

MU110-24.8I

Analog output module 8 channel

User guide

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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

MU110-24.8I is an extension module with 8 analog outputs.
The module has the following functions:

– module control and parametrization via RS485 network
– RS485 Network diagnostics
– error and alarm signal generation
– Slave in the RS485 network

The module can be configured with the *Mx110 Configurator* software using an RS485-USB interface adapter (not included). The latest version of the configuration software is available for download on ***www.akytec.de.***

2.2 Design and indication

Table 2.1 Indication

LED	LED state	Description
POWER	ON	Power on
RS485	Flashing	Data exchange via RS485 interface
FAULT	ON	Data exchange via RS485 interface is interrupted

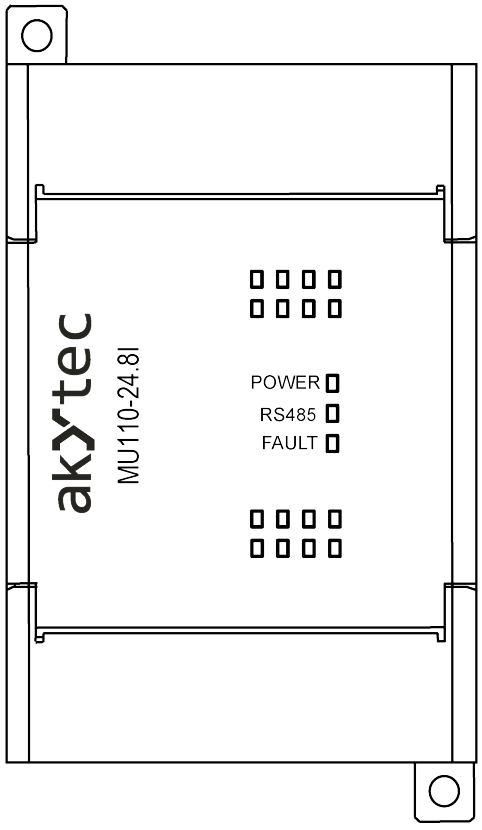


Fig. 2.1 Front view of MU110-24.8I

There are three jumpers under the front cover :

– X2 – restore factory settings
– X3 – service function
– X1 – DRAM write-protection

All the jumpers are in OFF position by default.

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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	–
	analog	–
Outputs	digital	–
	analog	8
Output signal		4-20 mA
Load resistance		0…1300 Ohm
Auxiliary voltage		10…36 V DC
RS485 interface	Terminal	D+, D-
	Protocol	Modbus RTU/ASCII, akYtec
	Baud rate	2.4…115.2 kbit/s
	Data bits	7, 8
	Parity	even, odd, none
	Stop bits	1, 2
Accuracy, max.		±0.5%
Dimensions		63 × 110 × 75 mm
Weight, max.		500 g
Material		plastic
IP code		IP20

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 environmental conditions must be observed:

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

Table 3.2 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.***

The module is controlled by the master device in an RS485 network.
The addresses from 1 to 247 can be used. The address 0 is reserved for broadcasting.
The following Modbus functions are supported:
– 03 (0x03) Read Holding Registers
– 04 (0x04) Read Input Registers
– 16 (0x10) Preset Multiple Registers
The register addresses are given in *Table 4.3*.
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).
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.

Table 4.1 Configuration parameters

Name	Parameter	Valid value	Meaning	Default settings
Basic parameters				
dev	Device	Up to 8 symbols		MU110-24.8I
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	

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Name	Parameter	Valid value	Meaning	Default settings
Sbit	Stop bits*	0	1	1
		1	2	
A.Len	Address bits	0	8	8
		1	11	
Addr	Device address	1…247		16
Prot	Protocol	0	akYtec	akYtec
		1	Modbus-RTU	
		2	Modbus-ASCII	
t.out	Time-out, s	0…600		0
Rs.dL	Response delay, ms	0…45		2
Output parameters				
O.ALr	Safe output status, %	0…100		0

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

The output status according to the output value is given in the table below:

Table 4.2 Output status

Output value*		Output Status
Configuration	**Modbus Command**	
0	0	4 mA
1	1000	20 mA
0..1	0…1000	4–20 mA

NOTE
*The configuration program uses internal communication protocol instead of Modbus protocol. For this reason, the ranges of output value during configuration and in Modbus command can differ. For example, in order to activate output AO1 during the functional test, the output value should be set to 1, but in Modbus command the output value 1000 should be recorded in register 0000.

4.1 Output functional test

In order to check functioning of the device outputs, proceed as follows:
– Connect the module to the computer USB-port via USB/RS485 adapter.
– Connect a voltmeter and a resistor box as shown in *Fig. 4.1*.
– Start the "Mx110 Configurator" program
– If connection with the module has not been established automatically, network parameters of the configuration program should be changed.
– Select "Device -> I/O Status…" in the menu to open the "Output status" window.
– Set individual outputs to 0 or 1 to check their functionality.
– The functional test is successful if the voltage is within the range between 10±0.05 V at 20 mA and 2±0.05 V at 4 mA.

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– Contact the Technical Support of akYtec GmbH in case of any deviations.

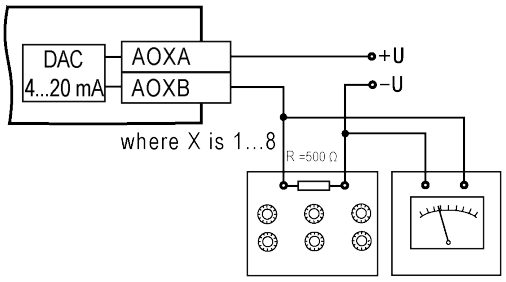


Fig. 4.1 Functional Test

4.2 Fault condition

If data exchange via RS485 is interrupted, i.e. the command is not received from the network Master within the time specified in parameter **t.out**, then all outputs with parameter **Log**=0 will be set to the safe state. The safe state is the output value specified in parameter **O.ALr** (Safe output status) for each output.
In this case:

– LED FAULT is on.
– LED FAULT is OFF with a new request received from the Master.
– The outputs remain in the safe state until the command from the Master about status change is received.
– If **t.out** is set to 0, 'Fault Condition' is not defined.

NOTE
Non-Volatile Memory
Since the non-volatile memory has limited re-write capabilities (~ 1 million cycles), it is not recommended to change the Safe output status (**O.ALr**) by a Modbus command so often as the output value.

4.3 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 RS-485 interface repeater.
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. Termination resistors for 150 Ohm are the most efficient for this purpose.
The modules can be used as slave devices only. Master device can be a PLC, a PC with SCADA software or a control panel.

4.4 Modbus registers

All variables and parameters in *Table 4.3* are of the INT16 type.
R – read access
W – write access

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Table 4.3 Modbus registers

Parameter	Valid value		Access	Register	
	Configura-tion	Modbus command		hex	dec
Output value AO1	0…1	0…1000	RW	0000	0000
Output value AO2	0…1	0…1000	RW	0001	0001
Output value AO…	0…1	0…1000	RW	…	…
Output value AO8	0…1	0…1000	RW	0007	0007
Safe output status (**O. ALr**) AO1	0…100	0…1000	RW	0010	0016
Safe output status (**O. ALr**) AO2	0…100	0…1000	RW	0011	0017
Safe output status (**O. ALr**) AO…	0…100	0…1000	RW	…	…
Safe output status (**O. ALr**) AO8	0…100	0…1000	RW	0017	0023
Time-out (**t.out**), s.	0…600	0…600	RW	0030	0048

4.5 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.
3. Put jumper X1 into position “closed”.

Thereby the following is to be observed:

– 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 any power loss.

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5 Installation

5.1 Mounting

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

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 the *Sect. 3.2* must be considered when choosing the installation site.
Dimensional drawings are given in Appendix A. Only vertical positioning of the device is allowed.
The device has been 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 mm^2.

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 Outputs

MU110-24.8I has 8 analog outputs 4-20 mA which can be controlled via RS485 network.

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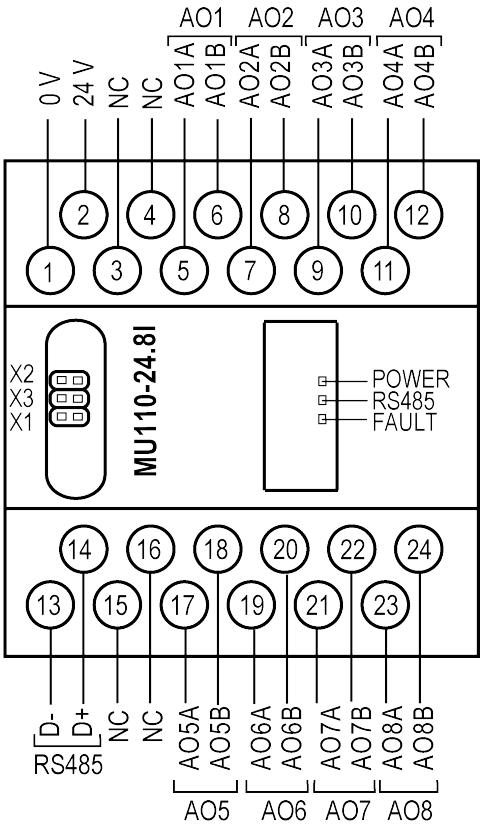


Fig. 5.1 Electrical connections

Table 5.1 Terminal assignments

No.	Description	No.	Description
1	Power supply (0 V)	13	RS485 (D-)
2	Power supply (24 V)	14	RS485 (D+)
3	NC (not connected)	15	NC (not connected)
4	NC (not connected)	16	NC (not connected)
5	Output 1+ (AO1A)	17	Output 5+ (AO5A)
6	Output 1- (AO1B)	18	Output 5- (AO5B)
7	Output 2+ (AO2A)	19	Output 6+ (AO6A)
8	Output 2- (AO2B)	20	Output 6- (AO6B)
9	Output 3+ (AO3A)	21	Output 7+ (AO7A)
10	Output 3- (AO3B)	22	Output 7- (AO7B)
11	Output 4+ (AO4A)	23	Output 8+ (AO8A)
12	Output 4- (AO4B)	24	Output 8- (AO8B)

An external voltage source for analog outputs is required. The voltage is calculated as follows:

$$U_{min} < U < U_{max}$$

$$U_{min} = 10\ V + 0.02A \cdot R$$

$$U_{max} = U_{min} + 2.5\ V$$

where

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U_{min}, U_{max} – minimum and maximum permissible voltage, V
R – current-limiting resistor, Ohm.

If $U > U_{max}$, it is necessary to use additional resistance R for current limitation. It is calculated as follows:

$$R_{min} < R < R_{max}$$

$$R_{min} = \frac{U - U_{max}}{I_{max}}$$

$$R_{max} = \frac{U - U_{min}}{I_{max}}$$

where

$I_{max.}$ – maximum output current (20 mA).

NOTE

The voltage of an external auxiliary voltage source may not exceed 36 V.

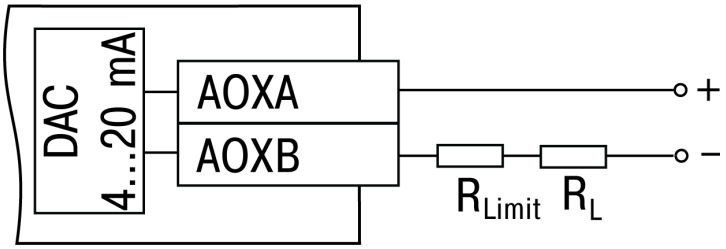


Fig. 5.2 Output wiring

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6 Factory settings restoration

If the communication between the module and a 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. Module will operate with the default network parameters, the user settings are 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 any foreign body in the enclosure must be avoided!

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

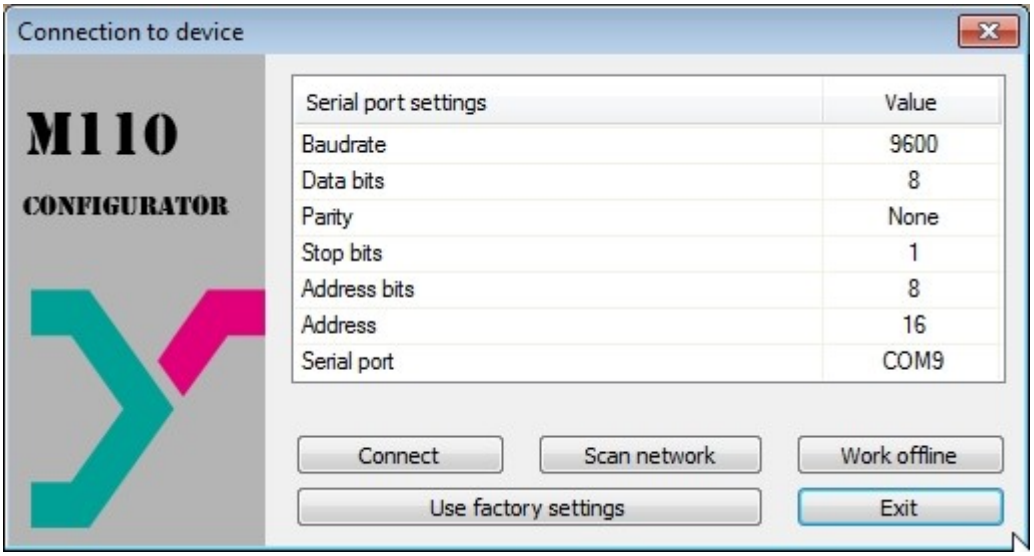


Fig. 6.1 Mx110 Configurator start window

7. Click ‘Connect’ to establish the connection with 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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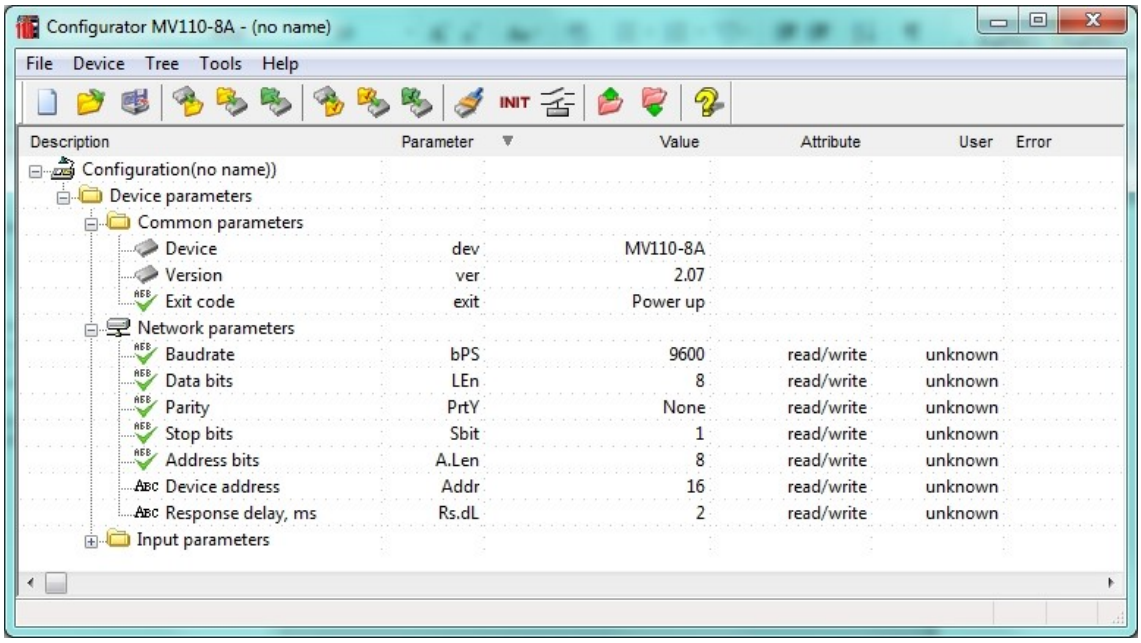


Fig. 6.2 Mx110 Configurator main window

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, bit/s	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

– Module MU110-24.8I	1
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Appendix A. Dimensions

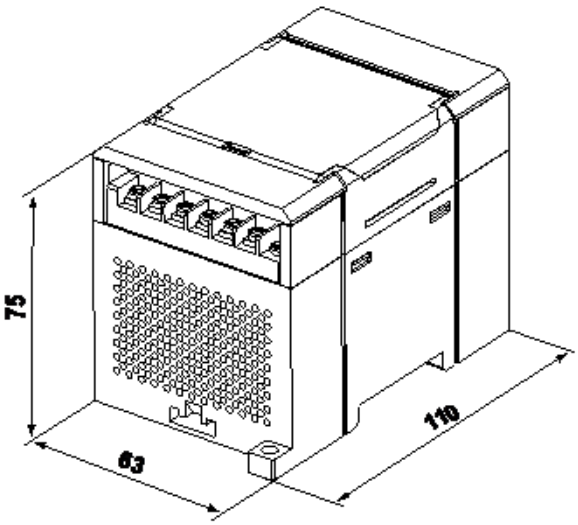


Fig. A.1 External dimensions

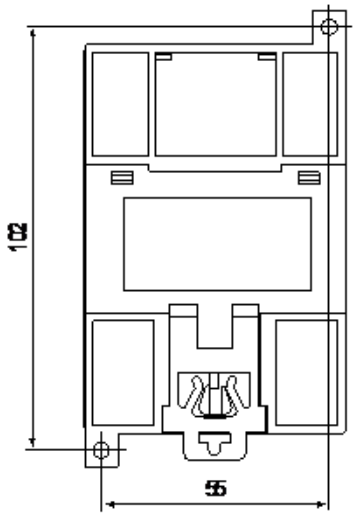


Fig. A.2 Wall mounting dimensions

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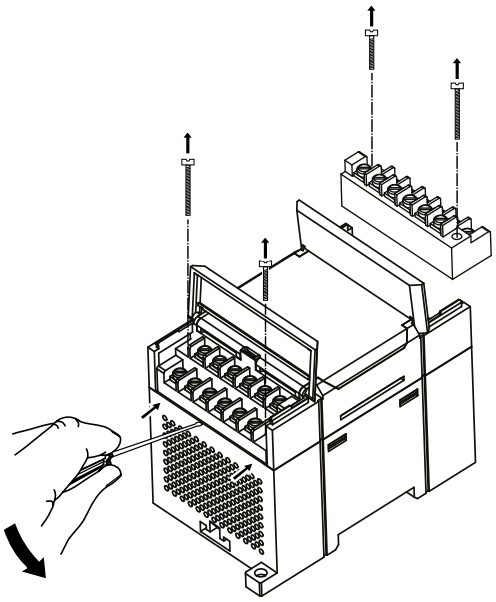


Fig. A.3 Replacement of terminal blocks

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Appendix B. Galvanic Isolation

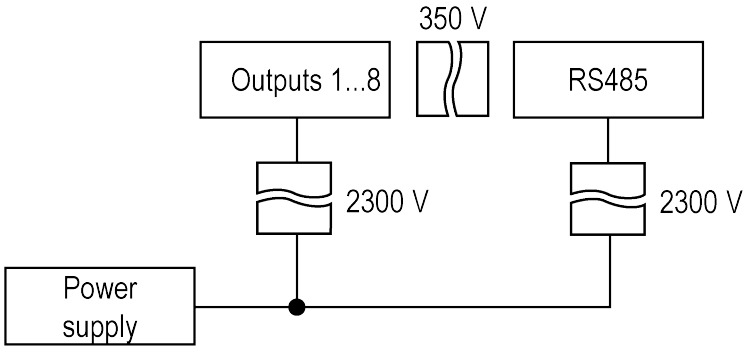


Fig. B.1 Galvanic isolation of MU110–24.8I

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