

## M1 Series

humidity temperature transmitters

### INSTRUCTION MANUAL



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## CONTENTS

Overview.....	4
Operation .....	5
Power supply.....	5
Operating range and limits .....	5
Temperature compensation of the humidity sensor .....	6
Output range.....	6
Installation.....	6
General recommendations .....	6
Installation and wiring of the base plate .....	7
Measuring humidity or temperature only .....	9
Installation of the electronics module.....	10
Maintenance.....	10
Cleaning or replacing the dust filter .....	10
Periodic calibration check .....	10
Service connector.....	12
Service cable .....	13
Specifications .....	14
Appendix 1: Practical Advice for Measuring Humidity.....	15
Appendix 2: Calibration.....	15
Appendix 3: Accessories for the M1 Series .....	15

### PLEASE, READ THIS FIRST

- Check the product for any physical damage that may have occurred during shipment. We carefully pack and routinely insure all shipments. If any damage has occurred, it is your responsibility to file a claim with the carrier, **prior to returning the damaged product**. Please note that our warranty does not cover damage during shipment.
- Prior to installation, get fully familiarized with the operating limits of the product and with the installation instructions provided in this manual.
- Do not remove the sensor protection (dust filter) from the probe. Both sensors (humidity and temperature) can be mechanically damaged by careless removal of the protection.
- Identification labels (model number, output ranges, etc.): identification labels are located (a) on the shipping box and (b) inside the electronics module, under the printed circuit board (pop out the board to read the label).

Every instrument is carefully calibrated before shipment and should not require any further adjustments before installation. If you have any question or problem, please call our service department at 631/427-3898 and press 5 (or ask for extension 21).

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## Overview

The M1 series are humidity and temperature transmitters suitable for cost sensitive applications where conditions are within the range of 0 to 100 %RH and -30 to 70°C (-22 to 158°F). The M1 series measures both humidity and temperature and can also be used to measure either humidity or temperature only.

Linearized output signals (DC current or voltage) are provided for transmission over a length of cable to a remote display, recorder, controller or data processing unit. Two types of electronic circuit are available: 2-wire, loop powered (4...20 mA current signal) and 3-wire (voltage or current signal).

Well proven sensors and a robust housing make the M1 series appropriate for use both in commercial and in industrial applications. Digital signal processing within the M1 series ensures consistent product performance and also facilitates the task of field maintenance with features such as potentiometer free – digital calibration.

### Main Features:

- relative humidity and temperature measurement
- available as 2-wire loop powered or as 3-wire circuit type
- well proven, durable humidity and temperature sensors
- potentiometer free – digital calibration
- test connector for communication with the HygroPalm 3 indicator <sup>1)</sup>

1) allows the HygroPalm 3 to read and / or calibrate the transmitter

The M1 series features a unique installation method that is both convenient and problem free. Each M1 series transmitters includes a base plate and a plug-in electronics module. During installation, the base plate is mounted first and wired without the electronics module. This is done at the same time as general electrical work. During that time, the electronics module and probe can safely be stored away.

The M1 series was designed for simple field maintenance and to minimize any downtime:

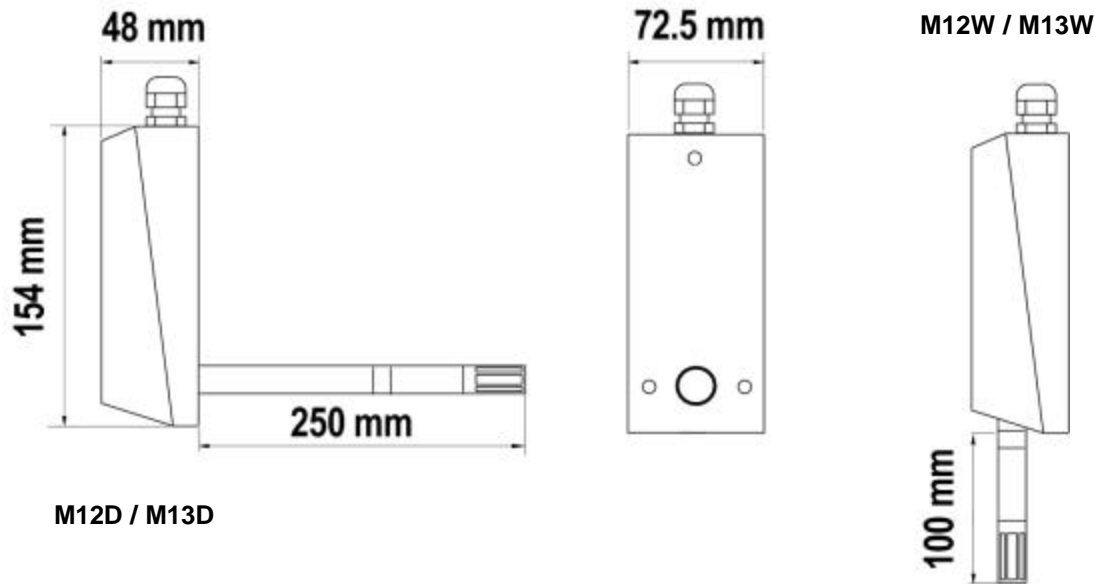
- Operation of the M1 transmitter can be easily verified in the field by connecting a HygroPalm 3 indicator to the M1 service connector. This is done without interrupting the output signals.
- Calibration is entirely digital, without any potentiometer.
- Should the electronic module develop a problem, it can easily be removed from the base plate and replaced with another module without any wiring work.

The M1 series is available in the following configurations:

Model	Measurement <sup>1)</sup>	Circuit Type	Installation
<b>M12W</b>	%RH + Temperature	2-wire, loop powered	Wall mount
<b>M12D</b>	%RH + Temperature	2-wire, loop powered	Duct mount (through Wall)
<b>M13W</b>	%RH + Temperature	3-Wire	Wall mount
<b>M13D</b>	%RH + Temperature	3-Wire	Duct mount (through Wall)

1) The M1 series is also available for humidity or temperature measurement only

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Dimensions in mm

## Operation

### *Power supply*

Depending on the circuit type, transmitters of the M1 series require the following supply voltage:

a) 2-wire (M12): 10..28 VDC (depending on the load connected to the output). The minimum supply voltage can be determined as follows:  $V_{min} = 10\text{ V} + 0.02 \times \text{Load (ohm)}$ . For the maximum load of  $250\Omega$ , the minimum supply voltage is  $10 + 0.02 \times 250 = 15\text{ VDC}$ . With both output circuits closed, the maximum current consumption is 40 mA.

b) 3-wire (M13): 10 to 35 VDC (minimum 15 V for current outputs) or 12 to 24 VAC. With both output circuits closed, the maximum current consumption is 50 mA.

### *Operating range and limits*

The M1 series can operate within 0 to 99 %RH non condensing and  $-40$  to  $60^{\circ}\text{C}$  ( $-40$  to  $140^{\circ}\text{F}$ ) at the probe and electronics. The useful application range of the M1 series is 0 to 100%RH and  $-30$  to  $70^{\circ}\text{C}$  ( $-22$  to  $158^{\circ}\text{F}$ ) at the probe.

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**Operating the transmitter and/or its probe outside of the temperature operating limits can result in permanent damage.**

As far as possible, avoid sudden condensation at the sensors. When measuring at high humidity, condensation may occur on the humidity sensor due to a sudden difference in temperature with the environment. This does not damage the sensor. However, this will produce an overflow reading (an output signal of more than 100 %RH) for as long as condensation is present on the humidity sensor.

### ***Temperature compensation of the humidity sensor***

Practically every make of relative humidity sensor requires a compensation for the effect of temperature on the humidity output signal in order to measure accurately over a wide range of temperature conditions. In the specific case of an instrument using a capacitive sensor, compensation is required because the dielectric characteristics of both the water molecule and the hygroscopic polymer used in the sensor vary with temperature.

The M1 series uses the temperature data from the Pt100 RTD to provide automatic compensation for the effect of temperature on the humidity sensor. The temperature compensation uses normal room temperature as a reference. Because of this, calibration of the M1 series is always done at normal room temperature.

### ***Output range***

The standard range of the relative humidity output is 0 to 100%RH. Other ranges are available on request. The temperature output depends on the range specified when ordering - see identification labels (a) on shipping box and (b) on the transmitter enclosure.

## **Installation**

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

Relative humidity is extremely dependent on temperature. Proper measurement of relative humidity requires that the probe and its sensors be at exactly the temperature of the environment to be measured. Because of this, the location where you choose to install the probe can have a significant effect on the performance of the instrument. The following guidelines should guarantee good instrument performance:

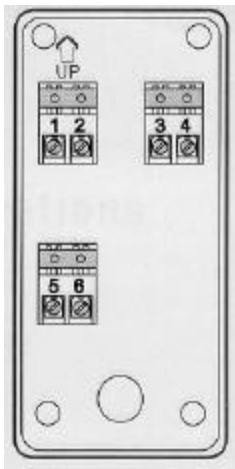
- a) **Select a representative location:** install the probe where humidity, temperature and pressure conditions are representative of the environment to be measured.
- b) **Provide good air movement at the probe:** air velocity of at least 200 ft/ minute (1 meter/second) facilitates adaptation of the probe to changing temperature.
- c) **Avoid the following:** (1) Close proximity of the probe to a heating element, a cooling coil, a cold or hot wall, direct exposure to sun rays, etc. (2) Close proximity of the probe to a steam injector, humidifier, direct exposure to precipitation, etc. (3) Unstable pressure conditions resulting from excessive air turbulence.

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- d) Immerse as much of the probe as possible in the environment to be measured.
- e) Prevent the accumulation of condensation water at the level of the sensor leads. Install the probe so that the probe tip is looking downward. If this is not possible, install the probe horizontally.

### Installation and wiring of the base plate

The base plate should be installed first, using screws with an approximate diameter of 5/32".

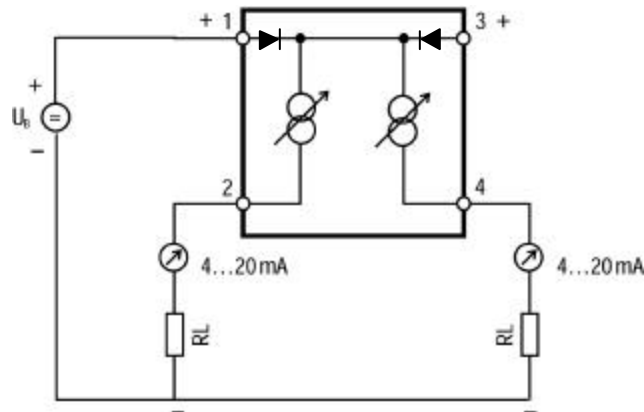
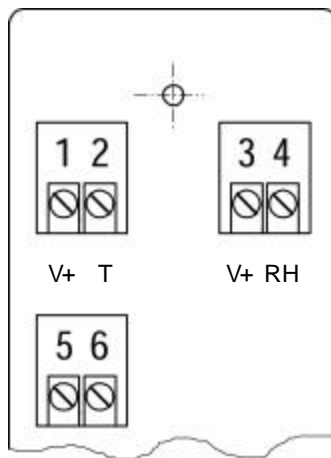


#### Installation Note (through wall installation)

You may want to provide an orifice at a distance of about 3" from the probe of the transmitter for future use by a reference probe and HygroPalm indicator.

The base plate of the M1 transmitter is supplied with one sealing cable grip (normally, the base plate is installed with the cable grip on top). This cable grip provides effective sealing only with cables having the proper outside diameter. Preferably, use a cable with an outside diameter of 0.236 to 0.275 inch (6 to 7 mm) and with 18 AWG wires. Avoid running the cables connecting the unit in the same conduit as 110 VAC power cables. Depending on the installation, you may have to use a cable with twisted pairs or a shielded cable to avoid electromagnetic interference.

### M12: 2-wire, loop powered



Base Plate Terminals	Description
1 and 3	10...35 VDC (+)
2	temperature output
4	relative humidity output
5 and 6	not used

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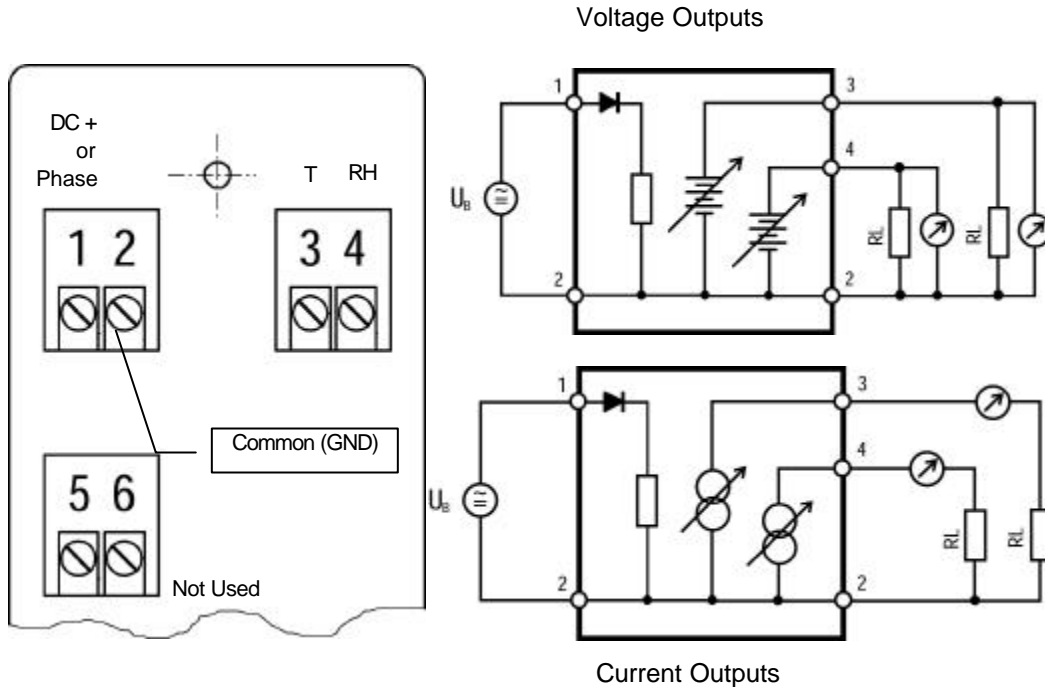
Note: it is not necessary to connect both terminals 1 and 3 to the plus side of the power supply. The transmitter will operate normally with just one of these terminals connected.

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## M13: 3-wire



Base Plate Terminals	Description
1	10...35 VDC (+) or 24 VAC
2	common (-) <sup>1)</sup>
3	Temperature (+) / Output 2
4	Humidity (+) / Output 1
5 (+) and 6 (-)	Not Used

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

In order to determine the maximum length of cable that can be used to connect the transmitter to other devices, the first step is to find out what is the resistance per unit of length of the cable that you plan on using.

- Current outputs: the maximum permissible cable length, connecting the unit to other devices, is determined by the total resistance resulting from the addition of the cable resistance and that of the devices connected in series with the unit. This resistance should not exceed 250 ohms.
- Voltage outputs: the maximum cable length can be determined under consideration of the voltage drop caused by the current flowing to the devices connected to the unit. The voltage drop in the cable depends both on cable resistance and on the equivalent resistance of the devices connected in parallel to the unit. The total resistance connected to each unit output must at least be equal to 1000 ohms. Cable resistance should not be more than 1/1000 of the load resistance.

### Measuring humidity or temperature only

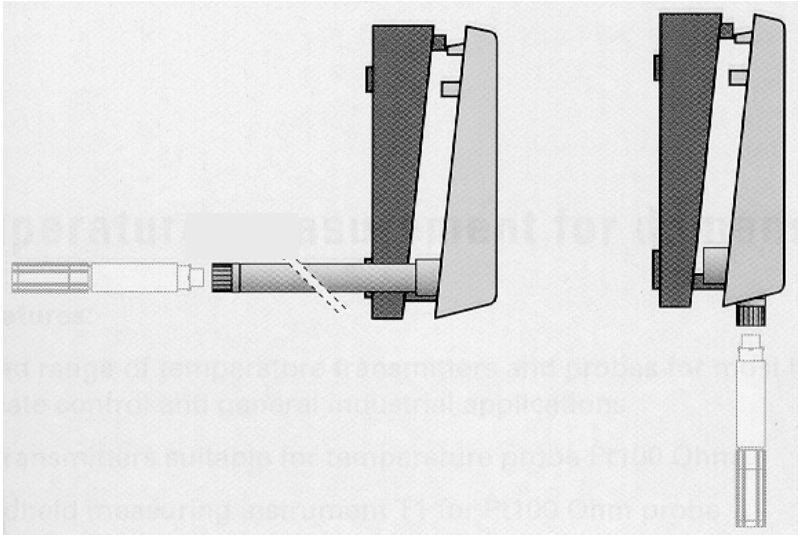
M12 (2-wire, loop powered): the transmitter can be factory configured to allow one of the two current loops to remain open (please specify which output will be used when ordering). Without this special configuration, both current loops should be closed.

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M13 (3-wire): the humidity and temperature circuits are independent one from the other. Any output can be operated without closing the loop for the other output.

## ***Installation of the electronics module***



Once the base plate has been installed and wired, the electronics module can be inserted and secured with the screws provided. The transmitter is ready to operate.

## **Maintenance**

### ***Cleaning or replacing the dust filter***

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

Before putting on a new dust filter, check the alignment of both sensors with the probe. The wires that connect the sensors to the probe are very thin and bend easily. If this happens, correct the alignment by holding the sensor very gently with a pair of small flat nosed pliers.

### ***Periodic calibration check***

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.

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

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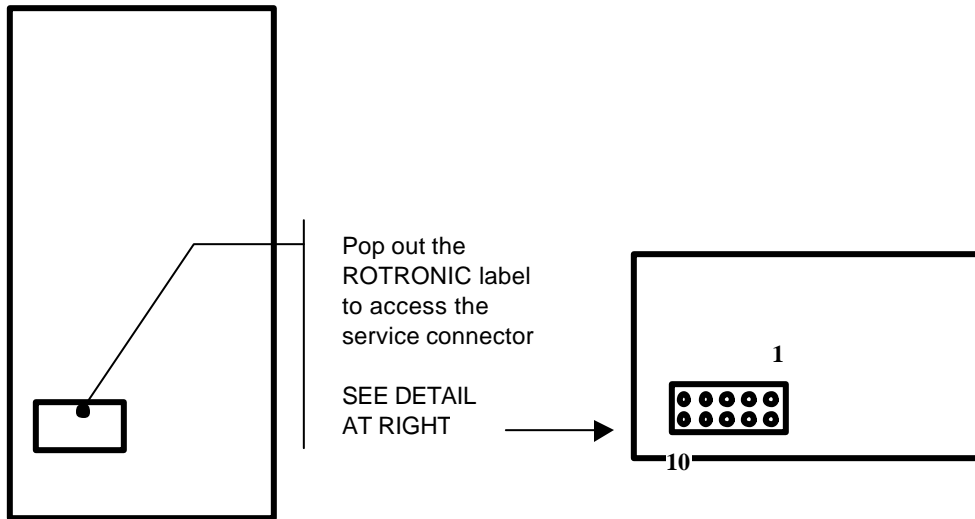
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For routine calibration checks, the probe should be verified at one or two values of humidity. For more details, see **service connector**, **service cable** and **appendix 2 - calibration**.

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## Service connector

Transmitters of the M1 series feature a keyed 10-pin service connector. This service connector can be used to connect M1 transmitter to probe input 1 of the HygroPalm 3 indicator with a service cable. For details, see **service cable**.



Pin #	Wire Color	Signal
1		Temperature Lo <sup>1)</sup>
2		Temperature Hi <sup>1)</sup>
3		Humidity Lo <sup>1)</sup>
4		Humidity Hi <sup>1)</sup>
5		Ground
6		V+ (power to service cable)
7		Not Used
8		Not Used
9		Not Used
10		Internal digital signal (DIO)

1) current outputs: pins 1 and 2, as well as pins 3 and 4, are connected to each side of a precision 49.9 ohm resistor (0.1%) which is in series with the output current. With a signal of 4 .. 20 mA current output the voltage measured across pins 1 and 2 (or pins 3 and 4) is within the range of 200 ... 998 mV.

voltage outputs: pins 1 and 2, as well as pins 3 and 4 have exactly the same voltage as the corresponding output

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## Service cable



Service cable ACRLXB5 is used to connect the service connector of the M1 to probe input 2 of the HygroPalm 3 portable indicator.

The ACRLXB5 service cable allows to do any of the following:

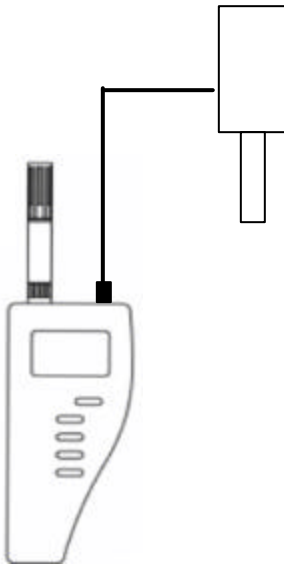
a) Display locally the signals of the M1 transmitter with the HygroPalm 3. This makes it possible to validate the entire measuring loop: probe, transmitter, wiring and central processing unit. If so desired, a PC with the Rotronic HW3 software can be used to make the M1 transmitter generate a fixed signal.

Note: the HygroPalm should be configured to read temperature in the same unit as the M1 transmitter. This can be done directly on the HygroPalm.

b) 1-point adjustment of the M1 transmitter probe with the HygroPalm 3 or single/multi-point adjustment against a reference environment.

A 1-point adjustment can be done against a reference probe connected to probe input 1 of the HygroPalm. See separate HygroPalm manual for detailed instructions.

A known reference environment is required for a multi-point adjustment. In that case it is not necessary to connect a reference probe to the HygroPalm. See separate HygroPalm manual for detailed instructions.



Note: both probe inputs of the HygroPalm should be configured for a digital HygroClip probe.

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## Specifications

	M12	M13
Humidity sensor	Rotronic Hygromer™ C94 thin film capacitive	
Temperature sensor	Pt100 RTD	
Circuit type	2-wire, loop powered	3-wire
Output signal type	4-20 mA, loop powered	0...1/5/10 V / 0/4...20 mA
Operating limits at probe	0...100%RH and -40...60°C (-40...140°F)	
Operating limits at transmitter	0...99%RH non condensing -40...60°C (-40...140°F)	
Standard output range	0...100 %RH / 0...100°C / 0...100°F	
Useful measuring range	0 ... 100 %RH and -30 ...70°C / -22...158°F	
Accuracy at 20..25°C / 68..77°F	± 2 %RH and ± 0.3°C / ± 0.5°F	
Repeatability	± 0.3%RH and better than ±0.1°C (±0.2°F)	
Humidity sensor stability	better than 1%RH over a year	
Response time (without filter)	10 seconds (%RH and temperature)	
Field calibration	requires HygroPalm 3 indicator and service cable	
Supply voltage	10..28VDC; 10V + 0.02 x Load	10(15)...35VDC/ 12...24 VAC
Current consumption	20 mA / output	< 50 mA
Max. load current outputs	250 O	250 O
Min. load voltage output		1000 O / V
Electrical connections	W and D models: screw terminals and cable grip	
Sensor protection	W and D models: wire mesh filter	
Max air velocity at probe	20 m /s (3900 ft / min) – valid for W and D models	
Housing material	ABS	
Protection grade	W and D models: IP65 / NEMA 4	
Dimensions (W and D models)	housing: 154 x 72.5 x 48 mm (6.06 x 2.86 x 1.89") probe diameter 15 mm (0.6") probe length: 250 mm / 9.8" (D model), 100 mm / 3.9" (W model)	
Weight	292 g (10.3 oz)	

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## Appendix 1: Practical Advice for Measuring Humidity

The most common source of error when measuring relative humidity is a difference between the temperature of the probe and the temperature of the environment. At a humidity condition of 50 %RH, a temperature difference of 1°C (1.8 °F) typically results in an error of 3 %RH on relative humidity.

When the probe is mounted through a wall, avoid temperature errors by inserting as much of the probe as possible in the environment to be measured.

In extreme situations, condensation may occur on the sensors when the probe is colder than the environment. As long as the humidity / temperature limits of the humidity sensor are not exceeded, condensation does not alter the calibration of the sensor. However, the sensor has to dry out before it can provide a valid measurement.

Non-moving air is an excellent insulator. When there is no air movement, surprising differences in temperature and humidity can be noted over short distances. Air movement at the probe generally results in measurements that are both faster and more accurate.

## Appendix 2: Calibration

Field calibration of the M1 transmitter requires a HygroPalm 3 indicator and a service cable ACRLXB5 (see service cable). Connect cable ACRLXB5 to probe input 2 of the HygroPalm 3 and select probe 2 on the HygroPalm prior to calibrating. Press the MENU key of the HygroPalm to access the function menu and use the UP and DOWN keys to navigate the function menu. Selections are confirmed by pressing the ENTER key. Select one of the calibration functions: ADJUST M-PT, ADJUST 1-PT or ADJUST REF. Detailed calibration instructions are provided separately in the HygroPalm manual. Follow the same procedure as you would to calibrate a probe attached to the HygroPalm.

Note that the M1 transmitter must be powered up during calibration.

## Appendix 3: Accessories for the M1 Series

Order Code	Description
HygroPalm 3	HygroPalm 3, field calibrator
ACRLXB5	Cable: service connector M1 to HygroPalm 3 (probe input 2 )
EAx-SCS	humidity std, SCS certified, pack of 5 where xx = 00 (0 %RH) = 05 (5 %RH) = 10 (10 %RH) = 11 (11 %RH) = 20 (20 %RH) = 35 (35 %RH) = 50 (50 %RH) = 65 (65 %RH) = 75 (75 %RH) = 80 (80 %RH) = 95 (95 %RH)

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ER-15	calibration device for the M1 series transmitters
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