LABOR – ASTER

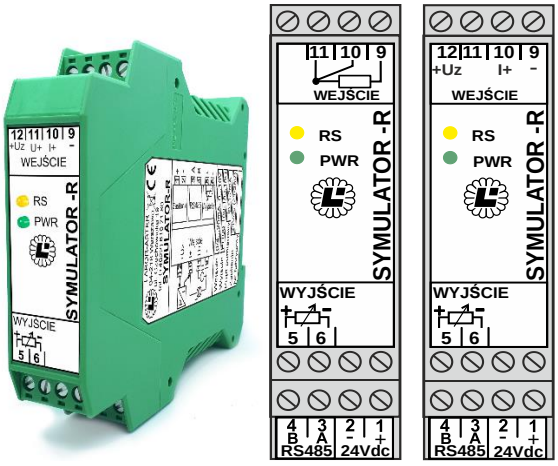
INDUSTRIAL AUTOMATION

Certyfikat nr QS/14/07

AC 083
QMS

RESISTANCE SIMULATOR (for Pt100 too) with separation type SIMULATOR-R

- **Conversion of any analog standard into resistance**
- **Repetition of the input resistance from a RTD sensor for example Pt100**
- **Accuracy class 0.1%**
- **At the input additional power for a two-wire transmitter**
- **Measure reading and setting resistance via the MODBUS RTU protocol**
- **RS485 with galvanic optoisolation**
- **Input, output, power supply and transmission circuits are separated from one another**



APPLICATION:

Attention: The Simulator output must be connected to continuously supply power. It cannot be multiplexed. If it is multiplexed then the fix time of simulated resistance when the current appears is 2 sec.

The basic purpose of the Simulator-R is to repeat the input resistance to the output with galvanic separation. The simulated output resistance can also be controlled by any standard analog signal. Measurement reading and value setting can be done by MODBUS RTU. The reading of the input measurement and setting of the output resistance value can be realized by the MODBUS RTU protocol.

Typically Simulator-R on its output performs resistance linearly to input signal. For version with analog input and output simulating temperature sensor (eg. Pt100) there can be implemented non-linear 10-points characteristic of the sensor so the output is linear to temperature.

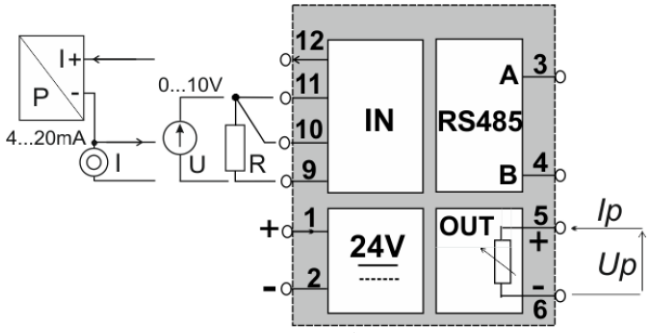
Example for input 0…10V and sensor Ni1000 -60…+200°C:

a) Linear resistance (standard version of Simulator-R)

Input [V]	Resistance [Ω]	Temperature [°C]
0	695 →	-60
5	(2407+695)/2=1551 →	about 90
10	2407 →	200

b) Linear temperature

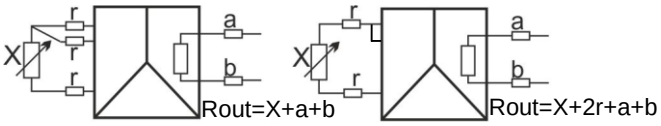
Input [V]	Temperature [°C]	Resistance [Ω]
0	-60 →	695
5	(200+60)/2=70 →	1417
10	200 →	2407



Block diagram, description of Simulator-R terminals

BASIC TECHNICAL PARAMTERES:

Supply voltage	-	24Vdc (21...28Vdc) / 60mA
Input	-	as ordered, for e.g.: 0…20mA, 4…20mA / 50Ω 0…10V / 100kΩ, resistive sensor Pt100 etc.
Auxiliary voltage on input for two-wire transmitter Uz	-	16V at 20mA
Output	-	resistance 30Ω÷30kΩ
Minimum range span for output resistance	-	20 Ω
Output current at output Ip	-	as ordered, for ex. 1mA
Class	-	0.1%
Nonlinearity	-	(12 bits) ±0.025%
Temperature drift	-	±0.005% / °C
Connection of Pt100 sensor	-	three wires line



Communication connector	-	RS485
Transmission protocol	-	MODBUS RTU
Galvanic separation	-	2kV, 50Hz or equivalent between all circuits
Housing	-	22,5 x 99 x 114,5mm
level of security	-	IP20
mounting	-	on rail TS35
Safety requirements	-	**PN-EN 61010-1:2002**
EMC requirements	-	**PN-EN 61000-6-1** **PN-EN 61000-6-3**

HOW TO ORDER :

Simulator-R-(input)-(output)-(max measure current)-(nonlinearity)

- (input): 0-10V, Pt100 0-100°C etc.
- (output): 0-2kΩ, Ni100 0-200°C etc.
- (max measure current): 0.1mA, 1mA etc.
- (nonlinearity): if needed specify 10-point characteristic out(in)

Attention: information about the maximal permissible measuring current is only indicative but it is necessary to complete the order!

Working conditions :

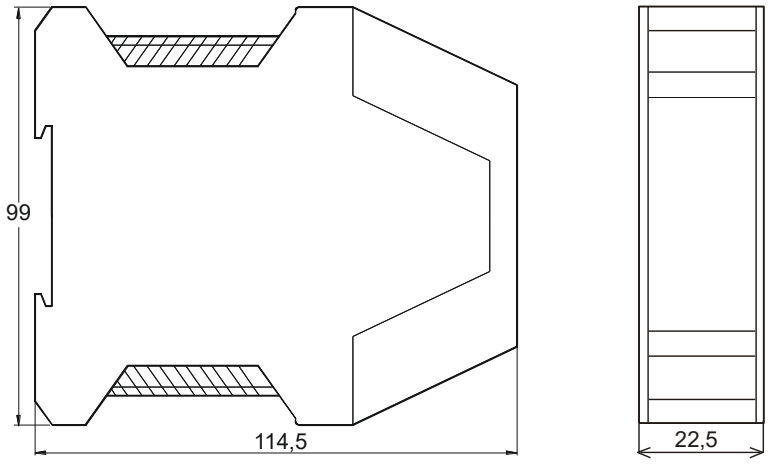
Ambient temperature for safe	-	-30 ÷ +70°C
Ambient temperature for working	-	-30 ÷ +70°C
Relative humidity	-	max 90%
ambient atmosphere	-	dust and corrosive gases free
Working position	-	all

Production and distribution: **LABOR – ASTER**
Poland, 04-218 Warszawa, ul. Czechowicka 19
tel. +48 22 610 71 80, +48 22 610 89 45, fax. +48 22 610 89 48
e-mail: biuro@labor-automatyka.pl labor@labor-automatyka.pl ; **http://** www.labor-automatyka.pl

Version 03/2021

LABOR – ASTER

INDUSTRIAL AUTOMATION



Description of the program

The program has two basic modes of operation that differ in the state of the RES input signal and 3 states for the resistance simulation. The RES signal is always generated when the unit is turned on and flashes with the power LED. After about 10 seconds, the signal turns off if configuration registers aren't read. During RES activity, sending any accepted read frame (READ_HOLD_REG {0x03} or READ_INPUT_REG {0x04}) of the MODBUS RTU protocol to the 127 address and register number greater than or equal to 7 results in a refresh time of 10 seconds. When the RES signal is active, the transmission parameters are fixed at 9600 8 N 1 and the device address 127 (0x7F) irrespective of the programmed registers. In this mode it is possible to program the device and write every MODBUS registers.

Program mode (register 15)

0	Device simulates resistance from analog input according to the analog primary readings and its settings. The read resistance is written to the initial registers 3 and 4 and it can be used by other devices to retransmit the signal through by the MODBUS RTU protocol. In this case, the register 3 represents the value of read resistance with scale correlation (register 2) and the register 4 has steering value in units of 0.01% (0...10000).
1	Device simulates resistance as the signal source is a pair of registers 1 and 2 set from the MODBUS RTU protocol. Device tries to simulate the given resistance. If this is not possible, the resistance closest to that is set. In this case, the limit is only physical capabilities and depends on the correlation of the permissible current and the ability to control voltage of device. Specification of these parameters is included in execution documentation.
2	The signal source is another device and register. The value of reading register is scaled by the scaling function according to the values from the relevant registers. Result is saved on the scale 0…10000 to register 4 and then the resistance measured according to the set parameters. Device measures input signal and is available in corresponding register, but its value is omitted in the calculation process.

Scaling function

When reading scaling, you need to specify the device address, registry number, and scaling data as needed. The device performs a mathematical function that scales to the values realized by the device. The scaling result represents the steering value 0…10000. Incorrect setting of the value causes the result to be cut off to the realizable values.

$$result = offset + register * \begin{cases} scale < 0; 1/(-scale) \\ scale = 0; 1 \\ scale > 0; scale \end{cases}$$

Where:

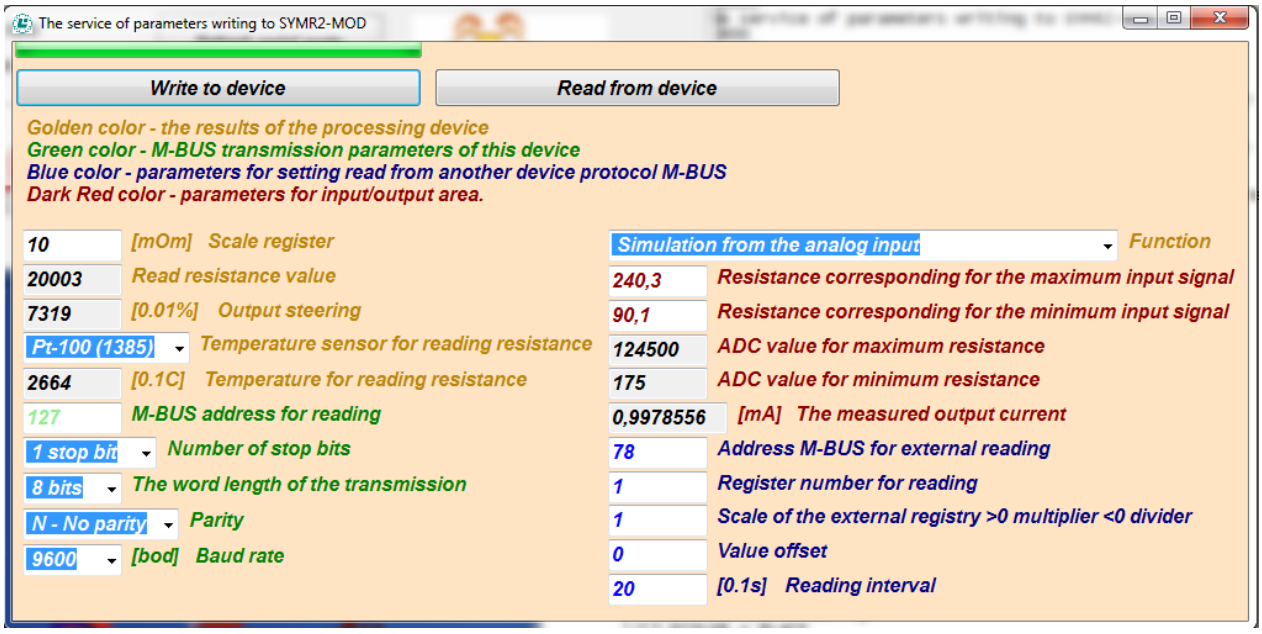
register	Value reading from slave device. 17th register has this number.
scale	Scale is set in 18th register.
offset	Offset for result. Value is read from 19th register.

Map of MODBUS RTU registers

Register	~RES	RES[i]	Describe
1.	RO RW	RW	The value of the simulated resistor. The value multiplied by the scale register will always result in milliohms. Recordable in simulation mode of resistance and SLAVE MODBUS.
2.	RO	RW	Scale register. Specifies the value in milliohms [mΩ] unit in registers 1 and 3.
3.	R0	RW	Read resistance value. The value divided by the previous scale register. The value used for retransmission to the second device and execution control in the resistance simulation mode.
5.	R0	RW	Type of temperature sensor. [ii]
6.	R0	R0	Calculated temperature with approximation according to standards. The temperature given in 0,1ºC eg. 21ºC has value 210.
7.	RW	RW	Device address in Modbus space.
8.	RW	RW	Number of stop bits.
9.	RW	RW	Length of byte. Value 8,9. In RES equal 8.
10.	RW	RW	Parity. 'N' (no control) 'E' (even) 'O' (odd). In RES mode It sets to default 'N'.
11.	RW	RW	The youngest register of baud rate. In RES mode It sets 9600.
12.	RW	RW	The oldest register of baud rate. In RES mode It sets 0.
13.	RO	RO	The youngest register of real baud rate.
14.	RO	RO	The oldest register of real baud rate.
15.	RO	RW	Program mode
16.	RO	RW	Device address in Modbus area (for mode 2).
17.	RO	RW	Number of register to read from another device.
18.	RO	RW	Scale for external register reading. >0 multiplier, <0 divisor
19.	RO	RW	Offset.

Attention: *Device has many other registers written and read at other addresses e.g. factory calibration data. Their recording in RES mode may result in the device being calibrated.*

For the programming of the device requires "labor.inf" driver installed and program "Labor Programmer" - all for download at www.labor-automatyka.pl. The program was written in bilingual Polish-English version. The driver installation guide for Windows XP, Windows 7 and Windows 10 is available on the website. Below the program window in English version.



[i] The power LED flashes when the signal is activated. Always active for 10 seconds. In order to maintain the state, it is necessary to continuously read the parameters from the MODBUS RTU protocol. There is a special function that forces the RES state from the serial interface and is available in the corresponding program.

[ii] It doesn't always occur. Option available upon agreement.