

MV110-24.32DN

Digital input module 32 channel

User guide

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MV110-24.32DN_3-EN-144182-1.2
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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.

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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.

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 Function

Digital input/output module **MV110-24.32DN** is an expansion module with **32** digital inputs.
The module functions as follows:

– Connection of peripherals with digital outputs;
– Digital signal processing;
– Pulse counter (refer to *sect. 2.2*);
– Diagnostics of RS485 Network status;
– Generation of the appropriate error signals or alarm signals;
– Slave device in Modbus protocol structure.

The module supports Modbus-RTU and Modbus-ASCII protocols and is equipped 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.***

2.2 Counter Function

Additionally the module can use all inputs as fast 16-bit counter with operating counting frequency up to 1 kHz. Minimum one-pulsetime is 0.5 ms. Pulseswith higher frequency or less one-pulse time are ignored. The counter responses on rising edge.
When switching off the counterstatus is saved in the long-term memory. In case of full filling the counter is reset to zero and counting continues.
Function of debouncing can be activated for each input. For this purpose, during configuration parameter **tin.c** (debouncing filter) shall be set to "**On**" (refer to *Table 5.1*). It is recommended to use this function at signal frequency up to 90 Hz and duty ratio 50% and more.

2.3 RS485 network

I/O modules of Mx110 series uses common standard RS485 to exchange data. RS485 serial interface ensures communication via two-wire line in half-duplex mode. The modules support protocols ModbusRTU, Modbus ASCII and akYtec.The network consists of a host device and can have up to 32 slave devices. Maximum length is 1,200 m. The number of slave devices and network length can be increased with interface extender RS485.
Separate devices (slave devices) are connected 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 connection and interconnection tie lines are not allowed.
Line reflections always occur in open cable terminals (the first and the last nodes in the bus- bar). The higher the chosen data transmission rate, the stronger they are. A terminating resistor is provided to keep reflections at minimum possible level. Experience proved that it is the most efficient to provide for terminating resistors 150 Ohm.
All modules are used only in slave mode. PLC, computers with SCADA software and control panel can be host devices.

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2.4 Design and indication

Enclosure	plastic, grey, for wall mounting or mounting on DIN-rail
Terminal blocks	2 plug-in terminalblocks with 48 screw terminals
LED “POWER”	power supply
LED “RS-485”	flashes in case of data exchangevia serial port
LED “FAULT”	is on if data exchange via serial port is terminated
32 LEDs “INPUTS”	are on in case of logical 1 in the appropriate input

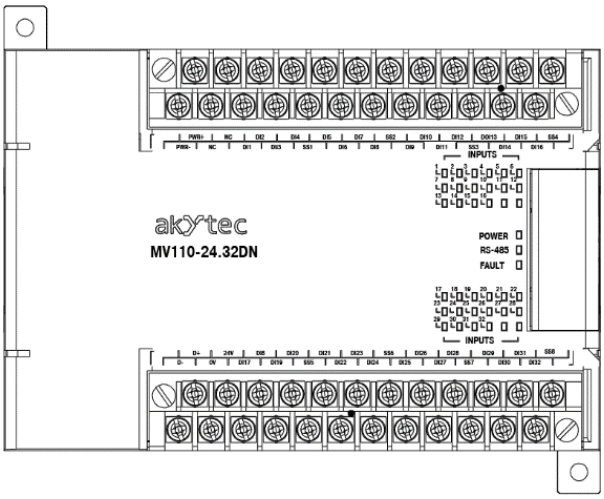


Fig. 2.1 Front View

Dimensional Sketches are given in *Appendix A.*.
Under the cover on the front panel of the module three DIP-switches are located (refer to *Fig. 4.1*):

1. Factory settings restoration (see *sect. 6*);
2. Service function;
3. Hardware protection from long-term memorywriting.

All 3 switches are not enabled during delivery.

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3 Specifications

3.1 Specifications

Table 3.1 General specifications

Power supply		24 (20…28)V DC
Power consumption, max.		25 W
Inputs	digital	32
	analog	
RS485 interface	Terminals	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, max.		800 g
Material		plastic
IP code		IP20

Table 3.2 Input specifications

Type	Switching contact,NPN, PNP
Galvanic Isolation	In groups
Insulation strength	1500 V
Pulse frequency, max.	1 kHz
Pulse width,min.	0.5 ms
Current, max	7 mA
Line 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

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 Installation

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

– The module is intended to be installed in the housing on a DIN-rail or on the wall.
– Install the module in the housingwith clean, dry and controllable environment. Requirements are specified in *sect. 3.2*.
– The module is designed for convective self-cooling. It should be taken into account when the installation place is chosen.

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!

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

– Electrical connections are given in *Fig. 4.1*, and terminal arrangement is given in *Table 4.1*.
– Connection variants for various types of signals and connection of output relays are given in *Fig. 4.2*– 4.4.
– Connect the power supply to the terminals **24 V / 0 V**.
– Cross section in the connection place should be**≤1.5 mm²**.

NOTE
EMC safety
Signal cables should be routed separately or screened from the supply cables.
Only shielded cable can be used for the signal lines.
It is strongly recommended to connect the screen in the electrical cabinet in accordance with EMC requirements.

– Connect the RS485 lines to the terminals D(+) and D(-).
– Twisted pair cable shouldbe used for the connection to RS485 interface. Maximal cable length is 1200 m.

4.2 Hardware write protection

In case of strong electromagnetic interferences or similar condition, data in the long-term memory can be lost.
DIP switch 3 (hardware write-protection) allows avoiding data loss. The following steps shall be performed:

1. Turn the power supply off.
2. Open the front cover of the module (see *Fig. 4.1*).
3. Set DIP switch 3 in ON position.

Notice the following:
– In order to change configuration parameters, the switch should be set in OFF position
– Till the switch is in the position ON, input counters will be reset at power off.

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4.3 Inputs

The following can be connected at input:
– Switch contacts,
– NPN transistor outputs with open collector,
– PNP transistor outputs with open collector.
Pay attention to the following during connection:
– All SS terminals are connected between each other.
– Total resistance of the sensor output with connection lines shall not exceed 100 Ohm.

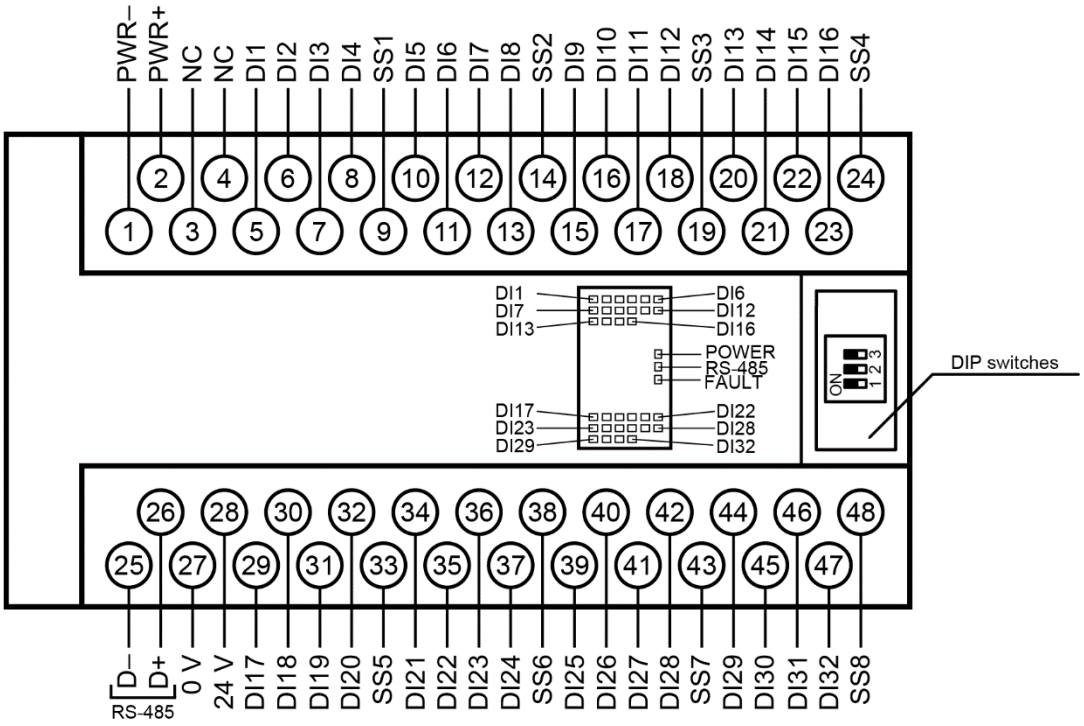


Fig. 4.1 Electrical connections

Table 4.1 Terminal assignments MV110-24.32DN

No	Indication	Description	No	Indication	Description
1	0V	Power supply	**25**	D-	RS485 D-
2	24V		**26**	D+	RS485 D+
3	NC	Not connected	**27**	0	Built-in power supply (0 V)
4	NC	Not connected	**28**	24V	Built-in power supply (24 V)
5	DO1	Input 1	**29**	DO17	Input 17
6	DO2	Input 2	**30**	DO18	Input 18
7	DO3	Input 3	**31**	DO19	Input 19
8	DO4	Input 4	**32**	DO20	Input 20
9	COM1	Common negative for Inputs 1-4	**33**	COM5	Common negative for inputs 17-20

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No	Indication	Description	No	Indication	Description
10	DO5	Input 5	**34**	DO21	Input 21
11	DO6	Input 6	**35**	DO22	Input 22
12	DO7	Input 7	**36**	DO23	Input 23
13	DO8	Input 8	**37**	DO24	Input 24
14	COM2	Common negative for Inputs 5-8	**38**	COM6	Common negative for Inputs 21-24
15	DO9	Input 9	**39**	DO25	Input 25
16	DO10	Input 10	**40**	DO26	Input 26
17	DO11	Input 11	**41**	DO27	Input 27
18	DO12	Input 12	**42**	DO28	Input 28
19	COM3	Common negative for Inputs 9-12	**43**	COM7	Common negative for Inputs 25-28
20	DO13	Input 13	**44**	DO29	Input 29
21	DO14	Input 14	**45**	DO30	Input 30
22	DO15	Input 15	**46**	DO31	Input 31
23	DO16	Input 16	**47**	DO32	Input 32
24	COM4	Common negative for Inputs 13-16	**48**	COM8	Common negative for Inputs 29-32

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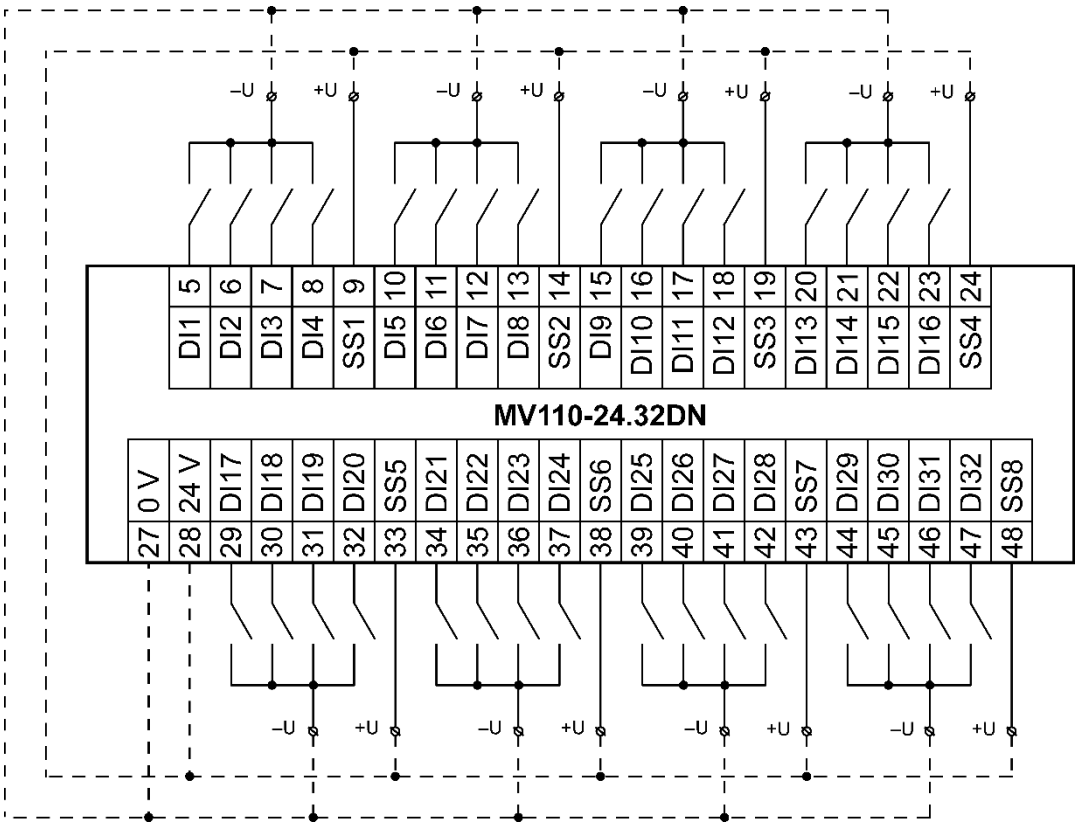


Fig. 4.2 Connection of switch contacts

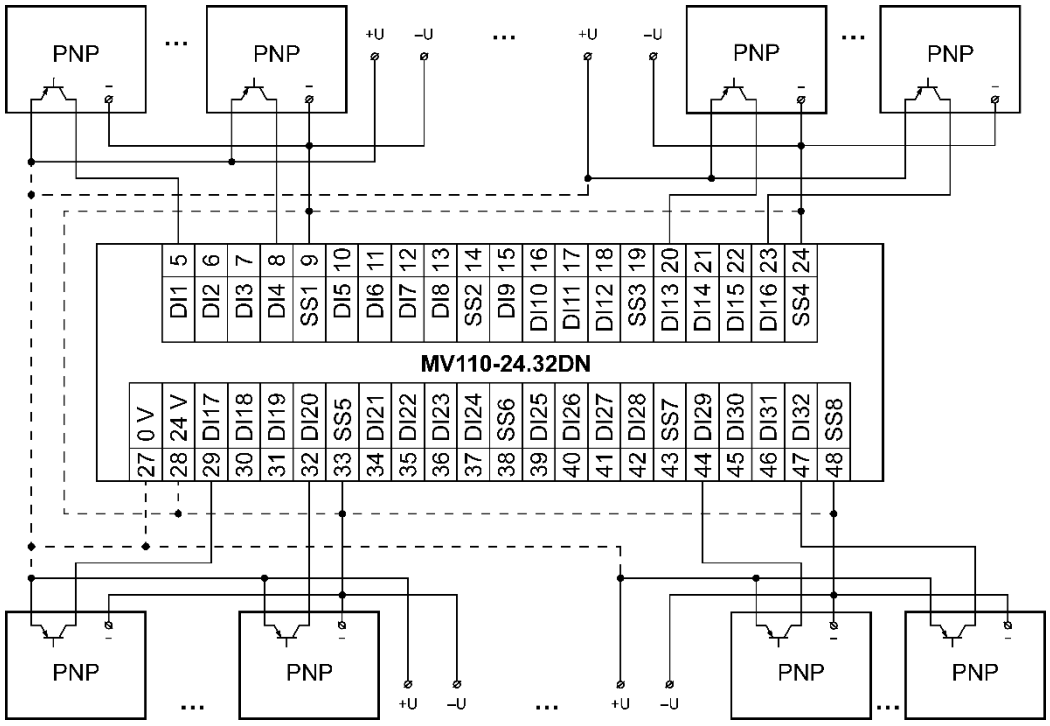


Fig. 4.3 Connection of 3-wire sensors with PNP-transistor output

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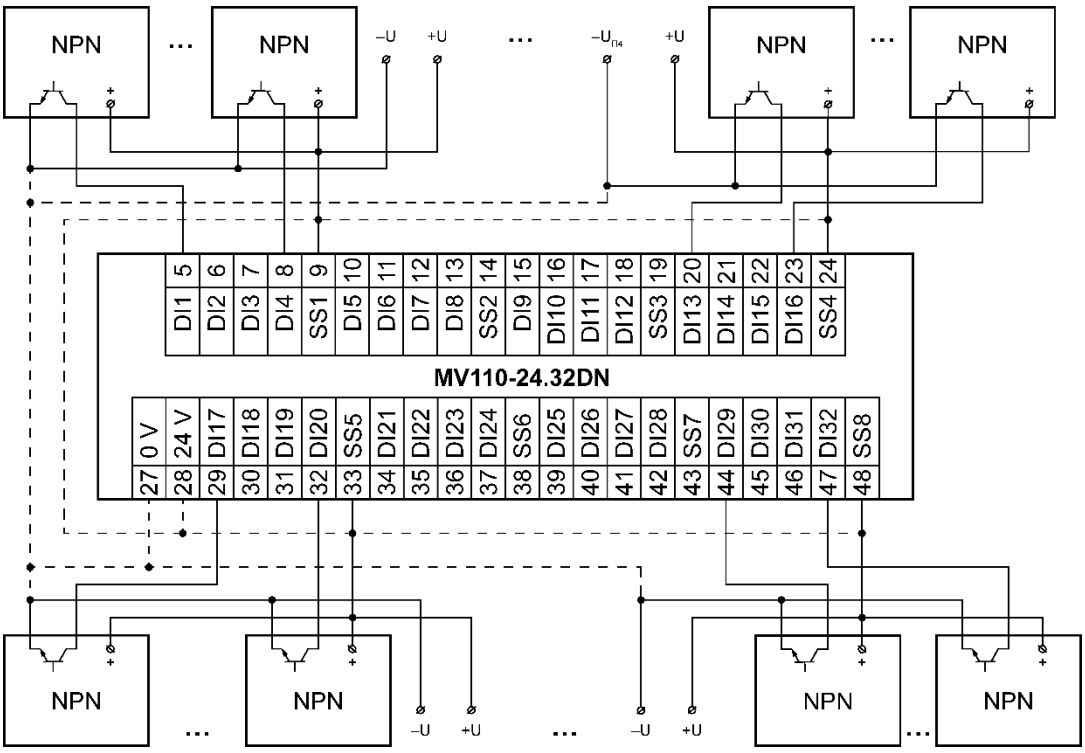


Fig. 4.4 Connection of 3-wire sensors with NPN-transistor output

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5 Configuration and operation

5.1 Configuration

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

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

Module has to be configured first before operating in RS485 network. The following steps are required:

1. Install M110 Configurator on the PC.
2. Connect the module to the USB interface of the PC over RS485-USB interface adapter IC4 (not included). Connect the D+/D- terminals of the module with the D+/D- contacts of the adapter.
3. Connect the power supply to 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 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.

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Table 5.1 Configuration parameters

Name	Parameter	Valid value	Meaning	Default setting
Basic parameters				
dev	Device	up to 8 characters		MV110-24.32DN
ver	Firmware version	up to 8 characters		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
Rs.dL	Response delay, ms	0…45		2
Input parameters				
Tin.C	Debouncing filter	0	off	0
		1	on	

* *Invalid network parameter combinations:*

– *prty=0; sbit=0; len=0*

– *prty=1 ;sbit=1; len=1*

– *prty=2; sbit=1; len=1*

5.2 Input/Counter Status

Input status can be read out as a bit mask. The appropriate Modbus registers are given in *Table 5.2*.
The least significant bit of the mask corresponds to input 1.
To reset the counter, 0 should be specified in the appropriate register.

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5.3 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**), all outputs are set to a safe status.
In this condition the following applies:

– LED “FAULT” is on.
– As soon as a query is received from the host device, indication is off.
– If **t.out** parameter is set to **0**, then fault status doesn’t occur.

Parameters **t.out** and **O.ALr** can be set during configuration or operation as well. The note ‘**Permanent memory**’ in *sect. 5.4* should be taken into account.

5.4 Memory addressing

All variables and parameters in *Table 5.2* are specified for type **uint16**.
R – access to read out, **W** – access to write.

Table 5.2 Modbus register

Parame-ter	Unit	Value		Access	Address	
		Configu-ration	Modbus-Com-mand		hex	dex
Time-out (**t.out**)	s	0…600	0…600	RW	0060	0096
Bit mask of input status	-	-	**0… 4294967-295**	**R**	**0063, 0064**	**0099, 0100**
Counter DI1	-	0…65535	0…65535	RW	0065	00101
Counter DI2	-	0…65535	0…65535	RW	0066	00102
Counter DI...	-	0…65535	0…65535	RW	...	...
Counter DI32	-	0…65535	0…65535	RW	0084	00132

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6 Factory Settings Restoration

If communication between the computer and the module is not established, and network parameters of the module are unknown, the network factory settings should be restored. The following steps shall be performed:

– Power off the module.
– Remove the cover on the front panel of the module.
– Install DIP-switch X2. The module will operate with network parameters set by the manufacturer, user settings are saved.
– Power on again.

WARNING
Dangerous voltage
The voltage on some components of the circuit board can be dangerous! Direct contact with the circuit board or penetration of a foreign body in the enclosure must be avoided!

– Start configuration program "Mx110 Configurator".
– Enter the values from *Table 6.1* in window "Connect Device" or press button "Use factory settings" (refer to *Fig. 6.1*).

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

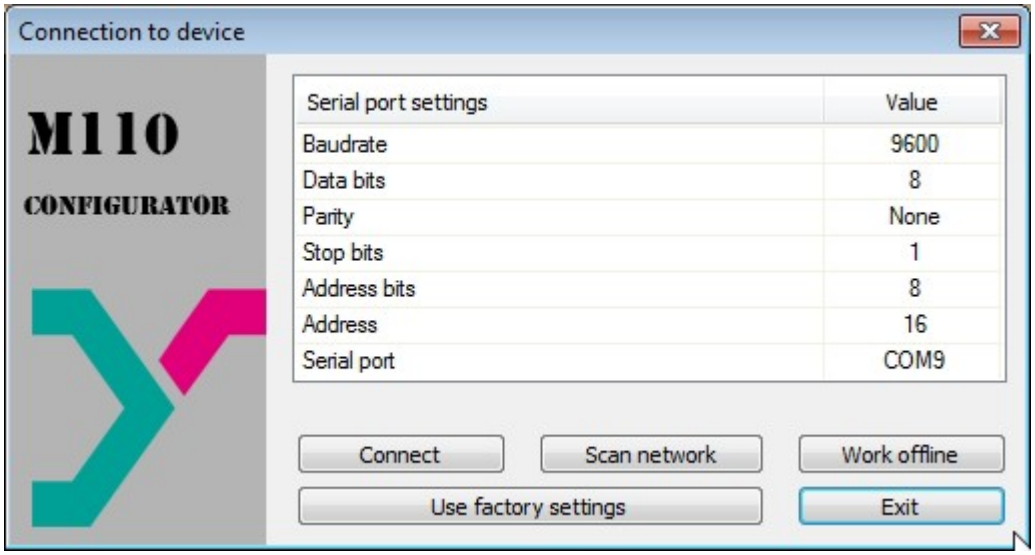


Fig. 6.1 Mx110 Configurator start window

– Press button "Connect". Connection with the factory network parameters will be established.
– Main window of the configurator is opened. Now the saved parameters of the module can be read out (refer to *Fig. 6.2*).

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– Open folder "Network parameters" in the main window of "Mx110 Configurator" and write values of the network parameters.

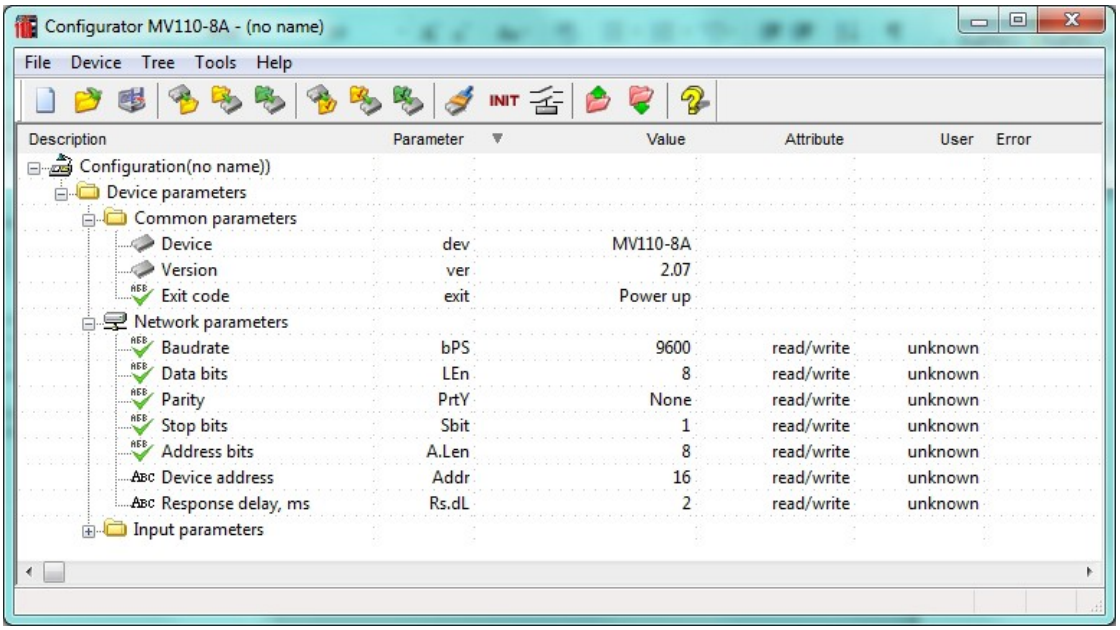


Fig. 6.2 Mx110 Configurator main window

– Close "Mx110 Configurator".
– Turn off the power supply.
– Take out Jumper X2.
– Close the front cover.
– Turn on the power supply.
– Restart "Mx110 Configurator".
– Enter the written network parameters.
– Press button "Connect".

The module is ready for operation.

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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. Appendix A. Dimensions

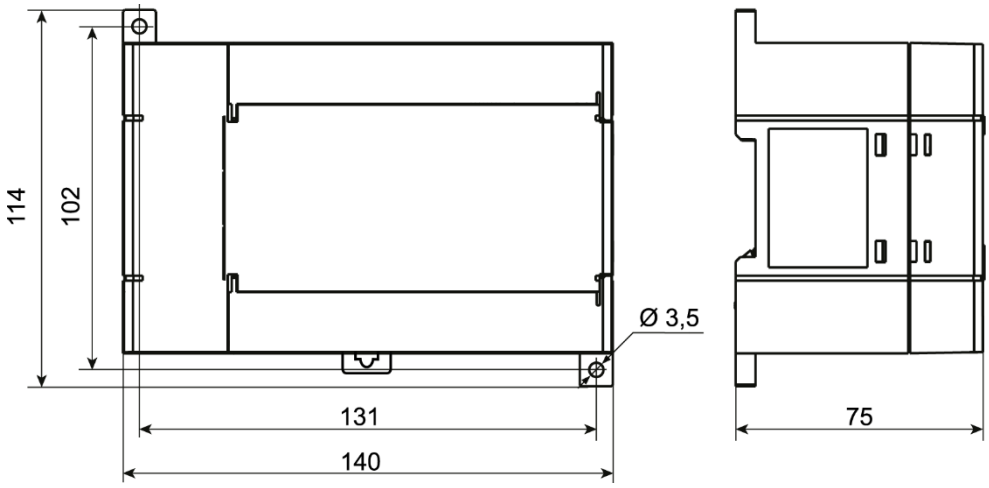


Fig. A.1 Dimensions

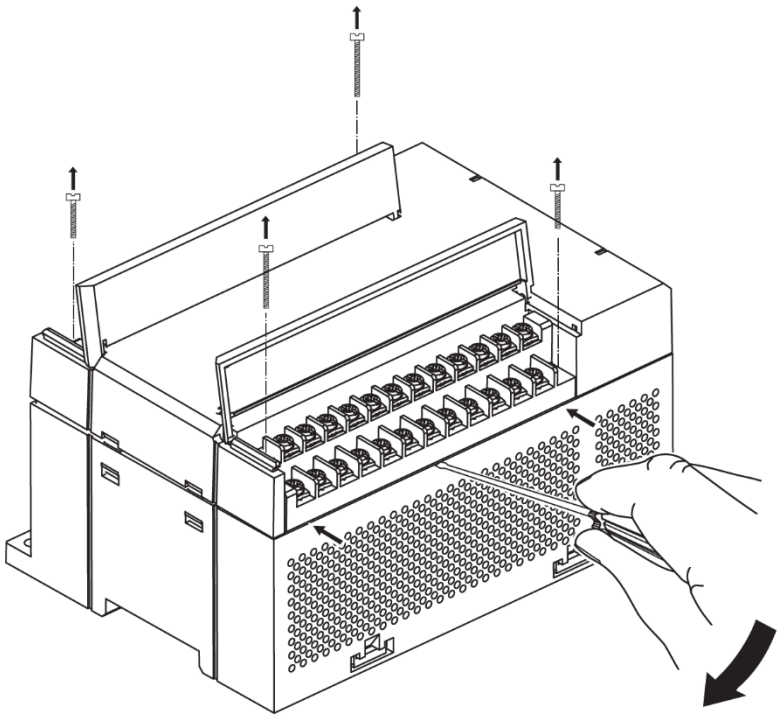


Fig. A.2 Replacement of terminal blocks

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