

FST Series

Narrow Range
Humidity - Temperature 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 remove the sensor protection (dust filter) from the probe. Both sensors (humidity and temperature) can be mechanically damaged by careless removal of the protection.
- Identification labels (model number, output ranges, etc.): identification labels are located (a) on the shipping box and (b) inside the electronics module, under the printed circuit board (pop out the board to read the label).

Every instrument is carefully calibrated before shipment and should not require any further adjustments 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).

Overview

The FST series are narrow range humidity and temperature transmitters suitable for applications such as semi-conductor clean rooms and fab areas where conditions must be maintained within strict limits, and are essentially within the range of 35 to 50 %RH and 20 to 25°C / 68 to 78°F.

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. Two types of electronic circuit are available: 2-wire, loop powered (4...20 mA current signal) and 3-wire (voltage or current signal).

Well proven sensors and a robust housing make the FST series appropriate for use in industrial applications. Digital signal processing within the FST series ensures consistent product performance and also facilitates the task of field maintenance with features such as potentiometer free – digital calibration.

Main Features:

- relative humidity and temperature measurement
- available as 2-wire loop powered or as 3-wire circuit type
- well proven, durable humidity and temperature sensors
- potentiometer free – digital calibration
- test connector for communication with the HygroPalm 3 indicator ¹⁾

1) allows the HygroPalm 3 to read and / or calibrate the transmitter

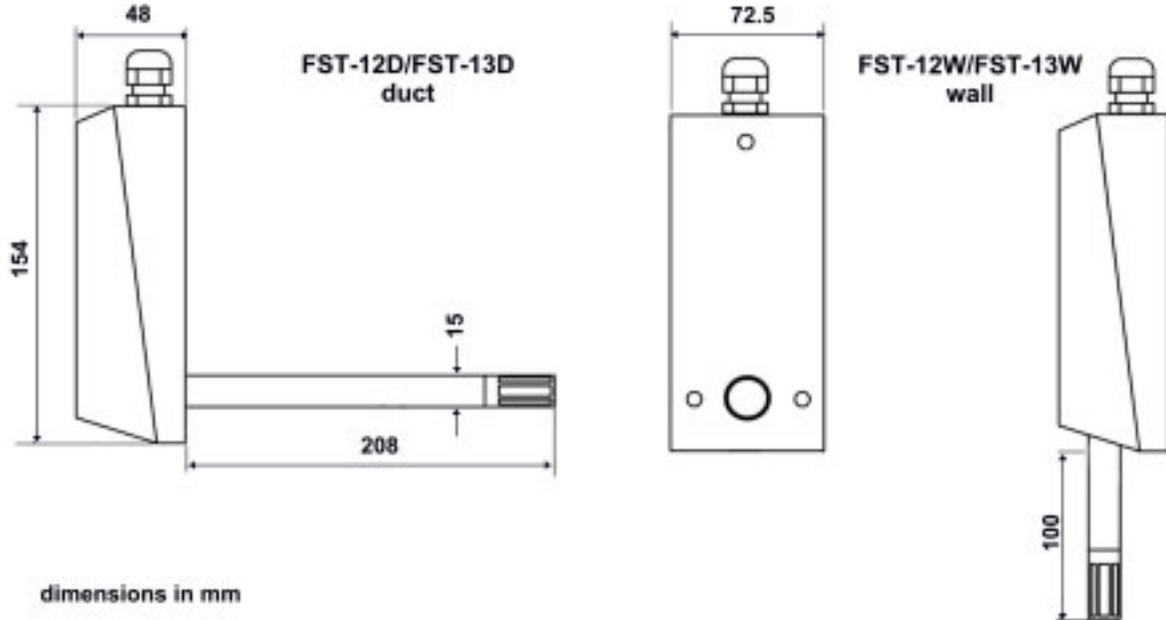
The FST series features a unique installation method that is both convenient and problem free. Each FST series transmitters includes a base plate and a plug-in electronics module. During installation, the base plate is mounted first and wired without the electronics module. This is done at the same time as general electrical work. During that time, the electronics module and probe can safely be stored away.

The FST series was designed for simple field maintenance and to minimize any downtime:

- Operation of the FST transmitter can be easily verified in the field by connecting a HygroPalm 3 indicator to the FST service connector. This is done without interrupting the output signals.
- Calibration is entirely digital, without any potentiometer.
- Should the electronic module develop a problem, it can easily be removed from the base plate and replaced with another module without any wiring work.

The FST series is available in the following configurations:

Model	Measurement	Circuit Type	Installation
FST-12W	%RH + Temperature	2-wire, loop powered	Wall mount
FST-12D	%RH + Temperature	2-wire, loop powered	Duct mount (through Wall)
FST-13W	%RH + Temperature	3-Wire	Wall mount
FST-13D	%RH + Temperature	3-Wire	Duct mount (through Wall)



dimensions in mm

Operation

Power supply

Depending on the circuit type, transmitters of the FST series require the following supply voltage:

- a) 2-wire (FST-12): 10...28 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 250Ω , the minimum supply voltage is $10 + 0.02 \times 250 = 15\text{ VDC}$. With both output circuits closed, the maximum current consumption is 40 mA.
- b) 3-wire (FST-13): 10 to 35 VDC (minimum 15 VDC for current outputs) or 12 to 24 VAC. With both output circuits closed, the maximum current consumption is 50 mA.

Operating range and limits

The FST series was designed to operate within the range of 30 to 60 %RH and 20 to 25°C / 68 to 78°F.

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 of the humidity sensor

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, even over a narrow 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 FST series uses the temperature data from the Pt100 RTD 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 FST series is always done at normal room temperature.

Output range

The standard range of the relative humidity output is 30 to 60%RH. The temperature output depends on the range specified when ordering - see identification labels (a) on shipping box and (b) on the transmitter enclosure.

Installation

Do not unnecessarily remove the sensor protection from the probe. The sensors can easily be damaged when not protected.

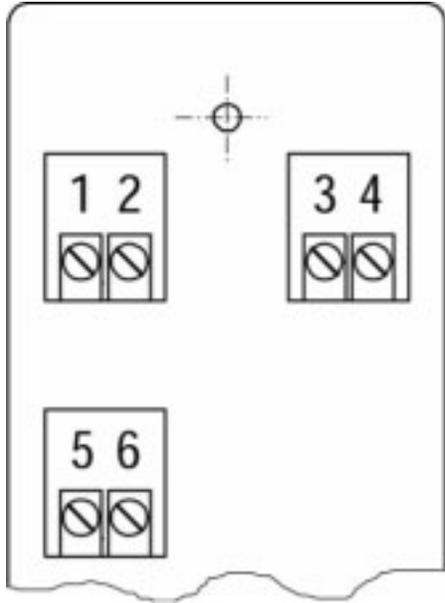
General recommendations

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:

- a) **Select a representative location:** install the probe 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.**
- e) **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.

Installation and wiring of the base plate

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

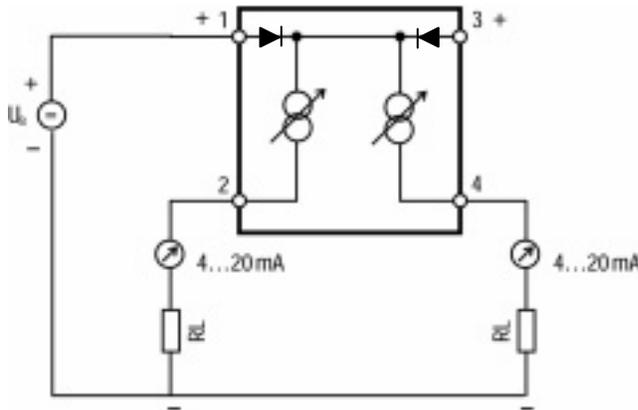


Installation Note (through wall installation)

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.

The base plate of the W and D models is supplied with one sealing cable grip (normally, the base plate is installed with the cable grip on top). 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. Avoid running the cables connecting the unit in the same conduit as 110 VAC power cables. Depending on the installation, you may have to use a cable with twisted pairs or a shielded cable to avoid electromagnetic interference.

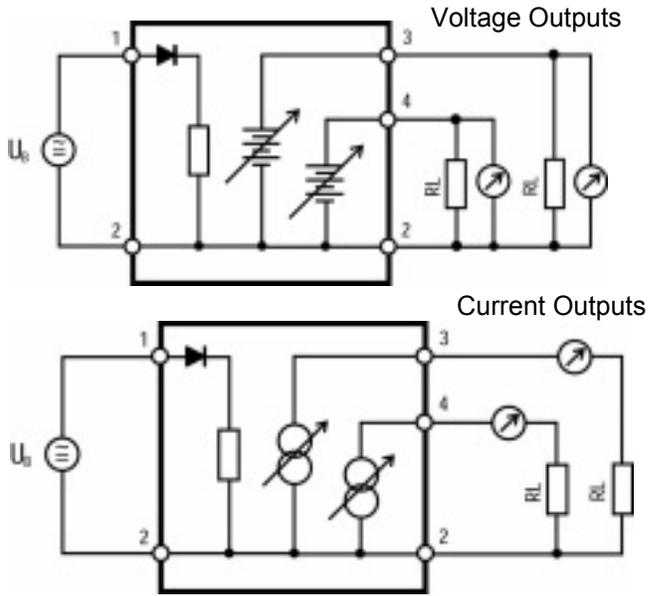
FST-12: 2-wire, loop powered



Base Plate Terminals	Description
1 and 3	10...28 VDC (+)
2	temperature output
4	relative humidity output
5 and 6	not used

Note: proper operation of the transmitter requires that both output current loops be closed. It is not necessary to connect both terminals 1 and 3 to the plus side of the power supply. The transmitter will operate normally with just one of these terminals connected.

FST-13: 3-wire



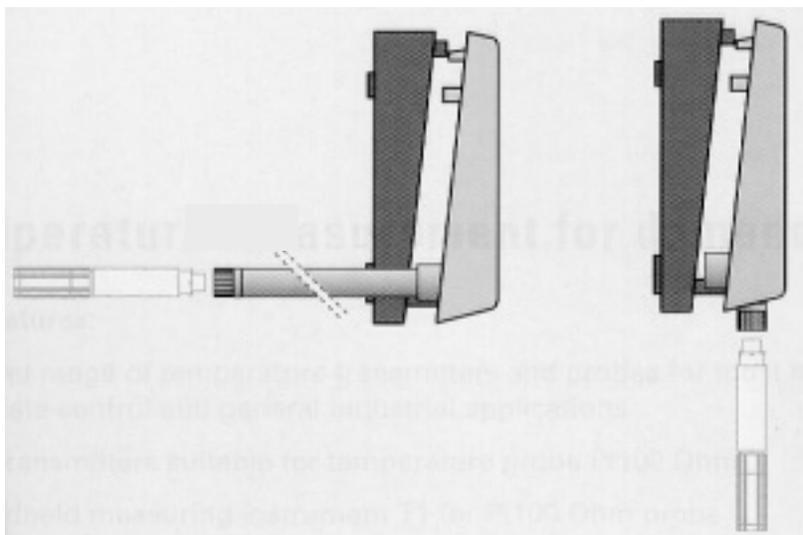
Base Plate Terminals	Description
1	10 (15) ...35 VDC (+) or 12 to 24 VAC
2	common (-)
3	Temperature (+)
4	Humidity (+)
5 and 6	Not Used

Note: the humidity and temperature output circuits are independent one from the other and it is possible to operate the transmitter with just one output connected.

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.

Installation of the electronics module



Once the base plate has been installed and wired, the electronics module can be inserted and secured with the screws provided. The transmitter is ready to operate.

Maintenance

Periodic calibration check

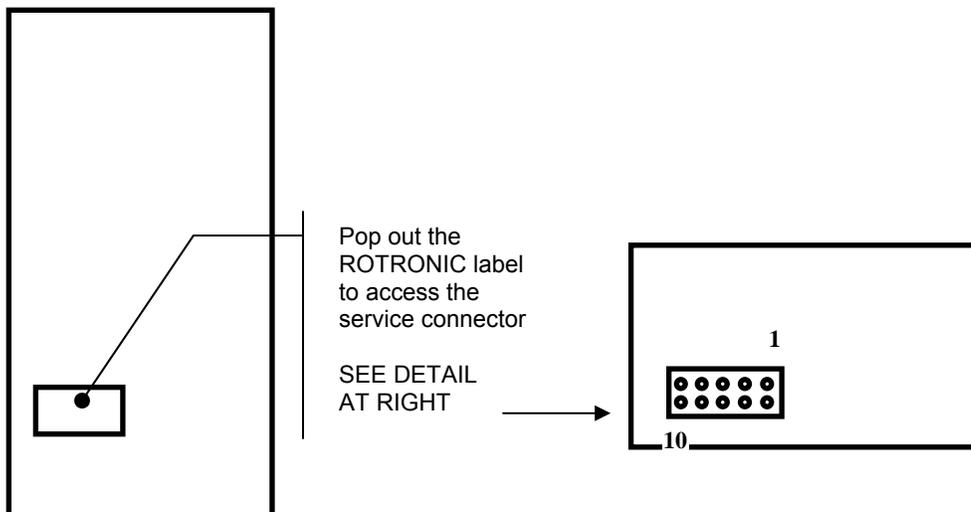
Long term stability of the ROTRONIC Hygromer humidity sensor is typically better than 1 %RH per year. For maximum accuracy, calibration of the probe should be verified every 6 to 12 months. Applications where the probe is exposed to significant pollution may require more frequent verifications.

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

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 - calibration**.

Service connector

The keyed 10-pin service connector can be accessed after popping out the Rotronic label located on the front of the enclosure (use a small screwdriver). This connector is used to connect the transmitter to a HygroPalm 3 indicator with a service cable. For details, see **service cable**.



Pin #	Wire Color	Signal
1		Temperature Lo ¹⁾
2		Temperature Hi ¹⁾
3		Humidity Lo ¹⁾
4		Humidity Hi ¹⁾
5		Ground
6		V+ (power to service cable)
7		Not Used
8		Not Used
9		Not Used
10		Internal digital signal (DIO)

1) current outputs: pins 1 and 2, as well as pins 3 and 4, are connected to each side of a precision 49.9 ohm resistor (0.1%) which is in series with the output current. With a signal of 4 .. 20 mA current output 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



Service cable ACRLXB5 is used to connect the 10-pin service connector of the FST to probe input 2 of the HygroPalm 3 portable indicator.

The service cable allows any of the following:

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

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

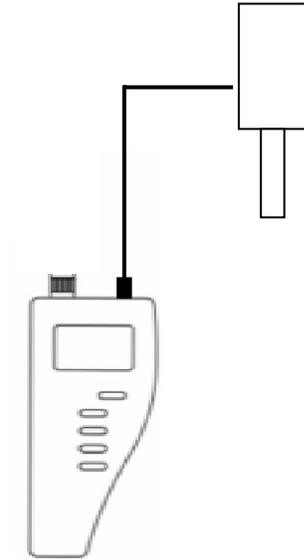
Note: the HygroPalm should be configured to read temperature in the same unit as the transmitter. Changing the temperature unit can be done directly on the HygroPalm.

- b) Single/multi-point adjustment against a reference environment with the HygroPalm 3.

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 with 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 these connections are the opposite of what is shown on the drawing to the left.** For detailed instructions, see separate HygroPalm manual – HygroPalm Function Menu – Adjust REF.



Note: both probe inputs of the HygroPalm should be configured for a digital HygroClip probe.

Specifications

	FST-12	FST-13
Humidity sensor	Rotronic Hygromer™ C94 thin film capacitive	
Temperature sensor	Pt100 RTD	
Circuit type	2-wire, loop powered	3-wire
Output signal type	4...20 mA, loop powered	0...1V, 0...5V, 0...10V 0...20 mA, 4...20 mA
Operating limits at probe	0...100%RH and -40...60°C / -40...140°F	
Operating limits at transmitter	0...99%RH non condensing and -40...60°C / -40...140°F	
Standard output range	30...60 %RH / 0...50°C / 50...100°F / 0...100°F	
Accuracy at 20..25°C / 68..78°F	± 1%RH from 30 to 60 %RH ± 0.2°C / ± 0.4°F (± 0.3°C / ± 0.5°F at other temperatures)	
Repeatability	± 0.2%RH and better than ±0.1°C / ±0.2°F	
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	10..28VDC; 10V + 0.02 x Load	10...35VDC/ 12...24 VAC minimum 15 VDC for current outputs
Current consumption	20 mA / output	< 50 mA
Max. load current outputs	250 Ω	250 Ω
Min. load voltage output		1000 Ω / V
Electrical connections	screw terminals and cable grip	
Sensor protection	wire mesh filter	
Max air velocity at probe	20 m /s (3900 ft / min)	
Housing material	ABS	
Protection grade	IP65 / NEMA 4	
Dimensions	housing: 154 x 72.5 x 48 mm 6.06 x 2.86 x 1.89" probe length: 208 mm / 8.2" (D model), 100 mm / 3.9" (W model) probe diameter 15 mm (0.6")	
Weight	292 g / 10.3 oz	

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.

Appendix 2: Calibration

Field calibration of the FST transmitter requires a HygroPalm 3 indicator and a service cable ACRLXB5 (see service cable). 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 calibration functions: ADJUST M-PT, ADJUST 1-PT or ADJUST REF. Detailed calibration instructions are provided separately in the HygroPalm manual. Follow the same procedure as you would to calibrate a probe attached to the HygroPalm.

Note that the FST transmitter must be powered up during calibration.

Appendix 3: Accessories for the FST Series

Order Code	Description
HygroPalm 3	HygroPalm 3, field calibrator
ACRLXB5	Cable: service connector FST to HygroPalm 3 (probe input 2)
ER-15	calibration device for the FST series transmitters (except S model)
EAx-SCS	humidity std, SCS certified, pack of 5 where xx = 00 (0 %RH) = 05 (5 %RH) = 10 (10 %RH) = 20 (20 %RH) = 35 (35 %RH) = 50 (50 %RH) = 65 (65 %RH) = 80 (80 %RH) = 95 (95 %RH)