EN



MV110-16DN

Analog input module
16 channel

User guide

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1. Description

1.1 Function

Digital input module MV110-16DN is an expansion module with 16 digital inputs.

The module has the following functions:

– Connecting peripheral devices with digital outputs
– Interpretation of digital signals
– Pulse counter (see 1.2)
– RS485 network state diagnostics
– Generating corresponding fault and alarm signals
– Slave in Modbus network

The module supports Modbus RTU, Modbus ASCII protocols with automatic protocol identification.

The module is to be configured using ‘M110 Configurator’ software via RS485-USB interface adapter IC4 (not included). The latest version of the configuration software is available for download on www.akytec.de.

1.2 Counter function

The module also has the ability to use all of its inputs as fast 16 bit counters with a counting frequency of up to 1 kHz. The minimum pulse width is limited to 0.5 ms. Pulses of higher frequency or of shorter duration are ignored. The counter is responsive to any rising edges.
When switching off power, the actual count state remains retained in permanent memory. The counter is set to 0, if it has been reached an overflow, and counting continues.
The module has a debouncing function. This function can be activated for each input by setting tin.c (debouncing filter) to "On" when making configuration of device parameters (see Table 5.1). The function is recommended at signal frequencies up to 90 Hz and if the duty cycle is 50% and more.

1.3 RS485 network

I/O modules of Mx110 series use common standard RS485 for data exchange. RS485 serial interface is based on two-wire technology and half-duplex mode. Protocols Modbus RTU, Modbus ASCII and akYtec are supported. The network consists of a master device and can contain up to 32 slave devices. 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. A terminating resistor is needed to minimize reflections. Experience proves that the most efficient practice is to use terminating resistors of 150 ohm.

The module can be used as slave devices only. Master device can be PLC, PC with SCADA software or control panel.

1.4 Construction

– Enclosure: Plastic, grey, for wall and DIN rail mounting
– Terminal strips: 2 extractable terminal strips with 20 screw terminals each
– LED „POWER“: power supply
– LED „RS-485“: blinks when exchanging data at serial port
– LED „FAULT“: lights up when the data exchange process on serial port is broken
– 16 LEDs „INPUTS“: light up, when at relative input is 1

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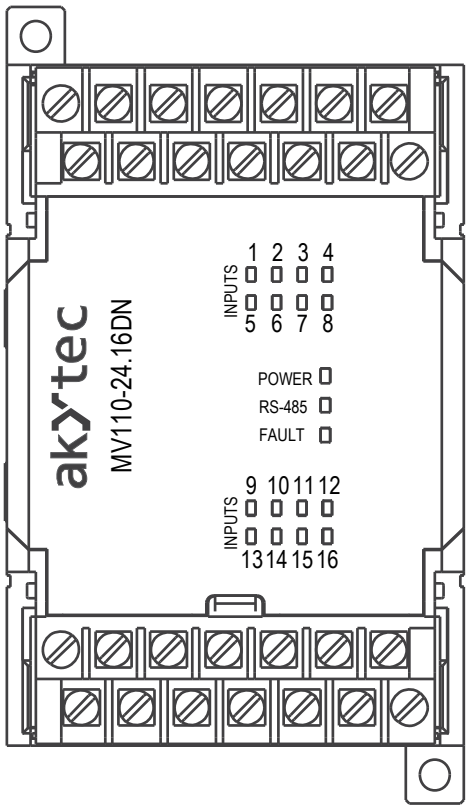


Fig. 1.1 Front View

Dimensions are shown in Appendix A.

Under the cover on the front panel of the module there are three jumpers (refer to Fig. 4.1):

– X2 Factory settings recovery (see 6)
– X3 Service function
– X1 Hardware write protection of permanent memory (see 4.1.1)

All 3 jumpers are not inserted as supplied.

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2. Specifications

Table 2.1 General technical data

Power supply		24 (20…28) V DC
Power consumption, max.		6 W
Inputs	Digital	16
	Analog	–
Outputs	Digital	–
	Analog	–
RS485 interface	Connection	D+, D-
	Protocols	Modbus RTU / ASCII, akYtec
	Baud rate	2.4…115.2 kbit/s
	Data bits	7, 8
	Parity	even, odd, none
	Stop bits	1, 2
Dimensions		63 x 110 x 75 mm
Weight		approx. 240 g
Material		plastic

Table 2.2 Technical data of inputs

Property	MV110-16DN
Input signal	Switch contact
	NPN/PNP
Galvanical isolation	1500 V, in groups of 4
Pulse frequency, max.	1 kHz
Pulse length, min.	0.5 ms
Integrated voltage source	24±3 V
Current, max.	8.5 mA (with 27 V)
Logical „1“, min.	4.5 mA
Logical „0“, max.	1.5 mA
Lead resistance, max.	–

2.1 Environmental conditions

The module 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 2.5 Environmental conditions

Condition	Permissible range
Ambient temperature	-20…+55°C
Transportation and storage	-25…+55°C
Relative humidity	up to 80% (at +25°C, non-condensing)
IP code	IP20
Altitude	up to 2000 m above sea level

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3. Safety

Explanation of the symbols and keywords used:

⚠ **DANGER** — ***DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.***

⚠ **WARNING** — ***WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.***

⚠ **CAUTION** — ***CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.***

▶ **NOTICE** — ***NOTICE indicates a potentially harmful situation which, if not avoid-ed, may result in damage of the product itself or of adjacent objects.***

3.1 Intended use

The device has been designed and built solely for the intended use described in this guide, and may only be used accordingly. The technical specifications contained in this guide must be observed.

The device 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

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4. Installation

⚠ **WARNING**

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

- The module is designed for DIN rail mounting in a control cabinet or for wall mounting.
- The mounting enclosure must provide a clean, dry and controlled environment. For further requirements refer to the subchapter 2.3.
- The device has been designed for natural convection cooling. Make sure that the cabinet provides sufficient clearance for natural convection.

4.1 Wiring

⚠ **WARNING**

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!

▶ **NOTICE**

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

- Electrical connections are shown in Fig. 4.1 and pin assignments are shown in Table 4.1.
- Connection variants for different signal types are shown in Fig. 4.2 – 4.4.
- Connect power supply to the 24V / 0V terminals.
- The maximum conductor cross-section for power supply is 1.5 mm^2

▶ **NOTICE**

EMC-safety
Signal cables should be routed separately or screened from the supply cables.
Only shielded cable may be used for data transmission and signal lines.
Shield in the control cabinet for best electromagnetic immunity recommended.

- Connect the RS485 line to the terminals D+ and D-.
- Use twisted pair cable for RS485 connection. The length of the line should not exceed 1200 m.

4.1.1 Hardware write protection of permanent memory

The data in permanent memory may be lost because of strong electromagnetic interferences or similar conditions.
The jumper X1 (hardware write protection) makes it possible to avoid data loss.
The following steps are required:

- Switch off the power supply
- Open the cover on the front panel of the module (see Fig. 4.1)
- Put the jumper X1 in the position “closed”

Thereby the following is to observe:

- To change the configuration parameters, the jumper X1 must be removed again.
- As long as jumper X1 is put, the input counter will be reset after any power loss.

4.1.2 MV110-16DN

To the input of type DN can be connected:

- potential-free contacts
- NPN transistor outputs with open collector

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– PNP transistor outputs

When connecting the following is to observe:

The inputs of the module MV110-16DN are galvanically isolated in groups of 4 (1...4, 5...8, 9...12, 13...16). When connecting the sensors, use only to the group related common negative terminal, please:

– inputs DI1…DI4 – terminal SS1
– inputs DI5…DI8 – terminal SS2
– inputs DI9…DI12 – terminal SS3
– inputs DI13…D16 – terminal SS4

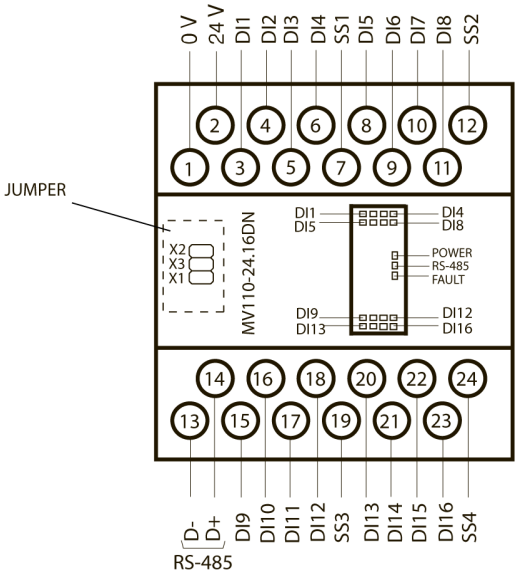


Fig. 4.1 Electrical connections of MV110-16DN

Table 4.1 Terminal assignment of MV110-16DN

No	Connection	Description	No	Connection	Description
1	0 V	Power supply	13	D-	RS485 D-
2	24 V	Power supply	14	D+	RS485 D+
3	DI1	DI1	15	DI9	DI9
4	DI2	DI2	16	DI10	DI10
5	DI3	DI3	17	DI11	DI11
6	DI4	DI4	18	DI12	DI12
7	SS1	Input voltage 1-4	19	SS3	Input voltage 9-12
8	DI5	DI5	20	DI13	DI13
9	DI6	DI6	21	DI14	DI14
10	DI7	DI7	22	DI15	DI15
11	DI8	DI8	23	DI16	DI16
12	SS2	Input voltage 5-8	24	SS4	Input voltage 13-16

Connection variants for different signal types are shown in Figures 4.2 – 4.4.

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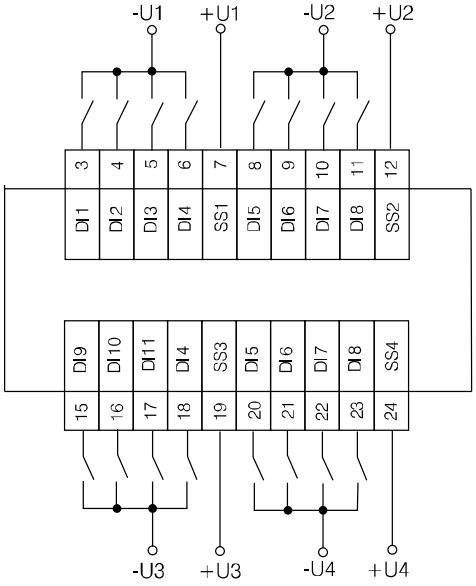


Fig. 4.2 Connection of switch contacts to the MV110-16DN

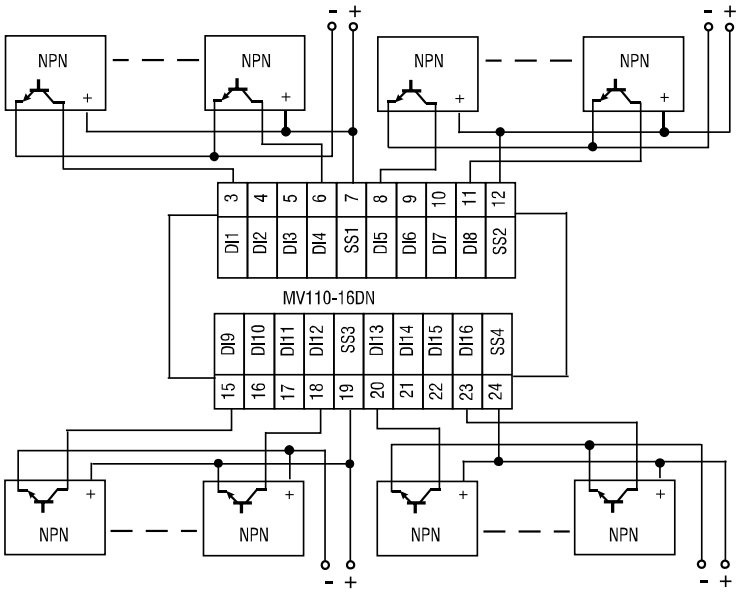


Fig. 4.3 Connection of 3-wire sensors with NPN transistor outputs to the MV110-16DN

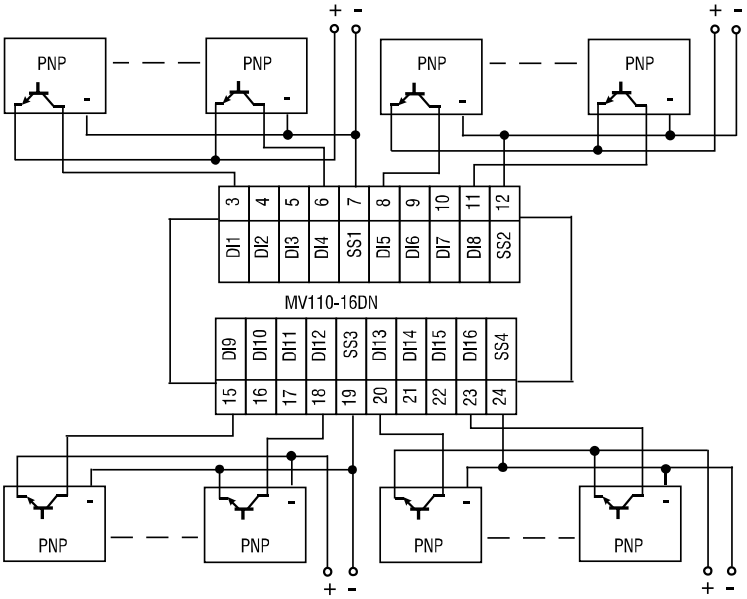


Fig. 4.4 Connection of 3-wire sensors with PNP transistor outputs to the MV110-16DN

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5. Configuration

▶ NOTICE

Before starting
Before switching on, make sure that the device has been kept at the specified ambient temperature (-20... +55 ° C) for at least 30 minutes.

Parameters of the module can be read, edited and saved with 'M110 Configurator' software. The full list of parameters is shown in the Table 5.1.

Module has to be configured first before operating in RS485 network.

The following steps are required:

– Install M110 Configurator on the PC.
– The module should be connected to USB port of the PC over a USB/RS485 adapter (not included). Connect the D+/D- terminals of the module with the D+/D- contacts of the adapter.
– Connect the power supply to 24V/0V terminals of the module.
– Turn on the power supply.
– Run the Mx110 Configurator.

If the factory settings of the module have not been changed, the connection to the module is automatically established, the module automatically recognized, its configuration parameters read out and an appropriate configuration mask open.

If it does not happen, parameters of the configurator have to be changed.

Table 5.1 Configuration parameters

Name	Parameter	Valid value	Meaning	Default settings
Common parameters				
dev	Device	Up to 8 symbols		MV110-16D
ver	Firmware version	Up to 8 symbols		manufacturer
Network parameters				
bPS	Baud rate, kbit/s	0	2.4	9.6
		1	4.8	
		2	9.6	
		3	14.4	
		4	19.2	
		5	28.8	
		6	38.4	
		7	57.6	
		8	115.2	
LEn	Data bits *	0	7	8
		1	8	
PrtY	Parity *	0	none	none
		1	even	
		2	odd	
Sbit	Stop bits *	0	1	1
		1	2	
A.Len	Address bits	0	8	8
		1	11	
Addr	Device address	1…247		16
t.out	Time-out, s	0…600		0
Prot	Protocol	0	akYtec	0
		1	Modbus RTU	
		2	Modbus ASCII	
Rs.dL	Response delay, ms	0…45		2
Output parameters				
Tin.C	Debouncing filter	0	off	0
		1	on	

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***** *Invalid network parameter combinations:*

- *prty=0; sbit=0; len=0*
- *prty=1; sbit=1; len=1*
- *prty=2; sbit=1; len=1*

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6. Operation

In the operation mode the module is controlled by a network Master in Modbus network.

In addition, the input states and counter states can be read out and the counter states can be set to 0 (see 6.1).

Modbus functions 03, 04 for reading and 16 for writing can be used.

6.1 Input and counter status

The input status can be read out as a bitmask. The corresponding Modbus registers can be taken from the table 6.1. The least significant bit of the mask corresponds to the input 1.
To reset the counter, write 0 to the corresponding register.

6.2 Fault condition

If the data exchange on the serial port is interrupted (i. e. there is no command from the master within the time specified by the parameter **t.out**), the following applies:

– LED FAULT flashes.
– Once a request from the master device comes, the display ‘refreshes’.
– If **t.out** parameter is set to 0, ‘Fault Condition’ is not defined.

6.3 Memory addressing

All variables and parameters in the Table 6.2 are of the type UNIT16.

R – read access
W – write access

Table 6.1 Modbus register

Parameter	Unit	Access	Address	
			hex	dec
Time-out, s (**t.out**)	1..600	RW	0030	0048
Input status bitmask	0..65535	R	0033	0051
Counter status of the input 1	0..65535	RW	0040	0064
Counter status of the input 2	0..65535	RW	0041	0065
…	…	…	…	…
Counter status of the input 16	0..65535	RW	004F	0079

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7. Factory settings restoration

If the communication between the module and PC cannot be established and network parameters of the module are unknown, the default network settings should be restored. The following steps are required:

– Turn off the power supply
– Remove the front cover of the module
– Insert the jumper X2. Module will operate with the default network parameters, the user settings remain stored.
– Turn on the power supply again

WARNING

Dangerous voltage
Electric shock could kill or seriously injure.
The voltage on some components of the circuit board can be danger-ous! Direct contact with the circuit board or penetration of a foreign body in the enclosure must be avoided!

– Run M110 Configurator
– In the window ‘Connection to device’ enter the values from the Table 7.1 or click the key ‘Use factory settings’ (see Fig. 7.1)

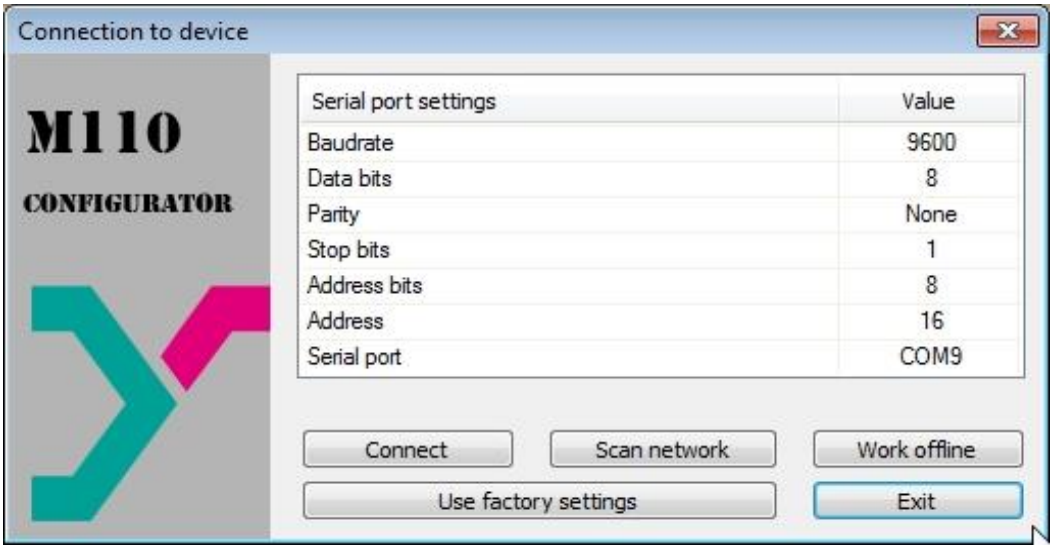


Fig. 7.1 Start window of configuration software

– Click ‘Connect’ to establish the connection with factory settings
– The main window of the Configurator opens. Saved user parameters of the module can be read now (see Fig. 7.2).
– Open folder ‘Network parameters’ and note the user network parameters

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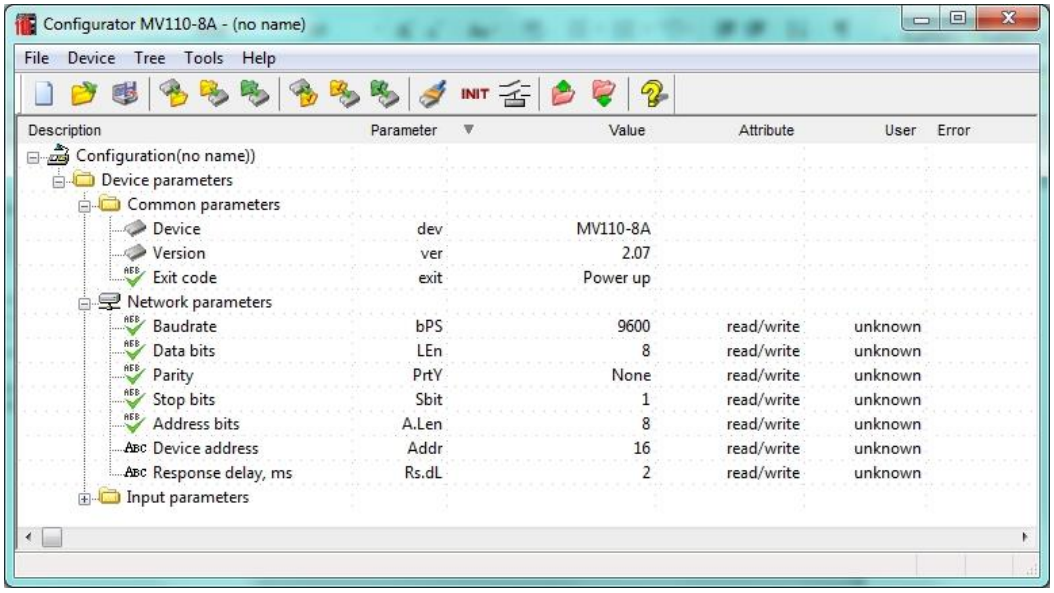


Fig. 7.2 Main window of M110 Configurator

– Close M110 Configurator
– Turn off the power supply
– Take out the Jumper X2
– Close the front cover
– Turn on the power supply again
– Start M110 Configurator
– Enter the noted network parameters
– Click ‘Connect’

The module is now ready for operation.

Table 7.1 Network factory settings

Parameter	Name	Default
Baudrate	**bPS**	9600
Data bits	**LEn**	8
Parity	**PrtY**	none
Stop bits	**Sbit**	1
Address bits	**A.Len**	8
Address	**Addr**	16
Response delay, ms	**Rs.dL**	2

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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.

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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**

Transport damage, completeness
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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10. Scope of delivery

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Appendix A. Dimensions

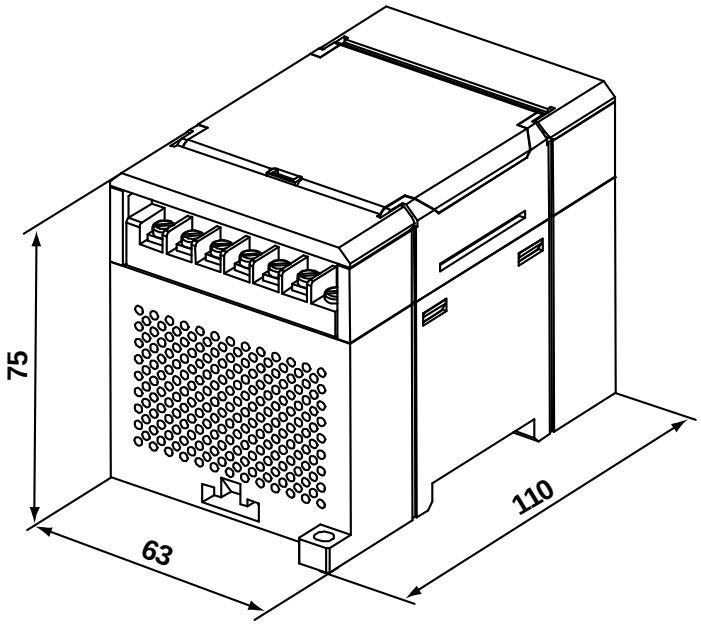


Fig. A.1 External dimensions

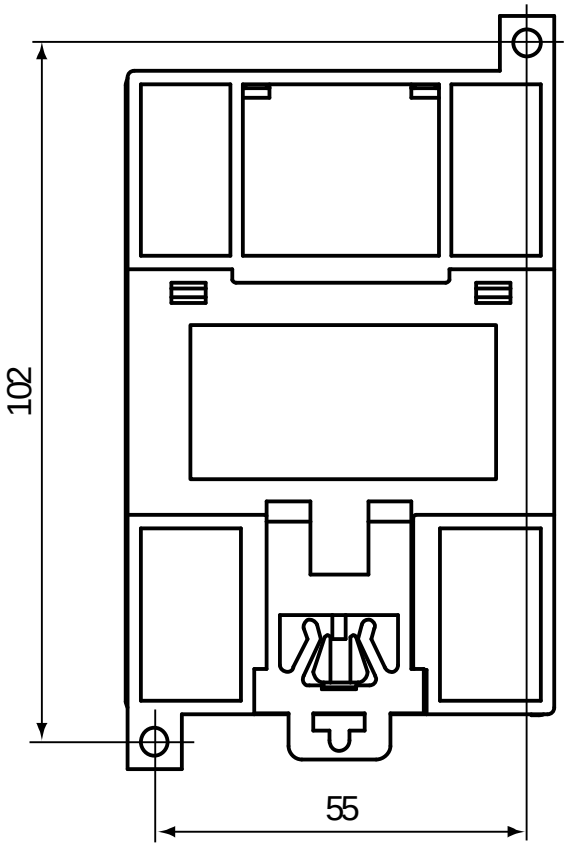


Fig. A.2 Wall mounting dimensions

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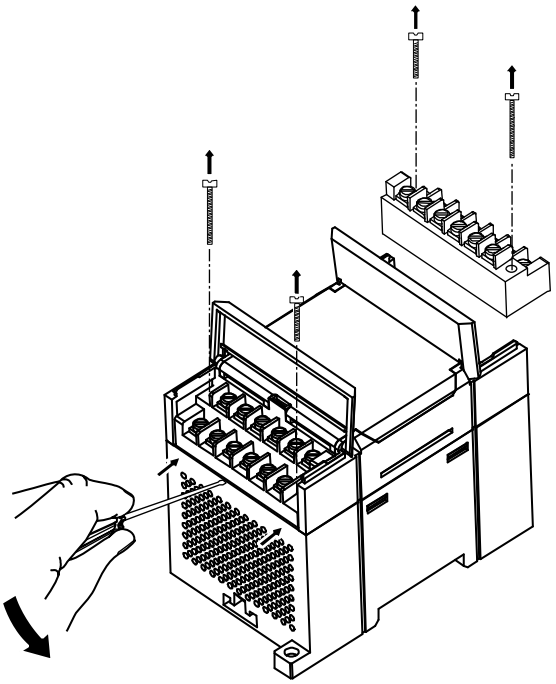


Fig. A.3 Replacement of terminal blocks

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