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HM4

Humidity and Temperature Probe
with Heated Sensor

Instruction Manual

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1   Overview

The HygroMet4 (HM4) series of devices are digital humidity and temperature probes based on ROTRONIC AirChip3000 technology. The probe permits heating of the sensor during humidity and temperature measurement. It was developed for use in meteorological applications and wherever high humidity and the risk of condensation on the sensor is likely.

The HM4 has two freely configurable and user adjustable linear analog outputs (voltage/current). It also has an RS-485 interface for direct exporting of measured values with the HW4 software and configuration of the probe. The manual **E-M-HW4v3-F2-023** describes all software functions. Using the RS-485 interface, it is possible to build a network of up to 64 simultaneously evaluable HM4 probes.

The HM4 offers the following user functions:

- Simultaneous measurement and heating
- Measurement of relative humidity and temperature and calculation of all psychrometric parameters
- Freely programmable sensor heating (RoHumiHeat) prevents condensation on the sensor
- Adjustable sensor cleaning (RoHumiClean) to minimise soiling of the sensor
- SMD Thermo sensor element
- Outstanding accuracy and repeatability
- Integrated real-time clock
- Freely scalable analog output signals
- RS-485 interface
- Calibration / adjustment of humidity and temperature measured values
- Simulation mode
- User-specific device settings

Simple updating of the AirChip3000 firmware keeps the devices in the HM4 series up to date with improved functionality.

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1.1   Scope

This manual is valid for the HM4 probe series with firmware version V1.1. The low-order digit of the firmware version stands for minor changes, e.g. correction of errors that do not influence the main functionality of the device.

1.2   Background Information on the Principle of Measurement

In environments with high humidity (>90 %RH) near saturation point there is a risk of condensation forming on the humidity sensor. To avoid resultant incorrect measurement, the sensor can be heated above ambient temperature to avoid condensation. The same applies for outdoor measurements in mist or high levels of dew.

The probes in the HygroMet4 series from ROTRONIC (HM4) measure temperature and humidity simultaneously. Formation of condensation on the capacitive SMD humidity sensor can be prevented by raising the temperature above ambient temperature, thereby enabling accurate humidity measurements even when the measurement environment has already reached dew point (100 %RH). Figure 1 provides an overview of the basic elements of the HM4 probe.
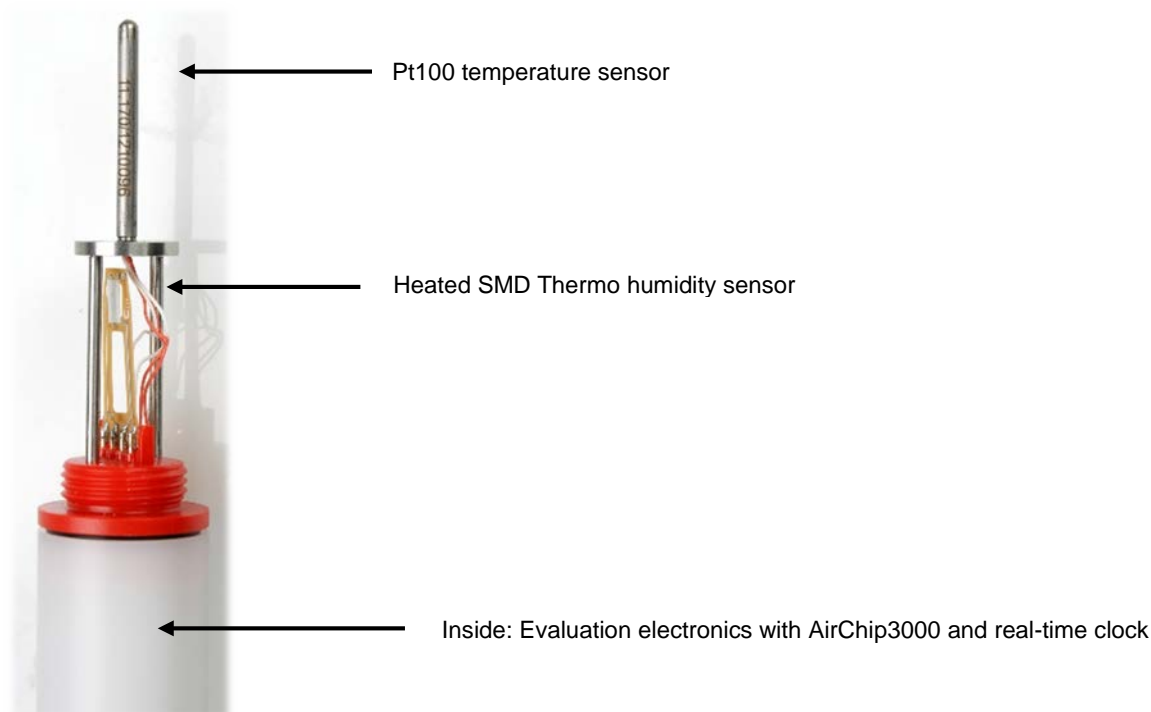
Pt100 temperature sensor

Heated SMD Thermo humidity sensor

Inside: Evaluation electronics with AirChip3000 and real-time clock

Figure 1: Overview of the basic elements of the HM4 probe.

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2   Mechanical Variants and Dimensions

The HM4 is a new development from ROTRONIC and comes in three variants:

- Connector directly at the housing

- Connector on remote cable

- Cable with open ends

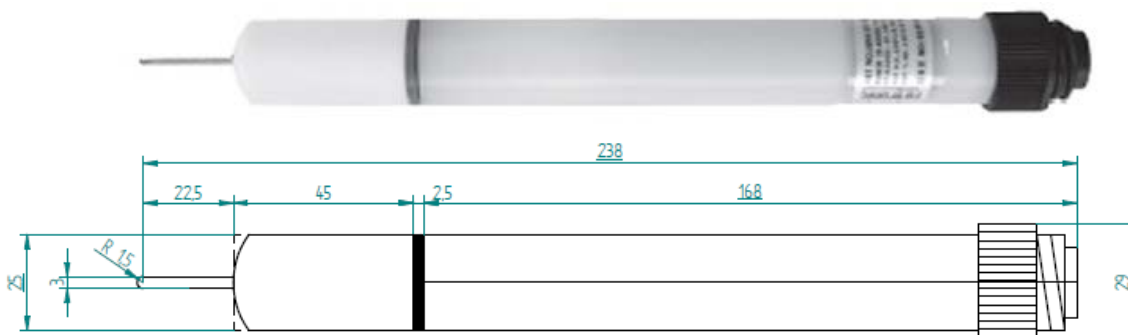## 2.1.1   HM4 with 7-Pin Tuchel Connector at Housing

Figure 2: Dimensions of the HygroMet4 with Tuchel connector at the housing in mm

2.1.2   HM4 with Cable

The HM4 is available with a cable length of 2 m or 5 m. The cable is available with open ends or Tuchel T7 connectors.
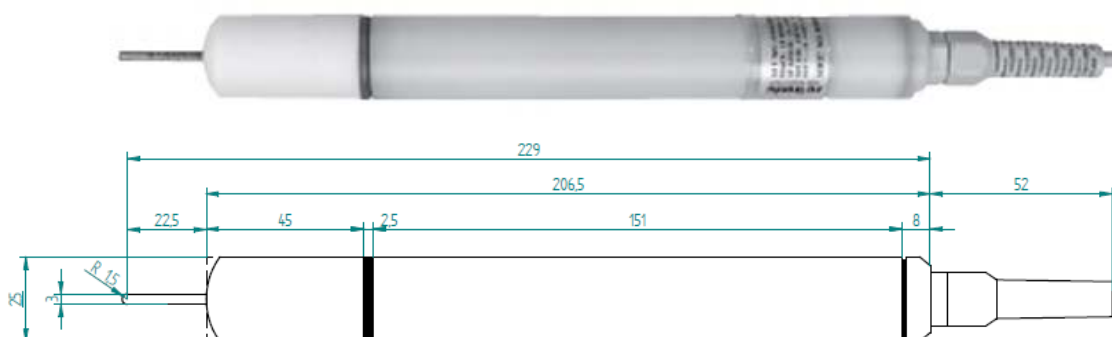

Figure 3: Dimensions of the HygroMet4 with cable in mm

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3   General

3.1   Power Supply

The HM4 requires a power supply of 15...24 VDC (55 mA) for full functionality, but may already be operated on 5 VDC with the following restrictions:

- Analog output only 0...1 V
- RoHumiClean function only available to a limited extent (see chapter 4.1.6)

Detailed Power Supply Specifications:

Operating State	Current Consumption
5 VDC, without heater	<35 mA
5 VDC, with heater	<55 mA
24 VDC, without heater	<20 mA
24 VDC, with heater	<30 mA

3.2   Measured Parameters

The HM4 measures relative humidity and temperature. The heated SMD humidity sensor allows simultaneous heating and measurement. The temperature is measured at the tip of the probe by an external Pt100 sensor.

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3.3   Calculated Parameters

The HM4 can calculate all psychrometric parameters and assign them to the outputs with the HW4 software.

- Dew point (Dp)
- Frost point (Fp)
- Wet bulb temperature (Tw)
- Enthalpy (H)
- Vapour concentration (Dv)
- Specific humidity (Q)
- Mixing ratio (R)
- Saturation vapour concentration (Dvs)
- Vapour partial pressure (E)
- Water vapour saturation pressure (Ew)

Remark:

The above parameters are dependent on barometric pressure. Using the HW4 software, it is possible to store the barometric pressure at the probe in the HM4 probe. Programming of the HM4 with the HW4 software is described in the manual **E-M-HW4v3-F2-023**.

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3.4   Analog Outputs

The ROTRONIC HW4 software enables free configuration and scaling of the analog outputs. The measured values (humidity, temperature) and resultant calculated values can thus be assigned to the analog outputs (Out1, Out2) and scaled at will. The output variants (current or voltage) are defined by the order code. They may be changed afterwards at will without need to recalibrate the device (output type / scaling).

Default scaling of the outputs ex works:

Output	Scale
Output 1 (Out1)	0…100 %RH
Output 2 (Out2)	-40…60 °C

The scale of the output variables and assignment of the measured variables to the outputs can be changed at will with the HW4 software. The following output variables are available to the user:

- Relative humidity
- Temperature
- Calculated parameters

By scaling, the user can set the limits of the temperature and measurement range freely to any values between -999 and +9,999. Temperature measurements are possible in the following units:

- °C (degrees Celsius)
- °F (degrees Fahrenheit)

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The analog outputs have a resolution of 16 bits and, depending on the output variant, a maximum offset as named in the table below.

Order Code	Signal Type	Maximum Offset
HM431	0…20 mA	20 µA
HM432	4…20 mA	No offset
HM433	0…1 V	1 mV
HM434	0…5 V	10 mV
HM435	0…10 V	10 mV

Important:

The maximum load values and minimum load resistances must be taken into account for the current and voltage outputs. See chapter 10 for details.

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3.5   RS-485 Interface

The RS-485 interface is used to connect the HM4 to a PC. A PC running the HW4 software (Professional version) offers the following functions:

- Recording and display of current measured and calculated values
- Configuration of the probe
- Calibration and adjustment of the probe

Depending on the type of probe connection (Tuchel connector / open ends), different accessories are needed to connect the HM4 to a PC:

- **Tuchel connector:**

  HM4 probes with a Tuchel connector are connected with AC3010-T (RS-485-to-USB adapter). The device can then be found and integrated using the HW4 software:

  Devices and Groups > RS485 > Search for Devices connected via AC3010 adapter

- **Open ends:**

  HM4 probes with open cable ends require AC3010 (RS-485-to-USB adapter) or AC3011 (RS-485-to-Ethernet adapter). Both adapters allow an RS-485 network with up to 64 probes. The device can then be found and integrated using the HW4 software:

  Devices and Groups > RS485 > Search for Devices connected via AC3010 adapter

  Devices and Groups > RS485 > Search for Devices connected via AC3011 adapter

See the manual **E-M-HW4v3-Main**, points 6.4, 7.5 and 11.2.2, for detailed information on building RS-485 networks and integrating HM4 probes in the HW4 software. Accessories such as AC3010 and AC3011 are described in the manual **E-M-HC2-accessories**.

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3.6   HW4 Software Compatibility

The devices in the HM4 series are fully integrated in the HW4 software V3.4 and later.

3.7   Real-Time Clock

The HM4 probes are equipped with a battery-powered real-time clock. The button battery of the type CR-1220 guarantees clock operation for a period of about 10 years. The battery of the real-time clock is only used when the HM4 is not connected to an external power supply.

The real-time clock is set ex works and can be readjusted with the HW4 software. The maximum rate deviation of the clock is ±5 minutes per month (<116 ppm).

3.8   Sensor Filter

The probe must be protected at all times against dust and weather influences by a polyethylene filter. The filter has a pore size of 20 µm (ROTRONIC order code: NSP-25-PE).

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4 User-Specific Settings and Functions

The HM4 has a variety of functions and settings that can be adapted by users to their requirements. This chapter contains an overview of all functions and their default settings.

4.1 General AirChip3000 Functions

This section outlines the general functions of the AirChip family available in the HM4. All functions can be used with the HW4 software and are described in detail in the manual **E-M-HW4v3A2-001**.

4.1.1 Humidity and Temperature Measurement

Humidity and Temperature Adjustment
- One-point or multi-point humidity calibration and adjustment   - One-point and two-point temperature calibration and adjustment   - Time stamp for every calibration and adjustment point   - Saving and display of the last adjustment data and values   - Creation of a calibration and adjustment log

IMPORTANT:

All heating and cleaning functions must be switched off during calibration and adjustment!

4.1.2 Device Validation

Simulation Mode
Defines freely selectable values at the analog and digital outputs. Simulation mode is enabled/disabled with the HW4 software.

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4.1.3 Write Protection for Device Settings

Write Protection
The device settings can be protected with a password. Password protection is configured with the HW4 software.

4.1.4 Alarm Functions

Limitation of the Humidity Value
The humidity measured value can be limited to 100 %RH.

Out-of-Limits Value Alarm
Specific limit values can be defined for humidity, temperature and the calculated values; an alarm is shown in the HW4 software when they are exceeded.
The alarm function can be enabled or disabled.

Bad Sensor Alarm
This function is a fixed component of the HM4 firmware and cannot be disabled. A short circuit at the sensor triggers a digital alarm, which is shown in the HW4 software.

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4.1.5 Sensor Heating (RoHumiHeat)

The sensor heating can be operated in three different modes:

- Permanent
- Time-dependent
- Value-dependent

Start Response

When changing from an unheated to a heated state, there is a transient phase in which the sensor is heated to above ambient temperature. Values measured by the probe are not refreshed for a period of 60 seconds until the heater has stabilised at the set temperature.

Stop Response

When changing from a heated to an unheated state, there is, analogously to the start response, a transient phase in which the sensor cools down to ambient temperature. The probe **does not refresh measured values for a period of four minutes** after being switched off until an unheated state has been reached.

Sensor Heating (RoHumiHeat), *Permanent*
ROTRONIC recommends this operating mode! It guarantees the highest operating reliability and measuring accuracy!   The humidity sensor is heated permanently. The heating rate is controlled by the ambient temperature.   The nominal temperature can be set with the HW4 software at will between 0.1 and 10 °C above ambient temperature. The mode "permanent sensor heating" is factory-set on a difference of 3 °C above ambient temperature. Temperature differences of more than 3 °C between the sensor and its environs caused by heating can have effects on the external temperature measurement. This is particularly possible in stagnant air because the heat energy is then not dissipated efficiently.   The function "permanent sensor heating" can be enabled/disabled with the HW4 software.

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Sensor Heating (RoHumiHeat), *Time-Dependent*

The sensor heating can be activated cyclically. The following time intervals are available:

- Hourly
- Daily
- Weekly
- Monthly

The duration of the heating cycle is also freely selectable in minutes.

The temperature of the heated sensor can be selected freely between 0.1 °C and 10 °C above ambient temperature.

ROTRONIC offers the time-dependent heating function as a feature for applications in which cyclical heating suffices. **Please note, however, that condensation could form on the sensor in an unheated state.** If condensation does form on the sensor when it is in operation, it can only be removed reliably with the RoHumiClean function (five minutes cleaning at 150 °C).

Temperature differences of more than 3 °C between the sensor and environs caused by heating can have effects on the external temperature measurement. This is particularly possible in stagnant air because the heat energy is then not dissipated efficiently.

The start and stop responses follow the general function description above. The function "time-dependent sensor heating" can be enabled/disabled with the HW4 software.

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Sensor Heating (RoHumiHeat), *Value-Dependent*
The sensor heating can be activated on the basis of definable temperature/humidity values: - Below a definable temperature threshold value   - Above a definable temperature threshold value   - Below a definable humidity threshold value   - Above a definable humidity threshold value   The sensor heating is then activated as long as the measured temperature or humidity is below or above the threshold value defined. The temperature of the humidity sensor can be selected freely between 0.1 °C and 10 °C above ambient temperature. ROTRONIC offers the value-dependent heating function for applications in which value-dependent heating suffices. **Please note, however, that condensation could form on the sensor in an unheated state.** If condensation does form on the sensor when it is in operation, it can only be removed reliably with the RoHumiClean function (five minutes cleaning at 150 °C). Temperature differences of more than 3 °C between the sensor and its environs caused by heating can have effects on the external temperature measurement. This is particularly possible in stagnant air because the heat energy is then not dissipated efficiently. The start and stop responses follow the general function description above. The function "value-dependent sensor heating" can be enabled/disabled with the HW4 software.

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4.1.6 Sensor Cleaning (RoHumiClean)

Sensor cleaning can take place in three time intervals:

- Daily
- Weekly
- Monthly

The duration of the cleaning cycle is freely selectable in minutes. The cleaning temperature can be set up to 150 °C. No measurements are carried out during the cleaning phase. The last measured value is frozen until the cleaning cycle is finished.

Stop Response

After cleaning, the sensor needs to cool down. No values are measured for **a period of five minutes after cleaning** until this state has been reached.

Working Principle

Heating of the sensor up to 150 °C removes volatile and non-volatile contaminants. The sensor is thus cleaned and, if water has entered the housing, dried completely. This prevents electrochemical corrosion.

Note:

When the sensor is heated to 150 °C, a drop of water on the surface of the sensor evaporates in about three minutes.

A minimum power supply of 15 VDC is needed to initiate sensor cleaning manually with the HW4 software. If this is not available in the field application, the function is still activated, but might not reach the required temperature. The limit values are as follows:

- Power supply: 15 VDC attainable heating temperature: 150 °C
- Power supply: 10 VDC attainable heating temperature: 100 °C
- Power supply: 5 VDC attainable heating temperature: 35 °C

The function can be enabled/disabled with the HW4 software.

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4.2   Factory Defaults

All factory defaults and functions of the HygroMet4 are described below. The HW4 software (V3.4.0 or higher) is needed to change them. The following connection cable is needed: AC3010-T (for probe with Tuchel connector) or AC3010 (for probe with open ends).

Configurable Setting	Factory Default
Unit of measurement (Metric / English)	Metric
Analog output	Dependent on order code
Psychrometric calculations	Disabled
Analog output 1: Scale, parameter, unit	0…100 %RH
Analog output 2: Scale, parameter, unit	-40…60 °C

Functions	Factory Default
Adjustment	3-point humidity adjustment, 1-point temperature adjustment
Write protection	Disabled
Measured value limitation at 100 %RH	Enabled
Measured value alarm, invalid measured value (digital alarm)	Disabled
Simulator mode	Disabled
Sensor heating (RoHumiHeat)	Enabled
Sensor cleaning (RoHumiClean)	Disabled

- See the manual **E-T-AC3000-DF-V1** for a detailed description of all AirChip3000 functions.
- All configurations of the HM4 with the software are described in the following manuals: **E-M-HW4v3-F2-023, E-M-HW4v3-Main** (points 6.4, 7.5 and 11.2.2), **E-M-HW4v3-A2-001**

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5   Mechanical Installation

5.1   General

Relative humidity is very dependent on temperature. Proper measurement of relative humidity requires that the probe and its sensor have exactly the same temperature as the environment that is to be measured. For this reason, the location where the probe is installed can have a significant influence on the performance of the device. The following guidelines should guarantee good device 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 1 metre/second (200 ft/minute) facilitates adaptation of the probe to changing temperature.

c) **Avoid the following:**
   (1) Placing the probe too close to heating elements, cooling coils, cold or hot walls, in direct sunlight, etc.
   (2) Placing the probe too close to steam injectors, humidifiers, in direct precipitation, etc.
   (3) Unstable pressure conditions resulting from high air turbulence.

d) **Immerse as much of the probe as possible in the environment to be measured.**

e) **Prevent an accumulation of condensation water in the area of the sensor leads**. Install the probe so that the probe tip points downwards. If this is not possible, install the probe horizontally.

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6 Electrical Installation

This sections contains general information on electrical wiring.

6.1 General Connection Information

Heavy machinery and measuring instruments should not share the same electric cables for power supply. If this cannot be avoided, noise filters and surge protectors should be used, as integrated in most UPS devices. The ground wires of the power supply and analog outputs should be routed separately to avoid measurement errors.

6.1.1 Signal Cable Information

The following guidelines are derived from the European standard EN 50170 for the transmission of signals by copper wires. Note on installation planning: when determining the position of machinery and equipment, the rules given in EN 50170 should be followed with due regard to local circumstances.

All ROTRONIC products are tested for electromagnetic compatibility according to EMC Directive 2004/108/EC and the following European standards:

- EN 61000-6-1: 2007, EN 61000-6-2: 2005
- EN 61000-6-3: 2007, EN 61000-6-4: 2007

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

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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 RS-485 - Data signals for PCs, printers, etc. - Shielded analog inputs - Unshielded DC voltage (≤ 60 V) - Shielded process signals (≤ 25 V) - Unshielded AC voltage (≤ 25 V) - Coaxial cables for CRT monitors	**Installed in common bundles or channels/conduits**
- DC voltage from 60 V to 400 V (unshielded) - AC voltage from 25 V to 400 V (unshielded)	**Installed in separated bundles or channels/conduits, without minimum distance**
- DC and AC voltage > 400 V (unshielded) - Telephone lines - Lines leading into EX-rated areas	**Installed in separated bundles or channels/conduits**

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6.2 Wiring

This section describes the wiring of the device with connection possibilities.

6.2.1 Electrical Diagrams

The HM4 is connected with the 7-pin Tuchel connector or the connection cable with open ends. The maximum permissible cable length depends on the voltage drop caused by the flow of current to the devices connected to the HM4 outputs. The effective load of a HM4 output comprises the cable and load resistance and should amount to at least 1000 Ω/V (for voltage outputs according to Figure 4). The cable resistance should not be more than 1/1000 of the load resistance.
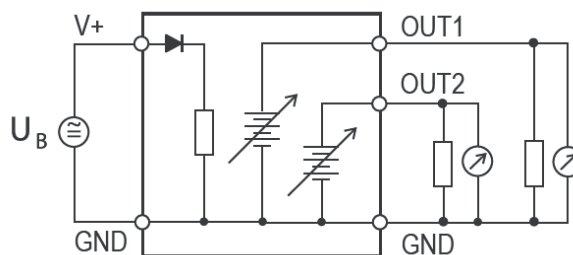

Figure 4: Voltage outputs

The maximum permissible length of the cable connecting the unit to other devices is determined by the total resistance resulting from addition of the cable resistance and resistance of the devices connected to the unit in series. This resistance should not exceed 500 ohm (load) (for current outputs according to Figure 5).
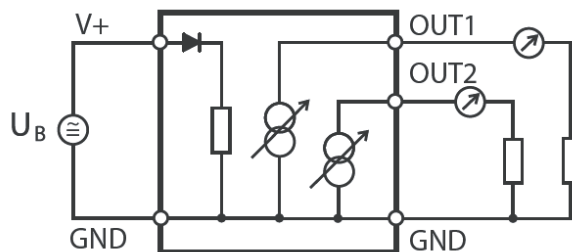

Figure 5: Current outputs

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6.3   Tuchel Connector Pin Configuration

The HM4 probe is available with a Tuchel connector. It is connected either directly at the housing or remotely at the end of a cable.

Figure 6: Tuchel connector and pin numbering

Pin	Name	Function
1	V (+)	5…24 VDC 15…24 VDC, depending on output variant and functions used
2	GND	Supply ground
3	AGND	Analog GND
4	OUT2, analog	Temperature (default setting: -40…60 °C)
5	RS-485 +	RS-485 TX+ / RX+
6	OUT1, analog	Humidity (default setting: 0…100 %RH)
7	RS-485 -	RS-485 TX- / RX-

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6.4 Cable Connection with Open Ends

Wire Colour	Name	Function
Green	V (+)	5…24 VDC 15…24 VDC, depending on output variant and functions used
Grey / Shield	GND	Supply ground
Yellow	AGND	Analog GND
Brown	OUT2, analog	Temperature (default setting: -40…60 °C)
Red	RS-485 +	RS-485 TX+ / RX+
White	OUT1, analog	Humidity (default setting: 0…100 %RH)
Blue	RS-485 -	RS-485 TX- / RX-

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7   Operation

7.1   Load Resistance Requirements of the Analog Outputs

Depending on the output variant, there are different limit values for the load resistance of the analog outputs.

Output Variant	Load Resistance Specification
0…1 V	≥1 kΩ
0…5 V	≥5 kΩ
0…10 V	≥10 kΩ
0…20 mA	≤500 Ω
4…20 mA	≤500 Ω

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7.2 RS-485 Interface

The HM4 has a serial RS-485 port. If the number of USB or TCP/IP network ports available is not enough, the serial RS-485 interface can be used to connect up to 64 devices in a subnet (as shown in Figure 7). ROTRONIC offers the RS-485 T-junction box **AC3021** as suitable accessory for this.

To read out the measured values, it is also possible to access the HM4 directly without the HW4 software using digital commands. See the manual **E-M-AC3000-CP** for the main AirChip3000 commands.

Important:

The RS-485 network address of an HM4 is factory set to "0". The integration of a new factory-configured RS-485 device in an RS-485 network is performed by the HW4 software. The new device is identified by detection of the address "0", which is then overwritten with the first free RS-485 address (i.e. the first address not yet used in the network). This automatic mechanism prevents malfunctions from double allocation of addresses and use of the invalid address "0" in the network.
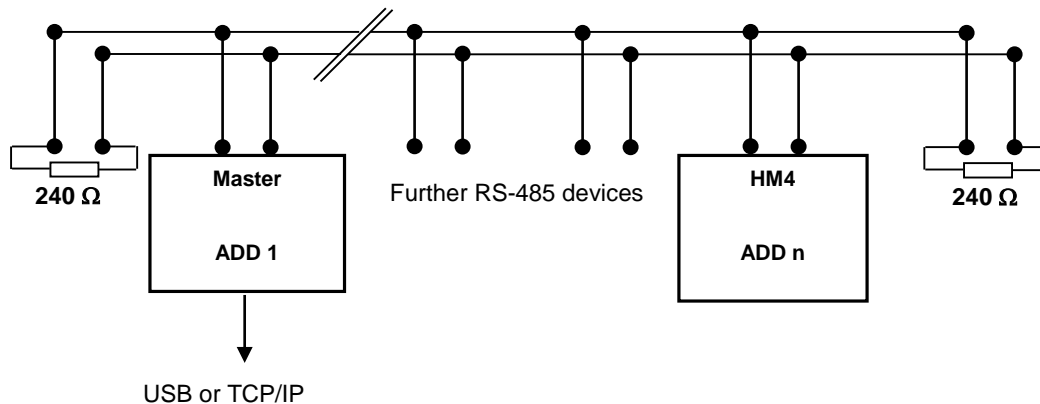

Figure 7: Example of an RS-485 network with master (e.g.: HF5, HF8) and HM4.

Remarks:

- The start and end of the bus line must both be terminated with a resistor of 240 Ω.
- All devices must have the same baud rate of 19,200 baud (symbols/s).
- It is possible to use an **HF5, HF8**, **AC3011** cable (Ethernet-to-RS-485 converter) or **AC3010** cable (USB-to-RS-485 converter) as master in the RS-485 network.
  The **HF5** and **HF8** must then be allocated an RS-485 address. The **AC3011** and **AC3010** cables do not need a network address.
- The HM4 cannot be supplied with power from the network; it needs a separate power supply of 15…24 VDC.

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- All functions that can be set in the device with the HW4 software are described in the manuals **E-M-HW4v3-Main** (points 6.4 and 7.5) and **E-M-HW4v3-F2-023**.
- Only devices in the HygroClip2 generation may be interconnected in the RS-485 network. A mixed network of HygroClip1 and HygroClip2 devices is not possible.

Other specifications of the RS-485 network:

Parameter	Value
Baud rate	19,200
Parity	None
Data bits	8
Stop bits	1

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8 Maintenance

This chapter describes calibration, adjustment, validation and filter changes as well as the tools necessary for this, e.g. service cable.

8.1 Service Cable

The following two service cables may be used for maintenance and calibration:

- **AC3010** (USB-to-RS-485 converter) for devices with open ends
- **AC3010-T** (USB-to-RS-485 converter) for devices with a Tuchel connector

The cables have an internal power feed of 5 VDC. This suffices for calibration, device settings and the sensor heating (RoHumiHeat), but not for the cleaning function (RoHumiClean) and analog outputs greater than 0...1V.

Remark:

An **AC3011** cable (Ethernet-to-RS-485 converter) can also be used.

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8.2 Calibration

Both the **Pt100-RTD temperature sensor** used in the probe and the corresponding electronics are very stable and **do not normally need to be calibrated** after initial factory calibration. The long-term stability of the **SMD Thermo humidity sensor** from ROTRONIC is normally better than 1 %RH per year. For maximum accuracy, the calibration of the humidity probe should be checked **every 6-12 months**. Applications in which the humidity probe is exposed to considerable contamination could require more frequent checks.

- Remove the filter from the probe and screw the probe into the calibration device. Connect the probe with the PC via the AC3010 cable.
- Note that the cap of the calibration device needs to be located on the bottom side as in the Figure 8 below.
- Start the HW4 software and look for the connected HM4 probes (*HW4 Menu > Devices and Groups > Search for Devices > Search for USB Master or Search for Ethernet Master*).
- The device tree of the HM4 lists all calibration and adjustment functions. The basic guidelines for calibration and adjustment are described in the manual **E-M-CalBasics**.
- Further instructions are to be found in the HM4 software manual **E-M-HW4v3-A2-001**.

IMPORTANT:
All heating and cleaning functions must be switched off during calibration and adjustment!

Figure 8: Calibration device with installed HM4 probe.

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8.3 Filter Maintenance

Depending on the application and environmental conditions, the filter must be checked from time to time and cleaned or replaced when soiled.

1. Unscrew the filter from the probe housing and carefully pull the filter off the probe in a straight line.

2. When placing the filter back on again, take care not to damage or bend the wires of the Pt100 sensor (Figure 9).
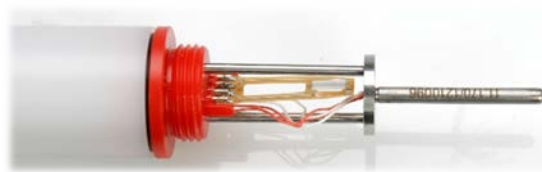

Figure 9: Probe head (filter removed)

8.4 Validation of the Analog Outputs

The HM4 offers the possibility to set the analog outputs to a fixed value. This makes it possible to test if the output stages of the HM4 are working correctly. The function can be activated with the HW4 PC software. Setting of fixed values is described in the manual **E-M-HW4v3-F2-023**.

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9   Firmware Update

The HM4 firmware can be updated with the HW4 software. Firmware updates are available for downloading on the ROTRONIC website. They are written to the HM4 probe with an **AC3010**, **AC3010-T** or **AC3011** service cable.

IMPORTANT:

There must be a permanent connection to the computer and a stable power supply during the update process.

Procedure:

- Connect the HM4 with one of the above-mentioned connection cables or devices.
  Note:
  As from 2014 the service cables have a standard USB driver. Older cables need a ROTRONIC USB driver, which is installed on the PC together with the HW4 software. See the manual **E-M-HW4v3-Main** for detailed information on the ROTRONIC USB driver.
- Download the latest firmware to your PC from the ROTRONIC website www.rotronic.com.
- Launch the HW4 software on the PC and look for the HW4 probe.
  HW4 Main Menu > Devices and Groups > Search for Devices > Search for USB Master / Search for Ethernet Master
- Under *Device Manager* in the device tree, select *Extras > Firmware Update*
  For further information, see the manual **E-M-HW4v3-F2-023**

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10 Technical Data

General	
Device type	Humidity / Temperature probe
Circuit type	3-wire

Power Supply	
(V+)	15…24 VDC (for all output variants and functions)
	5…24 VDC (only 0…1 V analog output and sensor heating available)
Current consumption	<35 mA @ V+= 5 VDC (without sensor heating)
	<55 mA @ V+= 5 VDC (with sensor heating)
	<20 mA @ V+= 24 VDC (without sensor heating)
	<30 mA @ V+ = 24 VDC (with sensor heating)
Electrical connection	Tuchel connector (7-pin) / Open ends
Polarity protection	Protective diode

Humidity Measurement	
Sensor	SMD Thermo
Measurement range	0…100 %RH
Measuring accuracy @ 23 °C	±1.5 %RH (sensor heating switched on)
Extended measuring accuracy	±2.5 %RH @ 80 °C (sensor heating switched on)
	±2.5 %RH @ 60 °C (sensor heating switched on)
	±2.0 %RH @ 40 °C (sensor heating switched on)
	±2.0 %RH @ 0 °C (sensor heating switched on)
	±3.0 %RH @ -20 °C (sensor heating switched on)
	±4.0 %RH @ -40 °C (sensor heating switched on)
Long-term stability	<1 %RH/year
Response time	Typically: 25 s (wind velocity at sensor: 1 m/s)

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Temperature Measurement	
Sensor	Pt100 RTD, Class B 1/3 DIN
Measurement range	-40…85 °C, standard scale: -40…60 °C
Measuring accuracy @ 23 °C	±0.1 °C
Extended measuring accuracy	±0.1 °C @ -40…60 °C (sensor heating switched on) ±0.15 °C @ 60…85 °C (sensor heating switched on)
Long-term stability	<0.1 °C/year
Response time	Typically: 30 s, (wind velocity at sensor 1 m/s)

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

Startup Time and Measurement Interval	
Startup time	<9 s (typical)
Measurement interval	20 s (typical)

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Configurable Analog Outputs		
Output 1		Can be assigned to every parameter
	Default parameter	Humidity
	Default range	Per order code
Output 2		Can be assigned to every parameter
	Default parameter	Temperature
	Default range	Per order 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)
	Accuracy analog output	±1.5 mV (voltage output, 0…1 V) ±15 mV (voltage output, 0…5/10 V) ±30 µA (current output, 0/4…20 mA)
	Maximum offset at start of range	0…1 V : 1 mV 0…5 V : 10 mV 0…10 V : 10 mV 0…20 mA : 20 µA 4…20 mA : no offset
	User-configurable range limits	-999…+9,999 units
	Refresh interval	20 s
	Short circuit tolerant	Yes
	Max. load	500 Ω (current output)
	Min. load resistance	1 kΩ (voltage output, 0…1 V) 5 kΩ (voltage output, 0…5 V) 10 kΩ (voltage output, 0…10 V)
	Resolution	16 Bit

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Digital Interface	
Interface type	RS-485
	Baud rate : 19,200
	Parity : none
	Data bits : 8
	Stop bits : 1

Sensor Heating (RoHumiHeat)	
Heating temperature	0.1…10 °C above ambient temperature
Operating modes	Permanent, time interval or value-dependent

Sensor Cleaning (RoHumiClean)	
Heating temperature	To 150 °C
Operating modes	Programmable time interval

General Specifications	
Probe material	POM (polyoxymethylene)
Filter material	Polyethylene, 20 µm pore size
Dimensions	238 x 29 mm (model with connector at housing)
	281 x 25 mm, plus cable depending on order code (model with cable)
Weight	150 g (model with connector at housing)

Conformity with Standards	
CE / EMC immunity	EMC Directive 2004/108/EC: EN 61000-6-1: 2007, EN 61000-6-2: 2005
	EN 61000-6-3: 2007, EN 61000-6-4: 2007
Solder type	Lead-free (RoHS directive)
Fire protection class	Corresponds to UL94-HB
FDA / GAMP directives	CFR21 Part 11 and GAMP5

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Environmental Limits	
Operation	-40…85 °C / 0…100 %RH, non-condensing
Housing protection grade	IP65
Maximum wind velocity	20 m/s (7,870 ft /min), with filter

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10.1   Dew Point Accuracy

The HM4 can be configured to calculate the dew point on the basis of the measurement of the relative humidity and temperature. The accuracy of this conversion varies depending on the humidity and temperature conditions as shown in Figure 10:
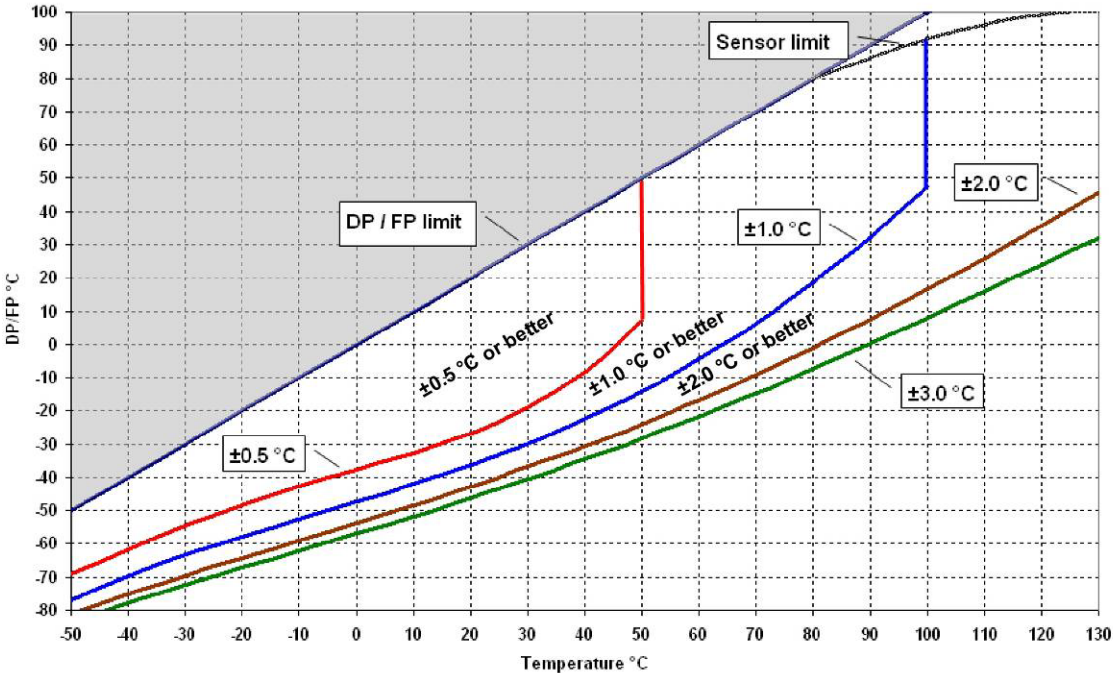
Figure 10: Dependency of the accuracy of dew point calculation from the measured humidity and temperature values

Example:

At a temperature of 20 °C, a dew point value between -27 °C and 20 °C is calculated with an accuracy of ±0.5 °C or better.

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11   Accessories

All accessories for ROTRONIC products are to be found in the manual **E-M-HC2-accessories**. The most important connection cables for HM4 probes are shown below:

Order Code	Description	
AC3010	USB/RS-485 converter with open line ends. Allows connection of the RS-485 lines of the HM4 probe to the USB port of a PC. The HM4 then works as slave in an RS-485 network.	USB connector (Type A) Open line ends
AC3010-T	USB/RS-485 converter with Tuchel socket. Allows connection of the RS-485 interface of the HM4 probe (with Tuchel connector) to the USB port of a PC. The HM4 then works as slave in an RS-485 network.	USB connector (Type A) Tuchel socket
EM-25-HM	Calibration device	

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12   Additional Documents

Document Name	Contents
E-M-HC2-accessories	Accessories such as service cables, calibration accessories, filters for probes, transmitters
E-T-AC3000-DF-V1	AirChip3000, description and main functions
E-M-HW4v3-DIR	List of all HW4 manuals
E-M-HW4v3-Main	HW4 software version 3: general instructions and description of functions
E-M-HW4v3-F2-023	HW4 software version 3: HM4 humidity and temperature probe, device configuration, data handling
E-M-HW4v3-A2-001	HW4 software version 3: device adjustment, overview of functions of AirChip3000 devices
E-M-AC3000-CP	AirChip 3000 communication protocol options
E-M-CalBasics	Adjustment principles for humidity and temperature adjustment
E-T-HumiDefs	Humidity definitions

Remark:

The full document names are followed by the respective version numbers. These version numbers are omitted in the above table.

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13   Document Versions

Version	Date	Remark
V1_00	September 2014	Release document
V1_12	September 2014	Version update