

<b>E-M-HF3-V1_13</b>	Rotronic AG Bassersdorf, Switzerland
Document code	Unit
<b>HygroFlex HF3 Transmitters and Thermo-hygrostats: User Guide</b>	<b>Instruction Manual</b>
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# HygroFlex HF3 Transmitters and thermo-hygrostats

## User Guide



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## Applicability:

This manual applies to all instruments of the HF3 series with firmware version 1.x, where 1.x can be 1.0, 1.1, etc. Changes to the last digit of the version number reflect minor firmware changes that do not affect the manner in which the instrument should be operated.

## 1 Overview

The HF3 transmitters and thermo-hygrostats measure temperature, relative humidity and the dew or frost point. The HF3 series is designed for fixed installation in cost sensitive HVAC applications where conditions are within the range of 0 to 100 %RH and -40 to 60°C (-40 to 140°F).

The HF3 features well proven sensors and a robust housing. Digital signal processing ensures consistent product performance and also facilitates the task of field maintenance with features such as potentiometer free - digital calibration.

Based on the ROTRONIC AirChip 3000 digital technology, the HF3 series offers the following user functions:

- User configurable settings
- Calculation of the dew or frost point
- Humidity temperature calibration and adjustment
- Simulator mode
- Automatic humidity sensor test and drift compensation
- Sensor failure mode
- Data recording

The ability for the user to easily update the AirChip 3000 firmware means that instruments of the HF3 series can be kept up-to-date regarding any future functionality improvement.

**HF3 transmitters:** two types of electronic circuit are available: HF32: 2-wire, loop powered (4...20 mA current signal) and HF33: 3-wire (voltage or current signal). Both circuit types provide linear analog outputs signals for transmission over a length of cable to a remote display, recorder, controller or data processing unit. The HF3 transmitters can be used to measure humidity only, temperature only or both parameters.

**HF3 thermo-hygrostats:** the HF34 (3-wire circuit type) is available as a thermo-hygrostat (humidity and temperature), as a thermostat (temperature only) or as a hygrostat (humidity only).

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## 2 Models

### 2.1 Ordering codes

HF32 (2-wire, loop powered) and HF33 (3-wire)									
1	2	3	4	5	6			Circuit type, supply voltage and output signal type	
HF320-									2-wire (loop powered), 10 to 28 VDC, 4...20 mA
HF331-									3-wire, 15 to 40 VDC or 12 to 28 VAC, 0...20 mA
HF332-									3-wire, 15 to 40 VDC or 12 to 28 VAC, 4...20 mA
HF333-									3-wire, 5 to 40 VDC or 5 to 28 VAC, 0...1 V
HF334-									3-wire, 10 to 40 VDC or 8 to 28 VAC, 0...5 V
HF335-									3-wire, 15 to 40 VDC or 12 to 28 VAC, 0...10 V
Installation type / Mechanical configuration									
	D				X				Duct mount (through wall), probe: Ø 15 x 235 mm (0.6 x 9.2")
	S								Space mount – no apparent probe
	R								Space mount – with apparent probe
	W				X				Wall mount, apparent probe: Ø 15 x 85 mm (0.6 x 3.3")
Parameters (analog outputs)									
		B				X	X	X	Humidity (0...100 %RH) and Temperature - see range below
		H	X	X		X	X	X	Humidity only (0...100 %RH)
		T				X	X	X	Temperature only (see range below)
		1	X	X					Humidity and Dew / Frost point
		A							Temperature and Dew / Frost point - see range below
Temperature ranges									
			1	X					0...50 °C
			6	X					0...100 °F
			S	T					Custom range (specify when ordering)
Optional display (type S and R only)									
						D			LC display - HF32: no backlight, HF33: backlight
						X			No display
Dew / frost point ranges									
						X	B	X	-50...50
						X	C	X	-50...100
						X	S	C	Custom range (specify when ordering)

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**Notes:**

- Output 1: relative humidity or dew point
- Output 2: temperature
- The dew / frost point range uses the same unit (°C or °F) as the temperature output. The factory default setting is frost point below freezing
- Custom range: be sure to clearly specify the desired range at the time of the order. When a special range has been ordered, the letters ST and XSC are used in columns 4 and 6 in the above table. These generic codes will be replaced with a specific code only for quantity and repeat orders

Thermo-Hygrostats: HF34									
1	2	3	4	5	6	Circuit type and supply voltage			
HF346-						3-wire, 8 to 40 VDC or 12 to 28 VAC			
						Installation type / Mechanical configuration			
	D					Duct mount (through wall), probe: Ø 15 x 235 mm (0.6 x 9.2")			
	W					Wall mount, probe: Ø 15 x 85 mm (0.6 x 3.3")			
						Parameters (relay contacts)			
		B		X	X	Humidity and Temperature - see SP span below			
		H	X	X	X	Humidity only - see SP span below			
		T		X	X	X	X	Temperature only - see SP span below	
		1	X	X		Humidity and Dew / Frost point - see SP span below			
		A				X	X	Temperature and Dew / Frost point - see SP span below	
						Temperature: SP (set-point) potentiometer span			
			S	T		Custom span (specify when ordering – see note below)			
						Dew / frost point: SP (set-point) potentiometer span			
				S	C	Custom span (specify when ordering – see note below)			
						Humidity: SP (set-point) potentiometer span			
						S	H	Custom span (specify when ordering – see note below)	

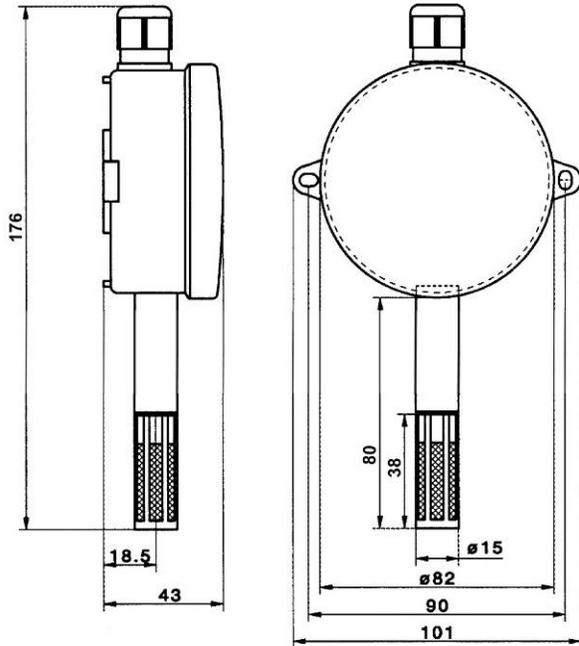
**Notes:**

- Relay 1: relative humidity or dew / frost point
- Relay 2: temperature
- The dew / frost point uses the same unit (°C or °F) as temperature. The factory default setting is frost point below freezing
- When ordering, be sure to clearly specify the adjustment span of each set point potentiometer.  
**To facilitate a precise adjustment of the set point , it is highly recommended to specify a narrow span for the potentiometer**
- In the above table, the letters ST, SC and SH are used in columns 4, 5 and 6 for the adjustment span. These generic codes will be replaced with a specific code only for quantity and repeat orders
- The factory default for the humidity, temperature or dew / frost point dead band is 0.5

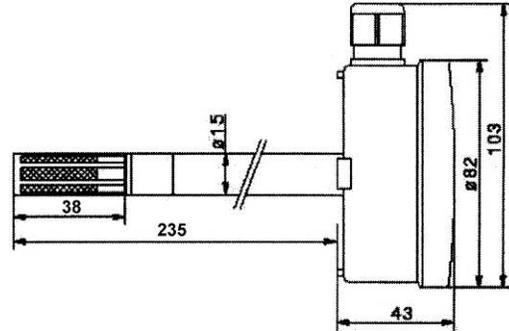
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## 2.2 Mechanical configurations and dimensions

**Type W: wall mount**

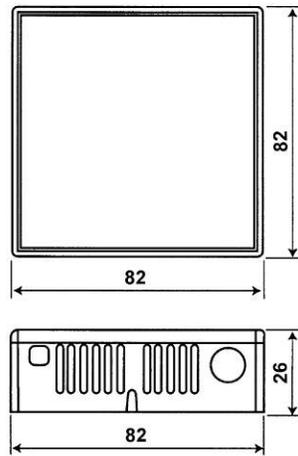


**Type D: duct mount**

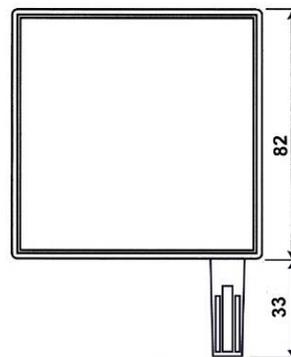


Dimensions in mm

**Type S: space mount**



**Type R: space mount extended probe**



Dimensions in mm

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## 2.3 Display option



The LC display option is available only with type R and type S. The upper line corresponds to relative humidity or dew / frost point and the bottom line corresponds to temperature.

The display can be configured to show a trend indicator on each line:

- ▲ : increasing value
- ▼ : decreasing value

In the event of an alarm the display shows the symbol [ ! ] to the right of the value.

For instructions see the following HW4 manual: **E-M-HW4v2.1-F2-002**.

The display option for the HF33 has a backlight. The display option for the HF32 does not have a backlight.

## 3 General description

### 3.1 Power supply

Depending on the circuit type, the HF3 requires the following power supply:

- a) **HF32** (2-wire, loop powered): 10...28 VDC - depending on the load connected to the output(s). The minimum supply voltage can be determined as follows:

$$V_{\min} = 10 \text{ V} + (0.02 \times \text{Load}^*) \quad * \text{Load resistance in ohms.}$$

For the maximum load of 500 Ω, the minimum supply voltage is 10 + (0.02 x 500) = 20 VDC. With both output circuits closed, the maximum current consumption is 40 mA.

- b) **HF33** (3-wire with analog outputs): 15 to 40 VDC (see note below) or 12 to 28 VAC. With both output circuits closed, the maximum current consumption is 50 mA.

Note: depending on the type of output signal, the HF33 will operate with the following minimum voltage

0...1 V outputs:	5 VDC or 5 VAC
0...5 V outputs:	10 VDC or 8 VAC
0...10 V outputs:	15 VDC or 12 VAC
0...20 mA or 4 ...20 mA outputs:	6 VDC or 5 VAC with 0 Ω load 15 VDC or 12 VAC with 500 Ω load

- c) **HF34** (3-wire): 8 to 40 VDC or 12 to 28 VAC. With both relays energized, the maximum current consumption is 50 mA.

### 3.2 Measured parameters

The HF3 measures relative humidity with a ROTRONIC Hygromer® IN1 capacitive sensor and temperature with a Pt100 RTD.

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### 3.3 Calculated parameters

Using the ROTRONIC HW4 software, the HF3 can be configured by the user to calculate either the dew point or the frost point.

### 3.4 Analog output signals (HF32 and HF33)

**HF32 and HF33:** with the ROTRONIC HW4 software any of the two analog output signals can be made to correspond to one of the following:

- Relative humidity
- Temperature
- Dew or frost point

Any output can also be disabled.

The scale of each analog output can be set within the numerical limits of -999.99 and 9999.99.

The D/A converters used to generate the analog output signals feature a 16-bit resolution and exhibit a small positive offset at the bottom of the signal range as indicated below:

Signal type	Maximum offset at range bottom
0...1 V	3 mV
0...5 V	50 mV
0...10 V	90 mV
0...20 mA	4 µA
4...20 mA	No offset

**HF33:** the ROTRONIC HW4 software allows changing the type of output signal to one of the following: 0...20 mA, 4...20 mA, 0...1V, 0...5V or 0...10V. Both output signals are automatically configured with the same signal type. No calibration or adjustment is required after changing the type of output signal.

In the case of voltage output signals, load requirements apply to the external device or circuit connected to the HF3 transmitter. These requirements are defined in the "Operation" chapter

### 3.5 Relay outputs (HF34)

Each of the two independent SPDT relays has its own set-point which can be adjusted with a potentiometer located on the printed circuit board. A relay is energized when the value of the monitored parameter is higher than the corresponding set-point. Operation of each relay is indicated by a LED located on the HF34 printed circuit board. This LED is lit when the corresponding relay is energized.

Using the ROTRONIC HW4 software any of the two relays can be made to correspond to one of the following:

- Relative humidity
- Temperature
- Dew or frost point

If so desired, any relay can also be disabled. The minimum and maximum limits for the two adjustable set-points (potentiometer) can be set within the numerical limits of -999.99 and 9999.99 and the dead band for each set-point can also be adjusted.

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### 3.6 Service connector

The service connector (UART interface with a mini-USB type connector) allows connecting the HF3 either to a PC running the ROTRONIC HW4 software or to a probe input of another instrument that is compatible with the HygroClip 2 (HC2) probes. In both cases a service cable is required. See "Maintenance" for the location of the service connector and for the type of service cable to be used.

- Connecting the HF3 to a PC is used to configure the HF3, gain access to the HF3 functions such as humidity and temperature adjustment, read data from the HF3 on the PC and update the AirChip 3000 firmware.
- Connecting the HF3 to another instrument is useful only when the other instrument has its own display and keypad (example HP23 hand-held calibrator). The connection allows showing the data measured by the HF3 on the other instrument display and also allows using the other instrument internal menu to do for example a humidity and temperature adjustment of the HF3.

### 3.7 Sensor protection (dust filter)

With the exception of models with the S configuration, the HF3 is supplied with a Polyethylene filter to protect the sensors against dust particles and high air velocity.

## 4 User configurable settings and functions

The HF3 ships configured as specified on the customer order. The HF3 can be installed and used just as any conventional humidity and temperature transmitter and most users will never need to use the HF3 configurable settings and functions.

Making use of the HF3 configurable settings and functions is entirely up to the user and the appropriate settings depend on the user application. We have provided below a short description of the HF3 functions and also indicated the factory default settings.

### 4.1 Function overview

MEASUREMENT ACCURACY AND RELIABILITY	
AirChip 3000 Functions	Description
▶ Humidity / temperature adjustment	<ul style="list-style-type: none"> <li>○ 1-point or multi-point humidity calibration or adjustment</li> <li>○ 1-point or 2-point temperature calibration or adjustment</li> <li>○ Generate a time stamp for calibrations and adjustments</li> <li>○ Retain and view last adjustment date and adjustment values</li> <li>○ Generate calibration and adjustment protocols</li> </ul>
▶ Automatic humidity sensor test and optional drift compensation	<p>Tests the humidity sensor for drift caused by contaminants and can be used to automatically apply a correction. The test is automatically carried out at regular intervals of time. Can be configured, enabled, or disabled</p> <p>The humidity sensor status can be verified either with the HW4 software and is shown as Good, SQ-tuned (corrected for drift) or Bad (defective)</p>

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<b>MEASUREMENT ACCURACY AND RELIABILITY</b>	
▶ Data recording	<p>The data recording function differs from a true data logging function in the sense that the AirChip 3000 does not time stamp the data. The data recording function can be used to investigate events such as a sensor malfunction as well as to retrieve data that would otherwise be lost</p> <ul style="list-style-type: none"> <li>○ Start or stop data recording - up to 2000 value pairs (%RH and temperature). Starting a recording session erases all previously recorded data</li> <li>○ The recording mode and log interval can be specified</li> <li>○ When the device is powered off, the recording session is paused but not ended. As long as the recording session has not been ended, the device automatically resumes recording data when powered up again</li> <li>○ The recorded data can be downloaded to a PC with the HW4 software, time stamped and viewed</li> </ul>

<b>MEASUREMENT LOOP VALIDATION</b>	
<b>AirChip 3000 Functions</b>	<b>Description</b>
▶ Simulator mode	Used to generate fixed values for the humidity, temperature and calculated parameter. Can be configured, enabled or disabled

<b>DEVICE SAFEGUARDS</b>	
<b>AirChip 3000 Functions</b>	<b>Description</b>
▶ Device write protection	Used to protect the device with a password to prevent unauthorized digital access by a digital user. Can be configured, enabled or disabled

<b>PROCESS PROTECTION / PROTECTION OF OTHER DEVICES</b>	
<b>AirChip 3000 Functions</b>	<b>Description</b>
▶ Limit humidity output to 100 %RH	Used to prevent the humidity signal from exceeding 100 %RH when condensation forms on the sensor. Can be enabled or disabled
▶ Out-of-limit value alarm	<p>Used to specify the normal range for humidity, temperature and the calculated parameter depending on the user application. Can be configured, enabled or disabled</p> <p>Out-of-limit values trigger a digital alarm which can be also be seen on the optional display</p>
▶ Bad sensor alarm	<p>Built-in function. Cannot be disabled</p> <p>A bad humidity or temperature sensor triggers a digital alarm which can be also be seen on the optional display</p>
▶ Fail safe mode	Used to specify a "safe" fixed value for humidity and for temperature in the event of a sensor failure. Can be configured, enabled or disabled

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## 4.2 Factory default settings

**Note:** Configuration of the HF3 by the user and access to its functions requires a PC with the ROTRONIC HW4 software (version 2.1.1 or higher) installed. Service cable AC3006 or AC3009 is used to connect the HF3 service connector to a USB port of the PC.

Configurable Settings	Applicability	Factory default
Unit system (Metric or English)	HF32, HF33, HF34	As per ordering code
Analog signal type (4...20 mA or other)	HF33	As per ordering code
Psychrometric calculation	HF32, HF33, HF34	As per ordering code
Output 1 parameter, scale and unit	HF32, HF33	As per ordering code (%RH or DP)
Output 2 parameter, scale and unit	HF32, HF33	Temperature, unit as per ordering code
Relay 1 set-point potentiometer adjust. span	HF34	As per order (%RH or DP)
Relay 2 set-point potentiometer adjust. span	HF34	As per order (temperature)
Display resolution (optional)	HF32-S, HF33-S	1 decimal
Display backlight (optional)	HF33-S	Always on
Displayed parameters	HF32, HF33	As per ordering code
Trend indicator (display)	HF32-S, HF33-S	Enabled
Device name	HF32, HF33, HF34	Instrument model

Functions	Applicability	Factory default
Humidity / temperature adjustment	HF32, HF33, HF34	
Device write protection	HF32, HF33, HF34	Disabled
Limit humidity output to 100 %RH	HF32, HF33	Enabled
Out-of-limit value digital / display alarm	HF32-S, HF33-S	Disabled
Data recording	HF32, HF33, HF34	Enabled (loop mode – 10 min. interval)
Automatic humidity sensor test	HF32, HF33, HF34	Disabled
Humidity sensor drift compensation	HF32, HF33, HF34	Disabled
Fail safe mode	HF32, HF33, HF34	Disabled
Simulator mode	HF32, HF33	Disabled

- For a detailed description of all AirChip 3000 / HF3 main functions see document **E-T-AC3000-DF-V1**
- Instructions regarding the configuration of the HF3 and access to its functions are provided in the following manuals:
  - E-M-HW4v2.1-F2-002**
  - E-M-HW4v2.1-Main** (§ 6.5)
  - E-M-HW4v2.1-DR-001**
  - E-M-HW4v2.1-A2-001**
  - E-M-AC3000-CP**
- The factory default setting for dew / frost point calculation is frost point below freezing

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## 5 Mechanical installation

### 5.1 General guidelines

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.

### 5.2 Type D – through wall mount



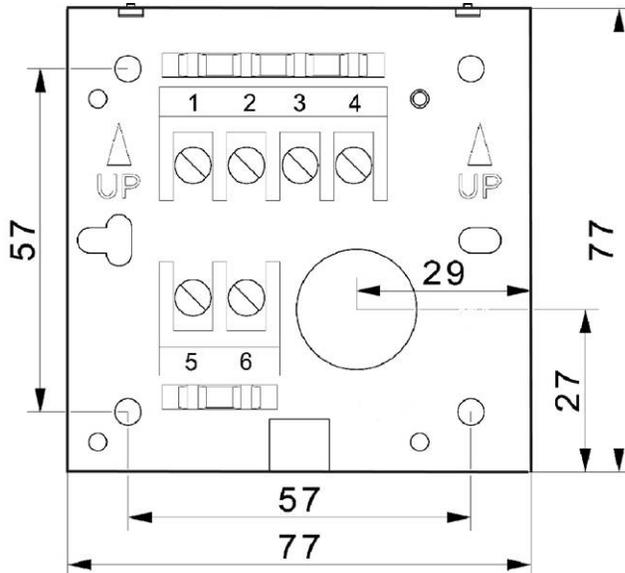
Part **AC5005** is a flange with compression fitting that is designed to hold the probe of the HF3 type D when mounted through a wall (see Accessories). The HF3 does not require any additional support. The AC5005 allows easy installation and removal of the HF3.

### 5.3 Type W – surface mount

The transmitter housing can be attached to the mounting wall using screws with an approximate diameter of 3 mm (1/8").

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#### 5.4 Type R and S – surface mount



Type R and type S consist of a base plate and an electronics module that plugs into the base plate. The base plate is installed and wired first.

The base plate should be installed with terminals 1 to 4 placed on top. Preferably, use a cable with 18 AWG wires.

Once the base plate has been installed and wired, the electronics module can be inserted and secured with the screw provided.

Note: dimensions in mm

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## 6 Electrical installation

### 6.1 General guidelines

#### ***Power supply wiring***

Heavy machinery and instrumentation should not share the same power supply wiring. If this cannot be avoided, noise filters and surge protectors should be used. Most UPS devices have those features already integrated.

#### ***General guidelines for signal cables***

The following guidelines are derived from European Standard EN 50170 for the transmission of signals by copper wires. When planning an installation, the rules provided by EN 50170 should be followed under consideration of local circumstances to determine the position of machines and equipment.

All ROTRONIC products are tested for Electromagnetic Compatibility according to EMC Directive 2004/106/EG and following European standards:

- EN 61000-6-1: 2001, EN 61000-6-2: 2005
- EN 61000-6-3: 2005, EN 61000-6-4: 2001 + A11

Whenever the level of electromagnetic interference is expected to be high, both the instruments and signal cables should be placed as far away as possible from the source of interference.

In general, signal cables should be installed in bundles or channels / conduits, separate from other cables as indicated in the table below:

<ul style="list-style-type: none"> <li>• Bus signals such as RS485</li> <li>• Data signals for PCs, printers etc.</li> <li>• shielded analog inputs</li> <li>• unshielded direct current (&lt;= 60V)</li> <li>• shielded process signals (&lt;= 25 V)</li> <li>• unshielded alternate current (&lt;= 25V)</li> <li>• coaxial cables for CRT monitors</li> </ul>	<b>in common bundles or channels / conduits</b>
<ul style="list-style-type: none"> <li>• direct current from 60 V to 400 V (unshielded)</li> <li>• alternate current from 25V to 400 V (unshielded)</li> </ul>	<b>in separated bundles or channels / conduits, without minimum distance</b>
<ul style="list-style-type: none"> <li>• direct and alternate current &gt; 400 V (unshielded)</li> <li>• Telephone lines</li> <li>• lines leading into EX-rated areas</li> </ul>	<b>in separated bundles or channels / conduits, without minimum distance</b>

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### **Lightning protection**

Cabling in areas with a risk of lightning requires a lightning protection. For cabling underground in between buildings, we recommend the use of special fiber optic cables. If this is not possible, use copper cables that are suitable for underground installation.

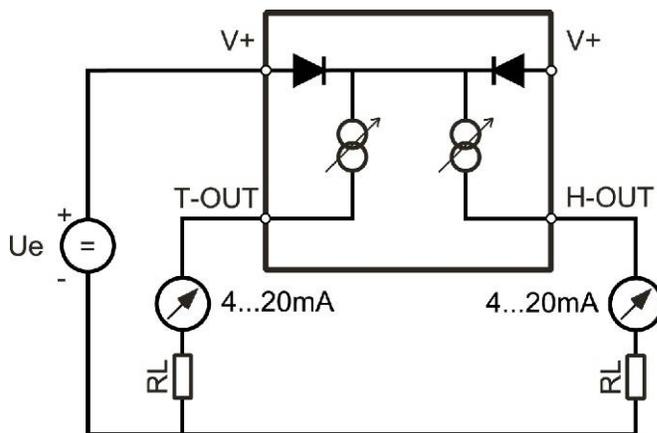
## **6.2 Cable grip and cable specifications**

Both type D and type W have one M16 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 6 to 7 mm (0.236 to 0.275 inch) with 18 AWG wires.

## **6.3 Wiring**

### **6.3.1 HF32: 2-wire, loop powered transmitter**

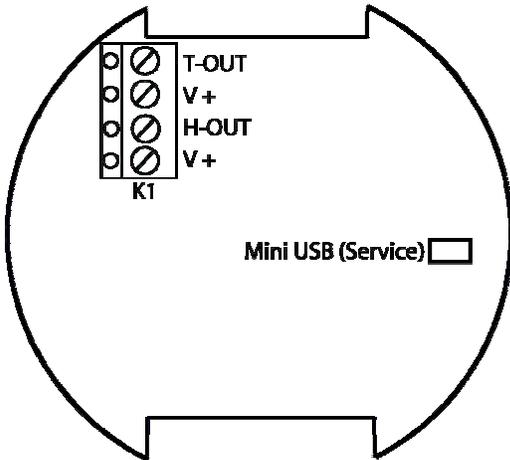
#### **Electrical diagram**



The maximum permissible cable length connecting the HF32 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.

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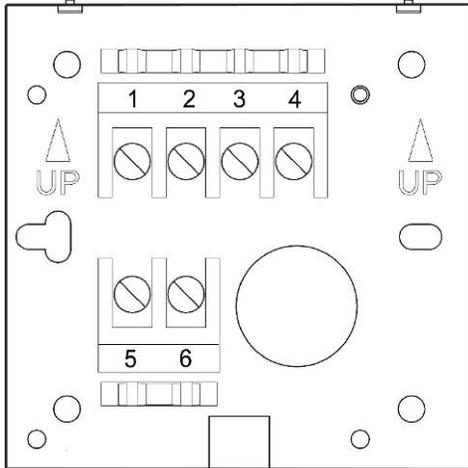
**Terminal block diagram for type D and W**



Terminals	Description
T-OUT	Temperature output (+) OUT-2
V+	Power supply: 10...28 VDC (+)
H-OUT	Relative humidity or dew point (+) OUT-1
V+	Power supply: 10...28 VDC (+)

**Note:** connect the + of the power supply to only one of the V+ terminals. The two terminals marked V+ are internally connected.

**Terminal block diagram for type R and S**



Terminals	Description
1	Power supply: 10...28 VDC (+)
2	Temperature output (+) OUT-2
3	Power supply: 10...28 VDC (+)
4	Relative humidity or dew point (+) OUT-1
5	Not used
6	Not used

**Note:** connect the + of the power supply to only one of the terminals 1 or 3. Terminals 1 and 3 are internally connected.

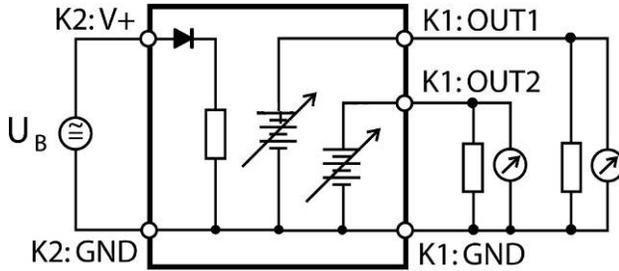
**Measuring humidity or temperature only**

Unless configured to measure either humidity only or temperature only, proper operation of the HF32 requires both current loops to be closed. The HF32 can be directly ordered from the factory to measure either humidity or temperature only. When necessary, any unused output of the HF32 can be disabled with the ROTRONIC HW4 software. When the HF32 is configured with one of the two outputs disabled, close only the loop that is being used.

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### 6.3.2 HF33: 3-wire transmitter

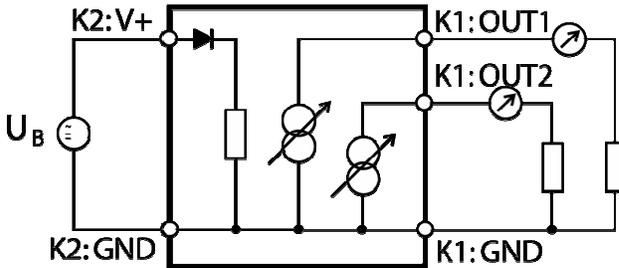
#### Electrical diagram for voltage outputs



The maximum permissible 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 should be at least 1000 ohms. Cable resistance should not be more than 1/1000 of the load resistance.

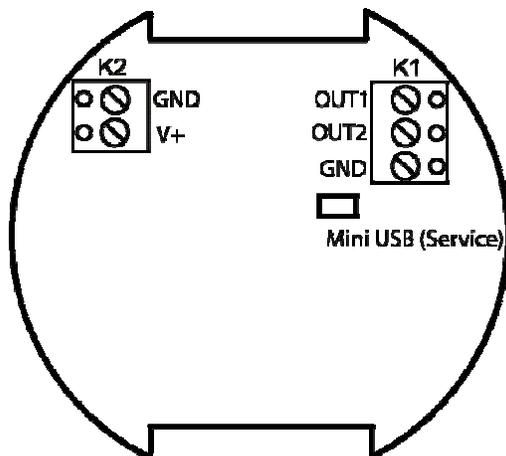
Minimum load requirements apply to the external device or circuit connected to the HF3 transmitter. These requirements are defined in the "Operation" chapter

#### Electrical diagram for 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.

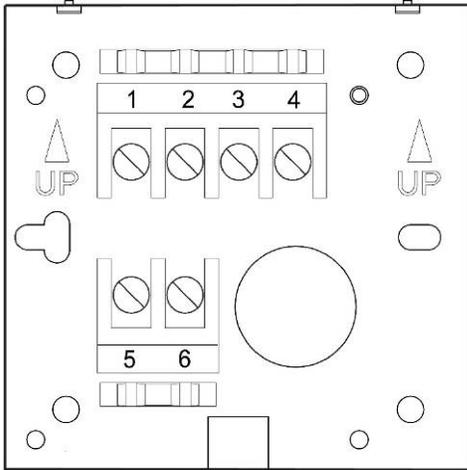
#### Terminal block diagram for type D and W



Terminals	Description
V+	Power supply: 15...40 VDC (+) or 12...28 VAC (Phase)
GND	Power supply (-) or neutral
OUT1	Relative humidity or dew point (+) OUT-1
OUT2	Temperature output (+) OUT-2
GND	Ground (tied with other GND)

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**Terminal block diagram for type R and S**



Terminals	Description
1	Power supply: 15...40 VDC (+) or 12...28 VAC (Phase)
2	Power supply (-) or neutral / ground
3	Relative humidity or dew point (+) OUT-1
4	Temperature output (+) OUT-2
5	Not used
6	Not used

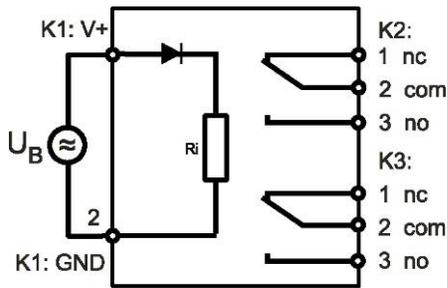
**Measuring humidity or temperature only**

Operation of the HF33 does not require both current loops to be closed. When using the HF33 to measure either humidity only or temperature only, close only the loop that is being used.

If necessary, any unused output of the HF32 can be disabled with the ROTRONIC HW4 software.

**6.3.3 HF34: thermo-hygrostat**

**Electrical diagram**

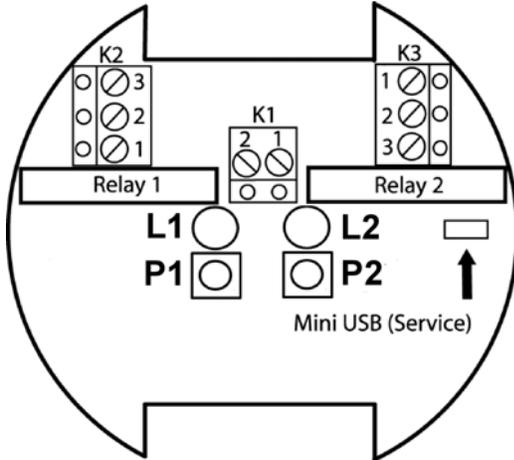


NC: normally closed contact (relay not energized)

NO: normally open contact (relay not energized)

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**Terminal block diagram for type D and W**



Terminals	Description
K1-1	Power supply: 15...40 VDC (+) or 12...28 VAC (Phase)
K1-2	Power supply (-) or neutral / ground
K2-1	Relay 1: humidity. Normally closed
K2-2	Relay 1: humidity. Common
K2-3	Relay 1: humidity. Normally open
K3-1	Relay 2: temperature. Normally closed
K3-2	Relay 2: temperature. Common
K3-3	Relay 2: relative temperature. Normally open

- L1** : LED for relay 1 (lit when relay is energized)
- L2** : LED for relay 2 (lit when relay is energized)
- P1** : Set point adjustment potentiometer for relay 1
- P2** : Set point adjustment potentiometer for relay 2

Note: the parameter (relative humidity, temperature, dew or frost point) corresponding to each relay can be changed with the HW4 software.

**6.3.4 Grounding (HF32, HF33 and HF34)**

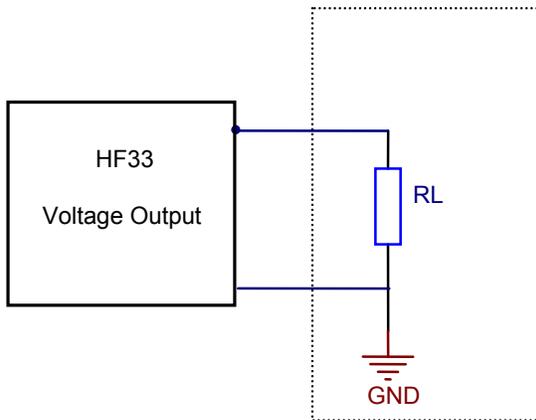
We generally recommend grounding the (-) side of the power supply, especially if the electronics will be subjected to a low humidity environment (35 %RH or less).

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## 7 Operation

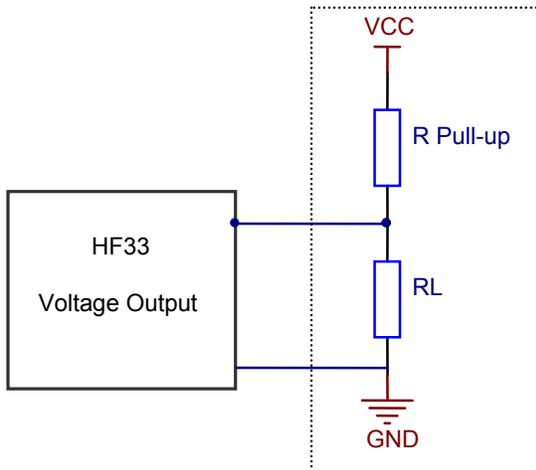
### 7.1 Minimum load requirements for the HF33 with voltage outputs

The following requirements apply to any external device or circuit connected to the HF33 transmitter with voltage outputs:



HF33 output signal	Input resistance RL
0...1V	$\geq 1\text{k}\Omega$
0...5V	$\geq 5\text{k}\Omega$
0...10V	$\geq 10\text{k}\Omega$

In the situation where the external device uses an internal pull-up resistor the value of this resistor should meet the requirements shown below. It is also necessary to add a pull-down resistor RL connected to ground in order to be able to read 100% of the range of the HF33 voltage output.



HF33 signal	VCC	R pull-up	RL
0...1V	3.3V	$\geq 250\text{ k}\Omega$	1 k $\Omega$

HF33 signal	VCC	R pull-up	RL
0...1V	5.0V	$\geq 400\text{ k}\Omega$	1 k $\Omega$
0...5V	5.0V	$\geq 400\text{ k}\Omega$	5 k $\Omega$

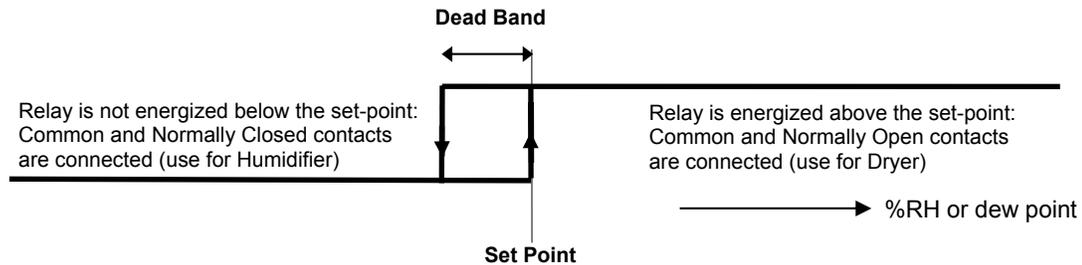
HF33 signal	VCC	R pull-up	RL
0...1V	10.0V	$\geq 1\text{ M}\Omega$	1 k $\Omega$
0...5V	10.0V	$\geq 1\text{ M}\Omega$	5 k $\Omega$
0...10V	10.0V	$\geq 1\text{ M}\Omega$	10 k $\Omega$

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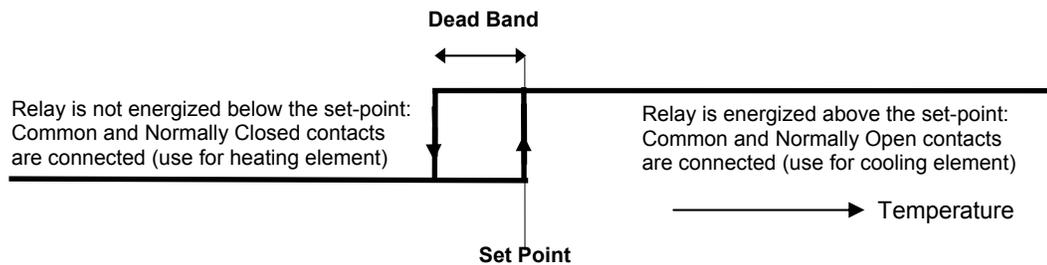
## 7.2 HF34 thermo-hygrostat

### 7.2.1 Relay operating diagram

#### Relay 1



#### Relay 2



### 7.2.2 Set point adjustment procedure

Two different procedures can be used to adjust each set point. Both require connecting the HF34 to a PC with the ROTRONIC HW4 software running.

#### Note:

Adjustment of the set point is by means of a surface mount potentiometer. The scale corresponding to the minimum and maximum positions of the potentiometer can be changed with the ROTRONIC HW4 software. Precise adjustment of the set point with the potentiometer is made easier when using a narrow scale. Using the example of 50.0 %RH for the set point, it is much easier to precisely adjust the potentiometer at 50.0 %RH with a scale of 49 to 51 %RH than it is with a scale of 0 to 100 %RH. It should be noted that a scale of 49 to 51 %RH does limit any future set point adjustment in the field to only  $\pm 1.0$  %RH.

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#### Procedure 1:

- 1) Use cable AC3006 to connect the HF34 service connector to a USB port of a PC with the HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v2.1-Main**
- 2) Start HW4 and search for the HF34 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- 3) Use the HF34 Device Manager to enable the HF34 simulator function (see HW4 manual **E-M-HW4v2.1-F2-002**). Set the fixed humidity and temperature signals to the desired value for both the humidity and temperature set points.
- 4) Slowly turn each set-point potentiometer up or down so as to find the position where the corresponding LED switches on and off (see 7.3.3). This position of the potentiometer corresponds to the desired set-point value.
- 5) Disable the HF34 simulator function
- 6) Disconnect the HF34 from the PC

Note: when the set-point is a dew or frost point value, proceed as follows prior to using the above procedure:

- 1) In the HW4 Main Menu bar, select View > Psychrometric Conversions.
- 2) Under Input Parameter, select dew or frost point.
- 3) Enter the value of the dew or frost point and a temperature value such as 25°C
- 4) Calculate the relative humidity corresponding to the dew or frost point.
- 5) Write down the relative humidity value. The temperature value of 25°C and the calculated relative humidity value will be used when setting the HF34 simulated values.

#### Procedure 2:

- 1) Use cable AC3006 to connect the HF34 service connector to a USB port of a PC with the HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v2.1-Main**
- 2) Start HW4 and search for the HF34 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- 3) Open the HF34 Device Manager. In Device Manager, the relays tab shows the current value of each set point (see HW4 manual **E-M-HW4v2.1-F2-002**).
- 4) Turn each set-point potentiometer up or down in small increments (see 7.3.3). Refresh the Relays form in Device Manager to show the new value of each set point. Repeat this operation until each set point has the desired value.
- 5) Disconnect the HF34 from the PC

## 8 Maintenance

### 8.1 Service cable

- Cable AC3006 converts UART (service connector) to USB and is used to connect the HF3 to a USB port of a PC running the ROTRONIC HW4 software. Prior to using this cable, the ROTRONIC USB driver must be installed on the PC. Both the driver and the installation instructions (document **E-M-HW4v2.1-Main**) are located on the HW4 CD.
- As an alternative, cable AC2001 is used to connect the HF3 to a probe input of the HP23 hand-held calibrator. For service purposes, the HP23 offers essentially the same functionality as the HW4 software.

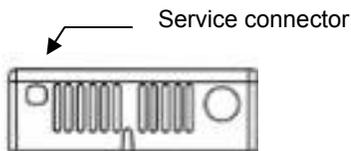
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## 8.2 Location of the service connector (mini-USB type)

**WARNING:** the service connector is a UART interface with a mini-USB connector type. Do not connect the service connector directly to the USB port of a PC or hub.

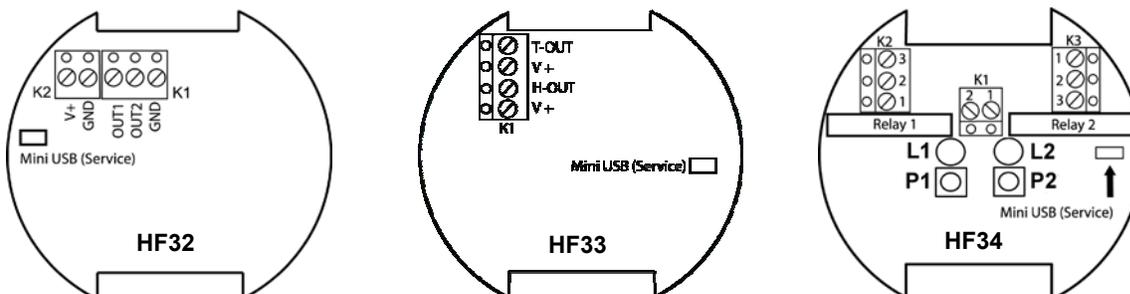
### 8.2.1 Type R and S

The service connector (UART interface) is located at the bottom of the transmitter, on the left side.



### 8.2.2 Type D and W

The service connector (UART interface) is located inside of the enclosure and can be accessed after removing the cover.



## 8.3 Periodic calibration check

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

Long term stability of the ROTRONIC Hygromer humidity sensor is typically better than 1 %RH per year. For maximum accuracy, calibration of the HF3 should be verified every 6 to 12 months. Applications where the HF3 is exposed to significant pollution may require more frequent verifications. Calibration and adjustment of the HF3 can be done with either a PC with the HW4 software installed or with another instrument such as the HP23 hand-held calibrator.

Procedure for calibrating or adjusting the HF3 with the ROTRONIC HW4 software:

- Use cable AC3006 to connect the service connector of the HF3 to a USB port of a PC with the HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v2.1-Main**
- Start HW4 on the PC and search for the HF3 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HF3 with HW4, expand the device tree to see the HF3 functions. Select Probe Adjustment.
- For further instructions see HW4 manual **E-M-HW4v2.1-A2-001**

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## 8.4 Cleaning or replacing the dust filter (type D and W)

Depending on the application, the dust filter may require cleaning from time to time. 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.

### 8.4.1 Validation of the output signals transmission

If so desired, transmission of the HF3 output signals can be validated by using the simulator function. The HW4 software is required to enable and configure this function. When this function is enabled the HF3 generates fixed digital and analog signals as specified by the user. For instructions see HW4 manual **E-M-HW4v2.1-F2-002**

## 9 Firmware updates

Firmware updates will be available on the ROTRONIC website for downloading. Firmware files are given a name that shows both to which device the file applies and the version number of the firmware. All firmware files have the extension HEX. Procedure for updating the firmware:

- Use cable AC3006 to connect the service connector of the HF3 to a USB port of a PC with the ROTRONIC HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v2.1-Main**
- Copy the firmware update file from the ROTRONIC website to the PC.
- Start HW4 software on the PC and search for the HF3 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HF3, expand the device tree to see the HF3 functions. Select Device Manager. In the Device Manager menu bar select Tools > Firmware Update. For instructions see HW4 manual **E-M-HW4v2.1-F2-002**

## 10 Technical data

### 10.1 Specifications

General	HF32	HF33	HF34
Device type	Humidity temperature transmitter		Thermo-hygrostat
Circuit type	2-wire, loop powered	3-wire	
Mechanical configuration types	D, R, S and W		D and W

Power supply and connections	HF32	HF33	HF34
Supply voltage (VDD)	10...28VDC V min = 10 V + (0.02 x Load*) *Load resistance in ohms.	15...40 VDC or 12...28 VAC	8...40 VDC or 12...28 VAC
Nominal current consumption	2 x 20 mA	< 50 mA	< 50 mA
Electrical connections	Type D and W: terminal block and M16 cable grip Type R and S: terminal block		Type D and W: terminal block and M16 cable grip
Polarity protection	Protective diode on V+		

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Humidity measurement	HF32	HF33	HF34
Sensor	ROTRONIC Hygromer® IN1		
Measuring range	0...100 %RH		
Measurement accuracy at 23 °C	±2.0 %RH (Type D, S and W) / ± 1.0 %RH (Type R)		±2.0 %RH
Repeatability	0.3 %RH		
Long term stability	< 1 %RH / year		
Sensor time constant	Typical 10 sec, 63% of a 35 to 80 %RH step change (1m/sec air flow at sensor)		

Temperature measurement	HF32	HF33	HF34
Sensor	Pt100 RTD, IEC 751 1/3 class B		
Measuring range	-40...60 °C / -40...140 °F		
Measurement accuracy at 23 °C	±0.3 °C (Type D, S and W) / ±0.2 °C (Type R)		
Repeatability	0.05°C		
Long term stability	< 0.1°C / year		
Sensor time constant	Typical 4 sec, 63% of a step change (1m/sec air flow at sensor)		

Calculated parameters	HF32	HF33	HF34
Psychrometric calculations	Dew or frost point (user configurable option)		

Start-up time and data refresh rate	HF32	HF33	HF34
Start-up time	3.4s (typical)	1.9s (typical)	
Data refresh rate	3.4s (typical)	1.7s (typical)	

Configurable analog outputs	HF32	HF33
Output 1	Can be made to correspond to any parameter	
Factory default parameter	Relative humidity or dew / frost point	
Factory default scale	0...100 %RH or -50...50 °C DP or -50...100 °F DP	
Output 2	Can be made to correspond to any parameter	
Factory default parameter	Temperature	
Factory default scale	0...50 °C or 0... 100 °F	
Output 1 and Output 2		
Signal type	4...20 mA	0...20 mA 4... 20 mA 0... 1 V 0... 5 V 0... 10 V (user configurable)
User configurable scaling limits	-999.99 ... 9999.99 engineering units	
Maximum offset at bottom of signal range	no offset	0...1V signal range : 3 mV 0...5 V signal range : 50mV 0...10 V signal range : 90mV 0...20 mA signal range : 4uA 4...20 mA signal range : no offset
Short circuit tolerant	Yes	
Maximum external load	500 Ω	500 Ω (current output)
Minimum external load	0 Ω	1 kΩ (0...1 V output) 5 kΩ (0...5 V output) 10 kΩ (0...10 V output) 0 Ω (current output)

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<b>Configurable relay outputs</b>	<b>HF34</b>
Relay 1	Can be made to correspond to any parameter
Factory default parameter	Relative humidity or dew / frost point
Factory default set-point scale	0...100 %RH or -50...50 °C DP or -50...100 °F DP
Relay 2	Can be made to correspond to any parameter
Factory default parameter	Temperature
Factory default set-point scale	0...50 °C or 0... 100 °F
Relay 1 and Relay 2	
Set point adjustment	Surface mount potentiometer
User configurable set-point limits	Potentiometer minimum and maximum: 0...100 for humidity -100...200 for temperature or the dew / frost point
Energized relay indication	LED
Relay type	SPDT (single pole double throw)
Maximum switching voltage	250 VAC 1)
Maximum switching current	6 A (AC) 1)
	1) Resistive load

<b>Digital interface (service connector)</b>	<b>HF32</b>	<b>HF33</b>	<b>HF34</b>
Interface type	UART (Universal Asynchronous Receiver Transmitter)		
Maximum service cable length	5 m (16.4 ft)		

<b>General specifications</b>	<b>HF32</b>	<b>HF33</b>	<b>HF34</b>
Optional display (S and R configurations only)	LC, 1 or 2 decimals resolution, no backlight, trend indication	LC, 1 or 2 decimals resolution, with backlight and trend indication	
Probe material	Polycarbonate, except type R and S		Polycarbonate
Probe dust filter material	Polyethylene, except type R and S		Polyethylene
Housing material	ABS		
Housing protection grade	IP 65, except type R and S		IP 65
Physical dimensions	See Models		
Weight	90 g (3.1 oz)		105 g (3.7 oz)

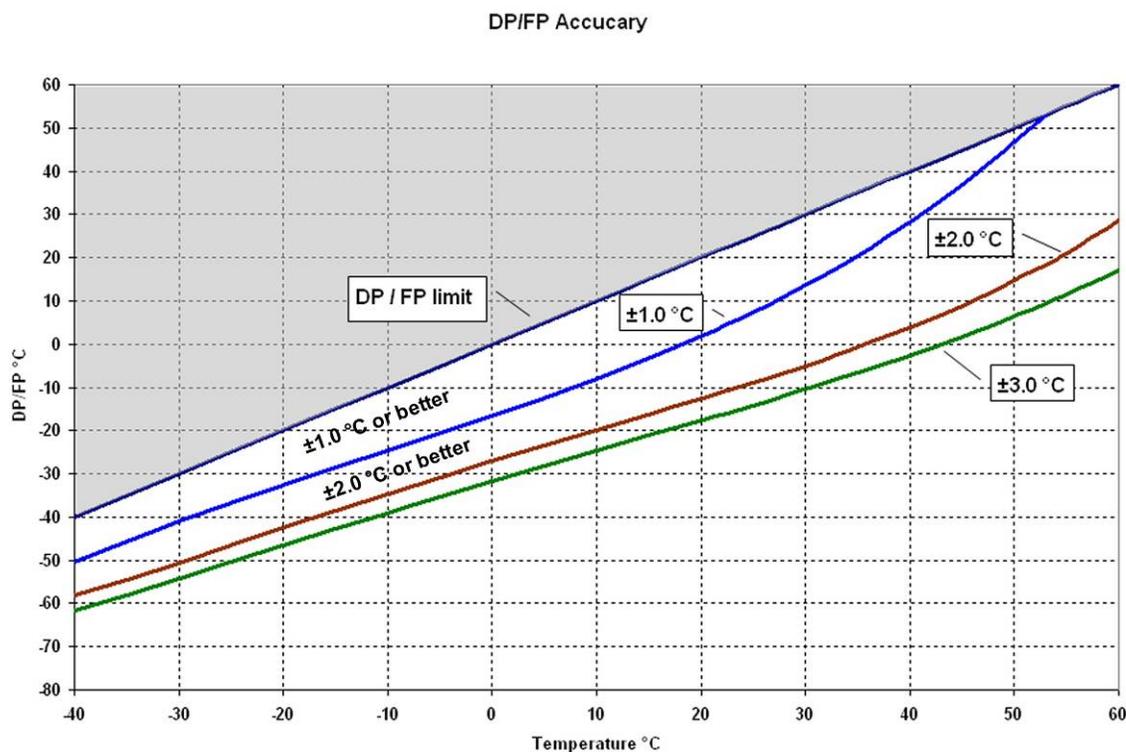
<b>Conformity with standards</b>	<b>HF32</b>	<b>HF33</b>	<b>HF34</b>
CE / EMC immunity	EMC Directive 2004/108/EG: EN 61000-6-1: 2001, EN 61000-6-2: 2005 EN 61000-6-3: 2005, EN 61000-6-4: 2001 + A11		
Solder type	Lead free (RoHS directive)		
Fire protection class	Corresponds to UL94-HB		
FDA / GAMP directives	compatible		

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Environmental limits	HF32	HF33	HF34
Storage and transit	-50...+70 °C / -20...+70 °C (models with display) 0...100 %RH, non condensing		
Operating limits at electronics	-40 ... +60 °C / -10...60 °C (models with display) 0...100 %RH, non condensing		
Temperature limits at probe	-40...+60 °C		
Maximum humidity at sensor	100 %RH		
Maximum air velocity at probe	20 m/s (3,935 ft /min), except type R and S		
Critical environments	Humidity sensor: as per DV04-14.0803.02 - Critical chemicals		

## 10.2 Dew point accuracy

The HF3 can be configured to calculate either the dew point or frost point based on the measurement of relative humidity and temperature. The accuracy of this conversion varies, depending on the humidity and temperature conditions as shown in the graph below:



**Example:** at a temperature of 10 °C, a dew point value of 0 °C is measured with an accuracy of  $\pm 1.0\text{ °C}$  or better.

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## 11 Accessories

### 11.1 Configuration and communication software

The ROTRONIC HW4 software (version 2.1.0 or higher) allows configuring the HF3

HW4 is compatible with Windows XP, Vista and NT4 with SP6a or higher. For more details see separate instruction manual provided with the software.

Order Code	Description
<b>HW4-E</b>	HW4 software, Standard Edition ( single user)
<b>HW4-P</b>	HW4 Professional Edition, ERES regulations compliant (FDA / GAMP), multi user

### 11.2 Service cables

Order Code	Description	
<b>AC3006</b>	Mini-USB service connector (UART) to a PC USB port. Cable electronics convert UART interface to USB interface. Approximate length: 1.7 m  HF3 must be powered	
<b>AC3008</b>	Mini-USB service connector (UART) to Ethernet port. Cable electronics convert UART interface to TCP/IP. Approximate length: 1.7 m  Requires AC adapter (9 VDC). <b>Do not power the HF3 when using this cable</b>	
<b>AC3009</b>	Mini-USB service connector (UART) to a PC USB port. Cable electronics convert UART interface to USB interface. Approximate length: 1.7 m  Requires AC adapter (9 VDC). <b>Do not power the HF3 when using this cable</b>	
<b>AC2001</b>	Mini-USB service connector (UART) to 7-pin probe connector of the HP23 hand-held calibrator or other instrument with display and keypad. Approximate length: 1.7 m  HF3 must be powered	

#### IMPORTANT:

- Prior to using cable AC3006 or AC3009, the ROTRONIC USB driver must be installed on the PC (available from the HW4 CD or from [www.rotronic-humidity.com](http://www.rotronic-humidity.com)). For installation instructions see document **E-M-HW4v2.1-Main** (§ 6.3).

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- Prior to connecting cable AC3008 to an active Ethernet network you must configure the TCP/IP settings of the cable using either the HW4 software (version 2.1.0 or higher) or the TCP/IP configuration tool available from [www.rotronic-humidity.com](http://www.rotronic-humidity.com). For instructions see the HW4 manual **E-M-HW4v2.1-Main** (§ 6.4) and technical note **E-M-TCPIP-Conf**

### 11.3 Mounting Hardware

Order Code	Description	
<b>AC5005</b>	Use for tough wall installation of the HF3 type D: mounting flange with compression fitting for (15 mm / 0.6" diameter probe).  Maximum temperature 100 °C (212°F)	

### 11.4 Calibration accessories

Order Code	Description
<b>EA00-SCS</b>	0.5 %RH humidity std, SCS cert., pack of 5
<b>EA05-SCS</b>	5 %RH humidity std, SCS cert., pack of 5
<b>EA10-SCS</b>	10 %RH humidity std, SCS cert., pack of 5
<b>EA20-SCS</b>	20 %RH humidity std, SCS cert., pack of 5
<b>EA35-SCS</b>	35 %RH humidity std, SCS cert., pack of 5
<b>EA50-SCS</b>	50 %RH humidity std, SCS cert., pack of 5
<b>EA65-SCS</b>	65 %RH humidity std, SCS cert., pack of 5
<b>EA80-SCS</b>	80 %RH humidity std, SCS cert., pack of 5
<b>EA95-SCS</b>	95 %RH humidity std, SCS cert., pack of 5
<b>ER-15</b>	Calibration device for 15mm diameter probes

For instructions regarding the ROTRONIC humidity standards and calibration devices see document **E-M-CalBasics**.

### 11.5 Spare filters

Order Code		Slotted cap	Filter Insert	Notes
<b>NSP-PCG-PE</b>		Polycarbonate, grey	Polyethylene	Standard filter insert
<b>NSP-PCG-WM</b>			Wire mesh	For applications requiring faster response time
<b>NSP-PCG-TF</b>			Teflon	High humidity, low air flow

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## 12 Supporting documents

Document File Name	Contents
<b>E-T-AC3000-DF-V1</b>	AirChip 3000 Description and Main Functions
<b>E-M-HW4v2.1-DIR</b>	List of the HW4 manuals
<b>E-M-HW4v2.1-Main</b>	HW4 software version 2.1: General instructions and functions common to all devices
<b>E-M-HW4v2.1-F2-002</b>	HW4 software version 2.1: HF3 transmitters and hygrostats Device configuration and AirChip 3000 functions
<b>E-M-HW4v2.1-A2-001</b>	HW4 software version 2.1: Probe Adjustment function AirChip 3000 devices
<b>E-M-HW4v2.1-DR-001</b>	HW4 software version 2.1: Data Recording Function AirChip 3000 Devices
<b>E-M-AC3000-CP</b>	AirChip 3000 Communication Protocol
<b>E-M-CalBasics</b>	Temperature and humidity adjustment basics Instructions for using the ROTRONIC humidity standards
<b>E-T-HumiDefs</b>	Humidity Definitions

**Note:** All document file names have an extension corresponding to the document release number (example of a first release: E-M-HW4v2.1-Main\_10). This extension is not shown in the above table.

## 13 Document releases

Doc. Release	Date	Notes
_10	Jul. 10, 2008	Original release
_11	Oct. 2, 2008	Added service cables AC3008 and AC3009
_12	Nov. 6, 2008	Modified the order code tables Added minimum load requirements for the HF33 Changed the terminal block layout HF33D / HF33W
_13	Dec. 3, 2008	Changed the factory default settings