

E7110-8A eight-channel analog input module measures and converts analog signals from common RTDs, thermocouples or 4-20 mA transmitters to 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

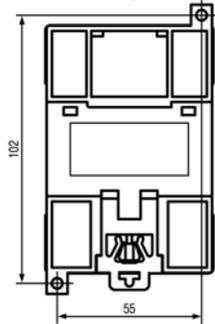
Always adhere to the safety provisions applicable in the country of use. The voltage of terminal contacts of the device is life-threatening. Only trained personal can operate the module.

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:

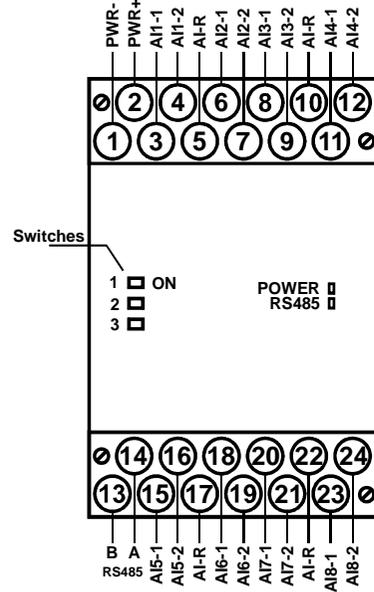
- collect the cables for connection of the module to the external devices, power source and RS485 interface cable.
- connect the module to the power source;
- connect the module to external devices;
- connect the module to RS485 interface;
- apply power;

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



Switches:

«1» – resets device to the factory network settings (see below). «OFF» by default (device is not set to the factory network settings).

«2», «3» – not in use.

Terminal block contacts

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	1-1 Input	15	5-1 Input
4	1-2 Input	16	5-2 Input
5	R Input	17	R Input
6	2-1 Input	18	6-1 Input
7	2-2 Input	19	6-2 Input
8	3-1 Input	20	7-1 Input
9	3-2 Input	21	7-2 Input
10	R Input	22	R Input
11	4-1 Input	23	8-1 Input
12	4-2 Input	24	8-2 Input

All R terminals are connected, sensors may be plugged to any of them

POWER Led indicator lights when power is on

RS485 indicator blinks when data exchange is in progress

External devices

The module may be connected with various types of thermocouples, resistance thermometers, position sensors etc. See Annex 2 for more information.

External devices scan

The module addresses external devices in sequential cyclic way. Set the in-t parameter to add the device into the scanning cycle. The sensor is out of the cycle if the in-t parameter is "oFF".

The sampling period is set by ItrL parameter in the range of 0,3...30 s. If it is impossible to perform scanning with set ItrL value (e.g. if sampling period is 0,3 s for each of 8 inputs), the module increases the sampling interval automatically to minimal possible value.

The input module provides automatic compensation of thermocouple cold junction. If necessary (e.g. for calibration tests), cold junction autocorrection can be disabled by setting oFF value for CJ-.C parameter.

When working with active transducers with voltage or current output the measurement scale may be adjusted in order to display parameters directly in their own measurement units (kPa, m etc). The adjustment is performed for each input by setting Ain.L and Ain.H parameters for lower and upper limits of the measurement range corresponding to minimal and maximal values of the output signal.

Example: The Ain.L parameter is to be set 00,00 and Ain.H parameter 25,00 for the pressure sensor with 4...20 mA output (in-t = 11) working in the range of 0...25 atmospheres. The data is thus processed and displayed in atmospheres.

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

Delivery set:

— Analog input module E7110

— Set of eight 50 Ohm resistors

All necessary software may be downloaded from manufacturer's website.

Please contact your distributor for more information.

General technical data

Power supply	90...264 VAC (nominal 220 V) 47...63 Hz or 20...375 VDC (nominal 24 V)
Power consumption	<6 VA
Analog inputs number	8
One input scanning time for RTD	<0.9 s
for TC and U or I sources	<0.6 s
Full scale error margin for TC	±0.5%
for RTD and U or I sources	±0.25%
Insulation dielectric strength	1500 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

Digital filter

To decrease the influence of pulse interference on the module functionality, data digital filtering is used. It runs independently for each input and takes two steps.

At the first step, noise signals are filtered. The module calculates the difference between two last measured values of the parameter and compares it to the limit deviation set by user. If the difference exceeds the limit, the last measured value is considered as unreliable and its processing is suspended. Next measurement demonstrates if the doubtful result is caused by interference. If it is the case, the result is not taken into consideration.

The limit deviation is set by **in.FG** parameter. The lower is the **in.FG** value, the lower is interference influence. On the other hand, due to repeated measurements, it decreases the reactivity of the device to fast changes of measured parameters. The **in.FG** value should conform to the rate of parameter change and sampling period.

To disable the filter, set 0 for **in.FG** value.

At the second step the measurement results are smoothed exponentially according to filter time constant (**in.FD** parameter) set by user for each input.

By increasing the **in.FD** value the interference influence is decreased, but at the same time the device reacts more slowly to the changes of measured parameter.

To disable the filter, set 0 for **in.FD** value.

Measurements correction

If necessary, measured and filtered values from each input can be corrected using **in.SH** (characteristic shift) and **in.SL** (characteristic slope) parameters.

Note The corrections of measurements changes metrological performance of the device and should be performed only by qualified personal for valid reasons.

Characteristic shift parameter is added to the measured value and is measured in the same units. It is used to eliminate the influence of the sensor initial error (e.g. R_0 for resistance thermometers). For Pt RTD **in.SH** parameter is used alongside with internal non-linearity correction

Characteristic slope is used to compensate the sensor errors and the influence of shunt resistance variance (for devices with current output). It can be set in the range 0,900...1,100 (±10%).

External devices diagnostics

Running module controls the functionality of connected devices and signals by RS485 network in case of following errors:

- Resistance thermometer breakage or short circuit.
- Thermocouple breakage.
- Thermocouple cold junction temperature higher than 90 °C or lower than -10 °C.

Some types of failures cannot be registered by the module:

- Current and voltage transducers breakage (in this case measured value is zero or the error is considered as "value is too low").
- Due to RTD short circuit detection, the module considers signals lower than 25 Ohm as doubtful. E.g. 0...2000 Ohm sensor does not work correctly in 0...25 Ohm range.

Given the device operates normally, in case of failure a special packet is transmitted. In the Modbus network the exception code is transmitted in status register, while the last correctly obtained data are saved in measurement results registers (see Annex 1 for more information).

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 switch 1 to ON position. 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 (see Annex 1) 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 configuring program
10. Turn off the device
11. Set the switch to OFF position
11. Close the front panel of the device
12. Turn on the device and launch the configuring 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.

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 input module

E7110-8A

User manual

ANNEX 1. RS485 networking using Modbus protocol

Reading, editing and saving of the parameters is performed using configuring software. For more information see Configurator E7110 software user manual

Modbus addressing

Base address range in Modbus protocol is 1...247.

Broadcast address is 0.

Device parameters

General parameters

Name	Description	Permitted values	Factory settings
dEv	Device name	up to 8 symbols	MV110-8A
vEr	Software version	up to 8 symbols	2.01
exit	Cause of reboot	0: software reset 6: hardware reset 7: power supply turning on 8: watchdog timer	

Configuration parameters

Parameter		Permitted values	Factory settings
Name	Description		
Cj-C	Thermocouple cold junction compensation	0: OFF 1: ON	ON
in-t	External device type	00 OFFsee Annex 2 for details	OFF
in.Fd	Filter time constant	from 0 to 1800	0.0
ltrl	Sampling period	from 0.3 to 30	0.5
in.SH	Characteristic shift	from -999 to 9999	0.0
in.SL	Characteristic slope	from 0.9 to 1.1	1.0
in.FG	Filter pass band	from 0 to 9999	0.0
Ain.L	[Measurement range] lower limit	from -999 to 9999	0.0
Ain.H	[Measurement range] upper limit	from -999 to 9999	100.0
dP	Decimal point	1, 2, 3	1
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	from 0 to 65535	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

Input status scan

Modbus operates by ASCII or RTU. Measured values from each input, measurement time and status may be read by standard commands for reading groups of registers (commands 03 and 04).

Measured data are presented in two formats: 4 byte floating point numbers and 2 byte integer. Integer is a measured value multiplied by 10 raised to the power of dP parameter. The dP value may be equal to 0, 1, 2 or 3 and is set independently for each channel.

Note. When the dP parameter's value is 2 or 3, measured value multiplied by 10 raised to the power of dP may be more than 32767 / less than -32768 (for signed values) or exceed 65535 (for non-signed values) and therefore can not be represented in int16 data type. It should be taken into account when setting the dP parameter.

Both formats may be read independently using their addresses according to the table.

Modbus registers

Parameter	Type	Register address	
		(hex)	(dec)
Decimal point position (dP) for the input 1	int16	0000	0
Measured data from input 1 as integer (considering decimal point position)	int16	0001	1
Measurement status for the input 1 (exception code)	int16	0002	2
Circular measurement time for the input 1	int16	0003	3
Input 1 measured value with floating point	Float32	0004, 0005	4, 5
Decimal point position (dP) for the input 2	int16	0006	6
Measured data from input 2 as integer (considering decimal point position)	int16	0007	7
Measurement status for the input 2 (exception code)	int16	0008	8
Circular measurement time for the input 2	int16	0009	9
Input 2 measured value with floating point	Float32	000A, 000B	10, 11
...
Decimal point position (dP) for the input 8	int16	002A	42
...	int16	002B	43
Measurement status for the input 8 (exception code)	int16	002C	44
Circular measurement time for the input 8	int16	002D	45
Input 8 measured value with floating point	Float32	002E, 002F	46, 47
Notes: (1) All registers are read-only. For reading use commands 03 and 04. (2) When transmitting 4 byte values, register with smaller number is used for high-order word.			

Measurement time is circular time with 0,01 s interval transmitted as 2 bytes. It corresponds exactly to the moment of measurement in the channel, so the transmission delay in RS485 network may be neglected when calculating differential component for PID regulation etc. The circular time count starts at the moment device is turned on and returns to zero every 65536 cycles (655,36 seconds).

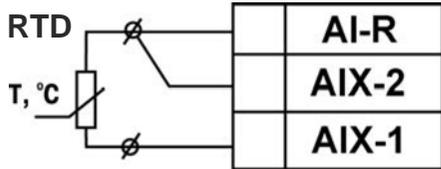
Measurement status is a Modbus register containing a code for exception or error which occurs during measurement.

Error	Status register value
Measured value is definitely incorrect	0xF000
Data are not ready. Wait for the result of the first measurement after switching the device on	0xF006
The sensor is off	0xF007
The thermocouple cold junction temperature is too high	0xF008
The thermocouple cold junction temperature is too low	0xF009
The measured value is too high	0xF00A
The measured value is too low	0xF00B
Sensor short circuit	0xF00C
Sensor breakage	0xF00D
ADC not responding	0xF00E
Incorrect calibration factor	0xF00F
For successful measurement the register value is 0x0000. Note: 0x00 format here and elsewhere in the manual corresponds to hexadecimal numbers	

ANNEX 2. External devices connection

Resistance thermometers

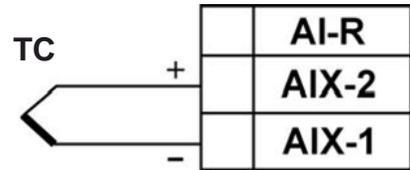
To avoid influence of connecting cables on the result of measurements, RTDs should be connected to the device by 3-wire circuit. One of the thermometer leads is thus connected to the device with two wires, another lead with one wire. Use cables of the same material and length to obtain equal resistance of the connections.



Thermocouples

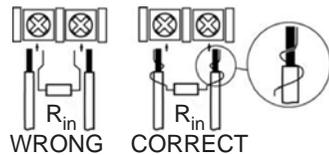
Note Only thermocouples with insulated and unearthened hot junction may be used with the module, since their negative leads are united at the device's input.

If thermocouple's cold junction cannot be connected directly to the device contacts, extend the connection using compensating thermocouple cable. Respect polarity.



Active transducers

Active transducers must be powered from an external source. Transducers with current output (0-5 mA, 0-20 mA, 4-20 mA) should be connected only via 50.0 Ohm shunt resistor (resistance variation less than 0,1%). Use resistors with high stability and minimal temperature coefficient of resistance. Set of resistors is delivered with the module. Install the resistor according to scheme below: Output cable of the resistor should be on the same side of the terminal screw as the sensor cable. Twist or solder sensor cable and resistor output cable, if cross-section of the resistor cable is thicker

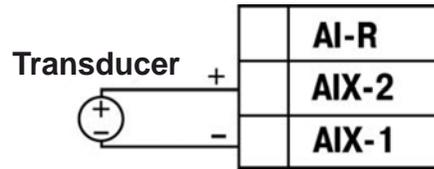


than 0,35 mm.

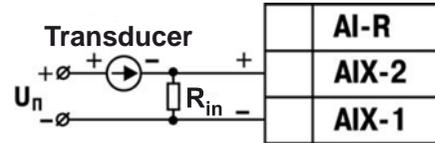
Warning! Failure to comply with this instruction may result in the loss of contact between resistor output cable and terminal screw. This may lead to the damage of the device.

Transducers with voltage (-50...+50 mV, 0-1 V) output may be connected directly to the device.

Note Negative leads of the transducers are united in the device.



Active transducer with voltage output
-50.0...50.0 mV or 0...1.0 V



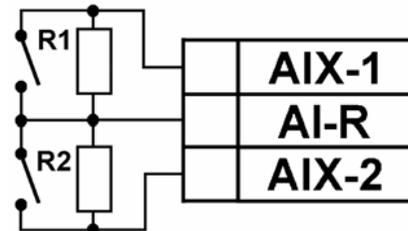
Digital output

Up to 16 dry contact digital outputs (switches, relay groups etc) may be connected to the module. Each analog output may be used to connect two digital outputs.

Any resistors with identical resistance values in the range 200...3000 Ohm may be used as shunts.

Digital output status is represented as an integer from 1 to 4.

Value	Contact 1	Contact 2
1	Open	Open
2	Closed	Open
3	Open	Closed
4	Closed	Closed



Discrete sensors with dry contacts output

External devices of various types

Various types of external devices may be connected to the module simultaneously. All eight inputs of the module are absolutely identical and therefore any device could be connected to any of them. Each device is designated by the number of the output to which it is connected. External device type is set by in-t parameter for each input independently.

In-t parameter

in-t	External device	in-t	External device
00	Off	19	type R thermocouple
03	Pt 100	20	type N thermocouple
06	type K thermocouple	21	type J thermocouple
07	-50...+50 mV	25	type T thermocouple
08	Pt 50	29	Digital input
11	4...20 mA	30	Ni 100
12	0...20 mA	33	Pt 500
13	0...5 mA	35	Ni 500
14	0...1 V	38	Pt 1000
17	type B thermocouple	40	Ni 1000
18	type S thermocouple		
Factory setting: 03 (Pt100)			