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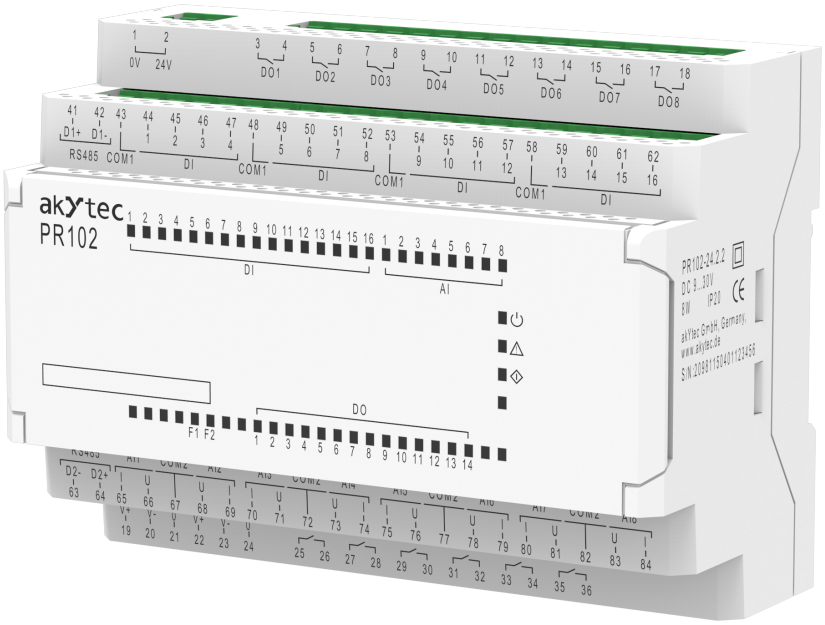

PR102.24.2.2

Programmable relay

User guide

PR102.24.2.2_3-EN-83550-1.6

Contents

1 Introduction

This manual describes the functions, configuration, operating instructions, programming and troubleshooting of the multifunctional programmable relay PR102 (hereinafter referred to as PR102, device, or relay).

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***)
- **NTC** – negative temperature coefficient sensor
- **Project** – user application created in ALP software that also includes the device configuration
- **PTC** – positive temperature coefficient sensors
- **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

Programmable relays of PR100 series have been designed and built solely for the intended use described in this manual, and may only be used accordingly. The technical specifications contained in this manual must be observed. Only by akYtec GmbH recommended extension modules may be connected to the relay.

The relay may be operated only in properly installed condition.

Improper use

Any other use is considered improper. Especially to note:

- This device should not be used for medical devices which receive, control or otherwise affect human life or physical health.
- The device should not be used in an explosive environment.

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

2 Overview

The programmable relay PR102 is a small controller, developed for automated control systems in industry, agriculture, building technology and household applications.

User program is created as a function plan with the ALP programming software, which is available for free download.

The ALP project includes not only the program but also the device configuration.

The PR102 enables the following basic functions:

– programming and configuration using ALP software
– digital / analog input signal processing
– digital / analog output control
– master or slave in Modbus network over RS485 interface
– real-time clock

The analog inputs can be also used as digital inputs (Sect. 4.3.2).

The device is designed in a plastic enclosure for DIN rail mounting. The enclosure has 3-level stepped form for the installation in switchboards.

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

3 Specifications

3.1 Specification tables

Table 3.1 General specification

Power supply		24 (9…30) V DC
Power consumption, max.		8 W
Galvanic isolation		no
Reverse polarity protection		yes
Inputs	Digital	16
	Analog	8
Outputs	Digital	14
	Analog	2
Network interface		2 × RS485
Protocol		Modbus-RTU, Modbus-ASCII
Mode		Master/Slave
Baud rate		9.6…115.2 kbit/s
Galvanic isolation		1500 V / 1 s
Extension modules		up to 2 PRM
Real-time clock accuracy		± 3 s / day
Backup battery		CR2032
Dimensions (with terminal blocks)		123 × 108 × 58 mm
Mounting		DIN-rail (35 mm)
Weight		approx. 350 g

Table 3.2 Digital inputs

HIGH level	8.5…30 V / 2…5 mA
LOW level	-3…+5 V / 0…15 mA
Pulse length, min.	5 ms
Response time, max.	30 ms
Pulse frequency, max.	200 Hz
Galvanic isolation	no

Table 3.3 Analog inputs

ADC resolution		12 bit
Sampling time, max.		1 ms
Galvanic isolation		no
Analog mode 1 (Linear input)		
Input signal		0-10 V, 4-20 mA, 0-300 kΩ
Input resistance for 0-10 V input		10 kΩ
Basic error		±0.5 %
Temperature influence		±0.5 % / 10 °C
Analog mode 2 (Temperature sensors)		
Input signal		see Tab. 3.4
Least significant bit value, max.		1 °C
Basic error	PTC thermistors	±1.5 %
	NTC thermistors	±1.0 %
Temperature influence		±0.5 % / 10 °C
Digital mode		
Nominal input voltage		24 V DC
HIGH/LOW threshold (adjustable in ALP)		2.5…10 V
LOW/HIGH threshold (adjustable in ALP)		3…10.5 V
Pulse length, min.		5 s
Signal frequency, max.		100 Hz

Table 3.4 Sensors (analog mode 2)

Sensor	Measurement range
RTD	
Pt 500 (α = 0.00385 °C⁻¹)	–200…+850 °C
500P (α = 0.00391 °C⁻¹)	–200…+850 °C
Cu 500 (α = 0.00426 °C⁻¹)	–50...+200 °C
500M (α = 0.00428 °C⁻¹)	–180...+200 °C
Ni500 (α = 0.00617 °C⁻¹)	–60...+180 °C
Cu 1000 (α = 0.00426 °C⁻¹)	–50...+200 °C
1000M (α = 0.00428 °C⁻¹)	–180...+200 °C
Pt 1000 (α = 0.00385 °C⁻¹)	–200...+850 °C
1000P (α = 0.00391 °C⁻¹)	–200...+850 °C
Ni 1000 (α = 0.00617 °C⁻¹)	–60...+180 °C
Thermistors / NTC	
B57861S series, 2 kΩ, $B_{25/100}$ = 3560K	–55…+100 °C
B57861S series, 3 kΩ, $B_{25/100}$ = 3988K	–55…+145 °C
B57861S series, 5 kΩ, $B_{25/100}$ = 3988K	–35…+145 °C
B57861S series, 10 kΩ, $B_{25/100}$ = 3988K	–35…+155 °C
B57861S series, 30 kΩ, $B_{25/100}$ = 3964K	–20…+155 °C
B57861S series, 50 kΩ, $B_{25/100}$ = 3760K	–10…+155 °C
NTC 3435, 10 kΩ	–40…+105 °C
NTC 3977, 10 kΩ	–40…+125 °C
Thermistors / PTC	
KTY82-110	–55…+150 °C
KTY82-120	
KTY82-121	
KTY82-122	
KTY82-150	
KTY82-151	

Table 3.5 Digital outputs

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
Service life, electrical	AC	200,000 switching cycles
	DC	100,000 switching cycles
Galvanic isolation		individual
between outputs		1780 V / s
against other circuits		2300 V / s

Table 3.6 Analog outputs

Output signal		4-20 mA, 0-10 V
External voltage supply		15…30 V
Basic error, max.		±0.5%
Temperature influence		±0.5% / 10°C
DAC resolution		12 bit
Load resistance	R_I (4-20 mA), max.	300 Ω
	R_U (0-10 V), min.	1 kΩ
Galvanic isolation		510 V / 1 s, individual

Table 3.7 Programming

Software	ALP
Interface	USB

Memory	ROM	128 kB
	RAM	32 kB
	Retain	1016 Byte
	Network variables	128 Byte
Program execution cycle, min.		1 ms

3.2 Operating conditions

The device is designed for natural convection cooling.
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 3.8 Operating conditions

Condition	Permissible range
Operating temperature	-40…+55 °C
Relative humidity	up to 80 % (at +25 °C, non-condencing)
Attitude	up to 2000 m above sea level
IP code	IP20
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 PR102 programming connector (Fig. 6.3, Pos. 4) to PC over a USB-to-microUSB 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. Make sure the indicator ⚠ shows no error.
5. Start ALP and ensure the device is detected correctly.
6. Open the configuration window using the menu item ***Device > Configuration*** or the toolbar icon  .
7. Configure the relay.
8. 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 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 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.

4.3 Analog inputs

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

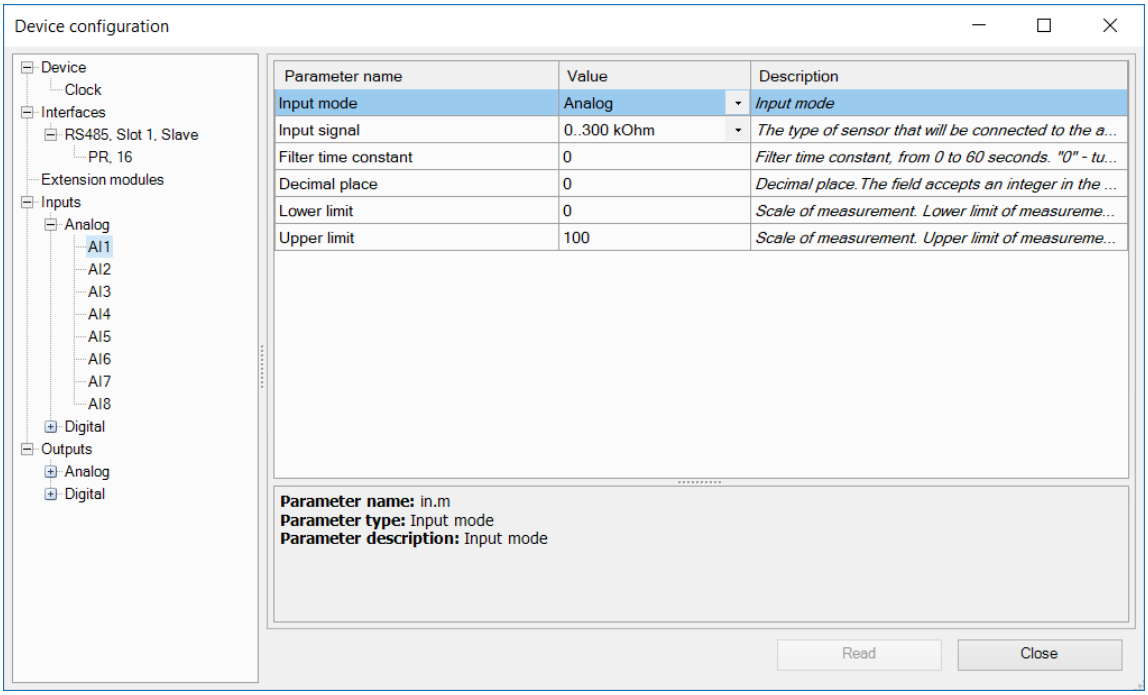

Fig. 4.1 Analog input configuration

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.

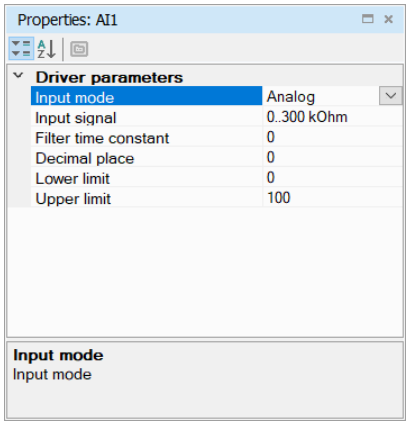

Fig. 4.2 Property Box for analog input

4.3.1 Analog mode

Configurable parameters:
– ***Input mode*** – select ***Analog***
– ***Analog filter*** – filter time constant (sect. 4.3.3)
– ***Input signal*** – linear signals (Tab. 3.2) or temperature sensors (Tab. 3.3)

With the option "4-20 mA", a 121 Ω shunt resistor is connected to each channel.

– ***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)*** – The input value is saved as REAL32 and INT16 in the device Modbus register. Decimal point offset determines the decimal point shift to the right while saving the input value as INT16. For instance: If the input value is 3.14 and the offset is 1, then 31 will be written in the INT16 register.

4.3.2 Digital mode

Configurable parameters:

– ***Input mode*** – select ***Digital***
– ***Debouncing 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 2.5…10 V and should be lower than HIGH level by at least 0.5 V
– ***HIGH*** – switching threshold from LOW to HIGH, can be adjusted in ALP in the range 3.0…10.5 V and should be higher than LOW level by at least 0.5 V

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

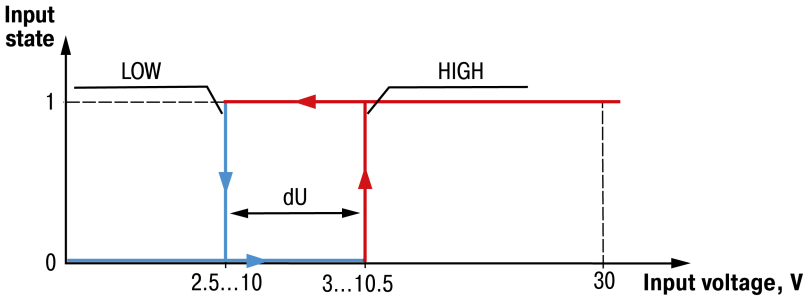

Fig. 4.3 Digital mode of an analog input

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 0.5 V.

4.3.3 Analog filter

The input filter stabilizes the input reading. The filter parameter 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…60 s for each input separately. The setting 0 disables the filter.

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.

4.4 Analog outputs

PR102 has two analog outputs. Output signal can be selected in ALP (Fig. 4.4).

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

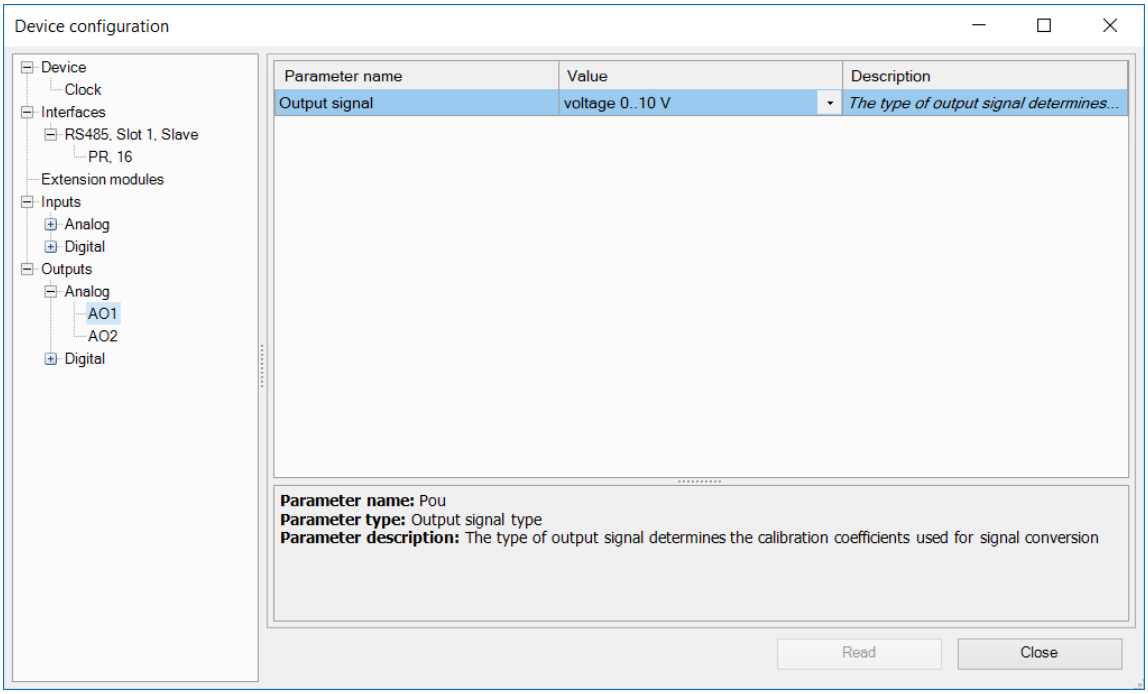

Fig. 4.4 Analog outputs configuration

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.

4.5 RS485 interface

PR102 uses the common standard RS485 for data exchange. RS485 serial interface is based on two-wire technology and half-duplex mode. Protocols Modbus RTU / ASCII are supported, with automatic protocol detection.

The network consists of a master device and up to 16 slaves. The maximum length is 1200 m. The number of slave devices and the network length can be increased using a RS485 interface repeater.

Devices are connected to a network according to linear (bus) topology. It means that the line goes from the first device to the second one, from the second one to the third one, etc. Star connections and spur lines are not allowed. Line reflections always occur at the open bus ends (the first and the last node). The higher the data transmission rate, the stronger they are. Terminating resistors are sometimes needed to minimize reflections. Experience proves that the most efficient practice is to use terminating resistors of 150 Ω.

The device has two RS485 interfaces and can be used as master or/and slave. For further information about Modbus working and RS485 interface configuration see ALP HELP.

4.5.1 Master mode

There can be only one master in Modbus network.

The following request methods are supported:

– time-controlled reading (Master parameter ***Interval between requests***)
– event-controlled reading / writing
– write by change (default)

PR102 as a master can control up to 16 slaves. Each slave can maintain up to 256 variables. It is allowed to use the same name and the same address for different slaves.

4.5.2 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 4.1.

Table 4.1 Modbus registers

Parameter	Data type	Modbus function	Address (hex)	Address (dec)	Access
DI1…DI16 status bitmask	BOOL	0x01, 0x02	0x1000-0x100F	4096–4111	R
	UINT16	0x03, 0x04	0x0100	256	R
AI1 REAL	REAL32	0x03, 0x04	0x0B00, 0x0B01	2816, 2817	R
AI2 REAL	REAL32	0x03, 0x04	0x0B02, 0x0B03	2818, 2819	R
AI3 REAL	REAL32	0x03, 0x04	0x0B04, 0x0B05	2820, 2821	R
AI4 REAL	REAL32	0x03, 0x04	0x0B06, 0x0B07	2822, 2823	R
AI5 REAL	REAL32	0x03, 0x04	0x0B08, 0x0B09	2824, 2825	R
AI6 REAL	REAL32	0x03, 0x04	0x0B0A, 0x0B0B	2826, 2827	R
AI7 REAL	REAL32	0x03, 0x04	0x0B0C, 0x0B0D	2828, 2829	R
AI8 REAL	REAL32	0x03, 0x04	0x0B0E, 0x0B0F	2830, 2831	R
AI1 INT*	UINT16	0x03, 0x04	0x0B80	2944	R
AI2 INT*	UINT16	0x03, 0x04	0x0B81	2945	R
AI3 INT*	UINT16	0x03, 0x04	0x0B82	2946	R
AI4 INT*	UINT16	0x03, 0x04	0x0B83	2947	R
AI5 INT*	UINT16	0x03, 0x04	0x0B84	2948	R
AI6 INT*	UINT16	0x03, 0x04	0x0B85	2949	R
AI7 INT*	UINT16	0x03, 0x04	0x0B86	2950	R
AI8 INT*	UINT16	0x03, 0x04	0x0B87	2951	R
AI1 DP INT*	UINT16	0x03, 0x04	0x0BC0	3008	R
AI2 DP INT*	UINT16	0x03, 0x04	0x0BC1	3009	R
AI3 DP INT*	UINT16	0x03, 0x04	0x0BC2	3010	R
AI4 DP INT*	UINT16	0x03, 0x04	0x0BC3	3011	R

Parameter	Data type	Modbus function	Address (hex)	Address (dec)	Access
AI5 DP INT*	UINT16	0x03, 0x04	0x0BC4	3012	R
AI6 DP INT*	UINT16	0x03, 0x04	0x0BC5	3013	R
AI7 DP INT*	UINT16	0x03, 0x04	0x0BC6	3014	R
AI8 DP INT*	UINT16	0x03, 0x04	0x0BC7	3015	R
AI1 status (digital mode)	BOOL	0x01, 0x02	0x1010	4112	R
AI2 status (digital mode)	BOOL	0x01, 0x02	0x1011	4113	R
AI3 status (digital mode)	BOOL	0x01, 0x02	0x1012	4114	R
AI4 status (digital mode)	BOOL	0x01, 0x02	0x1013	4115	R
AI5 status (digital mode)	BOOL	0x01, 0x02	0x1014	4116	R
AI6 status (digital mode)	BOOL	0x01, 0x02	0x1015	4117	R
AI7 status (digital mode)	BOOL	0x01, 0x02	0x1016	4118	R
AI8 status (digital mode)	BOOL	0x01, 0x02	0x1017	4119	R
DO1…DO14, F1, F2 status bitmask	BOOL	0x01, 0x02	0x000-0x000F	0-15	RW**
	UINT16	0x03, 0x04	0x000	0	RW**
AO1 REAL (0…1)	REAL32	0x03, 0x04	0x0A00, 0x0A01	2560, 2561	RW**
AO2 REAL (0…1)	REAL32	0x03, 0x04	0x0A02, 0x0A03	2562, 2563	RW**
AO1 INT (0…10000)*	UINT16	0x03, 0x04	0x0A80	2688	RW**
AO2 INT (0…10000)*	UINT16	0x03, 0x04	0x0A81	2689	RW**
Network variables	BOOL	0x01, 0x02, 0x05, 0x0F	0x2000-0x23F0	8192-9200	RW
	UINT16	0x03, 0x04, 0x06, 0x10	0x0200-0x023F	512-575	RW
Seconds	UINT16	0x03, 0x04, 0x06, 0x10	0x0400	1024	RW
Minutes	UINT16	0x03, 0x04, 0x06, 0x10	0x0401	1025	RW
Hours	UINT16	0x03, 0x04, 0x06, 0x10	0x0402	1026	RW
Day	UINT16	0x03, 0x04, 0x06, 0x10	0x0403	1027	RW
Month	UINT16	0x03, 0x04, 0x06, 0x10	0x0404	1028	RW
Year	UINT16	0x03, 0x04, 0x06, 0x10	0x0405	1029	RW
Weekday	UINT16	0x03, 0x04	0x0406	1030	R
Week of month	UINT16	0x03, 0x04	0x0407	1031	R
Calender week	UINT16	0x03, 0x04	0x0408	1032	R

*Used for network data exchange over network variables.
DP* = *Decimal point offset (Sect. 4.3.1)
AIx INT* = *AIx REAL × 10^{DP}
For outputs ***DP*** = 4 (constant)

** Output status can be only written via network in I/O mode (Sect. 6.4).

5 Installation

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. For dimension drawing see Fig. A.1.

Installation:

1. Place the device on a DIN rail as shown in Fig. 5.1.
2. Press the device firmly against the DIN rail in the direction of arrow 2 until the latch locks.
3. Wire the device using the supplied terminal blocks.

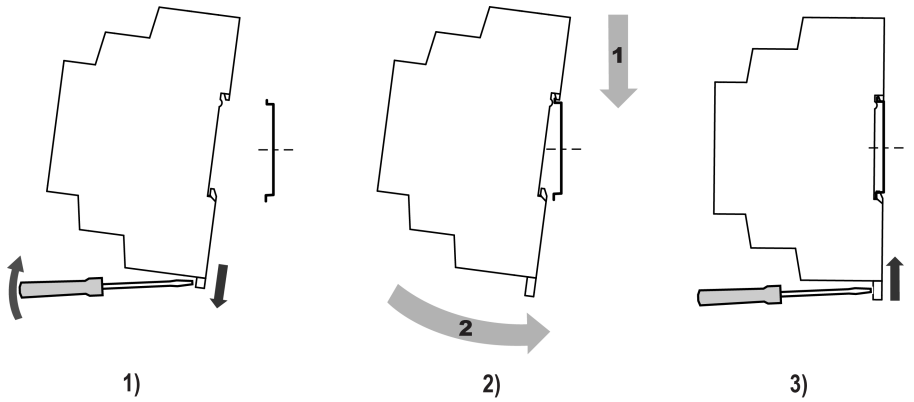

Fig. 5.1

Removing:

1. Take off the terminal blocks without disconnecting wires.
2. Insert a screwdriver into the eyelet of the slide interlock.
3. Loosen the slide interlock and then remove the relay from the DIN rail.

5.1 Galvanic isolation

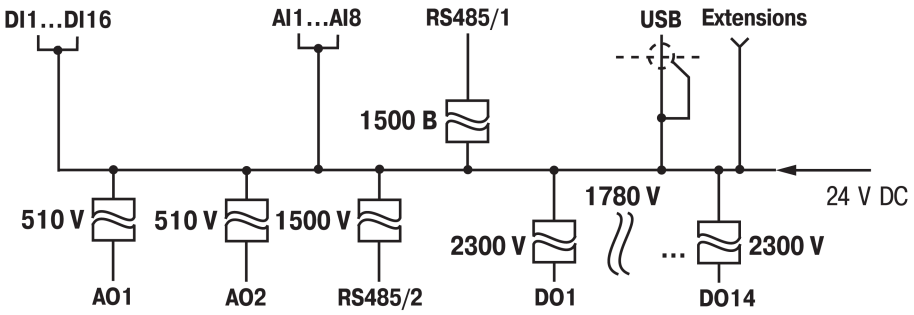

Fig. 5.2 Galvanic isolation

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 9 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 (-40 ... +55 °C) for at least 30 minutes.

5.2.1 Terminal block layout

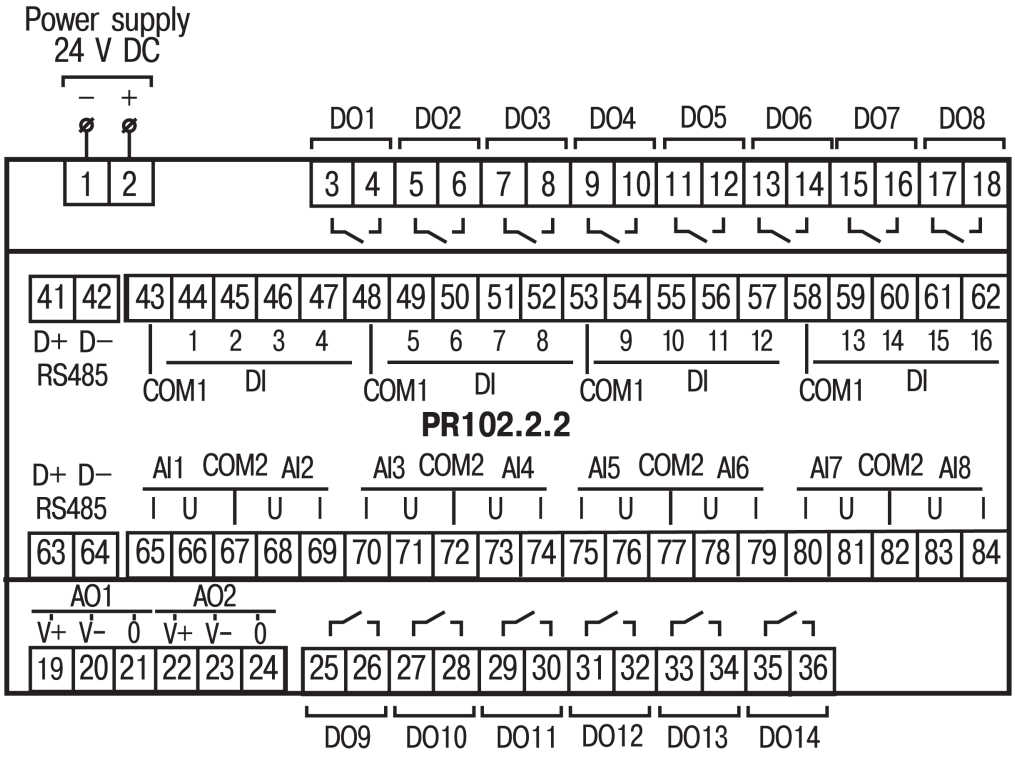

Fig. 5.3 Terminal block layout

Table 5.1 Terminal assignment

No.	Mark-ing	Description	No.	Mark-ing	Description
1	0 V	Power supply	63	D-	RS485 interface 2
2	24 V	Power supply	64	D+	RS485 interface 2
3	DO1	DO1 digital output	65	I	AI1 current input
4	DO1	DO1 digital output	66	U	AI1 voltage input
5	DO2	DO2 digital output	67	COM2	AI1...AI8 common contact
6	DO2	DO2 digital output	68	U	AI2 voltage input
7	DO3	DO3 digital output	69	I	AI2 current input
8	DO3	DO3 digital output	70	I	AI3 current input
9	DO4	DO4 digital output	71	U	AI3 voltage input
10	DO4	DO4 digital output	72	COM2	AI1...AI8 common contact
11	DO5	DO5 digital output	73	U	AI4 voltage input
12	DO5	DO5 digital output	74	I	AI4 current input
13	DO6	DO6 digital output	75	I	AI5 current input
14	DO6	DO6 digital output	76	U	AI5 voltage input
15	DO7	DO7 digital output	77	COM2	AI1...AI8 common contact
16	DO7	DO7 digital output	78	U	AI6 voltage input
17	DO8	DO8 digital output	79	I	AI6 current input
18	DO8	DO8 digital output	80	I	AI7 current input
41	D+	RS485 interface 1	81	U	AI7 voltage input
42	D-	RS485 interface 1	82	COM2	AI1...AI8 common contact
43	COM1	DI1…DI16 common contact	83	U	AI8 voltage input
44	DI1	DI1 digital input	84	I	AI8 current input
45	DI2	DI2 digital input	19	V+	AO1 +24 VDC
46	DI3	DI3 digital input	20	V-	AO1 -24 VDC
47	DI4	DI4 digital input	21	0	AO1 analog output
48	COM1	DI1…DI16 common contact	22	V+	AO2 +24 VDC
49	DI5	DI5 digital input	23	V-	AO1 -24 VDC
50	DI6	DI6 digital input	24	0	AO2 analog output
51	DI7	DI7 digital input	25	DO9	DO9 digital output
52	DI8	DI8 digital input	26	DO9	DO9 digital output
53	COM1	DI1…DI16 common contact	27	DO10	DO10 digital output
54	DI9	DI9 digital input	28	DO10	DO10 digital output
55	DI10	DI10 digital input	29	DO11	DO11 digital output
56	DI11	DI11 digital input	30	DO11	DO11 digital output
57	DI12	DI12 digital input	31	DO12	DO12 digital output
58	COM1	DI1…DI16 common contact	32	DO12	DO12 digital output
59	DI13	DI13 digital input	33	DO13	DO13 digital output
60	DI14	DI14 digital input	34	DO13	DO13 digital output
61	DI15	DI15 digital input	35	DO14	DO14 digital output
62	DI16	DI16 digital input	36	DO14	DO14 digital output

5.2.2 Digital inputs

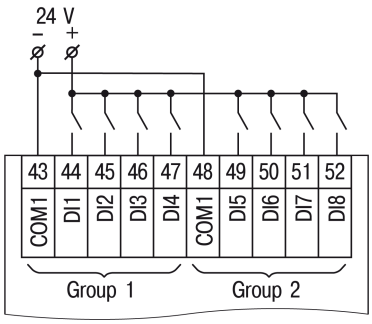

Fig. 5.4 Switch contacts wiring

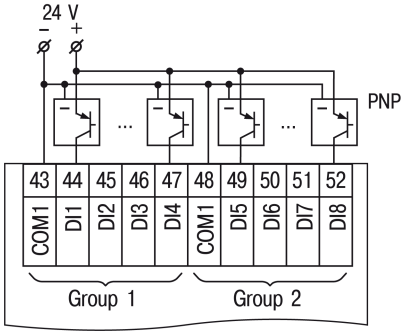

Fig. 5.5 PNP sensors wiring

5.2.3 Analog inputs

Table 5.2 Sensor cable requirements

Signal	Length, max. (m)	Total resistance, max. (Ω)
4-20 mA	100	100
0-10 V	100	5
0-300 kΩ	100	—

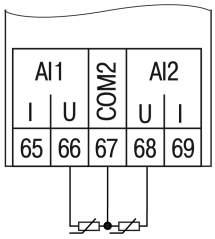

Fig. 5.6 RTD sensors wiring

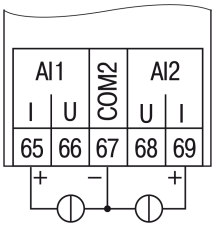

Fig. 5.7 Current sensors wiring

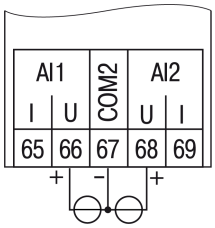

Fig. 5.8 Voltage sensors wiring

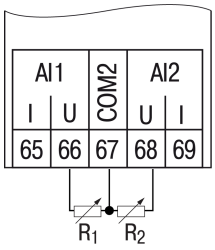

Fig. 5.9 Resistance sensors wiring

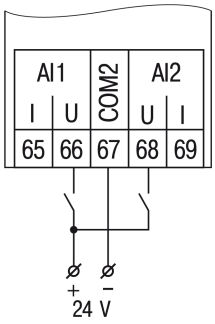

Fig. 5.10 Switch contacts wiring (digital mode)

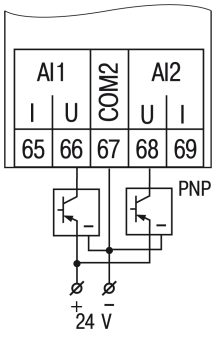

Fig. 5.11 PNP sensors wiring (digital mode)

5.2.4 Digital outputs

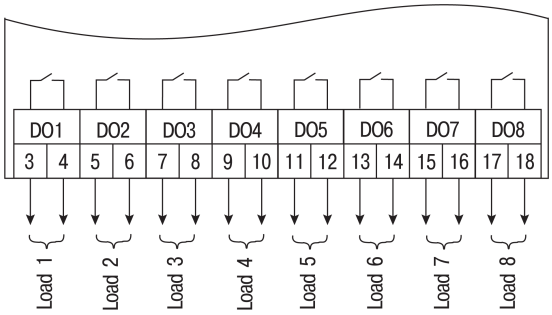

Fig. 5.12 Relay outputs

5.2.5 Analog outputs

Analog outputs need external voltage supply.

CAUTION
The external supply voltage may not exceed 30 V. Higher voltage can damage the device.

The analog outputs are galvanically isolated from each other.

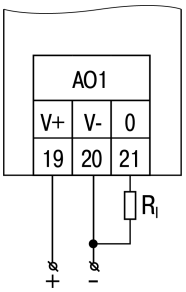

Fig. 5.13 Output 4-20 mA

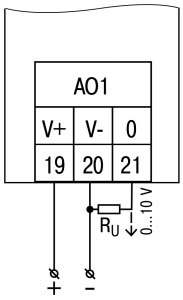

Fig. 5.14 Output 0-10 V

Load resistance for 4-20 mA output signal must not exceed 300 Ω.
Load resistance for 0-10 V output signal must not be lower than 1 kΩ.

5.3 Extension modules

WARNING
PR102 must be powered off before connecting to extension modules.

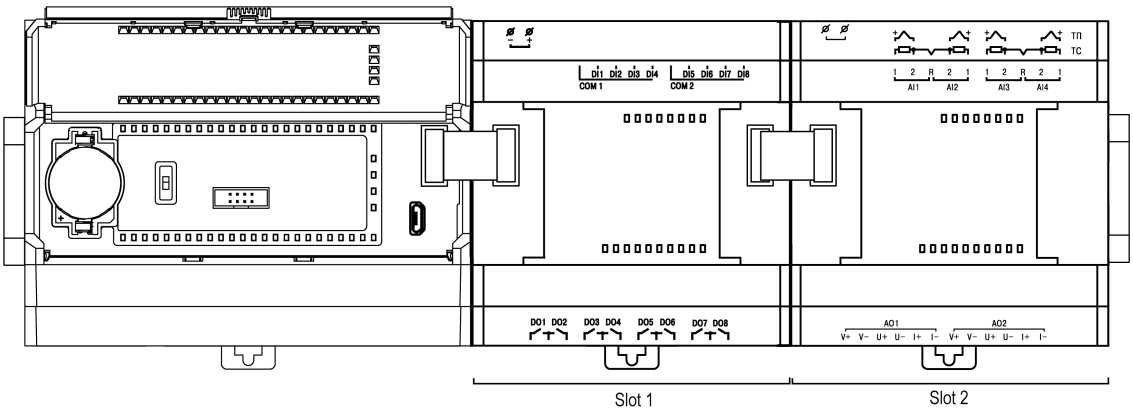

Fig. 5.15

The PRM modules are connected to PR102 in series. Maximum two modules can be connected.

Mount the module on the DIN rail to the right of the PR102 and connect them using the supplied 4.5 cm flat cable.

PRM has two EXT connectors located under the right and left covers on the device front. The connector under the left cover is used to connect the 1st PRM to PR102.

When connected, the flat cable should be placed in a special recess under the cover to enable PRM to be pushed close to PR102 (Fig. 5.16).

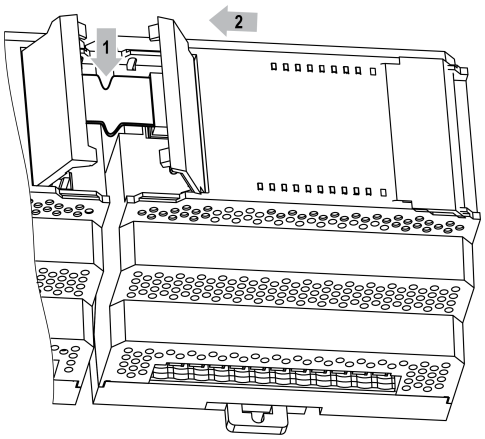

Fig. 5.16

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. 5.17*).

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.

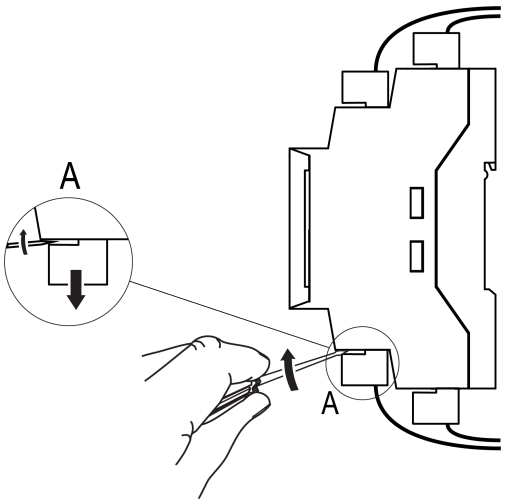

Fig. 5.17 Quick replacement

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 (-40 ... +55 °C) for at least 30 minutes.

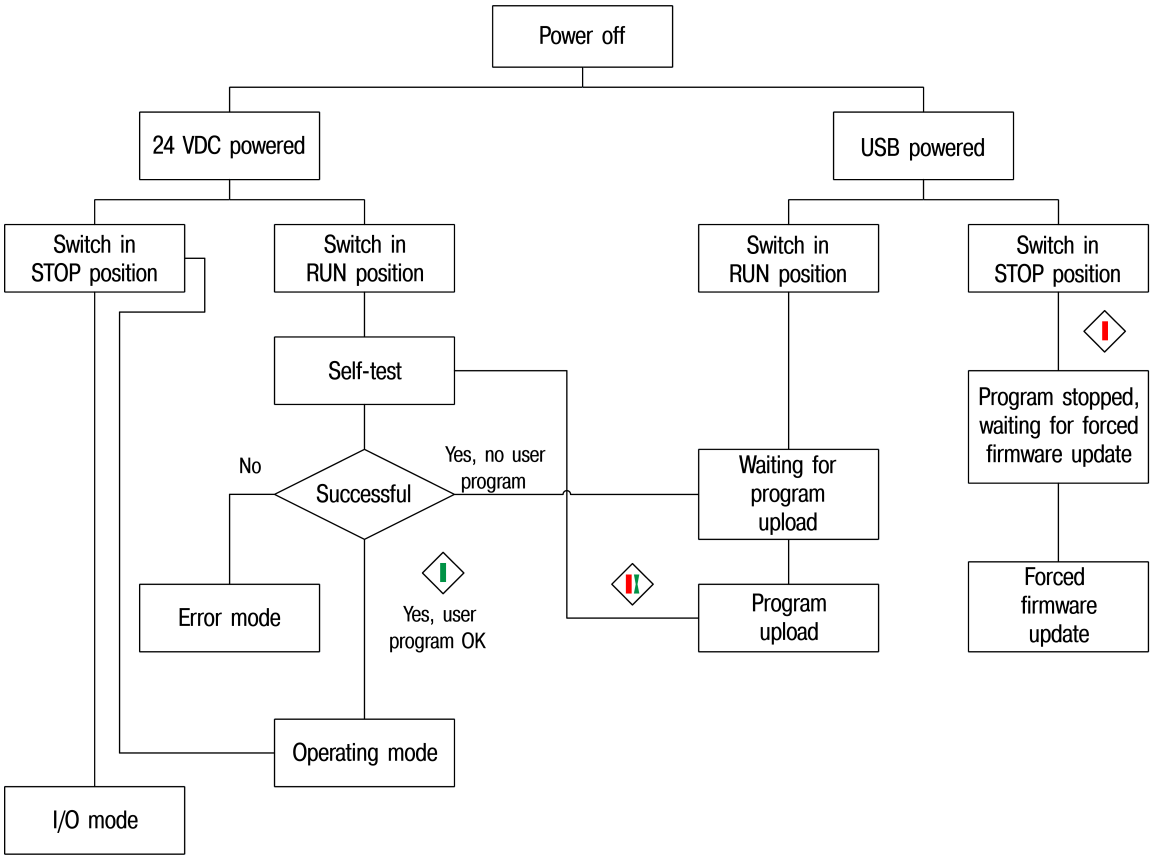

Fig. 6.1 Operation diagram

NOTE

The inputs, outputs and the RS485 interfaces are disabled when the device is powered via USB.

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

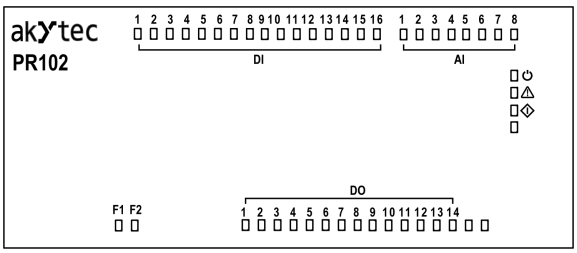

Fig. 6.2 Front view

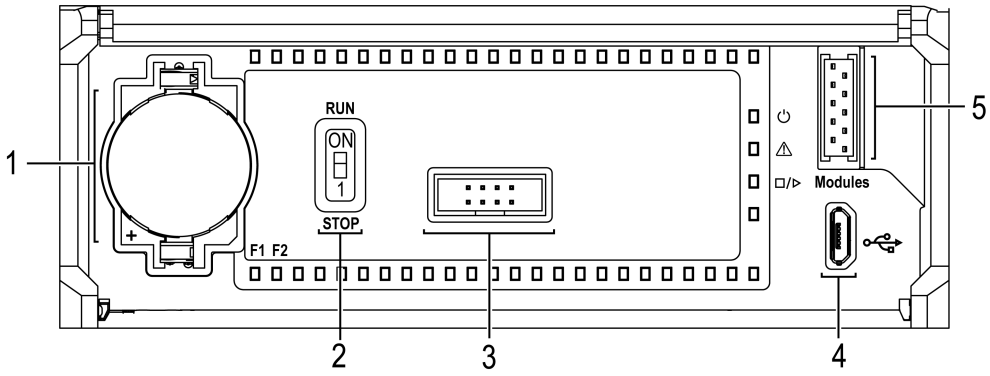

Fig. 6.3 Front cover open

Under the front cover:

1. RTC battery
2. RUN/STOP switch
3. Service connector
4. microUSB programming connector
5. Extension module connector

Table 6.1 Indicators

LED	Color	State	Description
⏻	green	ON	Power on
⚠	red	ON	– program checksum error – retain memory error – system error
		slow flashing	Overheating
F1	green	—	Programmable
F2	green	—	
DI1…DI16	green	ON	HIGH on input
AI1…AI8	green	ON	HIGH on input (digital mode)
DO1…DO14	green	ON	Output is on
⏀	red	ON	24 V DC power off, powered over USB, program stopped
	green	ON	24 V DC power on, program is executed
	red / green	red – ON green – fast flashing	24 V DC power on, program is being transferred to device

6.3 Error mode

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

Table 6.2 Error indication

Indication	Cause	Remedy
⚠ ON	Program checksum error	Update the firmware
	Retain memory error	
	System error	Re-load the user program in the device. If it does not help, contact technical service
⚠ flashing	Overheating	Ensure the operation temperature according to Tab. 3.6

6.4 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.

The I/O mode can be used for

– firmware update
– user program rewriting if it causes an incorrect operation of the device

To activate the I/O mode, turn the RUN/STOP switch (Fig. 6.3, Pos. 2) to ***STOP*** position.

To switch to normal operation, turn the RUN/STOP switch to ***RUN*** position.

6.5 Extension modules

PRM extension modules are used to increase the number of I/O points. For installation see Sect. 5.3. The operation of a module is determined by user program in basic device. Previously the module must be added to the project configuration. See PRM user guide and ALP HELP for further information.

After the first connection to the basic device, the ERROR LED on the module blinks, since there is no data exchange between the module and the basic device. Only when the module is added to the basic device configuration and the project is transferred to the device, the ERROR LED on the module goes out. If that doesn't happen, update the module firmware.

6.6 Real-time clock

A charged backup battery (Fig. 6.3, Pos. 1) 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 (Tab. 3.6), 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).

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 PR102 programming connector (Fig. 6.3, Pos. 4) to PC over a USB-to-microUSB connection cable.
2. Power on the device.
3. Turn the RUN/STOP switch to ***STOP*** position.

   The LED ⏀ lights red. The firmware and user program are blocked.
4. Check in the Windows Device Manager which COM port is assigned to the device.
5. Enter this COM port number in ALP mask ***Device > Port Settings*** and confirm with ***OK***.
6. Select menu item ***Device > Firmware update***. The currently connected device will be proposed. You can select another one.

   During firmware update, the LED ⏀ flashes green and the ALP progress bar is displayed on PC.
7. After the firmware update is successfully completed (message in ALP, LED ⏀ lights red), turn the RUN/STOP switch to ***RUN*** position to start the normal device operation.

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

8 Maintenance

8.1 General instructions

The maintenance includes:
– cleaning of the housing and terminal blocks from dust, dirt and derbis
– checking the device fastening
– checking the wiring (connecting leads, fastenings, mechanical damage)

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

8.2 Battery replacement

NOTE
The supply voltage may remain on when replacing the battery. This will prevent the real-time clock reset.

To replace the RTC battery:

1. Open the front cover (*Fig. 8.1*).
2. Using a screwdriver, pick up the battery on the right and remove it from the device.
3. Observing polarity, insert a new battery.
4. Close the cover.

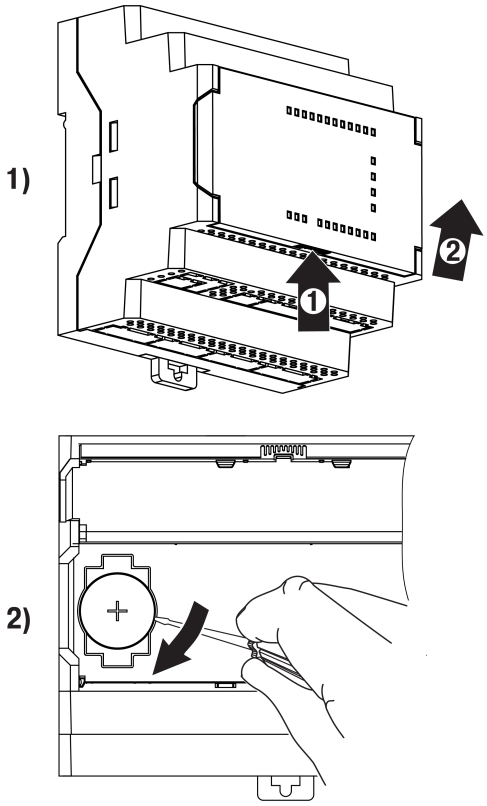

Fig. 8.1 Battery replacement

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: -40 … +55 °C

NOTE

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

PR102	1
Short guide	1
Terminal blocks (set)	1

Appendix A Dimensions

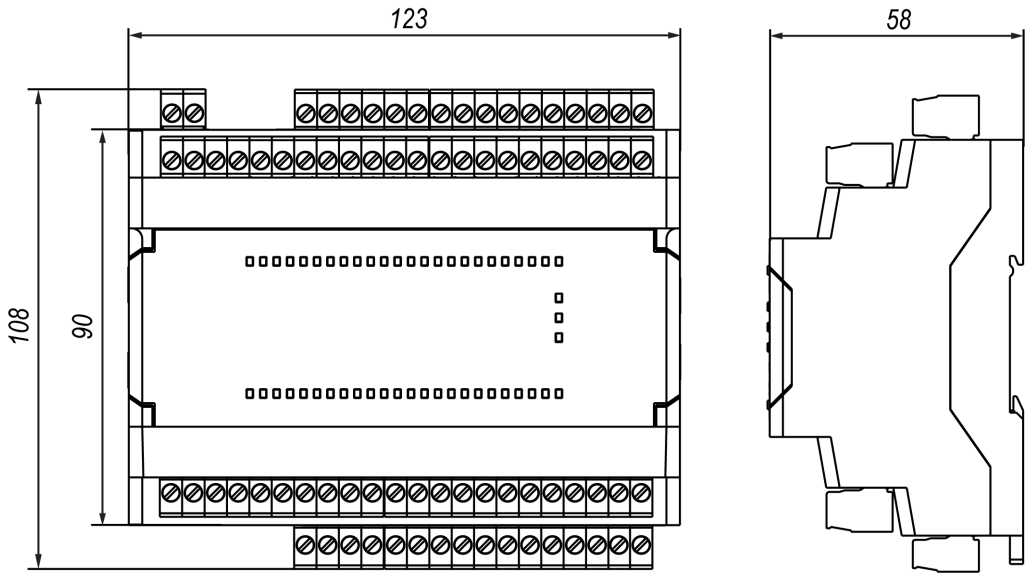

Fig. A.1 Dimensions

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 to the input.

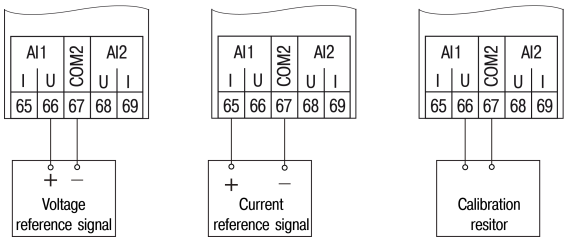

Fig. B.2 Connection of the reference signal source to an input

Notes on input wiring see sect. 5.2.3

2. Connect the PR102 programming connector (Fig. 6.3, Pos. 4) to PC over a USB-to-microUSB connection cable.
3. Power on the PR102.
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 type of input signal and other calibration parameters (Fig. B.3).

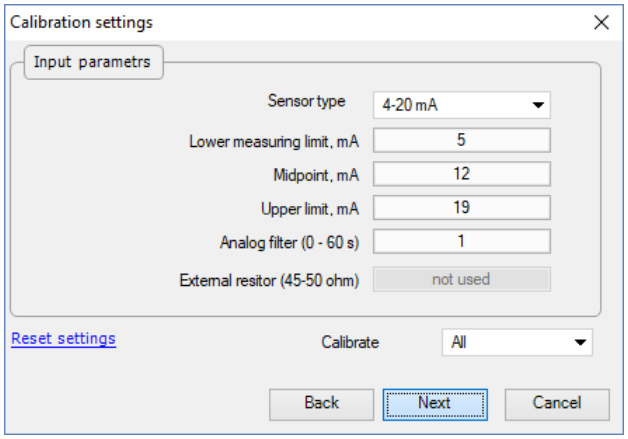

Fig. B.3 Configuration parameters

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.

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

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

B.2 Analog outputs

To calibrate an output:

1. Connect the measuring device and the voltage source to the output depending on the configurated output signal (Fig. B.4).

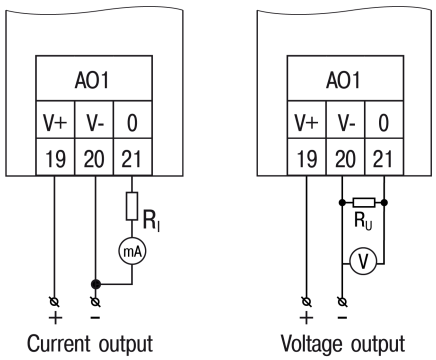

Fig. B.4 Output calibration

Notes on output wiring see sect. 5.2.4.

2. Connect the PR102 programming connector (Fig. 6.3, Pos. 4) to PC over a USB-to-microUSB connection cable.
3. Power on the PR102.
4. Start ALP and select the menu item ***Device > Calibration*** to start the calibration tool.
5. Select ***Analog outputs*** as calibration target.
6. Select the type of output signal and the output to be calibrated. If you select ***All***, all outputs will be calibrated sequentially, so the appropriate reference source has to be applied to all outputs.
7. Measure the signal on the output indicated in the upper right window corner, enter the value in the input field.

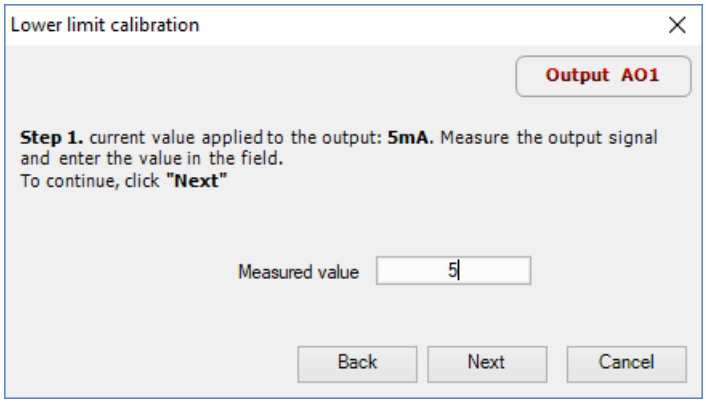

Fig. B.5 Lower limit calibration

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