

MV110–24.16D(DN)

Digital input module 16 channel

User guide

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MV110–24.16D(DN)_3-EN-142731-1.7
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1 Introduction

1.1 Abbreviations

MX110_configurator – configuration software
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*)

1.2 Symbols and key words

WARNING
WARNING indicates a potentially dangerous situation that could result in death or serious injuries.

CAUTION
CAUTION indicates a potentially dangerous situation that could result in minor injuries.

NOTICE
NOTICE indicates a potentially dangerous situation that could result in damage to property.

NOTE
NOTE indicates helpful tips and recommendations, as well as information for efficient and trouble-free operation.

1.3 Intended use

The device has been designed and built solely for the intended use described here, and may only be used accordingly. The technical specifications contained in this document must be observed.
The device may be operated only in properly installed condition.

Improper use

Any other use is considered improper. Especially to note:
– The device may not be used for medical applications.
– The device may not be used in explosive environment.
– The device may not be used in atmosphere in which there are chemically active substances.

1.4 Limitation of liability

Our company does not bear any responsibility with respect to breakdowns or damages caused by using the product in a manner other than described in the Manual or in violation of the current regulations and technical standards.

1.5 Safety

WARNING
Ensure the mains voltage matches the voltage marked on the nameplate. Ensure the device is provided with its own power supply line and electric fuse.

WARNING
The device terminals may be under a dangerous voltage. De-energize the device before working on it. Switch on the power supply only after completing all works on the device.

NOTICE
Supply voltage may not exceed 28 V. Higher voltage can damage the device.
If the supply voltage is lower than 20 V DC, the device cannot operate properly but will not be damaged.

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NOTICE
If the device is brought from a cold to a warm environment, condensation may form inside the device. To avoid damage to the device, keep the device in the warm environment for at least 1 hour before powering on.

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2 Overview

2.1 Basic features

Digital input module MV110-24.16D(DN) 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
– RS485 network state diagnostics
– Generating corresponding fault and alarm signals
– Slave in Modbus network

The module uses Modbus-RTU and Modbus-ASCII protocols with automatic protocol identification.
The module can be configured with the *Mx110 Configurator software* using an RS485-USB interface adapter (not included).

2.2 Design and indication

Table 2.1 Indication

LED	LED state	Description
INPUTS 1...16	ON	HIGH on input
RS485	Flashing	Data exchange at serial port
POWER	ON	Power on
FAULT	ON	Data exchange process is nterrupted

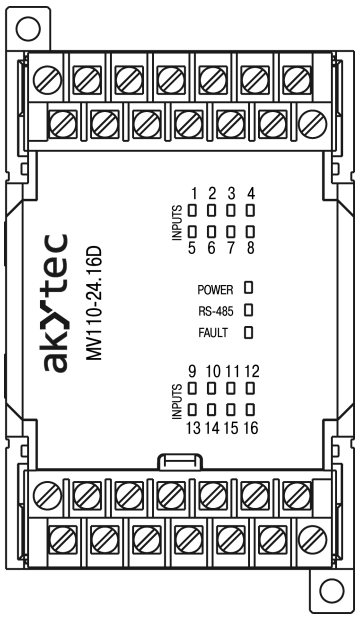


Fig. 2.1 Front view of MV110-24.16D

Under the cover on the front panel of the module there are located three jumpers:

– X2 – Factory settings recovery
– X3 – Service function
– X1 – Hardware write protection of permanent memory

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3 Specifications

3.1 Specifications

Table 3.1 Specifications

Parameter		Value
Power supply		24 (20…28) V DC
Power consumption, max.		6 W
Inputs	Digital	16
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 × 110 × 75 mm
Weight, max.		500 g
Material		plastic
IP Code		IP 20

Table 3.2 Technical data of inputs

Property	MV110-24.16D	MV110-24.16DN
Input signal	Switch contact	
	NPN	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.	7 mA	8.5 mA (with 27 V)
Logical „1“, min.	-	4.5 mA
Logical „0“, max.	-	1.5 mA
Lead resistance, max.	100 Ohm	-

3.2 Operating conditions

The module is designed for natural convection cooling that 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

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Table 3.3 Operating 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)
Altitude	up to 2000 m above sea level

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4 Configuration and operation

NOTE
Before switching on, make sure that the device was stored at the specified ambient temperature (-***20 ... +55 °C) for at least 60 minutes.***

In the operation mode the module is controlled by a network Master in Modbus network.
In addition, the input status and counter status can be read out and the counter status can be set to 0 (see *Section 4.2*).
Modbus functions 03, 04 can be used for reading and 16 can be used for writing.
The software and its user guide can be found on the *akYtec site*.
The module should be configured first before operating in the RS485 network.
The following steps are required:

1. Install the Mx110 Configurator on a PC.
2. The module should be connected to the 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.
3. Connect the power supply to the 24V/0V terminals of the module.
4. Turn on the power supply.
5. 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 is automatically recognized, its configuration parameters are read out and an appropriate configuration mask opens.
If it does not happen, parameters of the configurator have to be changed.
Parameters of the module can be read, edited and saved with the 'Mx110 Configurator' software.
The full list of parameters is shown in the Table below.

Table 4.1 Configuration parameters

Name	Parameter	Valid value	Meaning	Default settings
Common parameters				
dev	Device	Up to 8 symbols		MV110-24.16D
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

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Name	Parameter	Valid value	Meaning	Default settings
		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	

NOTE
* Invalid network parameter combinations:
– *prty=0; sbit=0; len=0*
– *prty=1; sbit=1; len=1*
– *prty=2; sbit=1; len=1*

4.1 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 length are ignored. The counter is responsive to any rising edges.
When the power is turned off, the actual counter status remains retained in permanent memory.
The counter resets to 0 if an overflow is reached, 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 4.1*). The function is recommended at signal frequencies up to 90 Hz and if the duty cycle is 50% and more.

4.2 Input and counter status

The input status can be read out as a bitmask. The corresponding Modbus registers can be taken from *table 4.2*. The least significant bit of the mask corresponds to input 1.
To reset the counter, write 0 to the corresponding register.

4.3 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

4.4 RS485 network

The I/O modules of Mx110 series use a widespread standard RS485 for data transmission. The RS485 serial interface is designed as a 2-wire system in the half duplex mode. The modules support Modbus RTU, Modbus ASCII and akYtec protocols. The network consists of one master and can have up to 32 slaves. The maximum cable length is 1200 m. The number of slaves and the cable length can be increased using an RS485 interface repeater.

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Devices are connected to a network according to linear (bus) topology. It means that connection is led from the first device to the second, from the second to the third, etc. Star topology and stubs are not permitted.
Reflections from cables always occur at the open cable ends (first and last bus system participant). They increase proportionately with the baud rate. To avoid reflections on long cables, it is necessary to use appropriate termination resistors. For this purpose, 150 Ohm termination resistors are the most efficient.
The modules can be used as slave devices only. Master device can be a PLC, a PC with SCADA software or a control panel.

4.5 Modbus registers

Table 4.2 Modbus registers

Parameter	Value (Unit)	Type	Register	
			(Hex)	(Dec)
Bit mask of input status	0…65535	Uint16	0033	0051
Counter DI1–DI16	0…65535	Uint16	0040–004F	0064–0079
Baud rate	0 – 2,4 (kBd); 1 – 4,8 (kBd); 2 – 9,6 (kBd); 3 – 14,4 (kBd); 4 – 19,2 (kBd); 5 – 28,8 (kBd); 6 – 38,4 (kBd); 7 – 57,6 (kBd); 8 – 115,2 (kBd)	Uint16	0209	0521
Data bits	0 – 7 1 – 8	Uint16	020A	0522
Stop bits	0 – 1 stop bit 1 – 2 stop bits	Uint16	020B	0523
Parity	0 – none 1 – even 2 – odd	Uint16	020C	0524
Response time-out	0…45 (ms)	Uint16	020D	0525
Device address	1…255	Uint16	020F	0527
Network address length	0 – 7 1 – 8	Uint16	0211	0529
Time-out	0…600 s	Uint16	0030	0048
Device name	—	String	F000	61440
Device version	—	String	F010	61456

Writing to the registers is performed with function 16 (0x10), reading with functions 03 or 04 (the device supports both functions).

4.6 Hardware write protection of permanent memory

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

1. Switch off the power supply.
2. Open the cover on the front panel of the module.

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3. Put jumper X1 into position “closed”.

Thereby the following is to observe:

– To change the configuration parameters, jumper X1 must be removed again.
– As long as jumper X1 is inserted, the input counter will be reset after every loss of power.

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5 Installation

5.1 Mounting

The device is designed to be installed on a DIN rail or using two screws on a mounting panel in an electric cabinet.
The operating conditions from *Sect. 3.2* must be considered when choosing the installation site.
Dimensional drawings are given in *Appendix A A.*. Only the vertical positioning of the device is allowed.
The device is designed for natural convection cooling. Make sure that the cabinet provides sufficient clearance for natural convection.

5.2 Wiring

WARNING
Electric shock could kill or seriously injure

WARNING
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 an electric fuse!

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

Connect power supply to the 24V / 0V terminals.
The maximum conductor cross-section for power supply is 1.5 mm².

NOTE

EMC safety

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

Only a shielded cable may be used for signal lines.

Connect the RS485 cable to terminals D+ and D-.
Connection to the RS485 interface is carried out via a twisted pair cable.

5.2.1 MV110-24.16D

The following can be connected to the input of type D:
– potential-free contacts
– NPN transistor outputs with open collector
When connecting the following is to be observed:
– All the COM terminals are internally wired together
– The common resistor of the sensor output together with connecting cables may not exceed 100 Ohm

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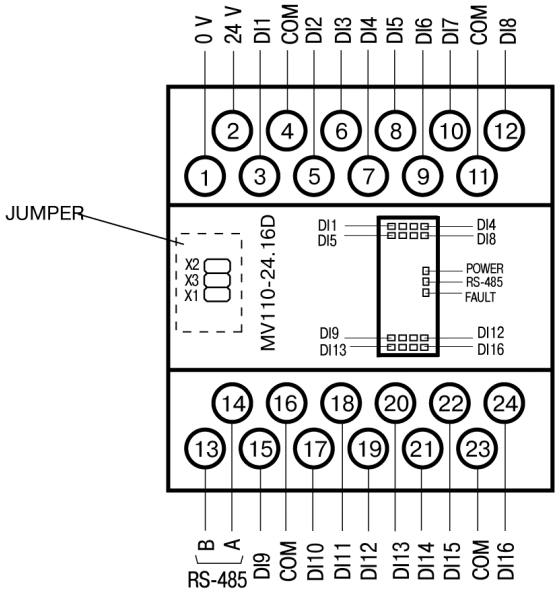


Fig. 5.1 Electrical connections of MV110-24.16D

Table 5.1 Terminal assignment MV110–24.16D

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

Connection variants for different signal types are shown in the Figures below.

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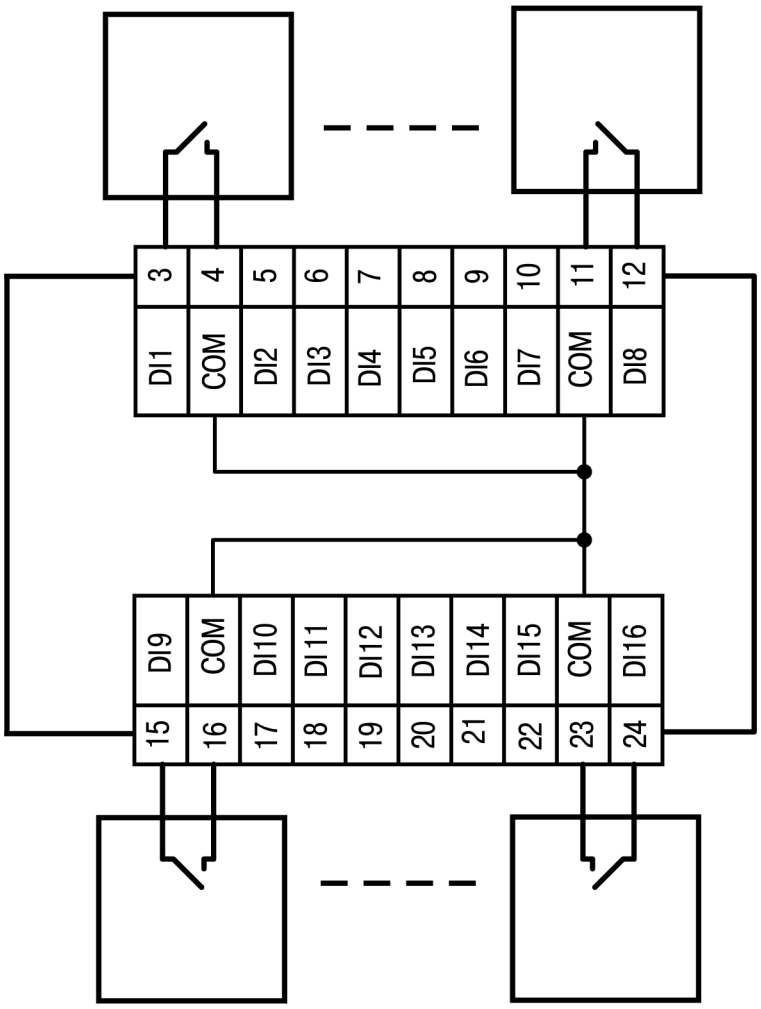


Fig. 5.2 Connection of switch contacts to MV110-24.16D

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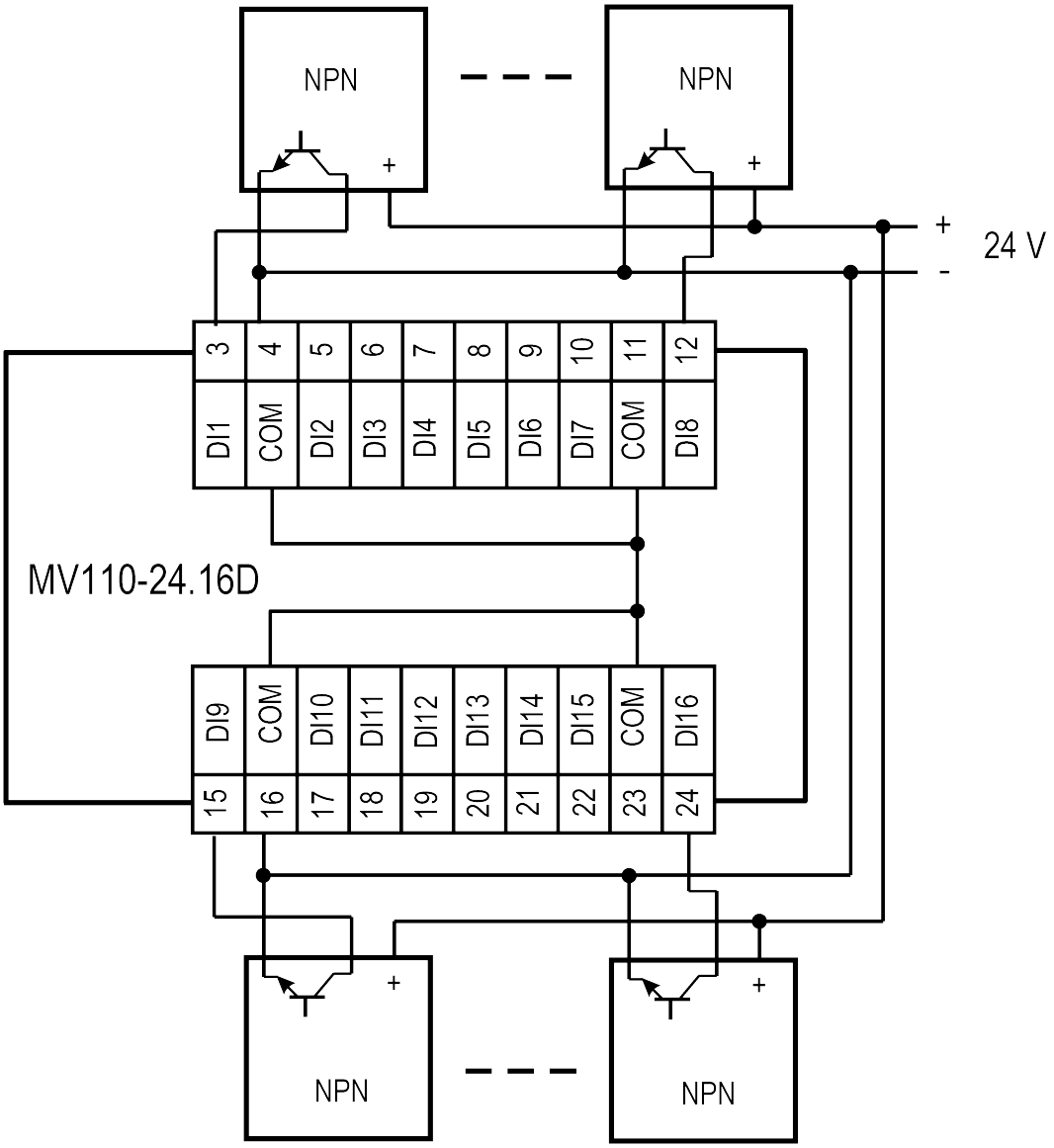


Fig. 5.3 Connection of 3-wire sensors with NPN transistor outputs to MV110-24.16D

5.2.2 MV110-24.16DN

The input of type DN can be used to connect:
– potential-free contacts
– NPN transistor outputs with open collector
– PNP transistor outputs

When connecting the following is to be observed:
The inputs of module MV110-24.16DN are galvanically isolated in groups of 4 (1...4, 5...8, 9...12, 13...16). When connecting the sensors, use only the group related common negative terminal:
– inputs DI1…DI4 – terminal SS1
– inputs DI5…DI8 – terminal SS2
– inputs DI9…DI1 – terminal SS3
– inputs DI13…D16 – terminal SS4

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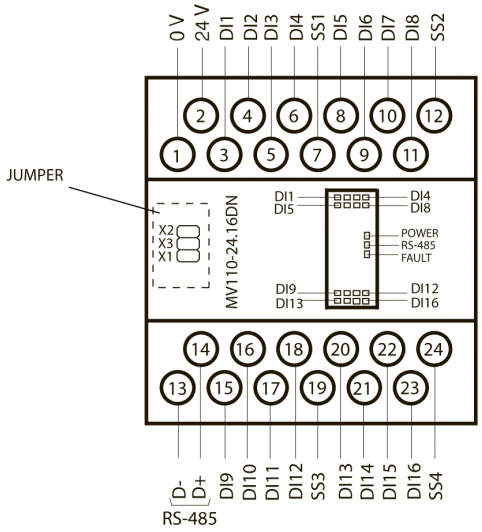


Fig. 5.4 Electrical connections of MV110-24.16DN

Table 5.2 Terminal assignment of MV110–24.16DN

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

Connection variants for different signal types are shown in the Figures below.

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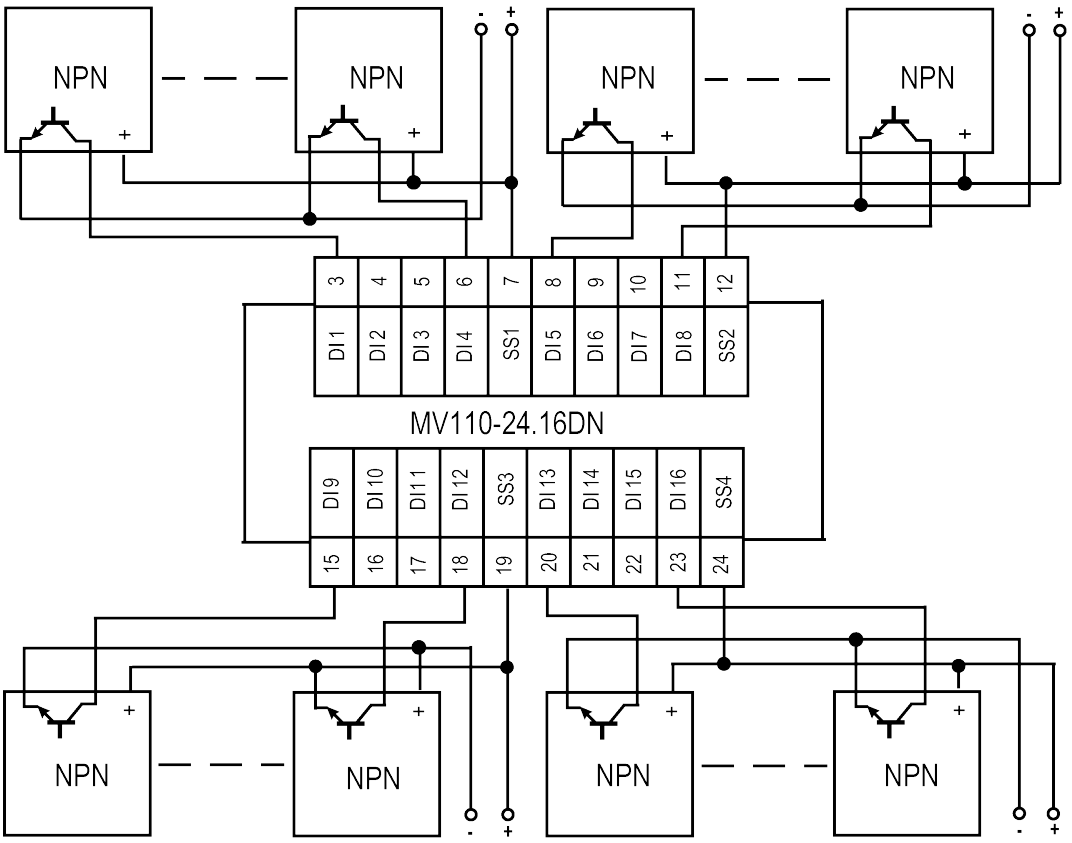


Fig. 5.5 Connection of switch contacts to the MV110-24.16DN

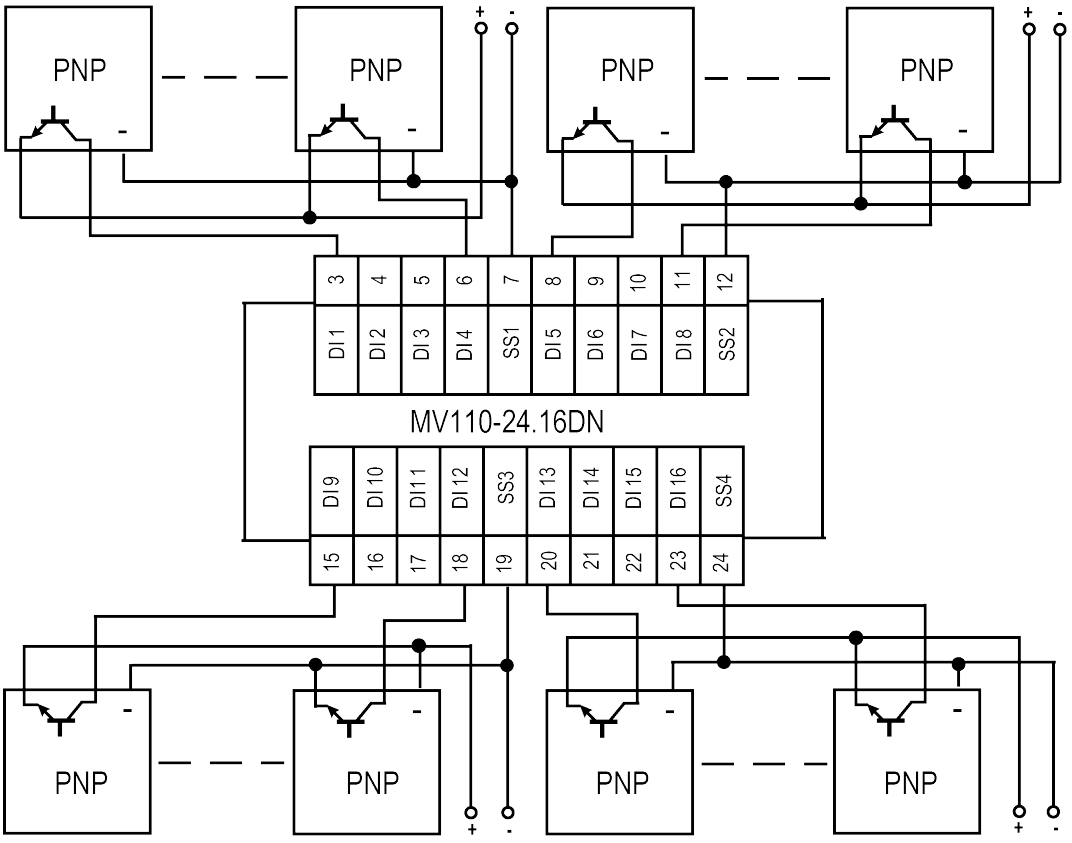


Fig. 5.6 Connection of 3-wire sensors with PNP transistor outputs to MV110-24.16DN

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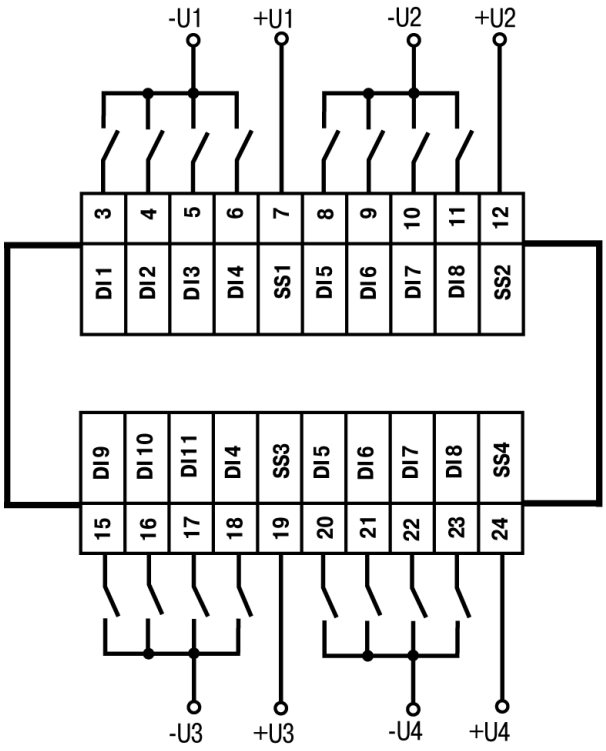


Fig. 5.7 Input wiring — switch contacts

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6 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:

1. Turn off the power supply.
2. Remove the front cover of the module.
3. Insert jumper X2. The module will operate with the default network parameters, the user settings remain saved.
4. Turn on the power supply again.

WARNING
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!

5. Start the Mx110 Configurator.
6. In window ‘Connection to device’ enter the values from *Table 6.1* or click ‘Use factory settings’.

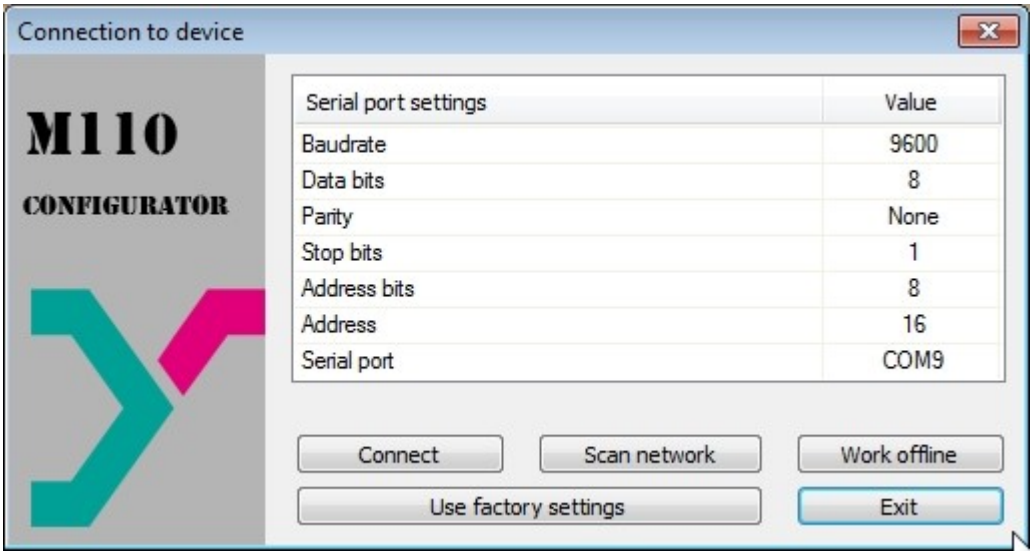


Fig. 6.1 Mx110 Configurator start window

7. Click ‘Connect’ to establish connection with the factory settings.
8. The main window of the Configurator opens. Saved user parameters of the module can be read now.
9. Open folder ‘Network parameters’ and note the user network parameters.

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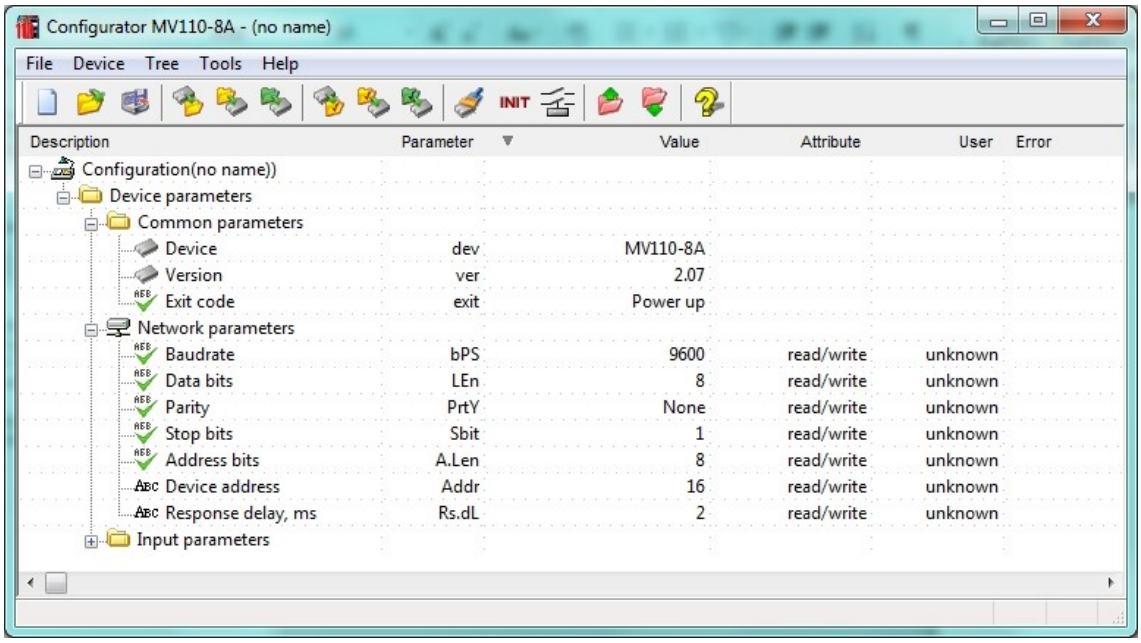


Fig. 6.2 Mx110 Configurator main window

10. Close the Mx110 Configurator.
11. Turn off the power supply.
12. Take out Jumper X2.
13. Close the front cover.
14. Turn on the power supply again.
15. Start the Mx110 Configurator.
16. Enter the noted network parameters.
17. Click ‘Connect’.

The module is now ready for operation.

Table 6.1 Factory settings for network parameters

Parameter	Name	Factory setting
Baud rate	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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7 Maintenance

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 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: -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!

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9 Scope of delivery

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Appendix A. Dimensions

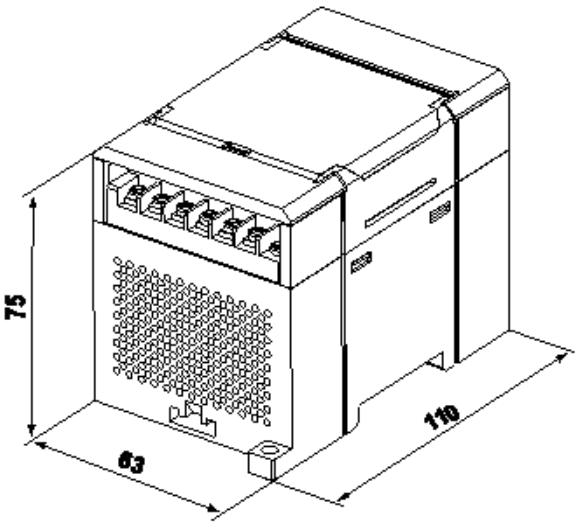


Fig. A.1 External dimensions

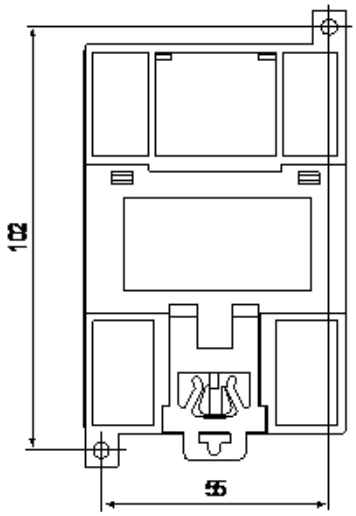


Fig. A.2 Wall mounting dimensions

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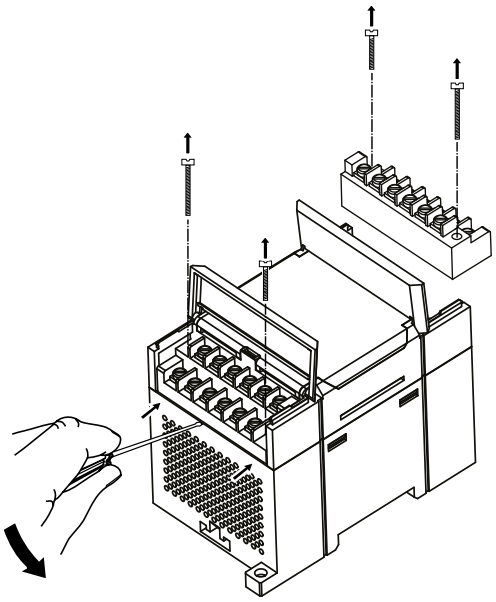


Fig. A.3 Replacement of terminal blocks

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Appendix B. Galvanic Isolation

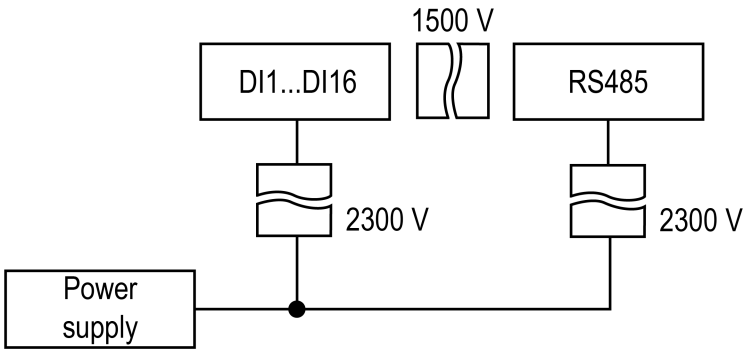


Fig. B.1 Galvanic isolation MV110–24.16D

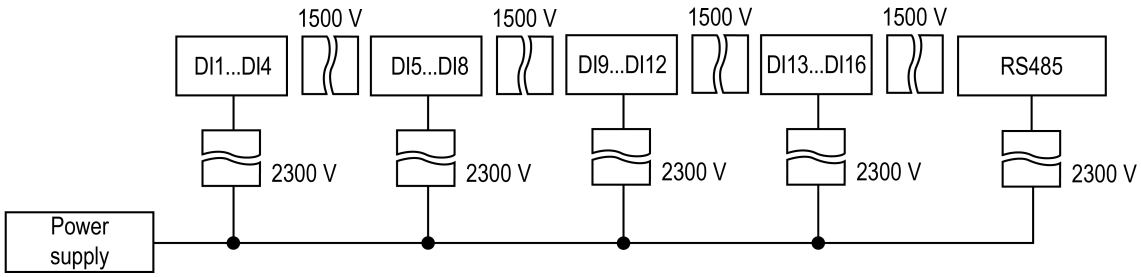


Fig. B.2 Galvanic isolation MV110–24.16DN

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