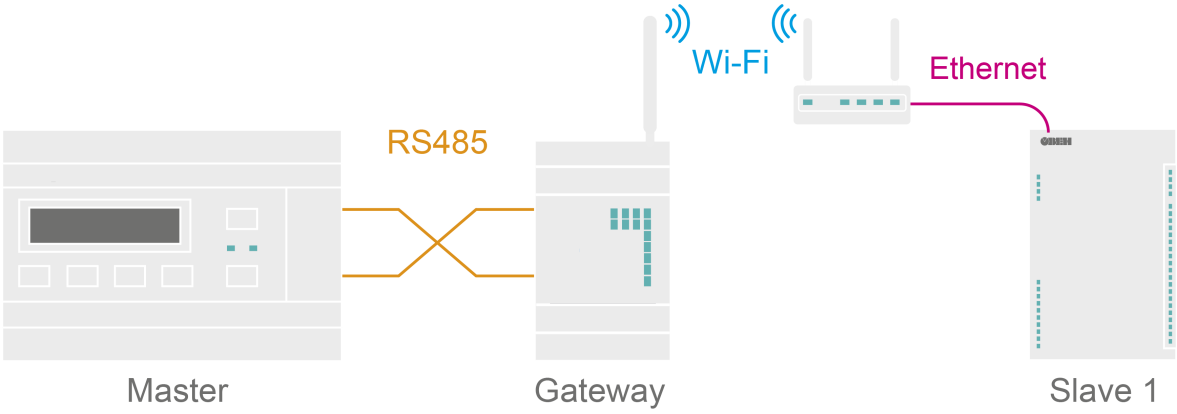


Fig. A.1 Wiring diagram

Table A.9 Network settings of devices connected to the gateway

Master		Slave	
Parameter	**Value**	**Parameter**	**Value**
Interface	RS485	Interface	Wi-Fi
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.10 Network settings of the gateway

RS485 (interface code– 0x40)		Wi-Fi	
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 format **40:0:10:0A0219D2:1F6:1:P** and is explained in the table:

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Table A.11 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 Wi-Fi network with a specific IP address, TCP port and a unique 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 Wi-Fi network. Modbus RTU/ASCII protocol will be converted to 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 Wi-Fi 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 Wi-Fi network, the Slave device is in the RS485 network.

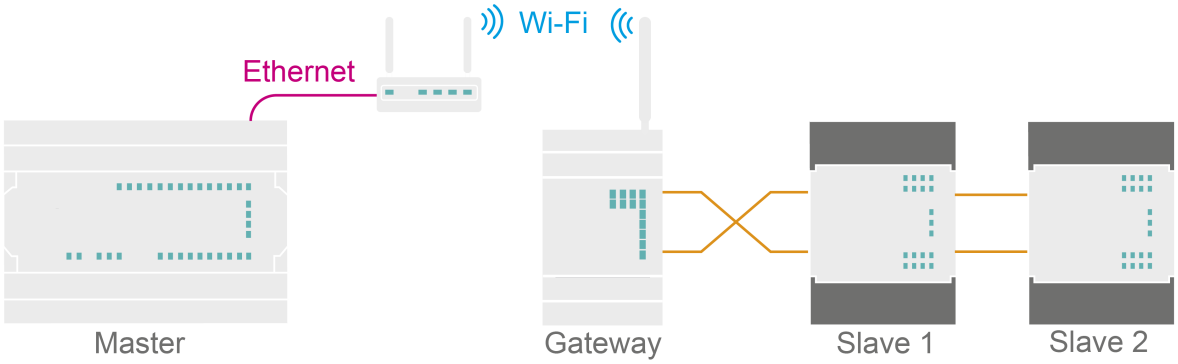


Fig. A.2 Wiring diagram

Table A.12 Network settings of devices connected to the gateway

Master		Slave		
Parameter	Value	Parameter	Value	
Interface	Wi-Fi	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 mask	255.255.0.0	Baud rate	9600 kbps	
–		Data bits	8 bits	
		Stop bits	1	

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Master		Slave	
Parameter	**Value**	**Parameter**	**Value**
		Parity	None

Table A.13 Network settings of the gateway

Wi-Fi (interface code – 0x06)		RS485 (interface code – 0x40)	
Parameter	**Value**	**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 Wi-Fi interface.

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

Table A.14 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 Wi-Fi 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 value of the **Protocol code** field to **A**.

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Appendix B. Modbus parameters and registers

Modbus parameters and registers of the gateway can be viewed in *akYtec Tool Pro* in **Parameter list**.

Table B.1 Modbus parameters and registers

Parameter	Address (dec)	Address (hex)	Number of registers	Read function	Write function	Data type
Mode settings						
Delay between packets	1542	0x0606	1	3	16	Unsigned 8
RS485 port mode	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

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Parameter	Address (dec)	Address (hex)	Number of registers	Read function	Write function	Data type
R23	1376	0x0560	16	3	16	String 256
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						
Pull-up resistors	526	0x020E	1	3	16	Enum 2
COM port baud rate	521	0x0209	1	3	16	Enum 9
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
Wi-Fi						
DNS server 1	12	0x000C	2	3	16	Unsigned 32
DNS server 2	14	0x000E	2	3	16	Unsigned 32
Wi-Fi state	61874	0xF1B2	1	3	-	Enum 10
Signal level	61766	0xF146	1	3	-	Signed 16
SSID	61767	0xF147	16	3	16	String 256
Password	61784	0xF158	16	3	16	String 256
DHCP	61764	0xF144	1	3	16	Enum 2
IP address*	61746	0xF132	2	3	-	Unsigned 32
Subnet mask*	61748	0xF134	2	3	-	Unsigned 32
Gateway*	61750	0xF136	2	3	-	Unsigned 32
New IP address	61740	0xF12C	2	3	16	Unsigned 32
New subnet mask	61742	0xF12E	2	3	16	Unsigned 32
New gateway	61744	0xF130	2	3	16	Unsigned 32
Wi-Fi access point						
SSID	61841	0xF191	16	3	16	String 256

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Parameter	Address (dec)	Address (hex)	Number of registers	Read function	Write function	Data type
Password	61858	0xF1A2	16	3	16	String 256

NOTE
* Unchangeable parameters.

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