HygroFlex HF5
Humidity Temperature Transmitters

User Guide

Table of contents

E-M-HF5-V1_10	Rotronic AG
	Bassersdorf, Switzerland
Document code	Unit
HygroFlex HF5 Humidity Temperature Transmitters: User Guide	**Instruction Manual**
	Document Type
Document title	Page **3** of 32

Applicability:

This manual applies to all instruments of the HF5 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 HF5 transmitter measures temperature and relative humidity, and calculates psychrometric parameters such as the dew or frost point. The HF5 series is designed for fixed installation in applications where high measurement accuracy is required. Depending on the probe model, the HF5 can measure conditions within the range of 0 to 100 %RH and -100 to 200°C (-148 to 392°F). The electronics operating range is limited to -40…60 °C (-10…60°C with the optional LC display).

The HF5 is available with a wide assortment of HygroClip 2 humidity-temperature probes to meet almost any requirement. The HygroClip 2 probes feature well proven, durable sensors. 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 HF5 series and HygroClip 2 probes offer the following user functions:

- User configurable settings
- Calculation of psychrometric parameters such as 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 both the HF5 and HygroClip 2 probe firmware means that instruments of the HF5 series can be kept up-to-date regarding any future functionality improvement.

HF5 transmitters with analog output signals: two types of electronic circuit are available: HF52: 2-wire, loop powered (4…20 mA current signal) and HF53: 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 and can be used to measure humidity only, temperature only or both parameters.

HF5 transmitters with digital output: the HF55 (3-wire circuit type) is available with the following combinations of digital interface: USB and RS-485 or Ethernet (TCP/IP) and RS-485.

2 Models

2.1 Ordering codes

Transmitters with analog output signals: HF52 (2-wire, loop powered) and HF53 (3-wire)									
									Circuit type, supply voltage and output signal type
HF520-									2-wire (loop powered), 10 to 28 VDC, 4…20 mA
HF531-									3-wire, 15 to 35 VDC or 12 to 24 VAC, 0…20 mA
HF532-									3-wire, 15 to 35 VDC or 12 to 24 VAC, 4…20 mA
HF533-									3-wire, 5 to 35 VDC or 5 to 24 VAC, 0…1 V
HF534-									3-wire, 10 to 35 VDC or 8 to 24 VAC, 0…5 V
HF535-									3-wire, 15 to 35 VDC or 12 to 24 VAC, 0…10 V
									Installation type / Mechanical configuration
	D								Duct mount (through wall)
	W								Wall mount
									Parameters (analog outputs)
		B					**X**	**X**	Humidity (0...100 %RH) and Temperature (see range below)
		H	**X**	**X**			**X**	**X**	Humidity only (0...100 %RH)
		T					**X**	**X**	Temperature only (see range below)
		1	**X**	**X**					Humidity & Dew point (see range below)
		A							Dew point and Temperature (see range below)
		C							Wet bulb temperature and Temperature (see range below)
		D							Enthalpy and Temperature (see range below)
		E							Specific humidity and Temperature (see range below)
		F							Vapor concentration and Temperature (see range below)
		H							Mixing ratio and Temperature (see range below)
		K							Sat. vapor concentration and Temperature (see range below)
		M							Partial vapor pressure and Temperature (see range below)
		N							Saturation vapor pressure and Temperature (see range below)

									Standard temperature output ranges
			1	X					0…50 °C
			2	X					10…40 °C
			3	X					-40…60 °C
			4	X					-30…70 °C
			5	X					-40…85 °C
			6	X					0…100 °F
			7	X					0…200 °F
			8	X					0…300°F
			9	X					-50…200 °F
									Optional keypad and display
					D				Keypad and display (HF52: no backlight – HF53: w. backlight)
					X				No keypad and display
									Electrical connections
						1			1x M16 cable grip (horizontal, type D w. display and type W)
						2			1x M16 cable grip (vertical, type D w/o display)
						5			1x ½" conduit adapter (horizontal, type D w. display and type W)
						6			1x ½" conduit adapter (vertical, type D w/o display)
									Standard calculated parameter ranges
							1		0…20
							2		0…25
							3		0…50
							4		0…100
							5		0…200
							6		0...500
							7		0...1000
							8		-20...20
							9		-25...25
							A		-40…40
							B	X	-50…50
							C	X	-50…100
							D	X	-50...200

Notes:

- The M16 cable grip is located at the bottom of the enclosure
- The ½" conduit adapter is located on top of the enclosure
- The calculated parameter range uses the same unit system (metric or English) as the temperature output

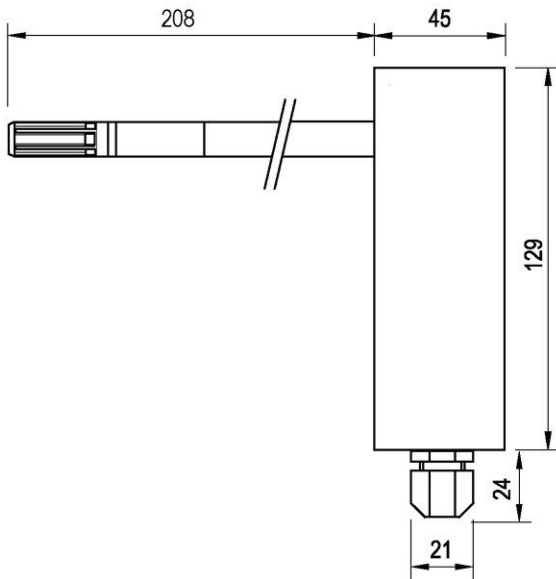| Transmitters with digital output: HF55				
				Circuit type and supply voltage
HF556-				3-wire, 15 to 35 VDC or 12 to 24 VAC
				Installation type / Mechanical configuration
	D			Duct mount (through wall)
	W			Wall mount
				Optional keypad and display
		D		Keypad and display with backlight
		X		No keypad and display
				Digital interface and electrical connections
			7	USB + RS-485, 1x M16 cable grip
			8	USB + RS-485, 1x 1/2"conduit adapter
			9	Ethernet + RS-485, 1x M16 cable grip
			A	Ethernet + RS-485, 1x 1/2" conduit adapter
			B	Ethernet wireless + RS-485, 1x M16 cable grip
			C	Ethernet wireless + RS-485, 1x 1/2" conduit adapter

Notes:

- The M16 cable grip is located at the bottom of the enclosure
- The ½" conduit adapter is located on top of the enclosure
- The enclosure of all models with digital interface is designed to be installed in the horizontal position
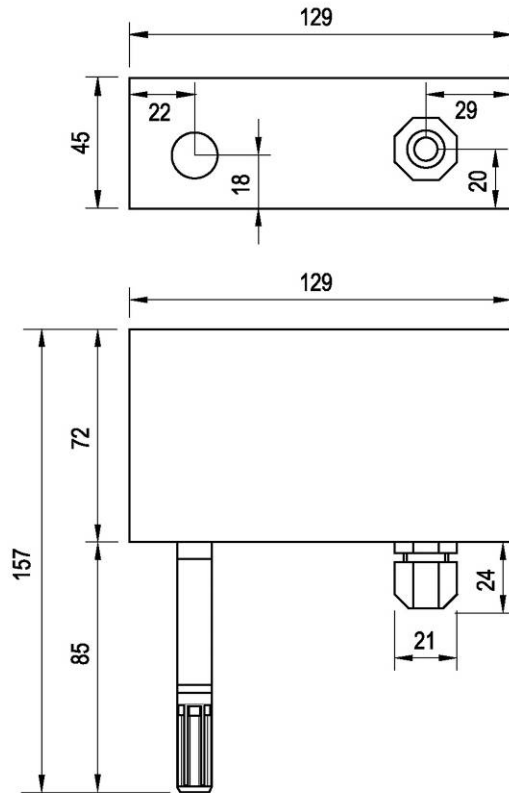
2.2 Mechanical configurations and dimensions
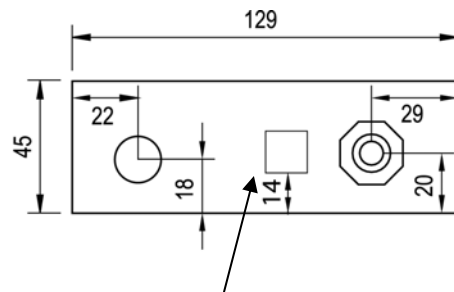
Type D: duct mount (vertical)

Type W: wall mount (horizontal)

Dimensions in mm

Models with USB or Ethernet interface

2.3   Display and keypad option

The LC display option for the HF53 and HF55 has a backlight. The LC display option for the HF52 does not have a backlight.

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-F2-005**.

3   General description

3.1   Power supply

Depending on the circuit type, the HF5 requires the following power supply:

a)   **HF52** (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 V + (0.02 x Load*)   *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)   **HF53** (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.

c)   **HF55** (3-wire) with digital outputs: 5 to 40 VDC or 12 to 28 VAC. Maximum current consumption:

Model with USB interface: 50 mA
Model with Ethernet (TCP/IP) interface: 300 mA

3.2   Measured parameters

The HF5 measures relative humidity with a ROTRONIC Hygromer® IN1 capacitive sensor and temperature with a Pt100 RTD.

3.3   Calculated parameters

Using the ROTRONIC HW4 software, the HF5 can be configured by the user to calculate one of the following parameters:

o   Dew point (Dp) above and below freezing
o   Frost point (Fp) below freezing and dew point above freezing
o   Wet bulb temperature (Tw)

- o Enthalpy (H)
- o Vapor concentration (Dv)
- o Specific humidity (Q)
- o Mixing ratio by weight (R)
- o Vapor concentration at saturation (Dvs)
- o Vapor partial pressure (E)
- o Vapor saturation pressure (Ew)

Note: some of the above parameters depend on the value of the barometric pressure. Using the ROTRONIC HW4 software, a fixed barometric pressure value can be specified. For instructions see the following HW4 manual: **E-M-HW4v2.1-F2-005**

3.4   Analog output signals (HF52 and HF53)

HF52 and HF53

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
- Calculated parameter

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.

HF53

The type of output signal can be changed by means of jumpers 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.

3.5   Digital interface (HF55)

a) Network interface

The HF55 is available with either a USB port or with an Ethernet (TCP/IP) port (wired or wireless).

b) RS-485 serial interface

In addition to the network interface the HF55 has also a RS-485 serial interface. When the number of available network ports is limited, the RS-485 serial port can be used to connect together up to 64 devices in a multi-dropped arrangement. In principle, an unlimited number of such networks can be monitored with the HW4 software, but each RS-485 multi-drop network is limited to 64 devices. The HF55 can be used either as a slave or a master, without special configuration. The master is automatically the device that is directly connected to a network (PC or LAN) by means of a USB port or TCP/IP port.

RS-485 Compatibility: The communications protocol used by the HF55 and other AirChip 3000 products is not compatible with the protocol used by the previous generation of ROTRONIC instruments. Do not connect legacy products and AirChip 3000 products to the same RS-485 multi-drop network.

3.6 Service connector

The service connector (UART interface with a mini-USB type connector) allows connecting the HF5 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 HF5 to a PC is used to configure the HF5, gain access to the HF5 and probe functions such as humidity and temperature adjustment, read data from the HF5 on the PC and update the firmware of the HF5 and probe.

- Connecting the HF5 to the probe input of another instrument is useful only when the other instrument has its own display and keypad, and has an internal menu equivalent to the menu of the HP23 hand-held calibrator. The connection allows showing the data measured by the HF5 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 HF5.

- o **HF55 (digital outputs)**: the digital interface (USB, Ethernet and RS-485) offers the same functionality as the service connector but does not allow connecting the HF5 to a HP23 hand-held calibrator.

3.7 Probe

The HF5 is compatible with all available models of HygroClip 2 probes. For detailed information, see document **E-M-HC2 Probes-V1**.

4 Functions

The HF5 and associated probe offer two groups of functions:

a) HF5 functions

- Psychrometric calculations *[as per ordering code]*
- Out-of-limit values *[disabled]*
- *Sensor alarm monitoring [enabled]*
- Simulator mode *[disabled]*

b) HygroClip 2 probe functions

- Temperature sensor signal conditioning
- Humidity sensor signal conditioning
- Sensor failure digital alarm
- Psychrometric calculations *[no calculation – see note below]*
- Out-of-limit values *[disabled – see note below]*
- Simulator mode *[disabled – see note below]*
- Automatic humidity sensor test and drift compensation *[disabled]*
- Sensor failure mode *[disabled]*
- Data recording *[off]*
- Humidity-temperature calibration and adjustment

<u>Notes:</u>

- o Where relevant, the function factory default is indicated in italics
- o For a general description of all HygroClip 2 probe functions see document **E-T-AC3000-DF-V1**
- o Enabling, configuring and using the HF5 and probe functions requires a PC with the HW4 software installed (version 2.1.0 or higher) and cable AC3006. See the following HW4 manuals:
  E-M-HW4v2.1-F2-005, E-M-HW4v2.1-DR-001 and **E-M-HW4v2.1-A2-001** .

It is important to note that when used together, the HF5 transmitter and HC2 probe (HygroClip 2) constitute a 2-component system. Each system component has its own microprocessor, firmware and functions. Some of these functions are unique to each system component. Other functions are found in both components.

HF52 (2-wire, loop powered transmitter): due to the necessity of limiting the current consumption of the combination of HF52 and HC2 probe to less than 4 mA, most probe functions such as RH sensor test, sensor alarms, data recording and probe adjustment are not available.

HF53 and HF55: the functions and settings of the HF5 transmitter and HygroClip 2 probe (HC2) operate together as indicated below:

Function / Setting	HF5	HC2	Notes
Device protection	X	X	Individual to the HF5 and HC2 probe
RS-485 address	X	X	Individual to the HF5 and HC2 probe
Device Name	X	X	User defined description The device name of the HC2 probe is not diaplayed by HW4 and is replaced with the HF5 Input Name
Calculation	X	X	Psychrometric calculation HF5 setting overrides HC2 probe setting
Fixed pressure value	X		Barometric pressure used for some psychrometric calculations
Data refresh rate	X		HF53 and HF55: when set above 1 s, causes the HC2 probe not to be powered in between measurements (HF52 has a minimum data refresh rate of 5 s)
Simulator function	X	X	Generates fixed humidity and / or temperature value When enabled, HF5 settings override the HC2 probe settings
Unit system	X	X	HF5 setting overrides HC2 setting regarding the HF5 HC2 probe settings still apply at the level of the probe **Make sure to use the same humidity symbol and the same temperature unit for both the HF5 and probe.**
Out-of-limits value alarm	X	X	HF5 settings are independent from the HC2 probe settings. The HC2 probe settings have an effect only when the HF5 is enabled to monitor the probe alarms. When out-of-limit values have been defined for the same parameter for both the HF5 and probe, any alarm is triggered based on the narrowest set of limits.
Analog outputs	X	X	Parameter and scale HC2 probe settings have no effect on the HF5
Display settings	X		No effect on the HC2 probe
Automatic RH sensor test and compensation		X	Sensor status can be read with HW4 or with the optional display of the HF53 or HF55 **The automatic RH sensor test and compensation is function is not operational when the probe is connected to a HF52**

Function / Setting	HF5	HC2	Notes
Sensor alarm and sensor failure mode		X	The HC2 probe can be configured to trigger an alarm when the RH sensor test returns a bad result. Independently of the RH sensor test, the HC2 probe will trigger an alarm in the event of a major failure of either the RH or temperature sensor (shorted or open sensor). The HC2 probe can also be configured to generate a fixed value for humidity and temperature whenever a sensor alarm is triggered. HF53 and HF55 can be set to monitor the HC2 sensor alarms **The HF52 cannot be used to monitor the HC2 sensor alarms**
Data recording		X	Can be started or stopped either with HW4 or from the HF53 or HF55 keypad **Data recording by the HC2 probe is not available when the probe is connected to a HF52**

5   User configurable settings

5.1   Software settings

Configuration of the HF5 by the user requires a PC with the ROTRONIC HW4 software (version 2.1.0 or higher) installed and service cable AC3006 to connect the HF5 service connector to the PC. The HF55 can also be configured by connecting either the USB or Ethernet interface. The following settings can be configured with the HW4 software:

| Configurable Setting	Applicability	Factory default
Unit system	HF52, HF53, HF55	As per ordering code
Output 1 parameter, scale and unit	HF52, HF53	As per ordering code (%RH or Calc)
Output 2 parameter, scale and unit	HF52, HF53	Temperature, unit as per ordering code
Psychrometric calculation	HF52, HF53, HF55	As per ordering code
Fixed barometric pressure value	HF52, HF53, HF55	1013.25 hPa
Data refresh rate	HF52	5 second
	HF53, HF55	1 second
Display resolution (optional)	HF52, HF53, HF55	1 decimal
Display backlight (optional)	HF53, HF55	Always on
Trend indicator	HF52, HF53, HF55	Enabled
Allow menu access (internal menu)	HF52, HF53, HF55	Enabled
RS-485 address	HF52, HF53, HF55	0
TCP/IP settings	HF55	See document **IN-E-TCPIP-Conf**
Device name	HF52, HF53, HF55	Instrument model
Device write protection	HF52, HF53, HF55	Disabled

Notes:

o General configuration instructions as well as specific instructions for configuring the RS-485 settings of the HF55 are provided in the HW4 manual **E-M-HW4v2.1-F2-005** and **E-M-HW4v2.1-Main** (§ 6.5).
o The factory default setting for dew / frost point calculation is frost point below freezing
o Instructions for configuring the TCP/IP settings of the HF55, are provided in document **IN-E-TCPIP-Conf**

5.2 Hardware settings (HF53 output signal type)

The type of analog output signals generated by the HF53 can be configured as follows by means of the jumpers located on the upper PCB:
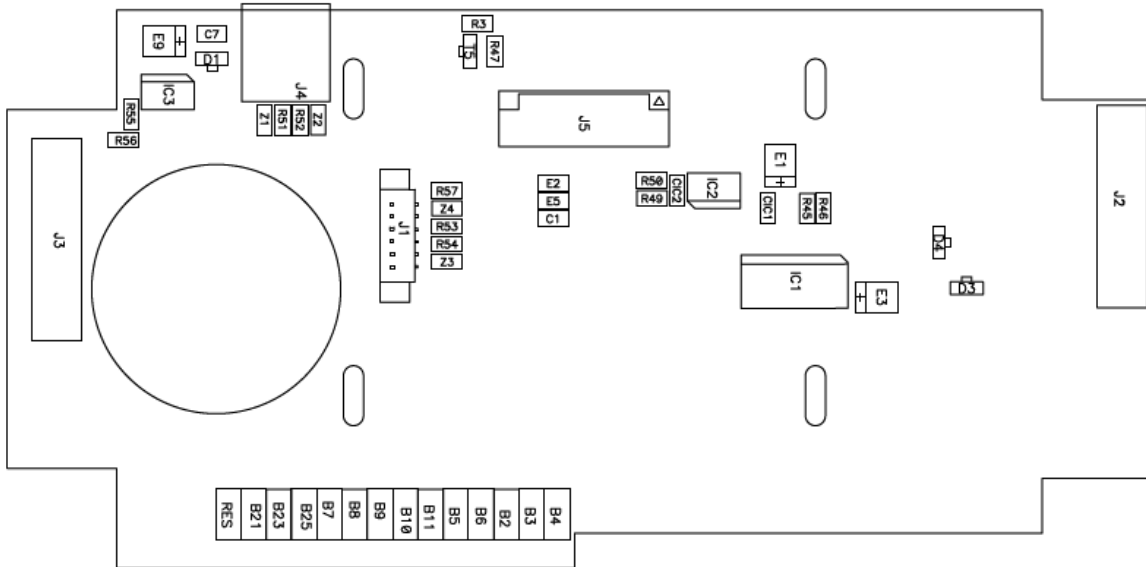
	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B21	B23	B25
0...1V	X			X		X			X				X
0...5V		X		X			X		X			X	
0...10V			X	X				X	X			X	X
0...20mA	X				X	X				X	X		
4...20mA	X				X	X				X	X		X

6 Mechanical installation

6.1 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.
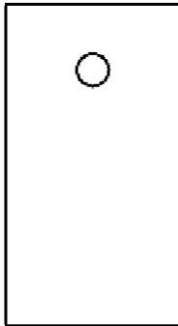
6.2 HF5 enclosure

The HF5 enclosure consists of a base and a cover held together with 4 screws. To open the enclosure, use a metric 2.5 mm hex key. Prior to re-assembling the enclosure, verify that the red seal is sitting properly in its groove on the base.
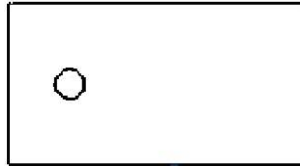
6.3   Installation of the HF5 type D (through wall mount)

Mounting position of the enclosure

Vertical:

HF52 and HF53 type D without keypad and display

Horizontal:

HF52 and HF53 type D with keypad and display
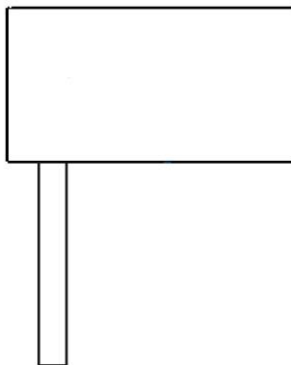
HF55 type D

Mounting hardware

Part **AC 1306** is a flange and part **AC1304-M** is a compression fitting designed to hold the probe of the HF5 type D when mounted through a wall (see Accessories). The HF5 does not require any additional support.

6.4   Installation of the HF5 type W (surface mount)
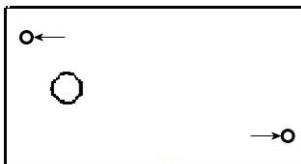
Mounting position of the enclosure

Horizontal:

HF52, HF53 and HF55 type W

Mounting hardware

Method 1: The HF5 is supplied with 2 screws, 2 drywall anchors and two rubber washers. The base of the enclosure has 2 screw-wells (see drawing) that are normally closed at the bottom. Use the template provided with the HF5 to drill mounting holes in the wall and insert the drywall anchors. Place a rubber washer on each screw. Insert a screw in each well and push to open the bottom of the well.

Method 2: When a DIN-rail (35 mm / 1 3/8 ") is available use part **AC5002** (not included). This is a DIN-rail mounting kit consisting of 2 clamps that attach to the back of the enclosure with the screws provided.

7   Electrical installation

7.1   General wiring 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:

• Bus signals such as RS485 • Data signals for PCs, printers etc. • shielded analog inputs • unshielded direct current (<= 60V) • shielded process signals (<= 25 V) • unshielded alternate current (<= 25V) • coaxial cables for CRT monitors	**in common bundles or channels / conduits**
• direct current from 60 V to 400 V (unshielded) • alternate current from 25V to 400 V (unshielded)	**in separated bundles or channels / conduits, without minimum distance**
• direct and alternate current > 400 V (unshielded) • Telephone lines • lines leading into EX-rated areas	**in separated bundles or channels / conduits, without minimum distance**

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.

7.2   Guidelines for RS-485 wiring (HF55)

RS-485 Cable

Using a symmetrical transmission method in combination with low capacity/ low attenuation twisted pair cables, allows extremely reliable long distance connections. The use of a high grade shielded cable avoids cross talk between the transmitted signals and also reduces the potential of external interference. For the RS-485 cable, we recommend using a cable Cat. 5e ANSI/ TIA /EIA-568-A-5.

In general the RS-485 cable should be shielded and comply with the following specifications:

- Cable capacitance   <=300pF/m or 90 pF/ft
- Line impedance $100 \, \Omega \, \pm 15 \, \Omega$
- Line resistance $140 \, \Omega/km$ or $225 \, \Omega$
- Signal lines   Twisted pair

RS485 Network

<u>**Note**</u>: Depending on your application, it may be necessary to terminate the RS-485 wiring with a 240 Ohm resistor. Termination resistors should be placed only at the extreme ends of the data line, and no more than two terminations should be placed in any single segment of an RS-485 network.

Voltage potential issues

The existence of a voltage-potential between instruments that are interconnected can be a source on concern in large installations, installations with different mains power supply and in inter-building networking.

As a first measure, the shield of a signal cable should be connected at both ends. In the case of a data cable, a low-resistance potential equalization cable may also have to be used. This cable should be run parallel and as near as possible to the data cable, preferably in the same conduit. The shield of the data cable should under no circumstances be used as equalization cable! The conductors of the potential equalization cable should ideally be stranded in order to be effective also in case of high- frequency interference.

The following points should also be observed:

- Close the parasitic circuit
- Connect all devices to the potential equalizing cable as often as possible. Electrical conductors such as machine elements, metal tubes or supporting constructions should be integrated into the system.
- Protect the potential-equalization cable and connections against corrosion.
- Select the cross-section of the potential equalization cable according to the maximum equalization current.

If these different measures do not correct the problem, a galvanic separation according to ISO 9549 may have to be installed. You may also want to consider the use of fiber-optic cables.

7.3   Cable grip and cable specifications

The HF5 is supplied either with one M16 sealing cable grip or with a ½" conduit adapter. The M16 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.

7.4   Wiring

7.4.1 *HF52: 2-wire, loop powered transmitter*

Electrical diagram
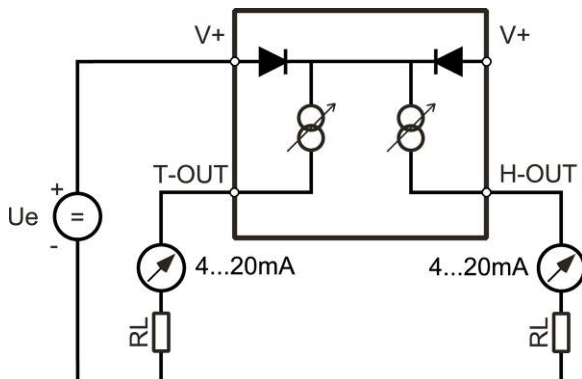
The maximum permissible cable length connecting the HF52 to other devices is determined by the total resistance resulting from the addition of the cable resistance and that of the devices connected in series with the unit. This resistance should not exceed 500 ohms.

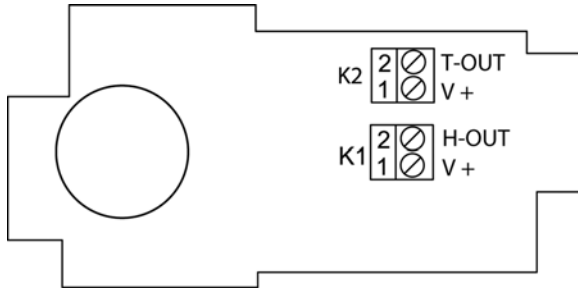| E-M-HF5-V1_10 | Rotronic AG |
	Bassersdorf, Switzerland
Document code	Unit
HygroFlex HF5 Humidity Temperature Transmitters: User Guide	**Instruction Manual**
	Document Type
Document title	Page **19** of 32

Terminal block diagram

| Terminals	Description
K2-2: T-OUT	Temperature output (+) OUT-2
K2-1: V+	Power supply: 10…28 VDC (+)
K1-2: H-OUT	Relative humidity or dew point (+) OUT-1
K1-1: 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.

Measuring humidity or temperature only

Unless configured to measure either humidity only or temperature only, proper operation of the HF52 requires both current loops to be closed. The HF52 can be directly ordered from the factory to measure either humidity or temperature only. When necessary, any unused output of the HF52 can be disabled with the ROTRONIC HW4 software. When the HF52 is configured with one of the two outputs disabled, close only the loop that is being used.

7.4.2 *HF53: 3-wire transmitter*

Electrical diagram for voltage outputs
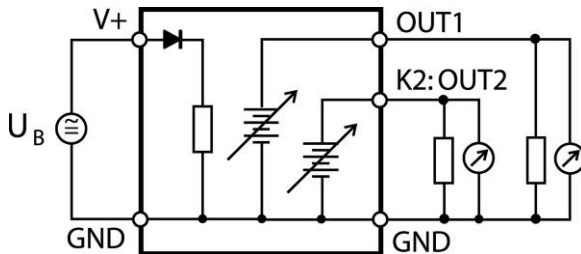
The maximum permissible cable length can be determined under consideration of the voltage drop caused by the current flowing to the devices connected to the unit. The voltage drop in the cable depends both on cable resistance and on the equivalent resistance of the devices connected in parallel to the 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.

Electrical diagram for current outputs
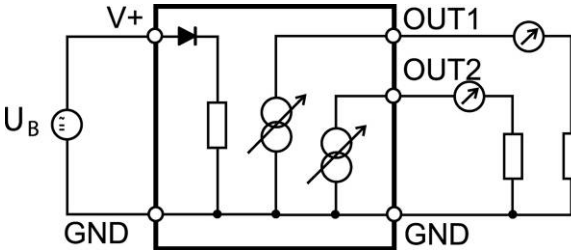
The maximum permissible cable length, connecting the unit to other devices, is determined by the total resistance resulting from the addition of the cable resistance and that of the devices connected in series with the unit. This resistance should not exceed 500 ohms.

Terminal block diagram

Type D and W (horizontal mount)
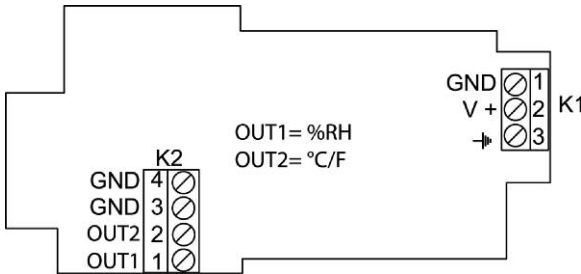
Type D (vertical mount)
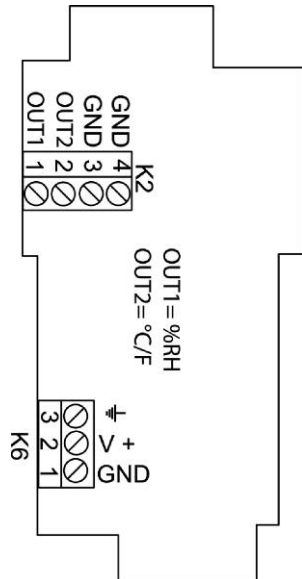
Terminals	Description
K1-1: GND	Power supply (-) or neutral (tied with other GND)
K1-2: V+	Power supply: 15…40 VDC (+) or 12…28 VAC (Phase)
K1-3: -▶	Protective ground (see note below)
K2-4: GND	Ground (tied with other GND)
K2-3: GND	Ground (tied with other GND)
K2-2: OUT2	Temperature output (+)
K2-1: OUT1	Relative humidity or dew point (+)
K6-1: GND	Power supply (-) or neutral (tied with other GND)
K6-1: V+	Power supply: 15…40 VDC (+) or 12…28 VAC (Phase)
K6-3: -▶	Protective ground (see note below)

Note: Terminals K1-3 or K6-3 (protective or earth ground) are not tied with GND. If so desired, K1-3 or K6-3 can be tied with GND by closing a solder pad on the PCB

Measuring humidity or temperature only

Operation of the HF53 does not require both current loops to be closed. When using the HF53 to measure either humidity only or temperature only, close only the loop that is being used.
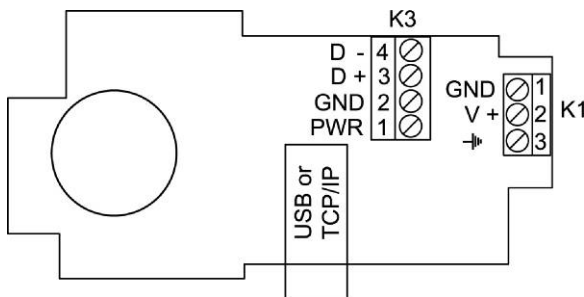
Using the ROTRONIC HW4 software, any unused output of the HF53 can be disabled.

7.4.3 *HF55: digital output*

Connectors and terminal block diagram

Terminals	Description
K1-1: GND	Power supply (-) or neutral (tied with other GND)
K1-2: V+	Power supply: 5…40 VDC (+) or 12…28 VAC (Phase)
K1-3: -►	Protective ground (see note below)
K3-4: D-	RS-485 Bi-directional TX- / RX -
K3-3: D+	RS-485 Bi-directional TX+ / RX +
K3-2: GND	Ground / Power supply (-)
K3-1: PWR	DC (+) 15…40 VDC (+) (optional, see note below)

<u>**Notes:**</u>

Terminal K1-3: this terminal (protective or earth ground) is not tied with GND. If so desired, K1-3 can be tied with GND by closing a solder pad on the PCB

Terminal block K3 (RS-485): pins K3-1 and K3-2 can be used to power all instruments on a RS-485 multi-drop from a single external 15 VDC power supply with adequate mA rating. In this case, do not use terminals K3-1 and pin K1-2 (normally used to power the HF55).

WARNING: Connecting a device to an active Ethernet network can disrupt communications on the network. Before connecting the HF5, make sure that it is properly configured for your network

7.4.4 *Grounding (all models)*
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).

8   Operation

8.1   HF52 and HF53 transmitters (analog outputs)

Use the HW4 software to configure the HF5 as desired, complete the mechanical and electrical installation and simply power up the HF5.

8.2   HF55 (digital output)

IMPORTANT: Prior to use, the HF55 must be configured by the user

Configuration and operation of the HF55 requires a PC with the HW4 software (version 2.1.0 or higher) installed.

a) USB network connection

Prior to connecting the HF55 to a USB port you must install the ROTRONIC USB driver on the HW4 PC. For instructions see the HW4 manual **E-M-HW4v2.1-Main** (§ 6.3)

b) Ethernet (TCP/IP) network connection (wired or wireless)

Prior to connecting the HF55 to an active Ethernet network you must configure the HF55 TCP/IP settings. For instructions see the HW4 manual **E-M-HW4v2.1-Main** (§ 6.4) and technical note **IN-E-TCPIP-Conf**

WARNING: Connecting a device to an active Ethernet network can disrupt communications on the network. Before connecting the HF5, make sure that it is properly configured for your network

c) RS-485 serial interface (multi-drop)

Instructions for configuring the RS-485 settings of the HF55 are provided in the following HW4 manuals **E-M-HW4v2.1-Main** (§ 6.5) and **E-M-HW4v2.1-F2-005**.

Notes:

o   Instruments connected to the same RS-485 network must be configured to use the same baud rate
o   Instruments connected to the same RS-485 network must be configured with a unique
     RS-485 address
o   **RS-485 Compatibility**: The communications protocol used by the HF55 and other AirChip 3000 products is not compatible with the protocol used by the previous generation of ROTRONIC products. Do not connect legacy products and AirChip 3000 products to the same RS-485 multi-drop network.

8.3   Internal menu (optional keypad and display)

<u>Note</u>: Unauthorized access to the menu can be prevented by disabling the "display menu" setting
(use the HW4 software > Device Manager > Display)

MENU key: open / close menu

ENTER key: menu item selection

Menu navigation keys + / -
Change value up / down
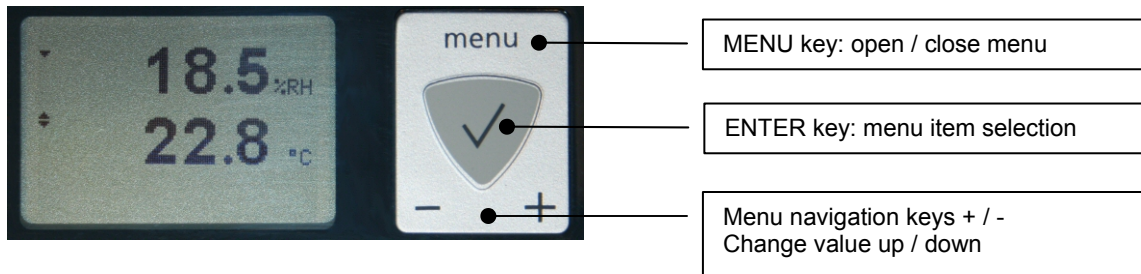
HF52 transmitter:

Main Menu	Menu Items	Selections / Information	Notes
Device Settings			
	Units	Metric / English	
	Contrast		LC display contrast adjustment
	Trend	On / Off	Trend indication on the display
Device Information			
	Version	Firmware version	
	Serial Nbr	Serial number	
	Address	RS-485 address	
	Type	Device type	
	Name	Device name	User defined
Probe Information			
	Version	Firmware version	
	Serial Nbr	Serial number	
	Address	RS-485 address	
	Name	Device name	User defined

HF53 and HF55 transmitters:

Main Menu	Menu Items	Selections / Information	Notes
Device Settings			
	Units	Metric / English	
	Back Light	Key Press / On / Off	Display backlight mode
	Contrast		LC display contrast adjustment
	Trend	On / Off	Trend indication on the display
Device Information			
	Version	Firmware version	
	Serial Nbr	Serial number	
	Address	RS-485 address	
	Type	Device type	
	Name	Device name	User defined

Main Menu	Menu Items	Selections / Information	Notes
Probe Information			
	Version	Firmware version	
	Serial Nbr	Serial number	
	Address	RS-485 address	
	Name	Device name	User defined
	SensorTest	Humidity sensor status	Off / Good / SQ-Tuned / Bad
	Record	On / Off	Data recording by the probe (max. 2000 values)
Humidity Adjust			
	RefValue	Humidity reference value	± 0.1 %RH steps
	Acquired		Number of cal. points in probe memory
	<Acquire>		Save cal. point to probe memory
	<Delete>		Erases all calibration points
	<Adjust>		Effect depends on number of calibration points
Temperature Adjust			
	RefValue	Temperature reference value	± 0.1 ˚C steps
	<Adjust>		1-point adjustment only (offset)

- o **Record:** both the recording mode (start / stop and the log interval cannot be changed from the menu and are as configured with the ROTRONIC HW4 software
- o **SensorTest:** Off means that the humidity sensor has not been tested due to the configuration settings of the test. For a description of the automatic humidity sensor test and drift compensation (SQ-tuning) see documents **E-T-AC3000-DF-V1** and **E-M-HW4v2.1-F2-005**

8.4   Displayed parameters (optional keypad and display)

When the menu is not active, press the ENTER key to change which parameters are shown on the display:

- o   Relative humidity and temperature
- o   Relative humidity , temperature and calculated parameter (when the calculated parameter is enabled)
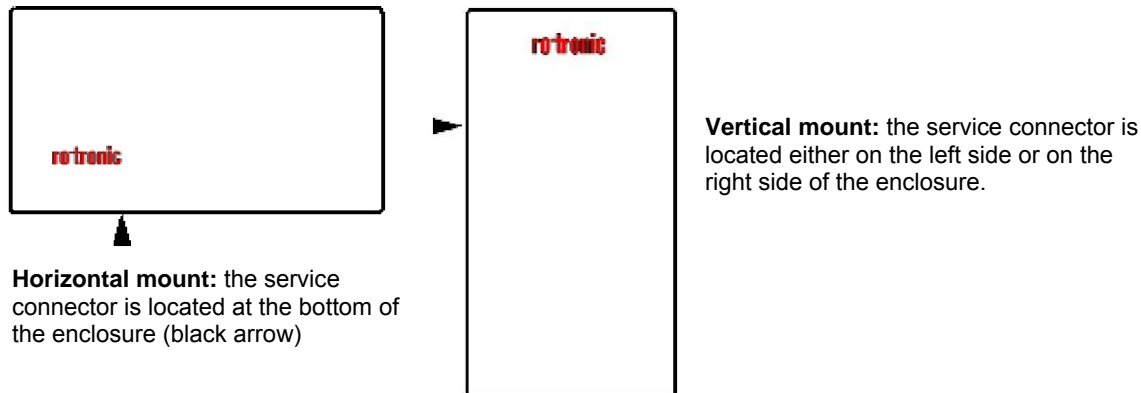
9   Maintenance

9.1   Service cable

- • Cable AC3006 is used to connect the HF5 to a USB port of a PC running the ROTRONIC HW4 software.
- • As an alternative, cable AC2001 is used to connect the HF5 to a probe input of the HP23 hand-held calibrator. For service purposes, the HP23 offers essentially the same functionality as the HW4 software.

E-M-HF5-V1_10	Rotronic AG
	Bassersdorf, Switzerland
Document code	Unit
HygroFlex HF5 Humidity Temperature Transmitters: User Guide	**Instruction Manual**
	Document Type
Document title	Page **25** of 32

9.2   Location of the service connector (mini USB type)

The service connector can be accessed without opening the enclosure after removing the small red sealing cover.

Horizontal mount: the service connector is located at the bottom of the enclosure (black arrow)

Vertical mount: the service connector is located either on the left side or on the right side of the enclosure.

9.3   Periodic calibration check of the probe

Both the Pt 100 RTD temperature sensor used in the probe 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 probe should be verified every 6 to 12 months. Applications where the probe is exposed to significant pollution may require more frequent verifications.

<u>Note</u>: **the HygroClip 2 probe cannot be adjusted when connected to the HF52 transmitter**

a) Procedure for adjusting the probe using the optional keypad (HF53 / HF55)

Temperature adjustment

The keypad of the HF53 or HF55 allows only a 1-point adjustment of temperature. The effect of a 1-point temperature adjustment is to add the same offset to all measured values.

- When temperature is stable, press the MENU key to show the internal menu on the display
- Use the (-) key to select Temperature Adjust and press the ENTER key
- Make sure that the text line beginning with RefValue is highlighted and press the ENTER key
- Use the (+) or (-) key to change the reference value to match the temperature reference
- Use the (-) key to highlight the Adjust text line and press the ENTER key
- The HF5 confirms the adjustment with the message "Adjust OK"
- Press the MENU key twice to exit the menu and return the HF5 to normal operation

Notes:

o   Any temperature adjustment should be done prior to adjusting humidity.
o   The calibration point is automatically deleted from the probe memory after an adjustment
o   Because the HF5 has no real time clock, the date of the adjustment is not written to the probe. If retaining the adjustment date is important, use the HW4 software to adjust the probe.

Humidity adjustment

The keypad of the HF53 or HF55 allows a multi-point adjustment of humidity. The effect of a humidity adjustment depends on the number of calibration points present in the probe memory prior to the adjustment:

- - one calibration point: offset added to all measured values
- - two calibration points: offset and slope
- - three or more calibration points: offset, slope, linearity

For maximum accuracy use at least 3 to 4 calibration points distributed equally across the measurement range of interest. The calibration points (maximum 100) can be acquired in any order but we recommend going from low humidity values to high humidity values.

- When humidity is stable, press the MENU key to show the internal menu on the display
- Use the (-) key to select Humidity Adjust and press the ENTER key
- Make sure that the text line beginning with RefValue is highlighted and press the ENTER key
- Use the (+) or (-) key to change the reference value to match the reference humidity
- Use the (-) key to highlight the Acquire text line and press the ENTER key
- Note that the "Acquired" counter is incremented by 1 (number of calibration points in the probe memory)
- When all calibration points have been acquired, use the (-) key to highlight the Adjust text line and press the ENTER key. **Do not adjust the probe before having acquired all calibration points**.
- The HF5 confirms the adjustment with the message "Adjust OK"
- Press the MENU key twice to exit the menu and return the HF5 to normal operation

Notes:

- o All calibration points are automatically deleted from the probe memory after an adjustment
- o The Delete text line can be used to manually delete all calibration points prior to a probe adjustment
- o Because the HF5 has no real time clock, the date of the adjustment is not written to the probe. If retaining the adjustment date is important, use the HW4 software to adjust the probe.

b) Using the HW4 software to adjust the probe connected to a HF53 or HF55:

- Use cable AC3006 to connect the service connector of the HF5 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**. In the case of the HF55, a connection with the PC can be established via the USB (ROTRONIC USB driver) or Ethernet interface.
- Start HW4 on the PC and search for the HF5 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HF5 with HW4, expand the device tree to see the HF5 functions. Select Probe and Probe Adjustment.
- For further instructions see HW4 manual **E-M-HW4v2.1-A2-001**

9.4   Cleaning or replacing the probe dust filter

See document **E-M-HC2 Probes-V1**

9.5   Validation of the output signals transmission

If so desired, transmission of the HF5 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 HF5 generates fixed digital and analog signals as specified by the user. For instructions see document **E-M-HW4v2.1-F2-005**

10   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 HF5 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**. In the case of the HF55, a connection with the PC can be established via the USB (ROTRONIC USB driver) or Ethernet interface.
- Copy the firmware update file from the ROTRONIC website to the PC.
- Start HW4 software on the PC and search for the HF5 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HF5, expand the device tree to see the HF5 functions. Select Device Manager. In the Device Manager menu bar select Tools > Firmware Update. For instructions see document **E-M-HW4v2.1-F2-005**

11   Technical data

11.1   Specifications

General	HF52	HF53	HF55
Device type	Humidity temperature transmitter with analog output signals		Humidity temperature transmitter with digital output
Circuit type	2-wire, loop powered	3-wire	
Mechanical configuration types	D and W		

Power supply and connections	HF52	HF53	HF55
Supply voltage (VDD)	10…28VDC V min = 10 V + (0.02 x Load*) *Load resistance in ohms.	15…40 VDC or 12…28 VAC	5…40 VDC or 12…28 VAC
Nominal current consumption	2 x 20 mA	< 50 mA	Model with USB interface: 50 mA Model with Ethernet interface: 300 mA
Electrical connections	Terminal block and M16 cable grip or ½" conduit adapter		Connector (USB or Ethernet), terminal block (power supply and RS-485) and M16 cable grip or ½" conduit adapter
Polarity protection	Protective diode on V+		

Humidity and temperature measurement	
See document **E-M-HC2 Probes** > Specifications	

Calculated parameters	HF52	HF53	HF55
Psychrometric calculations	Dew point (Dp) above and below freezing Frost point (Fp) below freezing and dew point above freezing Wet bulb temperature (Tw) Enthalpy (H) Vapor concentration (Dv) Specific humidity (Q) Mixing ratio by weight (R) Vapor concentration at saturation (Dvs) Vapor partial pressure (E) Vapor saturation pressure (Ew)		

Start-up time and data refresh rate	HF52	HF53	HF55
Start-up time	14 s (typical)	3.s (typical)	3 s (typical)
Data refresh rate	5 s (typical)	1 s (typical)	1 s (typical)

Configurable analog outputs	HF52	HF53
Output 1	Can be made to correspond to any parameter	
Factory default parameter	Relative humidity or dew / frost point	
Factory default scale	As per ordering code	
Output 2	Can be made to correspond to any parameter	
Factory default parameter	Temperature	
Factory default scale	As per ordering code	
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	
Short circuit tolerant	Yes	
Maximum external load	500 Ω	500 Ω (current output)
Minimum external load	0 Ω	1000 Ω (voltage output) 0 Ω (current output)

Digital interface	HF55
Interface type	USB and RS-485 or Ethernet (TCP/IP) wired or wireless and RS-485

Service connector	HF52	HF53	HF55
Interface type	UART		
Maximum service cable length	5 m (16.4 ft)		

General specifications	HF52	HF53	HF55
Optional display	LC, 1 or 2 decimals resolution, no backlight, trend and alarm indication	LC, 1 or 2 decimals resolution, backlight, trend and alarm indication	
Probe material	Polycarbonate		
Probe dust filter material	Polyethylene		
Housing material	ABS		
Housing protection grade	IP 65 (except HF55 – USB or Ethernet)		
Physical dimensions	See Models		
Weight	250 g (8.8 oz)		250 g (8.8 oz)

Conformity with standards	HF52	HF53	HF55
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		

Environmental limits	HF52	HF53	HF55
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	Depends on probe model		
Maximum humidity at sensor	100 %RH up to 80 °C (176 °F) 75 %RH at 100 °C (212 °F) 45 %RH at 125 °C (260 °F) 15 %RH at 150 °C (302 °F)		
Maximum air velocity at probe	20 m/s (3,935 ft /min)		
Critical environments	Humidity sensor: as per DV04-14.0803.02 - Critical chemicals		

11.2   Dew point accuracy

See document **E-M-HC2 Probes** > **Dew point accuracy**

12   Accessories

12.1   Configuration and communication software

The ROTRONIC HW4 software (version 2.1.0 or higher) allows configuring the HF5. 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
HW4-E	HW4 software, Standard Edition (single user)
HW4-P	HW4 Professional Edition, ERES regulations compliant (FDA / GAMP), multi user

12.2   Service cables

Order Code	Description	
AC3006	Mini-USB service connector (UART) to a PC USB port. Cable electronics convert UART interface to USB interface	
AC2001	Mini-USB service connector (UART) to 7-pin probe connector of the HP23 hand-held calibrator.	

IMPORTANT: Prior to using cable AC3006, 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.

12.3   Mounting hardware

Order Code	Description	
AC5002	DIN-rail mounting kit (consists of 2 clamps that attach to the back of the enclosure with the screws provided). DIN-rail (35 mm / 1 3/8") not included	
AC1303-M + AC1305	Mounting flange (AC1305) and compression fitting (AC1303-M) for 15 mm / 0.6" diameter probe. Use for though wall installation of the HF5 type D Maximum temperature 200 °C (392°F)	

12.4   Calibration accessories

See document **E-M-HC2 Probes-V1**

12.5   Spare filters

See document **E-M-HC2 Probes-V1**

13 Supporting documents

Document File Name	Contents
E-M-HC2 Probes-V1	HygroClip 2 (HC2) Humidity Temperature Probes, User Guide
E-T-AC3000-DF-V1	AirChip 3000 Description and Main Functions
E-M-HW4v2.1-DIR	List of the HW4 manuals
E-M-HW4v2.1-Main	HW4 software version 2.1: General instructions and functions common to all devices
E-M-HW4v2.1-F2-005	HW4 software version 2.1: HF5 transmitter and probes Device Manager and Data Recording 3000 functions
E-M-HW4v2.1-A2-001	HW4 software version 2.1: Probe Adjustment function AirChip 3000 devices
E-M-HW4v2.1-DR-001	HW4 software version 2.1: Data Recording Function AirChip 3000 Devices
E-M-AC3000-CP	AirChip 3000 Communication Protocol
IN-E-TCPIP-Conf	Configuration procedures for ROTRONIC devices with Ethernet (TCP/IP) interface
E-M-CalBasics	Temperature and humidity calibration basics Instructions for using the ROTRONIC humidity standards
E-T-HumiDefs	Humidity Definitions
DV04-14.0803.02	Critical chemicals
E-T-HC2-Equivalence	Product equivalence with previous models

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.

14 Document releases

Doc. Release	Date	Notes
_10	Jun 27, 2008	Original release