



# ACTIVE AND PASSIVE TEMPERATURE AND HUMIDITY TRANSMITTER

DO 9861T humidity and temperature transmitters convert the humidity and temperature measured by two sensors into a 4±20 mA signal. An LCD indicator allows the value of the process signal and the various parameters to be displayed.

The accurate design and choice of components make the instruments precise and reliable for a long working life. The R.H. sensor is temperature compensated. The instruments have two sensors, a capacitive sensor for measuring relative humidity and a Platinum resistive sensor (Pt100, 100 Ω at 100°C) for measuring temperature.

The transmitters measure the relative humidity (% RH), the sensor temperature (TC), and calculate the wet bulb temperature (WT), the dew point temperature (DP), the absolute humidity (gr/m3) and the mixing ratio (gr/kg - grams of water per kg of dry air). The temperatures are expressed in degrees Celsius.

The measurements refer to an atmospheric pressure of 1013.25 mbar. Once the physical quantity to be checked has been selected, the output current will be proportional and the status of the relays will depend on that variable.

## Technical characteristics DO 9861T

Relative humidity input	Capacity	300 pF
	Transducer energizing	10 kHz
	Cable length	<10 m multiple screen (about 2 nF) additional error about 0.003 pF/pF
	Accuracy	Instrument: 0.1% of reading ±1 digit ±0.01%/°C Sensor: ±2.5% (5...90%), +3/-2.5% (90...98%)
	Working range of sensor	Relative humidity: 5...98% @ 23°C Dew point temperature (DP°C): -60...+100 DP°C (-20 DP°C @ 23°C) Temperature range: -40...+150°C

During use, check that the sensor is compatible with the atmosphere used

Temperature input	2/4 wires Pt100	-50...+199.9°C
	Transducer energizing	0.5 mA dc
	Cable length	<10 m not screened <50 m screened (about 5 nF)
	Accuracy	0.2°C ±0.1% of reading ±0.01°C/°C

Output current A and B	4,00...20,00 mA	Dry bulb temperature -50.0...+199.9°C
		Wet bulb temperature -50.0...+199.9°C
		Relative humidity 0.0...+100.0% RH
		Absolute humidity 0.0...+1999 gr/m3
	Accuracy	±2.5% RH 0.5% of reading ±0.02 mA

R Load	Load resistance	$R_{Lmax} = \frac{V_{dc}-9}{0,022}$ $R_{Lmax} = 636 \Omega$ @ Vdc = 24 Vdc
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Relay outputs	A and B	Bistable exchange contacts 3 A/230 V ac potential free contact
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Feed	Passive	4±20 mA, 10...35 V dc, see figure 2
	Active	24 or 230 V ac -15/+10%, 1 VA, 48...62 Hz, see figure 1

Response time*	Without filter	6 seconds
	With filter	3 minutes

Case	Front panel	122x120 mm
	External dimensions	122x120x56 mm
	Protection class	IP64

\* time required to reach 63% of the final variation.

## Key functions

**PRG** Programming of the parameters is activated by pressing the PRG key along with the ▲ and ▼ keys. The message P1 appears on the display to indicate that parameter P1 is being programmed. When the PRG key is pressed in sequence the messages P2, P3, etc. appear as well as the corresponding parameters. After P13 the instrument returns to normal function.

**SET** Key for setting the relay intervention threshold. The ON or OFF symbol appears on the display to indicate that the instrument is showing the switching on or the switching off threshold of relay A or relay B.

**TD/TW** When this key is pressed the dry bulb temperature TD or the wet bulb temperature TW is shown at the top of the display

**UNIT** - When this key is pressed the dew point temperature (DP), the relative humidity (% RH), the absolute humidity (gr/m3 - grams of water per cubic metre of dry air) or the mixing ratio (gr/kg, grams of water per kg of dry air)

## EXAMPLES OF CONNECTION OF THE DO 9861T

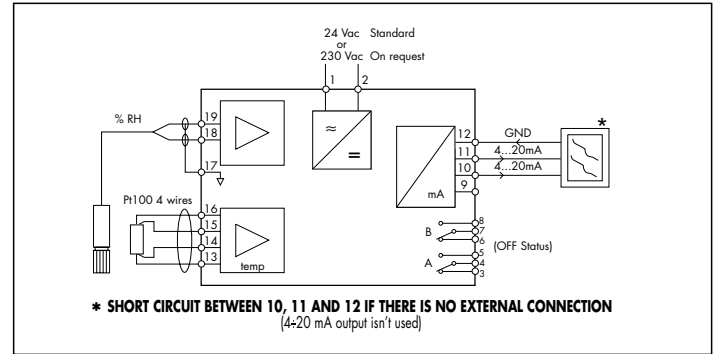


Fig. 1: Connection of the humidity and temperature sensor, screened cable, Pt100 4 wires + screen, active transmitter with alternating power supply, double analog output 4±20 mA

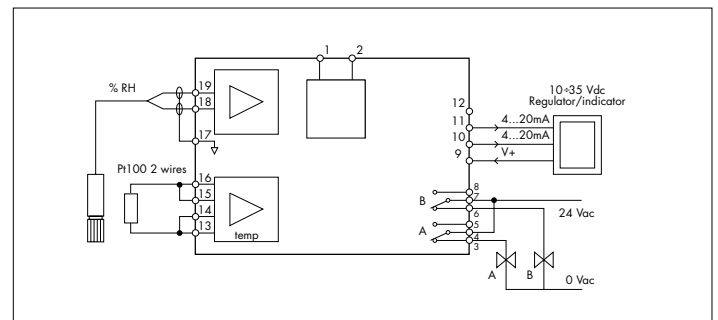
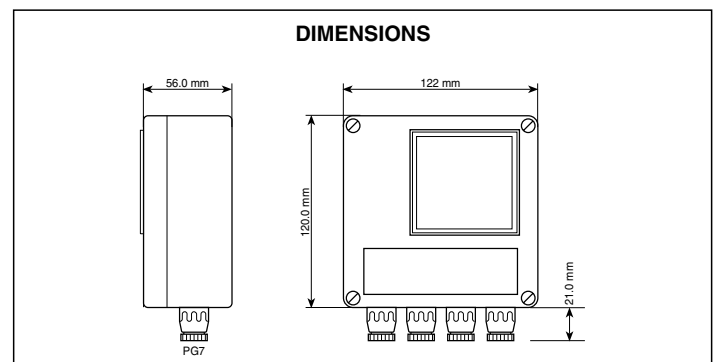
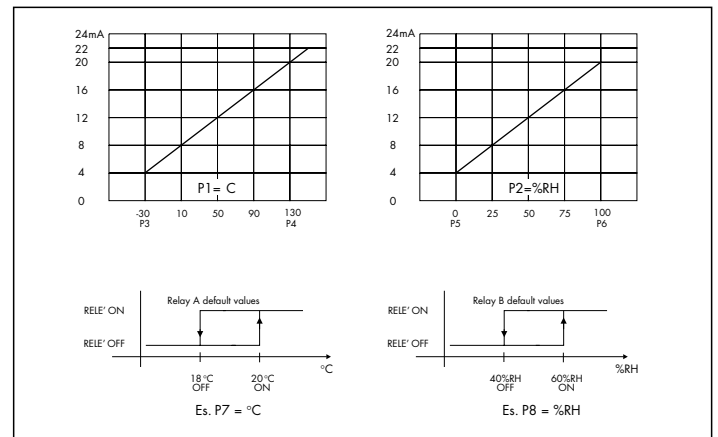


Fig. 2: Connection of the humidity and temperature sensor, screened cable, Pt100 2 wires, passive transmitter, fed with 3 wires by a regulator/indicator, double analog output 4±20 mA.



is shown at the bottom of the display.

- When pressed along with the CAL key it activates the humidity sensor calibration function.

**OK** Confirms the programming parameters, or the relay SET values, and stores them.

**CAL** - When pressed along with the UNIT key it activates the humidity sensor calibration function.

- Key used to confirm the calibration of the humidity sensor.

**▲** - Key used to increase the value displayed during programming of the parameters.

- During programming of the relay SET points.
- During calibration.

**▼** - Key used to decrease the value displayed during programming of the parameters.

- During programming of the relay SET points.
- During calibration.

## Display

### Symbol description

**TD** indicates that the value shown is the dry bulb temperature in °C.

**TW** indicates that the value shown is the wet bulb temperature in °C.

**DP** indicates that the value shown is the dew point temperature in °C.

**% RH** indicates that the value shown is the relative humidity.

**gr/m3** indicates that the value shown is the absolute humidity (gr per m3 of air).

**gr/kg** indicates that the value shown is the mixing ratio (gr per kg of dry air).

**A** indicates that relay A is ON.

**B** indicates that relay B is ON.

**ON** indicates that the value shown corresponds to the closing threshold of the contacts of relay A or B.

**OFF** indicates that the value shown corresponds to the closing threshold of the contacts of relay A or B.

### Programming the parameters

It is possible to select the corresponding quantities:

- Dry bulb temperature (TD °C)
- Wet bulb temperature (TW °C)
- Dew point temperature (DP °C)
- Relative humidity (% RH)
- Absolute humidity (a gr/m3)
- Mixing ratio (x gr/kg).

The range that may be set for each quantity is:

- Dry bulb, wet bulb and dew point temperature: -60.0...+100.0°C
- Relative humidity: 0.0...100.0% RH
- Absolute humidity: 0.0...1999 gr/m3
- Mixing ratio: 0.0...1999 gr/kg.

### Parameters for the DO 9861T

P1 Physical quantity on which depends the operation of the analog output 1 (TD, TW, DP, % RH, gr/m3, gr/kg).

P2 Physical quantity on which depends the operation of the analog output 2 (TD, TW, DP, % RH, gr/m3, gr/kg).

P3 Value corresponding to 4 mA at analog output 1.

P4 Value corresponding to 20 mA at analog output 1.

P5 Value corresponding to 4 mA at analog output 2.

P6 Value corresponding to 20 mA at analog output 2. P7 Physical quantity on which depends the operation of relay A (TD, TW, DP, % RH, gr/m3, gr/kg).

P8 Physical quantity on which depends the operation of relay B (TD, TW, DP, % RH, gr/m3, gr/kg).

P9 Delay time in intervention of relay A. May be set between 0 and 255 seconds both during the opening and the closing.

P10 Delay time in intervention of relay B. May be set between 0 and 255 seconds both during the opening and the closing.

P11 Calibration of Pt100 probe.

P12 Current calibration of output 1 at 4 mA and 20 mA.

P13 Current calibration of output 2 at 4 mA and 20 mA.

P14 R.H. calibration after the replacement of R.H. sensor.

To alter one of the parameters, press the PRG key until the message corresponding to the parameter that is to be changed appears on the display.

Using the ▲ and ▼ keys, bring the parameter shown to the desired value.

Press OK to confirm.

Before starting programming, select the quantity to be displayed with the TD/TW and UNIT keys; the instrument will use this as the default value. If there is an interruption in the power supply this value will be displayed when it starts again.

To change the quantity shown, just press UNIT or TD/TW.

### Setting the relay SET points

- Press the SET key, the ON symbol appears on the display and the letter A to

indicate that the value displayed corresponds to the switching-on threshold of relay A.

- To change this value press the ▲ and ▼ keys.

- Press SET, the OFF symbol appears and the letter A to indicate that the value displayed corresponds to the switching-off threshold of relay A.

- To change this value press the ▲ and ▼ keys.

- Press the SET key, the ON symbol appears on the display and the letter B to indicate that the value displayed corresponds to the switching-on threshold of relay B.

- To change this value press the ▲ and ▼ keys.

- Press SET, the OFF symbol appears and the letter B to indicate that the value displayed corresponds to the switching-off threshold of relay B.

- To change this value press the ▲ and ▼ keys.

- Press SET, the instrument stores the values and returns to normal operation.

NOTE: While the SET point is being set (ON or OFF symbols lit), the instrument returns to normal operation if no key is pressed for 2 minutes.

### Calibration of the humidity sensor in DO 9861T transmitter

#### Calibrating the offset of the humidity sensor:

- Insert the probe in the container of the 75.4% relative humidity saturated solution. Wait at least 30 minutes.

- With the UNIT key select the indication of relative humidity (% RH) on the display.

- With the TD/TW key select the indication of the dry bulb temperature (TD).

- Press the CAL and UNIT keys together; the message CAL will appear at the top of the display.

- With the ▲ and ▼ keys adjust the relative humidity value indicated on the display to the correct value corresponding to the temperature and saturated humidity of the salt used.

- Wait a few minutes to ensure that the reading is stable.

- Press CAL to confirm this value. The message CAL will disappear.

- Remove the probe from the container and replace the cap of the container immediately.

#### Calibrating the slope of the humidity sensor:

- Insert the probe in the container of the 33% relative humidity saturated solution. Wait at least 30 minutes.

- With the UNIT key select the indication of relative humidity (% RH) on the display.

- With the TD/TW key select the indication of the dry bulb temperature (TD).

- Press the CAL and UNIT keys together; the message CAL will appear at the top of the display.

- With the ▲ and ▼ keys adjust the relative humidity value indicated on the display to the correct value corresponding to the temperature and saturated humidity of the salt used.

- Wait a few minutes to ensure that the reading is stable.

- Press CAL to confirm this value. The message CAL will disappear.

- Remove the probe from the container and replace the cap of the container immediately.

#### NOTE:

**1. The point at 75% RH must always be calibrated before the one at 33% RH.**

**2. If the instrument measures a value higher than 50% RH it calibrates the offset, if it measures a lower value it calibrates the slope of the sensor.**

**3. After the replacement of the R.H. sensor, calibration of humidity has to be carried out by means of the saturated solutions, first at 75% and then at 33%, as per the following instructions:**

- **Insert the probe in the container of the 75% R.H. saturated solution.**

**Wait at least 30 minutes.**

- **Press the PROG key until the message P14 appears on the display.**

- **Press CAL and OK keys at the same time.**

- **With the ▲ and ▼ keys adjust the relative humidity value indicated on the display to the correct value of the salt used.**

- **Press CAL key to confirm.**

- **Insert the probe in the container of the 33% R.H. saturated solution.**

**Wait at least 30 minutes.**

- **With the ▲ and ▼ keys adjust the relative humidity value indicated on the display to the correct value of the salt used.**

- **Press CAL key to confirm. The message CAL disappears, calibration procedure is finished and now the instrument starts measuring again.**

#### Calibrating the Pt100 temperature sensor (100 Ω at 0°C)

- Connect the probe to the instrument. Press the PRG key until the message P11 appears on the display.

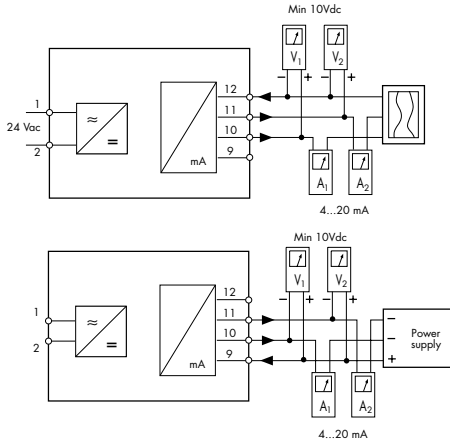
- Press the CAL key twice. The message P11 appears at the bottom of the display while the temperature is shown at the top.

- Immerse only the Pt100 sensor and a precision thermometer, for reference, in the zero calibration bath. Wait until the reading has become stable.

- With the ▲ and ▼ keys adjust the temperature value measured by the Pt100 sensor so that it coincides with the value on the reference thermometer.
- Immerse the Pt100 sensor and the reference thermometer in the full scale calibration bath. Wait until the reading has become stable.
- With the ▲ and ▼ keys adjust the temperature value measured by the Pt100 sensor so that it coincides with the value on the reference thermometer.
- Press OK to confirm.

**N.B.: If the temperature shown by the instrument is between  $\pm 12^{\circ}\text{C}$ , the instrument calibrates the probe offset, otherwise it calibrates the gain.**

### Calibrating the analog output



- Connect a precision milliammeter to analog output 1, for reference.
- Press the PRG key until the message P12 appears on the display. The message P12 appears at the top of the display while 4.0 appears at the bottom to indicate calibration at 4 mA.
- With the ▲ and ▼ keys adjust the value of the output current so as to have an indication of 4.00 mA on the reference milliammeter.
- Press the CAL key. The message P12 appears at the top of the display while 20.0 appears at the bottom to indicate calibration at 20 mA.
- With the ▲ and ▼ keys adjust the value of the output current so as to have an indication of 20.00 mA on the reference milliammeter.
- Connect a precision milliammeter to analog output 2.
- Press the PRG key until the message P13 appears on the display. The message P13 appears at the top of the display while 4.0 appears at the bottom to indicate calibration at 4 mA.
- With the ▲ and ▼ keys adjust the value of the output current so as to have an indication of 4.00 mA on the reference milliammeter.
- Press the CAL key. The message P13 appears at the top of the display while 20.0 appears at the bottom to indicate calibration at 20 mA.
- With the and keys adjust the value of the output current so as to have an indication of 20.00 mA on the reference milliammeter.
- Press OK to confirm.

### Error signals

- OFL** Signal which appears during measurement when the value to be shown is out of scale.
- ERR** Signal which appears to indicate that the sensor is faulty or is disconnected, if referring to the dry bulb temperature or the relative humidity. If referring to the other parameters, it indicates that it is impossible to calculate that value (DP, gr/m<sup>3</sup>, gr/kg).
- Signal which appears to indicate that the temperature sensor is faulty or is disconnected.
- E4** Reading error on the EEPROM.

### Order code

- DO 9861T:** Two outputs 4÷20 mA to measure relative humidity and temperature.
- DO 9861TV/1:** Vertical fixed probe L=130 mm.
- DO 9861TO/2:** Horizontal probe L=330 mm, sliding joint.
- DO 9861TC/1-2:** Probe L=130 mm, cable L=2 meters.
- DO 9861TC/2-5:** Probe L=330 mm, sliding joint, cable L=5 meters.
- DO 9861TC/2-10:** Probe L=330 mm, sliding joint, cable L=10 meters.
- HD75:** saturated salt solution 75% R.H. with adapter M 12x1
- HD33:** saturated salt solution 33% R.H. with adapter M 12x1
- HD9008.21.1:** holder for vertical sensor, wall distance 250mm, hole Ø 26.  
Use with reduction HD9008.26.14
- HD9008.21.2:** holder for vertical sensor, wall distance 125mm, hole Ø 26.  
Use with reduction HD9008.26.14
- HD9008.26/14:** reduction for Ø 26 and Ø 14mm holes, for HD9008.21.1 and HD9008.21.2
- HD9008.31:** flange with sensor block Ø 14mm for duct sensors of the series TC and TO.



HD 9008.31 flange with sensor block.



Holder HD 9008.21.2 +  
HD 9008.26/14 125 mm.



Holder HD 9008.21.1 +  
HD 9008.26/14 250 mm.

