

# FH Series

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.
- 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).

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).

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## DESCRIPTION

Transmitters of the FH series are used to measure humidity and temperature in manufacturing areas, clean rooms, research laboratories and other industrial applications. 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 FH series uses the HygroClip S plug-in probe. This probe has two analog outputs as well as a digital input / output. The HygroClip S measures relative humidity with a ROTRONIC HYGROMER™ C94 capacitive humidity sensor. This well proven sensor offers exceptional durability and stability in all kinds of environments. Temperature is measured with a precision RTD Pt100 sensor. The HygroClip S has an operating range of 0...100 %RH and -40...85°C (-40... 185°F). Digital signal processing within the HygroClip S maintains accurate measurements over the entire operating range.

FH series transmitters include a base plate and an electronics module 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 FH series was designed to facilitate maintenance and minimize down time. Test connectors make it possible to verify operation of the FH in the field without interrupting the output signals. The HygroClip S itself is a 100% interchangeable digital probe: calibration data, sensor characteristics, serial number, etc. are retained within a non-volatile memory. Should the probe require maintenance, it can be replaced in seconds without any loss of accuracy and without requiring a recalibration of the FH transmitter. ROTRONIC offers easy-to-use software and accessories for in-house calibration of the HygroClip S. If you do not wish to calibrate, or if the HygroClip has to be replaced, use our unique HygroClip exchange program. This plan is supported by the ROTRONIC worldwide distribution network. The replacement probe is either a brand new HygroClip S or a reconditioned probe with a brand new humidity sensor and dust filter.

The FH series is available in the following configurations:

Model	Measurement	Circuit Type	Installation
F22H-65	%RH + Temperature	2-Wire Loop Powered	Wall mount (surface) or remote probe *)
F22H-31	%RH + Temperature	2-Wire Loop Powered	Duct mount (through Wall)
FH-65	%RH + Temperature	3-Wire	Wall mount (surface) or remote probe *)
FH-31	%RH + Temperature	3-Wire	Duct mount (through Wall)

\*) remote probe requires an extension cable (see accessories)

## OPERATION

### ***Power Supply***

Transmitters of the FH series require the following supply voltage:

- 2-Wire Transmitters: 8..35 VDC (depending on the load connected to the output)

The minimum supply voltage can be determined as follows:  $V_{\min} = 8\text{ V} + 0.02 \times \text{Load (ohm)}$ . For the maximum load of  $500\Omega$ , the minimum supply voltage is  $8 + 0.02 \times 500 = 18\text{ VDC}$ .

The maximum current consumption is 40 mA.

- 3-Wire Transmitters: 10 (15)..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  $500\Omega$ .

3-Wire transmitters have a typical current consumption of 35 mA.

### ***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 identification labels (a) on shipping box and (b) inside electronics module under the printed circuit board).

### ***Temperature Operating Range and Temperature Limits***

The FH series can operate within 14 to 140°F (-10 to 60°C) at the electronics.

The temperature operating range of the HygroClip S probe is -40...185°F (-40...85°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 HygroClip S probe 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 HygroClip S is done at normal room temperature rather than at the temperature of operation at the sensor.

### **Sensor Protection**

The HygroClip S probe is supplied as a standard with a wire-mesh dust filter to protect the sensors. Special environments may require using a foam filter (consult ROTRONIC).

### **Output Signals**

The FH series is available with the following output signals:

- 2-Wire Transmitters: 4-20 mA
- 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. An identification label located on the enclosure shows the type of output signal for each unit..

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.

## **INSTALLATION**

<p><b>Do not unnecessarily remove the dust filter from the HygroClip probe. The sensors can easily be damaged when not protected.</b></p>
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### **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.

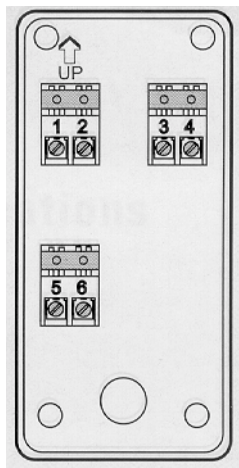
c) **Avoid the following:** (1) Close proximity of the probe to a heating element, a cooling coil, a cold or hot wall, direct exposure to sun rays, etc. (2) Close proximity of the probe to a steam injector, humidifier, direct exposure to precipitation, etc. (3) Unstable pressure conditions resulting 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 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 and remote probes)

Providing an orifice at a distance of about 3" from the probe of the transmitter will make it possible to insert a reference HygroClip S probe for future calibration checks.

### ***Wiring***

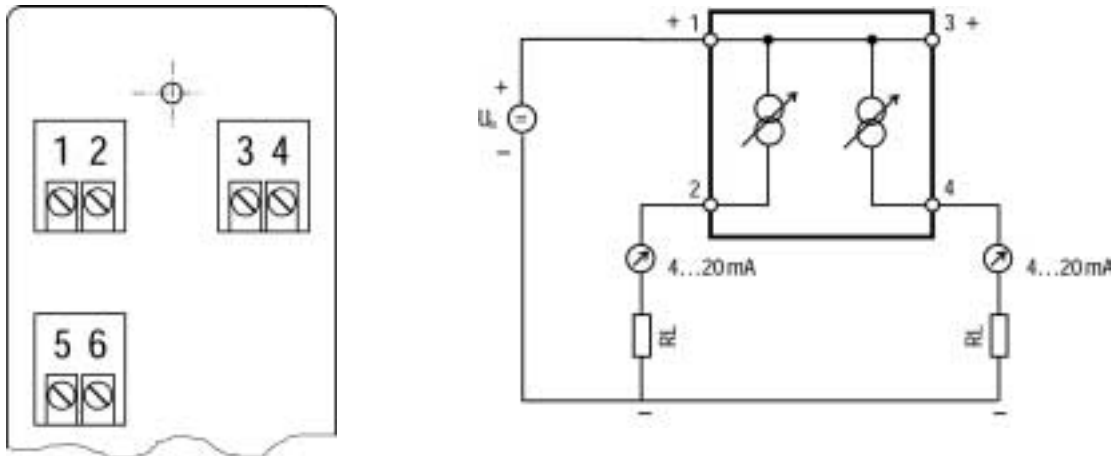
The base plate of the standard FH series transmitter is supplied with one sealing cable grip. This cable grip provides effective sealing only with cables having the proper outside diameter. Preferably, use a cable with an outside diameter of 0.236 to 0.275 inch (6 to 7 mm) and with 18 AWG wires. Depending 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 1000 ohms. 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.

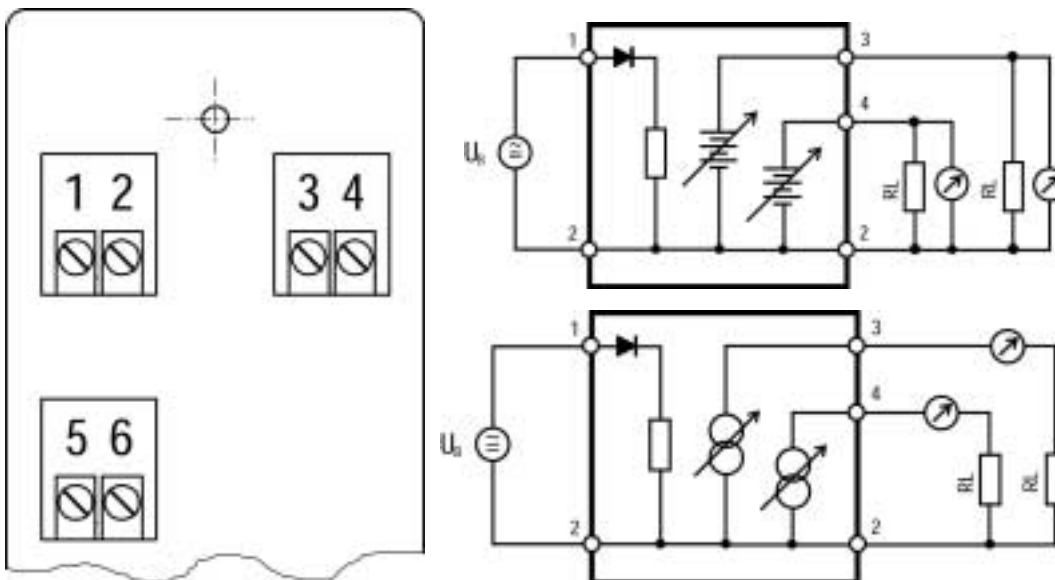
**Wiring Diagrams – 2-Wire Loop-Powered Models**



Model	Base Plate Terminals	Description
F22H-31	1 or 3 (internally connected)	8...35 VDC (+)
F22H-65	2	temperature output (-)
	4	relative humidity output (-)
	5 and 6	not used

*Measuring humidity only: the humidity and temperature circuits of the F22H are not independent circuits. Proper operation of the transmitter requires that both circuits be closed. Even if the temperature signal is not going to be used, a wire should be run between terminal 2 and the minus side of the power supply.*

**Wiring Diagrams – 3-Wire Models**



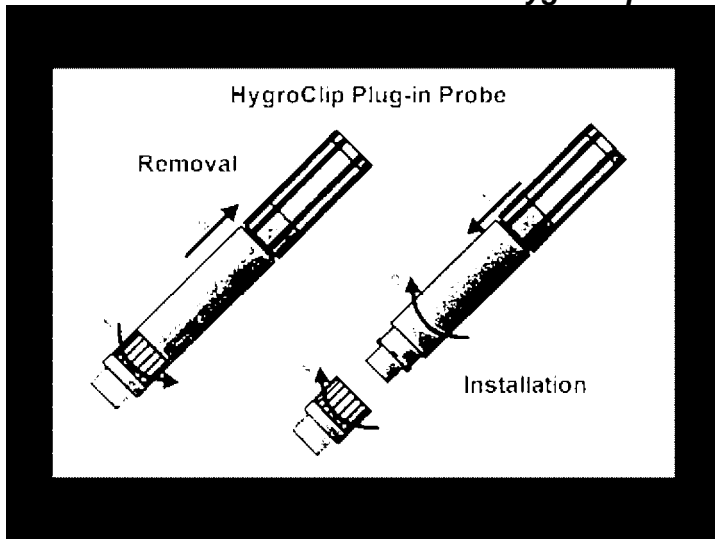
Model	Base Plate Terminals	Description
FH-31	1	10...35 VDC (+) or 24 VAC
FH-65	2	common (-)
	3	temperature output (+)
	4	relative humidity output (+)
	5 and 6	not used

*Measuring humidity only: the humidity and temperature circuits of the FH are independent. If so desired, only one circuit may be used at a time.*

### Grounding

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

### Installation and Removal of the HygroClip S Probe

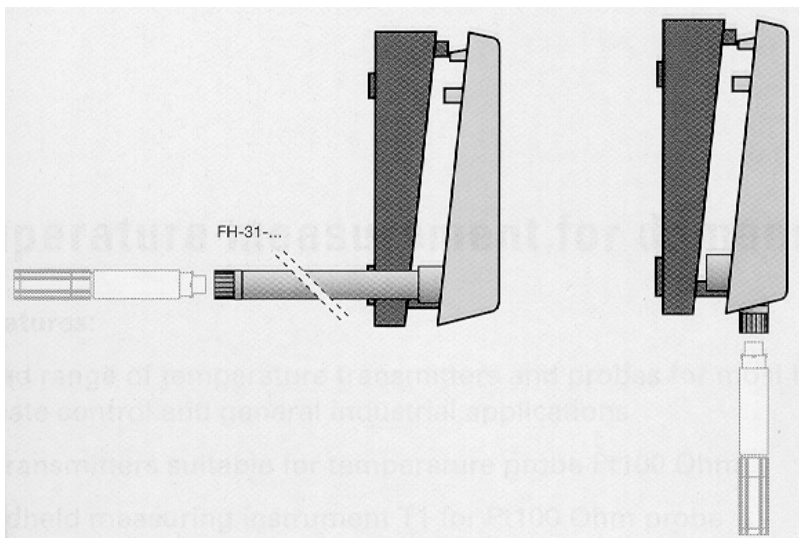


Both the HygroClip S and the probe base on the transmitter are marked with a dot.

The probe can be inserted straight into the connector when the two dots are aligned. When the dots are not aligned, the probe should be rotated clockwise during insertion.

After inserting the probe, turn the locking ring clockwise to secure the probe.

### 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

### ***Cleaning or Replacing the Dust Filter of the HygroClip S***

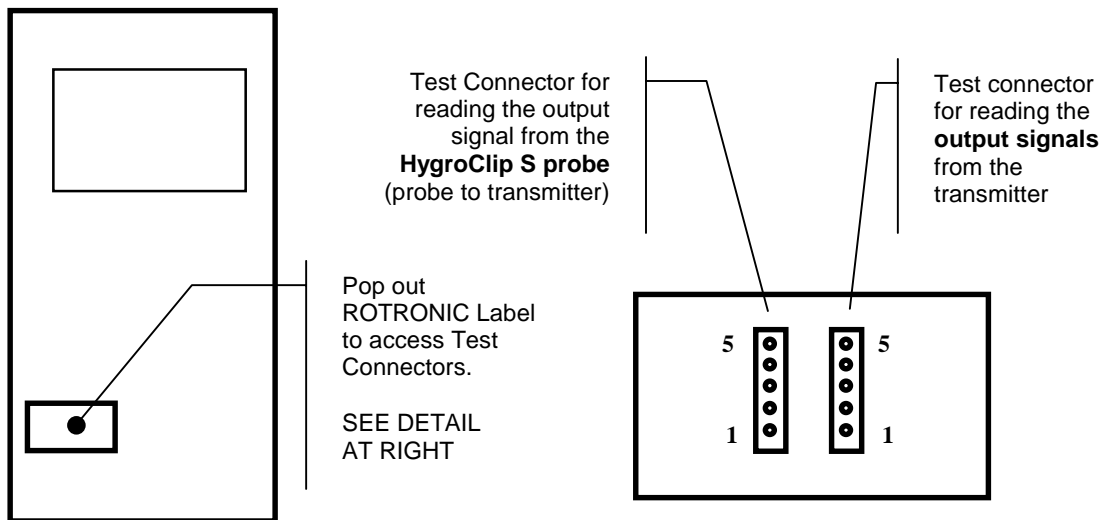
The dust filter should be cleaned from time to time, depending on the conditions of measurement. Cleaning should be done without removing the filter from the probe. Clean the filter with a fine brush. If this is not sufficient, the filter should be replaced. To do this, unscrew the filter from the probe.

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 (on-site)***

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 FH series are equipped with two 5-pin keyed test connectors that permits reading the signal from the HygroClip S probe or the output signals from the transmitter, without interrupting operation of the transmitter.



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

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<b>FH Outputs Test Connector Pin #</b>	<b>Wire Color</b>	<b>Signal</b>
<b>1</b>	<b>Green</b>	<b>Humidity (HI) for current output or Humidity (+) for voltage output</b>
<b>2</b>	<b>Yellow</b>	<b>Humidity (LO) for current output or Ground for voltage output</b>
<b>3</b>	<b>Brown</b>	<b>not used</b>
<b>4</b>	<b>White</b>	<b>Temperature (HI) for current output or Temperature (+) for voltage output</b>
<b>5</b>	<b>Gray</b>	<b>Temperature (LO) for current output or Ground for voltage output</b>

A test cord that fits these connectors is available from ROTRONIC  
Part number: R87 / AK3029-4P

The signals from the test connectors can be read with any precision DVM:

- HygroClip:

Humidity:  $0...1\text{ V} = 0...100\%RH$

Temperature:  $-0.4...0.85\text{ V} = -40...85^{\circ}C$  (independent of the temperature range of the FH)

- FH Outputs:

Voltage Outputs: direct read out of the outputs.

Example  $0...5\text{ V} = 0...100\%RH$  or  $0...5\text{ V} = 0...100^{\circ}F$  (or other temperature range)

Current Outputs: indirect read out of the current signal. The test connector uses the voltage drop across a 10 ohm resistor that is part of the output circuit.

Example  $40...200\text{ mV} = 0...100\%RH$  or  $40...200\text{ mV} = 0...100^{\circ}F$  (or other temperature range)

The readings of the DVM can be compared with the readings of any reference instrument.

### ***Checking the electronic circuits of the FH Transmitter***

The components used in the circuits of the FH transmitter are very stable and should not exhibit any noticeable long-term drift. Some users may find it necessary to verify that the signals from the HygroClip S probe are correctly reproduced at the output of the transmitter.

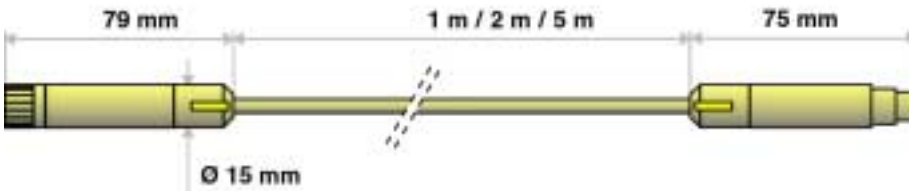
To verify this, remove the HygroClip S from the transmitter. You can now use the HygroClip test connector to inject two precisely known voltages to simulate the HygroClip S probe. At that time, the output signals of the FH transmitter can be compared with the input voltages.

Transmitters that have drifted should be returned to the factory for repair or replacement.

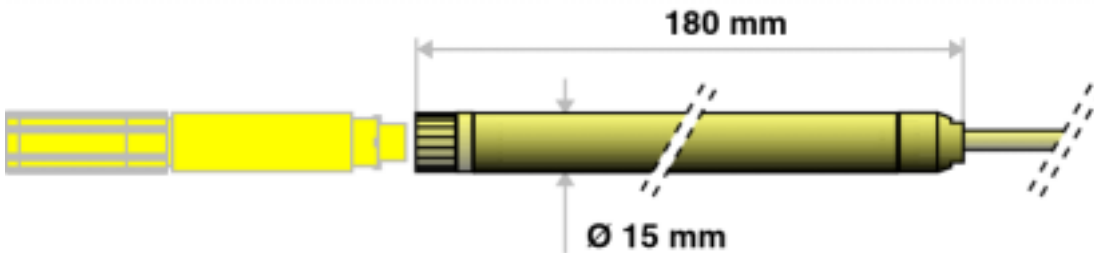
## ACCESSORIES

### *Extension cables for the HygroClip S (models F22H-65 or FH-65)*

- MOK-xx-DAT05: (xx = 1, 2 or 5 meters)  
for F22H-65 or FH-65



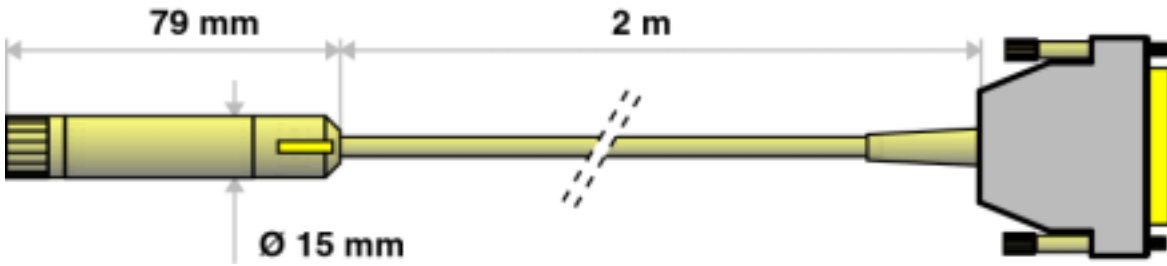
- HPH-xx-DAT05: xx = length of cable in meters (maximum 100m or 500 ft)  
for FH-65 only (not compatible with F22H-65)



### *Calibration cable for the HygroClip S*

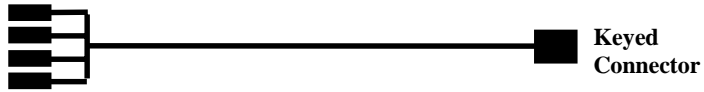
The MOK-02-WIN cable is used to connect the HygroClip S probe to the COM port of a PC. This cable is shipped together with the ROTRONIC HW3 software which is used to read and calibrate the probe from the PC.

<b>PC</b>	Pentium 90MHz or better
<b>Windows<sup>®</sup></b>	95/98 or NT <sup>®</sup>
<b>Memory</b>	32MB
<b>Disk Space</b>	20MB free
<b>Drives</b>	CD ROM drive required
<b>Monitor</b>	VGA or Super VGA
<b>Resolution</b>	800 x 600 or higher (set to small fonts) High Color 16Bit (256 Color minimum)
<b>COM Port</b>	RS232 (COM 1-4)
<b>Software</b>	HW3 (includes - MSIE 4.0 Browser - Adobe <sup>®</sup> Acrobat Reader) MS Internet Explorer: for best viewing, set fonts to smallest



For customers who do not have a humidity generator, ROTRONIC offers a wide range of certified humidity standards and a calibration chamber that fits the HygroClip S.

***Test Cable***



Test Cord R87/AK3029-4P for use with a DVM

## SPECIFICATIONS

Probe (plug-in)	HygroClip S
Humidity Sensor	ROTRONIC HYGROMER™ C94
Temperature Sensor	Pt100 RTD
Operating Limits at Probe	0...100%RH and -40...85°C (-40...185°F)
Operating Temperature at Transmitter Electronics	-10...60°C (14...140°F)
Humidity Measuring Range	0..100 %RH
Humidity Output Range	0..100%RH
Temperature Measuring Range	Range must be within temperature limits of probe
Standard Temperature Output Ranges	0..100°F or 0..100°C
Output Signals (linear)	F22H: 4-20 mA (max. load 500Ω) FH: 0-5 V (min. load 1000 Ω) or 4-20 mA (max. load 500Ω)
Accuracy at 68..77°F (20..25°C)	±1.5%RH from 0 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)
Supply Voltage	F22H: 8..35VDC; 8V + 0.02 x Load FH: 10 (15)..35VDC or 24VAC - 35 mA
Sensor Protection	Wire Mesh Filter
Weight	0.7 lbs (300 g)
Case Material	ABS
Case Protection	DIN IP 65 (splash proof)

