



MU110-8I

Analog output module
8 channel

User guide

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Description

1 Description

1.1 Functions

MU110-8I is an extension module with 8 analog outputs.

The module provides 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 'M110 Configurator' software (on CD included) using a RS485-USB interface adapter (not included). The latest version of the configuration software is available for download on www.akytec.de.

1.2 RS485 network

The I/O modules of Mx110 series use the common standard RS485 for data exchange.

The serial interface RS485 enables communication via two-wired line in half-duplex mode. The module supports the Modbus RTU and Modbus ASCII protocols with automatic protocol detection.

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 network length can be increased using RS485 interface repeater.

Separate 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 chosen 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 modules can be used as slave devices only. Master device can be PLC, PC with SCADA software or control panel.

1.3 Design

- | | |
|-------------------|---|
| – Enclosure | plastic, grey, for DIN-rail or wall mounting |
| – Terminal blocks | 2 plug-in terminal blocks with 24 screw terminals |
| – LED "POWER" | power supply indicator |
| – LED "RS-485" | flashes at data exchange via RS485 interface |
| – LED "FAULT" | lit when data exchange via RS485 interface is interrupted |

Dimensional drawings are given in App. A.

There are three jumpers under the front cover (see Fig. 4.1):

- X2 – restore factory settings (see 7)
- X3 – service function
- X1 – DRAM write-protection (see 4.1.1)

All jumpers are in OFF position by default.

Specifications

2 Specifications

Table 2.1 General Specifications

Power supply		24 (18...29) 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	none, even, odd
	Stop bits	1, 2
Accuracy, max.		±0.5%
Dimensions		63 x 110 x 75 mm
Weight		approx. 500 g
Material		plastic

2.1 Operating conditions

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 2.1 Environmental conditions

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

Safety

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 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.

Installation

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 intended to be mounted on a DIN-rail or on a wall. For the dimension drawings see Appendix A.
- Install the module in a cabinet with clean, dry and controlled environment. For further details see 2.1.
- The module is designed for natural convection cooling. It should be taken into account when choosing the installation site.

4.1 Wiring

 DANGER

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!

 CAUTION

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

- The electrical connections are shown in Fig. 4.1 and 4.2 the terminal assignments in Table 4.1.
- Connect the power supply to the terminals 24V /0V.
- The maximum conductor cross-section is 1.5 mm².

 NOTICE

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

 NOTICE

Only a shielded cable may be used for signal lines.

- Connect the RS485 lines to the terminals D+ / D-.
- Twisted pair cable should be used for the connection to the RS485 interface. Maximal cable length is 1200 m.

4.1.1 Hardware write protection

Data stored in permanent memory can be lost because of strong electromagnetic interference.

Use the jumper X1 (Hardware write-protection) to avoid data loss.

Proceed as follows:

- Turn off the device;
- Open the front cover (see Fig. 4.1)
- Set the jumper X1.

Notice:

- to change the configuration parameters, the jumper X1 must be removed again.

4.1.2 Outputs

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

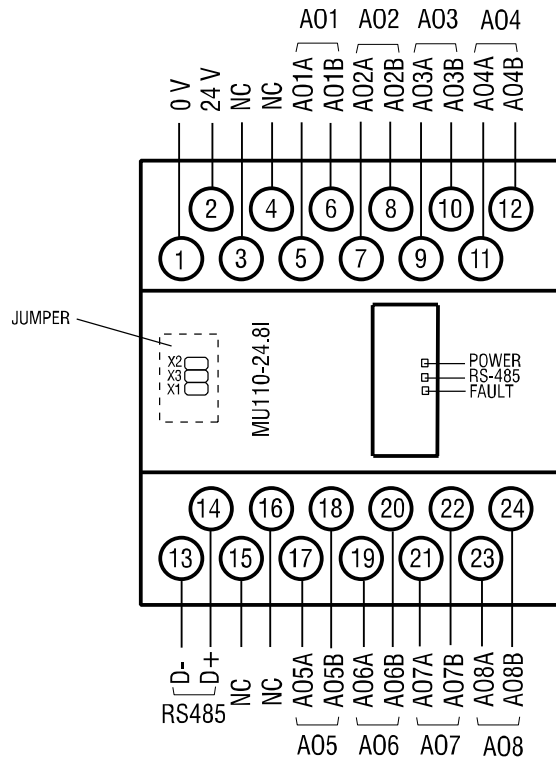


Fig. 4.1 Electrical connections

Table 4.1 Terminal assignments

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

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

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

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

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

where

U_{min} , U_{max} – minimum and maximum permissible voltage, V

R – current-limiting resistor, ohm.

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

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

Installation

$$R_{\min} = (U - U_{\max}) / I_{\max}$$

$$R_{\max} = (U - U_{\min}) / I_{\max}$$

where

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

► **NOTICE**

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

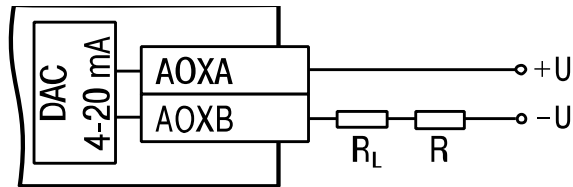


Fig. 4.2 Output wiring

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 (on the CD included). The full list of parameters is shown in the Table 5.1.

To control the module via Modbus network refer section 6.3 “Modbus addressing”

The module should be configured first before operating in RS485 network.

Proceed as follows:

- install the configuration software “M110 Configurator” on the PC
- connect the device to the USB interface of the PC over USB/RS485 adapter (not included)
- connect the power supply to the terminals 24V / 0V
- turn on the device
- start the M110 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 should be changed.

Table 5.1 Configuration parameters

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

Configuration

Name	Parameter	Valid value	Meaning	Default
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

* 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

The module is controlled by the Master device in a 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 is given in Table 6.2.

The output status according to the output value is given in Table 6.1.

Table 6.1 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 the register 0000.

6.1 Output functional test

In order to check the 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. 6.1
- Start the configuration program "M110 Configurator"
- If connection with the module has not been established automatically, network parameters of the configuration program should be changed
- Select the menu path "Device -> I/O Status..." to open "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
- Contact the Technical Support of akYtec GmbH in case of any deviations.

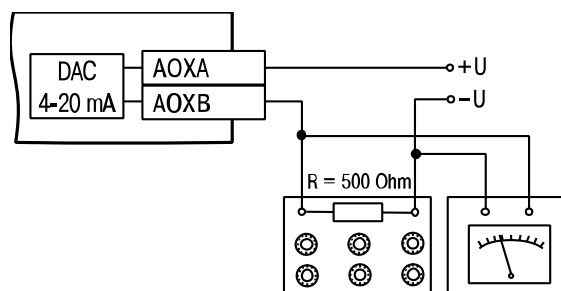


Fig. 6.1 Functional Test

Operation

6.2 Fault state

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

- LED FAULT is on
- LED FAULT is off with a new query 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** parameter is set to 0, the fault state doesn't occur.

Parameters **t.out** and **O.ALr** can be set during configuration or operation and are saved in the non-volatile memory.

Non-Volatile Memory

Since the non-volatile memory is not unlimited rewritable (~ 1 million), it is not recommended to change the Safe output status (O.ALr) by a Modbus command so often as the output value.

► NOTICE

6.3 Modbus addressing

All variables and parameters in the Table 6.2 are of the type INT16

R – read access

W – write access

Table 6.2 Modbus register

Parameter	Valid value		Access	Address	
	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

Restore factory settings

7 Restore factory settings

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

Proceed as follows:

- power off the module
- open the front cover
- set the jumper X2
- the module will operate with the default network parameters, the user settings remain stored
- switch the power on



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 the 'M110 Configurator' software
- set the parameters to default (see Table 7.1) or click "Use factory settings" (see Fig. 7.1) in the dialog window "Connection to device"

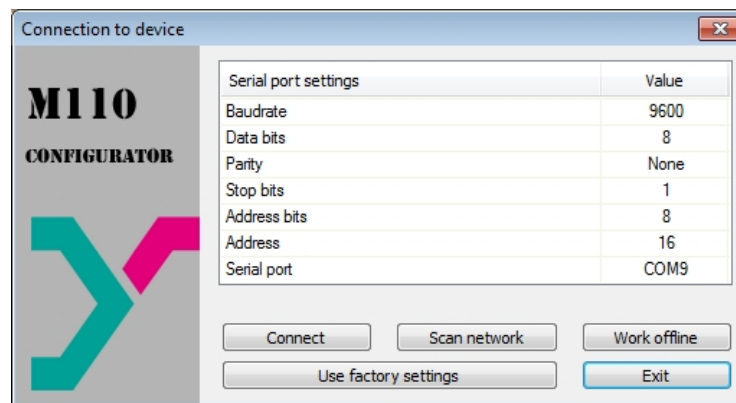


Fig. 7.1 "Connection to device" dialog window

- click "Connect" to establish the connection with factory settings
- the main window with the device mask opens
- saved user parameters can be read now (see Fig. 7.2)
- open the folder "Network parameters" and note the user network parameters

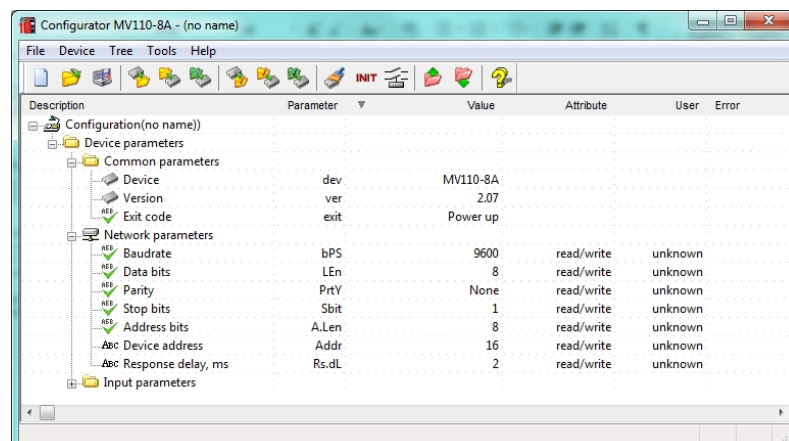


Fig. 7.2 Device mask

Restore factory settings

- close M110 Configurator
- switch the power off
- remove the jumper X2
- close the front cover
- switch the power on 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	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

Maintenance

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 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.

Transportation and storage

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!

Scope of delivery

10 Scope of delivery

- | | |
|--------------------------------------|---|
| – Module MU110-8I | 1 |
| – User guide | 1 |
| – CD with software and documentation | 1 |

11 Appendix A Dimensions

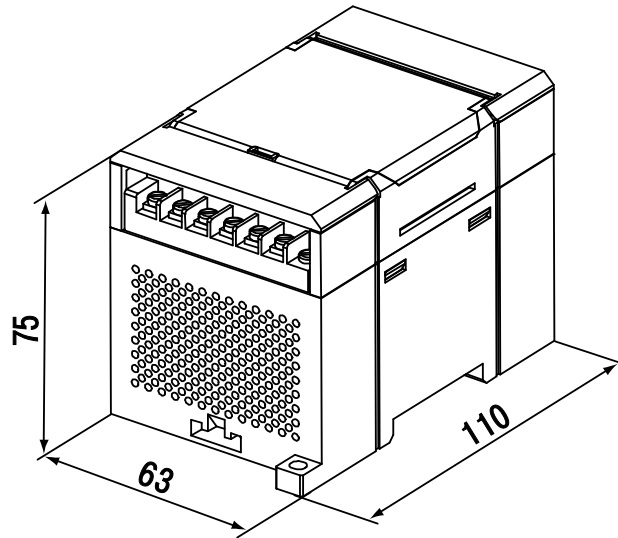


Fig. A.1 External dimensions

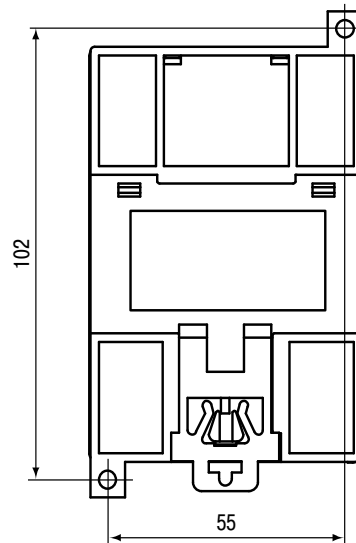


Fig. A.2 Wall mounting dimensions

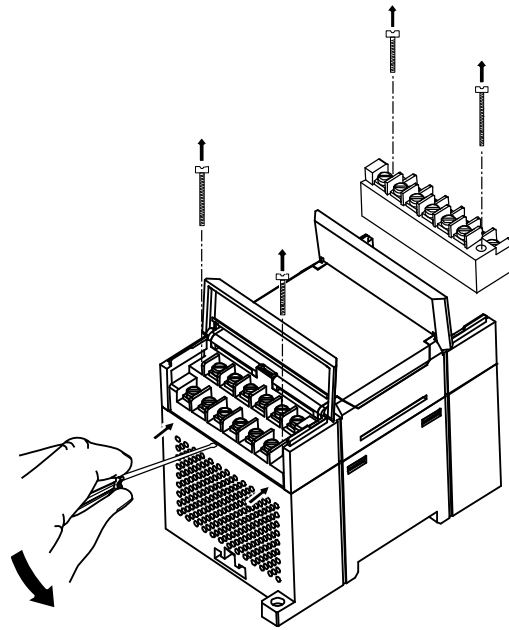


Fig. A.3 Replacement of terminal blocks