Solutions For Automation & Robotics

SFAR-S-16DO

User Manual

Expansion Module – 16 Digital Outputs

Modbus

Global Control 5 Sp. z o.o.
Warsaw, Poland
www.gc5.pl

Table of content

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 judgment 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-S-16DO Module is an innovative device that provides a simple and cost-effective extension of the number of outputs in popular PLCs.

The module has 16 Digital Outputs. All inputs and outputs are isolated from the logic of using optocouplers.

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 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

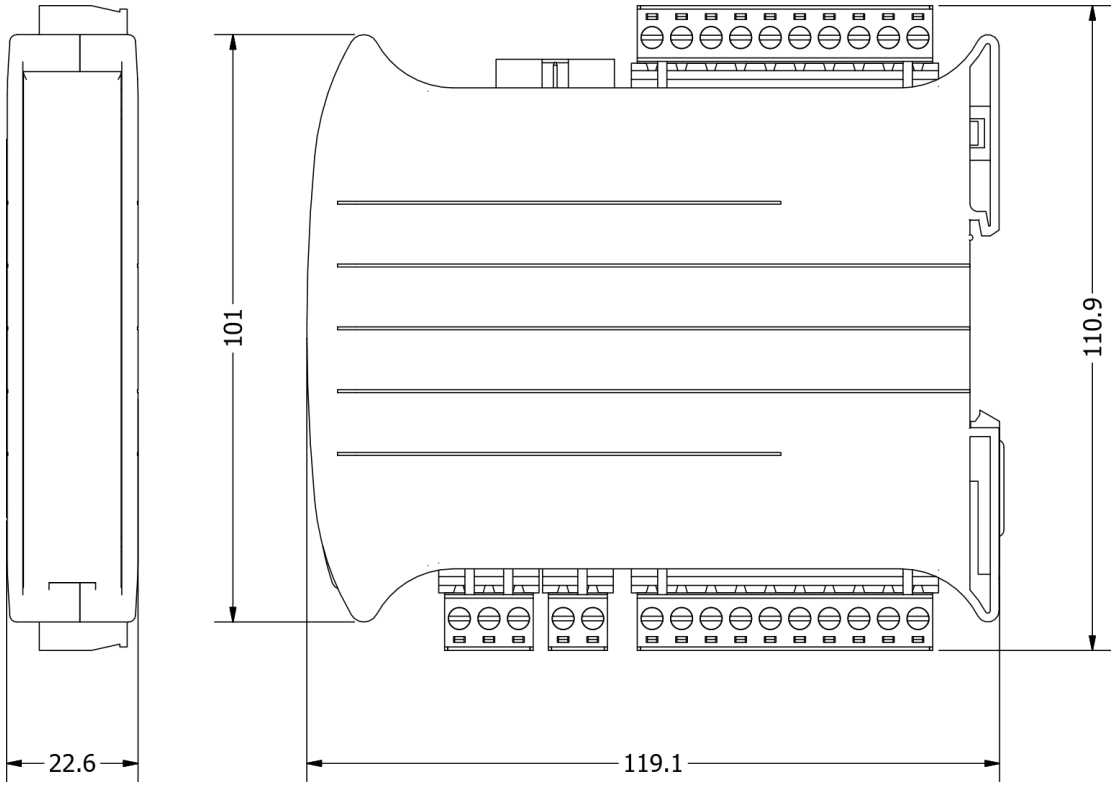
Power Supply	Voltage	10-38 V DC; 10-28 V AC
	Power consumption*	2.4 W @ 24 V DC
		3 VA @ 24 V AC
Digital Outputs	No of outputs	16
	Max Voltage	30 V
	Max current	500 mA
	Output Type	PNP
	Isolation	1500 Vrms
Temperature	Work	-10 °C - +50°C
	Storage	-40 °C - +85°C
Connectors	Power Supply	2 pin
	Communication	3 pin
	Outputs	10 pin
	Quick connector	IDC10
	Configuration	Mini USB
Size	Height	119.1 mm
	Length	101 mm
	Width	22.6 mm
Interface	RS485	Up to 128 devices

Table 1 - Technical specifications

*Power consumption with active Modbus transmission, all outputs on 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. Power connectors, communication and IOs are at the bottom and top of the module. USB connector configuration and indicators are located on the front of the module.



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 RS485 twisted pair cable this termination is typically 120 Ω.

3.3. Setting Module Address in RS485 Modbus Network

The following table shows how to set switch to determine the address of the module. The module address is set with the switches in the range of 0 to 31. Addresses from 32 to 255 can be set via RS485 or USB.

Adr	SW5	SW4	SW3	SW2	SW1
0	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	ON	OFF
3	OFF	OFF	OFF	ON	ON
4	OFF	OFF	ON	OFF	OFF
5	OFF	OFF	ON	OFF	ON
6	OFF	OFF	ON	ON	OFF
7	OFF	OFF	ON	ON	ON
8	OFF	ON	OFF	OFF	OFF
9	OFF	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON	OFF
11	OFF	ON	OFF	ON	ON
12	OFF	ON	ON	OFF	OFF
13	OFF	ON	ON	OFF	ON
14	OFF	ON	ON	ON	OFF
15	OFF	ON	ON	ON	ON

Adr	SW5	SW4	SW3	SW2	SW1
16	ON	OFF	OFF	OFF	OFF
17	ON	OFF	OFF	OFF	ON
18	ON	OFF	OFF	ON	OFF
19	ON	OFF	OFF	ON	ON
20	ON	OFF	ON	OFF	OFF
21	ON	OFF	ON	OFF	ON
22	ON	OFF	ON	ON	OFF
23	ON	OFF	ON	ON	ON
24	ON	ON	OFF	OFF	OFF
25	ON	ON	OFF	OFF	ON
26	ON	ON	OFF	ON	OFF
27	ON	ON	OFF	ON	ON
28	ON	ON	ON	OFF	OFF
29	ON	ON	ON	OFF	ON
30	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON

Table 2 - Setting Module Address in RS485 Modbus Network

3.4. 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 3 - Types of variables

3.5. 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.

3.5.1. Default settings

You can restore the default configuration by the switch SW6 (see 3.5.2 - Restore the default configuration)

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

Table 4 - Default settings

3.5.2. Restore the default configuration

To restore the default configuration:

- turn the power off
- turn the switch SW6 on
- turn the power on
- when power and communication LED flash turn the switch SW6 off

WARNING! After restoring the default configuration all values stored in the registers will be cleared as well.

3.5.3. Configuration registers

Modbus Address	Dec	Hex	Name	Values
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 5 - Configuration registers

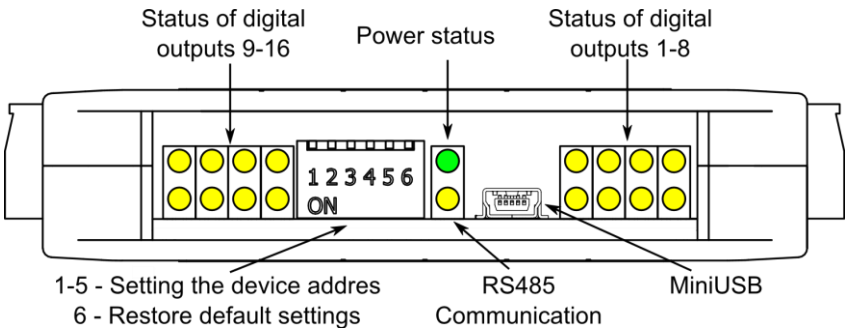
3.5.4. Watchdog information

This 16-bits register specifies the time in milliseconds to watchdog reset. If module does not receive any valid message within that time, all Digital and Analog Outputs will be set to the default state.

This feature is useful if there is an interruption in data transmission and for security reasons. Output states must be set to the appropriate state in order to reassure the safety of persons or property.

The default value is 0 milliseconds which means the watchdog function is disabled.

4. Indicators



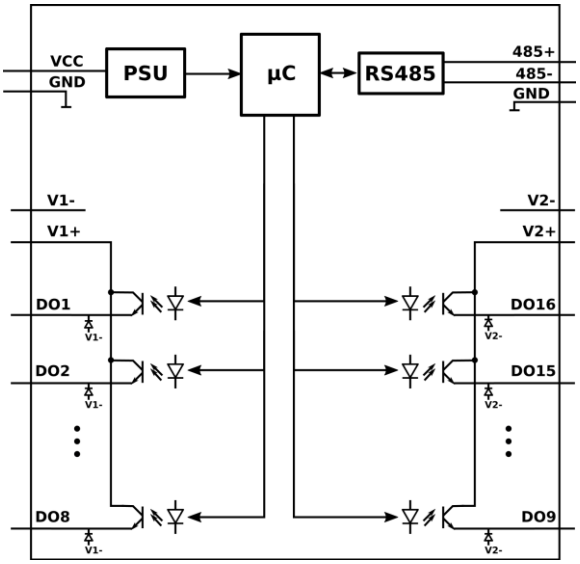
Picture 2 - Indicators

Indicator	Description
Power supply	LED indicates that the module is correctly powered.
Communication	The LED lights up when the unit received the correct packet and sends the answer.
Outputs state	LED indicates that the output is on.

Table 6 - Description of Indicators

5. Module connection

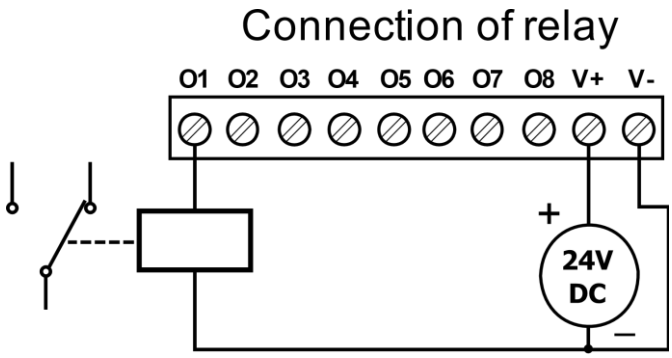
5.1. Block diagram



Picture 3 – Block diagram

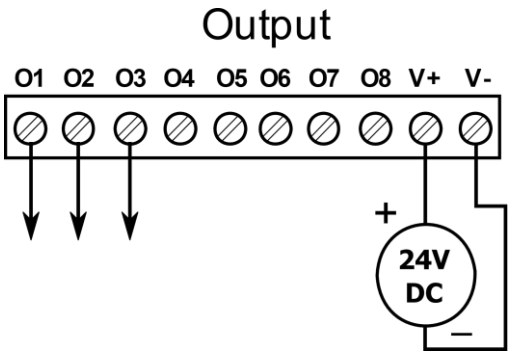
5.2. Connection of digital output

5.2.1. Connection of relay



Picture 4 – Connection of relay

5.2.2. Connection of output

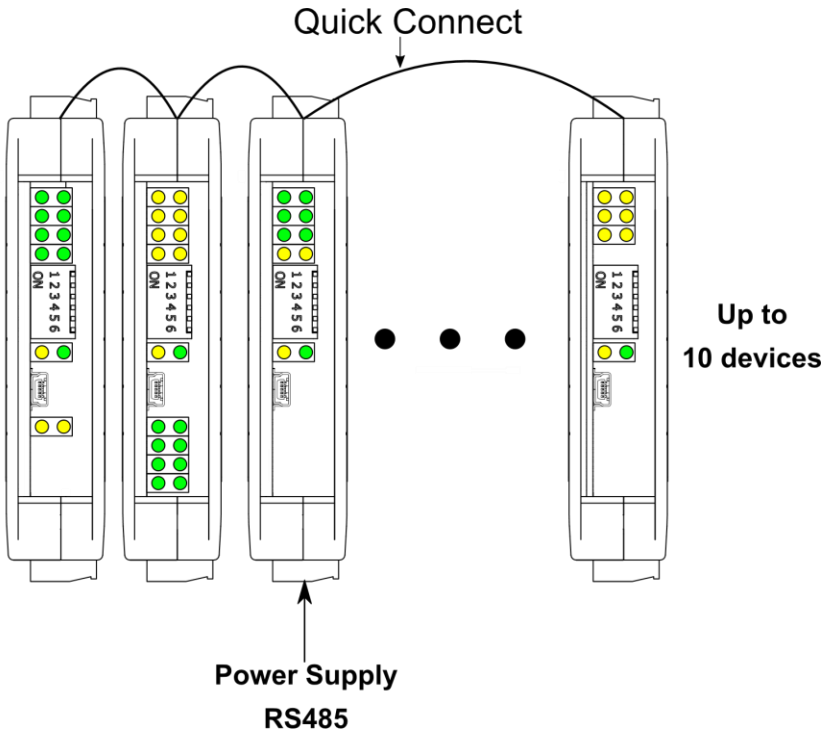


Picture 5 – Connection of output

5.3. Quick connect

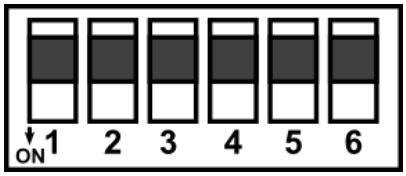
Quick Connect is an unique feature of modules that allows you to quickly connect group of devices with a flat ribbon cable. Thanks to this solution, it is enough to connect power and RS485 communication to one of the devices in the group and the others will be powered and communicated with ribbon cable.

The Quick Connect is sufficient to connect up to 10 devices next to each other. What is important that the various types of modules in the SFAR-S family can be connected with the ribbon cable.



Picture 6 – Connection of quick connect

6. Switches



Picture 7 - Switches

Switch	Function	Description
1	Module address +1	Setting module address from 0 to 31
2	Module address +2	
3	Module address +4	
4	Module address +8	
5	Module address +16	
6	Restoring default settings	Restoring default settings (see 3.5.1 - Default settings and 3.5.2 - Restore the default configuration).

Table 7 - Description of switches

7. Modules Registers

7.1. Registered access

Modbus	Dec	Hex	Register Name	Access	Description
30001	0	0x00	Version/Type	Read	Version and Type of the device
30002	1	0x01	Switches	Read	Switches state
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 3.5.3)
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
40013	12	0x0C	Default Output State	Read & Write	Default output state (after power on or watchdog reset)
40033	32	0x20	Received packets MSB	Read & Write	No of received packets

Modbus	Dec	Hex	Register Name	Access	Description
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	
40052	51	0x33	Outputs	Read & Write	Output state

Table 8 - Registered access

7.2. Bit access

Modbus Address	Dec Address	Hex Address	Register name	Access	Description
193	192	0x0C0	Default state of output 1	Read & Write	Default state of output 1
194	193	0x0C1	Default state of output 2	Read & Write	Default state of output 2
195	194	0x0C2	Default state of output 3	Read & Write	Default state of output 3
196	195	0x0C3	Default state of output 4	Read & Write	Default state of output 4
197	196	0x0C4	Default state of output 5	Read & Write	Default state of output 5
198	197	0x0C5	Default state of output 6	Read & Write	Default state of output 6
199	198	0x0C6	Default state of output 7	Read & Write	Default state of output 7
200	199	0x0C7	Default state of output 8	Read & Write	Default state of output 8
201	200	0x0C8	Default state of output 9	Read & Write	Default state of output 9
202	201	0x0C9	Default state of output 10	Read & Write	Default state of output 10
203	202	0x0CA	Default state of output 11	Read & Write	Default state of output 11
204	203	0x0CB	Default state of output 12	Read & Write	Default state of output 12
205	204	0x0CC	Default state of output 13	Read & Write	Default state of output 13
206	205	0x0CD	Default state of output 14	Read & Write	Default state of output 14
207	206	0x0CE	Default state of output 15	Read & Write	Default state of output 15
208	207	0x0CF	Default state of output 16	Read & Write	Default state of output 16
817	816	0x330	Output 1	Read & Write	Output 1 state
818	817	0x331	Output 2	Read & Write	Output 2 state
819	818	0x332	Output 3	Read & Write	Output 3 state
820	819	0x333	Output 4	Read & Write	Output 4 state
821	820	0x334	Output 5	Read & Write	Output 5 state
822	821	0x335	Output 6	Read & Write	Output 6 state

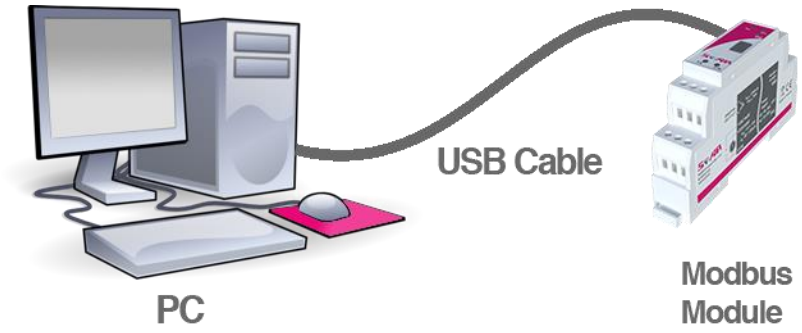
Modbus Address	Dec Address	Hex Address	Register name	Access	Description
823	822	0x336	Output 7	Read & Write	Output 7 state
824	823	0x337	Output 8	Read & Write	Output 8 state
825	824	0x338	Output 9	Read & Write	Output 9 state
826	825	0x339	Output 10	Read & Write	Output 10 state
827	826	0x33A	Output 11	Read & Write	Output 11 state
828	827	0x33B	Output 12	Read & Write	Output 12 state
829	828	0x33C	Output 13	Read & Write	Output 13 state
830	829	0x33D	Output 14	Read & Write	Output 14 state
831	830	0x33E	Output 15	Read & Write	Output 15 state
832	831	0x33F	Output 16	Read & Write	Output 16 state

Table 9 - Bit access

8. Configuration software

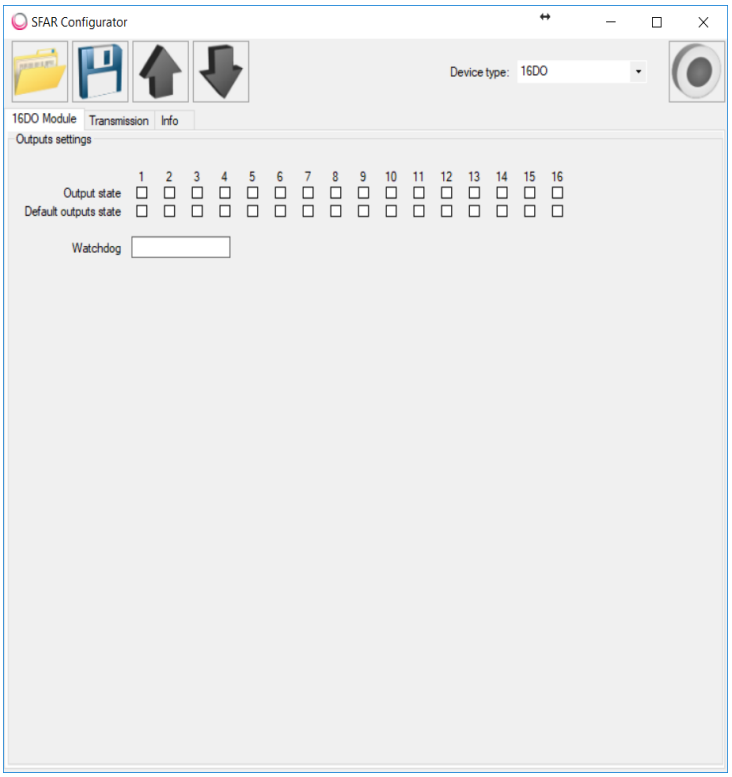
Modbus Configurator is the type of software which is designed to set the communication module registers over Modbus network as well as to read and write the current value of other registers of the module. It's a convenient way to test the system as well as to observe real-time changes in the registers.

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



Picture 8 - Configuration process

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



Picture 9 - Configurator