

SENSOR-TRANSMITTER
FOR RELATIVE HUMIDITY
AND AIR TEMPERATURE
WITH MODBUS RTU COMMUNICATION



MS9045/MS9055





SERVICE MANUAL

PLOVDIV 2020

Replaces Edition 2018-02-22

TYPE OF HOUSING		
	MS9045 wall mounting	
	for operating temperatures from -10°C to +85°C	
	MS9054 with remote transmitter and threaded connection	
	for operating temperatures	
	from -40°C to +125°C	from -40°C to +140°C

	This is a service manual ! All addresses are given! At access from RS485 to use only addresses associated with:
1.	Communication Set Up
2.	Measured values for RH% and °C
3.	Set alert values for RH% and °C
4.	Parameters related to alarm times / time delay and duration /
5.	Configuring Discrete Outputs for Buzzer and Alarm
6.	Configure the analog outputs to match the measurement range
	THE TRANSMITTERS ARE FACTORY TUNED ! PROGRAMMING VIA RS485 BY UNQUALIFIED PERSONNEL MAY RESULT IN THEIR OUT OF SERVICE !

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I. ADVANTAGES

- ✓ **High accuracy and Fast reaction**
- ✓ **Wide temperature ranges (from -40 to 70,125 or 140)°C**
- ✓ **Fast recovery after condensation of water**
- ✓ **Does not require user setup**
- ✓ **In a compact housing with wall mounting options or with a remote sensor**
- ✓ **MODBUS RTU serial communication in an isolated RS485 - Option**
- ✓ **Four programmable discrete outputs - Option**
- ✓ **Selecting the logic level of the discrete outputs - + 5VDC or + Vext**
- ✓ **Programmable combinations of alarm events**
- ✓ **Built-in alarm buzzer triggered by an alarm event - Option**
- ✓ **Built-independent temperature sensor Pt100 or Pt1000- Option**
- ✓ **Programmable digital filters for EMI protection**
- ✓ **Certificate of calibration from an accredited laboratory - Option**

II. ORDER CODE

MS 9045 - X.X.X.X.X.X.X
MS 9055 - X.X.X.X.X.X.X.X.X.X.X

Operating temperature
CODE

T1 - up to 70 °C
T2 - up to 120 °C
T3 - up to 140 °C**

Operating length - n
CODE

n1 - n=100mm
n2 - n=150mm
n3 - n=200mm
n4 - n=250mm
n5 - n=300mm T°C
n6 - n=400mm
n7 - n=500mm(max)
nZ - other in request
(from 100 to 500)

Threaded connections
CODE

G0 - N/A
G1 - M 18
G2 - M20
G3 - G 1/2'
GZ - other in request

Distance of threaded
from corps - m
CODE

m0 - m=0(next to corps)
m1 - m=60mm
m2 - m=120mm
mZ - other in request

Calibration
CODE

L0 - N/A
L1 - Certificate from accreditation
laboratory

Communication *
CODE

S0 - N/A
S1 - RS 485

Alarm *
CODE

Z0 - N/A
Z1 - buzzer

Digital outputs*
CODE

K0 - N/A
K1 - K1,K2,K3,K4

Analog outputs for T °C and/or RH%
CODE

0 - Two-wire, no isolation 4-20 mA for RH %
1 - Two-wire, no isolation 4-20 mA for RH % and T°C
2 - Three-wire, isolation 4-20 mA for RH %
3 - Three-wire, isolation 4-20 mA for RH % and T°C
4 - Three-wire, no isolation 0-10 V for RH %
5 - Three-wire, no isolation 0-10 V for RH % and T°C
6 - Three-wire, isolation 0-10 V for RH %
7 - Three-wire, isolation 0-10 V for RH % and T°C

Relative humidity sensor (accuracy)
CODE

C0 - 1,5% in range 10-90%
C1 - 2% in range 10-90%

Additional RTD sensor
CODE

R0 - N/A
R1 - Pt 100
R2 - Pt 1000

* Only in case of three-wire connection of analog outputs!

** Only humidity sensor without temperature correction

Example MS9045 - R1.C1.0.K0.Z0.S0.L1

MS9055 - T2.n7.G3.m2.R0.C0.7.K1.Z1.S1.L1

Ms9045

CODE

R1 - Additional RTD Pt 100
C1 - Sensor accuracy RH % - 2 %
0 - Two-wire, no isolation 4-20mA for RH %
K0 - N/A
Z0 - N/A
S0 - N/A
L1 - Certificate from accreditation laboratory

Ms9055

CODE

T2 - up to 120 °C
n7 - Operating length 500mm
G3 - Threaded connections 1/2'
m2 - Distance of threaded from corps 120mm
R0 - N/A
C0 - Sensor accuracy RH % - 1,5 %
7 - Three-wire, isolation 0-10 V for RH % and T°C
K1 - K1,K2,K3,K4
Z1 - Buzzer
S1 - RS 485 communication
L1 - Certificate from accreditation laboratory



The installation must comply with the condition that the electronics in the transmitter box are at an operating temperature of $\leq 70^{\circ}\text{C}$

III. MS 9045/MS 9055 FEATURES

- The digital outputs, the RS 485 communication output and the buzzer output are only possible for a three-wire connection scheme;
- The output for RS 485 communication is isolated from the supply voltage
- Analogue outputs can be bring out in the following combinations at customer request: - two currents 4-20 mA (RH% and $T^{\circ}\text{C}$); - two voltage 0-10 V (RH% and $T^{\circ}\text{C}$); - one current 4-20 mA (RH% or $T^{\circ}\text{C}$) and one voltage 0-10 V (RH% or $T^{\circ}\text{C}$).
- Two-wire current outputs can be powered from different sources and galvanically separated, if they do not have a common GND;
- For two-wire connection with one power source, the positive terminals need to be united by the user.
- When using the temperature channel only, it is also necessary to supply power to the RH measuring channel.

IV. DESIGNATION

The sensor transmitter MS9045 / MS9055 is equipped with a capacitive sensor for relative air humidity measurement, a built-in integrated temperature sensor and a transmitter. There is also an optional built-in RTD temperature sensor type Pt 100 or Pt1000 on request.

The units are available in several types of housing for different applications, depending on the installation method, the temperature range and the degree of protection for the electronics.

MS9045- Box IP65 82x80x56 mm wall mounting up to 70°C

MS9055- Box IP65 82x80x56 mm with remote sensor up to 140°C

Analogue transmitter output transmits the measured input value in a standard format: $4 \div 20$ mA DC; $0 \div 10$ V DC or another in the order that appears in the order code. The MS9045/MS9055 is factory tuned and no further adjustment is needed.

The sensor MS9045/MS9055 provides four digital outputs (4 configurable alarms (RH-Lo / Hi, T-Lo / Hi). The user selects the logic unit level by jumper - 5 V or supply voltage.

The built-in buzzer connected to the K4 is enabled or disabled via jumper.

Isolated RS 485 provides MODBUS RTU communication. Access to parameters is possible via RS 485 or USB / UART TTL communicator.



If RS 485 is present, the USB connector should not be used!


The relative humidity sensor is protected with a removable protective cap, which should be well tightened together with the rubber seal.

With the built-in sensor and temperature transmitter option, the user is given the possibility of compactness and cost reduction.

To program the transmitters MicroSyst offers:

- Base software for Windows operating system
- USB / RS485 or USB / TTL Serial Programming Converters
- User Configuration Instructions for Transmitters
- Instruction for complete system setup and configuration of the transmitters.

WHEN USB / TTL SERIAL PROGRAMMING CONVERTERS IS USED !

	<ul style="list-style-type: none"> • The MS9045 / 55 is connected via the USB 5 mini connector, but the signal levels are TTL! • The MS9045 / 55 should not be plugged in directly into a USB port on a computer! • When set up, MS9045 / 55 must be powered!
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The model has a wide application for control and monitoring in:

- ✓ dryers
- ✓ chambers for the pharmaceutical industry
- ✓ warehouses for storage of fruits and vegetables
- ✓ Production premises and others.

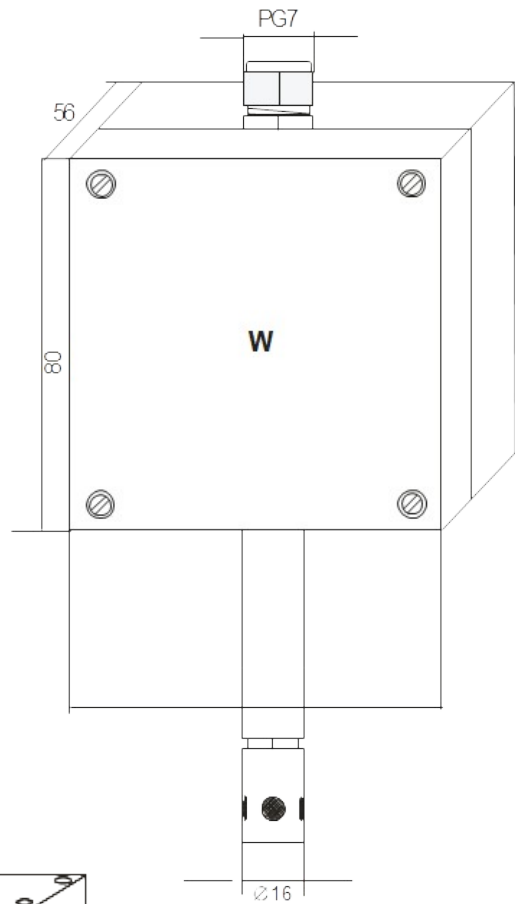
V. TECHNICAL DATA OF MS 9045/MS 9055

Analog inputs		
Sensors	Relative humidity	Temperature
- sensitive element	capacities sensor	integral sensor
- temperature correction	Yes	
- accuracy of measurement	2 % 1,5 % (on request)	±0.5°C; from 10°C to +70°C ±1°C (max.) -10°C ÷ +85°C ±2°C (max.) -10° ÷ +125°C ±3°C (max.) -55° ÷ +125°C
- range of measurement	10÷ 90 % rh	On request within the limits of -40÷ 140 °C
- measurng interval	0.07 ÷ 2 s	~0,8s
- resolution	0.05 % rh	0,0625 °C
Analog outputs	в обхват 0 ÷ 100 % rh	съгласно код на заявка, °C
Two -ware -current	4÷20 ma	4÷20 ma
Three- ware -current	4÷20 mA	4÷20 mA
Three- ware voltage	0÷10 V	0÷10 V

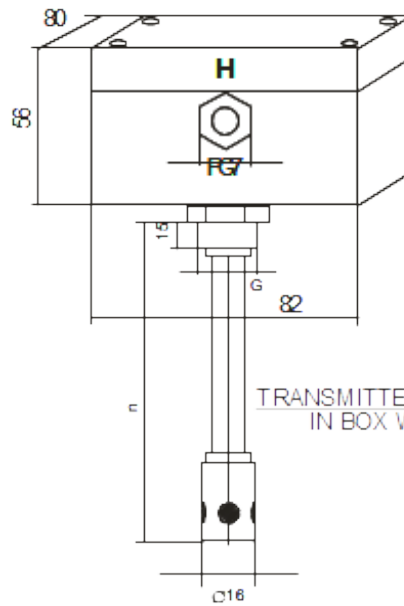
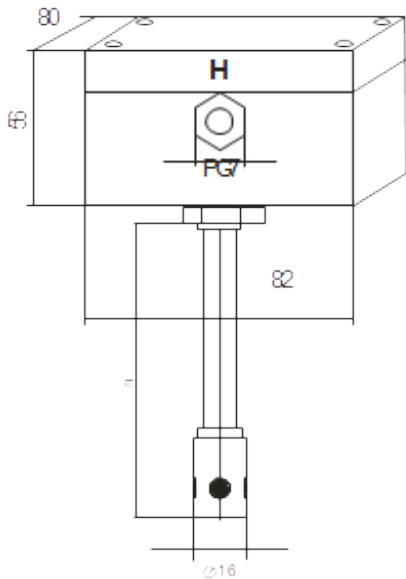
Discrete outputs K1,K2,K3,K4 4 configurable alarms (RH,T)	K1-ALARM Lo K2-ALARM Hi	K3-ALARM Lo K4-ALARM Hi		
Communication	MODBUS RTU 9600/19200; non/even; 1 / 2 stop			
Communication port.				
RS485	galvanically isolated			
USB/UART TTL communicator.	Coupling - Mini 5 USB			
Power supply voltage	I Out: 9 ÷ 33 VDC		U Out: 12÷28 VDC	
Operating conditions				
Temperature	-20...70 °C			
Relative humidity	5 ... 95 % rh			
Probe operating temperature	-20...70 °C			
Storage conditions				
Temperature	-20 ÷ 70 °C			
Relative humidity	без кондензация 5 ÷ 95 % rh			
Gauge dimensions and installation				
	Wall mounting box MS9045	Box without threaded connection MS9055	Box with threaded connection MS9055	Box with high temperature performance MS9055
Corps	IP65	Stainless steel Nr.1.4571	Stainless steel Nr.1.4571	Stainless steel Nr.1.4571
Dimensions	82x80x56 mm	n = 50, 100, 150,300, 500 mm *Other sizes are also allowed	n = 50, 100, 150,300, 500 mm,G = 1/2", M18, M20* *Other sizes are also allowed	n = 50, 100, 150,300, 500 mm, G= 1/2", M18, M20* *Other sizes are also allowed
Weight	min 100 gr.	min 100 gr.	min 100 gr.	min 100 gr.
Applications	for environments close to atmospheric	For more aggressive environments	For more aggressive environments	For more aggressive environments
Advantages	compact box for easy wall mounting	For high temperature	With threaded connection	For high temperature

VI. TYPE OF HOUSING AND SIZES OF MS9045 /9055

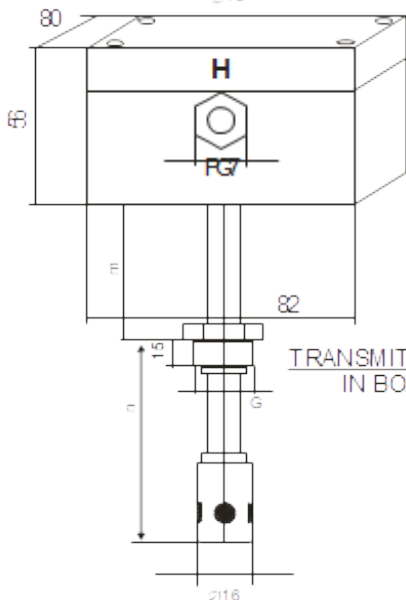
TRANSMITTER MS 9045
WALL MOUNTING BOX IP 65



TRANSMITTER MS 9055 WITH REMOTE SENS OR
IN BOX WITHOUT THREADED CONNECTION



TRANSMITTER MS 9055 WITH REMOTE SENS OR
IN BOX WITH THREADED CONNECTION

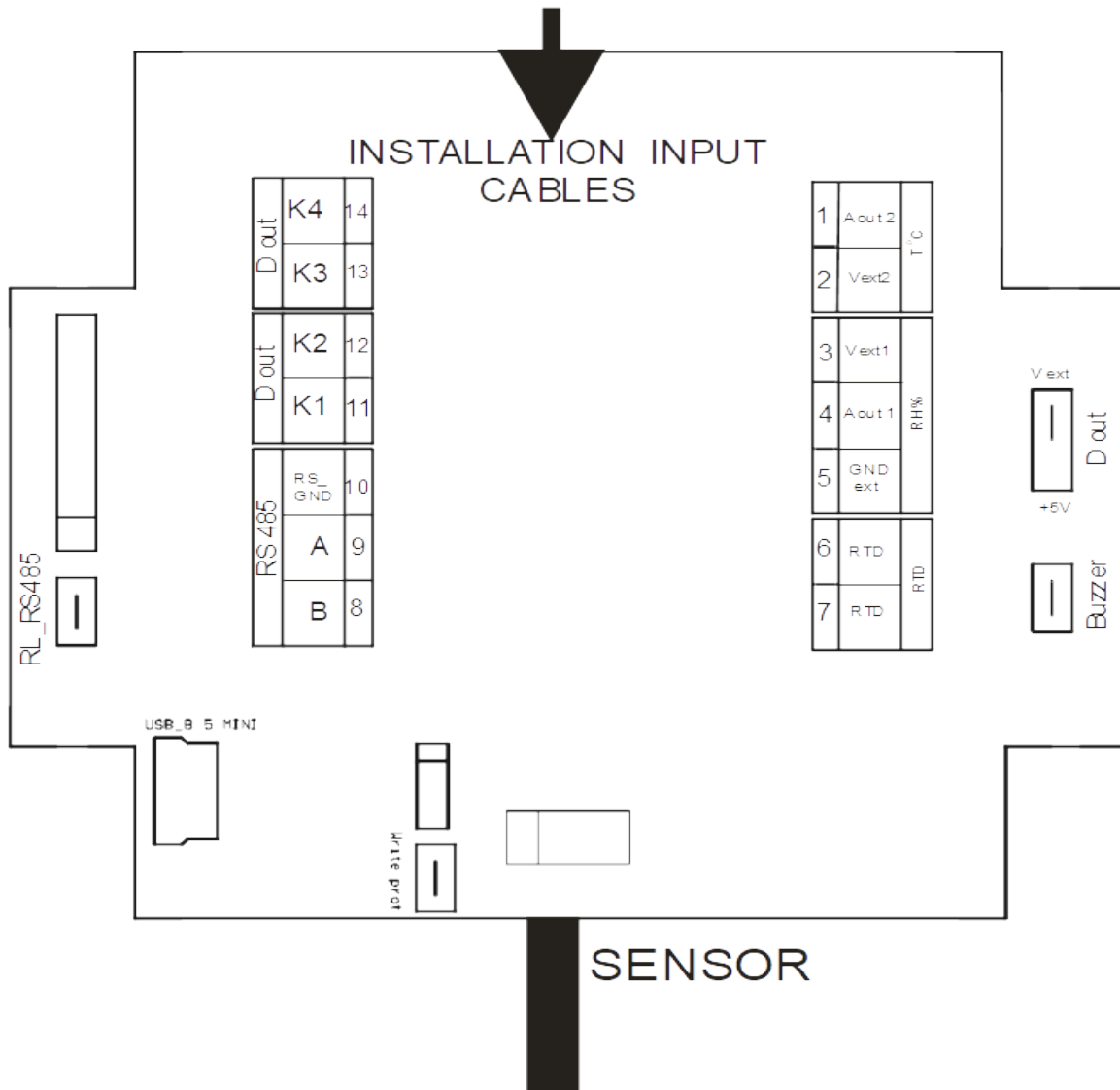


TRANSMITTER MS 9055 WITH REMOTE SENS OR
IN BOX WITH THREADED CONNECTION
DISTANCE -m FROM CORPS

VII. TERMINAL BLOCK AND CONNECTION SCHEME

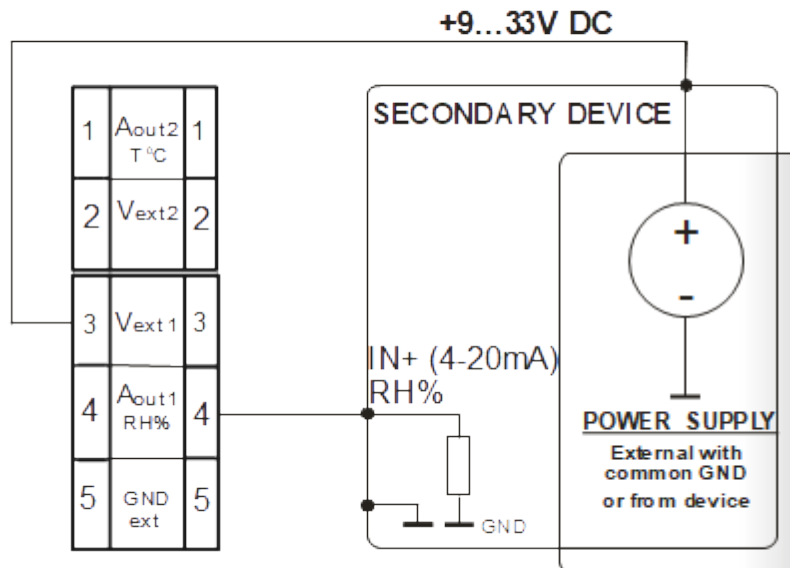
- **TWO-WIRE CONNECTION** - Devices are powered by the signal line. Analog outputs can only be 4-20mA current. Only two wires per channel are needed to form and retransmit the current signal.
- **THREE- WIRE CONNECTION** - The devices are powered REGARDLESS of the signal line. Analog outputs can be current (0-20mA, 4-20mA), voltage (0-10V) or current and voltage. For the formation and retransmission of the current / voltage signal, three wires are required for each channel.

1. MS9045 /MS 9055 relative humidity transmitter Terminal Block

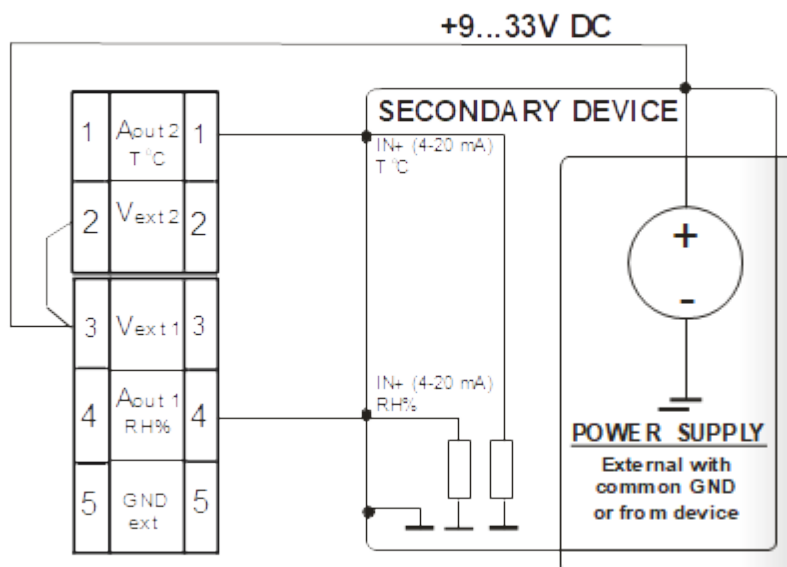


2. Connection schemes

2.1 Analog two-wire current (4...20 mA) output for RH%.

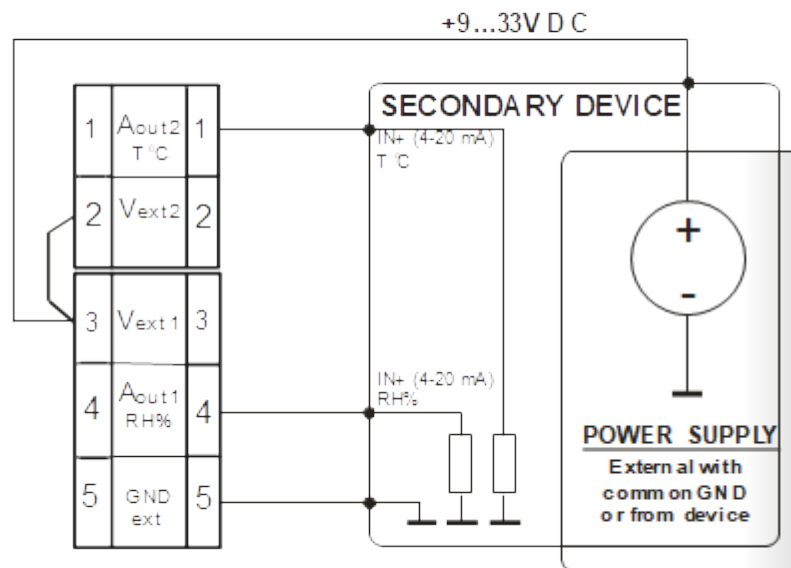


2.2 Analog two-wire - current (2x4...20 mA) output for RH% and T°C.



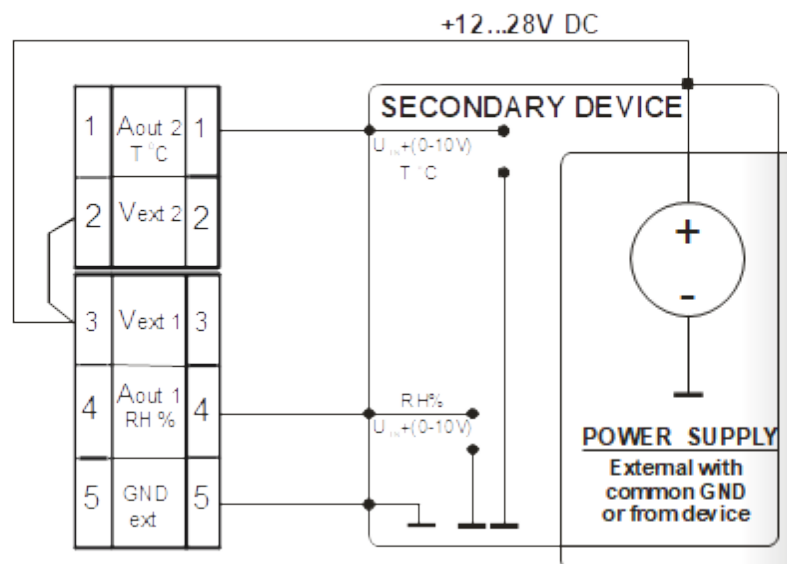
When powering from two separate devices V_{ext1} and V_{ext2} is provided by the respective device and the bridge between terminal 1 and terminal 2 is not needed

2.3. Analog three - wire current (2x4..20 mA) output for RH% and T°C.



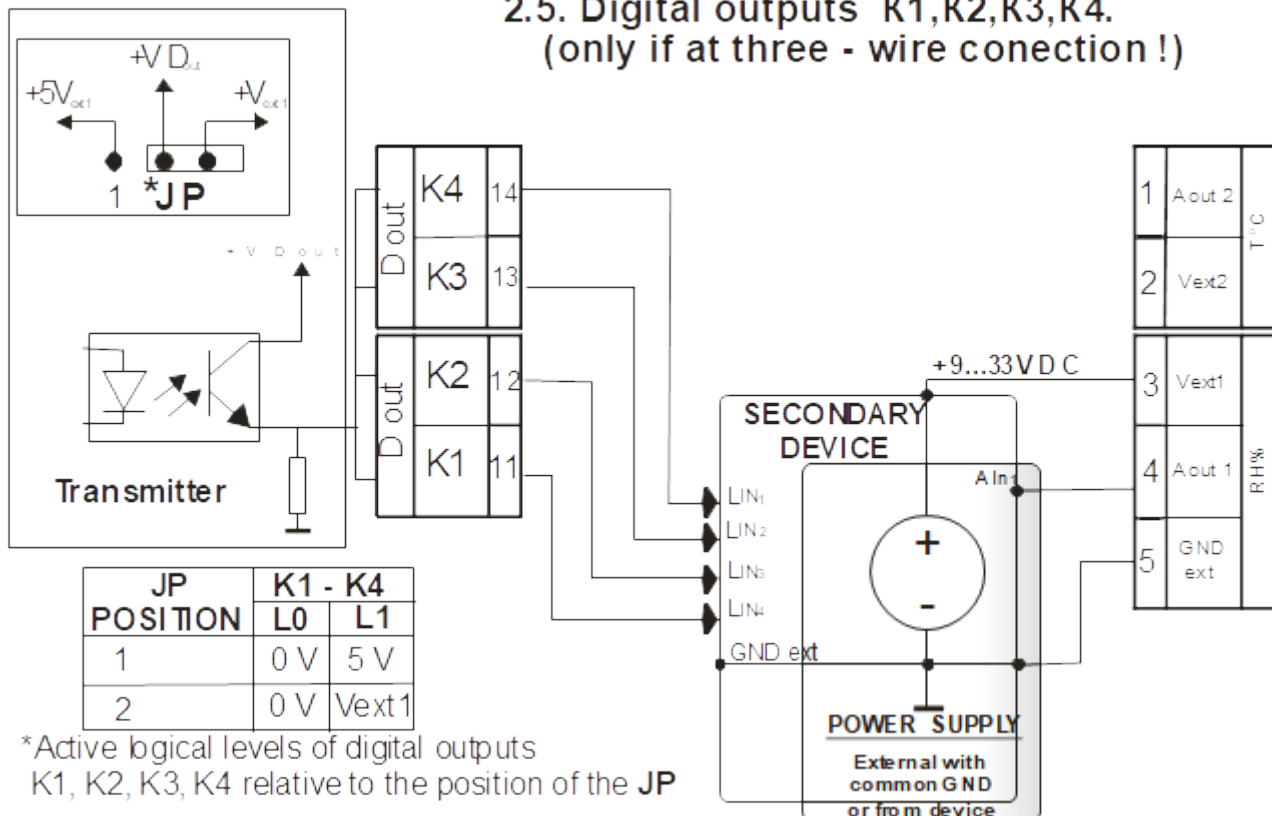
When powering from two separate devices Vext 1 and Vext 2 is provided by the respective device and the bridge between terminal 1 and terminal 2 is not needed

2.4. Analog three - wire voltage (2x0...10V) output for RH% and T°C.

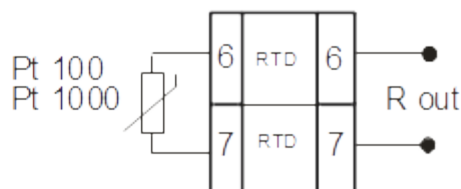


When powering from two separate devices Vext 1 and Vext 2 is provided by the respective device and the bridge between terminal 1 and terminal 2 is not needed

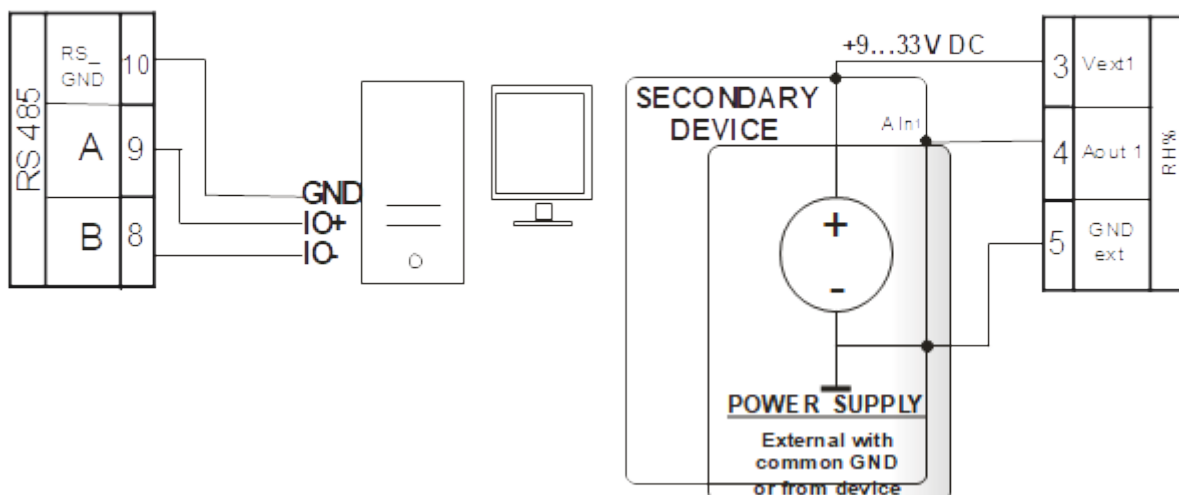
2.5. Digital outputs K1,K2,K3,K4. (only if at three - wire conection !)



2.6. Analog two - wire R (Ω) output T[°]C.



2.7. RS 485 communication (only if at three-wire conection!)



VIII. COMMUNICATION

The device is MODBUS RTU SLAVE, capable of communicating at 9600 or 19200 bps. Addresses other than those specified in the parameter table should not be used.

	<i>Addresses other than those specified in the parameter table should not be used!</i>
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MODBUS FUNCTION	IMPLEMENTED MODBUS FUNCTIONS
01	read coil- Reading single bits.
03	read reg - Reading HOLDING REGISTERS, Float format IEEE754
05	preset coil - Single bit save
06	write single reg- Record of an HOLDING REGISTER,Float format IEEE754
16	write multiple reg -Record of multiple successive HOLDING REGISTERS. the function is designed to record FLOAT values in IEEE754 format

Symbol	Address, type	Function	
ZnFin	24, Integer	Zone Filter	R/W
FinTime	25, LSByte	Time filter (x~350ms). Range 0 ÷ 255. It works regardless of the value of Fin.	R/W
Fin	26,LSByte	Filter factor. Less value - a heavier filter. Range 1 ÷ 127. At 127, the function is off	R/W
ALARM PIN assignment	28,Integer	Configure alarm outputs	R/W
TAlmLo,s RH	33,MSByte	Alarm delay time (low level),s	R/W
TAlmLo,s T	33,LSByte	Alarm delay time (low level),s	R/W
T1AlmLo RH	34,MSByte	Time to turn on alarm output (low level),s (0-constant while in alarm)	R/W
T1AlmLo T	34,LSByte	Time to turn on alarm output (low level),s (0-constant while in alarm)	R/W
THi RH	35,MSByte	Alarm delay time (high level),s	R/W
THi T	35,LSByte	Alarm delay time (high level),s	R/W
T1Hi RH	36,MSByte	Time to turn on alarm output (high level),s (0-constant while in alarm)	R/W
T1Hi T	36,LSByte	Time to turn on alarm output (high level),s (0-constant while in alarm)	R/W
//LmA RH	62,Integer	DAC codes 12-bit calibration values, corresponding to AOUT mA, (current)	R/W
//HmA RH	63,Integer	DAC codes 12-bit calibration values, corresponding to AOUT mA, (current)	R/W

//LV	RH	64,Integer	DAC codes 12-bit calibration values, corresponding to AOUT V,(voltage)	R/W
//HV	RH	65,Integer	DAC codes 12-bit calibration values, corresponding to AOUT V,(voltage)	R/W
//LmA	T	66,Integer	DAC codes 12-bit calibration values, corresponding to AOUT mA, (current)	R/W
//HmA	T	67,Integer	DAC codes 12-bit calibration values, corresponding to AOUT mA, (current)	R/W
//LV	T	68,Integer	DAC codes 12-bit calibration values, corresponding to AOUT V,(voltage)	R/W
//HV	T	69,Integer	DAC codes 12-bit calibration values, corresponding to AOUT V,(voltage)	R/W
Firmware		126,Int	The production version is recorded but can be overwritten!	R/W!
MODBUS ADDRESS		127,Integer	MODBUS address of the specific appliance. Range 1- 247.	R/W
TunMode		155, LSByte	Control calibration Aout	R/W
DAClive	RH	156, Int	Current DAC code	R
DAClive	T	157, Int	Current DAC code	R
T_x		158, Int		
OFFSET IN RH		524,Float	Offset RH	R/W
%RH/C		526,Float	Temperature correction. About -0,032 is set.	R/W
ALARM LO RH		528,Float	Alarm levels	R/W
ALARM HI RH		530,Float	Alarm levels	R/W
ALARM LO T		532,Float	Alarm levels	R/W
ALARM HI T		534,Float	Alarm levels	R/W
L,mA	RH	550,Float	Calibration values measured at current output, (mA)	R/W
H,mA	RH	552,Float	Calibration values measured at current output, (mA)	R/W
L,V	RH	554,Float	Calibration values measured at voltage output, (V)	R/W
H,V	RH	556,Float	Calibration values measured at voltage output, (V)	R/W
Lo at	RH	558,Float	Custom setup A Out1 RH% за 4 mA(2V)	R/W
Hi at	RH	560,Float	Custom setup настройка A Out1 RH% за 20 mA(10V)	R/W
L,mA	T	562,Float	Calibration values measured at current output, (mA)	R/W
H,mA	T	564,Float	Calibration values measured at current output, (mA)	R/W
L,V	T	566,Float	Calibration values measured at voltage output, (V)	R/W
H,V	T	568,Float	Calibration values measured at voltage output, (V)	R/W
//AOut2 Lo at T		570,Float	Custom setup A Out1 T°C за 4 mA(2V)	R/W
//AOut2 Hi at T		572,Float	Custom setup A Out1 T°C за 20 mA(10V)	R/W
AOUT1	RH	724,Float	AOut current (mA,V)	R/W
AOUT2	T	726,Float	AOut current (mA,V)	R/W

Hz	728,Float	Frequency input signal	R/W
RH%	730,Float	Measured RH%	R/W
T °C	732,Float	Measured temperature T °C	R/W
Hz/C	736,Float	Average frequency temperature correction. It is calculated automatically by% RH / C at both"Calibration Input" points and namely it is used.	R/W
	726,Float		R/W

Configuration of alarm outputs

4 - KIND OF ALARM EVENTS		4 OUTPUTS				ALARM PIN assignment				
		KA	KB	KC	KD	bit II	16 bit register			
RH%	RH% < ALARM LO					15-12	15-12	11-8	7-4	3-0
	RH% > ALARM HI, if HI > LO or ALARM LO < RH% < HI, if HI < LO					11-8				
T °C	T °C < ALARM LO					7-4				
	T °C > ALARM HI, if HI > LO or ALARM LO < T °C < HI, if HI < LO					3-0				

SYMBOL	Address, type	Function	
BAUDRATE 19200	442, Coil	0-9600; 1- 19200	
EVEN PARITY	443, Coil	0 – no; 1 – yes	
2 STOP BITS	444, Coil	0 – 1 stop bit ; 1 – 2 stop bit	
DISABLE BROUDCAST	445, Coil	0 – enable; 1 - disable	
AOut1 0-I(mA) 1-U(V)	488, Coil	Output 1 with settings: 0 – current ; 1 – voltage;	
1-20-100% AOut1	489, Coil	Output Format : 0 – 0 ÷ 100% ; 1 - 20 ÷ 100%	
AOut2 0-I(mA) 1-U(V)	491, Coil	Output 2 with settings: 0 – current ; 1 – voltage;	
1-20-100% AOut2	492, Coil	Output Format : 0 – 0 ÷ 100% ; 1 - 20 ÷ 100%	
Exchange Aout fysical PI	494, Coil	He exchanges the legs of the processor AOUT1 / 2	
Unlimited	495, Coil	Unlimited 0-100% RH	
Write protected! 0-NO	2960, Coil	Protection from recording and changing settings. <i>Determined by a jumper in the device.</i> 0 - No (possible change of parameters) 1 - Yes (device is protected from recording)	R
KA	2961, Coil	Alarm outputs	
KB	2962, Coil	Alarm outputs	
KC	2963, Coil	Alarm outputs	
KD	2964, Coil	Alarm outputs	

Table Linearisation

The values have to be! To be monotonous. The table sets a reference curve, which device attached it self during operation (shifted and scaled) to the input calibration . The Data after recording of processor are from of the Sensor Data Sheet and should be fit

	Symbol	Address	Object	DATA	
1	Hz	70	Holding reg.	Integer	
	RH%	71	Holding reg.	Int.0,1x	
2	Hz	72	Holding reg.	Integer	
	RH%	73	Holding reg.	Int.0,1x	
3	Hz	74	Holding reg.	Integer	
	RH%	75	Holding reg.	Int.0,1x	
4	Hz	76	Holding reg.	Integer	
	RH%	77	Holding reg.	Int.0,1x	
5	Hz	78	Holding reg.	Integer	
	RH%	79	Holding reg.	Int.0,1x	
6	Hz	80	Holding reg.	Integer	
	RH%	81	Holding reg.	Int.0,1x	
7	Hz	82	Holding reg.	Integer	
	RH%	83	Holding reg.	Int.0,1x	
8	Hz	84	Holding reg.	Integer	
	RH%	85	Holding reg.	Int.0,1x	
9	Hz	86	Holding reg.	Integer	
	RH%	87	Holding reg.	Int.0,1x	
10	Hz	88	Holding reg.	Integer	
	RH%	89	Holding reg.	Int.0,1x	
11	Hz	90	Holding reg.	Integer	
	RH%	91	Holding reg.	Int.0,1x	
12	Hz	92	Holding reg.	Integer	
	RH%	93	Holding reg.	Int.0,1x	
13	Hz	94	Holding reg.	Integer	
	RH%	95	Holding reg.	Int.0,1x	
14	Hz	96	Holding reg.	Integer	
	RH%	97	Holding reg.	Int.0,1x	
15	Hz	98	Holding reg.	Integer	
	RH%	99	Holding reg.	Int.0,1x	
16	Hz	100	Holding reg.	Integer	
	RH%	101	Holding reg.	Int.0,1x	
17	Hz	102	Holding reg.	Integer	
	RH%	103	Holding reg.	Int.0,1x	

18	Hz	104	Holding reg.	Integer	
	RH%	105	Holding reg.	Int.0,1x	
19	Hz	106	Holding reg.	Integer	
	RH%	107	Holding reg.	Int.0,1x	
20	Hz	108	Holding reg.	Integer	
	RH%	109	Holding reg.	Int.0,1x	

Input Calibration							
		Symbol	Address	Object	DATA	Mirror (no auto fill T,f)	
		(auto fill T,f)					
1	эталон	f(Hz)	110	Hold reg	Int.		
		RH%	111	Hold reg	Int.	1135	Int.0,1x
		T °C	114	Hold reg	Int.		Int.0,1x

Input Calibration							
		Symbol	Address	Object	DATA	Mirror (no auto fill T,f)	
		(auto fill T,f)					
2	эталон	f(Hz)	112	Hold reg	Int.		
		RH%	113	Hold reg	Int.	1137	Int.0,1x
		T °C	115	Hold reg	Int.		Int.0,1x
Temperature for table data							
		T tabl.	116	Hold reg	Int.	Int.0,1x	

Calibration

The probe is placed in a medium with RH% which is known. Write (MODBUS func.06) the value in the first field RH%. The humidity is changed to a second reference and recorded in the second field RH%

In these operations, the instrument automatically fills the remaining four fields with its current measurements (T, f (Hz)). They may change later, but in general there is no need.

If it is necessary to change only RH% without autofill T, f mirror registers 1135, 1137 are used.

The calibration does not place temperature requirements (for example, to be constant or equal to the T table.) Regarding RH%, normally the two points are not close - they are points of linkage of the linearization table curve. If only one reference point is set, the other one remains unchanged, ie. Changes the slope of the feature. To offset the feature without changing the slope, use the OFFSET III parameter (adds it after all other calculations).

OUTPUT Calibration			
Tun Mode	155, LSByte	<p>0-normal output mode; 1-fixed output 20% (4mA/2V); 2-fixed output 100% (20mA/10V); 3-fixed output 60% (12mA/6V). 128- test mode - do not measure, but the temperature and frequency are set by hand. This mode can be used not only for calibration output, but also for tests. The modes 1 and 2 are used for the calibration of the outputs. For this purpose, the corresponding real values recorded on a connected measuring device must be recorded in the AOUT. The device immediately adjusts its output. Mode 3 is for verification only. When calibrating, the output MUST be within range (not saturated). Otherwise, the calibration should be repeated. When power on Tun Mode = 0.</p>	R/W
<p>The OUT and DAC parameters are automatically recorded by the instrument during calibration. They can also be directly entered. The DAC parameters are 12 bit DAC values</p>			

IX. RECOMMENDATIONS AGAINST ELECTROMAGNETIC INTERFERENCE (EMI)

Recommendations for the use of connecting wires

- ✓ For longer distances for lines subjected to electromagnetic disturbances, it is desirable to use a twisted pair conductor.
- ✓ For better noise protection, a shielded cable may be used, which must be grounded at one end only.
- ✓ Wires carrying contiguous types of signals can be packed together, but if the signals are different, the wires must be separated to prevent electromagnetic interference.
- ✓ When conductors with different type of signals have to be crossed, this should be done at an angle of 90 degrees and at the maximum distance.
- ✓ Wires with weak signals and wires connecting the sensors to the controller must not pass near contactors, motors, generators, radio transmitters and wires with high currents.

WARRANTY CARD

Warranty card №:.....

Warranty term:..... months

Factory number:.....

The items were purchased from :.....

Invoice number:...../..... 20..... year .

GUARANTEE CONDITIONS

The guaranty consists in free repairs of all the factory defects which can occur during the guarantee period. **The repair is performed as in the repair base is being presented the current guarantee card with which the device is bought.** The warranty does not refer to issue caused by a bad transport, bad conservation, wrong exploitation, nature disasters, not following the instructions and the cases when there is an attempt to fix any defects by other people. In those cases the issue is being fixed only against payment.

The maintenance during the guarantee period and doing the claims happens according to the valid legislation.

PERFORMED REPAIRS IN THE SERVICE

Service	Date of receipt	Order number	Type of repairs done	Date of transmission	Carried out the repair

Seller:.....

Buyer:.....

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