



## MV110-16D(DN)

### Digital input module 16 channel

### User guide

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## Description

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### 1 Description

#### 1.1 Function

Digital input module MV110-16D(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 (see 1.2)
- 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 'M110 Configurator' software (on CD included) using a RS485-USB interface adapter (not included).

#### 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

The I/O modules of MV110 series use a widespread standard RS485 for data transmission. The RS485 serial interface is designed as 2-wire system in half duplex mode. The modules support Modbus RTU, Modbus ASCII and akYtec protocols. A network consists of one master and can have up to 32 slaves. The maximum cable length is 1200 m. Quantity of slaves and the cable length can be increased using an RS-485 interface repeater.

The individual devices (slaves) are joined together in a linear or rather 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. Termination resistors for 150 ohm are the most efficient for this purpose.

All modules of this series can be operated only in slave mode. In the capacity of master can be used SPSs, PCS with SCADA-Software or operator terminals.

## Description

### 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

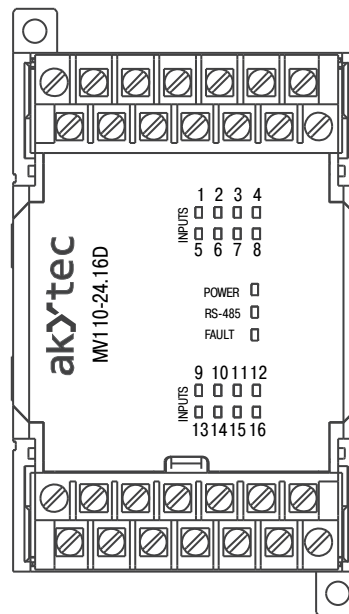


Fig. 1.1 Front view of MV110-16D

Dimensions are shown in Appendix A.

Under the cover on the front panel of the module there are located three jumpers (see 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.

## Specifications

### 2 Specifications

#### 2.1 Ordering key

The module MV110-16D(DN) can be delivered in two variants depending on the input type.

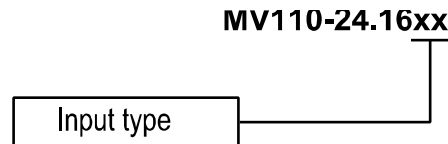


Fig. 2.1 Ordering key

Input type:

- D                    NPN digital inputs
- DN                -        NPN/PNP digital inputs, in groups of 4 galvanically isolated

#### 2.2 Technical data

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	MV110-16D	MV110-16DN
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	–

## Specifications

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### 2.3 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 2.3 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

## Safety

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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 avoided, 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 manual, and may only be used accordingly. The technical specifications contained in this manual 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 devices that sustain, monitor or otherwise affect human life or health.
- The device may not be used in potentially explosive environment.
- The device may not be used in an atmosphere with chemically active agents.

### 4 Installation



**CAUTION**

#### ***Improper installation***

***Improper installation can cause serious or minor injuries and damage the module. 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 an electric fuse!***



**CAUTION**

***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 4.4 and pin assignments are shown in Table 4.1 and 4.2.
- Connection variants for different signal types are shown in Fig. 4.2 – 4.3 and 4.5 – 4.7.
- Connect power supply to the 24V / 0V terminals.
- The maximum conductor cross-section for power supply is 1.5 mm<sup>2</sup>



**NOTICE**

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

#### 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.



## Installation

### 4.1.2 MV110-16D

To the input of type D can be connected:

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

When connecting the following is to observe:

- All the COM terminals are internally wired together.
- The common resistor of the sensor output together with connecting cables may not exceed 100 ohm.

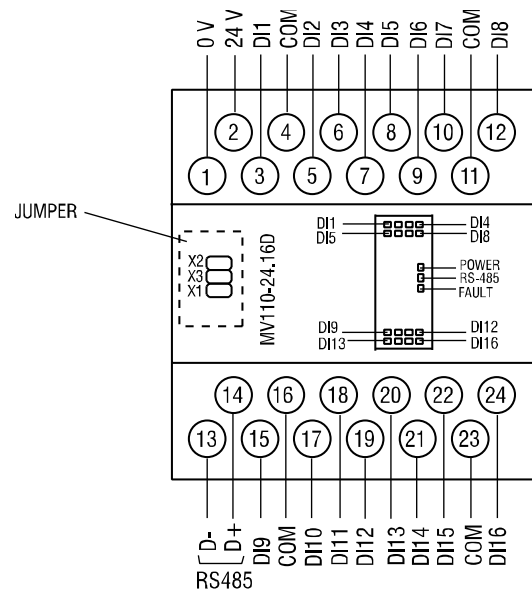


Fig. 4.1 Electrical connections of MV110-16D

Table 4.1 Terminal assignment of MV110-16D

No	Conne- ction	Description	No	Conne- ction	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	COM	Common nega- tive	16	COM	Common nega- tive
5	DI2	DI2	17	DI10	DI10
6	DI3	DI3	18	DI11	DI11
7	DI4	DI4	19	DI12	DI12
8	DI5	DI5	20	DI13	DI13
9	DI6	DI6	21	DI14	DI14
10	DI7	DI7	22	DI15	DI15
11	COM	Common nega- tive	23	COM	Common nega- tive
12	DI8	DI8	24	DI16	DI16

Connection variants for different signal types are shown in Figures 4.2 – 4.3.

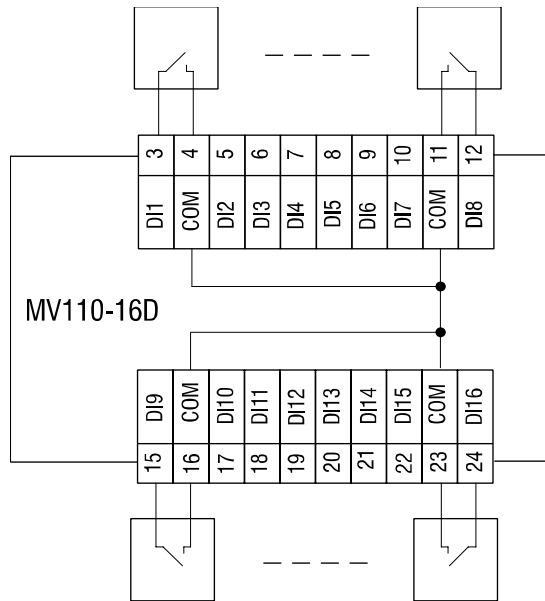


Fig. 4.2 Connection of switch contacts to the MV110-16D

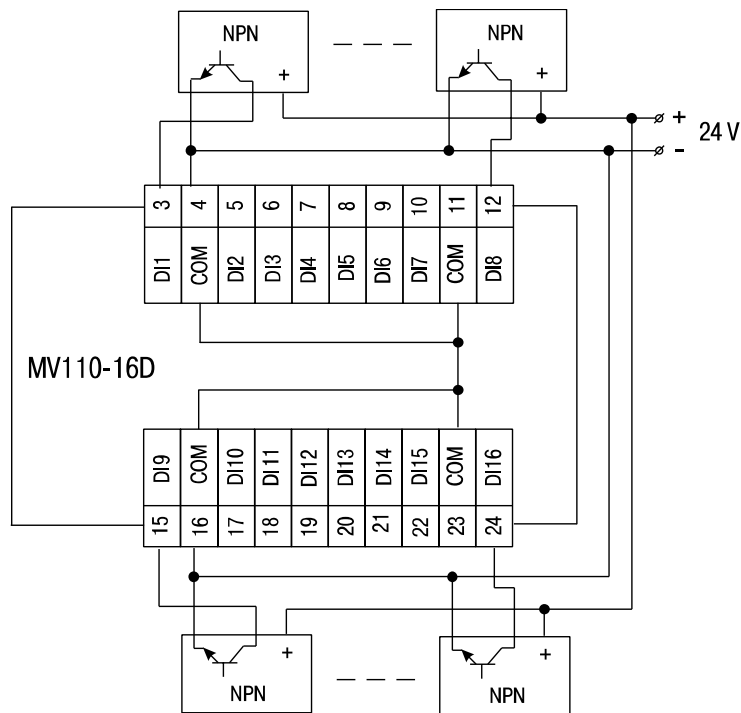


Fig. 4.3 Connection of 3-wire sensors with NPN transistor outputs to the MV110-16D

#### 4.1.3 MV110-16DN

To the input of type DN can be connected:

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

When connecting the following is to observe:

## Installation

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...DI16        - terminal SS4

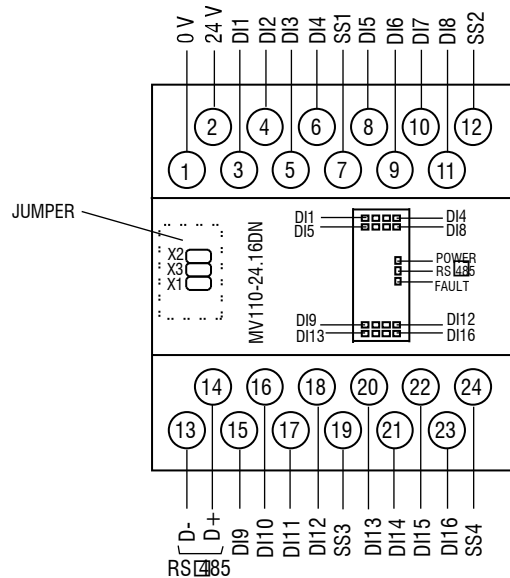


Fig. 4.4 Electrical connections of MV110-16DN

Table 4.2 Terminal assignment of MV110-16DN

Contact number	Connection	Description	Contact number	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 4.5 – 4.7.

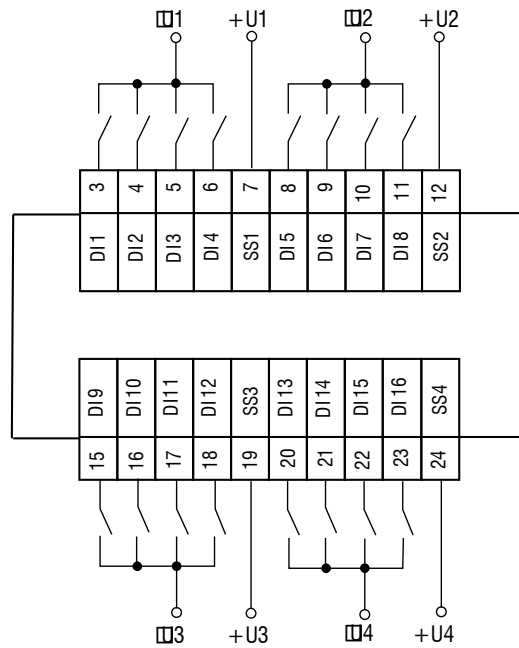


Fig. 4.5 Connection of switch contacts to the MV110-16DN

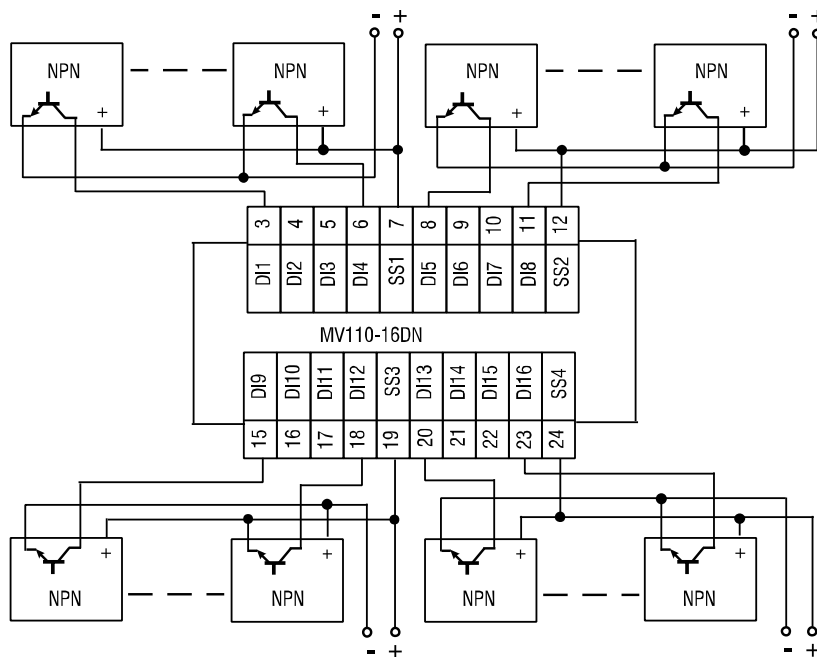


Fig. 4.6 Connection of 3-wire sensors with NPN transistor outputs to the MV110-16DN

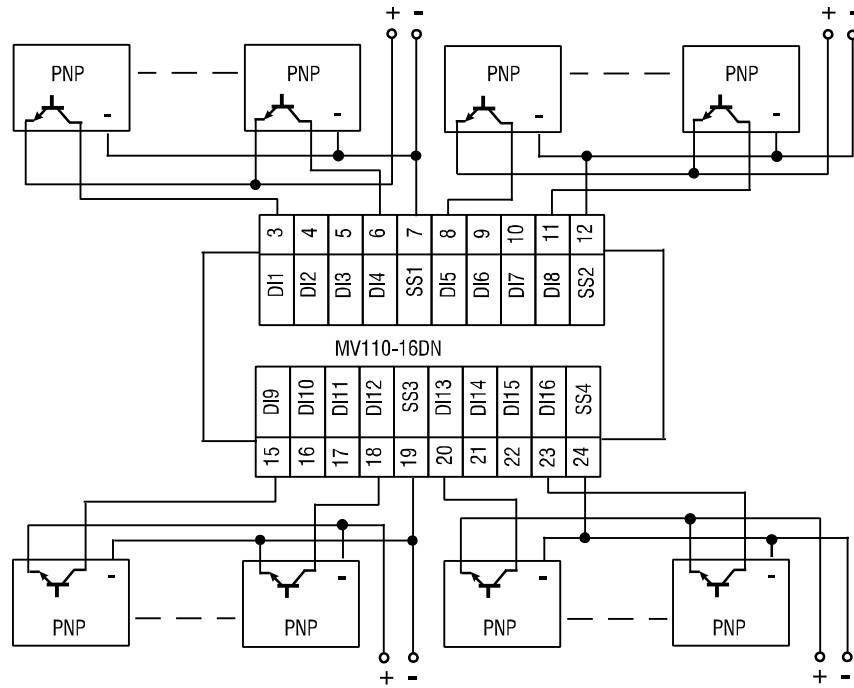


Fig. 4.7 Connection of 3-wire sensors with PNP transistor outputs to the MV110-16DN

## Configuration

### 5 Configuration

► NOTICE

**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 the Table 5.1.

The software and its user guide can be found on the CD (included).

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 M110 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.

Table 5.1 Configuration parameters

Name	Parameter	Valid value	Meaning	Default settings
<b>Common parameters</b>				
<b>dev</b>	Device	Up to 8 symbols		MV110-16D
<b>ver</b>	Firmware version	Up to 8 symbols		manufacturer
<b>Network parameters</b>				
<b>bPS</b>	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	
<b>LEn</b>	Data bits *	0	7	8
		1	8	
<b>PrtY</b>	Parity *	0	none	none
		1	even	
		2	odd	
<b>Sbit</b>	Stop bits *	0	1	1
		1	2	
<b>A.Len</b>	Address bits	0	8	8
		1	11	
<b>Addr</b>	Device address	1...247		16

## Configuration

Name	Parameter	Valid value	Meaning	Default settings
<b>t.out</b>	Time-out, s	0...600		0
<b>Prot</b>	Protocol	0	akYtec	0
		1	Modbus RTU	
		2	Modbus ASCII	
<b>Rs.dL</b>	Response delay, ms	0...45		2
<b>Output parameters</b>				
<b>Tin.C</b>	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*

## Operation

### 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



## Restore factory settings

### 7 Restore factory settings

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

 **DANGER**

#### **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!**

- 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)

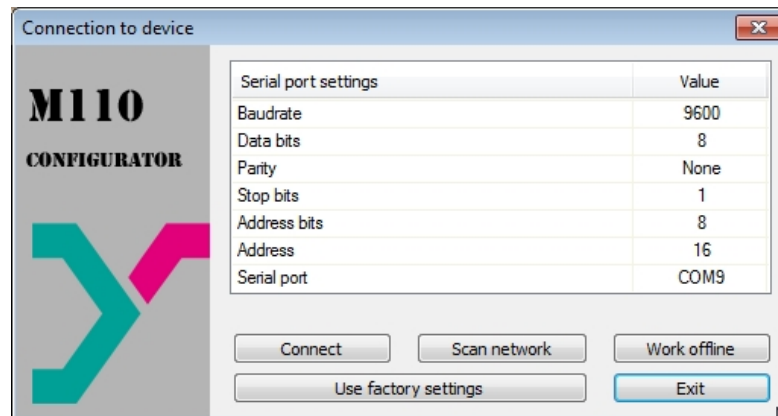


Fig. 7.1 M110 Configurator start window

- 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

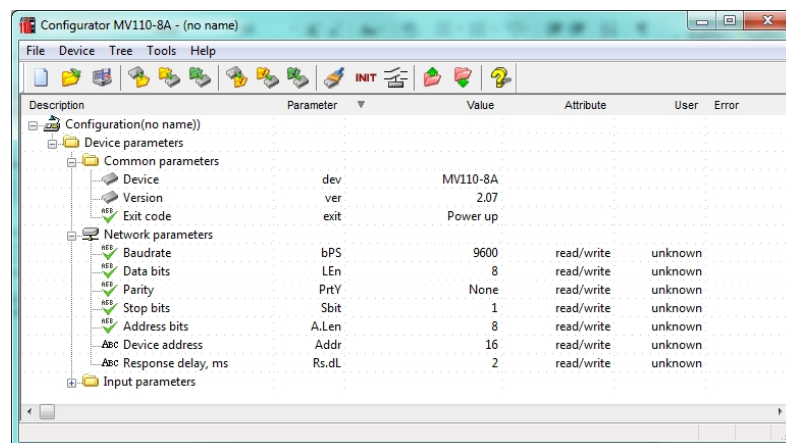


Fig. 7.2 M110 Configurator main window

## Restore factory settings

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- 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 Factory settings for network parameters*

Parameter	Name	Factory setting
Baud rate	<b>bPS</b>	9600
Data bits	<b>LEn</b>	8
Parity	<b>PrtY</b>	None
Stop bits	<b>Sbit</b>	1
Address bits	<b>A.Len</b>	8
Address	<b>Addr</b>	16
Response delay, ms	<b>Rs.dL</b>	2

## Maintenance

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### 8 Maintenance

The maintenance includes:

- cleaning of the housing and terminal blocks from dust, dirt and debris
- checking the fastening of the device
- checking the wiring (connecting leads, fastenings, mechanical damage)

The safety information in section 3 must be observed when carrying out maintenance.

## 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 module 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 range: -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!***

## Scope of delivery

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### 10 Scope of delivery

- Module MV110-16D(DN) 1
- User guide 1
- CD with software and documentation 1

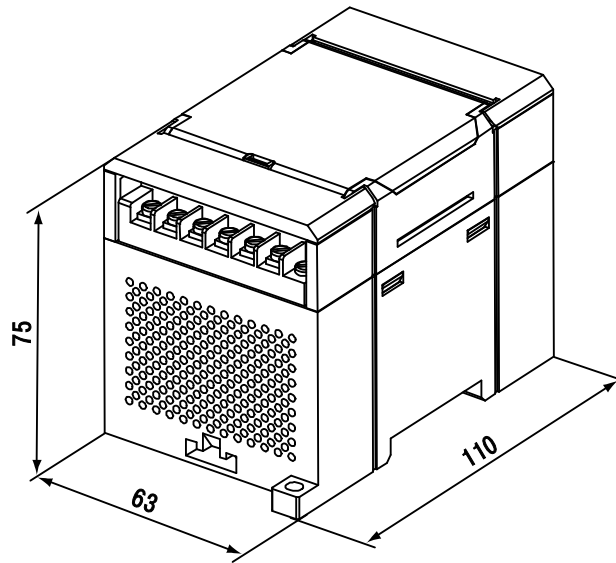


Fig. A.1 External dimensions

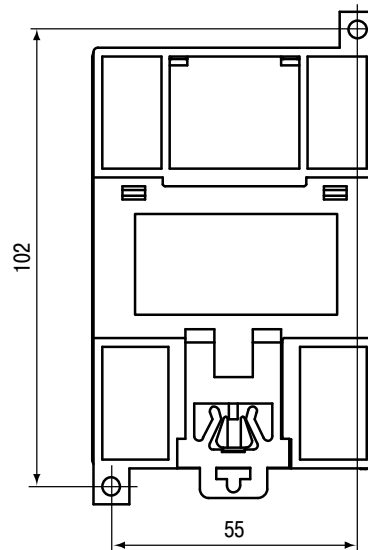


Fig. A.2 Wall mounting dimensions

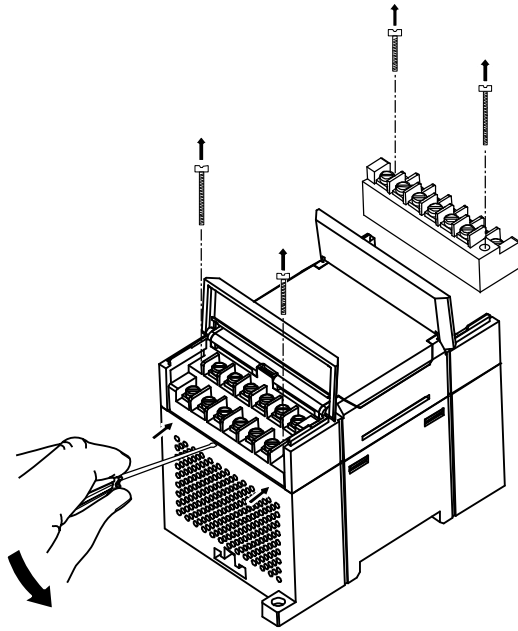


Fig. A.3 Replacement of terminal blocks