PR200

Programmable relay

User guide

CE

Contents

Introduction

This manual describes the functions, configuration, operating instructions, programming and troubleshooting of the multifunctional programmable relay PR200 (hereinafter referred to as PR200, device, or relay).

Terms and abbreviations

ALP – programming software akYtec ALP for programming PR series relays, based on Function Block Diagram (FBD) programming language

ADC – analog-digital converter

DAC – digital-analog converter

Display element – program element used to display information on the device display

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).

Project – user application created in ALP software that also includes the device configuration

RAM – random access memory, volatile part of the device memory

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)

ROM – read-only memory, non-volatile part of the device memory

Symbols and key words

⚠ **DANGER**	*DANGER indicates an imminent dangerous situation that will result in death or serious injuries if not prevented.*
⚠ **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   Overview

The programmable relay PR200 is a small controller. User program is created as a function plan with the ALP programming software, which is available for download for free. The ALP project includes the program as well as the device configuration. Dynamically allocated memory enables to create complicated programs with many functional blocks, display elements and advanced display management.

The PR200 enables the following basic functions:

- output control according to input statuses and program logic
- configuration using ALP software or function buttons
- comprehensive display programming
- 2 programmable LEDs
- master and / or slave in Modbus network
- Real-time clock
- expandable with I/O modules

The relay is available in several versions, for DC and AC voltage, equipped with only digital or a combination of digital and analog inputs and outputs. The analog inputs can be configured as analog or as digital. The relay can be expanded with additional I/O modules.

Optional are up to two RS485 interfaces for connection to Modbus networks available.

The device is designed in a plastic enclosure for DIN rail mounting. The enclosure has 3-level stepped form for distributor installation. Plug-in terminal blocks enable quick and easy replacement of the device.

Front view:

- two-line 32-character alphanumeric LCD display
- two LEDs: F1 (green) and F2 (red), program-controlled
- 6 function buttons [ALT] [∨] [∧] [SEL] [OK] [ESC] for system menu and display navigation

Under the interface cover (to the right):

- EXT: 10 pole connector for extension modules

- PRG: mini-USB socket for PC connection. USB A-plug to micro B-plug connection cable is in the package included.
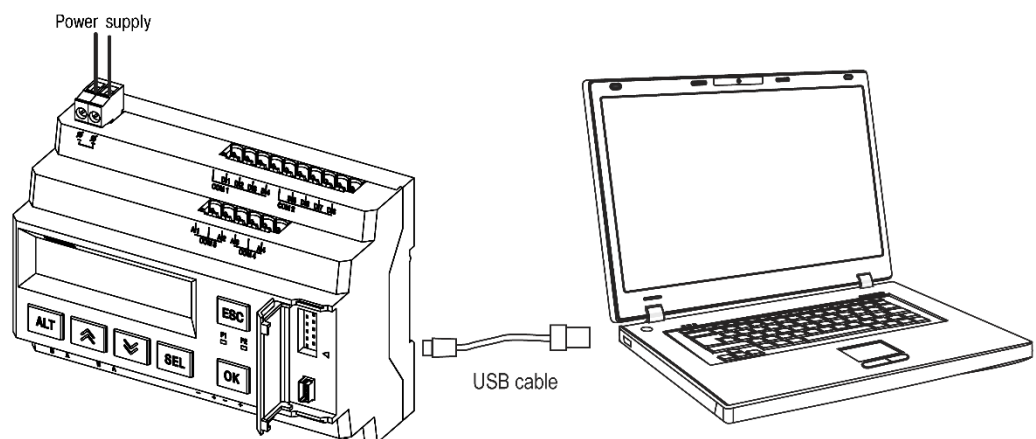

Fig. 1.1   Connection to PC (open interface cover)

1.1 Intended use

Programmable relays of PR200 series have 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. Only by akYtec GmbH recommended extension modules may be connected to the relay.

The relay may be operated only in properly installed condition.

Improper use

Any other use is considered improper. Especially to note:

– This 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 an explosive environment.
– The device should not be used in an atmosphere with chemically active substance.

1.2 Ordering key

The relay PR200 can be ordered in various designs depending on the required supply voltage, number and type of inputs, outputs and interfaces:

PR200-X.X.X

Supply voltage

I/O
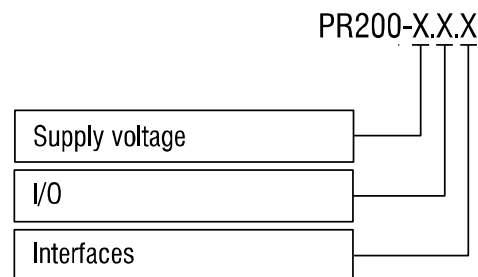
Interfaces

Supply voltage
230 - 230 (94…264) V AC
24 - 24 (19…30) V DC

I/O
1 - 8 DI, 6 DO
2 - 8 DI, 4 AI, 8 DO, 2 AO (4-20 mA)
4 - 8 DI, 4 AI, 8 DO, 2 AO (0-10 V)

RS485 interfaces
0 - none *
1 - 1 *
2 - 2

The models .0 and .1 can be upgraded later by installing up to two interface cards (app. G). Ordering code for the interface card: PR-IC485

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2   Specifications

Table 2.1   General specification

Device	230.1.x	230.2.x 230.4.x	24.1.x	24.2.x 24.4.x
Power supply	230 (94…264) V AC; 50 (47…63) Hz		24 (19…30) V DC	
Power consumption, max	10 VA	17 VA	10 W	10 W
Galvanic isolation	2830 V		1780 V	
Appliance class	II		III	
Integrated voltage source	-	24±3 V DC 100 mA	-	-
Galvanic isolation	-	1780 V	-	-
Inputs Digital	8			
Analog *	-	4	-	4
Outputs Digital (relay)	6	8	6	8
Analog	-	2	-	2
Programming				
Software	akYtec ALP			
Interface	Mini USB 2.0			
Program cycle, min	1 ms			
Function buttons	6			
LEDs	F1 (green), F2 (red), programmable			
LCD display	2x 16 digits, backlight adjustable			
Language	English			
RS485 interface **	2-pole plug-in terminal block			
Protocols	Modbus RTU/ASCII (master/slave)			
Baud rate	9.6…115.2 kbit/s			
Interface card	PR-IC485 (max. 2)			
Galvanic isolation	1500 V			
Dimensions	123 x 108 x 58 mm (with terminal blocks)			
Mounting	DIN rail (35 mm)			
Weight	approx. 350 g			
IP code	IP20			

* Analog inputs AI1…AI4 can also be configured as digital inputs
** For x.x.1 and x.x.2 models only

Table 2.2   Digital inputs

Device	230.1.x 230.2.x 230.4.x	24.1.x 24.2.x 24.4.x
Input signal	Switch contact	Switch contact PNP with open collector Digital signals -3…+30 VDC
Input voltage	230 V AC	24 V DC
Input voltage, max	264 V AC	30 V DC
Logical 1	159…264 V (0.75…1.5 mA)	15…30 V (5 mA)
Logical 0	0…40 V (0…0.5 mA)	-3…+5 V (0…1 mA)
Pulse length, min	50 ms	2 ms
Response time, max	100 ms	30 ms
Galvanic isolation	in groups of 4 (1-4, 5-8)	
Test voltage between input groups	1780 V	

Specifications

Device	230.1.x 230.2.x 230.4.x	24.1.x 24.2.x 24.4.x
Test voltage against other circuits	2830 V	

Table 2.3   Analog inputs

Device	x.2.x, x.4.x
Galvanic isolation	none
Analog mode	
Input signal	0-10 V, 4-20 mA, 0-4000 ohm
Input voltage *	-36…+36 V
Input resistance (0-10 V)	61 kohm
Input resistance (4-20 mA)	121 ohm
Basic error	±0.5%
Temperature influence	±0.05%/10°C
Resolution	2.7 mV / 6 µA
ADC resolution	12 bit
Sampling time for 4 inputs, max	10 ms
Digital mode	
Logic 1 **	0…10 V, adjustable
Logic 0 **	0…10 V, adjustable
Current at input voltage 15…30 V, max	5 mA

* If the voltage at one input is below -0.5 V, the accuracy for all inputs cannot be guaranteed.
*** Parameter can be set in ALP Property Box using the option **Input mode** = **digital**.*

Table 2.4   Digital outputs

Type	relay (NO)
Switching capacity AC	5 A, 250 V (resistive load)
Switching capacity DC	3 A, 30 V
Minimum load current	10 mA (at 5 V DC)
Service life, electrical	
3 A, 30 V DC	200,000 switching cycles
5 A, 250 V AC (resistive load)	100,000 switching cycles
Galvanic isolation	in groups of 2 (1-2, 3-4, 5-6, 7-8)
Test voltage between output groups	1780 V
Test voltage against other circuits	2830 V

Table 2.5   Analog outputs

Device	x.2.x	x.4.x
Auxiliary voltage	12…30 V DC	12…30 V DC
Quantity	2	
Output signal	4-20 mA	0-10 V
Output load, max	1 kohm	2 kohm
Basic error, max	±0.5%	
Temperature influence	±0.05%/10°C	
Inductive load, max	50 µH	-
Signal conversion time	100 ms	
DAC resolution	10 bit	
Galvanic isolation	2830 V, individual	2830 V, in group

Specifications

Table 2.6   Memory

ROM memory	128 kB
RAM memory	32 kB
Retain memory	1016 Byte
Network variable memory *	128 Byte

* The limitation applies only to the slave mode, in which all network variables are automatically declared as retain.

Table 2.7   Real-time clock

Accuracy	±3 s/day (25°C)
Correction	-2.75…+5.5 min/month
Backup, min	8 years
Backup battery	CR2032

2.1   Environmental conditions

The device is designed for natural convection cooling. It should be taken into account when choosing the installation site.

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 2.8

Conditions	Permissible range
Ambient operating temperature	-20…+55°C
Storage temperature	-25…+55°C
Relative humidity	up to 80% (at +25°C, non-condensing)
Altitude	up to 2000 m above sea level
EMC immunity	conforms to IEC 61000-6-2
EMC emission	conforms to IEC 61000-6-4

3   Installation

The relay is designed for DIN rail mounting. The environmental conditions from the section 2.1 must be observed. For the dimension drawing see Appendix. A

3.1   Mounting

– Align the upper slide of the DIN rail mounting groove with the DIN rail and push it onto the rail.
– Wire external connections in accordance with sec. 3.2 using plug-in terminal blocks (included).

Removal:

– Take off the terminal blocks without disconnecting the wires.
– Insert a screwdriver into the eyelet of the slide interlock, push it down and remove the relay from the rail.
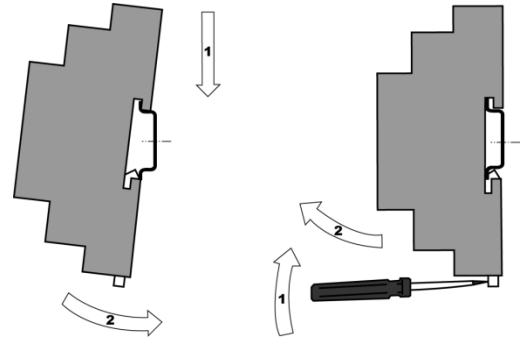
Fig.   3.1

3.2   Wiring

⚠ **WARNING**

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.
Do not feed any external devices from the power contacts of the device.
Remove the terminal blocks only after powering off the device and all connected equipment.

⚠ **WARNING**

The device must be powered off before connecting to peripheral devices, internal bus or PC. Switch on the power supply only after the wiring of the device has been completed.

⚠ **WARNING**

The program runs after transferring it to the relay. It is recommended to transfer the program before wiring the relay.
Otherwise ensure that all peripheral devices are disconnected from relay outputs before transferring the program.

Ⓝ **NOTICE**

Supply voltage for 24 VDC models may not exceed 30 V. Higher voltage can damage the device.
If the supply voltage is lower than 19 V DC, the device cannot operate properly but will not be damaged.

Ⓝ **NOTICE**

Signal cables should be routed separately or screened from the supply cables. Shielded cable should be used for the signal lines to ensure compliance with the EMC requirements.

ℹ **NOTE**

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

– For terminal assignment, see Tables 3.1, 3.2
– For I/O electrical connections, see Fig. 3.2…3.7
– For terminal blocks layouts, see app. B

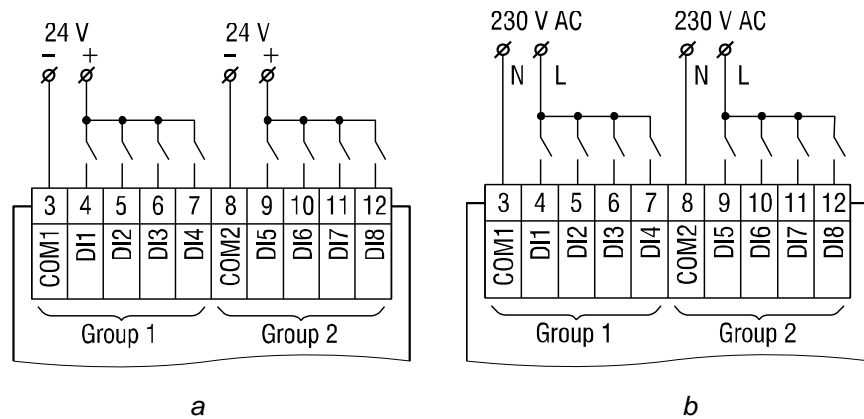– Maximum conductor cross-section is 0.75 mm²

3.2.1 Inputs

Fig. 3.2   Connection of switch contacts to digital inputs: a) 24.x.x, b) 230.x.x

NOTICE

230.x.x models
The digital inputs are divided into two groups, each of four inputs. All inputs must be operated on the same phase. Different phases are not allowed.
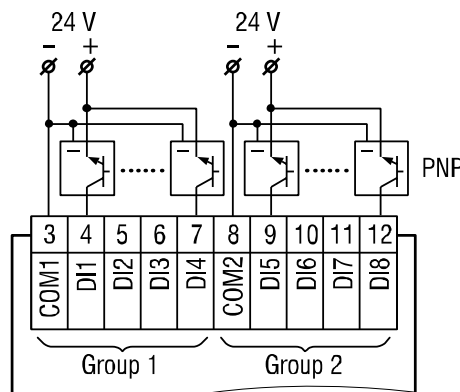

Fig. 3.3   Connection of 3-wire sensors with PNP transistor outputs to digital inputs (24.x.x only)

For 24.x.x models, it is permissible to connect sensors with switch contacts and transistor outputs to digital inputs within the same input group.
If the galvanic isolation between inputs groups is not required, a common power supply, including the integrated 24 VDC voltage source, can be used for both groups.
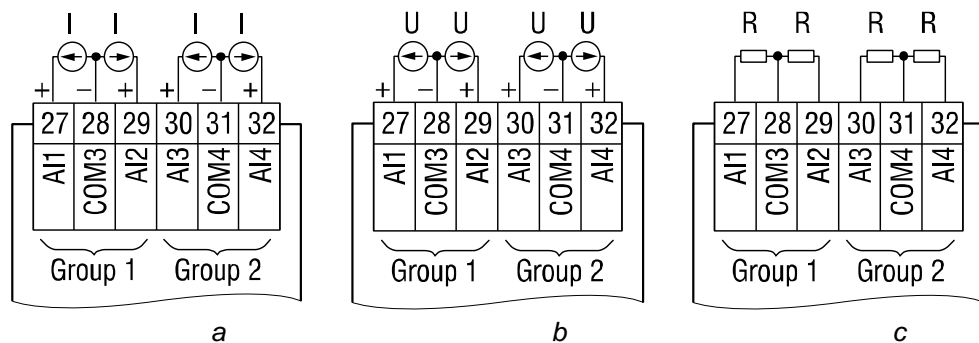
Fig. 3.4   Analog inputs: a) 4-20 mA, b) 0-10 V, c) 0-4000 ohm

Different sensors can be connected within a group. For example, AI1 can be configured as digital and AI2 as analog 4-20 mA.
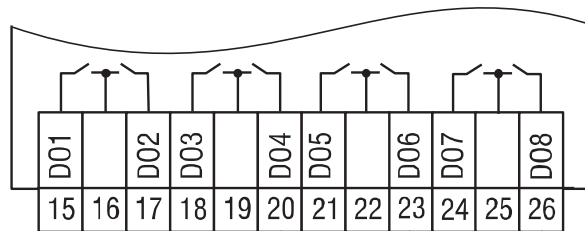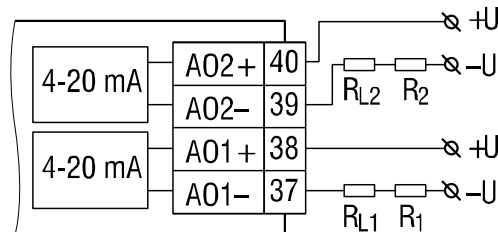
3.2.2 Outputs

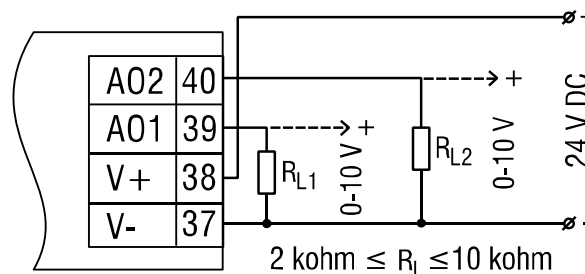*Fig. 3.5 Relay outputs*

Fig. 3.6 Analog outputs 4-20 mA (x.2.x)

Fig. 3.7 Analog outputs 0-10 V (x.4.x)

NOTICE | ***The output voltage of an external voltage source may not exceed 30 V. Higher voltage can damage the device.***

For voltage supply of analog outputs 4-20 mA or 0-10 V, the integrated voltage source can be used.

3.2.3 Terminal assignment

For terminal layouts see App. B.

Table 3.1 Terminal assignment

No.	Marking	Description
1	AC230V L / DC24V-	AC / DC power supply *
2	AC230V N / DC24V+	AC / DC power supply *
3	COM1	DI1...DI4 common contact
4	DI1	DI1 digital input
5	DI2	DI2 digital input
6	DI3	DI3 digital input
7	DI4	DI4 digital input
8	COM2	DI5...DI8 common contact
9	DI5	DI5 digital input
10	DI6	DI6 digital input
11	DI7	DI7 digital input
12	DI8	DI8 digital input
13	OUT 24V+	24 VDC integrated voltage source **
14	OUT 24V-	24 VDC integrated voltage source **
15	DO1	DO1 digital output
16	-	DO1...DO2 common contact
17	DO2	DO2 digital output

No.	Marking	Description
18	DO3	DO3 digital output
19	-	DO3...DO4 common contact
20	DO4	DO4 digital output
21	DO5	DO5 digital output
22	-	DO5...DO6 common contact
23	DO6	DO6 digital output
24	DO7	DO7 digital output
25	-	DO7...DO8 common contact
26	DO8	DO8 digital output
27	AI1	AI1 analog input
28	COM3	AI1...AI2 common contact
29	AI2	AI2 analog input
30	AI3	AI3 analog input
31	COM4	AI3...AI4 common contact
32	AI4	Analog input AI4
33	RS-485 D-	RS485 Interface 1-
34	RS-485 D+	RS485 Interface 1+
35	RS-485 D-	RS485 Interface 2-
36	RS-485 D+	RS485 Interface 2+
37…40		see Table 3.2

* *Depending on device model (230.x.x or 24.x.x)*

** *230.x.x model only*

Table 3.2   Terminals 37-40

No.	Marking	Description
x.2.2		
37	AO1-	AO1 analog output (4-20 mA)
38	AO1+	
39	AO2-	AO2 analog output (4-20 mA)
40	AO2+	
x.4.2		
37	V-	-24 VDC external voltage supply
38	V+	+24 VDC external voltage supply
39	AO1	AO1 analog output (0-10 V)
40	AO2	AO2 analog output (0-10 V)

3.3   Quick replacement

PR200 is equipped with plug-in terminal blocks which enable quick replacement of the device without disconnecting the existing wiring (Fig. 3.8).

To replace the device:

− power off all connected lines including power supply

− remove the terminal blocks

− replace the device

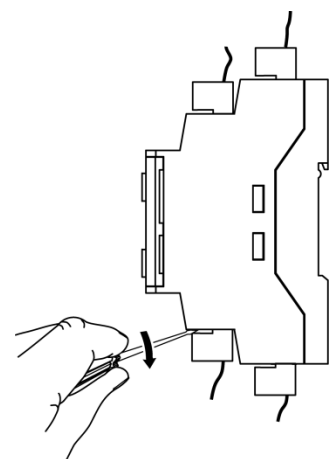− connect the terminal blocks with existing wiring to the device

Fig. 3.8   Quick replacement

4   Hardware resources

To use all hardware resources in a program, the device must be configured. The configuration is carried out in ALP and is transferred as a part of user project to the device memory. The configuration parameters are stored in non-volatile memory of the device and are safe when the device is powered off.

The device can also be configured with the function buttons via the system menu without being connected to ALP (sect. 5.2). If some parameter has been changed this way, it has to be taken from the device memory into the ALP project in order to keep the project syncronized. Use **Read** button in the corresponding mask in the configuration window.

The following hardware can be configured:

- Display
- Clock
- Interfaces (sect. 4.3)
- Extension modules
- Inputs (sect. 4.1)
- Outputs (sect.4 2)

See ALP Help for detailed information about configuration.

4.1   Analog inputs AI1…AI4

To configure analog inputs use the ALP menu item *Device > Configuration*. Open the node *Inputs > Analog* in the open window **Device configuration** (Fig. 4.1) and select an analog input.
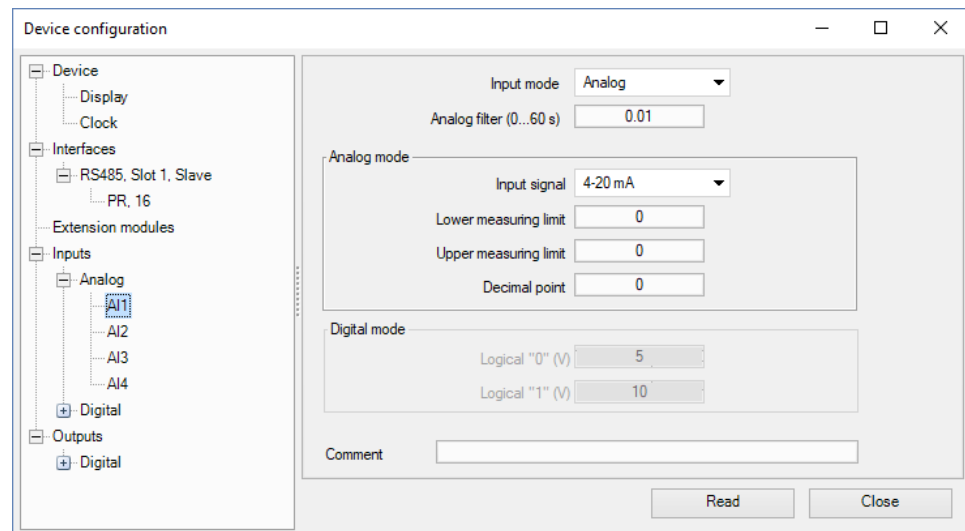

Fig. 4.1   Analog input configuration

For quick access select an input in the circuit program and use Property Box (see Fig. 4.2) to set the parameters. The parameter **Input mode** has to be set first.
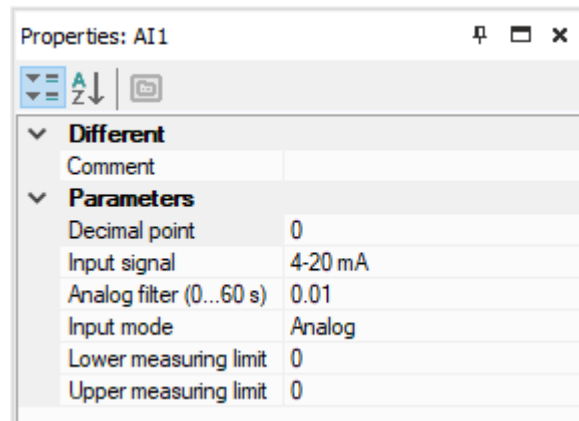
Fig. 4.2   Property Box for analog input

See ALP Help for detailed information about analog input configuration.

4.1.1   Analog mode

Configurable parameters:

- **Input mode** – select **Analog**
- **Filter** – filter time constant (0…60 s)
- **Input signal** – 4-20 mA, 0-10 V, 0-4000 ohm
- **Lower limit** – lower measuring limit
- **Upper limit** – upper measuring limit
- **Decimal places** – parameter **DP** for Modbus request (Table 4.2). The parameter **DP** has to be set to determine the accuracy, if the measured value is requested over Modbus as integer.

If the type of input signal is selected, the input must be configured on the hardware side using jumpers XP1…XP4 on the middle PCB in accordance with the selection.
The middle PCB is under the top PCB, but the last one does not need to be removed in this case. The location of the jumpers on the PCB is shown in Fig. 4.3.
Jumper positions corresponding to the input signals are shown in Fig. 4.4.
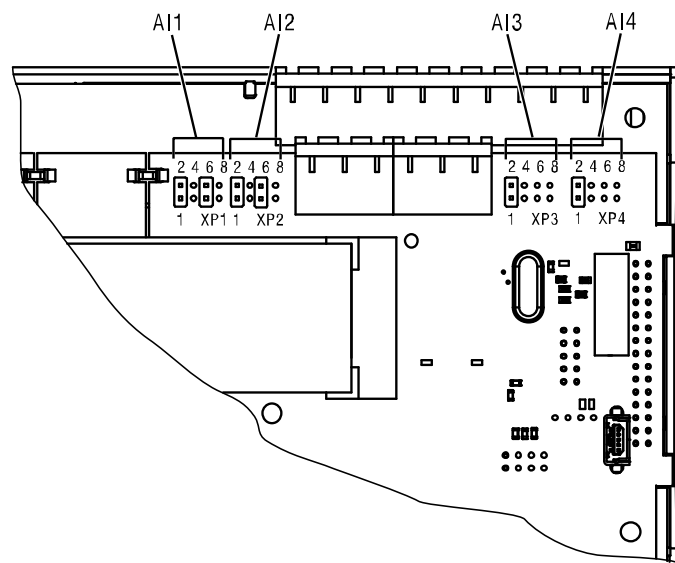All analog inputs are configured for 4-20 mA by default.

Fig. 4.3   Input jumpers on the middle PCB

⚠ WARNING	*The voltage on some components on the circuit board can be dangerous. Direct contact with the circuit board or penetration of a foreign body in the enclosure must be avoided.*

To configure the input hardware:

    – remove the front cover
    – set the jumpers on the respective jumper block XP in accordance to the expected input signal using a thin tool (e.g. tweezers)
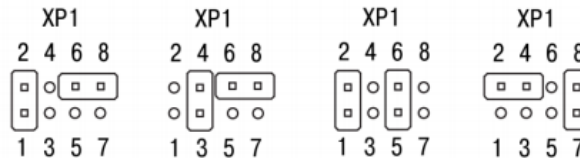   – close the front cover.

Fig. 4.4   Input jumper positions
a) 0-10 V, b) 4-20 mA, c) digital mode, d) 0-4000 ohm

The lower and upper measuring limits must be set to scale the input signal.

Scaling is not available if the signal 0-4000 ohm is selected. In that case the measured value is represented only in REAL32 format. The parameter **Decimal places** (**DP**) is not available for 0-4000 ohm signal as well.

The resistance input is designed for 2 wire sensors only.

The effect of lead resistance can be compensated in the program.

4.1.2   Digital mode

Configurable parameters:

    – **Input mode** – select **Digital**
    – **Filter** – filter time constant (0…60 s)
    – **Logical 0** – 0…10 V
    – **Logical 1** – 0…10 V

The input operates as a comparator with parameters **Logical 0** and **Logical 1** which determine the hysteresis and can be set in the range of 0…10 V (Fig. 4.5).
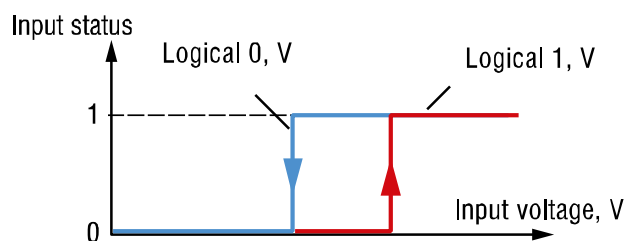

Fig. 4.5   Digital mode operation

4.1.3   Analog input filtering

The input filter stabilizes the input reading. The filter setting is a time constant representing the time interval in which the signal reaches 0.63 of the measured value. It can be set within the range of 0.01…60 s with the increment of 0.001 second for each input separately.

The greater the time constant, the higher the damping of the interference signal and the slower the reaction to rapid changes in the input value.

4.2   Analog outputs AO1, AO2

The model x.2.x has two analog outputs 4-20 mA, x.4.x has two analog outputs 0-10 V.

To control an output, a value of type REAL32 within the range 0…1 has to be assigned to it in the program.

When the value of 0.5 is applied to the output 4-20 mA, the output current will be 12 mA.

When the value of 0.5 is applied to the output 0-10 V, the output voltage will be 5 V.

See ALP Help for detailed information about analog output configuration.

4.3 RS485 interface

Up to two RS485 interface cards can be installed in the PR200 for communication via Modbus RTU / ASCII protocol as master or slave.

If your device has less than two RS485 interfaces, you can order the required interface cards PR-IC485 and install them (App. G).

The interface card is configured as a slave by default. To use the interface as a master, set the jumpers XP4 and XP5 on the interface card in accordance with the Fig. 4.6:

- set the both jumpers to **M** position
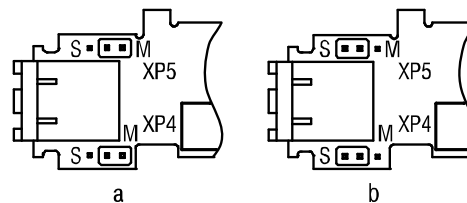- configure the interface using the ALP menu item ***Device > Configuration***

Fig. 4.6   Interface card jumper positions: master (a), slave (b)

See ALP Help for detailed information about RS485 interface configuration. The parameters can also be changed via system menu (sect. 5.2).

4.3.1 Slave mode

Available network functions:

- read digital I/O status
- read analog I/O value
- read / write network variables
- read / write Real-Time Clock data

Corresponding Modbus registers are listed in Tab. 4.1.

Modbus RTU and Modbus ASCII protocols are supported, with automatic protocol detection.

To add an interface, use the context menu of the node **Interfaces** in the configuration tree and select ***Add interface > RS485*** (Fig. 4.7). The new interface is a slave by default.

Use the context menu of the new interface to add a master device (Fig 4.8).

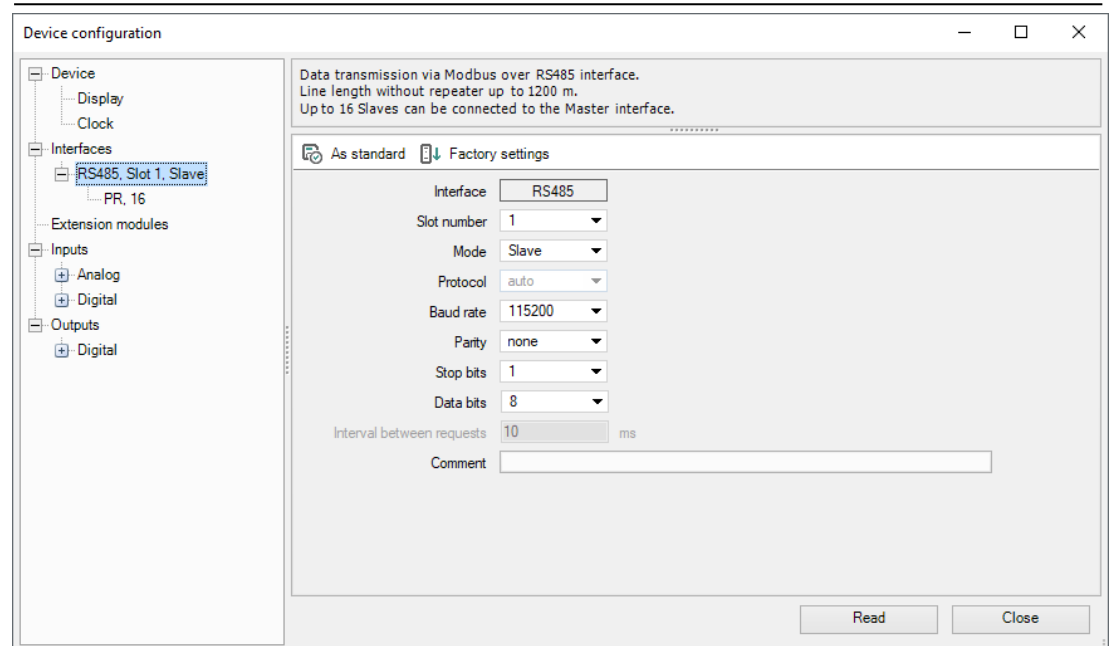Define the name and the Modbus address for the master.

Fig. 4.7   Slave configuration in Slave mode

Following parameters can be set for Master:

- **Name** – device name in the configuration tree
- **Address** – device address in the Modbus network.
- **Change register order** – reverse the register order according to the method of storing variables in device memory
- **Change byte order** – reverse the byte order in a register according to the method of storing variables in device memory

See ALP Help for further details about configuration in the Slave mode.

To create a variable for polling click the ➕ icon.

To delete the selected variable click the ❌ icon.
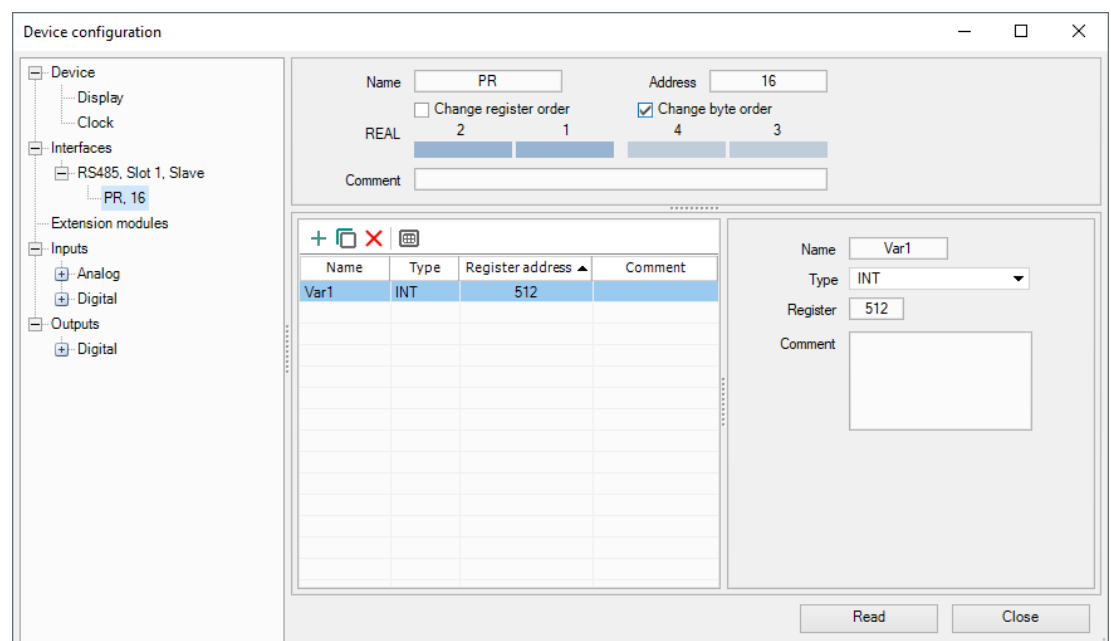
Fig. 4.8   Master configuration in Slave mode

Hardware resources

Table 4.1   Modbus registers

Model	Parameter	Data type	Address (hex)	Modbus function
Inputs				
All	DI1...DI8 input status	BOOL	0x1000 – 0x1007	0x01, 0x02
		UINT16	0x0100	0x03, 0x04
x.2.x x.4.x	AI1 measured value REAL	REAL32	0x0B00, 0x0B01	0x03, 0x04
	AI2 measured value REAL	REAL32	0x0B02, 0x0B03	0x03, 0x04
	AI3 measured value REAL	REAL32	0x0B04, 0x0B05	0x03, 0x04
	AI4 measured value REAL	REAL32	0x0B06, 0x0B07	0x03, 0x04
	AI1 measured value UINT *	UINT16	0x0B80	0x03, 0x04
	AI2 measured value UINT *	UINT16	0x0B81	0x03, 0x04
	AI3 measured value UINT *	UINT16	0x0B82	0x03, 0x04
	AI4 measured value UINT *	UINT16	0x0B83	0x03, 0x04
	AI1 decimal point (DP) UINT *	UINT16	0x0BC0	0x03, 0x04
	AI2 decimal point (DP) UINT *	UINT16	0x0BC1	0x03, 0x04
	AI3 decimal point (DP) UINT *	UINT16	0x0BC2	0x03, 0x04
	AI4 decimal point (DP) UINT *	UINT16	0x0BC3	0x03, 0x04
	AI1 input status (digital mode)	BOOL	0xB800	0x01, 0x02
	AI2 input status (digital mode)	BOOL	0xB810	0x01, 0x02
	AI3 input status (digital mode)	BOOL	0xB820	0x01, 0x02
	AI4 input status (digital mode)	BOOL	0xB830	0x01, 0x02
Outputs				
x.1.x	DO1...DO6, F1, F2 output status	BOOL	0x0000 – 0x0007	0x01, 0x02
		UINT16	0x0000	0x03, 0x04
x.2.x x.4.x	DO1...DO8, F1, F2 output status	BOOL	0x0000 – 0x0009	0x01, 0x02
		UINT16	0x0000	0x03, 0x04
x.2.x x.4.x	AO1 output value (0…1)	REAL32	0x0A00, 0x0A01	0x03, 0x04
	AO2 output value (0…1)	REAL32	0x0A02, 0x0A03	0x03, 0x04
	AO1 output value (0…10000)	UINT16	0x0A80	0x03, 0x04
	AO2 output value (0…10000)	UINT16	0x0A81	0x03, 0x04
All	Network variables	BOOL	0x2000 – 0x23F0	0x01, 0x02, 0x05, 0x0F
		UINT16	0x0200 – 0x023F	0x03, 0x04, 0x06, 0x10
Real-time clock				
All	Seconds	UINT16	0x0400	0x03, 0x04, 0x06, 0x10
	Minutes	UINT16	0x0401	0x03, 0x04, 0x06, 0x10
	Hours	UINT16	0x0402	0x03, 0x04, 0x06, 0x10
	Day	UINT16	0x0403	0x03, 0x04, 0x06, 0x10
	Month	UINT16	0x0404	0x03, 0x04, 0x06, 0x10
	Year	UINT16	0x0405	0x03, 0x04, 0x06, 0x10
	Weekday	UINT16	0x0406	0x03, 0x04
	Week of month	UINT16	0x0407	0x03, 0x04
	Calendar week	UINT16	0x0408	0x03, 0x04

* **AI1 measured value UINT = AI1 measured value REAL * 10 ^{DP}** (sect. 4.1.1)

*For outputs **DP** = 4 (constant)*

4.3.2   Master mode

There can be only one master in Modbus network.

Hardware resources

PR200 as a master can control up to 16 slaves over one RS485 interface. Each slave can maintain up to 256 variables. To use the same name and the same address for different slaves is allowed.

To add an interface, use the context menu of the node **Interfaces** in the configuration tree and select **Add interface > RS485** (Fig. 4.9). Change the mode to **Master** in the right window part.
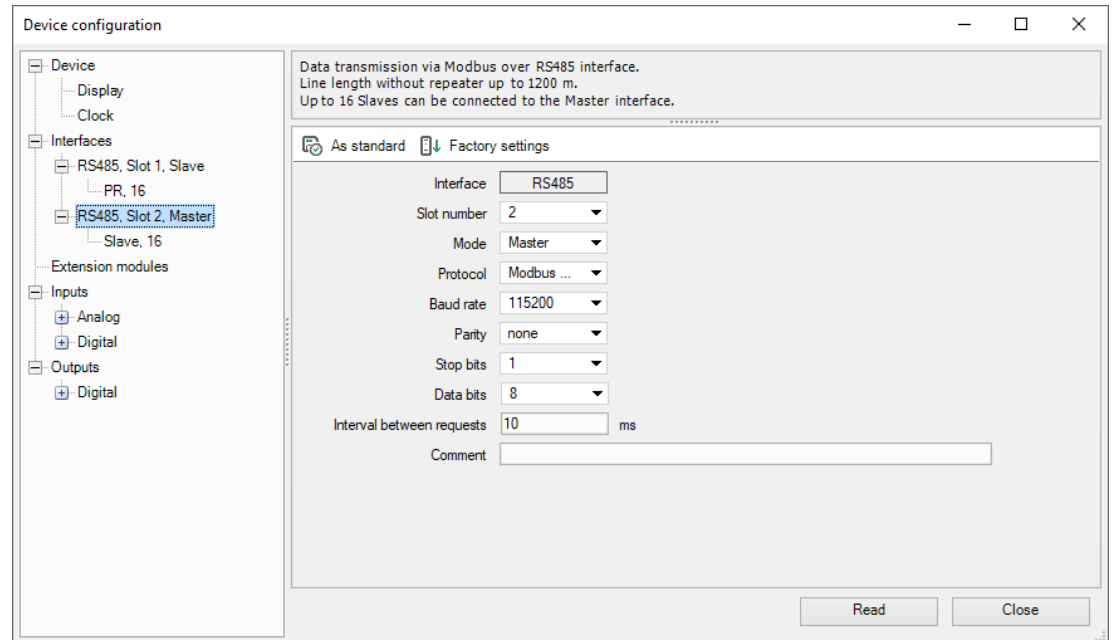

Fig. 4.9   Master configuration in Master mode

Add the required number of slave devices using the context menu of the new interface (Fig 4.10). Define the name and the Modbus address for each slave.

Following parameters can be set for the slave:

- **Name** – device name in the configuration tree
- **Address** – device address in the Modbus network.
- **Polling cycle** – time between requests (0…65535 ms)
- **Retries** – number of request retries if no reply (0…255)
- **Timeout** – maximum time to wait for reply (0…65535 ms)
- **Status variable** – status of slave device (BOOL variable)
- **Start query** – start / stop polling (BOOL variable)
- **Change register order** – reverse the register order according to the method of storing variables in the device memory
- **Change byte order** – reverse the byte order in a register according to the method of storing variables in the device memory

See ALP Help for further details about configuration in Master mode.

To create a variable to be requested click th e ✚ icon (Fig. 4.10).

To delete the selected variable click the ✖ icon.

The reading request is trigged by the **Polling cycle** by default. Optionally it can be triggered by changing a variable of type BOOL.

The writing request is triggered by change of parameter value. Optionally it can be triggered by changing. a variable of type BOOL.
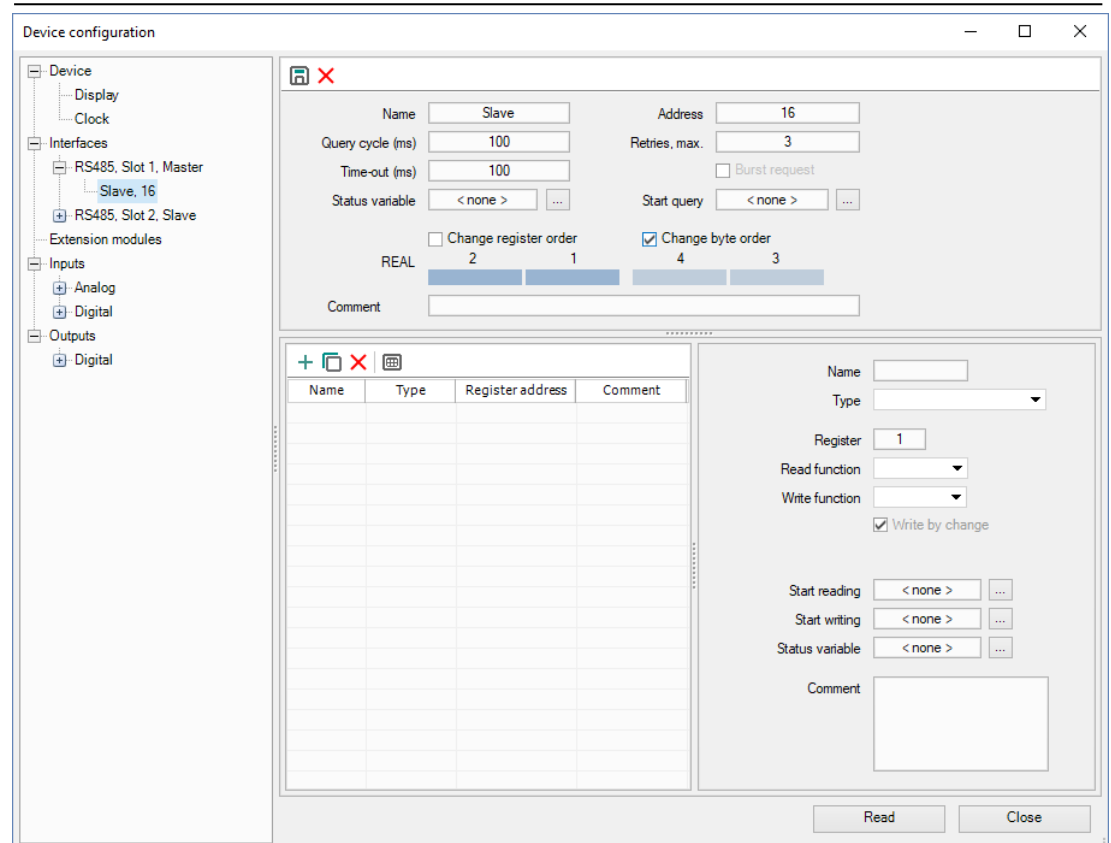

Fig. 4.10   Slave configuration in Master mode

Note:

If PR200 is a master in the Modbus network, it is necessary to observe the following rules to speed up the polling of all slaves:

- If one or more slaves are disconnected or not accessible, it is recommended to block the polling of these slaves in the program using the parameter **Start query** or to minimize the parameter **Timeout** for these slaves. Otherwise, the response time is significantly increased with the number of unavailable slaves and the sum of time-outs.
- When setting the master parameter **Interval between requests** (Fig. 4.9), the number of slaves and the total number of requests must be taken into account. If the total polling takes actually longer than the set value, this parameter will be ignored.

4.4   Service modes

To switch the device to one of the two service modes, use the jumpers XP2 and XP3 on the top PCB (Fig. 4.11).

⚠ WARNING   *The voltage on some components on the circuit board can be dangerous. Direct contact with the circuit board or penetration of a foreign body in the enclosure must be avoided.*

🛈 NOTICE   *Do not set the jumpers XP2 and XP3 at the same time, otherwise the device can be damaged.*
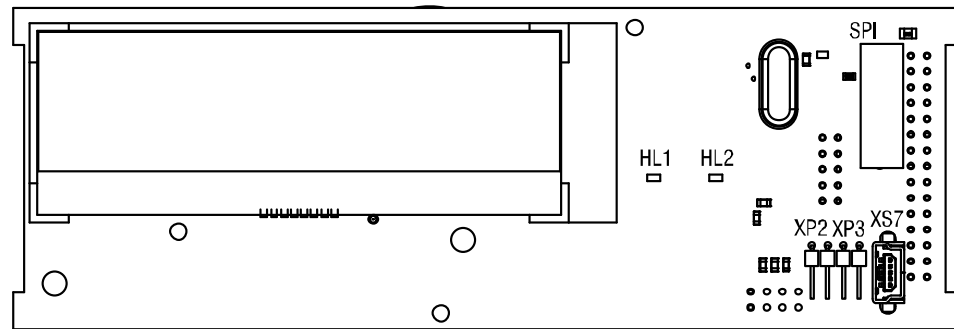
Fig. 4.11   Service mode jumpers

RUN-STOP mode

In RUN-STOP mode the execution of the program is interrupted. It can be useful if the system menu is unavailable, e.g. if the corrupted program leads to device malfunction.

Set XP2 jumper to activate RUN-STOP mode.

In RUN-STOP mode, a new program can be uploaded to the device.

In this mode the device can be used only as a slave and the network variables are disabled.

DOWN mode

DOWN mode is necessary for troubleshooting if a firmware update was unsuccessful (power outage, communication errors etc.). In this mode the firmware update can be forced. See ALP Help for further details about firmware update.

Set XP3 jumper to activate DOWN mode.

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5   Operation

Once the program has been transferred to the non-volatile memory, the relay restarts. On startup, the relay performs a self-test. If it is unsuccessful, the relay will switch to error mode (sect. 5.1). Otherwise, the program will run (Fig. 5.1)

⚠ **WARNING**

The program is executed after it has been transferred to the relay. It is recommended to transfer the program before wiring the relay.
Otherwise ensure that all external devices are disconnected from outputs before transferring the program.

ℹ **NOTE**

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.

Operation of the device is cycle oriented:

1. operational readiness test
2. input process image update
3. program execution for one cycle
4. output process image update
5. back to 1.
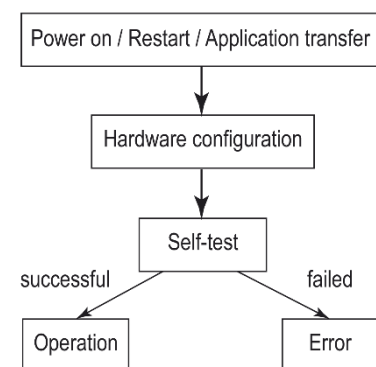
Fig. 5.1   Operating sequence

5.1   Error mode

In the error mode, the program is stopped until the error cause is eliminated.

Table 5.1   Error indication

Indication	Cause	Remedy
LOGIC Program INVALID	Invalid program	Repair the program in ALP
LOGIC Program MEMORY ERROR	Retain variables cannot be read	
LOGIC Program BLOCKED	RUN-STOP mode is activated, program stopped (sect. 4.4)	Remove the RUN-STOP jumper and restart the device
LED F2 lit	Firmware damaged	Update the firmware or contact the service center
LED F2 blinks		
LOGIC Program STOPPED	Program stopped	Start the program using system menu and restart the device

5.2   System menu

The system menu allows you to view the most important parameters of the device and perform a quick configuration without connection to ALP.

The program can be interrupted by using the system menu item **Device > Program**. Select **Stop program** to stop the program execution or **Run program** to start it. After changing the setting, the device must be restarted for the change to take effect. When the program is interrupted, all parameters except the network variables are available via via system menu and Modbus network in Slave mode.

Press ⌁ALT⌁ button for 3 seconds to access the menu.

Press ⌁ESC⌁ button for 3 seconds to exit the menu.

The menu can be password protected. The password can be set and changed in ALP or using the system menu. If the password is lost, it can be changed by loading a new project to the device.

5.2.1   Display navigation

The display can be used in view or edit mode. The edit mode is only for editable display elements available.

View mode

To move between lines use ⌁∧⌁ and ⌁∨⌁ buttons.

To enter the selected level, use ⌁OK⌁ button, to exit the level, use ⌁ESC⌁ button.

Edit mode

Use ⌁SEL⌁ button to enter the edit mode from the current display. The first editable element starts flashing.

Use ⌁∧⌁ and ⌁∨⌁ buttons to change the parameter.

To move between characters, use the button combinations:

  – ⌁ALT⌁ + ⌁∧⌁ – one character to the left
  – ⌁ALT⌁ + ⌁∨⌁ – one character to the right.

To save the new value and exit the edit mode, use ⌁OK⌁.

To reset the parameter to its previous value and exit the edit mode, use ⌁ESC⌁ button.

To save the new value staying in the edit mode, use ⌁SEL⌁ button. The next editable parameter will be displayed selected.

Next time, when the edit mode is activated, the last changed parameter will be displayed.

If a parameter has been changed in the edit mode, it must be transferred to the ALP project using the **Read** button in the corresponding dialog window.

5.2.2 Menu structure
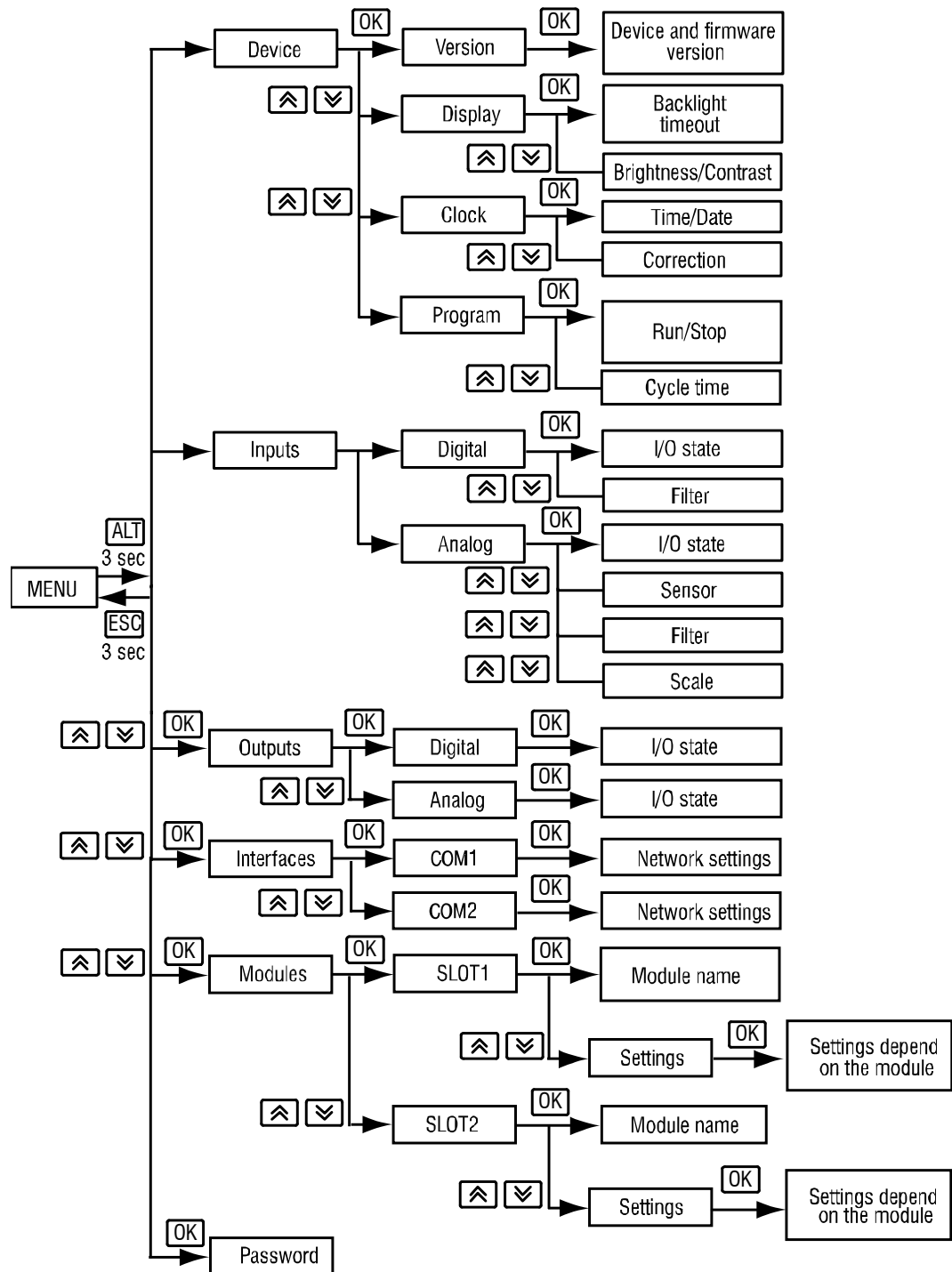
Fig. 5.2   System menu

Inputs

– **Digital**
  o **I/O state** – status of digital inputs displayed as a bitmask: 1/0 (ON/OFF).
    The first bit in the mask corresponds to the input DI1.
  o **Filter** – debouncing filter time constant (0…255 ms), displayed in pairs. Use
    ⌃ / ⌄ buttons to navigate between pairs.

– **Analog**
  o **I/O state** – status of analog inputs as scaled measured values of REAL32
    type, displayed in pairs. Use ⌃ / ⌄ buttons to navigate between pairs.
  o **Sensor** – type of the input signal

- o **Filter** – analog filter time constant within the range of 0.01…60 s with the increment of 0.001 s, displayed in pairs. Use ⧆ / ⧆ buttons to navigate between pairs.
- o **Scale** – lower and upper limits for input signal scaling. Use ⧆ / ⧆ buttons to navigate between inputs.

Outputs

- − **Digital**
    - o **I/O state** – status of digital outputs, including LED indicators F1/F2, displayed as a bitmask: 1/0 (ON/OFF). The first bit in the mask corresponds to the output DO1, the last bit in the mask corresponds to the indicator F2.
- − **Analog**
    - o **I/O state** – status of analog outputs as REAL32 values within the range of 0…1, displayed in pairs. Use ⧆ / ⧆ buttons to navigate between pairs.

Interfaces

Interface configuration depends on the interface mode, Master or Slave. Select the interface to view its parameters (sect. 4.3).

- − **Slave mode**
    - o **Settings**
        - ▪ **Baud rate** – **Data bits** – **Parity** – **Stop bits**
    - o **Protocol**
        - ▪ Interface mode / **Address** – master address
- − **Master mode**
    - o **Settings**
        - ▪ **Baud rate** – **Data bits** – **Parity** – **Stop bits**
    - o **Protocol**
        - ▪ Interface mode / **Devices** – list of slaves from the project
            - • **Address** – slave address
            - • **Period** – Query cycle (ms)
            - • **Timeout** – Time-out (ms)
            - • **Attemts** – Retries, max.
        - ▪ **Pause** – Interval between requests (ms)

Modules

This menu item contains the information about the extension modules connected to the base device. The item is hidden if there are no modules connected.
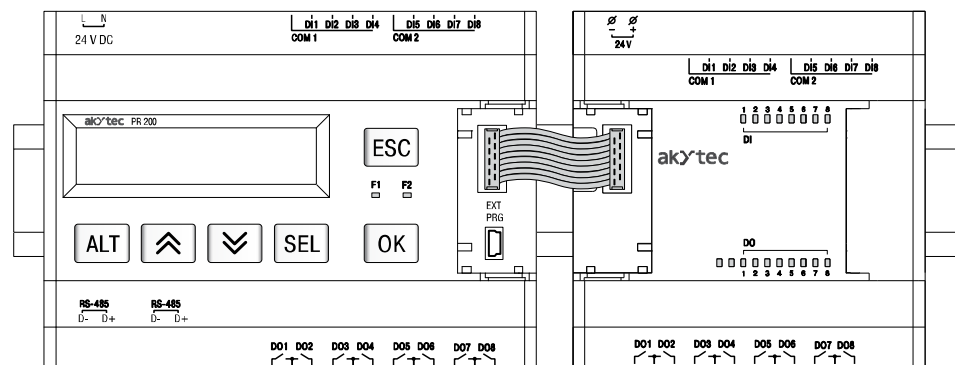
Fig. 5.3   Extension module connection

Password

Password can be set or changed (sect. 5.2).

5.3   Display programming

The display can be programmed using one or more display forms. To switch between two display forms, jump conditions have to be created. Jump condition can be an event of a

function button or of a variable. For further details about display programming, see ALP Help.

For display navigation, see section 5.2.1.

When assigning a jump condition to a function button, don't forget that the user function of the button has a higher priority than its system function, i.e. ⧉ and ⧉ buttons cannot be used to scroll the lines inside a display if they are used as the jump condition for it.

6 Maintenance

The maintenance includes:

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

⚠ NOTICE	*The device should be cleaned with a damp cloth only. No abrasives or solvent-containing cleaners may be used. During maintenance, observe the safety instructions in the section "Installation".*

7   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

i 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!*

8   Scope of delivery

– PR200	1
– Short guide	1
– USB cable	1
– Terminal blocks (set)	1
– Coding elements (set)	1
– USB stick with software and documentation	1

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

Appendix A.   Dimensions
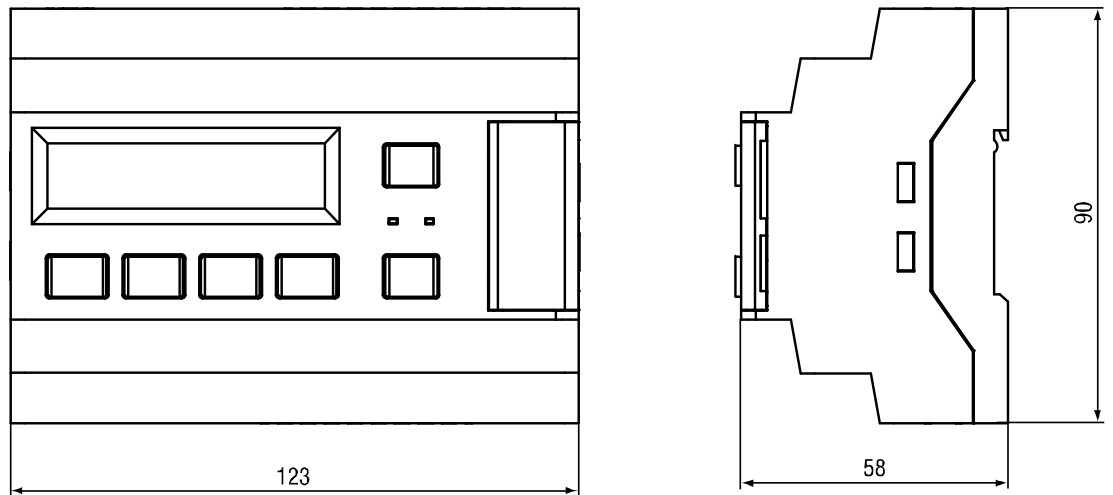
Fig. A.1   Dimensions without terminal blocks

Appendix B.   Terminal layouts
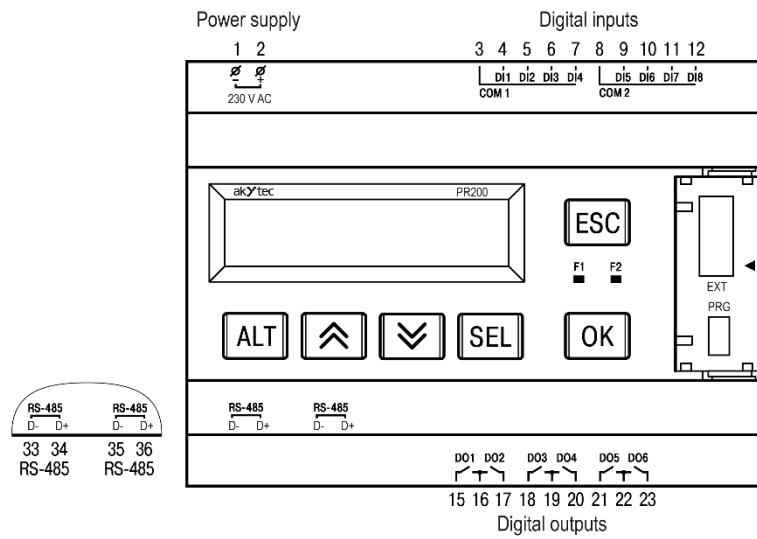
Fig. B.1   PR200-230.1.2
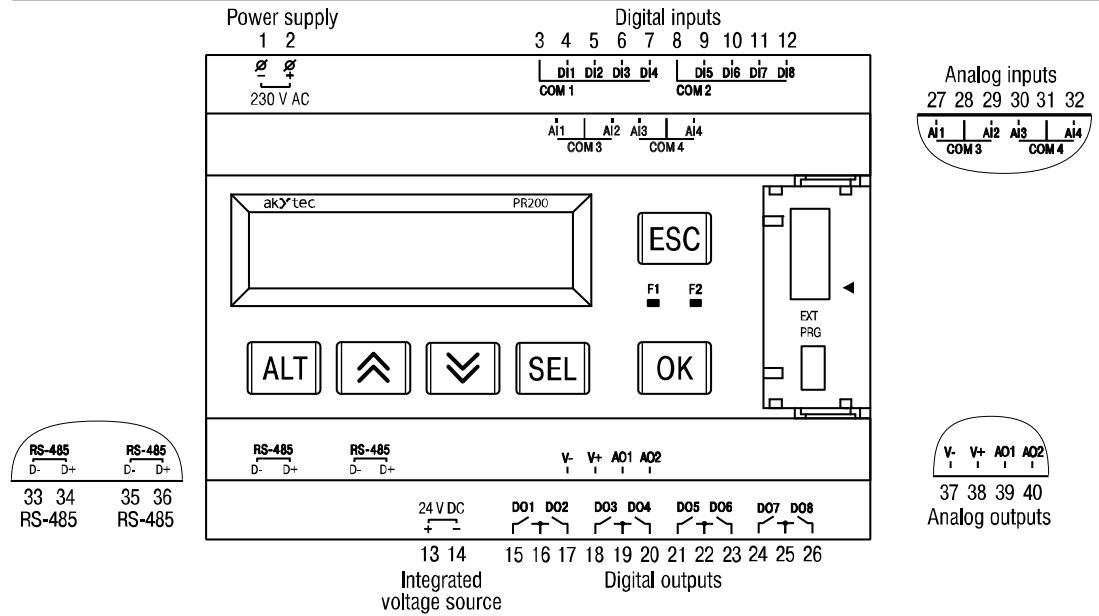
Fig. B.2   PR200-230.2.2

Fig. B.3   PR200-230.4.2
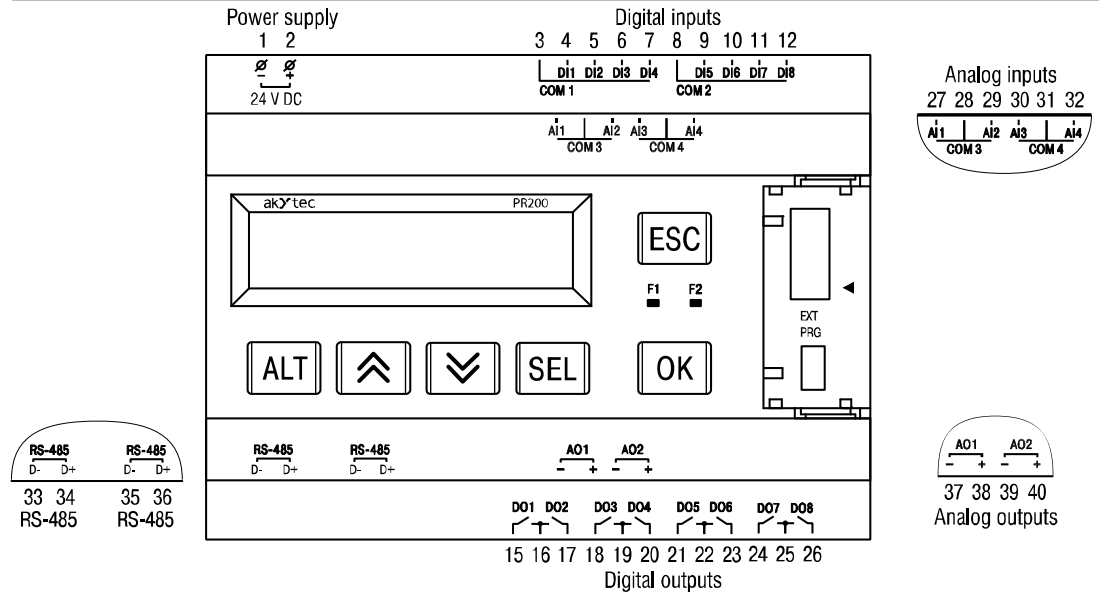
Fig. B.4   PR200-24.1.2

Fig. B.5   PR200-24.2.2
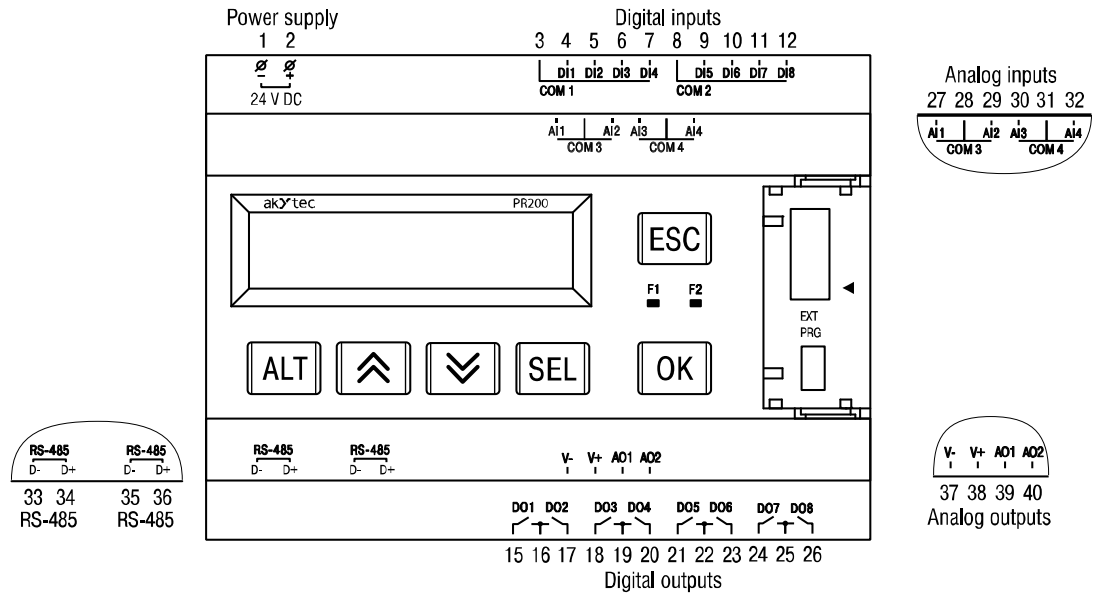
Fig. B.6   PR200-24.4.2

Appendix C.   Galvanic isolation
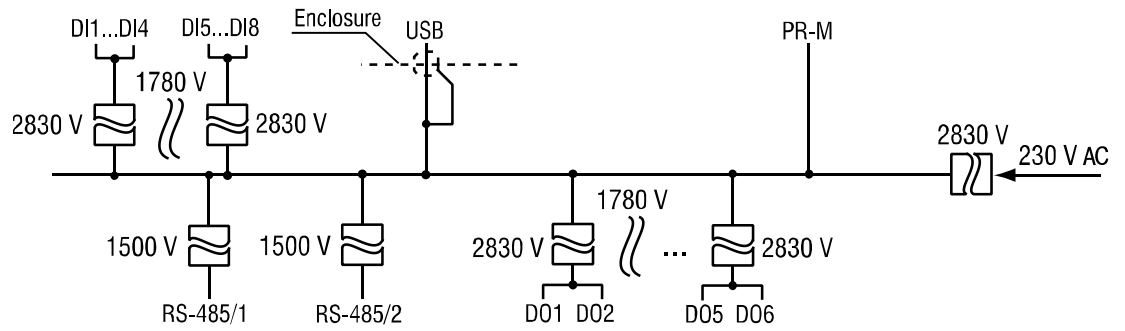
Fig. C.1   PR200-230.1.x galvanic isolation
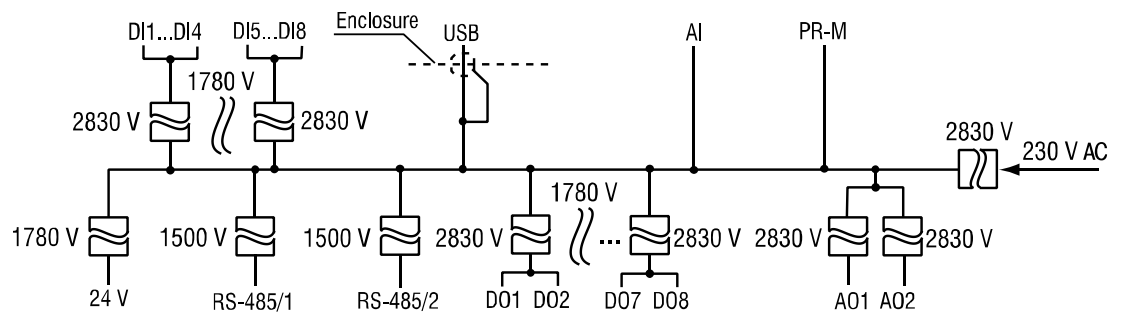
Fig. C.2   PR200-230.2.x galvanic isolation
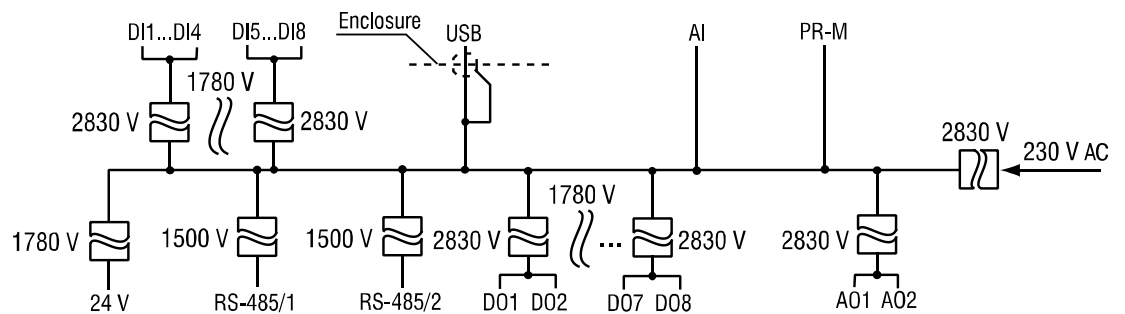
Fig. C.3   PR200-230.4.x galvanic isolation
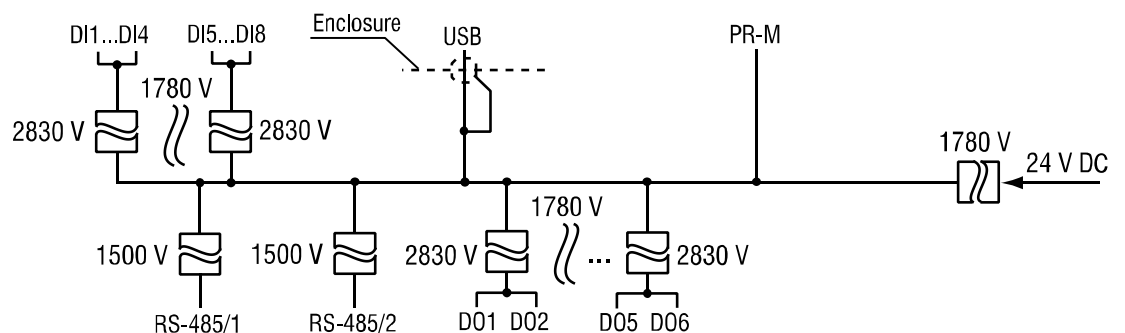
Fig. C.4   PR200-24.1.x galvanic isolation
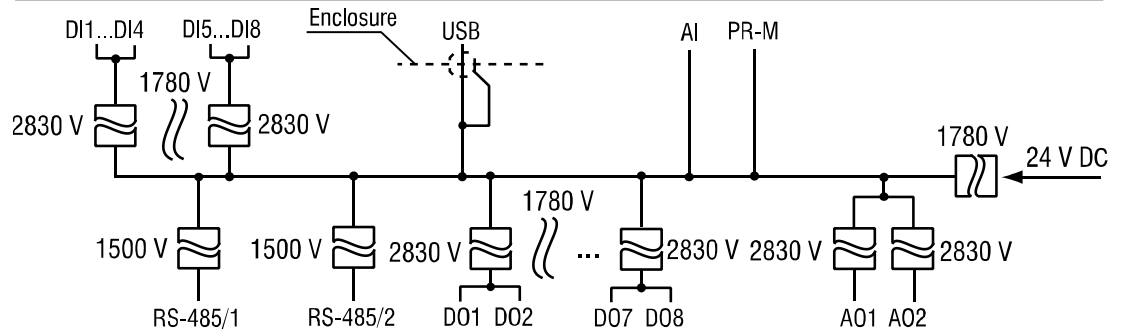
Fig. C.5   PR200-24.2.x galvanic isolation
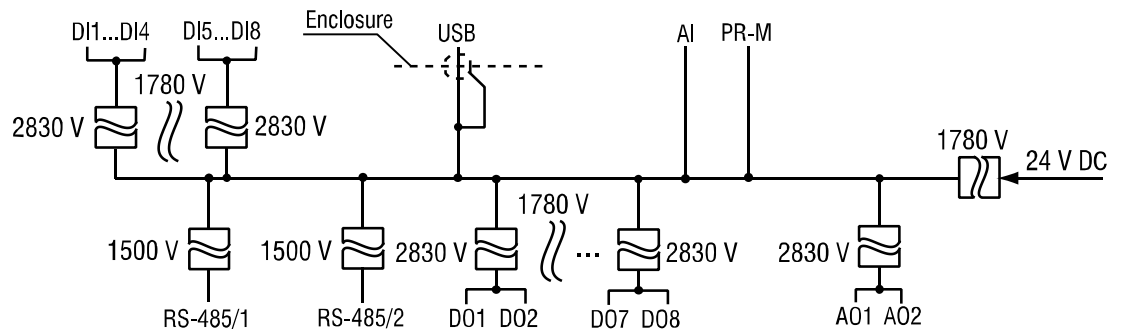
Fig. C.6   PR200-24.4.x galvanic isolation

Appendix D. Circuit diagrams
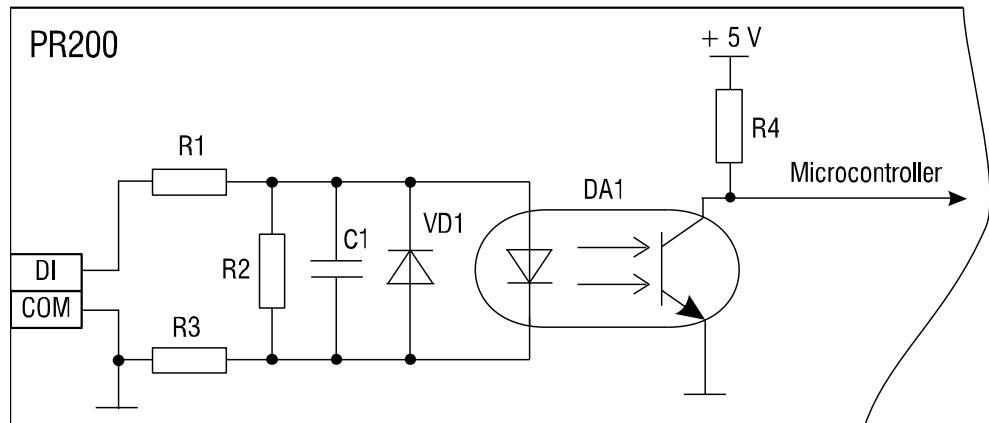
Fig. D.1 PR200-230.x.x digital input circuit diagram
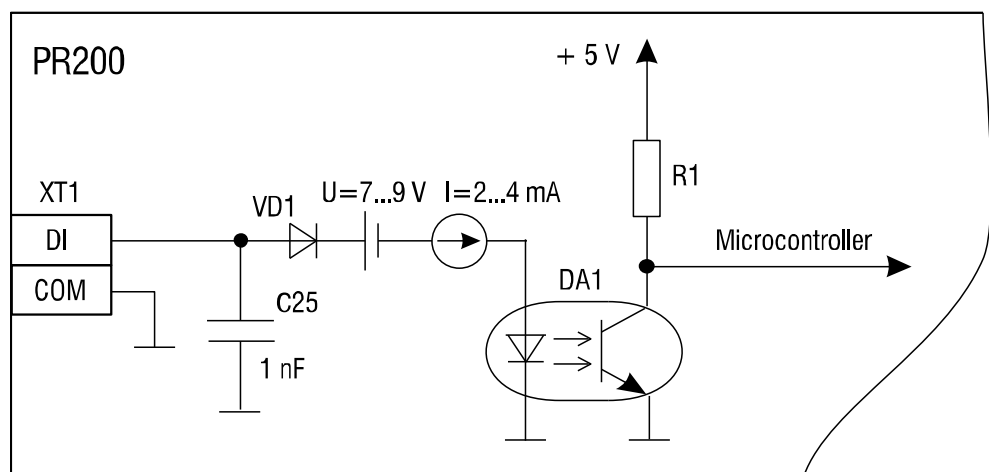
Fig. D.2 PR200-24.x.x digital input circuit diagram
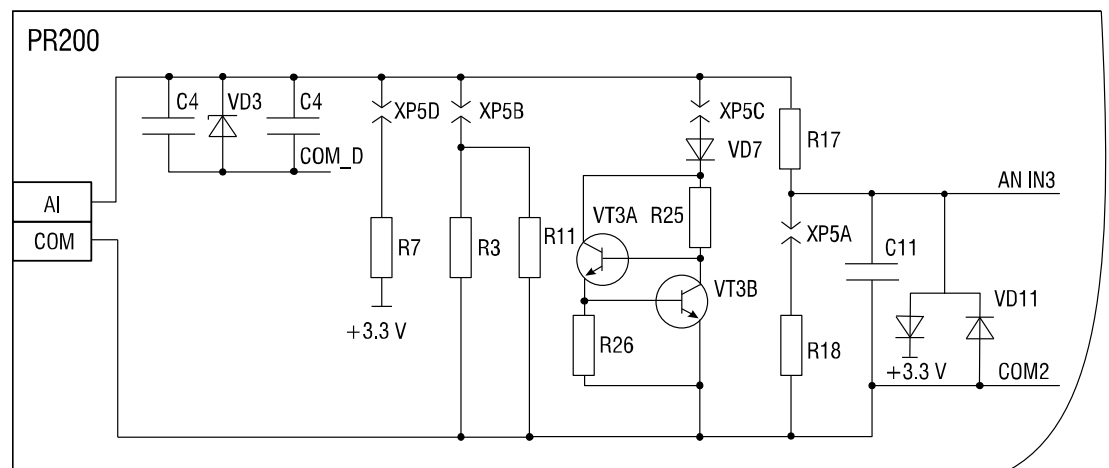
Fig. D.3 Analog input circuit diagram

Appendix E.   Calibration

E.1   General

If the accuracy of the input or output of the module is no longer in accordance with the specification, it can be calibrated.

NOTICE
Ensure a reliable power supply to the device during the calibration. If it fails, the calibration should be repeated.

– Each analog input and output has its own calibration coefficients for each sensor type.
– The calibration is performed using a reference signal source connected to the device input or output.
– The calibration coefficients are calculated based of the ratio between the current input signal and the reference signal and stored in the non-volatile device memory.
– If the calculated coefficients go beyond the permissible limits, a message about the error cause will be displayed.

E.2   Input

Input signals: 4-20 mA, 0-10 V, 0-4000 ohm

1. Connect the reference signal source of accuracy class at least 0.05 to the input (Fig. E.1).
2. Connect the basic device to the PC.
3. Switch on the device power supply.
4. Start ALP and select the menu item **Device > Calibration** to start the calibration tool.
5. Select the device model in the open dialog window.
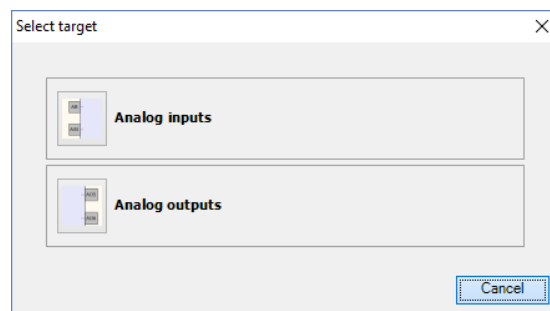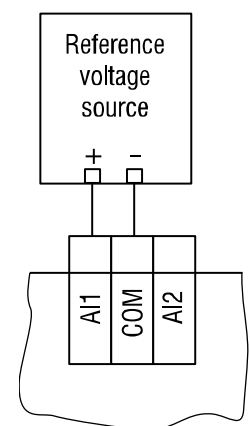6. Select **Analog inputs** as calibration target (Fig. E.2).

Fig. E.1

Fig. E.2

7. Select the type of input signal and set the other calibration parameters (Fig. E.3).
   o Set the three points for calibration curve and the filter time constant.The greater the filter time constant, the longer the calibration process will take, but the more precise calibration will be achieved.
   o Select the input to calibrate. If you select **All**, all inputs will be calibrated sequentially, therefore the appropriate reference signal has to be applied to all inputs.
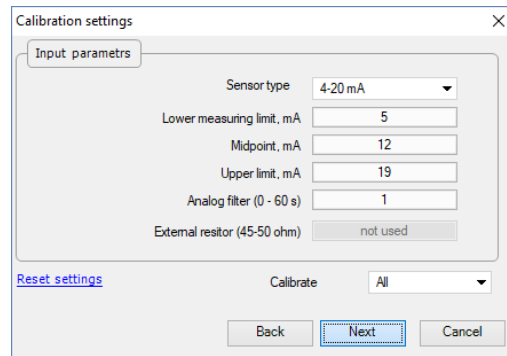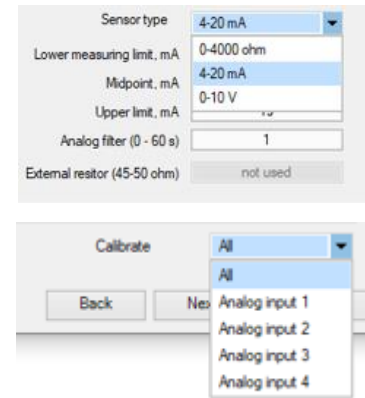

Fig. E.3

8.   Click **Next** to continue and follow the instructions.

Click the item **Reset settings** to use the default calibration settings.

E.3 Output 4-20 mA

1.   Connect an auxiliary voltage source, a measuring device of resolution 0.001 V and a reference resistance box of accuracy class at least 0.05 to the output (Fig. E.4).

2.   Ensure the supply voltage is within the range 15…28 V.

3.   Set the reference resistance box to 500 ohm.

4.   Connect the device to the PC.

5.   Switch on the device power supply.

6.   Start ALP and select the menu item ***Device > Calibration*** to start the calibration tool.

7.   Select the device model in the open dialog window.

8.   Select ***Analog outputs*** as calibration target (Fig. E.2).

9.   Calculate the output current from the measured output voltage and the set resistance; enter the result in the input field (Fig. E.5).

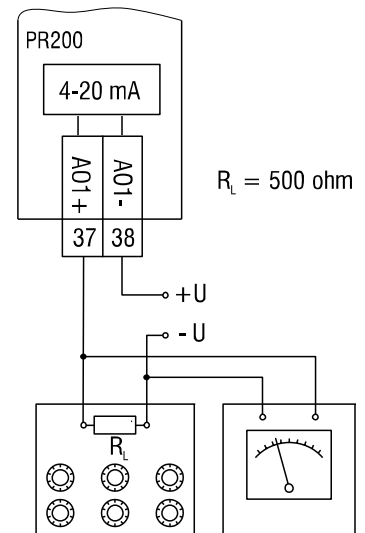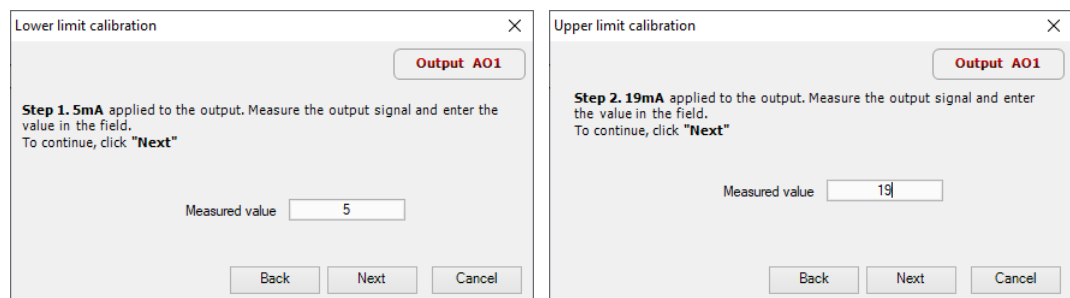10. Click **Next** to continue and follow the instructions.

Fig. E.4

Fig. E.5

E.4 Output 0-10 V

1.   Connect a reference voltage source and a measuring device of accuracy class at least 0.05 to the output (Fig. E.6).
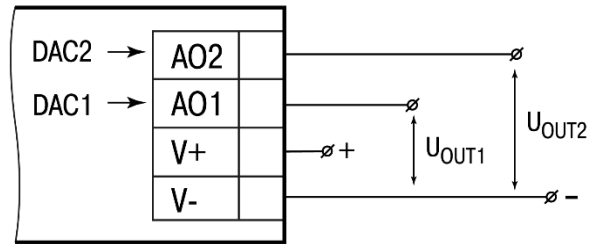
Fig. E.6

2.   Connect the device to the PC.
3.   Switch on the device power supply.
4.   Start ALP and select the menu item **Device > Calibration** to start the calibration tool.
5.   Select the device model in the open dialog window.
6.   Select **Analog outputs** as calibration target (Fig. E.2).
7.   Enter the measured output voltage in the input field (Fig. E.5).
8.   Click **Next** to continue and follow the instructions.

Appendix F.   Battery replacement

⚠️ **WARNING**	*Dangerous voltage* *The voltage on some components of the circuit board can be dangerous. Direct contact with the circuit board or penetration of a foreign body in the enclosure must be avoided.*

1. Remove the front cover with the keypad (Fig. F.1)
2. Lever the top PCB from the side of the USB connector with a screwdriver and carefully release it from the pin connectors of the middle PCB. (Fig. G.2).
3. Turn over the released top PCB, lever the CR2032 battery with the screwdriver and pull out from the nest (Fig. F.3).
4. Install a new battery
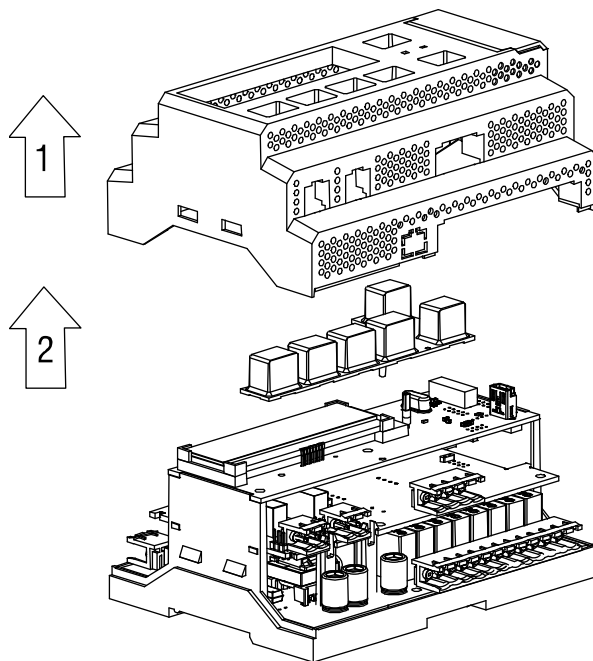5. Perform the disassemble operations in reverse order to assemble the device.
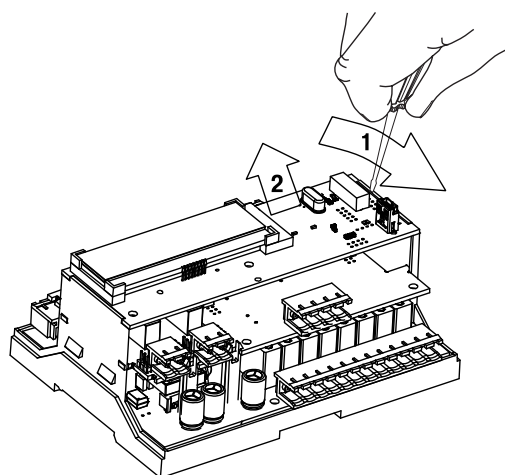

Fig. F.1   Front cover removing

Fig. F.2   Top PCB removing
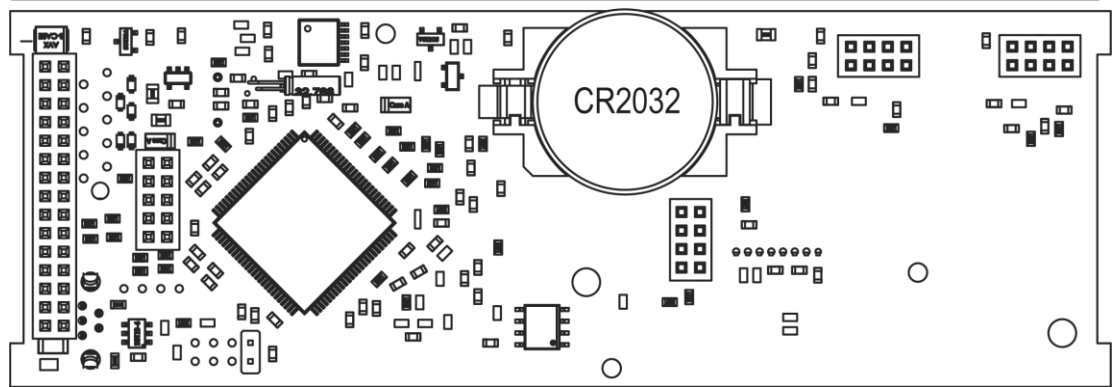
Appendix F.   Battery replacement

Fig. F.3   Back side view of the top PCB

Appendix G. Interface card installation

⚠ **WARNING** | *Dangerous voltage*

The voltage on some components of the circuit board can be dangerous. Direct contact with the circuit board or penetration of a foreign body in the enclosure must be avoided.

1. Remove the front cover with the keypad (Fig. G.1).
2. Lever the top PCB from the side of the USB connector with a screwdriver and carefully release it from the pin connectors of the middle PCB (Fig. F.2, G.1a).
3. Cut an opening in the front cover for the network connection and fix the card on the mounting pins (Fig. G.1b).
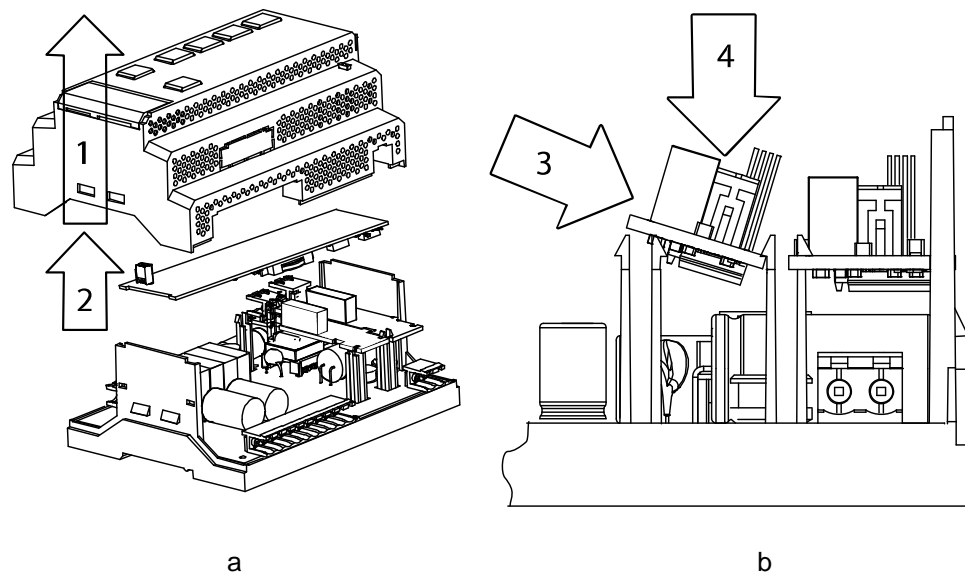4. Assemble in reverse order.

a   b

Fig. G.1