

# RS485 MODBUS Module 6TE

Expansion Module – 6 temperature inputs

Version 1.4 — 12/02/2013

User Manual



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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 judgment 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

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- 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

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### 2.1. Purpose and description of the module

The 6TE module allows you to measure the temperature with attached popular sensor Pt100, Pt500, Pt1000, Ni100, KTY81-110, NTC (Carel) and thermocouple (type J, K, T, N, S, R, B). In addition, it is possible to measure voltages in the range 256mV (10 $\mu$ V resolution) and to 2048mV (100 $\mu$ V resolution) as well as the measurement of resistance to 8k $\Omega$ .

The device has a set of six inputs for the temperature measurement. It is possible to 2- or 3-wire measurement of sensors Pt100, Ni100, Pt500, Pt1000 and 2-wire measurement thermocouples and other sensors. In addition, the module is equipped with 2 configurable digital outputs (alarms).

Values are read via RS485 (Modbus), so we can easily integrate the module with popular PLCs, HMI or PC equipped with the appropriate adapter.

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.

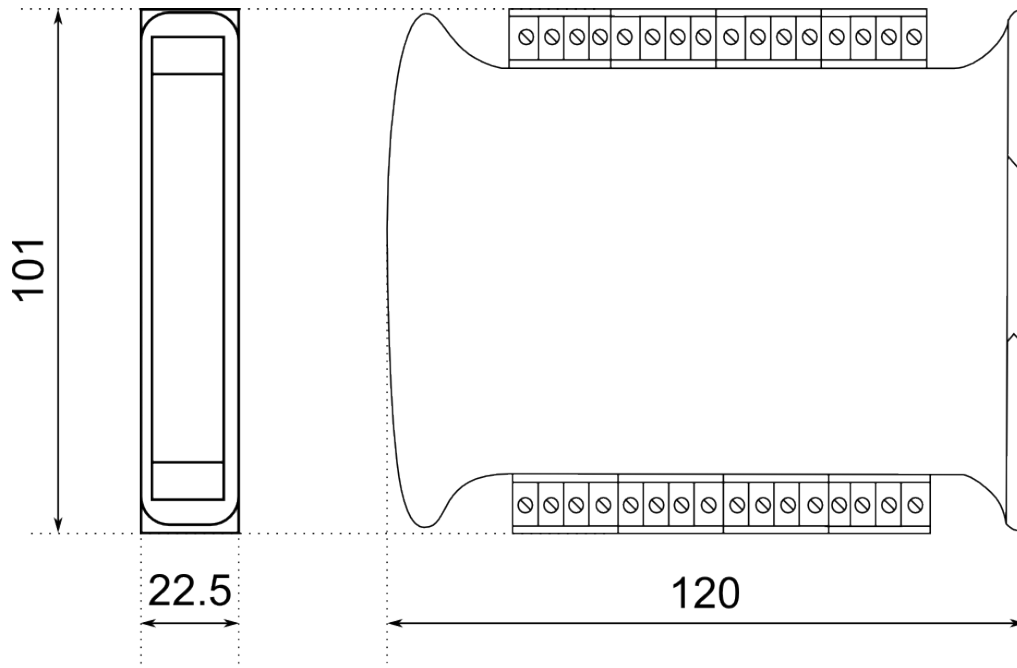
Module configuration is done via USB by using a dedicated computer program. You can also change the parameters using the MODBUS protocol.

## 2.2. Technical Specifications

<b>Power Supply</b>	Voltage	12-24 V DC $\pm$ 20%
	Maximum Current	120 mA @ 12V / 100 mA @ 24V
<b>Inputs</b>	No of inputs	6
	Pt100 operation range	-200°C - +850°C
	Pt500 operation range	-200°C - +850°C
	Pt1000 operation range	-200°C - +850°C
	Ni100 operation range	-60°C - +180°C
	KTY81-110 operation range	-55°C - +150°C
	J thermocouple operation range	-200°C - +1200°C
	K thermocouple operation range	-200°C - +1300°C
	T thermocouple operation range	-200°C - +400°C
	N thermocouple operation range	-200°C - +1300°C
	S thermocouple operation range	-0°C - +1700°C
	R thermocouple operation range	-0°C - +1700°C
	B thermocouple operation range	-0°C - +1800°C
	Resistance	From 0 to 8000 $\Omega$ (1 $\Omega$ resolution)
	Voltage	0 to 2048mV (0,1mV resolution) 0 to 256mV (0,01mV resolution)
	Measuring current	~250 $\mu$ A
	Measurement resolution	0,1°C
	Measurement error	$\pm$ 0,5°C
Cold junction temperature measurement	-55°C - +100°C	
Measurement error of the cold junction temperature	$\pm$ 1°C	
ADC processing time	150ms / channel	
<b>Digital outputs</b>	Maximum current and voltage	500mA / 55V
<b>Temperature</b>	Work	-20 °C - +65°C
	Storage	-40 °C - +85°C
<b>Connectors</b>	Power Supply	2 pin
	Communication	3 pin
	Inputs and outputs	2 x 10 pin
	Quick connector	IDC10
	Configuration	Mini USB
<b>Size</b>	Height	120 mm
	Length	101 mm
	Width	22,5 mm
<b>Interface</b>	RS485	Up to 128 devices

### 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. Power connectors, communication and IOs are at the bottom and top of the module. USB connector configuration and indicators located on the front of the module.



### 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  $\Omega$ .

#### 3.3. Setting Module Address in RS485 Modbus Network

The following table shows how to set switch to determine the address of the module. The module address is set with the switches in the range of 0 to 31. Addresses From 32 to 255 can be set via RS485 or USB.

Addr	SW5	SW4	SW3	SW2	SW1	Addr	SW5	SW4	SW3	SW2	SW1	Addr	SW5	SW4	SW3	SW2	SW1
0	OFF	OFF	OFF	OFF	OFF	11	OFF	ON	OFF	ON	ON	22	ON	OFF	ON	ON	OFF
1	OFF	OFF	OFF	OFF	ON	12	OFF	ON	ON	OFF	OFF	23	ON	OFF	ON	ON	ON
2	OFF	OFF	OFF	ON	OFF	13	OFF	ON	ON	OFF	ON	24	ON	ON	OFF	OFF	OFF
3	OFF	OFF	OFF	ON	ON	14	OFF	ON	ON	ON	OFF	25	ON	ON	OFF	OFF	ON
4	OFF	OFF	ON	OFF	OFF	15	OFF	ON	ON	ON	ON	26	ON	ON	OFF	ON	OFF
5	OFF	OFF	ON	OFF	ON	16	ON	OFF	OFF	OFF	OFF	27	ON	ON	OFF	ON	ON
6	OFF	OFF	ON	ON	OFF	17	ON	OFF	OFF	OFF	ON	28	ON	ON	ON	OFF	OFF
7	OFF	OFF	ON	ON	ON	18	ON	OFF	OFF	ON	OFF	29	ON	ON	ON	OFF	ON
8	OFF	ON	OFF	OFF	OFF	19	ON	OFF	OFF	ON	ON	30	ON	ON	ON	ON	OFF
9	OFF	ON	OFF	OFF	ON	20	ON	OFF	ON	OFF	OFF	31	ON	ON	ON	ON	ON
10	OFF	ON	OFF	ON	OFF	21	ON	OFF	ON	OFF	ON						

### 3.4. 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

### 3.5. Communication settings

The data stored in the modules memory are in 16-bit registers. Access to registers is via MODBUS RTU or MODBUS ASCII.

#### 3.5.1. Default settings

You can restore the default configuration by the switch SW6 ( see 3.5.2 - Restore the default configuration)

Baud rate	19200
Parity	No
Data bits	8
Stop bits	1
Reply Delay [ms]	0
Modbus Type	RTU

#### 3.5.2. Restore the default configuration

To restore the default configuration:

- turn off the power
- turn on the switch SW6
- turn on the power
- when power and communication LED flash turn off the switch SW6

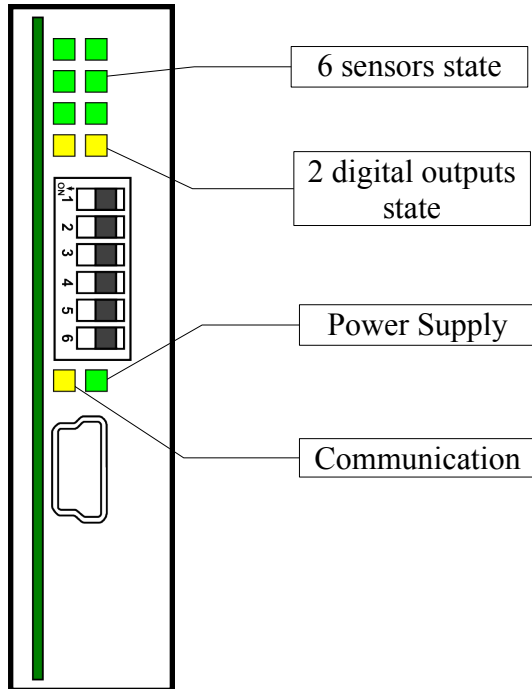
**Caution!** After restoring the default configuration all values stored in the registers will be cleared as well.

### 3.5.3. Configuration registers

Modbus	Dec	Hex	Name	Values
Address				
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

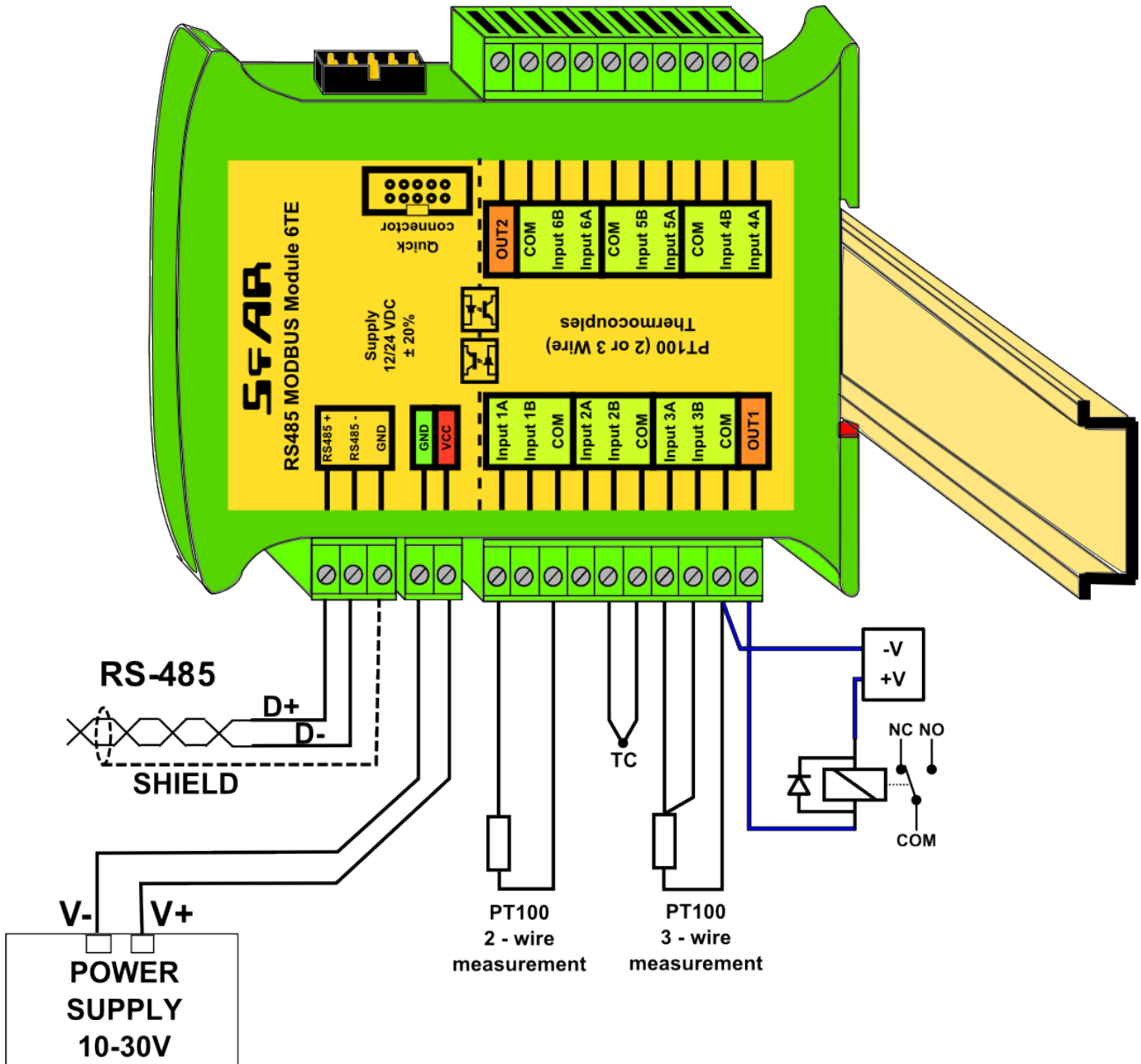


#### 4. Indicators

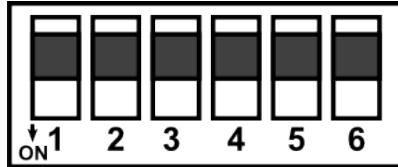


Indicator	Description
Power supply	LED indicates that the module is correctly powered.
Communication	The LED lights up when the unit received the correct packet and sends the answer.
Inputs state	LED indicates that the sensor is connected.
Outputs state	LED indicates that the output is on.

5. Module Connection



## 6. Switches



Switch	Function	Description
1	Module address +1	Setting module address from 0 to 31
2	Module address +2	
3	Module address +4	
4	Module address +8	
5	Module address +16	
6	Restoring default settings	Restoring default settings (see 3.5.1 - Default settings and 3.5.2 - Restore the default configuration).

## 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	Switches	Read	Switches state
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 3.5.3)
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)
40033	32	0x20	Received packets MSB	Read & Write	No of received packets
40034	33	0x21	Received packets LSB	Read & Write	
40035	34	0x22	Incorrect packets MSB	Read & Write	No of received packets with error
40036	35	0x23	Incorrect packets LSB	Read & Write	
40037	36	0x24	Sent packets MSB	Read & Write	No of sent packets
40038	37	0x25	Sent packets LSB	Read & Write	
30051	50	0x32	Inputs	Read	Connected sensors Bit in high state → sensor is connected
40052	51	0x33	Outputs	Read & Write	Alarms state bit 6 and 7 alarm outputs
30053	52	0x34	Temperature 1	Read	Temperature or measured analog  in mV·10 for voltage to 2048mV in mV·100 for voltage to 256mV in °C·10 for temperature in Ω for resistance
30054	53	0x35	Temperature 2	Read	
30055	54	0x36	Temperature 3	Read	
30056	55	0x37	Temperature 4	Read	
30057	56	0x38	Temperature 5	Read	
30058	57	0x39	Temperature 6	Read	
30059	58	0x3A	Alarm temperature 1	Read	Alarm temperature for alarm output 1
30060	59	0x3B	Alarm temperature 2	Read	Alarm temperature for alarm output 2
30061	60	0x3C	Junction temperature	Read	Module junction temperature
30062	61	0x3D	Measurement current	Read	Measurement current
40063	62	0x3E	MAX alarm level 1	Read & Write	If the temperature exceeds this value the corresponding alarm flag is set
40064	63	0x3F	MAX alarm level 2	Read & Write	
40065	64	0x40	MAX alarm level 3	Read & Write	
40066	65	0x41	MAX alarm level 4	Read & Write	
40067	66	0x42	MAX alarm level 5	Read & Write	
40068	67	0x43	MAX alarm level 6	Read & Write	
40069	68	0x44	MIN alarm level 1	Read & Write	If the temperature is below this value corresponding alarm flag is set
40070	69	0x45	MIN alarm level 2	Read & Write	

40071	70	0x46	MIN alarm level 3	Read & Write	<p>Alarm settings</p> <p>0 – alarm due to the current temperature 1 – Remember the value of the alarm, until reset by the master via Modbus</p>
40072	71	0x47	MIN alarm level 4	Read & Write	
40073	72	0x48	MIN alarm level 5	Read & Write	
40074	73	0x49	MIN alarm level 6	Read & Write	
40075	74	0x4A	Alarm settings 1	Read & Write	
40076	75	0x4B	Alarm settings 2	Read & Write	
40077	76	0x4C	Alarm settings 3	Read & Write	<p>Value of junction temperature</p>
40078	77	0x4D	Alarm settings 4	Read & Write	
40079	78	0x4E	Alarm settings 5	Read & Write	
40080	79	0x4F	Alarm settings 6	Read & Write	
40081	80	0x50	Constant junction temperature	Read & Write	
40082	81	0x51	Junction temperature offset	Read & Write	
40083	82	0x52	Input 1 settings	Read & Write	<p>Analog input mode:</p> <p>0 – input disabled 1 – voltage to 2048mV 2 – voltage to 256mV 3 – J thermocouple 4 – K thermocouple 5 – T thermocouple 6 – N thermocouple 7 – S thermocouple 8 – R thermocouple 9 – B thermocouple 10 – Pt100 3-wire 11 – Pt100 2-wire 12 – resistance to 8kΩ 13 - Ni100 14 – KTY81-110 15 – Pt500 3-wire 16 – Pt500 2-wire 17 – Pt1000 3-wire 18 – Pt1000 2-wire 19 – NTC Carel 2-wire<sup>1</sup></p> <p>+32 – junction temperature is taken from register 40081 "Constant junction temperature"</p>
40084	83	0x53	Input 2 settings	Read & Write	
40085	84	0x54	Input 3 settings	Read & Write	
40086	85	0x55	Input 4 settings	Read & Write	
40087	86	0x56	Input 5 settings	Read & Write	
40088	87	0x57	Input 6 settings	Read & Write	
40089	88	0x58	Output 1 settings	Read & Write	<p>Alarm output settings</p> <p>0 – output is set by PLC +1 – temperature from input 1 +2 – temperature from input 2 +4 – temperature from input 3 +8 – temperature from input 4 +16 – temperature from input 5 +32 – temperature from input 6</p>

<sup>1</sup> Sensor must be connected in parallel to resistor 7.5kΩ 1%

40090	89	0x59	Output 2 settings	Read & Write	+256 – Output is set if value is greater than Alarm Value (register 40091 or 40092) („cooling”) +512 – Output is set if value is less than Alarm Value ( register 40091 or 40092) („heating”)  +1024 – The lowest value from selected inputs +2048 – The greatest value from selected inputs (if not select either of the two above options than is used average value of selected inputs)
40091	90	0x5A	Alarm Value 1	Read & Write	Alarm value for outputs
40092	91	0x5B	Alarm Value 2	Read & Write	
40093	92	0x5C	Alarm hysteresis 1	Read & Write	The hysteresis value for alarm outputs
40094	93	0x5D	Alarm hysteresis 2	Read & Write	
40095	94	0x5E	Input resistance 1	Read & Write	Lead wire resistance for each input
40096	95	0x5F	Input resistance 2	Read & Write	
40097	96	0x60	Input resistance 3	Read & Write	
40098	97	0x61	Input resistance 4	Read & Write	
40099	98	0x62	Input resistance 5	Read & Write	
40100	99	0x63	Input resistance 6	Read & Write	

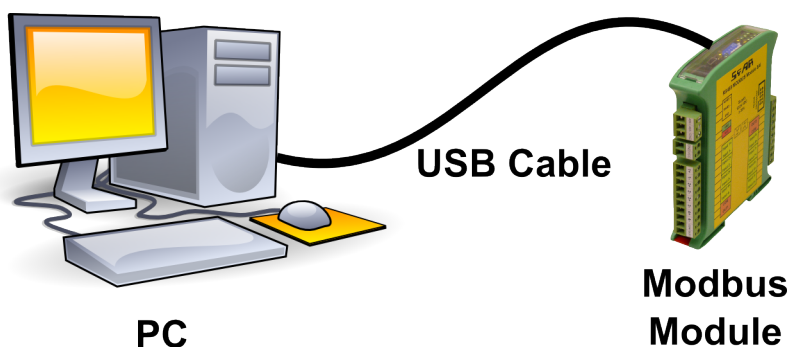
## 7.2. Bit access

Modbus Address	Dec Address	Hex Address	Register name	Access	Description
801	800	0x320	Input 1	Read	Set when the sensor is connected
802	801	0x321	Input 2	Read	Set when the sensor is connected
803	802	0x322	Input 3	Read	Set when the sensor is connected
804	803	0x323	Input 4	Read	Set when the sensor is connected
805	804	0x324	Input 5	Read	Set when the sensor is connected
806	805	0x325	Input 6	Read	Set when the sensor is connected
817	816	0x330	Alarm 1	Read	Alarm state 1
818	817	0x331	Alarm 2	Read	Alarm state 2
819	818	0x332	Alarm 3	Read	Alarm state 3
820	819	0x333	Alarm 4	Read	Alarm state 4
821	820	0x334	Alarm 5	Read	Alarm state 5
822	821	0x335	Alarm 6	Read	Alarm state 6
823	822	0x336	Digital output 1	Read & Write	State of digital output 1
824	823	0x337	Digital output 2	Read & Write	State of digital output 2

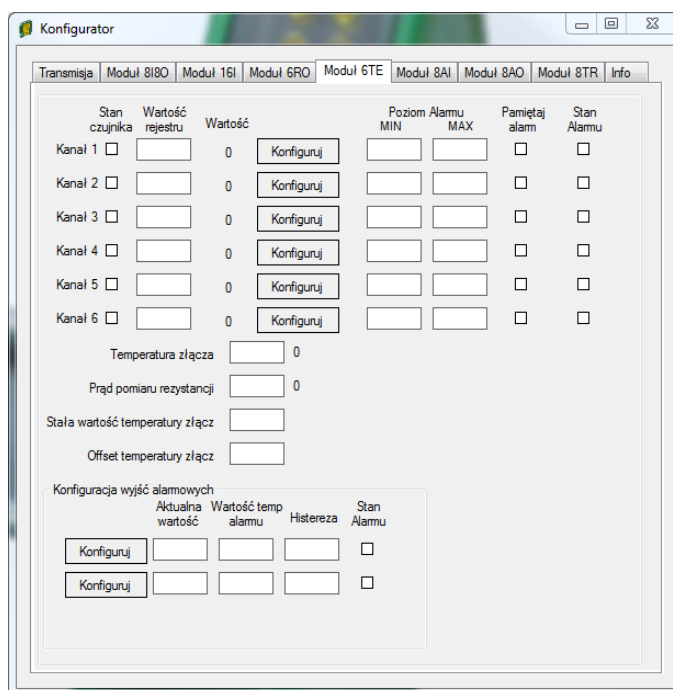
## 8. Configuration software

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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