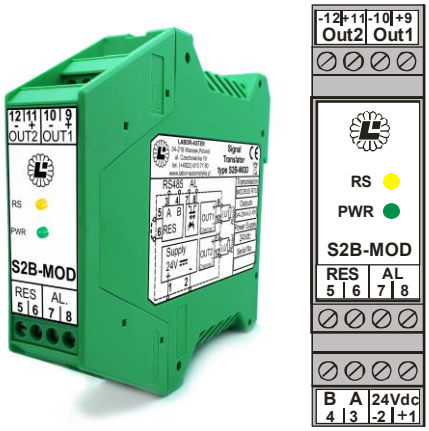
LABOR – ASTER

INDUSTRIAL AUTOMATION

AC 083
QMS

SIGNAL TRANSLATOR TYPE S2B-MOD

- **Translation of digital value RS485/MODBUS RTU to standard analog signal.**
- **2 separated output channels.**
- **Remote reading and retransmission of the signal from LABOR-ASTER devices equipped with MODBUS RTU protocol.**
- **Remote reading, retransmission and scaling of any register from any device with MODBUS RTU protocol.**
- **Remote setting of the value with possibility of converting type current/voltage.**
- **RS485 link with galvanic optoisolation.**
- **Input, output and power supply circuits mutually separated.**
- **Possibility of up to 254 devices into the network.**
- **Full realization of the standard in SLAVE mode.**
- **Loss of transmission alarm.**
- **Registration of channels values in set time interval and possibility of reconstruction last saved value after loss of power supply.**
- **Program *"Labor Programmer"* for easy programming it.**



APPLICATION :

The **S2B-MOD** translator is used in measurement systems basing on **MODBUS RTU** communication network**.**

The translator is used as a "SLAVE" (receives requests sent by "MASTER" device) and as a "MASTER" (transmits reading requests to other "SLAVE" device). User can remotely read any register from a devices equipped with MODBUS RTU protocol, scale it and set output signal. In "SLAVE" mode device fully perform MODBUS RTU protocol including diagnostic counters. From the perspective of the protocol service the device is seen as a set of 16-bit registers and two 1-bit registers. Below is description of analog channel workspace.

Variable	Address	Value
Channel1	0 – registers space	0÷10000 +10%
	0 – relays space	0 – voltage 1 – current
Channel2	1 – registers space	0÷10000 +10%
	1 – relays space	0 – voltage 1 – current

For entering programming mode RES terminals should be shorted.

HOW TO ORDER:

Signal translator **S2B-MOD**

BASIC TECHNIAL PARAMETERS

Voltage supply	-	24Vdc (21...28Vdc) / 120mA
Output signal	-	0…20mA , Rload < 700Ω
(2 separated channels)		0...10V , Rload > 2kΩ
Class	-	0.1%
Nonlinearity	-	(12 bits) ±0.025%
Temperature drift	-	±0.01%/°C
Communication connector	-	RS485
Transmission protocol	-	MODBUS RTU
Transmission speed	-	50 … 115200 bods
Device address	-	1…254
Data bits	-	8,9
Parity	-	N(none),E(parity),O(odd)
Stop bits	-	1,2
Factory settings	-	9600 bods, module address 127,8,N,1
Amount of devices on one RS485 line	-	max 254
Line length	-	max 1200m
Galvanic separation	-	2kV between all circuits
Housing	-	22,5 x 99 x 114,5mm
protection level	-	IP20
mounting	-	on TS35 rail
Ambient temperature	-	0....55°C
Relative humidity	-	do 90%
Safety requirements	-	**PN-EN 61010-1:2002**
EMC requirements	-	**PN-EN 61000-6-1**
	-	**PN-EN 61000-6-3**

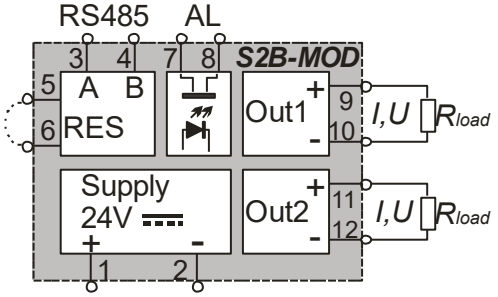


Fig.1 S2B-MOD block diagram and terminals description.

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Program description

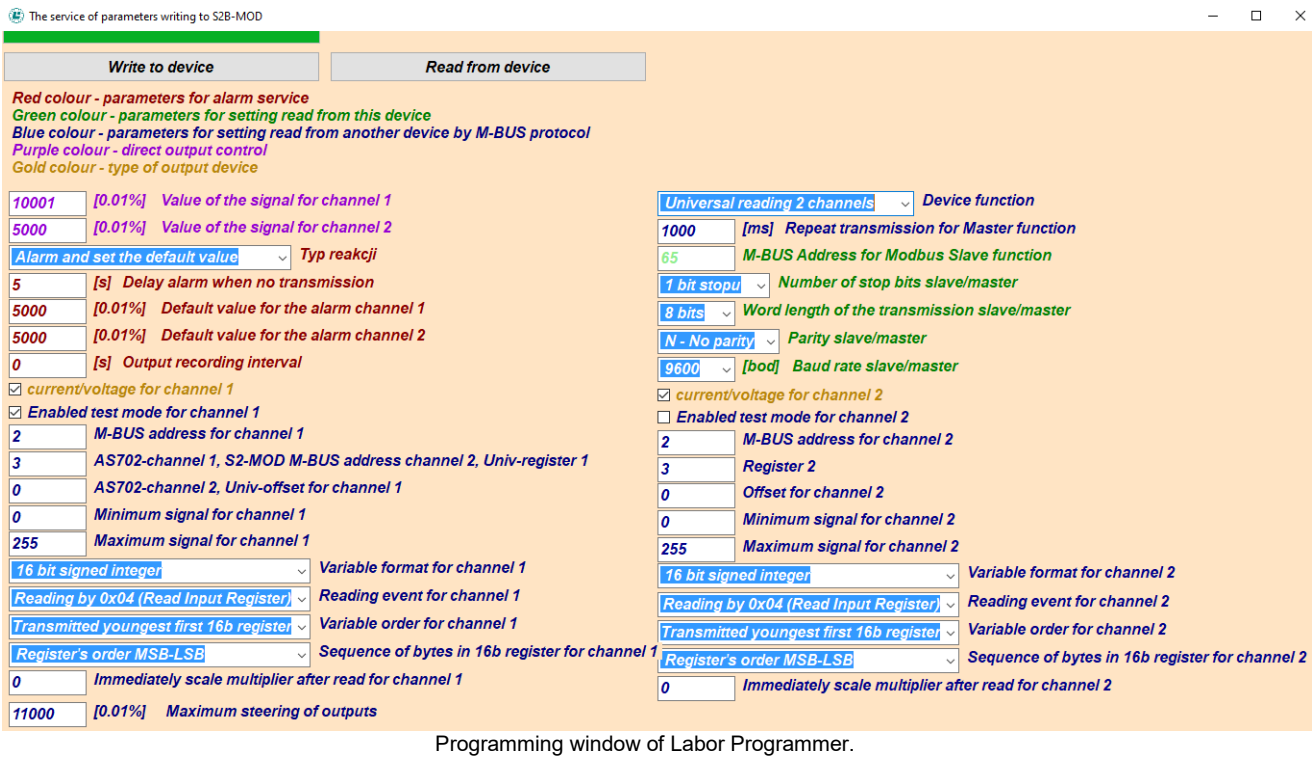
The program has 2 basic operating modes chosen by input signal on RES terminals. After shorting RES terminals the device enters programming mode. During programming mode transmission parameters are constant and as follows: 9600 8 N 1 and device address is 127 (0x7F). In the programming mode user can program all parameters including transmission parameters. After opening RES terminals all parameters are set as programmed. In the programming mode (RES terminals shorted) all registers are allowed to be written. In the normal mode (RES terminals opened) only some registers are allowed to be written. In the case of shorting RES terminals PWR LED starts flashing. For programming the device can be used any program supporting the MODBUS RTU protocol or the program "Labor Programmer" available free for download at www.labor-automatyka.pl.

The device has few modes.

1. Common end device with MODBUS RTU protocol. Registers settings depend on control program.
2. Signal transmitter from device type As702. In this mode the device is “MASTER”. It autonomously reads As702 device and writes its own registers.
3. Transmitter from one or two devices type S2-MOD. In this mode the device is “MASTER” and it reads data from them.
4. Transmitter from any device a variable in multiple formats. Readings are only to one channel. The device initially scales read value, then performs the mathematical scaling function.
5. Transmitter from any device a variable in multiple formats. Readings are to both channels. The device initially scales read value, then performs the mathematical scaling function.

Special parameter registers changes their meaning depending on transmission mode.

Alarm turns on after programmed delay time in case of loss of the communication with control program or remote device. Alarm parameters and its behavior is programmable.



Programming window of Labor Programmer.

Scaling function

In universal reading mode the user must determine device address, register number and data for scaling. The device performs math function of scaling to values allowed for the device meaning range 0-10000. Incorrect setting of value cuts function result to allowed values meaning range 0-11000. The function is presented below.

$$result = pedestal + (10000 - piedestal) \cdot \frac{register - minimum}{maximum - minimum}$$

where:

register	Value read from device.
minimum	Minimal value read from device in its physical values.
maximum	Maximal value read from device in its physical values. Upper limit set in register 35.
pedestal	Offset for the result. Usually it has value of: 0 – for 0…20mA or 0…10V signal 2000 – for conversion to 4…20mA from 0…20mA standard The value will never be lower than 0.75*pedestal. For 4…20mA it is about 3mA.

Example

Task

Read data from temperature transmitter in range -50…100ºC. Values are with multiplier of 10 meaning -500…1000. These physical values are available in MODBUS RTU register under address 65 and register number 2. Achieve standard analog signal 4…20mA on the output of channel 1. The device can be read by other controller once in a while.

Solution

Number	***Value***	***Description***
21	4	Universal reading of one device. Channel 1.
22	1000	Refreshing rate of 1 second. Reading can be incorrect once in a while.
23	65	Device address.
24	2	Register number.
25	2000	Pedestal.
26	-500	Minimal signal value. Represented in ”unsigned int” is 0xFE0C hex or 65036 decimal (65536 – 500).
27	1000	Maximal signal value.

Set output type by putting true value (1) to coil space under address 1. It will change output standard to current.

MODBUS RTU register map

The device has many other registers. For example it has calibration and test data. Modification of the data calibration by the customer will result in malfunction of the device and loss of the warranty claims in this respect. Each device is individually calibrated in the production process and the results are archived.

16-bit registers

Number	~RES	RES[1]	Description of the behavior
1.	RW	RW	Signal value for channel 1. Value from range 0-10000. Maximal value is 11000.
2.	RW	RW	Signal value for channel 2. Value from range 0-10000. Maximal value is 11000.
3.	RO	RO	Reserved[2].
4.	RO	RO	Reserved.
5.	RO	RO	Operating frequency of analog converters.
6.	RO	RW	Reaction on alarm situation[3]: 0 – do nothing, 1 – indication and zeroing of the output signal, 2 – indication and setting the output signal on the last saved value, 3 – indication and setting the output signal on default value. No further registration.
7.	RO	RW	Delay time in seconds before alarm indication when no refreshing of the output value. If equal to 0 then alarm is off.
8.	RO	RW	Default value for channel 1.
9.	RO	RW	Default value for channel 2[4].
10.	RO	RO	Reserved.
11.	RO	RO	Reserved.
12.	RO	RW	Registration time of channels, in seconds. If equal to 0 then no registration. After reset outputs will have last registered value or 0.
13.	RW	RW	Address on the bus. While in RES mode it is 127 (0x7F).
14.	RW	RW	Stop bits number. Values 1 or 2. While in RES mode it is 1.
15.	RW	RW	Byte size. Values 8 or 9. While in RES mode it is 8.[5]
16.	RW	RW	Parity. Allowed: ‘N’ (none) ‘E’ (parity) ‘O’ (odd). While in RES mode it is ‘N’.[5]
17.	RW	RW	Older word of transmission speed (any range 50…115200)
18.			Younger word of transmission speed. While in RES mod it is 9600.

[1] The PWR LED flashes when you activate the signal. This is a special mode for programming the device.
[2] All registers with reserved address are designed for further application design. Their reading does not cause an error. Reading value is always zero.
[3] Alarms are supported in “MASTER” as well as in “SLAVE” mode. In case of “MASER” alarm occurs when lack of response. When in “SLAVE” mode alarm occurs when value is not refreshed. In case of “SLAVE” only channel 1 is tested.
[4] Value is set in case of not using channel 2 in “MASTER” mode.
[5] 9 data bits only with none parity (N). With parity settings (E or O) select byte size 9 to get transmission with 8 data bits and parity bit.

19.	RO	RO	Older word of real transmission speed[6].
20.			Younger word of real transmission speed.
21.	RO	RW	Device function: 0 – Modbus slave. 1 – Retransmission from LABOR-ASTER device type AS702 2 – Retransmission from LABOR-ASTER device type S2MOD. 3 – Retransmission from LABOR-ASTER device type S2MOD. Operation with two S2MODs 4 – Universal reading from single device. Channel 1. 5 – Universal reading from two devices. Channel 1 and 2.
22.	RO	RW	For other than Modbus “SLAVE” mode it is transmission refreshing period, in milliseconds. Allowed values are more than 200 or equal to zero. In case of zero, reading is without any transmission breaks. It is not recommended due to impossibility of reading by other devices.
23.	RO	RW	0 1 As702 reading address. 2 S2MOD device address. Reading to channel 1. 3 S2MOD device address. Reading to channel 1. 4 Address for channel 1. 5 Address for channel 1.
24.	RO	RW	0 1 Choosing output (1-8) of As702 device to channel 1 2 3 S2MOD device address. Reading to channel 2. 4 Register number in read device. 5 Register number in read device for channel 1.
25.	RO	RW	0 1 Choosing output (1-8) of As702 device to channel 2 2 3 4 Result pedestal[7]. 5 Result pedestal for channel 1.
26.	RO	RW	4 Minimum[8] 5 Minimum for channel 1.
27.	RO	RW	4 Maximum[9] 5 Maximum for channel 1.
28.	RO	RW	4 5 Address for channel 2.
29.	RO	RW	4 5 Register number in read device for channel 2.
30.	RO	RW	4 5 Pedestal for channel 2.
31.	RO	RW	4 5 Minimum for channel 2.

[6] It is transmission speed calculated by microcontroller relative to its reference frequency. Each transmission speed setting is always burdened with discretization error. Its allowed value for one bod while serial transmission equals to 2,5%. The device allows setting any transmission sped from range 50-115200 bods to within discretization error. The device guarantees correctness of transmission speed setting for typical values: 50 110 150 300 600 1200 2400 4800 9600 14400 19200 38400 57600 115200 bods. Other values can be performed with different error.

[7] This value is added to the result.

[8] This is the minimum value of read register for which signal value is equal to: 0.

[9] This is the maximal value of read register for which signal value is equal to: 10000-pedestal.

32.	RO	RW	4 5 Maximum for channel 2.
33.	RO	RO	Reserved.
34.	RO	RO	Reserved.
35.	RO	RO	Upper output value. Max is 11050. The device will not go above this value (it is hardware limitation which does not affect scaling equation. Same for both channels.
36.	RO	RO	***Variable format for channel 1, bits b0-b4.*** **0** 16 bit signed integer value **1** 16 bit unsigned integer value **2** 32 bit signed integer value **3** 326 bit unsigned integer value **4** 64 bit signed integer value **5** 64 bit unsigned integer value **6** The single precision variable (float in C) transmitted in binary form by IEEE 764 standard **7** The double precision variable (double in C) transmitted in binary form by IEEE 754 standard ***Read request for channel 1, bit b5.*** **0** Reading through command 0x03 – Read Holding Register. **1** Reading through command 0x04 – Read Input Register. ***Order of variable transmission for channel, bit b6.*** 0 Transmitted first youngest register 16 bits. 1 Transmitted first oldest register 16 bits. ***Order of bytes transmission for register, bit b7.*** 0 MSB LSB. 1 LSB MSB ***Test bit b15***[10]***.*** 1 The transmitted frame is a test mode which reflects the work and performance of the converter in text mode. The frame has an address of 127 and it appears immediately after the reading of the value from another device.
37.	RO	RO	The scale multiplier after reading. Integer 16 bit and defines the exponent of 10 ^ this value. If it is not zero then the read value is pre-scaled.
38.	RO	RO	Variable format for channel 2.
39.	RO	RO	The scale multiplier for channel 2.

Relay space map

Number	~RES	RES	Description of the behavior	
1.	RO	RW RO	0	Voltage is on in channel 1. Calibration blocks writing.
			1	Current is on in channel 1. Calibration blocks writing.
2.	RO	RW RO	0	Voltage is on in channel 2. Calibration blocks writing.
			1	Current is on in channel 2. Calibration blocks writing.

RO Read only register.

RW Read and write register.

[10] If this bit is set, then if data is read the test text frame is sent to the test address of the 127 with the following format: cFormat = <code formats HEX> scale = <scale> 1 Read * scale = <read value> Buffer: <bytes read in hex>