Temperature sensors with Modbus RTU communication

- Modbus RTU communication over RS485 line
- Wide range of power supply
- Hight accuracy

Description

The temperature sensors are intended for general-purpose application in control and regulation systems for the temperature measurement in airflows, in outside, in the pipeline. The head of sensor is made of the plastic material, cover is provided with quick-locking screws, the stem is made of stainless steel (DIN1.4301). By standard, the sensors are supplied in pass-through design with two glands. Only sensors ordered as end pieces (type P12M/K) are equipped with a single gland.

Basic technical parameters

Power supply	12 to 30 VDC
Measuring range	-50 to 200°C
P14M	-50 to 120°C
P10M, P11M	-30 to 50 °C
P18M (cable sensor Pt1000)	-50 to 200°C (order by 400°C)
Ambient temperature	-30 to 50 °C
Relative humidity	< 80 %
Accuracy	± 0,5 °C
Settling time (P10M)	30 minutes
Communication	RS485, protocol Modbus RTU
Communication speed	1200 ÷ 19200 Bd
Protection type P10M	IP65 IP30
Terminal board	COB (wire max. 1,5 mm^2)
Terminal board type (P18M)	CPP(wire max. 0,75 mm²)
Cable gland	PG9 / 8 mm

Summary

Interior	**P10M**
Outdoor Air	**P11M**
Duct probe	**P12M-L1**
Well insertion probe	**P13M-L2**
Strap-mount	**P14M**
Quick-action	**P16M-L3**
Cable type	**P18M**

Arrangement of jumpers and connectors (Fig.1)
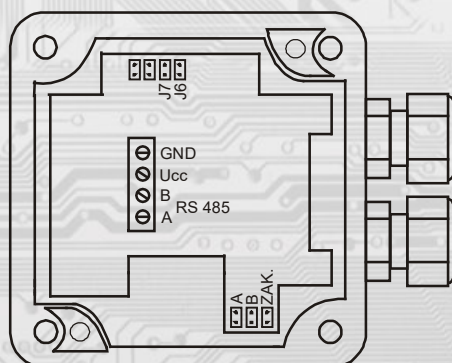
A…definition of idle status (conductor A)
B…definition of idle status (conductor B)
ZAK…termination resistor 120R
J6…jumper "service" - enabling writing the configuration value
J7...jumper "service" (setting a fixed address 255 and setup communication speed of 19200 baud)

Standard length L1 and L2

L1 (mm)	L2 (mm)	L3 (mm)
120	100	100
180	160	160
240	220	
300	280	
360	340	

Max. operation temperature

P10,P11,P16	80°C
P14	120°C
P12	200°C
P13	200°C

V/9.10

Properties of the communication protocol
Protocol Modbus RTU with adjustable Baud rate 1200 - 57600 Bd, 8 bits, no parity, 1 stop bit, line RS485, half-duplex operation

Description of data registers:
To read these registers use command no. 03 "register reading" (0x03 Read Holding Registers).

Temperature measurement:
- is conducted over a resistive sensor Pt1000. The sensor is built into the stem and connected to the circuit board by means of a loose lead and connectors. The measured temperature is evaluated electronically and the values are transmitted to the control system in as a 16 - bit signed integer multiplied by a constant 10:
Register 0 x0005 ** (measurement temperature): 0xFE0C; 65036dek (-50°C) 0x07D0; 2000dek (200°C)
In case of fault of the analogue input (short circuit or interruption of the temperature probe), the sensors transmits the value 0x7FFF = 32767dek.

Description of conguration registers:
EXTENDED REGISTERS can only be modified if the J6 jumper (enabling writing the configuration values) and J7 jumper (setting the fixed sensor address to 255 and setting the baudrate to 19 200 Bd - these network variables are reserved for configuration only and, therefore, if the required sensor address of 255 is set, the sensor modifies to 254 automatically) are inserted. In case only the J7 jumper is inserted, it is possible to use a fixed address and baudrate without the risk of overwriting the configuration parameters. The configuration is carried out by **command 16** (multiple register preset 0x10). The changes are written and configuration is finished by extracting the J6 and J7 jumpers. No reset is necessary for proper function.
X Reg = 8 byte, ie 4 registers MODBUS

	address range X Reg **	
X Reg	[hex]	[dek]
X Reg 0	0x2001 ÷ 0x2004	8193 ÷ 8196
X Reg 1	0x2005 ÷ 0x2008	8197 ÷ 8200
X Reg 2	0x2009 ÷ 0x200C	8201 ÷ 8204

	content X Reg						
X Reg	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
X Reg 0	-	-	ZD_TEXT/0	ZD_TEXT/1	ZD_TEXT/2	ZD_TEXT/3	ZD_TEXT/4	ZD_TEXT/5
X Reg 1	ZD_TEXT/6	ZD_TEXT/7	ZD_TEXT/8	ZD_TEXT/9	-	ZD_INT	ZD_OFF/Hi	ZD_OFF/Lo
X Reg 2	-	-	SK_ADR	SK_SPD	-	-	-	-

ZD_TEXT The custom text field, range is 10 bytes. It is determined for the client´s identification of the device.

ZD_INT Type of temperature sensor, The range is 1 byte. Takes the value 0 to 255. The number format is 16-bit unsigned integer

value ZD_INT [hex]	0x00	0x01	0x02 až 0xFF
value ZD_INT [dek]	0	1	2 to 255
sensor type	Ni 1000/5000ppm	Ni 1000/6180ppm	Pt 1000/3850ppm

ZD_OFF Correction of temperature. Range is 2 bytes, form of number with sign (signed integer) multiplied by the constant 10. 0x0001 = 0,1°C, 0xFFFF = -0,1°C.
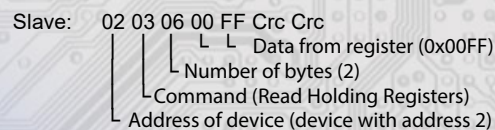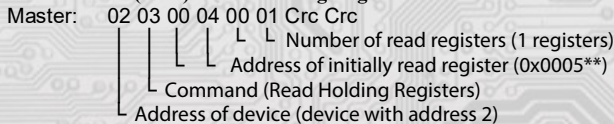
SK_ADR Network address. Range is 1 byte. It acquires the values 0 ÷ 255 dek, whereas the address 0 is reserved for the broadcast and the sensor does not respond to it, the address 255 is reserved for the controller configuration. Thus the range of available addresses is 1 ÷ 254. The number format is unsigned integer.

SK_SPD Baud rate. range is 1 byte, It acquires the values 0 ÷ 4. The number format is unsigned integer.

value SK_SPD [hex]	0x00	0x01	0x02	0x03	0x04
value SK_SPD [dek]	0	1	2	3	4
speed [Bd]	1200	2400	4800	9600	19200

Examples of communication:

Command 03 (0x03): Read Holding Registers:
Master: 02 03 00 04 00 01 Crc Crc
                    │ │   │   └ └ Number of read registers (1 registers)
                    │ │   └ Address of initially read register (0x0005**)
                    │ └ Command (Read Holding Registers)
                    └ Address of device (device with address 2)

Slave: 02 03 06 00 FF Crc Crc
                    │ │ └ └ Data from register (0x00FF)
                    │ └ Number of bytes (2)
                    └ Command (Read Holding Registers)
   └ Address of device (device with address 2)

The address of initial register is 0x0005** which is the address of measured temperature register. Thus: the measured temperature 0x00FF = 25,5° C.
** During the transfer the addresses of registers are indexed from zero, i.e. register 0x0001 is physically sent through the bus bar as 0x0000... (zero based addressing).

Assembly and connection:

The wires are connected to a terminal strip (Fig. 1), which can be accessed by removing the screws and head cap. The signal terminals A and B on the sensors are connected to the serial line as per the rules for connection of devices in RS485 serial lines (Fig. 2). The use of A, B, ZAK. jumpers is subject to general rules for communication through RS485 lines (note: at end points of the RS485 line, it is necessary to connect a terminating resistor through the ZAK. jumper). The sensors are supplied from a single 12 to 30 DC power supply, while the supply voltage is connected to the terminals marked by + and – (Fig. 2). It is recommended to interconnect the devices using a multi-core shielded cable, which hosts data as well as power supply wires. The cable shield must be interconnected between individual segments of the line and only connected to the lowest potential (PE terminal) in the switchboard. When you are done, install the cap by mounting all the four screws.

Example of wiring the sensors in the system
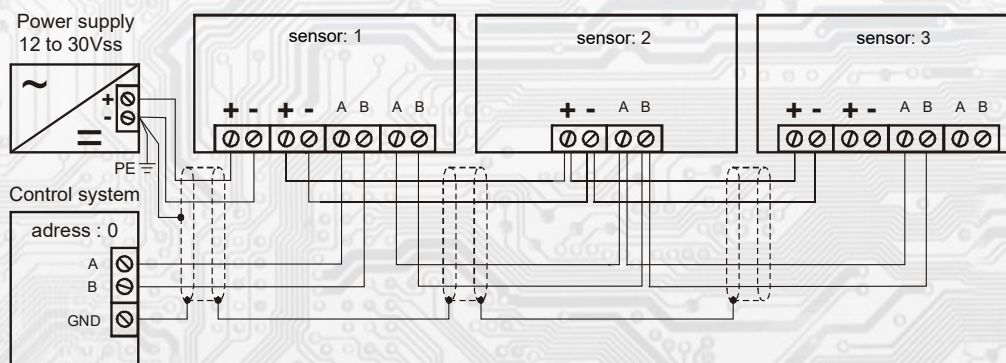
Technical description, execution

P10M	sensors for temperature measuring in interior applications.
P11M	sensors are designed for temperature measuring of outdoor air. They are provided with a plastics console for attaching to a wall; the actual sensing element is positioned in a stainless steel stem of 25mm length; the terminal board for connecting is positioned in a plastics head.
P12M-L1	sensor execution for mounting into air conditioning ducts. With the exception of the console, the execution is identical with P11x; L1 denotes the shank length specified in millimeters, for example P12I-120 is a conventional sensor with stem length of 120 mm.
P13M-L2	the sensors are designed for measuring operations in pipelines. As an accessory a part of the sensor is a stainless steel well fitted with a thread G 1/2: of length L2 mm, which was tested for pressure of 4,0 MPa.
P14M	strap-mount sensors
P16M-L3	quick-response type of sensors: stem length L3 = 100 or 160 mm.
P18M	transducers with the cable sensor (length 2m)

By standard, the sensors are supplied in pass-through design with two glands. Only sensors ordered as end pieces (eg. type P12M/K) are equipped with a single gland. The markings behind the slash are K (eg P12M/K).

Method of ordering

State the quantity of pieces and the sensor type in the order .
An example of an order:

> 5 pieces sensor   P13M-100 0/150

Sensor type
Thermowell length
Temperature range

Dimensions and accessories

P12M/K

74

39

L1

Ø6

P16M/K

66

39

13   G 1/2″

L3

Ø4

Thermowell

OK 22

13   G 1/2"

L2

Ø10

Central holder A - for P12x

55

3 holes of 4,5 mm diameter

P16M

66

39

13   G 1/2″

L3

Ø4

P14M/K

74

39

min Ø 15 mm
max Ø 100 mm

Maximum temperature of the surface measured
tp < 120°C

Side holder A - for P11x

39

2 holes of 4,5 mm diameter

Wall Mount- P10x

64

34