SFAR-1M-4DI

User Manual

Expansion Module – 4 Digital Inputs with counters memory

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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

4DI Module is an innovative device that provides a simple and cost-effective extension of the number of lines of input in popular PLCs.

The module has 4 Digital Inputs with configurable timer/counter option, which allows to connect two encoders. All inputs are isolated from the logic by optocouplers. Each channel can be individually configured in one of several modes.

The module has a fast non-volatile FRAM memory that stores values of the counters and the counters captured. This means that even after a power failure, these values are stored and can further use when the power returns

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
Digital Inputs	No of inputs	4
	Voltage range	0 − 36 V
	Low State „0"	0 − 3 V
	High State „1"	6 − 36 V
	Input impedance	4 kΩ
	Isolation	1500 Vrms
	Input Type	PNP or NPN
Counters	No	4
	Resolution	32 bits
	Frequency	1 kHz (max)
	Impulse Width	500 µs (min)
Temperature	Work	-20°C - +65°C
	Storage	-40°C - +85°C
Connectors	Power Supply	3 pin
	Communication	3 pin
	Inputs	2 x 3 pin
	Configuration	Mini USB
Size	Height	90 mm
	Length	56,4 mm
	Width	17,5 mm
Interface	RS485	Up to 128 devices

Table 1 - Technical specifications

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

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.
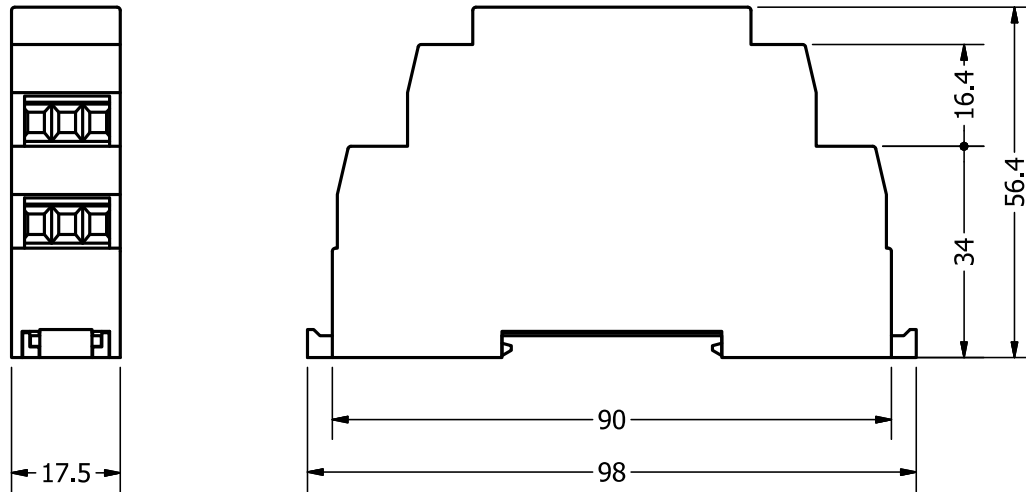
Picture 1 - Dimensions of the product

3.   Configurating of the communication

3.1. Grounding and shielding

In most cases, IO modules will be installed in an enclosure along with other devices which generate electromagnetic radiation. Examples of these devices are relays and contactors, transformers, motor controllers etc. This electromagnetic radiation can induce electrical noise into both power and signal lines, as well as direct radiation into the module causing negative effects on the system. Appropriate grounding, shielding and other protective steps should be taken at the installation stage to prevent these effects. These protective steps include control cabinet grounding, module grounding, cable shield grounding, protective elements for electromagnetic switching devices, correct wiring as well as consideration of cable types and their cross sections.

3.2. 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 an RS485 twisted pair cable this termination is typically 120 Ω.

3.3. 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

3.4. Communication settings

The data stored in the module's memory is given in the16-bit registers. The access to registers happens via Modbus RTU or Modbus ASCII.

3.4.1. 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

3.4.2. Configuration registers

Modbus	Dec	Hex	Name	Values
Address				
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

4.   Indicators
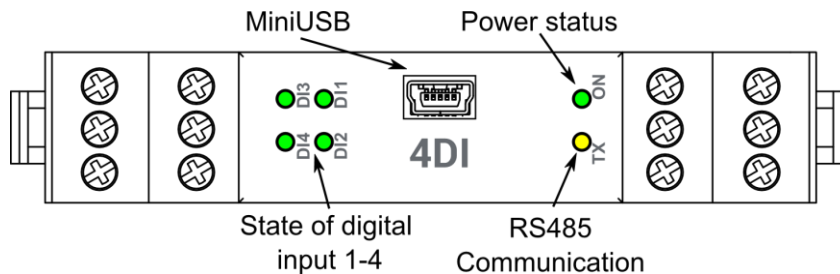
Picture 2 - Indicators

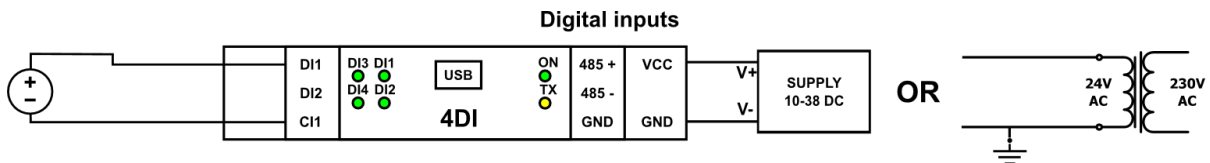| Indicator	Description
ON	LED indicates that the module is correctly powered.
TX	The LED lights up when the unit received the correct packet and sends the answer.
1, 2, 3, 4	LED indicates that on the input is high state.

Table 5 - Description of indicators

5.   Module connection

5.1. Block diagram
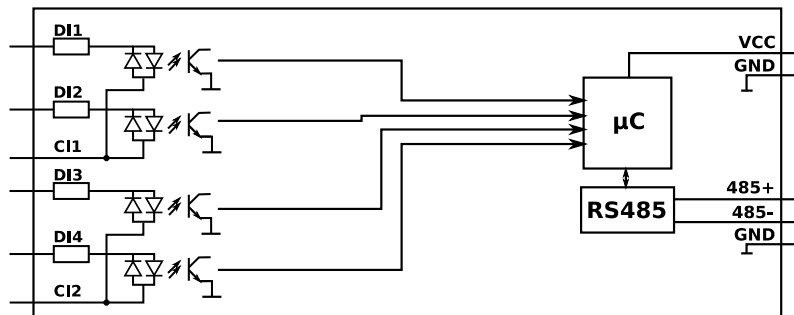
Picture 3 - Block diagram

5.2. Connection of digital inputs

Picture 3 – Connection of digital inputs

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 3.4.2.)
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)
40009	8	0x08	Watchdog	Read & Write	Watchdog
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
40038	37	0x25	Sent packets LSB	Read & Write	
30051	50	0x32	Inputs	Read	Inputs state
40053	52	0x34	Counter 1 MSB	Read & Write	32-bit counter 1
40054	53	0x35	Counter 1 LSB	Read & Write	
40055	54	0x36	Counter 2 MSB	Read & Write	32-bit counter 2
40056	55	0x37	Counter 2 LSB	Read & Write	
40057	56	0x38	Counter 3 MSB	Read & Write	32-bit counter 3
40058	57	0x39	Counter 3 LSB	Read & Write	
40059	58	0x3A	Counter 4 MSB	Read & Write	32-bit counter 4
40060	59	0x3B	Counter 4 LSB	Read & Write	
40061	60	0x3C	CCounter 1 MSB	Read & Write	32-bit value of captured counter 1
40062	61	0x3D	CCounter 1 LSB	Read & Write	
40063	62	0x3E	CCounter 2 MSB	Read & Write	32-bit value of captured counter 2
40064	63	0x3F	CCounter 2 LSB	Read & Write	
40065	64	0x40	CCounter 3 MSB	Read & Write	32-bit value of captured counter 3
40066	65	0x41	CCounter 3 LSB	Read & Write	

Modbus	Dec	Hex	Register Name	Access	Description
40067	66	0x42	CCounter 4 MSB	Read & Write	32-bit value of captured counter 4
40068	67	0x43	CCounter 4 LSB	Read & Write	
40069	68	0x44	Counter Config 1	Read & Write	Counter Configuration +1 – time measurement (if 0 counting impulses) +2 – autocatch counter every 1 sec +4 – catch value when input low +8 – reset counter after catch +16 – reset counter if input low +32 – encoder
40070	69	0x45	Counter Config 2	Read & Write	
40071	70	0x46	Counter Config 3	Read & Write	
40072	71	0x47	Counter Config 4	Read & Write	
40073	72	0x48	Catch	Read & Write	Catch counter
40074	73	0x49	Status	Read & Write	Captured counter

Table 6 - Registered access

6.2. Bit access

Modbus Address	Dec Address	Hex Address	Register name	Access	Description
10801	800	0x320	Input 1	Read	Input 1 state
10802	801	0x321	Input 2	Read	Input 2 state
10803	802	0x322	Input 3	Read	Input 3 state
10804	803	0x323	Input 4	Read	Input 4 state
1153	1152	0x480	Capture 1	Read & Write	Capture counter 1
1154	1153	0x481	Capture 2	Read & Write	Capture counter 2
1155	1154	0x482	Capture 3	Read & Write	Capture counter 3
1156	1155	0x483	Capture 4	Read & Write	Capture counter 4
1169	1168	0x490	Captured 1	Read & Write	Captured value of counter 1
1170	1169	0x491	Captured 2	Read & Write	Captured value of counter 2
1171	1170	0x492	Captured 3	Read & Write	Captured value of counter 3
1172	1171	0x493	Captured 4	Read & Write	Captured value of counter 4

Table 7 - Bit access
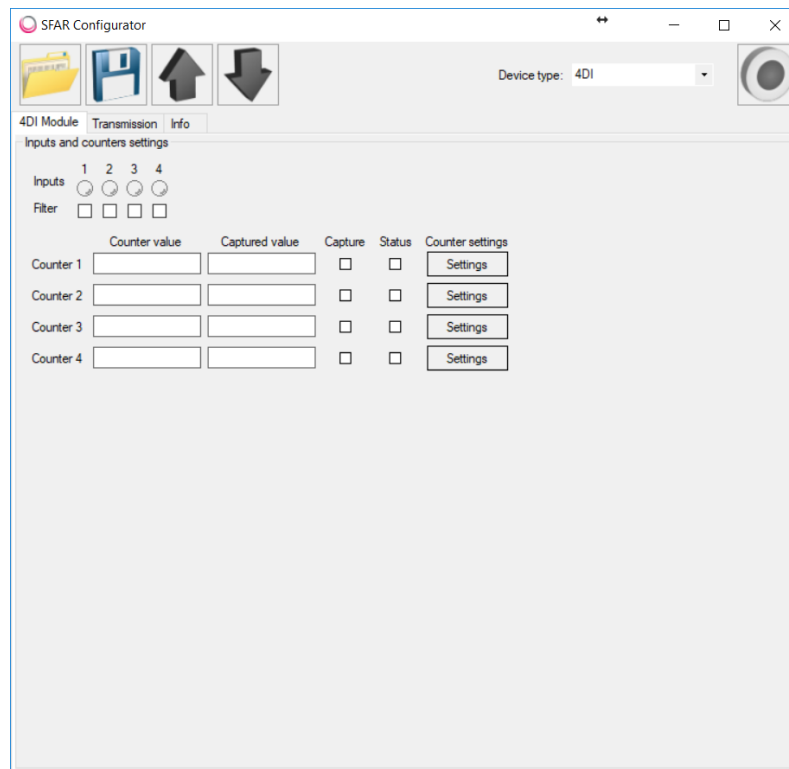
7.   Configuration software

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.
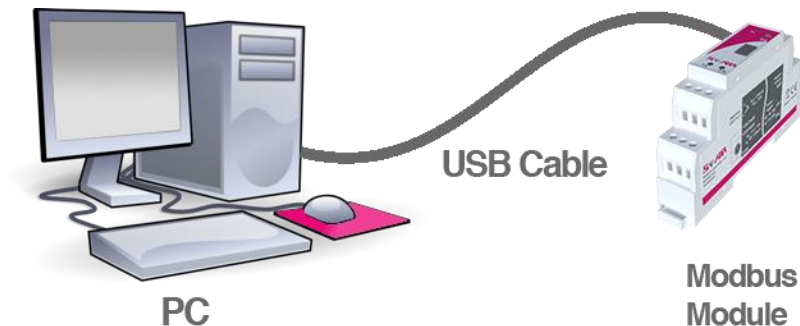
Picture 5 - Configuration process

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

Picture 6 - Configurator