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RELAY OUTPUTS EXPANSION MODULE
with MODBUS RTU output

MR-RO-4

WARRANTY. The F&F products are covered by a warranty of the 24 months from the date of purchase. Effective only with proof of purchase. Contact your dealeror directly with us. More information how to make a compliant can be found on the website: www.fif.com.pl/reklamacje

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Do not dispose of this device to a garbage bin with other unsorted waste! In accordance with the Waste Electrical and Electronic Equipment Act any household electro-waste can be turned in free of charge and in any quantity to a collection point established for this purpose, as well as to the store in the event of purchasing new equipment (as per the old for new rule, regardless of brand). Electro-waste thrown in the garbage bin or abandoned in the bosom of nature pose a threat to the environment and human health.

Purpose

The MR-RO-4 module is used as an external device that extends relay outputs of the PLC programmable controllers or other devices in which data is exchanged via the RS-485 port with MODBUS RTU protocol.

Features

* 1 C/O separated contact
* ON / OFF control
* output status
* timer control options:
  - delayed activation
  - delayed activation for a preset time
  - cyclic operation ON / OFF
  - cyclic operation OFF / ON
* state memory state after power outage
* automatic start for time function
* time of the last output switching
* number output switching
* number of executed cycles for time functions

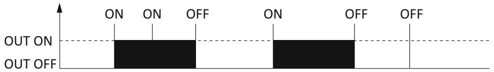
Functioning

The MR-RO-4 module is equipped with four controllable relay outputs (separated contacts). Each of the outputs operate independently and in accordance to the preset mode of operation and parameters assigned to it. The setting and reading the output status, operation parameters and adjustment of all communication and data exchange parameters is carried out via RS-485 port using MODBUS RTU communication protocol. Power is indicated by a green LED U light. Correct data exchange between the module and other device is indicated by the LED yellow Tx light.

OPERATION MODES

0. ON/OFF

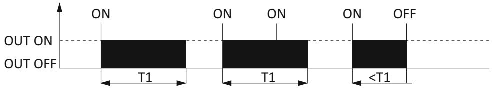
The default mode of module operation in which the output is directly switched on and off using commands sent via Modbus.



1. Delayed activation

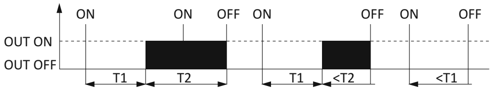
Upon receiving of the ON command, the controller measures the time set in parameter T1 and activates the relay. The relay will shut down after receiving the OFF command. Sending the OFF command during the T1 time countdown will abort the cycle. Another ON command received at the time T1 or when the relay is already switched on will be ignored.

2. Activation for a preset time



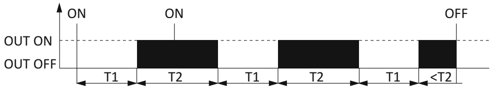
The relay activates after receiving the ON command, and deactivates when the preset time is up. Next cycle can be initiated by sending the next ON command. Sending the OFF command turns off the relay. The ON command received during T1 time will be ignored.

3. Delayed activation for a preset time



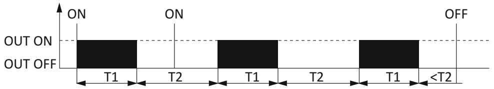
The module starts measuring time T1 after receiving the ON command and then closes the relay for a time T2, after which the relay is switched off. Next cycle after completing the previous one can be activated by sending another ON command. Sending the OFF command OFF breaks the execution of the cycle and turns off the relay. The ON command received during cycle execution will be ignored.

4. OFF/ON cycle



Cyclic operations OUT OFF (relay off) for the time T1 and OUT ON (relay on) for the time T2. The cycle is started by sending the ON command. The number of executed cycles depends on the 0x235 registry value. If this register is set to 0, the program will be executed cyclically until the OFF command is sent. If this registry value is other than zero (max. 65 535), the controller performs a predetermined number of cycles, then turns off. Sending the OFF command during the cycle breaks its execution and turns off the relay. The ON command received during cycle execution will be ignored. After the programmed number of cycles the next ON command starts the program from the beginning.

5. ON/OFF cycle

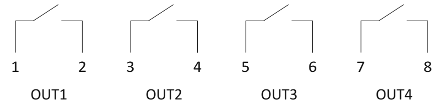


Cyclic operations OUT ON (relay on) for the time T1 and OUT OFF (relay off) for the time T2. The cycle is started by sending the ON command. The number of executed cycles depends on the 0x235 registry value. If this register is set to 0, the program will be executed cyclically until the OFF command is sent. If this registry value is other than zero (max. 65 535), the controller performs a predetermined number of cycles, then turns off. Sending the OFF command during the cycle breaks its execution and turns off the relay. The ON command received during cycle execution will be ignored. After the programmed number of cycles the next ON command starts the program from the beginning.

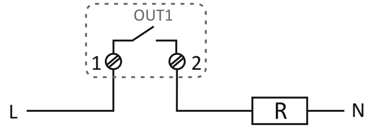
STATE MEMORY AND AUTOMATIC START

Special functions of the state memory and automatic start can be activated for each of the outputs.
The active **memory of the state** restores the state of the program from before the power outage when the power is back on. State memory sets the contact in position from before the power outage for the 0 mode. Setting the state memory for modes 1-5 means that if at the time of the power outage the program was in progress, then when the power is restored it will be launched from the beginning.
Active **automatic start** function (only if the state memory function is inactive) is the automatic execution of the selected operating mode after switching on the power supply of the module.

Description of the outputs (contacts)



An example of connecting the controlled receiver to the OUT1 output.



Installation

Installation:
1. Set the selected MODBUS communication parameters and communications parameters prior to unit installation.
2. Disconnect the power in the distribution box.
3. Install the module on the rail.
4. Connect the module power supply to terminals +/- in accordance with the indications.
5. Connect signal output A/B (port RS-485) to the MASTER output of another device.
6. Connect the power cables of the controlled receivers to the corresponding terminals of the contacts.

Protection

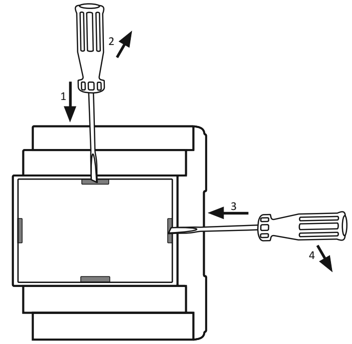
1. Galvanic isolation between the contacts of the relay and the system power supply and communication path (min. 3 kV).
2. No galvanic isolation between power supply and RS-485 line.
3. Overcurrent protection of power supply input and communication input (up to a maximum of 60 V DC) with automatic return feature.

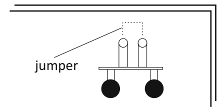
Specifications

supply voltage	9÷30V DC
output	
contact	separated 1NO
AC-1 load	<16A
number of contacts	4
port	RS-485
communication protocol	Modbus RTU
operation mode	SLAVE
indication	
power	green LED
communication	yellow LED
power consumption	<2W
working temperature	-20÷50°C
terminal	2,5mm² screw terminals
tightening torque	0.4Nm
dimensions	4 modules (90 mm)
mounting	on TH-35 rail
ingress protection	IP20

Reset of communication settings

The configuration jumper is located under the front casing of the module. Activating the controller with jumper closed will restore factory settings of the communication parameters. To do this, remove the front casing of the module. Slip the tip of the screwdriver into the cutouts at the casing frame and pry gently. Put a jumper on the two pins. Restart the module. After the reset, switch off the power and remove the jumper. Fit the facade lid to the LEDs and lightly press into the frame.





MODBUS RTU protocol parameters

Communication parameters	
Protocol	MODBUS RTU
Operation mode	SLAVE
Port settings (factory settings)	bit/s: 1200 / 2400 / 4800 / **9600** / 19200 / 38400 / 57600 / 115200 Data bits: **8** Parity: **NONE** / EVEN / ODD Start bits: **1** Stop bits: 1 / 1.5 / **2**
Range of network addresses (factory setting)	1÷245 (**1**)
Command codes	1: Input state reading (0×01 - Read Coils) 3: Registers group reading (0×03 - Read Holding Register) 5: Output states recording (Write Single Coils) 6: Single register value setting (0×06) - Write Single Register)
Maximum frequency of queries	15Hz

Communication registers

address	description	funct.	type	atrib.
256	Reading of current one and recording of new base address: 1÷245	03 06	int	read write
257	Reading of current one and recording of new transmission rate: 0:1200 / 1:2400 / 2:4800 / 3:9600 / 4:19200 / 5:38400 / 6:57600 / 7:115200	03 06	int	read write
258	Reading of current one and recording of new parity value: 0:NONE / 1:EVEN / 2:ODD	03 06	int	read write
259	Reading of current one and recording of new stop bits quantity: 0:1bit / 1:1.5bit / 2:2bits	03 06	int	read write
260	Factory settings: Enter 1.	06	int	write
Please note! Any change in communication parameters (transmission rate, quantity of stop bits, parity) will be applied only after power restart.				
1024-1025	Module operation time [s] R1024×256²+R1024	03	int	read
1026-1027	Serial number R1026×256²+R1027	03	int	read
1028	Production date: 5 bits-day; 4 bits-month; 7 bits-year (without 2000)	03	int	read
1029	Software version	03	int	read
1030	Completion: 0 - Lo; 1 - Hi.	03	int	read
1031-1035	Identifier: F& | F | MB | -4 | DI	03	int	read
1039	Configuration jumper: 0-open; 1-closed	03	int	read
The transducer does not support broadcast commands (address 0).				

Output registers

address	description	command	type	atrib.
0	Out1: Read and write output state recording ON/OFF	01/05	bit	read write
1	Out2: Read and write output state recording ON/OFF	01/05	bit	read write
2	Out3: Read and write output state recording ON/OFF	01/05	bit	read write
3	Out4: Read and write output state recording ON/OFF	01/05	bit	read write
Entering the ON command (0xFF00) executes the program dependent on the selected operating mode. Entering the OFF command (0x0000) breaks the execution of the selected program and opens the contact.				
16	Out1: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program dependent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	read write
17	Out1: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	read
18/19	Out1: contact closing counter [s] R18×256²+R19	03	int	read
20/21	Out1: time of the last contact closing [s] R20×256²+R21	03	int	read
22/23	Out1: total time of contact switching [s] R22×256²+R23	03	int	read
24/25	Out1: number of the completed program cycles (applies to mode 4 and 5) R24×256²+R25	03	int	read
Please note! Total time and number of contact switching are not retained after power failure.				
32	Out2: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program dependent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	read write
33	Out2: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	read
34/35	Out2: contact closing counter [s] R18×256²+R19	03	int	read
36/37	Out2: time of the last contact closing [s] R20×256²+R21	03	int	read
38/39	Out2: total time of contact switching [s] R22×256²+R23	03	int	read
40/41	Out2: number of the completed program cycles (applies to mode 4 and 5) R24×256²+R25	03	int	read
Please note! Total time and number of contact switching are not retained after power failure.				
48	Out3: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program dependent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	read write
49	Out3: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	read
50/51	Out3: contact closing counter [s] R18×256²+R19	03	int	read
52/53	Out3: time of the last contact closing [s] R20×256²+R21	03	int	read
54/55	Out3: total time of contact switching [s] R22×256²+R23	03	int	read
56/57	Out3: number of the completed program cycles (applies to mode 4 and 5) R24×256²+R25	03	int	read
Please note! Total time and number of contact switching are not retained after power failure.				
64	Out4: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program dependent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	read write
65	Out4: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	read
66/67	Out4: contact closing counter [s] R18×256²+R19	03	int	read
68/69	Out4: time of the last contact closing [s] R20×256²+R21	03	int	read
70/71	Out4: total time of contact switching [s] R22×256²+R23	03	int	read
72/73	Out4: number of the completed program cycles (applies to mode 4 and 5) R24×256²+R25	03	int	read
Please note! Total time and number of contact switching are not retained after power failure.				

Configuration registers

address	description	func.	type	atrib.
512	Out1: operation mode 0- ON/OFF; 1- delayed activation; 2 - activation for a preset time; 3 - delayed activation for a preset time; 4 - OFF/ON cycle; 5- ON/OFF cycle.	03/06	int	read write
513	Out1: time base V1 (1÷65 535) T1 time = V1 × F1	03/06	int	read write
514	Out1: multiplier F1 0 - ×0,1 (T1: 0,1÷6553,5s) 1 - ×1 (T1: 1÷65 535s)	03/06	int	read write
515	Out1: time base V2 (1÷65 535) T2 time = V2 × F2	03/06	int	read write
516	Out1: multiplier F2 0 - ×0,1 (T2: 0,1÷6553,5s) 1 - ×1 (T2: 1÷65 535s)	03/06	int	read write
517	Out1: number of ON/OFF cycles for modes 4 and 5 (1÷65 535) Value 0 – continuous operation (unlimited number of cycles)	03/06	int	read write
518	Out1: State memory. 0 – inactive; 1 – active.	03/06	int	read write
519	Out1: Automatic start. 0 – inactive; 1 – active.	03/06	int	read write
528	Out2: operation mode 0- ON/OFF; 1- delayed activation; 2 - activation for a preset time; 3 - delayed activation for a preset time; 4 - OFF/ON cycle; 5- ON/OFF cycle.	03/06	int	read write
529	Out2: time base V1 (1÷65 535) T1 time = V1 × F1	03/06	int	read write
530	Out2: multiplier F1 0 - ×0,1 (T1: 0,1÷6553,5s) 1 - ×1 (T1: 1÷65 535s)	03/06	int	read write
531	Out2: time base V2 (1÷65 535) T2 time = V2 × F2	03/06	int	read write
532	Out2: multiplier F2 0 - ×0,1 (T2: 0,1÷6553,5s) 1 - ×1 (T2: 1÷65 535s)	03/06	int	read write
533	Out2: number of ON/OFF cycles for modes 4 and 5 (1÷65 535) Value 0 – continuous operation (unlimited number of cycles)	03/06	int	read write
534	Out2: State memory. 0 – inactive; 1 – active.	03/06	int	read write
535	Out2: Automatic start. 0 – inactive; 1 – active.	03/06	int	read write
544	Out3: operation mode 0- ON/OFF; 1- delayed activation; 2 - activation for a preset time; 3 - delayed activation for a preset time; 4 - OFF/ON cycle; 5- ON/OFF cycle.	03/06	int	read write
545	Out3: time base V1 (1÷65 535) T1 time = V1 × F1	03/06	int	read write
546	Out3: multiplier F1 0 - ×0,1 (T1: 0,1÷6553,5s) 1 - ×1 (T1: 1÷65 535s)	03/06	int	read write
547	Out3: time base V2 (1÷65 535) T2 time = V2 × F2	03/06	int	read write
548	Out3: multiplier F2 0 - ×0,1 (T2: 0,1÷6553,5s) 1 - ×1 (T2: 1÷65 535s)	03/06	int	read write
549	Out3: number of ON/OFF cycles for modes 4 and 5 (1÷65 535) Value 0 – continuous operation (unlimited number of cycles)	03/06	int	read write
550	Out3: State memory. 0 – inactive; 1 – active.	03/06	int	read write
551	Out3: Automatic start. 0 – inactive; 1 – active.	03/06	int	read write
560	Out4: operation mode 0- ON/OFF; 1- delayed activation; 2 - activation for a preset time; 3 - delayed activation for a preset time; 4 - OFF/ON cycle; 5- ON/OFF cycle.	03/06	int	read write
561	Out4: time base V1 (1÷65 535) T1 time = V1 × F1	03/06	int	read write
562	Out4: multiplier F1 0 - ×0,1 (T1: 0,1÷6553,5s) 1 - ×1 (T1: 1÷65 535s)	03/06	int	read write
563	Out4: time base V2 (1÷65 535) T2 time = V2 × F2	03/06	int	read write
564	Out4: multiplier F2 0 - ×0,1 (T2: 0,1÷6553,5s) 1 - ×1 (T2: 1÷65 535s)	03/06	int	read write
565	Out4: number of ON/OFF cycles for modes 4 and 5 (1÷65 535) Value 0 – continuous operation (unlimited number of cycles)	03/06	int	read write
566	Out4: State memory. 0 – inactive; 1 – active.	03/06	int	read write
567	Out4: Automatic start. 0 – inactive; 1 – active.	03/06	int	read write

Configuration parameters – factory settings	
operation mode	0 (ON/OFF)
V1 - time base T1	10
F1 - multiplier for T1	1
V2 - time base T2	10
F2 - multiplier for T2	1
Number of cycles	0 (continuous operation)
State memory	0 (OFF)
Automatic start	0 (OFF)