HT420

HUMIDITY-TEMPERATURE TRANSMITTER

INSTRUCTION MANUAL

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BEFORE YOU GET STARTED

- INSPECT YOUR NEW UNIT 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 YOUR INSTRUMENT. PLEASE NOTE THAT OUR WARRANTY DOES NOT COVER DAMAGE DURING SHIPMENT.

- VERIFY THE SPECIFICATIONS OF YOUR INSTRUMENT AND GET FULLY ACQUAINTED WITH ITS MAIN CHARACTERISTICS: SUPPLY VOLTAGE, ELECTRICAL CONNECTIONS, ADJUSTMENTS, OPERATING LIMITS. A LABEL LOCATED INSIDE THE CASE COVER OF TRANSMITTERS PROVIDES IMPORTANT INFORMATION.

Each ROTRONIC instrument is carefully calibrated before shipment. No further adjustments should be required before installation.

IMPORTANT

THE REMOTE PROBE OF THE HT420 MUST ALWAYS BE USED WITH ITS MATCHING TRANSMITTER. PROBES ARE NOT INTERCHANGEABLE.

DO NOT REMOVE THE SENSOR PROTECTION FROM THE PROBE (SLOTTED CAP OR DUST FILTER) UNLESS YOU HAVE TO. BOTH SENSORS CAN BE MECHANICALLY DAMAGED BY CARELESS REMOVAL OF THE SENSOR PROTECTION.

OPERATION

1. Power Supply

The HT420 is available for operation with one of the following supply voltages: 110 VAC, 24 VAC and 24 VDC. The supply voltage may vary up to ± 15% from the nominal value.

DC operated units are equipped with a DC/DC converter and require 100 mA. AC operated units are equipped with a 2.5 VA transformer.

2. Measuring Range

Relative humidity is measured from 0 to 100%RH.

Temperature measurement depends on the range specified when ordering the unit (see label inside the case cover). The standard temperature range is 0-300°F

3. Temperature Limits

OPERATING THE TRANSMITTER AND/OR ITS PROBE OUTSIDE OF THE TEMPERATURE LIMITS MAY RESULT IN INACCURATE MEASUREMENTS AND PERMANENTLY DAMAGE THE UNIT.

The temperature limits of the HT420 are as follows:

Transmitter : 20 to 122°F (-5 to 50°C)
Remote Probe : -60 to 260°F (-50 to 125°C)

4. Temperature Compensation

Practically every make of relative humidity sensor requires a compensation for the effect of temperature on the humidity output signal 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 electronic circuit of the HT420 uses data from the precision Pt 100 RTD to automatically compensate the effect of temperature on the accuracy of humidity measurement. This is being done by adding to the humidity output signal a correction which is proportional to the product of temperature and relative humidity.

The temperature compensation uses normal room temperature as a reference. Because of this, calibration of the unit should be done at normal room temperature rather than at the temperature of operation at the sensor.

5. Humidity Limits

As far as possible, avoid sudden condensation at the sensors.
When measuring at high humidity, condensation may occur on the humidity sensor due to a sudden difference in temperature with the environment. This does not damage the sensor. However, this will produce an overflow reading (an output signal of more than 100 %RH) for as long as condensation is present on the humidity sensor.

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)

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

6) Sensor Protection

In most instances, we recommend using a dust filter (available from RIC) to protect the sensors.

Be sure to use a FILTER when:

.MEASURING AT AIR VELOCITY ABOVE 2.5 m/s (500 feet/min).
.MEASURING IN A DUSTY ENVIRONMENT

7. Output Signals

The HT420 transmitter is available with various types of output signals corresponding to the specifications given when ordering the unit (see label inside the case cover). Outputs can be as follows:

Current Outputs: 4-20 mA, 0-20 mA

Voltage Outputs: 0-5 V, 0-1 V.

The output signals are linear and are consistent with the requirements of most data/signal processing instrumentation (panel meter, controller, computer card, etc.).

Units with current outputs behave as a variable source of current and adjust the current flowing through the terminals as a function of relative humidity and temperature. Both output signals may be read with any current sensing device having a maximum impedance of 500 ohms. When several devices are connected in series with the transmitter, the resulting impedance should not exceed 500 ohms, wiring included.

Units with voltage outputs behave as a variable voltage source and adjust the voltage across the terminals as a function of relative humidity and temperature. Both output signals may be read with any voltage sensing device having a minimum impedance of 1000 ohms. When several devices are connected in parallel with the transmitter, the resulting impedance should not be less than 1000 ohms.

All units have a terminal (-) which is common to both the humidity and temperature signals. Both unit outputs are internally connected to the common wire (-) by means of a 1 Microfarad capacitor. This reduces the influence of electromagnetic induction on the output signals and provides protection of the output circuits against transients.

8. Grounding

Operation of the HT420 does not require that the unit be electrically grounded. However, we recommend grounding the instrument, especially if the electronic circuits are subjected to a low humidity environment (less than 35 %RH).

The third terminal (-) on the output signals side is internally connected to the third terminal on the supply voltage side. Grounding the instrument can be done on either side.

INSTALLATION

A) MECHANICAL INSTALLATION

1) General

INSTALL THE PROBE OF THE TRANSMITTER AT A LOCATION WHERE CONDITIONS ARE TYPICAL OF THE ENVIRONMENT TO BE MEASURED. AVOID LOCATIONS WHERE MEASUREMENTS MAY BE AFFECTED BY:

. TEMPERATURE EFFECTS RESULTING FROM CLOSE PROXIMITY OF THE SENSORS TO A HEATING ELEMENT, A COOLING COIL, A COLD WALL, DIRECT EXPOSURE TO SUN RAYS, ETC.

. HUMIDITY EFFECTS RESULTING FROM CLOSE PROXIMITY OF THE SENSORS TO A VAPOR INJECTOR, HUMIDIFIER, ETC.

. UNSTABLE PRESSURE RESULTING FROM AIR TURBULENCE IN SOME HIGH VELOCITY AIR DUCTS (RELATIVE HUMIDITY IS DIRECTLY PROPORTIONAL TO PRESSURE).

2) Sensor Protection

Avoid removing the dust filter or slotted cap used to protect the sensors. If you must replace the dust filter or slotted cap, proceed as follows:

Carefully unscrew the filter or slotted cap from the probe. If you are removing a slotted cap, make sure that the sensors do not get caught in the ribs of the cap. Before putting on the dust filter or cap, 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. Do not puncture the sensor.

3) Fastening the Case

. Remove the case cover to have access to the 4 holes for mounting the case. These are separated from the inner section of the transmitter case. Screws with an approximate diameter of 5/32" should be used. The position, location and dimensions of the mounting holes are shown on the "installation" diagram.

. If the surface of the mounting wall is at a temperature of more than 100°F, use an insulating spacer (not provided) between the transmitter case and the wall or duct. This spacer should be at least 1" thick.

4) Probe Installation

Immersion Depth

Install the probe of the HT420 so that it is fully immersed in the environment to be measured.

This is critical since partial probe immersion can result in a difference between the temperature at the sensors and that of the environment. Such a difference can create a large error of measurement and/or a malfunction.

Distance from Mounting Wall

Use a mounting bracket (not provided) to provide a distance of at least 3 to 4" between probe and mounting wall. This reduces the influence of the mounting wall temperature on measurements.

Position

Install the probe so as to eliminate any possibility of condensation water accumulating at the level of the sensor leads. Install the probe in a downward position. If this is not possible, install the probe horizontally.

Do not install the probe in an upward position.

B) ELECTRICAL INSTALLATION

If your unit was supplied with terminals, a diagram of the terminals is attached to this manual. If your unit was supplied with a connector, a connector diagram is attached to this manual.

The two output signals share a common wire (-). When using a dual recorder or a dual controller, use a model that accepts a common return wire (you may have to move a jumper or a dip switch in the recorder or controller).

1) Standard Wiring

The standard HT420 is supplied with two sealing cable grips and two blocks of terminals, one for the supply voltyage, the other for the output signals.

The cable grips provide effective sealing only with cables having the proper outside diameter. If only one cable is being used to wire the unit, make sure to seal the unused cable grip.

2) Type of Connecting Cable

Preferably, use two cables with an outside diameter of 0.236 to 0.275 inch (6 to 7 mm) and with at least 3 wires each (12AWG).

If you are installing a 24 VAC or a 24 VDC unit, you may use only one cable with at least 5 wires.

Depending on the installation, you may have to use a cable with twisted pairs or a shielded cable to avoid electro-magnetic interference.

3) Maximum Cable Length

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 500 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 1/100 of the load resistance. In the case where load resistance is only 1000 ohms, the cable resistance should not exceed 10 ohms.

4) Where to run the Cables

Avoid running the cables 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 interferences due to electromagnetic induction caused by switching.

5) Grounding

Operation of the transmitter does not necessarily require that the electronics be grounded. However, we generally recommend grounding, especially if the electronics are subjected to a low humidity environment (35 %RH or less).

MEASUREMENT

a) BY NATURE, HUMIDITY AND TEMPERATURE MEASUREMENTS REQUIRE THAT THE PROBE BE AT EQUILIBRIUM WITH THE ENVIRONMENT TO BE MEASURED. LACK OF TEMPERATURE EQUILIBRIUM CAN RESULT IN LARGE ERRORS, ESPECIALLY WITH RELATIVE HUMIDITY. ALLOW SUFFICIENT TIME FOR THE SENSORS TO COME TO EQUILIBRIUM WITH EACH NEW SET OF CONDITIONS.

b) RELATIVE HUMIDITY IS STRONGLY DEPENDENT ON TEMPERATURE. UNLESS MOISTURE IS BEING ADDED TO THE ENVIRONMENT, RELATIVE HUMIDITY DECREASES SHARPLY AS TEMPERATURE INCREASES. READINGS MADE AT DIFFERENT TEMPERATURES SHOULD NOT BE DIRECTLY COMPARED ONE WITH ANOTHER. FOR INSTANCE, THE RELATIVELY COLD AIR AT THE DISCHARGE OF A DRYING OVEN MAY BE SATURATED WITH WATER VAPOR (100 %RH), WHILE THE RELATIVE HUMIDITY OF THE SAME (BUT WARMER) AIR STREAM INSIDE THE OVEN MAY BE LESS THAN 50 %RH.

MAINTENANCE

Maintenance of the instrument is limited to the following:

1) Cleaning or Replacing the Dust Filter:

The MF15 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 with a solution of water and mild detergent. If this does not remove most of the stains, the filter should be replaced. To do this, unscrew the filter from the probe.

When removing the filter, make sure that the sensors do not get caught. The humidity sensor is sometimes mistaken for a "white paper tag". Do not remove 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. Do not puncture the sensor with sharp pliers or tweezers or pull too hard on the sensor.

2) Periodic Calibration Check:

Typically, the long term stability of the humidity sensor is 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 pollution may require more frequent verifications.

SHOULD A PROBLEM OCCUR WHICH CANNOT BE CORRECTED WITH 1) or 2), PLEASE CALL US BEFORE DOING ANYTHING ON THE UNIT. OUR WARRANTY CLEARLY EXCLUDES ANY UNAUTHORIZED REPAIRS OR MODIFICATIONS.

CALIBRATION

To access the adjustment potentiometers, remove the cover of the transmitter. **A label, located inside the cover, shows the location of the different adjustment potentiometers.**

Full calibration of the HT420 transmitter requires a 2-point calibration of temperature and a 4-point calibration of humidity.

DURING CALIBRATION, STABILITY OF TEMPERATURE IS THE SINGLE MOST IMPORTANT REQUIREMENT.

CALIBRATION INSTRUCTIONS MUST BE FOLLOWED EXACTLY IN THE SEQUENCE GIVEN IN THIS MANUAL.

BECAUSE THE HT420 IS TEMPERATURE COMPENSATED, ANY CALIBRATION OF TEMPERATURE MUST BE FOLLOWED BY A CALIBRATION OF HUMIDITY.

1. Temperature Calibration

Remove the Pt100 RTD from the probe and replace it by a decade box that simulates the resistance of the RTD at different temperatures.

Adjust the electronic circuit as follows:

a) Low Temperature Adjustment:

- Set the decade box to simulate 32 °F or 0 °C.
- Connect a voltmeter to the T (+) and COM (-) terminals.
- Position the T max potentiometer at the middle of its span.
- Adjust the T min potentiometer so that the voltmeter reads a signal corresponding to 32 °F or 0 °C. The T min potentiometer sets the zero of the temperature measuring bridge.

b) High Temperature Adjustment:

- Set the decade box to simulate a temperature close to the top of the transmitter measuring range.
- Adjust the readings with the T max potentiometer. The T max potentiometer sets the gain of the temperature measuring bridge.

Put the Pt100 RTD back on the probe and check the complete transmitter at room temperature:

Place both the probe of the HT420 and a certified thermometer in the same stream of air. If the sensors are not protected by a dust filter, limit air velocity to max. 500 ft/min (2.5 m/s) to prevent sensor damage. AIR MOVEMENT IS ESSENTIAL AND MUST BE AT LEAST 200 ft/min (1 m/s) FOR THE VERIFICATION TO BE VALID.

If required, touch up the temperature output with the T min potentiometer.

PROCEED TO HUMIDITY CALIBRATION

2. Humidity Calibration

WHEN CALIBRATING HUMIDITY, STABILITY OF TEMPERATURE IS THE SINGLE MOST IMPORTANT REQUIREMENT. DO NOT CALIBRATE UNLESS TEMPERATURE STABILITY IS +/- 0.4 F OR BETTER DURING THE PERIOD OF TIME REQUIRED FOR EACH CALIBRATION POINT. FOR INSTANCE, DO NOT CALIBRATE IN DIRECT EXPOSURE TO AN AIR CONDITIONING VENT, IN DIRECT EXPOSURE TO SUNLIGHT OR CLOSE TO A HEATING ELEMENT. IF NECESSARY, SHELTER THE PROBE AND CALIBRATION DEVICE BY PUTTING THEM IN AN INSULATED BOX.

Calibration Device:

A calibration device is a small airtight container that fits on the instrument probe 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).

The calibration device is slipped over the probe and sealed tightly with the compression fitting.

Humidity Standards:

ROTRONIC humidity standards permit calibration by non-skilled personnel. These standards are available in boxes of 5 glass ampules 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 most standards are a salt solution, metal parts which have come in contact with the liquid should be cleaned after each use.

As an alternative to the ROTRONIC humidity standards, you may prepare and use your own saturated salt solutions. If you do so, follow the procedure described in ASTM standard # E 104-85. The process of producing a known humidity inside the calibration device requires that the humidity standard, the air volume inside the calibration device and the humidity sensor be at equilibrium one with another, both in temperature and humidity. Because of this requirement, calibration usually takes from 45 to 60 minutes for each value.

Calibration Sequence:

CALIBRATE HUMIDITY AT A STABLE TEMPERATURE IN THE RANGE OF 68 TO 77 °F (20..25 °C).

a) Adjustment with the 35 %RH Potentiometer:

THE FIRST CALIBRATION ADJUSTMENT MUST BE AT 35 %RH OR AT A VALUE CLOSE TO THAT.

- Connect a voltmeter to the %RH (+) and COM (-) terminals.
- Set the 80% potentiometer in mid position.
- Unscrew the knurled receptacle of the calibration device.
- Install the calibration device on the probe of your instrument and seal tightly.
- Place one fibre disc (each box of RIC 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 ampule of 35 %RH solution so that all liquid drops to the bottom of the ampule. Snap off top and empty contents on fibre disc. SINCE THE AMPULE IS MADE OF GLASS, EXERCISE PROPER CAUTION (GLOVES, SAFETY GLASSES) WHEN SNAPPING OFF THE TOP.
- Put the knurled 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 SENSOR.
- Allow at least 45 minutes to insure that the calibration device, the solution and the sensor are in a state of equilibrium. This is verified by monitoring the voltmeter.
- At equilibrium (stable output signal), adjust the reading of the voltmeter with the 35% potentiometer.
- Remove the knurled receptacle from the calibration device. Throw away the wet disc (non reusable). THOROUGHLY WASH AND DRY THE RECEPTACLE, REMOVING ALL TRACES OF LIQUID.

b) Adjustment with the 80 %RH Potentiometer:

USE 80 %RH AS THE SECOND CALIBRATION VALUE AS THIS PROVIDES THE BEST OVERALL ACCURACY OVER THE FULL RANGE OF MEASUREMENT. IF MORE APPROPRIATE FOR A SPECIFIC APPLICATION, YOU MAY USE ANY OTHER HUMIDITY VALUE ABOVE 35 %RH.

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

Note: If the second calibration value is higher than 80 %RH, allow for more time (2 hours) and provide tighter temperature stability during calibration (at 95 %RH, a difference of 0.2°F between the sensor and calibration device or solution already results in 0.6 %RH error).

c) Adjustment at low humidity:

- Adjust the low humidity reading with the 10% potentiometer. Preferably, the reference humidity should be provided by an EA05 standard or by a saturated solution of Lithium Bromide (6.4 %RH @ 25°C). You may also use EA10, EA20 or a saturated solution of Lithium-Chloride (11.3 %RH @ 25°C).

- The 0 %RH reading is adjusted with the 0% potentiometer. The reference humidity may be given by an EA00 standard. Equilibration usually requires about 1 to 2 hours to achieve good accuracy.