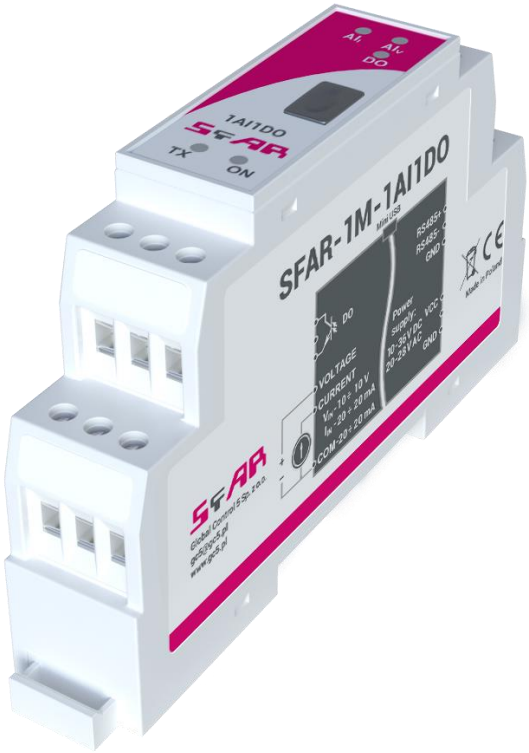
Solutions For Automation & Robotics

SFAR-1M-1AI1DO

User Manual

Expansion Module – 1 Analog Input, 1 Digital Output



Modbus

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Thank you for choosing our product.

This manual will help you with proper handling and operating of the device.

The information included in this manual have been prepared with utmost care by our professionals and serve as a description of the product without incurring any liability for the purposes of commercial law.

This information does not discharge you from the liability of your own judgement and verification.

We reserve the right to change product specifications without notice.

Please read the instructions carefully and follow the recommendations concluded therein.

WARNING!

Failure to follow instructions can result in equipment damage or impede the use of the hardware or software.

1. Safety rules

1. Refer to this manual before the first use
2. Make sure that all cables are connected properly before the first use
3. Please ensure proper working conditions, according to the device specifications (e.g., supply voltage, temperature, maximum power consumption)
4. Turn the power supply off before making any modifications to wiring connections.

2. Module features

2.1. Purpose and description of the module

SFAR-1M-1AI1DO module allows voltage or current measurement and has one Digital Output. Values are read via RS485 (Modbus), so it can be easily integrated with popular PLCs, HMI or PC equipped with the appropriate adapter.

The device has 1 input to voltage measurement and 1 input for current measurement (both inputs can be used in this same time). In addition, the module is equipped with 1 configurable Digital Output (PNP or NPN type).

This module is connected to the RS485 bus with twisted-pair wire. Communication is via Modbus RTU or Modbus ASCII. The use of 32-bit ARM core processor provides fast processing and quick communication. The baud rate is configurable from 2400 to 115200.

The module is designed for mounting on a DIN rail in accordance with DIN EN 5002.

The module is equipped with a set of LEDs to indicate the status of inputs and outputs which is useful for diagnostic purposes and helping to find errors.

Module configuration is done via USB by using a dedicated computer program. You can also change the parameters using the Modbus protocol.

2.2. Technical specifications

Power Supply	Voltage		10-38 V DC; 10-28 V AC
	Power consumption[1]		1 W @ 24 V DC
			2 VA @ 24 V AC
Isolation	Isolation between power supply and I/O		1000 V DC
Inputs	No of inputs		2
	Absolute maximum input voltage		± 60 V
	Voltage input impedance		100 k Ω
	Voltage measurement accuracy		± 0.2%
	Voltage input mode 0 – 10 V -10 – 10 V	Max voltage	± 16.386 V
		Resolution	1 mV
	Voltage input mode 0 – 1 V -1 – 1 V	Max voltage	± 2.048 V
		Resolution	1 mV
	Absolute maximum input current		± 35 mV
	Current input impedance		100 Ω
	Current measurement accuracy		± 0.1%
	Current input mode 0 – 20 mV -20 – 20 mV	Max current	± 20.048 mV
		Resolution	1 µA
	Current input mode 4 – 20 mV	Max current	20.048 mV
		Resolution	1‰
	Measurement resolution		16 bits
	ADC processing time		70 ms / channel
Digital Outputs	Maximum current and voltage		250 mA / 50 V
Temperature	Work		-20 °C - +65°C
	Storage		-40 °C - +85°C
Connectors	Power Supply		2 pin
	Communication		3 pin
	Inputs & Outputs		2 x 3 pin
	Configuration		Mini USB

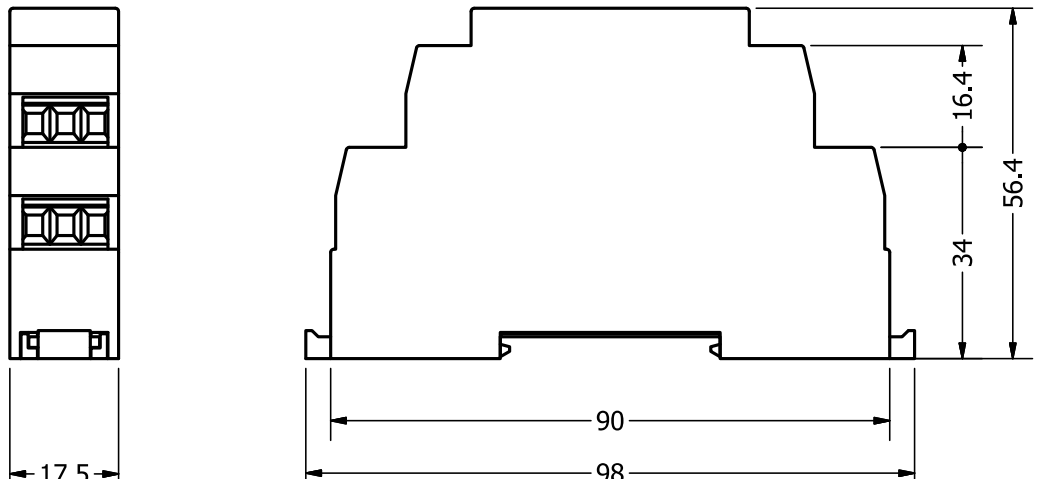
[1] Power consumption with active Modbus transmission, all outputs on and high state on all inputs

Size	Height	90 mm
	Length	56,4 mm
	Width	17,5 mm
Interface	RS485	Up to 128 devices

Table 1 - Technical specifications

2.3. Dimensions of the product

The appearance and dimensions of the module are shown below. The module is mounted directly to the rail in the DIN industry standard.



Picture 1 - Dimensions of the product

2.4. Network termination

Transmission line effects often represent the problem of data communication networks. These problems include reflections and signal attenuation.

To eliminate the presence of reflections at the end of the cable, the cable must be terminated at both ends with a resistor across the line equal to its characteristic impedance. Both ends must be terminated since the direction of propagation is bi-directional. In the case of RS485 twisted pair cable this termination is typically 120 Ω.

2.5. Types of Modbus registers

There are 4 types of variables available in the module

Type	Beginning address	Variable	Access	Modbus Command
1	00001	Digital Outputs	Bit Read & Write	1, 5, 15
2	10001	Digital Inputs	Bit Read	2
3	30001	Input Registers	Registered Read	3
4	40001	Output Registers	Registered Read & Write	4, 6, 16

Table 2 - Types of variables

2.6. Communication settings

The data stored in the module's memory is given in the 16-bit registers. The access to registers happens via Modbus RTU or Modbus ASCII.

2.6.1. Default settings

Parameter name	Value
Address	1
Baud rate	19200
Parity	No
Data bits	8
Stop bits	1
Reply Delay [ms]	0
Modbus Type	RTU

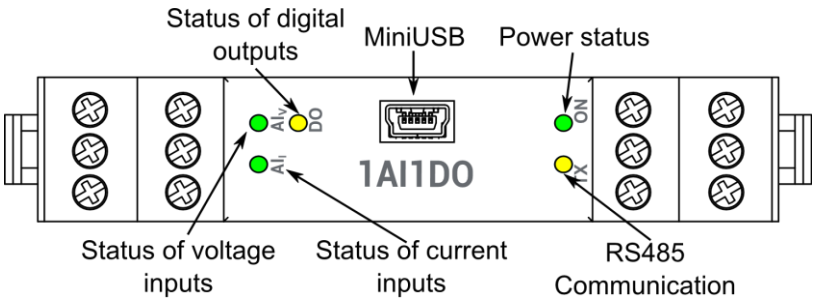
Table 3 - Default settings

2.6.2. Configuration registers

Modbus Address	Dec	Hex	Name	Values
40002	1	0x01	Address	From 0 to 255
40003	2	0x02	Baud rate	0 – 2400 1 – 4800 2 – 9600 3 – 19200 4 – 38400 5 – 57600 6 – 115200 other – value * 10
40005	4	0x04	Parity	0 – none 1 – odd 2 – even 3 – always 1 4 – always 0
40004	3	0x03	Stop Bits LSB	1 – one stop bit 2 – two stop bits
40004	3	0x03	Data Bits MSB	7 – 7 data bits 8 – 8 data bits
40006	5	0x05	Response delay	Time in ms
40007	6	0x06	Modbus Mode	0 – RTU 1 – ASCII

Table 4 - Configuration registers

3. Indicators



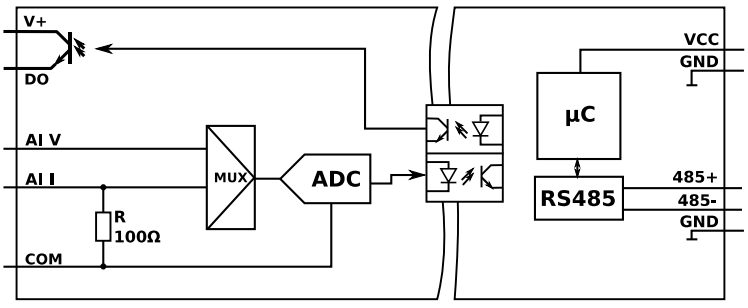
Picture 2 – Indicators

Indicator	Description
ON	LED indicates that the module is correctly powered.
TX	The LED lights up when the unit received the correct packet and sends the answer.
V_{IN} I_{IN}	LED indicates that the signal to input is connected and is different from 0
DO	LED indicates that the output is on.

Table 5 Description of indicators

4. Module connection

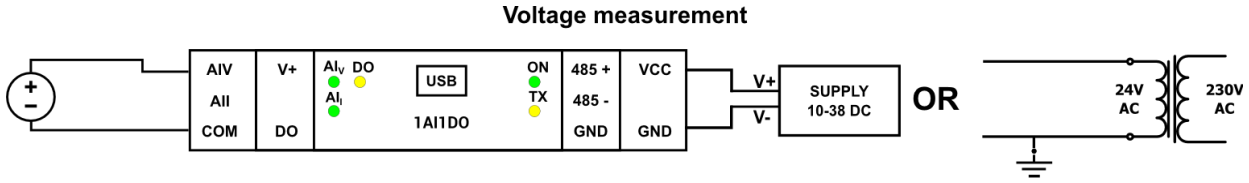
4.1. Block diagram



Picture 3 - Block diagram

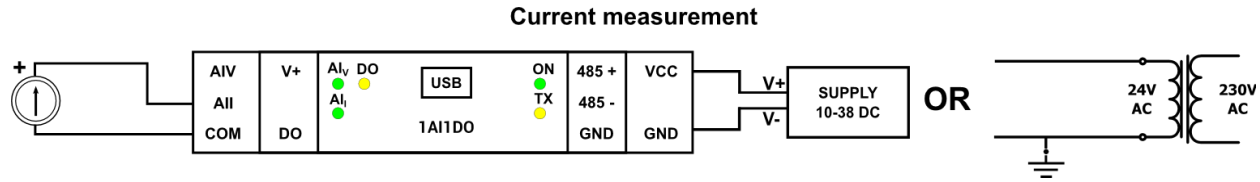
4.2. Connection of analog inputs

4.2.1. Connection of voltage measurement



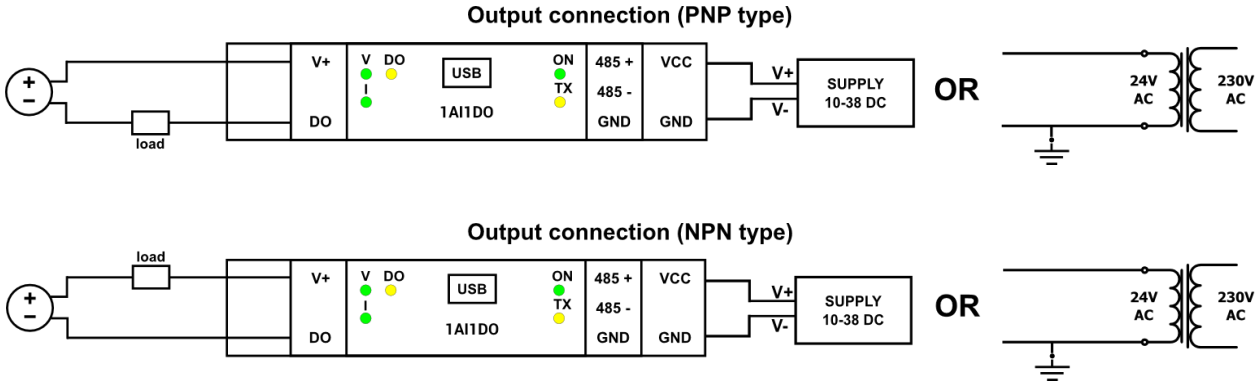
Picture 4 – Connection of voltage measurement

4.2.2. Connection of current measurement



Picture 5 – Connection of current measurement

4.3. Connection of digital output



Picture 6 – Connection of digital output

5. Analog filtering

If the measured signal is interrupted it is possible to eliminate the disruptions by switching the lowpass filter on. It is possible to configure the filter for all inputs (it is not possible to enable the filter for only one input). The filter parameter corresponds to the filter time constant. Step response of the filter is shown in the graph below.

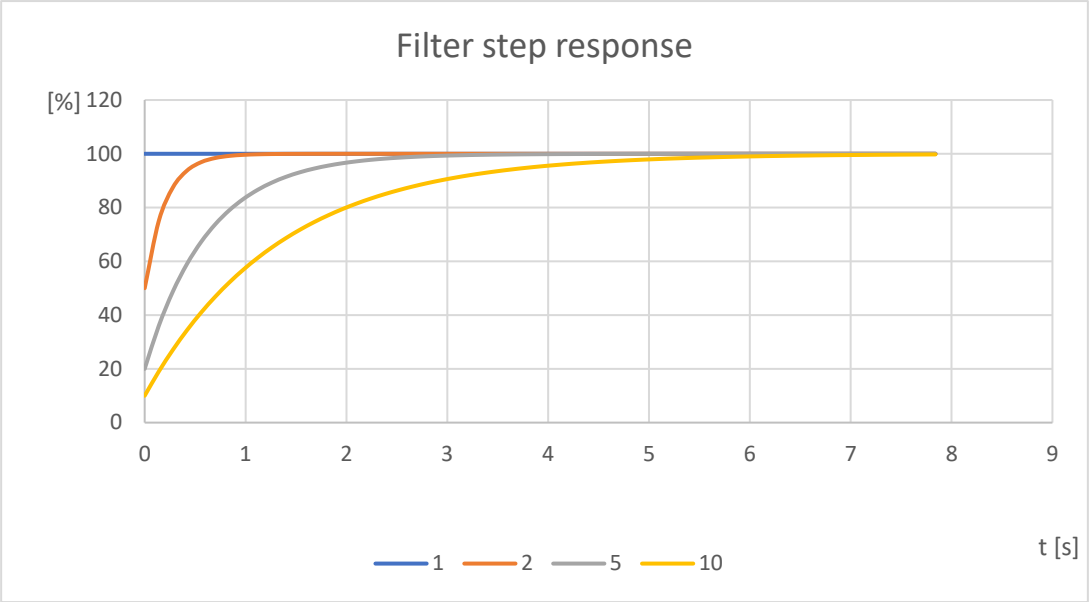


Chart 1- Step response add different coefficients

6. Modules Registers

6.1. Registered access

Modbus	Dec	Hex	Register Name	Access	Description
30001	0	0x00	Version/Type	Read	Version and Type of the device
30002	1	0x01	Address	Read	Module Address
40003	2	0x02	Baud rate	Read & Write	RS485 baud rate
40004	3	0x03	Stop Bits & Data Bits	Read & Write	No of Stop bits & Data Bits (see 2.6.2.)
40005	4	0x04	Parity	Read & Write	Parity bit
40006	5	0x05	Response Delay	Read & Write	Response delay in ms
40007	6	0x06	Modbus Mode	Read & Write	Modbus Mode (ASCII or RTU)
40010	9	0x09	Filter	Read & Write	Measurement filtering, value from 1 to 10 See 7. Analog filtering
40033	32	0x20	Received packets MSB	Read & Write	No of received packets
40034	33	0x21	Received packets LSB	Read & Write	
40035	34	0x22	Incorrect packets MSB	Read & Write	No of received packets with error
40036	35	0x23	Incorrect packets LSB	Read & Write	
40037	36	0x24	Sent packets MSB	Read & Write	No of sent packets

Modbus	Dec	Hex	Register Name	Access	Description
40038	37	0x25	Sent packets LSB	Read & Write	
30051	50	0x32	Inputs	Read	Connected inputs Bit in high state → signal is connected
40052	51	0x33	Outputs	Read & Write	Alarms state bit no. 3 Digital Output
30053	52	0x34	Voltage	Read	Voltage in µV
30054	53	0x35	Current	Read	Current in µA or ‰
40055	54	0x36	Alarm – max voltage	Read & Write	Maximum value of voltage excess which causes set bit no 1 in the register 40052
40056	55	0x37	Alarm – min voltage	Read & Write	Minimum value of voltage. If voltage drops below this voltage bit no 1 in the register 40052 is set.
40057	56	0x38	Alarm – max current	Read & Write	Maximum value of current excess which causes set bit no 1 in the register 40052
40058	57	0x39	Alarm – min current	Read & Write	Minimum value of current. If current drops below this voltage bit no 1 in the register 40052 is set.
40059	58	0x3A	Voltage alarm configuration	Read & Write	Alarms configuration 0 – alarms state depends on actual values 1 – alarms state need to clear by master
40060	59	0x3B	Current alarm configuration	Read & Write	
40061	60	0x3C	Voltage input configuration	Read & Write	0 – OFF 1 – 0 .. 10 V 2 – -10 .. 10 V 3 – 0 .. 1 V 4 – -1 .. 1 V
40062	61	0x3D	Current input configuration	Read & Write	0 – OFF

Modbus	Dec	Hex	Register Name	Access	Description
					1 – 0 .. 20 mA (in µA) 2 – 4 .. 20 mA (in ‰) 3 – -20 mA .. 20 mA (in µA)
40063	62	0x3E	Digital Output configuration	Read & Write	Digital Output configuration 0 – output controlled by master 1 – output state depends voltage 2 – output state depends current +256 – output set if value is greater than alarm value (40065 register) („cooling") +512 – output set if value is below than alarm value (40065 register) („warming")
40064	63	0x3F	Alarm value	Read & Write	Alarm value
40065	64	0x40	Alarm hysteresis	Read & Write	Hysteresis for alarm

Table 6 - Registered access

6.2. Bit access

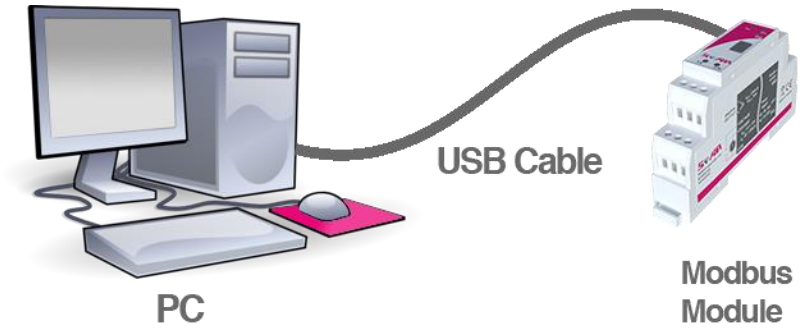
Modbus Address	Dec Address	Hex Address	Register name	Access	Description
801	800	0x320	Voltage input	Read	Voltage input state
802	801	0x321	Current input	Read	Current input state
10817	816	0x330	Voltage alarm	Read & Write	Voltage alarm state
10818	817	0x331	Current alarm	Read & Write	Current alarm state
10819	818	0x332	Digital Output	Read & Write	Digital Output state

Table 7 - Bit access

7. Configuration software

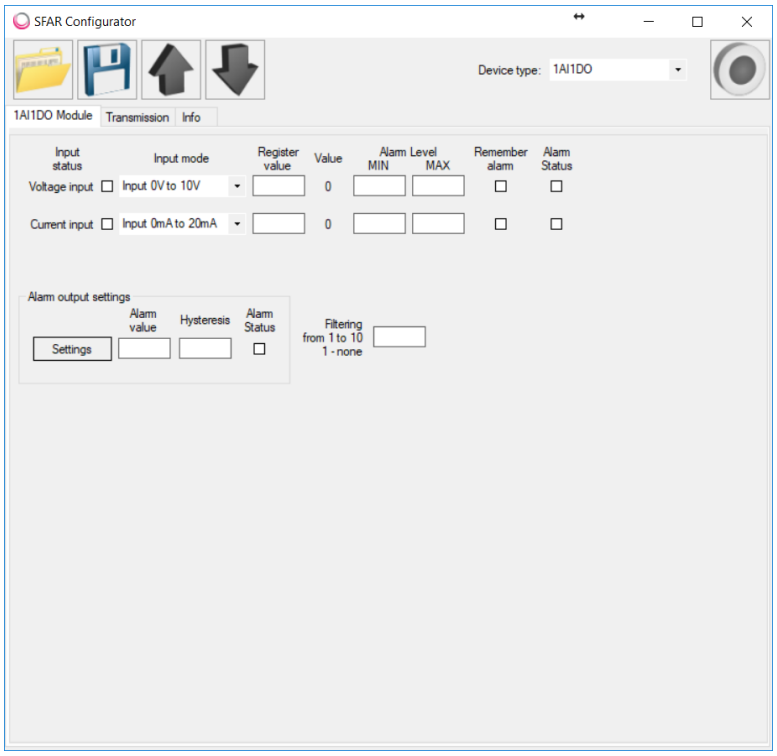
Modbus Configurator is the type of software which is designed to set the communication module registers over Modbus network as well as to read and write the current value of other registers of the module. It's a convenient way to test the system as well as to observe real-time changes in the registers.

Communication with the module happens via the USB cable. The module does not require any drivers.



Picture 7 - Configuration process

Configurator is a universal software, whereby it is possible to configure all available modules.



Picture 8 - Configurator