

F Series

**HUMIDITY
AND
HUMIDITY-TEMPERATURE
TRANSMITTERS**

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.
- See the label on the shipping box for information about the model number of the transmitter, the supply voltage as well as the type and range of the output signals. An identical label is also located under the printed circuit board.
- 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

Transmitters of the F series are used to measure humidity or a combination of humidity and temperature in commercial HVAC installations, clean rooms, research laboratories and light (clean) manufacturing areas. The electronic circuitry is either of the 2-wire loop powered type or of the 3-wire type. Linearized output signals (DC current or voltage) are provided for transmission over a length of cable to a remote display, recorder, controller or data processing unit.

The F series features the ROTRONIC HYGROMER™ capacitive humidity sensor. This well proven sensor offers exceptional durability and stability in all kinds of environments. This fact is reflected in the 3-year full warranty that covers the transmitters of the F series. Reliability is further enhanced by the easy-to-perform field calibration. Measurement accuracy and fast response are provided over the entire range of humidity conditions, even when the sensor is exposed to extremely high or low humidity over long periods of time. An electronic compensation circuit maintains the accuracy of humidity measurement at all temperatures.

Models that measure both humidity and temperature, use an RTD Pt100 as the temperature sensor.

F series transmitters include a base plate and a module (sensor and electronics) which plugs into the base plate. The base plate can be installed and wired without the module at the same time as general electrical work is being done. During that period of time, the electronics module can safely be stored away.

The F series is available in the following configurations:

Model	Measurement	Circuit Type	Installation
F2C-W	Humidity	2-Wire Loop Powered	Space Mount (Surface)
FT2C-W	Hum. + Temperature	2-Wire Loop Powered	Space Mount (Surface)
F2C-D	Humidity	2-Wire Loop Powered	Duct Mount (Through Wall)
FT2C-D	Hum. + Temperature	2-Wire Loop Powered	Duct Mount (Through Wall)
F3V-W	Humidity	3-Wire	Space Mount (Surface)
FT3V-W	Hum. + Temperature	3-Wire	Space Mount (Surface)
F3V-D	Humidity	3-Wire	Duct Mount (Through Wall)
FT3V-D	Hum. + Temperature	3-Wire	Duct Mount (Through Wall)

OPERATION

Power Supply

Transmitters of the F series require the following supply voltage:

- 2-Wire loop powered transmitters: 10..35 VDC - depending on the load connected to the output(s)

The minimum supply voltage can be determined as follows: $V_{min} = 10\text{ V} + [0.02 \times \text{Load (ohm)}]$. For the maximum load of 500Ω , the minimum supply voltage is $10 + [0.02 \times 500] = 20\text{ VDC}$. The maximum current consumption is 20 mA per output circuit.

- 3-Wire transmitters: 10..35 VDC or 24 VAC

Models with a current output require a minimum of 15 VDC when the load connected to the output(s) is 500Ω . 3-Wire transmitters have a typical current consumption of 16 mA (Humidity only) or 32 mA (combined humidity and temperature).

Output Range

The range of the relative humidity output is 0 to 100%RH. The temperature output depends on the range specified when ordering (see label on shipping box and under the printed circuit board).

Temperature Operating Range and Temperature Limits

The F series can operate within 23 to 122°F (-5 to 50°C) at the electronics.

The temperature operating range of space mount models (surface) is the same as the temperature limits of the electronics. For through wall (duct) installation models, the temperature limits at the sensor(s) are -22..158°F (-30..70°C).

Operating the transmitter and/or its probe outside of the temperature limits can result in permanent damage.

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.

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 F series uses an NTC located next to the humidity sensor 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, calibration of the unit is done at normal room temperature rather than at the temperature of operation at the sensor.

Sensor Protection

Transmitters of the F series for through wall (duct) installation are supplied as a standard with a dust filter to protect the sensors. Space mount transmitters do not have a dust filter since the sensor(s) relies on natural ventilation through the slots of the enclosure.

When using a transmitter for through wall installation in a clean environment with rapidly changing conditions, it is recommended to use a slotted cap with screen (available from ROTRONIC) as opposed to using a dust filter.

Never use the transmitter without protecting the sensors with either a filter or a slotted cap.

Output Signals

The F series is available with the following output signals:

- 2-Wire loop powered transmitters: 4-20 mA

The transmitter behaves as a variable load and adjusts the current flowing through the terminals as a function of relative humidity and temperature. The output signal 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.

- 3-Wire transmitters: 0-20 mA, 4-20 mA, 0-1 V or 0-5 V. The output signal depends on the type specified when ordering (see label on shipping box and under the printed circuit board).

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

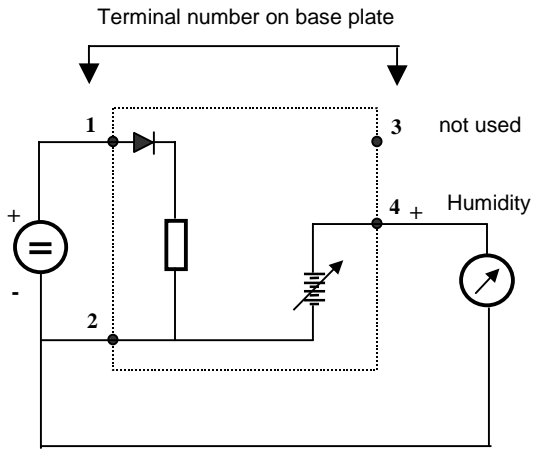
Units with current outputs behave as a variable source of current and adjust the current flowing through the terminals as a function of relative humidity and temperature. The output signal may be read with any current sensing device having a maximum impedance of 500 ohms. When several devices are connected 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. The 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.

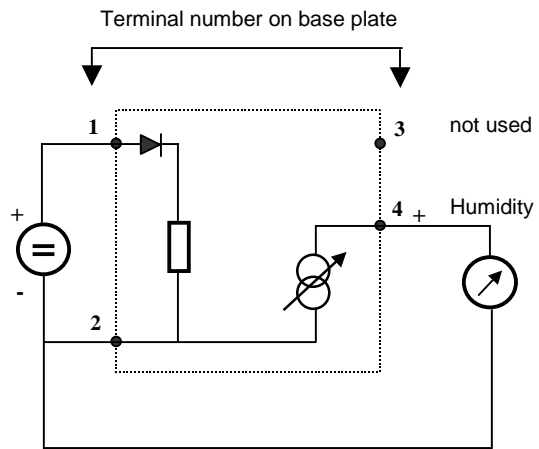
Wiring Diagrams

The wiring diagram for transmitters that measure humidity only is as follows:

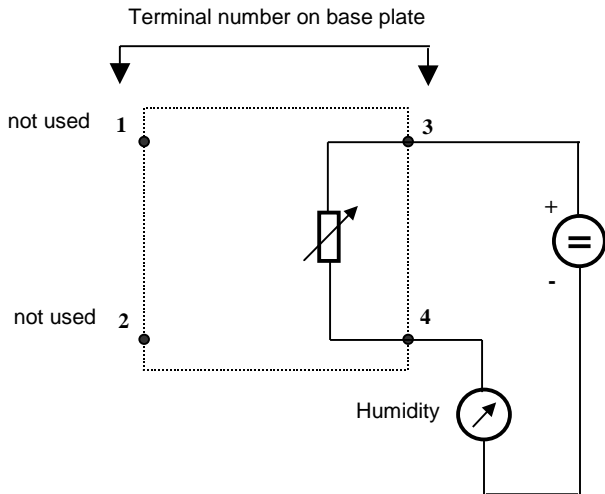
3-Wire Transmitter with voltage output



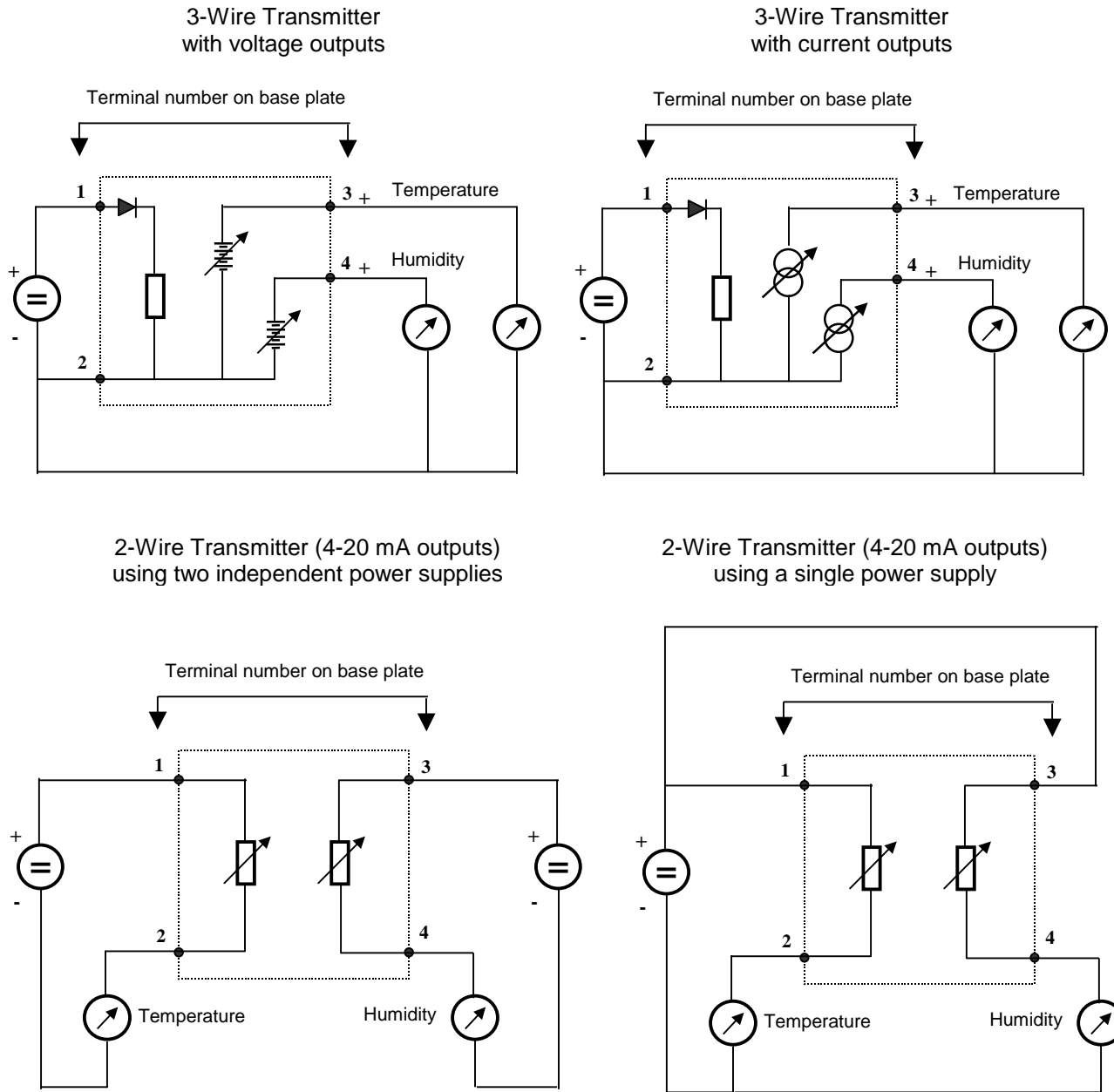
3-Wire Transmitter with current output



2-Wire Transmitter (4-20 mA output)



The wiring diagram for transmitters that combine humidity and temperature measurement is as follows:



Grounding

Operation of the F series 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).

INSTALLATION

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

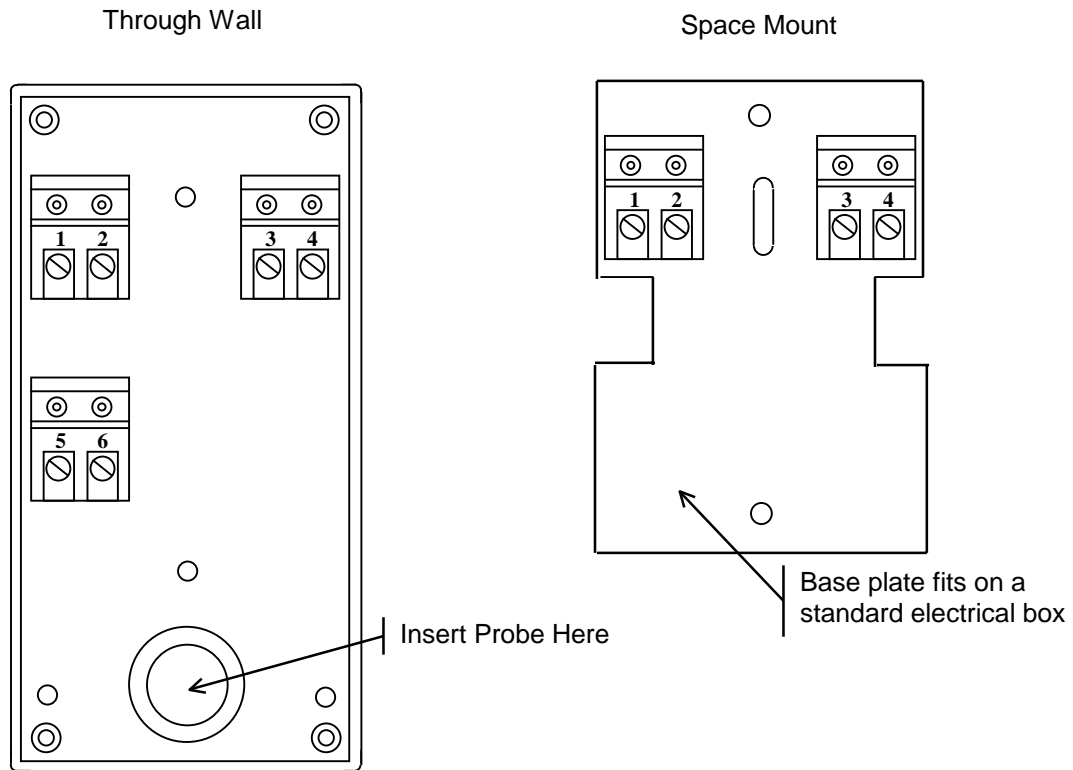
General Recommendations

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 sensor leads. Install the probe so that the probe tip is looking downward. If this is not possible, install the probe horizontally.

Installation of the Base Plate

The base plate should be installed first, using screws with an approximate diameter of 5/32".



IMPORTANT (Through wall installation only)

In order to be able to use a calibrator for future calibration checks, an orifice should be provided at a distance of about 6" from the center of the base plate. Calibrators available from ROTRONIC require an orifice with a diameter of 13/16" (21 mm). We recommend that this orifice be equipped with a QMA-15 probe holder and a rubber stopper. The orifice will be used to insert the probe of the calibrator and to verify the readings of the transmitter.

The base plate of the through wall model is supplied with one sealing cable grip. This cable grip provides effective sealing only with cables having the proper outside diameter. Preferably, use a cable with an outside diameter of 0.236 to 0.275 inch (6 to 7 mm) and with 18 AWG wires. Depending on the installation, you may have to use a cable with twisted pairs or a shielded cable to avoid interference.

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 100 kohms. Cable resistance should not be more than 1/1000 of the load resistance.

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 interference due to electromagnetic induction caused by switching.

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

Transmitter Type	Terminals Description (see base plate)
2-Wire, humidity only	1: not used 2: not used 3: (+) Supply Voltage 4: 4-20 mA (humidity)
3-Wire, humidity only	1: (+) Supply Voltage 2: (-) Supply Voltage and Common 3: not used 4: (+) Humidity (current or voltage)
2x2-Wire, humidity and temperature	1: (+) Supply Voltage 2: 4-20 mA (temperature) 3: (+) Supply Voltage 4: 4-20 mA (humidity)
3-Wire, humidity and temperature	1: (+) Supply Voltage 2: (-) Supply Voltage and Common 3: (+) Temperature (current or voltage) 4: (+) Humidity (current or voltage)

See also Wiring Diagrams

Installation of the Electronics Module

Once the base plate has been installed and wired, the plug-in module (sensor(s) and electronics can be inserted and secured with the screws provided. The transmitter is ready to operate.

Example:
Through wall installation.



MAINTENANCE

Cleaning or Replacing the Dust Filter (through wall model)

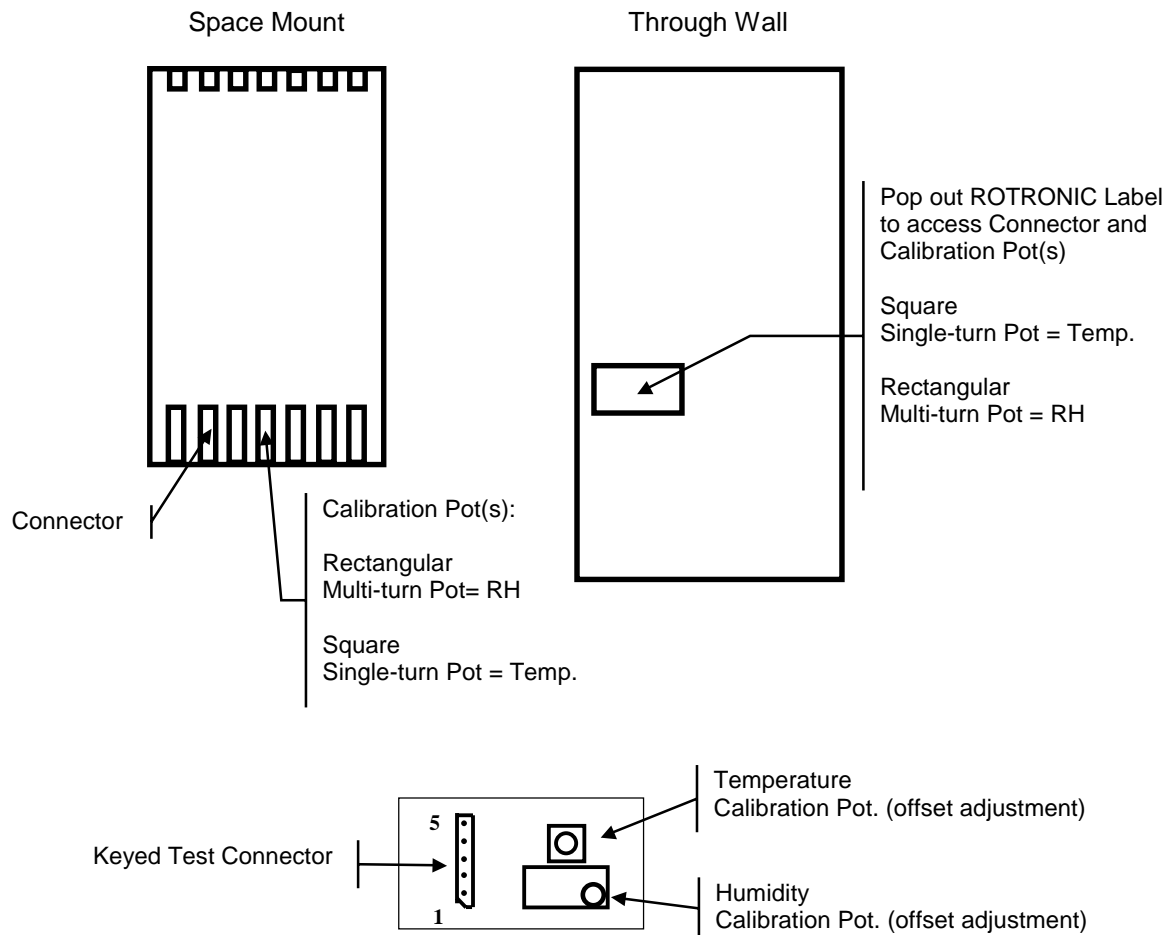
The dust filter should be cleaned from time to time, depending on the conditions of measurement. Cleaning should be done without removing the filter from the probe. Gently wipe the filter with a solution of water and mild detergent. If this does not remove most of the stains, the filter should be replaced.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

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

Long term stability of the humidity sensor is typically better than 1 %RH per year. For maximum accuracy, calibration of the unit should be verified every 6 to 12 months.

Transmitters of the F series are equipped with a 5-pin keyed test connector that permits reading the signal(s) without interrupting the operation of the transmitter.



Test Connector Pin #	Wire Color	Signal
1	Green	Humidity (+)
2	Yellow	Humidity (-)
3	Brown	not used
4	White	Temperature (+)
5	Gray	Temperature (-)

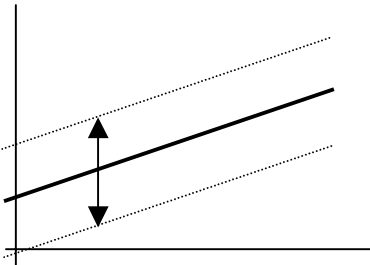
The ROTRONIC A2C calibrator can be used to directly read the signal(s) provided by the test connector. The A2C comes with test cable AK3029-B used to connect the A2C with the transmitter. The humidity-temperature probe connected to the A2C provides the reference readings necessary to check the accuracy of the F transmitter. As an alternative, any suitable reference instrument may be used and the signal(s) from the test connector can be read with a multimeter (use test cable AK3029-4P to connect the DVM to the transmitter).

The signals from the test connector are as follows:

- 2-Wire and 2x2-Wire Transmitters: 40..200 mV.
- 3-Wire Transmitters: 0..1 V

For humidity, this corresponds to 0..100%RH. For temperature, this corresponds to the range specified when ordering the transmitter (see label on shipping box and under the printed circuit board).

A one-point calibration check can be done by comparison between a reference instrument and the signal(s) provided by the test connector. If an offset adjustment of the transmitter is required, use the potentiometer(s) located next to the test connector.



Note: during a 1-point adjustment against a reference probe, make sure that both the reference probe and transmitter are ventilated and provide enough time for both to equilibrate.

SPECIFICATIONS

Humidity Sensor	ROTRONIC HYGROMER™ C94
Temperature Sensor (FT Models)	Pt100 RTD
Operating Temperature at Electronics	23..122°F (-5..50°C)
Humidity Measuring Range	10..100 %RH
Humidity Output Range	0..100%RH
Standard Temperature Output Range (FT Models)	0..100°F or 0..100°C
Temperature Limits at Sensors	Space Mount Models: 23..122°F (-5..50°C) Duct Mount Models: -22..158°F (-30..70°C)
Output Signals (linear)	F2C/FT2C: 4-20 mA (max. load 500Ω) F3V/FT3V: 0-5 V (min. load 1000 Ω)
Accuracy at 68..77°F (20..25°C)	± 2%RH from 10 to 100%RH ± 0.5°F (±0.3°C)
Repeatability	± 0.3%RH and ±0.2°F (±0.1°C)
Humidity Sensor Stability	better than 1%RH over a year
Response Time (without filter)	10 seconds (%RH and temperature)
Calibration Potentiometers	2 for Humidity, 2 for Temperature
Supply Voltage	F2C/FT2C: 10..35VDC; min. 10V + [0.02 x Load] F3V/FT3V: 15..35VDC/24VAC - 16/32 mA (F/FT)
Sensor Protection	Duct Mount Models: PPS Dust Filter
Weight	Space Mount Models: 0.3 lbs (120g) Duct Mount Models: 0.7 lbs (300 g)
Case Material	ABS
Case Protection	Duct Mount Models: DIN IP 54

MECHANICAL CONFIGURATIONS

