Mini Modbus 4DI-M

Expansion Module – 4 digital inputs with counters memory

Version 1.8 **User Manual**

Manufactured for

aspar

Thank you for choosing our product.

This manual will help you with proper support and proper operation of the device.

The information contained 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 release you from the obligation of own judgement and verification.

We reserve the right to change product specifications without notice.

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

WARNING!

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

1. Safety rules

- Before first use, refer to this manual
- Before first use, make sure that all cables are connected properly
- Please ensure proper working conditions, according to the device specifications (eg: supply voltage, temperature, maximum power consumption)
- Before making any modifications to wiring connections, turn off the power supply

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 allow 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 used to indicate the status of inputs and outputs 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.

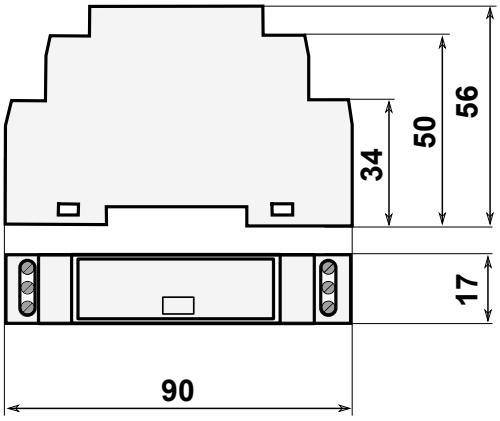
2.2. Technical Specifications

Power Supply	Voltage	10-38VDC; 20-28VAC
	Maximum Current*	62 mA @ 12V / 35 mA @ 24V
Digital Inputs	No of inputs	4
	Voltage range	0 – 36V
	Low State „0”	0 – 3V
	High State „1”	6 – 36V
	Input impedance	4kΩ
	Isolation	1500 Vrms
	Input Type	PNP or NPN
	Dry input contacts	No
Counters	No	4
	Resolution	32 bits
	Frequency	1kHz (max)
	Impulse Width	500 µs (min)
Temperature	Work	-10 °C - +50°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 mm
	Width	17 mm
Interface	RS485	Up to 128 devices

* Maximum current with active Modbus transmission and high state on all inputs

2.3. *Dimensions of the product*

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



3. Communication configuration

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 present a problem on data communication networks. These problems include reflections and signal attenuation.

To eliminate the presence of reflections from 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

3.4. *Communication settings*

The data stored in the modules memory are in 16-bit registers. Access to registers is 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

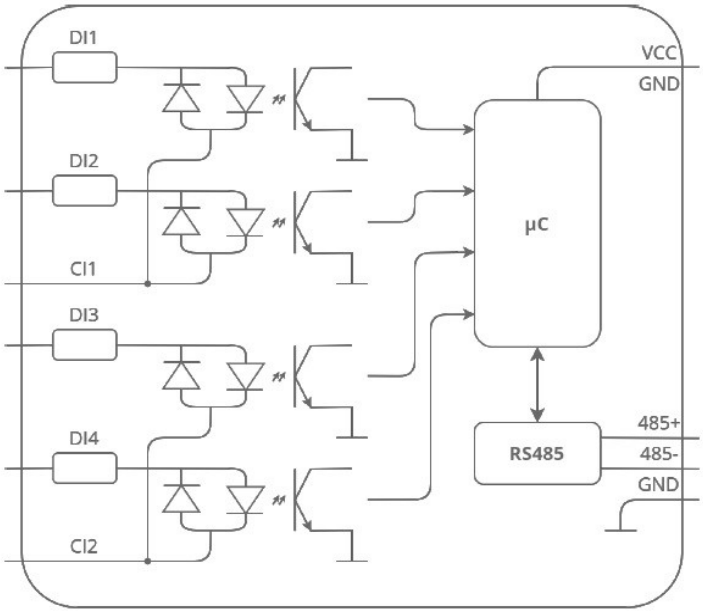
3.4.2. Configuration registers

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

4. Indicators

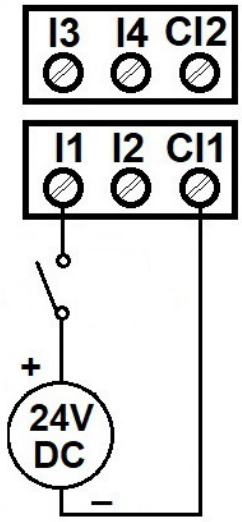
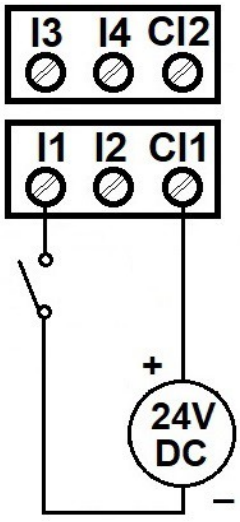
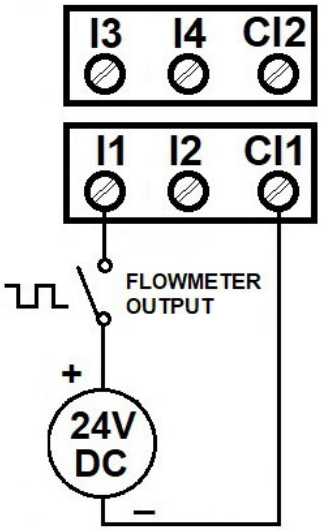
Indicator	Description
ON	LED indicates that the module is correctly powered.
TX	The LED lights up when the unit received the correct packet and sends the answer.
1, 2, 3, 4	LED indicates that on the input is high state.

5. Block diagram

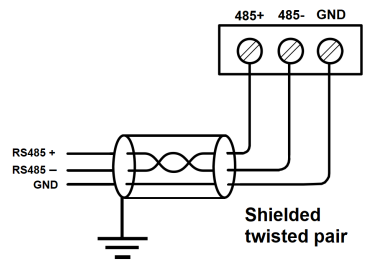
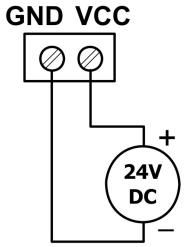
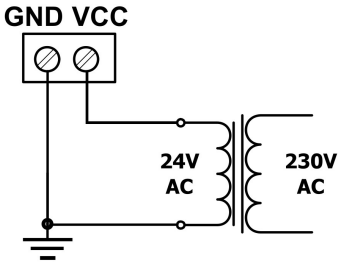


6. Module Connection

6.1. Digital inputs

Sink input, PNP	Source input, NPN	FLOWMETER
		

6.2. Communication, power supply

Communication	Power supply, DC Voltage 24VDC	Power supply, AC voltage 24VAC
		

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	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 LSB	Read & Write	No of received packets
40034	33	0x21	Received packets MSB	Read & Write	
40035	34	0x22	Incorrect packets LSB	Read & Write	No of received packets with error
40036	35	0x23	Incorrect packets MSB	Read & Write	
40037	36	0x24	Sent packets LSB	Read & Write	No of sent packets
40038	37	0x25	Sent packets MSB	Read & Write	
30051	50	0x32	Inputs	Read	Inputs state
40053	52	0x34	Counter 1 LSB	Read & Write	32-bit counter 1
40054	53	0x35	Counter 1 MSB	Read & Write	
40055	54	0x36	Counter 2 LSB	Read & Write	32-bit counter 2
40056	55	0x37	Counter 2 MSB	Read & Write	
40057	56	0x38	Counter 3 LSB	Read & Write	32-bit counter 3
40058	57	0x39	Counter 3 MSB	Read & Write	
40059	58	0x3A	Counter 4 LSB	Read & Write	32-bit counter 4
40060	59	0x3B	Counter 4 MSB	Read & Write	
40061	60	0x3C	CCounter 1 LSB	Read & Write	32-bit value of captured counter 1
40062	61	0x3D	CCounter 1 MSB	Read & Write	
40063	62	0x3E	CCounter 2 LSB	Read & Write	32-bit value of captured counter 2
40064	63	0x3F	CCounter 2 MSB	Read & Write	
40065	64	0x40	CCounter 3 LSB	Read & Write	32-bit value of captured counter 3
40066	65	0x41	CCounter 3 MSB	Read & Write	
40067	66	0x42	CCounter 4 LSB	Read & Write	32-bit value of captured counter 4
40068	67	0x43	CCounter 4 MSB	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

7.2. 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

8. Type and version

Information about the type and version of the module is contained in register number 30001. The codes of all available Modbus IO modules are presented below in tabular form, as well as information on how to decode the read value.

Type	Code after conversion	Type	Code after conversion	Type	Code after conversion
MOD-8I8O	0	MOD-1AI	40	SDM-6TE	26
MOD-16I	1	MOD-1TE	41	SDM-16I	12
MOD-16O	2	MOD-4DI	42	SDM-8I8O	11
MOD-6RO	3	MOD-2I2O	43	SDM-16O	14
MOD-8TR	4	MOD-4DO	44	SDM-6RO	15
MOD-16I-M	6	MOD-4DI-M	45	SDM-16RO	16
MOD-16RO	7	MOD-1AO	46	SDM-8AI	22
MOD-8I8RO	8			SDM-8AO	31
MOD-6TE	10				
MOD-8AI	20				
MOD-8AO	30				

Example:

Module **MOD-8I8O**, register value 30001 in decimal system 10240, we convert to hexadecimal system. The value is 28 00. The first bit is the firmware version, in order to read, we convert the hexadecimal value of 28 to the decimal value, ie: 40, divide by 10 and we have the value of firmware **4.0**. The second bit is the version **0** type, ie module MOD-8I8O according to the table.

MOD-4DI-M, 30001 -> 2861 (dec), 0B 2D (hex), 0B (hex)->11(dec) /10 -> 1.1 - firmware version

2D (hex)-> 45 (dec)-> **45** - code MOD-4DI-M

MOD-4DI, 30001 -> 3114 (dec), 0C 2A (hex), 0C (hex)->12(dec) /10 -> 1.2 - firmware version

2A (hex)-> 42 (dec)-> **42** - code MOD-4DI

MOD-2I2O, 30001 -> 7979 (dec), 1F 2B (hex), 1F (hex)->31(dec) /10 -> 3.1 - firmware version

2B (hex)-> 43 (dec)-> **43** – code MOD-2I2O

9. How to read double registers? Examples.

Register

53 (MSB)	**52** (LSB)

BIN

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1

DEC

0	1297

DWORD

1297

Register

53	52

BIN

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

DEC

0	65535

DWORD

65535

Register

53	52

BIN

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

DEC

1	0

DWORD

65536

Register

53	52

BIN

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1

DEC

1	305

DWORD

65841 = (1 x 65536+305)

Register

53	52

BIN

0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1

DEC

1541	1297

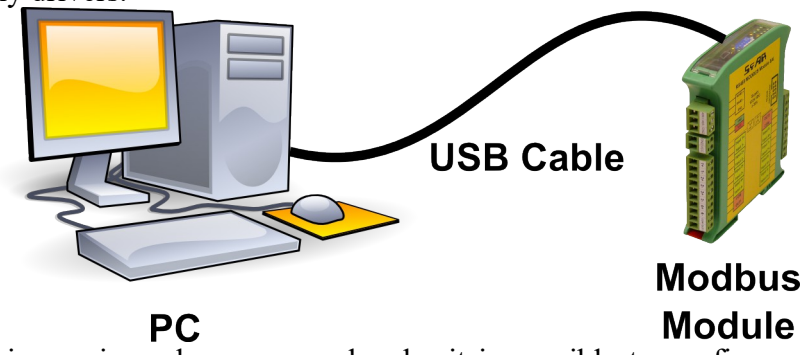
DWORD

100992273 = (1541 x 65536+1297)

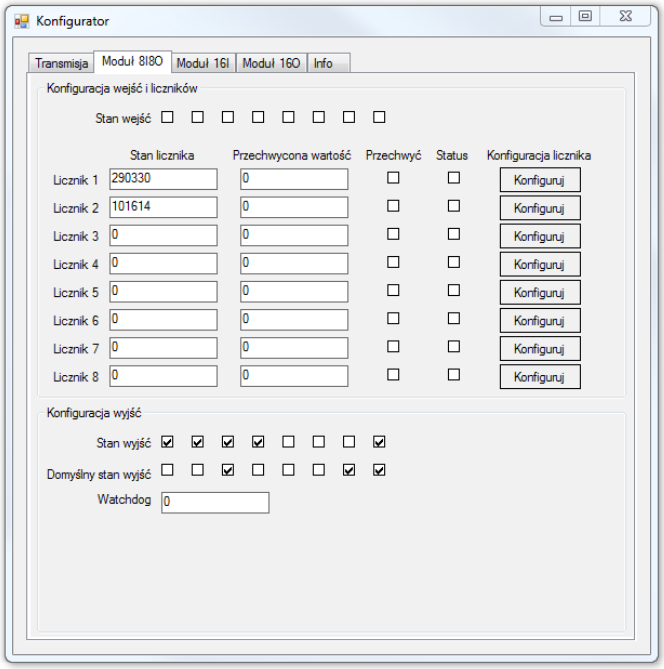
10. Configuration software

Modbus Configurator is software that is designed to set the module registers responsible for communication over Modbus network as well as to read and write the current value of other registers of the module. This program can be a convenient way to test the system as well as to observe real-time changes in the registers.

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



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



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