

# H290D

**Humidity Transmitter  
with optional temperature output**

## **INSTRUCTION MANUAL**



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## CONTENTS

|   |    |
|---|----|
| GENERAL DESCRIPTION                                       | 3  |
| OPERATION   | 4  |
| Power Supply  | 4  |
| Operating limits  | 4  |
| Automatic temperature compensation of the humidity sensor | 5  |
| Analog output signals                                     | 5  |
| Optional temperature sensor                               | 5  |
| Sensor Protection   | 5  |
| INSTALLATION  | 6  |
| General recommendations                                   | 6  |
| Mechanical installation                                   | 7  |
| Terminal blocks and wiring diagrams                       | 8  |
| MAINTENANCE   | 10 |
| Cleaning or replacing the probe dust filter               | 10 |
| Periodic calibration check                                | 10 |
| Service connector   | 11 |
| Service cable   | 12 |
| SPECIFICATIONS  | 13 |
| APPENDIX 1: Practical Advice for Measuring Humidity       | 14 |
| APPENDIX 2: Field adjustment of the analog outputs        | 15 |
| APPENDIX 3: Accessories for the H290D                     | 15 |

### PLEASE, READ THIS FIRST:

- Check the product for any physical damage that may have occurred during shipment. We carefully pack and routinely insure all shipments. If any damage has occurred, it is your responsibility to file a claim with the carrier, prior to returning the damaged product. Please note that our warranty does not cover damage during shipment.
- Prior to installation, get fully familiarized with the operating limits of the product and with the installation instructions provided in this manual.
- Do not unnecessarily remove the sensor protection (dust filter or slotted cap) from the probe. Both sensors (humidity and temperature) can be mechanically damaged by careless removal of the protection. The ROTRONIC HYGROMER™ humidity sensor looks like a small white paper tag. Do not remove from the probe!

Each ROTRONIC instrument is carefully calibrated before shipment. No further adjustments should be required before installation. If you have any question or problem, please visit our web site at [www.rotronic-usa.com](http://www.rotronic-usa.com) or call our service department at 631/427-3898 and press 5 (or ask for extension 21).

## GENERAL DESCRIPTION

The H290D is a humidity transmitter designed for OEM applications. The H290D consists of a probe that is hard wired to a small open board with a 2 m / 6.5 ft cable. Humidity is measured with the ROTRONIC HYGROMER™ IN-1 capacitive humidity sensor. This sensor offers fast response and exceptional stability, even in high humidity environments. Sensor durability has proven to be excellent in a wide range of applications.

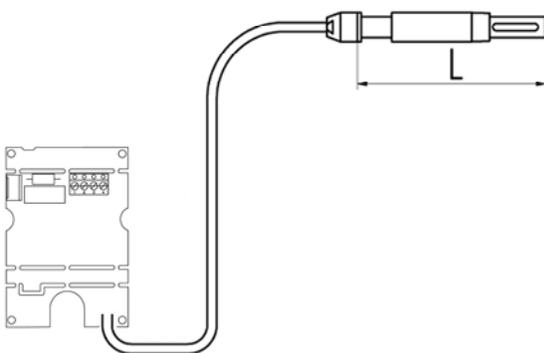
The H290D is suitable for measurements within the range of 0...100%RH at temperatures within the range of -40 to 150 °C (-40 to 302 °F). At temperature values above 80°C, the maximum humidity to which the humidity sensor can be exposed is gradually limited. Both the probe and sensor survive exposure to temperature in the range of -75 to 200°C / -100 to 390°F.

The probe of the H290D is equipped with a Pt100 RTD temperature sensor. Data from this sensor is used to compensate the effect of temperature on the humidity sensor so as to maintain accurate humidity measurements over a wide range of temperature values.

As an option, the probe of the H290D can be equipped with an additional temperature sensor (RTD or thermistor, make and model to be specified when ordering). In that case, the H290D is equipped with an additional 3-position terminal block for direct connection to the temperature sensor. As an alternative option, data from the temperature compensation RTD can be made available as a voltage or current output signal (consult factory).

Two basic types of electronic circuit are available: H292D: 2-wire, loop powered (4...20 mA current signal) and H293D: 3-wire (voltage or current signal). The analog output signal is linear and can be transmitted over a length of cable to a remote display, recorder, controller or data processing unit. Digital signal processing within the H290D ensures consistent product performance and also facilitates the task of field maintenance:

- Operation of the H290D can easily be verified in the field by connecting a HygroPalm 3 indicator to the internal service connector of the transmitter. This is done without interrupting the output signals.
- The HygroPalm 3 indicator also allows digital, potentiometer-free adjustment of the H290D against a suitable reference.



Probe diameter: 15mm / 0.59"

Probe length (L):

standard 100 mm / 3.9"

optional: 250 mm / 9.8"

Probe cable: 2 m / 6.5 ft

Note: the short probe length (100 mm / 3.9") is designed for full immersion in the environment to be measured. Do not use this probe in a through wall installation when there is a significant temperature difference between the two sides of the wall as this will result in measurement errors.

## OPERATION

### *Power Supply*

#### **H292D (2-wire)**

This model accepts 10...28 VDC - depending on the load connected to the output(s). The minimum supply voltage can be determined as follows:  $V_{min} = 10 V + (0.02 \times Load)$  with the load resistance in ohms. For the maximum load of 250Ω, the minimum supply voltage is  $10 + (0.02 \times 250) = 15$  VDC. With both output circuits closed, the maximum current consumption is 40 mA.

#### **H293D (3-wire)**

This model accepts 12 to 24 VAC or 10 to 35 VDC (minimum 15 VDC for current outputs). With both output circuits closed, the maximum current consumption is 50 mA. The common terminal of the output signals is tied to the power supply AC neutral or DC negative.

### *Operating limits*

The board of the H290D can operate within 0 to 99 %RH non-condensing and -40 to 60°C / -40 to 140°F.

For measurement purposes, the useful temperature limits at the probe are -40 to 160°C / -40 to 320°F. Both the probe and sensors survive exposure to temperature within the range of -75 to 200°C / -100 to 390°F. Operating the transmitter and/or its probe outside of the operating limits can result in permanent damage and is not covered under the warranty.

At temperatures below 80°C / 176°F, the humidity sensor can operate for long periods of time in environments up to 100%RH. At higher temperature, the maximum humidity to which the humidity sensor can be subjected is as follows:

- . 100 %RH up to 80°C / 176°F
- . 90 %RH at 90 °C / 194 °F
- . 50 %RH at 120 °C / 248°F
- . 20 %RH at 150 °C / 302°F

Exceeding the above limits may permanently "shift" the humidity sensor and require a new calibration or replacement of the RH sensor. ***Sensor damage due to exposure beyond these limits is not covered under the warranty.***

When measuring at high humidity, condensation may occur on the humidity sensor when the sensor temperature is lower than the temperature of its environment. At temperatures below 80 °C / 176°F condensation does not damage the sensor. However, condensation causes the humidity signal to stay at its maximum value for as long as condensation is present on the humidity sensor. ***To ensure meaningful readings in high humidity applications, be sure to provide tight temperature control and limit the rate at which temperature can increase.***

### ***Automatic temperature compensation of the humidity sensor***

Practically every make of relative humidity sensor requires a signal correction in order to maintain accurate measurements over a wide range of temperature conditions. The probe of the H290D is equipped with a Pt100 RTD temperature sensor used to provide automatic compensation for the effect of temperature on the humidity sensor.

The temperature compensation uses normal room temperature as a reference. Because of this, adjustment of the humidity output signal is always done at normal room temperature.

### ***Analog output signals***

Within the H290D transmitter series, the signals provided by the humidity sensor and compensation RTD are digitized. The resolution of the internal digital signals is 0.03 %RH and 0.03°C (0.06°F). These values represent the absolute resolution limit of the H290D series.

**Humidity (standard):** the analog humidity signal is generated by a 12-bit D/A converter (maximum 4096 steps). The standard range of the humidity analog signal is 0...100 %RH. Partial ranges are available on request. Resolution of the analog humidity signal and signal noise are the same as for the internal digital signal: 0.03 %RH.

**Temperature (optional):** the optional analog temperature signal is also generated by a 12-bit D/A converter. Resolution (noise) of the optional analog temperature output signal depends on the span of the temperature range. With a span of up to 100°C / 200°F, the analog signal resolution is the same as the resolution of the internal digital signal resolution: 0.03°C / 0.06°F. Accuracy of the optional temperature signal depends also on the range (consult factory).

Information on the analog output(s) can be found on identification labels located on the shipping box and on the printed circuit board.

### ***Optional temperature sensor***

The probe of the H290D is pre-wired for an additional temperature sensor. As an option, the factory can install on the probe an additional RTD or a thermistor (make and model to be specified by the customer). When the H290D is supplied with this option, an additional 3-position terminal block is also provided. This permits either a direct 2-wire or 3-wire connection with the temperature sensor.

### ***Sensor Protection***

The standard filter used to provide mechanical protection to the sensors of the H290D is a plastic slotted cap with a wire mesh insert. This filter is suitable for "clean" applications and should not require replacement. For other applications, we recommend using the optional filter. This consists of a metal base with a replaceable cartridge. Different types of cartridges are available. The stainless steel wire mesh cartridge is suitable for most applications.

## INSTALLATION

**Do not unnecessarily remove the dust filter from the probe. The sensors can easily be damaged when not protected.**

### ***General recommendations***

Relative humidity is extremely dependent on temperature. Proper measurement of relative humidity requires that the probe and its sensors be at exactly the temperature of the environment to be measured. Because of this, the location where you choose to install the probe can have a significant effect on the performance of the instrument. The following guidelines should guarantee good instrument performance:

- Select a representative location: install the probe where humidity, temperature and pressure conditions are representative of the environment to be measured.
- Provide good air movement at the probe: air velocity of at least 200 ft/ minute (1 meter/second) facilitates adaptation of the probe to changing temperature.
- Avoid the following: (1) Close proximity of the probe to a heating element, a cooling coil, a cold or hot wall, direct exposure to sun rays, etc. (2) Close proximity of the probe to a steam injector, humidifier, direct exposure to precipitation, etc. (3) Unstable pressure conditions resulting from excessive air turbulence.
- Immerse as much of the probe as possible in the environment to be measured.
- Prevent the accumulation of condensation water at the level of the sensor leads. Install the probe so that the probe tip is looking downward. If this is not possible, install the probe horizontally.

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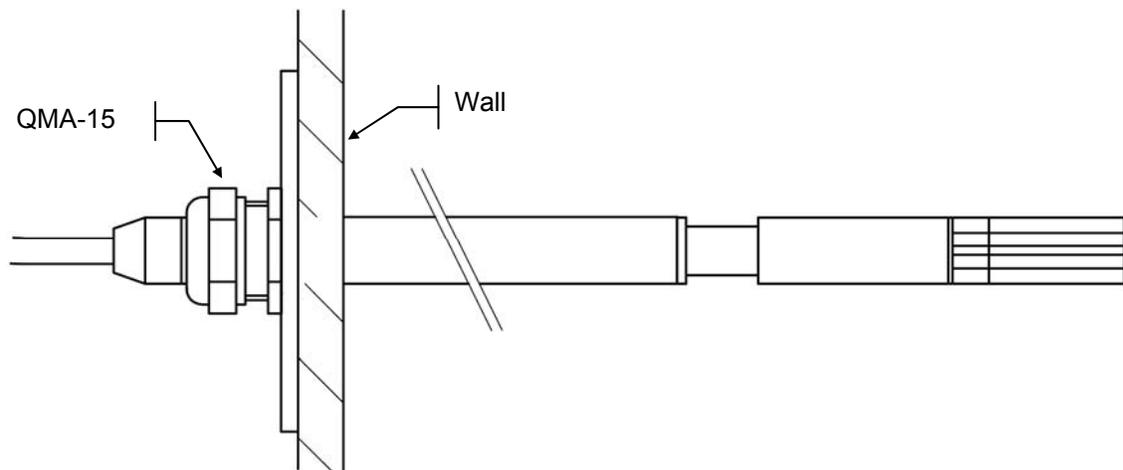
## ***Mechanical installation***

Insufficient probe immersion typically creates errors in the measurement of both humidity and temperature and may even cause a malfunction.

- **Standard 100 mm (3.9") probe:** this probe is generally not suitable for through wall installation and is designed for full immersion in the environment to be measured. At least 15 to 20" of the probe cable should be inserted together with the probe.
- **Optional 250 mm (9.8") probe:** this probe is designed for through wall installation. To facilitate probe installation and removal, we recommend using a probe holder mod. QMA-15. This holder is a mounting flange that is equipped with a compression fitting.

### **Installation of the 250 mm probe**

Make sure that about 230 mm (9") of the probe are immersed in the environment to be measured.

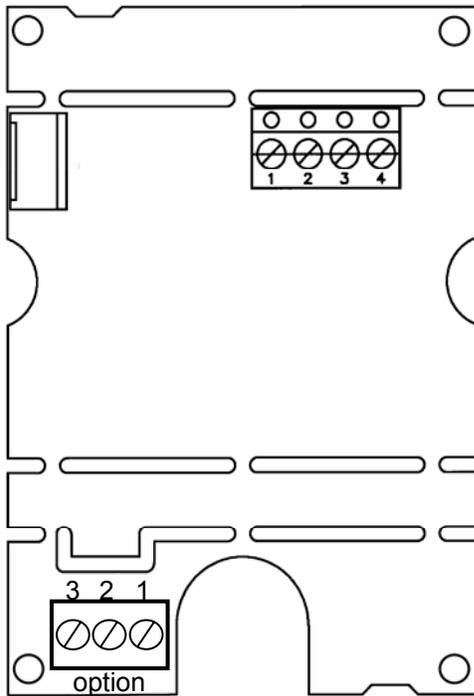


Installation Note: You may want to provide an orifice at a distance of about 3" from the probe of the transmitter for future use by a reference probe and HygroPalm indicator.

## Terminal blocks and wiring diagrams

Note: for manufacturing reasons, the H290D is equipped with a 4-pos terminal block. The standard H290D provides an analog output signal only for humidity and only 3 positions of the terminal block have to be wired.

### H292D (2-wire), loop powered

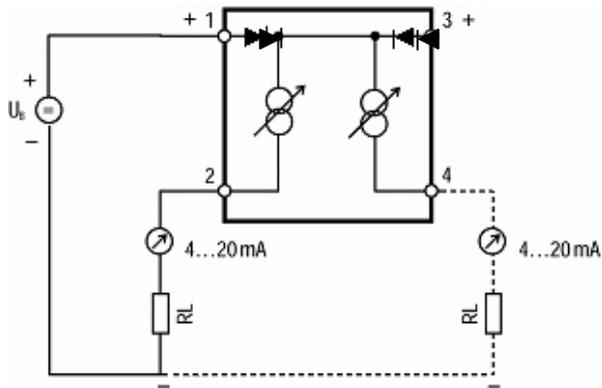


- 1: 10...28 VDC (+)
- 2: Humidity analog out
- 3: 10...28 VDC (+)
- 4: Temperature analog out (optional)

Note: connect either terminal 1 or 3 to the plus side of the power supply. These terminals are internally connected and the H292D will operate normally with just one of these terminals is being used.

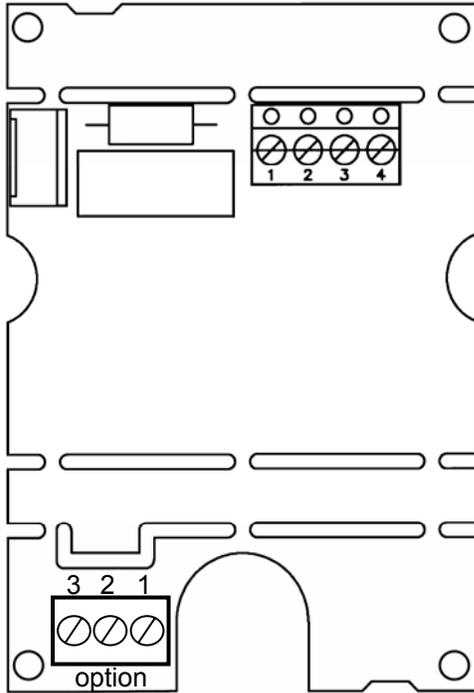
Optional Terminal Block: used for direct connection to an additional temperature sensor. Pos 2 and 3 are tied at the probe tip.

When the H292D has been factory configured to provide both a humidity and a temperature analog signal (optional), both current loops must be closed!



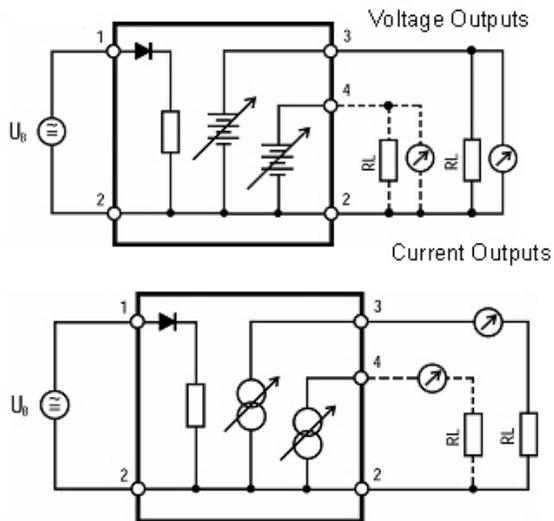
| Terminal Block | Description                                 |
|----------------|---|
| 1 and 3        | 10...28 VDC (+)                             |
| 2              | relative humidity output (analog signal)    |
| 4              | optional temperature output (analog signal) |

**H293D (3-wire)**



1: 10 (15) ...35 VDC (+) or 12 to 24 VAC phase  
 2: DC (-) or AC neutral  
 3: Humidity analog out  
 4: Temperature analog out (optional)

Optional Terminal Block: used for direct connection to an additional temperature sensor. Pos 2 and 3 are tied at the probe tip.



| Terminal Block | Description                                   |
|----------------|---|
| 1              | 10 (15) ...35 VDC (+) or 12 to 24 VAC phase   |
| 2              | DC (-) or AC neutral                          |
| 3              | Relative humidity output ( analog signal +)   |
| 4              | Optional temperature output (analog signal +) |

We generally recommend grounding the negative side of the DC power supply, especially if the electronics will be subjected to a low humidity environment (35 %RH or less).

In order to determine the maximum length of cable that can be used to connect the transmitter to other devices, the first step is to find out what is the resistance per unit of length of the cable that you plan on using.

- Current outputs: the maximum permissible cable length, connecting the unit to other devices, is determined by the total resistance resulting from the addition of the cable resistance and that of the devices connected in series with the unit. This resistance should not exceed 250 ohms.
- Voltage outputs: the maximum cable length can be determined under consideration of the voltage drop caused by the current flowing to the devices connected to the unit. The voltage drop in the cable depends both on cable resistance and on the equivalent resistance of the devices connected in parallel to the unit. The total resistance connected to each unit output must at least be equal to 1000 ohms. Cable resistance should not be more than 1/1000 of the load resistance.

## MAINTENANCE

### *Cleaning or replacing the probe dust filter*

Standard filter: the standard filter is a plastic slotted cap with a wire-mesh insert. This filter is designed for “clean” applications and should not require replacement. Warning: removing this filter may result in mechanical damage to the sensors.

Optional filter: this filter consists of a metal base and a removable filter cartridge attached to the base with a screw. Depending on the conditions of measurement, the filter cartridge should be checked from time to time. If necessary, the filter cartridge can be easily removed for cleaning. To maintain the mechanical protection of the sensors, leave the metal base on the probe.



Corroded, discolored or clogged filter cartridges should be replaced.

### *Periodic calibration check*

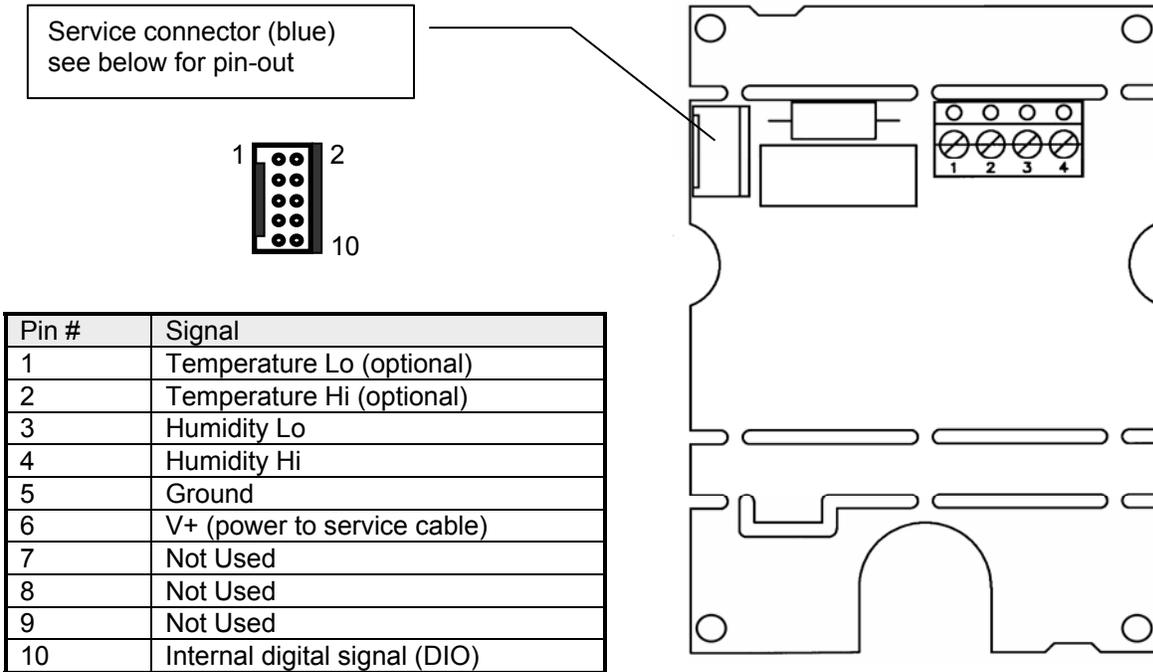
As long as the probe is operated in an environment free of chemical contaminants and within the operating limits, the long term stability of the humidity sensor is typically better than 1 %RH per year. For maximum accuracy, calibration of the unit may be verified every 6 to 12 months.

Both the Pt 100 RTD temperature sensor and associated electronics are very stable and should not require any calibration after the initial factory adjustment.

Field adjustment of the H290D series requires a HygroPalm 3 indicator and a service cable ACRLXB5. For routine calibration checks, the probe should be verified at one or two values of humidity. For more details, see **service connector, service cable and appendix 2 - field adjustment of the analog outputs**.

## Service connector

The keyed 10-pin service connector is used to connect the H290D to a HygroPalm 3 indicator with a service cable. For details, see service cable.



### Pins 1, 2, 3 and 4 (analog signals):

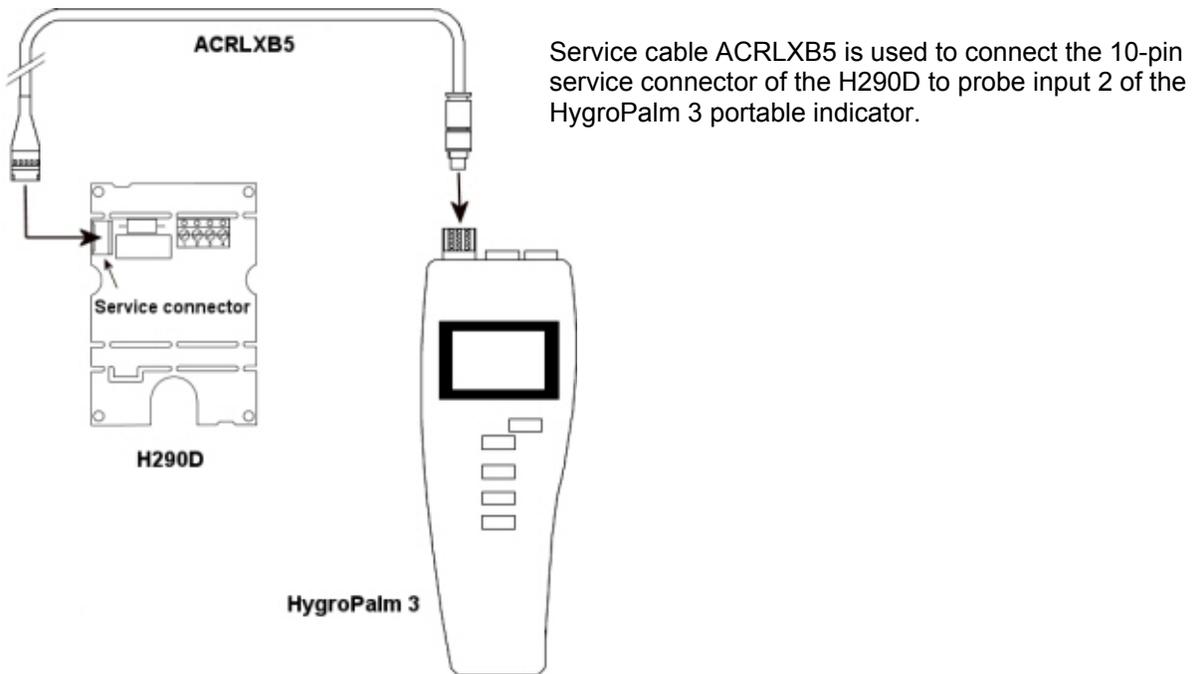
#### Current outputs:

Pins 1 and 2, as well as pins 3 and 4, are connected to each side of a 49.9 ohm resistor (0.1% precision) which is in series with the output current. With an output signal of 4 ... 20 mA the voltage measured across pins 1 and 2 (or pins 3 and 4) is within the range of 200 ... 998 mV.

#### Voltage outputs:

Pins 1 and 2, as well as pins 3 and 4 have exactly the same voltage as the corresponding output

## Service cable



Together with the HygroPalm 3, the service cable allows any of the following:

- a) Display locally the digital signals of the transmitter on the HygroPalm 3.

This can be used to validate the entire measuring loop: transmitter, wiring and central processing unit.

Note: the HygroPalm should be configured to read temperature in the same unit as the transmitter. Changing the temperature unit can be done directly on the HygroPalm.

- b) Single/multi-point adjustment against a reference environment.

A known reference environment is required for a multi-point adjustment and it is not necessary to connect any probe to the HygroPalm. For detailed instructions, see separate HygroPalm manual – HygroPalm Function Menu – Adjust M.PT or Adjust 1PT.

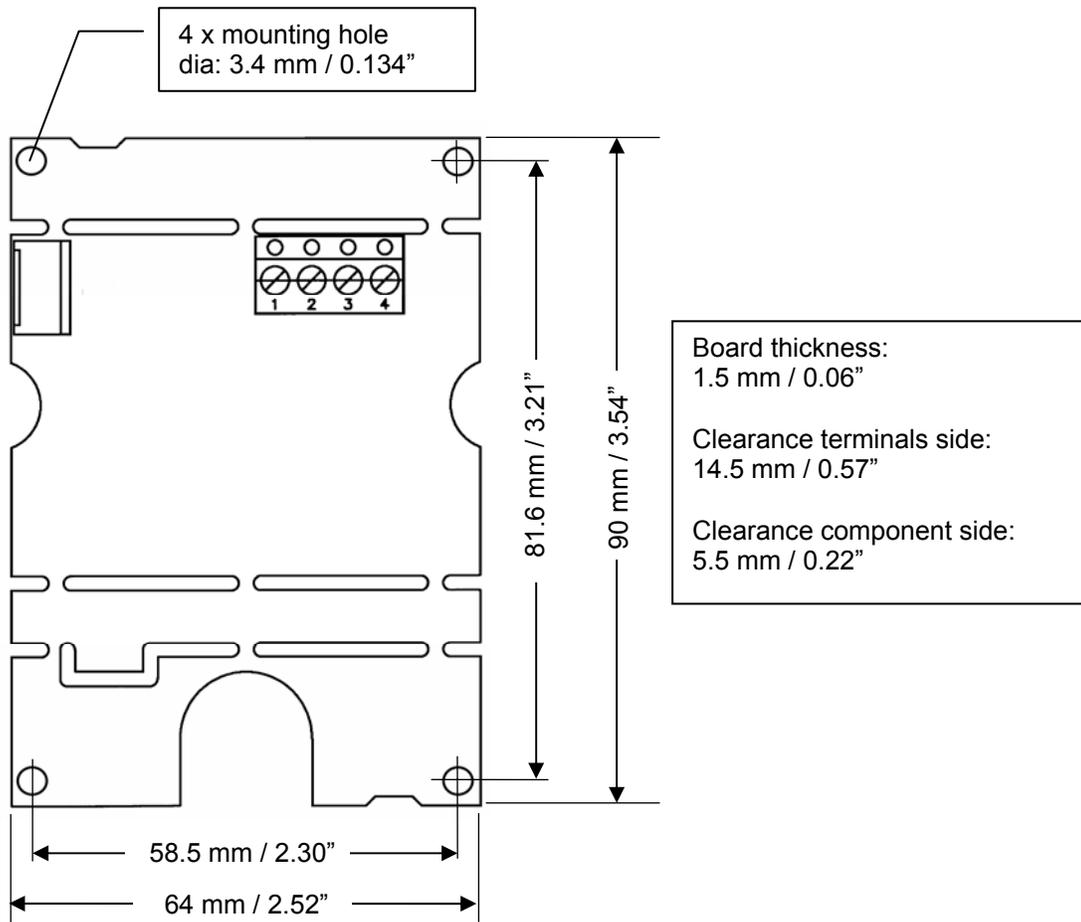
- c) 1-point adjustment against a reference probe connected to the HygroPalm 3.

For a 1-point adjustment against a reference probe, connect the service cable to probe input 1 of the HygroPalm 3 (the 5-pin connector of the cable is also compatible with this input). Use an adapter cable such as the MOK-02-B5 to connect the reference probe to probe input 2 of the HygroPalm 3.

Note that the connections to the HygroPalm 3 may be different from what is shown in the above drawing. For detailed instructions, see separate HygroPalm manual – HygroPalm Function Menu – Adjust REF.

## SPECIFICATIONS

|                                 | H292D  | H293D  |
|---------------------------------|--|--|
| Humidity sensor                 | ROTRONIC Hygromer™ IN-1 thin film capacitive   |  |
| Temperature sensor              | Pt100 RTD (used for compensating the humidity sensor)  |  |
| Circuit type                    | 2-wire, loop powered   | 3-wire   |
| Output signal type              | 4...20 mA, loop powered  | 0...1 V, 0...5V, 0...10 V<br>0...20 mA, 4...20 mA                |
| Operating limits at probe       | -40...160°C / -40...320°F survival: -75...200°C / -100...390°F<br>100%RH up to 80°C / 176°F<br>90%RH at 90 °C / 194 °F<br>50%RH at 120 °C / 248°F<br>20%RH at 150 °C / 302°F |  |
| Operating limits at transmitter | 0...99%RH non condensing and -40...60°C / -40...140°F  |  |
| Standard output range           | 0...100 %RH  |  |
| Accuracy at 20..25°C / 68..77°F | ± 1.5%RH   |  |
| Repeatability                   | ± 0.3%RH   |  |
| Humidity sensor stability       | better than 1%RH over a year   |  |
| Response time (without filter)  | 10 seconds (%RH and temperature)   |  |
| Field calibration               | requires HygroPalm 3 indicator and service cable   |  |
| Supply voltage                  | VDC = 10 + (0.02 x Load*)<br>Maximum: 28 VDC<br><br>* Load resistance in Ohms  | 10...35VDC/ 12...24 VAC<br>minimum 15 VDC<br>for current outputs |
| Current consumption             | 20 mA / output   | < 50 mA  |
| Max. load current outputs       | 250 Ω  | 250 Ω  |
| Min. load voltage output        |  | 1000 Ω   |
| Electrical connections          | Terminals 12 AWG   |  |
| Sensor protection (standard)    | Plastic slotted cap with wire mesh insert  |  |
| Max air velocity at probe       | 20 m /s (3900 ft / min) with wire mesh insert  |  |
| Dimensions                      | PCB: 90 x 64 mm / 3,54 x 2.52"<br>Probe length: 100 mm / 3.9" (standard)<br>250 mm / 9.8" (optional)<br>Probe diameter 15 mm / 0.6"<br>Probe cable: 2m / 6.5 ft              |  |
| Probe material                  | PPS  |  |
| Weight                          | 225 g / 8 oz   |  |
| CE conformance                  | EN61000-6-2:2001, EN61000-6-4:2001   |  |



## APPENDIX 1: Practical Advice for Measuring Humidity

The most common source of error when measuring relative humidity is a difference between the temperature of the probe and the temperature of the environment. At a humidity condition of 50 %RH, a temperature difference of 1°C (1.8 °F) typically results in an error of 3 %RH on relative humidity.

When the probe is mounted through a wall, avoid temperature errors by inserting as much of the probe as possible in the environment to be measured.

In extreme situations, condensation may occur on the sensors when the probe is colder than the environment. As long as the humidity / temperature limits of the humidity sensor are not exceeded, condensation does not alter the calibration of the sensor. However, the sensor has to dry out before it can provide a valid measurement.

Non-moving air is an excellent insulator. When there is no air movement, surprising differences in temperature and humidity can be noted over short distances. Air movement at the probe generally results in measurements that are both faster and more accurate.

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## APPENDIX 2: Field adjustment of the analog outputs

Field adjustment of the H290D series analog outputs requires a HygroPalm 3 indicator and a service cable ACRLXB5 (see service cable).

Both probe inputs of the HygroPalm should be configured for a digital HygroClip probe. Connect cable ACRLXB5 to probe input 2 of the HygroPalm 3 and select probe 2 on the HygroPalm prior to calibrating. Press the MENU key of the HygroPalm to access the function menu and use the UP and DOWN keys to navigate the function menu. Selections are confirmed by pressing the ENTER key. Select one of the probe adjustment functions: ADJUST M-PT, ADJUST 1-PT or ADJUST REF. Detailed instructions are provided separately in the HygroPalm manual. Follow the same procedure as for calibrating any probe connected to the HygroPalm. Note that the H290D must be powered up during calibration.

H292D (2-wire, loop powered): when the H292D has been factory configured to provide both an analog humidity output signal and the optional temperature analog signal, both current loops must be closed when adjusting the transmitter.

## APPENDIX 3: Accessories for the H290D

| Order Code  | Description  |
|-------------|--|
| HygroPalm 3 | HygroPalm 3, field calibrator  |
| ACRLXB5     | Cable: service connector H290D to HygroPalm 3 (probe input 2 )   |
| ER-15       | calibration device for the H290D probe   |
| EAx-SCS     | humidity std, SCS certified, pack of 5<br>where xx = 00 (0 %RH)<br>= 05 (5 %RH)<br>= 10 (10 %RH)<br>= 20 (20 %RH)<br>= 35 (35 %RH)<br>= 50 (50 %RH)<br>= 65 (65 %RH)<br>= 80 (80 %RH)<br>= 95 (95 %RH) |
| QMA-15      | Probe holder (flange with compression fitting)   |