



PR110

Programmable relay

User guide

Contents

1	Description	2
1.1	Functions	2
1.2	Connection to RS485 Network	2
1.3	Ordering information	3
1.4	Design	3
2	Specifications	5
2.1	Environmental conditions	6
3	Safety	7
3.1	Intended use	7
4	Mounting	8
5	Wiring	9
5.1	Inputs	12
5.2	Outputs	13
5.3	Programming interface	13
6	Operation	14
6.1	Modbus communication	14
7	Firmware update	16
8	Maintenance	17
9	Transportation and storage	18
10	Scope of delivery	19
Appendix A Dimensions		20
Appendix B Connection to PC		22

Description

1 Description

1.1 Functions

Programmable relay PR110 is a logic module. Applications are created in Function Block Diagram with akYtec ALP software. The relay has 8 or 12 digital inputs (24 V DC) and 4 or 8 digital outputs (see 1.3 Device versions) and provides the following functions:

- connection of peripheral devices (sensors/actuators) with digital inputs and outputs
- output status control according to input status and logic of the saved program
- input and output status indication
- fault status indication
- real-time clock (optional)

1.2 Connection to RS485 Network

The relay can be connected to Modbus network via interface adapter PR-MI485, which can be ordered separately. Thus there will be the following additional functions available:

- Slave device in Modbus network
- support of Modbus-RTU and Modbus-ASCII protocols with automatic protocol detection
- for additional information about other functions in Modbus network, see section 6.2 “Modbus communication”

The PR110 uses common standard RS485 for data exchange. The network consists of a Master device and can contain up to 32 Slave devices. Maximum length is 1,200 m. The number of Slave devices and network length can be increased using RS485 interface repeater.

Separate devices are connected according to linear (bus) topology. It means that the line goes from the first device to the second one, from the second one to the third one, etc. Star connections and spur lines are not allowed.

Line reflections always occur at each of the 2 ends of the bus (the first and the last node). The higher the data transmission rate, the stronger they are. A terminating resistor is needed to minimize the reflections. Line termination may be a 150 ohms value (0.5 W) resistor.

The relay can be used as a Slave device only. Master device can be PLC, computer with SCADA software or control panel.

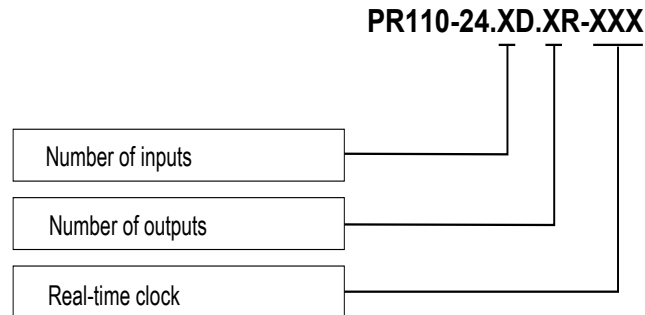
Description

1.3 Ordering information

Depending on the required number of inputs/outputs the relay PR110 can be ordered in two variants with 12 or 20 I/O points:

Relay with 12 I/O points has 8 inputs and 4 outputs

Relay with 20 I/O points has 12 inputs and 8 outputs



Number of Inputs

8 - 8 inputs
12 - 12 inputs

Number of outputs:

4 - 4 outputs
8 - 8 outputs

Real-time clock:

RTC - with real-time clock
- - without real-time clock

1.4 Design

- Enclosure: plastic, grey, for DIN-rail or wall mounting
- Terminals: 2 plug-in terminal blocks with 24(40) screw terminals
- LED "POWER" power supply indicator
- LED "COM" flashes at data exchange over "PROG" port
- LED "FAULT" lit at fault (see table 5.1) and when transferring the application to device
- 8(12) LEDs "INPUTS" lit at logical 1 at the corresponding input
- 4(8) LEDs OUTPUTS lit at corresponding switched output
- Port PROG (RJ12) to connect different adapters

Description

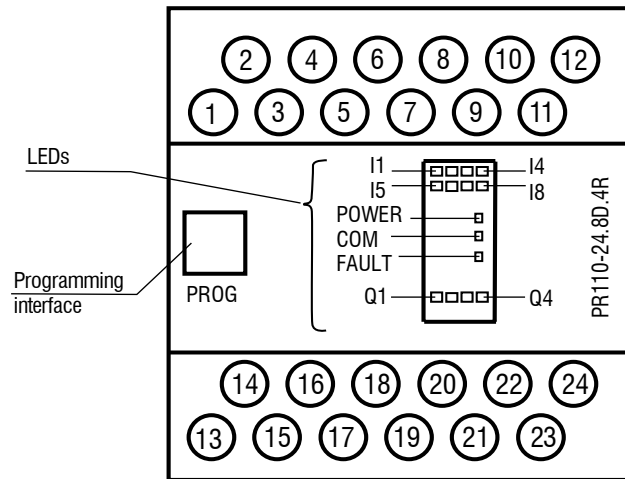


Fig. 1.1 PR110-24.8D.4R front view

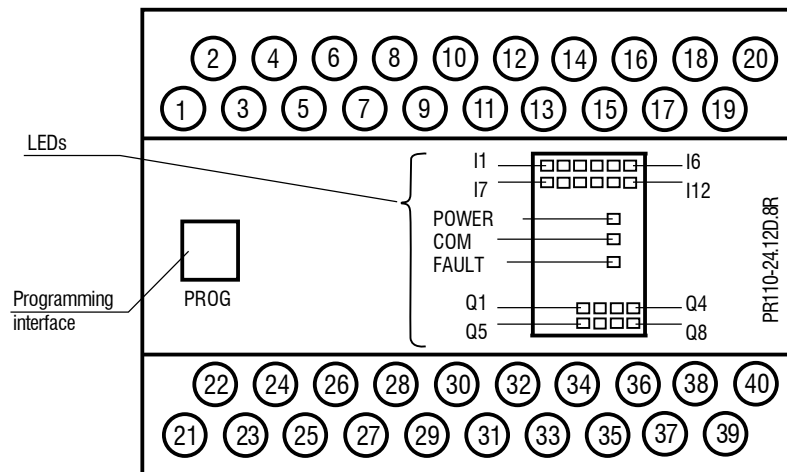


Fig. 1.2 PR110-24.12D.8R front view

Dimensional Sketches are given in Appendix A

Specifications

2 Specifications

Table 2.1 General data

		PR110-24.8D.4R	PR110-24.12D.8R
Power supply		24 (21...27) V DC	
Power consumption, max.		6 W	8 W
Inputs		8	12
Outputs		4	8
Programming	Interface	UART, USB*	
	Connector	RJ12	
	Functional blocks	63	
RS485 Network connection		Interface adapter PR-MI485	
Protocols		Modbus RTU/ASCII (Slave)	
Dimensions		63 x 110 x 73 mm	96 x 110 x 73 mm
Weight		approx. 210 g	approx. 320 g
Material		Plastic	

* Using the programming adapter PR-KP20 (not included)

Table 2.2 Inputs

Input signal	switch contact, PNP open collector
Input voltage	24±3 V DC
Logical 1	9...27 V (3.5...9.0 mA)
Logical 0	0...2 V (0...0.5 mA)
Pulse length, min.	5 ms
Galvanic isolation	in group of 4
Dielectric strength	1500 V

Table 2.3 Digital outputs

Output type	Relay output, NO	
Switching voltage	AC	≤250 V
	DC	≤30 V
Continuous current at maximum voltage	AC	5 A (resistive load)
	DC	3 A
Minimum load current	10 mA (at 5 V DC)	
Galvanic isolation	separate outputs	
Dielectric strength	1500 V	
Switching cycles	min. 200,000	
Switching time	≤10 ms	

Table 2.4 Real-time clock (optional)

Accuracy	±2 s/day (25°C)
Correction	-2.75...+5.5 min/month
Backup	min. 110 hours at 25°C
Backup battery charging time	10 h

Specifications

2.1 Environmental conditions

The following environment conditions must be met:

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

Table 2.7

Condition	Permissible range
Ambient temperature	-20...+55 °C
Transportation and storage	-25...+55 °C
Relative humidity	up to 95% (at +25°C, non-condensing)
IP Code	IP20
Altitude	up to 2000 m above sea level

Safety

3 Safety

Explanation of the symbols and keywords used:

 **DANGER**

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury

 **NOTICE**

NOTICE indicates a potentially harmful situation which, if not avoided, may result in damage of the product itself or of adjacent objects.

3.1 Intended use

The device has been designed and built solely for the intended use described in this manual, and may only be used accordingly. The technical specifications contained in this manual must be observed.

The relay may be operated only in properly installed condition

Improper use

Any other use is considered improper. Especially to note:

- The device should not be used for medical devices, which receive, control or otherwise affect human life or physical health.
- The device should not be used in a potentially explosive environment.
- The device should not be used in an atmosphere with chemically active substances.

Mounting

4 Mounting



Improper installation

Improper installation can cause serious or minor injuries and damage the control panel. Installation must be performed only by fully qualified personnel.

- The programmable relay is intended to be mounted in a cabinet on DIN-rail or on the wall. For the dimension drawings see Appendix A.
- Install the relay in a cabinet with clean, dry and controlled environment.
- The relay is designed for natural convection cooling. It should be taken into account when choosing the installation place.

5 Wiring

 **WARNING**

Dangerous voltage

Electric shock could kill or seriously injure.

All electrical connections must be performed by a fully qualified electrician.

Ensure that the mains voltage matches the voltage marked on the nameplate!

Ensure that the device is provided with its own power supply line and electric fuse!

 **CAUTION**

Switch on the power supply only after the wiring of the device has been completely performed.

- Terminal blocks are shown in Fig. 5.1, 5.2, and pin assignments are given in Tables 5.1, 5.2.
- Electrical connections for inputs and outputs are shown in Figures 5.3 – 5.5.
- Connect the supply voltage to terminals 24 V and 0 V.
- The maximum conductor cross-section for power supply is 1.5 mm².

 **NOTICE**

Signal cables should be routed separately or screened from the supply cables.

 **NOTICE**

Only a shielded cable may be used for the signal lines.

- COM terminals should be connected to the negative pole of an auxiliary voltage source. The switch contact or sensor with the open PNP-collector connected to the input connects the input with the positive pole of an auxiliary voltage source.
- The digital inputs have 4-grouped galvanic isolation (1..4, 5..8, 9..12). When connecting sensors, use only common negative terminal of the same group.
- When connecting external signals to input terminals, the specifications of the external signal source should be observed.
- The connection to the Modbus network should be carried out over PROG interface with PR-MI485 adapter (not included in the delivery). For detailed information refer the user manual of the adapter.

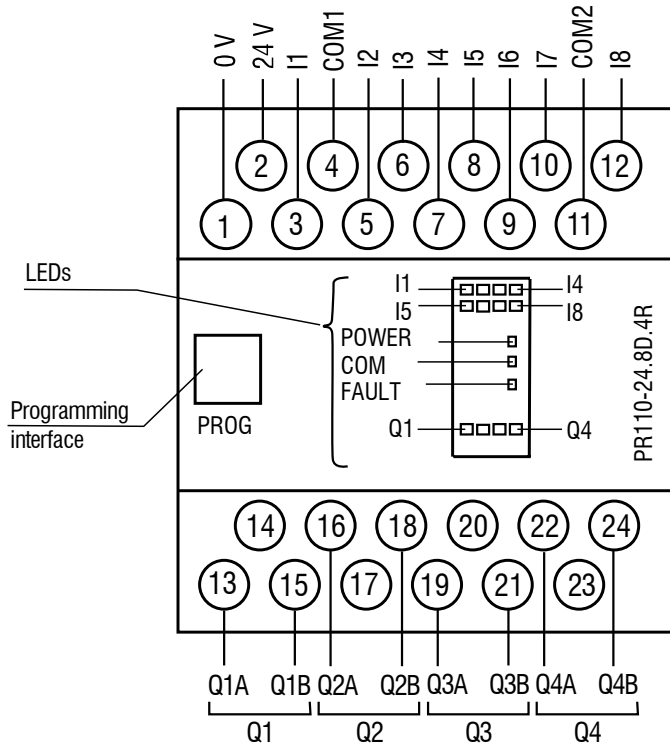


Fig. 5.1 PR110-24.8D.4R terminal blocks

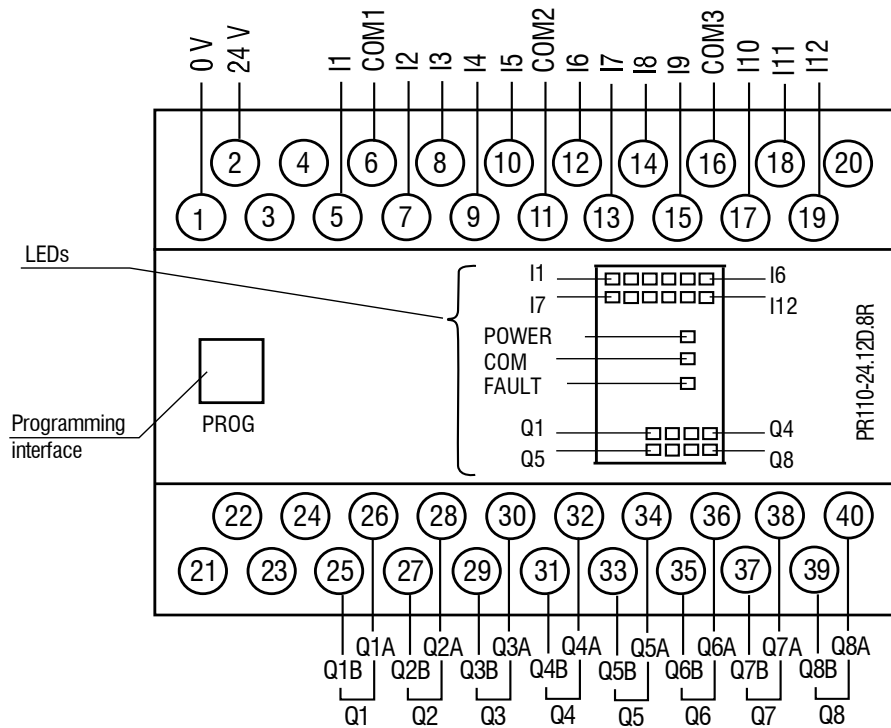


Fig. 5.2 PR110-24.12D.8R terminal blocks

Wiring

Table 5.1 PR110-24.8D.4R pin assignment

No.	Name	Function
1	0 V	Power supply
2	24 V	Power supply
3	I1	Input I1
4	COM1	I1..I4 common negative pole
5	I2	Input I2
6	I3	Input I3
7	I4	Input I4
8	I5	Input I5
9	I6	Input I6
10	I7	Input I7
11	COM2	I5..I8 common negative pole
12	I8	Input I8
13	Q1A	Output Q1
14	–	free
15	Q1B	Output Q1
16	Q2A	Output Q2
17	–	free
18	Q2B	Output Q2
19	Q3A	Output Q3
20	–	free
21	Q3B	Output Q3
22	Q4A	Output Q4
23	–	free
24	Q4B	Output Q4

Table 5.2 PR110-24.12D.8R pin assignment

No.	Name	Function
1	0 V	Power supply
2	24 V	Power supply
3	–	free
4	–	free
5	I1	Input I1
6	COM1	I1..I4 common negative pole
7	I2	Input I2
8	I3	Input I3
9	I4	Input I4
10	I5	Input I5
11	COM2	I5..I8 common negative pole
12	I6	Input I6
13	I7	Input I7
14	I8	Input I8
15	I9	input I9
16	COM3	I9..I12 common negative pole
17	I10	Input I10
18	I11	Input I11
19	I12	Input I12
20	–	free
21	–	free
22	–	free

Wiring

No.	Name	Function
23	–	free
24	–	free
25	Q1B	Output Q1
26	Q1A	Output Q1
27	Q2B	Output Q2
28	Q2A	Output Q2
29	Q3B	Output Q3
30	Q3A	Output Q3
31	Q4B	Output Q4
32	Q4A	Output Q4
33	Q5B	Output Q5
34	Q5A	Output Q5
35	Q6B	Output Q6
36	Q6A	Output Q6
37	Q7B	Output Q7
38	Q7A	Output Q7
39	Q8B	Output Q8
40	Q8A	Output Q8

5.1 Inputs

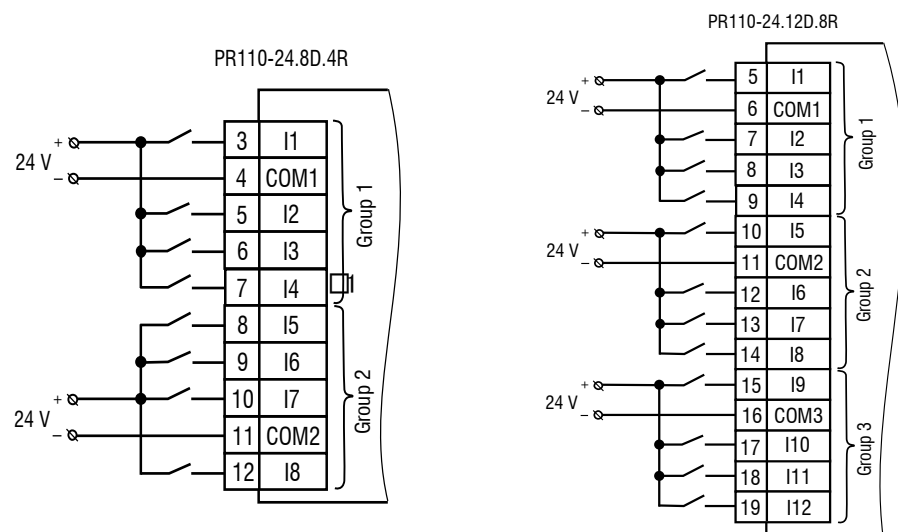


Fig. 5.3 Connection of switch contacts

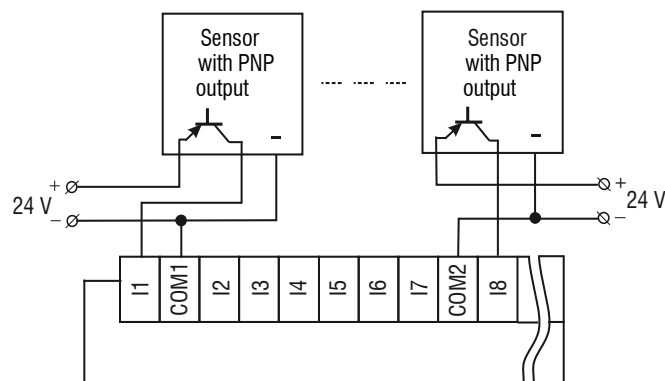


Fig. 5.4 Connection of 3-wire sensors with PNP-transistor output

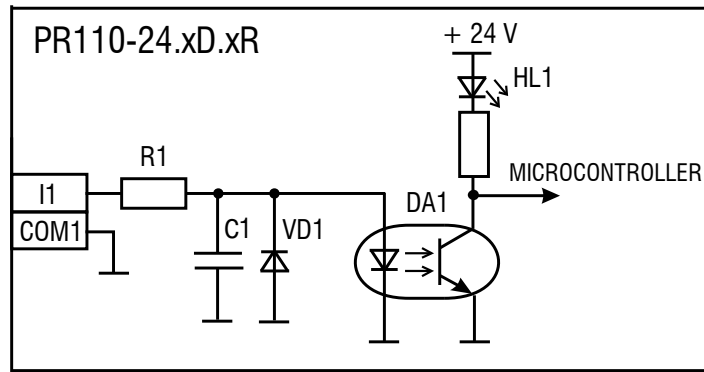


Fig. 5.5 Input block diagram

5.2 Outputs

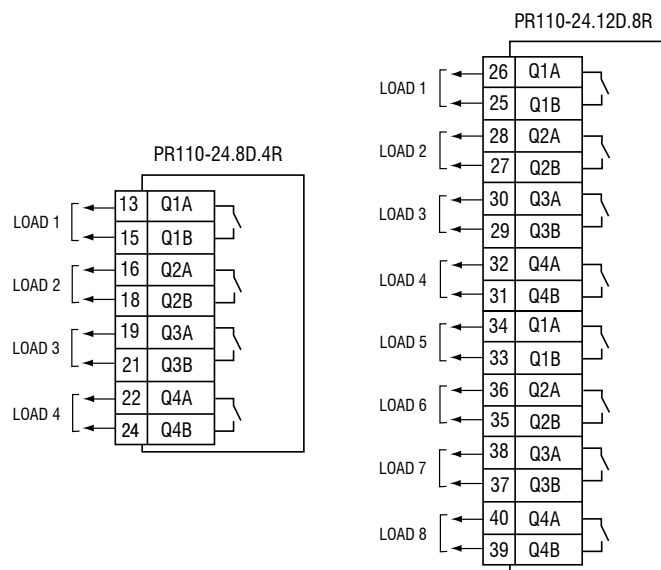


Fig. 5.6 Output connections

5.3 Programming interface

To program the relay it must be connected to USB-port of the PC over PR-KP20 adapter (not included into the delivery package). The adapter must be connected to the relay over PROG interface.

► NOTICE

Switch the power supply on only after connecting the programming cable.

Using *akYtec ALP software* the user can transfer the device settings and the application to the relay. The required power supply for the adapter is provided over USB port from the PC.

Network parameters of interface:

Baud rate	9.6 kbit/s
Data bits	8
Parity	none
Stop bits	1

Operation

6 Operation

► NOTICE

Before starting

Before switching on, make sure that the device was stored at the specified ambient temperature (-20...+55 ° C) for at least 30 minutes.

User application for the relay is created using programming software *akYtec ALP*. For detailed information about programming see Online Help for *akYtec ALP*. Once the application has been transferred to the relay persistent memory, the relay re-starts.

On start up the relay runs a self-test. If unsuccessful, the relay will go to the error state (see Table 6.1). Otherwise the user application runs.

Table 6.1 Error messages

LED "FAULT"	Cause	Remedy
flashes	Firmware is damaged	Update the firmware or refer to akYtec service department
lit	User application is not correct	Repair the application with the akYtec ALP software and repeat the download

6.1 Modbus communication

The connection to the Modbus network should be carried out over PROG interface with PR-MI485 adapter (not included in the delivery). For communication with Master device, the relay network parameters must be set. Necessary steps are described in online help for *akYtec ALP*.

The relay supports Modbus-RTU and Modbus-ASCII protocols with automatic protocol detection.

The relay functions as a Slave device in Modbus network:

- read input and output status
- read and write network parameters
- read and set the real-time clock

The following parameters are available for reading and writing:

Table 6.2 Modbus parameters

Parameter		Address	Modbus functions
Digital inputs		0x1000 – 0x100B	0x01, 0x02
		0x1000	0x03, 0x04
Digital outputs		0x0000 – 0x1007	0x01, 0x02, 0x05, 0x0F
		0x0000	0x03, 0x04, 0x06, 0x10
Network inputs		0x2000 – 0x21FF	0x01, 0x02, 0x05, 0x0F
		0x0200 – 0x021F	0x03, 0x04, 0x06, 0x10
Network outputs		0x3000 – 0x31FF	0x01, 0x02
		0x0300 – 0x031F	0x03, 0x04
Real-time clock	Seconds	0x0400	0x03, 0x04, 0x06, 0x10
	Minutes	0x0401	0x03, 0x04, 0x06, 0x10
	Hours	0x0402	0x03, 0x04, 0x06, 0x10
	Day	0x0403	0x03, 0x04, 0x06, 0x10
	Month	0x0404	0x03, 0x04, 0x06, 0x10

Operation

Year	0x0405	0x03, 0x04, 0x06, 0x10
Day of week	0x0406	0x03, 0x04
Week of month	0x0407	0x03, 0x04
Calendar week	0x0408	0x03, 0x04

Network inputs and outputs are special types of variables. They can be used in the application to process the values transmitted from the Master to the relay (or from the relay to the Master). For example, a parameter of timer or counter can be read or changed.

Variables transmitting values from the Master to the relay should be specified as network input variables.

Variables used to read out the data from the relay should be specified as network outputs.

For further details about using of network variables see online help for *akYtec ALP*.

Firmware update

7 Firmware update

To update the relay firmware the following is required:

- PC with Windows XP/Vista/7
- Interface adapter PR-KP20
- Programming software *akYtec ALP*

Update procedure:

- Connect the relay to the PC according to Fig. B.1
- Switch on the power supply
- In *akYtec ALP* select menu item "*Device->Firmware Update...*"
- Follow the instructions on the screen.

Maintenance

8 Maintenance

The maintenance includes:

- cleaning of the housing and terminal blocks from dust, dirt and debris
- checking the fastening of the device
- checking the wiring (connecting leads, fastenings, mechanical damage)

The device should be cleaned with a damp cloth only. No abrasives or solvent-containing cleaners may be used. The safety information in section 3 must be observed when carrying out maintenance

Transportation and storage

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.

Permitted storage temperature: -25...+55 °C

► NOTICE

Transport damage, completeness

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!

Scope of delivery

10 Scope of delivery

- Programmable relay PR110 1
- User guide 1

Appendix A Dimensions

Appendix A Dimensions

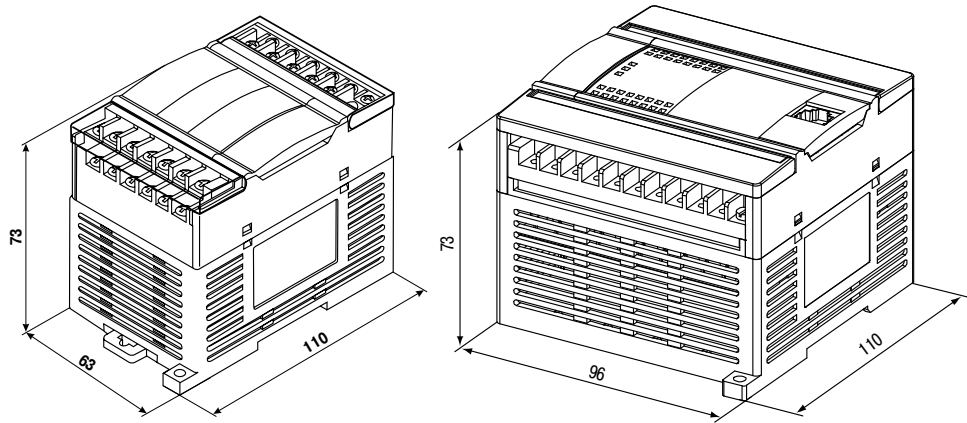


Fig. A.1 External dimensions PR110-24.8D.4R (left) and PR110-24.12D.8R (right)

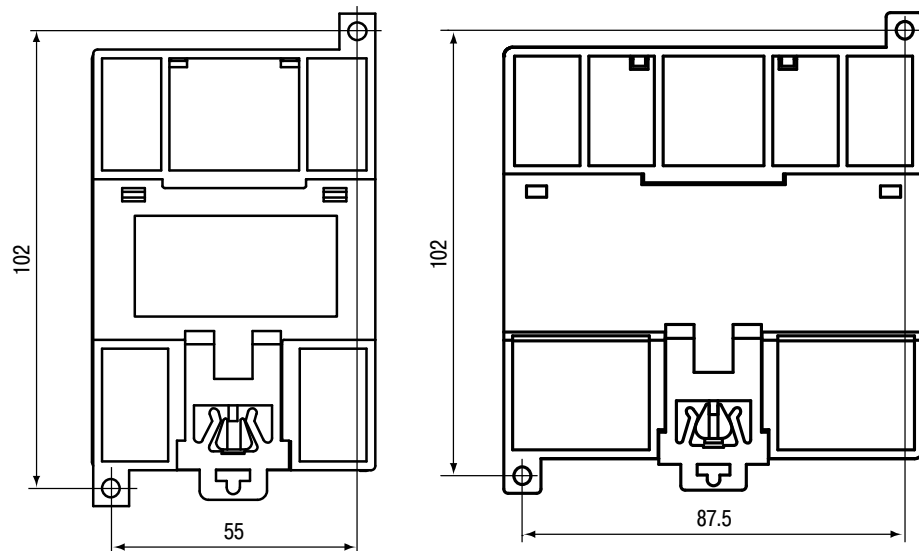


Fig. A.2 Wall mounting dimensions PR110-24.8D.4R (left) and PR110-24.12D.8R (right)

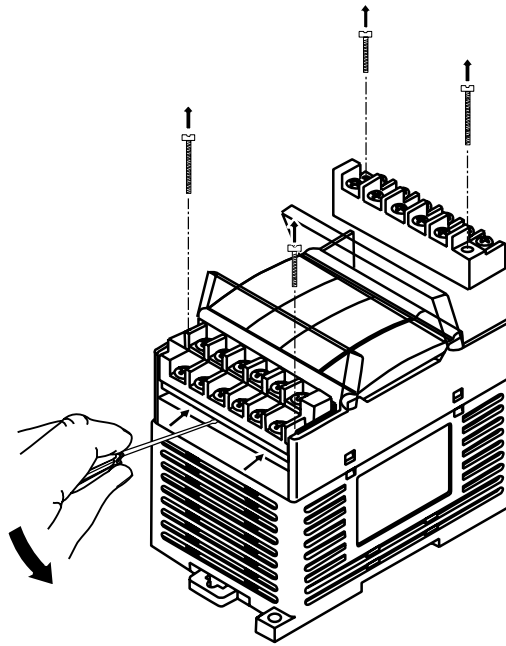


Fig. A.3 Replacement of terminal blocks

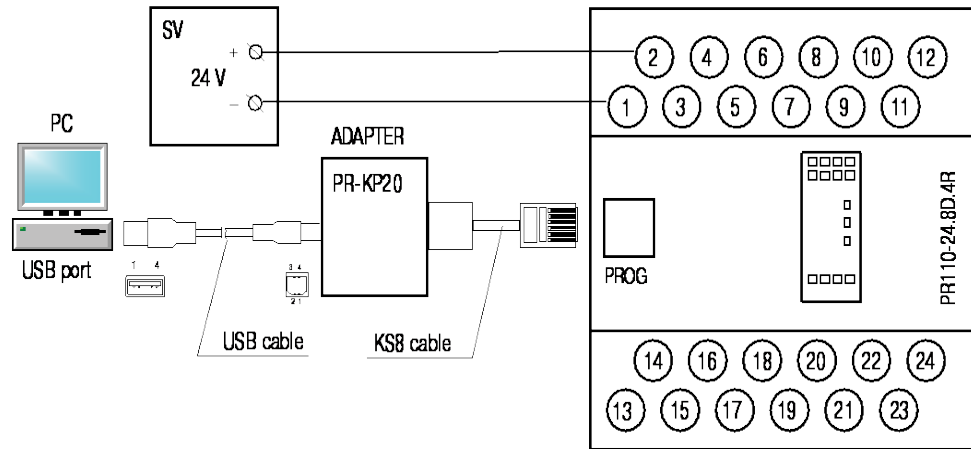


Fig. B.1 Connection to PC