

# Relative Humidity Measurement and Calibration

*The widest range of humidity products from a pioneer of RH sensor development*



## Michell's instruments have been successfully applied in the following markets:

- Compressed Air Dryers
- Pharmaceutical
- Standards Laboratories and Metrology
- Semiconductors
- Natural Gas and Petrochemicals
- Industrial and Pure Gas Production
- Power Generation
- Metallurgy
- ... and many more

## Product Ranges

### Dew-Point Transmitters

Michell offers the widest range of dew-point sensors and transmitters on the market. From the industry standard Easidew 2-wire transmitter to the new, rugged Easidew PRO I.S. for hazardous areas, all are supplied with sensors traceable to national standards.

### Portable Instruments

Michell's range of easy-to-operate portable instruments provides fast, accurate and stable measurement of dew point, relative humidity and moisture concentration. They are designed to satisfy the most demanding industrial conditions, and are unique in the market for giving repeatedly fast response to low dew points.

### Chilled Mirror Instruments

Chilled Mirror is a fundamental measuring technology offering the user exceptionally accurate, reliable and repeatable measurements from trace moisture to high humidity. Michell offers a range of instruments based on a rugged sensor design that is equally suitable for installation in demanding process environments or for use as an accurate reference instrument in a National Standards Laboratory.

### Calibration Instruments

Michell has a wide offering of calibration equipment for the verification of trace moisture, dew-point and relative humidity sensors. A modular concept means that Michell's engineers can build for you a customized calibration solution that meets your exact needs. Components may include air compressor and dryer; low range or high range humidity generator; simple sensor housing or environmentally controlled test chamber and finally, verification using a traceable Michell Chilled Mirror Hygrometer.

### Process Analyzers

Michell's range of analyzers is specifically designed to provide reliable on-line measurement in process applications such as dedicated water and hydrocarbon dew-point determination in natural gas. Three sensing technologies are used: the Ceramic Impedance sensor for measurements in gas and liquid phase; Quartz Crystal Microbalance for trace moisture in process gases and the Dark Spot Chilled Mirror for hydrocarbon dew point.

### Oxygen Analyzers

Michell brings you the very latest technologies in oxygen measurement, designed to give years of reliable and accurate service in laboratory, process and flue gas applications. From instruments featuring a unique sealed-reference zirconia sensor to a transmitter with the latest generation thermo-paramagnetic oxygen technology, all Michell Oxygen Analyzers are available in a range of different configurations.

### Relative Humidity Instruments

Michell's own RH sensing technology provides excellent resolution, long term stability and speed of response. We offer a wide range of humidity and temperature measuring sensors and instruments, including relative humidity transmitters, humidity and temperature transmitters as well as handheld indicators. The humidity generator range includes the most stable humidity generator on the market.

# Accreditations

## UKAS

At Michell Instruments we understand and endorse the need to conform to recognized standards for quality and calibration. Our calibration laboratory maintains full traceability to British (NPL) and American (NIST) Humidity Standards.

Michell Instruments Limited has been accredited to UKAS (United Kingdom Accreditation Service) for the calibration of dew-point hygrometers since 1986 (laboratory number 0179) and our current dew-point calibration range is -90 to +90°C (-130 to +194°F). For full details of our measurement capability please see our Schedule of Accreditation. Our traceability to NIST (National Institute of Standards & Technology) is over the range -75 to +20°C (-103 to +68°F).



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As a result of the European Accreditation (EA), our UKAS accreditation carries equal validity in any country which is a member of the EA.

## NVLAP

Michell's UKAS accreditation is commonly recognized in the USA as equivalent to NVLAP (National Voluntary Laboratory Accreditation Program).

## ISO 9001:2008

Michell Instruments Limited has been awarded registration to BS EN ISO 9001:2008.

These prestigious accreditations and registration give Michell Instruments Limited a unique position within the field of hygrometry - independently audited and commended by National Bodies on both quality and calibration.



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## HAZARDOUS AREA PRODUCTS

Michell Instruments Limited produces (besides its extensive RH range), products specifically designed for use within hazardous areas or locations. These products use various methods of protection to impart the safety level required. All such products are independently assessed and certified to many international standards, including, but not limited to, ATEX (European), IECEx, CSA, FM, UL, GOSK-R and GOST-K.

Accreditations and certificates for these products can be downloaded from the Michell website ([www.michell.com](http://www.michell.com)) under the Product Documents/Accreditations section.

The installation and use of products approved for use in hazardous areas or locations must only be carried out by suitably trained personnel, and in accordance with the latest national standards currently in use in that region.

Version 3.0

# Michell Instruments

## Global Leader for Solutions in Moisture, Humidity and Gas Analysis

Established in 1974, the Michell Instruments Group of Companies brings more than 35 years of research, design and state-of-the-art technology to the world of moisture measurement and control. The current products include:

### Products

- dew-point transmitters
- chilled mirror hygrometers
- relative humidity (RH) sensors
- process moisture analyzers
- hydrocarbon dew-point analyzers
- moisture in liquid analyzers
- oxygen analyzers

### Technology Centers

Michell's Technology Center of Excellence is in Ely, UK, where many research projects are carried out in association with world-famous, and nearby, Cambridge University. Other R&D facilities are based in Oosterhout, The Netherlands and Lyon, France.

### Manufacturing

Michell Instruments has three manufacturing locations: Oosterhout, The Netherlands; Lyon, France and Ely UK (the main certified {BS EN ISO 9001:2008} manufacturing facility). This UK location also boasts UKAS accreditation, NIST and NPL, certified calibration traceability, and many other worldwide approvals including ATEX, FM, UL, CSA and many more.



### Service and Support

Michell prides itself with an extensive network of factory trained application engineers, subsidiaries and distributors stretching across 56 countries. Service centers and calibration laboratories are located on three continents - North America, Europe and Asia. The company, always aware of the importance of after-sales, offers field support and exchange programs to maintain continuous operation at its customers' facilities.

### Applications

High-precision capacitive moisture transmitters help customers to measure trace moisture in their process applications and are the No. 1 choice for manufacturers of drying systems worldwide. Relative Humidity transmitters and temperature sensors are widely used in HVAC applications, weather stations, pharmaceutical storage and many other processes where controlled environmental conditions are crucial.

Companies around the world save thousands of euros using Michell's humidity calibration systems, incorporating the Michell reference chilled mirror dew-point hygrometers. The calibration of portable hygrometers and relative humidity instruments in-house, reduces down-time and cuts expense.

Michell offers the high-speed measurement of oxygen in a range of applications, including combustion optimization for power stations, controlling levels of CO<sub>2</sub> for breweries, and clean-gas processes, such as silicon wafer production and pure gas generation.

Users in the natural gas industry and power plants save millions of euros in repairs and down-time by using the Condumax II hydrocarbon dew-point analyzers. These instruments ensure transmission of natural gas quality at custody transfer and also prevent gas burner failure and prolong the life of process equipment.

Other analyzers for moisture in hydrocarbon liquids are available in explosion proof, intrinsically safe, as well as laboratory versions, and allow the continuous measurement of the moisture content in a wide range of hydrocarbon liquids, including transformer oil, hydraulic oil, petrochemical fractions and pure hydrocarbons.

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# Product Guide

## Choosing the best product from this catalog

In this catalog we offer a wide range of products for a large number of applications. In order to help you find the correct product we have grouped the products in two ways: with product names and colored application groups.

The structure of the product names are as follows:

**PC** – probe with a connector to the cable

**PF** – probe with a fixed cable

**RM** – room monitoring

**WM** – wall mount

**DT** – duct mount

**WR** – wall-mount transmitter with remote probe on a cable

**DM** – for direct measurement with a hand meter

**H** – capacitive humidity sensors

**I** – interchangeable sensor module (Hygrosmart)

**SF** – dew-point instrument based on capacitive sensor technology

**Easidew** – dew-point instruments based on ceramic sensor technology, for low dew points.

## Colored application groups

The six color levels you will find as a label on each product are based on application structure. For example, complex or accurate applications can be named as precision manufacturing - this group of applications often has demands for precise measurement instruments. Greenhouses, indoor swimming pools and storage of pharmaceutical products are controlled environments. Storage of paper, building automation and humidity control in museums is included in the HVAC category. The colors used in this catalog can be used as a guide for choosing the most suitable instrument for your application.

Precision manufacturing
Environmental control
HVAC
Meteorological
Calibration
Sensors

## Chemical tolerance

When moisture levels need to be measured in a gas (or in air), changes in temperature, the composition of the gas and the humidity level will all influence the stability of the measurement. In some cases the gas needs to be analyzed prior to selection of the right product. Michell's H-type capacitive humidity sensors have a long track record of good performance in various types of contaminated atmosphere. If you are unsure about your gas composition, we recommend that you contact your sales representative or Michell application engineer to verify the application with our extensive chemical tolerance database.

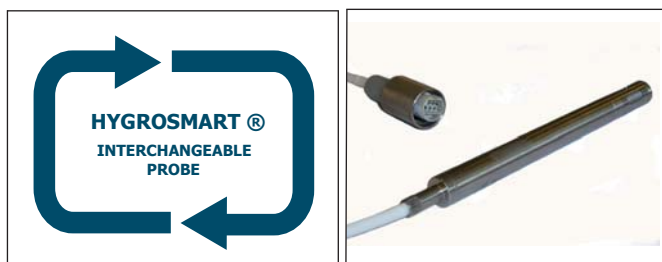
## Interchangeable module

A number of products within our product range offer a unique interchangeable module, the I7000. Thanks to this concept there is no need to recalibrate your instrument. Simply replace the module for a factory calibrated module. The plug-and-play system guarantees fast replacement with a short down-time and no maintenance. Products presented in this catalog that are equipped with this interchangeable module, are marked with the interchangeable module symbol.



## Interchangeable probe

In order to achieve better specifications, Michell Instruments has designed some of their products for use with an interchangeable probe. This interchangeable probe is resistant to temperatures of up to 200°C. As with the interchangeable module, the interchangeable probe has a plug-and-play system that guarantees fast replacement with almost no down-time or maintenance. The interchangeable probe can be sent back to the factory for servicing. Products presented in this catalog that are equipped with this interchangeable probe, are marked with the interchangeable probe symbol.



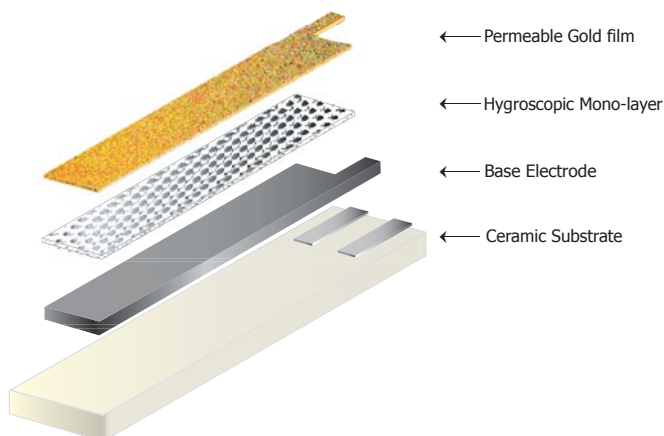
# Humidity Sensor Technology

## Easidew Advanced Ceramic Moisture Sensor Technology for direct trace moisture and dew-point measurements

Michell's Easidew transmitters and instruments are rugged, industrial hygrometers for reliable moisture analysis, from trace levels to ambient air conditions. They can be used on a wide range of gases, including hazardous area applications (flammable or explosive gases), and with many corrosive gases. All Easidew instruments use Michell's Advanced Ceramic Moisture Sensor technology.

The cutting edge Michell Ceramic Sensor is constructed using state-of-the-art thin and thick film techniques. Operation of the sensor depends upon the adsorption of water vapor into a porous non-conducting "sandwich" between two conductive layers built on top of a base ceramic substrate. The active sensor layer is very thin – less than one micron (a millionth of a metre) and the porous top conductor that allows transmission of water vapor into the sensor is precisely engineered to nanotechnology standards, thousandths of a millionth of a metre thick, in order to ensure precise and repeatable measurement.

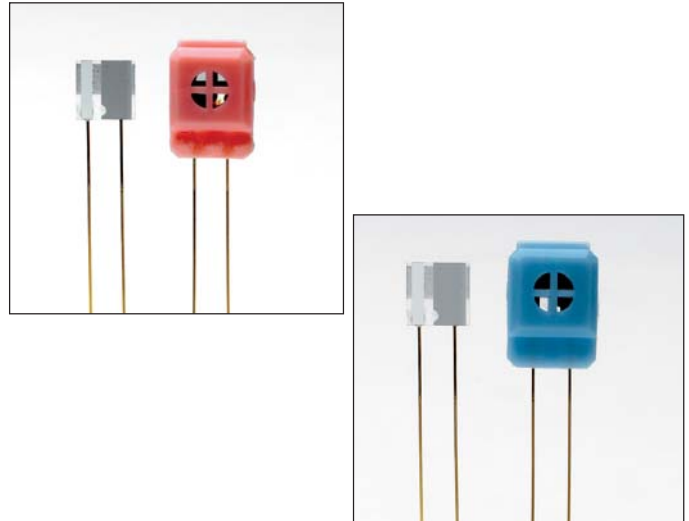
Therefore the sensor responds very rapidly to changes in applied moisture, both when being dried (on process start-up) and when called into action if there is moisture ingress into a process. Despite this extreme sensitivity to changes in moisture content, the Michell Ceramic Moisture Sensor is incredibly rugged, due to the nature of its construction. To protect the sensor further against contaminants and burrs or metal shavings adhering to the pipework it is housed in a protective HDPE guard that keeps contaminants out but is porous to water vapor. All Michell Easidew Ceramic Moisture Sensors give 2°C dew point or better accuracy and excellent long-term reliability and stability in process applications.



Ceramic sensor tile layers

## Relative Humidity Sensors

Michell's H5000 and H6000 Series are capacitive humidity sensors providing fast and accurate measurement of relative humidity in air, gases and other environments.



The H5000 is used to control ambient environments and is suitable for many applications. It can be used under repetitive and prolonged conditions of high humidity (close to saturation). Condensation or wetting do not alter sensor performance.

The H6000 provides enhanced protection from contamination and corrosive environments and can be used in most applications. It can meet the requirements resulting from difficult operations, such as tile, brick and pasta drying. It is protected against chemical contents in air and is very suitable for poultry farms or fruit/vegetable storage environments.

Key features of the H5000 and H6000 Series sensors are:

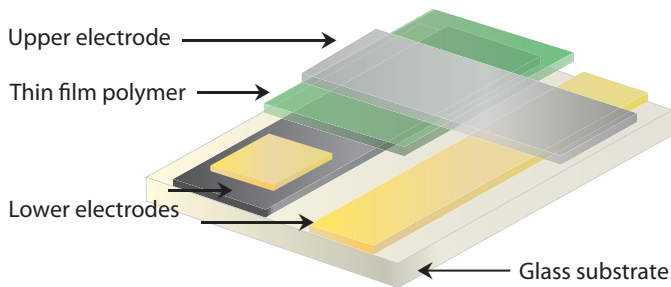
- Suitable for high humidity levels
- Wide operating temperature range
- Withstands condensation or wetting

### Operating principle

The H5000 and H6000 relative humidity sensors are polymer film capacitive devices and benefit from extremely fast response, low hysteresis and high long-term stability.

# Humidity Sensor Technology

Michell's relative humidity sensors were originally developed by the French company Coreci S.A. In 2008, the Michell Group acquired the technology and the dedicated team of sensor engineers in Lyon, France that have developed the product line and achieved an enviable, world-wide reputation for sensor quality and performance.



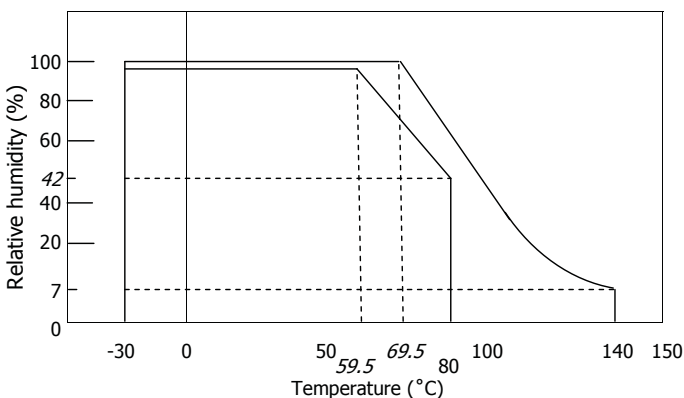
Relative Humidity Sensor tile layers

The key to the sensor's performance is the design and construction of the super-thin hygroscopic polymer material that forms the dielectric of the sensor, sandwiched between two conductive metal electrodes. The outer electrode is engineered to have a porosity specific to water vapor and therefore adapts extremely quickly and reversibly to the prevailing humidity, giving a large capacitance response and therefore high sensitivity.

The sensors and their components have been specially designed and manufactured to provide excellent metrological features while avoiding interference of the measured environment.

## Operating range

Michell's H5000 and H6000 Series relative humidity sensors have an extremely wide range of operation for temperature and relative humidity measurements, making them suitable for virtually any application.



The maximum upper limit of the operating range is represented by the following water/air mixing ratios:

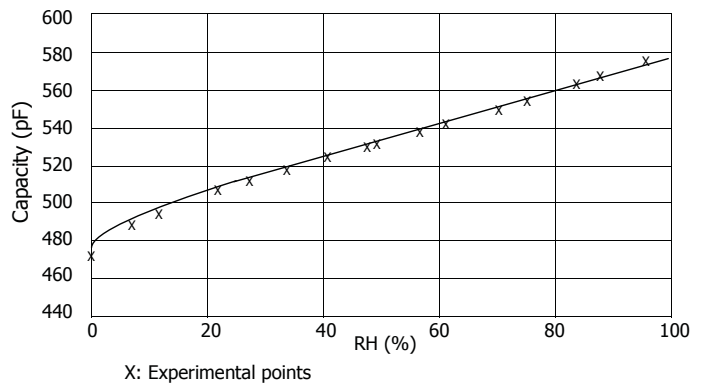
H5000: 250g water/Kg dry air, temp +200°C (+392°F)

H6000: 250g water/Kg dry air, temp +200°C (+392°F)

250g/kg dry air corresponds to 95% RH max at 70°C (158°F) or 21% RH max at 99°C (210°F)

## Typical response curve

This curve illustrates the large sensitivity range of the sensor in terms of capacitance (pF) for 0 to 100% RH measurement range. See below for a typical variation of approximately 86 pF for a 100% RH variation.



## Long term measurement stability

The excellent metrological characteristics of the H5000 and H6000 ensure that short- and long-term drift are minimized.

Under extreme and prolonged conditions of high humidity (>95% RH), a drift may be observed, but it is reversible once ambient conditions are restored.

Duration (DAYS):	1	7
Reversible deviation (% RH):	2%	3%

Long-term drift is low for a wide range of temperature and RH values. Typically, for a 12-month period the drift is less than 2%, measured at 75% RH and at ambient room temperature.



# Humidity Sensor Technology

Calibration of in-service hygrometers should be verified on a 6 to 12 months schedule. Under normal operating conditions, accuracy is excellent, and an adjustment is normally not necessary. Saturated salt and unsaturated salt RH reference elements are available for calibration procedures, as well as more sophisticated automatic calibrators such as the S503, S904 and OptiCal. Under normal operating conditions, experience has shown that the life expectancy of sensors is longer than 10 years.

## Behaviour in corrosive environments

H5000 and H6000 sensors use a synthetic polymer as a dielectric that is intrinsically resistant to corrosion and contamination. However, many industrial applications involve a large number of acid and oxidizing agents, and the long-term sensor reactions to oxidizing environments (such as SO<sub>2</sub>) with high RH levels are quite interesting. The KESTERNICH test is used to simulate the unit response under these conditions.

The test consists of immersing the products in an aggressive gas. A single testing day corresponds to 1 year under normal operating conditions, which accelerates ageing by 365 times. The KESTERNICH test (name of its inventor) meets the DIN 50.018 KF W 0.2 S standards.

Michell's H5000 and H6000 sensors have been subjected to the KESTERNICH test under the supervision of an external laboratory - Laboratoire Central des Industries Electriques (L.C.I.E., n0356502 dated 14 July 1991).

The test results showed:

**Appearance:** slight alteration after 10 years.

**Operation:** No measurable effect after 10 years.

## Condensation and cleaning

Condensation or occasional wetting have no adverse effects on H Series sensor reliability. H5000 and H6000 revert to their initial metrological features once the liquid water has been thoroughly eliminated.

**H5000:** at humidities above 98% RH there is a high risk of wetting. In this case the sensor will not be damaged, but 2-3 hours may be necessary before the sensor reverts to its normal condition.

**H6000:** wetting could occur in close-to-saturation operating conditions but in such cases the sensor will not be seriously damaged and it may take up to 30 minutes before reverting to its initial measuring conditions.

It is recommended not to touch the surfaces of the sensor with mechanical devices or your finger. Do not try to remove particles or deposits as they do not modify the characteristics of the sensor.

**Cleaning:** may be done by immersing the sensor in clean water and drying naturally in air.

## Influence of air velocity on the measurement

H5000 and H6000 sensing elements require some elementary precautions in order to prevent the pollution of the active surface. The H5100 & H6100 cover provides mechanical protection.

H6000 hydrophobic layer increases dust protection in high air flow and in case of frequent wetting.

In all cases, some form of mechanical protection, such as a slotted, sintered or polymer guard is recommended. It is generally not necessary to force fluid circulation due to the rapid response time of the sensor, however a moving air or gas flow will aid equilibration times in the process itself. Fluid flow velocity up to 20m/second will have no adverse effects on sensors protected by a mechanical cover.

## Calibration recommendations

All types of RH generators can be used for short calibration periods or for tests under 24 hours. Nevertheless, Stable Saturated Salt Solutions (S.S.S.S.) are suitable for calibrations and inspection but are not recommended for long-term tests, especially at high humidity.

A stabilization period of 5-15 minutes is recommended for relative humidity sensor calibration or other tests, depending upon the method of RH generation (e.g. a 15 minute period is recommended for S.S.S.S.). However, it should be noted that the actual stabilization time of some saturated and unsaturated mixtures can be significantly longer. Michell can advise on a calibration timing protocol to suit your exact needs.

# PCMini52

## Digital Relative Humidity and Temperature Mini Probe w/Analog Output

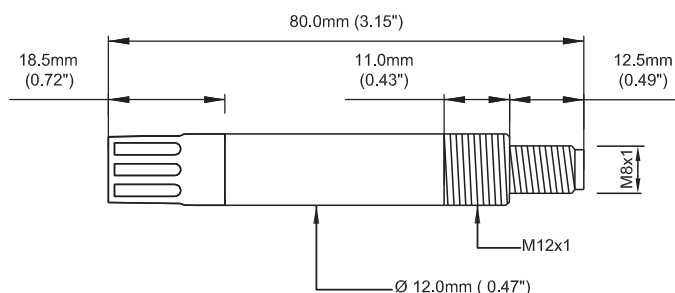


The micro processor control and multi-point calibration gives the PCMini52 RH probe excellent performance in terms of accuracy and linearity. The mini probe can provide two linear analog outputs for temperature and relative humidity, dew point, absolute humidity or wet bulb temperature.

### Highlights

- Output can be % RH, calculated absolute humidity, dew point or wet bulb temperature + temperature
- Excellent linearity, ( $\mu\text{P}$ ) micro processor temperature compensated
- Low power consumption, fast settling time
- Small size: L = 80mm,  $\phi$ 12mm (L = 3.15",  $\phi$ 0.47")

### Dimensions



### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-20 to +80°C (-4 to +176°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (10–90% RH)
Accuracy at 23°C (73°F) Temperature	±0.2°C (±0.36°F)
Stability – RH Sensor	±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal options	0–1, 0–5, 0–10 V
Supply voltage	14–35 V DC (for 0–5 / 10 V output) 4.5–35 V DC (for 0–1 V output) or 14–26 V AC (for all output ranges)
Operating conditions	
Operating temperature	
Sensing element	-30 to +85°C (-22 to +185°F)
Housing	-30 to +85°C (-22 to +185°F)
Storage	-40 to +85°C (-40 to +185°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Housing material	Molded polymer or stainless steel (ordering option)
Dimensions	L=80mm, $\phi$ 12mm (L=3.15", $\phi$ 0.47")
Weight	10g (0.35oz)
Electrical connections	4 pin, M8 connector

### Accessories and Spare Parts

12mm (0.47") Slotted protection cap, black	A000003
12mm (0.47") PVDF filter	A000017
12mm (0.47") PVDF filter with protection cap, black	A000018
12mm (0.47") Mesh filter with protection cap, black	A000022
12mm (0.47") Flat SS sintered dust filter	A000023
12mm (0.47") Arrow 20 $\mu\text{m}$ SS sintered filter	A000028
12mm (0.47") Connector with 2m (6.5') cable	A000033
12mm (0.47") Connector with 5m (16') cable	A000036
12mm (0.47") Connector with 10m (33') cable	A000037
1/2" NPT SS adj fitting for SS probe	A000101
Aluminum mounting flange for $\phi$ 12.0mm ( $\phi$ 0.47") SS probes	A000111
$\phi$ 90mm (3.54") WM weather prot. cap (in combination with A000111 for $\phi$ 12mm (0.47") probes)	A000120
$\phi$ 120mm (4.72") WM weather prot. cap (in combination with A000111 for $\phi$ 12mm (0.47") probes)	A000125
12mm (0.47") Connector without cable (with solder terminals)	A000321
12mm (0.47") Connector with cable (customer spec length)	A000321-xx
12mm (0.47") Connector with 20m (25.6') cable	A000322
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

## Electrical Connections

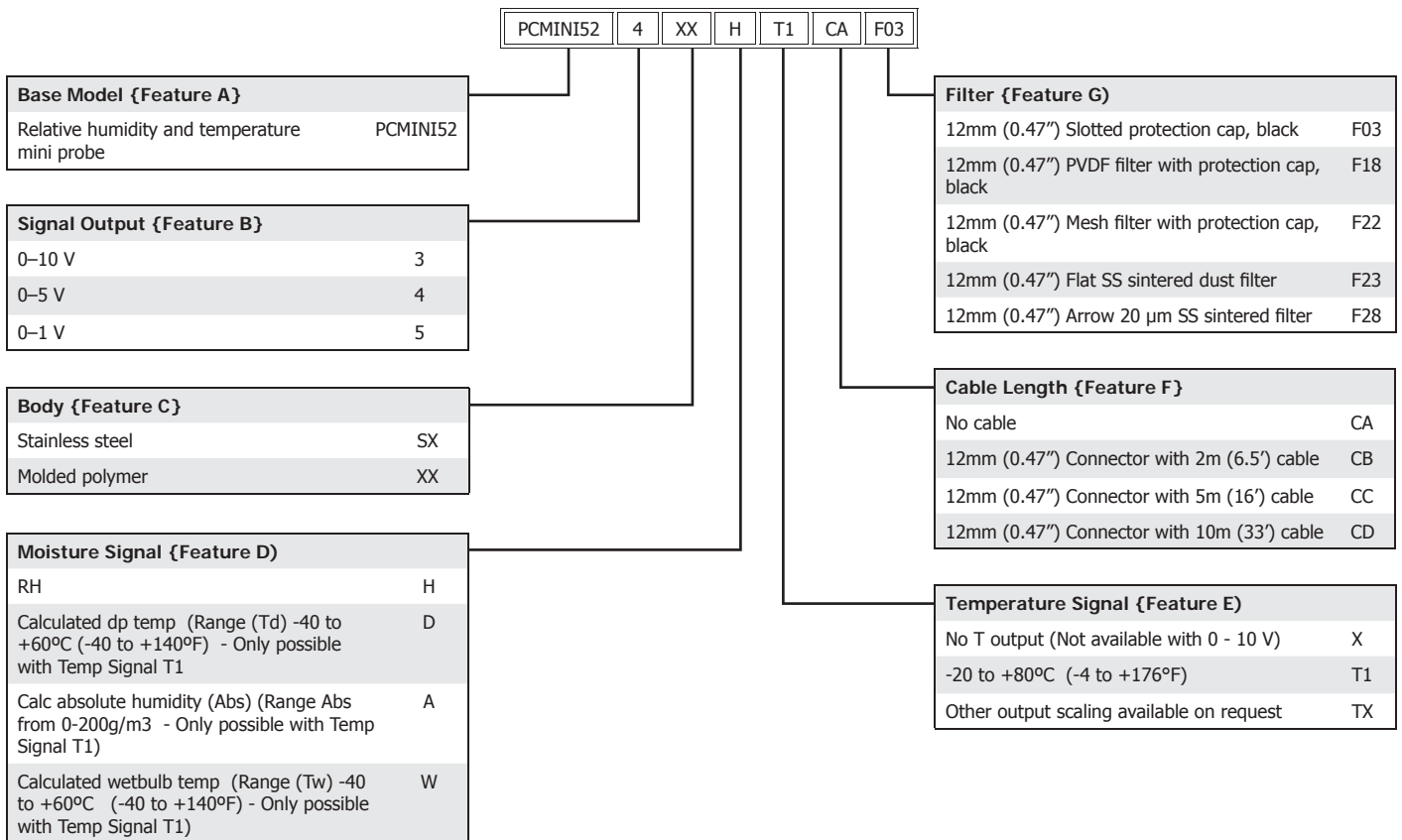
Cable	
Brown	Supply voltage V +
White	Output RH, Dew Point or Absolute Humidity
Black	Output temperature
Blue	Common ground

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}+{Feature G}

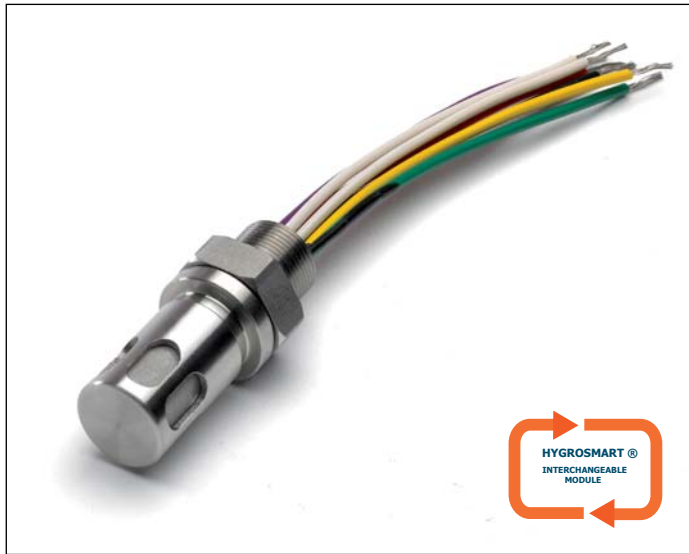
**Order example:** PCMINI52+4+XX+H+T1+CA+F03

Relative humidity and temperature mini probe PCMini52, 0-5 V output, molded polymer body, 0-100% RH signal, -20 to +80°C (-4 to +176°F) temperature range, no cable, 12mm slotted protection cap black



# PCMini70

## Relative Humidity and Temperature Mini Probe

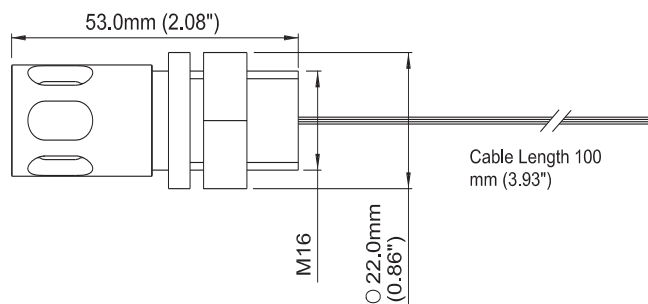


The PCMini70 is a relative humidity mini probe based on the interchangeable Hygrosmart module.

### Highlights

- Designed for OEM applications
- Based on the interchangeable Hygrosmart module
- Compact housing

### Dimensions



### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +85°C (-22 to +185°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.2°C (±0.36°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal (RH)	0-1 V
Output signal (T)	3-wire 1/3 DIN Pt100 direct
Supply voltage	5 V DC ±5%
Load resistance	R > 5K Ω Digital: CMOS compatible
Current consumption	1.5 mA max
Operating conditions	
Operating temperature	-30 to +85°C (-22 to +185°F)
Sensing element	-40 to +85°C (-40 to +185°F)
Housing	-40 to +85°C (-40 to +185°F)
Storage	-40 to +85°C (-40 to +185°F)
Mechanical specification	
Housing material	AISI 316
Dimensions	L=53mm , ø22mm (L=2.08", ø0.86")
Filter	AISI 316 Stainless steel mesh
Weight	65g (2.3oz)
Electrical connections	Threaded nipple + nut

### Accessories and Spare Parts

Hygrosmart without Pt100 output	<b>17-0-00-0</b>
Hygrosmart with Pt100 output	<b>17-0-00-1</b>
SS cap slotted with mesh filter	<b>K1</b>
SS cap slotted with PTFE filter	<b>Z1</b>

## Electrical Connections

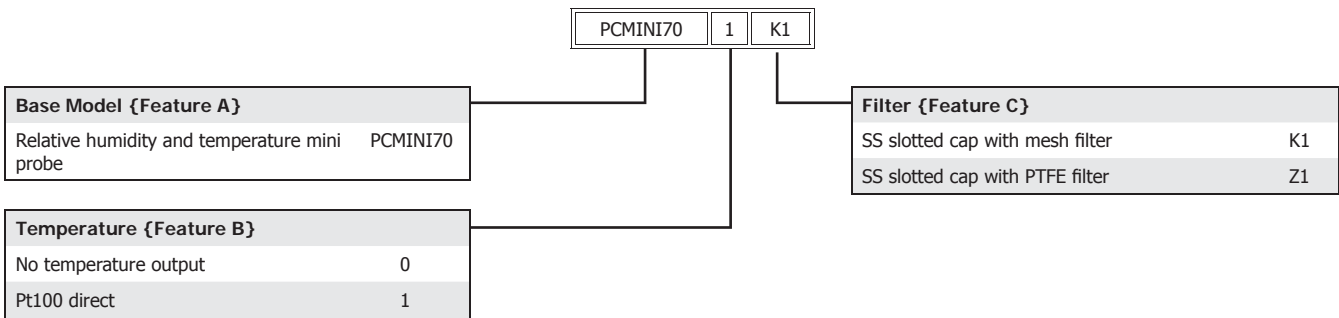
Cable		
Green		Pt100
White		
White		
Black	0 V	- Common ground
Red	+5 V	- Supply Voltage V+
Violet	Out V	- Output RH (Volt)
Yellow	Out F	- Output RH (freq)

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}

**Order example:** PCMINI70+1+K1

Relative humidity and temperature mini probe PCMini70, Pt100 direct output and stainless steel cap slotted with mesh filter



# PC33 & 52

## Analog Relative Humidity and Temperature Probe

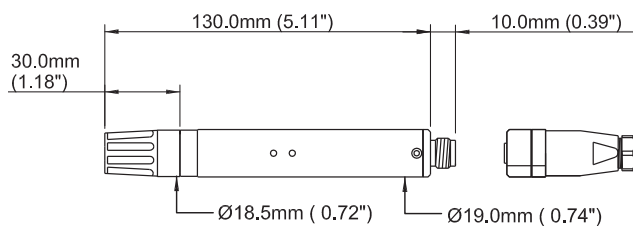


The PC series offers a comprehensive range of relative humidity probes for accurate, stable and repeatable measurements. Available with analog output signals, the PC series can be installed in a wide variety of applications.

### Highlights

- Low cost PC33 with analog output is designed for HVAC applications
- PC52 with analog output is designed for accurate measurement in controlled environments

### Dimensions



### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-20 to +80°C (-4 to +176°F)
Accuracy at 23°C (73°F) Humidity	PC52: <math>\pm 2\%</math> RH (10–90% RH) PC33: <math>\pm 3\%</math> RH (30–80% RH)
Accuracy at 23°C (73°F) Temperature	PC52: $\pm 0.2^\circ\text{C}$ ( $\pm 0.36^\circ\text{F}$ ) PC33: $\pm 0.3^\circ\text{C}$ ( $\pm 0.54^\circ\text{F}$ )
Stability – RH Sensor	$\pm 1\%$ RH/year
Response time – RH Sensor	<math>< 10</math> sec typical (for 90% of the step change)
Electrical output/input	
Output signal	4–20 mA, 0–1, 0–5, 0–10 V
Supply voltage	14–30 V DC (for 0-5 / 0-10 V output) 5–30 V DC (0–1 V & mA output)
Operating conditions	
Operating temperature Probe, Housing	-30 to +85°C (-22 to +185°F)
Storage	-40 to +85°C (-40 to +185°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Housing material	Molded polymer or stainless steel (ordering option)
Dimensions	L=130mm, $\phi$ 19mm (L=5.11", $\phi$ 0.74")
Weight	30g (1.06oz) without cable (molded polymer version)
Electrical connections	M12

### Accessories and Spare Parts

19mm (0.75") slotted protection cap black	A000002
19mm (0.75") PVDF filter	A000014
19mm (0.75") PVDF filter with protection cap black	A000015
19mm (0.75") Mesh filter with protection cap, black	A000021
19mm (0.75") Arrow SS sintered filter 5 $\mu$ m / 10 $\mu$ m / 20 $\mu$ m	A000025/26/27
19mm (0.75") Connector, no cable, with screw terminals	A000030
19mm (0.75") Connector with cable (customer spec length)	A00030XM
19mm (0.75") Connector with 2m (6.5') cable	A000031
19mm (0.75") Connector with 5m (16') cable	A000032
19mm (0.75") Foil filter 2 $\mu$ m with protection cap black	A000040
19mm (0.75") Oleophobic foil filter 0.7 $\mu$ m with protection cap black	A000042
19mm (0.75") Foil filter 1.5 $\mu$ m w/protection cap black	A000044
3/4" NPT SS adj. fitting for SS probes	A000100
Al mounting flange for $\phi$ 19.0mm ( $\phi$ 0.75") SS probe	A000110
$\phi$ 90.0mm ( $\phi$ 3.54") Wall mount weather protection cap	A000120
$\phi$ 120.0mm ( $\phi$ 4.72") Wall mount weather protection cap	A000125
Mini flange for $\phi$ 19.0mm ( $\phi$ 0.75") molded polymer probe	A000150
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

## Electrical Connections

Voltage output		
Cable	Connector	
White	Pin 1	Power Supply V +
Green	Pin 4	Output RH +
Yellow	Pin 2	Output temperature +
Brown	Pin 3	Common ground

4-20 mA output 2-wire		
Cable	Connector	
White	Pin 1	Output RH +
Brown	Pin 3	Output RH -
Green	Pin 4	Output temperature +
Yellow	Pin 2	Output temperature -

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}

**Order example:** PC33+4+XX+T3+A+02

Relative humidity and temperature probe with 1 pt calibration PC33, 0-5 V output, molded polymer body, temperature range 0 to +50°C, no cable, 19mm slotted protection cap

**Order example:** PC52+4+XX+T3+A+02

Relative humidity and temperature probe with 2 pt calibration PC52, 0-5 V output, molded polymer body, temperature range 0 to +50°C, no cable, 19mm slotted protection cap

PC33	4	XX	T3	A	02
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Base Model {Feature A}	
Relative humidity and temperature probe	PC33

Signal Output {Feature B}	
4-20 mA	2
0-10 V	3
0-5 V	4
0-1 V	5

Body {Feature C}	
Stainless steel	SX
Molded polymer	XX

Temperature {Feature D}	
No T output RH only	X
-20 to +80°C (-4 to +176°F)	T1
0 to +50°C (+32 to +122°F)	T3
Other output scaling available on request	TX

Cable {Feature E}	
No cable	CA
19mm (0.75") Connector, no cable, with screw terminals	CB
19mm (0.75") Connector with 2m (6.5') cable	CC
19mm (0.75") Connector with 5m (16') cable	CD

Filter {Feature F}	
19mm (0.75") slotted protection cap black	02
19mm (0.75") PVDF filter with protection cap black	15
19mm (0.75") Mesh filter with protection cap, black	21
19mm (0.75") Arrow SS sintered filter 5µm	25
19mm (0.75") Arrow SS sintered filter 10µm	26
19mm (0.75") Arrow SS sintered filter 20µm	27
19mm (0.75") Foil filter 2µm with protection cap black	40
19mm (0.75") Oleophobic foil filter 0.7µm with protection cap black	42
19mm (0.75") Foil filter 1.5µm w/protection cap black	44

PC52	4	XX	T3	A	02
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Base Model {Feature A}	
Relative humidity and temperature probe	PC52

Signal Output {Feature B}	
4-20 mA	2
0-10 V	3
0-5 V	4
0-1 V	5

Body {Feature C}	
Stainless steel	SX
Molded polymer	XX

Temperature {Feature D}	
No T output RH only	X
-20 to +80°C (-4 to +176°F)	T1
0 to +50°C (+32 to +122°F)	T3
Other output scaling available on request	TX

Cable {Feature E}	
No cable	CA
19mm (0.75") Connector, no cable, with screw terminals	CB
19mm (0.75") Connector with 2m (6.5') cable	CC
19mm (0.75") Connector with 5m (16') cable	CD

Filter {Feature F}	
19mm (0.75") slotted protection cap black	02
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19mm (0.75") Oleophobic foil filter 0.7µm with protection cap black	42
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# PC62 & 62V

## Digital Relative Humidity & Temperature Probe with Digital or Analog Output

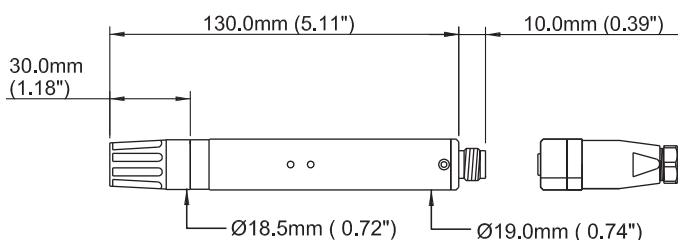


The PC series offers a comprehensive range of relative humidity probes for accurate, stable and repeatable measurements. Available with analog or digital output signals, the PC series can be installed in a wide variety of applications.

### Highlights

- PC62 is designed for high accurate measurements in precision manufacturing applications
- Digital or analog output possible on the PC62
- PC62 available with calculated absolute humidity, dew point or wet bulb temperature output

### Dimensions



### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-20 to +80°C (-4 to +176°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (10–90% RH)
Accuracy at 23°C (73°F) Temperature	±0.2°C (±0.36°F)
Stability – RH Sensor	±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V, RS232, RS485
Supply voltage	14–30 V DC (for 0–5 / 0–10 V / RS485 / RS232 output) 5–30 V DC (0–1 V output)
Operating conditions	
Operating temperature Probe, Housing	-30 to +85°C (-22 to +185°F)
Storage	-40 to +85°C (-40 to +185°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Housing material	Molded polymer or stainless steel (ordering option)
Dimensions	L=130mm, Ø19mm (L=5.11", Ø0.74")
Weight	30g (1.06oz) (molded polymer) without cable
Electrical connections	M12

### Accessories and Spare Parts

19mm (0.75") Slotted protection cap black	A000002
19mm (0.75") PVDF filter	A000014
19mm (0.75") PVDF filter with protection cap black	A000015
19mm (0.75") Mesh filter with protection cap black	A000021
19mm (0.75") Arrow SS sintered filter 5µm / 10µm / 20µm	A000025/26/27
19mm (0.75") Connector, no cable, with screw terminals	A000030
19mm (0.75") Connector, with cable (customer spec length)	A000030XM
19mm (0.75") Connector with 2m (6.5') cable	A000031
19mm (0.75") Connector with 5m (16') cable	A000032
19mm (0.75") Foil filter 2µm with protection cap black	A000040
19mm (0.75") Oleophobic foil filter 0.7µm with protection cap black	A000042
19mm (0.75") Foil filter 1.5µm w/protection cap black	A000044
3/4" NPT SS adj. fitting for SS probes	A000100
Al mounting flange for Ø19.0mm (Ø0.75") SS probe	A000110
Ø90.0mm (Ø3.54") Wall mount weather protection cap	A000120
Ø120.0mm (Ø4.72") Wall mount weather protection cap	A000125
Mini flange for Ø19.0mm (Ø0.75") molded polymer probe	A000150
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC



# PC62 & 62V

## Electrical Connections

Voltage output		
Cable	Connector	
White	Pin 1	Power Supply V +
Green	Pin 4	Output RH +
Yellow	Pin 2	Output temperature +
Brown	Pin 3	Common ground

Cable	Connector	RS232	RS485
White	Pin 1	Power supply V +	Power Supply V +
Green	Pin 4	TX	TX/RX +
Yellow	Pin 2	RX	RX/TX -
Brown	Pin 3	Ground	Ground

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}+{Feature G}

**Order example:** PC62V+4+XX+T1+TD+CA+02

Relative humidity and temperature probe PC62V, 0-5 V output, molded polymer, temp range -20 to +80°C (-4 to +176°F) with calculated dew-point temperature and temperature output, no cable, 19mm slotted protection cap, black

<table border="1" style="margin: auto;"> <tr> <td>PC62</td> <td>1</td> <td>XX</td> <td>TC</td> <td>CA</td> <td>02</td> </tr> </table>	PC62	1	XX	TC	CA	02	<table border="1" style="margin: auto;"> <tr> <td>PC62V</td> <td>4</td> <td>XX</td> <td>T1</td> <td>TD</td> <td>CA</td> <td>02</td> </tr> </table>	PC62V	4	XX	T1	TD	CA	02																											
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# PFMini72

## Relative Humidity and Temperature Probe



PFMini72 relative humidity probes are equipped with the Hygrosmart relative humidity sensor/converter. This interchangeable module has miniaturized electronics and does not require recalibration.

### Highlights

- Designed for meteorological applications
- Based on the interchangeable Hygrosmart module

### Technical Specifications

#### Performance

Measurement range (RH)	0–100% RH
Measurement range (T)	-20 to +80°C (-4 to +176°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.2°C (±0.36°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)

#### Electrical output/input

Output signal (RH)	0–1 V
Output signal (T)	0–1 V or 3-wire 1/3 DIN Pt100 direct
Supply voltage	5.5–32 V DC
Current consumption	2 mA max

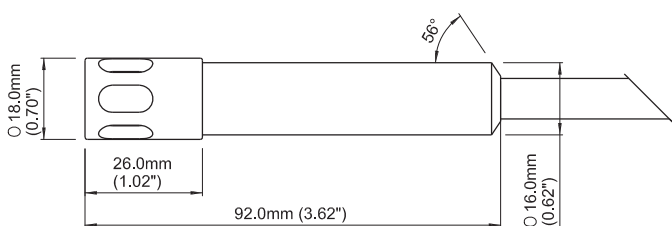
#### Operating conditions

Operating temperature	
Probe	-20 to +80°C (-4 to +176°F)
Housing	-20 to +80°C (-4 to +176°F)
Storage	-40 to +85°C (-40 to +185°F)

#### Mechanical specification

Ingress protection	IP65 (NEMA 4 level)
Housing material	316L
Dimensions	L=92mm, ø18mm (L=3.62", ø0.70")
Weight	150g (5.29oz)
Electrical connections	4- or 6-wire output cable, length 2m (6.5')

### Dimensions




### Accessories and Spare Parts

Mounting clip	2510367
Hygrosmart without Pt100 output	17-0-00-0
Hygrosmart with Pt100 output	17-0-00-1
SS cap slotted with mesh filter	K1
SS cap slotted with PTFE filter	Z1

## Electrical Connections

4 wire cable	
White	Output RH +
Black	Common ground
Red	Power supply V+
Blue	Output temperature +

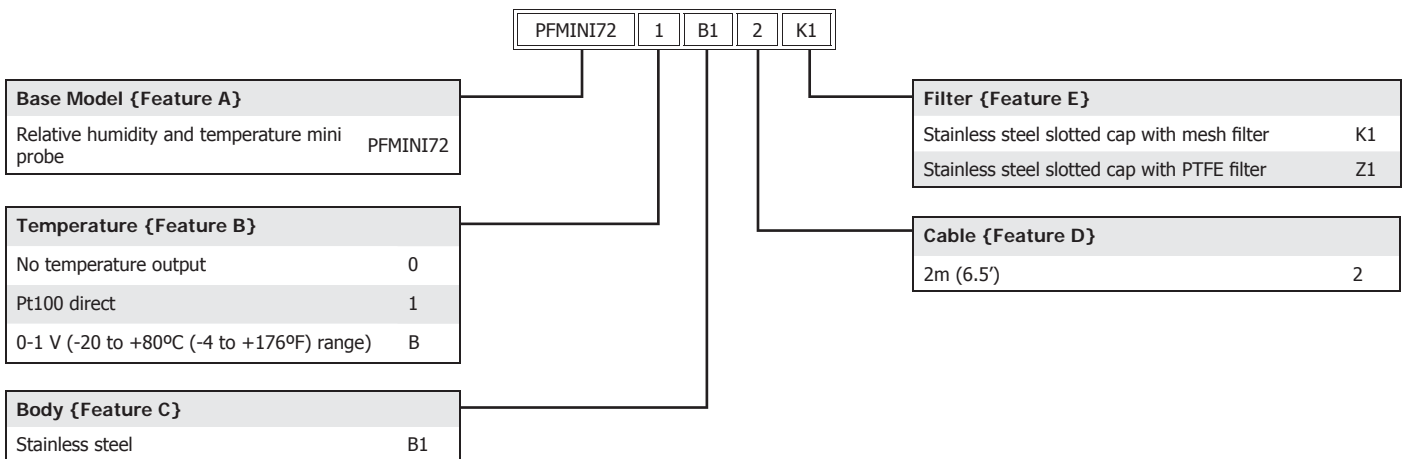
6 wire cable	
White	Output RH +
Black	Common ground
Red	Power supply V+
Blue	 Pt100
Yellow	
Green	

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}

**Order example:** PFMINI72+1+B1+2+K1

Relative humidity and temperature mini probe PFMini72, Pt100 direct output, stainless steel body, 2m (6.5') cable, stainless steel slotted cap with mesh filter



# PF211

## HVAC Relative Humidity Probe



PF211 relative humidity probes are equipped with the Hygrosmart relative humidity sensor/converter. This interchangeable module has miniaturized electronics and does not require recalibration.

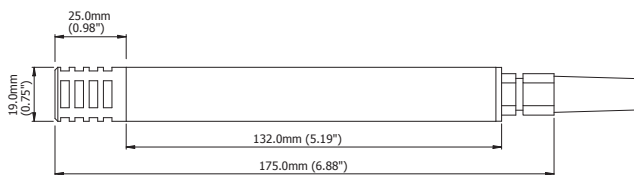
### Highlights

- Designed for HVAC and Environmental Control applications
- Based on the interchangeable Hygrosmart module

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +70°C (-22 to +158°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.2°C (±0.36°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal (RH)	4–20 mA, 0–10 V
Output signal (T)	3-wire 1/3 DIN Pt100 direct
Supply voltage	10–32 V DC for 4–20 mA output 15–32 V DC for 0–10 V output 24 V AC ±10% (PF211B)
Load resistance	Output 4–20 mA: Rload < (Uv-9)/0.02 Output 0–10 V: R > 1K Ω
Current consumption	20 mA max
Operating conditions	
Operating temperature Probe, Housing, Storage	-30 to +70°C (-22 to +158°F)
Mechanical specification	
Ingress protection	IP54
Housing material	ABS
Dimensions	L=175mm, ø19mm (L=6.89", ø0.75")
Weight	184g (6.49oz)
Electrical connections	5 or 6-wire output cable, 3m (9.8')

### Dimensions



### Accessories and Spare Parts

Mounting clip	2510387
Molded polymer fitting	3401135
Fixing collar	3420085
SS sintered filter	H4
ABS cap slotted with PTFE filter, white	Z2
Hygrosmart with Pt100 output (RH = 0.2-1 V)	17-4-00-1
Hygrosmart with Pt100 output (RH = 0-1 V)	17-0-00-1

Electrical Connections

PF 211-A: 4-20 mA output 2-wire	
<b>Cable</b>	<b>Connector</b>
Red	Output RH +
Blue	Output RH -
White	
Yellow	
Green	

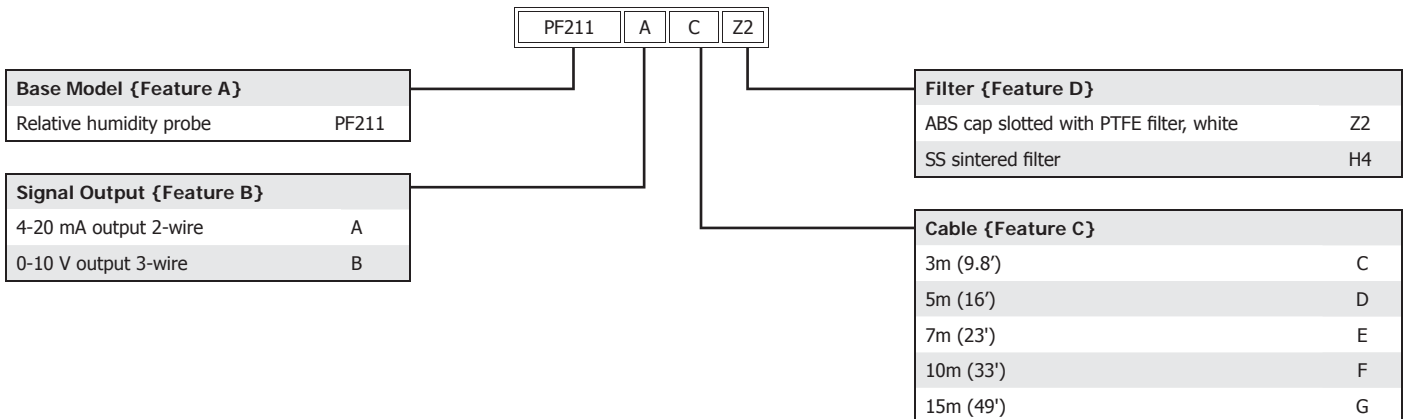
PF 211-B: V output (0-10 V)	
<b>Cable</b>	<b>Connector</b>
Red	Power supply V +
Black	Common ground
Blue	Output RH +
White	
Yellow	
Green	

Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}

Order example: PF211+A+C+Z2

Relative humidity probe PF211, output signal 4-20 mA , 3m (9.8') cable, ABS cap slotted with PTFE filter, white



# SF52

## Dew-Point Transmitter



The SF52 dew-point transmitter from Michell Instruments can provide 4–20 mA or voltage signal for either dew point or absolute humidity with excellent accuracy and linearity. The robust housing, together with an operating pressure of up to 20 bar (290 psi), makes the SF52 ideal for many dew-point and moisture measurement applications.

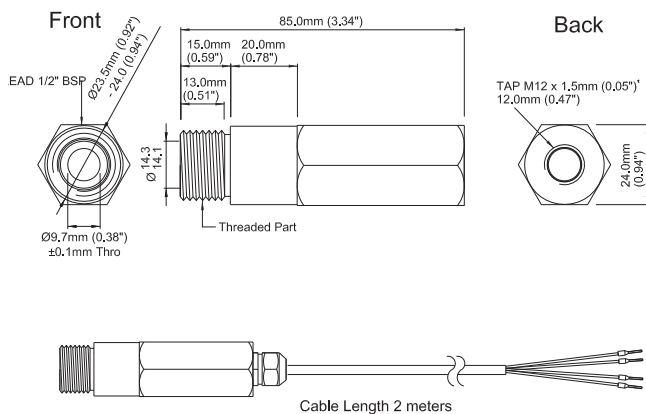
### Highlights

- Designed for OEM dryer applications
- Dew-point or absolute humidity output
- Flush fitting filter disc for minimal flow disturbance
- Cost-effective dew-point solution

### Technical Specifications

Performance	
Measurement range (dew point)	-40 to +60°C (-40 to +140°F), dew-point temperature
Measurement range (absolute humidity)	0 to 200 g/m <sup>3</sup> (0 to 87.4 gr/ft <sup>3</sup> )
Accuracy (dew point)	±2°C (±3.6°F) dew point
Accuracy (absolute humidity)	0.4 to 3 g/m <sup>3</sup> (0.175 to 1.311 gr/ft <sup>3</sup> ) on value of absolute humidity
Stability	<1°C / year (<1.8°F / year)
Response time	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V or 4–20 mA
Supply voltage	14–30 V DC (for 0–10 V output) 8–30 V DC (for 0–1 / 0–5 V / 4–20 mA output)
Current consumption	9 mA + load current
Supply voltage influence	±0.005% RH/V
Operating conditions	
Operating temperature	Probe, Housing: -30 to +85°C (-22 to +185°F) Storage: -40 to +85°C (-40 to +185°F)
Operating pressure	20 bar (290 psi) maximum
Temperature coefficient	Temperature compensated across operating temperature range
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Housing material	Nickel-coated brass
Dimensions	L=85mm, ø24mm (L=3.34", ø0.94") (max)
Filter	HDPE front filter
Weight	320g (11.29oz)
Mechanical connections	G 1/2" BSP (DIN ISO 228) or 1/2" NPT
Cable	2m (6.5')

### Dimensions




### Accessories and Spare Parts

HDPE filter	A000019
Bonded seal, (DIN ISO 228) G1/2" (BSP)	A000340
Sample block without filter	A000350
Sample block with filter	A000351

### Electrical Connections

Cable	Voltage output/mA output
White	Power supply V+
Green	Output Td+
Brown	Common ground



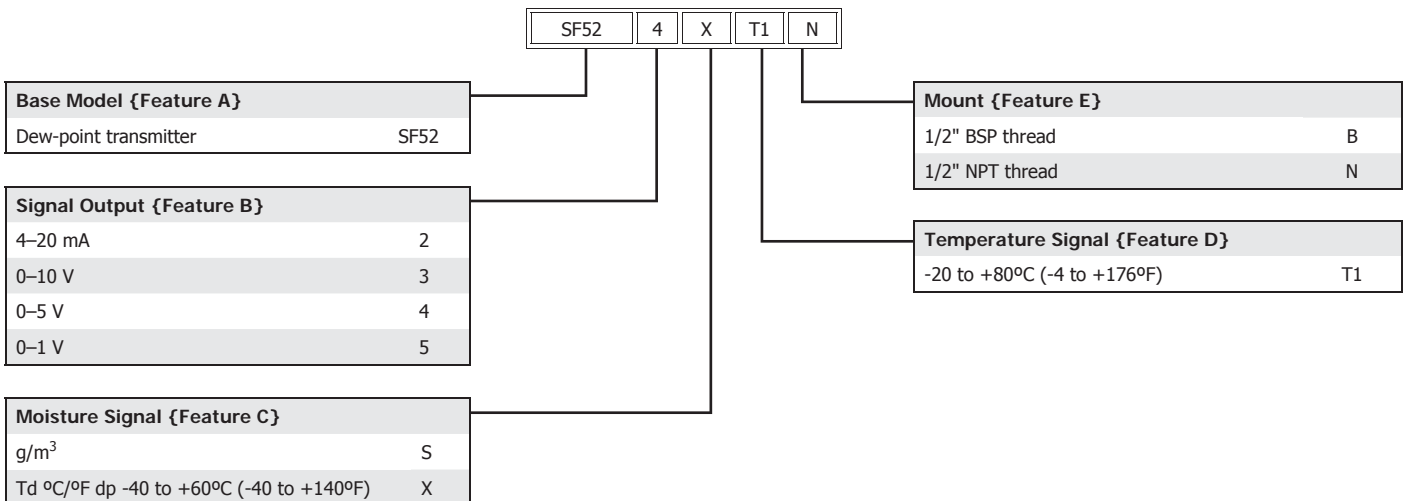
load max 500 Ω

### Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}

Order example: SF52+4+X+T1+N

Dew-point transmitter SF52, 0-5 V output, Td °C/°F dp signal -40 to +60°C (-40 to +140°F), temperature range -20 to +80°C (-4 to +176°F), 1/2" NPT pressure port



# Easidew Transmitter

## 2-Wire Dew-Point Transmitter



The Easidew Transmitter is designed for ease of use, incorporating all the features needed to make installation and operation as simple as possible. For the first time, dew-point measurement is made as accessible as temperature and pressure with this fully configured, calibrated transmitter that can be instantly incorporated into your air or gas management and control system.

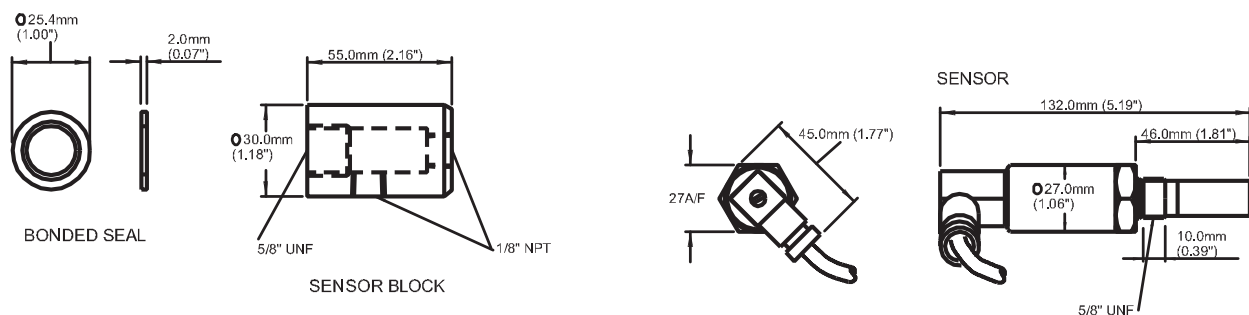
### Highlights

- 2-wire loop powered connection
- Dew point or ppm moisture content
- IP66 (NEMA 4)
- Excellent sensor protection
- Measurement range -100 to +20°C (-148 to +68°F)
- Operating temperature -40 to +60°C (-40 to +140°F)
- Fast response

### Technical Specifications

Performance									
Measurement range (dp)	-100 to +20°C (-148 to +68°F) dew point								
Accuracy (dp)	±2°C (±3.6°F) dew point								
Response time	5 mins to T95 (dry to wet)								
Repeatability	0.5°C (0.9°F) dew point								
Electrical output/input									
Output signal	4-20 mA (2-wire connection, current source) User configurable over range								
Output	Dew point, moisture content for ppm <sub>v</sub>								
Output range	Dew point: -100 to +20°C (-148 to +68°F) Moisture content in gas: 0-3000 ppm <sub>v</sub>								
Supply voltage	12-28 VDC								
Load resistance	Max 250 Ω @ 12 V (500 Ω @ 24 V)								
Current consumption	20 mA max								
Operating conditions									
Operating humidity	0–100% RH								
Operating temperature	-40 to +60°C (-40 to +140°F)								
Operating pressure	45 MPa (450 barg / 6500 psig) max								
Flow rate	1 to 5 Nl/min (2.1 to 10.6 scfh) mounted in standard sampling block; 0 to 10 m/sec (0 to 32.8 fps) direct insertion								
Temperature coefficient	Temp compensated across operating temp range								
Mechanical specification									
Ingress protection	IP66 in accordance with standard BS EN 60529:1992, and NEMA 4 in protection accordance with standard NEMA 250-2003								
Housing material	Stainless steel								
Dimensions	L=132mm x ø27mm (L=5.19" x ø1.00")								
Filter	HDPE Guard <10µm (80µm sint guard optional)								
Mounting Thread	5/8" - 18 UNF								
Weight	150g (5.29oz)								
Electrical connections	See table								
Interchangeability	Fully interchangeable transmitter								
Diagnostic conditions (factory programmed)	<table border="1"> <thead> <tr> <th>Condition</th> <th>Output</th> </tr> </thead> <tbody> <tr> <td>Sensor fault</td> <td>23 mA</td> </tr> <tr> <td>Under-range dew point</td> <td>4 mA</td> </tr> <tr> <td>Over-range dew point</td> <td>20 mA</td> </tr> </tbody> </table>	Condition	Output	Sensor fault	23 mA	Under-range dew point	4 mA	Over-range dew point	20 mA
Condition	Output								
Sensor fault	23 mA								
Under-range dew point	4 mA								
Over-range dew point	20 mA								

### Dimensions





# Easidew Transmitter

## Accessories and Spare Parts

Pack of 10 replacement HDPE guards	<b>EA2-HDPE</b>
SS sintered guard replacement	<b>SSG</b>
Easidew communications kit for EA2	<b>EA2-CK</b>
SS sample block (5/8" UNF thread with 1/8" NPT ports)	<b>CSB</b>
3/4"-16 UNF to 5/8" UNF male adapter, SS (Panametrics thread)	<b>APT-PAN</b>
G 1/2" to 5/8" UNF male adapter, SS (E&H or GEI thread)	<b>APT-GEI</b>
1/2" BSP to 5/8" UNF thread adapter	<b>APT-BSP</b>
Cable, 0.8m (2.62') length with fittings + additional cable	<b>EA2-CAB-XX</b>
Easidew Sampler (see Accessories Section for details)	<b>EA2-SAM</b>
10 pk particulate filter cartridges (for SS filter unit (9996061))	<b>SSF-PF-10PK</b>
6mm (0.24") O.D thick walled PTFE sample tube	<b>PTFE-XX</b>

## Electrical Connections

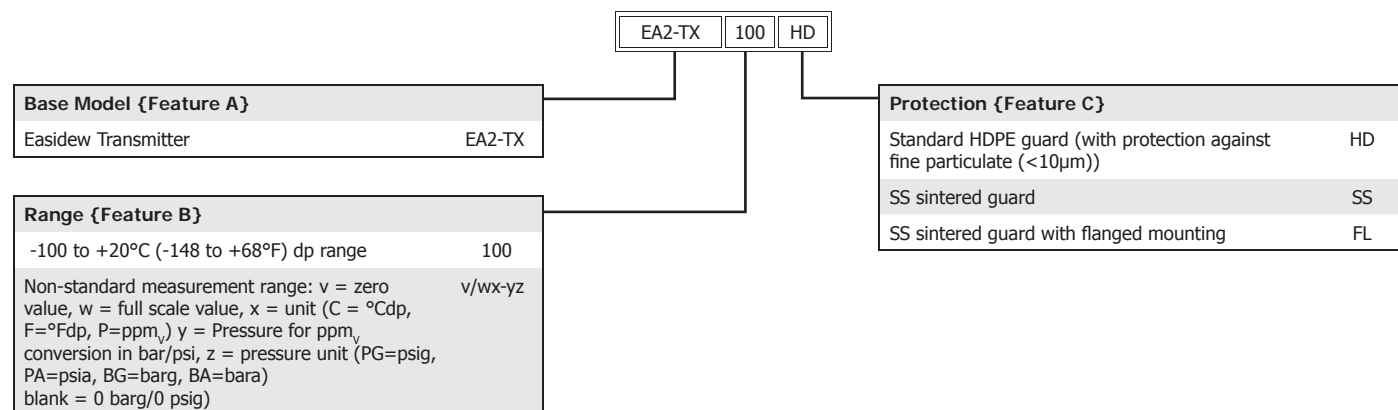
4-20 mA connections 2-wire	
Pin 1	4-20 mA
Pin 3	POWER

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}

**Order example:** EA2-TX+100+HD

Easidew Transmitter, 2-wire, 4-20 mA output , measurement range -100 to +20°C (-148 to +68°F) dp, HDPE guard



# Easidew TX I.S.

## ATEX, FM/CSA Certified Dew-Point Transmitter



An ATEX, FM/CSA certified, 2-wire, rugged impedance dew-point transmitter for continuous measurement in hazardous area applications.

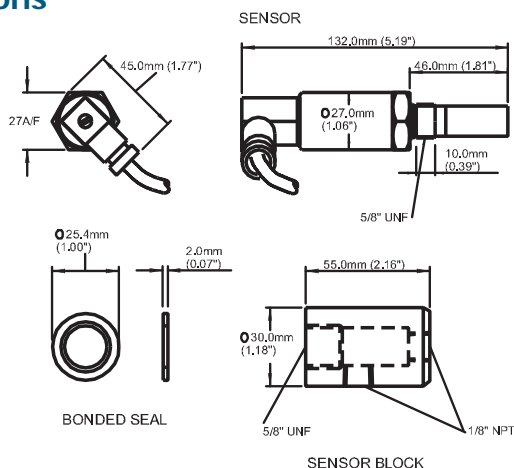
### Highlights

- ATEX FM/CSA certified
- 2-wire loop powered connection
- Dew point or ppm moisture content
- IP66 (NEMA 4)
- Excellent sensor protection
- Wide measurement range, calibrated -100 to +20°C (-148 to +68°F) dew point
- Operating temperature: -40 to +60°C (-40 to +140°F)
- Fast response

### Technical Specifications

Performance		
Measurement range (dp)	-100 to +20°C (-148 to +68°F) dew point	
Accuracy (dp)	±2°C (±3.6°F) dew point	
Response time	5 mins to T95 (dry to wet)	
Repeatability	0.5°C (0.9°F) dew point	
Electrical output/input		
Output signal	4-20 mA (2-wire connection, current source) User configurable over range	
Output	Dew point, moisture content for ppm <sub>v</sub>	
Output range	Dew point: -100 to +20°C (-148 to +68°F) Moisture content in gas: 0-3000 ppm <sub>v</sub>	
Supply voltage	12-28 V DC	
Load resistance	Max 250 Ω @ 12 V (500 Ω @ 24 V)	
Current consumption	20 mA max	
Operating conditions		
Operating humidity	0-100% RH	
Operating temperature	-40 to +60°C (-40 to +140°F)	
Operating pressure	45 MPa (450 barg / 6500 psig) max	
Flow rate	1 to 5 NI/min (2.1 to 10.6 scfh) mounted in standard sampling block; 0 to 10 m/sec (0 to 32.8 fps) direct insertion	
Temperature coefficient	Temperature compensated across operating temperature range	
Mechanical specification		
Hazardous Area Certificates	ATEX - II 1 G Ex ia IIC T4 (-20°C ≤ Ta ≤ +70°C) FM - IS / I / 1 / ABCD / T4 Ta = +70°C CSA - IS Class 1 Div 1 Groups ABCD T4 IECEx - Ex ia IIC T4 (-20°C ≤ Ta ≤ +70°C)	
Ingress protection	IP66 in accordance with standard BS EN 60529:1992, and NEMA 4 in protection accordance with standard NEMA 250-2003	
Housing material	Stainless steel	
Dimensions	L=132mm x ø27mm (L=5.19" x ø1.06")	
Filter	HDPE Guard <10µm 80µm sintered guard (optional)	
Mounting Thread	5/8" - 18 UNF	
Weight	150g (5.29oz)	
Interchangeability	Fully interchangeable transmitter	
Diagnostic conditions (factory programmed)	Condition	Output
	Sensor fault	23 mA
	Under-range dew point	4 mA
	Over-range dew point	20 mA
Approved galvanic isolators	KFD2-CR-EX1.20200 KFD2-CR-EX1.30200 KFD0-CS-EX1.50P KFD0-CS-EX2.50P KFD2-STC4-EX1.H MTL5041, MTL5040	

### Dimensions



Issue No: Easidew TX IS\_97168\_V3\_UK\_0312

# Easidew TX I.S.

## Accessories and Spare Parts

Pack of 10 replacement HDPE guards	<b>EA2-HDPE</b>
SS sintered guard replacement	<b>SSG</b>
Easidew communications kit for EA2	<b>EA2-CK</b>
SS sample block (5/8" UNF thread with 1/8" NPT ports)	<b>CSB</b>
3/4"-16 UNF to 5/8" UNF male adapter, SS (Panametrics thread)	<b>APT-PAN</b>
G 1/2" to 5/8" UNF male adapter, SS (E&H or GEI thread)	<b>APT-GEI</b>
1/2" BSP to 5/8" UNF thread adapter	<b>APT-BSP</b>
Cable, 0.8m (2.62') length with fittings + additional cable	<b>EA2-CAB-XX</b>
Easidew Sampler (see Accessories Section for details)	<b>EA2-SAM</b>
10 pk particulate filter cartridges (for SS filter unit (9996061))	<b>SSF-PF-10PK</b>
KFD0-CS-EX1.50P galvanic isolator (for Easidew PRO I.S. - Pepperl & Fuchs)	<b>GI-PF-01</b>
6mm (0.24") O.D thick walled PTFE sample tube	<b>PTFE-XX</b>

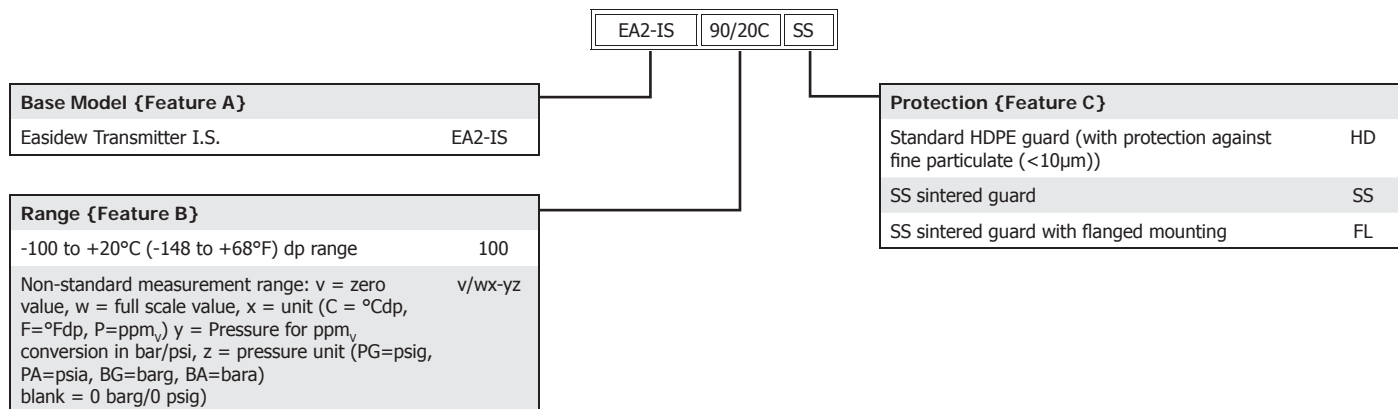
## Electrical Connections

4-20 mA connections 2-wire	
Pin 1	4-20 mA
Pin 3	POWER

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}

**Order example:** EA2-IS+90/20C+SS  
Easidew Transmitter I.S., -90 to +20°C dp range, stainless steel sintered guard



# Easidew PRO I.S.

## Intrinsically Safe Dew-Point Transmitter



The Easidew PRO I.S. is a rugged intrinsically safe 2-wire dew-point transmitter for trace moisture measurement in liquids and gases. It is certified for use in IS Class 1 Div 1 Groups A,B,C and D, Ex II 1G EX ia IIC T4 and I.S. I 1 ABCD T4 (Ta = +60°C) hazardous area locations.

### Highlights

- ±1°C (±1.8°F) accuracy
- Moisture in gases or liquids capability
- 2-wire connection
- Output configurable in ppm<sub>v</sub> and ppm<sub>w</sub> moisture content

### Simple Operation

The Easidew Pro I.S. is easy to install and operate. It requires a 12 to 28 V DC supply and provides a linear 4-20 mA signal representing moisture content.

### Moisture in Gases

The output can be configured by the customer, using simple software, to any range within -100 to +20°C (-148 to +68°F) dp, or 0-3,000 ppm<sub>v</sub> in gases. As the Easidew PRO I.S. responds to water vapor pressure in the gas sample, it will give the user an accurate determination of the actual dew-point at pressure up to 45 MPa (450 barg / 6500 psig). Flow rate is not critical to measurement accuracy (1 to 5 Nl/min (2.1 to 10.5 scfh)), though speed of response will be improved by operating at a higher sample flow.

### Moisture in Liquids

In addition to its Moisture in Gases capabilities the Easidew PRO I.S. can be used to monitor moisture in non-polar liquids. It is factory programmed to provide an output in ppm<sub>w</sub>. This requires the saturation constants of the liquid to be programmed into the transmitter either at the factory or by the user, using the application software, available as a free download from [www.michell.com](http://www.michell.com)

## Technical Specifications

### Performance

Measurement range (dp)	-100 to +20°C (-148 to +68°F) dew point
Accuracy (dp)	±1°C (±1.8°F) dp (+20 to -60°C (+68 to -76°F)) ±2°C (±3.6°F) dp (-60 to -100°C (-76 to -148°F))
Response time	5 mins to T95 (dry to wet)
Repeatability	0.5°C (0.9°F) dew point

### Electrical output/input

Output signal	4-20 mA (2-wire connection, current source) User configurable over range
Output	Dew point, moisture content for ppm <sub>v</sub> , ppm <sub>w</sub>
Output range	Dew point: -100 to +20°C (-148 to +68°F) Moisture content in gas: 0-3000 ppm <sub>v</sub> Moisture content in liquid: 0-3000 ppm <sub>w</sub>
Supply voltage	12-28 V DC
Load resistance	Max 250 Ω @ 12 V; 500 Ω @ 24 V
Current consumption	Max 23 mA depending on output signal
Saturation constants (For moisture in liquids measurements only)	6-point look-up table for saturation constants up to 3000 ppm <sub>w</sub> over the temperature range 0 to +50°C. Saturation constants for 8 common liquids can be programmed into the Easidew PRO I.S. via the application software. Alternatively the user can program saturation constants manually.

### Operating conditions

Operating humidity	0-100% RH
Operating temperature	-40 to +60°C (-40 to +140°F)
Operating pressure	45 MPa (450 barg / 6500 psig) max
Flow rate	1 to 5 Nl/min (2.1 to 10.5 scfh) mounted in sampling block; 0 to 10 m/sec (0 to 32.8 fps) direct insertion

### Mechanical specification

Hazardous Area Certificates	ATEX - II 1 G Ex ia IIC T4 (-20°C ≤ Ta ≤ +70°C) FM - IS / I / 1 / ABCD / T4 Ta = +70°C CSA - IS Class 1 Div 1 Groups ABCD T4 IECEx - Ex ia IIC T4 (-20°C ≤ Ta ≤ +70°C)	
Ingress protection	IP66 in accordance with standard BS EN 60529:1992, and NEMA 4 in protection accordance with standard NEMA 250-2003	
Housing material	Stainless steel	
Filter	80µm sintered guard HDPE Guard <10µm (optional)	
Mounting Thread	5/8" - 18 UNF	
Weight	1.27kg (2.8lbs)	
Electrical connections	Screw terminal, M20 x 1.5mm	
Fault conditions (factory programmed)	Condition	Output
	Sensor fault	23 mA
	Under-range dew point	4 mA
	Over-range dew point	20 mA
Approved galvanic isolators	KFD2-CR-EX1.20200 KFD2-CR-EX1.30200 KFD0-CS-EX1.50P KFD0-CS-EX2.50P KFD2-STC4-EX1.H MTL5041, MTL5040	

# Easidew PRO I.S.

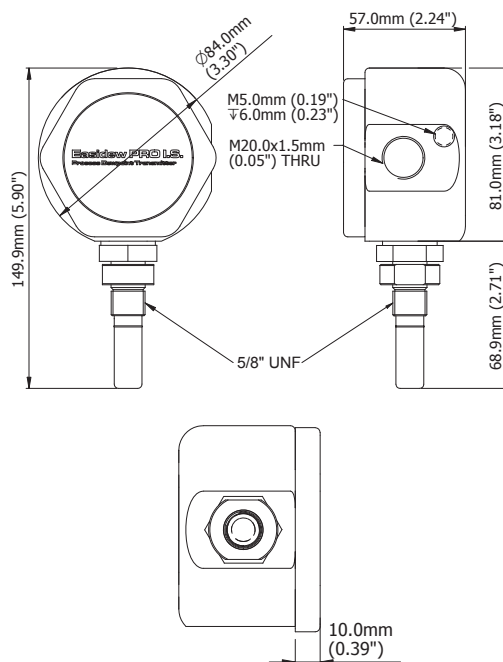
## Electrical Connections

4-20 mA connections 2-wire	
Pin 2	POWER
Pin 4	4-20 mA

## Accessories and Spare Parts

Wall mounting bracket for Easidew PRO I.S.	<b>EPR-BRK</b>
Cable entry adapter M20 to 1/2" NPT, brass	<b>CEA-M20-NPT-B</b>
Cable entry adapter M20 to 1/2" NPT, SS	<b>CEA-M20-NPT-SS</b>
Cable entry adapter M20 to 1/2" BSP, brass	<b>CEA-M20-BSP-B</b>
Cable entry adapter M20 to 1/2" BSP, SS	<b>CEA-M20-BSP-SS</b>
Hazardous area cable gland, brass ø3-8mm cable	<b>CG-M20-B</b>
Hazardous area cable gland, SS ø3-8mm cable	<b>CG-M20-SS</b>
SS sintered guard replacement	<b>SSG</b>
KFD0-CS-EX1.50P galvanic isolator (for Easidew PRO I.S. - Pepperl & Fuchs)	<b>GI-PF-01</b>
SS sample block (5/8" UNF thread with 1/8" NPT ports)	<b>CSB</b>
3/4"-16 UNF to 5/8" UNF male adapter, SS (Panametrics thread)	<b>APT-PAN</b>
G 1/2" to 5/8" UNF male adapter, SS (E&H or GEI thread)	<b>APT-GEI</b>
1/2" BSP to 5/8" UNF thread adapter	<b>APT-BSP</b>
Easidew communications kit	<b>EA2-CK</b>
Adapter for EA2-CK for use with Easidew PRO I.S.	<b>EPR-CK-ADT</b>
Easidew Sampler (see Accessories Section for details)	<b>EA2-SAM</b>
10 pk particulate filter cartridges (for SS filter unit 9996061))	<b>SSF-PF-10PK</b>

## Dimensions



## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}

**Order example:** EPR-IS+0/2P-500PG

Easidew PRO I.S Transmitter, ATEX Certified, 2-wire, ATEX certified, with 0 - 2 ppm<sub>v</sub> output range at 500 psig

EPR-IS	0/2P-500PG	EPR-LQ-IS	0/3000	01
<b>Base Model - for measurements in gas {Feature A}</b> Easidew PRO I.S. Transmitter, ATEX certified with sintered guard      EPR-IS		<b>Base Model - for measurements in liquids {Feature A}</b> Easidew PRO I.S. Transmitter, ATEX certified with sintered guard      EPR-LQ-IS		
<b>Range {Feature B}</b> -100 to +20°C (-148 to +68°F) dp range      100 Non-standard measurement range: v = zero value, w = full scale value, x = unit (C = °Cdp, F=°Fdp, P=ppm <sub>v</sub> ) y = Pressure for ppm <sub>v</sub> conversion in bar/psi, z = pressure unit (PG=psig, PA=psia, BG=barg, BA=bara) blank = 0 barg/0 psig      v/wx-yz		<b>Range {Feature B}</b> 0 - 3000 ppm <sub>w</sub> (standard)      0/3000 Programmed user-supplied range      y/z (y = ppm <sub>w</sub> zero value z = ppm <sub>w</sub> full scale value)		
<b>Liquid {Feature C}</b>				
Programmed user-supplied CS values		00		
Methane		01		
Propane		02		
Ethane		03		
Propylene		04		
Ethylene		05		
Butane		06		
Isobutane		07		
Pentane		08		
1-Butene		09		
Cyclopentane		10		

# Easidew Online

## Dew-Point Hygrometer



A panel- or bench-mounting hygrometer with digital display, analog and digital outputs and dual alarm feature, offering excellent reliability and repeatability.

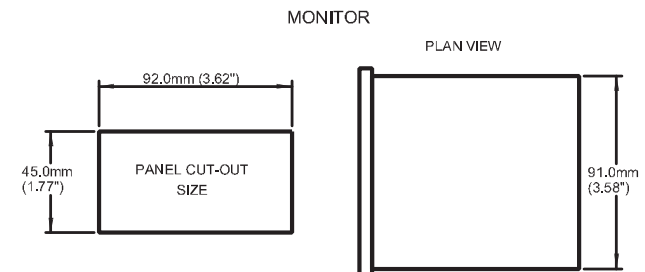
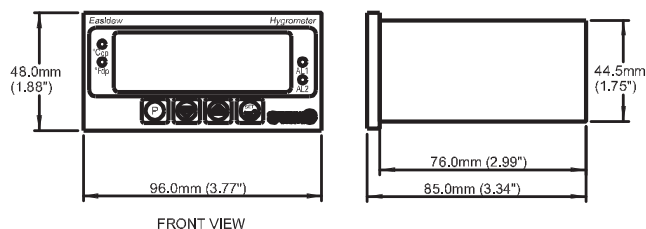
### Highlights

- Dew point or ppm moisture content
- Analog and digital outputs
- IP66 (NEMA 4) Sensor and IP65 (NEMA 12) Monitor (front panel only)
- Excellent sensor protection
- -100 to +20°C (-148 to +68°F) total dew-point range
- Dual alarms
- Clear and easy to read display

### Technical Specifications

Performance	
Measurement range	-100 to +20°C (-148 to +68°F) dew point 0–3000 ppm <sub>v</sub> ppm <sub>v</sub> output or non-standard dew-point range must be specified at time of order
Accuracy (dp)	±2°C (±3.6°F) dew point
Response time	5 mins to T95 (dry to wet)
Repeatability	0.5°C (0.9°F) dew point
Electrical output/input	
Output signal	4–20 or 0–20 mA, maximum load resistance 500 Ω RS232
Supply voltage	85 to 264 V AC, 50/60 Hz
Load resistance	Max 250 Ω @ 12 V / 500 Ω @ 24 V
Current consumption	60 mA max
Operating conditions	
Operating humidity	0–100% RH
Operating temperature	Sensor -40 to +60°C (-40 to +140°F) Monitor 0 to 50°C (+32 to +122°F)
Mechanical specification	
Ingress protection	Monitor IP65 (NEMA 12) front panel only Sensor IP66 (NEMA 4)
Dimensions	Monitor 1/8 DIN case, 96 x 48 x 85mm (3.77 x 1.88 x 3.34") incl clearance (wxhxd) Sensor 132 x 27 A/F mm (5.13 x 1.06") (length x diameter across hex flats)
Filter	HDPE
Weight	150g (5.29oz)
Electrical connections	Sensor cell supplied
Alarm	Front panel configuration of alarm points
Sensor cable	0.8m (2.6') supplied as standard max 800m (2,600')
Mains cable	2m (6.5') cable supplied

### Dimensions



## Electrical Connections

Pin		Pin	
1	To sensor Blue cable	13	Output mA -
3	To sensor Green cable	14	Output mA +
4	To sensor Red cable	16	Alarm relay contact
7	Alarm relay contact 2 - N/O	17	Alarm relay contact
8	Alarm relay contact 2 - N/C	23	Power supply N
9	Alarm relay contact 2 - com	24	Power supply L

## Accessories and Spare Parts

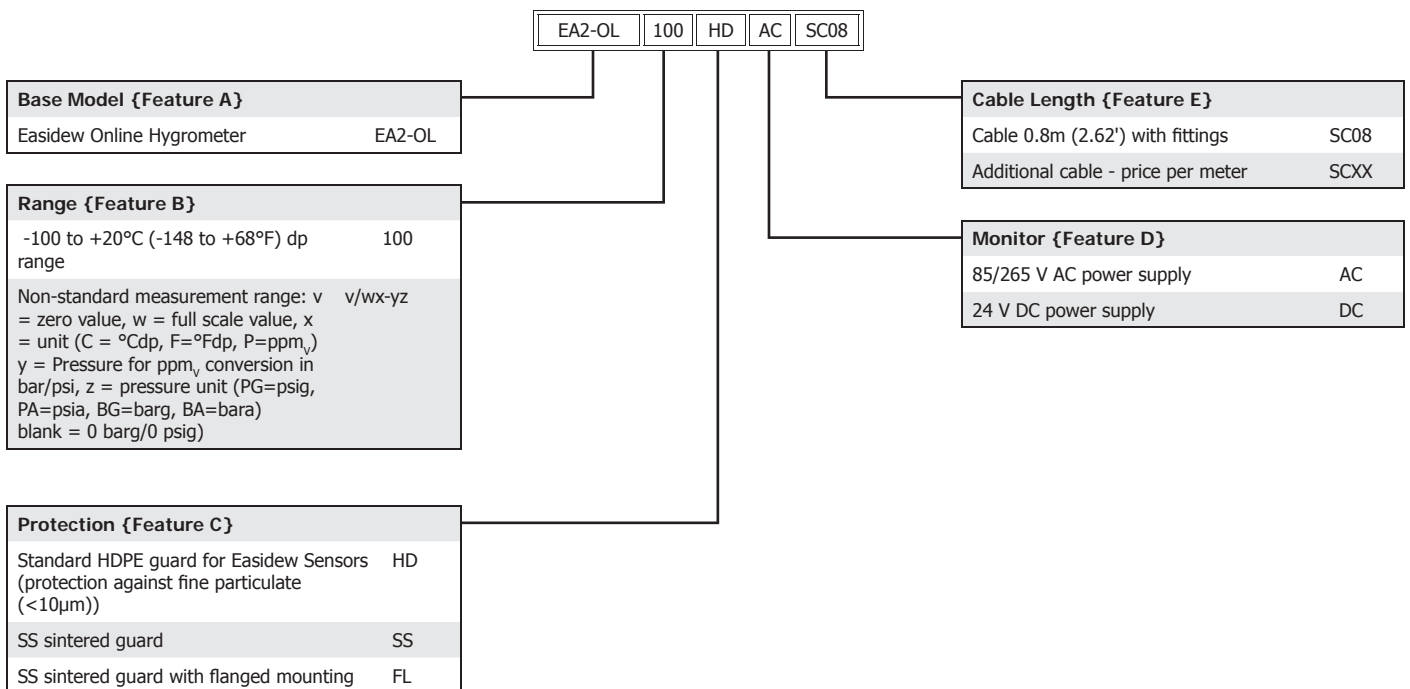
Pack of 10 replacement HDPE guards	<b>EA2-HDPE</b>
SS sintered guard replacement	<b>SSG</b>
Easidew communications kit for EA2	<b>EA2-CK</b>
SS sample block (5/8" UNF thread with 1/8" NPT ports)	<b>CSB</b>
KFD0-CS-EX1.50P galvanic isolator (for Easidew PRO I.S. - Pepperl & Fuchs)	<b>GI-PF-01</b>
3/4"-16 UNF to 5/8" UNF male adapter, SS (Panametrics thread)	<b>APT-PAN</b>
G 1/2" to 5/8" UNF male adapter, SS (E&H or GEI thread)	<b>APT-GEI</b>
1/2" BSP to 5/8" UNF thread adapter	<b>APT-BSP</b>
Cable, 0.8m (2.62') length with fittings + additional cable	<b>EA2-CAB-XX</b>
Easidew Sampler (see Accessories Section for details)	<b>EA2-SAM</b>
10 pk particulate filter cartridges (for SS filter unit (9996061))	<b>SSF-PF-10PK</b>
6mm (0.24") O.D thick walled PTFE sample tube	<b>PTFE-XX</b>

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}

**Order example:** EA2-OL+100+HD+AC+SC08

Easidew Transmitter, -100 to +20°C (-148 to +68°F) dp range, HDPE guard, 85/265 V AC power supply & 0.8m (2.62') cable with fittings



# MDM25

## Hand-Held Hygrometer



The MDM25 is a portable, battery-operated handmeter, and is available with a number of different probe configurations. It displays relative humidity, temperature and one calculated value, making this handmeter suitable for a wide range of applications. The user can choose to display either °C or °F.

### Highlights

- Displays %RH and temperature, plus dew point, absolute humidity and wet bulb temperature
- Simple to operate
- Long term stability:  $\pm 1\%$  RH over 12 months

### Technical Specifications: Hand Meter

Performance	
Measurement units	%RH, °C/°F Ta, °C/°F Td, g/m <sup>3</sup> , °C/°F Tw
Mechanical specification	
Ingress protection	IP54 - Hand meter only
Handmeter housing material	Molded polymer housing ABS + rubber surround
Weight	300g (10.58oz)
Display resolution	Graphic LCD 128 x 64 pixels
Electrical output/input	
Supply voltage	4.5 V (3 x AA batteries - provide approximately 70 hours of operation)
Electrical connections	M9 5-way triad connector

### Probes

Performance	
Measurement range (RH)	0 - 100% RH
Accuracy at 25°C (77°F) Temperature	< $\pm 0.2^\circ\text{C}$ ( $\pm 0.36^\circ\text{F}$ )
Stability - RH Sensor	$\pm 1\%$ RH/year
Response time - RH Sensor	<10 sec typical (for 90% of the step change)
Measurement & operating range (T)	
Fixed and Standard probe	-20 to +80°C (-4 to +176°F)
Sword probe	-20 to +100°C (-4 to +212°F)
Remote probe	-20 to +150°C (-4 to +302°F)
Accuracy at 25°C (77°F)	
Humidity	- Fixed probe $\pm 2\%$ RH (10 - 90% RH) - Remote probes $\pm 2\%$ RH (5 - 95% RH)
Mechanical specification	
Weight:	
Fixed Probe	FPR 30g (1.06 oz)
Standard Probe	SPR 90g (3.17 oz)
Sword Probe	SWPR 500g (1.1 lb)
Round 300mm probe	HTPR300 380g (13.4 oz)
Round 500mm probe	HTPR500 620g (1.37 lb)

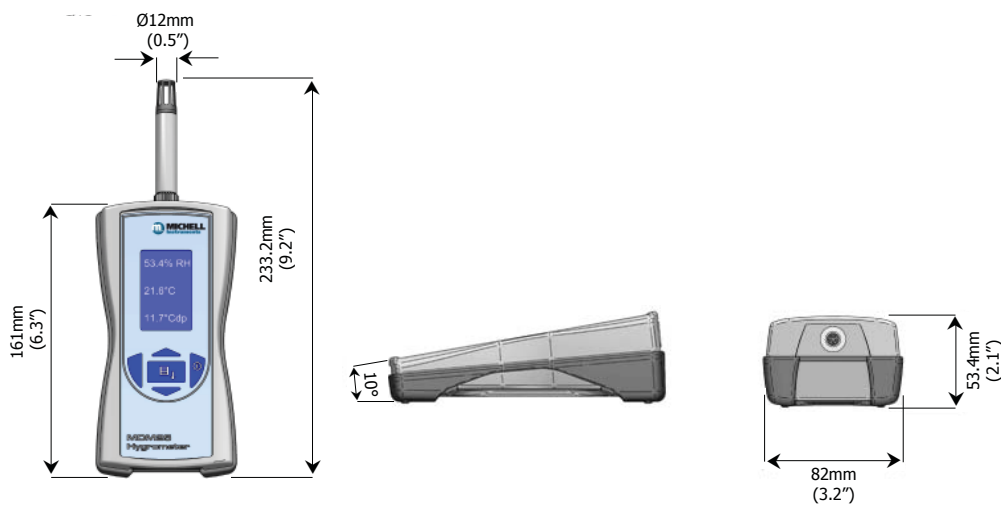
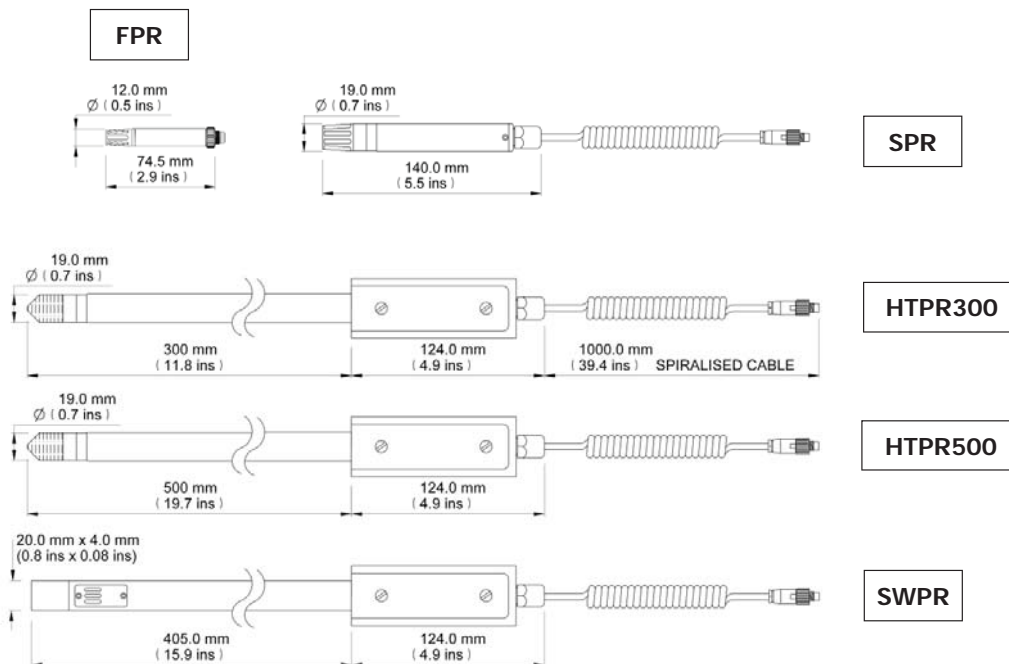
### Accessories and Spare Parts

19mm (0.75") slotted protection cap black	A000002
12mm (0.47") Slotted protection cap, black	A000003
19mm (0.75") PVDF filter	A000014
12mm (0.47") PVDF filter	A000017
12mm (0.47") PVDF filter with protection cap, black	A000018
19mm (0.75") mesh filter with protection cap, black	A000021
12mm (0.47") Mesh filter with protection cap, black	A000022
12mm (0.47") Flat SS sintered dust filter	A000023
19mm (0.75") Arrow SS sintered filter 10µm	A000026
12mm (0.47") Arrow 20 µm SS sintered filter	A000028

Rubber surround for hand meter case	A000400
Carrying case	A000401
Batteries (3 AA Alkaline cells)	A000402
Fixed probe	MDM-FPR
Standard probe	MDM-SPR
Sword type probe	MDM-SWPR
Remote high temperature probe 300mm (18")	MDM-HTPR
Remote high temperature probe, 500mm (19.6")	MDM-HTPR
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC



## Dimensions

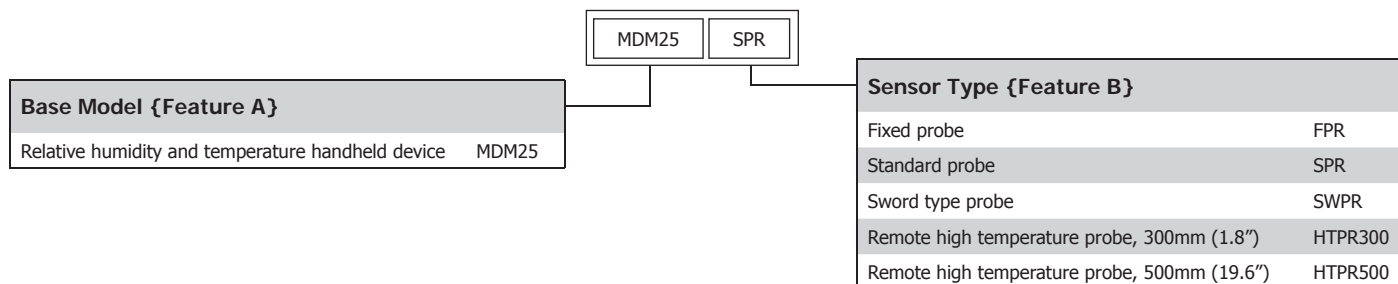


## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}

**Order example:** MDM25+SPR

Relative humidity and temperature handheld device with fixed probe (comes standard with 3 AA Alkaline batteries)



# MDM300

## Advanced Dew-Point Hygrometer



The MDM300 High-Speed Dew-Point Hygrometer offers rapid spot check measurements of dew-point or moisture content, in a compact instrument packed with features and intelligent engineering.

An extremely fast response and accurate, stable measurement is complemented by an instrument which is easy to use, has data-logging and built-in sampling components as standard, and can be supplied with a range of accessories including a stand-alone sampling system and a practical carry case.

### Highlights

- Repeatable fast measurements, each in less than 15 minutes for T95 to -60°C (-76°F)
- Long battery life with up to 48 hours of typical usage between charges
- Best in its class: 1°C (1.8°F) accuracy
- External device input 4-20 mA for dew-point, temperature or pressure transmitters
- Bluetooth connection for data download
- Built-in basic sensor protection sampling system allowing measurements up to 350 barg (5000 psig)
- Easy operation

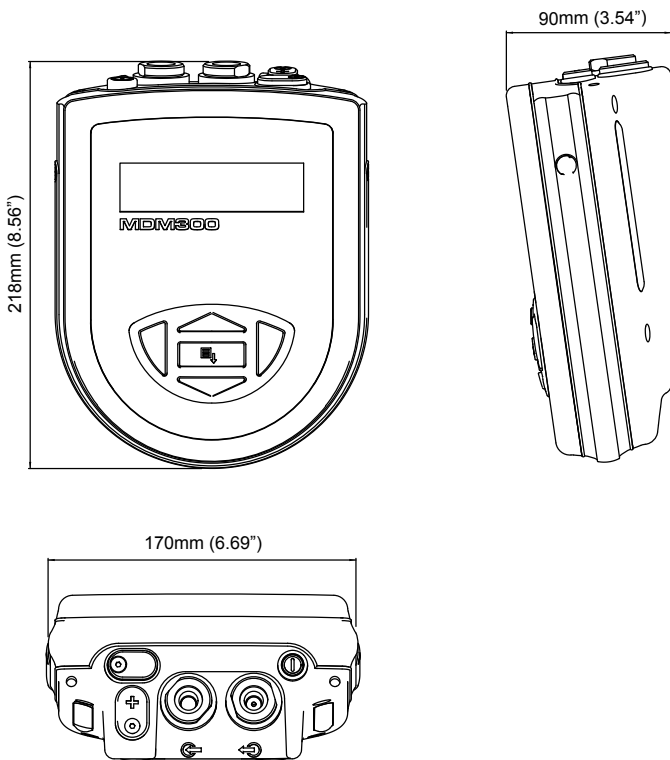
### Technical Specifications

Performance	
Measurement technology	Michell ceramic sensor
Accuracy	± 1°C from -60 to +20°C (-76 to +68°F) dp ± 2°C from -100 to -60°C (-148 to -76°F) dp ± 0.2°C (0.3°F) temperature
Measurement range	Calibrated -100 to +20°C (-148 to +68°F) dp Readings to +30°C dp
Measurement units	°C, °F, K dew point ppm <sub>v</sub> , ppm <sub>w</sub> for air, N <sub>2</sub> , H <sub>2</sub> , CO <sub>2</sub> , SF <sub>6</sub> Gas temperature: %RH, gm <sup>3</sup> , gkg <sup>-1</sup> Option: active pressure (bara/g, psig, MPa, KPa)
Resolution (display)	0.1 for all dp derived units and autoranging where appropriate, e.g. ppm
Resolution (measurement)	0.1°C dew point
Typical response speed	T95 in ≤15 minutes to -60°C (-76°F)
Repeatability	Better than 0.1°C (0.2°F)
Stability	0.1°C (0.2°F)
Sensitivity	0.01°C (0.02°F) or better
Hysteresis	0.05°C (0.1°F)
Electrical output/input	
Auxiliary inputs	4-20 mA external input selectable as either dp, temperature or pressure
Battery type	NiMH 4.8V
Battery operating life	Up to 48 hours of typical usage between charges
Battery charger	Intelligent charger (supplied)
Operating conditions	
Operating pressure range	35 MPa (350 barg / 5000 psig) max
Operating environment	Outdoors 0-100% RH condensing
Operating temperature	-20 to +50°C (-4 to +122°F)
Storage/transport temp	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Display	Blue LCD graphical display
Enclosure type	Steel fiber-loaded high-impact polyamide 6
IP/NEMA rating	IP66 (NEMA 4)
Gas connections	1/8" NPT female (other options available)
Flow across sensor	0.2 to 1.2 NI/min (0.5 to 2.5 scfh)
Filters	50 micron stainless steel sinter in the inlet port (other porosities available)
Gas wetted materials	316 stainless steel
Outline dimensions	218 x 170 x 90mm (8.6 x 6.7 x 3.5") (dxwxh)
Weight	1.35kg (2.98lbs)
General	
Data Logging	8 megabytes; Log interval: 5 to 60 second; Logs per log file: Up to 10,000
Communications	(Wireless) Bluetooth™ range up to 5m (16.5ft)
Languages	English, Spanish, Portuguese, Italian, French, German

## Accessories and Spare Parts

Carry bag – for standard and I.S. instruments  
 Swagelok gas fittings – various sizes available  
 Cable for external dew-point sensor – various lengths available  
 External temperature sensor – various cable lengths available  
 External pressure sensor – various cable lengths available  
 External dew-point sensor for standard instrument – versions for standard and I.S instruments available  
**Please contact us for a full list of accessories and spares with order codes and prices**

## Dimensions



## Order Codes

MDM300-STD - Advanced Portable Hygrometer		
Feature	Item	Description
Base Model	MDM300-STD	Base unit

# RM33 & 52

## Relative Humidity and Temperature Transmitter, HVAC Room Monitor



The RM series of relative humidity and temperature transmitters offers a comprehensive range of output signals and measurement ranges. The transmitters are housed in a wall mounting enclosure making these instruments ideal for HVAC and building management applications.

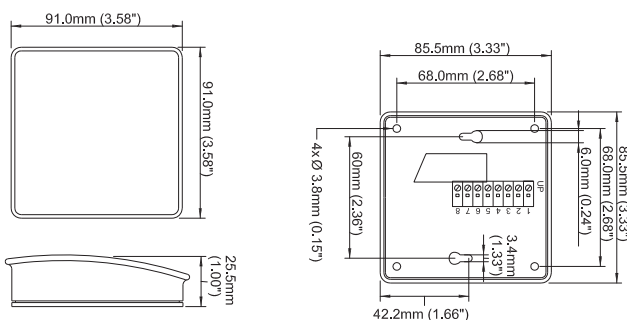
### Highlights

- Designed for low cost HVAC applications
- Quick installation: electrical rear connection with screw terminals
- Long term stability

### Technical Specifications

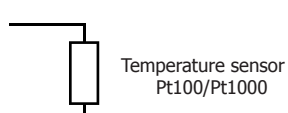
Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	0 to +50°C (+32 to +122°F)
Accuracy at 23°C (73°F) Humidity	RM52: <±2% RH (10–90% RH) RM33: <±3% RH (30–80% RH)
Accuracy at 23°C (73°F) Temperature	RM52: ±0.2°C (±0.36°F) RM33: ±0.3°C (±0.54°F)
Temperature influence	±0.05% RH/°C (±0.027% RH/°F)
Stability – RH Sensor	±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V 4–20 mA (2-wire)
Supply voltage	14–35 V DC (for 0–5 / 0–10 V output) 4.5–35 V DC (for 0–1 V / 4–20 mA {RH only} output) 14–26 V AC (for all output ranges)
Supply voltage influence	±0.01% RH/V typical
Operating conditions	
Operating humidity Housing, Storage	10–90% RH
Operating temperature Electronics Storage	0 to +50°C (+32 to +122°F) -40 to +75°C (-40 to +167°F)
PRT	
Measurement range	Pt100/1000: -50 to +200°C (-58 to +392°F)
Accuracy	Pt100/1000: ±0.15%
Mechanical specification	
Ingress protection	N/A
Housing material	White molded polymer
Dimensions	91 x 91 x 25.5mm (3.58 x 3.58 x 1.00")
Filter	N/A
Weight	85g (3oz)
Electrical connections	Screw terminals

### Dimensions

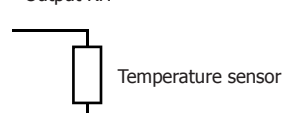


## Electrical Connections

Voltage output	
Pin 1	Pin 1
Pin 2	Pin 2
Pin 3	Pin 3
Pin 4	Output temperature +
Pin 5	Output RH +
Pin 6	Common ground
Pin 7	Power supply V+
Pin 8	Pin 7
	Pin 8
	Humidity with temperature sensor



mA output	
Pin 1	Output RH +
Pin 2	Output RH -
Pin 3	Pin 3
Pin 4	Output temperature +
Pin 5	Output RH +
Pin 6	Common ground
Pin 7	Power supply V+
Pin 8	Pin 7
	Pin 8
	Humidity with temperature sensor

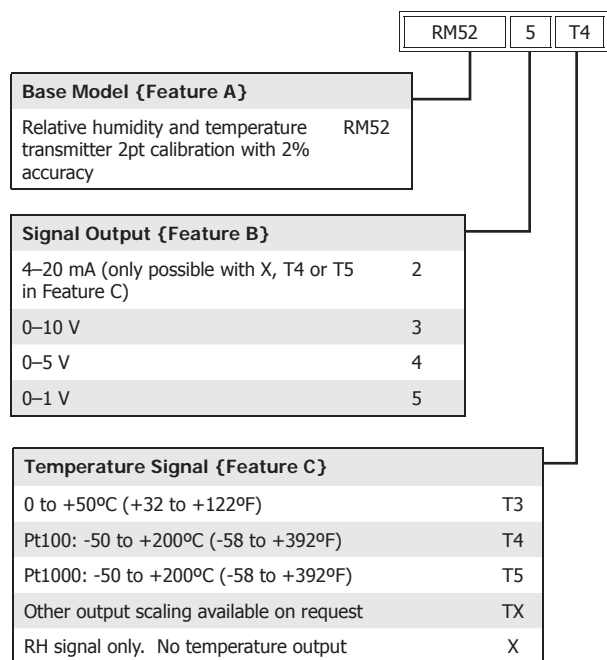
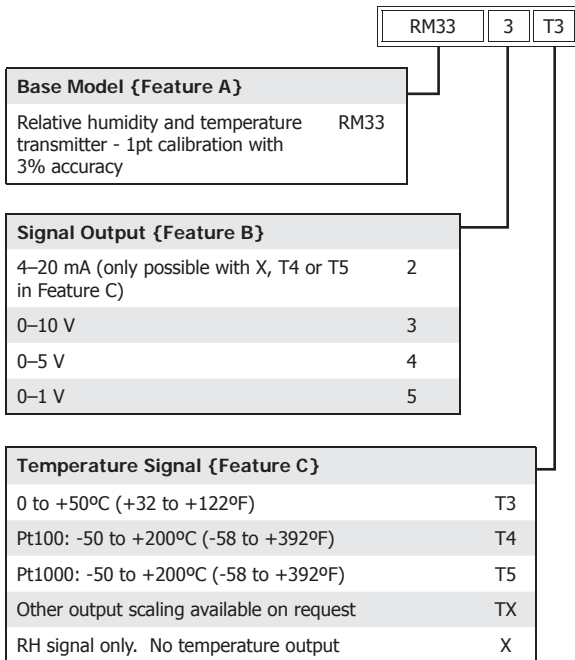


## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}

**Order example:** RM33+3+T3

Relative humidity and temperature transmitter RM33, 0-10 V output, 0 to 50°C (+32 to +122°F) temperature range



# WM33 & 52

## Relative Humidity and Temperature Transmitter, Wall Mount



The WM Series are wall-mounted units that have the ability to display and provide an output signal of % RH, dew point or absolute humidity and temperature. The WM Series offers excellent measurement accuracy and stability wherever a wall-mounted sensor is required.

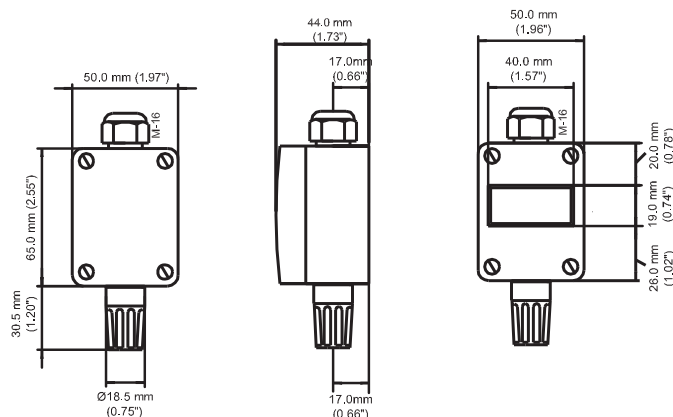
### Highlights

- WM33 is designed for low cost HVAC applications
- WM52 has digital technology and is designed for accurate measurements in a controlled environment
- Easy to re-calibrate to maintain high accuracy

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-20 to +80°C (-4 to +176°F)
Accuracy at 23°C (73°F) Humidity	WM52: <math>\pm 2\%</math> RH (10–90% RH) WM33: <math>\pm 3\%</math> RH (30–80% RH)
Accuracy at 23°C (73°F) Temperature	WM52: <math>\pm 0.2^\circ\text{C}</math> (<math>\pm 0.36^\circ\text{F}</math>) WM33: <math>\pm 0.3^\circ\text{C}</math> (<math>\pm 0.54^\circ\text{F}</math>)
Stability – RH Sensor	$\pm 1\%$ RH/year
Response time – RH Sensor	<math>< 10</math> sec typical without filter (for 90% of the step change)
Electrical output/input	
Output signal	4–20 mA, 0–1, 0–5, 0–10 V
Supply voltage	14–30 V DC (for 0–5 / 0–10 V output) 5–30 V DC (for 0–1 V & 4–20 mA output)
Operating conditions	
Operating temperature	
Probe, Housing	-30 to +85°C (-22 to +185°F)
Storage	-40 to +85°C (-40 to +185°F)
PRT	
Measurement range	Pt100/1000: -50 to +200°C (-58 to +392°F)
Accuracy	Pt100/1000: $\pm 0.15^\circ\text{C}$
Mechanical specification	
Housing material	White molded polymer
Weight	82g (2.89oz)
Electrical connections	Screw terminals
Alternative outputs	
Dew point	-40 to +60°C (-40 to +140°F)
Absolute humidity	0–200g/m <sup>3</sup> (0–87.4gr/ft <sup>3</sup> )

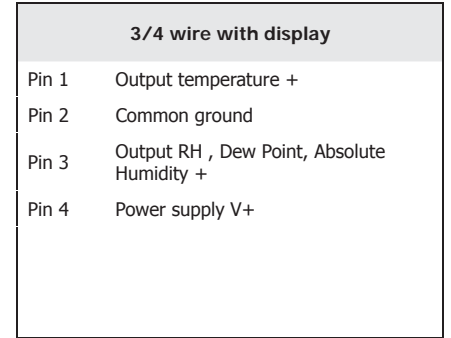
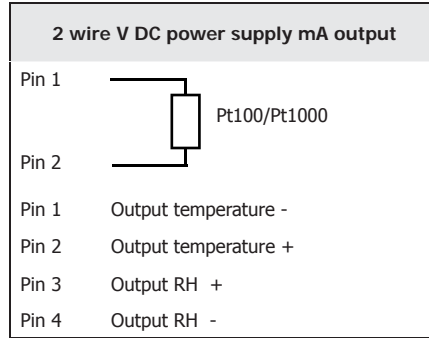
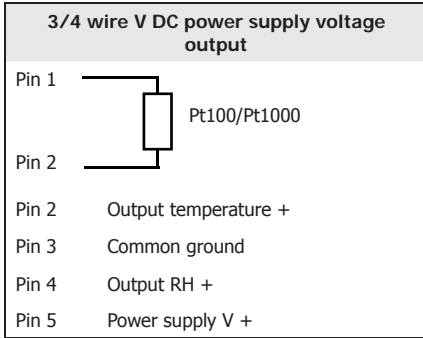
### Dimensions



### Accessories and Spare Parts

19mm (0.75") Slotted protection cap white	A000001
19mm (0.75") PVDF filter	A000014
19mm (0.75") PVDF filter with protection cap white	A000016
19mm (0.75") Mesh filter with protection cap black	A000021
19mm (0.75") Arrow stainless steel sintered filter 5/10/20 $\mu\text{m}$	A000025/26/27
19mm (0.75") Foil filter 2 $\mu\text{m}$ with protection cap white	A000041
19mm (0.75") Oleophobic foil filter 0.7 $\mu\text{m}$ with protection cap white	A000043
19mm (0.75") Foil filter 1.5 $\mu\text{m}$ with protection cap white	A000045
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

## Electrical Connections

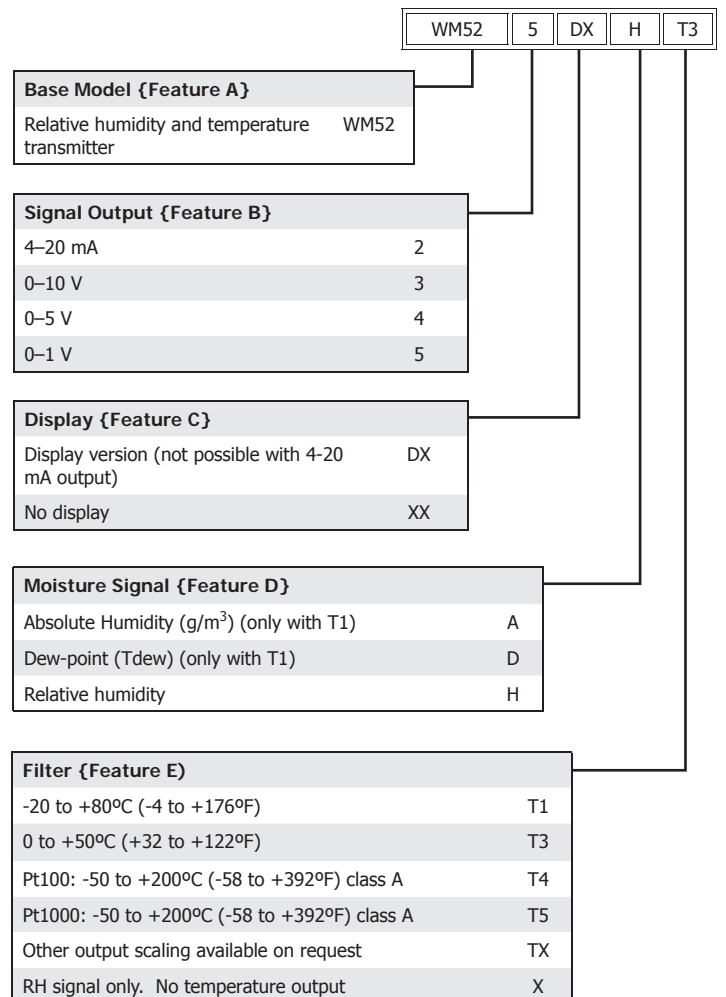
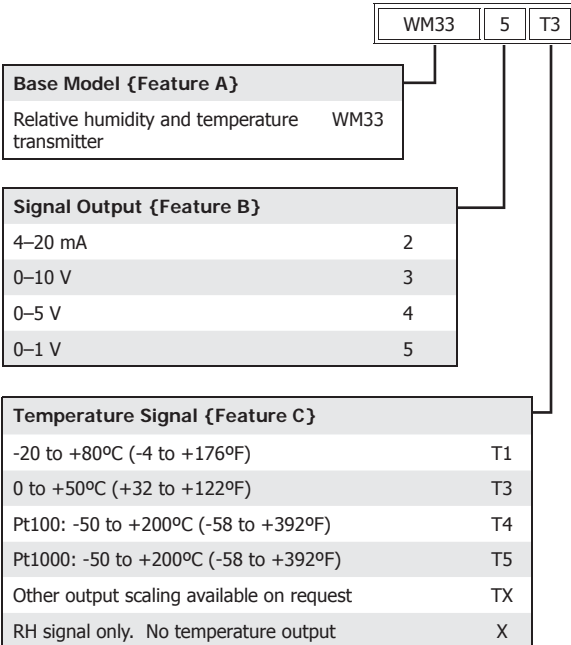


## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}

**Order example:** WM52+5+DX+H+T3

Relative humidity and temperature transmitter WM52, 0-1 V output, with display, relative humidity configuration and 0 to 50°C temperature range



# WM261

## Digital Relative Humidity & Temperature Transmitter, Wall Mount

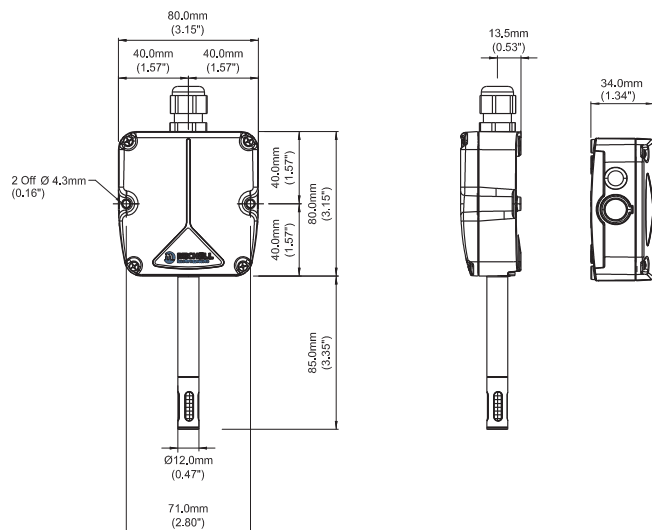


The WM261 has been developed for high precision measurement of relative humidity and temperature. This transmitter is available with a range of outputs.

### Highlights

- Designed for accurate measurement in a controlled environment
- Temperature output scaling configurable on request
- Linearization for a specific isotherm on request

### Dimensions



### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-20 to +80°C (-4 to +176°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	Pt100 1/3DIN direct ±0.2°C (±0.36°F) Current output ±0.3°C (±0.54°F)
Stability – RH sensor	<±1% RH/year
Response time	10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal (RH) configurable on request	4–20 mA 0–1, 0–5, 0–10 V
Output signal (T) configurable on request	4–20 mA 3-wire 1/3 DIN Pt100 direct 0–1, 0–5, 0–10 V
Supply voltage	Output 4–20 mA: V + = 12–30 V DC Output 0–10 V: V + = 15–30 V DC Output 0–5 V: V + = 10–30 V DC Output 0–1 V: V + = 8–30 V DC
Load resistance	Output 4–20 mA: Rload < (Uv-9) / 0.02 Output 0–10 V: R > 10 k $\Omega$ Output 0–5 V: R > 5 k $\Omega$ Output 0–1 V: R > 1 k $\Omega$
Current consumption	2 x 20 mA max
Operating conditions	
Operating temperature	
Probe	-30 to +85°C (-22 to +185°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Housing material	PPO + POM
Dimensions	
Housing	80 x 80 x 34mm (3.15 x 3.15 x 1.34")
Probe	L=85mm, $\varnothing$ 12mm (L=3.35", $\varnothing$ 0.47")
Weight	100g (3.53oz)
Electrical connections	Screw terminals

### Accessories and Spare Parts

You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT

HKC



## Electrical Connections

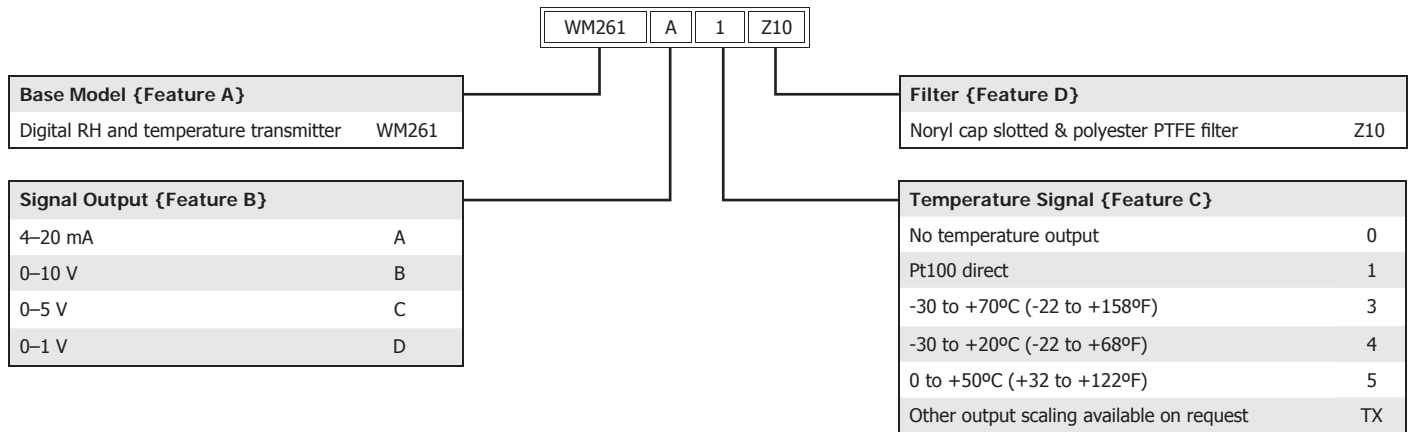
Version mA output and Pt100 direct		Version mA output for RH and Temperature		Version V output and Pt100 direct		Version V output for RH and Temperature	
Pin 1	Output RH +	Pin 1	Output temperature +	Pin 1	Power supply V +	Pin 1	Power supply V +
Pin 2	Output RH -	Pin 2	Output Temperature -	Pin 2	Common ground	Pin 2	Common ground
Pin 3		Pin 3	Output RH +	Pin 3	Output RH +	Pin 3	Output Temperature +
Pin 4		Pin 4	Output RH -	Pin 4		Pin 4	Output RH +
Pin 5		<b>Warning:</b> Temperature channels Pin 1 and Pin 2 must be powered always		Pin 5			

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}

**Order example:** WM261+A+1+Z10

Relative humidity transmitter WM261 with 4-20 mA output, Pt100 direct signal, noryl slotted cap and polyester PTFE filter



# WM281

## Digital Relative Humidity & Temperature Transmitter, Wall Mount



The WM281 relative humidity transmitter includes the interchangeable Hygrosmart module. The interchangeable module lets you recalibrate the transmitter simply by replacing the sensor head with the Hygrosmart module. As a result, maintenance costs are greatly reduced and down-time is minimized.

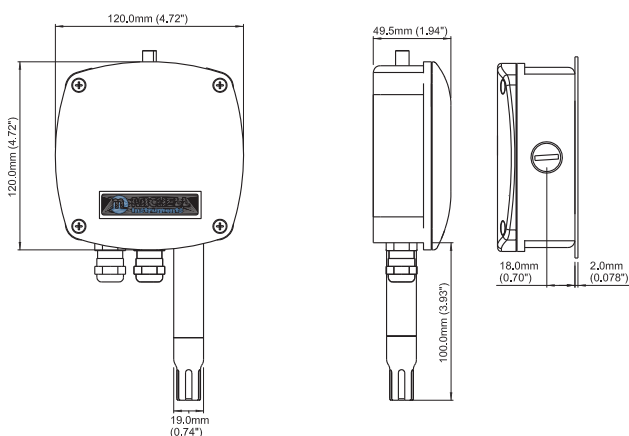
### Highlights

- Analog and digital output standard
- Based on the interchangeable Hygrosmart module
- Analog output signals selectable through software
- Metric or US measurement units selectable through software

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +70°C (-22 to +158°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5-95% RH)
Accuracy at 23°C (73°F) Temperature	±0.4°C (±0.72°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal configurable on request	0–1, 0–5, 0–10 V 0–20 mA, 4–20 mA, RS485
Supply voltage	15 - 27 V AC / 18 - 38 V DC
Load resistance	Current output: R ≤ 500 Ω
Power consumption	1.7 W
Operating conditions	
Operating temperature Probe	-30 to +85°C (-22 to +185°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP67
Material Housing	Aluminum die casting
Probe	Delrin
Dimensions Housing	120 x 120 x 49.5mm (4.72 x 4.72 x 1.94")
Probe	L=100mm, ø 19mm (L=3.93", ø0.74")
Weight	450g (15.87oz)
Electrical connections	Screw terminals

### Dimensions



### Accessories and Spare Parts

RS422/485 to PC (RS232) converter	<b>330185</b>
USB cable/software for configuration	<b>F035263</b>
SS sintered filter	<b>H2</b>
SS sintered filter with teflon coating	<b>J2</b>
Delrin cap slotted with SS mesh filter	<b>K7</b>
Delrin cap slotted with PTFE filter, white	<b>Z7</b>
Hygrosmart with Pt100 output (RH = 0-1 V)	<b>I7-0-00-1</b>
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	<b>HKC</b>

## Electrical Connections

Pin		Pin	
1	Power Supply V +	8	Output Channel 2 Ground
2	Power Supply V -	9	RS485 Data +
3	Output RS485 Ground	10	RS485 Data -
4	Ground	11	Not connected
5	Output Channel 1 Temperature +	12	Not connected
6	Output Channel 1 Ground	13	Output Channel 3 (not connected)
7	Output Channel 2 RH +	14	Output Channel 3 Ground (not connected)

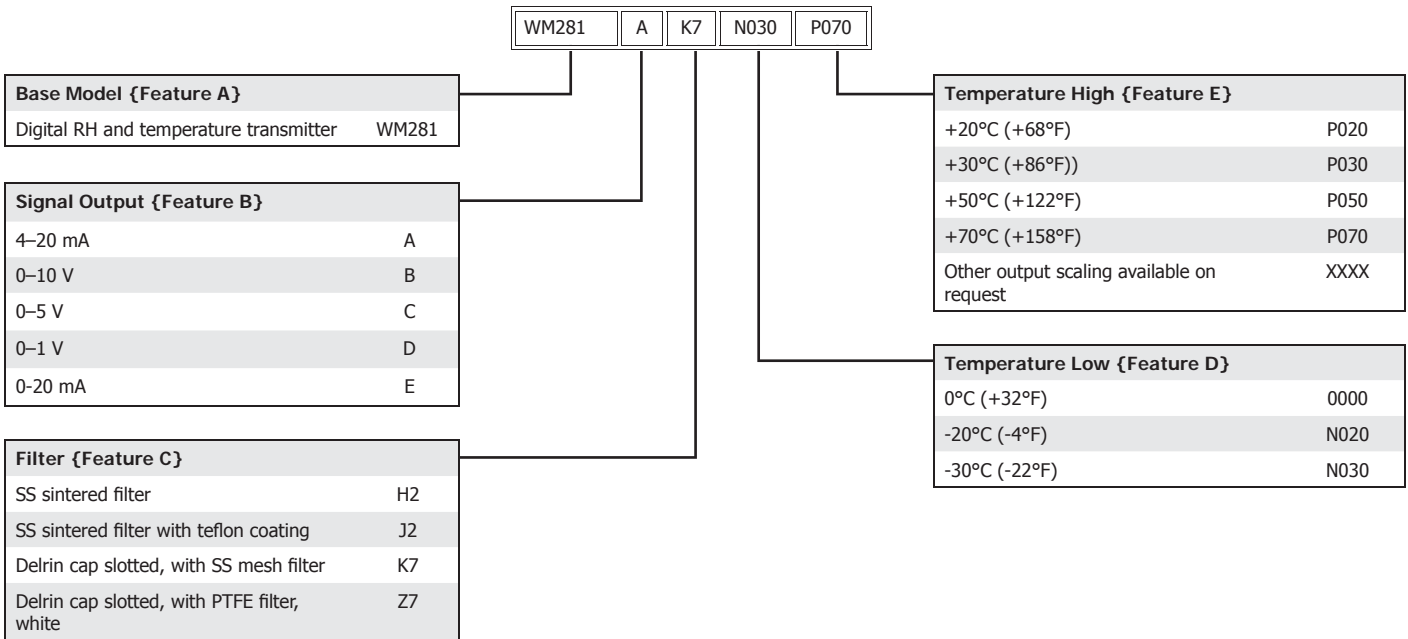
**Do not connect pin 2 (V -) to pin 4 (Ground)**

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}

**Order example:** WM281+A+K7+N030+P070

Digital RH and temperature transmitter WM281, 4-20 mA output, delrin cap slotted with stainless steel mesh filter, temp range -30 to +70°C (-22 to +158°F)



# WM291

## Digital Relative Humidity & Temperature Transmitter, Wall Mount



The WM291 relative humidity transmitter includes the interchangeable Hygrosmart module. The interchangeable module lets you recalibrate the transmitter simply by replacing the sensor head with the Hygrosmart module. As a result, maintenance costs are greatly reduced and down-time is minimized.

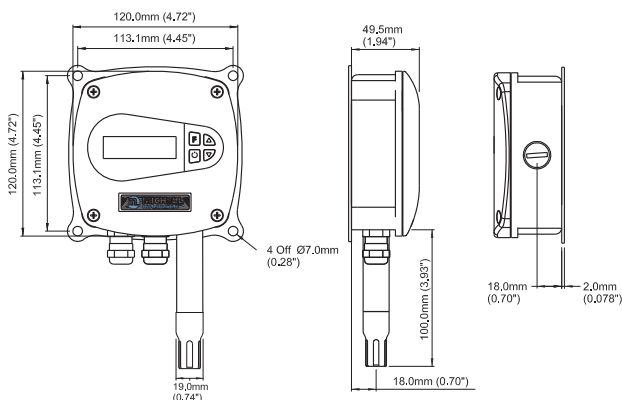
### Highlights

- Three outputs
- Analog and digital output standard
- Based on the interchangeable Hygrosmart module
- Analog output signals selectable through software
- Metric or US measurement units selectable through software
- Available with calculated absolute humidity, dew-point, frost point, mixing ratio or specific enthalpy output

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +70°C (-22 to +158°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5-95% RH)
Accuracy at 23°C (73°F) Temperature	±0.4°C (±0.72°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V 0–20 mA, 4–20 mA, RS485
Supply voltage	15 - 27 V AC / 18 - 38 V DC
Load resistance	Current output: R ≤ 500 Ω
Power consumption	1.7 W
Operating conditions	
Operating temperature	
Probe	-30 to +85°C (-22 to +185°F)
Housing	-20 to +70°C (-4 to +158°F)
Storage	-30 to +70°C (-22 to +158°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Material	
Housing	Aluminum die casting
Probe	Delrin
Dimensions	
Housing	120 x 120 x 49.5mm (4.72 x 4.72 x 1.94")
Probe	L=100mm, ø19mm (L=3.93", ø0.74")
Weight	450g (15.87oz)
Electrical connections	Screw terminals
Display resolution	LCD, 2 lines x 16 characters

### Dimensions



### Accessories and Spare Parts

RS422/485 to PC (RS232) converter	330185
USB cable/software for configuration	F035263
SS sintered filter	H2
SS sintered filter with teflon coating	J2
Delrin cap slotted with SS mesh filter	K7
Delrin cap slotted with PTFE filter, white	Z7
Hygrosmart with Pt100 output (RH = 0-1 V)	I7-0-00-1
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

Electrical Connections

Pin		Pin	
1	Power Supply V +	8	Output Channel 2 Ground
2	Power Supply V -	9	RS485 Data +
3	Output RS485 Ground	10	RS485 Data -
4	Ground	11	Not connected
5	Output Channel 1 Temperature +	12	Not connected
6	Output Channel 1 Ground	13	Output Channel 3 (optional)
7	Output Channel 2 RH +	14	Output Channel 3 Ground (optional)

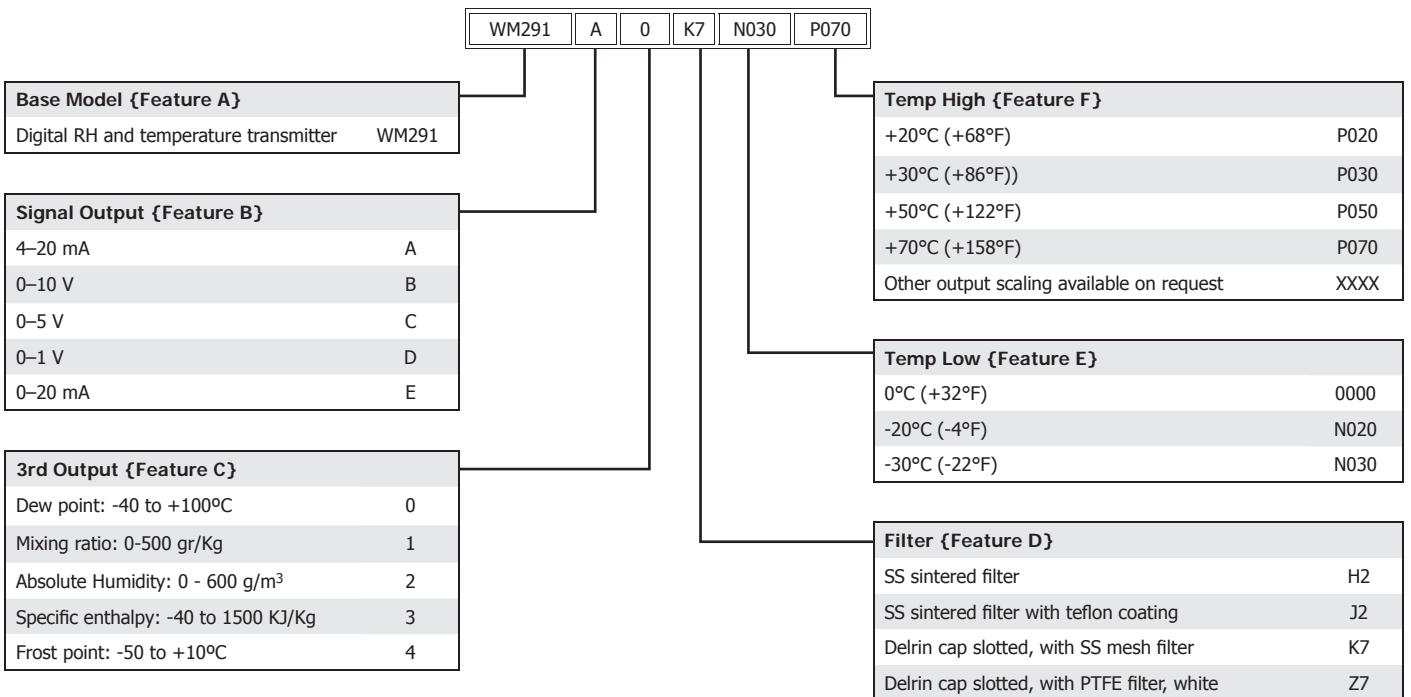
Do not connect pin 2 (V -) to pin 4 (Ground)

Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}

Order example: WM291+A+0+K7+N030+P070

Digital RH and temperature transmitter WM291 for wall-mounting, 4-20 mA output, dp display -40 to +100°C, Delrin cap slotted, with stainless steel mesh filter, temp range -30 to +70°C (-22 to +158°F)



## DT269

## Digital Relative Humidity &amp; Temperature Transmitter, Duct Mount

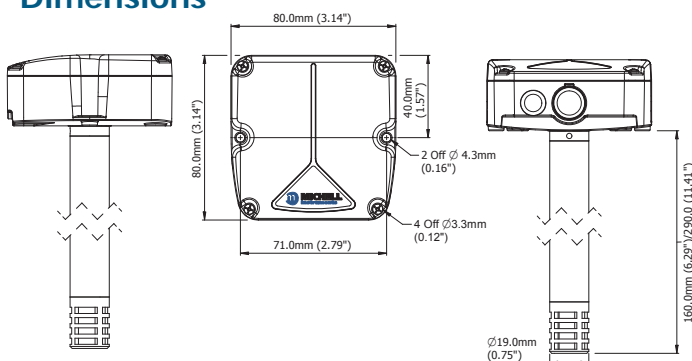


The DT269 transmitter has a I7000 Hygrosmart module. Thanks to this solution, the sensor can be changed on site quickly and simply, providing greatly reduced maintenance costs. The transmitter does not need recalibration after the sensor is changed.

## Highlights

- Designed for accurate measurement in a controlled environment
- Based on the interchangeable Hygrosmart module
- Temperature output scaling configurable on request
- Linearization for a specific isotherm on request

## Dimensions



## Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-20 to +80°C (-4 to +176°F)
Accuracy at 23°C (73°F) Humidity	<math><\pm 2\%</math> RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	Pt100 1/3 DIN direct $\pm 0.2^\circ\text{C}$ ( $\pm 0.36^\circ\text{F}$ )
Stability – RH Sensor	<math><\pm 1\%</math> RH/year
Response time – RH Sensor	<math>< 10</math> sec typical (for 90% of the step change)
Electrical output/input	
Output signal (RH) configurable on request	4–20 mA 0–1, 0–5, 0–10 V
Output signal (T) configurable on request	4–20 mA 3-wire 1/3 DIN Pt100 direct 0–1, 0–5, 0–10 V
Supply voltage	Output 4–20 mA: V+ = 12–30 V DC Output 0–10 V: V+ = 15–30 V DC Output 0–5 V: V+ = 10–30 V DC Output 0–1 V: V+ = 8–30 V DC
Load resistance	Output 4–20 mA: Rload <math>< (V-9) / 0.02</math> Output 0–10 V: R > 10 k $\Omega$ Output 0–5 V: R > 5 k $\Omega$ Output 0–1 V: R > 1 k $\Omega$
Current consumption	2 x 20 mA max
Operating conditions	
Operating temperature	
Probe	-30 to +85°C (-22 to +185°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Material	PPO + POM
Dimensions	
Housing	80 x 80 x 34.5mm (3.14 x 3.14 x 1.35")
Probe	L=85/178mm, $\varnothing 19\text{mm}$ (L=3.35/7.01", $\varnothing 0.75$ ")
Weight	100g (3.53oz)
Electrical connections	Screw terminals

## Accessories and Spare Parts

Al mounting flange for $\varnothing 19\text{mm}$ (0.75") SS probes	FLA019
SS sintered filter	H4
ABS cap slotted with PTFE filter, white	Z2
Hygrosmart without Pt100 output (RH = 0–1 V)	I7-0-00-0
Hygrosmart with Pt100 output (RH = 0–1 V)	I7-0-00-1
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

## Electrical Connections

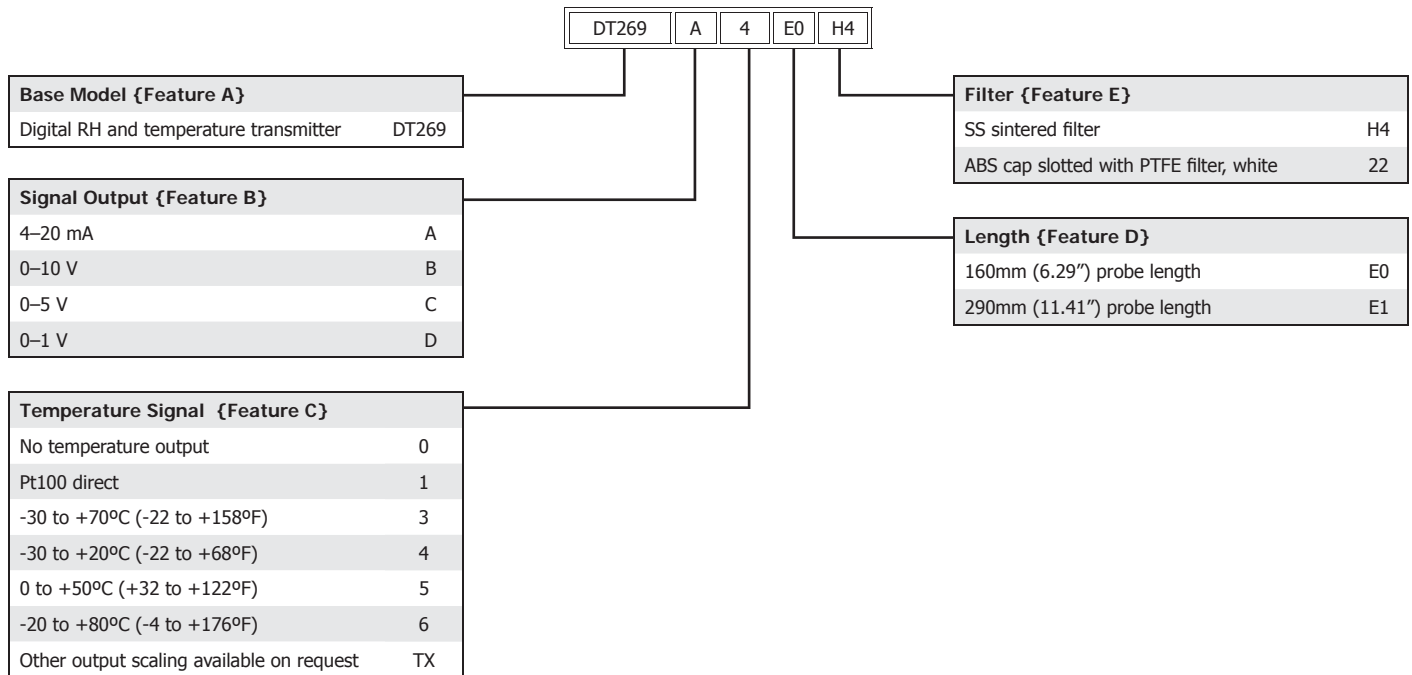
Version mA output and Pt100 direct		Version mA output for RH and Temperature		Version V output and Pt100 direct		Version V output for RH and Temperature	
Pin 1	Output RH +	Pin 1	Output temperature +	Pin 1	Power supply V +	Pin 1	Power supply V +
Pin 2	Output RH -	Pin 2	Output Temperature -	Pin 2	Common ground	Pin 2	Common ground
Pin 3		Pin 3	Output RH +	Pin 3	Output RH +	Pin 3	Output Temperature +
Pin 4		Pin 4	Output RH -	Pin 4		Pin 4	Output RH +
Pin 5		<b>Warning:</b> Temperature channels Pin 1 and Pin 2 must be powered always		Pin 5		Output RH -	

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}

**Order example:** DT269+A+4+E0+H4

Digital RH and temperature transmitter DT269, 4-20 mA output, -30 to +20°C (-22 to +68°F) temp range, 160mm (6.30") probe length, stainless steel sintered filter



# DT722

## Rugged Industrial Relative Humidity and Temperature Transmitter, Duct Mount



The DT722 is a rugged industrial relative humidity and temperature transmitter designed for process applications where accurate, stable measurement and control of humidity and temperature is required.

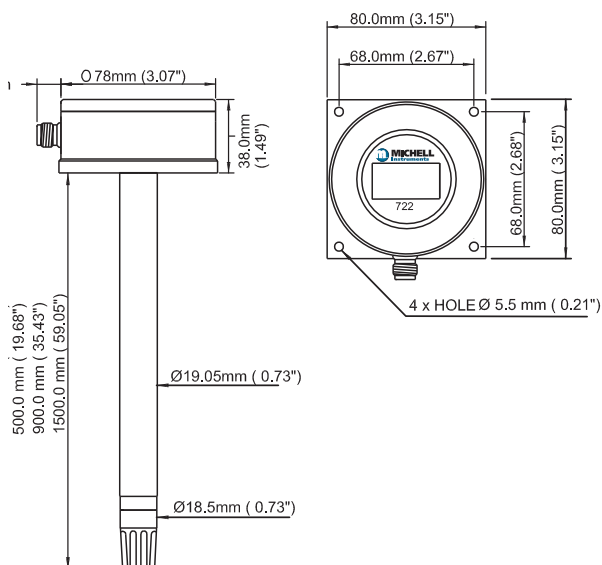
### Highlights

- Designed for accurate measurement in a harsh environment
- Can withstand temperatures up to 150°C (300°F)
- Stainless steel housing
- Calculated moisture signal output, optional

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-40 to +150°C (-40 to +302°F)
Accuracy at 25°C (77°F) Humidity	<±2% RH (5-95% RH)
Accuracy at 25°C (77°F) Temperature	±0.2°C (±0.36°F) typical
Stability – RH Sensor	±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	4–20 mA
Supply voltage	8–35 V DC
Supply voltage influence	±0.01% RH/V typical
Operating conditions	
Operating temperature	
Probe	-40 to +150°C (-40 to +302°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +75°C (-40 to +167°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Housing material	Stainless steel
Weight	200mm: 800g (7.87": 28.22oz) 300mm: 900g (11.81": 31.75oz) 500mm: 1040g (19.69": 2.29lb)
Electrical connections	4 pin, M12

### Dimensions



### Accessories and Spare Parts

19mm (0.75") Slotted protection cap black	A000002
19mm (0.75") PVDF filter	A000014
19mm (0.75") PVDF filter w/ protection cap black	A000015
19mm (0.75") Mesh filter w/ protection cap black	A000021
19mm (0.75") Arrow SS sintered filter 5µm / 10µm / 20µm	A000025/26/27
19mm (0.75") connector, no cable, w/screw terminal	A000030
19mm (0.75") Connector, with cable (customer spec length)	A000030XM
19mm (0.75") connector with 2m (6.5') cable	A000031
19mm (0.75") connector with 5m (16') cable	A000032
19mm (0.75") Foil filter 2µm w/protection cap black	A000040
19mm (0.75") Oleophobic foil filter 0.7µm with protection cap black	A000042
19mm (0.75") Foil filter 1.5µm w/protection cap black	A000044
3/4" NPT SS adj. fitting for SS probes	A000100
Al mounting flange for Ø19mm (0.75") SS probes (outside Ø80mm (3.15"))	A000110
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC



## Electrical Connections

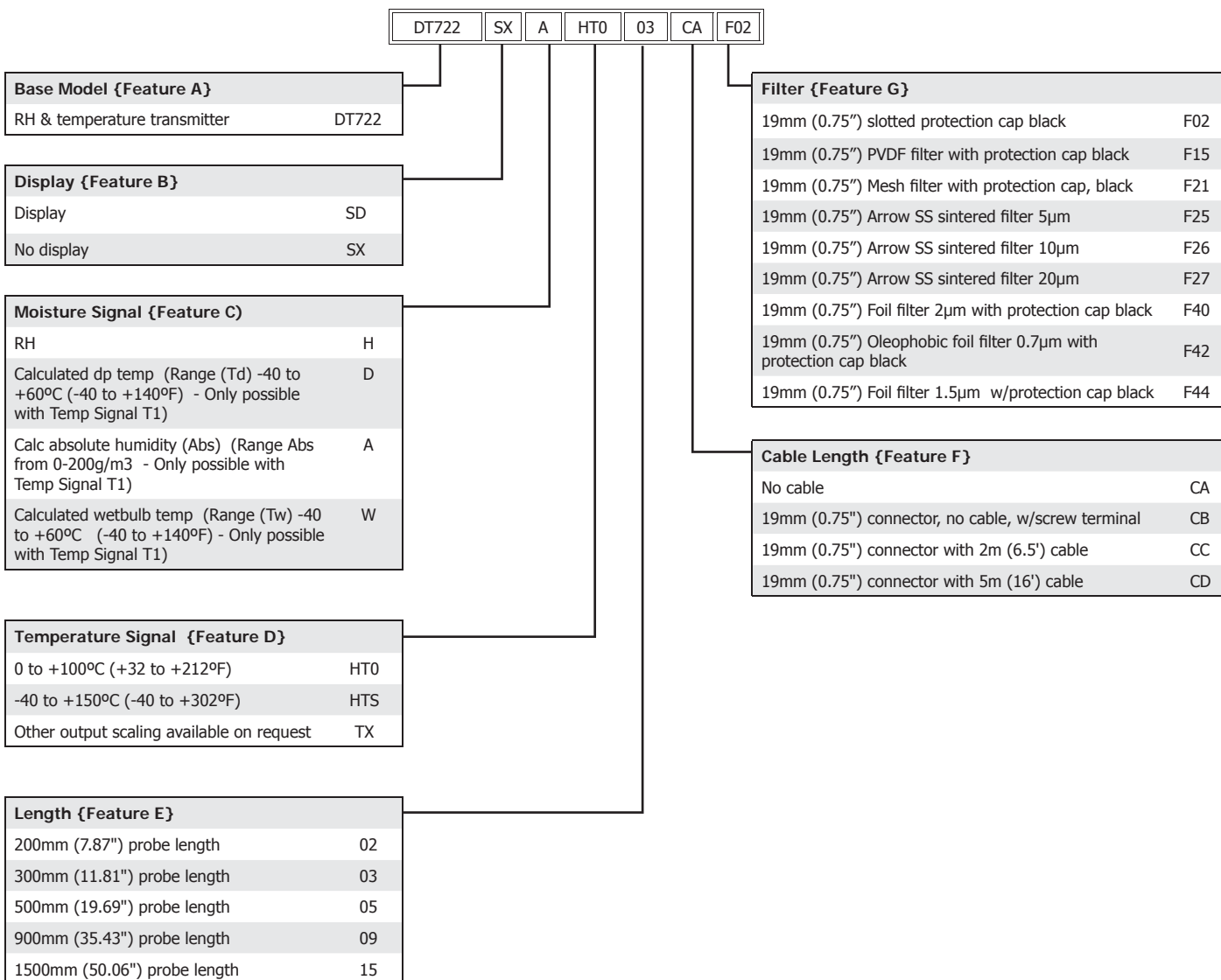
Connections		
Cable	Pin	
White	Pin 1	Output RH +
Brown	Pin 3	Output RH -
Green	Pin 4	Output T +
Yellow	Pin 2	Output T -
Connect RH + with T + by user		

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}+{Feature G}

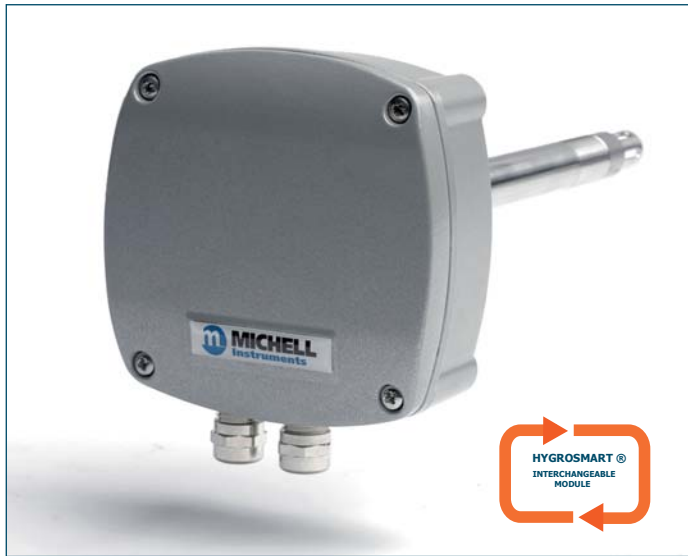
**Order example:** DT722+SX+A+HT0+03+CA+F02

RH & temperature transmitter DT722, no display, Output 1 - calc absolute humidity, Output 2 - temp output 0 to +100°C (+32 to +212°F), 300mm (11.81") probe length, no cable, 19mm slotted protection cap black



# DT282

## Digital Relative Humidity and Temperature Transmitter - Duct Mount



The DT282 relative humidity transmitter includes the interchangeable Hygrosmart module. The interchangeable module lets you recalibrate the transmitter simply by replacing the sensor head with the Hygrosmart module. As a result, maintenance costs are greatly reduced and down-time is minimized.

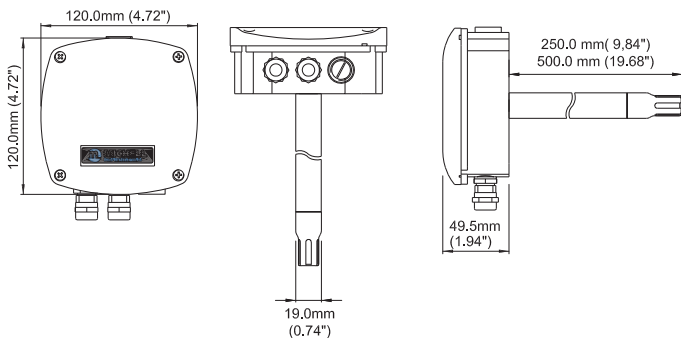
### Highlights

- Analog and digital output standard
- Based on the interchangeable Hygrosmart module
- Analog output signals selectable through software
- Metric or US measurement units selectable through software

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +70°C (-22 to +158°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.4°C (±0.72°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V 0–20 mA, 4–20 mA, RS485
Supply voltage	15 - 27 V AC / 18 - 38 V DC
Load resistance	Current output: R ≤ 500 Ω
Power consumption	1.7 W
Operating conditions	
Operating temperature	
Probe	-30 to +85°C (-22 to +185°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP67
Material	
Housing	Aluminum die casting
Probe	Stainless steel AISI 316
Dimensions	
Housing	120 x 120 x 49.5mm (4.72 x 4.72 x 1.94")
Probe	L=250/500mm ø19mm (L=9.84/19.68" ø0.74")
Weight	450g (15.87oz)
Electrical connections	Screw terminals

### Dimensions



### Accessories and Spare Parts

RS422/485 to PC (RS232) converter	<b>330185</b>
USB cable/software for configuration	<b>F035263</b>
Al mounting flange for ø19mm (0.75") SS probes	<b>FLA019</b>
SS sintered filter	<b>H2</b>
SS sintered filter with teflon coating	<b>J2</b>
AISI 316 cap slotted with SS mesh filter	<b>K6</b>
SS cap slotted with PTFE filter	<b>Z6</b>
Hygrosmart with Pt100 output (RH = 0-1 V)	<b>I7-0-00-1</b>
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	<b>HKC</b>

Electrical Connections

Pin		Pin	
1	Power Supply V +	8	Output Channel 2 Ground
2	Power Supply V -	9	RS485 Data +
3	Output RS485 Ground	10	RS485 Data -
4	Ground	11	Not connected
5	Output Channel 1 Temperature +	12	Not connected
6	Output Channel 1 Ground	13	Output Channel 3 (not connected)
7	Output Channel 2 RH +	14	Output Channel 3 Ground (not connected)

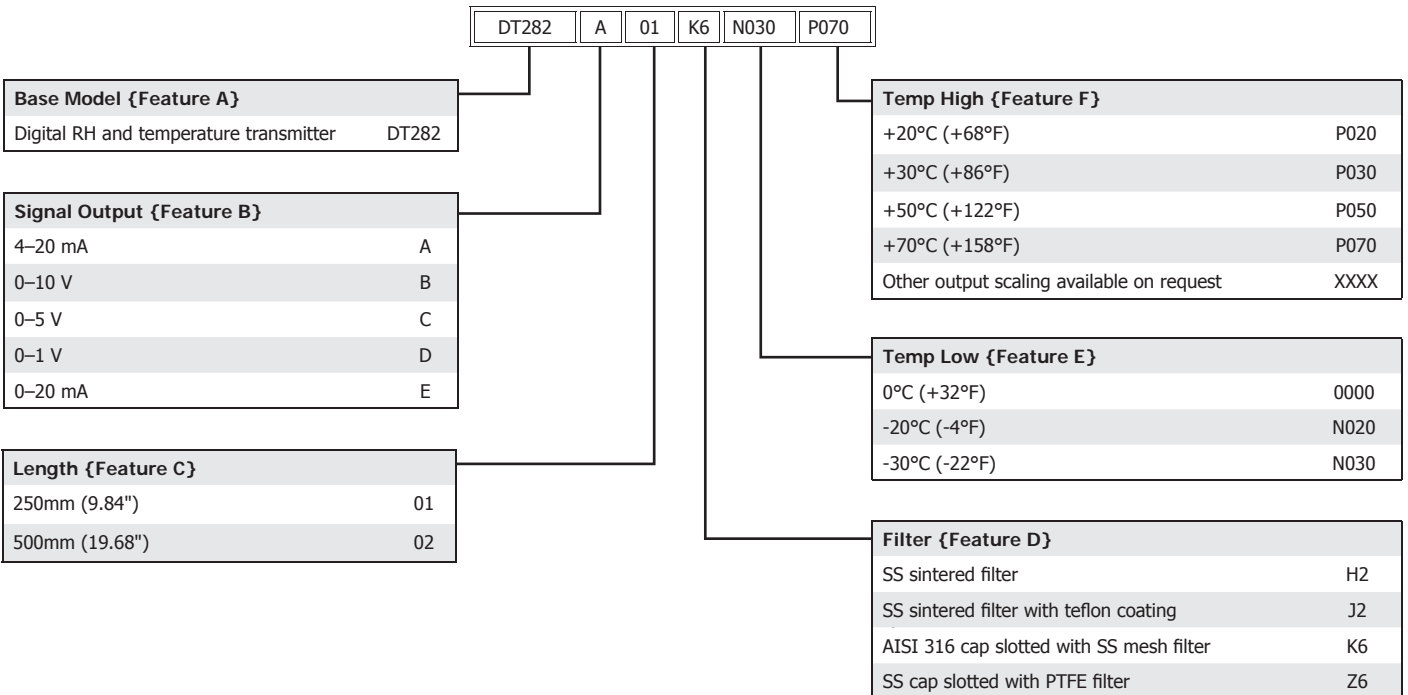
**Do not connect pin 2 (V -) to pin 4 (Ground)**

Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}

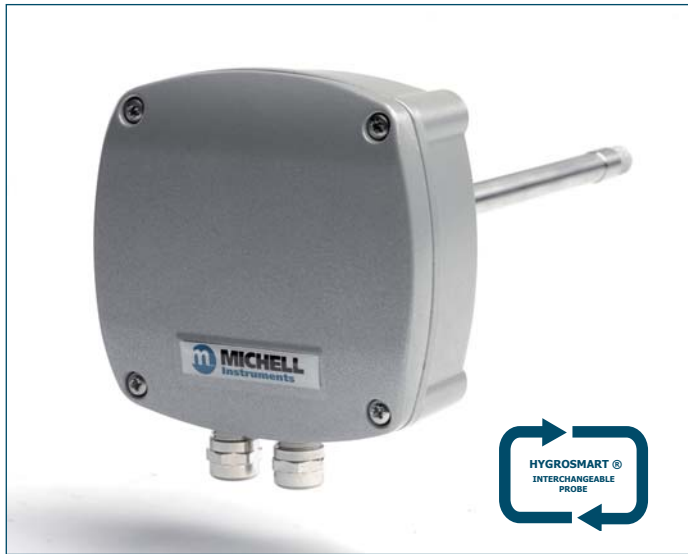
**Order example:** DT282+A+01+K6+N030+P070

Digital RH and temperature transmitter DT282, 4-20 mA output, stainless steel probe 250mm (9.84"), AISI 316 cap slotted with stainless steel mesh filter, temp range -30 to +70°C (-22 to +158°F)



# DT284

## Digital Relative Humidity and Temperature Transmitter - Duct Mount



The DT284 relative humidity transmitter uses the Hygrosmart module, integrated in the interchangeable probe. This device can be used in high-temperature applications due to the remote placing of the measurement element and its small overall size.

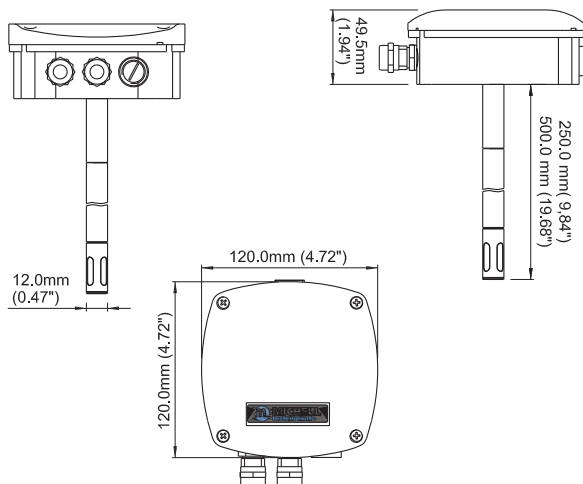
### Highlights

- 12mm (0.47") probe diameter
- Analog and digital output standard
- Interchangeable probe
- Analog output signals selectable through software
- Metric or US measurement units selectable through software
- Can withstand temperatures up to 140°C (284°F)

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +140°C (-22 to +284°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.4°C (±0.72°F)
Stability – RH Sensor	±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V 0–20 mA, 4–20 mA, RS485
Supply voltage	15 - 27 V AC / 18 - 38 V DC
Load resistance	Current output: R ≤ 500 Ω
Power consumption	1.7 W
Operating conditions	
Operating temperature	-30 to +140°C (-22 to +284°F)
Probe	-30 to +70°C (-22 to +158°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP67
Material	
Housing	Aluminum die casting
Probe	Stainless steel
Dimensions	
Housing	120 x 120 x 49.5mm (4.72 x 4.72 x 1.94")
Probe	L=250/500mm ø12mm (L=9.84/19.68" ø0.47")
Weight	450g (15.87oz)
Electrical connections	Screw terminals

### Dimensions



### Accessories and Spare Parts

SS probe 250mm (9.84"), SS cover & mesh filter	USTE003
SS probe 500mm (19.69"), SS cover & mesh filter	USTE010
SS probe 250mm (9.84"), SS cover & sinter filter	USTE011
SS probe 500mm (19.69"), SS cover & sinter filter	USTE012
PEEK probe 250mm (9.84") & cover, SS mesh filter	USTE013
PEEK probe 500mm (19.69") & cover, SS mesh filter	USTE014
RS422/485 to PC (RS232) converter	330185
USB cable/software for configuration	F035263
Al mounting flange for ø12mm (0.47") SS probes	FLA012
SS sintered filter	H3
SS sintered filter with teflon coating	J3
SS mesh filter	K8
PEEK protection cap with SS mesh filter	K9
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

Electrical Connections

Pin		Pin	
1	Power Supply V +	8	Output Channel 2 Ground
2	Power Supply V -	9	RS485 Data +
3	Output RS485 Ground	10	RS485 Data -
4	Ground	11	Not connected
5	Output Channel 1 Temperature +	12	Not connected
6	Output Channel 1 Ground	13	Output Channel 3 (not connected)
7	Output Channel 2 RH +	14	Output Channel 3 Ground (not connected)

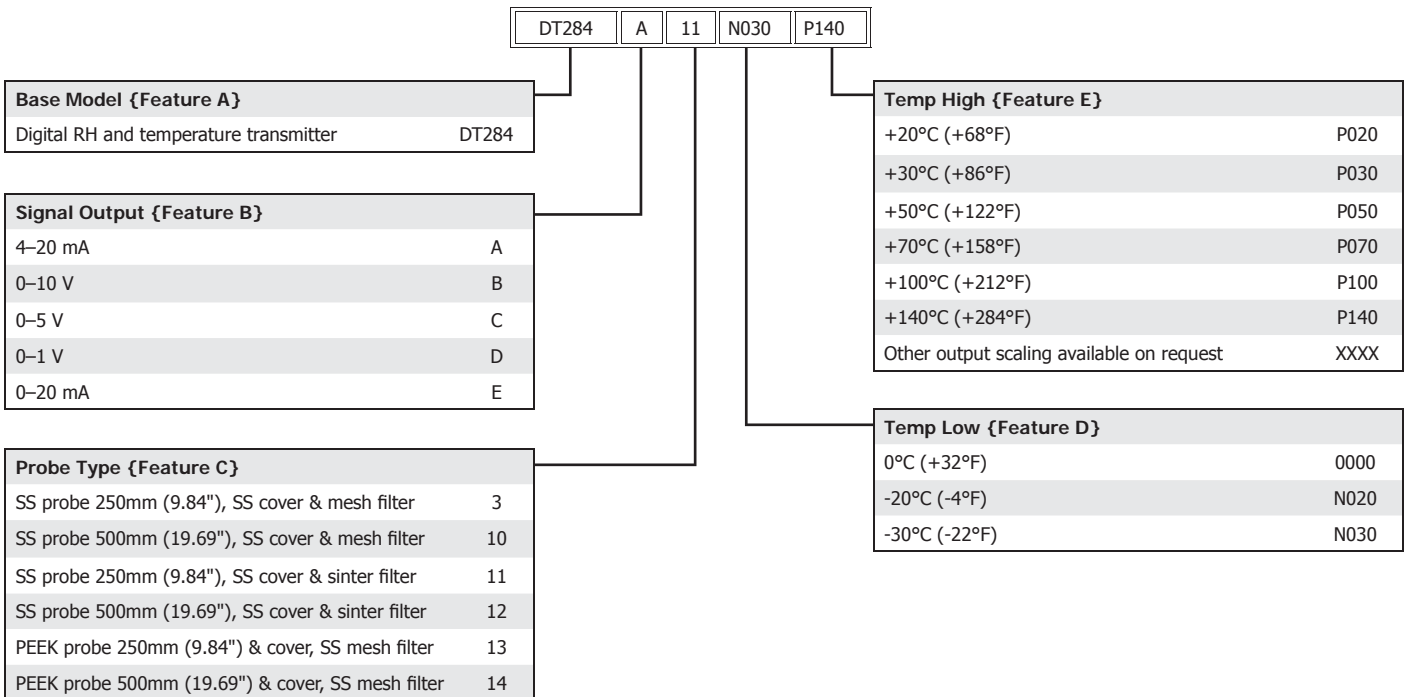
Do not connect pin 2 (V -) to pin 4 (Ground)

Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}

Order example: DT284+A+11+N030+P140

Digital RH and temperature transmitter DT284, 4-20 mA output, stainless steel probe 250mm (9.84"), stainless steel cover and sintered filter, temp range -30 to +140°C (-22 to +284°F)



# WR283

## Digital Relative Humidity and Temperature Transmitter - Remote Probe for High Temperatures



The WR283 relative humidity sensor uses the Hygrosmart module, integrated in the interchangeable probe and cable. This device can be used in high-temperature applications thanks to the remote placing of the measurement element and its small overall size. The interchangeable probe allows for simple recalibration and lower maintenance costs.

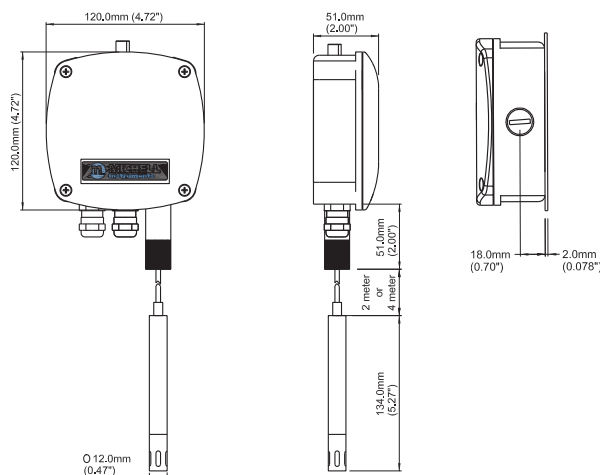
### Highlights

- Analog and digital output standard
- Interchangeable probe
- Analog output signals selectable through software
- Metric or US measurement units selectable through software
- Can withstand temperatures up to 200°C (392°F)

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +200°C (-22 to +392°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.4°C (±0.72°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V 0–20 mA, 4–20 mA, RS485
Supply voltage	15 - 27 V AC / 18 - 38 V DC
Load resistance	Current output: R ≤ 500 Ω
Power consumption	1.7 W
Operating conditions	
Operating temperature	
Probe	-30 to +200°C (-22 to +392°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP67
Material	
Housing	Aluminum die casting
Probe	Stainless steel
Dimensions	
Housing	120 x 120 x 51mm (4.72 x 4.72 x 2.00")
Probe	L=134mm, ø12mm (L=5.27", ø0.47")
Weight	450g (15.87oz)
Electrical connections	Screw terminals

### Dimensions



### Accessories and Spare Parts

RS422/485 to PC (RS232) converter	330185
USB cable/software for configuration	F035263
Al mounting flange for ø12mm (0.47") SS probes	FLA012
SS sintered filter	H3
SS sintered filter with teflon coating	J3
SS mesh filter	K8
PEEK protection cap with SS mesh filter	K9
SS probe, cover & mesh filter, 2m (6.56') cable	USTE002
SS probe, cover & mesh filter, 2m + 2m extension (6.56' + 6.56') cable	USTE005
SS probe, cover & sinter filter, 2m (6.56') cable	USTE006
SS probe, cover & sinter filter, 2m + 2m extension (6.56' + 6.56') cable	USTE007
PEEK probe, cover, SS mesh filter, 2m (6.56') cable	USTE008
PEEK probe, cover, SS mesh filter, 2m + 2m extension (6.56' + 6.56') cable	USTE009
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

## Electrical Connections

Pin		Pin	
1	Power Supply V +	8	Output Channel 2 Ground
2	Power Supply V -	9	RS485 Data +
3	Output RS485 Ground	10	RS485 Data -
4	Ground	11	Not connected
5	Output Channel 1 Temperature +	12	Not connected
6	Output Channel 1 Ground	13	Output Channel 3 (not connected)
7	Output Channel 2 RH +	14	Output Channel 3 Ground (not connected)

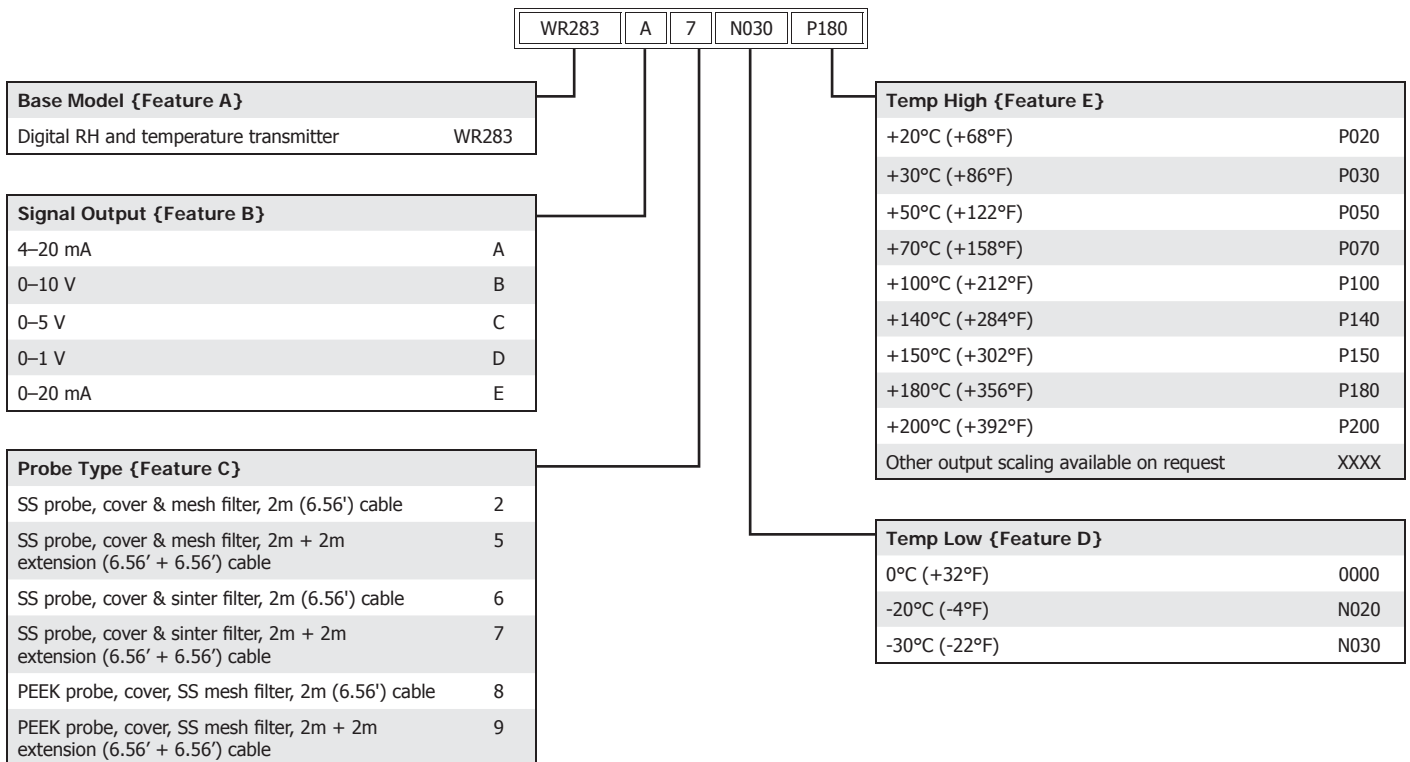
Do not connect pin 2 (V -) to pin 4 (Ground)

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}

**Order example:** WR283+A+7+N030+P180

Digital RH and temperature transmitter WR283 with 4-20 mA output, stainless steel probe with 2m + 2m extension (6.56' + 6.56') cable and stainless steel sintered filter, temp range -30 to +180°C (-22 to +356°F)



# WR285

## Digital Relative Humidity Transmitter - Remote Probe for Pressurized Applications up to 30 bar (400 psi)



The WR285 relative humidity sensor uses the Hygrosmart module, integrated in the interchangeable probe. This device can be used in high-temperature applications due to the remote measurement element and its small overall size. The interchangeable probe allows for simple recalibration and lower maintenance costs.

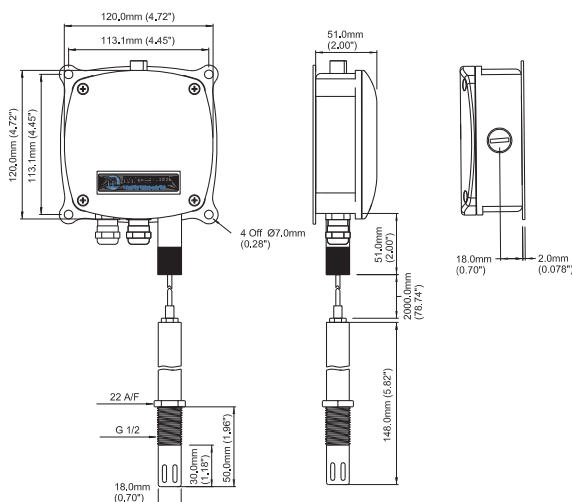
### Highlights

- Up to 30 bar (400 psi) pressure
- Analog and digital output standard
- Interchangeable probe
- Analog output signals selectable through software
- Metric or US measurement units selectable through software
- Can withstand temperatures up to 120°C (248°F)

### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Accuracy at 25°C (77°F) Humidity	<±2% RH (5–95% RH)
Stability – RH Sensor	±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V 0–20 mA, 4–20 mA, RS485
Supply voltage	15 - 27 V AC / 18 - 38 V DC
Load resistance	Current output: R ≤ 500 Ω
Power consumption	1.7 W
Operating conditions	
Operating temperature	
Probe	-30 to +120°C (-22 to +248°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP67
Material	
Housing	Aluminum die casting
Probe	Stainless steel
Dimensions	
Housing	120 x 120 x 51mm (4.72 x 4.72 x 2.00")
Probe	L=148mm, ø18mm (L=5.82", ø0.70")
Weight	450g (15.87oz)
Electrical connections	Screw terminals

### Dimensions



### Accessories and Spare Parts

RS422/485 to PC (RS232) converter	<b>330185</b>
USB cable/software for configuration	<b>F035263</b>
SS interchangeable probe with 2m (6.56') cable	<b>USTE015</b>
SS cap slotted with mesh filter	<b>K1</b>
SS cap slotted with PTFE filter	<b>Z1</b>
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	<b>HKC</b>



## Electrical Connections

Pin		Pin	
1	Power Supply V +	8	Output Channel 2 Ground
2	Power Supply V -	9	RS485 Data +
3	Output RS485 Ground	10	RS485 Data -
4	Ground	11	Not connected
5	Not connected	12	Not connected
6	Not connected	13	Output Channel 3 (not connected)
7	Output Channel 2 RH +	14	Output Channel 3 Ground (not connected)

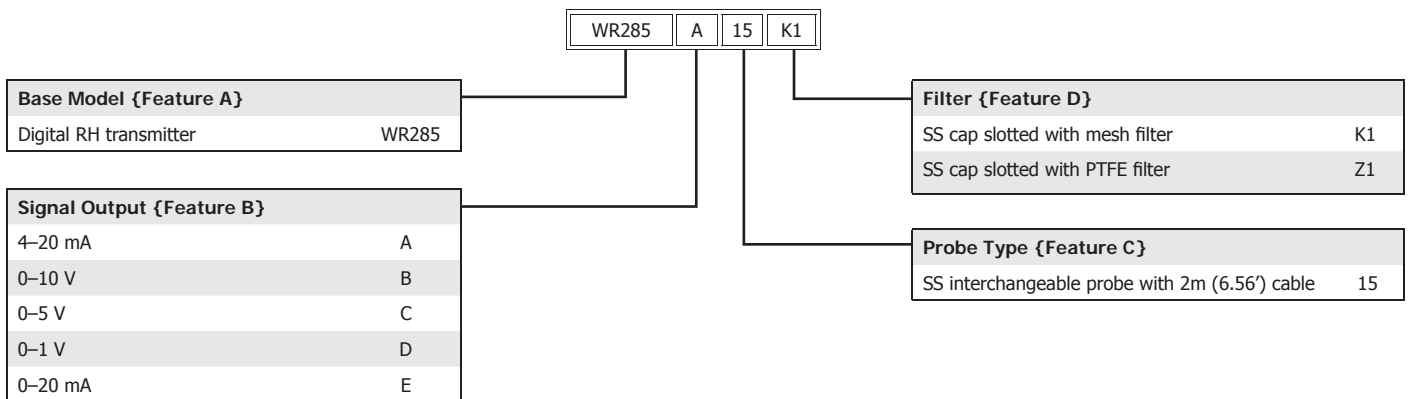
Do not connect pin 2 (V -) to pin 4 (Ground)

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}

**Order example:** WR285+A+15+K1

Digital RH transmitter WR285, 4-20 mA output, stainless steel probe with 2m (6.56') cable, stainless steel cap with mesh filter



# WR293

## Digital Relative Humidity and Temperature Transmitter - Remote Probe for High Temperatures

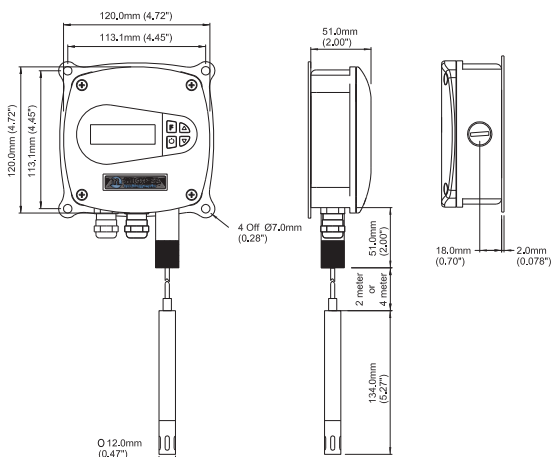


The WR293 relative humidity transmitter uses the Hygrosmart module, integrated in the interchangeable probe. This device can be used in high-temperature applications due to the remote measurement element and its small overall size. The interchangeable probe allows for simple recalibration and lower maintenance costs.

### Highlights

- Three outputs
- Analog and digital output standard
- Interchangeable probe
- Analog output signals selectable through software
- Metric or US measurement units selectable through software
- Available with calculated absolute humidity, dew-point, frost point, mixing ratio or specific enthalpy output
- Can withstand temperatures up to 200°C (392°F)

### Dimensions



### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +200°C (-22 to +392°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.4°C (±0.72°F)
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal	0–1, 0–5, 0–10 V 0–20 mA, 4–20 mA, RS485
Supply voltage	15 - 27 V AC / 18 - 38 V DC
Load resistance	Current output: R ≤ 500 Ω
Power consumption	1.7 W
Operating conditions	
Operating temperature	
Probe	-30 to +200°C (-22 to +392°F)
Housing	-30 to +70°C (-22 to +158°F)
Storage	-40 to +70°C (-40 to +158°F)
Mechanical specification	
Ingress protection	IP65 (NEMA 4 level)
Material	
Housing	Aluminum die casting
Probe	Stainless steel
Dimensions	
Housing	120 x 120 x 51mm (4.72 x 4.72 x 2.00")
Probe	L=134mm, ø12mm (L=5.27", ø0.47")
Weight	450g (15.87oz)
Electrical connections	Screw terminals
Display resolution	LCD, 2 lines x 16 characters

### Accessories and Spare Parts

RS422/485 to PC (RS232) converter	330185
USB cable/software for configuration	F035263
Al mounting flange for ø12mm (0.47") SS probes	FLA012
SS sintered filter	H3
SS sintered filter with teflon coating	J3
SS mesh filter	K8
PEEK protection cap with SS mesh filter	K9
SS probe, cover & mesh filter, 2m (6.56') cable	USTE002
SS probe, cover & mesh filter, 2m + 2m extension (6.56' + 6.56') cable	USTE005
SS probe, cover & sinter filter, 2m (6.56') cable	USTE006
SS probe, cover & sinter filter, 2m + 2m extension (6.56' + 6.56') cable	USTE007
PEEK probe, cover, SS mesh filter, 2m (6.56') cable	USTE008
PEEK probe, cover, SS mesh filter, 2m + 2m extension (6.56' + 6.56') cable	USTE009
You can check your hygrometer with the Control Kit HKC which is based on the principle of non-saturated salt solutions. Refer to technical data sheet CONTROL KIT	HKC

Issue No: WR293\_97194\_V3\_UK\_0811

## Electrical Connections

Pin		Pin	
1	Power Supply V +	8	Output Channel 2 Ground
2	Power Supply V -	9	RS485 Data +
3	Output RS485 Ground	10	RS485 Data -
4	Ground	11	Not connected
5	Output Channel 1 Temperature +	12	Not connected
6	Output Channel 1 Ground	13	Output Channel 3 (optional)
7	Output Channel 2 RH +	14	Output Channel 3 Ground (optional)

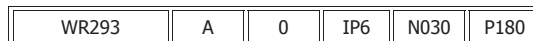
Do not connect pin 2 (V -) to pin 4 (Ground)

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}

**Order example:** WR293+A+0+IP6+N030+P180

Digital RH and temperature transmitter WR293, 4-20 mA output, dew point calculated, stainless steel probe with 2m (6.56') cable and stainless steel sintered filter, -30 to +180°C (-22 to +356°F) temp range



Base Model {Feature A}	
Digital RH and temperature transmitter - Remote Probe for High Temperatures	WR293

Signal Output {Feature B}	
4-20 mA	A
0-10 V	B
0-5 V	C
0-1 V	D
0-20 mA	E

3rd Output {Feature C}	
Dew point: -40 to +100°C	0
Mixing ratio: 0-500 gr/Kg	1
Absolute Humidity: 0-600 g/m <sup>3</sup>	2
Specific enthalpy: -40 to 1500 KJ/Kg	3
Frost point: -50 to +10°C	4

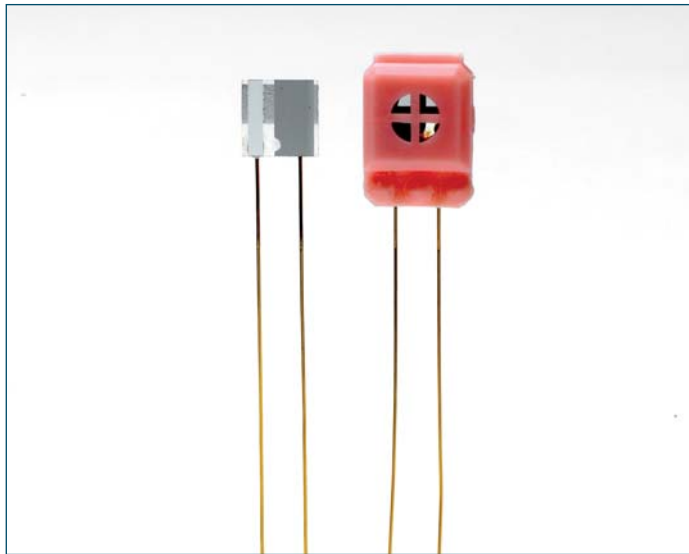
Temp High {Feature F}	
+20°C (+68°F)	P020
+30°C (+86°F)	P030
+50°C (+122°F)	P050
+70°C (+158°F)	P070
+100°C (+212°F)	P100
+140°C (+284°F)	P140
+150°C (+302°F)	P150
+180°C (+356°F)	P180
+200°C (+392°F)	P200
Other output scaling available on request	XXXX

Temp Low {Feature E}	
0°C (+32°F)	0000
-20°C (-4°F)	N020
-30°C (-22°F)	N030

Probe Type {Feature D}	
SS probe, cover & mesh filter, 2m (6.56') cable	IP2
SS probe, cover & mesh filter, 2m + 2m extension (6.56' + 6.56') cable	IP5
SS probe, cover & sinter filter, 2m (6.56') cable	IP6
SS probe, cover & sinter filter, 2m + 2m extension (6.56' + 6.56') cable	IP7
PEEK probe, cover, SS mesh filter, 2m (6.56') cable	IP8
PEEK probe, cover, SS mesh filter, 2m + 2m extension (6.56' + 6.56') cable	IP9

# H5000 & 5100

## Capacitive Relative Humidity Sensor

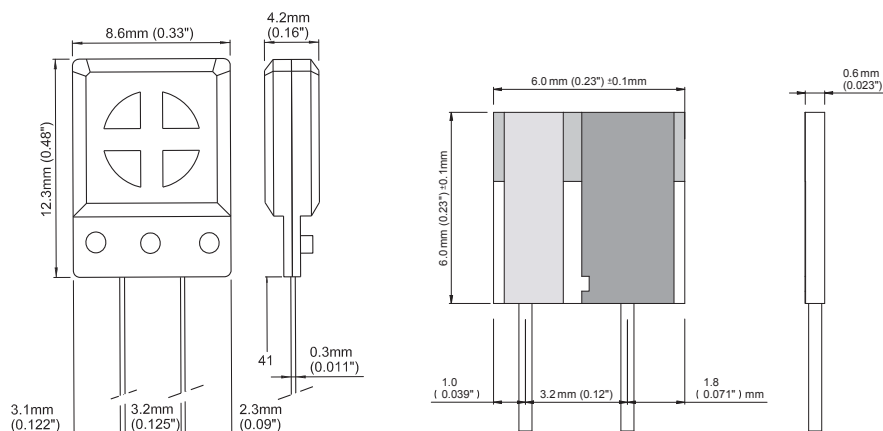


The operating principle of these capacitive relative humidity sensors are based on the hygroscopic properties of their polymer, which is used like a dielectric in a capacitor. The polymer gets in equilibrium with its humid environment quickly, and reversibly, and changes its capacity value depending on the humidity level.

### Highlights

- Capacitive thin film sensor
- Measuring range: RH 0–100%, Temp: -30 to +200°C (-22 to +365°F)
- Mixing ratio: 250g (8.82oz) water/kg of dry air
- Low hysteresis
- Response time: 4 seconds

### Dimensions



### Technical Specifications

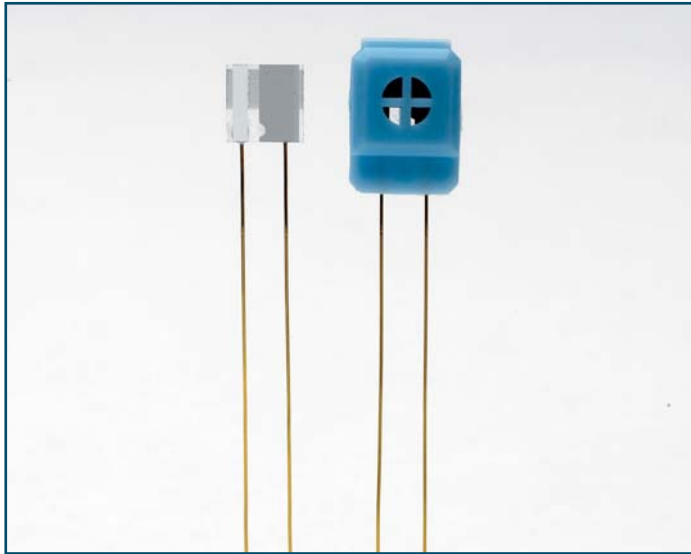
	H5000	H5100
<b>Response time</b> 90% of scale for a step change from 11% to 75% RH	4 sec	4 sec
<b>Operating range</b> Humidity Temperature	0–100% RH -30 to +200°C (-22 to +392°F)	0–100% RH -30 to +100°C (-22 to +212°F)
Pressure	0.04–30 bar (0.6–400 psi)	0.04–30 bar (0.6–400 psi)
<b>Mixing ratio</b>	250g (8.82oz) water/Kg dry air	
<b>Nominal capacity</b> 75% RH @ 23°C (73°F)	500 pF ± 10%	
<b>Sensitivity</b> 11–75% RH @ 23°C (73°F)	0.86 pF / % RH	
<b>Linearity</b> 11–90% RH @ 23°C (73°F)	± 2.5% RH	
<b>Long term stability</b> (12 months) control @ 11% RH	< 1% at 23°C (73°F)	
<b>Maximum air speed</b> (without protection)	< 20m/sec	
<b>Hysteresis</b>	Typical value = 0.5% RH	
<b>D Factor loss tangent @10 KHz</b> 75% RH @ 23°C (73°F)	Typical value = 0.007	
<b>Supply voltage</b> Peak-to-peak	2.5 V AC DC component < 0.2 V	
<b>Operating frequency range</b>	5–300 KHz	
<b>Protection cap</b>	No	Yes
<b>Weight</b>	0.1g (0.0004oz)	1g (0.035oz)

### Order Codes

H5-000 without protective housing	<b>Minimum order 50 pieces</b>
H5-100 with protective housing	<b>Minimum order 50 pieces</b>

# H6000 & 6100

## Capacitive Relative Humidity Sensor



The operating principle of capacitive relative humidity sensors are based on the hygroscopic properties of their polymer, which is used like a dielectric in a capacitor. The polymer gets in equilibrium with its humid environment quickly, and reversibly, and changes its capacity value depending on the humidity level.

### Highlights

- Suitable for corrosive atmosphere
- Teflon coated
- Capacitive thin film sensor
- Measuring range: 0–100% RH, Temp: -30 to +200°C (-22 to +365°F)
- Mixing ratio: 250g (8.82oz) water/kg of dry air
- Low hysteresis
- Response time: 20 seconds

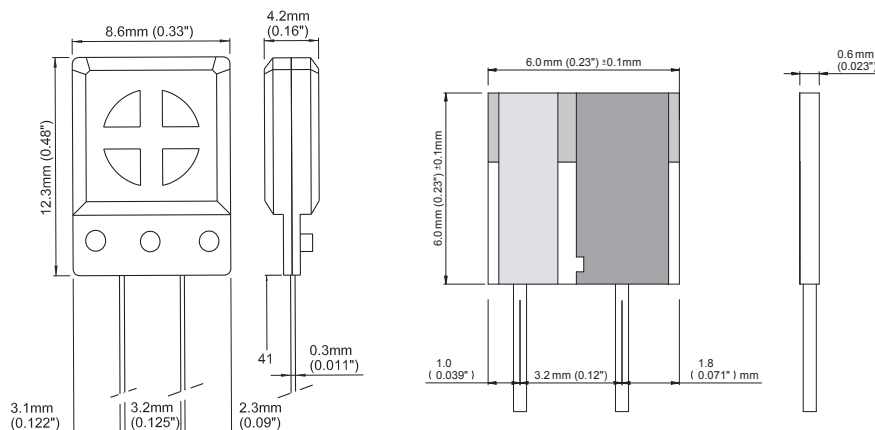
### Technical Specifications

	H6000	H6100
<b>Response time</b> 90% of scale for a step change from 11 to 75% RH	20 sec	20 sec
<b>Operating range</b> Humidity Temperature	0–100% RH -30 to +200°C (-22 to +392°F)	0–100% RH -30 to +100°C (-22 to +212°F)
Pressure	0.04–30 bar (0.6–400 psi)	0.04–30 bar (0.6–400 psi)
<b>Mixing ratio</b>	250g (8.82oz) water/Kg dry air	
<b>Nominal capacity</b> 75% RH @ 23°C (73°F)	500 pF ± 10%	
<b>Sensitivity</b> 11–75% RH @ 23°C (73°F)	0.86 pF / % RH	
<b>Linearity</b> 11–90% RH @ 23°C (73°F)	± 2.5% RH	
<b>Long term stability</b> (12 months) control @ 11% RH	< 1% at 23°C (73°F)	
<b>Max. air speed</b> (without protection)	< 20m/sec	
<b>Hysteresis</b>	Typical value = 0.5% RH	
<b>D Factor loss tangent @10 KHz</b> 75% RH @ 23°C (73°F)	Typical value = 0.007	
<b>Supply voltage</b> Peak-to-peak	2.5 V AC DC component < 0.2 V	
<b>Operating frequency range</b>	5/300 KHz	
<b>Protection cap</b>	No	Yes
<b>Weight</b>	0.1g (0.0004oz)	1g (0.035oz)

### Order Codes

H6-000 without protective housing	<b>Minimum order 50 pieces</b>
H6-100 with protective housing	<b>Minimum order 50 pieces</b>

### Dimensions



# I7000 & 7400 (Hygrosmart)

## Interchangeable Module for Relative Humidity

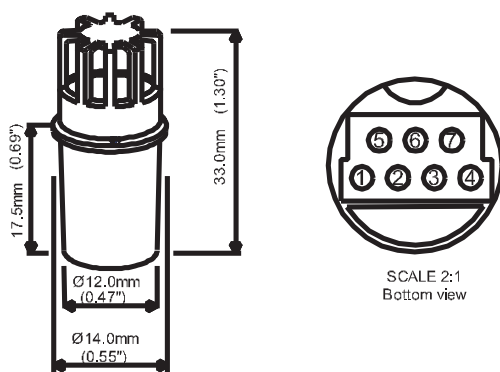


The I7000 (Hygrosmart) Series is interchangeable without the need for recalibration. The small size allows its integration in any equipment while the plug-and-play system allows fast replacement even by non-skilled staff.

### Highlights

- Interchangeable without recalibration
- Sensor response time: <10sec
- Linearization for a specific isotherm on request
- Can be used up to peak temperatures of 95°C (200°F)

### Dimensions

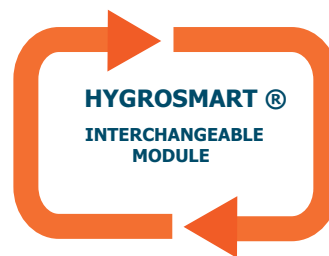


### Technical Specifications

Performance	
Measurement range (RH)	0–100% RH
Measurement range (T)	-30 to +85°C (-22 to +185°F)
Accuracy at 23°C (73°F) Humidity	<±2% RH (5–95% RH)
Accuracy at 23°C (73°F) Temperature	±0.2°C (±0.36°F) Pt100 1/3 DIN direct
Stability – RH Sensor	<±1% RH/year
Response time – RH Sensor	<10 sec typical (for 90% of the step change)
Electrical output/input	
Output signal (RH)	I7000: 0–1 V I7400: 0.2–1 V Digital, variable frequency output
Output signal (T)	3-wire 1/3 DIN Pt100 direct
Supply voltage	5 V DC ±5%
Power consumption	≤ 1.5 mA max
Operating conditions	
Operating temperature	-30 to +85°C (-22 to +185°F)
Probe, Housing	-30 to +85°C (-22 to +185°F)
Storage	-40 to +85°C (-40 to +185°F)
Mechanical specification	
Housing material	NORYL PPO UL 94 V0
Dimensions	L=33mm, $\varnothing 14\text{mm}$ (L=1.3", $\varnothing 0.55$ ")
Weight	3g (0.1oz)
Electrical connections	RH: 3-wire T: 3-wire

### Accessories and Spare Parts

Mini flange	1A01210
Connecting kit with wires	6A06350
Connecting kit for PCB	6A05130



# I7000 & I7400

## Electrical Connections

Pin	
1	Output frequency
2	Common Ground
3	Power Supply V + (5 V DC)
4	Output RH + 0-1 V DC (I7000) (Output 0.2-1 V DC (I7400))
5	
6	
7	

**Digital output**

Characterized by a variable frequency pulse train in function of the relative humidity.

$\% RH = [(T_{on} / T_{off}) * 2049 - 1] / 16.12$

## Order Codes

I7000 & I7400 - Interchangeable Module for Relative Humidity		
Feature	Item	Description
Type	I7-0-00-0	0-1 V without temp configuration
	I7-0-00-1	0-1 V with direct Pt100
	I7-4-00-0	0.2-1 V without temp configuration
	I7-4-00-1	0.2-1 V with direct Pt100

# S503

## Relative Humidity Generator for Calibrations



The S503 Humidity Generator enables users of humidity sensors, transmitters and portable devices to quickly and accurately generate a stable humidity in a test chamber to validate or calibrate sensors.

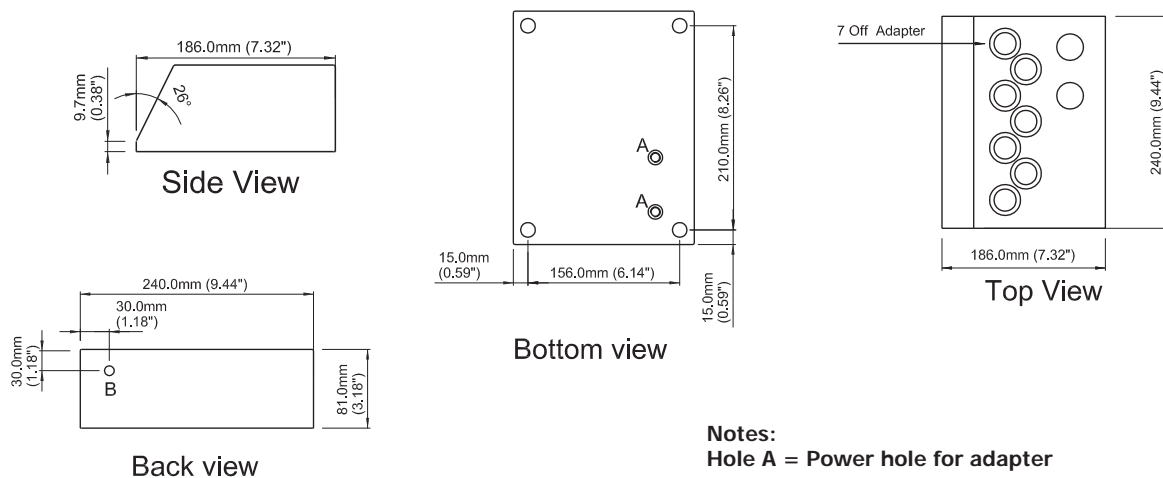
### Highlights

- Generates humidity levels between 10–90% RH
- Highly portable
- Fast stabilization of chamber humidity
- Independent reference hygrometer – optional
- Multiple sensors can be calibrated at the same time

### Technical Specifications

Humidity	
Generation range	10–90% RH in steps of 0.1% RH
Accuracy	±2% RH or better (5–95% RH)
Stability chamber	Better than ±0.5%
Stabilization time to set point	<10 minutes
Temperature	
Temperature accuracy	±0.3°C (±0.54°F) - internal reference
Operating temperature (ambient)	+15 to +35°C (+59 to +95°F)
Sensor under Calibration	
Voltage read out	0–1, 0–5, 0–10 V
Current read out	4–20 mA
Voltage supply	15 V DC, ±10% at 30 mA max
General	
Probe ports	7 off – sensor body diameters 5 to 25mm (0.2 to 0.98") accommodated by port adapters
Desiccant chamber	25g (0.88oz) capacity
Saturation chamber	25ml capacity, distilled water
Display	3½ digit LCD, 13mm (0.5") characters
Supply	12 V DC (100 - 240 V AC adapter included)
Weight	1.85kg (4.08lb)

### Dimensions



**Notes:**  
Hole A = Power hole for adapter



Accessories and Spare Parts

0.25kg (0.55lbs) desiccant (orange)	A000171
ø18.5mm (0.73") molded polymer port adpt (for ø8mm (0.31") probes)	A000180
ø18.5mm (0.73") molded polymer port adpt (for ø12mm (0.47") probes)	A000190
ø18.5mm (0.73") blind stop	A000200
Carrying case for the S503	A000230
Water bottle	A000242
Tool for changing the port adapters	A000265
SS port adapter for Optidew	A000272
Polymer port adpt ø18.5mm (0.73") to ø3mm (0.19") (for Optidew probe)	A000273
Blind stop for Optidew adapter	A000277
Blind stop for PRT adapter	A000278
AI adapter & blind stop (to be modified by customer) (M30x1)	A000280
AI port adapter ø client specific & blind stop (M30x1)	A000280X
AI port adpt for ø12mm (0.47") probe, blind stop (M30x1)	A000281
AI port adpt for ø13.5mm (0.53") probe, blind stop (M30x1)	A000282
AI port adpt for ø14mm (0.55") probe, blind stop (M30x1)	A000283
AI port adpt for ø15mm (0.59") probe, blind stop (M30x1)	A000284
AI port adpt for ø18.5mm (0.73") probe, blind stop (M30x1)	A000285
AI port adpt for ø19mm (0.75") probe, blind stop (M30x1)	A000286
AI port adpt for ø24mm (0.95") probe, blind stop (M30x1)	A000287
AI port adpt for ø25mm (0.98") probe, blind stop (M30x1)	A000288
Optidew Vision reference hygrometer with sensor	OPT-V-01
Control sensor	HT757T00



S503 calibration set

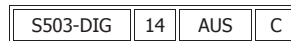


S503-DIG-LC

Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}

Order example: S503-DIG+14+AUS+C  
Relative Humidity Generator for Calibrations



Type {Feature A}	
Base unit - S503, including 7 user-specified port adapters, power adapter, desiccant and adapter tool	S503-DIG
Base unit - S503-DIG with extended chamber (0.54 liter extra)	S503-DIG-LC
Base unit -Calibration kit with Optidew adapters - S503, with 5 user-specified port adapters, 2 Optidew adapters (A000272 and A000273), power adapter, desiccant and adapter tool	S503-DIG-OPT
Base unit -Calibration kit - S503, including hand meter and probe (with calibration certificate), 7 user-specified port adapters, power adapter, desiccant, distilled water bottle (water not included), adapter tool and carrying case	S503-DIG-SET

Adapter {Feature B}	
Port adapter 12mm (0.47")	12
Port adapter 13.5mm (0.53")	13.5
Port adapter 14mm (0.55")	14
Port adapter 15mm (0.59")	15
Port adapter 18.5mm (0.73")	18.5
Port adapter 19mm (0.75")	19
Port adapter 24mm (0.94")	24
Port adapter 25mm (0.98")	25

Display {Feature D}	
Display in deg C	C
Display in deg F	F

Power {Feature C}	
Australian power supply	AUS
European power supply	EUR
North American power supply	NA
UK power supply	UK

# Optidew Vision

## Precision Dew-Point Meter



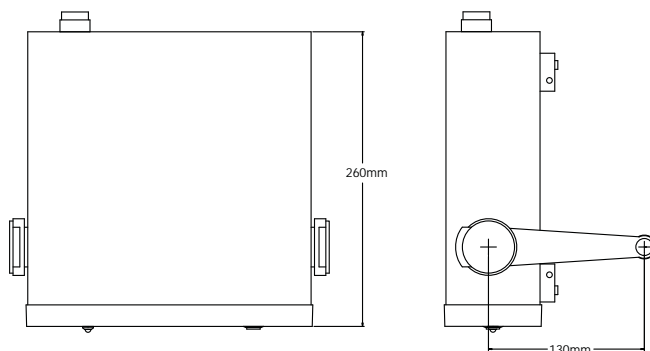
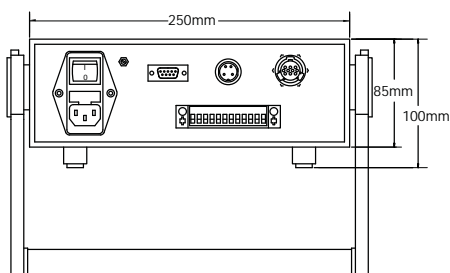
For laboratory or process humidity measurement with best accuracy and virtually zero drift, Optidew Vision combines latest sensor design with digital control technology.

The Optidew Vision can be used with an S503 Relative Humidity Generator, providing a low cost, high accuracy, portable RH calibration package.

### Highlights

- Fundamental drift free dew point measurement
- Measurement Range: <math><0.5</math> to 100 %RH from -40 to +90°C (-40 to +194°F) ambient
- $\pm 0.2^{\circ}\text{Cdp}$  accuracy. Optional higher accuracy available
- High temperature sensor option to +130°C (+266°F)
- NEMA-12 bench-top housing
- Display and output of multiple engineering units
- High pressure sensor option to 25 MPa (250 barg)

### Dimensions



## Technical Specifications

### Performance

Measurement range at sensor temp of 20°C:	
1-stage	-30 to +90°Cdp (-22 to +194°Fdp)
2-stage	-40 to +90°Cdp (-40 to +194°Fdp)
High temperature	-20 to +130°Cdp (-4 to +266°Fdp)

Measurement accuracy	$\pm 0.2^{\circ}\text{Cdp}$ $\pm 0.1^{\circ}\text{C}$ temperature $\pm 0.15^{\circ}\text{Cdp}$ accuracy optional
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Measurement units	$^{\circ}\text{C}$ , $^{\circ}\text{F}$ dew point; %RH; $^{\circ}\text{C}$ , $^{\circ}\text{F}$ temperature; $\text{g}/\text{m}^3$ ; $\text{g}/\text{kg}$ ; $a_w$ ; $\Delta$ ( $t - t$ dew point)
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Response speed	1°C/sec plus settling time (dew point dependent)
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Power supply	85 to 264 V AC, 47/440 Hz
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### Dew-Point Sensor

Mirror options available	Gold plated copper Solid gold 316 stainless steel – high temp sensor
--------------------------	----------------------------------------------------------------------------

Temperature measurement	4 wire Pt100, 1/3 DIN class B
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Sample flow rate	0.1 to 2 l/min in sampling block
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Max velocity	10 m/sec direct insertion 30 m/sec with sintered guard
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Pressure	2 MPa (20 barg) 25 MPa (250 barg) optional
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Ingress protection	IP66 (NEMA 4) IP65 25 MPa (250 barg) sensor (NEMA 12)
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Cable length	2m (Maximum 30m) ((6.5') (Max 98'))
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### Remote PRT

Temperature measurement	4 wire Pt100, 1/10 DIN class B
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Cable length	2m (Maximum 30m) ((6.5') (Max 98'))
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### Transmitter Electronics

Resolution	0.1 for $^{\circ}\text{C}$ , $^{\circ}\text{F}$ and %RH 0.01 for $\text{g}/\text{m}^3$ and $\text{g}/\text{kg}$
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Outputs	<table> <tr> <td>Analog</td> <td>Two channels 0/4-20 mA</td> </tr> <tr> <td>Digital</td> <td>RS232 (RS485 optional)</td> </tr> <tr> <td>Alarm</td> <td>Volt free contact, 2A @ 30 V DC</td> </tr> </table>	Analog	Two channels 0/4-20 mA	Digital	RS232 (RS485 optional)	Alarm	Volt free contact, 2A @ 30 V DC
Analog	Two channels 0/4-20 mA						
Digital	RS232 (RS485 optional)						
Alarm	Volt free contact, 2A @ 30 V DC						

Status LEDs	Power on, DCC and alarm status
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Operating temperature	-20 to +50°C (-4 to +122°F) ambient
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Enclosure	Standing case with carry handle. Panel mounting kit optional
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Ingress protection	IP54 (NEMA 2)
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Cable pack	Power and RS232 cables
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# Optidew Vision

## Accessories and Spare Parts

High accuracy calibration to $\pm 0.15^{\circ}\text{Cdp}$ (not available with HT sensor)	OPV-ACC
Sintered SS guard for particulate contamination 10-12 $\mu\text{m}$	OPV-SSG
HDPE sintered guard for particulate and liquid protection 10 $\mu\text{m}$	OPV-HSG
Membrane sensor guard for protection from liquid contamination $>0.2 \mu\text{m}$	OPV-MSG
Membrane element, to replace membrane sensor guard (pack 1) $>0.2 \mu\text{m}$	OPV-ME
Sensor sampling block - SS with 1/8" NPT in/out threaded gas ports	OPV-SSB
Air cooled heatsink, heat sink and cooling fan (specify 110 or 220 V) includes sensor sampling block	OPV-ACH
Liquid cooled block w/gas ports & coolant channel. Requires ext coolant supply	OPV-LCB
Sensor lock nut kit - to mount the dew-point sensor to a panel or bulkhead	OPV-SLK
Sensor cable - dew point only, 2m (6.56 ft) with connectors	OPV-SC
Additional length sensor cables for dew-point and temperature sensor price per meter - specify X meters additional	OPV-SCX
High temperature sensor cable - dew point only, 2m (6.56 ft) with connectors	OPV-HTSC
Additional length sensor cables for high temperature sensor price per meter - specify X meters additional	OPV-HTSCX
Remote PRT, 2m (6.56 ft) cable with connector	OPV-PRT
Panel mounting kit for 19" rack	OPV-PMK
Heavy duty transport case	OPV-TCS
Cleaning materials required for periodic maintenance of cooled mirror dew-point hygrometer sensors (fluids not included)	CM-CLN-KIT



Optidew Vision & S503 combination (not supplied as standard)

## Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}+{Feature D}+{Feature E}+{Feature F}

**Order example:** OPV+HT-SC02+02-ACE-SS+H+2+CM-STD

Optidew Vision with 2m (6.5') hi temp cable assemblies for dp & t, 2 stage sensor Acetal housing + SS stud mirror, high pressure (up to 25 MPa), RS232 output & standard traceable in-house calibration



Base Model {Feature A}	
Base unit: Dew-Point Hygrometer	OPV

Cable Length {Feature B}	
2m (6.5') cable assemblies for dp & t	SC02
Additional cable - price per meter	SCXX
2m (6.5') hi temp cable assemblies for dp & t	HT-SC02
Additional high temp cable - price per meter	HT-SCXX

Sensor {Feature C}	
1 stage sensor Acetal + Au coated Cu mirror	01-ACE-STD
2 stage sensor Acetal + Au coated Cu mirror	02-ACE-STD
2 stage sensor Acetal + Au stud mirror	02-ACE-AUS
2 stage sensor Acetal + SS stud mirror	02-ACE-SS
2 stage sensor Acetal + Pt stud mirror	02-ACE-PLT
2 stage sensor PEEK + Au coated Cu mirror	02-PEEK-STD
2 stage sensor PEEK + Au stud mirror	02-PEEK-AUS
2 stage sensor PEEK + SS stud mirror	02-PEEK-SS
2 stage sensor PEEK + Pt stud mirror	02-PEEK-PLT
2 stage sensor SS + Au coated Cu mirror	02-SS-STD
2 stage sensor SS + Au stud mirror	02-SS-AUS
2 stage sensor SS + SS stud mirror	02-SS-SS
2 stage sensor SS + Pt stud mirror	02-SS-PLT

Calibration {Feature F}	
Standard traceable in-house calibration	CM-STD
High accuracy traceable calibration to $\pm 0.15^{\circ}\text{C}$	CM-ACC
5-pt UKAS dew-point calibration (specify points required on order)	CM-DPUKAS
Additional UKAS dew-point calibration point	CM-DPAP01
5-pt UKAS RH calibration at one temp (specify points required on order)	CM-RHUKAS
Additional UKAS RH calibration point	CM-RHAP01
Additional five UKAS RH points at alt temp	CM-RHAT

Digital {Feature E}	
RS232	2
RS485	4

Pressure {Feature D}	
Low pressure (up to 2 MPa)	L
High pressure (up to 25 MPa)	H

# S904

## Relative Humidity and Temperature Generator for Calibrations

### Technical Specifications



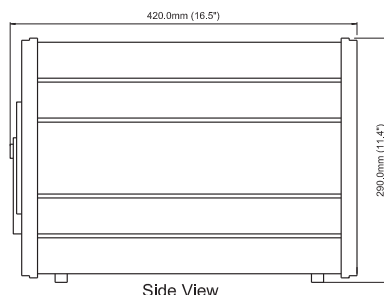
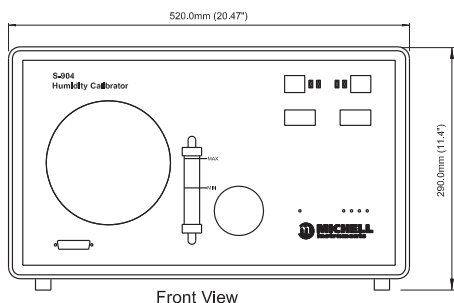
The S904 humidity and temperature generator is designed to calibrate and verify the operation of relative humidity sensors and transmitters. With a chamber temperature range of +10 to +50°C (+50 to +122°F), a uniformity of  $\pm 0.1^\circ\text{C}$  ( $\pm 0.02^\circ\text{F}$ ) and the ability to generate 10–90% RH, accurate and repeatable calibrations are made easy.

### Highlights

- Relative humidity and temperature controlled chamber
- Excellent stability within chamber:  $\pm 0.2\%$  RH, Temp.  $\pm 0.1^\circ\text{C}$  ( $\pm 0.02^\circ\text{F}$ )
- Optional in-built data-logging for reference probe and probes under calibration
- Probes with body diameters between 5 to 25mm (0.2 to 0.98") can be accepted

<b>Humidity</b>	
Generator range	10-90% RH
Accuracy	$\leq \pm 1\%$ RH (10–70% RH)
Control element	$\leq \pm 1.5\%$ RH (70–90% RH)
Stability	$\pm 0.2\%$ RH (20–80% RH)
<b>Temperature</b>	
Generator range	+10 to +50°C (+50 to +122°F) (lowest T set point = 10°C (18°F) below ambient)
Accuracy	$\pm 0.1^\circ\text{C}$ ( $\pm 0.2^\circ\text{F}$ )
Stability	$\pm 0.1^\circ\text{C}$ ( $\pm 0.2^\circ\text{F}$ )
<b>Chamber</b>	
Ramp rate from +20 to +40°C (+68 to +104°F)	1.5°C / minute (2.7°F / minute)
+40 to +20°C (+104 to +68°F)	0.7°C / minute (1.2°F / minute)
Control element	Removable relative humidity sensor
<b>General</b>	
Probe ports	up to 5 – sensor body diameters 5 to 25mm (0.2 to 0.98") accommodated by port adapters
Chamber volume	2000cm <sup>3</sup> (122.1in <sup>3</sup> )
Chamber dimensions	105 x 105 x 160mm (4.13 x 4.13 x 6.3") (wxhxd)
Instrument dimensions	520 x 290 x 420mm (20.5 x 11.4 x 16.5") (wxhxd)
Set point resolution	0.1 for humidity and temperature
Displays	3 digit LED, 10mm (0.39") characters
Supply	85–264 V AC, 47–63 Hz, 150 VA
Weight	20kg (44lb)

### Dimensions

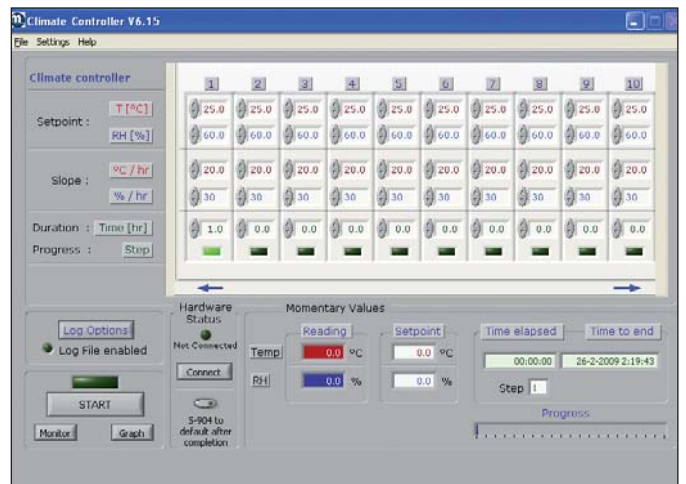
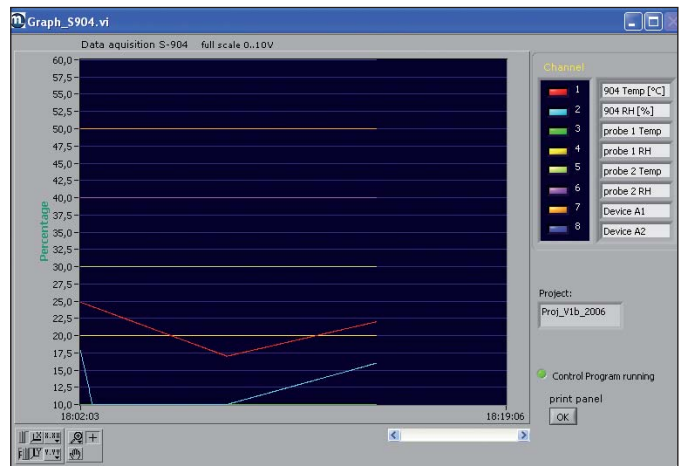
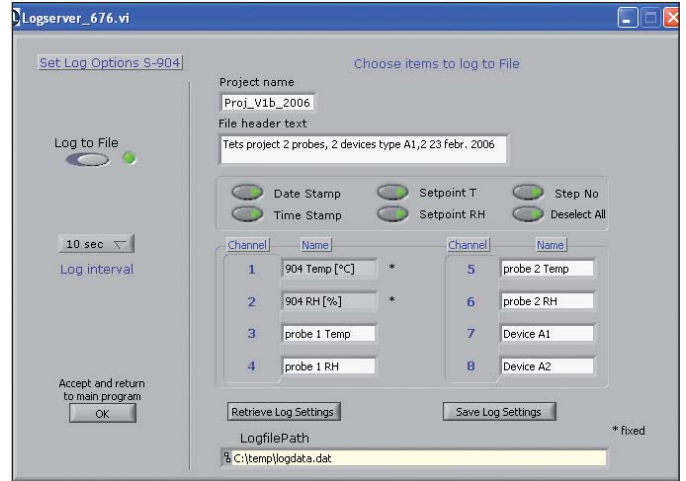


Accessories and Spare Parts

0.25kg (0.55lbs) desiccant (orange)	A000171
ø18.5mm (0.73") Blind stop	A000200
Drying module	A000240
Water bottle	A000242
Door kit with 5 ports. 5 adapters to be specified	A000263
Door kit with 5 ports and 25 adapters (5 x ø19mm (0.75"), 4 x ø12mm (0.47"), ø13.5mm (0.53"), ø15mm (0.59"), ø18.5mm (0.73"), ø24mm (0.94") - and blind stops. Adapter tool included)	A000264
Tool for changing the port adapters	A000265
Door with clear window - no ports	A000266
Door without ports	A000268
Door kit for use with MI Optidew. (Optidew dew-point sensor port adapter, PRT port adapter and 4 x ø19mm (0.75") adapters. Adapter tool included)	A000269
Polymer port adpt ø18.5mm (0.73") to ø3mm (0.19") (for Optidew probe)	A000273
Blind stop for Optidew adapter	A000277
Blind stop for PRT adapter	A000278
M30x1 Molded polymer port adpt & blind stop (to be modified by customer)	A000290
Polymer port adpt ø client specific & blind stop	A000290X
Polymer port adpt for ø12mm (0.47") probe, blind stop (M30x1)	A000291
Polymer port adpt for ø13.5mm (0.53") probe, blind stop (M30x1)	A000292
Polymer port adpt for ø14mm (0.55") probe, blind stop (M30x1)	A000293
Polymer port adpt for ø15mm (0.59") probe, blind stop (M30x1)	A000294
Polymer port adpt for ø18.5mm (0.73") probe, blind stop (M30x1)	A000295
Polymer port adpt for ø19mm (0.75") probe, blind stop (M30x1)	A000296
Polymer port adpt for ø24mm (0.95") probe, blind stop (M30x1)	A000297
Polymer port adpt for ø25mm (0.98") probe, blind stop (M30x1)	A000298
Transport Case for OptiCal and S904	OCAL-TC
Control sensor	HT961T00

1. S904 set point temperature (0-10 V = 0 to 100°C (32 to 212°F)
2. S904 set point RH (0-10 V = 0 to 100% RH)
3. Free to use (0-10 V)
4. Free to use (0-10 V)
5. Free to use (0-10 V)
6. Free to use (0-10 V)
7. Free to use (0-10 V)
8. Free to use (0-10 V)

The acquisition system only measures 0-10 V on every channel so the 4-20 mA signals from the Optidew are converted to a 0-10 V signal. Channels 1 and 2 are not available for logging signals. A 500 Ω resistor must be used.



Labview logging software

Order Codes

S904 - Relative Humidity and Temperature Generator for Calibrations

Feature	Item	Description
Type	S904	Base unit
	S904-D	Base unit - with RS232/USB interface (data-logging software for PC - 6 channel data-logger)

# OptiCal

## Relative Humidity and Temperature Generator with built-in Chilled Mirror Reference



The OptiCal is a bench-top, fully self-contained humidity/temperature calibrator. The system comprises a humidity and temperature controlled chamber that can house up to five or more humidity sensors, depending on their physical dimensions. The humidity and temperature within the chamber are closed-loop controlled and continuously monitored by a precision chilled mirror reference hygrometer. The OptiCal works by time-proportioning the flows of dry and saturated air according to the pre-selected relative humidity value. The chamber temperature is controlled by a four-zone Peltier heat pump arrangement for maximum stability and minimum temperature gradient. The saturator assembly can be filled easily with the distilled water reservoir at the front of the unit and the easily accessible desiccator can be re-charged by heating when required. No other maintenance is necessary. The only external service required is a single phase power supply.

### Highlights

- Precision relative humidity and temperature calibrator
- Generate 10 to 90% RH over +10 to +50°C (+50 to +122°F) temperature
- Integral chilled mirror reference hygrometer
- UKAS Accredited Calibration, as standard
- Humidity and temperature profile generation for unattended verification of sensors
- Transportable to allow on-site calibrations

### Technical Specifications

#### Reference Hygrometer

Type Optidew chilled mirror dew-point transmitter

#### Humidity

Generator range 10–90% RH  
 Accuracy  $\leq \pm 1\%$  RH (10–70% RH)  
 Control element  $\leq \pm 1.5\%$  RH (70–90% RH)  
 Stability  $\pm 0.2\%$  RH (20–80% RH)

#### Temperature

Generator range +10 to +50°C (+50 to +122°F)  
 (lowest T set point = 10°C (18°F) below ambient)  
 Accuracy  $\pm 0.1^\circ\text{C}$  ( $\pm 0.2^\circ\text{F}$ )  
 Stability  $\pm 0.1^\circ\text{C}$  ( $\pm 0.2^\circ\text{F}$ )

#### Chamber

Ramp rate from  
 +20 to +40°C (+68 to +104°F) 1.5°C / minute (2.7°F / minute)  
 +40 to +20°C (+104 to +68°F) 0.7°C / minute (1.2°F / minute)

Control element Removable relative humidity sensor

#### General

Probe ports up to 5 – sensor body diameters 5–25mm (0.2 to 0.98") accommodated by port adapters

Chamber volume 2000 cm<sup>3</sup> (122.1in<sup>3</sup>)

Chamber dimensions 105 x 105 x 160mm (4.13 x 4.13 x 6.3") (wxhxd)

Instrument dimensions 520 x 290 x 420mm (20.5 x 11.4 x 16.5") (wxhxd)

Set point resolution 0.1 for humidity and temperature

Displays High definition 2 lines alpha numeric

Measurement units °C, °Cd<sub>p</sub>, % RH  
 g/kg, g/m<sup>3</sup>, (t-t<sub>s</sub>), a<sub>w</sub>

#### Outputs

Analog Two channels 4–20 mA or 0–20 mA  
 Digital RS232 (RS485 optional)  
 Alarm Volt free contact, 2A @ 30 V DC

Supply 85–264 V AC, 47–63 Hz, 150 VA

Weight 20kg (44lb)

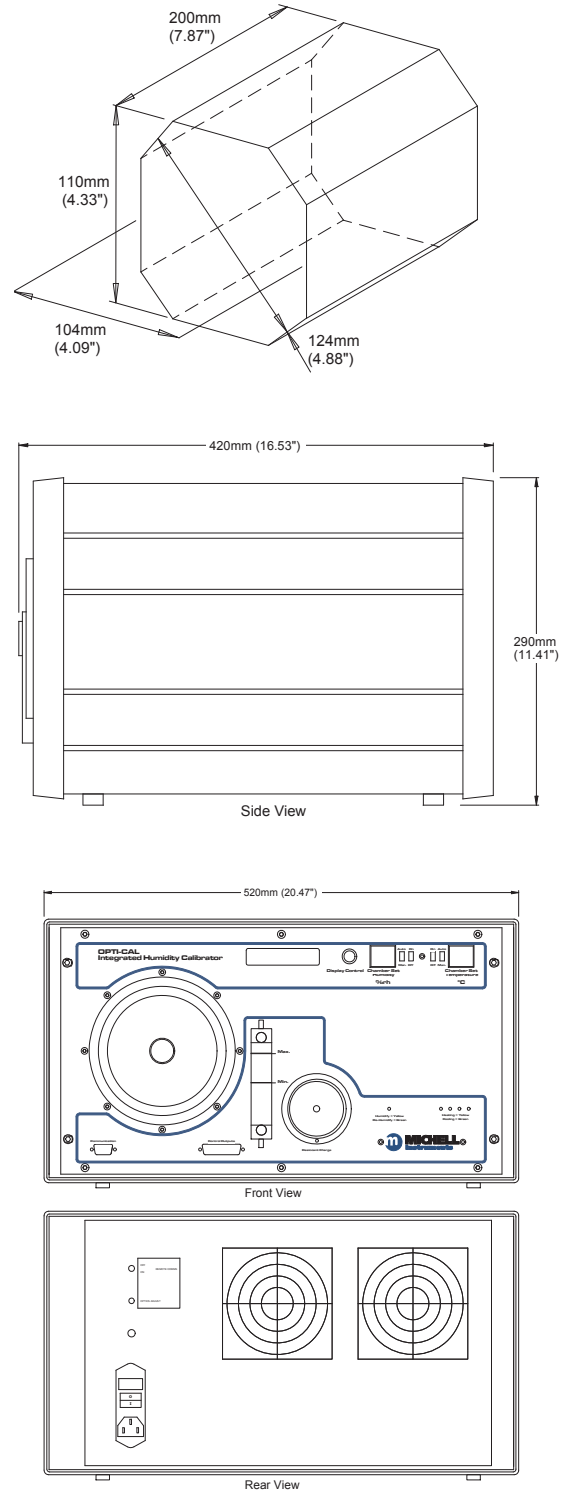


Logging and profiling software

Accessories and Spare Parts

0.25kg (0.55lbs) desiccant (orange)	A000171
ø18.5mm (0.73") Blind stop	A000200
Drying module	A000240
Water bottle	A000242
PRT sensor	A000243
Door kit with 5 ports. 5 adapters to be specified	A000263
Door kit with 5 ports and 25 adapters (5 x ø19mm (0.75"), 4 x ø12mm (0.47"), ø13.5mm (0.53"), ø15mm (0.59"), ø18.5mm (0.73"), ø24mm (0.94") - and blind stops. Adapter tool included)	A000264
Tool for changing the port adapters	A000265
Door with clear window - no ports	A000266
Door without ports	A000268
Door kit for use with MI Optidew. (Optidew dew-point sensor port adapter, PRT port adapter and 4 x ø19mm (0.75") adapters. Adapter tool included)	A000269
Polymer port adpt ø18.5mm (0.73") to ø3mm (0.19") (for Optidew probe)	A000273
M30x1 Molded polymer port adpt & blind stop (to be modified by customer)	A000290
Polymer port adpt ø client specific & blind stop	A000290X
Polymer port adpt for ø12mm (0.47") probe, blind stop (M30x1)	A000291
Polymer port adpt for ø13.5mm (0.53") probe, blind stop (M30x1)	A000292
Polymer port adpt for ø14mm (0.55") probe, blind stop (M30x1)	A000293
Polymer port adpt for ø15mm (0.59") probe, blind stop (M30x1)	A000294
Polymer port adpt for ø18.5mm (0.73") probe, blind stop (M30x1)	A000295
Polymer port adpt for ø19mm (0.75") probe, blind stop (M30x1)	A000296
Polymer port adpt for ø24mm (0.95") probe, blind stop (M30x1)	A000297
Polymer port adpt for ø25mm (0.98") probe, blind stop (M30x1)	A000298
Control sensor	HT961T00
Transport Case for OptiCal and S904	OCAL-TC

Dimensions



Order Codes

OPTICAL - Precision humidity calibration system with temperature control. Includes 5 port door and integrated chilled mirror reference hygrometer with 3 point UKAS RH calibration		
Feature	Item	Description
Base Model	OPTICAL	Base unit

# Control Kit

## For the Calibration of Relative Humidity Sensors



### Technical Specifications

The control kit consists of:

- 5 phials of the same humidity value
- 7 test strips
- 1 control chamber with version HKCxxC, without control chamber with version HKCxxS
- Box dimensions: 100 x 140 x 40mm (3.93 x 5.51 x 1.57")
- Weight: 0.15kg (0.33lb)

### Accuracy

An accuracy of  $\pm 3\%$  RH can be achieved if the test procedure is adhered to.

### Operating Conditions

- Reference temperature:  $+23^{\circ}\text{C} \pm 1^{\circ}\text{C}$  ( $+73^{\circ}\text{F} \pm 1.8^{\circ}\text{F}$ )
- Environmental humidity stabilized  $\pm 10\%$
- Set up conditions:  
Temperature between 0 and  $+50^{\circ}\text{C}$  ( $+32$  and  $+122^{\circ}\text{F}$ ) with correction to be applied according to the instruction manual.

Humidity between 40 and 60% RH

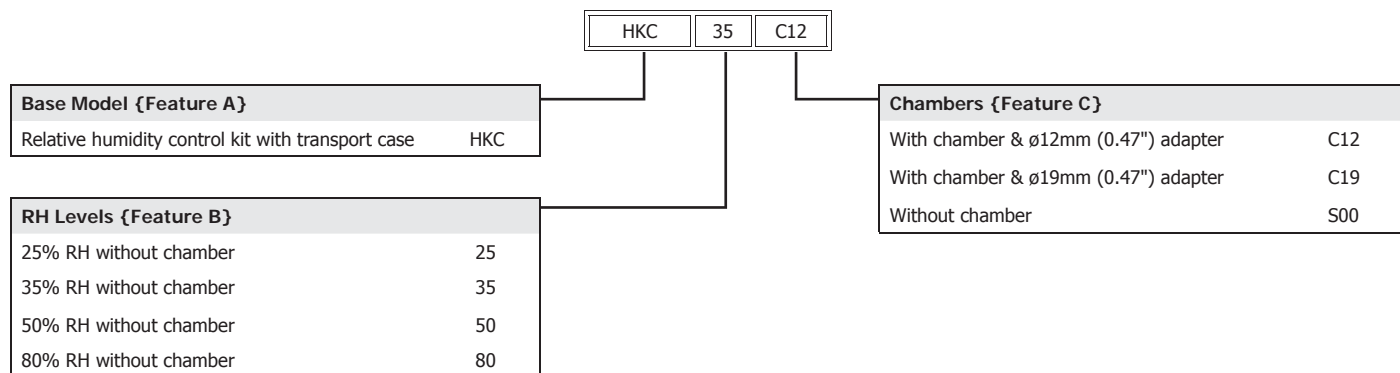
- The instrumentation should be checked and the control kit must be kept in the same environment at least 10 hours before the procedure is started
- Shelf life of the solutions:  
In phial: unlimited  
In the control chamber: 2 hours

### Ordering Codes

To construct the order code, select the relevant feature from the tables below, starting with the base model, which is {Feature A} and then add on options to create a string: {Feature A}+{Feature B}+{Feature C}

**Order example:** HKC-25-C12

25% RH control kit with chamber &  $\phi 12\text{mm}$  (0.47") adapter, including transport case





## Effects of pressure, temperature and concentration on humidity parameters



In nature, water exists in three different states: gaseous (vapor), liquid (rain, fog) and solid (snow, ice, hail). Water in the gaseous state is invisible. The maximum quantity of water vapor that the air can contain depends on temperature and pressure. The table below shows how the parameter change influences the measured values.

Relative humidity is the ratio of the actual quantity of water vapor that an air sample contains to the maximum quantity of water vapor that such a sample can contain at the sample pressure and temperature.





















	Temperature Increase	Temperature Decrease	Pressure Increase	Pressure Decrease	Vapor Increase	Vapor Decrease
% RH	↓	↑	↑	↓	↑	↓
Dew Point	↔	↔	↑	↓	↑	↓
Absolute Humidity	↔	↔	↑	↓	↑	↓
Mix Ratio	↔	↔	↔	↔	↑	↓
Concentration of Water Vapor	↔	↔	↔	↔	↑	↓

# Accessories

Item	Associated products
 A000001 19mm (0.75") Slotted protection cap white	WM33 & 52
 A000002 19mm (0.75") Slotted protection cap black	PC33, 52, 62 & 62V DT722, MDM25
 A000003 12mm (0.47") Slotted protection cap, black	PCMini52, MDM25
 A000014 19mm (0.75") PVDF filter	PC33, 52, 62 & 62V WM33 & 52 DT722, MDM25
 A000015 19mm (0.75") PVDF filter with protection cap black	PC33, 52, 62 & 62V DT722
 A000016 19mm (0.75") PVDF filter with protection cap white	WM33 & 52
 A000017 12mm (0.47") PVDF filter	PCMini52, MDM25
 A000018 12mm (0.47") PVDF filter with protection cap, black	PCMini52, MDM25
 A000019 HDPE filter	SF52
 A000021 19mm (0.75") Mesh filter with protection cap black	PC33, 52, 62 & 62V WM33 & 52 DT722, MDM25

Item	Associated products
 A000022 12mm (0.47") Mesh filter with protection cap, black	PCMini52, MDM25
 A000023 12mm (0.47") Flat SS sintered dust filter	PCMini52, MDM25
 A000025 19mm (0.75") Arrow SS sintered filter 5µm A000026 19mm (0.75") Arrow SS sintered filter 10µm	PC33, 52, 62 & 62V WM33 & 52 DT722
 A000027 19mm (0.75") Arrow SS sintered filter 20µm	PC33, 52, 62 & 62V WM33 & 52 DT722
 A000028 12mm (0.47") Arrow 20 µm SS sintered filter	PCMini52, MDM25
 A000040 19mm (0.75") Foil filter 2µm with protection cap black	PC33, 52, 62 & 62V DT722
 A000041 19mm (0.75") Foil filter 2µm with protection cap white	WM33 & 52
 A000042 19mm (0.75") Oleophobic foil filter 0.7µm with protection cap black	PC33, 52, 62 & 62V DT722
 A000043 19mm (0.75") Oleophobic foil filter 0.7µm with protection cap white	WM33 & 52
 A000044 19mm (0.75") Foil filter 1.5µm w/protection cap black	PC33, 52, 62 & 62V DT722

# Accessories

	Item	Associated products		Item	Associated products
	<b>A000045</b> 19mm (0.75") Foil filter 1.5µm with protection cap white	WM33 & 52		<b>K9</b> PEEK protection cap with SS mesh filter	WR283 WR293 DT284
	<b>H2</b> SS sintered filter	WM281 WM291 DT282		<b>SSG</b> SS sintered guard replacement	Easidew Easidew I.S. Easidew PRO I.S. Easidew Online
	<b>H3</b> SS sintered filter	WR283 WR293 DT284		<b>Z1</b> SS cap slotted with PTFE filter	PCMini70 PFMini72 WR285
	<b>H4</b> SS sintered filter	PF211 DT269		<b>Z2</b> ABS cap slotted with PTFE filter, white	DT269 PF211
	<b>J2</b> SS sintered filter with teflon coating	WM281 WM291 DT282		<b>Z6</b> SS cap slotted with PTFE filter	DT282
	<b>J3</b> SS sintered filter with teflon coating	WR283 WR293 DT284		<b>Z7</b> Delrin cap slotted with PTFE filter, white	WM281 WM291
	<b>K1</b> SS cap slotted with mesh filter	PCMini70 PFMini72 WR285		<b>EA2-HDPE</b> Pack of 10 replacement HDPE guards. (For protection against fine particulate (<10µm))	Easidew Easidew I.S. Easidew PRO I.S. Easidew Online
	<b>K6</b> AISI 316 cap slotted with SS mesh filter	DT282		<b>17-0-00-0</b> Hygrosmart without Pt100 output	PCMini70 PFMini72 DT269
	<b>K7</b> Delrin cap slotted with SS mesh filter	WM281 WM291		<b>17-0-00-1</b> Hygrosmart with Pt100 output (RH = 0-1 V)	PCMini70 PFMini72 WM281 WM291 DT269/DT282 PF211 (V)
	<b>K8</b> SS mesh filter	WR283 WR293 DT284		<b>17-4-00-1</b> Hygrosmart with Pt100 output (RH = 0.2-1 V)	PF211 (mA)

# Accessories

	Item	Associated products
	<b>A000030</b> 19mm (0.75") Connector, no cable, with screw terminals	PC33, 52, 62 & 62V DT722
	<b>A000030XM</b> 19mm (0.75") Connector, with cable (customer spec length)	PC33, 52, 62 & 62V DT722
	<b>A000031</b> 19mm (0.75") Connector with 2m (6.5') cable	PC33, 52, 62 & 62V DT722
	<b>A000032</b> 19mm (0.75") Connector with 5m (16') cable	PC33, 52, 62 & 62V DT722
	<b>A000033</b> 12mm (0.47") Connector with 2m (6.5') cable	PCMini52
	<b>A000036</b> 12mm (0.47") Connector with 5m (16') cable	PCMini52
	<b>A000037</b> 12mm (0.47") Connector with 10m (33') cable	PCMini52
	<b>A000321</b> 12mm (0.47") Connector without cable (with solder terminals)	PCMini52
	<b>A000321-xx</b> 12mm (0.47") Connector with cable (customer spec length)	PCMini52
	<b>A000322</b> 12mm (0.47") Connector with 20m (25.6') cable	PCMini52

# Accessories

Item	Associated products
	<b>A000100</b> 3/4" NPT SS adj. fitting for SS probes PC33, 52, 62 & 62V DT722
	<b>A000101</b> 1/2" NPT SS adj fitting for SS probe. Only to be used with SS probe housing PCMini52
	<b>A000110</b> Al mounting flange for ø19mm (0.75") SS probes (outside ø80mm (3.15")) PC33, 52, 62 & 62V DT722
	<b>A000111</b> Aluminum mounting flange for ø12.0mm (ø0.47") SS probes (outside ø40.0mm (ø 1.57")). To be used with SS probes PCMini52
	<b>A000120</b> ø90mm (3.54") WM weather prot. cap (in combination with A000111 for ø12mm (0.47") probes) PC33, 52, 62 & 62V PCMini52
	<b>A000125</b> ø120mm (4.72") WM weather prot. cap (in combination with A000111 for ø12mm (0.47") probes) PC33, 52, 62 & 62V PCMini52
	<b>A000150</b> Mini flange for ø19.0mm (ø0.75") molded polymer probe PC33, 52, 62 & 62V
	<b>A000340</b> Bonded seal, (DIN ISO 228) G1/2" (BSP) SF52
	<b>FLA012</b> Al mounting flange for ø12mm (0.47") SS probes DT262 DT284 WR283 WR293
	<b>FLA019</b> Al mounting flange for ø19mm (0.75") SS probes DT269 DT282

Item	Associated products
	<b>1A01210</b> Mini flange I7000 I7400
	<b>2510367</b> Mounting clip PFMini72
	<b>2510387</b> Mounting clip PF211
	<b>3420085</b> Fixing collar PF211
	<b>3401135</b> Molded polymer fitting PF211
	<b>6A05130</b> Connecting kit for PCB I7000 I7400
	<b>6A06350</b> Connecting kit with wires I7000 I7400

# Accessories

	Item	Associated products
	<p><b>EA2-CK</b> EASIDew communications kit for EASIDew and Pura 2-wire transmitters. Enables connection to PC or laptop; re-ranging and reconfiguration of output via configuration software</p>	<p>EASIDew TX EASIDew TX I.S. EASIDew PRO I.S. EASIDew PRO Liquids I.S. Pura Transmitter Pura Transmitter I.S.</p>
	<p><b>F035263</b> USB cable/software for configuration</p>	<p>WM281, WM291 DT282, DT284 WR283, WR285 WR293,</p>
	<p><b>330185</b> RS422/485 to PC (RS232) converter</p>	<p>WM281, WM291 DT282, DT284 WR283, WR285 WR293,</p>
	<p><b>G1-PF-01</b> KFD0-CS-EX1.50P galvanic isolator (for EASIDew PRO I.S. - Pepperl &amp; Fuchs)</p>	<p>EASIDew PRO I.S. EASIDew I.S.</p>

# Accessories
















	Item	Associated products
	<b>A000350</b> Sample block without filter	SF52
	<b>A000351</b> Sample block with filter	SF52
	<b>EA2-SAM</b> Easidew Sampler SS block w/filter cartridge (0.3µm), inlet/outlet push ftgs, m-valve & PTFE vent tube (6mm (0.24")), mtg bracket	Easidew Easidew I.S. Easidew PRO I.S. Easidew Online
	<b>CSB</b> SS sample block (5/8" UNF thread with 1/8" NPT ports)	Easidew Easidew I.S. Easidew PRO I.S. Easidew Online

# Accessories

	Item	Associated products		Item	Associated products
	<p><b>A000180</b> ø18.5mm (0.73") molded polymer port adpt (for ø8mm (0.31") probes)</p> <p><b>A000190</b> ø18.5mm (0.73") molded polymer port adpt (for ø12mm (0.47") probes)</p>	S503		<p><b>A000273</b> Polymer port adpt ø18.5mm (0.73") to ø3mm (0.19") (for Optidew probe)</p>	S904 S503 OptiCal
	<p><b>A000200</b> Blind stop ø18.5mm (ø0.73")</p>	S904 OptiCal		<p><b>A000277</b> Blind stop for Optidew adapter</p>	S503 S904
	<p><b>A000263</b> Door kit with 5 ports. 5 adapters to be specified</p>	S904 OptiCal		<p><b>A000278</b> Blind stop for PRT adapter</p>	S503 S904
	<p><b>A000264</b> Door kit with 5 ports and 25 adapters (5 x ø19mm (0.75"), 4 x ø12mm (0.47"), ø13.5mm (0.53"), ø15mm (0.59"), ø18.5mm (0.73"), ø24mm (0.94") - and blind stops. Adapter tool included)</p>	S904 OptiCal		<p><b>A000280</b> Al adapter &amp; blind stop (to be modified by customer) (M30x1)</p>	S503
	<p><b>A000266</b> Door with clear window - no ports</p>	S904 OptiCal		<p><b>A000280X</b> Al port adapter ø client specific &amp; blind stop (M30x1)</p>	S503
	<p><b>A000268</b> Door without ports</p>	S904 OptiCal		<p><b>A000281</b> Al port adpt for ø12mm (0.47") probe, blind stop (M30x1)</p>	S503
	<p><b>A000269</b> Door kit for use with MI Optidew. (Optidew dew-point sensor port adapter, PRT port adapter and 4 x ø19mm (0.75") adapters. Adapter tool included)</p>	S904 OptiCal		<p><b>A000282</b> Al port adpt for ø13.5mm (0.53") probe, blind stop (M30x1)</p>	S503
	<p><b>A000272</b> SS port adapter for Optidew</p>	S503		<p><b>A000283</b> Al port adpt for ø14mm (0.55") probe, blind stop (M30x1)</p>	S503



# Accessories

	Item	Associated products		Item	Associated products	
	<b>A000284</b> Al port adpt for ø15mm (0.59") probe, blind stop (M30x1)	S503			<b>A000292</b> Polymer port adpt for ø13.5mm (0.53") probe, blind stop (M30x1)	S904 OptiCal
	<b>A000285</b> Al port adpt for ø18.5mm (0.73") probe, blind stop (M30x1)	S503			<b>A000293</b> Polymer port adpt for ø14mm (0.55") probe, blind stop (M30x1)	S904 OptiCal
	<b>A000286</b> Al port adpt for ø19mm (0.75") probe, blind stop (M30x1)	S503			<b>A000294</b> Polymer port adpt for ø15mm (0.59") probe, blind stop (M30x1)	S904 OptiCal
	<b>A000287</b> Al port adpt for ø24mm (0.95") probe, blind stop (M30x1)	S503			<b>A000295</b> Polymer port adpt for ø18.5mm (0.73") probe, blind stop (M30x1)	S904 OptiCal
	<b>A000288</b> Al port adpt for ø25mm (0.98") probe, blind stop (M30x1)	S503			<b>A000296</b> Polymer port adpt for ø19mm (0.75") probe, blind stop (M30x1)	S904 OptiCal
	<b>A000290</b> M30x1 Molded polymer port adpt & blind stop (to be modified by customer)	S904 OptiCal			<b>A000297</b> Polymer port adpt for ø24mm (0.95") probe, blind stop (M30x1)	S904 OptiCal
	<b>A000290X</b> Polymer port adpt ø client specific & blind stop	S904 OptiCal			<b>A000298</b> Polymer port adpt for ø25mm (0.98") probe, blind stop (M30x1)	S904 OptiCal
	<b>A000291</b> Polymer port adpt for ø12mm (0.47") probe, blind stop (M30x1)	S904 OptiCal				

# Accessories



Item	Associated products
<b>A000171</b> 0.25 kg (0.55lbs) desiccant (orange)	S503 S904
<b>A000230</b> Carrying case for the S503	S503
<b>A000240</b> Drying module	S904 OptiCal
<b>A000242</b> Water bottle	S503 S904
<b>A000243</b> PRT sensor	S904 OptiCal
<b>A000265</b> Tool for changing the aluminum port adapters	S503 S904
<b>HT961T00</b> Control sensor	S904 OptiCal
<b>HT757T00</b> Control sensor	S503



Item	Associated products
<b>OCAL-TC</b> Transport Case for OptiCal	Optical
<b>OPT-V-01</b> Optidew vision reference hygrometer with sensor	S503

# Applications for Humidity Sensors

Michell humidity sensors are used in hundreds of applications, including:

## Agriculture

- Agricultural and Crop Research
- Agrochemical
- Environmental Testing
- Poultry/Meat/Egg/Dairy
- Greenhouses

## Aerospace

- MIL Spec Welding
- Cabin Environment
- Environmental Testing
- Coatings
- Parts Storage
- Space Purge Systems
- Weather Monitoring

## Automotive

- HVAC Manufacturing
- Dynamometer/Engine Test Cells
- Paint Booths
- In-Vehicle Air Quality
- Environmental Testing
- Metrology – Cal Lab
- Maintenance Alarms
- Compressed Air Dew Point

## Bricks/Ceramics

- Ceramic Greenware Drying
- Product Quality
- Glaze Application
- Environmental Testing
- Concrete Curing

## Chemical/Petroleum

- Polymerization
- Raw Material Testing and Storage
- Manufacturing Drying Processes
- Optimizing Production Costs
- Intermediates Storage
- Environmental Conditions
- Natural Gas Quality
- Environmental Testing

## Coatings

- Powder Coating
- Adhesive Curing
- Adhesive Tape
- Application Test
- Maintenance Alarms
- Environmental Testing

## Atmospheric

- Environmental Research
- Snowmaking Machines
- Soil Moisture
- Plant Growth Chambers
- Climatology
- Hydrometeorology

## Environmental Chamber

- Electronics Test
- Climatic Stability Evaluation
- Product Testing on Animals
- Plant Growth Chambers
- Equipment Cabinet

## Food/Beverage

- CO<sub>2</sub> Drying
- Drying Process
- Energy cost savings
- Environmental Testing

## Fuel Cell

- Manufacturing
- Testing
- Fuel Monitoring
- Maintenance Alarms

## Healthcare

- Stop Contamination
- Dental Casting Formulation
- Pill Coating
- Extend Shelf Life
- Environmental Testing
- Respiratory Therapy

## High Tech

- Optical Coating
- Waveguide Pressurization
- Maintenance Alarms

## HVAC

- Indoor Swimming Pool
- Control
- Climate Control
- Energy Use
- BMS, DCV and IAQ
- Hazardous Locations
- Outdoor Measurement

## Industrial Applications

- Heat Treating
- Welding Hoods
- Adhesives
- Maintenance Alarms
- Environmental Testing

# Applications

## Leather/Textile

- Dyeing/Printing
- Process Control
- Product Quality
- Storage & Transportation
- Maintenance Alarms

## Marine

- Inert Gas Systems
- Lubrication Oil Monitoring
- Weather Observation
- Maintenance Alarms

## Metallurgy

- Furnace Gas
- Lubrication and Quench Oil
- Dry Air Storage
- Sintering Furnace
- Maintenance Alarms
- Environmental Testing

## Meteorology

- Professional Forecasting
- Agricultural and Forest
- Emergency Management
- Fire Hazard Warning
- Airport Weather monitoring
- Road and Rail Weather

## Metrology

- Direct Calibration
- Indirect Calibration
- HVAC
- Standards Storage

## Military

- Vehicle Air Quality
- Dry Air Storage
- Drive-in Chambers
- Weapons Test Chambers
- Torpedo Environmental testing
- Rocket Environmental testing
- Maintenance Alarms
- Environmental Testing

## Museums

- Artifact Storage and Display
- Transportation
- HVAC
- Maintenance Alarms

## Nuclear

- Containment vessel
- Dry Air Storage
- Assembly/Disassembly
- Encapsulation Research
- Maintenance Alarms

## Packaging

- Product Storage
- Printing Labelling
- Development
- Environmental Testing

## Paint

- Long Term Testing Outdoors
- Water Based Paint Booths
- Solvent Based Paint Booth
- Accelerated Life Testing
- Maintenance

## Paper

- Process Air Exiting Hood
- Compressed Air
- Conversion/Storage Rooms
- Lubrication Oil
- Roof Protection
- Storage
- Distribution
- Pad Air/Gas
- Quality Control

## Pharmaceutical

- Bioreactors
- Clean Rooms
- Compressed Air
- Incubators
- Stability Testing
- Packaging
- Storage & Transportation
- Production Areas
- Animal Test Facilities
- Tablet Coating
- Environmental Testing

## Molded polymers

- Blow Molding PET
- Compressed Air
- Hopper Humidity
- HVAC – Manufacturing
- Extrusion
- Blown Film
- Printing & Labelling
- Pellet Storage
- Production Area
- Product Storage
- Injection Mold Preparation
- Shipping & Supply Chain

# Applications

## Power/Energy

- Dew Point in SF6
- Compressed Air
- Gas Turbine Inlet Air
- Lubrication Oil
- H<sub>2</sub> Cooling Loop
- Bag Houses
- Transformer Maintenance
- Maintenance Alarms

## Process

- Monitor Environments
- Adhesives
- Prevent Corrosion
- Prevent Contamination
- Preserve Texture
- Conserve Energy
- Environmental Testing

## Rubber

- Natural Rubber Storage
- Tire Cord Storage
- Maintenance Alarms

## Semi Conductor

- Clean Rooms
- Compressed Air
- Environmental Compensations
- Glove Boxes
- Lithium Battery Manufacturing
- Environmental Chambers
- Photo Resist Operations
- IC Packaging
- PCB Manufacturing
- Extended Life Testing

## Storage

- Warehousing
- Museums
- Movement of Goods
- Container Testing
- Wine Barrel
- Fruit

## Tobacco

- Tobacco Conditioning
- Cigarette Making
- Packaging
- Storage & Transportation
- Maintenance Alarms

## Transportation

- Containers
- Storage
- Shipping
- Live Animal Shipments
- Cabin Monitoring
- Bulk Products
- Highway Icing
- Airport Weather

## Wood

- Kiln Drying
- Laminates/By-product Drying
- Dry Air Storage
- Adhesive Research

# A Guide to the Measurement of Humidity

The following text is reproduced with kind permission from the National Physical Laboratory. It was originally published in a booklet, *A Guide to the Measurement of Humidity*.

## 1 What is humidity?

The word 'humidity' denotes the presence of water vapour in air or other gases. Water vapour is the gaseous form of water, and can be thought of much like any other kind of gas. It is normally transparent, and makes up about one hundredth (or one percent) of the air around us.

Humidity arises in practice because, in the same way that hot water gives off steam, so water at lower temperatures – including ice – also gives off water vapour. Wherever there is water or ice, there is evaporation (or its opposite, condensation). The extent to which this happens depends upon a number of factors, the most important of which is temperature. Similarly, other liquid or solid materials – most of which have some water content – will give off (or sometimes soak up) water vapour. Of course, water vapour can also be found in places where there is no liquid or solid nearby, for example in remote parts of the Earth's atmosphere.

Air (or empty space, or any other gas) has a given capacity to absorb water vapour. This capacity depends mainly on temperature. Generally speaking, the hotter the air, the more water vapour it can hold. The graph in Figure 1 illustrates this.

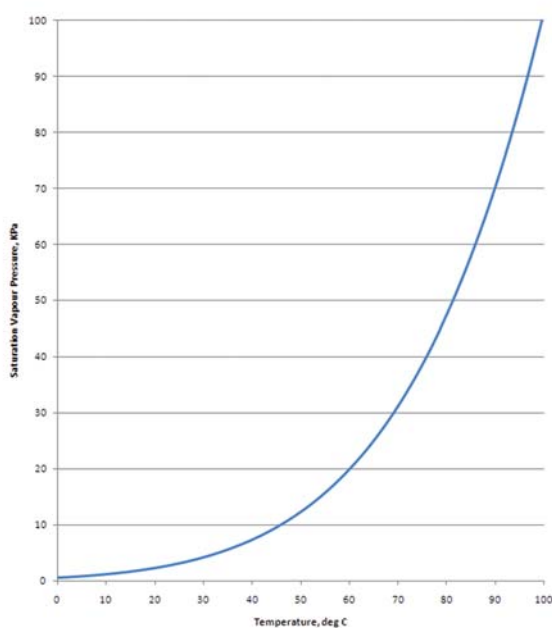


Figure 1. Saturation vapour pressure of water increases with temperature

At any particular temperature, air that contains its full capacity of water vapour, is said to be 'saturated'. The 'relative humidity' of the air expresses how fully saturated it is with water vapour. A variety of other ('absolute') measures are used to express how much water vapour is actually present (irrespective of temperature or level of saturation).

Definition and explanations of the most important of these terms are given in the next Section.

### 1.1 Humidity terms and definitions

Some vocabulary specific-to-humidity and other common words with specialised meanings in this context are as follows:

**Absorption (of water vapour)** – retention (of water vapour) by penetration into the bulk of a material

**Adsorption (of water vapour)** – retention (of water vapour) as a surface layer on a material

**Condensate** – condensed material, e.g. liquid water or ice

**Desorption** – release of adsorbed or absorbed substance

**Desiccant** – any substance which exerts a drying action by chemically absorbing water vapour

**Dry-bulb temperature** – measured air temperature, usually paired with a 'wet-bulb' temperature to derive a value of relative humidity

**Humidity** – the presence of water vapour in air or other gas. Some people use 'humidity' to mean relative humidity only. Strictly speaking, 'humidity' also refers to all kinds of absolute indications of humidity. For very low humidity, other more specific terms, tend to be used

**Hygrometer** – any instrument for measuring humidity

**Hygrometry** – the subject of humidity measurement

**Hygroscopic** – tending to absorb water vapour

**Inert gas** – chemically non-reactive gas, such as nitrogen, helium, argon, etc

**Moisture** – commonly used to refer to liquid water or water vapour in any form, 'moisture' is also the term particularly used to mean water that is absorbed or bound into any material

# A Guide to the Measurement of Humidity

**Probe** – the part of an instrument that houses the sensor remotely from the main body of the instrument, e.g. at the end of a connecting electrical lead. In some situations the word 'probe' may be used to refer to an entire hygrometer. Also loosely used interchangeably with 'sensor' and 'transmitter'. 'Probe' may also refer to a tube used to extract gas for measurement.

**Sensor** – the active or sensing part of a measuring instrument. There are some cases where a whole hygrometer is referred to as a 'sensor'. Also loosely used interchangeably with 'probe' and 'transmitter'.

**Transmitter** – instrument which normally gives an electrical output (analog or digital) rather than a displayed result. The sensing head may be an integral part of the transmitter or may be connected via an external cable. Also loosely used interchangeably with 'probe' and 'sensor'.

**Wet-bulb temperature** – temperature indicated by a thermometer sheathed in wet wicking, and influenced by the rate of evaporation from the wicking. Usually paired with a 'dry-bulb' temperature to derive a value of relative humidity.

## 1.2 Definitions of measured quantities

Many of the following definitions are based on those in the British Standard BS 1339: 1965 (confirmed 1981, under revision in 1996), 'Definitions, formulae and constants relating to the humidity of the air'. As given below, the definitions are explanatory rather than rigorous. For rigorous definitions, BS 1339 should be consulted. In practice, the usage of some terms varies according to the context: for example the terms in the field of air-conditioning are sometimes different from the terms used in meteorology for the same quantities. In each case a preferred term is given below, but qualifying notes indicate where there are common alternatives in use.

Units of measurement for expressing the quantities are given, and may have alternative forms, e.g. 'grams per cubic metre' is given by 'g m<sup>-3</sup>', alternatively written 'g/m<sup>3</sup>'.

**Absolute humidity** – The mass of water vapour present in unit volume of moist air of a given temperature and pressure. SI (metric) units are grams of water per cubic metre of air (g m<sup>-3</sup>). Older references may be in terms of pounds per million cubic feet (lb/MMscf) or in grains per cubic foot (gr ft<sup>-3</sup>). (One grain 0.0648 gram.).

**NOTE:** In chemical engineering the preferred term for this concept is 'volumetric absolute humidity', while 'absolute humidity' is used to denote the quantity referred to in this document as 'mixing ratio'. In meteorology the preferred term is 'vapour concentration'. Other terms such as 'vapour density', 'mass concentration' and 'moisture content by volume' are also sometimes used to mean the same thing.

**USAGE:** It is important not to confuse the particular quantity 'absolute humidity' with the general category of 'absolute measurements of humidity'.

**Dew point (or dew-point temperature)** – The temperature at which dew, or condensation, forms, on cooling a gas. This is, in effect, the temperature at which air becomes saturated in equilibrium with water. Expressed in degrees Celsius (°C) or occasionally in other units of temperature (e.g. in degrees Fahrenheit (°F) in USA). See also frost point.

**USAGE:** Negative dew points, with respect to super-cooled water below 0°C, are always shown with a minus (-) sign. Where there is any risk of ambiguity, a plus (+) sign may also be used for positive dew points:

e.g. 'a range of dew points between -5 °C and +5 °C'

The term 'dew point' is often used generally to include 'frost point' (see below). However in the range just below 0 °C, where either frost or dew (super-cooled water) can form, the values of dew point and frost point differ.

The use of initials (e.g. 'dp') is not a recognized abbreviation, but it occurs widely, and is used to distinguish clearly between dew-point temperatures and other values of (air) temperature. For example a dew-point value might be expressed in the form '1.0°C dp'

**Enthalpy (of humid gas)** – Measure of the total energy in a humid gas. Enthalpy is a function of the gas temperature and pressure, and of the moisture content, since water absorbs energy on changing from condensed state to vapour. Enthalpy is a useful concept in air conditioning, where it is important to know how much of the 'stored' energy will be consumed, or released, when the temperature or water content is raised, or lowered. Enthalpy of a gas can be defined as the sum of 'sensible' and 'latent' heat for each component in the gas. (See below for definitions of sensible heat and latent heat.) Values of enthalpy are conventionally expressed relative to a datum point (i.e. a zero or base line). For a dry gas, this is normally the heat content at 0°C. For water vapour, the enthalpy is usually expressed relative to the heat content of liquid water at 0.01°C.

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Expressed in terms of energy per quantity of dry gas, i.e. kilojoules per kilogram ( $\text{kJ kg}^{-1}$ ) (or other units, for example British thermal units per pound, Btu/lb).

**Equilibrium relative humidity (ERH) (over a substance)** – The value of relative humidity of the air, at which there is no net exchange of moisture with any nearby substance. This is used for indirectly indicating or controlling the condition of moisture-sensitive substances such as paper. Expressed as a percentage (%). (See also water activity.)

**Frost point (or frost-point temperature)** – The temperature at which frost forms on cooling a gas. This is, in effect, the temperature at which air is saturated in equilibrium with ice. It is the exact counterpart to dew point (though values differ). Expressed in degrees Celsius,  $^{\circ}\text{C}$ , or occasionally in other units of temperature, i.e. in degrees Fahrenheit ( $^{\circ}\text{F}$ ), in USA. (See also dew point.)

**Humidity ratio** – Mixing ratio.

**Latent Heat** – Heat stored in a substance but not directly related to its temperature. For example, heat is stored in a gas because this heat was originally supplied to evaporate it. 'Latent' means 'hidden'. Expressed in energy per unit mass of substance, i.e. joules per kilogram ( $\text{J kg}^{-1}$ ). (See also enthalpy, sensible heat.)

**Mixing ratio** – Mass of water vapour per unit mass of dry air with which it is associated. It is a dimensionless ratio, but is often expressed in grams of water per kilogram of dry gas ( $\text{g kg}^{-1}$ ) or in other units of mass.

For low levels of moisture content, this may be expressed in parts per million by weight, i.e. mass of water vapour per million parts mass of dry gas ( $\text{ppm}_w$  or  $\text{ppm}(w)$ ).

**NOTE:** In chemical engineering this quantity is normally termed 'absolute humidity' – but must not be confused with the definition of 'absolute humidity' given above. Mixing ratio is also alternatively known as 'humidity ratio'.

**Moisture content** – A humidity term best reserved for general descriptive or qualitative use only. Use of this term to identify a measured quantity should be avoided, as there is a risk of confusion because 'moisture content' has been used in the past to mean both mixing ratio and specific humidity. Moisture content is also a term particularly used to refer to the proportion of water held in liquids or solids.

**Mole** – Amount of substance, which contains as many elementary entities as there are atoms in 12 grams of carbon 12. Expressed in moles (symbol, mol).

**NOTE:** When the mole is used, the elementary entities must be specified as atoms, molecules, etc.

**Mole fraction** – The mole fraction of a component is the ratio of the amount (number of moles) of that component to the total amount of substance present. Expressed as a dimensionless ratio.

**Partial pressure (of water vapour)** – The part of the overall pressure exerted by the water vapour component in a gas. Expressed in units of pressure such as pascals (Pa) or in multiples; kilopascals (kPa) or megapascals (MPa), with non-SI alternatives such as millibar (mbar) or millimetres of mercury (mm Hg).  $100 \text{ Pa} = 1 \text{ mbar} \approx 0.75 \text{ mm Hg}$ .

**Parts per million** – Abbreviated as 'ppm', it must always be stated whether this is by mass (weight) or by volume, and whether the figure is the ratio of water vapour to dry gas, or to total (moist) gas.

**Parts per million by volume ( $\text{ppm}_v$ ,  $\text{ppm}(v)$ )** – Volume of water vapour per total volume of gas, for an ideal gas. Sometimes expressed relative to the total volume of moist gas (mole fraction times one million) or sometimes relative to the total dry gas. For small numbers of parts per million, the two are almost identical; at higher humidity they become significantly different.

**Parts per million by weight, or mass ( $\text{ppm}_w$ ,  $\text{ppm}(w)$ )** – Sometimes used to express the amount (mass) of water vapour relative to the total dry gas (mixing ratio times one million), but sometimes to express the amount relative to the total moist gas (specific humidity times one million). For small numbers of parts per million, the two are almost identical; at higher humidity they become significantly different.

**Percentage saturation** – The ratio of the actual mixing ratio to the saturation mixing ratio at the same temperature, expressed as a percentage (%).

**NOTE:** Under ordinary climatic conditions the percentage saturation is almost identical to the relative humidity.

**Relative humidity** – The ratio of the actual vapour pressure to the saturation vapour pressure over a plane liquid water surface at the same temperature, expressed as a percentage. This is commonly understood when the term 'X percent relative humidity' is used. For actual vapour pressure,  $e$ , and saturation vapour pressure,  $e_s$

$$\text{relative humidity (in \%)} = \frac{e}{e_s} \times 100 \quad (1)$$



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**USAGE:** The phrase 'relative humidity' is commonly abbreviated RH although this is not a recognized abbreviation. Values of relative humidity are commonly expressed in units of percent relative humidity (% RH).

Care must be taken when expressing uncertainties, changes or fractional differences in relative humidity. For example, the difference between 50% RH and 52% RH is 2% RH. This can also be expressed as a difference of 4% of value. It is important to distinguish clearly between these two kinds of statement.

**Saturation vapour pressure (of water)** – Maximum pressure of water vapour that can exist at a given temperature. Expressed in units of pressure e.g. in pascals (Pa), or in non-SI units such as millibars (mbar) or millimetres of mercury (mm Hg).

**Sensible heat (of a gas)** – Energy that resides in a gas according to its temperature. Expressed in terms of energy per mass of gas, e.g. in joules per kilogram (J kg<sup>-1</sup>), or equivalent units. (See also enthalpy, latent heat.)

**Specific humidity** – Mass of water vapour per unit mass of humid air. May be expressed as a dimensionless ratio, or in grams of water per kilograms of humid gas (g kg<sup>-1</sup>) or in kilograms per kilogram (kg kg<sup>-1</sup>)

**Vapour pressure** – That part of the total pressure contributed by the water vapour. Expressed in units of pressure e.g. in pascals (Pa), or in non-metric units such as millibars (mbar) or millimetres of mercury (mm Hg).

**Water activity (of a substance)** – Water activity (a) is the relative humidity, which is eventually reached in a closed space where a hygroscopic substance, such as a foodstuff, has been placed. It is the same as equilibrium relative humidity (ERH) except that it is expressed on a scale of 0 to 1 (no units), instead of 0% to 100%. Water activity is particularly used in connection with foodstuffs. (See also equilibrium relative humidity.)

## 2 Significance of temperature and pressure for humidity measurement

### 2.1 The effects of temperature on humidity measurement

The effect of temperature on humidity is highly significant. Failure to take this into account can sometimes lead to errors so large that the measurement is meaningless. In many situations, the largest single source of uncertainty in a humidity measurement is the effect of temperature differences from place to place in the process, room or chamber. The importance of considering the temperature effects carefully cannot be overstated when relative humidity is the parameter of interest.

### Temperature and condensation

One common cause of error in humidity measurement is the occurrence of unwanted condensation. Condensation can occur at cold spots, which are below the dew point of the gas. In sampling systems, any condensation totally invalidates the sampling process, since it changes the water vapour content of the gas. To prevent condensation, sample systems should always be kept at a temperature above the maximum dew point, by heating them if necessary.

### Temperature and absorption or desorption of water

Many materials contain moisture as part of their structure; particularly organic materials, salts, and anything which has small pores. The quantity of water in these materials depends on the humidity of the surrounding gas, and on the temperature. When the temperature changes, water migrates from the material to the surrounding gas or vice versa. Like condensation, this can cause changes in the measured humidity. However, unlike condensation, there is not usually a critical temperature: whenever the temperature changes, water moves between the material and the gas.

When measuring low dew points, desorption or absorption of water vapour as the temperature changes can produce very large errors in measurement. Even in normal ambient conditions, absorption or desorption can begin to be significant, depending on the type of material.

### Temperature and saturation vapour pressure of water

The saturation vapour pressure of water depends strongly on temperature. Near room temperature, the air's capacity to hold water vapour doubles for every 10°C increase in temperature. The steepness of this variation gradually changes across the temperature range. At 80°C the saturation vapour pressure doubles for every 20°C rise. At -60°C the saturation vapour pressure doubles for only a 5°C rise in temperature.

### Temperature and relative humidity

Relative humidity is highly dependent on temperature – especially so because vapour pressure appears twice in the formula for relative humidity,

$$\text{relative humidity (in \%)} = \frac{e}{e_s} \times 100 \quad (2)$$

(e is the water vapour pressure, and e<sub>s</sub> is the saturation vapour pressure at the prevailing ambient temperature.)

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Table 1. Effect of a temperature change of 1 °C at various levels of temperature and relative humidity. The change in the relative humidity levels is not symmetric.

Relative humidity	Temperature					
	10°C	20°C	30°C	40°C	50°C	60°C
10% RH	±0.7% RH	±0.6% RH	±0.6% RH	±0.6% RH	±0.5% RH	±0.5% RH
50% RH	±3.5% RH	±3.2% RH	±3.0% RH	±3.0% RH	±2.6% RH	±2.3% RH
90% RH	±6.3% RH	±5.7% RH	±5.7% RH	±5.4% RH	±4.6% RH	±4.1% RH

Roughly speaking, at room temperature, a change in dew point of 1°C corresponds to a change in relative humidity of 6 percent of the relative humidity value. For example at 50% RH, an uncertainty in dew point of ±1°C corresponds to an uncertainty of ±3% RH.

A change of 1°C in the measurement of the ambient temperature has almost exactly the same significance. The size of the effect under different conditions is illustrated in Table 1.

Overall, a useful rule of thumb is that ±1°C uncertainty in either dew point or temperature leads to an uncertainty of ±6 percent of the relative humidity value.

## A note on temperature measurement in air

A thermometer indicates its own temperature. It is important to note this because a thermometer may not always be at the same temperature as its surroundings. Thermometers can be influenced by the temperatures of other objects nearby (not the ones which are intended to be measured). Thermometers can also suffer from time lags, and self-heating errors may affect electrical resistance thermometers. All these effects are at their worst when a measurement is undertaken in air, as opposed to in liquid. Errors from these sources can easily amount to several tenths of a degree, so the effects on relative humidity can be significant, as shown above.

## 2.2 The effects of pressure on humidity measurement

Since all measurements of humidity stem from the measurement of a vapour pressure of water, it follows that variations in overall pressure of the gas system may have an effect on the measured humidity. Throughout this document, the values of pressure are given in absolute terms (atmospheric pressure being 101325 Pa, or 1013 mbar), and not in 'gauge' pressures (where atmospheric pressure would have a value of zero).

In a gas mixture such as room air, the total pressure  $P(\text{total air})$  of the system can be expressed as the sum of partial pressures:

$$P_{(\text{total})} = P_{(\text{nitrogen})} + P_{(\text{oxygen})} + P_{(\text{water})} + P_{(\text{others})} \quad (3)$$

It therefore follows that if any of the partial pressures of the component gases varies, the total pressure  $p(\text{total})$  will vary. Also, if the total system pressure is changed, either by compression or expansion, each of the component partial pressures will be changed by a similar factor to  $p(\text{total})$ .

This basic rule can be applied to any measure of humidity to predict the effect of changes in either component or overall pressures. Below are some simple examples showing the effect of pressure change.

### Effect of doubling pressure on a relative humidity of 40% RH at constant temperature, without changing composition

Relative humidity is expressed as a ratio of vapour pressures (the actual vapour pressure relative to the saturation vapour pressure). Doubling  $p(\text{total})$  will yield a similar doubling of  $p(\text{water})$ . If the saturation vapour pressure remains unchanged (i.e. if temperature is unchanged) then a relative humidity of 40% RH would be doubled to 80% RH.

As a general approximate rule, the actual relative humidity value can be multiplied by the fractional change in total system pressure to give the resultant value of relative humidity. NOTE: Where the result exceeds 100% RH, condensation WILL occur.

This rule is similar for other measures of concentration in terms of mass per unit volume, such as absolute humidity ( $\text{g m}^{-3}$ ).

### Effect of doubling system pressure on mixing ratio, without changing composition

The mixing ratio of water in a gas system is simply the ratio of the mass of the water vapour to the mass of the dry gas.

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If any gas is compressed or expanded without adding or removing components, then the mass of all components is unchanged. Therefore the mixing ratio is unaltered by the pressure change. This can also be deduced from the fact that the definition of mixing ratio does not involve pressure or temperature.

The rule is similar for other dimensionless measures of concentration (those expressed in mass per unit mass, or volume per unit volume), such as mole fraction and specific humidity, including cases where these are expressed in terms of parts per million.

## Effect of doubling system pressure on dew-point temperature, without changing composition

The dew-point temperature of a System is directly related to the water vapour pressure of that system. From equation (2) it can be seen that a doubling of total pressure  $p(\text{total})$  will yield a doubling of the water vapour pressure,  $p(\text{water})$ . Reference to vapour pressure tables will allow the new dew-point temperature to be calculated.

For example, for a system of pure water vapour with a dew point of  $+10^{\circ}\text{C}$ , the water vapour pressure is about 1228 Pa. If the system pressure is doubled, the resultant water vapour pressure will be  $2 \times 1228 = 2456$  Pa, which equates to a dew-point temperature of about  $+20.8^{\circ}\text{C}$ .

For dew points in the presence of air or other gases (rather than pure water vapour alone), a correction may need to be made for the water vapour enhancement factor (see below).

## Water vapour enhancement factor

The examples above assume that all the component gases exhibit 'ideal gas' behaviour. In practice a small, pressure-dependent correction may be required: the 'water vapour enhancement factor'.

In air, this numerical correction is less than 1% of value when pressure is doubled from atmospheric pressure. For a tenfold increase from atmospheric pressure, the effect is between about 1% and 10% of value, depending on the dew point of the gas.

## 3 Selection of a type of hygrometer

### 3.1 Identifying measurement needs

To ensure 'fitness for purpose' it must be clear first of all what is the purpose. Is a humidity measurement needed at all? If so, what use is it to the business or process?

To be useful, how should the results be expressed? Is the measurement to meet a practical need, or to comply with a documented specification, and is the specification meaningful and realistic? Once the need and aim of making the measurement is clear, it is important to decide what factors are relevant to achieving this aim. The user should consider the following issues:

### 3.2 Measurements required

**Relative or absolute** – Which unit or scale of measurement? The quantity of interest may be relative humidity, dew point, or some other measure of the concentration of water vapour.

It is best to select a method of measurement which intrinsically detects the quantity of interest. Many hygrometers display results in terms of two or more humidity parameters. This is often useful, but it should be understood that normally only one parameter is being measured, and the other values are the result of numerical conversions. Because of this, an instrument might give a reliable indication of only one of the parameters shown, while providing a less good indication of the other parameters.

**Range (humidity and other variables)** – Different types of measurement are suited to different ranges of humidity. It is best to avoid using an instrument at the upper or lower extreme of its range of measurement. Ranges of temperature, flow rate, and pressure or vacuum also need to be specified in order to select the best instrument.

For example, where use at elevated pressure is planned, the construction of the instrument may be as important as the operating principle. On the other hand, for some types of measurement, a correction may have to be applied to the results if the pressure varies.

**Performance** – It is worth deciding if any particular performance characteristics are important for the application in question. There may be a need to set criteria for sensitivity, stability (in terms of repeatability or reproducibility), uncertainty, response time, resolution, linearity or hysteresis.

**Output, readout** – The humidity result may simply be shown as a number on a digital display, or on a numbered scale. It may be given as an electrical voltage or current signal (analog output). Several parameters or units of humidity may be shown, together with temperature. Readings may be given continuously or at intervals.

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## 3.3 Instrument format and usage

**Sampling** – Sampling is an important issue in all humidity measurement. The sampling approach may be that of ‘immersion’, where the instrument sits wholly or partly in the environment to be measured; or the gas may be ‘sampled’ by extracting it to the instrument through a tube. Some immersion sensors benefit from being in still air, some from being in moving air, and for some the flow rate of air is critical. When measuring gases with very low water content, the quality of the sampling pathway is critical; hygroscopic materials in the pathway can change the water content of the sample. Also, care must be taken with certain types of hygrometer, which may themselves affect the environment, by giving off either water or heat. (Indeed any instrument introduced at the wrong temperature will influence its environment, affecting the measurement result.) Conversely, moisture and heat from the operator may affect measurements using hand-held hygrometers.

**Type of gas** – In gases other than air, chemical compatibility may be an issue. Calibration specific to the gas in question may be required.

**Materials of construction** – Aside from considering the hygroscopic nature of materials, other aspects of suitability may need to be addressed. Some materials may be chemically incompatible with the environment of interest. Materials may be unacceptable for other reasons, such as avoidance of Molded polymers and glass for reasons of hygiene or safety.

**Ease of use** – Some hygrometers are straightforward to use. Others require some skill.

**Use for control or monitoring** – In some gases the user simply needs to measure humidity. In others, the humidity measurement is fed into a process of control of humidity. If so, then access to the electrical output in some form is usually necessary. For use in control of humidity, the response time and the degree of hysteresis are usually important.

**Hazardous areas** – In areas where there is some hazard, such as an explosive atmosphere, suitable precautions must be taken. For example, extraction of sample gas to remote probes may reduce the risk in some cases, while other sensors can be designed to be intrinsically safe, by limiting the electrical power to a level low enough that it cannot ignite the atmosphere. Where this is a concern, an appropriate certification of intrinsic safety should be sought.

**End use** – Humidity itself may be of interest, or humidity may be used as an indication of the moisture content of other solid or liquid substances. If so, it may give no more than a very indirect indication of the actual content, though ERH and water activity are proper indications, in a different way, of the condition or equilibrium of materials with the environment.

**Calibration** – Method of calibration, and ease of doing so, should be considered. even when there does not appear to be a call for highly accurate results.

**Robustness** – Both hygrometer sensors and casings vary in their robustness against condensation, drying out, temperature extremes, dust, chemical or other contamination, vibration, or even simple handling.

**Versatility** – If more than one kind of use is envisaged, the adaptability of the hygrometer should be borne in mind.

**Interchangeability** – It may be desirable to have a set of hygrometers which can be used interchangeably, or to substitute other probes for use with the main body of the hygrometer. It may be necessary to replace components of the sensor which might fail. In any of these cases, it is important to consider how interchangeable the instruments or components really are. Interchangeability is best ensured by calibration against a consistent reference. However, replacing a key component of an instrument may invalidate its previous calibration.

**Maintenance** – Some types of hygrometers need routine cleaning, regeneration, or replacement of parts.

**Availability of spares** – It may be worth knowing about spare parts; whether they can be fitted by the user, and whether they are freely available locally and quickly. Any consumable supplies, such as charts, should be available and clearly coded or identified, as they are not always interchangeable.

**After-sales service** – The availability of a warranty, or of a good maintenance or service contract may be a factor in the decision.

## 4 How to interpret the data sheet information?

Detailed below are technical terms used to make statements about instrument performance, as typically found in manufacturers’ data sheets. They are:

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- range
- resolution
- uncertainty (accuracy)
- repeatability
- reproducibility
- non-linearity
- hysteresis
- response time
- long-term stability
- temperature coefficient

This list is not exhaustive, although it indicates the most important specifications to consider when selecting an instrument. Practical considerations such as dimensions, power supplies and output signals, may have little or no significance to the measurement performance characteristics of the unit. However, these practical elements should be carefully selected if the instrument is to meet the full working requirement of the application.

Each characteristic is explained separately below. However, although separately defined, it is not always possible in practice to distinguish between some of them.

Formal definitions of these terms are given in the ISO document 'International Vocabulary of Basic and General Terms in Metrology' (Second edition, 1993).

## Measuring range

The stated measuring ranges for temperature and humidity provide guidance as to the upper and lower temperature and humidity environments to which the instruments sensors can be applied. Often an additional specification: operating range (electronics) is also stated; this confirms the conditions in which the instrument's electronics (other than the sensor, or probe) can safely operate. Where a maximum or minimum humidity is stated, it is often the case that the humidity sensor will be damaged if these limits are exceeded.

## Resolution

Where an instrument features a display of its measured values, the indication will have a resolution of, say, 0.1% RH or 1% RH. Specification of this in the data sheet simply informs the user to what degree of precision the measurement can be noted. Resolution may not significantly affect the uncertainty of measurement, except in the case of a coarse resolution of, say, 1% RH, where the display will round the actual value up or down to the nearest significant figure, thereby introducing an additional error of up to  $\pm 1\%$  RH, depending on the method of rounding.

## Uncertainty (accuracy)

The uncertainty of a measurement is defined as the parameter characterising the range in which the 'true value' can be expected to lie. It defines a 'margin of doubt' about a reading or estimated value, together with a level of confidence (normally 95%) that the 'true value' will lie within this range.

**NOTE:** Often, the uncertainty for an instrument is specified for ideal operating conditions at a temperature of 20°C or 23°C. However, further contributions such as hysteresis, linearity, reproducibility and temperature dependence will need to be taken into account when estimating the overall uncertainty for an instrument. The method of use may make an important contribution to the overall uncertainty achieved.

Strictly speaking, 'accuracy' is a qualitative term only. For example, an instrument or measurement might be described generally as 'accurate' or 'not accurate'. If accuracy is to be quantified, it should be expressed in terms of uncertainty, for example, '... an uncertainty of  $\pm 5\%$  RH ...' (not '... an accuracy of  $\pm 5\%$  RH ...'). However, the word 'accuracy' continues to be used loosely in specifications to refer to the maximum difference that can be expected between the reading given by an instrument and the 'true value' being measured.

## Repeatability

In general terms, the repeatability of an instrument is the closeness of agreement of multiple readings repeated under the same conditions of measurement. To quantify repeatability, the spread or dispersion of results may be quoted, e.g. in terms of a standard deviation of a number of readings.

## Reproducibility

In general terms, reproducibility is an instrument's capacity to reproduce a previous measurement. This may be at a later date, or after undergoing significant changes in conditions, for example, after a change of operator, or of location. To quantify reproducibility, the spread or dispersion of results may be quoted, e.g. in terms of a standard deviation of a number of readings.

## Non-linearity

In an ideal world, if a calibration were carried out at two points in a measurement range (high and low) the instrument would behave similarly at values in-between. However, it is usual to find some deviation from this ideal, due to non-linearity of the sensor. In other words most sensors exhibit a calibration curve, as opposed to a straight line.

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The deviation from the ideal calibration line will have a maximum or minimum, usually expressed in the form: 'Non-linearity  $\pm 0.5\%$  RH', at a given temperature. It should also be noted that linearity characteristics can be significantly affected by temperature. When having an instrument calibrated, linearity is a factor to bear in mind when deciding how many measurements are needed and at what intervals throughout the range of measurement.

## Hysteresis

Hysteresis, in general terms, is the dependence of a reading upon whether the condition is approached from above or below the value of interest. For example, given a humidity cycle of say 10% RH to 50% RH to 90% RH and back to 50% RH, most hygrometers would not give an identical reading on both occasions at 50% RH.

Hysteresis is related to repeatability, but includes any 'directional' effect.

Hysteresis should be considered if the measurement is to be used for control purposes, for example to activate on-off control of air conditioning.

## Response time

Response times are included in specifications to provide an indication of how long the instrument takes to react to changes in the applied condition. While the sensor itself may have a particular response time, any screening of the sensing element, e.g. by a protective filter, will slow down this response. Effective air movement will speed it up. (Constant and specified air flow is required for a response time test.) Response times are practically always slower for falling humidity than for rising humidity.

Quantitatively, response times are usually quoted in terms of the time taken to register 63% of a step change in the applied condition (although other conventions are sometimes used, e.g. 90%).

Response times are usually quoted for the hygrometer alone, at constant temperature. However, response times of the associated sampling systems may be much greater. Optimistic specifications of response time may raise false expectations for the user to see stable measurements after very short time periods. However, for most relative humidity measurements, the time taken for the sensor and nearby materials to equilibrate with respect to temperature is by far the most significant factor influencing the response time. For measurements of dry gases, equilibration of moisture in the sampling system is usually the key influence.

## Long-term stability

The measurement characteristics of any instrument will change with respect to time, due to gradual changes in electrical or material components. Estimates of long-term stability or drift, refer to the likely change in the instrument's measurement performance with respect to time. Regular checks of calibration should be made to quantify this potential problem. Although it may sometimes be desirable to adjust the hygrometer reading in the light of drift, performance could be compromised by the adjustment process, and the overall drift characteristics could be masked by frequent adjustments.

Quantitatively, drift may be expressed in terms of a time span and a figure. However, if an instrument was subject to drift of less than 4% RH per year, it would not follow from this that the drift over six months would be less than 2% RH (though it could be expected to be somewhat less than the annual figure). Drift is not always consistent, and measurements of drift always include some contribution from short-term variability.

## Temperature coefficient

Temperature variation has a most significant influence on relative humidity itself. In addition, every humidity sensor has a temperature coefficient, which can be simply explained as a change in measurement characteristic at a different temperature. A temperature coefficient might be expressed, for example, as 0.1% RH per °C, which could result in an additional 5% error when measuring at a temperature 50°C away from the calibrated temperature.

## 5 What is calibration?

Calibration is the process of comparing a measuring instrument against an authoritative reference for the same type of measurement, to identify any bias or systematic error in the readings. The outcome of a calibration is normally a certificate listing any corrections that need to be applied to the values indicated by the instrument, together with an estimate of the uncertainty in the calibration, and other relevant information. For example, a calibration of a given instrument at, say, 50% RH, might show it to read too high by 1% RH. If so, a required correction of -1% RH would be shown on the certificate.

Calibration is often taken to mean 'adjustment of the instrument to read correctly'. This is not true. Calibration and adjustment of an instrument are quite separate concepts, and the two should not be confused. Thus, when arranging for the calibration of any instrument, it is important to establish clearly whether or not the instrument is to be adjusted as well as calibrated. If so, it should be specified whether calibration information is required only after adjustment, or whether results are also required for the initial or 'as found' condition.

# A Guide to the Measurement of Humidity

Any calibration corrections identified on a certificate of calibration should be applied to measured values obtained using that instrument. If the calibration corrections cannot be applied, the quoted uncertainty in the results should include an allowance for this.

## What is checking?

A measurement check is not the same thing as a calibration. A check is a test to confirm whether or not some condition is fulfilled (for example to confirm that the performance of an instrument has not drifted). The outcome of a check is not normally a certificate of calibration. However, checks of a measuring instrument against another (stable) instrument are often useful at intervals in between calibrations.

## 6 Recommended practices in humidity measurements

### 6.1 General practical recommendations

- Where relative humidity is of interest, a direct measurement of relative humidity is usually best. Where an absolute measure of humidity is needed, choose dew point, vapour pressure or similar measurements.
- Establish the measurement requirements at the purchasing stage in order to have the right instrument for the job.
- Allow hygrometers to equilibrate in any new environment. This is particularly necessary after changes in temperature due to transportation or storage. Depending on the instrument and on how great the change in conditions, this may require from only a few minutes to many hours.
- Follow Michell Instruments' care instructions for the instrument. Some instruments need routine cleaning or other maintenance. Before using any solvent cleaner, check with Michell Instruments that this will not harm the sensor or other materials of construction.
- Wherever possible, ensure that hygrometers are calibrated under the conditions of use, i.e. at similar values of humidity and temperature, and (if relevant) in similar conditions of pressure, airflow, etc.
- Keep a record of calibrations and any adjustments to the hygrometer. This will show the long-term stability of the instrument and allow the associated

uncertainty to be assessed.

- Check instruments, if possible, at intervals between calibrations, by comparison with another (stable) instrument, to monitor for long-term drift. Routine checks are also useful before and after subjecting an instrument to transportation or other stress, which might lead to a shift in its performance. Where the check is against two (or more) instruments this is even better: not only does this add confidence, but in the event of one instrument drifting among a set of three, it can be seen which reading is most suspect.
- Cleanliness of the environment will affect different hygrometers in different ways. Dust and airborne droplets should be avoided or filtered out if possible. Contaminants can come from the most surprising sources, ordinary urban pollution, for example.
- The readings given by some types of hygrometer are sensitive to gas type. For any Instrument which reads in terms of mass per unit volume, e.g. in grams per cubic metre, it must be confirmed whether the calibration is valid for the gas in use.
- Avoid using instruments in direct sunlight or near any other source of heat, unless they are suitably shielded to prevent measurement errors.

### 6.2 Sampling in general

- Relative humidity measurements should be carried out at a representative temperature. Failure to allow temperature equilibration will lead to a false indication of the relative humidity.
- Variations in vapour pressure from place to place can occur where an environment is subject to any addition or removal of water. If so, care must be taken over where to make a measurement in order to obtain a representative result.
- Sources and sinks of water vapour should be avoided in any sampling system. Invasion of stray water can be minimised by attention to leaks, hygroscopic materials, droplets and condensation. The lower the humidity, the more critical these precautions are.
- Hygroscopic materials should be avoided. Many materials contain moisture as part of their structure, particularly organic materials (whether natural or synthetic), salts (or anything which contains them), and anything which has small pores. Temperature changes can increase the tendency of these materials to affect the humidity of the surrounding air.

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- Condensation in a sampling process can invalidate humidity measurements by reducing the water content of the gas being measured. What is more, condensed liquid may alter the humidity elsewhere by dripping or running to other locations and evaporating there. In these circumstances, measurement results may be misleading if hygrometer location is not considered carefully.
- Water droplets or mist must be avoided. These can result in overestimates of the humidity of the air between the droplets. Such results may exceed 100% RH, or may be impossible to interpret meaningfully. Droplets of liquid also damage some electrical types of humidity sensor. Filtering the air sample can eliminate droplets.
- If pumps are used for sampling gas, these should be located after the hygrometer, to avoid contaminating the measurement environment. Where possible, oil free pumps should be used, or filters employed. Oscillations in pressure due to pumping can sometimes be reduced or buffered using a needle valve or a reservoir of large volume.
- Special treatments such as filtration can change the amount of moisture in a gas. Some drying agents take out other gases, too.
- When sealing any sensor or probe into a port or manifold in a duct or chamber, leaks through the probe or electrical cable should be considered. These are not always sealed against passage of ambient air.
- Where sampling involves a step change in temperature, pressure or gas flow rate, relative to the process being sampled, results may need to be converted or interpreted. For example 'pressure dew point' will differ from the value found after expanding the gas sample to atmospheric pressure. Care should be taken to distinguish between 'gauge' and absolute values of pressure.

## 6.3 Dew point in general

- The measuring environment and all parts of the sampling pathway must be kept above the dew point if condensation is to be avoided. Electrical trace heating or other heating methods should be used if necessary. An excess temperature of 10°C above the dew point is usually a safe margin.

- For measurements in the region below 0°C it must be clear whether the condensate is dew or frost. Failure to distinguish between these can result in errors of about 1°C for every 10 °C below zero.

## 6.4 Relative humidity in general

- Due care must be taken of temperature.
- Care must be taken when expressing uncertainties, changes or fractional differences in relative humidity. For example, the difference between 50% RH and 52% RH is 2% RH. This can also be expressed as a difference of 4% of value. It is important to distinguish clearly between these two kinds of statement.

## 6.5 Recommendations specific to ranges of measurements

- Ambient humidity - Avoid using hygrometers near the body, which is a source of heat and moisture. Do not breathe close to the measurement.
- High humidity, above the ambient range - Ample lines should be maintained above the dew point of the gas being measured, to avoid condensation. Electrical trace heating is often the most practical method.
- Low humidity, and very dry gases - If possible, prepare for measurements by flushing sample lines and hygrometers with dry gas, or by evacuating to low pressure. Drive off stray residual water by baking assemblies if possible (but not instruments – unless designed for this!). The lower the moisture content to be measured, the more dramatically the required drying time multiplies.
- Avoid hygroscopic materials. At low humidity (anything much below a dew point of 0°C) the amounts of water given off by organic and porous materials can dramatically affect the value of humidity. The lower the level of moisture, the more significant the effects.
- Choose impermeable materials, to avoid inward diffusion of moisture through sampling tubes and enclosures. Steel and other metals are practically impermeable. PTFE ('Teflon') is only slightly permeable and will usually be satisfactory for dew points above -20°C, and sometimes below this level. Materials such as PVC and rubber are relatively permeable and so totally unsuitable at low humidity, and not really satisfactory in any humidity range.



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- Surface finish of pipework is important for very dry gases. Even the tiny quantities of water adsorbed on the surfaces of non-hygroscopic materials can have significant effect. Polished or electropolished steel is recommended for the best results.
- Clean environments are always best for humidity measurements, but this is especially critical at very low humidity. Even fingerprints harbour water. High purity cleaning agents are recommended: Analytical Reagent (AR) quality solvents for oil-based contaminants, and purified water (distilled or deionized) for salts. Cleaning should be followed by thorough drying by a clean method.
- Sample tubing should be as short in length as possible. The surface area should be minimised by using the narrowest tubing that the flow conditions will permit.
- Avoid leaks. Minimising the number of connections (elbows, tees, valves, etc.) helps with this.
- Adequate flow of the gas sample should be ensured, to minimise the influence of sources of stray water in the flow path.
- 'Dead ends' should be avoided, as they cannot easily be flushed.
- Back-diffusion of moisture should be minimised, e.g. by fast flow rates of gas, long exhaust tubes after the sensor, or by valves which isolate the low-humidity region from ambient air.
- Protective filters can slow the response time of sensors. This can be avoided by removing any filter, but the benefit must be weighed against the risk of damage to the sensor.
- Sensors should not normally be submerged in liquids. In the case of a resistive (electrolytic) sensor, water or other liquids would certainly damage the sensor beyond repair.
- Salt solutions are especially commonly used for calibration of electrical sensors, and should be provided with traceability directly or via a calibrated hygrometer. Protection of sensors from direct contact with salt or solution is most important as contamination would destroy or seriously impair the sensing element.

## Impedance dew-point hygrometer

- Sensors constructed using aluminium oxide or ceramics essentially respond to vapour pressure. They are often used at high pressure, or to sample gas originating from systems at high pressure. If so, care must be taken to ensure that the sample pressure is known, and a correction applied if necessary.
  - As for other electrical sensors, filtration should be used to protect from dust and droplets or mist.
  - Regular calibration is particularly important for ceramic hygrometers. The calibration intervals may be dependent on usage.
  - Aluminium oxide sensors normally exhibit a temperature coefficient, which may be partially compensated within the instrument, but not totally. If the hygrometer must be used at a temperature, other than that at which it was calibrated, ensure that any necessary correction to the reading is made, and that any resulting uncertainty is taken into account.
  - When using the sensors at low levels of moisture, the precautions listed above under 'sampling' and 'low humidity' should be observed.
- ## 6.6 Practical recommendations for specific types of hygrometer
- ### Relative humidity capacitive sensor
- Care should be taken to avoid mechanical shock (impact) or thermal shock (sudden temperature changes). Sensors should be protected from steam or water sprays, and from direct sunlight.
  - Where a sensor is at risk of exposure to dust, droplets, or the occasional knock during handling, the appropriate guard or filters for the sensor head should be used.
  - Any temptation to breathe on the sensor, or to wave it over cups of tea, etc. should be resisted. Filters and saturation guarding may protect the sensor, but these actions carry a risk of damage by condensation or other contamination.

# Notes

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