Humidity and temperature transmitter for HVAC applications, environmental monitoring, pharmaceutical storage, food transport, greenhouse automation, etc. It calculates the Dew Point and the Wet Bulb temperature. Equipped with an antistatic UV-resistant thermoplatic housing with low thermal conductivity and high reflection. RS485 with MODBUS-RTU protocol digital output. Connection via screw terminals.

TECHNICAL CHARACTERISTICS

| Humidity	
Sensor	Capacitive
Measuring range	0…100% RH
Resolution	0.1% RH
Accuracy	± 1,5% (0…90% RH) / ± 2% (90…100% RH) @ T=15…35 °C ± 1,5 + 1,5% neasure)% @ T= remaining range
Sensor working temperature	-40…+80 °C
Long term stability	< 1% / year
Temperature	
Sensor	Pt100 1/3 DIN
Measuring range	-40…+80 °C
Resolution	0.1 °C
Accuracy	± 0.2 °C ± 0.15% of the measured value
Long term stability	0.2 °C / year
Dew Point	
Sensor	Parameter calculated from the measurement of temperature and relative humidity
Measuring range	-40…+60 °C DP
Resolution	0.1 °C DP
Accuracy	See graph 1
General characteristics	
Output	RS485 (1 Unit Load) with MODBUS-RTU protocol, not isolated
Power supply	5…30 Vdc
Consumption	4 mA typical @ 12 Vdc
Dimensions	Ø 26 x 185 mm (probe body, excluding cable gland)
Degree of protection	IP 54
Operating temperature/humidity	-40…+80 °C / 0…100% RH
Material	ASA
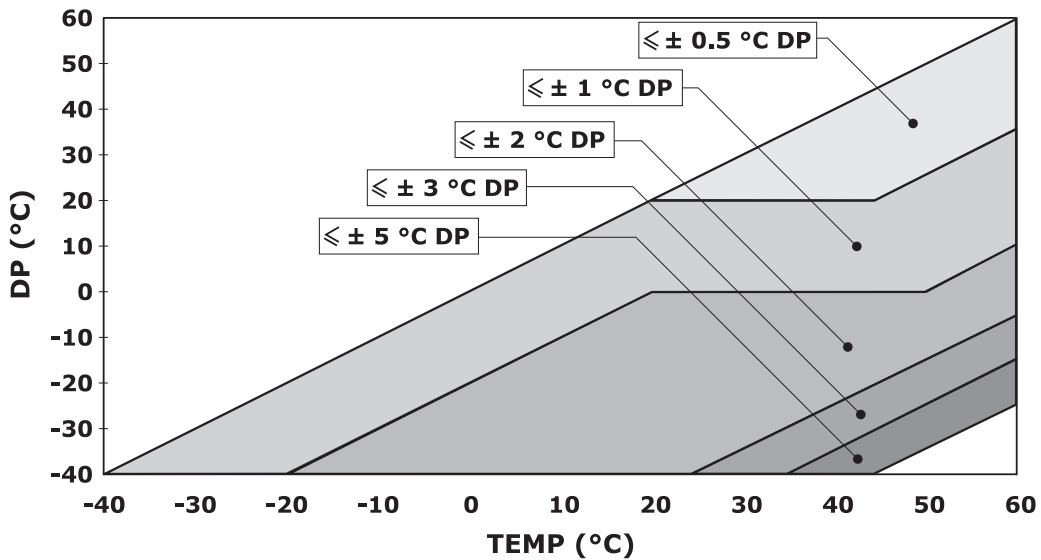
Graph 1 – Accuracy of the dew point measurement

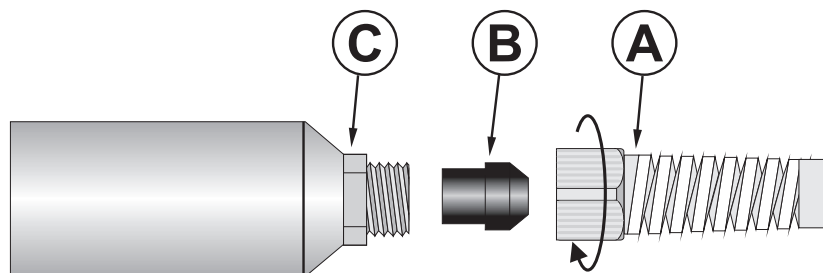## SETTING THE RS485 COMMUNICATION PARAMETERS OF THE TRANSMITER

Before connecting the transmitter to the RS485 network, an address must be assigned and the communication parameters be set, if different from the factory preset.

The setting of the parameters is performed by connecting the transmitter to the PC by using a RS485/USB (e.g. **RS48**) or RS485/RS232 converter. If a RS485/USB converter is used, it is necessary to install the related USB drivers in the PC. The transmitter has to be powered separately.
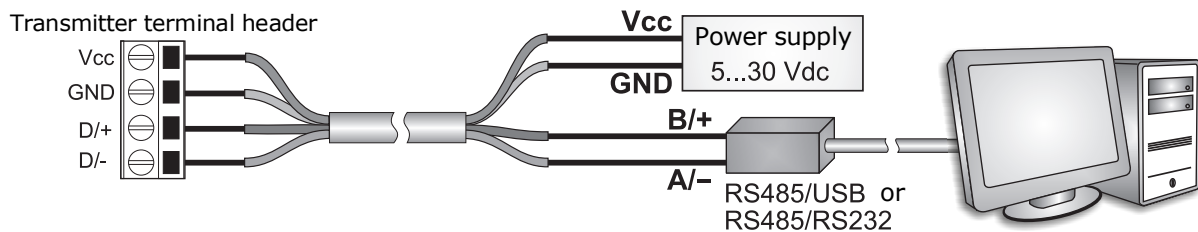
NOTES ON THE INSTALLATION OF UNSIGNED USB DRIVER: before installing unsigned USB driver into operating systems starting from Windows 7, it is necessary to restart the PC by disabling the driver signing request. If the operating system is 64-bit, even after installation the request of driver signing have to be disabled each time the PC is restarted.

Follow these procedures to access the transmitter terminal board: unscrew grommet "A", take off rubber bulb "B" and unscrew bottom "C". Insert the cable through A, B and C elements and connect it to the terminal board. Hold the cable firmly while screwing grommet "A" to avoid twisting.

PROCEDURE FOR SETTING THE PARAMETERS

1. Start with the transmitter not powered.

2. Start a standard serial communication program, such as Hyperterminal. Set the COM port number to which the transmitter will be connected, set the Baud Rate to 57600 and the communication parameters as follows:

<div align="center">Data Bits: 8   Parity: None   Stop Bits: 2</div>

3. Switch the transmitter on and wait to receive the **&** character, then send (within 10 s from power on) the **@** command and press **Enter**.

   Note: if the transmitter does not receive the **@** command within 10 seconds from power on, the RS485 MODBUS mode is automatically activated. In such a case, it is necessary to switch off and on again the transmitter.

4. Send the command **CAL USER ON**.

   Note: the command CAL USER ON is disabled after 5 minutes of inactivity.

5. Send the serial commands in the following table to set the RS485 MODBUS parameters:

Command	Response	Description
CMAnnn	&|	Set RS485 address to nnn
		Ranging from 1 to 247. Preset on 1
CMBn	&|	Set RS485 Baud Rate
		n=0 $\Rightarrow$ 9600 n=1 $\Rightarrow$ 19200
		Preset on 1 $\Rightarrow$ 19200
CMPn	&|	Set RS485 transmission mode
		n=0 $\Rightarrow$ 8-N-1 (8 data bits, no parity, 1 stop bit) n=1 $\Rightarrow$ 8-N-2 (8 data bits, no parity, 2 stop bits) n=2 $\Rightarrow$ 8-E-1 (8 data bits, even parity, 1 stop bit) n=3 $\Rightarrow$ 8-E-2 (8 data bits, even parity, 2 stop bits) n=4 $\Rightarrow$ 8-O-1 (8 data bits, odd parity, 1 stop bit) n=5 $\Rightarrow$ 8-O-2 (8 data bits, odd parity, 2 stop bits)
		Preset on 2 $\Rightarrow$ 8-E-1
CMWn	&|	Set receiving mode after RS485 transmission
		n=0 $\Rightarrow$ Violate protocol and go in Rx mode right after Tx n=1 $\Rightarrow$ Respect protocol and wait 3.5 characters after Tx
		Preset on 1 $\Rightarrow$ Respect the protocol

6. You can check the parameters setting by sending the following serial commands:

Command	Response	Description
RMA	*Address*	Read RS485 address
RMB	*Baud Rate* (0,1)	Read RS485 Baud Rate 0 $\Rightarrow$ 9600 , 1 $\Rightarrow$ 19200
RMP	*Tx Mode* (0,1,2,3,4,5)	Read RS485 transmission mode 0 $\Rightarrow$ 8-N-1 1 $\Rightarrow$ 8-N-2 2 $\Rightarrow$ 8-E-1 3 $\Rightarrow$ 8-E-2 4 $\Rightarrow$ 8-O-1 5 $\Rightarrow$ 8-O-2
RMW	*Rx Mode* (0,1)	Read receiving mode after RS485 transmission 0 $\Rightarrow$ Violate protocol and go in Rx mode right after Tx 1 $\Rightarrow$ Respect protocol and wait 3.5 characters after Tx

OPERATING MODE CONNECTION
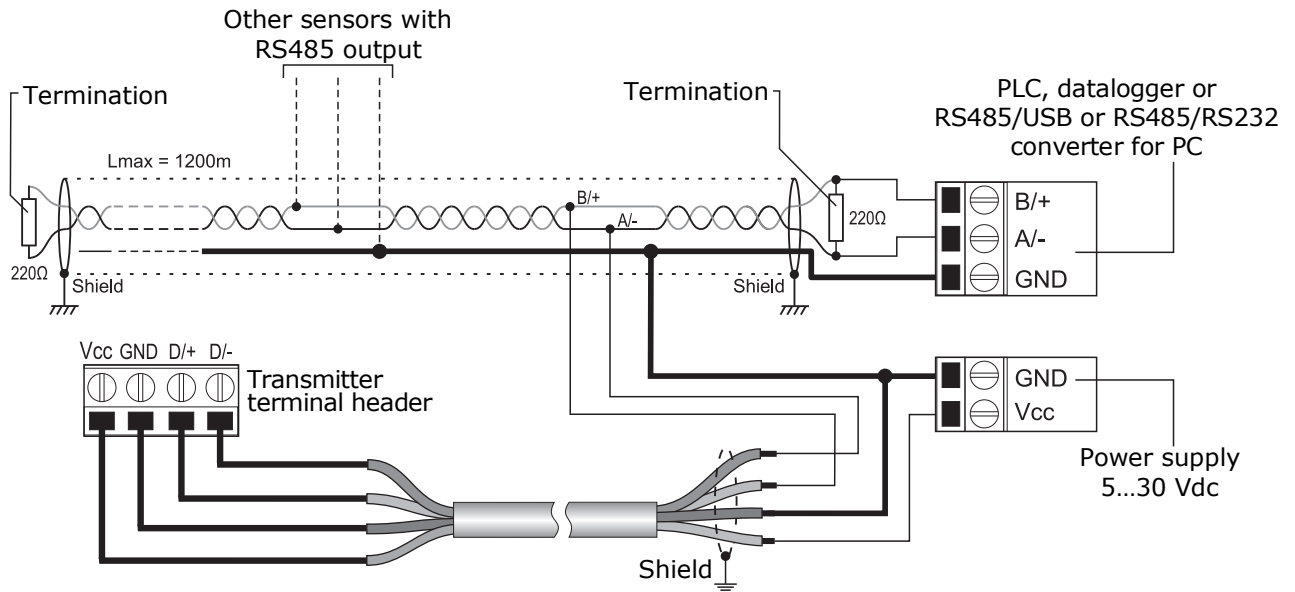
In the RS485 connection, the instruments are connected through a twisted-pair shielded cable for signals and a third wire for ground. Line terminations should be placed at the two ends of the network. The maximum number of devices that can be connected to the RS485 line (Bus) depends on the load characteristics of the devices to be connected. The RS485 standard requires that the total load does not exceed 32 unit loads. The load of an HD9008.T17S transmitter is equal to 1 unit load. If the total load is greater than 32 unit loads, divide the network into segments and add a signal repeater between a segment and the successive one. Line termination should be applied at both ends of each segment.

OPERATING MODE

The transmitter enters RS485 MODBUS-RTU mode after 10 seconds from power on. In the first 10 seconds from power on the transmitter does not reply to requests from the MODBUS master unit. After 10 seconds, it is possible to send MODBUS requests to the transmitter.

In MODBUS mode, you can read the values measured by the instrument through the function code 04h (Read Input Registers). The following table lists the information available with the appropriate register address:

Address	Quantity	Format
0	Temperature in °C (x10)	16-bit Integer
1	Temperature in °F (x10)	16-bit Integer
2	Relative humidity in % (x10)	16-bit Integer
3	Dew Point in °C (x10)	16-bit Integer
4	Dew Point in °F (x10)	16-bit Integer
5	Wet bulb temperature in °C (x10)	16-bit Integer
6	Wet bulb temperature in °F (x10)	16-bit Integer
5	Status register bit 0 = 1 ⇒ temperature measurement error bit 1 = 1 ⇒ humidity measurement error bit 2 = 1 ⇒ dew point calculation error bit 3 = 1 ⇒ configuration data error bit 4 = 1 ⇒ program memory error bit 5 = 1 ⇒ wet bulb temperature calculation error	16-bit Integer

INSTALLATION

For wall-mounted installation, the HD9008.21.1 (distance from wall 250 mm) and HD9008.21.2 (distance from wall 125 mm) supports are available.

For outdoor installation, use the HD9007A-1 or HD9007A-2 ring-shield to protect the probe from solar radiations, rain and wind.

RELATIVE HUMIDITY CALIBRATION

The transmitter is factory calibrated and ready to use. It is possible to perform the periodical calibration of the relative humidity sensor at the two points 33% and 75% RH.

No calibration is scheduled for the temperature sensor.

Before starting calibration procedure, it is advisable to **verify**, with the aid of 33.0% RH and 75.4% RH saturated solutions, the necessity for a new calibration: perform calibration only if you notice a measurement error of some relative humidity percentage points in at least one of the two checked points.

The calibration must be performed at a temperature ranging between 18 and 30 °C.

The calibration procedure cancels previous calibration data.

For a correct sensor calibration, the first point must be 75% RH and the second point 33% RH.

Calibration preliminary operations

Make sure that in the chamber containing the saturated saline solutions there are at the same time:

- s lid-state salt,
- liquid solution or wet salt, especially for 75% RH solution.

The instrument and the saturated solutions to be used are to be kept in an environment at stable temperature for the entire period of calibration. Wait for at least a couple of hours at stable temperature so that the instrument and the saturated solutions reach thermal equilibrium with the environment before starting the calibration procedure. It is mostly important for a good calibration that the probe and the solution have the same temperature. Please remember that plastic material is a bad conductor of heat.

To configure the analog outputs, proceed as follows:

1. Unscrew the protection grid of the probe and the cap of the saturated solution.
   Note: if there is any liquid inside the measurement chamber, dry it with clean absorbent paper. To extend the saturated solutions life, it is important that solutions stay open only for the time necessary to insert the sensor.

2. Screw the probe to the saturated solution container. Do not touch the sensitive element with your hands or other objects or liquids.

3. After inserting the sensor, wait for at least 30÷45 minutes.

4. Connect the transmitter to the PC (by using an RS485/USB or RS485/RS232 converter).

5. Start a standard serial communication program, such as Hyperterminal. Set the COM port number to which the transmitter will be connected, set the Baud Rate to 57600 and the communication parameters as follows:

   Data Bits: 8   Parity: None   Stop Bits: 2

6. Start with the transmitter not powered. Switch the transmitter on and wait to receive the **&** character, then send (within 10 s from power on) the **@** command and press **Enter**.
   Note: if the transmitter does not receive the **@** command within 10 seconds from power on, the RS485 MODBUS mode is automatically activated. In such a case, it is necessary to switch off and on again the transmitter.

7. Send the command **S0** to read the temperature measured by the probe.

8. Read the relative humidity value corresponding to the measured temperature in the relative humidity-solution temperature correspondence table. For 75% RH solution the table is the following:

Temp. °C	HD75
10	75.67
15	7 61
20	75.47
25	7 29
30	75.09
35	7 87
40	74.68
45	7 52
50	74.43

9. Send the command **CAL START**.

   Note: the command CAL START is disabled after 5 minutes of inactivity.

10. Send the serial command **CHAnnnn**, where nnnn is the value previously read in the saturated solution table. The value is written without decimal point (ex.: indicate 7547 if the value read in the table is 75.47%) and must be between 7300 (73.00%) and 7700 (77.00%). The transmitter replies with **&|** if the command is correctly received.

11. Remove the probe from the 75% RH saturated solution and screw it to the 33% RH saturated solution.

12. After inserting the sensor, wait for at least 30÷45 minutes.

13. Send the command **S0** to read the temperature measured by the probe.

14. Read the relative humidity value corresponding to the measured temperature in the relative humidity-solution temperature correspondence table. For 33% RH solution the table is the following:

Temp. °C	HD33
10	33.47
15	3 30
20	33.07
25	3 78
30	32.44
35	3 05
40	31.60
45	3 10
50	30.54

15. Send the command **CAL START**.

   Note: the command CAL START is disabled after 5 minutes of inactivity.

16. Send the serial command **CHBnnnn**, where nnnn is the value previously read in the saturated solution table. The value is written without decimal point (ex.: indicate 3307 if the value read in the table is 33.07%) and must be between 3000 (30.00%) and 3500 (35.00%). The transmitter replies with **&|** if the command is correctly received.

17. Place again the sensor protection grid, avoiding to touch the sensitive element. After use, immediately close with its cap the saturated solution used.

   Note: store the salt solutions in the dark at a temperature of about 20 °C.

ORDERING CODES

HD9008.T17S Humidity and temperature transmitter, Pt100 sensor. RS485 MODBUS-RTU output. Temperature measuring range -40...+60 °C. Power supply 5...30 Vdc. Thermoplastic housing. Dimensions ⌀26 x 185 mm. Connection via screw terminals.

RS48 PC connecting cable for the MODBUS parameters configuration. With built-in RS485/USB converter. Free wires on instrument side and A-type USB connector on PC side.

HD75 Saturated solution for calibration at 75% RH.

HD33 Saturated solution for calibration at 33% RH.

HD9008.21.1 Holder for vertical probes. Distance from wall 250 mm. Hole Ø 26 mm.

HD9008.21.2 Holder for vertical probes. Distance from wall 125 mm. Hole Ø 26 mm.

HD9007A-1 12-ring protection from solar radiations. Supplied with mounting bracket.

HD9007A-2 16-ring protection from solar radiations. Supplied with mounting bracket.