E7110-8I analog output module generates eight independent 4-20 mA signals according to incoming digital data. The device can be used in a variety of automation systems at fieldbus level together with PLCs, HMIs or SCADA systems.

The Module operates in RS485 network using Modbus RTU / ASCII protocols selected automatically. The device is a Slave unit, so the Fieldbus network must include a Master unit, e.g. a PC with running SCADA system, controller or regulator. The device is delivered with a configuration software. PC with RS485/USB adapter (e.g. Evikon E1087) is used to configure the device.

The product complies with the 2004/108/EC and 2014/30/EU Directives on electromagnetic compatibility.

Safety requirements

Always adhere to the safety provisions applicable in the country of use. The voltage of terminal contacts of the device is life-threatening. Only trained personal can operate the module.

Operating conditions

Non ATEX-rated indoor spaces without aggressive gases, at atmospheric pressure (86...106,7 kPa), -10...+55 °C and 0...80% RH without condensation.

Installation and connection

The module is mounted to the wall or 35 mm DIN-rail and should be installed in the cabinet providing protection from moisture, dust and unauthorized access.
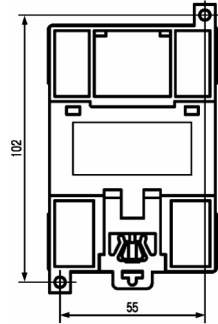
To connect the module proceed as follows:
— collect the cables for connection of the module to the external devices, power source and RS485 interface cable.
— connect the module to the power source;
— connect the module to external devices;
— connect the module to RS485 interface;
— apply power;
The device may be powered by DC or AC power source.

Power the module through the supply line which is not connected to the heavy-duty equipment. Installation of the power switch in the outer circuit is recommended. Powering of an external equipment through the device power terminals is forbidden. Independent DC supply unit mounted in the same electrical cabinet must be used to power the module. To connect external devices via RS485 interface use two-wire circuit. Overall length of all connections via RS485 interface should not exceed 1200 m. Switch off power for both units while connecting. Use twisted pair cable, respect polarities. The A cable is connected to A output of the device, cable B — to B output. Use cables with copper stranded wires with cross-section not exceeding 0,75 mm² to ensure the reliability of electrical connections. Strip and dip cable ends beforehand. Stripped end of the cable should not protrude over the terminal block.

We recommend to use screened cables and line interference filter to protect circuits from external inducted interferences.

Terminal contacts, switches and LED indicators
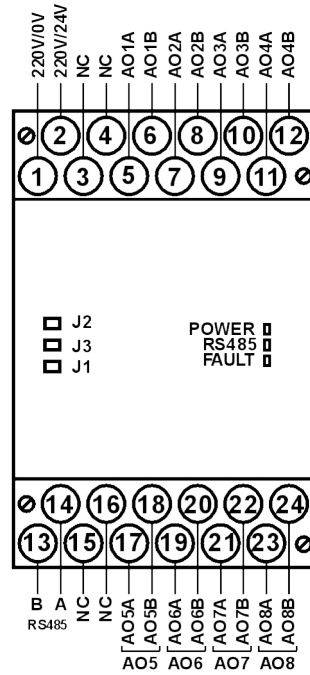
Jumpers functionality:
- J1 — write protection. Factory setting: open (write protection is off)

-J2 — return to factory network settings. By default J2 is open

- J3 – for manufacturer's service. J3 should be open during operation

LED indicators on the front panel

POWER: lights when power is on
RS485: blinks when data communication is in progress
FAULT: lights if RS485 data communication time-out occurs

Terminal block contacts functionality

Contact	Function	Contact	Function
1	AC 90...264 V power supply or DC power supply 20...375 V negative voltage	13	RS485 B line
2	AC 90...264 V power supply or DC power supply 20...375 V positive voltage	14	RS485 A line
3	not in use (NC)	15	not in use (NC)
4	not in use (NC)	16	not in use (NC)
5	Output 1 A (AO1A)	17	Output 5A (AO5A)
6	Output 1B (AO1B)	18	Output 5B (AO5B)
7	Output 2A (AO2A)	19	Output 6A (AO6A)
8	Output 2B (AO2B)	20	Output 6B (AO6B)
9	Output 3A (AO3A)	21	Output 7A (AO7A)
10	Output 3B (AO3B)	22	Output 7B (AO7B)
11	Output 4A (AO4A)	23	Output 8A (AO8A)
12	Output 4B (AO4B)	24	Output 8B (AO8B)

A is positive contact and B is negative contact for outputs 1-8

Analog outputs

The module has eight analog outputs. Each output operates independently as digital to analog converter (DAC).
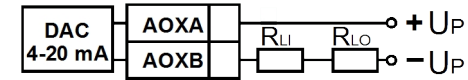
Connection to DAC 4...20 mA output

The DAC output is powered with an external direct current power supply/ The voltage of output power supply U_P is calculated as follows:

$U_{P\ min} < U_P < U_{P\ max}$,

$U_{P\ min} = 10\ V + 0.02\ A \times R_{LO}$

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

where $U_{P\ min}$ and $U_{P\ max}$ are minimum and maximum voltage and R_{LO} is DAC load resistance.

If the voltage of available power source exceeds the calculated $U_{P\ max}$ value, connect the limiting resistor R_{LI} in series with the load .

The limiting resistance is calculated as follows:

$R_{LI\ min} < R_{LI} < R_{LI\ max}$

$$R_{LI\ min} = \frac{U_P - U_{P\ max}}{I_{DAC\ max}}$$

$$R_{LI\ max} = \frac{U_P - U_{P\ min}}{I_{DAC\ max}}$$

where $R_{LI\ min}$ and $R_{LI\ max}$ are minimum and maximum allowed limiting resistance and $I_{DAC\ max}$ is maximum DAC output current.

After the device is turned on all inputs switch to the safe mode. Safe mode value is set for each output independently with **O.ALr** parameter.

Note DAC power supply voltage should not exceed 36 V.

Safe (fault) mode

If no signal is received from Master device during the time specified by **t.out** (maximum network timeout) parameter, module's outputs switch to safe, or fault, mode. The **t.out** parameter is set for all outputs at once, the safe condition is specified for each output independently with **O.ALr** parameter, which determines DAC value. **O.ALr** parameter is in the range of 0...100%. This parameter may be modified via Modbus protocol while operating. For the list of registers used to set the safe condition, see Annex 1.

Parameter **t.out** is set in the range 0...600 s via configurator or Modbus network. If **t.out** value is 0, the parameter is out of service and the output does not turn to safe state. When the device turns to the safe state, the LED indicator FAULT lights on the front panel. If a request from master device comes in fault mode, the LED indicator turns off, but outputs state does not change until a correct value is received from the Master

Note The safe state values may be changed via Modbus protocol. These data are saved to device non-volatile memory which has limited overwriting capacity (ca. 1 million). We don't recommend to change safe state parameters as frequently as DAC value is transmitted.

Fast replacement

If necessary, the module may be replaced without demounting the external connections.

Proceed as follows:
— de-energize all the connections of the module including power supply line
— unscrew fixing screws of the terminal blocks and detach the blocks
— take the input module off the rail or wall
— install the new module with removed terminal blocks
— mount terminal blocks and fix them with the screws

General technical data

Power supply	90...264 VAC (nominal 220 V) 47...63 Hz or 20...375 VDC (nominal 24V)
Power consumption	<6 VA
Analog outputs number	8
Analog outputs type	DAC 4-20 mA
Full scale error	± 0,5 %
Load resistance of the output	0…1300 Ohm
Output power supply	10…36 V
Digital interface	RS485, Modbus RTU or ASCII
Max baudrate	115200 bit/s
Dimensions	(63 ×110 ×73) ±1 mm
Weight	<0.5 kg
Protection class	IP20 front panel, IP00 terminal block

Hardware data protection

Due to electromagnetic interferences data stored in device non-volatile memory may be lost. The lost data, mostly configuration parameters, may be partly restored using configuration soft.

To protect data in non-volatile memory, de-energize the device, open the front panel and connect the jumper J1.

To reconfigure the device cut off the power, open the front panel and disconnect the jumper J1.

Output functional diagnostic

To check the outputs of your module for correct operation, proceed as follows:
— connect the module to the PC via RS485 adapter,
— connect the module to resistance box and comparator as shown below,
— launch configuration software and establish the connection
— go to I /O Status menu (see Configurator E7110 User manual)
— set output DAC 0 or 1.
— take readings from the voltage comparator.

The test is considered passed if the voltage is 10 ± 0,05 V at 20 mA current and -2 ± 0,05 V at 4 mA. Otherwise, adjust the device. In case of failure, bring the device to service.

R=500 Ohm
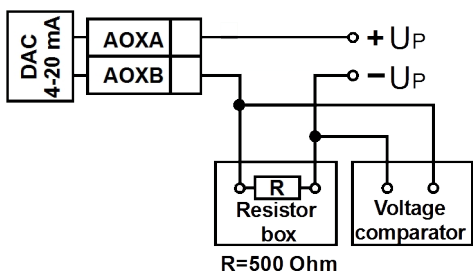
Return to factory settings

If user defined values of network parameters are lost, reset the device to the factory network settings to connect it to the computer.
To return to factory network settings proceed as follows:
1. Turn off the device
2. Open the face panel by lifting it with a hard thin instrument (e.g. a small screwdriver)
3. Set the J2 jumper. The device operates with factory network settings, but stores previously set parameters
4. Turn on the device
Warning! The voltage on some elements of the device's printed board could be fatal. Never touch the printed board or let foreign objects inside the device.
5. Launch the E7110 Configurator application
6. Set the factory network setting in the network configuration window or press the button "Factory network settings". Connection with the computer is now established using factory network settings.
7. Select "**Device: read all**" or open **Network parameters** folder to see the device network parameters.
8. Write down the device network parameters.
9. Close the configurating program
10. Turn off the device
11. Take away the J2 jumper
12. Close the front panel of the device
13. Turn on the device and launch the configurating program
13. Set the parameters recorded earlier in the Connection with the device window
14. Press Connect and select "**Device: Check connection**" to check the connection to the device.

Delivery set:

Analog input module E7110
All necessary software may be downloaded from manufacturer's website.
Please contact your distributor for more information.

Warranty

This product is warranted to be free from defects in material and workmanship for a period of one year from the date of original sale. During this warranty period Manufacturer will, at its option, either repair or replace product that proves to be defective. This warranty is void if the product has been operated in conditions outside ranges specified by Manufacturer or damaged by customer error or negligence or if there has been an unauthorized modification.

Analog output module

E7110-8I
User manual

Reading, editing and saving of the parameters is performed using configuring software. For more information see Configurator E7110 software user manual. Modbus operates by ASCII or RTU depending on **Prot** parameter. Parameters transmitted via RS485 network are called operational parameters.

Modbus addressing

Base address range in Modbus protocol is 1…247.
Broadcast address is 0.

Device parameters

The DAC value is transmitted during operation for each output with **r.OE** parameter in the range 0...1000.

r.OE value	Output DAC status
0	4 mA current
1000	20 mA current
between 0 and 1000	current between 4 and 20 mA

To distinguish between operational parameters of the same type, use their network address. For example, if device's base address is 16, then to read or write the Output 1 status use **r.OE** parameter with network address 16, for Output 2 with network address 17 etc. The eight-channel module operates thus as eight one-channel devices.

General parameters

Name	Description	Permitted values	Factory settings
dEv	Device name	up to 8 symbols	MU110-8I
vEr	Software version	up to 8 symbols	2.01

Network parameters factory settings

Parameter	Description	Factory setting
bPS	Baudrate, bit/s	9600
LEn	DWL, bit	8
PrtY	Dataword parity check	unavailable
Sbit	Number of stop-bits	1
A.Len	Network address length, bit	8
Addr	Base address	16
Rs.dl	Response delay in RS485 network, ms	2

Configuration parameters

Parameter		Permitted values	Factory settings
Name	Description		
Prot	Communication protocol	1: Modbus RTU 2: Modbus ASCII	1
O.ALr	Output value in safe mode	0,0...100,0 [%]	0,0
t.out	Max. network timeout, s	0...600	0
BPS	Baudrate, kbit/s	**0:** 2.4; **1:** 4.8; **2:** 9.6; **3:** 14.4; **4:** 19.2; **5:** 28.8 **6:** 38.4; **7:** 57.6; **8:** 115.2	9.6
LEn	DWL, bit	**0:**7, **1:**8	8
PrtY	Dataword parity check	**0:** no **1:** even **2:** odd	0
SBit	Number of stop-bits	**0:** 1 sbit **1:** 2 sbits	0
A.LEn	Network address length, bit	**0:** 8 **1:** 11	0
Addr	Base address	1...247	16
rS.dL	Response delay in RS485 network, ms	0...45	2

Note Due to hardware constraints the following parameter combinations cannot be used:
— **PrtY=0**, **Sbit=0**, **Len=0**
— **PrtY=1**, **Sbit=1**, **Len=1**
— **PrtY=2**, **Sbit=1**, **Len=1**

Modbus registers

Parameter	Unit	Value	Type	Register address	
				(hex)	(dec)
Output 1 value	0.1%	0...1000	int16	0000	0000
Output 2 value	0.1%	0...1000	int16	0001	0001
...	0.1%	0...1000	int16	...	...
Output 8 value	0.1%	0...1000	int16	0007	0007
Output 1 value in safe mode	0.1%	0...1000	int16	0010	0016
Output 2 value in safe mode	0.1%	0...1000	int16	0011	0017
...	0.1%	0...1000	int16	...	...
Output 8 value in safe mode	0.1%	0...1000	int16	0017	0023
Max. network timeout	s	0...600	int16	0030	0048

Note: For writing to register use command 16 (0x10), for reading use commands 03 and 04.

Evikon