

H290
HUMIDITY TRANSMITTER
INSTRUCTION MANUAL

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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 call our service department at 631/427-3898 and press 5 (or ask for extension 21).

DESCRIPTION

The H290 consists of a humidity probe that is hard wired to a small open board with a 6 ft (2 meter) cable. The probe has provisions for adding an RTD temperature sensor and is pre-wired for a direct 3-wire RTD connection with an external temperature measurement device.

The H290 series was specifically designed for OEM applications that require humidity measurement within the temperature range of -5 to 320°F (-20 to 160°C) and can survive exposure to temperatures in the range of -100 to 390°F (-75 to 200°C) at the probe. To maintain accuracy, the H290 series features a fully temperature compensated humidity output signal. Because of this, the H290 can be directly used with most makes of controllers. Humidity is measured with the ROTRONIC HYGROMER™ C94 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 industrial applications. This fact is reflected in the 3-year full warranty that covers the H290. Reliability is further enhanced by the easy-to-perform field calibration.

The H290 is a 3-wire transmitter that can operate either from a DC power supply (10-35 VDC) or from a 24 VAC power supply. The H290 can be ordered with either a 4..20 mA current output or a 0..5 V voltage output.

OPERATION

Power Supply

The H290 can operate with an unregulated supply voltage between 10 and 35 VDC or with 24 VAC. When powered with a DC voltage, the H290 requires a maximum of 30 mA.

Output Signal

The H290 can be ordered with one of the following output signals:

4 to 20 mA = 0 to 100%RH

0 to 5 V = 0 to 100 %RH.

The humidity signal is linearized.

Temperature Operating Range and Limits

The H290 was designed to operate within -5 to 320°F (-20 to 160°C) at the probe. Temperature up to 390°F (200°C) or below 5°F (-20°C) will not harm the probe. Temperature at the electronics (board) should be within 20 to 122°F (-5 to 50°C).

Operating either the board or the probe of the H290 outside of the temperature limits can result in permanent damage.

Humidity Limits

Depending on temperature, the maximum humidity to which the probe can be subjected is as follows:

- . 100 %RH up to 185°F (85°C)
- . 90 %RH at 212°F (100°C)
- . 60 %RH at 260°F (125°C)
- . 25 %RH at 320°F (160°C)

Exceeding the above limits may "shift" the humidity sensor and require a new calibration.

At temperatures below 185°F (85°C), the C94 sensor can operate for long periods of time in environments up to 100%RH. Direct condensation does not damage the sensor, however, this can produce an overflow reading (an output signal of more than 100 %RH) 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 so as to prevent the sensor from becoming colder than its environment.

Temperature Compensation

Practically every make of relative humidity sensor requires a temperature compensation in order to measure accurately over a wide range of temperature conditions. In the specific case of an instrument using a capacitive sensor, compensation is required because the dielectric characteristics of both the water molecule and the hygroscopic polymer used in the sensor vary with temperature.

The H290 uses the temperature measured by an RTD located next to the humidity sensor to provide the necessary compensation to the humidity output signal. Within the temperature range of -5 to 320°F (-20 to 160°C), this compensation maintains the temperature error to $\pm 2\%$ RH or less.

Sensor Protection

As a standard, the sensors of the H290 are protected with a PPS slotted cap with a stainless steel wire mesh insert.

When the application is "clean" and requires the fastest probe response as possible to humidity and temperature changes, the standard wire mesh insert may be replaced with a larger mesh size screen insert to increase air flow at the sensor (consult factory). A typical example of such an application would be a fast ramping environmental test chamber.

Do not unnecessarily remove the protective cap from the probe and never use the H290 without protecting the sensors.

Optional Temperature Sensor

The probe of the H290 has a 6-pin bulkhead. Two of these pins (pins 1 and 6) are free and can be used to add an RTD temperature sensor to the probe. The probe cable and the circuit board are already pre-wired for a direct 3-wire RTD connection (see INSTALLATION).

INSTALLATION

- **Do not remove the protective slotted cap from the probe. The sensors can easily be damaged when not protected.**
- **The ROTRONIC HYGROMER™ humidity sensor has the appearance of a small white paper tag. Do not remove from the probe!**

Mechanical Installation

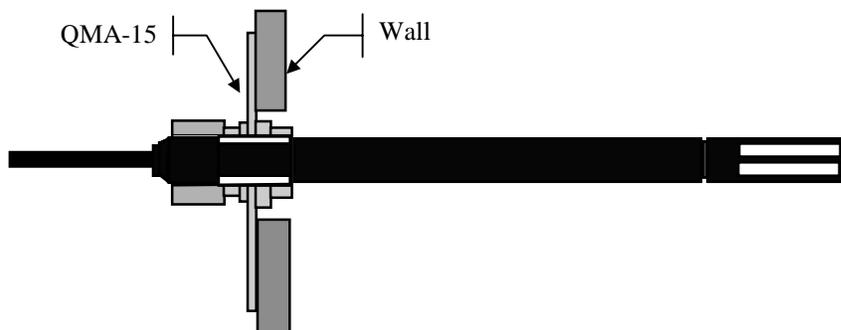
General Recommendations

Relative humidity is extremely dependent on temperature. Accurate measurement of relative humidity requires that the probe and sensors be always at the temperature of the environment to be measured. When mounting the probe, use the following guidelines to obtain good instrument performance:

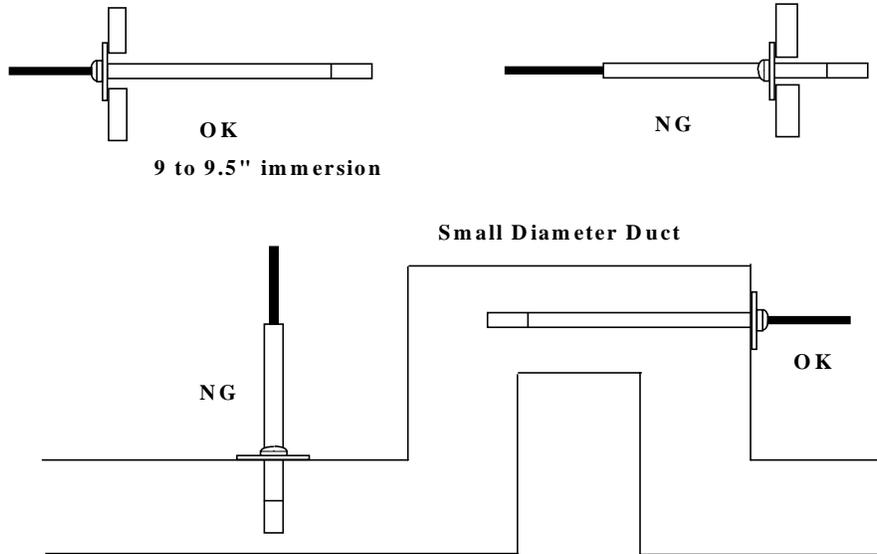
- a) **Select a representative location:** install the probe at a location where humidity, temperature and pressure conditions are representative of the environment to be measured.
- b) **Provide good air movement at the probe:** air velocity of at least 200 ft/ minute (1 meter/second) facilitates adaptation of the probe to changing temperature.
- c) **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.
- d) **Immerse as much of the probe as possible in the environment to be measured.**

Probe Installation

The probe of the H290 was 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.



Make sure that 9 to 9 1/2" (230-240mm) are **immersed in the environment to be measured** (see diagram at the end of this manual). Probe immersion depth is critical. Insufficient probe immersion may result in a difference between the temperature of the sensors and that of the environment. This will create a large error of measurement and/or a malfunction.



Probe Position

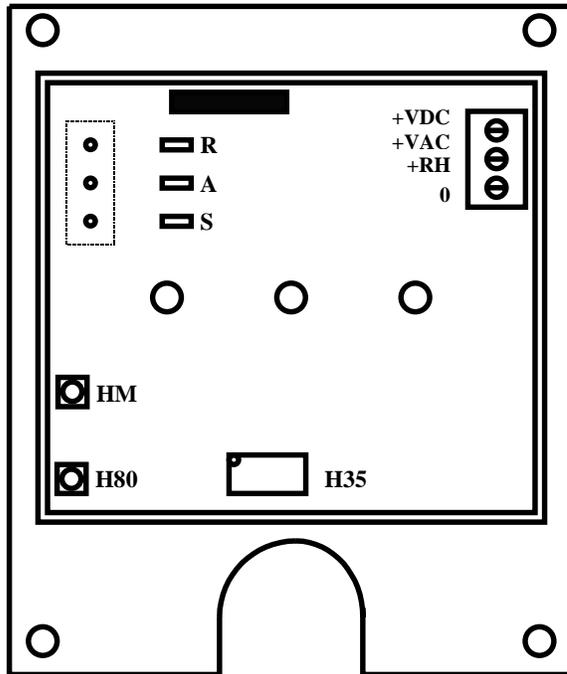
Install the probe so as to prevent the accumulation of condensation water at the level of the sensor leads. Install the probe so that the probe tip is looking downward. If this is not possible, install the probe horizontally.

Calibration Port

We recommend providing a calibration port (diameter 0.5" or 13 mm) next to the probe of the H290. During maintenance, this port can be used to introduce the probe of a PFC150 calibrator (available from ROTRONIC). For more details, see One-Point Calibration.

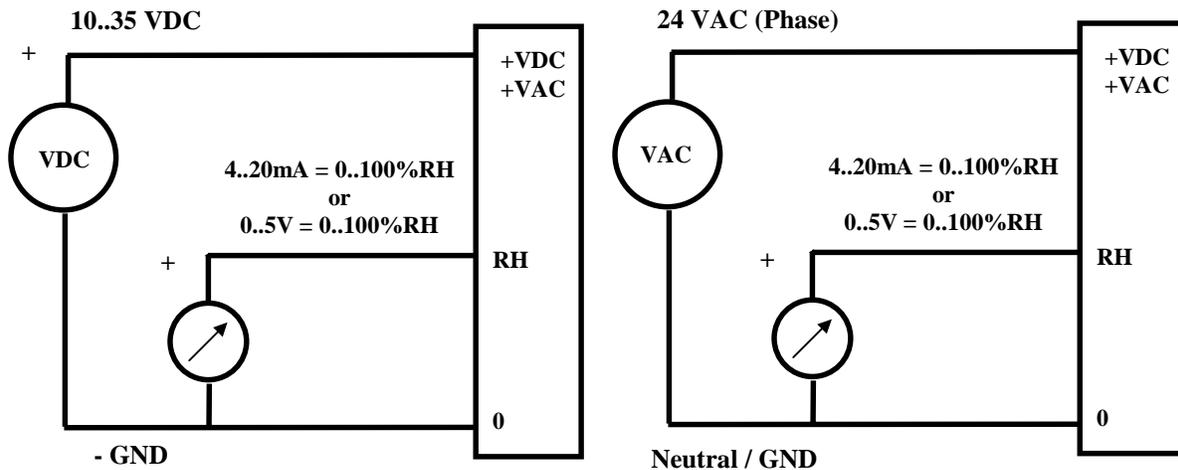
Electrical Installation

Board Plan



Make sure that you can correctly identify the function of each terminal. Applying power (+VDC / +VAC) to the output signal terminal (+RH) can severely damage the unit.

Wiring Diagram



Cabling

Avoid running the cable connecting the unit in the same conduit as 110 VAC power cables. If this cannot be avoided, a shielded cable or a cable with twisted wires may be required to prevent interference due to electromagnetic induction. Regarding the maximum cable length, use the following guidelines:

- Current Output: The maximum cable length is limited by the fact that the maximum load is 500Ω.

- Voltage Output: The current consumption of the H290 is less than 30 mA. This current flows through the return wire which is common to the output signal and the supply voltage. With a 12 AWG wire, the maximum cable length should not exceed 20 to 25 feet in order to minimize the error created by the voltage drop in the common (0) wire.

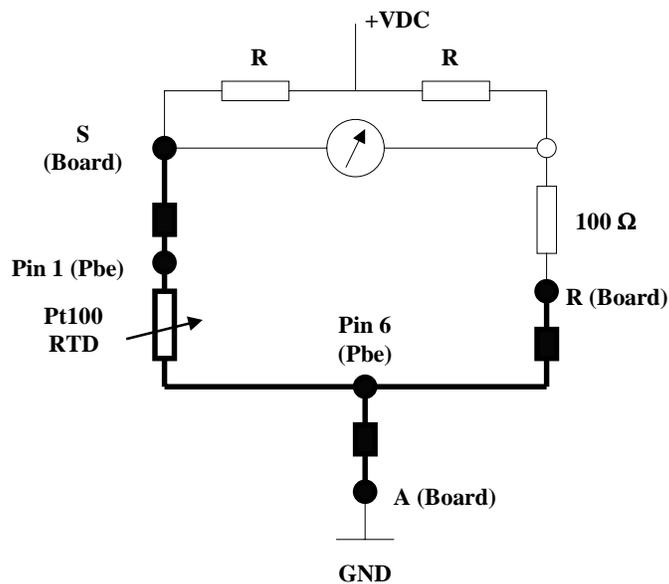
Grounding

We generally recommend grounding the H290, especially if the electronics will be subjected to a low humidity environment (35 %RH or less).

Optional Temperature Sensor

The probe of the H290 is pre-wired to accept an optional RTD temperature sensor. The RTD should be soldered to pins 1 and 6 located on the probe bulkhead. Pin 1 is connected by means of a green wire to the solder pad labeled S on the electronics board (see Board Plan). Pin 6 is connected by means of 2 wires: brown to the solder pad labeled R and violet to the solder pad labeled A. The board of the H290 has provisions for adding a terminal block to facilitate a direct RTD connection.

RTD 3-Wire Connection:



MAINTENANCE

Cleaning or Replacing the Dust Filter

The dust filter should be cleaned from time to time, depending on the conditions of measurement. Cleaning should be done without removing the filter from the probe. Gently wipe the filter. If this does not remove most of the stains, the filter should be replaced. To do this, unscrew the filter from the probe.

Before putting on a new dust filter, check the alignment of both sensors with the probe. The wires that connect the sensors to the probe are very thin and bend easily. If this happens, correct the alignment by holding the sensor very gently with a pair of small flat nosed pliers.

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.

Applications where the unit is exposed to significant levels of chemical contaminants may require more frequent verifications. The calibration procedure is described in detail in this manual.

CALIBRATION

CALIBRATION BASICS

When calibrating a relative humidity instrument, **temperature stability is the single most important requirement**. Calibration should be done at room temperature (60 to 80°F or 15 to 26 °C) and temperature should be stable to $\pm 0.25^{\circ}\text{C}$ or better during the period of time required for each calibration point. Do not calibrate close to an air vent or a heater, in direct exposure to sun rays, etc.

Calibration Device

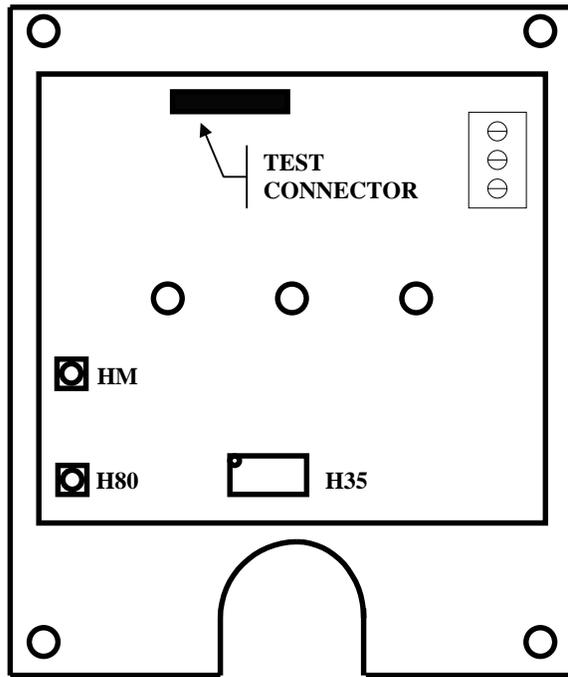
The ER15 calibration device is a small airtight container that slips over the probe of the H290 and seals around the humidity sensor. During calibration, a known reference humidity is produced inside the calibration device by means of a humidity standard (usually an aqueous salt solution).

Tip: During calibration, temperature stability may be increased by placing the tip of the probe and calibration device inside an insulating box filled with sand.

Humidity Standards

The ROTRONIC certified humidity standards permit calibration by non-skilled personnel. These standards are available in boxes of 5 glass ampoules of the same value, which can be stored indefinitely. Standards in the range of 5 to 95 %RH are non-saturated aqueous salt solutions that are precisely titrated at our factory for the right concentration. The 0 %RH humidity standard is made of small granules of a highly porous ceramic that have been dried at a high temperature. A Material Safety Data Sheet is available for each standard. Since humidity standards other than the 0 %RH standard are a salt solution, parts which have come in contact with the liquid should be cleaned after each use.

Calibration Potentiometers and Test Connector



Test Connector: used for a 1-Point Calibration (Requires A2C Calibrator)

H35: Offset Adjustment Potentiometer

H80: Slope Adjustment Potentiometer

HM: Potentiometer used for calibration at 5 or 10 %RH.

Calibration Procedures

One-Point Calibration

When the application is over a narrow range of humidity conditions, a one-point calibration may be used to facilitate maintenance and to save time. This consists in adjusting the output of the H290 against the display of a reference instrument (A2C calibrator). The output of the H290 can be read without interrupting the output signal by connecting the test cable of the A2C to the test connector of the H290.(see “calibration potentiometers and test connector” as well as the manual provided with the A2C). During the procedure, it is important to satisfy the following requirements:

- The humidity and temperature conditions that are prevalent during calibration must be reasonably stable. Over a period of 15 min., temperature should not vary by more than 1°F (0.5°C).
- The probe of both instruments should be ventilated or placed in the same stream of moving air. Air velocity must be at least 200 ft/min (1m/s).

Usually, it is temperature equilibrium that takes the longest time. Depending on the initial conditions, equilibration can take from a few minutes to as long as 15..20 minutes. If the initial temperature difference between the two probes is more than a few degrees, be sure to wait at least 15 min. before calibrating.

When both the A2C calibrator and the H290 provide stable readings, use the **H35** potentiometer to adjust the signal from the H290 so as to match the reading of the A2C.

Full Calibration

Full calibration of the H290 series requires a 3-point calibration which should be done exactly in the sequence indicated in this manual.

The first calibration adjustment should be at 35 %RH or at a value close to that.

- Slip an ER15 calibration device over the probe and make sure it seals tightly on the probe. The receptacle of the calibration device (or solution holder) should be under the probe tip. Remove the receptacle from the calibration device.
- Power the H290 and read the output signal (see INSTALLATION).
- Set the H80 and HM potentiometers in mid position.
- Place one fiber disc (with the exception of the EA00 standard, each box of ROTRONIC humidity standards includes 5 discs) in the receptacle of the calibration device. The purpose of this disc is to prevent accidental spilling of the solution inside the calibration device or on the humidity sensor.
- Tap the top of one ampoule of 35 %RH solution so that all liquid drops to the bottom of the ampoule. Snap off top and empty contents on fiber disc. **Since the ampoule is made of glass, exercise proper caution (gloves, safety glasses) when snapping off the top.**
- Put the receptacle back on the calibration device and make sure that the solution does not come in contact with the sensor: **The solution inside the calibration device should never be on top of the sensors.**
- Allow at least 60 minutes to insure that the calibration device, the solution and the sensor are in a state of equilibrium. This is verified by monitoring the output signal.
- At equilibrium (stable output signal), adjust the reading of the voltmeter with the **H35** potentiometer.
- Remove the receptacle from the calibration device. Throw away the wet disc (non reusable). **Thoroughly wash and dry the receptacle, removing all traces of the humidity standard.**

Use 80 %RH as the second calibration value as this provides the best overall accuracy over the full range of measurement.

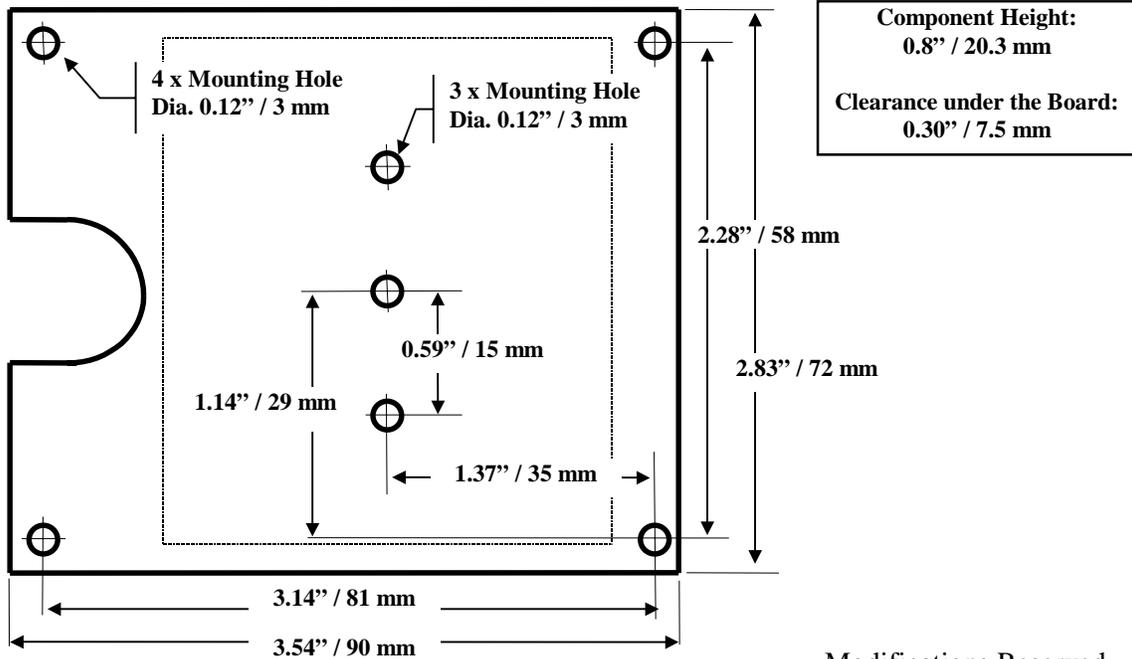
- Repeat the procedure used for the 35 %RH adjustment with an 80 %RH standard. Allow at least 60 minutes for equilibrium.
- At equilibrium, adjust the probe output with the H80 potentiometer
- Remove the receptacle from the calibration device and clean thoroughly.

Use 5 or 10 %RH as the last calibration value.

- Repeat the procedure with a 5 or 10 %RH standard. Allow at least 60 minutes for equilibrium.
- At equilibrium, adjust the probe output with the HM potentiometer
- Remove the receptacle from the calibration device and clean thoroughly.

SPECIFICATIONS

Humidity Sensor	ROTRONIC HYGROMER™ C94
Operating Temperature at Electronics	20..122°F (-5..50°C)
Humidity Measuring Range	0..100 %RH
Operating Temperature at Sensors	-5 to 320°F (-20 to 160°C)
Survival Temperature Limit at Sensors	-100 to 390°F (-75 to 200°C)
Humidity Limits at Sensors	100 %RH up to 185°F (85°C) 90 %RH at 212°F (100°C) 60 %RH at 260°F (125°C) 25 %RH at 320°F (160°C)
Output Signal (specify when ordering)	4..20mA (max. load 500 Ω) 0..5VDC (min. load 1000 Ω)
Accuracy at 68..77°F (20..25°C)	± 2%RH from 0 to 100%RH
Repeatability	± 0.5%RH
Humidity Sensor Stability	better than 1%RH over a year
Response Time (without filter)	10 seconds
Calibration Potentiometers	35, 80 and 10%RH
Supply Voltage	10-35 VDC/30 mA or 24 VAC
Electrical Connections	3 Wires
Terminals	12 AWG
Probe Cable Length	6 feet (2 meter), including probe
Sensor Protection	Slotted Cap with SS wire mesh
Probe Dimension/Material	9.84 x 0.59" (250 x 15 mm) / PPS
Board Dimensions	3.54 x 2.83" (90 x 72 mm)
Weight	0.5 lbs (220g)
Probe Holder	QMA15 (Order Separately)
Calibration Device	ER15 (Order Separately)



Modifications Reserved