



## PR200

### Programmable relay

### User guide

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## Introduction

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

### Terms and abbreviations

Following terms and abbreviations are used in the guide:

**HMI** – Human-Machine Interface

**Modbus** – application layer messaging protocol for client/server communication between devices connected on different types of buses or networks, originally published by Modicon (now Schneider Electric), currently supported by an independent organization Modbus-IDA ([www.modbus.org](http://www.modbus.org)).

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

**Retain memory** – non-volatile memory allocation for storing of retain variables

**Retain variables** – will not lose their values after a power-off/power-on cycle (restart)

**RAM** – random access memory, volatile part of system memory

**ROM** – read-only memory, non-volatile part of system memory

**Application** – user program created using ALP software

**Display element** – program element used for displaying information on the display

## Overview

### 1 Overview

The programmable relay PR200 is a small controller. User application is created as a function plan with the programming software 'akYtec ALP', included on the USB stick. The user application includes the logic program as well as the device configuration. The PR200 enables the following functions:

- control of the outputs according to the input status and the logic of the user application
- configuration with the function buttons or using ALP software
- comprehensive programming of LCD display
- 2 programmable LEDs
- Master and / or Slave in a Modbus network
- Real-time clock
- extension modules







The device is designed in a plastic enclosure for DIN rail mounting.

The enclosure has 3-level stepped form for distributor installation. Indicators and control elements are located on the front housing. There are mounting interlocks on the rear side.

Plug-in terminal blocks are placed on the upper and lower stepped surfaces. The blocks are used for connecting actuators, digital and analog sensors, RS485 network lines and other external equipment.

Plug-in terminal blocks enable quick and easy replacement of the device.

Front housing:

- 2-line alphanumeric display (16 characters each)
- two LEDs: F1 (green) and F2 (red), controlled by an application
- 6 function buttons       for system menu and display navigation

Under the front cover (rights):

- Connector EXT (10 pole) for extension modules
- Mini-USB socket PRG for connecting to PC. USB A-plug to micro B-plug connection cable is included in the package.

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 device has a 2-line 32-character LCD display. A real-time clock and up to 2 RS485 interfaces for connection to Modbus networks are available. The relay can be expanded with additional input and output modules. The analog inputs can be configured as analog or as digital.

For further details see section 4 'Functioning'

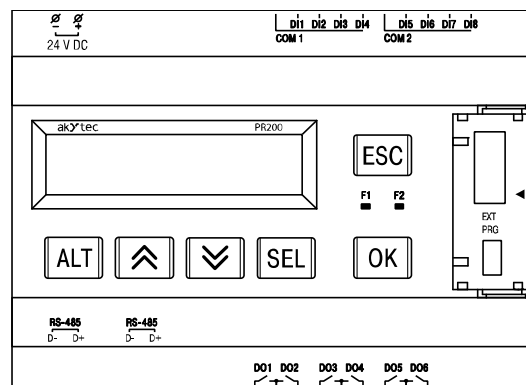
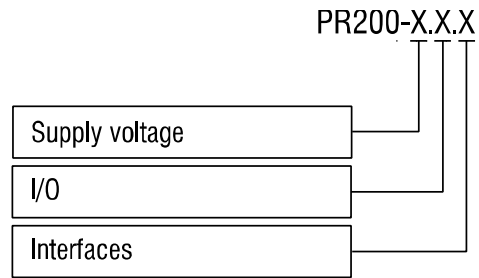


Fig. 1.1 Front housing (front cover is open)

## Overview

### 1.1 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)

4 - 8 DI, 4 AI, 8 DO, 2 AO (0-10 V)

#### Interfaces

0 - none

1 - RS485

2 - 2x RS485

The design of the relay enables to increase the number of RS485 interfaces by installing up to two interface cards.

Ordering code for interface card: PR-IC485

## 2 Specifications

Table 2.1 General specification

| Device                      | PR200-230.1                             | PR200-230.2<br>PR200-230.4 | PR200-24.1        | PR200-24.2<br>PR200-24.4 |
|-----------------------------|---|----------------------------|-------------------|--------------------------|
| Power supply                | 230 (94...264) V AC;<br>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<br>100 mA        | -                 | -                        |
| Galvanic isolation          | -                                       | 1780 V                     | -                 | -                        |
| Inputs                      | 8                                       |                            |                   |                          |
| Digital                     | 8                                       |                            |                   |                          |
| Analog *                    | -                                       | 4                          | -                 | 4                        |
| Outputs                     | 8                                       |                            |                   |                          |
| 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                                 |                            |                   |                          |
| Connection to RS485 Network | 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                       |                            |                   |                          |
| Mounting                    | DIN rail (35 mm)                        |                            |                   |                          |
| Weight                      | approx. 350 g                           |                            |                   |                          |
| Material                    | Plastic                                 |                            |                   |                          |

\* Analog inputs AI1...AI4 can also be configured as digital inputs

Table 2.2 Digital inputs

| Device                              | PR200-230.1                 | PR200-230.2<br>PR200-230.4 | PR200-24.1  | PR200-24.2<br>PR200-24.4 |
|-------------------------------------|-----------------------------|----------------------------|---|--------------------------|
| Input signal                        | Switch contact              |                            | Switch contact<br>PNP with open collector<br>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                      |                            |   |                          |
| Test voltage against other circuits | 2830 V                      |                            |   |                          |

## Specifications

Table 2.3 Analog inputs

| Device                                  | PR200-230(24).2, PR200-230(24).4 |
|---|----------------------------------|
| Galvanic isolation                      | none                             |
| <b>Mode</b>                             | <b>Analog</b>                    |
| Input signal                            | 0-10 V, 4-20 mA, 0-4000 ohm      |
| Input voltage *                         | -36...+36 V                      |
| Input resistance (0-10 V)               | 61 ohm                           |
| Input resistance (4-20 mA)              | 121 ohm                          |
| Basic error                             | ±0.5%                            |
| Temperature influence                   | ±0.05%/10°C                      |
| Resolution                              | 2.7 mV / 6 µA                    |
| Resolution ADC                          | 12 bit                           |
| Sampling time for 4 inputs, max         | 10 ms                            |
| <b>Mode</b>                             | <b>Digital</b>                   |
| 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                 | PR200-230(24).2    | PR200-230(24).4  |
|------------------------|--------------------|------------------|
| 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 |

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.

## Specifications

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 relay 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 2.1

| Conditions                    | Permissible range                    |
|-------------------------------|--------------------------------------|
| Ambient operating temperature | -20...+55°C                          |
| Storage temperature           | -25...+55°C                          |
| Relative humidity             | up to 80% (at +25°C, non-condensing) |
| IP Code                       | IP20                                 |
| 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 Safety

Explanation of the symbols and keywords used:

- |  |  |
|--|--|
|  <b>DANGER</b>  | <b><i>DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.</i></b>                          |
|  <b>WARNING</b> | <b><i>WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</i></b>                        |
|  <b>CAUTION</b> | <b><i>CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.</i></b>                       |
|  <b>NOTICE</b>  | <b><i>NOTICE indicates a potentially harmful situation which, if not avoided, may result in damage of the product itself or of adjacent objects.</i></b> |

#### 3.1 Safety precautions

- |   |   |
|---|---|
|  <b>WARNING</b>  | <b><i>Ensure that the mains voltage matches the voltage marked on the nameplate!<br/>Ensure that the device is provided with its own power supply line and electric fuse!<br/>Do not feed any external devices from the power contacts of the device.</i></b> |
|  <b>NOTICE</b>   | <b><i>It is necessary to observe the polarity while connecting 24V power sources. Improper connection can damage the device.</i></b>  |
|  <b>NOTICE</b> | <b><i>The device must be powered off before connecting to PC.</i></b>   |
|  <b>NOTICE</b> | <b><i>Removing of the terminal blocks may be performed only after powering off the device and all connected equipment.</i></b>  |

#### 3.2 Intended use

Programmable relays of PR200 series has been designed and built solely for the intended use described in this manual, and may only be used accordingly. The technical specifications contained in this manual must be observed. 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.

## Functioning

### 4 Functioning

Once the application has been transferred to the non-volatile memory, the relay restarts. On startup the relay runs a self-test. If unsuccessful, the relay switches to the fault mode (see 4.2). Otherwise the application runs (Fig. 4.1)



**WARNING**

***Before transferring the application to PR200 ensure that all devices connected to the relay outputs are disconnected. It is recommended to transfer the application before wiring the relay.***



**NOTICE**

***Before starting***

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

#### 4.1 Operating mode

Operating mode of the device is cycle oriented:

- Start (testing of operational readiness)
- Update of the input process image
- Running the application
- Update of the output process image
- Back to Start.

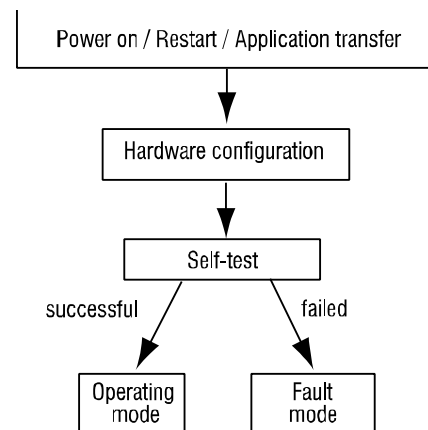


Fig. 4.1 Operating sequence

#### 4.2 Fault mode

Table 4.1 – Error messages

| Indication                 | Cause   | Remedy   |
|----------------------------|---|--|
| LOGIC Program INVALID      | Invalid application                                   | Repare application with ALP                                    |
| LOGIC Program MEMORY ERROR | Retain variables cannot be read                       |  |
| LOGIC Program BLOCKED      | RUN-STOP jumper is set, application stopped (see 4.6) | Remove the RUN-STOP jumper and restart the device              |
| LED F2 lit                 | Firmware is damaged                                   | Update firmware or contact the service center                  |
| LED F2 blinks              |   |  |
| LOGIC Program STOPPED      | Application stopped                                   | Start the application using system menu and restart the device |

#### 4.3 RS485 network interface

PR200 can have up to two RS485 interface cards (depends on modification) for communication via Modbus RTU / ASCII protocol as a Master or a Slave.

If your device has less than two RS485 interfaces, you can order the required interface cards PR-IC485 and install them. For installation instructions see section 7.

The interface card PR-IC485 is set to Slave by default. To use the interface as a Master, jumpers XP4 and XP5 on the card must be set in accordance with the Fig. 4.2:

## Functioning

- set jumpers on the interface card to the ‘M’ position
- configure the interface using the ALP software (*Menu>Device>Configuration*)

For detailed information about network interface configuration see ‘akYtec ALP Help’. Network parameters can also be changed using system menu.

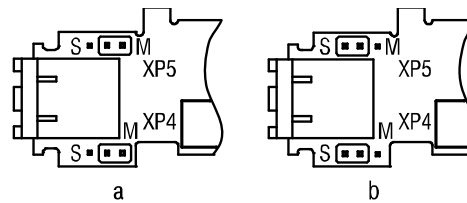


Fig. 4.2 PR-IC485 jumper positions: Master (a), Slave (b)

### 4.4 Slave mode

Functions:

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

Modbus registers are listed in Tab. 4.2.

In the slave mode the Modbus RTU and Modbus ASCII protocols are supported, with automatic protocol detection.

To add an interface click RMB on the node ‘Interfaces’ in the configuration tree and select ‘Add interface’ (Fig. 4.3). Click RMB on this interface and add a master device to it (Fig 4.4). See ALP Help for further instructions.

Following parameters can be set:

- Name – device name in the configuration tree
- Address – device address in a Modbus network.

To create a variable for polling click the ‘+’ icon (see Fig. 4.4).

To delete the selected variable click the ‘-’ icon.

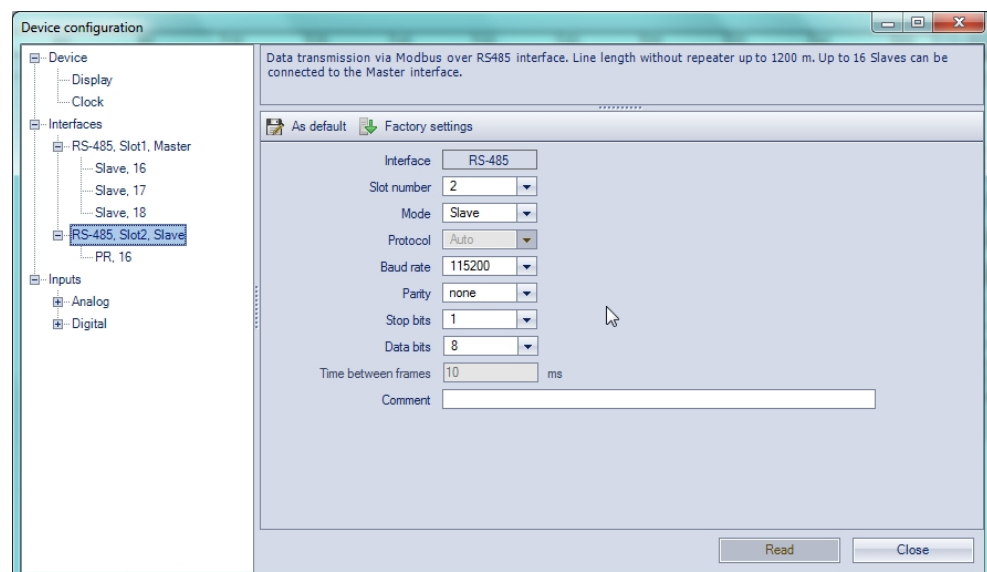


Fig. 4.3 Slave configuration in slave mode

## Functioning

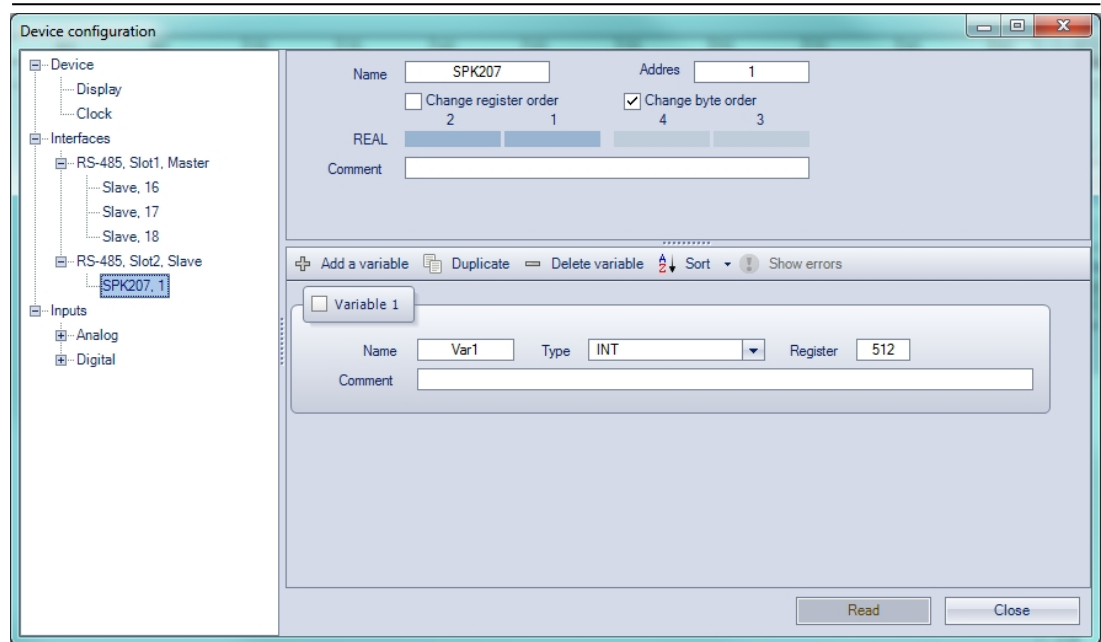


Fig. 4.4 Master configuration in slave mode

### 4.5 Master mode

There can be only one Master in a Modbus network.

To use the interface as a Master follow the instruction given in section 4.3 'RS485 network interface'.

PR200 as a Master can control up to 16 slave devices over each RS485 interface. Each slave device can use up to 256 variables. It is allowed to use the same name and the same address for different slave devices.

To add an interface click RMB on the node 'Interfaces' in the configuration tree and select 'Add interface' (Fig. 4.5). Set the interface to Master, click RMB on it and add the slave device (Fig 4.6).

See ALP Help for further instructions.

## Functioning

Table 4.2 Modbus registers

| Device                             | Parameter                                 | Data type | Address         | ModBus function        |
|------------------------------------|---|-----------|-----------------|------------------------|
| <b>Inputs</b>                      |   |           |                 |                        |
| All                                | Digital input status DI1...DI8            | BOOL      | 0x1000 – 0x1007 | 0x01, 0x02             |
|                                    |   | INT16     | 0x0100          | 0x03, 0x04             |
| PR200-230(24).2<br>PR200-230(24).4 | Measured value AI1 analog                 | REAL32    | 0x0B00, 0x0B01  | 0x03, 0x04             |
|                                    | Measured value AI2 analog                 | REAL32    | 0x0B02, 0x0B03  | 0x03, 0x04             |
|                                    | Measured value AI3 analog                 | REAL32    | 0x0B04, 0x0B05  | 0x03, 0x04             |
|                                    | Measured value AI4 analog                 | REAL32    | 0x0B06, 0x0B07  | 0x03, 0x04             |
|                                    | Measured value AI1 analog *               | INT16     | 0x0B80          | 0x03, 0x04             |
|                                    | Measured value AI2 analog *               | INT16     | 0x0B81          | 0x03, 0x04             |
|                                    | Measured value AI3 analog *               | INT16     | 0x0B82          | 0x03, 0x04             |
|                                    | Measured value AI4 analog *               | INT16     | 0x0B83          | 0x03, 0x04             |
|                                    | Decimal point (dp) AI1 analog             | INT16     | 0x0BC0          | 0x03, 0x04             |
|                                    | Decimal point (dp) AI2 analog             | INT16     | 0x0BC1          | 0x03, 0x04             |
|                                    | Decimal point (dp) AI3 analog             | INT16     | 0x0BC2          | 0x03, 0x04             |
|                                    | Decimal point (dp) AI4 analog             | INT16     | 0x0BC3          | 0x03, 0x04             |
|                                    | Analog input status AI1 digital           | BOOL      | 0xB800          | 0x01, 0x02             |
|                                    | Analog input status AI2 digital           | BOOL      | 0xB810          | 0x01, 0x02             |
|                                    | Analog input status AI3 digital           | BOOL      | 0xB820          | 0x01, 0x02             |
|                                    | Analog input status AI4 digital           | BOOL      | 0xB830          | 0x01, 0x02             |
| <b>Outputs</b>                     |   |           |                 |                        |
| PR200-230(24).2<br>PR200-230(24).4 | Digital output status (DO1...DO8, F1, F2) | BOOL      | 0x0000 – 0x0009 | 0x01, 0x02             |
|                                    |   | INT16     | 0x0000          | 0x03, 0x04             |
| PR200-230(24).1                    | Digital output status (DO1...DO6, F1, F2) | BOOL      | 0x0000 – 0x0007 | 0x01, 0x02             |
|                                    |   | INT16     | 0x0000          | 0x03, 0x04             |
| PR200-230(24).2<br>PR200-230(24).4 | Output value AO1 analog (0...1)           | REAL32    | 0x0A00, 0x0A01  | 0x03, 0x04             |
|                                    | Output value AO2 analog (0...1)           | REAL32    | 0x0A02, 0x0A03  | 0x03, 0x04             |
|                                    | Output value AO1 analog (0...10000)       | INT16     | 0x0A80          | 0x03, 0x04             |
|                                    | Output value AO4 analog (0...10000)       | INT16     | 0x0A81          | 0x03, 0x04             |
| All                                | Network variables                         | BOOL      | 0x2000 – 0x23F0 | 0x01, 0x02, 0x05, 0x0F |
|                                    |   | INT16     | 0x0200 – 0x023F | 0x03, 0x04, 0x06, 0x10 |
| <b>Real-time clock</b>             |   |           |                 |                        |
| All                                | Seconds                                   | INT16     | 0x0400          | 0x03, 0x04, 0x06, 0x10 |
|                                    | Minutes                                   | INT16     | 0x0401          | 0x03, 0x04, 0x06, 0x10 |
|                                    | Hours                                     | INT16     | 0x0402          | 0x03, 0x04, 0x06, 0x10 |
|                                    | Day                                       | INT16     | 0x0403          | 0x03, 0x04, 0x06, 0x10 |
|                                    | Month                                     | INT16     | 0x0404          | 0x03, 0x04, 0x06, 0x10 |
|                                    | Year                                      | INT16     | 0x0405          | 0x03, 0x04, 0x06, 0x10 |
|                                    | Weekday                                   | INT16     | 0x0406          | 0x03, 0x04             |
|                                    | Week of month                             | INT16     | 0x0407          | 0x03, 0x04             |
|                                    | Calendar week                             | INT16     | 0x0408          | 0x03, 0x04             |

\* To calculate the INT16 value, the value of type REAL32 is multiplied by  $10^{dp}$ , where 'dp' is a decimal point position and is set as configuration parameter (see 6.1.1).

For outputs dp = 4 is fixed.

## Functioning

Read request is triggered by the Polling cycle. Optionally it can be triggered by event, i.e. a variable of type BOOL.

Write request is triggered by change of parameter value. Optionally it can be triggered by event, i.e. a variable of type BOOL.

Following parameters can be set:

- Name – device name in the configuration tree
- Address – device address in a Modbus network.
- Polling cycle – time between requests (0...65535 ms)
- Timeout – maximum time to wait for reply (0...65535 ms)
- Retries – number of request retries if no reply (0...255)
- Status – status of slave device (BOOL variable)
- Polling – enable / disable polling (BOOL variable)
- Time between frames – the time span the master waits between the last response (or timeout) and the next request (Fig. 4.5).

When constructing a Modbus network with the PR200 as a master it is necessary to observe the following rules to speed up the process of receiving data from all devices:

- If one or more Slave are not connected or not accessible, it is recommended to block the polling of these devices in the application using the parameter 'Polling' or to minimize the parameter 'Timeout' for these devices. Otherwise, the response time will significantly increase with the number of unavailable devices and the sum of time-outs.
- When setting the parameter 'Time between frames' the number of Slaves and the total number of requests must be taken into account. This parameter will be ignored if the total polling time takes longer than the set value.

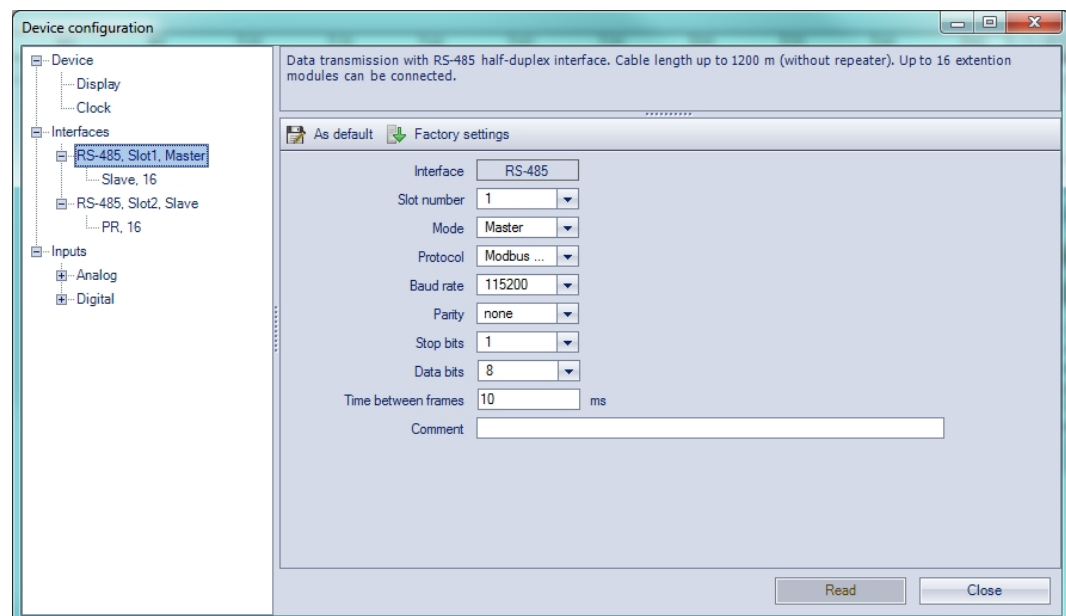


Fig. 4.5 Master configuration in master mode

## Functioning

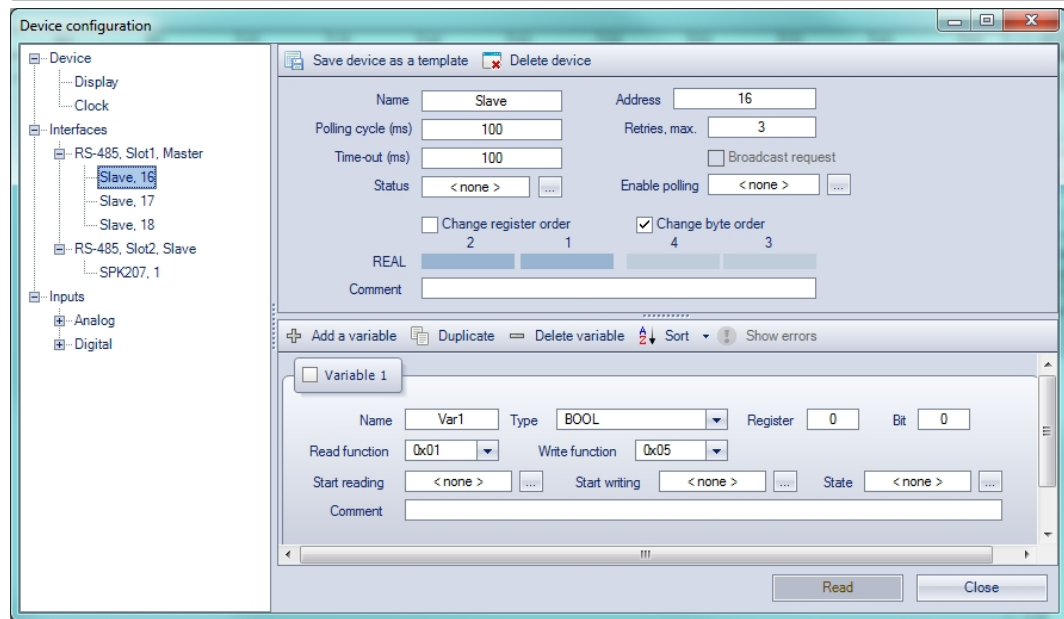


Fig. 4.6 Slave configuration in master mode

To create a variable to be requested click the '+' icon (see Fig. 4.6).

To delete the selected variable click the '-' icon.

Variable properties:

- Name
- Type – data type BOOL, INT16, REAL32
- Register – register address
- Bit – bit number in register (0...15), only for BOOL variables
- Number of registers –variable length
- Read function – Modbus read function
- Write function – Modbus write function
- Start reading – BOOL variable event to start the reading request
- Start writing – BOOL variable event to start the writing request
- Status – INT variable to store the error code
- Comment

### 4.6 Special modes

The connectors XP2 and XP3 under the device cover (Fig. 4.5) are used to set special device modes.

#### ► NOTICE

***Don't set the jumpers on connectors XP2 and XP3 at the same time, otherwise the device can be damaged.***

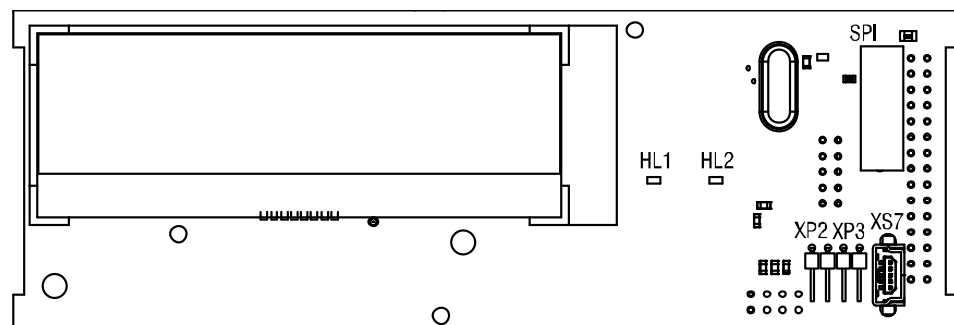


Fig. 4.5

## Functioning

---

### **'RUN-STOP' mode**

Setting a jumper on the XP2 connector activates 'RUN-STOP' mode. In this mode the user application is interrupted. It can be useful if the system menu is unavailable, e.g. the application is corrupted and leads to improper operation of the device.

While PR200 is in RUN-STOP mode, a new application can be uploaded to the device. In this mode the device can be used as a Slave. The input values can be read and the output values can be written, only network variables are disabled.

### **'Down.Mode' mode**

Setting the jumper on XP3 connector activates 'Down.Mode'. This 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.



## System menu


### 5 System menu


System menu enables to view the information about

- device modification
- firmware version
- cycle time
- I/O status

and other device parameters.

The application can be interrupted by using the menu item *Device>Program>Run/Stop*. When the setting is changed it requires a reboot to take effect. When the application is interrupted all parameters except network variables are available via Modbus in slave mode and via system menu. The menu is password protected, with can be set or changed in ALP or using the menu. If the password is lost, it can be changed by loading a new application.



Press the button  for 3 seconds to access the menu.

Press the button  for 3 seconds to exit the menu.

#### 5.1 Menu navigation




There are editable and not editable display elements thus the display can be used in view or edit mode.





##### View mode

To move between lines use  and  buttons.


To enter the selected level use  and  to exit.


##### Edit mode

Press  button to enter the edit mode from the current display. The first editable element starts flashing. Use buttons  and  to change the parameter. Use following button combinations to move between characters:

-  +  – one character to the left
-  +  – one character to the right.

To save the new value and exit Edit mode use .

To reset a parameter to its original value and exit Edit mode use .

To save the new value staying in the Edit mode use . The next editable parameter will be displayed selected.

The last changed parameter will be shown next time when the edit mode is entered.

## System menu

### 5.2 Menu content

The menu structure is shown in Fig. 5.1

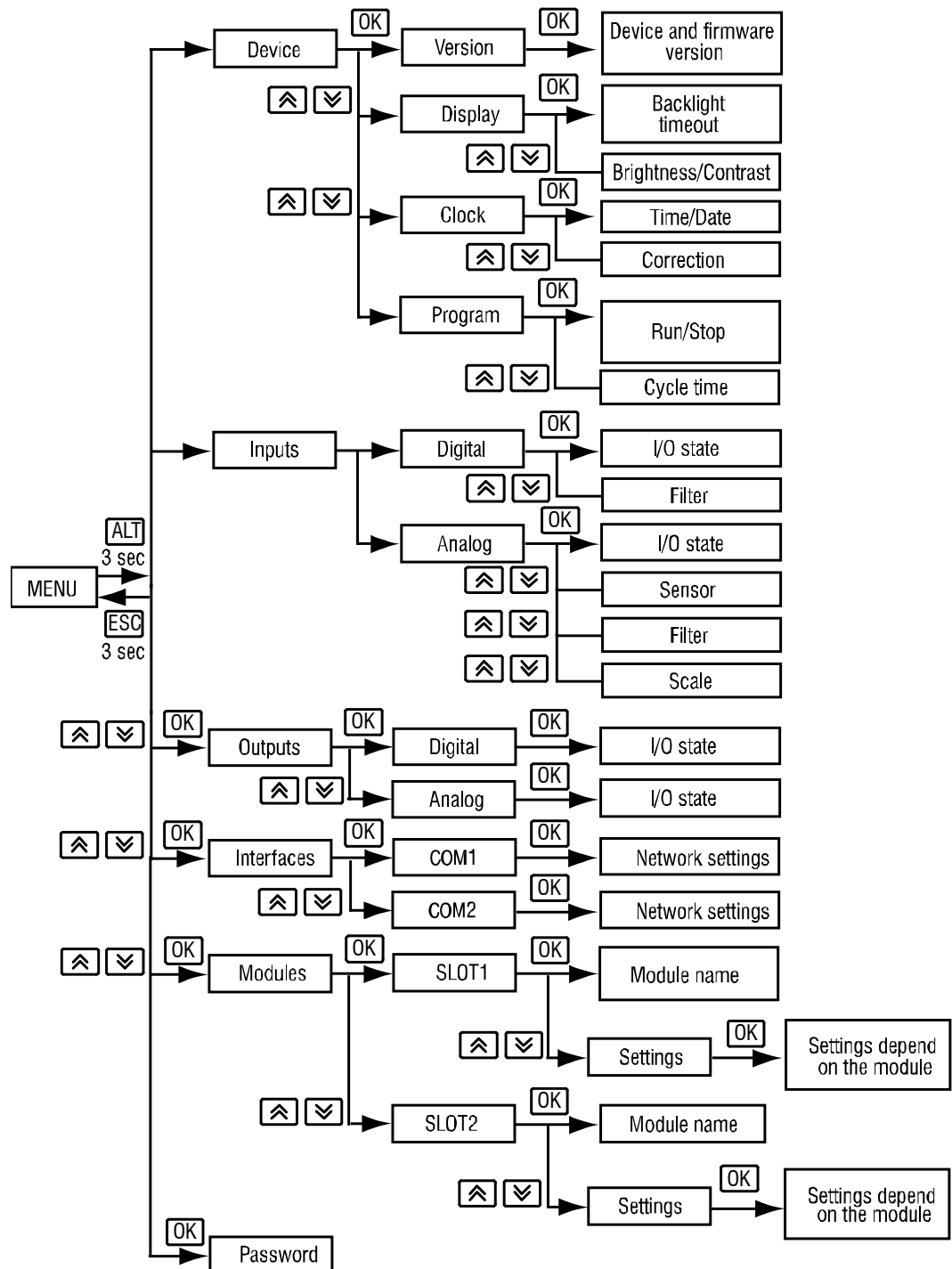


Fig. 5.1 System menu

### Inputs

#### – Digital

Status of digital inputs is displayed as a bitmask: 0 for OFF state, 1 for ON state. The first bit in the mask corresponds to input 1.

Use the menu item *Inputs>Digital>Filter* to set the time constant for the debouncing filter in the range of 0...255 ms.

## System menu

---

- **Analog**

Status of each analog input is displayed as a scaled measured value of REAL32 type. The lower and the upper limits can be set in the menu item *Inputs>Analog>Scale*.

The type of input signal can be selected in the menu item *Inputs>Analog>Sensor*. The menu item *Inputs>Analog>Filter enables* to set the time constant for the filter within the range of 0.01...60 s with the increment of 0.001 s.

## Outputs

- **Digital**

Status of digital outputs is displayed as a bitmask: 0 for OFF state, 1 for ON state. The first bit in the mask corresponds to output 1.

- **Analog**

Status of each analog output is displayed as a REAL32 value within the range of 0...1.

## Interfaces

Interface configuration depends on the interface mode, Master or Slave. To set interface parameters use the menu item *Interfaces* and select the interface.

- **Slave mode**

- o **Settings**

- Baud rate
- Data bits
- Parity
- Stop bits

- o **Protocol**

- Address

- **Master mode**

- o **Settings**

- Baud rate
- Data bits
- Parity
- Stop bits

- o **Protocol**

- List of configured devices (see 4.5 'Master mode')
  - Address
  - Polling cycle (ms)
  - Time-out (ms)
  - Retries, max.
- Time between frames (see 4.5 'Master mode')

## System menu

### Modules

Information about connected extension modules. If there are no connected modules, the menu item is hidden.

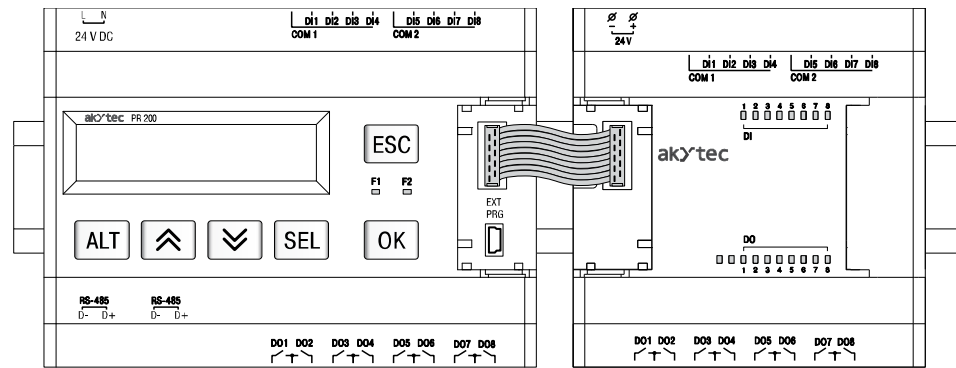


Fig. 5.2 Extension module connection

### Password

Password can be set or changed.

## Configuration

### 6 Configuration

PR200 has to be configured before use. Configuration is carried out with ALP software and is transferred as a part of the user application to the device. The configuration parameters are stored in permanent memory of the relay and are safe if device is powered off. Detailed information about programming PR200 is given in ALP Help.

Dynamically allocated memory enables to create complicated programs with many functional blocks, display elements and advanced display management.

#### 6.1 Analog inputs AI1...AI4

To configure analog inputs use the menu path *Device>Configuration*. A window 'Device configuration' appears (Fig. 6.1). Select the node *Inputs>Analog*.

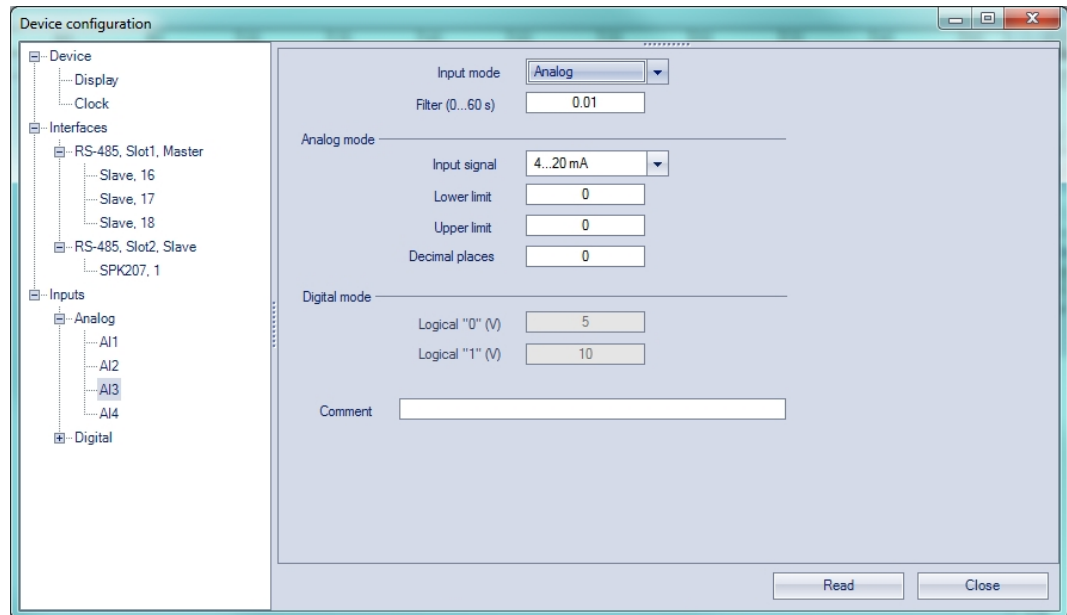


Fig. 6.1 Analog input configuration

For quick access select an input in the circuit program and set the parameters in the Property Box (see Fig. 6.2). First the parameter 'Input mode' has to be set.

Configuration parameters:

#### Analog input

Input mode – digital or analog mode

Filter – digital input filter time constant (0...60 s)

#### Analog mode only

Input signal – 4-20 mA, 0-10 V, 0-4000 ohm

Lower limit – lower limit of measured value

Upper limit – upper limit of measured value

Decimal places – 'dp' parameter for Modbus request (see Table 4.2)

The parameter 'dp' has to be set to determine the accuracy, if the measured value is transmitted over Modbus as integer.

#### Digital mode only

Logical 0 – voltage 0...10 V

Logical 1 – voltage 0...10 V

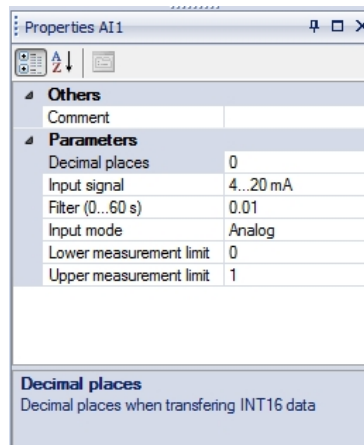


Fig. 6.2 Property Box

### 6.1.1 Analog mode

While creating an application the type of input signal must be selected. On the hardware side each input must be configured using jumpers in accordance with the selection.



**DANGER**

#### ***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.***



**NOTICE**

***All analog inputs are configured for 4-20 mA by default.***



**NOTICE**

***If input signal do not correspond with hardware configuration, the device can be damaged. Check the hardware configuration of inputs before connecting them.***

Jumper positions according to input configuration are shown in Fig. 6.3

The location of the jumpers on the board is shown in Fig. 6.4.

To configure the input proceed as follows:

- remove the front housing
- set the jumpers according to Fig. 6.3, 6.4, using a thin tool (e.g. tweezers)
- put the front housing back.

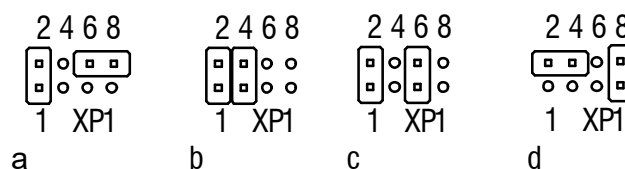


Fig. 6.3 Input configuration jumper positions  
a) 0-10 V, b) 4-20 mA, c) digital mode, d) 0-4000 ohm

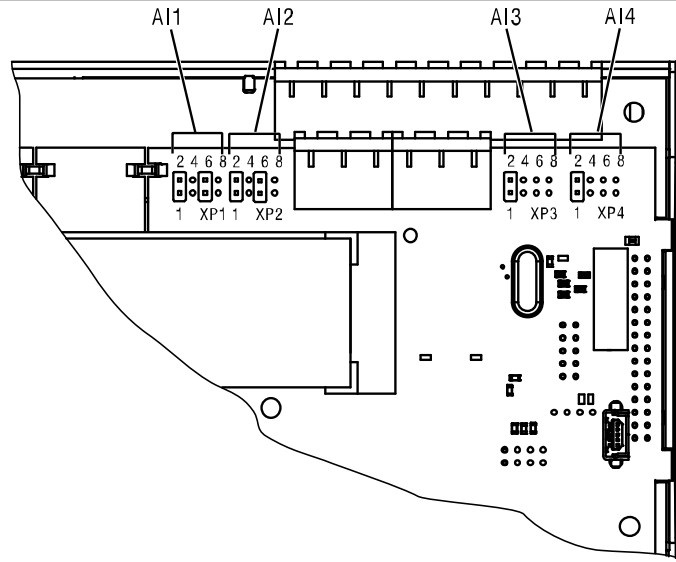


Fig. 6.4 Input configuration jumper location

There is a built-in shunt resistor of 121 ohm for measuring of 4-20 mA input signal in each channel.

To scale the input signal the lower and upper limit of measured value must be set. Scaling is not available if the signal 0-4000 ohm is selected. In that case the measured value is represented only as REAL32.

The parameter 'Decimal places' (dp) has to be set to determine the accuracy, if the measured value is transmitted over Modbus as integer. The parameter is not available if the signal 0-4000 ohm is selected.

The resistance input is designed for 2 wire sensors. The effect of lead resistance can be compensated in the application logic.

### 6.1.2 Digital mode

Input operates as a comparator with parameters Logical 0 and Logical 1, which determine the hysteresis (Fig. 6.5) and can be set in the range of 0...10 V.

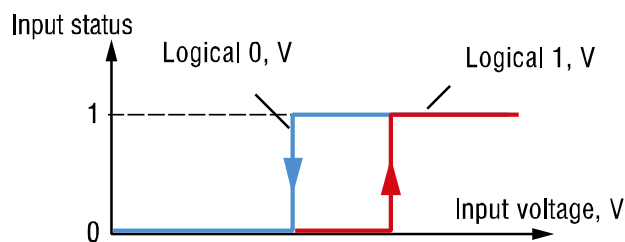


Fig. 6.5 Digital mode

### 6.1.3 Analog input filtering

The input filter is designed to steady the input reading. The input filter setting is a time constant in milliseconds. It is the time interval within which the signal reaches 0.63 of the measured value.

The time constant for each input can be set within the range of 0.01...60 s with the increment of 0.001 second.

The greater the time constant is, the higher the damping of interference signal and the slower the response to rapid changes of the input value are.

## Configuration

---

### 6.2 Analog outputs AO1, AO2

The PR200-230(24).2 has two analog outputs 4-20 mA, the PR200-230(24).4 has two analog outputs 0-10 V.

Assign to the output the value of type REAL32 within the range 0...1 to control it.

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.



### 6.3 Display elements

Different display elements can be created in the application. To switch between two display elements a jump condition has to be created. Jump condition can be an event of a function button or of a variable. For further details about display elements and jump conditions see 'akYtec ALP Help'.

See section 5.1 'Menu navigation' for display navigation.

When assigning a jump condition to the function button, don't forget that the user function will have a higher priority than the system function.

#### Example:

If the  and  buttons are used as a jump condition for a certain display, it will be impossible to use them to scroll the lines inside this display.

### 6.4 Auto Precision

Auto Precision function enables to display a REAL variable most precisely for the set number of reserved characters. To use the option select a display element with an associated variable of REAL type. Select 'AUTO' for the parameter 'Decimal digits' in the Property Box.

#### Example:

To display the variable VAR1 are 4 digits with Auto Precision reserved. The value of 1.546745 will be displayed as 1.547 (rounded). When the value got changed to 110.478696, it will be displayed as 110.5.



## Installation

### 7 Installation

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



**WARNING**

***Improper installation can cause serious or minor injuries or device damage. Installation must be performed only by fully qualified personnel.***

#### 7.1 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. 7.2 'Wiring' 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, and then remove relay from the rail.

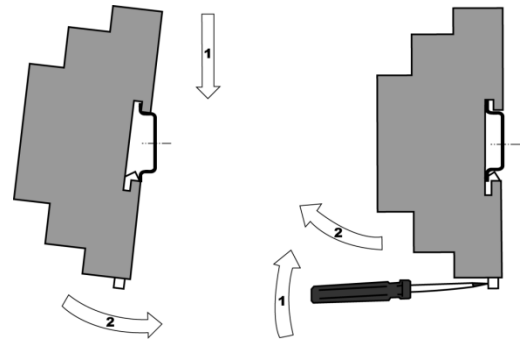


Fig. 7.1

#### 7.2 Wiring



**DANGER**

***Dangerous voltage***

***Electric shock could kill or seriously injure.***

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

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

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



**WARNING**

***The application runs after transferring it to the relay. It is recommended to transfer the application before wiring the relay.***

***Otherwise ensure that all external devices are disconnected from outputs before transferring the application.***



**WARNING**

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



**NOTICE**

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



**NOTICE**

***Only shielded cable can be used for the signal lines.***

- PR200 can be powered from AC or DC voltage, depends on modification.
- If supply voltage is lower than 19 V DC, the device cannot operate properly but will not be damaged.



**NOTICE**

***Supply voltage may not exceed 30 V. If supply voltage is higher than 30V DC, the device can be damaged.***

- Terminal assignment is given in Tables 7.1, 7.2 and layouts of terminal blocks are shown in Appendix B
- Electrical connections for inputs and outputs are given in Fig. 7.2 – 7.7

## Installation

- Maximum conductor cross-section is 0.75 mm<sup>2</sup>

### 7.2.1 Inputs

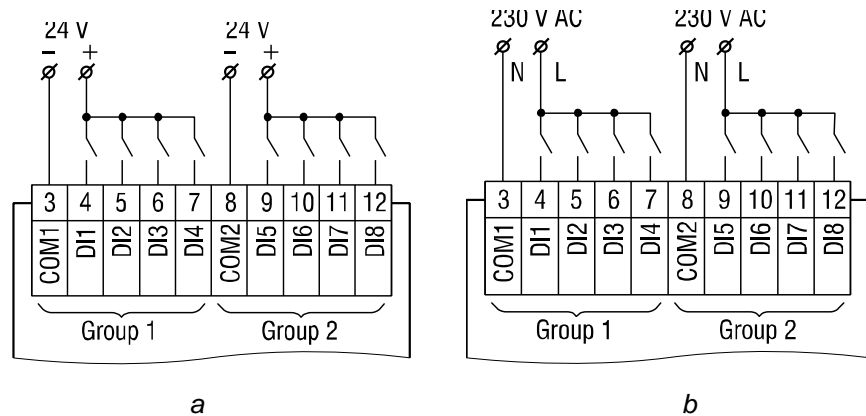


Fig. 7.2 Connecting switch contacts to digital inputs: a) PR200-24, b) PR200-230

### RR200-230 (AC power supply)

► NOTICE

The digital inputs are divided into two groups, each of four inputs. Within a group all inputs must be operated on the same phase. Different phases are allowed only between the groups.

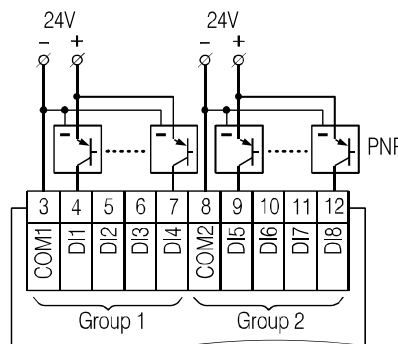
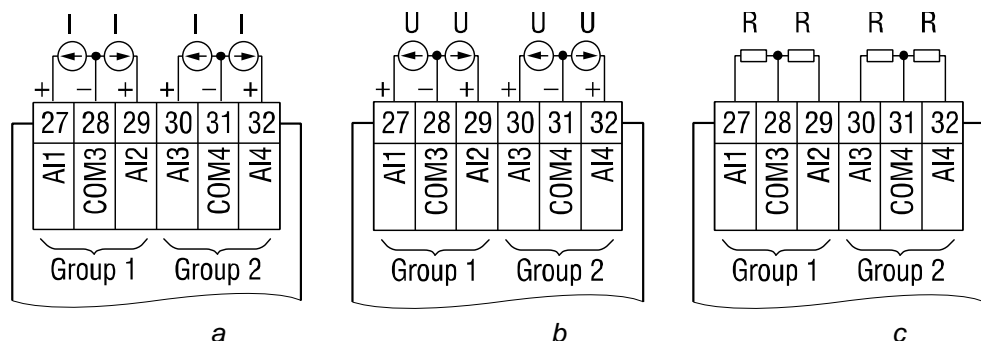


Fig. 7.3 Connecting 3-wire sensors with PNP transistor outputs (PR200-24 only)

For PR200-24 it is allowed to connect sensors with switch contact and transistor outputs within the same group. One voltage source can be used for two input groups. The integrated voltage source 24 V can be used for all inputs.



7.4 Wiring of analog inputs: a) 4-20 mA, b) 0-10 V, c) 0-4000 ohm

Different sensors can be connected within a group (AI1/AI2 or AI3/AI4). For example, AI1 can be configured as a digital input and AI2 as an analog input 4-20 mA.

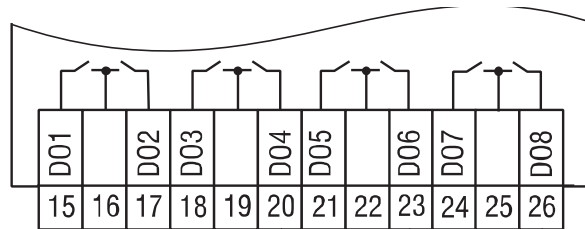


Fig.7.5 Relay outputs

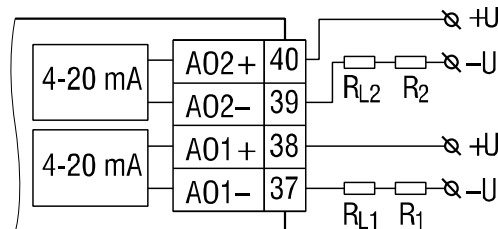


Fig. 7.6 Wiring of analog outputs 4-20 mA (PR200-X.2)

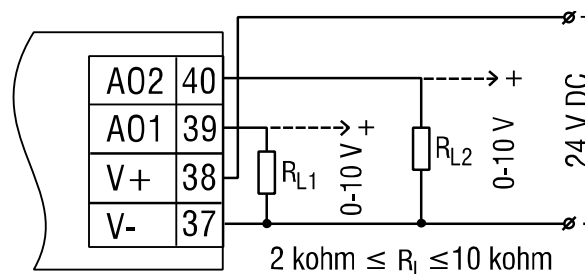


Fig. 7.7 Wiring of analog outputs 0-10 V (PR200-X.4)

► **NOTICE**

**The voltage of an external voltage source may not exceed 30 V.**

The integrated voltage source can be used for analog output 4-20 mA or 0-10 V.

An external load resistor  $R_L$  is required. The value of resistance  $R_L$  depends on supply voltage and can be determined from the diagram in Fig. 7.8. If a measuring resistance  $R_M$  is used for current measurement and  $R_M < R_L$ , then an additional load resistance  $R$  shall be used for current limitation. Resistance  $R$  can be determined as follows:

$$R = R_L - R_M$$

Example 1

$$U = 12 \text{ V}, R_L = R_M = 100 \text{ ohm}$$

Example 2

$$U = 24 \text{ V}, R_L = 700 \text{ ohm}, R_M = 100 \text{ ohm}, R = 600 \text{ ohm}$$

The used resistance may differ from the calculated value by no more than  $\pm 10\%$ .  
 The external voltage for the output 0-10 V may not exceed the range of 15...30 V.  
 The load resistance  $R_L$  may not exceed the range of 2...10 kohm.  
 This type of output can be also powered from integrated voltage source 24V.

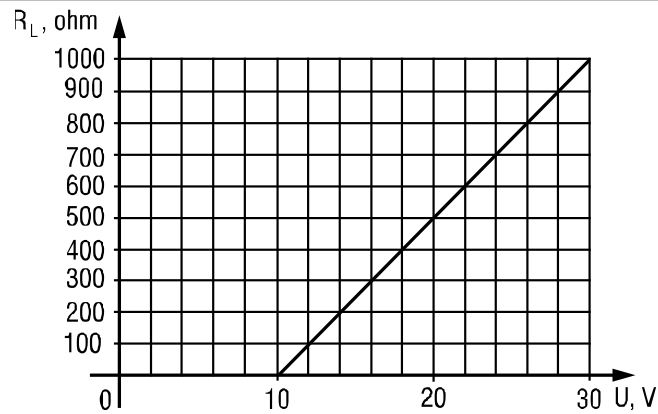


Fig. 7.8 Load resistance determination

Table 7.1 Terminal assignment

| No | Name               | Function                             |
|----|--------------------|--------------------------------------|
| 1  | AC230V L / DC24V - | Power supply AC / DC *               |
| 2  | AC230V N / DC24V + | Power supply AC / DC *               |
| 3  | COM1               | Common minus DI1...DI4               |
| 4  | DI1                | Digital input DI1                    |
| 5  | DI2                | Digital input DI2                    |
| 6  | DI3                | Digital input DI3                    |
| 7  | DI4                | Digital input DI4                    |
| 8  | COM2               | Common minus DI5...DI8               |
| 9  | DI5                | Digital input DI5                    |
| 10 | DI6                | Digital input DI6                    |
| 11 | DI7                | Digital input DI7                    |
| 12 | DI8                | Digital input DI8                    |
| 13 | OUT 24V+           | 24 V DC integrated voltage source ** |
| 14 | OUT 24V-           | 24 V DC integrated voltage source ** |
| 15 | DO1                | Digital output DO1                   |
| 16 | -                  | Common contact DO1...DO2             |
| 17 | DO2                | Digital output DO2                   |
| 18 | DO3                | Digital output DO3                   |
| 19 | -                  | Common contact DO3...DO4             |
| 20 | DO4                | Digital output DO4                   |
| 21 | DO5                | Digital output DO5                   |
| 22 | -                  | Common contact DO5...DO6             |
| 23 | DO6                | Digital output DO6                   |
| 24 | DO7                | Digital output DO7                   |
| 25 | -                  | Common contact DO7...DO8             |
| 26 | DO8                | Digital output DO8                   |
| 27 | AI1                | Analog input AI1                     |
| 28 | COM3               | Common minus AI1...AI2               |
| 29 | AI2                | Analog input AI2                     |
| 30 | AI3                | Analog input AI3                     |
| 31 | COM4               | Common minus AI3...AI4               |
| 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 |                    | see Table 7.2                        |
| 38 |                    | see Table 7.2                        |
| 39 |                    | see Table 7.2                        |
| 40 |                    | see Table 7.2                        |

\* Depending on device modification (PR200-230 or PR200-24)

\*\* PR200-230 only

## Installation

Table 7.2 Terminals 37-40

| No                       | Name | Function                       |
|--------------------------|------|--------------------------------|
| <b>PR200-230(24).2.2</b> |      |                                |
| 37                       | AO1- | Analog output AO1<br>(4-20 mA) |
| 38                       | AO1+ |                                |
| 39                       | AO2- | Analog output AO2<br>(4-20 mA) |
| 40                       | AO2+ |                                |
| <b>PR200-230(24).4.2</b> |      |                                |
| 37                       | V-   | -24 VDC                        |
| 38                       | V+   | +24 VDC                        |
| 39                       | AO1  | Analog output AO1<br>(0-10 V)  |
| 40                       | AO2  | Analog output AO2<br>(0-10 V)  |

### 7.3 Quick replacement

PR200 is equipped with plug-in terminal blocks which enable quick replacement of the device without disconnecting the existing wiring (Fig. 7.9).

To replace the device:

- power off all connected lines including power supply
- remove all detachable parts of the terminal blocks
- replace PR200
- connect detachable parts with existing wiring to the device

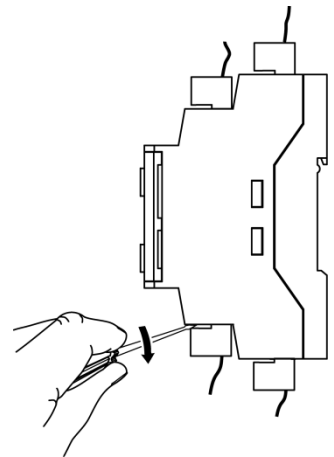


Fig. 7.9 Quick replacement

## Maintenance

---

### 8 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)

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

► NOTICE

***Spare parts***

***Use of unsuitable spare parts can cause property damage.***

***Spare parts must meet the technical requirements of the device manufacturer.***

***Use only original spare parts from the manufacturer!***

## Transportation and storage

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### 9 Transportation and storage

Pack the device in such a way as to protect it reliably against impact for storage and transportation. The original packaging provides optimum protection.

If the device is not taken immediately after delivery into operation, it must be carefully stored at a protected location. The device should not be stored in an atmosphere with chemically active substances.

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

▶ 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!***

**Scope of delivery**

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**10 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 |



Appendix A. Dimensions

Appendix A. Dimensions

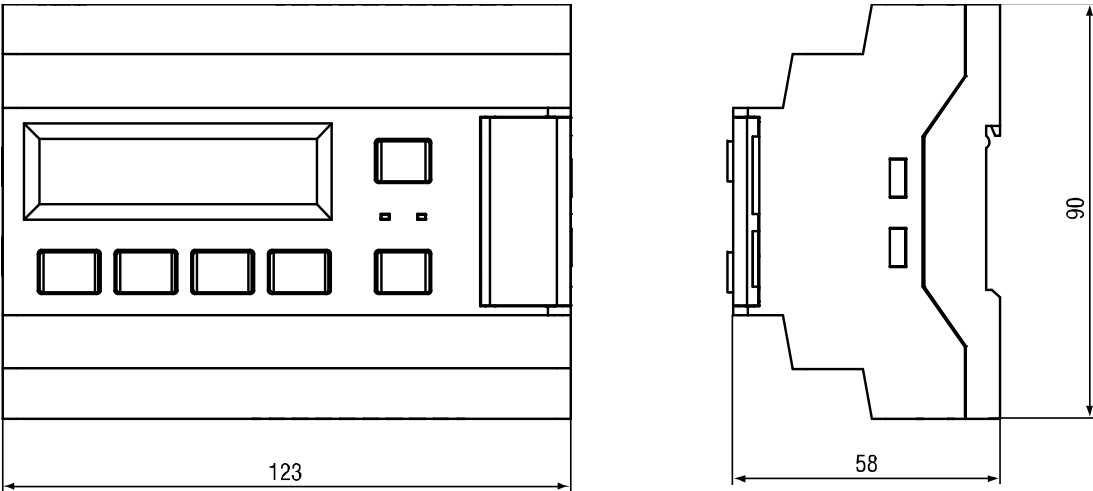


Fig. A.1

Appendix B. Terminal layouts

Appendix B. Terminal layouts

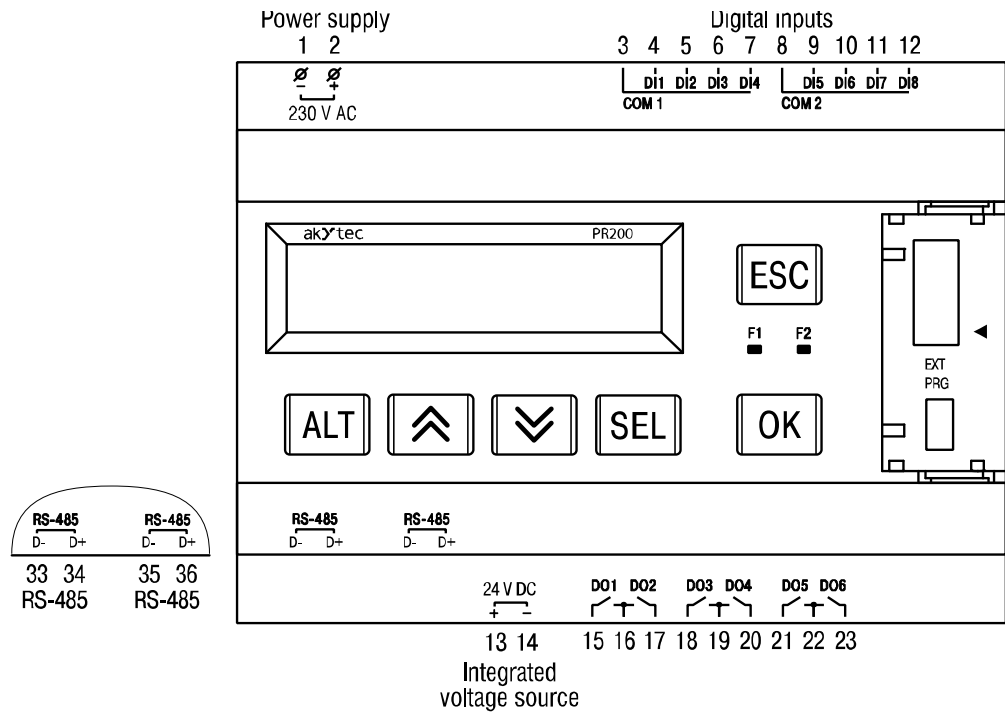


Fig. B.1 PR200-230.1.2

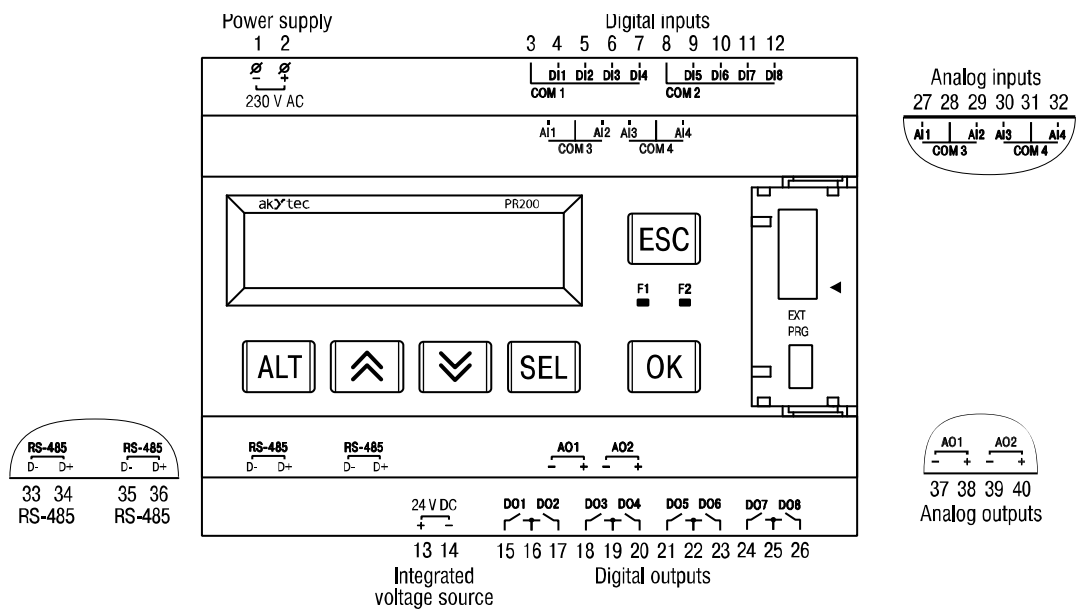


Fig. B.2 PR200-230.2.2

Appendix B. Terminal layouts

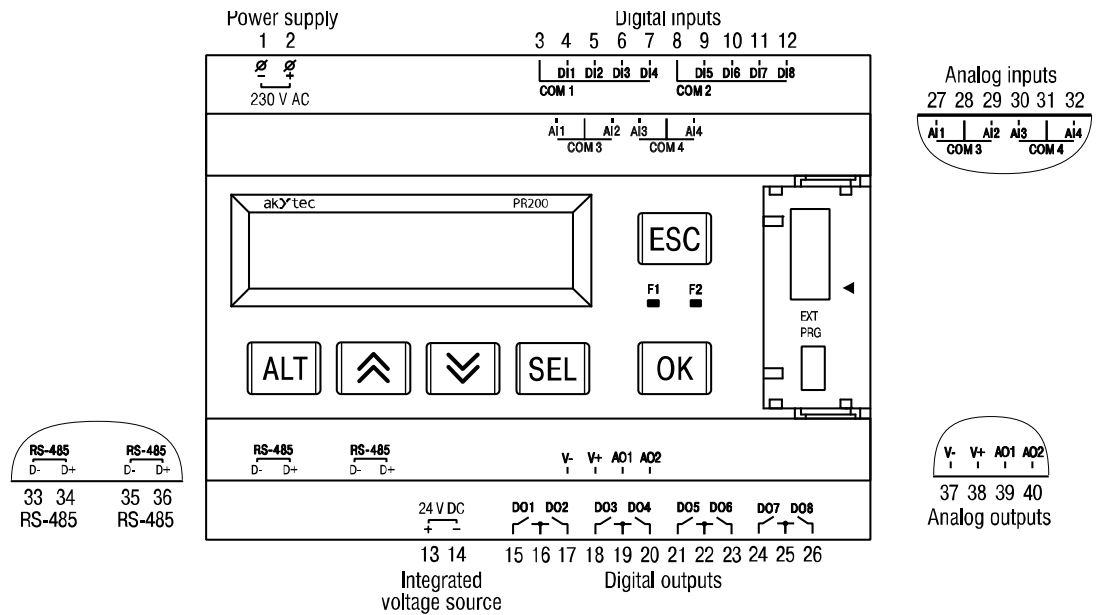


Fig. B.3 PR200-230.4.2

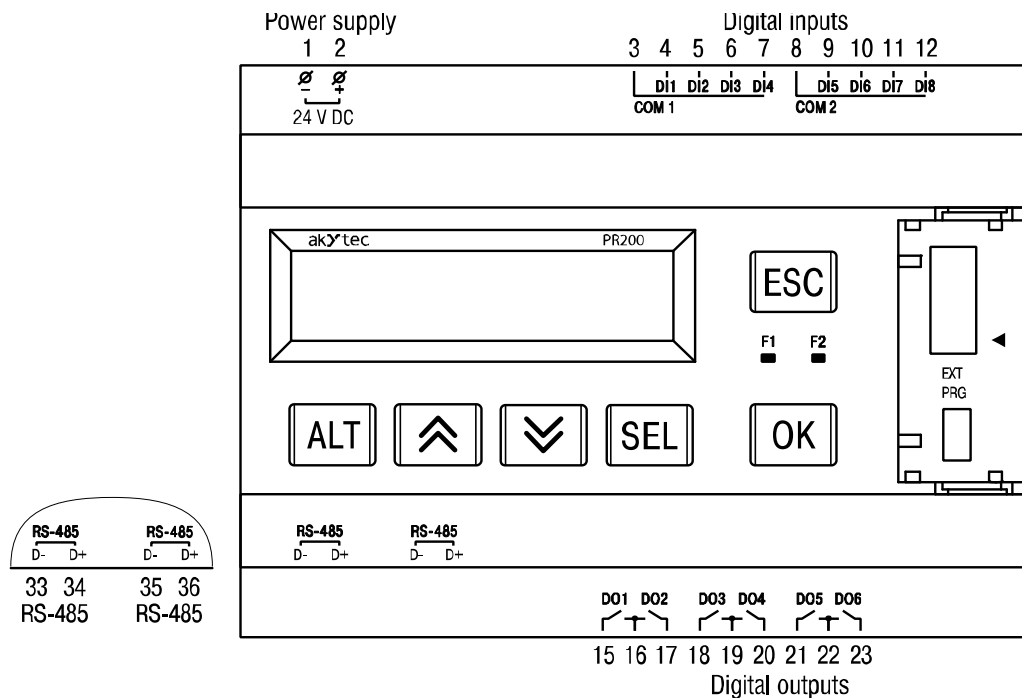


Fig. B.4 PR200-24.1.2

Appendix B. Terminal layouts

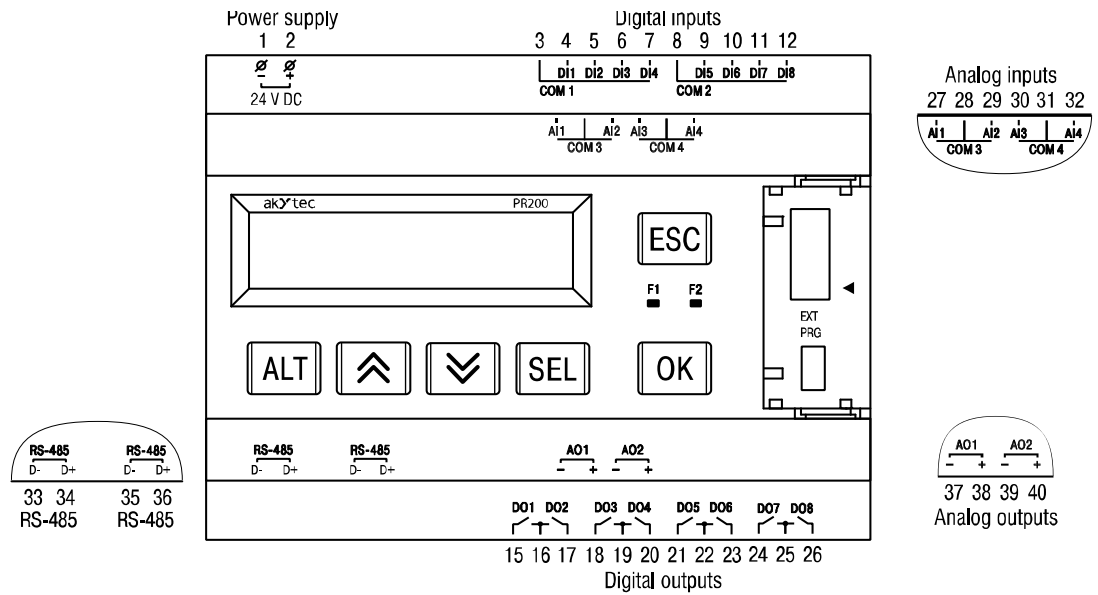


Fig. B.5 PR200-24.2.2

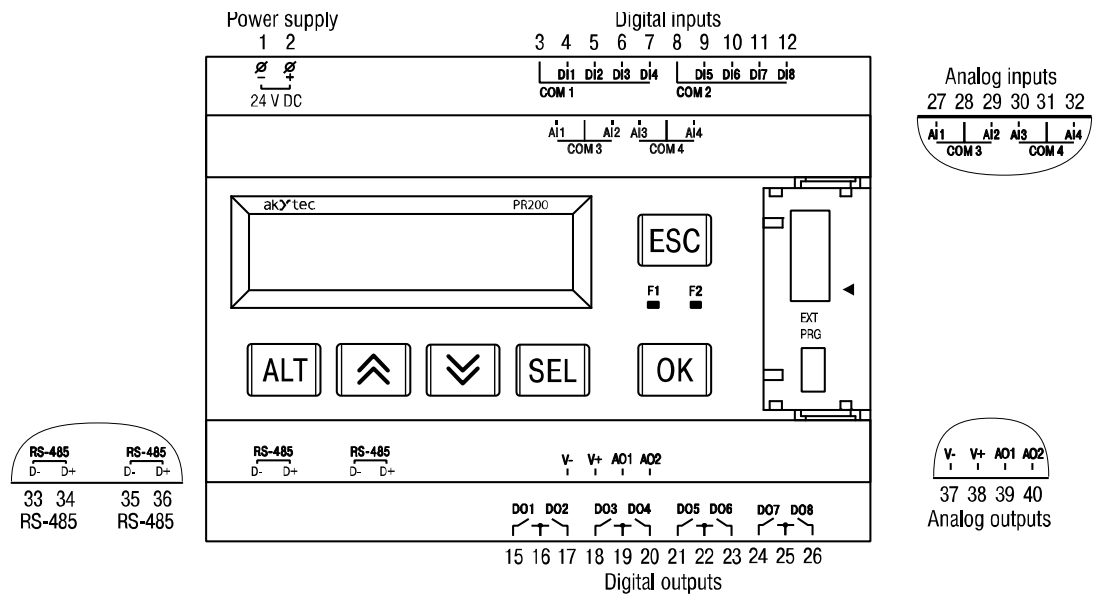


Fig. B.6 PR200-24.4.2

Appendix C. Galvanic isolation

Appendix C. Galvanic isolation

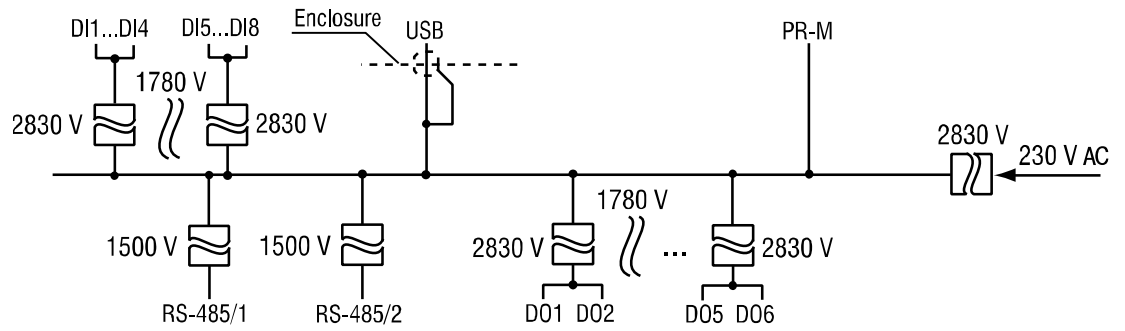


Fig. C.1 Galvanic isolation of PR200-230.1

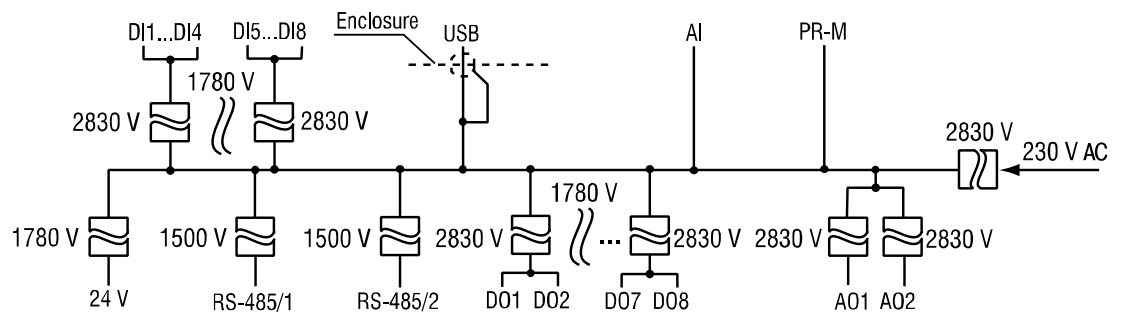


Fig. C.2 Galvanic isolation of PR200-230.2

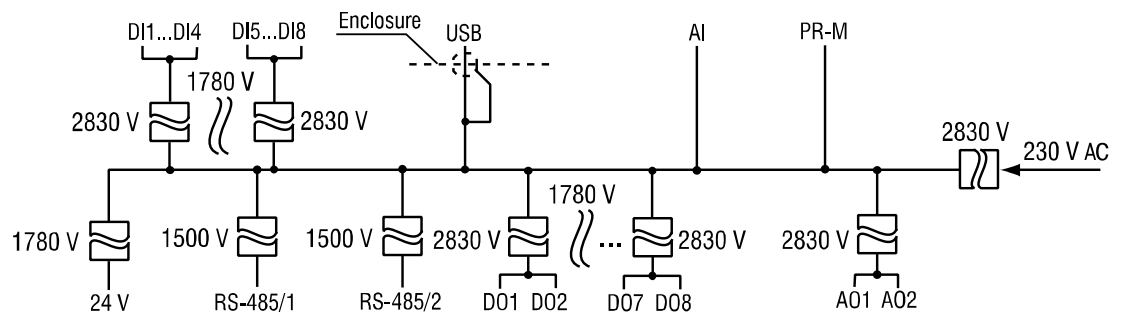


Fig. C.3 Galvanic isolation of PR200-230.4

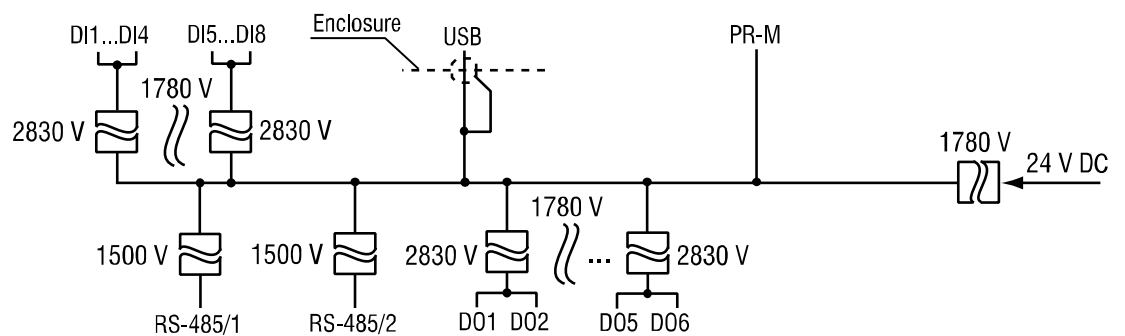


Fig. C.4 Galvanic isolation of PR200-24.1

Appendix C. Galvanic isolation

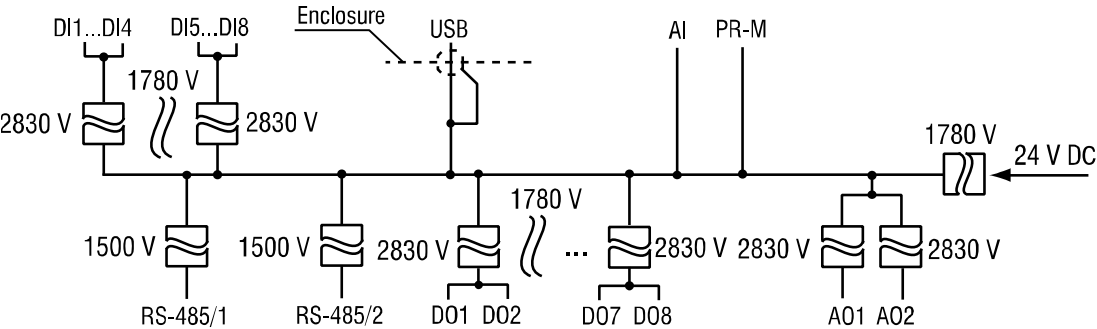


Fig. C.5 Galvanic isolation of PR200-24.2

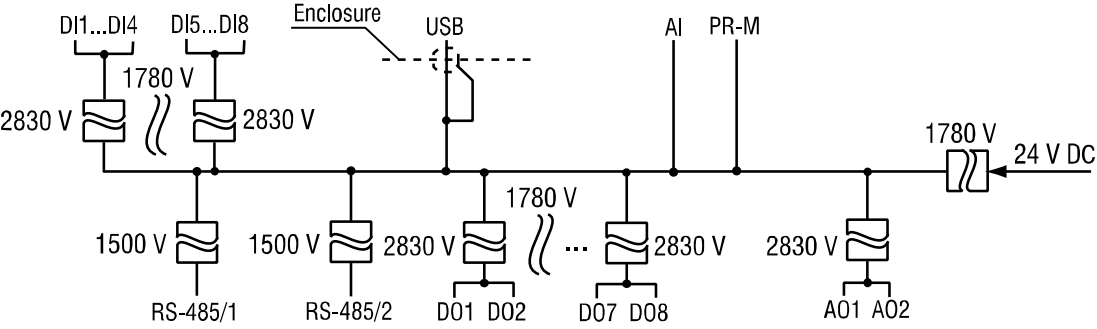


Fig. C.6 Galvanic isolation of PR200-24.4

Appendix D. Circuit diagrams

Appendix D. Circuit diagrams

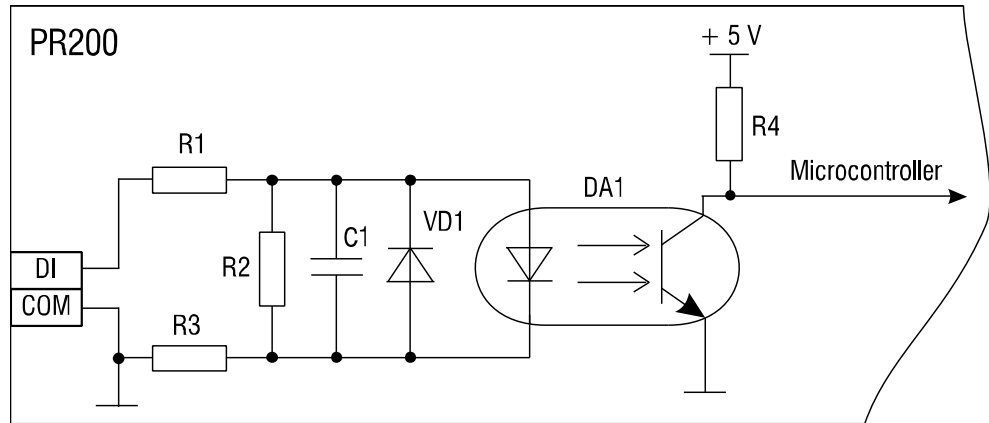


Fig. D.1 PR200-230 digital input circuit diagram

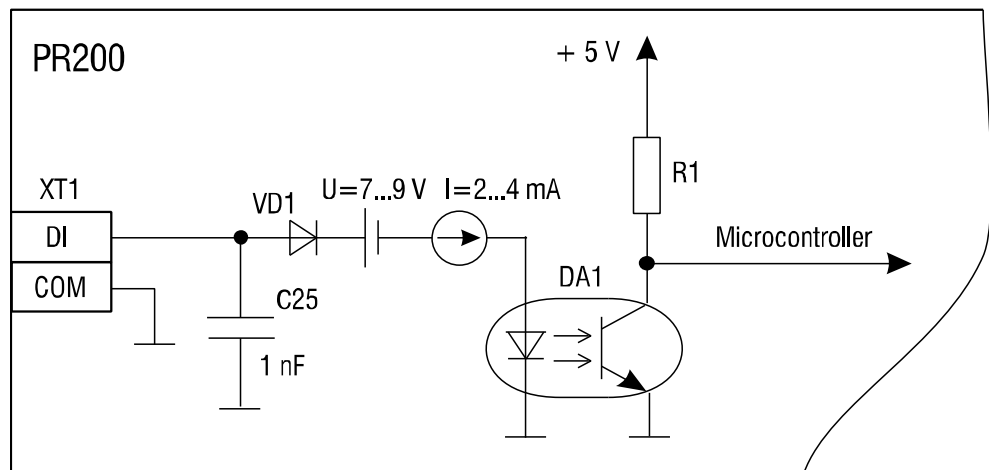


Fig. D.2 PR200-24 digital input circuit diagram

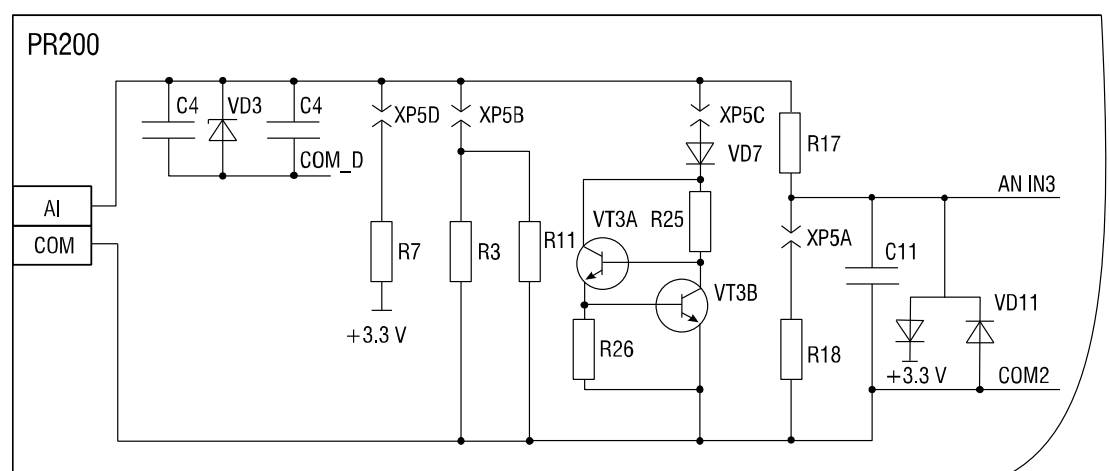


Fig. D.3 Analog input circuit diagram

Appendix E. Connection to PC

Appendix E. Connection to PC

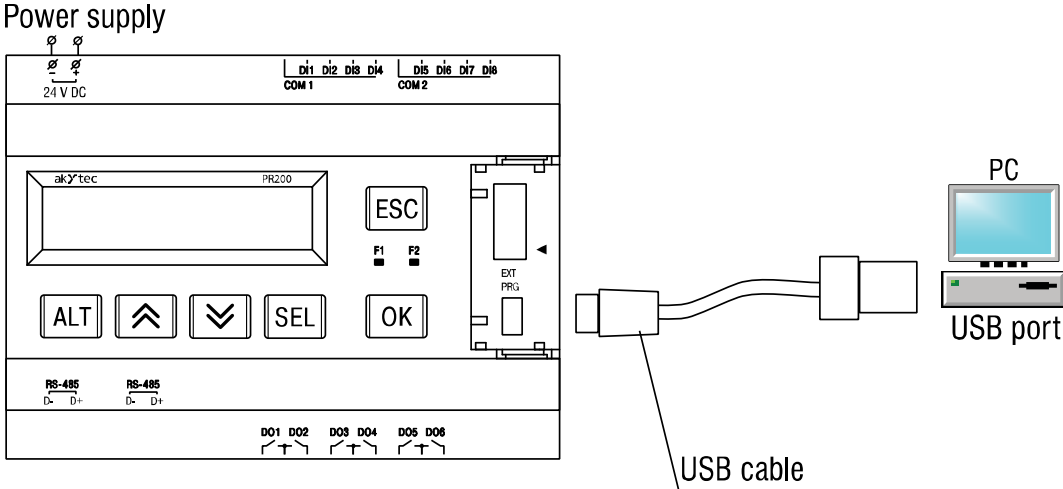


Fig. E.1 Connection to PC



## Appendix F. Calibration

### Appendix F. Calibration

#### F.1 General

Calibration should be carried out to restore the accuracy of the device

#### ► NOTICE

***Calibration must be performed only by fully qualified personnel.***

- Calibration is performed using the reference signal source connected to the contacts of the device. During the calibration the ratio between the input signal and the device reference voltage is calculated.
- The calculated calibration coefficients are stored to non-volatile memory of the device and used as a base for all calculations.
- Each analog input has its own calibration coefficients for each sensor type.
- If for some reasons the calculated coefficient exceeds the limits, error cause will be displayed.

#### F.2 Analog input

Calibration for input signal 4-20 mA, 0-10 V, 0-4000 ohm

1. Connect the reference voltage source of accuracy class at least 0.05 to the input AI1 (Fig. F.1).
2. Start ALP software, select menu item *Device>Calibration*, in the opened dialogue box select 'Analog inputs' (Fig. F.2)
3. Select the input signal.
4. Set the three curve points for calibration, the filter time constant and select the channel (Fig. F.3). Increasing the filter time constant increases the time of calibration but provides a more precise calibration coefficients. Each channel is calibrated individually. If 'All channels' is selected, all four channels will be calibrated, so it is necessary to select the appropriate curve points for all channels at once.
5. Click 'Next' to continue and follow the instructions.

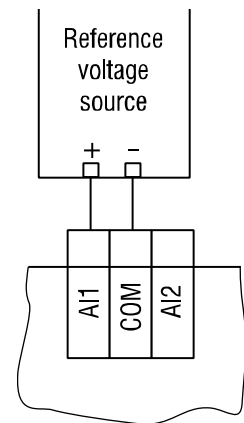


Fig. F.1

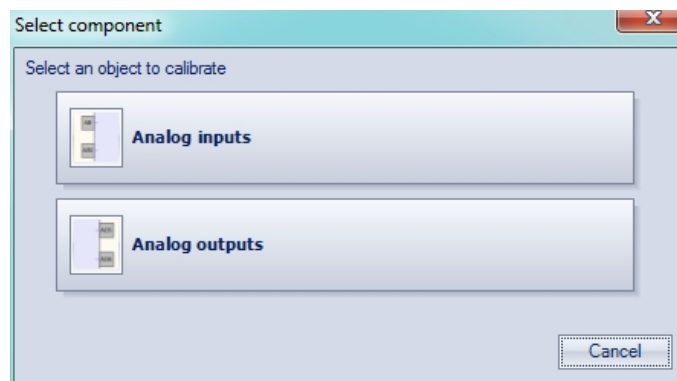


Fig. F.2

Appendix F. Calibration

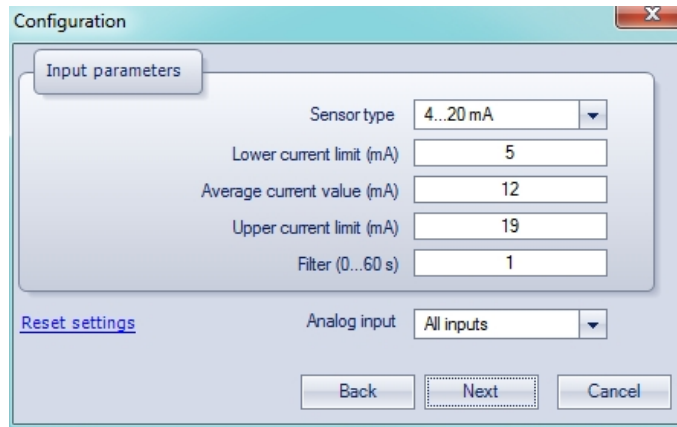


Fig. F.3

F.2 Analog output 4-20 mA

1. Connect the reference resistance box of accuracy class at least 0.05 to the Output AO1 (Fig. F.4).
2. Ensure the supply voltage is within the range 15...28 V.
3. The measuring device should be of resolution 0.001 V.
4. Set the reference resistance box to 500 ohm.
5. Start ALP software, select menu item *Device>Calibration*, in the opened dialogue box select *Analog outputs* (Fig. F.2)
6. Click 'Next' to continue and follow the instructions.
7. The output current should be calculated from the measured output voltage and entered in the displayed field.

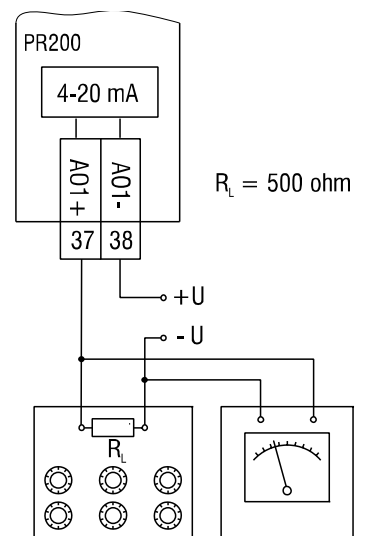


Fig. F.4

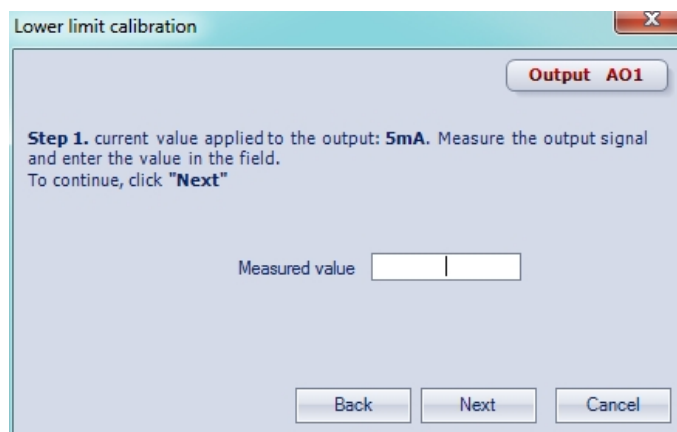


Fig. F.5

## Appendix G. Battery replacement

### Appendix G. Battery replacement



**DANGER**

#### *Dangerous voltage*

*The voltage on some components of the circuit board can be dangerous. Direct contact with the circuit board must be avoided.*

*Operation must be performed only by fully qualified personnel.*

1. Remove the front housing with the keypad (Fig. G.1)
2. Use a screwdriver to pry the top board near the USB connector and carefully separate it from the middle board. (Fig. G.2).
3. Turn over the top board, pry and pull out of the nest the CR2032 battery using a screwdriver (Fig. G.3).
4. Install a new battery
5. Perform the disassemble operations in reverse order to assemble the device.

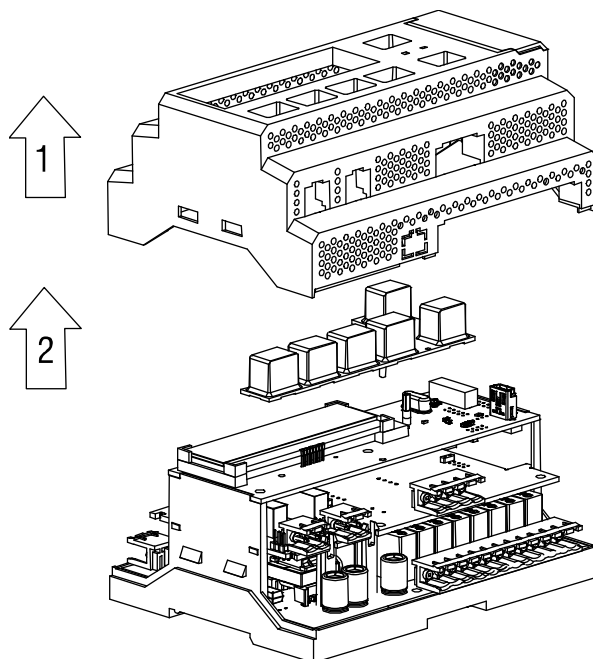


Fig. G.1 Front housing removing

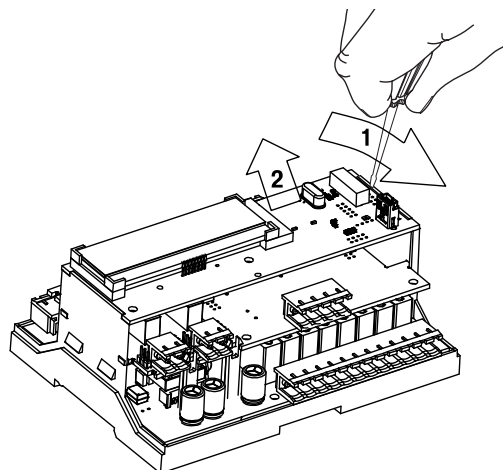


Fig. G.2 Top circuit board removing

Appendix G. Battery replacement

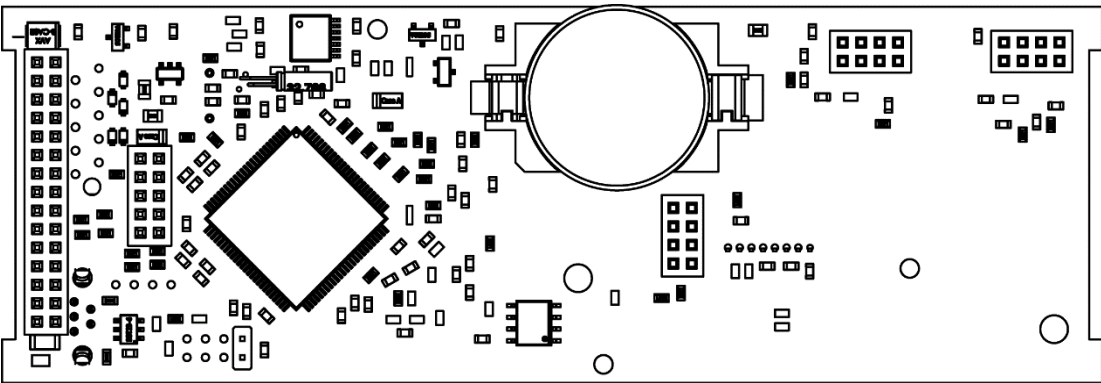


Fig. G.3 Back side view of the top board

## Appendix H. Interface card installation

### Appendix H. Interface card installation



DANGER

#### *Dangerous voltage*

*The voltage on some components of the circuit board can be dangerous. Direct contact with the circuit board must be avoided.*

*Operation must be performed only by fully qualified personnel.*

1. Remove the top cover with the keypad (Fig. G.1).
2. Use a screwdriver to pry the top board near the USB connector and carefully separate it from the middle board. (Fig. G.2, H.1a).
3. Cut an opening in the enclosure for the card terminal and mount the card on the mounting pins (Fig. H.1b).
4. Perform the disassemble operations in reverse order to assemble the device.

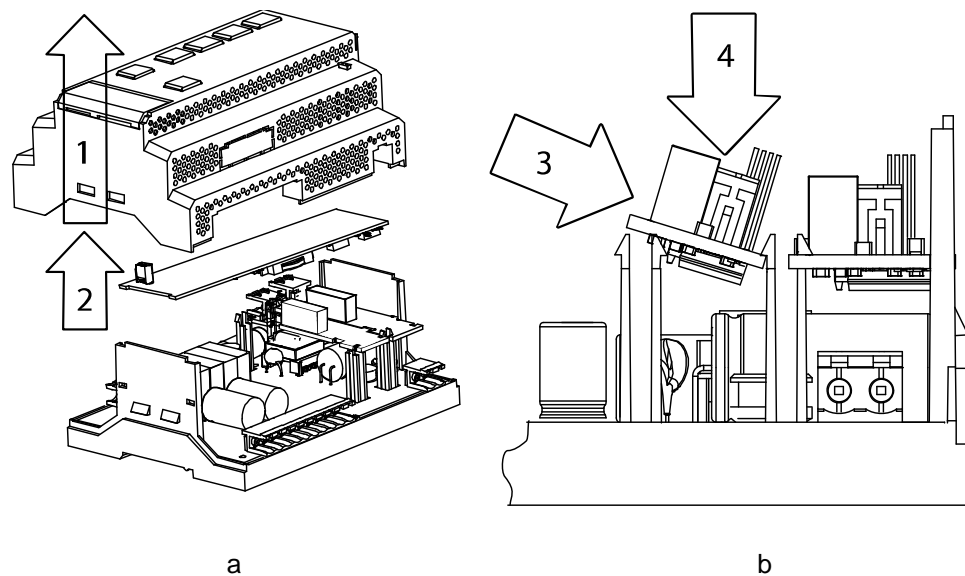


Fig. H.1