

PRM-X.1

Digital I/O extension module

User guide

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PRM-X.1_3-EN-127505-1.11
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1 Introduction

1.1 Terms and abbreviations

– **ALP** – programming software akYtec ALP for programming PR series relays, based on Function Block Diagram (FBD) programming language
– **Application** – user program created using ALP software
– **ADC** – analog-digital converter
– **DAC** – digital-analog converter
– **Slot 1, Slot 2** – position of the module relative to the main device

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 Recycling and disposal



The device is considered an electronics device for disposal in terms of European Directive 2012/19/EU and may not be disposed of as domestic garbage.
– Dispose of the device through channels provided for this purpose.
– Comply with all local and currently applicable laws and regulations.

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2 Overview

PRM extension modules provide additional inputs and outputs for the main device. The module inputs and outputs are controlled by a program running on the main device. To enable control, the module should be added to the device configuration in ALP (*Section 5*).
The module is a passive device and cannot be used without connection with the main device over an internal bus.
All models are designed in a plastic housing for DIN rail mounting.
Each PRM module is powered independently of the main device. The main device and the modules can be operated with different supply voltages.

2.1 Intended use

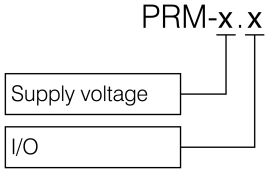
Extension modules of the PRM series are designed solely for the intended use described in this manual, and may only be used accordingly. The technical specifications contained in this manual must be observed.
The module may be operated only in properly installed condition.

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 substances.

2.2 Ordering code



Supply voltage		
230	–	230 (90…264) V AC
24	–	24 (19…30) V DC

I/O		
1	–	8 DI, 8 DO

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2.3 Front indicators

There are 18 LEDs on the front panel.

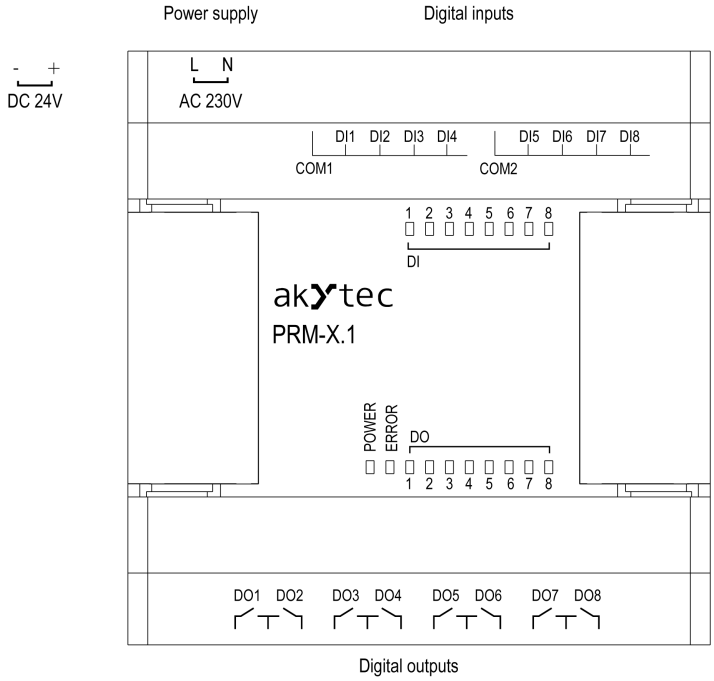


Fig. 2.1 Front view

Table 2.1 LED indicators

Indicator	Color	State	Value
POWER	Green	ON	Power on
ERROR	Red	Flashing	No communication with the main device
			Device model does not match the model specified in the project
			The firmware version of the main device and the module are incompatible
DI	Yellow	ON	HIGH on the corresponding input
DO	Yellow	ON	HIGH on the corresponding output

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3 Specifications

3.1 General specifications

Table 3.1 General specifications

Device		PRM-230.1	PRM-24.1
Power supply		~230 (90…264) V AC, 50 Hz ~230 (127…373) V DC	=24 (19 … 30) V DC
Power consumption, max.		8 VA	4 W
Galvanic isolation		2830 V	1780 V
Reverse polarity protection		–	yes
Inputs	Digital	8	
	Analog	—	
Outputs	Digital	8	
	Analog	—	
Internal bus	Frequency	2.25 MHz	
	Packet rate (each 16 bit)	4000 packet/s	
	Max. module number	2	
Programming software		akYtec ALP	
IP Code		IP20	
Dimensions		88 × 90 × 58 mm	
Mounting		DIN rail (35 mm)	
Weight, max.		400 g	

3.2 Digital inputs

Table 3.2 Digital inputs (DI)

Parameter	Value	
Power supply	230 V AC (max. 264 V AC)	24 V DC (max. 30 V DC)
Signal type	Switch contact	Switch contact PNP
HIGH level	159…264 V / 0.75…1.5 mA	15…30 V / 2…5 mA
LOW level	0…40 V / 0…0.5 mA	-3…+5 V / 0…1 mA
Pulse length, min.	50 ms	5 ms*
Response time, max.	100 ms	30 ms
Galvanic isolation against other circuits	2830 V	2830 V
* Maximum signal frequency depends on user program cycle, duty cycle and set filter time.		

3.3 Digital outputs

Table 3.3 Digital outputs (DO)

Parameter		Value
Type		relay (NO)
Maximum switching load voltage	AC	250 V (resistive load)
	DC	30 V (resistive load)
Maximum load current	AC	5 A, 250 V AC and cos(φ) > 0,95
	DC	3 A, 30 V DC
Load current at 5 V DC, min.		10 mA
Service life, electrical		200 000 switching cycles at 250 V AC, 5 A 50 000 switching cycles at 250 V AC, 7 A 100 000 switching cycles at 30 V DC, 3 A (resistive load)
Galvanic isolation against other circuits		2830 V

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3.4 Environmental conditions

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

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

Table 3.4 Environmental conditions

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

3.5 Galvanic isolation

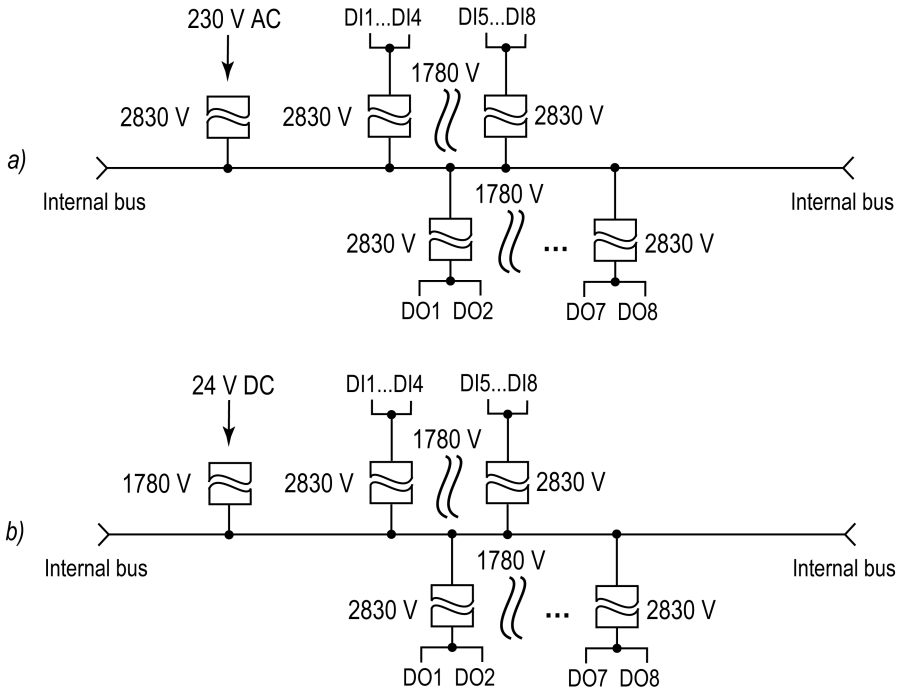


Fig. 3.1 Galvanic isolation of PRM-230 (a) and PRM-24 (b)

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4 Installation

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.

CAUTION
The device must be powered off before connecting to internal bus or peripheral devices. Switch on the power supply only after the wiring of the device has been completed.
Remove the terminal blocks only after powering off the device and all connected equipment.
Do not feed any external devices from the power contacts of the device.

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

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

NOTE
Before switching on, make sure that the device was stored at the specified ambient temperature for at least 1 hour.

The PRM series extension module should be mounted on a DIN rail to the right of the main device.



Fig. 4.1

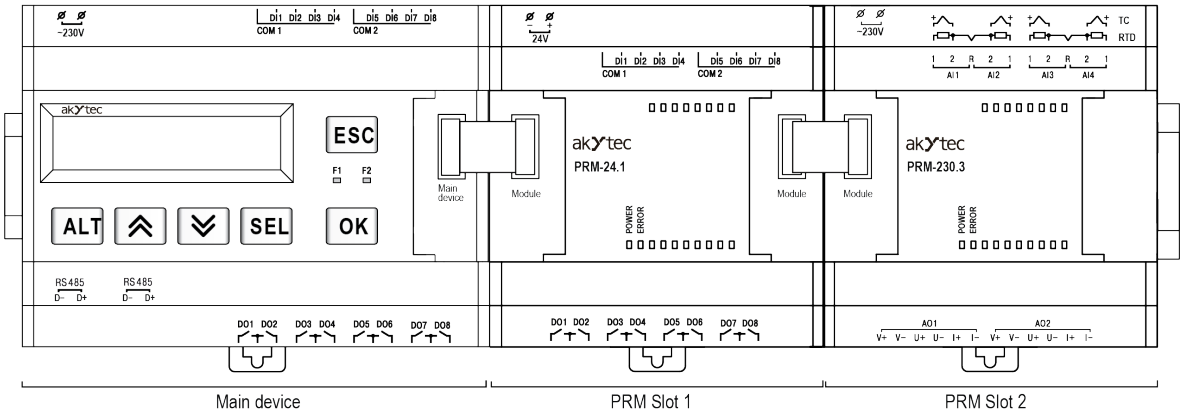
After mounting the module on the DIN-rail, an internal bus connection between the main device and the module should be arranged (*Sect. 4.1*). Then the power supply and the peripheral devices should be connected to the module terminal blocks (*Sect. 4.2*).
For dimensional drawings, see *Appendix A.*

4.1 Internal bus

An internal high-speed bus provides the same high-speed performance of the module as that of the main device. It allows reading of the input values and writing of the output values of the module within one program cycle.
The PRM modules are connected to the main device in series, in slot 1 and slot 2. Maximum two modules can be connected. To implement the internal bus, connect PRM to the main device, 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 the main device or the 2nd PRM to

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the 1st one. The connector under the right cover is used to connect the 2nd PRM. The module next to main device is always in slot 1. PRM cannot be connected in slot 2 without a module in slot 1.



When connected, the flat cable should be placed in a special recess under the cover to enable PRM to be pushed close to the main device (*Fig. 4.2*).

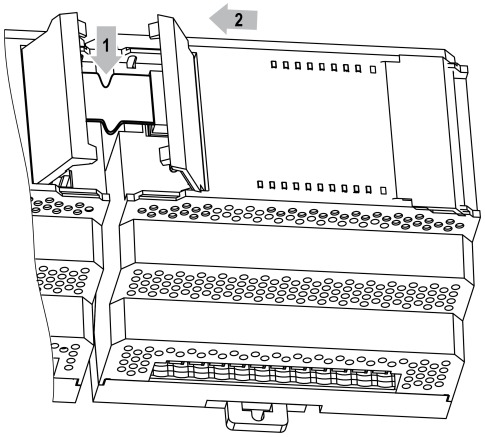


Fig. 4.2

4.2 Terminal block layout

For terminal block layout, see *Fig. 4.3 and 4.4*.
For terminal assignment, see *Tab. 4.1*

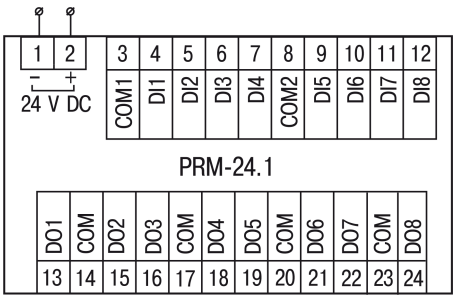


Fig. 4.3 PRM-24.1 terminal block layout

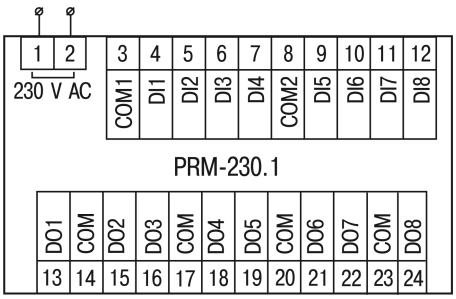


Fig. 4.4 PRM-230.1 terminal block layout

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Table 4.1 Terminal assignment

Marking	Description	Marking	Description
DC 24 V / - or AC 230 V	Power supply	DO1	Digital output DO1
DC 24 V / + or AC 230 V	Power supply	COM	Common contact DO1…DO2
COM1	Common contact DI1…DI4	DO2	Digital output DO2
DI1	Digital input DI1	DO3	Digital output DO3
DI2	Digital input DI2	COM	Common contact DO3…DO4
DI3	Digital input DI3	DO4	Digital output DO4
DI4	Digital input DI4	DO5	Digital output DO5
COM2	Common contact DI5…DI8	COM	Common contact DO5…DO6
DI5	Digital input DI5	DO6	Digital output DO6
DI6	Digital input DI6	DO7	Digital output DO7
DI7	Digital input DI7	COM	Common contact DO7…DO8
DI8	Digital input DI8	DO8	Digital output DO8

4.2.1 Switch contact

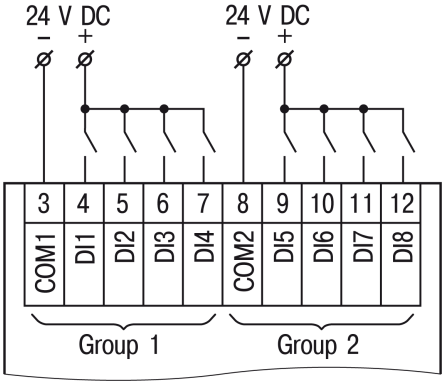


Fig. 4.5 Switch contact wiring (PRM-24)

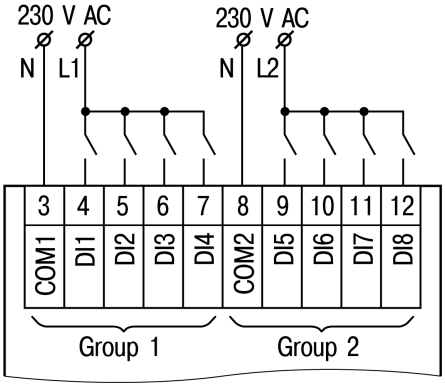


Fig. 4.6 Switch contact wiring (PRM-230)

4.2.2 PNP output sensors

For PRM-24, it is allowed to connect sensors with switch contacts and transistor outputs within the same input group. One voltage source can be used for two input groups.

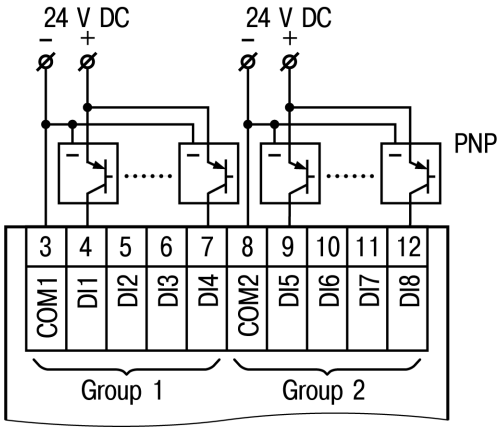


Fig. 4.7 3-wire sensor with PNP output wiring

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4.2.3 Relay output

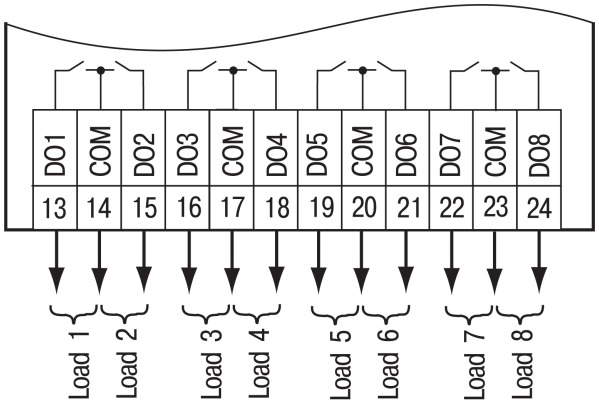


Fig. 4.8 Relay output wiring

4.3 Quick replacement

PRM is equipped with plug-in terminal blocks which enable quick replacement of the device without disconnecting the existing wiring.
To replace the device:

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

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5 Configuration

To add a module to the main device configuration:

1. Open a programmable relay project in ALP.
2. Open **Device configuration**.
3. Select item **Extension modules** in the structure tree.
4. Add a PRM module using the context menu (*Fig. 5.1*)

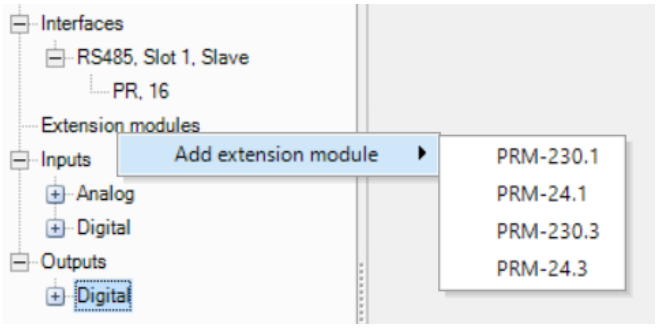


Fig. 5.1

Parameter **Slot number** (*Fig. 5.2*) is the position of PRM, counting from left to right from the main device. The module adjacent to the main device should be added to the configuration first with No. 1 (Slot 1). The next added module is always assigned as No. 2 (Slot 2). If there is no module assigned as No. 1, a new module cannot be assigned as No. 2.

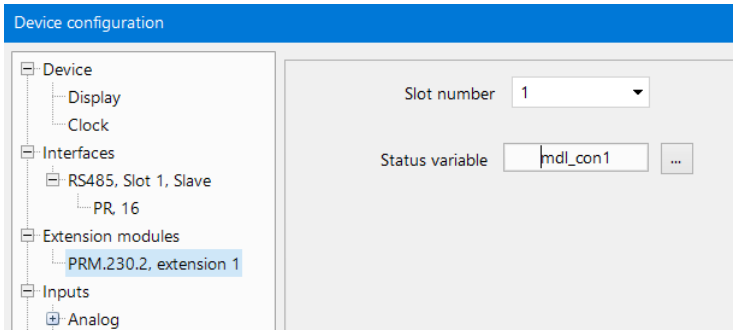


Fig. 5.2

Data exchange between the main device and PRM No. 2 is carried out through PRM No. 1. If PRM No. 1 is powered off, the data exchange between the main device and PRM No. 2 is interrupted.
PRM can be removed from the project only after disconnecting all the variables assigned to its inputs and outputs.
PRM position in the configuration can be changed using the context menu.
The project can be transferred to the main device irrespective of whether the modules are connected or not.
When a module is added to the configuration, additional inputs I1...I8 and outputs Q1...Q8 with the module number in brackets appear in the workspace (*Fig. 5.3*).
When a module is added to the project, its inputs and outputs become available for polling.
To read the inputs or change the status of the outputs, create variables of the appropriate type and associate them with module I/Os. If it is necessary to sample the module I/Os over the network, they have to be associated with network variables.

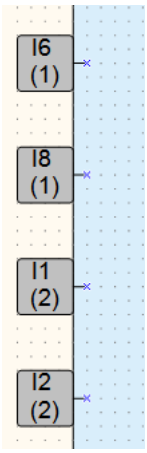


Fig. 5.3

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The Status parameter of the module can be associated with a BOOL variable to be used in the program.
Status value is 1 when communication with the module is established or the module model corresponds to the one specified in ALP.
Status value is 0 when communication with the module is lost or the position of the installed module does not correspond to the position specified in the ALP project.
Safe state can be assigned for each of the module digital outputs. This setting is available in the **Device/Device configuration/Outputs** menu and provides safety in case of incidents. The configuration parameter is to assign an output state for the digital outputs when the module does not receive commands from the main device (loss of communication).
For the PRM-24.1 modules, digital input filter time settings are available in the **Device configuration/Inputs** menu.
Debounce filter can be enabled for each digital input by the **Debounce filter, ms** parameter (from 0 to 255 ms) in Properties of the digital input. This parameter specifies the period when the signal will be debounced until the filter output state changes.

CAUTION
It is not recommended to use debounce filter for input signals with a frequency above 90 Hz and a duty cycle of 50 % or less. A useful signal can be missed.

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6 Firmware update

If a new project is loaded into the device and the firmware of the device and extension module are incompatible, the connection between them will be interrupted and the red **ERROR** indicator on the module will start flashing.
To update the firmware:

1. Connect the module to the main device over an internal bus.
2. Connect the main device to the PC.
3. Switch on the power supplies of the main device and the module.
4. Start ALP and select menu item **Device > Firmware update**.
5. Open tab **Extension modules**, select the extension number and the device model and confirm with **Select**.

NOTICE
Ensure reliable power supply of the main device and modules during the update. If it failed, the update should be probably repeated.

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7 Maintenance

The safety requirements (see *Section 4*) must be observed when the maintenance is carried out.

WARNING
Cut off all power before maintenance.

The maintenance includes:

– Cleaning of the housing and terminal blocks from dust, dirt and debris
– Checking the device fastening
– Checking the wiring (connecting wires, terminal connections, absence of mechanical damages)

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

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8 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: -20...+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!

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9 Scope of delivery

PRM	1
Short guide	1
Connection cable	1
Terminal blocks (set)	1

NOTE
The manufacturer reserves the right to introduce amendments to the scope of delivery.

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Appendix A. Dimensions

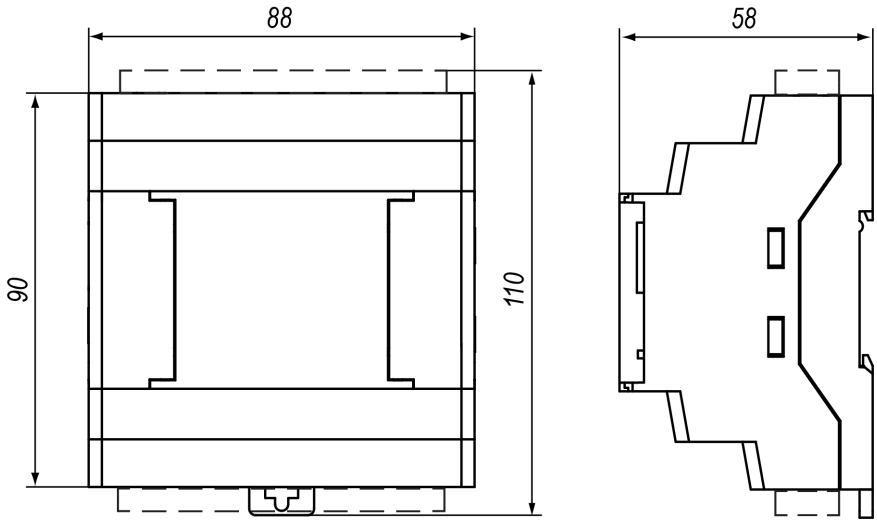


Fig. A.1

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Appendix B. Modbus register map

When the module is connected to the main device operating in Slave mode, the module registers for remote control are available via network interface.

Table B.1 Modbus functions

Name	Code	Description
MODBUS_READ_HOLDING_ REGISTERS	3 (0x03)	Read data from one or more holding registers
MODBUS_WRITE_MULTIPLE_ REGISTERS	16 (0x10)	Write a block of contiguous registers

Table B.2 Data types

Data type	Size (registers)	Size (Byte)	Description
Enum X	1	1	Specifies a selected parameter position in the list of parameters
Unsigned 8	1	1	Unsigned integer

Table B.3 PRM-1 Modbus registers

Name	Description	Address (DEC)	Address (HEX)	Number of registers	Read function	Write function	Data type
PRM-230.1							
Slot 1							
Device status	PRM-230.1, slot 1	6248	0x1868	1	3	-	Enum 2: 0 - Off 1 - On
Connection	PRM-230.1, slot 1	6249	0x1869	1	3	-	Enum 6: 0 - Not connected 1 - Initialization 2 - Found 3 - Inappropriate module type 4 - Invalid FW version 5 - Operation
New output bitmask	Digital outputs	6233	0x1859	1	3	16	Unsigned 8
DO 1	Safe state	6208	0x1840	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 2	Safe state	6209	0x1841	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged

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Name	Description	Address (DEC)	Address (HEX)	Number of registers	Read function	Write function	Data type
DO 3	Safe state	6210	0x1842	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 4	Safe state	6211	0x1843	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 5	Safe state	6212	0x1844	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 6	Safe state	6213	0x1845	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 7	Safe state	6214	0x1846	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 8	Safe state	6215	0x1847	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
Input bitmask	Digital inputs	6232	0x1858	1	3	-	Unsigned 8
Slot 2							
Device status	PRM-24.1, slot 2	6198	0x1836	1	3	-	Enum 2: 0 - Off 1 - On
Connection	PRM-24.1, slot 2	6199	0x1837	1	3	-	Enum 6: 0 - Not connected 1 - Initialization 2 - Found 3 - Inappropriate module type 4 - Invalid FW version 5 - Operation
Input bitmask	Digital inputs	6182	0x1826	1	3	-	Unsigned 8
DI 1	Debounce filter	6150	0x1806	1	3	16	Unsigned 8
DI 2	Debounce filter	6151	0x1807	1	3	16	Unsigned 8
DI 3	Debounce filter	6152	0x1808	1	3	16	Unsigned 8

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Name	Description	Address (DEC)	Address (HEX)	Number of registers	Read function	Write function	Data type
DI 4	Debounce filter	6153	0x1809	1	3	16	Unsigned 8
DI 5	Debounce filter	6154	0x180A	1	3	16	Unsigned 8
DI 6	Debounce filter	6155	0x180B	1	3	16	Unsigned 8
DI 7	Debounce filter	6156	0x180C	1	3	16	Unsigned 8
DI 8	Debounce filter	6157	0x180D	1	3	16	Unsigned 8
New output bitmask	Digital outputs	6183	0x1827	1	3	16	Unsigned 8
DO 1	Safe state	6158	0x180E	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 2	Safe state	6159	0x180F	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 3	Safe state	6160	0x1810	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 4	Safe state	6161	0x1811	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 5	Safe state	6162	0x1812	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 6	Safe state	6163	0x1813	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 7	Safe state	6164	0x1814	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 8	Safe state	6165	0x1815	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged

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Name	Description	Address (DEC)	Address (HEX)	Number of registers	Read function	Write function	Data type
PRM-24.1							
Slot 1							
Device status	PRM-24.1, slot 1	6148	0x1804	1	3	-	Enum 2: 0 - Off 1 - On
Connection	PRM-24.1, slot 1	6149	0x1805	1	3	-	Enum 6: 0 - Not connected 1 - Initialization 2 - Found 3 - Inappropriate module type 4 - Invalid FW version 5 - Operation
Input bitmask	Digital inputs	6132	0x17F4	1	3	-	Unsigned 8
DI 1	Debounce filter	6100	0x17D4	1	3	16	Unsigned 8
DI 2	Debounce filter	6101	0x17D5	1	3	16	Unsigned 8
DI 3	Debounce filter	6102	0x17D6	1	3	16	Unsigned 8
DI 4	Debounce filter	6103	0x17D7	1	3	16	Unsigned 8
DI 5	Debounce filter	6104	0x17D8	1	3	16	Unsigned 8
DI 6	Debounce filter	6105	0x17D9	1	3	16	Unsigned 8
DI 7	Debounce filter	6106	0x17DA	1	3	16	Unsigned 8
DI 8	Debounce filter	6107	0x17DB	1	3	16	Unsigned 8
New output bitmask	Digital outputs	6133	0x17F5	1	3	16	Unsigned 8
DO 1	Safe state	6108	0x17DC	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 2	Safe state	6109	0x17DD	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 3	Safe state	6110	0x17DE	1	3	16	Enum 3: 0 - open 1 - closed

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Name	Description	Address (DEC)	Address (HEX)	Number of registers	Read function	Write function	Data type
							2 - unchanged
DO 4	Safe state	6111	0x17DF	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 5	Safe state	6112	0x17E0	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 6	Safe state	6113	0x17E1	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 7	Safe state	6114	0x17E2	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 8	Safe state	6115	0x17E3	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
Slot 2							
Device status	PRM-24.1, slot 2	6198	0x1836	1	3	-	Enum 2
Connection	PRM-24.1, slot 2	6199	0x1837	1	3	-	Enum 6: 0 - Not connected 1 - Initialization 2 - Found 3 - Inappropriate module type 4 - Invalid FW version 5 - Operation
Input bitmask	Digital inputs	6182	0x1826	1	3	-	Unsigned 8
DI 1	Debounce filter	6150	0x1806	1	3	16	Unsigned 8
DI 2	Debounce filter	6151	0x1807	1	3	16	Unsigned 8
DI 3	Debounce filter	6152	0x1808	1	3	16	Unsigned 8
DI 4	Debounce filter	6153	0x1809	1	3	16	Unsigned 8
DI 5	Debounce filter	6154	0x180A	1	3	16	Unsigned 8

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Name	Description	Address (DEC)	Address (HEX)	Number of registers	Read function	Write function	Data type
DI 6	Debounce filter	6155	0x180B	1	3	16	Unsigned 8
DI 7	Debounce filter	6156	0x180C	1	3	16	Unsigned 8
DI 8	Debounce filter	6157	0x180D	1	3	16	Unsigned 8
New output bitmask	Digital outputs	6183	0x1827	1	3	16	Unsigned 8
DO 1	Safe state	6158	0x180E	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 2	Safe state	6159	0x180F	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 3	Safe state	6160	0x1810	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 4	Safe state	6161	0x1811	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 5	Safe state	6162	0x1812	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 6	Safe state	6163	0x1813	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 7	Safe state	6164	0x1814	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged
DO 8	Safe state	6165	0x1815	1	3	16	Enum 3: 0 - open 1 - closed 2 - unchanged

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