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HygroFlex HFM53 Humidity Temperature Transmitters

User Guide



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Applicability:

This manual applies to the HFM53 transmitter 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 HFM53 is a 3-wire humidity-temperature transmitter designed for fixed installation in outdoor applications where high measurement accuracy is required. Typical uses are meteorological towers, airport weather stations, building rooftops, etc. The enclosure is made of an aluminum alloy and is coated to withstand marine environments. The probe is separated from the transmitter by 3 m (9.8 Ft) of sunlight resistant hardwired cable terminated with a waterproof connector. The HFM53 transmitter operates within the temperature limits of -40...60 °C (-40...140°F).

The HFM53 is designed for use together with the HC2-S3 plug-in humidity-temperature probe. This probe is designed for meteorological applications, has a temperature operating range of -50 to 100°C (-58 to 212°F) and can measure humidity conditions within the range of 0 to 100 %RH.

The HFM53 provides two analog output signals (voltage or current) corresponding to any of the following: relative humidity, temperature or a calculated parameter such as dew point, enthalpy, mixing ratio, etc. The two signals are linear and can be transmitted over a length of cable to a remote display, recorder, controller or data processing unit.

The HC2-S3 probe features well proven, durable sensors. Digital signal processing within the probe ensures consistent product performance and also facilitates the task of field maintenance with features such as potentiometer free – digital calibration, hot-swapping of the probe, etc.

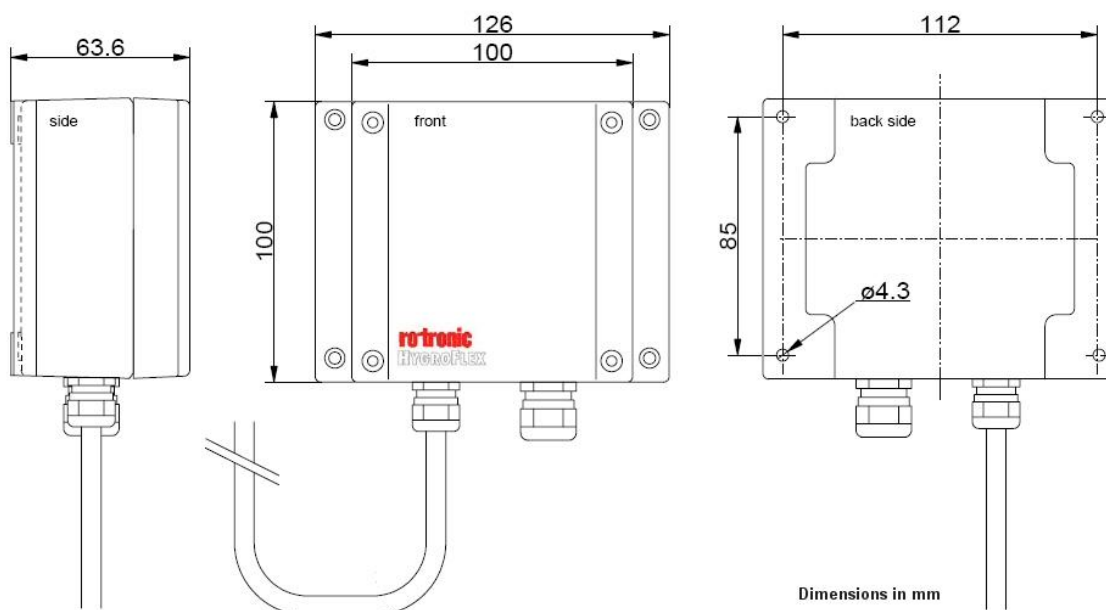
Based on the ROTRONIC AirChip 3000 digital technology the HFM53 and HC2-S3 probe offer the following user functions:

- 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 the HFM53 and HC2-S3 probe firmware means that both devices can be kept up-to-date regarding any future functionality improvement.

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2 Dimensional drawings



3 General description

3.1 Power supply

The HFM53 can be powered with either 15 to 40 VDC or 12 to 28 VAC. With both output circuits closed, the maximum current consumption is 50 mA.

3.2 Measured parameters

The HC2-S3 probe used with the HFM53 transmitter 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 HFM53 can be configured by the user to calculate one of the following parameters:

- 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)

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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-HW4v3-F2-016**

3.4 Analog output signals

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.

The HW4 software also allows selecting the type of analog signal from any of the following: 0...20 mA, 4...20 mA, 0...1V, 0...5V or 0...10V (see 5.2). Both output signals are automatically configured with the same signal type. No adjustment is required after changing the type of output signal.

3.5 Service connector

The service connector (UART interface with a mini-USB type connector) allows connecting the HFM53 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.

- The service connector is used to configure the HFM53 and to and update its firmware with the HW4 software.
- The service connector can be used to display the data measured by the HFM53 on another instrument such as the HP23 hand-held indicator. **Connecting the HF5 service connector to the probe input of another instrument does not give access to probe functions such as such as humidity and temperature adjustment, data recording, etc.**

3.6 Probe

The HFM53 is normally used with the HC2-S3 meteorological probe and is also compatible with all available models of HygroClip 2 probes. For detailed information, see document **E-M-HC2 Probes-V1**.

4 User configurable settings and functions

The HFM53 ships configured as specified on the customer order. Models with analog outputs can be installed and used just as any conventional humidity and temperature transmitter and most users will never need to use the HFM53 configurable settings and functions. Models with a digital interface generally require some configuration by the user.

Making use of the HFM53 and probe 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 HFM53 and probe functions and also indicated the factory default settings.

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4.1 Function overview

MEASUREMENT ACCURACY AND RELIABILITY (PROBE FUNCTIONS)	
AirChip 3000 Functions	Description
▶ Humidity / temperature adjustment	<ul style="list-style-type: none"> ○ 1-point or multi-point humidity calibration or adjustment ○ 1-point or 2-point temperature calibration or adjustment ○ Generate a time stamp for calibrations and adjustments ○ Retain and view last adjustment date and adjustment values ○ Generate calibration and adjustment protocols
▶ 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 with the HW4 software and is shown as Good, SQ-tuned (corrected for drift) or Bad (defective)</p>
▶ 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 use 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"> ○ Start or stop data recording - up to 2000 value pairs (%RH and temperature). Starting a recording session erases all previously recorded data ○ The recording mode and log interval can be specified ○ 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 ○ The recorded data can be downloaded to a PC with the HW4 software, time stamped and viewed

MEASUREMENT LOOP VALIDATION	
Functions	Description
▶ Simulator mode	Used to make the HFM53 generate fixed values for the humidity, temperature and calculated parameter. Can be configured, enabled or disabled

DEVICE SAFEGUARDS	
Functions	Description
▶ Device write protection	Used to protect the HFM53 with a password to prevent unauthorized digital access by a digital user. Can be configured, enabled or disabled

PROCESS PROTECTION AND PROTECTION OF OTHER DEVICES	
AirChip 3000 Functions	Description
▶ Limit humidity output to 100 %RH	This probe function is used to prevent the humidity signal from exceeding 100 %RH when condensation forms on the sensor. Can be enabled or disabled

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PROCESS PROTECTION AND PROTECTION OF OTHER DEVICES	
► Fail safe mode	Used to specify a "safe" fixed value for humidity and for temperature (HFM53 or probe) in the event of: <ul style="list-style-type: none"> ○ Loss of communication with the probe (HFM53 function) ○ Sensor failure (probe function) Can be configured, enabled or disabled

4.2 Factory default settings

Note:

- Configuration of the HFM53 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 HFM53 service connector to a USB port of the PC.

Configurable Settings	Factory default
Unit system (Metric or English)	As per ordering code
Analog signal type (4...20 mA or other)	As per ordering code
Psychrometric calculation	As per ordering code
Fixed pressure value	1013.25 hPa or 29.92 In Hg
Output 1 parameter, scale and unit	As per ordering code (%RH or other)
Output 2 parameter, scale and unit	Temperature, unit as per ordering code
Communication protocol	RO-ASCII
RS-485 address	0
Device name	Instrument model

Functions	Factory default
Humidity / temperature adjustment	
Device write protection	Disabled (HFM53 and probe)
Limit humidity output to 100 %RH	Enabled (probe)
Out-of-limit value digital alarm	Disabled (HFM53 and probe)
Data recording (probe)	Enabled (loop mode – 10 min. interval)
Automatic humidity sensor test	Disabled (probe)
Humidity sensor drift compensation	Disabled (probe)
Fail safe mode	Disabled (probe)
Monitor probe alarms	Enabled
Loss of communication with probe	Disabled (HFM53)
Simulator mode	Disabled (HFM53 and probe)

- For a detailed description of all AirChip 3000 / HFM53 main functions see document **E-T-AC3000-DF-V1**

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- Instructions regarding the configuration of the HFM53 and probe as well as access to the functions are provided in the following manuals:

E-M-HW4v3-Main
E-M-HW4v3-F2-016
E-M-HW4v3-F2-001
E-M-HW4v3-DR-001
E-M-HW4v3-A2-001
E-M-AC3000-CP

- The factory default setting for dew / frost point calculation is frost point below freezing

4.3 Interaction between the HFM53 and probe functions

It is important to note that when used together, the HFM53 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.

The functions and settings of the HFM53 transmitter and HygroClip 2 probe (HC2) operate together as indicated below:

Function / Setting	HF5	HC2	Notes
Device protection	X	X	Individual to the HFM53 and HC2 probe
RS-485 address	X	X	Individual to the HFM53 and HC2 probe
Device Name	X	X	User defined description The device name of the HC2 probe is not displayed by HW4 and is replaced with the HFM53 Input Name
Calculation	X	X	Psychrometric calculation HFM53 setting overrides HC2 probe setting
Data refresh rate	X		This setting has no effect on the HFM53 and probe.
Simulator function	X	X	Generates fixed humidity and / or temperature value When enabled, the HFM53 settings override the HC2 probe settings
Unit system	X	X	The HFM53 setting overrides HC2 probe setting regarding the HFM53 signals. The HC2 probe settings still apply when the probe is used alone Make sure to use the same humidity symbol and the same temperature unit for both the HFM53 and probe.
Out-of-limits value alarm	X	X	The HFM53 settings are independent from the HC2 probe settings. The HC2 probe settings have an effect only when the HFM53 is enabled to monitor alarms generated by the probe When out-of-limit values have been defined for the same parameter for both the HFM53 and probe, any alarm is triggered based on the narrowest set of limits (assuming that the HFM53 has been set to monitor probe alarms).
Analog outputs	X	X	Parameter and scale The HC2 probe settings have no effect on the HFM53

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4.4 HFM53 output signal type (hardware setting)

The analog output signal type generated by the HFM53 can be configured after connecting the service connector via a service cable to a PC running the ROTRONIC HW4 software. Instructions are provided in the following HW4 manual: **E-M-HW4v3-F2-016**

5 Mechanical installation

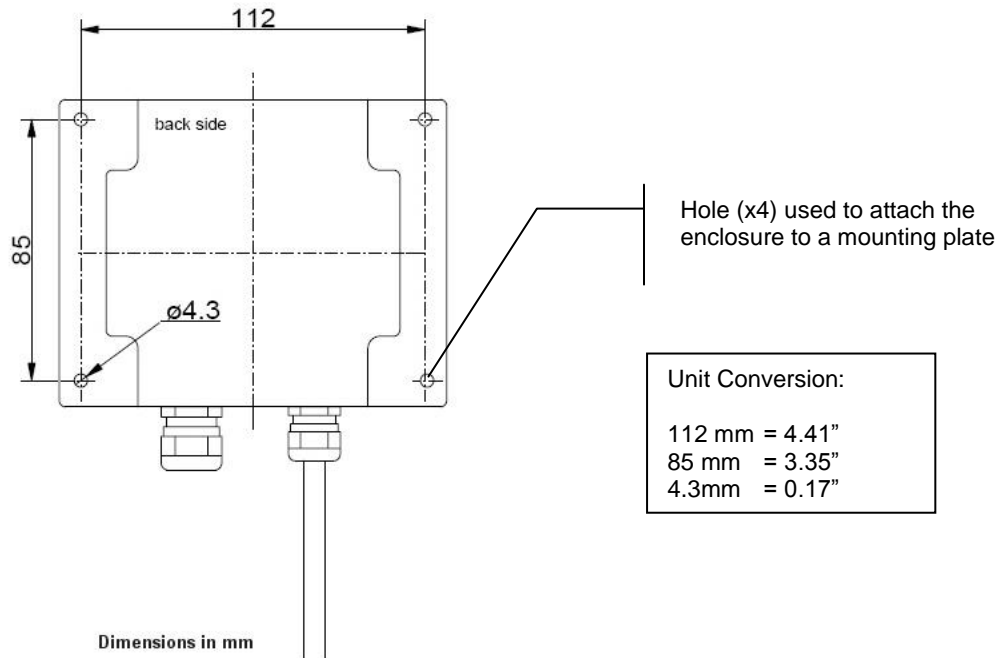
Each HFM53 transmitter is shipped in an individual box. The cable used to plug-in the HC2-S3 probe is already installed on the transmitter. The HC2-S3 S3 probe is shipped in a separate box.

The shipping box used for the HFM53 has a label with the following information: instrument type, main specifications and serial number. An identical label is located inside of the transmitter enclosure.

5.1 Installation of the transmitter enclosure

Use the 4 holes shown below to attach the enclosure on a suitable mounting plate. The mounting plate itself can be secured with U bolts to the pole that will also be used for the HygroClip S3 probe and radiation shield.

Mounting plate A-01172 is available from Rotronic and includes U bolts for use with a 1.5" diameter pole.



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5.2 Probe installation guidelines

Install the probe so that the local conditions at the sensors are typical of the environment to be measured:

- Use either a shield or a louvered shelter to protect the probe and sensors from direct exposure to solar radiation and precipitation. Natural aspiration shield SMP-41203-7 is available from ROTRONIC.
- In an open field, install the probe at least 4 feet (1.2 meter) above ground in the case of a grassy, non reflective field. For roof top installation or any installation above a reflective surface, a minimum elevation of 33 ft (10 meter) may be required.

6 Electrical installation

6.1 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:

<ul style="list-style-type: none"> ● 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
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<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • 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

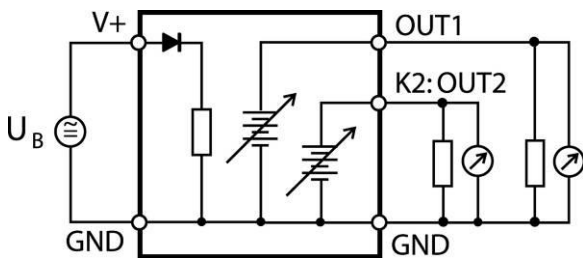
Cabling in areas with a risk of lightning requires a lightning protection. For cabling underground in between buildings, we recommend the use of special fiber optic cables. If this is not possible, use copper cables that are suitable for underground installation.

6.2 Cable grip and cable specifications

The HFM53 is supplied either with one M16 sealing cable grip. 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.

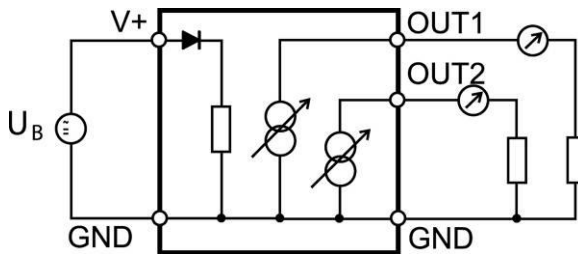
6.3 Wiring

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.

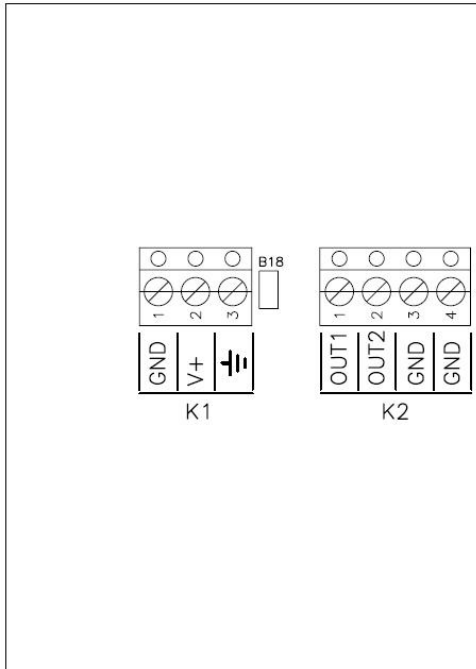
Electrical diagram for current outputs



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.

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Terminal block diagram



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)

Terminals	Description
K2-1: OUT1	Relative humidity or dew point (+)
K2-2: OUT2	Temperature output (+)
K2-3: GND	Ground (tied with other GND)
K2-4: GND	Ground (tied with other GND)

Note: Terminal K1-3 (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

Measuring humidity or temperature only

Operation of the HFM53 does not require both measurement loops to be closed. When using the HFM53 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 HFM53 can be disabled.

6.3.1 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).

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7 Operation

Use the HW4 software to configure the HFM53 as desired, complete the mechanical and electrical installation, connect the probe and simply power up the HFM53.

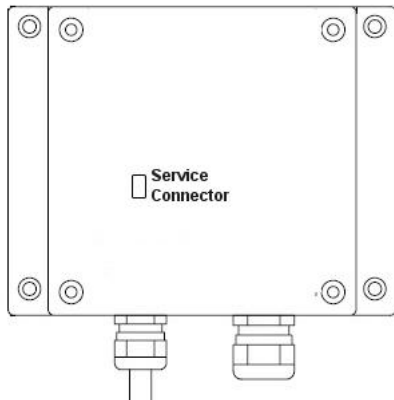
8 Maintenance

8.1 Service cable

Cable AC3006 is used to connect the HFM53 to a USB port of a PC running the ROTRONIC HW4 software. Prior to connecting the HFM53 to a USB port you must install the ROTRONIC USB driver on the PC (available from the HW4 CD or from www.rotronic-humidity.com). For instructions see the HW4 manual **E-M-HW4v3-Main** (§ 7.3). Service cable AC3006 does not power the HFM53 and the transmitter must be separately powered when using this cable.

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.



The service connector is located on the left side of the PCB and can be accessed after removing the enclosure cover.

8.3 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.

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Using the HW4 software to adjust the HC2-S3 probe:

For reasons of convenience, the HC2-S3 probe should be adjusted after being disconnected from the transmitter. It is also possible to adjust the probe while connected to the transmitter. In both cases a PC with the HW4 software installed is required.

- With the HC2-S3 probe disconnected from the transmitter, use cable AC3001 to connect the probe to a USB port of the PC. Cable AC3001 powers the probe directly from the USB port.
- With the HC2-S3 probe connected to the transmitter, use service cable AC3006 to connect the service connector of the HFM53 to a USB port of the PC. When using cable AC3006, HFM53 must be powered separately.

Note that in both cases the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v3-Main**. During the entire procedure the HFM53 must be powered

- After connecting either the probe or the transmitter to the PC, start HW4 on the PC and search for the probe or transmitter (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the device with HW4, expand the device tree to see the device functions. Note: when the HFM53 is connected to the PC, expand the device to see the probe.
- Select the probe and select Probe Adjustment function.
- For further instructions see HW4 manual **E-M-HW4v3-A2-001**

8.4 Cleaning or replacing the probe dust filter

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

8.5 Validation of the output signals transmission

If so desired, transmission of the HFM53 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 HFM53 generates fixed digital and analog signals as specified by the user. For instructions see document **E-M-HW4v3-F2-016**

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 HFM53 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-HW4v3-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 HFM53 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HFM53, 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-HW4v3-F2-016**

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10 Technical data

10.1 Specifications

General	HFM53
Device type	Humidity temperature transmitter with analog output signals
Circuit type	3-wire

Power supply and connections	HFM53
Supply voltage (VDD)	15...40 VDC or 12...28 VAC
Nominal current consumption	< 50 mA
Electrical connections	Terminal block and M16 cable grip
Polarity protection	Protective diode on V+

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

Calculated parameters	HFM53
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	HFM53
Start-up time	3.s (typical)
Data refresh rate	1 s (typical)

Configurable analog outputs	HFM53
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	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 (current output)

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Configurable analog outputs	HFM53
Minimum external load	1000 Ω (voltage output) 0 Ω (current output)

Service connector	HFM53
Interface type	UART
Maximum service cable length	5 m (16.4 ft)

General specifications	HFM53
Housing material	Aluminum die cast
Housing protection grade	IP 65
Physical dimensions	125 (W) x 100 (H) x 60 (D) mm
Weight	692 g (1 Lb 8.4 oz)

Conformity with standards	HFM53
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	HFM53
Storage and transit	-50...+70 °C , 0...100 %RH, non condensing
Operating limits at electronics	-40 ... +60 °C, 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

10.2 Dew point accuracy

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

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11 Accessories

The following accessories are available for mounting the HFM53 and its probe on a pole:

- A-01172 mounting plate
- SMP-41203-7 radiation shield

Both the mounting plate and radiation shield include U bolts suitable for a 1.5" pole

For other accessories and parts such as configuration software, service cables and spare dust filters please see document **E-M-HC2-accessories**.



A-01172 mounting plate



SMP-41203-7 radiation shield

12 Supporting documents

Document File Name	Contents
E-M-HC2 Probes-V1	HygroClip 2 (HC2) Humidity Temperature Probes, User Guide
E-M-HC2-accessories	Accessories and parts for probes, indicators and transmitters
E-T-AC3000-DF-V1	AirChip 3000 Description and Main Functions
E-M-HW4v3-DIR	List of the HW4 manuals
E-M-HW4v3-Main	HW4 software version 3: General instructions and functions common to all devices
E-M-HW4v3-F2-016	HW4 software version 3: Device Manager - HFM53 transmitter

E-M-HFM53-V1_11 Document code	Rotronic AG Bassersdorf, Switzerland Unit
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Document File Name	Contents
E-M-HW4v3-F2-001	HW4 software version 3: Device Manager – HC2 probe series
E-M-HW4v3-A2-001	HW4 software version 3: Probe Adjustment function AirChip 3000 devices
E-M-HW4v3-DR-001	HW4 software version 3: Data Recording Function AirChip 3000 Devices
E-M-AC3000-CP	AirChip 3000 Communication Protocol Options
E-M-CalBasics	Temperature and humidity calibration basics Instructions for using the ROTRONIC humidity standards
E-T-HumiDefs	Humidity Definitions

Note: All document file names have an extension corresponding to the document release number (example of a first release: E-M-HW4v3-Main_10). This extension is not shown in the above table.

13 Document releases

Doc. Release	Date	Notes
_10	Jan. 21, 2010	Original release
_11	Jun, 20, 2010	Updated document to HW4 software v.3