EN CE

akytec

PR200

Programmable relay

User guide

PR200_3-EN-132028-1.4

Contents

1 Introduction

1.1 Terms and abbreviations

- **ALP** – programming software akYtec ALP for programming PR series relays, based on Function Block Diagram programming language (FBD)
- **ADC** – analog-digital converter
- **DAC** – digital-analog converter
- **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
- **PWM** – pulse-width modulation
- **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
- **RTC** – real time clock
- **RTD** – resistance temperature detectors

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.

2 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 

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.

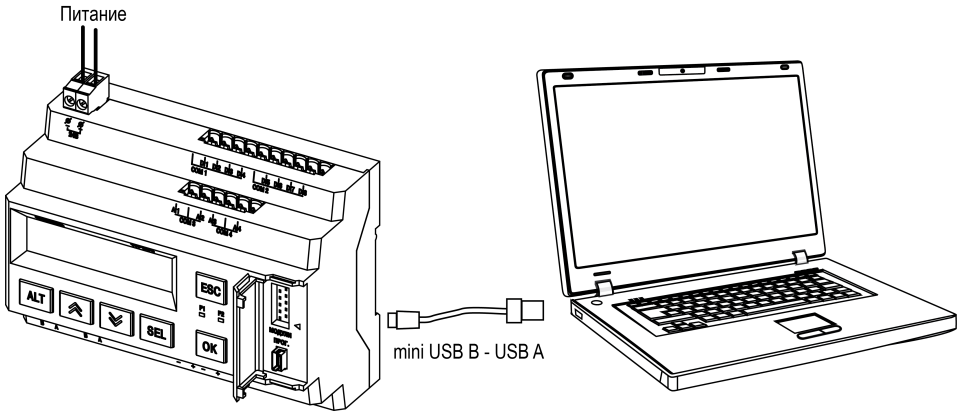


Fig. 2.1 Connection to PC (open interface cover)

2.1 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.

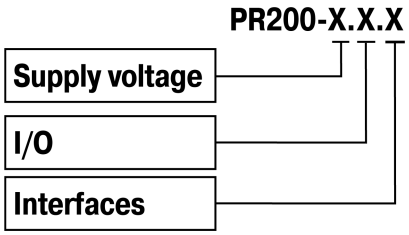
2.2 Improper use

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.

2.3 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:



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)
3 — 8 DI, 4 AI, 8 DO
4 – 8 DI, 4 AI, 8 DO, 2 AO (0-10 V)
5 – 8 DI, 4 AI, 8 DO (relay), 4 K (transistor)

Interfaces
0 – none
1 – RS485
2 – 2 × RS485

3 Specifications

3.1 Specifications

Table 3.1 General specification

Parameter	Value			
	230.1.X	**230.2/3/4/5.X**	**24.1.X**	**24.2/3/4/5.X**
Power supply	230 (94…264) V AC; 50 (47…63) Hz		24 (19…30) V DC	
Power consumption	10 VA	17 VA	10 W	10 W
Galvanic isolation	2830 V		1780 V	
Integrated voltage source	—	24±3 V DC, 100 mA	—	—
Galvanic isolation	—	1780 V	—	—
IP Code	IP20			
Dimensions	123 × 108 × 58 mm			
Mounting	DIN rail (35 mm)			
Weight	approx. 600 g			

Table 3.2 Digital inputs

Parameter	Value	
	230.X.X	**24.X.X**
Input voltage	230 V AC	24 V DC
Input voltage, max.	264 V AC	30 V DC
HIGH level	159…264 V / 0.75…1.5 mA	8.5…30 V / 2…15 mA
LOW level	0…40 V / 0…0.5 mA	-3…+5 V / 0…15 mA
Pulse length, min.	50 ms	2 ms
Response time, max.	100 ms	30 ms
Galvanic isolation against other circuits	2830 V	

Table 3.3 Analog inputs

Parameter	Value
ADC resolution	12 bit
Analog mode	
Input signal	0-10 V, 4-20 mA, 0-4 kΩ
Input resistance (for 0-10 V)	61 kΩ
Shunt resistance (for 4-20 mA)	121 Ω
Basic error	±0.5 %
Temperature influence	±0.5 % / 10 °C
Digital mode	
HIGH/LOW threshold (adjustable in ALP)	1…8 V
LOW/HIGH threshold (adjustable in ALP)	2…9 V
Pulse length, min.	5 ms
Signal frequency, max.	100 Hz

Table 3.4 Digital outputs (relays)

Parameter		Value
Type		relay (NO)
Switching capacity	AC	5 A, 250 V AC (resistive load)
	DC	3 A, 30 V DC
Load current at 5 V DC, min.		10 mA

Parameter		Value
Service life, electrical	AC	200,000 switching cycles
	DC	100,000 switching cycles
Galvanic isolation against other circuits		2830 V, in groups of 2
Galvanic isolation between output groups		1780 V

Table 3.5 Transistor outputs

Parameter	Value
Type	NPN
Switching current, max.	200 mA
Switching voltage, max.	60 V
Galvanic isolation against other circuits	2830 V

Table 3.6 Analog outputs

Parameter	Value
Output signal	4-20 mA (X.2.X), 0-10 V (X.4.X)
External voltage supply	15…30 V
Basic error, max.	±0.5%
Temperature influence	±0.05% / 10°C
Inductive load, max (for 4-20 mA)	50 µH
Signal conversion time	100 ms
DAC resolution	10 bit
Galvanic isolation against other circuit	2830 V

Table 3.7 Memory

Parameter	Value
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 3.8 Real-time clock

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

3.2 Operating conditions

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

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

Table 3.9 Environmental conditions

Condition	Permissible range
Ambient temperature	-40…+55 °C
Relative humidity	up to 80 % (at +35 °C, non-condencing)
Transportation and storage temperature	-25…+55 °C
Transportation and storage relative humidity	up to 80 %
Altitude	up to 2000 m above sea level
EMC immunity	conforms to IEC 61000-6-2
EMC emission	conforms to IEC 61000-6-4

4 Configuration and programming

4.1 General instructions

It is recommended to configure and program the device prior to installation and wiring. Configuration and programming take place after creating a user project in ALP.

WARNING
The device must be powered off before connecting to PC. Switch on the power supply only after the connection over USB cable is established.

Proceed as follows:

1. Connect the PR200 programming connector to PC over a USB-to-miniUSB connection cable.
2. Connect the power supply to the removable terminal block and plug it into the device.
3. Switch on the device power.
4. Start ALP and ensure the device is detected correctly.
5. Open the configuration window using the menu item ***Device > Configuration*** or the toolbar icon  .
6. Configure the relay.
7. Create a user program.

A completed project can be transferred to the device memory using the menu item ***Device > Transfer application to device***.
The following hardware can be configured:

– RTC
– RS485 interface
– digital inputs
– analog inputs
– analog outputs

See ALP Help for detailed information about configuration.

4.2 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. 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. 4.7*)
– Extension modules
– Inputs (*sect. 4.4*)
– Outputs (*sect. 4.5*)

See ALP Help for detailed information about configuration.

4.3 Digital inputs

Open the node ***Inputs > Digital*** in the open window ***Device configuration*** and select an input.
Each of the digital inputs has only one configurable parameter:
Debouncing – time constant for contact bounce suppression filter. It can be set in the range of 0… 255 ms. The setting 0 disables the filter.

4.4 Analog inputs

Open the node ***Inputs > Analog*** in the open window ***Device configuration*** (*Fig. 4.1*) and select an input for configuration.

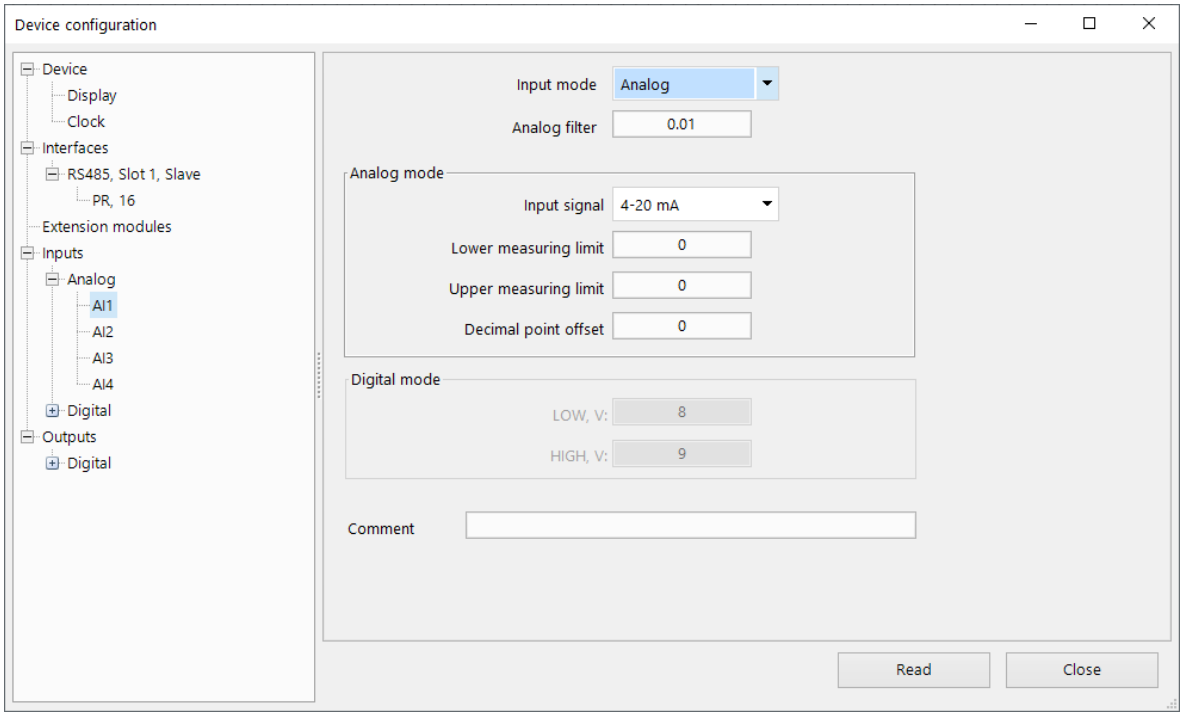


Fig. 4.1 Analog input configuration

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

NOTICE
Ensure that the input signal is connected to the correct input terminals and that the input configuration corresponds to the signal. Non-observance can cause damage to the device.

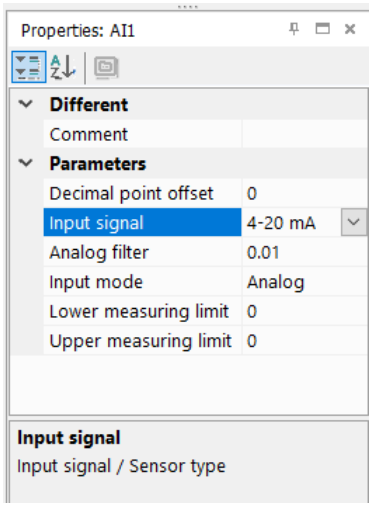


Fig. 4.2 Property Box for analog input

4.4.1 Analog mode

Configurable parameters:

– ***Input mode*** – select ***Analog***
– ***Filter*** – filter time constant (0…60 s)
– ***Input signal*** – I- 4-20 mA, 0-10 V, 0-4000 ohm
– ***Lower measuring limit*** – minimum level of the input signal
– ***Upper measuring limit*** – maximum level of the input signal.

  The lower and upper measuring limits are used to scale the input signal.

– ***Decimal point offset (DP)*** – parameter **DP** for Modbus request (see sect 4.7.2). 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 withthe 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.

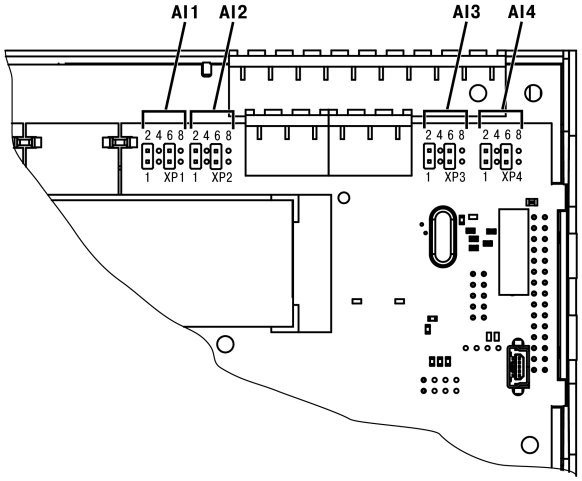


Fig. 4.3 Input jumpers on the middle PCB

CAUTION
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.

NOTE
If the input signal does not correspond with the hardware configuration, the device can be damaged. Check the positions of the jumpers XP1…XP4 before wiring.

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.

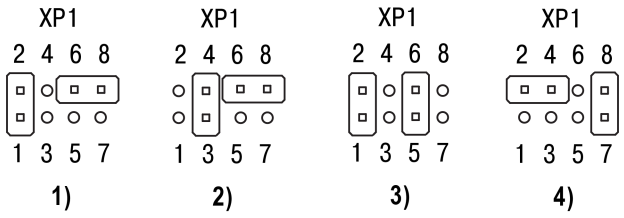


Fig. 4.4 Input jumper positions 1) 0-10 V, 2) 4-20 mA, 3) digital mode, 4) 0-4000 ohm

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.

4.4.2 Digital mode

Configurable parameters:

– ***Input mode*** – select ***Digital***
– ***Analog filter*** – time constant for contact bounce suppression filter. It can be set in the range of 0…255 ms. The setting 0 disables the filter.
– ***LOW*** – switching threshold from HIGH to LOW, can be adjusted in ALP in the range 1…8 V and should be lower than HIGH level by at least 1 V
– ***HIGH*** – switching threshold from LOW to HIGH, can be adjusted in ALP in the range 2…9 V and should be higher than LOW level by at least 1 V

The input operates as a comparator with parameters ***LOW*** and ***HIGH*** which determine the hysteresis.

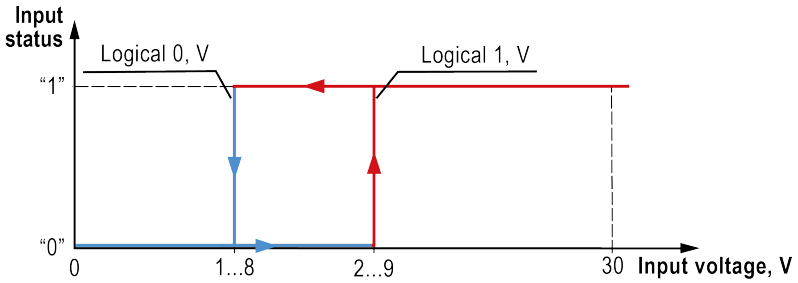


Fig. 4.5 Digital mode of an analog input

The input state will not change if the input voltage is within the dU interval. To avoid the ambiguity of determining the input state, the parameter ***HIGH*** must be set higher than the parameter ***LOW*** by at least 1 V.

4.4.3 Analog filter

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.

4.5 Analog outputs

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.

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

Example:
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 further information about analog output configuration.

4.6 Transistor outputs

Configurable parameters:

– ***Output mode*** – output cntrol mode: On/Off or PWM

– ***PWM period*** – period in PWM mode
– ***Minimum pulse length*** – minimum time between any adjacent pulse edges (the minimum duration of the on and off states of the output). It should be set greater than the response time of the actuator connected to it.

Valid range of ***PWM period*** is 0.0…1.0 (REAL).If the value is:

– less than zero or equal to zero – output is turned off
– in the range from zero to one – PWM duty cycle
– greater than or equal to one – the output is on.

4.7 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.
See ALP Help for detailed information about RS485 interface configuration. The parameters can also be changed via system menu (*sect 6.3*).

4.7.1 Master mode

There can be only one master in Modbus network.
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. 4.6*). Change the mode to **Master** in the right window part.

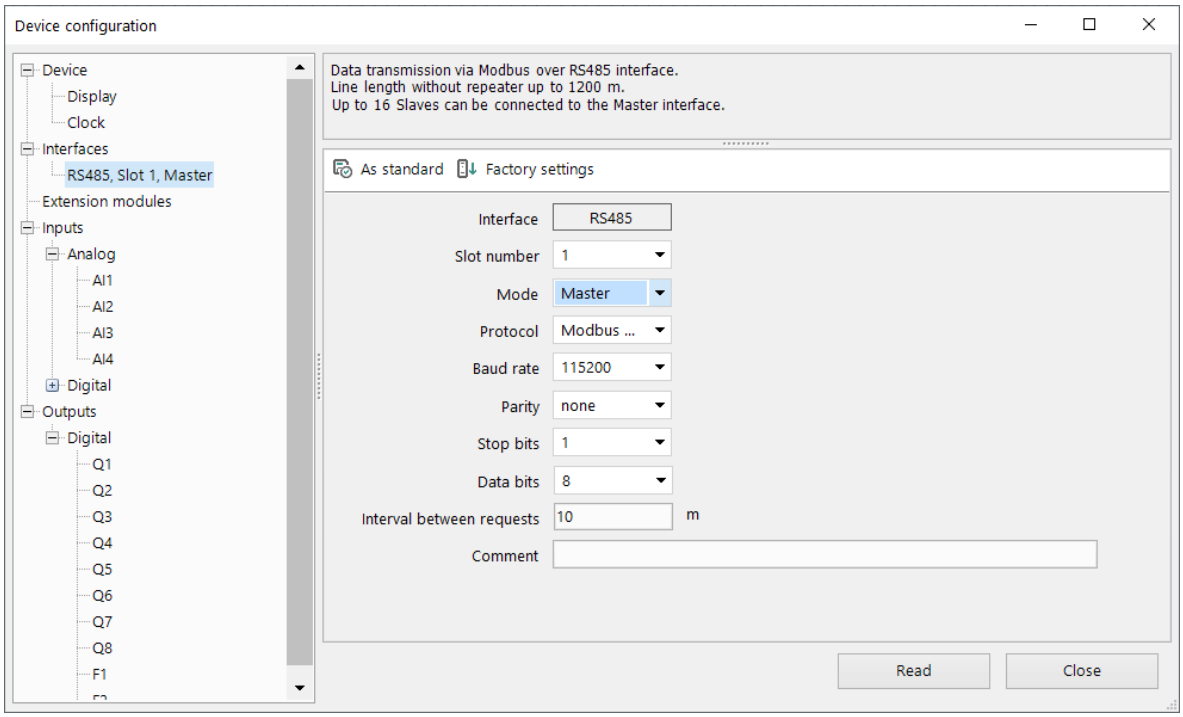


Fig. 4.6 Master configuration in Master mode

Add the required number of slave devices using the context menu of the new interface. 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.

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** , 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.

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

4.7.2 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***. The new interface is a slave by default.
Use the context menu of the new interface to add a master device.
Define the name and the Modbus address for the master.

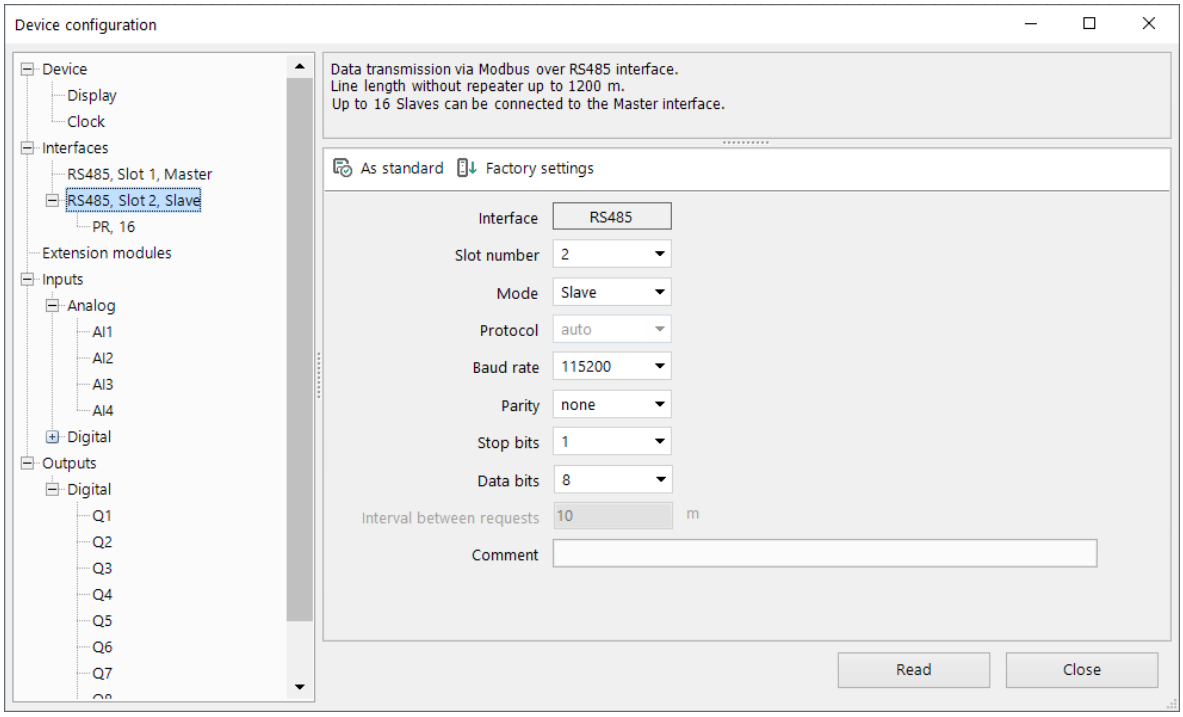


Fig. 4.7 Slave configuration in Master mode

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.
Following functions are supported:

– 01 (0x01) Read Coils
– 02 (0x02) Read Discrete Inputs
– 03 (0x03) Read Holding Registers
– 04 (0x04) Read Input Registers
– 05 (0x05) Write Single Coil
– 06 (0x06) Write Single Register
– 15 (0x0F) Write Multiple Coils
– 16 (0x10) Write Multiple Registers

To read the separate bits of a bitmask, use the functions 0x03 and 0x01. To calculate the bit number to be requested, multiply the bit mask register number by 16 and add the desired bit number within the mask.
Data types:

– BOOL – one bit
– UINT16 – 2 Byte unsigned integer
– REAL32 – 4 Byte float (byte order 2143)

Available Modbus registers are listed in Table below.

Table 4.1 Modbus registers

Model	Parameter	Data type	Address (hex)	Address (dec)	Modbus function	Access
Inputs						
All	DI1...DI8 input status	BOOL	0x1000 – 0x1007	4096–4103	0x01, 0x02	R
		UINT16	0x0100	256	0x03, 0x04	R
x.2.x, x.3.x, x.4.x, x.5.x	AI1 measured value REAL	REAL32	0x0B00, 0x0B01	2816, 2817	0x03, 0x04	R
	AI2 measured value REAL	REAL32	0x0B02, 0x0B03	2818, 2819	0x03, 0x04	R
	AI3 measured value REAL	REAL32	0x0B04, 0x0B05	2820, 2821	0x03, 0x04	R
	AI4 measured value REAL	REAL32	0x0B06, 0x0B07	2822, 2823	0x03, 0x04	R
	AI1 measured value UINT *	UINT16	0x0B80	2944	0x03, 0x04	R
	AI2 measured value UINT *	UINT16	0x0B81	2945	0x03, 0x04	R
	AI3 measured value UINT *	UINT16	0x0B82	2946	0x03, 0x04	R
	AI4 measured value UINT *	UINT16	0x0B83	2947	0x03, 0x04	R
	AI1 decimal point (DP) UINT *	UINT16	0x0BC0	3008	0x03, 0x04	R
	AI2 decimal point (DP) UINT *	UINT16	0x0BC1	3009	0x03, 0x04	R

Model	Parameter	Data type	Address (hex)	Address (dec)	Modbus function	Access
	AI3 decimal point (DP) UINT *	UINT16	0x0BC2	3010	0x03, 0x04	R
	AI4 decimal point (DP) UINT *	UINT16	0x0BC3	3011	0x03, 0x04	R
	AI1 input status (digital mode)	BOOL	0xB800	4112	0x01, 0x02	R
	AI2 input status (digital mode)	BOOL	0xB810	4113	0x01, 0x02	R
	AI3 input status (digital mode)	BOOL	0xB820	4114	0x01, 0x02	R
	AI4 input status (digital mode)	BOOL	0xB830	4115	0x01, 0x02	R
Outputs						
x.1.x	DO1...DO6, F1, F2 output status	BOOL	0x0000 – 0x0007	0–7	0x01, 0x02, 0x05, 0x0F	RW**
		UINT16	0x0000	0	0x03, 0x04, 0x06, 0x10	RW**
x.2.x, x.3.x, x.4.x	DO1...DO8, F1, F2 output status	BOOL	0x0000 – 0x0009	0–9	0x01, 0x02, 0x05, 0x0F	RW**
		UINT16	0x0000	0	0x03, 0x04, 0x06, 0x10	RW**
x.5.x	DO1…DO8, F1, F2 and outputs K1...K4 in digital mode status bitmask	BOOL	0x0000– 0x000D	0–13	0x01, 0x02, 0x05, 0x0F	RW**
		UINT16	0x000– 0x0013	0	0x03, 0x04, 0x06, 0x10	RW**
x.2.x, x.4.x	AO1 output value (0…1)	REAL32	0x0A00, 0x0A01	2560, 2561	0x03, 0x04	RW**
	AO2 output value (0…1)	REAL32	0x0A02, 0x0A03	2562, 2563	0x03, 0x04	RW**
	AO1 output value (0… 10000)	UINT16	0x0A80	2688	0x03, 0x04	RW**
	AO2 output value (0… 10000)	UINT16	0x0A81	2689	0x03, 0x04	RW**
x.5.x	Output K1 in PWM mode	REAL32	0x0A00, 0x0A01	2560, 2561	0x03, 0x04	RW**
	Output K2 in PWM mode	REAL32	0x0A02, 0x0A03	2562, 2563	0x03, 0x04	RW**

Model	Parameter	Data type	Address (hex)	Address (dec)	Modbus function	Access
	Output K3 in PWM mode	REAL32	0x0A04, 0x0A05	2564, 2565	0x03, 0x04	RW**
	Output K4 in PWM mode	REAL32	0x0A06, 0x0A07	2566, 2567	0x03, 0x04	RW**
Network variables						
All		BOOL	0x2000 – 0x23F0	8192–9200	0x01, 0x02, 0x05, 0x0F	RW
		UINT16	0x0200 – 0x023F	512–575	0x03, 0x04, 0x06, 0x10	RW
Real-time clock						
All	Seconds	UINT16	0x0400	1024	0x03, 0x04, 0x06, 0x10	RW
	Minutes	UINT16	0x0401	1025	0x03, 0x04, 0x06, 0x10	RW
	Hours	UINT16	0x0402	1026	0x03, 0x04, 0x06, 0x10	RW
	Day	UINT16	0x0403	1027	0x03, 0x04, 0x06, 0x10	RW
	Month	UINT16	0x0404	1028	0x03, 0x04, 0x06, 0x10	RW
	Year	UINT16	0x0405	1029	0x03, 0x04, 0x06, 0x10	RW
	Weekday	UINT16	0x0406	1030	0x03, 0x04	R
	Week of month	UINT16	0x0407	1031	0x03, 0x04	R
	Calendar week	UINT16	0x0408	1032	0x03, 0x04	R

* Used for network data exchange over network variables.
DP** = **Decimal point offset
***AIx INT** = **AIx REAL** × 10 ^{DP}*
For outputs ***DP*** = 4 (constant)
** Output status can be only written via network in I/O mode (*Sect 6.6*).

5 Montage

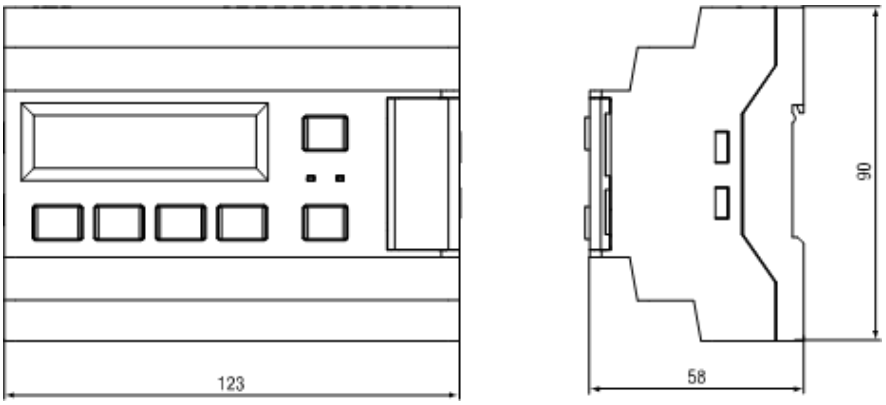


Fig. 5.1 Dimensions

The relay is designed for DIN rail mounting. The operating conditions from the *Sect. 3.2* should be taken into account when choosing the installation site.

Relay is equipped with plug-in terminal blocks which enable quick replacement of the device without disconnecting the existing wiring (*Fig. 5.2*).
To replace the device:

1. Power off all connected lines including power supply.
2. Remove the terminal blocks.
3. Replace the device.
4. Connect the terminal blocks with existing wiring to the device.

Reverse this procedure after replacing the device.

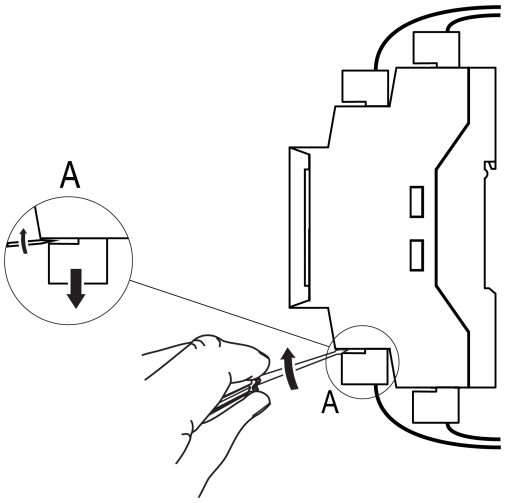
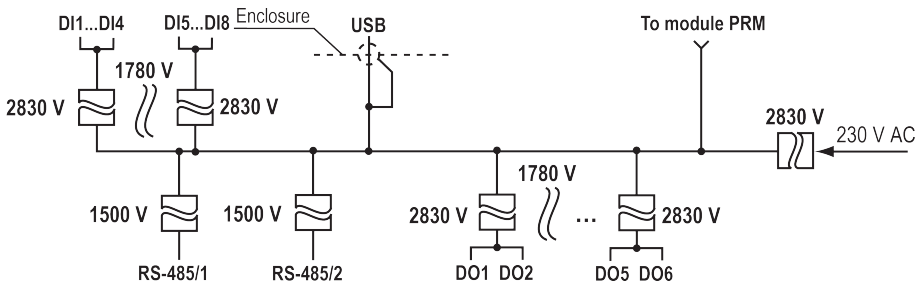
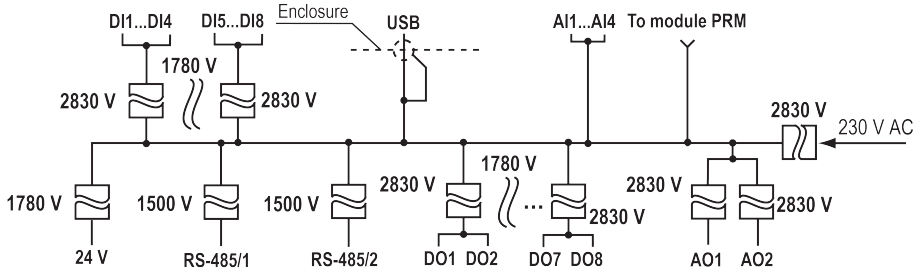
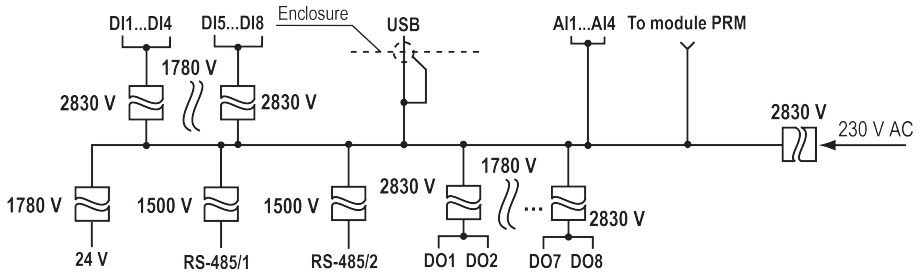
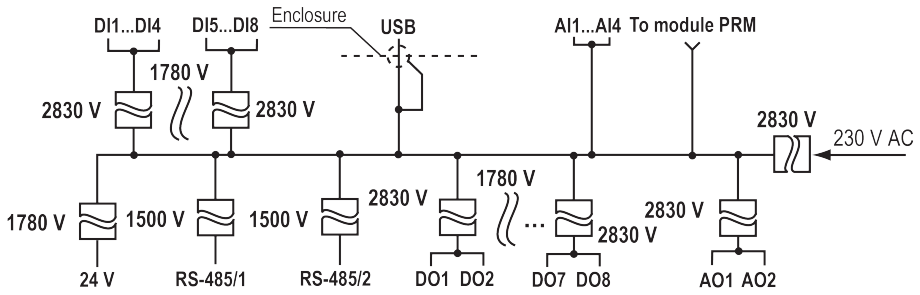
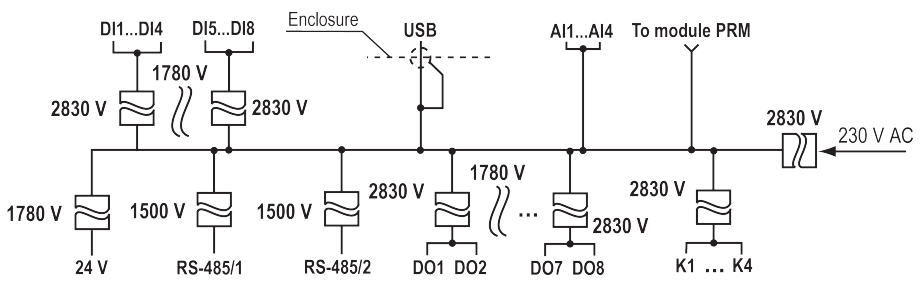
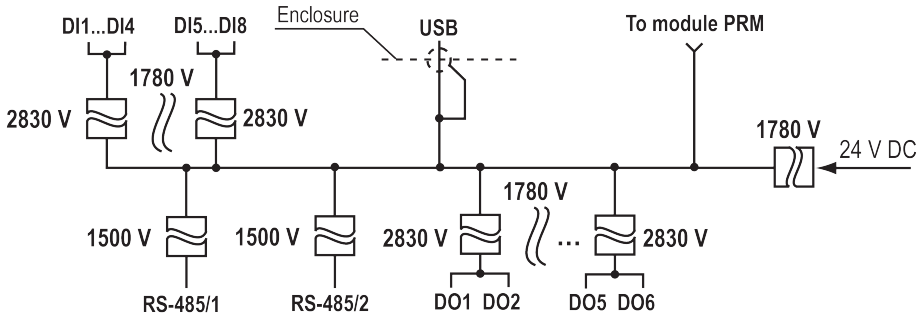
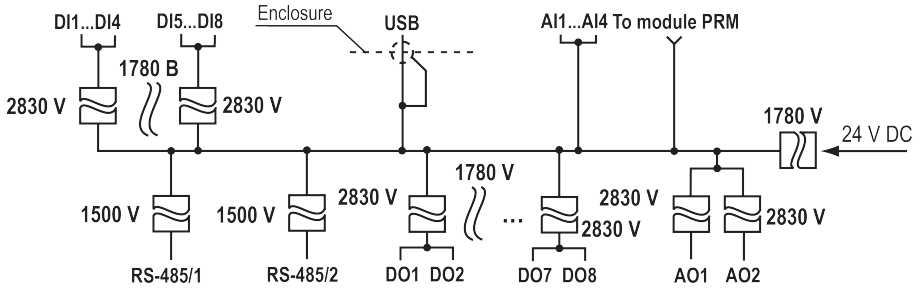
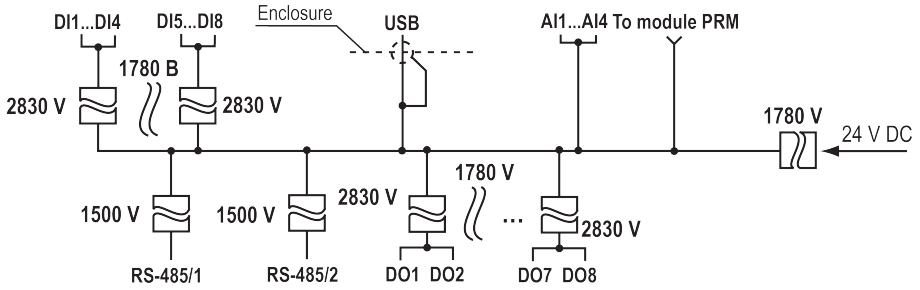
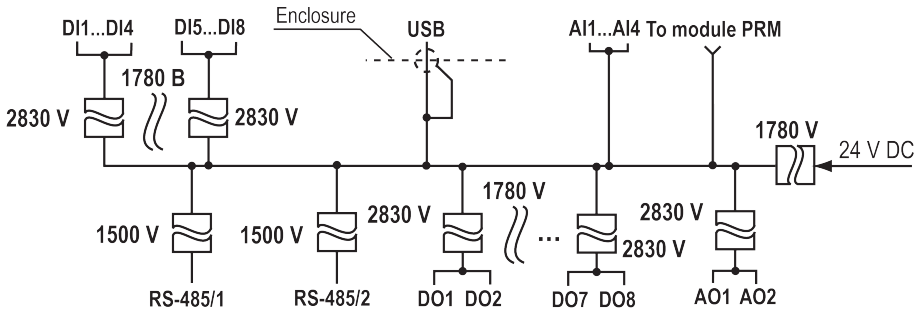
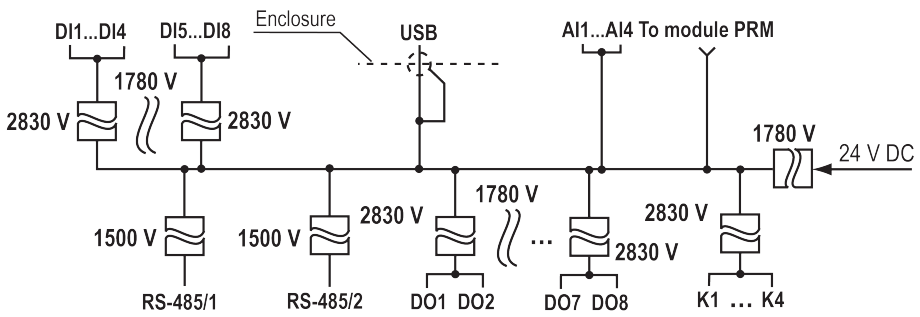


Fig. 5.2 Quick replacement

5.1 Galvanic isolation

Model	Galvanic isolation
PR200-230.1.X.X	
PR200-230.2.X.X	
PR200-230.3.X.X	
PR200-230.4.X.X	
PR200-230.5.X.X	

Model	Galvanic isolation
PR200-24.1.X.X	
PR200-24.2.X.X	
PR200-24.3.X.X	
PR200-24.4.X.X	
PR200-24.5.X.X	

5.2 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 or PC. Switch on the power supply only after the wiring of the device has been completed.

CAUTION
The program will be executed immediately after it has been transferred to the relay.
For safety reasons it is recommended to transfer the program before wiring the relay.
Otherwise, ensure that all external devices are disconnected from the relay outputs before transferring the program.

NOTICE
Supply voltage 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
Ensure that the input signal is connected to the correct input terminals and that the input configuration corresponds to the signal. Non-observance can cause the device damage.

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.

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

5.2.1 Terminal assignment

Table 5.1 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

No.	Marking	Description
17	DO2	DO2 digital output
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…41		see *Table 5.2*

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

Table 5.2 Terminals for analog outputs

No.	Marking	Description
x.2.x		
37	AO1-	AO1 analog output (4-20 mA)
38	AO1+	
39	AO2-	AO2 analog output (4-20 mA)
40	AO2+	
x.4.x		
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)

Table 5.3 Terminals for transistor outputs

No.	Marking	Description
x.5.x		
37	K1	Output K1
38	K2	Output K2
39	COM5	K1...K4 common contact
40	K3	Output K3
41	K4	Output K4

5.2.2 Digital inputs

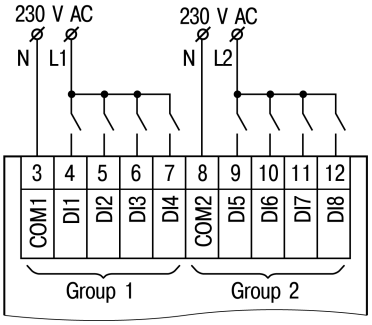


Fig. 5.3 Digital inputs wiring (230 V AC)

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.

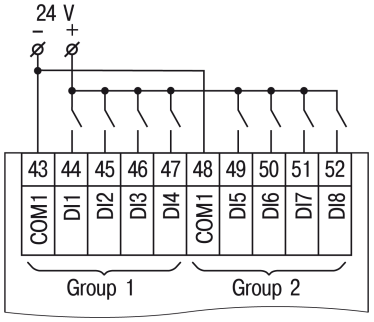


Fig. 5.4 Switch contacts wiring (24 V AC)

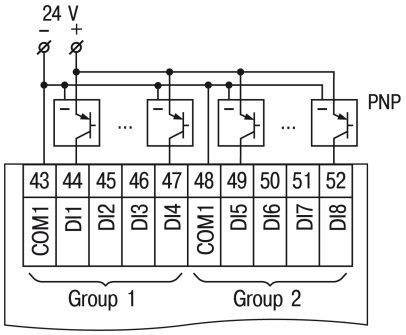


Fig. 5.5 PNP sensors wiring (24 V AC)

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.

5.2.3 Analog inputs wiring

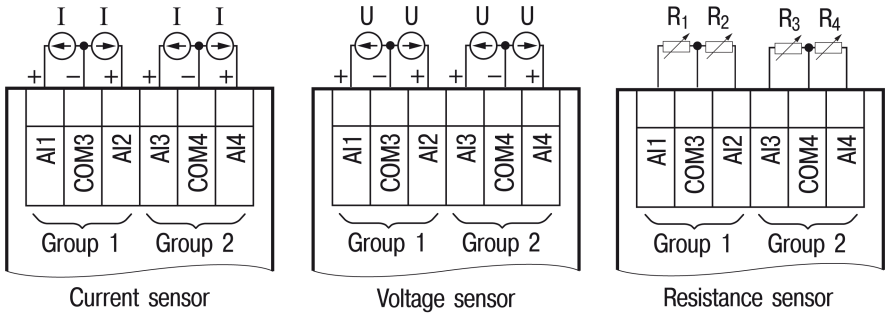


Fig. 5.6 Analog inputs wiring

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

5.2.4 Digital outputs

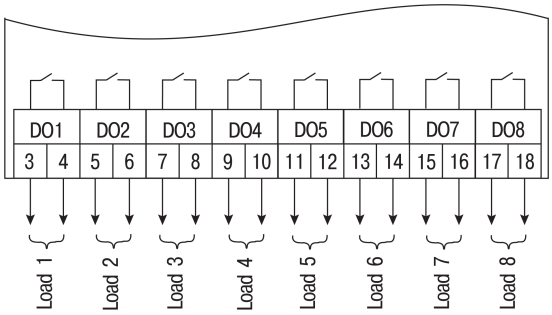


Fig. 5.7 Relay outputs

5.2.5 Analog outputs

Analog outputs require external voltage supply.

CAUTION
The external supply voltage 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.

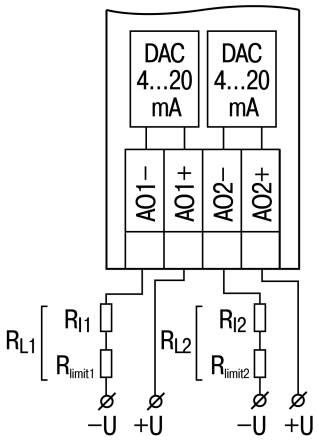


Fig. 5.8 4-20 mA output (x.2.x)

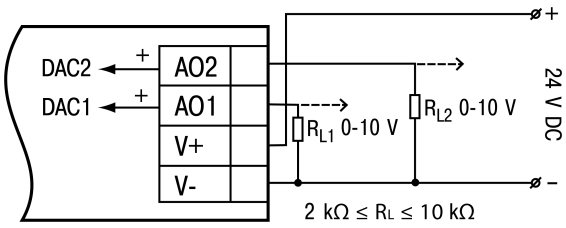


Fig. 5.9 0-10 V output (x.4.x)

5.2.6 Transistor outputs

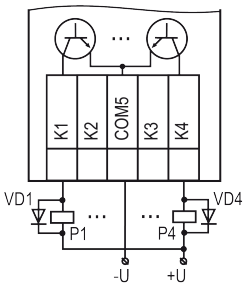


Fig. 5.10 Transistor outputs wiring

The transistor output wiring is shown in the *figure 5.10*. To prevent the transistor from failing due to high self-induction current, diodes VD1...VD4 should be installed parallel to the winding of external relays P1...P4.

NOTICE
Characteristics of low-voltage relays P1...P4: voltage max. 50 V at current max. 200 mA.

5.3 Using extension modules

NOTICE
The device must be powered off before connecting extension modules.

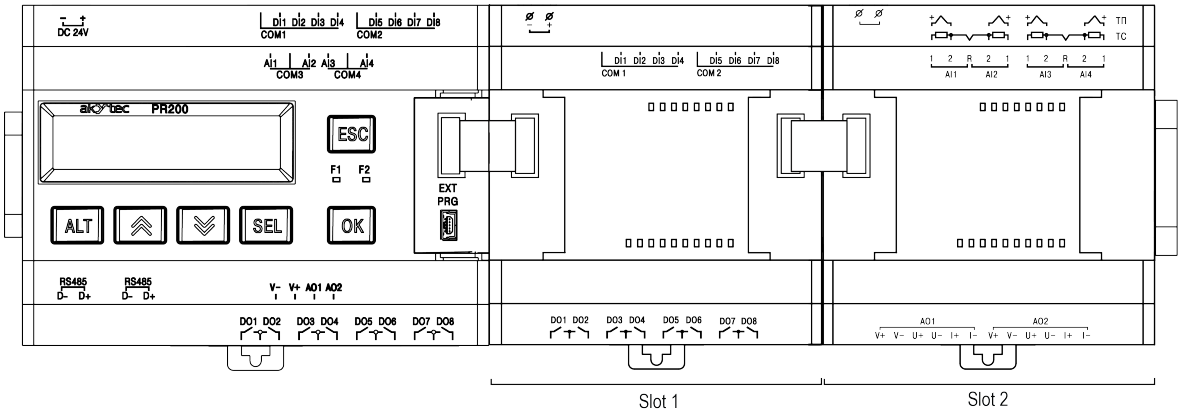


Fig. 5.11 Extension modules connection

Maximum two PRM modules can be connected to PR200 in series.
Mount the modules on the DIN rail to the right of the PR200 and connect them using the supplied 4.5 cm flat cable.
PRM has two EXT connectors located under the right and left front covers. The connector under the left cover is used to connect the 1st PRM to the PR200.
When connected, the flat cable should be placed in a special recess under the cover to enable the PRM to be pushed close to the PR200 (*Fig. 5.12*).

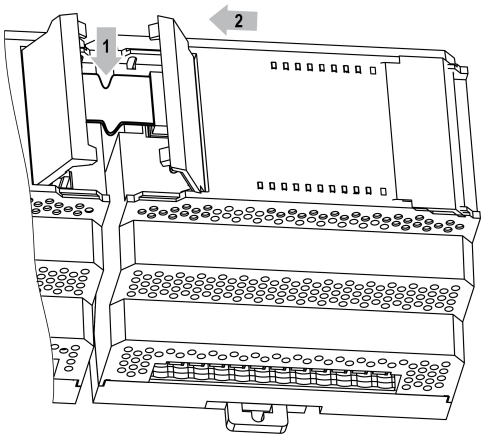


Fig. 5.12

Each module has an independent power supply. It is possible to combine the basic device and modules with different supply voltages.

5.4 Quick replacement

Relay is equipped with plug-in terminal blocks which enable quick replacement of the device without disconnecting the existing wiring (*Fig. 5.13*).
To replace the device:

1. Power off all connected lines including power supply.
2. Remove the terminal blocks.
3. Replace the device.
4. Connect the terminal blocks with existing wiring to the device.

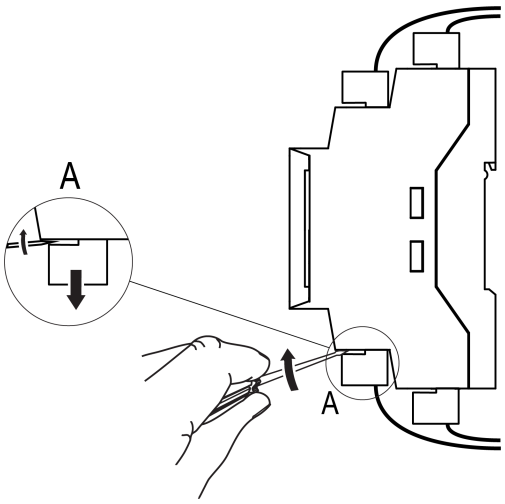


Fig. 5.13 Quick replacement

6 Operation

6.1 Operation diagram

WARNING
The program will be executed immediately after it has been transferred to the relay. For safety reasons it is recommended to transfer the program before wiring the relay. Otherwise, ensure that all external devices are disconnected from the relay outputs before transferring the program.

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

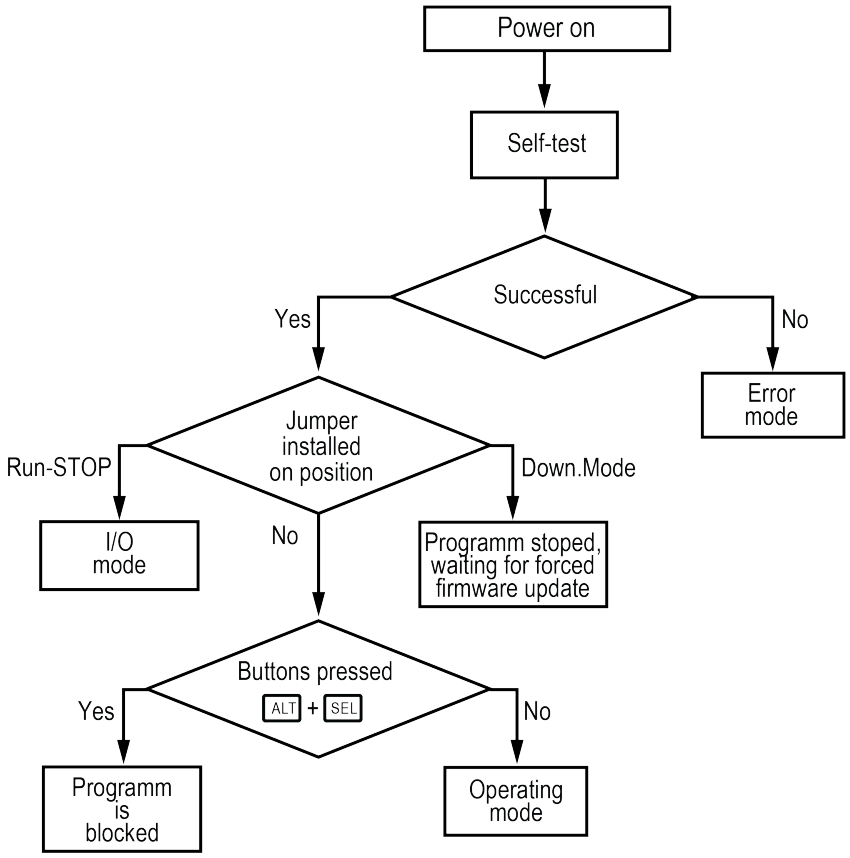
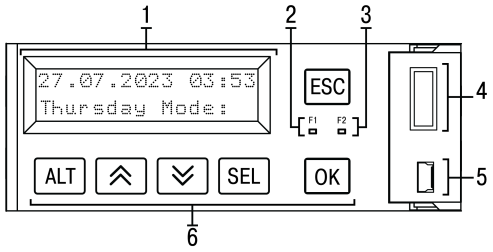


Fig. 6.1 Operation diagram

Once the program has been transferred to the device memory, the relay restarts.
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

6.2 Controls and interfaces



1. Two-line 16-digit LCD display
2. Green LED
3. Red LED
4. Extension module connector (under cover)
5. Programming connector (under cover)
6. Buttons

Fig. 6.2 Face plate

The purpose of LEDs F1 and F2 is determined during programming.

Table 6.1 Buttons

Button	Description
⩓ ⩔	Menu navigation / Parameter value editing
ALT	Used in combination with other buttons
SEL	Parameter selection / changed value saving
ESC	Cancel change (reset to original value) / exit edit mode
OK	Applying changes
ESC	Exit / Cancel
ALT + ⩓ or ALT + ⩔	Changing the position of the cursor / moving through the digits
ALT + SEL	Blocking the user program (*Sect. 6.8*)

6.3 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.

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.

Menu structure

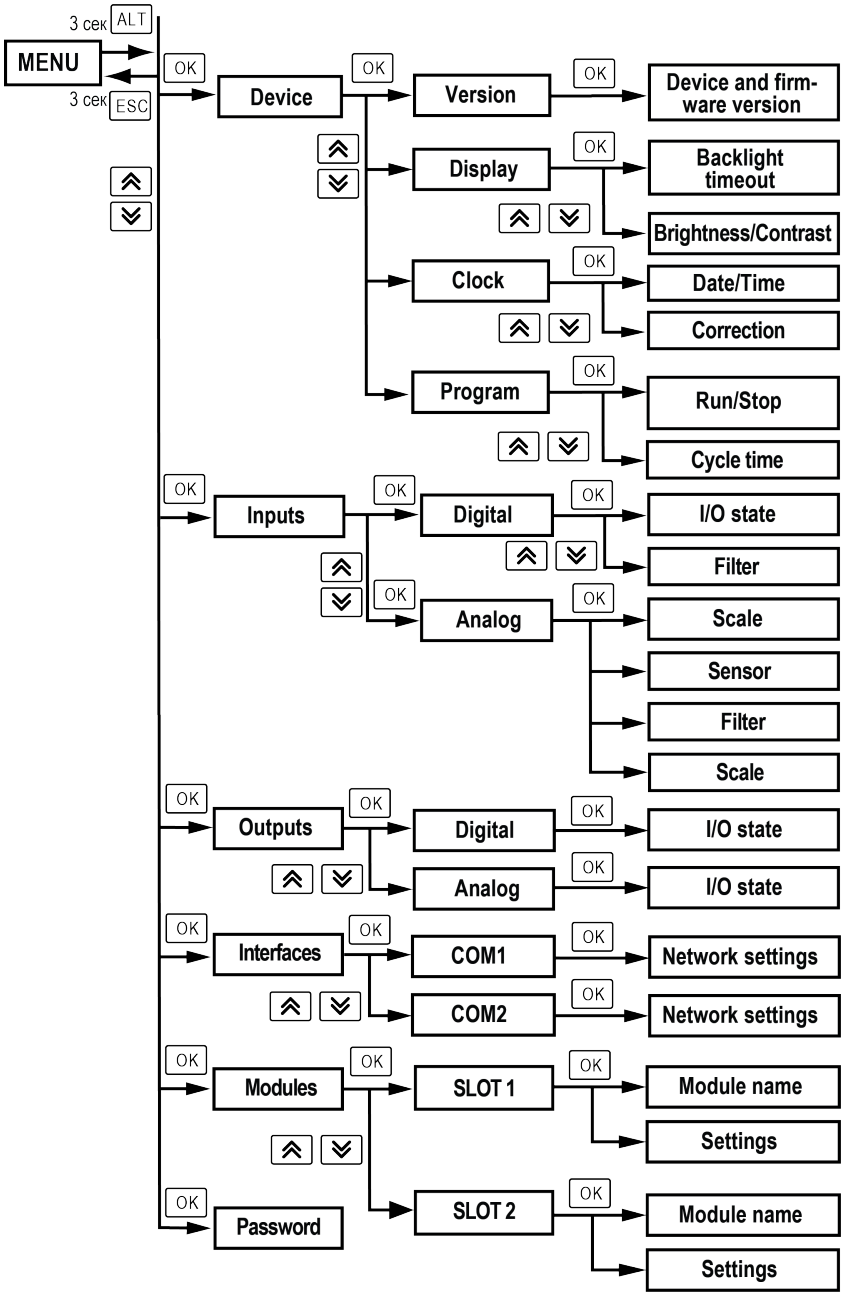


Fig. 6.3 System menu

Inputs

– **Digital**

  - **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.
  - **Filter** – debouncing filter time constant (0…255 ms), displayed in pairs. Use ⏫ / ⏬ buttons to navigate between pairs.
- **Analog**
  - **I/O state** – status of analog inputs as scaled measured values of REAL32 type, displayed in pairs. Use ⏫ / ⏬ buttons to navigate between pairs.
  - **Sensor** – type of the input signal.
  - **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.
  - **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**

    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.
- **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. 4.7*).
  - **Slave mode**

    Settings

    Baud rate – **Data bits** – **Parity** – **Stop bits**
  - **Protocol**

    Interface mode / **Address** – master address
- **Master mode**
  - **Settings**

    Baud rate – **Data bits** – **Parity** – **Stop bits**
  - **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.
- **Password**

  Password can be set or changed.

6.4 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.
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. ⏫ / ⏬ buttons cannot be used to scroll the lines inside a display if they are used as the jump condition for it.

6.5 Service modes

CAUTION
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.

NOTE
Do not set the jumpers XP2 and XP3 at the same time, otherwise the device can be damaged.

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

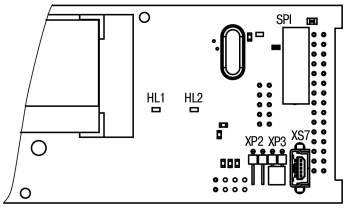


Fig. 6.4 Service mode jumpers

6.5.1 RUN-STOP mode

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.
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.

6.5.2 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 or *Sect 7*.
Set XP3 jumper to activate DOWN mode.

6.6 I/O mode

In I/O mode:
– user program is stopped
– relay operates as I/O extension module

To use the relay as I/O module, the RS485 interface must be previously configured in ALP as a slave. In I/O mode it is possible to read inputs and to control outputs, but there is no access to network variables. If any PRM modules are connected to the device, polling them via RS485 is impossible.
To activate the I/O mode see *sect. 6.5.1*.

6.7 Error mode

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

Table 6.2

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 6.5.1*)	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

6.8 User program lock mode

If the user program is unstable or causes the device to freeze, it can be forcibly blocked. This feature is available starting from firmware version 2.31. This mode is equivalent to the **Run-Stop** mode (see *sect. 6.5.1*), but to activate it you do not need to open the device housing.
Forced blocking of the user program can be activated in following cases:

– before the device is powered on
– if the device is freezing

To forcefully block the program that caused the device to freeze, press and hold the combination of buttons ALT + ESC. After the program is blocked, the device screen will show following message: «LOGIC Program: Blocked».
Once a user program has been locked, it can be overwritten using a PC. If the user program was blocked by mistake, then to start it it is enough to restart the device.

6.9 Extension modules

PRM extension modules are used to increase the number of I/O points. Please refer to the *section 5.3* for connection and installation of the extension modules. The operation of the extension modules is determined by user program in PR200.
The input polling time and the output state recording time of the extension modules are determined by complexity of the user program and they are the same as of PR200 inputs/outputs.

6.10 Real-time clock

A charged backup battery ensures uninterruptable operation of the built-in RTC for 5 years. In the case of operation at a temperature near the limits of the operating range, the operating time of the battery is reduced. For battery replacement see *sect 8.2*.
The time correction of RTC can be made in the configuration mask in ALP (see ALP HELP).
To set time and date using the device system menu:

1. Hold ALT button for 3 seconds to access the menu.
2. Press OK button to enter **Device** menu.
3. Use ⩛ button to reach **Clock** menu
4. Press OK button to enter **Time/Date** parameter.
5. Press SEL button to enter edit mode. The first digit starts flashing.
6. Use ⩓ and ⩛ buttons to change the value. To move between characters use ALT + ⩛ combination .
7. Press OK button to move to the next editable parameter or hold ESC button for 3 seconds to exit edit mode.

7 Firmware update

The firmware update is carried out in ALP using the menu item ***Device > Firmware update*** or during project transfer.
If the firmware update was unsuccessful (power outage, communication errors etc.), it can be forced. The forced firmware update can be made if the device is not detected in ALP, but the device connection is correctly displayed in the Windows Device Manager.
To force the firmware update:

1. Connect the PR200 programming connector (Pos. 4) to PC over a USB-to-miniUSB connection cable.
2. Power on the device.
3. Check in the Windows Device Manager which COM port is assigned to the device.
4. Enter this COM port number in ALP mask ***Device > Port Settings*** and confirm with ***OK***.
5. Select menu item ***Device > Firmware update***. The currently connected device will be proposed. You can select another one.

   During firmware update the ALP progress bar is displayed on PC.
6. Wait for the process to complete.

If problems were not resolved after a forced firmware update, contact technical support.

8 Maintenance

8.1 Maintenance

The safety requirements (see *Section 1.3*) must be observed when the maintenance is carried out.

WARNING
Cut off all power before maintenance.

The maintenance includes:

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

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

8.2 Battery replacement

NOTE
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.

To replace the RTC battery:

1. Remove the front cover with the keypad.
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.
3. Turn over the released top PCB, lever the CR2032 battery with the screwdriver and pull out from the nest.
4. Install a new battery.
5. Perform the disassemble operations in reverse order to assemble the device.

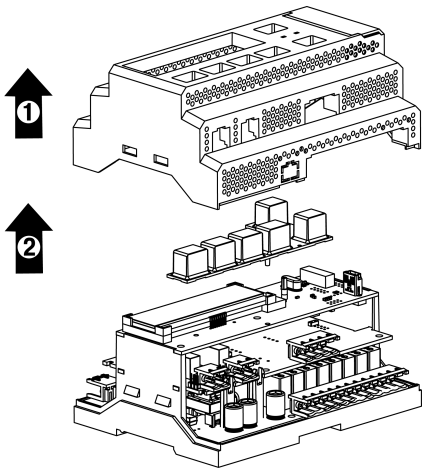


Fig. 8.1 Front cover removing

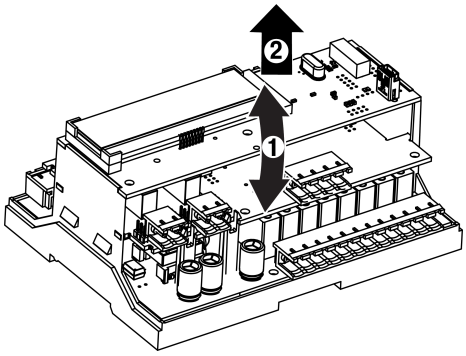


Fig. 8.2 Top PCB removing

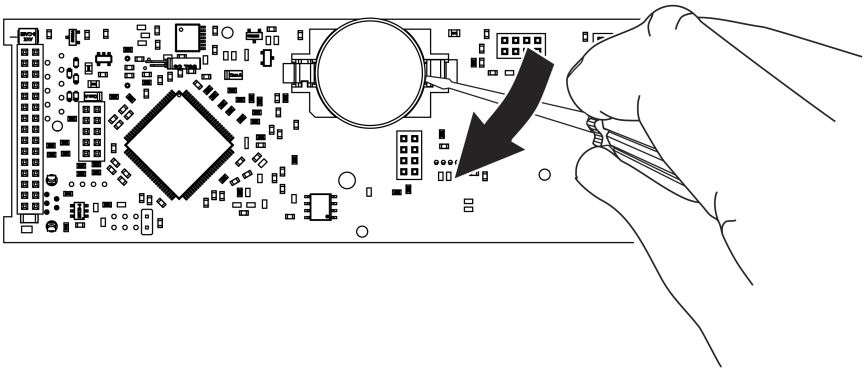


Fig. 8.3 Back side view of the top PCB

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!

10 Scope of delivery

PR200	1
Short guide	1
Terminal blocks (set)	1

Appendix A. Terminal layouts

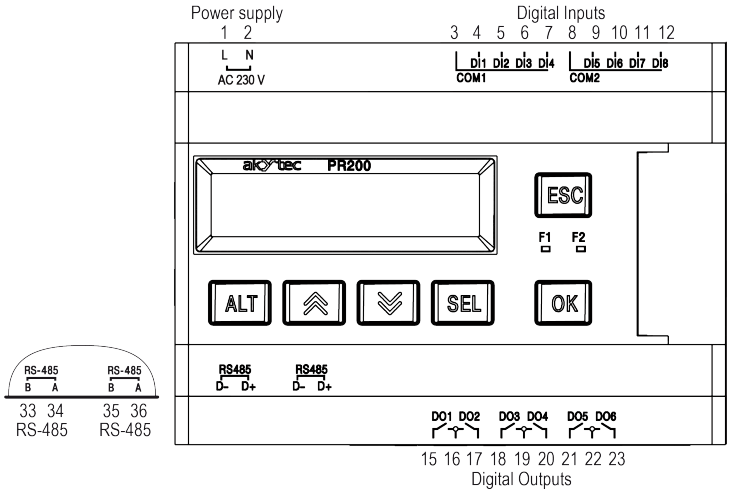


Fig. A.1 PR200-230.1.2

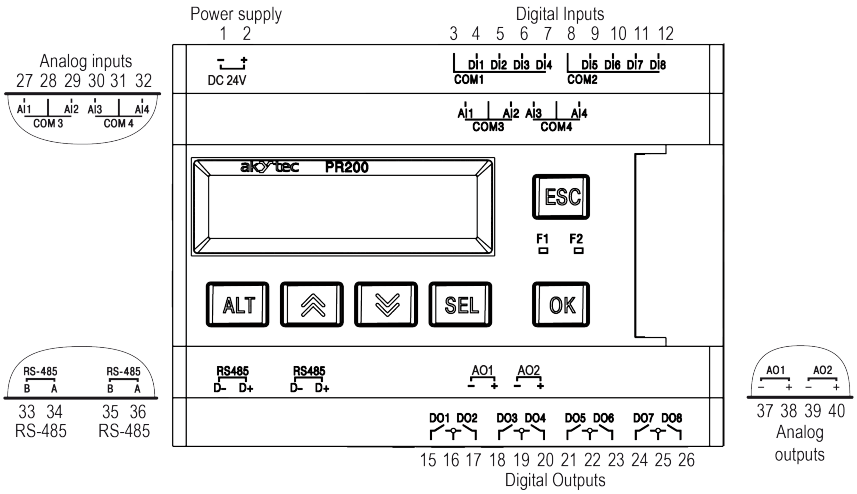


Fig. A.2 PR200-230.2.2

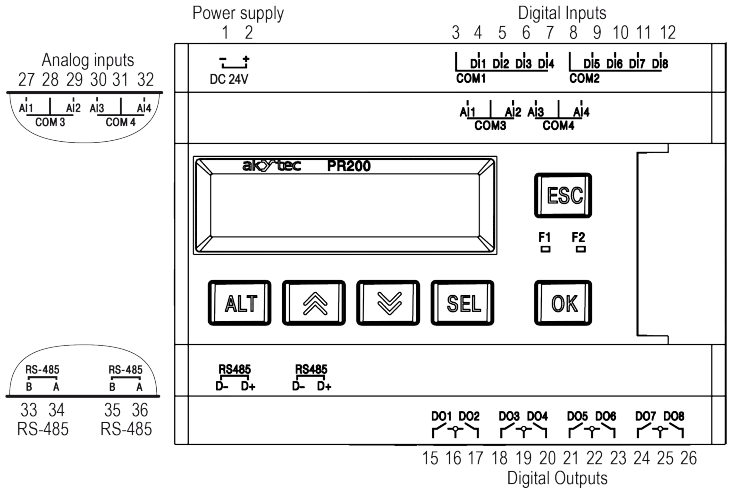


Fig. A.3 PR200-230.3.2

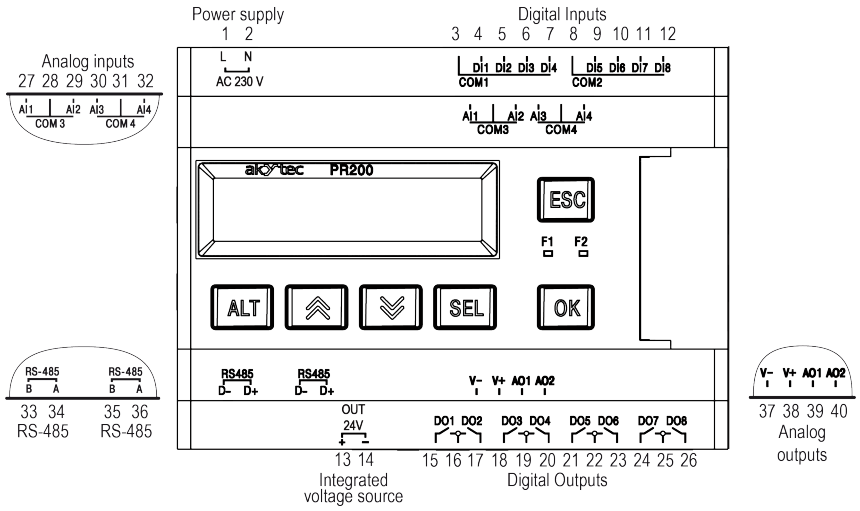


Fig. A.4 PR200-230.4.2

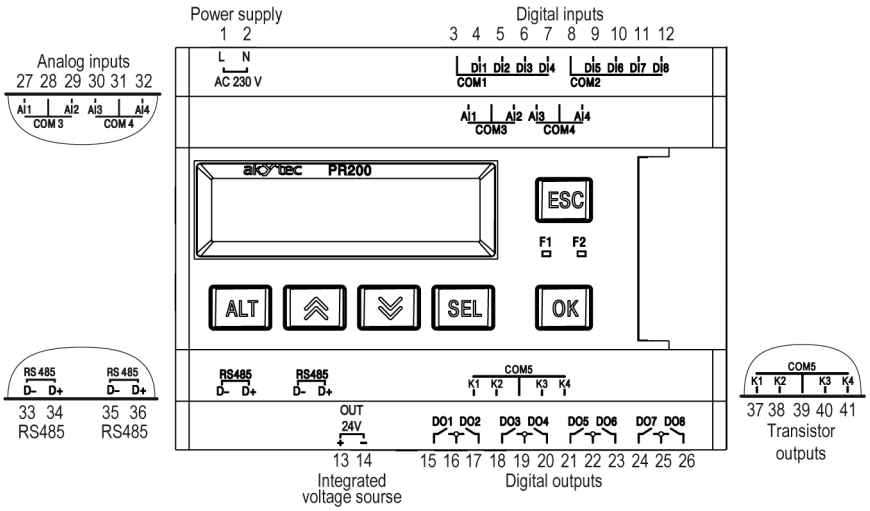


Fig. A.5 PR200-230.5.2

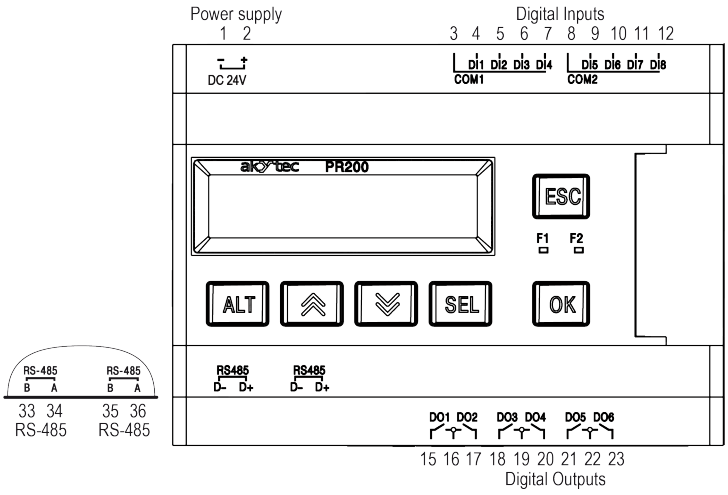


Fig. A.6 PR200-24.1.2

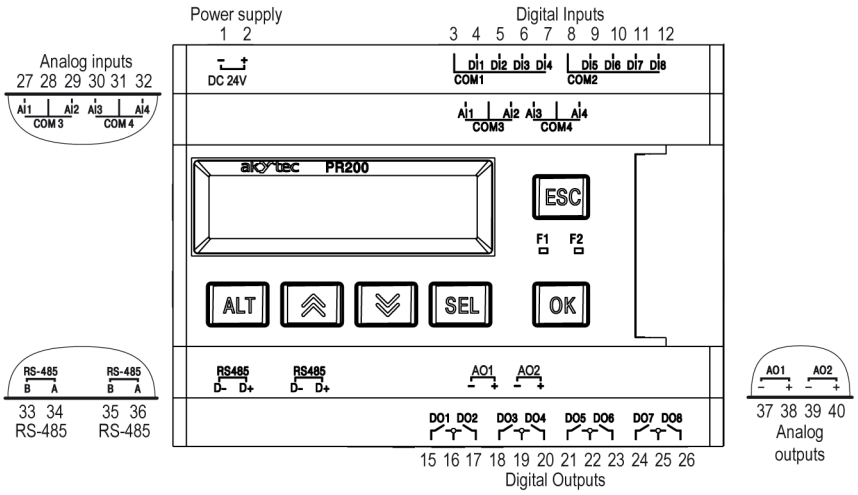


Fig. A.7 PR200-24.2.2

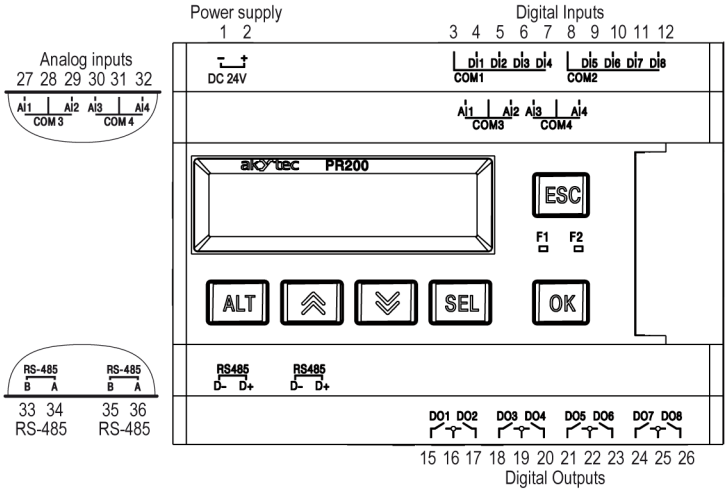


Fig. A.8 PR200-24.3.2

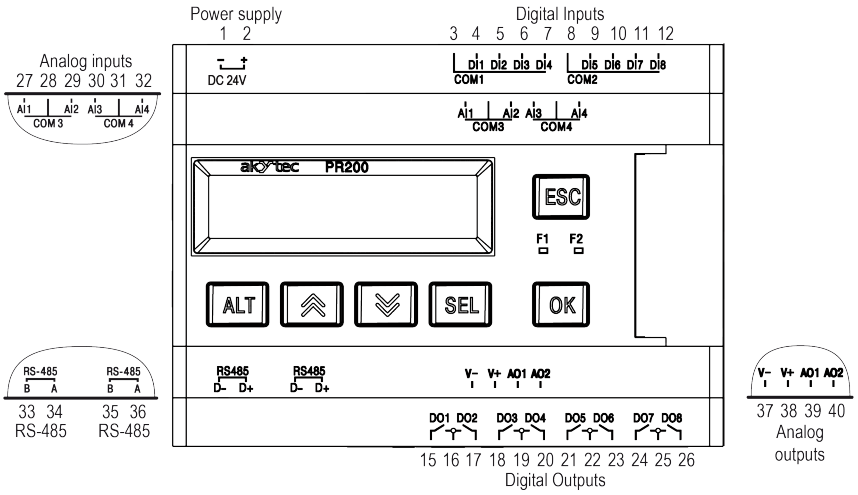


Fig. A.9 PR200-24.4.2

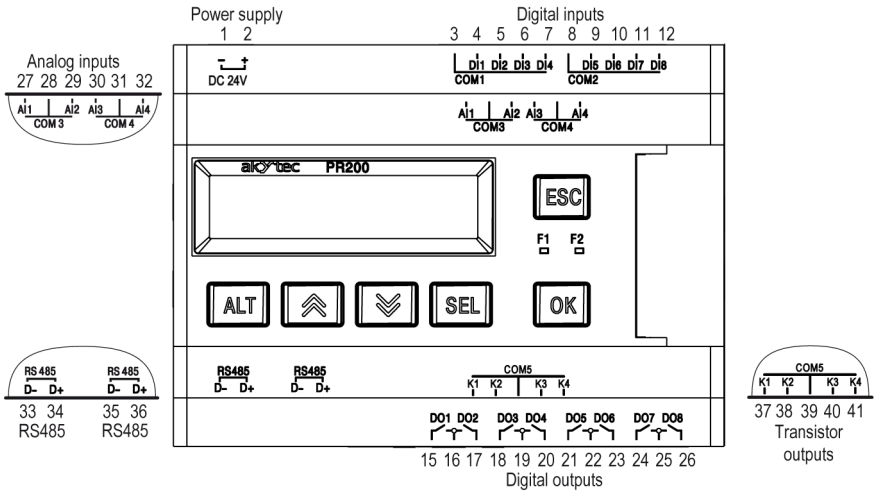


Fig. A.10 PR200-24.5.2

Appendix B. Calibration

If the accuracy of the input or output of the device is no longer in accordance with the specification, it can be calibrated. The module must be connected to the basic device to be calibrated. The calibration is carried out the same way as of the basic device.

CAUTION
Ensure reliable power supply of the basic device and modules 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 coefficients are calculated based on 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.

B.1 Analog inputs

To calibrate an input:

1. Connect the reference signal source of accuracy class at least 0.05 to the input.

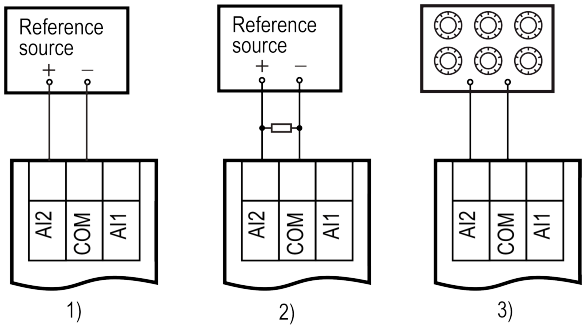


Fig. B.1 Connection of the reference signal source to an input

   Notes on input wiring see *sect 5.2.3*.
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 ***Analog inputs*** as calibration target.
6. Select the device model in the open dialog window.
7. Select ***Analog inputs*** as calibration target
8. Select the type of input signal and other calibration parameters.

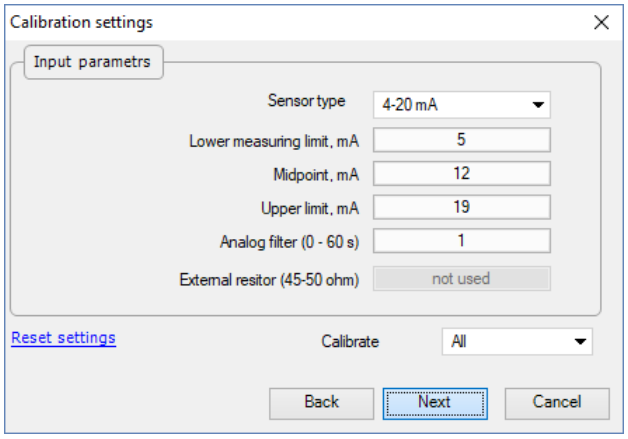


Fig. B.2 Configuration parameters

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 accurate calculation of the coefficients will be achieved.

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.

9. Click ***Next*** and follow the instructions.

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

B.2 Analog outputs

B.2.1 Output 4-20 mA

To calibrate an output:

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

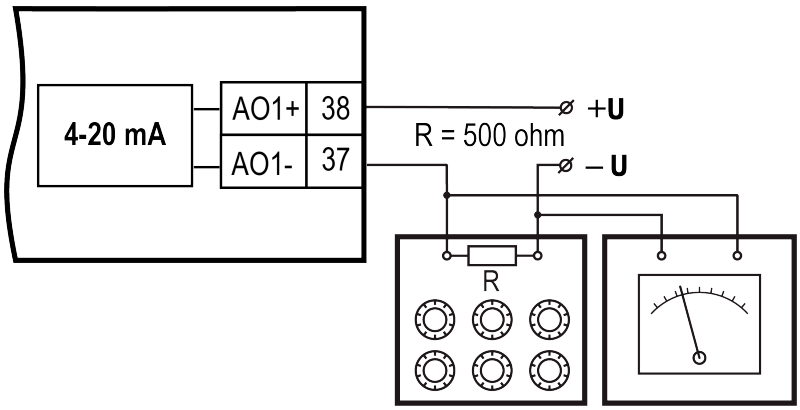


Fig. B.3

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.
9. Calculate the output current from the measured output voltage and the set resistance; enter the result in the input field.
10. Click **Next** to continue and follow the instructions.

B.2.2 Output 0-10 V

To calibrate an output:

1. Connect a reference voltage source and a measuring device of accuracy class at least 0.05 to the output.

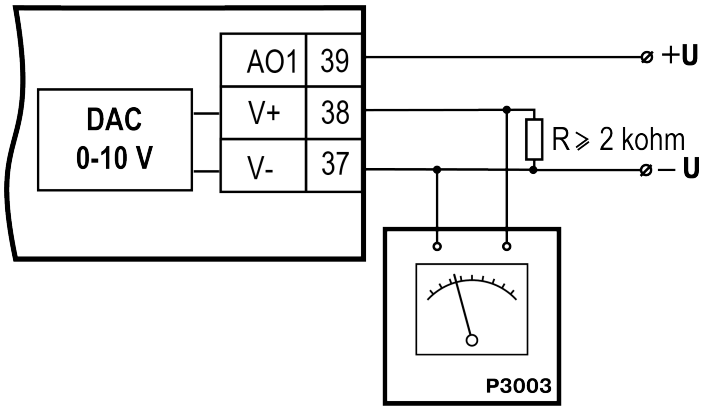


Fig. B.4

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.
7. Enter the measured output voltage in the input field.
8. Click ***Next*** to continue and follow the instructions.