F&F Filipowski L.P.
Konstantynowska 79/81, 95-200 Pabianice, POLAND
phone/fax (+48 42) 215 23 83 / (+48 42) 227 09 71
www.fif.com.pl; e-mail: biuro@fif.com.pl

MR-RO-4

Relay outputs
expansion module
with Modbus RTU output

Do not dispose of this device in the trash along with other waste!
According to the Law on Waste, electro coming from households free of charge and can give any amount to up to that end point of collection, as well as to store the occasion of the purchase of new equipment (in accordance with the principle of old-for-new, regardless of brand). Electro thrown in the trash or abandoned in 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.

Functions

» 4 independent outputs (NO contacts);
» 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;

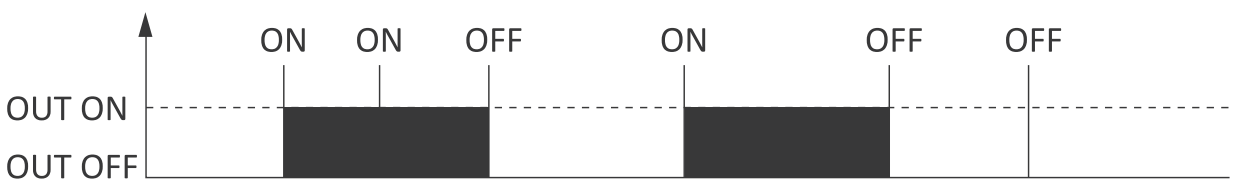
» Number output switching;
» Number of executed cycles for time functions.

Functioning

The MR-RO-4 module is equipped with 4 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.

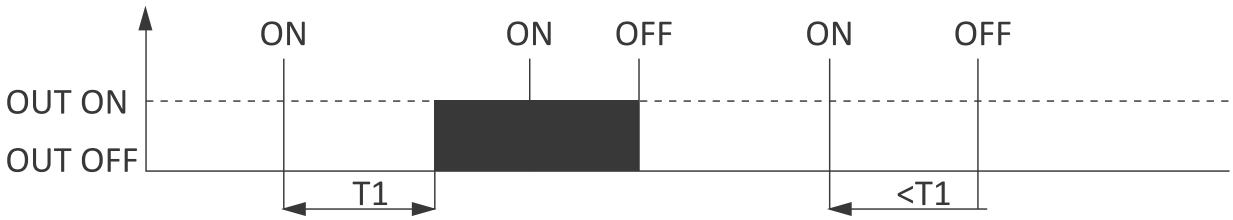
Working modes

Mode 0. ON/OFF



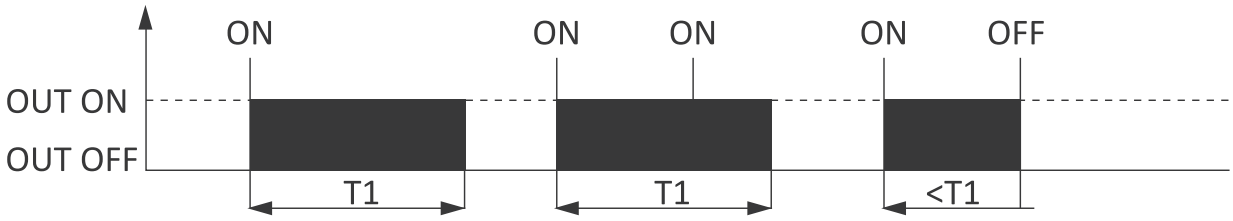
The default mode of module operation in which the output is directly switched on and off using commands sent via Modbus.

Mode 1. Delayed activation



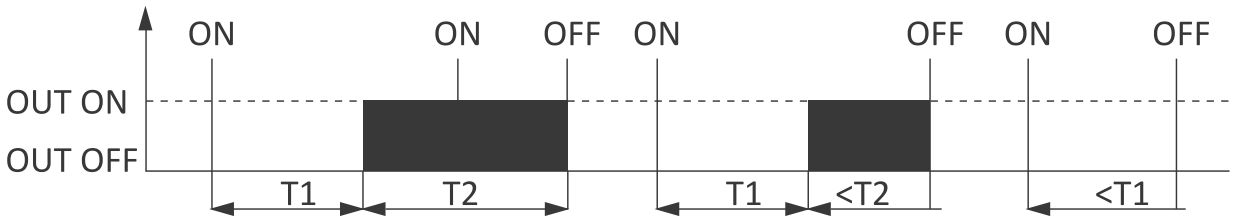
Upon receiving of the ON command, the controller measures the time set in parameter T1 and activates the relay. The relay will shut down after receiving the OFF command. Sending the OFF command during the T1 time countdown will abort the cycle. Another ON command received at the time T1 or when the relay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

Mode 2. Activation for a preset time



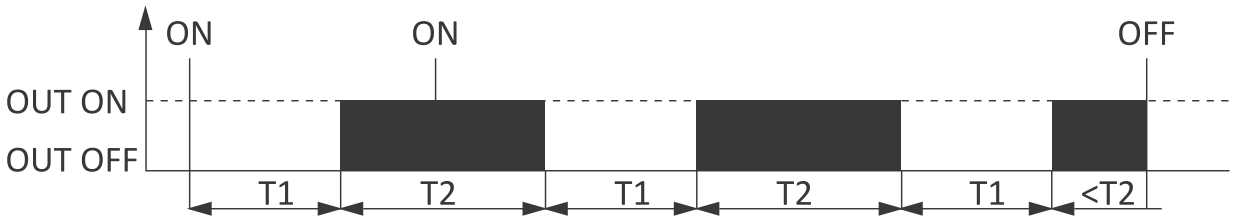
The relay activates after receiving the ON command, and deactivates when the preset time is up. Next cycle can be initiated by sending the next ON command. Sending the OFF command turns off the relay. The ON command received during T1 time will be ignored.

Mode 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.

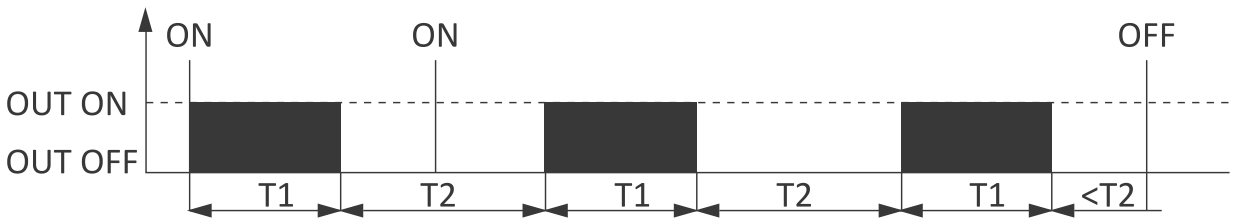
Mode 4. OFF/ON cycle



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.

Mode 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.

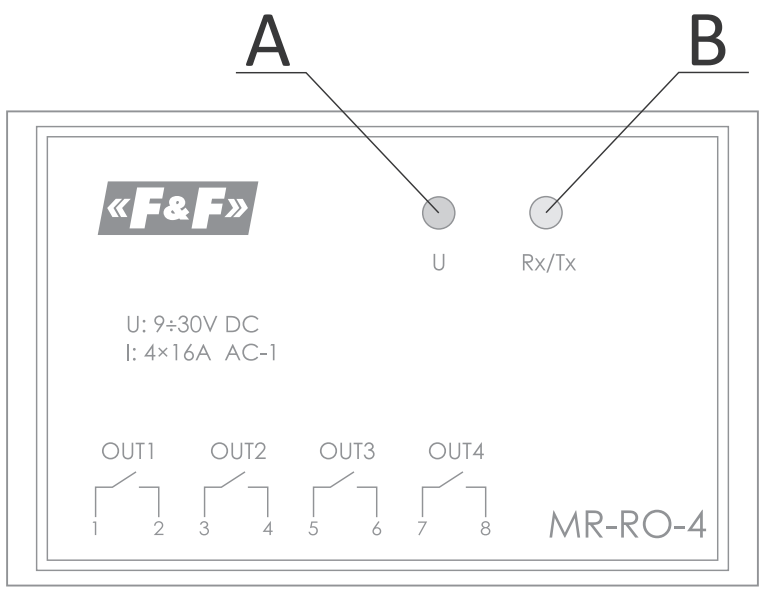
State memory and automatic start

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.

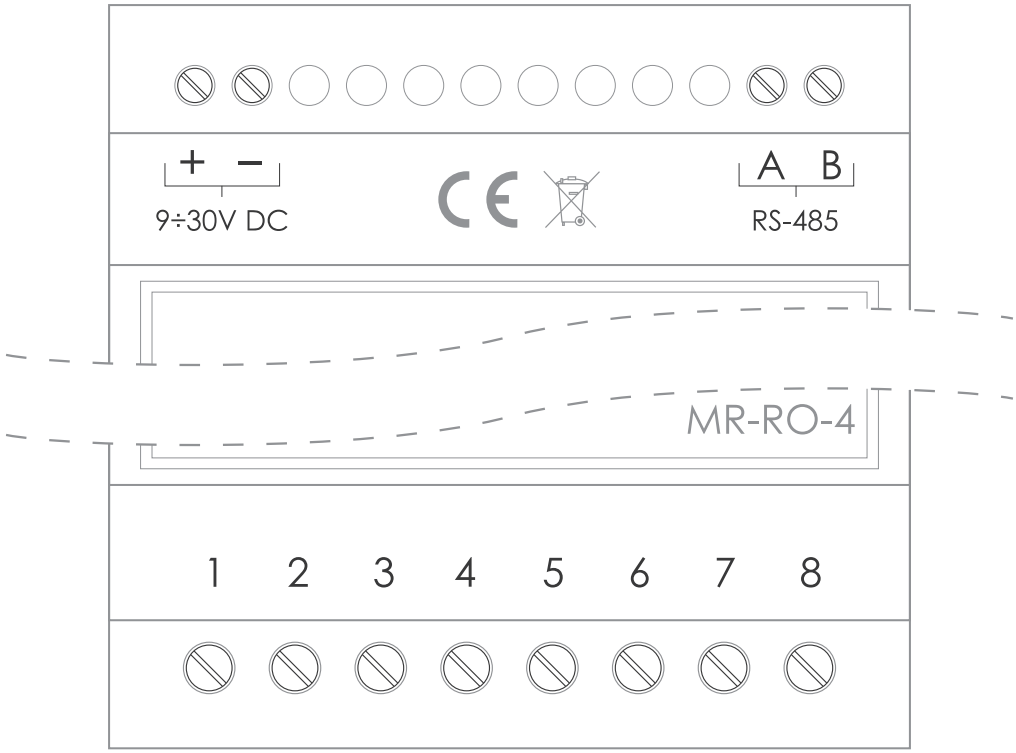
Device description



A – power supply

B – Modbus RTU data exchange

Terminals description



module supply (top terminals)

1 – power supply (+)
2 – power supply (–)

port RS-485 (top terminals)

11 – serial port (A)
12 – serial port (B)

relays outputs (bottom terminals)

1-2 – NO 1 contact
3-4 – NO 2 contact
5-6 – NO 3 contact
7-8 – NO 4 contact

RS-485 port is not galvanically isolated from the module supply voltage.

Galvanic isolation between the relay contacts and the system power supply and communication track (min. 3 kV).

Overcurrent protection for power supply and communication input (up to max. 60 V DC) with automatic return function.

Mounting

Recommended use of interference and surge filters (e.g. OP-230 from the F&F offer).

It is recommended to use shielded twisted-pair cables to connect the module to another device.

When using shielded cables, ground the screens only on one side and as close to the device as possible.

The ends of the signal line should be terminated with termination modules (e.g. LT-04 from the F&F offer).

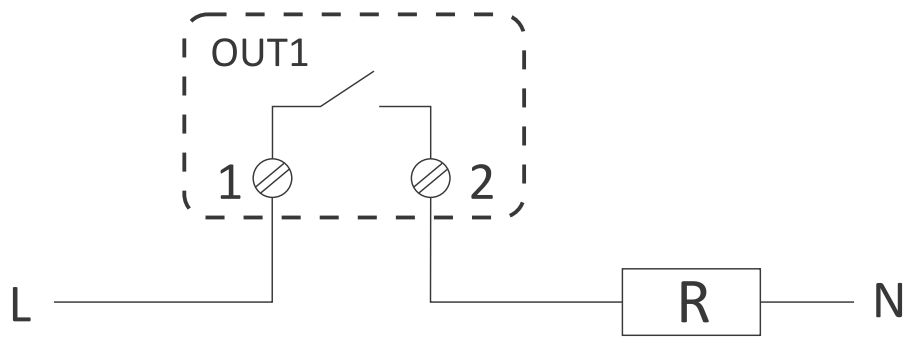
Do not route signal cables in parallel in close proximity to high and medium voltage lines.

Do not install the module in the immediate vicinity of high-power electric receivers, electromagnetic measuring instruments, phase power control devices and other devices that may cause interference.

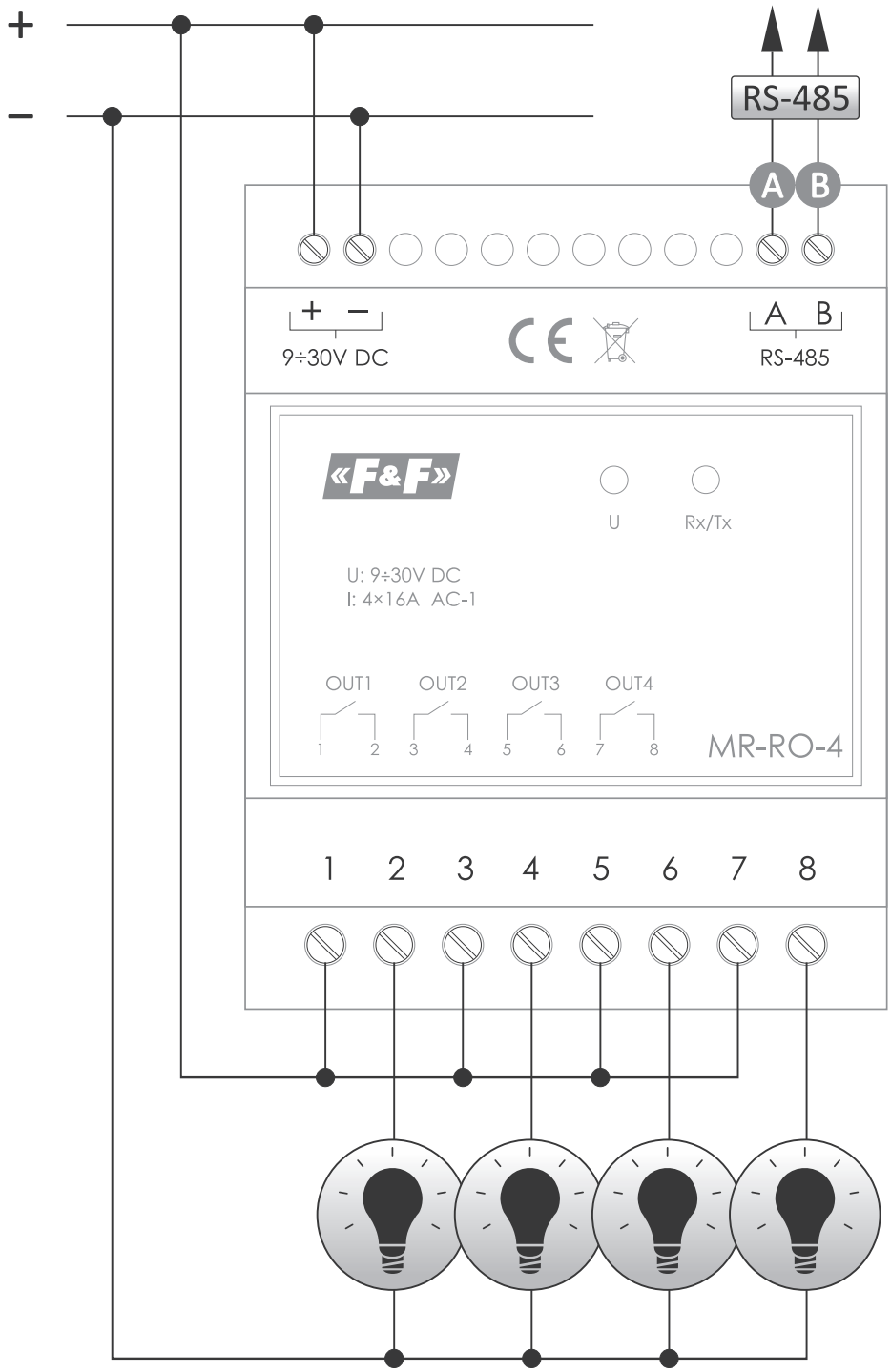
1. Before installing the module, set the selected Modbus communication parameters and working modes.
2. Disconnect the power in the distribution box.
3. Install the module on the rail.
4. Connect the module's power supply to terminals (+) and (–) as marked.
5. Connect signal output (A and B) RS-485 port to the Master output.
6. Connect the power supply wires of the controlled receivers to the corresponding terminals of the contacts.

Connection implementation

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

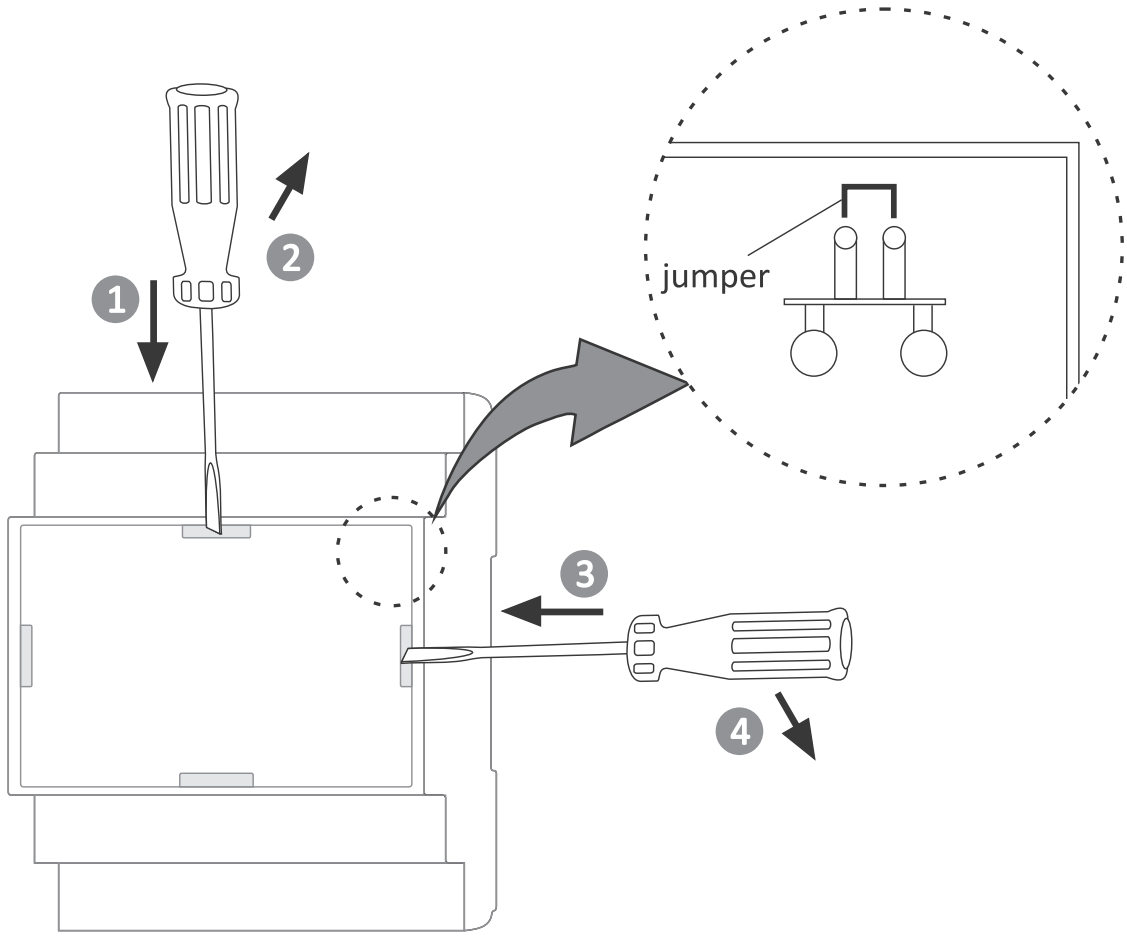


Wiring diagram



Communication settings reset

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 2 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.



MB Config service software

Service program for quick configuration of the device.
The program is available on the appliance sub-page or under the „Downloads” tab on the website: www.fif.com.pl.

Technical data

power supply	9÷30 V DC
maximum load current (AC-1)	4×16 A
contact	separowany 4×NO
port	RS-485
communication protocol	Modbus RTU
operating mode	Slave
power indication	green LED
communication indication	yellow LED
communcation parameters	
baud rate (adjustable)	1200÷115200 bits/s
data bits	8
stop bits	1/1.5/2
parity bits	EVEN/ODD/NONE
address	1÷247
power consumption	2 W
working temperature	-20÷50°C
terminal	2.5 mm^2 screw terminals
tightening torque	0.4 Nm
dimensions	4 modules (70 mm)
mounting	on TH-35 rail
ingress protection	IP20

Warranty

F&F products are covered by a 24-month warranty from the date of purchase. The warranty is only valid with proof of purchase. Contact your dealer or contact us directly.

CE declaration

F&F Filipowski L.P. declares that the device is in conformity with the essential requirements of the Low Voltage Directive (LVD) 2014/35/EU and the Electromagnetic Compatibility (EMC) Directive 2014/30/UE.

The CE and MID Declaration of Conformity, along with the references to the standards in relation to which conformity is declared, can be found at www.fif.com.pl from the product subpage.

Modbus RTU protocol parameters

Communication parameters	
Protocole	Modbus RTU
Operating mode	Slave
Port settings (factory settings)	Number of bits per second: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Data bits: 8 Parity: NONE, EVEN, ODD Start bits: 1 Stop bits: 1/1.5/2
Network address range (factory settings)	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 (0×05 – Write Single Coil) 6: Single register value setting (0×06) – Write Single Register)
Max. frequency of queries	15 Hz

Communication registers

address	description	func.	type	atr.
256	Reading of current one and recording of new base address: 1÷245	03 06	int	R/W
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	R/W
258	Reading of current one and recording of new parity value: 0:NONE / 1:EVEN / 2:ODD	03 06	int	R/W
259	Reading of current one and recording of new stop bits quantity: 0: 1 bit/1: 1,5 bit/2: 2 bits	03 06	int	R/W
260	Factory settings restore: Enter value 1.	06	int	W

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]: $1024 \times 256^2 + R1025$	03	int	R
1026 ÷ 1027	Serial number: $R1026 \times 256^2 + R1027$	03	int	R

Communication registers (cont.)

address	description	func.	type	atr.
1028	Production date: 5 bits – day; 4 bits – month; 7 bits – year (without 2000)	03	int	R
1029	Software version	03	int	R
1031 ÷ 1035	Identifier: F& | F | MB | 4 | RO	03	int	R
1039	Configuration jumper: 0 – open; 1 – close	03	int	R

The transducer does not support broadcast commands (address 0).

Legend: R – read, W – write

Configuration registers

address	description	func.	type	atr.
	OUT1			
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	R/W
513	Out1: V1 time base (1÷65535) T1 time = V1 × F1	03 06	int	R/W

Configuration registers (cont.)

address	description	func.	type	atr.
514	Out1: F1 multiplier 0: ×0.1 (T1: 0.1÷6553.5 s) 1: ×1 (T1: 1÷65535 s)	03 06	int	R/W
515	Out1: V2 time base (1÷65535) T2 time = V2 × F2	03 06	int	R/W
516	Out1: F2 multiplier 0: ×0.1 (T2: 0.1÷6553.5 s) 1: ×1 (T2: 1÷65535 s)	03 06	int	R/W
517	Out1: number of ON/OFF cycles for modes 4 and 5 (1÷65535) Value 0 – continuous operation (unlimited number of cycles)	03 06	int	R/W
518	Out1: State memory 0 – inactive; 1 – active	03 06	int	R/W
519	Out1: Automatic start 0 – inactive; 1 – active	03 06	int	R/W
	OUT2			
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	R/W

Legend: R – read, W – write

Configuration registers (cont.)

address	description	func.	type	atr.
529	Out2: V1 time base (1÷65535) T1 time = V1 × F1	03 06	int	R/W
530	Out2: F1 multiplier 0: ×0.1 (T1: 0.1÷6553.5 s) 1: ×1 (T1: 1÷65535 s)	03 06	int	R/W
531	Out2: V2 time base (1÷65535) T2 time = V2 × F2	03 06	int	R/W
532	Out2: F2 multiplier 0: ×0.1 (T2: 0.1÷6553.5 s) 1: ×1 (T2: 1÷65535 s)	03 06	int	R/W
533	Out2: number of ON/OFF cycles for modes 4 and 5 (1÷65535) Value 0 – continuous operation (unlimited number of cycles)	03 06	int	R/W
534	Out2: State memory 0 – inactive; 1 – active	03 06	int	R/W
535	Out2: Automatic start 0 – inactive; 1 – active	03 06	int	R/W

Continued on next page

Configuration registers (cont.)

address	description	func.	type	atr.
	OUT3			
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	R/W
545	Out3: V1 time base (1÷65535) T1 time = V1 × F1	03 06	int	R/W
546	Out3: F1 multiplier 0: ×0.1 (T1: 0.1÷6553,5 s) 1: ×1 (T1: 1÷65535 s)	03 06	int	R/W
547	Out3: V2 time base (1÷65535) T2 time = V2 × F2	03 06	int	R/W
548	Out3: F2 multiplier 0: ×0.1 (T2: 0.1÷6553.5 s) 1: ×1 (T2: 1÷65535 s)	03 06	int	R/W
549	Out3: number of ON/OFF cycles for modes 4 and 5 (1÷65535) Value 0 – continuous operation (unlimited number of cycles)	03 06	int	R/W
550	Out3: State memory 0 – inactive; 1 – active	03 06	int	R/W

Configuration registers (cont.)

address	description	func.	type	atr.
551	Out3: Automatic start 0 – inactive; 1 – active	03 06	int	R/W
	OUT4			
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	R/W
561	Out4: V1 time base (1÷65535) T1 time = V1 × F1	03 06	int	R/W
562	Out4: F1 multiplier 0: ×0.1 (T1: 0.1÷6553.5 s) 1: ×1 (T1: 1÷65535 s)	03 06	int	R/W
563	Out4: V2 time base (1÷65535) T2 time = V2 × F2	03 06	int	R/W
564	Out4: F2 multiplier 0: ×0.1 (T2: 0.1÷6553.5 s) 1: ×1 (T2: 1÷65535 s)	03 06	int	R/W
565	Out4: number of ON/OFF cycles for modes 4 and 5 (1÷65535) Value 0 – continuous operation (unlimited number of cycles)	03 06	int	R/W

Configuration registers (cont.)

address	description	func.	type	atr.
566	Out4: State memory 0 – inactive; 1 – active	03 06	int	R/W
567	Out4: Automatic start 0 – inactive; 1 – active	03 06	int	R/W

Outputs registers

address	description	func.	type	atr.
0	Out1: Read and write output state recording ON/OFF	01 05	bit	R/W
1	Out2: Read and write output state recording ON/OFF	01 05	bit	R/W
2	Out3: Read and write output state recording ON/OFF	01 05	bit	R/W
3	Out4: Read and write output state recording ON/OFF	01 05	bit	R/W

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.

Continued on next page

Outputs registers (cont.)

address	description	func.	type	atr.
	OUT1			
16	Out1: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program depen-dent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	R/W
17	Out1: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	R
18/19	Out1: contact closing counter [s]: R18×256²+R19	03	int	R
20/21	Out1: time of the last contact closing [s]: R20×256²+R21	03	int	R
22/23	Out1: total time of contact switching [s]: R22×256²+R23	03	int	R
24/25	Out1: number of the completed program cycles (applies to mode 4 and 5): R24×256²+R25	03	int	R

Note!
Total time and number of contact switching are not retained after power failure.

Outputs registers (cont.)				
address	**description**	**func.**	**type**	**atr.**
	OUT2			
32	Out2: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program depen-dent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	R/W
33	Out2: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	R
34/35	Out2: contact closing counter [s]: R34×256²+R35	03	int	R
36/37	Out2: time of the last contact closing [s]: R36×256²+R37	03	int	R
38/39	Out2: total time of contact switching [s]: R38×256²+R39	03	int	R
40/41	Out2: number of the completed program cycles (applies to mode 4 and 5): R40×256²+R41	03	int	R

Note!
Total time and number of contact switching are not retained after power failure.

Outputs registers (cont.)

address	description	func.	type	atr.
	OUT3			
48	Out3: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program depen-dent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	R/W
49	Out3: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	R
50/51	Out3: contact closing counter [s]: R50×256²+R51	03	int	R
52/53	Out3: time of the last contact closing [s]: R52×256²+R53	03	int	R
54/55	Out3: total time of contact switching [s]: R54×256²+R55	03	int	R
56/57	Out3: number of the completed program cycles (applies to mode 4 and 5): R56×256²+R57	03	int	R

Note!
Total time and number of contact switching are not retained after power failure.

Outputs registers (cont.)

address	description	func.	type	atr.
	OUT4			
64	Out4: Recording and reading of the output state ON/OFF Entering 1 (command ON) executes the program depen-dent on the selected operating mode. Entering 0 (command OFF) breaks the execution of the selected program and opens the contact.	03 06	int	R/W
65	Out4: output state reading ON/OFF 0 – contact open 1 – contact closed	03	int	R
66/67	Out4: contact closing counter [s]: R66×256²+R67	03	int	R
68/69	Out4: time of the last contact closing [s]: R68×256²+R69	03	int	R
70/71	Out4: total time of contact switching [s]: R70×256²+R71	03	int	R
72/73	Out4: number of the completed program cycles (applies to mode 4 and 5): R72×256²+R73	03	int	R

Note!
Total time and number of contact switching are not retained after power failure.

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


«F&F»