

SPC210-XX

Touchscreen PLC

User guide

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1 Introduction

This manual describes the functions, configuration, operating instructions and programming of touchscreen programmable controller SPC210–XX (hereinafter referred to as "device" or "PLC").

1.1 Terms and abbreviations

- **CODESYS (Controller Development System)** – software, integrated development environment for PLC programming, a trademark of Codesys Group
- **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*)
- **Retain-memory** – non-volatile device memory for retain variables
- **Retain-variable** – type of variable that keeps its value after device restart (power off/on cycle)
- **RTC** – real time clock
- **USB (Universal Serial Bus)** – serial communication interface
- **RAM (Random Access Memory)** – energy-dependent part of the device memory where data and executable project are temporarily stored
- **ROM (Read-Only Memory)** – non-volatile memory that is used to store user data and the project
- **PC** – personal computer
- **Functional grounding** – is not only used for electrical safety, but also for shielding against electromagnetic interference

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.

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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. Before working on the device, de-energize it and all connected devices. Switch on the power supply only after completing all works on the device.



NOTICE
Supply voltage may not exceed 28 VDC. Higher voltage can damage the device.
If the supply voltage is lower than 15 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.

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2 Overview

The SPC210-XX touchscreen PLC is designed to display and control technological processes.
Main functions:

– process and equipment control;
– display the state of the controlled object in real time, using graphical pictograms (indicators, rulers, equipment symbols, etc.);
– display of sensory elements that helps the operator to control the process or the object;
– control other devices by means of communication interfaces;
– record and read parameter values of other devices via communication interfaces.

The user application is created with CODESYS as a project for a specific task and loaded into the non-volatile memory of the device. The device can be used in automated control systems in industry, agriculture, building technology and household applications.

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3 Specifications

3.1 Specifications

Table 3.1 Specifications

Parameter	Value	
	SPC210-07	SPC210-10
System resources		
CPU	4x ARM Cortex™-A35 1200 MHz	
ROM	4GB (eMMC)	
RAM	512 MB (DDR3)	
Retain-memory	64 kB (MRAM)	
Minimum execution time of one program cycle	10 ms	
Real Time Clock (RTC)	±2 s/day at 25 °C, CR2032 battery	
Buzzer	Piezoelectric, program-controlled	
Display		
Type	TFT LCD, resistive	
Backlight	LED, program-controlled	
Number of colors displayed	16 million	16 million
Diagonal	7.0 ”	10.2 ”
Resolution	800 × 480 pixel	1024 × 600 pixel
Pixel size (W×H)	0.1926 × 0.1790 mm	0.2775 × 0.2760 mm
Active display area (W×H)	154.08 × 85.92 mm	222.00 × 132.48 mm
Brightness	300 cd/m²	350 cd/m²
Contrast	500:1	
Viewing angle left/right/top/bottom	80/80/60/80°	65/65/45/65°
Backlight MTBF	50 000 hours at 25°C	
Interfaces		
COM1 (DB9M)	RS232, RS485-1, RS485-2	Protocols: Modbus RTU (Master/Slave), Modbus ASCII (Master/Slave), akYtec (Master)
COM2 (3-pol terminal block)	RS485-3	
Ethernet (RJ45)		Baud rate: 10/100 Mbps; Functions: device connection, project and web visualization upload [1]; Protocols: Modbus TCP (Master/Slave), OPC UA (Server), MQTT (Client/Broker), SNMP (Manager/Agent); Other non-standard protocols can be implemented
USB Device		USB 2.0 type B socket; Function: connection to host in Mass Storage Device mode, project upload [1]

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Parameter	Value	
	SPC210-07	SPC210-10
USB Host	USB 2.0 type A socket, max. current of connected devices is 500 mA.; Function: connection to device to upload projects, transfer log and recipe files	
SD Card	Function: to upload projects, transfer log and recipe files	
Electrical		
Power supply	24 (15 ...28) VDC	
Startup current, max.	14 A within 200 µs	
Steady-state power consumption, max.	15 W	
Insulation resistance [2)]	20 MΩ at 500 VDC	
Dielectric withstand test	500 VAC /1 min.	
Appliance class	III	
Programming		
OS	Linux 4.19.232-rt104	
Programming environment	CODESYS V3.5 SP17 Patch 3	
Mechanical		
Mounting	for panel mounting	
Cooling	natural convection	
Vibration resistance	in the range of 10...25 Hz in X, Y, Z direction with acceleration up to 2G for 30 minutes	
Dimensions	201 x 148 x 39 mm	272 × 191× 42 mm
Mounting cutout	193 × 140 mm	261 × 179 mm
IP code (front / rear)	IP65 / IP20	
Weight	approx. 610 g	approx. 1130 g
Average lifetime, min.	10 years	
MTBF	60 000 hours	

NOTE
[1)] It is recommended to use the Ethernet interface to upload projects, although alternatively file transfer is also possible via USB.
[2)] Electrical insulation resistance between the device electrical circuits and the enclosure is not less than 20 MΩ at normal conditions and not less than 5 MΩ at the upper limit of the operating temperature range.

Table 3.2 Interfaces

Interface	Protocols	Baud rate[1)]	Cable length, max	Cable type
Ethernet	Modbus TCP (Master/Slave), OPC UA (Server), MQTT (Client/Broker), SNMP (Manager/ Agent)	10/100 Mbps	100 m	CAT5 UTP, STP or FTP

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RS485	Modbus RTU (Master/Slave), Modbus ASCII (Master/Slave), akYtec (Master)	1200, 2400, 4800, 9600, 19 200, 38 400, 57 600, 115 200 bps	1200 m[2)]	Shielded twisted pair
RS232			3 m	see *Section 5.1.2*
USB Host, SD	MSD	12 Mbps (USB)	to connect USB Flash/SD (mass storage devices)	
USB Device	Gateway		1,5 m	to connect the device to PC[3)]

NOTE
[1)] The criterion for correct functioning of the device communication interfaces is no more than 5% of erroneous data packets at any baud rate.
[2)] The greater the length, the lower the maximum possible data rate.
[3)] Over virtual Ethernet port, which is created on PC after USB driver installation.

Table 3.3 Connectable data storage devices

Parameter	Value
USB flash drive[1)]	
USB versions[2)]	1.0, 1.1, 2.0
File systems	FAT16[4)], FAT32[4)], NTFS (read only), ext4
SD memory cards[1)]	
Card formats[3)]	SD 1.0, SD 1.1, SDHC, SDXC
Class	SD Class 2 or higher
File systems	FAT16[4)], FAT32[4)], NTFS (read only), ext4

NOTE
[1)] Maximum storage capacity varies depending on file system type and device format.
[2)]USB 3.0 devices that do not support earlier USB specifications will not work with the device.
[3)] MicroSD cards must be connected via an adapter.
[4)] FAT is not log-structured file system. If power is interrupted while writing, the drive's partition table may be corrupted. This may cause problems with mounting the drive. In this case, the drive must be connected to a PC to correct file system errors. Therefore, it is recommended to use log-structured file systems (e.g. ext4).

3.2 Environmental conditions

The following environment conditions must be observed:
– clean, dry and controlled environment, low dust level;
– closed non-hazardous areas, free of corrosive or flammable gases.

Table 3.4 Environmental conditions

Condition	Permissible range
Ambient temperature	-10…+55 °C
Transportation and storage	-25 … +50 °C
Relative humidity	30…80 %(non-condensing)
Altitude	up to 2000 m ASL
Vibration / shock resistance	conforms to IEC 61131-2
EMC emission / immunity	conforms to IEC 61131-2

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4 Mounting

The safety requirements from *Section 1.5* must be observed.
The touchscreen PLC is designed in a plastic enclosure to be mounted in a panel. The device can be installed at any inclination angle.
The electrical cabinet design should protect the device enclosure from moisture, dirt and foreign objects.

1. Prepare a cutout in the installation panel (see *Fig. 4.2* or *Fig. 4.5*).
2. Install the device in the previously made mounting cutout of the panel.
3. Insert the mounting clips into the holes on the top and bottom sides of the enclosure.
4. Secure the mounting clips by tightening the screws with sufficient, but not excessive force.

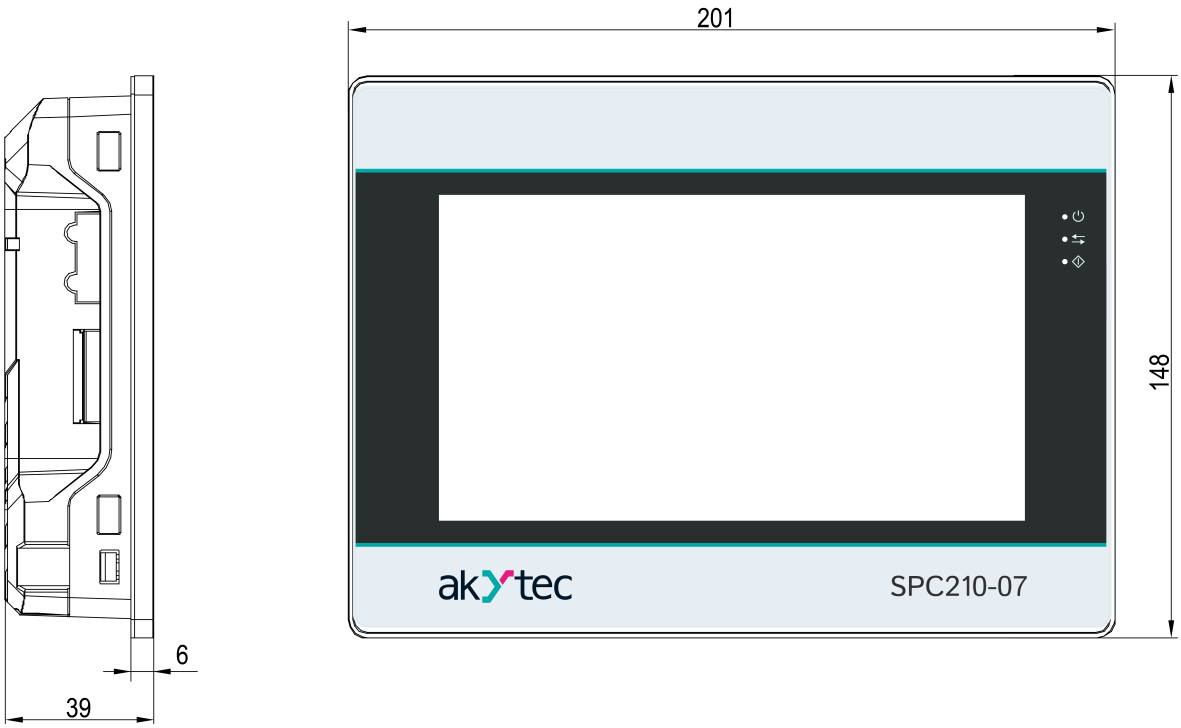


Fig. 4.1 SPC210-07 dimensions

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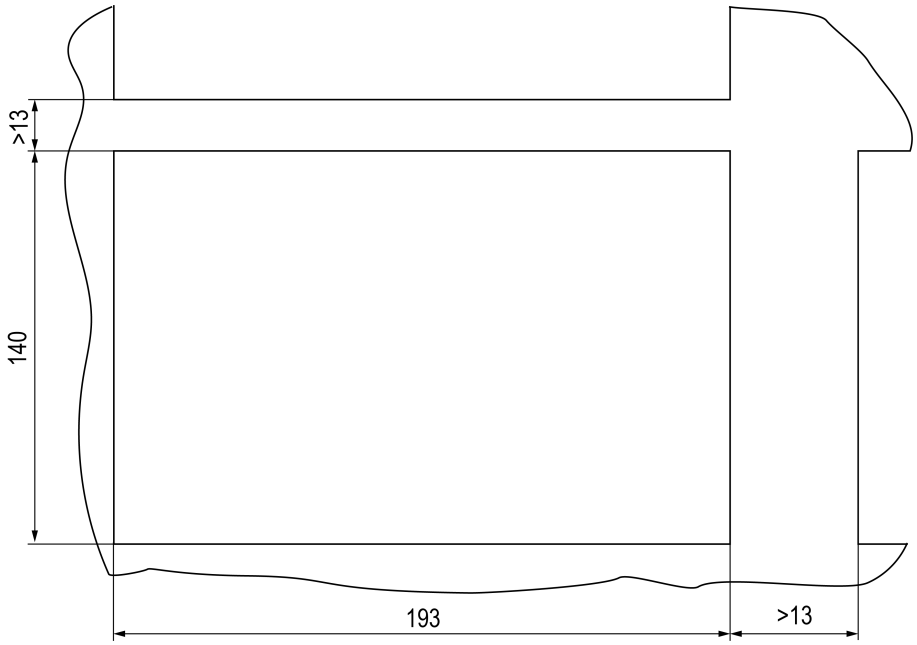


Fig. 4.2 SPC210-07 mounting cutout

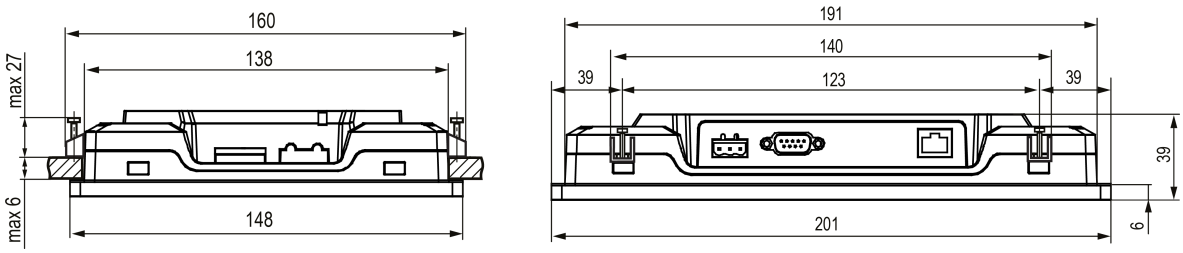


Fig. 4.3 SPC210-07 detailed dimensions

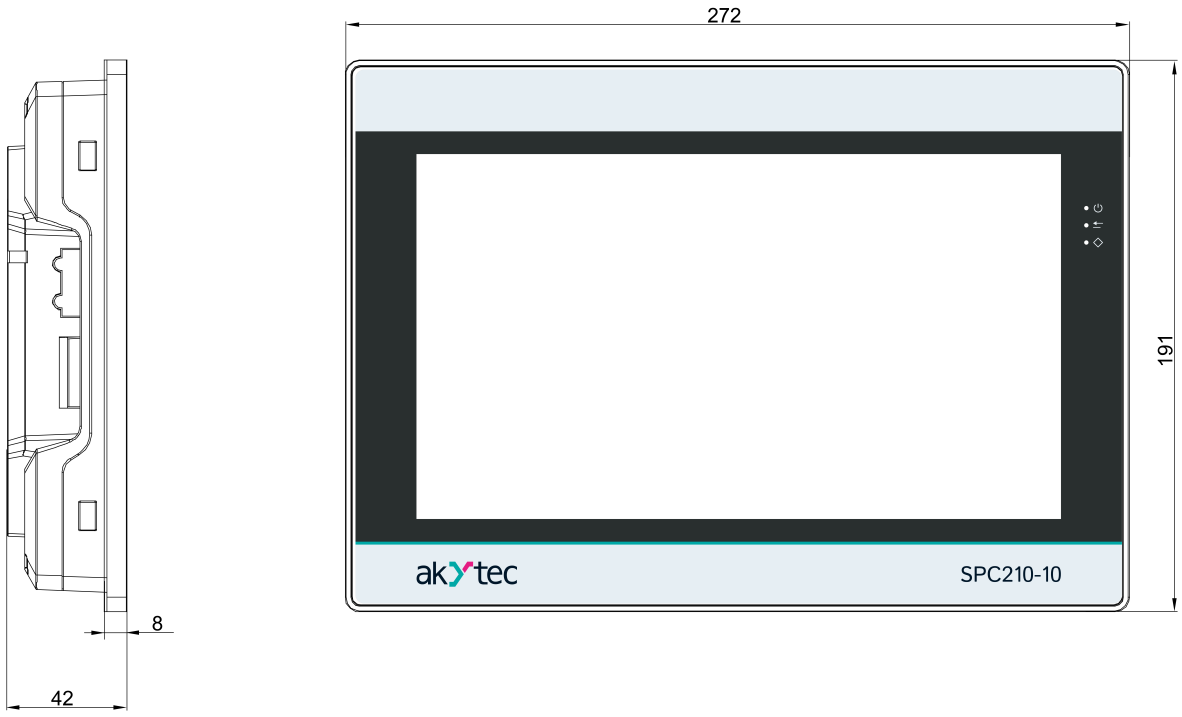


Fig. 4.4 SPC 210-10 dimensions

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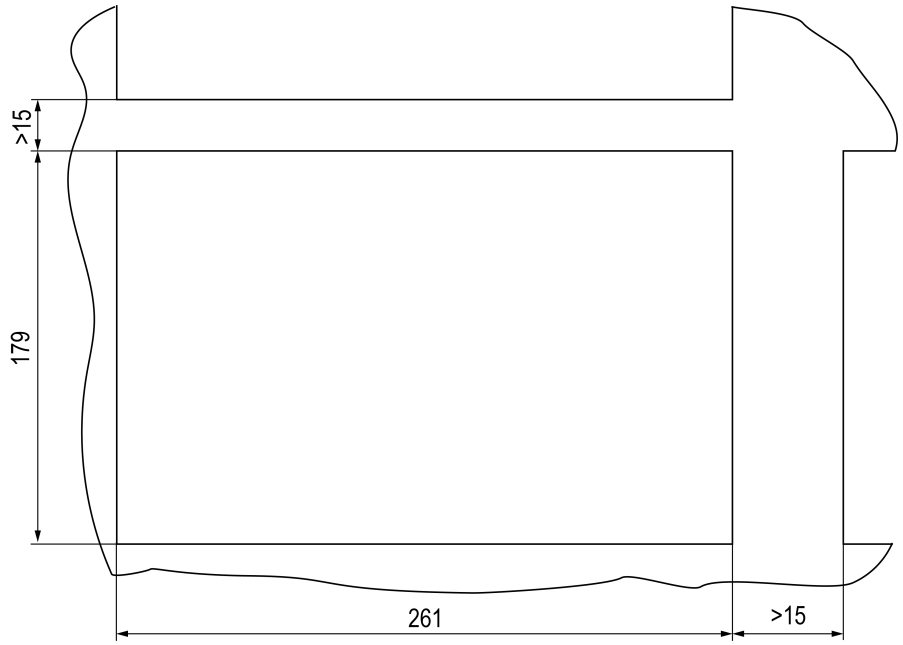


Fig. 4.5 SPC210-10 mounting cutout

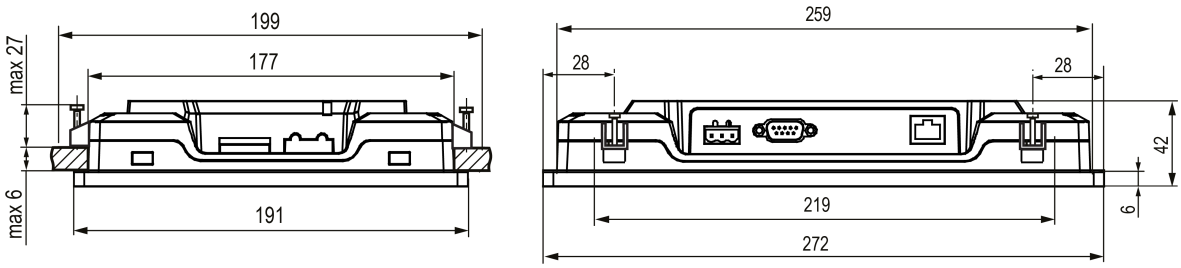


Fig. 4.6 SPC210-10 detailed dimensions

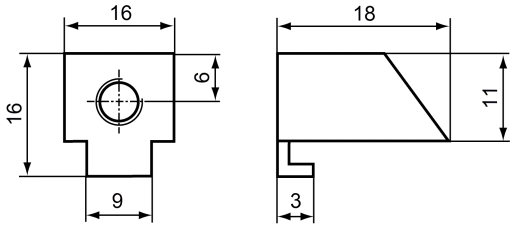


Fig. 4.7 Fastener dimensions

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5 Interfaces

5.1 Overview

All connectors are on the rear side of the device (see *Fig. 5.1* and *Fig. 5.2*):
– power connector (three-pin pluggable terminal block);
– COM1 connector (DB9M) for multi-interface adapter (included);
– RS485-3 interface with galvanic isolation (three-pin pluggable terminal block);
– USB Device connector (USB B) to connect the PLC to a PC (programming interface);
– USB Host connector (USB A) to connect a USB device;
– Ethernet connector (RJ45);
– SD card slot.

Conductor cross-section: 0.25…0.5 mm² / AWG24…AWG20

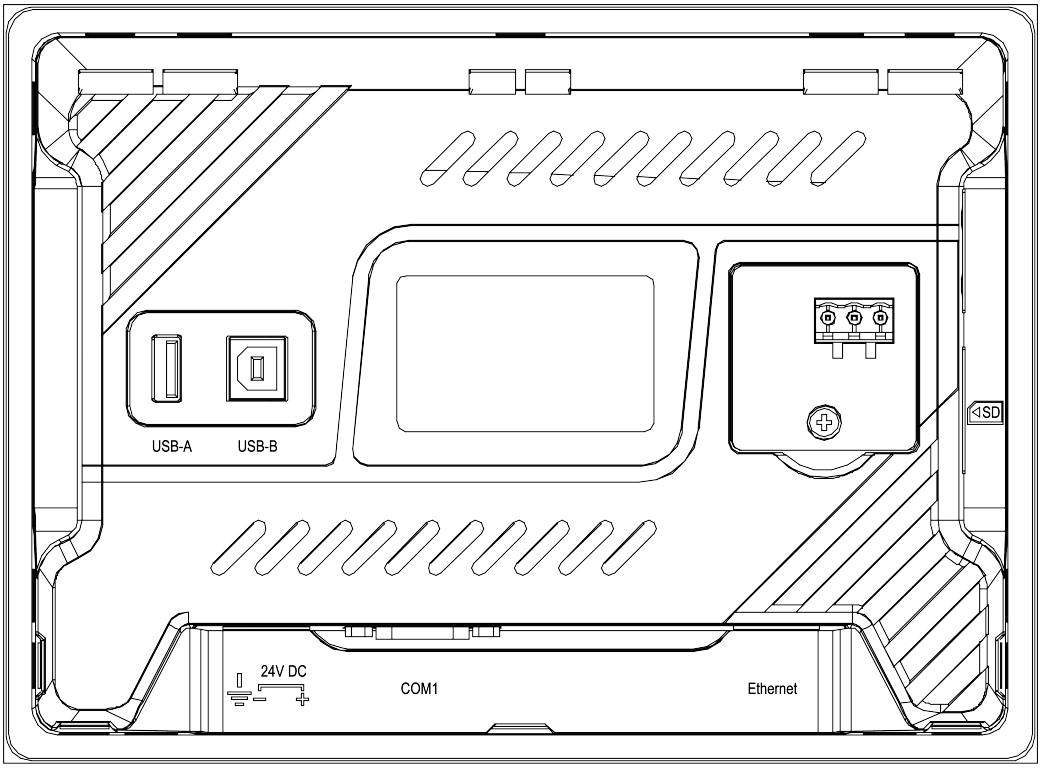


Fig. 5.1 SPC210–07 rear view

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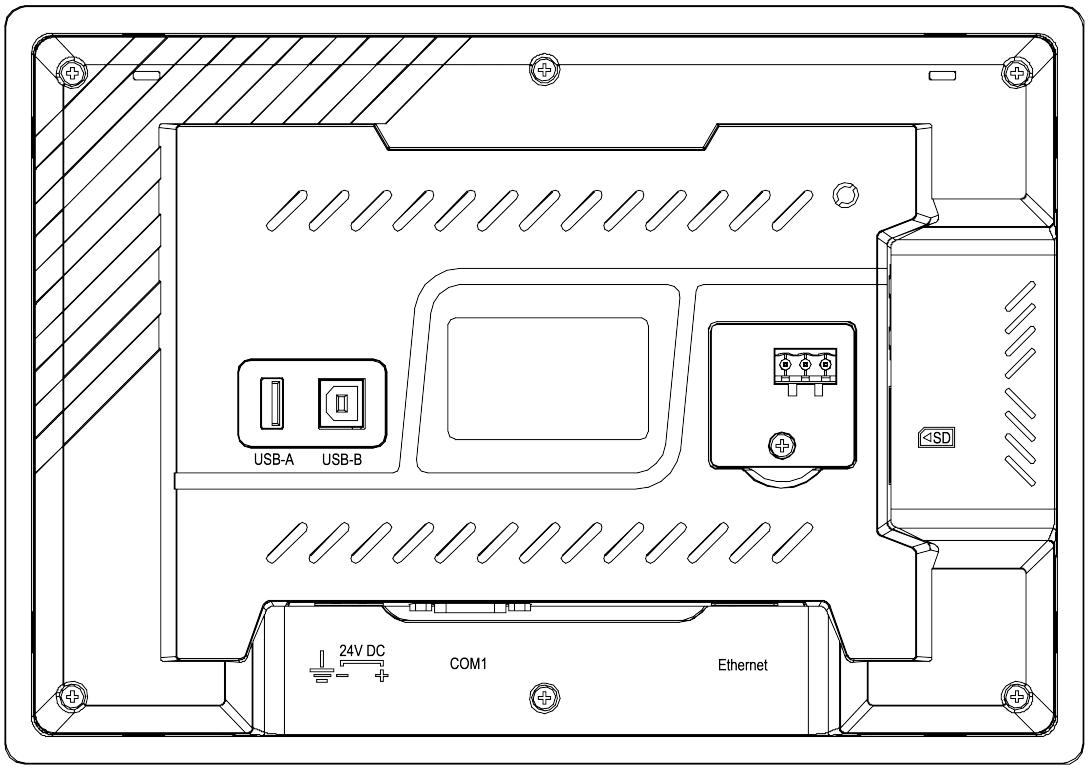
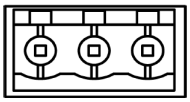


Fig. 5.2 SPC210–10 rear view

5.1.1 Power connector

The device should be powered from a local power supply unit of suitable capacity installed in the same electrical cabinet (see *Table 5.1*). The inrush current can peak at 14 A within 200 µs and can exceed 10In within 25 ms. Therefore, the rated power of the power source must be at least 30 W.

Table 5.1 Pin assignment of power connector

1 2 3 	**Signal**
1	Functional grounding
2	GND
3	+24 V

5.1.2 Connection over RS232 and RS485 interfaces

RS485 signal definition:
- A (D+) non-inverting signal;
- B (D-) inverting signal.

The RS485 and RS232 interfaces are independent and can be used simultaneously.
The COM1 connector physically combines three interfaces: RS232, RS485-1, RS485-2. To use the interfaces, the adapter included in the package is required (see *Fig. 5.4* and *Table 5.2*).
The adaptor is equipped with tension clamp connectors with push-buttons. Built-in termination resistors of 120 Ω can be connected using DIP switches.

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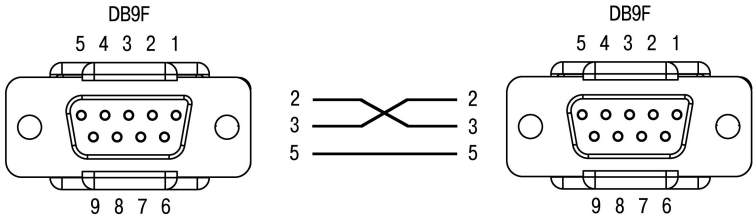


Fig. 5.3 Null-modem cable diagram for connection over RS232 port

The RS485-3 interface has individual interface board with galvanic isolation of 1000 V from other circuits and a 120Ω built-in terminating resistor under the interface cover. For pin assignment, see *Fig. 5.5*.

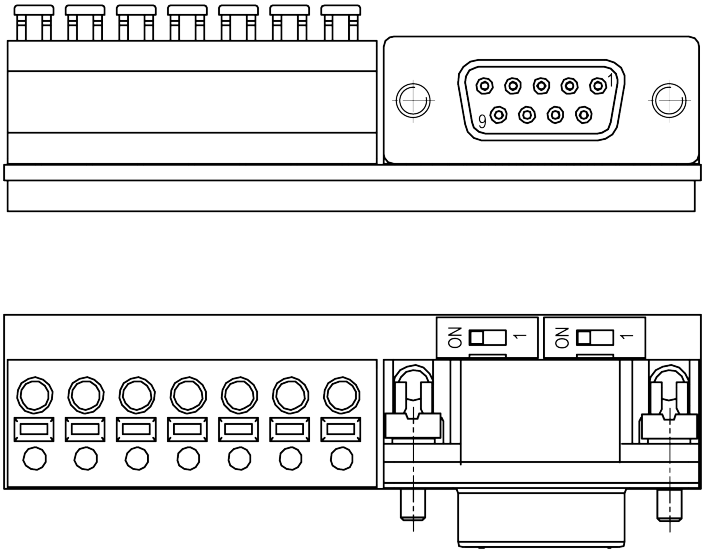
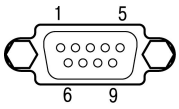


Fig. 5.4 SPC210 adapter

Table 5.2 Pin assignment of COM1 (DB9M) interface and SPC210 adapter

 COM1	Signal	SPC210 adapter
1	RS485-1 / A	**1**
2	RS232-1 / RX	**5**
3	RS232-1 / TX	**6**
4	RS485-2 / B	**4**
5	GND	**7**
6	RS485-1 / B	**2**
7	RS485-2 / A	**3**
8	–	–
9	–	–

All the RS485 interfaces are equipped with pull-up resistors:

– 485-1 - 1 kΩ;
– 485-2 - 1 kΩ;
– 485-3 - 10 kΩ.

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To connect external devices over RS232 and RS485 interfaces, use shielded twisted pair compliant with ISO/IEC 8482 and TIA/EIA-485-A standards or similar. Power the devices off before wiring.
To connect an external device with a DB9M connector to the RS232 interface, use null-modem cable (*Fig. 5.3*).
The length of the connection lines should not exceed:

– 485 - 1200 meters;
– 232 - 3 meters.

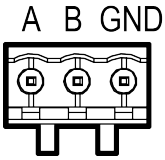


Fig. 5.5 RS485-3 pin assignment

5.1.3 USB device

The USB Device interface is intended to connect the device to a PC via a USB cable (*Fig. 5.6*). It is not recommended to use USB extenders or USB hubs. The USB Device and USB Host (*Section 5.1.5*) interfaces are interchangeable and cannot be used at the same time. You can switch between them in the PLC's web or on-screen configurator.

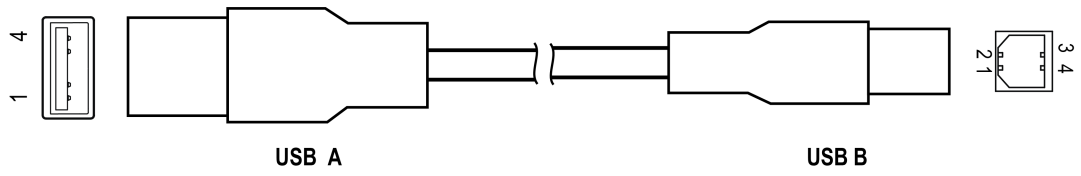


Fig. 5.6 USB cable diagram for device programming

Assignment of USB Device (USB B) connector contacts is given in the table below:

Table 5.3 Pin assignment of USB Device (USB B) connector

	**Signal**
1	+5 B
2	Data–
3	Data+
4	GND

5.1.4 Connection over Ethernet

For Ethernet connection, use a standard eight-wire twisted pair cable Cat. 5 10/100BASE-T/TX. The Ethernet interface supports automatic detection of the cable type (crossover or straight-through).

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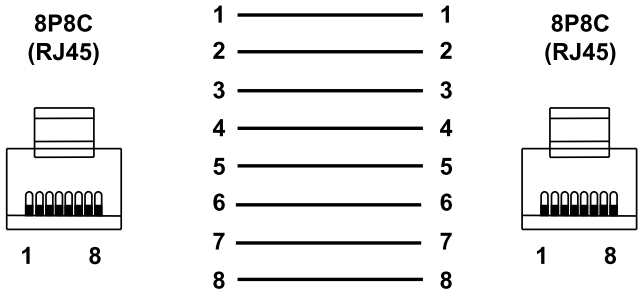


Fig. 5.7 Straight-through cable diagram for connecting the device over Ethernet

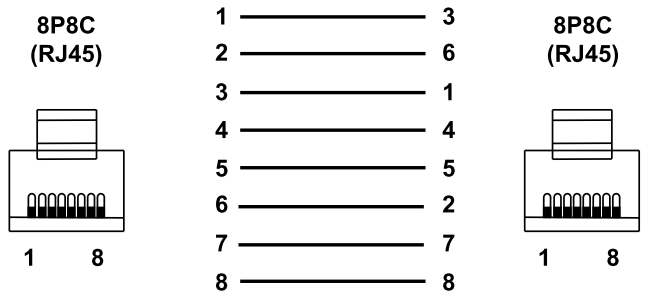
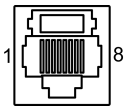


Fig. 5.8 Crossover cable diagram for connecting the device over Ethernet

The pin assignment of the Ethernet connector is given in the table below:

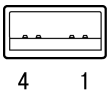
Table 5.4 Pin assignment of Ethernet connector

	**Signal**
1	Etx+
2	Etx–
3	Erx+
6	Erx–

5.1.5 Connection over USB Host

Using the USB Host interface, external USB flash drives and USB HID devices (keyboard, mouse) with USB A type connector can be connected to the PLC
The pin assignment of USB Host (USB A) connector is given in the table below:

Table 5.5 Pin assignment of USB Host (USB A) connector

	**Signal**
1	+5 B
2	Data–
3	Data+
4	GND

Only one of the USB Device and USB Host interfaces can be active at a time. You can switch between them in the PLC's web or on-screen configurator. If the user program continuously writes values to a file (this is particularly the case with data logging and trend recording), it is necessary to ensure that the device is connected to an uninterruptible power supply. Otherwise, there is a risk that

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archive data may be damaged in case of power failure. It is recommended to write data to a connected USB or SD drive to save the resource of the device memory.

5.1.6 SD card connection

The device left side has the slot to insert a SD flash memory card (see *Fig. 5.9*).

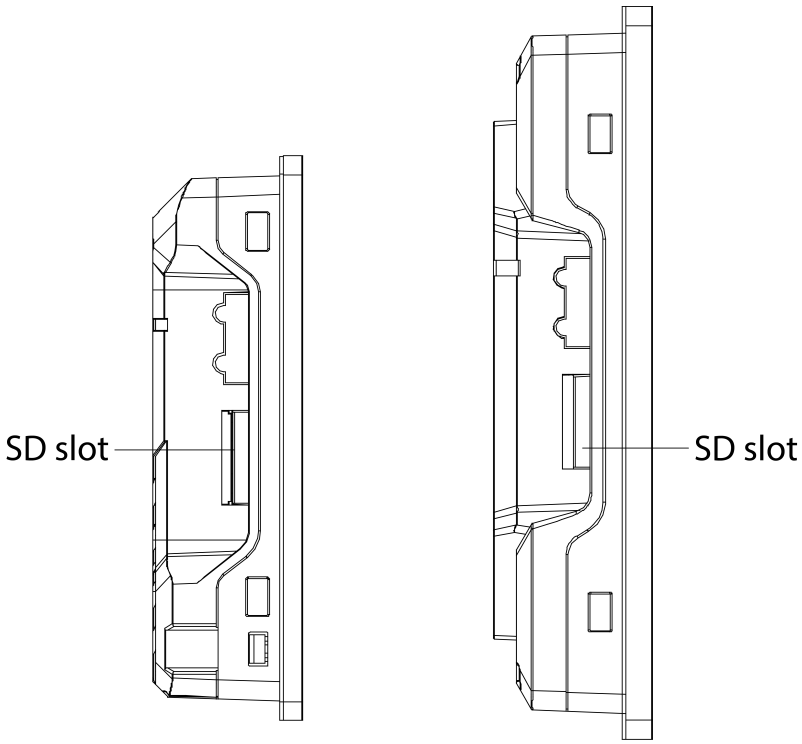


Fig. 5.9 Side view

5.2 EMC safety

The device operation may be affected by electromagnetic interference (EMI) caused by external electromagnetic fields. To reduce the influence of EMI, it is recommended:

– to use shielded signal cables. The cable shields must be electrically isolated from the peripheral equipment all along their routes. The shields of signal cables must be connected to a ground terminal in the electrical cabinet
– to connect the device functional ground with the cabinet ground point.
– to install the device in a metal enclosure without any power equipment inside. The enclosure must be grounded.
– to consider the rules of effective grounding system and laying of grounded shields.

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6 Configuration

To access the web interface configurator, see *Section 6.1*.
To access the on-screen configurator, see *Section 6.4*.

6.1 Web interface configurator

To configure the device:

1. Power on the device (the ⏻ indicator lights up). Wait until the firmware update is completed (the loading bar reaches the end and disappears).
2. Connect the device to a PC via Ethernet or USB interface. It is not recommended to connect the PC via an external USB hub.
3. Connect to the SPC210 web interface by entering the IP address of the device in the browser address bar, depending on the PC connection interface
   – the default IP address for the USB connection is **10.0.6.10**;
   – the default IP address for the Ethernet connection is **192.168.0.10.**

   Enter the user name and password in the authorization window:

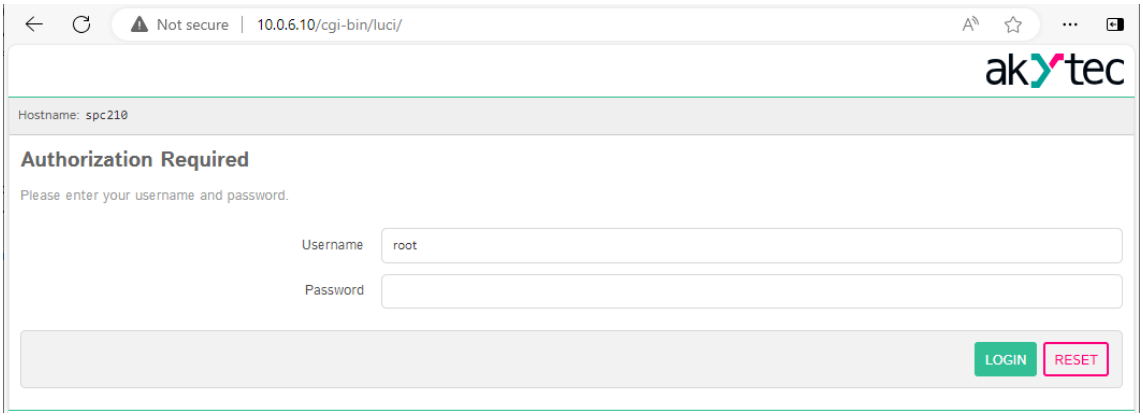


Fig. 6.1 Authorization window

Factory settings: user name – **root**; password – **akytec**.

NOTE
The RNDIS driver must be installed to enable working in the Windows OS. The driver is available in the web configurator in the section “Downloads” or at www.akytec.de.

6.2 Device access

To configure local and remote access to the device:

1. Open **System** / **Administration** tab in the web-interface:

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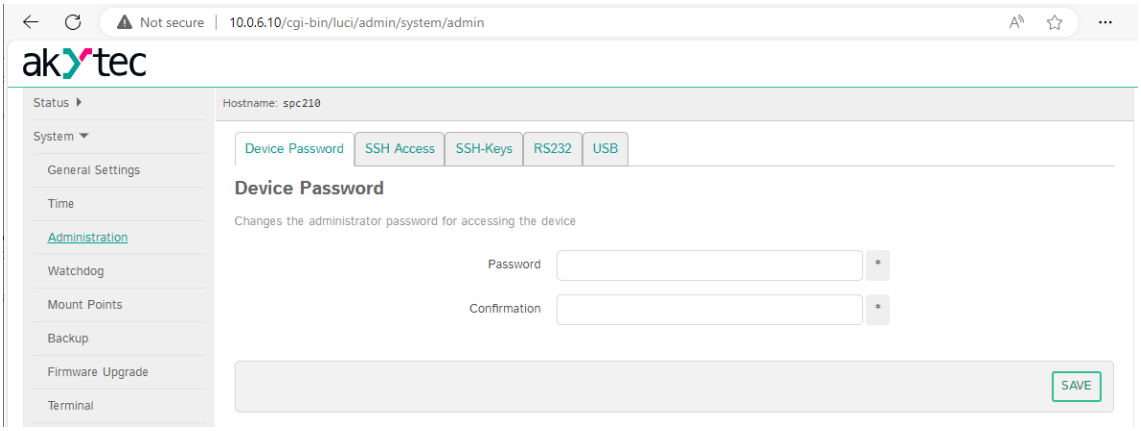


Fig. 6.2 Administration page

2. Make settings on the following tabs:
   - **Device Password** – to change the password for the "root" user;
   - **SSH Access** – to configure Dropbear server, which provides access to devices via SSH and SFTP protocols;
   - **SSH Keys** – to add public OpenSSH keys (.pub);
   - **RS232** – to configure access to the device system console over RS232 serial port;
   - **USB** – to select active port (USB A or USB B).
3. Open the **Services** / **FTP** tab in the web-interface and configure access to the FTP server:

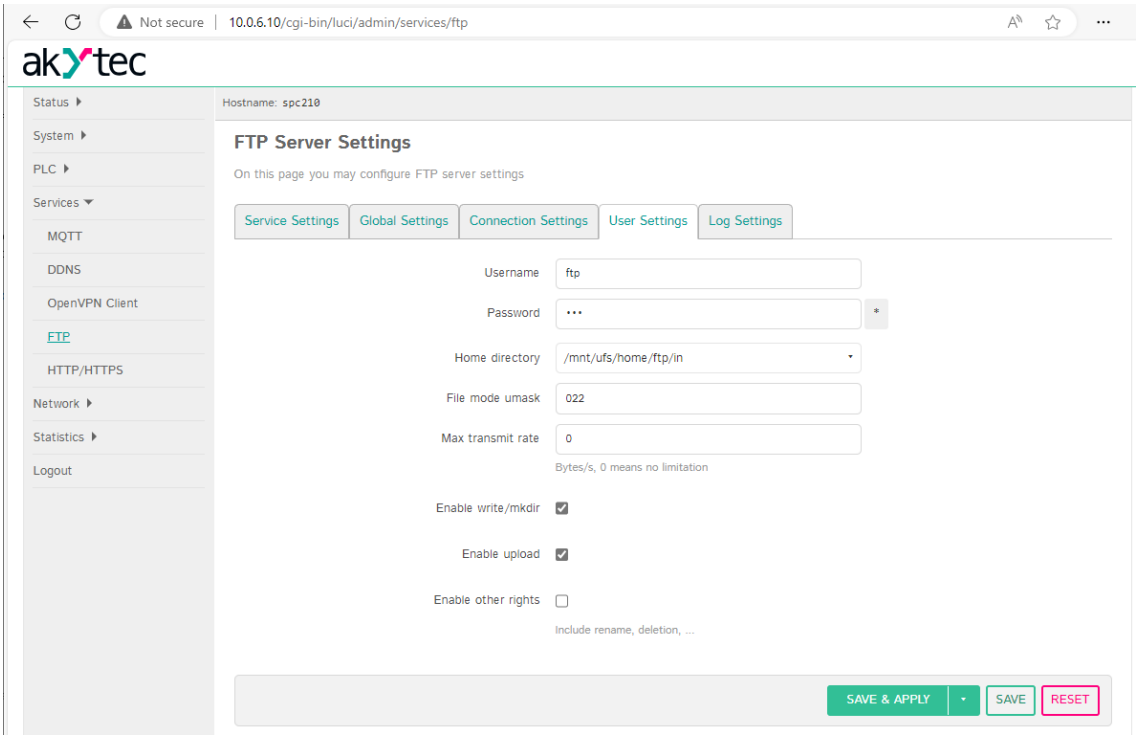


Fig. 6.3 FTP Server Settings

6.3 Firmware update

The latest firmware can be downloaded from www.akytec.de.

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6.4 On-screen configurator

15 - 20 seconds after the device is powered on, a loading bar appears on the display. The text under the bar BOOT MODE: [CODESYS] indicates that the CODESYS user project will be started after the PLC is booted.
A single tap on the screen stops the process and the on-screen configurator starts loading. The text below the bar changes to BOOT MODE: [CONFIG].
The on-screen configurator is described in the document "SPC210 on-screen configurator".

6.5 Factory settings restoration

To restore the factory settings:

1. Enter the device IP address in the browser and select the **System** / **Backup** tab in the configuration web-interface.
2. Click the **Reset** button to return the device settings to the default values (*Section 7.2*).

6.6 System console access

To access to the controller system console:

1. Enter the device IP address in the browser and select the **System** / **Terminal** tab in the configuration web-interface .

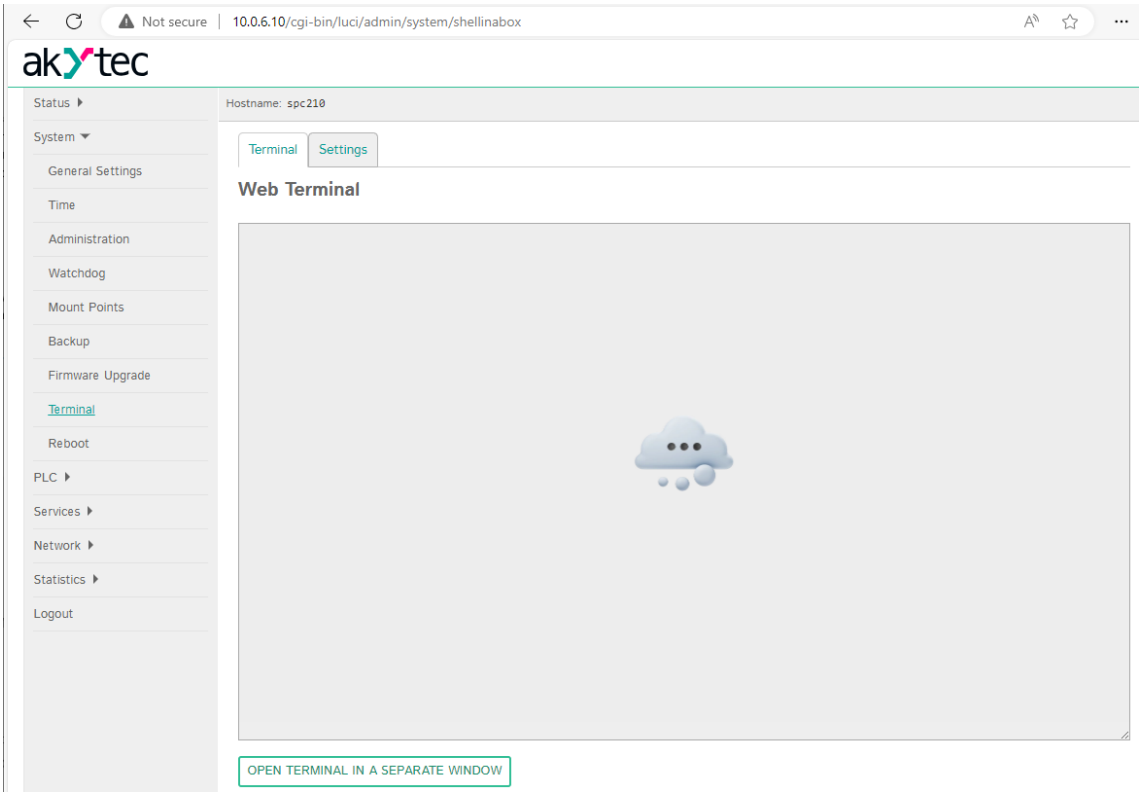


Fig. 6.4 Terminal page

2. Accept browser security exceptions to work with an unknown SSL certificate.
3. Click the **OPEN TERMINAL IN A SEPARATE WINDOW**. The controller system console will open in a new browser window.

To connect to the system console over the RS232 interface:

1. Select the **System** / **Administration** tab in the configuration web-interface and tick the **RS232 system console** box.
2. Connect the device to PC over RS232 interface.

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6.7 Uploading a user project from USB/SD

To upload a project to the device from a USB/SD drive, use the on-screen configurator (see *Section 6.4*).

6.8 Operation with CODESYS V3.5

To program the device with CODESYS:

1. Download and install CODESYS.

   NOTE
   The scope of delivery includes a license for the following components:
   – Modbus TCP Master;
   – Modbus TCP Slave;
   – Modbus Serial Master;
   – Modbus Serial Slave;
   – Web-visu;
   – Target-visu;
   – OPC UA Server.

   NOTE
   Installation of additional licenses is not supported.

2. To start CODESYS and install the *target file*:
   a. Start CODESYS V 3.5 and select **Tools / CODESYS Installer** or launch the **CODESYS Installer** utility via the **Start** menu.
   b. Click the **Install File** button and select the **akYtecTargets-3.5.17.xx.package**.
   c. Follow the instructions of the installer.
3. Create a project in CODESYS, while selecting the appropriate target device from the list.
4. Connect the device via the USB Device or Ethernet interface to the PC with the CODESYS installed
5. For connection via Ethernet, adjust the settings of the PC network adapter.
6. In the CODESYS interface, establish communication with the device.

A program created with CODESYS and transferred to the device ROM memory will be executed after device power up or reboot.
The USB Device or Ethernet interface can be used for connection between the device and CODESYS.
The USB Host port is used to transfer the project or other files to a USB flash drive.

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7 Design and programming

7.1 Structure diagram

The operation diagram is shown in the picture below:

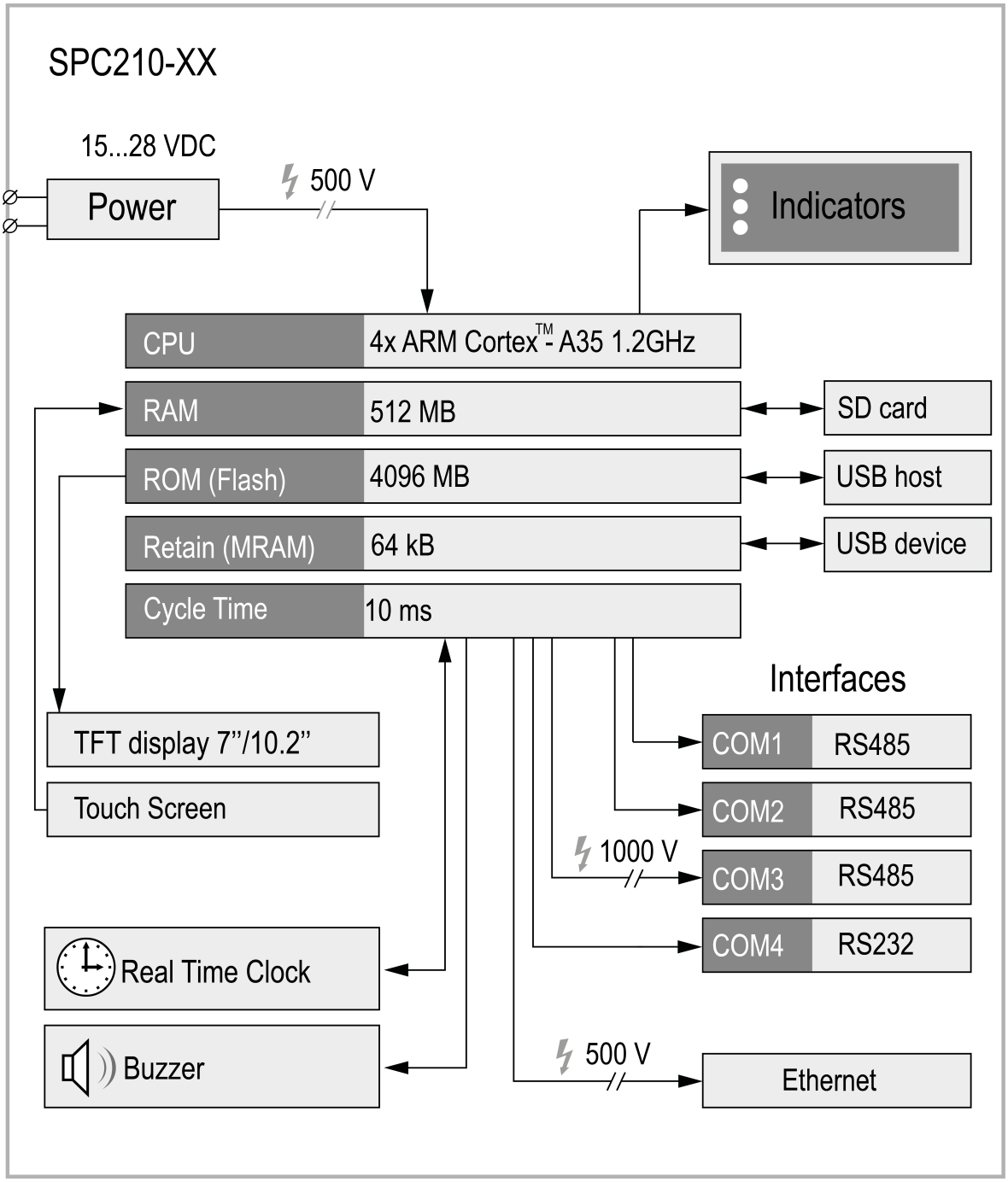


Fig. 7.1 Operation diagram

The device can be connected to a PC via USB Device or Ethernet interfaces.
The user program created with CODESYS is transferred to the ROM of the device. After power on, the device boots up within 90 seconds, the program is transferred to RAM and executed. In case the program execution has not started after power on, check if there is a project in the device memory, and follow the instructions from *Section 6.4*.
The TFT color display is combined with a touch panel. Graphical elements of the user program can be displayed and controlled in screen dialogs.

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Using the USB Host interface, external USB flash storage devices and USB HID devices (keyboard, mouse) can be connected to the device. The device has a slot to connect SD flash memory cards.
The device is equipped with a real-time clock. When the device is powered off, RTC is powered by a replacable battery of CR2032 type.

NOTE
The battery operating time is no longer than 5 years. If the device is used at temperatures at the limits of the operating range, the clock operating time is reduced.

The COM1 serial port is designed to connect the external devices over RS232 and RS485 interfaces. RS485 and RS232 interfaces are independent and can be used simultaneously.
The USB-Device and USB-Host interfaces cannot be used at the same time. You can switch between two USB interfaces in the PLC's web or on-screen configurator.

7.1.1 Indication

The device front panel has 3 indicators.

Table 7.1 Front indicators

Indicator	State	Description
⏻	ON	Power is on
	OFF	Power is off
⇆	Flashing	Data transfer over one of the serial ports
	OFF	No data transfer over serial ports
◈	ON	CODESYS program is running
	OFF	CODESYS program is stopped

7.1.2 Touch screen

The touch screen is operated by tapping or sliding on the screen with a finger or other convenient object (stylus) that does not cause damage to the screen.
The calibration of the screen can be performed in the on-screen configurator.

NOTE
To prevent deterioration of the screen image quality, the touch screen should be wiped clean regularly. Specialized protective coatings for resistive displays may be used.

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a)



b)



Fig. 7.2 Front panel: a) SPC210–07, b) SPC210–10

7.2 Factory settings

The device has the following factory default network settings:

– IP-address: **192.168.0.10**;
– Gateway: **192.168.0.1**;
– Subnet mask: **255.255.0.0**.

Factory settings for the virtual Ethernet port, which is used to program the device over the USB Device interface:

– DHCP server: **enabled**;
– IP-address: **10.0.6.10**;
– Subnet mask: **255.255.255.248**.

The option **Obtain IP address automatically** must be set in the PC virtual Ethernet port settings.

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8 Maintenance

The safety requirements 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 debris
– 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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9 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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10 Scope of delivery

— SPC210–XX	1 pc.
—Short guide	1 pc.
— Set of mounting clips	1 pc.
— Power supply terminal	1 pc.
— SPC210 adapter	1 pc.

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

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