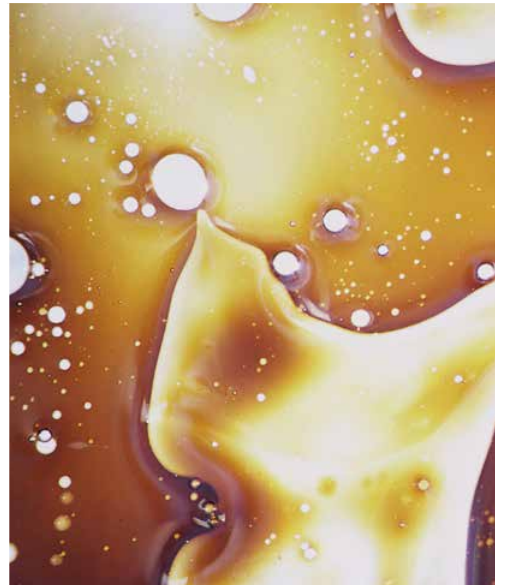
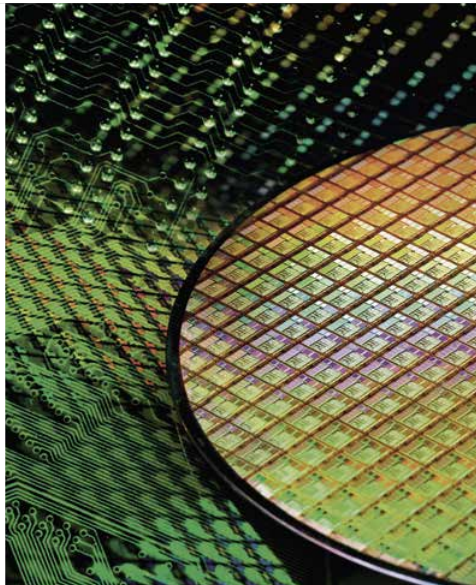


HUMIDITY / DEW POINT / TEMPERATURE /  
MOISTURE IN OIL / CARBON DIOXIDE /  
PRESSURE / WEATHER



**VAISALA**



# Measure and Succeed

**Accurate measurements for humidity, temperature, dew point, carbon dioxide, pressure and moisture in oil**

If the success of your operations depends on faultless measurements, we have the solution for you: Vaisala HUMICAP®, DRYCAP®, CARBOCAP® and BAROCAP® sensors – the unrivaled industry quality benchmarks.

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# VAISALA





*Demanding measurement requirements across multiple industries, from semiconductor to automotive to power, have always inspired Vaisala to continuously develop measurement instruments that set the benchmark for quality, accuracy, and reliability.*

*To ensure we continue to understand your needs, we keep a close eye on our customer surveys and on comments collected from the field. I would like to take this opportunity to thank you for your compliments regarding our product performance and technical customer service. But thank you even more for your comments on how we can improve, including suggestions for new product options and calibration services. For example, customer feedback played a vital role in developing the new GMW90 CO<sub>2</sub> measurement instrument with microglow technology in 2013.*

*Throughout our over 75-year history, Vaisala has succeeded together with our customers. Please keep on sharing how we can best address your needs and add value to your investment. We are here to help you succeed – your success is our success.*

A stylized, handwritten signature in blue ink, consisting of a series of fluid, connected strokes.

*Sampsa Lahtinen  
Executive Vice President  
Controlled Environment  
Vaisala*

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# Vaisala HUMICAP® Sensor for Measuring Relative Humidity



*In 1973, Vaisala introduced HUMICAP®, the world's first thin-film capacitive humidity sensor. Since then, Vaisala has become the market leader in relative humidity measurements, and thin-film capacitive humidity sensors have developed from one company's innovation into a global industry standard.*

Vaisala HUMICAP sensors guarantee quality and reliability, with their reputation for accuracy, excellent long-term stability, and negligible hysteresis.

## How It Works

HUMICAP is a capacitive thin-film polymer sensor consisting of a substrate on which a thin film of polymer is deposited between two conductive electrodes. The sensing surface is coated with a porous metal electrode to protect it from contamination and exposure to condensation. The substrate is typically glass or ceramic.

The thin-film polymer either absorbs or releases water vapor as the relative humidity of the ambient air rises or falls. The dielectric properties of the polymer film depend on the amount of absorbed water. As the relative humidity around the sensor changes,

the dielectric properties of the polymer film change, and so does the capacitance of the sensor. The instrument's electronics measure the capacitance of the sensor and convert it into a humidity reading.

## Typical Applications for Humidity Measurement

Vaisala's humidity instruments with HUMICAP sensors are suitable for a wide range of applications. From power and steel to life sciences and building automation, many industries need to measure humidity – here are just a few:

Humidity must be measured and controlled in many drying processes, such as those in construction material and paper manufacturing, and fluid bed dryers. The humidity of the process air is a good indicator of the progression of the drying process.

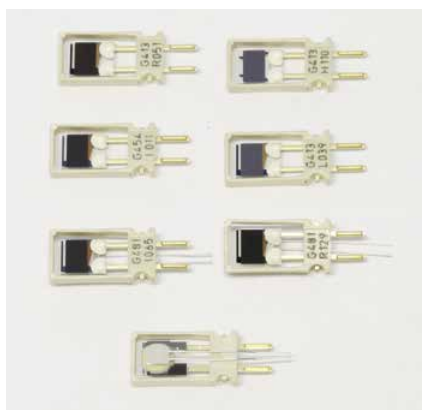
## HUMICAP in Brief

- A capacitive thin-film polymer sensor
- Full measurement range 0...100 %RH
- Accurate to  $\pm 1$  %RH
- Traceable humidity measurement
- Nearly 40 years on the market

## HUMICAP's Unique Benefits

- Excellent long-term stability
- Insensitive to dust and most chemicals
- Chemical purge option for stable measurements in environments with high concentrations of chemicals
- Sensor heating for measurements even in condensing environments
- Full recovery from condensation

Cleanrooms and other critical environments also require high-performance environmental measurements in order to operate consistently and within



*Family of HUMICAP sensors.*

specifications. In addition, glove boxes and isolators – used for handling moisture or gas-sensitive materials – benefit from accurate and reliable humidity measurements. Measuring humidity in a critical environment can be especially challenging.

In the food industry the dryers and ovens used in bread baking and cereal manufacture require a carefully controlled humidity level to maintain consistent quality and high yield, and to give distinctive characteristics to the finished product.

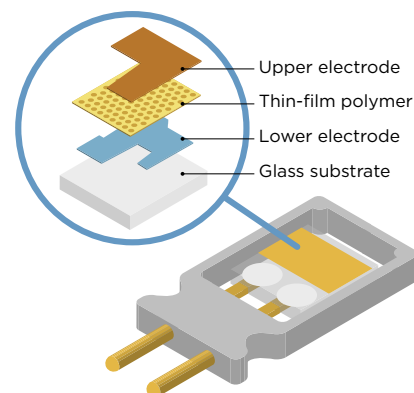
In building automation, optimizing both the temperature and relative humidity of the indoor environment enables a greater level of comfort for occupants than optimizing temperature alone. Careful humidity control is a must in museums, archives, warehouses, and other environments where humidity-sensitive materials are stored.

### Vaisala HUMICAP Humidity Products

Vaisala has everything you need for measuring humidity, with a wide range of humidity instruments covering applications from HVAC to the most demanding industrial applications, both indoors and out. Vaisala's humidity instrument offering includes transmitters, modules for volume applications, portable and handheld humidity meters, and humidity calibrators. The full range of humidity products can be found at [www.vaisala.com/humidity](http://www.vaisala.com/humidity)

#### Vaisala INTERCAP® Sensor

- Same measurement principle as in the HUMICAP® sensor
- Factory pre-calibrated - no additional calibration or adjustment needed
- Fully interchangeable
- Used in humidity instruments with  $\pm 3$  %RH accuracy



*Structure of the HUMICAP sensor.*

## HUMICAP® – The Story of Innovation

Until the early 1970s, hair hygrometers were commonly used in radiosondes. At that time, reliable humidity measurement was an unresolved challenge and to solve this, Vaisala began developing a new type of humidity sensor using semiconductors and thin-film materials. The revolutionary HUMICAP humidity sensor was introduced two years later, in 1973, at CIMO VI congress.

HUMICAP was a radical innovation that changed humidity measurements for good. The new technology was groundbreaking:

the sensor had no moving parts, and due to the advanced use of semiconductor and thin-film technologies, it was amazingly small. The sensor had a fast response time, good linearity, low hysteresis, and small temperature coefficient.

Despite the fact that the innovation was designed for a new type of a radiosonde, the greatest interest came from elsewhere: people working in environments as diverse as greenhouses, bakeries, warehouses, construction sites, brick and timber kilns, and

museums. The need for reliable humidity measurement was common to all, and instruments that could do this accurately were few and far between.

By 1980, a variety of products based on HUMICAP technology – from hand-held meters to industrial transmitters, calibrators, and other accessories – were being sold in over 60 countries. Since its birth, HUMICAP has been part of Vaisala's core business, propelling the company to industry leadership in the field of humidity measurement.

# VAISALA

For more information, visit [www.vaisala.com](http://www.vaisala.com) or contact us at [sales@vaisala.com](mailto:sales@vaisala.com)

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## How to Choose the Right Instrument for Measuring Humidity and Dew Point



### What is Humidity? An Introduction to Humidity Parameters

#### Partial Pressure of Water Vapor

Humidity is simply water in its gaseous phase, properly called water vapor. Because water vapor is a gas, most of the common gas laws apply to it, including Dalton's law of partial pressures. Dalton's law says that the total pressure of a gas is equal to the sum of the partial pressures of each of the component gases:

$$P_{\text{total}} = P_1 + P_2 + P_{3...}$$

If we consider air, the equation means that the total atmospheric pressure of 1.013 bar (14.7psia) is the sum of the partial pressures of nitrogen, oxygen, water vapor, argon, carbon dioxide, and various other gases in trace amounts.

#### Definition of Water Vapor Pressure

Water vapor pressure ( $P_w$ ) is the pressure exerted by the water vapor present in air or a gas. Temperature dictates the maximum partial pressure of water vapor. This maximum pressure is known as saturation vapor pressure ( $P_{ws}$ ). The higher the temperature, the higher the saturation vapor pressure and the more water vapor the air can hold. Thus, warm air has a greater capacity for water vapor than cold air.

*Learn the basics and get the best out of your humidity measurements.*

*Humidity measurement and control is called for in a wide variety of industrial applications. Each application has a different set of requirements for humidity instruments, such as required measurement range, tolerance to extreme temperature and pressure conditions, ability to recover from condensation, ability to operate in hazardous environments, and options for installation and calibration. There is no single device that is suitable for all needs. In fact, the range of available equipment is quite large, varying both in cost and quality.*

This paper discusses the following topics in order to help in selecting the right humidity instrument:

- Different humidity parameters
- Environmental conditions that influence the choice of humidity instrument
- Sensor properties that influence the choice of humidity instrument
- Practical guidelines for selecting a humidity instrument

If saturation vapor pressure is reached in air or in a gas mixture, the introduction of additional water vapor requires that an equal amount condenses out of the gas as a liquid or a solid. A psychrometric chart shows graphically the relation between saturation vapor pressure and temperature. In addition, vapor pressure tables can be used to see the saturation vapor pressure at any temperature, and there are also a number of computer-based calculation programs available.

## Effect of Pressure on Humidity

Dalton's law states that a change in the total pressure of a gas must have an effect on the partial pressures of all of the component gases, including water vapor. If, for example, the total pressure is doubled, the partial pressures of all component gases are doubled as well. In air compressors, a pressure increase "squeezes" water out of the air as it is compressed.

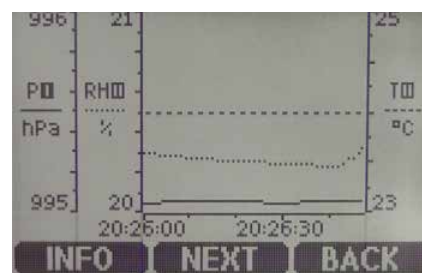


Humidity calculators are also available for mobile phones.

This happens because the partial pressure of water vapor ( $P_w$ ) is increased, but the saturation vapor pressure is still only a function of temperature. As pressure builds in a receiver tank and  $P_w$  reaches  $P_{ws}$ , water condenses into liquid and must ultimately be drained from the tank.



Some humidity measurement instruments allow an individual humidity parameter to be chosen which can then be followed on a graphical display. This picture shows different views of the Vaisala HUMICAP Hand-Held Humidity and Temperature Meter HM70 display.



## Relative Humidity

When thinking conceptually of water vapor as a gas, it's easy to define relative humidity. Relative humidity (RH) can be defined as the ratio of the partial water vapor pressure ( $P_w$ ) to the water vapor saturation pressure ( $P_{ws}$ ) at a particular temperature:

$$\%RH = 100\% \times P_w / P_{ws}$$

Relative humidity is strongly temperature dependent as the denominator in the definition ( $P_{ws}$ ) is a function of temperature. For example, in a room with an RH of 50% and a temperature of 20°C, increasing the temperature of the room to 25°C will decrease the RH to about 37%, even though the partial pressure of the water vapor remains the same.

Pressure will also change relative humidity. For example, if a process is kept at a constant temperature, relative humidity will increase by a factor of two if the process pressure is doubled.

## Dew Point Temperature

If a gas is cooled and gaseous water vapor begins to condense in the liquid phase, the temperature at which condensation occurs is defined as the dew point temperature ( $T_d$ ). At 100%RH the ambient temperature equals the dew point temperature. The further negative the dew point is from the ambient temperature, the smaller the risk for condensation and the drier the air.

Dew point directly correlates with saturation vapor pressure ( $P_{ws}$ ). The partial pressure of water vapor associated with any dew point can be easily calculated. Unlike RH, dew point is not temperature dependent but it is affected by pressure. Typical applications for dew point measurement include various drying processes, dry air applications, and compressed air drying.

## Frost Point Temperature

If the dew point temperature is below freezing – which is the case in dry gas applications – the term frost point ( $T_f$ ) is sometimes used to explicitly state that the condensing phase is ice. The frost point is always slightly higher than the dew point below 0°C as the water vapor saturation pressure of ice is different to water. People also often refer to dew point for subzero values, even though they mean frost point. Ask for clarification if you are not certain.

## Parts Per Million

Unit parts per million (ppm) is sometimes used for low levels of humidity. It is the ratio of water vapor to dry gas or total (moist) gas, and is expressed either by volume/volume ( $\text{ppm}_{vol}$ ) or mass/weight ( $\text{ppm}_w$ ). Parts per million ( $\text{ppm}_{vol}$ ) can be quantitatively expressed as follows:

$$\text{ppm}_{vol} = [P_w / (P - P_{ws})] \times 10^6$$

The ppm parameter is typically used when defining the water vapor content of pressurized and dry pure gases.

## Mixing Ratio

The mixing ratio ( $x$ ) is the ratio of water vapor mass to the mass of dry gas. It is dimensionless but often expressed in grams per kilogram of dry air. The mixing ratio is mainly used in drying processes and HVAC applications for calculating water content when the mass flow of air is known.

## Wet Bulb Temperature

Traditionally, the wet bulb temperature ( $T_w$ ) is the temperature indicated by a thermometer wrapped in a wet cotton sheath. The wet bulb and ambient temperatures can be

used together to calculate relative humidity or dew point. For example, the wet bulb temperature is used in air conditioning applications where it is compared to the dry bulb temperature to determine the cooling capacity of evaporative coolers.

## Absolute Humidity

Absolute humidity ( $a$ ) refers to the mass of water in a unit volume of moist air at a given temperature and pressure. It is usually expressed as grams per cubic meter of air. Absolute humidity is a typical parameter in process control and drying applications.

## Water Activity

Water activity ( $a_w$ ) is similar to equilibrium relative humidity and uses a scale of 0 to 1, instead of 0% to 100%.

## Enthalpy

Enthalpy is the amount of energy required to bring a gas to its current state from a dry gas at 0°C. It is used in air conditioning calculations.

# The Effect of Environmental Conditions on Humidity Measurement

Environmental conditions can have a significant effect on humidity and dew point measurements. Take the following environmental factors into consideration to achieve the best possible measurement result:

## Select a Representative Measurement Location

Always choose a measuring point that is representative of the environment being measured, avoiding any hot or cold spots. A transmitter mounted near a door, humidifier, heat source, or air conditioning inlet will be subject to rapid humidity changes and may appear unstable.

As relative humidity is strongly temperature dependent, it is very important that the humidity sensor is at the same temperature as the measured air or gas. When comparing the humidity readings of two different instruments, the thermal equilibrium between the units/probes and the measured gas is particularly crucial.

Unlike relative humidity, dew point measurement is independent

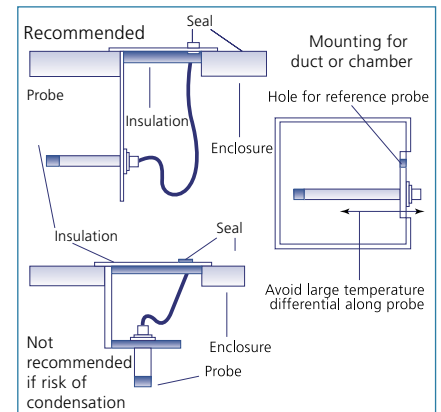
of temperature. However, when measuring dew point, pressure conditions must be taken into account.

## Beware of Temperature Differences

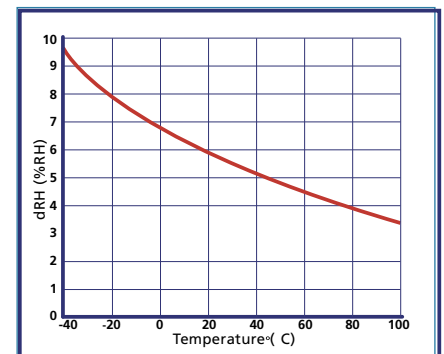
When mounting a humidity probe into a process, avoid temperature drops along the probe body. When there is a large temperature difference between the probe and the external environment, the whole probe should be mounted within the process and the cable entry point should be insulated.

When there is a risk of condensation, the probe should be mounted horizontally to avoid water dripping down the probe/cable and saturating the filter (see figure 1).

Ensure that air is allowed to flow around the sensor. Free air flow ensures that the sensor is in equilibrium with the process temperature. At 20°C and 50%RH, 1°C difference between the sensor and the measurement zone will cause an error of 3%RH. At 100%RH the error is 6%RH (see figure 2).



**Figure 1:** Mounting a humidity probe in a condensing environment.



**Figure 2:** Measurement error at 100%RH at various temperatures when the temperature difference between the ambient air and the sensor is 1°C.



## The Right Instrument for High Humidity

Environments with >90%RH are defined here as high humidity environments. At 90%RH a difference of 2°C can cause water to condense on the sensor, which in an unventilated space may take hours to dry. Vaisala humidity sensors will recover from condensation. However, if the condensed water is contaminated, the instrument accuracy can be affected due to deposits on the sensor, especially salt deposits. Even the life of the sensor may be shortened. In applications with high humidity where condensation can occur, a warmed sensor head probe such as the Vaisala HUMICAP® Humidity and Temperature Transmitter HMT337 should be used.

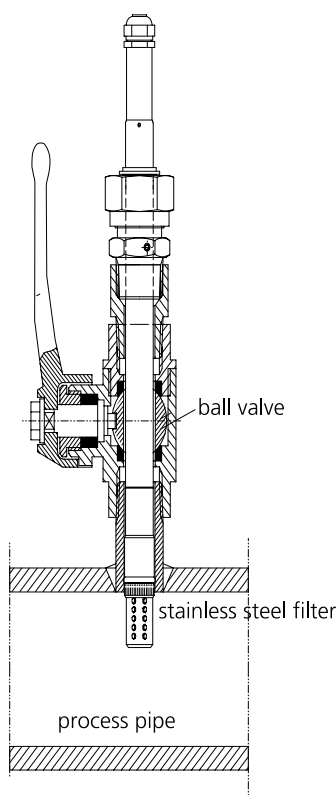
## The Right Instrument for Low Humidity

Environments with <10%RH are defined here as low humidity environments. At low humidities, the calibration accuracy of instruments measuring relative humidity may not be adequate. Instead, measuring dew point will provide a good indication of humidity. For example, Vaisala DRYCAP® products are designed for measuring dew point.

If a dryer fails in a compressed air system, water condensation may appear and the instrument will need to recover. Many dew point sensors are damaged or destroyed in such situations, but Vaisala DRYCAP® dew point sensors withstand high humidity – and even water spikes.

## The Right Instrument for Extreme Temperature and Pressure Conditions

Continuous exposure to extreme temperatures may affect sensor and probe materials over time. It is therefore very important to select a suitable product for demanding environments. In temperatures above



**Figure 3:** A ball valve installation in a process pipe line.

60°C the transmitter electronics should be mounted outside the process and only a suitable high temperature probe should be inserted into the high temperature environment. Moreover, built-in temperature compensation is required to minimize the errors caused by large temperature swings or operation at temperature extremes.

When measuring humidity in processes operating at around ambient pressure, a small leak may be tolerable and can be reduced by sealing around the probe or cable. However, when the process needs to be isolated, or when there is a large pressure difference between the process and the external environment, a sealed probe head with appropriate mounting must be used. Pressure leaks at the point of entry will alter the local humidity and result in false readings.

In many applications it is advisable to isolate the probe from the process with a ball valve to enable the removal of the probe for maintenance without shutting down the process (see figure 3).

## When is a Sampling System Needed for Dew Point Measurement?

Wherever possible, the probe should be mounted in the actual process to achieve the most accurate measurements and a rapid response time. However, direct installations are not always feasible. In such situations, sample cells installed in-line provide an entry point for a suitable measurement probe.

Note that external sampling systems should not be used to measure relative humidity because the change in temperature will affect the measurement. Sampling systems can instead be used with dew point probes. When measuring dew point, sampling systems are typically used to lower the temperature of the process gas, to protect the probe against particulate contamination, or to enable easy connection and disconnection of the instrument without ramping down the process.

The simplest dew point sampling setup consists of a dew point transmitter connected to a sampling cell. Vaisala has several models suitable for the most common applications and sampling needs. For example, the easy to install DSC74 sampling cell is designed for the flow and pressure conditions in compressed air applications.

In demanding process conditions, sampling systems must be designed carefully. As dew point is pressure dependent, a flow meter, pressure gauge, special non-porous tubing, filters, and pump may be needed. As an example, a flow chart showing the Vaisala DRYCAP® Portable Sampling System DSS70A for DM70 is shown in figure 4.

In a pressurized system a sample pump isn't needed as the process pressure induces a large enough flow to the sampling cell.

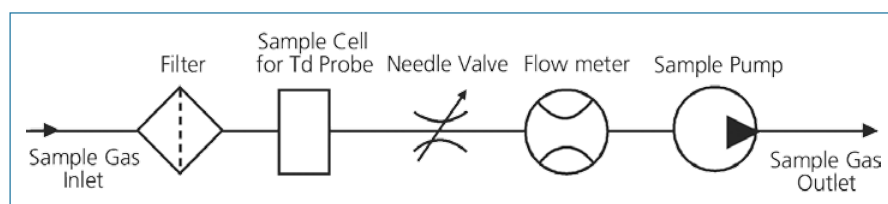
When measuring dew point with a sampling system, trace heating should be used when the ambient temperature around the cooling coil or connecting tube is within 10°C of the dew point temperature. This prevents condensation in the tubing that connects the dew point instrument to the process.

## Hazardous Environments

Only products with appropriate certification can be used in potentially explosive areas. For example, in Europe products must comply with the ATEX100a directive, which has been mandatory since 2003. Intrinsically safe products are designed in such a manner that even in the event of failure they do not generate enough energy to ignite certain classes of gas. The wiring from the intrinsically safe product into the safe area must be isolated via a safety barrier. For example, the Vaisala HMT360 series of intrinsically safe humidity transmitters are specially designed for use in hazardous environments.



*Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT360 is designed for hazardous and explosive environments.*



**Figure 4:** The DSS70A sampling system includes a filter to clean the gas and a needle valve to control the sample flow rate. A sample pump is needed to generate flow from an unpressurized process gas.

## Shock and Vibration

When the probe will be subject to excessive shock or vibration, the

choice of probe, mounting method, and installation location needs careful consideration.

## What Makes a Good Humidity Sensor?

Humidity sensor performance is a critical contributor to the overall quality of the humidity measurement. Consider the importance of the following sensor properties:

### Fast Response Time

The sensor response time is the speed of response when the sensor is subjected to a step change in humidity. In addition to the sensor, factors such as temperature, airflow, and filter type all have an effect on response time. A blocked filter will give a slower response.

### Optimal Measurement Range

The choice of humidity sensor depends on the application and operating temperature, especially at the extremes of humidity.

The majority of Vaisala's humidity sensors work over the full range from 0 to 100%RH. Vaisala HUMICAP® sensors are the optimal choice for applications with a relative humidity around 10–100%RH, whereas DRYCAP® sensors are designed for measurements in low humidities around 0–10%RH.

### Good Chemical Tolerance

Aggressive chemicals can damage or contaminate sensors. The instrument manufacturer should know the effects of various chemicals on their sensors and be able to give advice related to acceptable chemical concentrations.

### High Accuracy

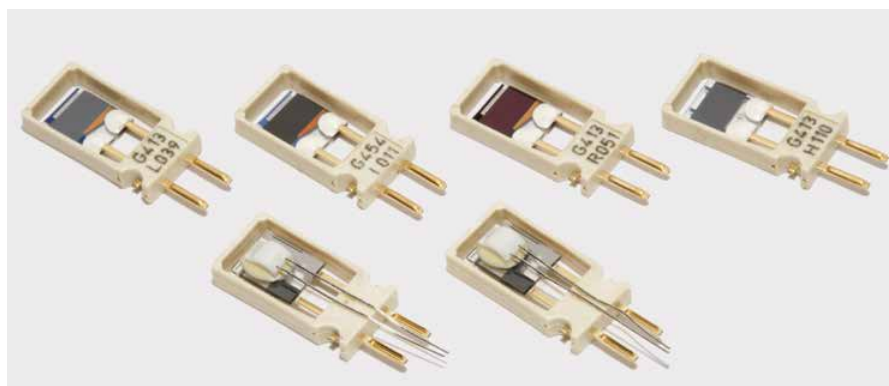
Accuracy as a term is well established, but difficult to define. Each step in the calibration chain – from the primary standard in an internationally recognized calibration laboratory, to the actual product

manufacture and the measurement on site – introduces measurement error. The sum of these potential errors is the uncertainty of the measurement.

When selecting a humidity sensor, consider the following factors associated with accuracy:

- Linearity over the working range
- Hysteresis and repeatability
- Stability over a period of time
- Temperature dependence of the sensor

During manufacture, Vaisala products are compared and adjusted against factory standards that are



*Humidity sensors from Vaisala.*

directly traceable to internationally recognized standards. The calibration chain is detailed in the

certificates that are supplied with the majority of Vaisala products.

## The Right Humidity Instrument for the Job



*Protective filters for Vaisala's humidity instruments.*

No matter what the application, the total range of gas temperatures and expected water vapor levels must be known in order to decide the optimal humidity parameters and the optimal instrument for the environment. The process pressure must also be known when measuring humidity within the process. In addition, it must be decided whether to make the measurement at the process pressure or at some other pressure. For gases other than air, the gas composition must be known.

The terms probe, transmitter, and sensor describe products that measure humidity. The probe is the part of the product that contains the humidity sensor. The probe may be rigidly bound to the transmitter

or connected with a flexible cable. The transmitter provides the output signal.

Vaisala designs and manufactures a range of products for measuring relative humidity, temperature, and dew point based on HUMICAP® and DRYCAP® sensors. All Vaisala humidity instruments feature built-in temperature compensation to minimize the errors caused by temperature variations and operation at extremes of temperature. Many of the products include built-in calculations for other humidity parameters.

### Protect the Sensor and Electronics with the Right Filter

As well as screening the sensor from any stray electromagnetic fields, the filter protects the sensor from dust, dirt, and mechanical stress. A membrane or netting filter is a good alternative for the majority of applications. In temperatures above 80°C, in high pressure, or in rapidly moving air up to 75 m/sec, a sintered filter should be used.

A suitable protective enclosure protects the instrument electronics

from dust, dirt, and excessive humidity. An enclosure with an IP65 or NEMA 4 classification gives good protection against dust and sprayed water. The cable entry points need to be sealed during installation.

When using the instrument outside, it should be mounted in a radiation shield or Stevenson screen to prevent solar radiation or extremes of weather from affecting the measurement.

### Must the Instrument Tolerate Condensation?

Making good quality humidity measurements in near-condensing conditions is very challenging. Warmed probe technology ensures reliable measurements when measuring relative humidity close to saturation point. The humidity level of the warmed probe always stays below the ambient level, where condensation occurs.

### Must the Instrument Withstand Exposure to Chemicals?

A chemical purge feature helps to maintain measurement accuracy in environments with a high concentration of chemicals or



cleaning agents. The chemical purge heats the sensor at regular intervals to remove chemicals that may have accumulated over time.

## The Importance of Electromagnetic Compatibility (EMC)

There are many standards defining the ability of products to withstand external electrical interference. In addition, the product must not generate emissions that can cause interference to sensitive equipment. Industrial applications have more demanding EMC requirements than HVAC installations – the CE marking used in Europe guarantees compliance.

## Consider Wiring and Earthing

Except for short cable runs, a screened cable is recommended. Proximity to high-voltage cables or RF sources should be avoided. It is good practice to earth the connection cable screen at a common point and avoid multiple earth points. Galvanic isolation is also available on some Vaisala products.



*Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330 is a flexible product family designed for demanding industrial applications.*

## Which Power Supply and Output Signals are Needed?

The majority of measurement instruments are powered using a low voltage supply. If a low voltage AC supply is used, an isolated supply is recommended for each transmitter to avoid earth loops or interference from an inductive load.

Analog output instruments usually have an option for both voltage and current outputs. The choice depends

on the length of the signal path and on the interfacing equipment. Some products have a 4–20mA loop power connection, which is a 2-wire system where the output signal current is measured in the supply line.

In addition to analog outputs, some Vaisala products feature digital communication via RS-232, RS-485, or LAN/WLAN interfaces. Selected commercial protocols (Modbus, BACnet) are also available.

## Consider Calibration before Purchasing

Instruments typically need to be calibrated every year or every second year. Calibration requirements depend on the application and the stability of the instrument, with wide variations in how easy it is to carry out field checking and calibration. Some instruments need to be sent to a laboratory for calibration, for example. Understanding the calibration needs is therefore an important part of instrument selection.

### Calibration Frequency

An individual calibration certificate for a particular instrument indicates the accuracy and linearity at the time

of calibration. However, it does not reflect the stability of the instrument in the long run. Calibration at routine intervals is essential to understand the instrument's long-term stability.

Calibration frequency depends on the operating environment. A rule of thumb for Vaisala instruments is that yearly calibration is enough for HUMICAP® products, whereas in most applications a two-year calibration interval is suitable for DRYCAP® products. When measuring in constant high humidity (>85%RH), high temperature (>120°C), or chemically aggressive atmospheres, more frequent checks may be needed.



*On-site calibration of a HMW90 humidity transmitter with a HM70 hand-held meter.*

## Humidity Instrument Calibration

In calibration, the humidity reading of an instrument is compared against a portable reference. The reference should be regularly calibrated and provided with a valid certificate. When selecting one of the many calibration methods, time, cost, technical requirements, expertise, and the unique needs of the organization must be balanced.

Portable meters and products that can be removed from the installation can be calibrated in an approved laboratory or returned to the instrument provider for calibration. Vaisala has four Service Centers around the world available for calibration.

Instruments installed in processes that operate within narrow boundaries can be calibrated using on-site one-point calibration that can be performed without disconnecting the instrument. One-point calibration can also be used to identify the need for further calibration and adjustment.

Some portables such as the Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter HM70 or the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 can be directly connected to the installed product and the readings compared to those on the portable meter's display.

In environments with large variations in humidity, multi-point calibration is recommended. Two-point or three-point calibrations



*Vaisala Humidity Calibrator HMK15 for multi-point on-site calibrations.*

can be accomplished in the field with the help of humidity-generating equipment, as long as the local environment is at a stable temperature. The advantage of multi-point calibration compared to one-point calibration is higher accuracy over the entire measurement range. Multiple humidity levels can be created with the Vaisala Humidity Calibrator HMK15, for example.

## Calibration of Dew Point Instruments

It is a demanding task to perform high-quality calibrations on low dew point instruments. For this reason, Vaisala doesn't recommend

customers perform calibrations on Vaisala DRYCAP® products. Instead, they should be calibrated in professional calibration laboratories, such as Vaisala Service Centers. However, it is possible to perform a field check on a dew point instrument to identify whether adjustment is needed, using the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70.

To learn more about Vaisala's humidity instruments, visit [www.vaisala.com/humidity](http://www.vaisala.com/humidity).

# VAISALA

For more information, visit [www.vaisala.com](http://www.vaisala.com) or contact us at [sales@vaisala.com](mailto:sales@vaisala.com)

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## HMT330 Series Humidity and Temperature Transmitters for Demanding Humidity Measurement



*The HMT330 transmitter family offers reliable performance for a wide variety of demanding industrial humidity measurements.*

The Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330 is designed for demanding industrial applications where stable measurements and extensive customization are essential. With multiple options to choose from, the instrument can be tailored to meet the specific needs of each individual application.

### Proven Vaisala HUMICAP® Performance

The HMT330 series incorporates Vaisala's 40 years of experience in industrial humidity measurement. The updated fourth-generation HUMICAP sensor provides accurate

and stable measurement even in environments with high humidity or chemical contaminants.

### Chemical Purge Minimizes Effects of Contaminants

In environments with high concentrations of chemicals and cleaning agents, the chemical purge option helps to maintain measurement accuracy between calibration intervals.

The chemical purge involves heating the sensor to remove harmful chemicals. The function can be initiated manually or programmed to occur at set intervals.

### Features/Benefits

- Six models for demanding industrial applications
- Full 0 ... 100 %RH measurement, temperature range up to +180 °C (+356 °F) depending on model
- Pressure tolerance up to 100 bar depending on model
- 4th generation Vaisala HUMICAP® sensor for superior accuracy and stability
- Graphical display and keypad for convenient operation
- Multilingual user interface
- Excellent performance in harsh conditions; good chemical tolerance
- Corrosion-resistant IP65/IP66 housing
- 6-point NIST traceable calibration (certificate included)
- 10-year warranty when annually calibrated at the Vaisala Service Center
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)
- Compatible with Vaisala viewLinc software



## Wide Range of Installation Options

The wide variety of measurement probes, several installation accessories, and universal mains and DC power options make the instruments easy to install in various locations and kinds of environment; walls, poles, pipelines, and ducts, for example. The input/output cable can be fed through the back of the transmitter, which is a useful feature, especially for cleanroom installations.

The HMT330 series includes six models:

- HMT331 for wall-mounted applications
- HMT333 for ducts and tight spaces
- HMT334 for high-pressure and vacuum applications
- HMT335 for high-temperature applications
- HMT337 for high-humidity applications
- HMT338 for pressurized pipelines

This device is designed to integrate seamlessly with the Vaisala viewLinc CMS, which is a Part 11/Annex 11 compliant software that can be easily implemented following the GAMP5 guidelines.

## Graphical Display of Measurement Data and Trends for Convenient Operation

The HMT330 series features a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

The optional data logger, with real-time clock, makes it possible to generate over four years of measurement history, and zoom in on any desired time or time frame.

The display alarm allows any measured parameter to be tracked, with freely configurable low and high limits.

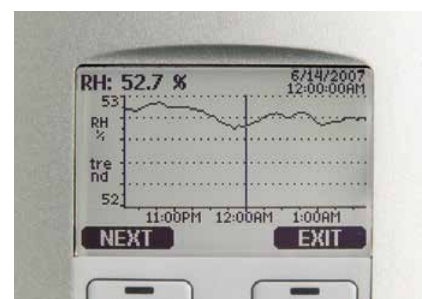
## Versatile Outputs and Data Collection

The HMT330 can support up to three analog outputs; an isolated galvanic power supply and relay outputs are also available.

For serial interface the USB connection, RS232, and RS485 can be used.

HMT330 is also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provides either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded



*The display shows measurement trends and over four years of real-time measurement history.*

data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the HMT330 to a PC via the service port.

## Flexible Calibration

The HMT330 instruments are calibrated at six humidity points at the factory and come with a calibration certificate that meets all the relevant traceability and compliance requirements.

A quick, one-point field calibration can be performed with the hand-held HM70 meter. A two-point field calibration can be performed, for example, with the HMK15 salt bath calibrator in a controlled environment. The transmitter can also be sent to Vaisala for recalibration, and accredited calibrations are available.

# Technical Data

## Performance

### RELATIVE HUMIDITY

Measurement range 0 ... 100 %RH

Accuracy (including non-linearity, hysteresis, and repeatability)

with Vaisala HUMICAP® 180 or 180R\* for typical applications

with Vaisala HUMICAP® 180C or 180RC\* for applications with

chemical purge/warmed probe

with Vaisala HUMICAP® 180VC catalytic sensor

with chemical purge for

H<sub>2</sub>O<sub>2</sub> environments

at +15 ... +25 °C (59 ... +77 °F) ±1 %RH (0 ... 90 %)

±1.7 %RH (90 ... 100 %RH)

at -20 ... +40 °C (-4 ... +104 °F) ±(1.0 + 0.008 x reading) %RH

at -40 ... +180 °C (-40 ... +356 °F) ±(1.5 + 0.015 x reading) %RH

Factory calibration uncertainty (+20 °C) ±0.6 %RH (0 ... 40 %RH)

±1.0 %RH (40 ... 97 %RH)

(Defined as ±2 standard deviation limits. Small variations possible; see also calibration certificate.)

Response time (90%) at +20 °C (+68 °F) 8 s/17 s\*\* with grid filter

in still air 20 s/50 s\*\* with grid + steel netting filter

40 s/60 s\*\* with sintered filter

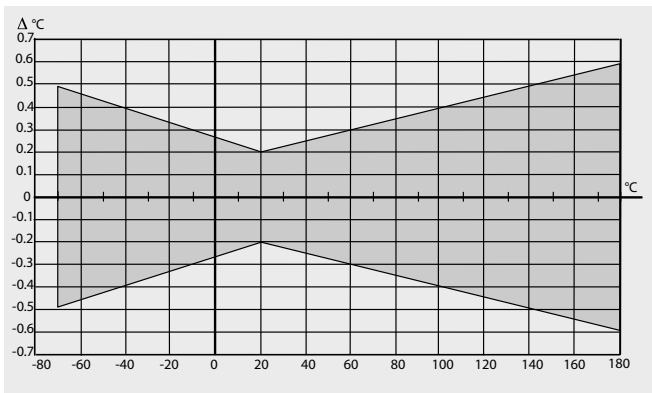
\*HUMICAP 180R or 180RC recommended

\*\* with HUMICAP 180R or 180RC or 180VC sensor

### TEMPERATURE

Accuracy at +20 °C (+68 °F) ±0.2 °C (±0.36 °F)

Accuracy over temperature range (measurement range depends on model)



Temperature sensor Pt100 RTD Class F0.1 IEC 60751

### Other available variables (model-dependent)

dew point temperature, mixing ratio, absolute humidity, wet bulb temperature, enthalpy, water vapor pressure

## Inputs and Outputs

Operating voltage 10 ... 35 VDC, 24 VAC ±20%

with optional power supply module 100 ... 240 VAC, 50/60 HZ

Power consumption at +20 °C (U<sub>in</sub> 24 VDC)

RS232 max. 25 mA

U<sub>out</sub> 2 x 0 ... 1 V/0 ... 5 V/0 ... 10 V max. 25 mA

I<sub>out</sub> 2 x 0 ... 20 mA max. 60 mA

display and backlight +20 mA

during chemical purge max. 110 mA

during probe heating (HMT337) +120 mA

Analog outputs (2 standard, 3rd optional)

current output 0 ... 20 mA, 4 ... 20 mA

voltage output 0... 1 V, 0... 5 V, 0... 10 V

Accuracy of analog outputs at +20 °C ±0.05% full scale

Temperature dependence of the

analog outputs ±0.005%/°C full scale

External loads

current outputs R<sub>L</sub> < 500 ohm

0 ... 1 V output R<sub>L</sub> > 2 kohm

0 ... 5 V and 0 ... 10 V outputs R<sub>L</sub> > 10 kohm

Max. wire size 0.5 mm<sup>2</sup> (AWG 20)

stranded wires recommended

Digital outputs RS232, RS485 (optional)

Protocols ASCII commands, MODBUS RTU

Service connection RS232, USB

Relay outputs (optional) 0.5 A, 250 VAC

Ethernet interface (optional)

Supported standards 10BASE-T, 100BASE-TX

Connector 8P8C (RJ45)

IPv4 address assignment DHCP (automatic), static

Protocols Telnet, MODBUS TCP/IP

WLAN interface (optional)

Supported standards 802.11b

Antenna connector type RP-SMA

IPv4 address assignment DHCP (automatic), static

Protocols Telnet, MODBUS TCP/IP

Security WEP 64/128, WPA2/802.11i

Authentication / Encryption (WLAN)

Open / no encryption

Open / WEP

WPA Pre-shared key / TKIP

WPA Pre-shared key / CCMP (a.k.a. WPA2)

Optional data logger with real-time clock

Logged parameters max. four with trend/min/max values

Logging interval 10 sec. (fixed)

Max. logging period 4 years, 5 months

Logged points 13.7 million points per parameter

Battery lifetime min. 5 years

Display LCD with backlight, graphical trend display

of any parameter

Menu languages English, Chinese, Finnish, French, German,

Japanese, Russian, Spanish, Swedish

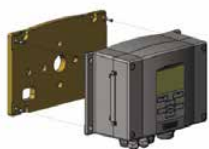
## Mechanics

Cable bushing	M20 x 1.5 for cable diameter 8 ... 11 mm/0.31 ... 0.43"
Conduit fitting	1/2" NPT
User cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft.) black cable
option 2	female plug with screw terminals
Probe cable diameter	
HMT333 (+80 °C)	6.0 mm
other probes	5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m (Additional lengths available, please see order forms for details)
Housing material	G-AlSi 10 Mg (DIN1725)
Housing classification	IP 66
	IP65 (NEMA4X) with local display
Weight	
depending on selected probe, cable and modules	1.0 - 3.0 kgs

## Operating Environment

Operating temperature	
for probe	same as measurement range
for transmitter body	-40 ... +60 °C (-40 ... 140 °F)
with display	0 ... +60 °C (32 ... 140 °F)
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Industrial Environment
Note: Transmitter with display test impedance of 40 ohm is used in IEC61000-4-5 (Surge immunity)	

## Mounting Options



*Mounting with Wall  
Mounting Kit\**



*Mounting with DIN Rail  
Installation Kit*



*Pole Installation with Installation  
Kit for Pole or Pipeline*

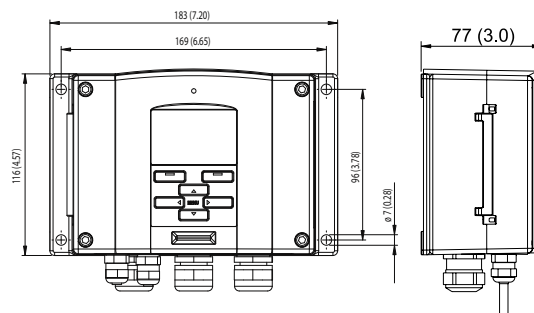


*Mounting Rain Shield with  
Installation Kit*

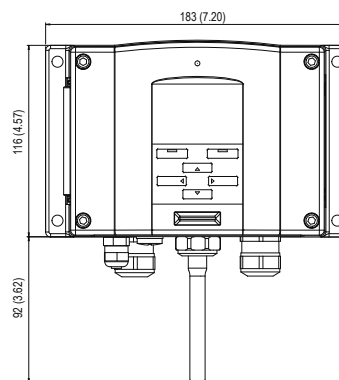
\*not mandatory for wall installations

## Dimensions

Dimensions in mm (inches)



Transmitter with WLAN antenna



TYPE APPROVED PRODUCT  
CERTIFICATE NO.: A-13529

# VAISALA

[www.vaisala.com/requestinfo](http://www.vaisala.com/requestinfo)

Vaisala takes pride in professional and comprehensive specifications that are based on scientific test methods and known standards. The accuracy specification takes into account repeatability, non-linearity, and hysteresis, and is given for the full measurement range, unless otherwise stated. This means our customers get truly reliable information with no gaps, helping them make the right decisions.



Scan the code for  
more information

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## HMT331 Humidity and Temperature Transmitter for Demanding Wall-Mounted Applications



*The HMT331 is a state-of-the-art wall-mounted humidity measurement instrument.*

The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT331 is a high-quality wall-mounted transmitter for demanding HVAC and condition-monitoring applications.

### Typical Applications

- cleanrooms
- pharmaceutical processes
- swimming halls
- museums and archives



*HMT331 Humidity and Temperature Transmitter with short flexible probe and optional WLAN.*

### Technical Data

Temperature measurement range	-40 ... +60 °C (-40 ... +140 °F)
-------------------------------	----------------------------------

### Accessories

USB service port cable with PC software	219916
Connection cable for HM70	211339
Wall-mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
DIN rail installation set	215094
PPS plastic grid filter with stainless steel net	DRW010281SP
Stainless steel sintered filter	HM47280SP

## HMT333 Humidity and Temperature Transmitter for Ducts and Tight Spaces

The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT333 is a versatile instrument for applications where a small remote probe is needed, for example in demanding HVAC applications. Its small thermal mass enables rapid response to temperature changes.



*The HMT333 transmitter's compact probe is designed for remote applications.*

### Flexible Installation

To install the probe in ducts, channels, and through walls, an installation kit is available with a stainless steel flange, lead-through piece, and steel support bar.

The HMT333 has two probe cable options – a flexible rubber cable that withstands temperatures of up to +80 °C, and a durable cable that withstands temperatures of up to +120 °C. Both cable options are available in lengths of 2, 5, and 10 meters. Additionally, flexible rubber cable (+80 °C) is available in 20-meter lengths.

For outdoor environments, the DTR502B solar radiation shield provides protection for the probe. The shield can be installed on a pole, beam, or flat surface.

### Typical Applications

- cleanrooms
- pharmaceutical processes
- environmental chambers
- processes with moderate temperature and humidity



*Duct installation kit for HMT333 and HMT337.*

### Technical Data

Temperature measurement range	-40 ... +80 °C (-40 ... +176 °F) or -40 ... +120 °C (-40 ... +248 °F)
-------------------------------	--

### Accessories

Duct installation kit	210697
Cable gland with split seal	HMP247CG
USB service port cable with PC software	219916
Connection cable for HM70	211339
Wall-mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
Solar radiation shield	DTR502B
DIN rail installation set	215094
PPS plastic grid filter with stainless steel net	DRW010281SP
PPS plastic grid filter	DRW010276SP
Stainless steel sintered filter	HM47280SP

## HMT334 Humidity and Temperature Transmitter for High Pressure and Vacuum Applications



*The HMT334 is ideal for permanent installations in pressurized or vacuum processes.*

The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT334 is designed for humidity measurement in pressurized spaces or vacuum chambers. Every probe is tested for gas and vacuum-tight installation.

### Typical Applications

- test chambers
- high-pressure and vacuum processes

### Technical Data

Temperature measurement range	-70 ... +180 °C (-94 ... +356 °F)
Operating pressure	0 ... 10 MPa (0 ... 100 bar)

### Accessories

Fitting body ISO M22 x 1.5	17223SP
Fitting body NPT 1/2"	17225SP
USB service port cable with PC software	219916
Connection cable for HM70	211339
Wall-mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
DIN rail installation set	215094
PPS plastic grid filter with stainless steel net	DRW010281SP
PPS plastic grid filter	DRW010276SP
Stainless steel sintered filter	HM47280SP
Stainless steel grid filter	HM47453SP

## HMT335 Humidity and Temperature Transmitter for High Temperatures



*The HMT335 has a robust stainless steel probe, ideal for hot processes with high flow rates.*

The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT335 has a long stainless steel probe designed for high temperatures.

### Robust Probe Ideal for High Flow Rates

With high tolerance for mechanical stress and high flow rates, the HMT335 is ideal for duct measurements. The stainless steel installation flange allows easy adjustment of the probe's installation depth.

### Typical Applications

- hot drying processes
- food processes, e.g. baking ovens



*The installation flange allows easy adjustment of the probe installation depth.*

### Technical Data

Temperature measurement range	-70 ... +180 °C (-94 ... +356 °F)
-------------------------------	-----------------------------------

### Accessories

Mounting flange	210696
USB service port cable with PC software	219916
Connection cable for HM70	211339
Wall-mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
DIN rail installation set	215094
PPS plastic grid filter with stainless steel net	DRW010281SP
PPS plastic grid filter	DRW010276SP
Stainless steel sintered filter	HM47280SP
Stainless steel grid filter	HM47453SP

## HMT337 Humidity and Temperature Transmitter for High Humidity Applications



*The HMT337 is ideal for the most demanding process and meteorological measurements in high-humidity condensing environments.*

The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT337 is delivered in one of three configurations:

- Basic, with a non-warmed probe for moderate humidity
- With a warmed probe, for near-condensing conditions and dew point measurement
- With a warmed probe and an additional temperature sensor, for near-condensing conditions and relative humidity measurement

### True Humidity Readings in Condensation Conditions

Vaisala's unique warmed probe provides fast and reliable measurement in environments where humidity is near saturation. The heating prevents condensation from forming on the sensor.

As the probe is heated, the humidity level inside it stays below the ambient level. With accurate temperature measurement, the ambient dew point can be calculated precisely.

If the relative humidity value is needed, an additional temperature sensor is used. The measured ambient temperature provides the compensation for calculating relative humidity and other humidity parameters.

### Installation Options

Tight installation through a process wall can be achieved with Swagelok® fittings. The optional HMT330MIK Installation Kit is available for outdoor installations; duct installation kits are also available.

#### Typical Applications

- professional meteorology
- intake air monitoring of engines and gas turbines
- timber drying kilns



*Duct installation kit for HMT333 and HMT337.*

#### Technical Data

Temperature measurement range	-70 ... +180 °C (-94 ... +356 °F)
-------------------------------	-----------------------------------

#### Accessories\*

Cable gland and AGRO	HMP247CG
Duct installation kit (RH probe)	210697
Duct installation kit (T probe)	215003
Swagelok fittings (NPT and ISO) for both RH and T probes (up to 10 bar)	
Solar radiation shield	DTR502B
Meteorological installation kit	HMT330MIK
USB service port cable with PC software	219916
Connection cable for HM70	211339
Wall-mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
DIN rail installation set	215094
Warmed probe accessory	HMT330WPA
PPS plastic grid filter with stainless steel net	DRW010281SP
PPS plastic grid filter	DRW010276SP
Stainless steel sintered filter	HM47280SP
Stainless steel grid filter	HM47453SP

\*for more installation accessories, check the order form



## HMT338 Humidity and Temperature Transmitter for Pressurized Pipelines



*The HMT338 is ideal for installations in pressurized processes where the probe needs to be removed while the process is running.*

The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT338 is designed for pressurized processes.

### Insert or Remove the Probe while the Process is Running

With “hot tapping”, the probe is inserted directly into the process while it is running, without the need for venting or lowering the process pressure.

The probe is tightened to a ball-valve assembly fixed to the process pipe or wall. The adjustable hex nut is hand-tightened to temporarily hold the probe in place. The probe is then pushed down to the appropriate depth. The hex nut is then tightened with a wrench to lock the probe in place. Hot tapping is possible in pressures up to 10 bar.

### Typical Applications

- process lines
- environmental chambers
- vacuum-drying processes
- compressed air lines with refrigerant dryers

### Technical Data

Temperature measurement range	-70 ... +180 °C (-94 ... +356 °F)
Operating pressure	0 ... 4MPa (0 ... 40 bar)

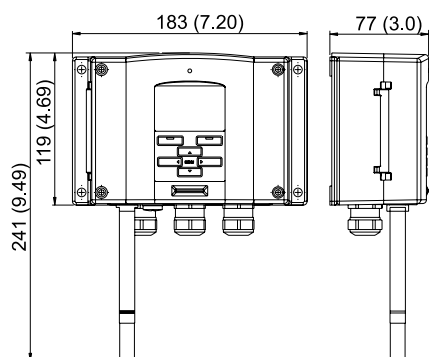
### Accessories

Ball-valve set	BALLVALVE-1
Pressure fitting ISO 1/2 to NPT 1/2	210662
USB service port cable with PC software	219916
Connection cable for HM70	211339
Wall-mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
DIN rail installation set	215094
PPS plastic grid filter with stainless steel net	DRW010281SP
PPS plastic grid filter	DRW010276SP
Stainless steel sintered filter	HM47280SP
Stainless steel grid filter	HM47453SP

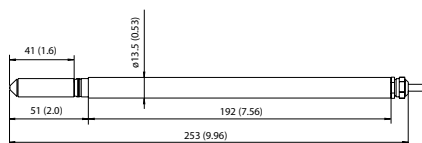
# Dimensions of the Probes for the HMT330 Series

Dimensions in mm (inches)

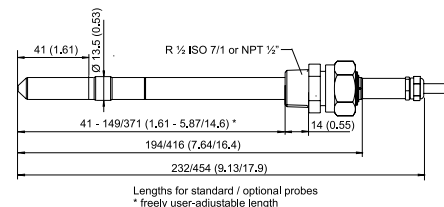
## HMT331 probe



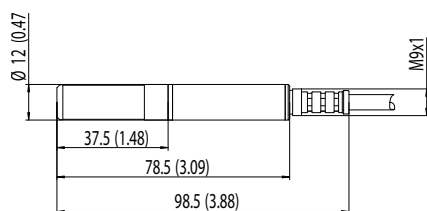
## HMT335 probe



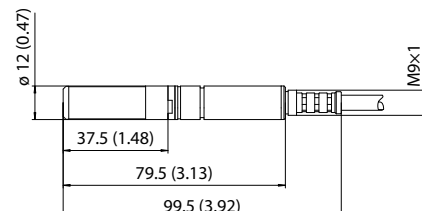
## HMT338 probe



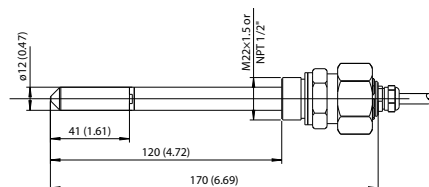
## HMT333 probe



## HMT337 RH probe



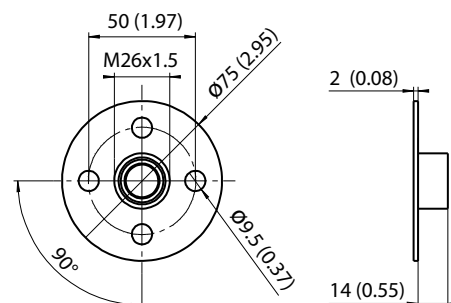
## HMT334 probe



## HMT337 T probe



## Installation flange





# When There's No Room for Error

When it comes to measuring humidity in harsh manufacturing environments, you don't want to cut corners. The **Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330** is an uncompromising transmitter you can depend on for years of trouble-free performance.

- Credibility that speaks for itself – close to 80,000 installations worldwide and counting
- **10-year warranty** when annually calibrated
- A wide range of options and configurations
- Built for extreme environments
- Support and service you can count on

Your customers choose the best. Why would you choose anything less?



[www.vaisala.com/HMT330](http://www.vaisala.com/HMT330)  
[sales@vaisala.com](mailto:sales@vaisala.com)

# VAISALA



## HMT360 Series Intrinsically Safe Humidity and Temperature Transmitters



The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT361 wall mount transmitter, shown with six probe options, is designed specifically for hazardous and explosive environments.

### Features/Benefits

- Measures humidity and temperature, outputs also dew point, mixing ratio, absolute humidity and wet bulb temperature
- Safe operation with the entire transmitter in hazardous areas: Division 1 and 2 (USA, Canada), Categories 1G / Zone 0 and 1D / Zone 20 with protection cover (EU)
- Intrinsically safe
- Designed for harsh conditions
- Vaisala HUMICAP® Sensor features high accuracy, excellent long-term stability, and negligible hysteresis
- Six probe options
- Temperature range between -70 ... +180°C (-94 ... +356°F) depending on the probe option
- NIST traceable (certificate included)

The Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT360 are the ideal solution for measuring humidity in hazardous areas. They operate safely and reliably even in the most hazardous classifications. The HMT360 transmitters' proven performance and technology conform with rigorous international standards.

### Intrinsically Safe

The entire HMT360 transmitter can be installed directly in explosive areas. It can withstand continuous exposure to potentially explosive environments that contain flammable gases or dust.

### Customized Configuration

Due to the microprocessor based electronics, options and accessories, the HMT360 series is truly flexible.

Customers may specify the transmitter configuration when ordering the instrument, however changes in configuration can also easily be made in the field.

### Interchangeable Probes

The HMT360 offers six probe options for various applications:

- |        |                         |
|--------|-------------------------|
| HMP361 | - wall mount            |
| HMP363 | - confined spaces       |
| HMP364 | - pressurized spaces    |
| HMP365 | - high temperature      |
| HMP367 | - high humidity         |
| HMP368 | - pressurized pipelines |

The interchangeable probes enable fast and easy removal or re-installation when required. Calibration, for example, is easy to perform due to the modular structure. All calibration coefficients are included in the probe unit itself, which means that probes can be switched between transmitter bodies without losing the accuracy.

### Optimized Sensors

In addition to the standard Vaisala HUMICAP® Sensor, an application specific, very chemically durable sensor is also available.

### Long-term Solution

The HMT360 transmitters are an investment; their rugged design, combined with trouble-free operation, ensure a long-term solution for monitoring humidity and dew point in explosive environments.

Customized calibration and maintenance contracts for the HMT360 series are available on request.



# Interchangeable Probes for HMT360 Intrinsically Safe Humidity and Temperature Transmitter



The HMP361 probe in this picture has a stainless steel netting filter.

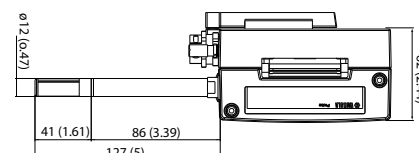
## Technical Data

### HMP361 for wall mounting

Temperature range	-40 ... +60 °C (-40 ... +140 °F)
Probe diameter	12 mm

## Dimensions

Dimensions in mm (inches)



The HMP363 probe is small and fits into tight spaces. This one is connected with a teflon cable.

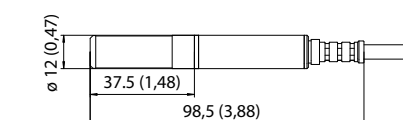
## Technical Data

### HMP363 for confined spaces

Temperature range with	
teflon cable	-40 ... +120 °C (-40 ... +248 °F)
rubber cable	-40 ... +80 °C (-40 ... +176 °F)
Probe cable length	2, 5 or 10 meters
Probe diameter	12 mm
Installation	
Duct installation kit	210697
Cable Gland M20x1.5 with splitting seal	HMP247CG
Swagelok for 12mm probe, 1/2" NPT thread	SWG12NPT12

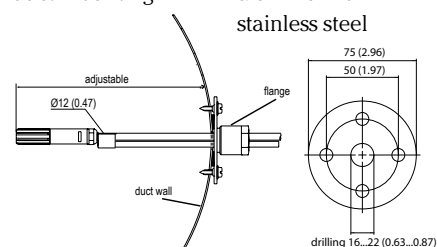
## Dimensions

Dimensions in mm (inches)



Installation kit for duct mounting

Installation flange: aluminum or stainless steel



The HMP364 probe is designed for measurement in pressurized spaces or vacuum chambers.

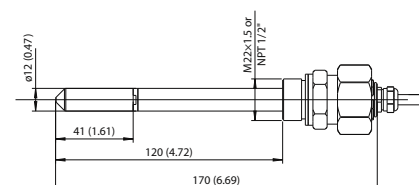
## Technical Data

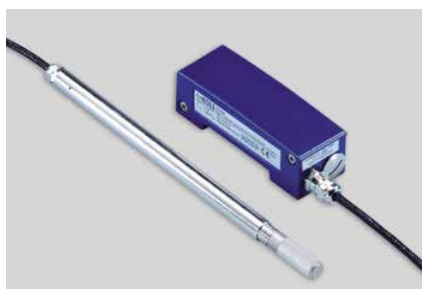
### HMP364 for high pressure

Temperature range	-70 ... +180 °C (-94 ... +356 °F)
Pressure range	0 ... 10 MPa
Probe cable length	2, 5 or 10 meters
Probe diameter	12 mm
Fitting body M22x1.5	17223
Fitting body NPT1/2	17225

## Dimensions

Dimensions in mm (inches)





The HMP365 probe is designed for high temperature environments.

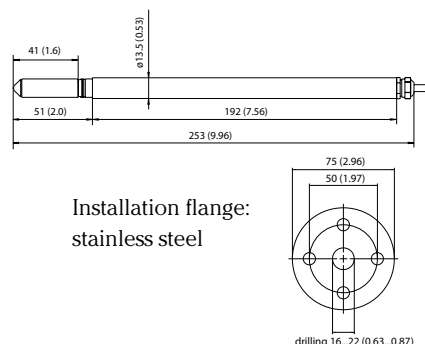
### Technical Data

#### HMP365 for high temperature

Temperature range	-70 ... +180 °C (-94 ... +356 °F)
Probe cable length	2, 5 or 10 meters
Probe diameter	13.5 mm
Installation	
Mounting flange	210696
Cable Gland M20x1.5 with splitting seal	HMP247CG

### Dimensions

Dimensions in mm (inches)



The HMP367 probe is constructed to be installed in environments with high humidities.

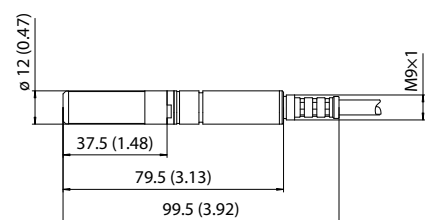
### Technical Data

#### HMP367 for high humidities

Temperature range	-70 ... +180 °C (-94 ... +356 °F)
Probe cable length	2, 5 or 10 meters
Probe diameter	12 mm
Installation	
Duct installation kit	210697
Cable Gland M20x1.5 with splitting seal	HMP247CG
Swagelok for 12mm probe, 3/8" ISO thread	SWG12ISO38
Swagelok for 12mm probe, 1/2" NPT thread	SWG12NPT12

### Dimensions

Dimensions in mm (inches)



The HMP368 probe enables flexible installation in pressurized pipelines.

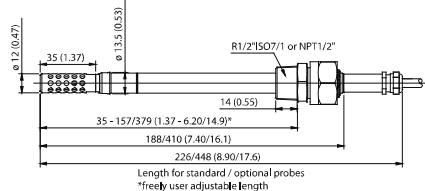
### Technical Data

#### HMP368 for pressurized pipelines

Temperature range	-70 ... +180 °C (-94 ... +356 °F)
Pressure range	0 ... 4 MPa
Probe cable length	2, 5 or 10 meters
Probe diameter	13.5 mm/12 mm
Two probe lengths available.	
Installation	
Fitting body ISO1/2 solid structure	DRW212076SP
Fitting body NPT1/2 solid structure	NPTFITBODASP
Ball valve ISO 1/2 with welding joint	BALLVALVE-1

### Dimensions

Dimensions in mm (inches)





# Technical Data

## Performance

### RELATIVE HUMIDITY

Measurement range 0 ... 100 % RH

Accuracy (including non-linearity, hysteresis, and repeatability)

with Vaisala HUMICAP® 180R for typical applications

at +15 ... +25 °C (59 ... +77 °F)  $\pm 1.0$  % RH (0 ... 90 %RH)

$\pm 1.7$  %RH (90 ... 100 %RH)

at -20 ... +40 °C (-4 ... +104 °F)  $\pm (1.0 + 0.008 \times \text{reading})$  %RH

at -40 ... +180 °C (-40 ... +356 °F)  $\pm (1.5 + 0.015 \times \text{reading})$  %RH

with Vaisala HUMICAP® 180<sub>L2</sub> for application with demanding

chemical environment

at -10 ... +40 °C (14 ... +104 °F)  $\pm (1.0 + 0.01 \times \text{reading})$  %RH

at -40 ... +180 °C (-40 ... +356 °F)  $\pm (1.5 + 0.02 \times \text{reading})$  %RH

Factory calibration uncertainty (+20 °C)  $\pm 0.6$  % RH (0 ... 40 %RH)

$\pm 1.0$  % RH (40 ... 97 %RH)

(Defined as  $\pm 2$  standard deviation limits. Small variations possible, see also calibration certificate.)

Response time (90 %) at +20 °C (+68 °F) in still air

with grid filter 17 s

with grid + steel netting filter 50 s

with sintered filter 60 s

### TEMPERATURE

Measurement range -70 ... +180 °C (-94 ... +356 °F)

(depends on selected probe)

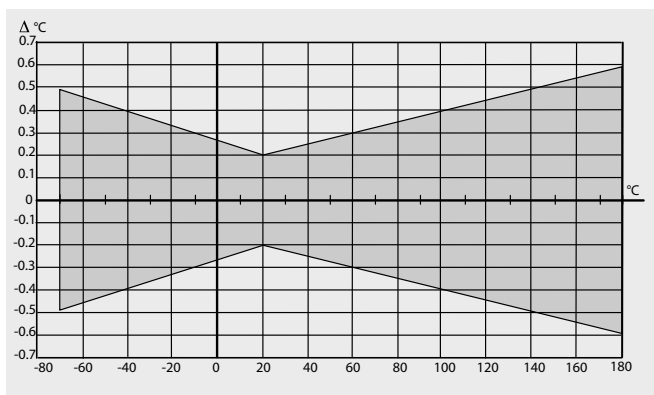
Typical accuracy of electronics at +20 °C (+68 °F)  $\pm 0.2$  °C (0.36 °F)

Typical temperature dependence

of electronics 0.005 °C/°C (0.005 °F/°F)

Sensor Pt1000 RTD Class F0.1 IEC 60751

Accuracy over temperature range



### OTHER VARIABLES

Optionally available dew point temperature, mixing ratio, absolute humidity, wet bulb temperature.

## Operating Environment

### Temperature range

operating temp. range for

electronics -40 ... +60 °C (-40 ... +140 °F)

with display -20 ... +60 °C (-4 ... +140 °F)

storage -40 ... +70 °C (-40 ... +158 °F)

Pressure range

see probe specifications

Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements; Industrial Environment.

NOTE! IEC 1000-4-5 complies only when using external EXI approved surge arrester in the safe area.

## Inputs and Outputs

Operating voltage 12 ... 28 V

with serial port (service mode) 15 ... 28 V

Analog outputs two-wire 4 ... 20 mA, one standard, one optional

Typical accuracy of analog outputs at +20 °C  $\pm 0.05$  % full scale

Typical temperature dependence

of analog outputs 0.005 % / °C (0.005 % / °F) full scale

Analog outputs connection via safety barriers

RS232C serial output for service use connector type RJ45

Display two-line LCD

## Mechanics

Connections screw terminals, 0.33...2.0 mm  
2 wires (AWG 14-22)

Cable bushings For 7.5...12mm or 10...15mm cable  
diameters (M20)

Conduit fitting NPT 1/2" (M20)

Housing material G-AlSi<sub>10</sub>Mg (DIN 1725)

Housing classification IP66 (NEMA 4X)

Housing weight 950 g

## Options and Accessories

Duct installation kit (for HMP363/367) 210697

Mounting flange (for HMP365) 210696

Ball valve ISO 1/2 with welding joint BALLVALVE-1  
(for HMP368)

pressure range at +20 °C (+68 °F): 0 ... 20 bar (0 ... 290 psia)  
(during installation max. 10 bar (145 psia))

Calibration adapter for HMK15 211302

Serial interface cable for PC

connectors RJ45 - D9 female 25905ZZ

Galvanic isolator 212483

Zener barrier 210664

Protection cover (for use in the

presence of combustible dust, ATEX) II 1 D IP65 T = 80 °C

## Classification with Current Outputs

EUROPE / VTT

EU (94/9/EC, ATEX100a) II 1 G Ex ia IIC T4 Ga  
VTT 09 ATEX 028 X issue No: 2  
Safety factors  $U_i = 28 \text{ V}$ ,  $I_i = 100 \text{ mA}$ ,  $P_i = 700 \text{ mW}$   
 $C_i = 1 \text{ nF}$ ,  $L_i$  negligibly low

Environmental specifications

$T_{amb}$  -40 ... +60 °C (-40 ... +140 °F)  
 $P_{amb}$  0.8 ... 1.1 bar

Dust classification (with protection cover) II 1 D (IP65  $T = 70 \text{ °C}$ )  
VTT 04 ATEX 023X

USA (FM) Classes I, II, III, Division 1, Groups A-G and  
Division 2, Groups A-D, F and G  
FM Project ID: 3010615

Safety factors:  $V_{max} = 28 \text{ VDC}$ ,  $I_{max} = 100 \text{ mA}$ ,  
 $C_i = 1 \text{ nF}$ ,  $L_i = 0$ ,  $P_i = 0.7 \text{ W}$ ,  $T_{amb} = 60 \text{ °C}$  (140 °F),  
T5

JAPAN (TIIS) Ex ia IIC T4  
Code number: TC20238

Safety factors:  $U_i = 28 \text{ VDC}$ ,  $I_i = 100 \text{ mA}$ ,  $C_i = 1 \text{ nF}$ ,  
 $P_i = 0.7 \text{ W}$ ,  $L_i = 0$ ,  $T_{amb} = 60 \text{ °C}$  (140 °F)

CANADA (CSA)

Class I Division 1 and Division 2, Groups A, B, C, D;  
Class II Division 1 and Division 2, Groups G and  
Coal Dust;

Class III CSA File No: 213862 0 000, CSA Report: 1300863  
Safety factors:  $T_{amb} = 60 \text{ °C}$ , T4,

Intrinsically safe when connected as per  
Installation Drawing DRW213478.

CHINA (PCEC) Ex ia II CT4  
Certificate No. CE092145  
Standard GB3836.1-2000 and GB3836.4-2000

IECEx (VTT) Ex ia IIC T4 Ga  
IECEx VTT 09.0002x issue No: 2

Safety factors  $U_i = 28 \text{ V}$ ,  $I_i = 100 \text{ mA}$ ,  $P_i = 700 \text{ mW}$   
 $C_i = 1 \text{ nF}$ ,  $L_i$  negligibly low

Environmental specification

$T_{amb}$  -40 ... +60 °C (-40 ... +140 °F)  
 $P_{amb}$  0.8 ... 1.1 bar

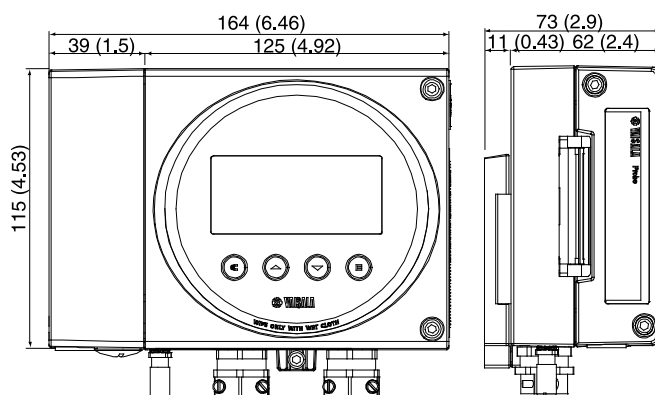
EAC (Russia, Kazakhstan, Belarus) (T RCU) 0Ex ia IIC T4 Ga X  
Certificate No. RU C-FI.MW06.B.00068

Environmental specifications

$T_{amb}$  -40 ... +60 °C (-40 ... +140 °F)  
 $P_{amb}$  0.8 ... 1.1 bar

## Dimensions

Dimensions in mm (inches)



## Accessories

		HMT361	HMT363	HMT364	HMT365	HMT367	HMT368
<b>Accessory</b>	<b>part number</b>						
Ball valve ISO 1/2 with welding joint	BALLVALVE-1						√
Cable Gland M20 x 1.5 with splitting seal	HMP247CG		√		√	√	
Duct installation kit	210697		√			√	
Fitting body ISO1/2 solid structure	DRW212076SP						√
Fitting body M22 x 1.5	17223			√			
Fitting body NPT1/2	17225			√			
Fitting body NPT1/2 solid structure	NPTFITBODASP						√
Mounting flange	210696				√		
Swagelok for 12mm probe, 1/2" NPT thread	SWG12NPT12		√			√	
Swagelok for 12mm probe, 3/8" ISO thread	SWG12ISO38		√			√	
Galvanic isolator	212483	√	√	√	√	√	√
Zener barrier	210664	√	√	√	√	√	√

# VAISALA

Vaisala takes pride in professional and comprehensive specifications that are based on scientific test methods and known standards. The accuracy specification takes into account repeatability, non-linearity, and hysteresis, and is given for the full measurement range, unless otherwise stated. This means our customers get truly reliable information with no gaps, helping them make the right decisions.



Scan the code for more information

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## HMT310 Humidity and Temperature Transmitter



The Vaisala HUMICAP® Humidity and Temperature Transmitter HMT310 models (from left to right): HMT313, HMT317, HMT314, HMT318, HMT315 and HMT311.

### Features/Benefits

- Latest generation Vaisala HUMICAP® sensor for excellent accuracy and stability
- Full 0 ... 100 %RH measurement, temperature range up to +180 °C (+356 °F), depending on model
- Small size, easy to integrate
- Insensitive to dust and most chemicals
- NIST traceable calibration (certificate included)

### Reliable Vaisala HUMICAP® Technology

The HMT310 incorporates the latest generation Vaisala HUMICAP® sensor. The sensor is a capacitive thin-film polymer sensor providing high accuracy, excellent long-term stability and negligible hysteresis. It is insensitive to dust, particulate dirt and most chemicals.

### Several Outputs, One Connector

The HMT310 is powered up with 10 ... 35 VDC. It has two analog outputs and an RS232 serial output. The output signal and the supply power travel in the same cable, the only cable connected to the unit.

### Chemical Purge

Chemical purge helps to maintain measurement accuracy between calibration intervals. It involves heating the sensor to remove harmful chemicals. The function can be initiated manually or programmed to occur at set intervals.

### Optional Functions

The following optional functions are available: several probes for various applications, calculated humidity quantities, variety of mounting kits, rain shield, sensor protection options and probe cable lengths, warmed probe and sensor heating for high humidity conditions (HMT317), and chemical purge for applications risking an interference with chemicals in the measuring environment.



# Technical Data

## Measured Values

### RELATIVE HUMIDITY

Measurement range 0 ... 100 %RH  
Sensor

Vaisala HUMICAP®180R	typical applications
Vaisala HUMICAP®180RC	applications with chemical purge/warmed probe
Vaisala HUMICAP®180V	catalytic sensor for H <sub>2</sub> O <sub>2</sub> environments
Vaisala HUMICAP®180VC	catalytic sensor with chemical purge for H <sub>2</sub> O <sub>2</sub> environments

Accuracy (including non-linearity, hysteresis, and repeatability)

at a temperature range of

+15 ... +25 °C (+59 ... +77 °F)	±1 %RH (0 ... 90 %RH) ±1.7 %RH (90 ... 100 %RH)
-20 ... +40 °C (-4 ... +104 °F)	±(1.0 + 0.008 x reading) %RH
-40 ... +180 °C (-40 ... +356 °F)	±(1.5 + 0.015 x reading) %RH

Factory calibration uncertainty ±0.6 %RH (0 ... 40 %RH) \*  
(+20 °C) ±1.0 %RH (40 ... 97 %RH) \*

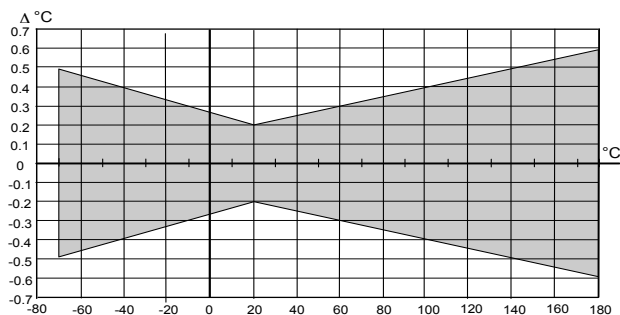
\* Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.

Response time (90 %) at +20 °C (+68 °F) 17 s with grid filter  
in 0.1 m/s air flow 50 s with grid and steel, netting filter  
60 s with sintered filter

### TEMPERATURE

HMT311	-40 ... +60 °C (-40 ... +140 °F)
HMT313	-40 ... +80 °C (-40 ... +176 °F) or -40 ... +120 °C (-40 ... +248 °F)
HMT314, HMT315, HMT317, HMT318	-70 ... +180 °C (-94 ... +356 °F)
Typical accuracy at +20 °C (+68 °F)	±0.2 °C (±0.36 °F)

Accuracy over temperature range (see graph below)



Temperature sensor Pt100 RTD Class F0.1 IEC 60751

## Electrical Connections

Two analog outputs, selectable and scalable	0 ... 20 mA or 4 ... 20 mA 0 ... 5 V or 0 ... 10 V 1 ... 5 V available through scaling
Typical accuracy of analog output at +20 °C	±0.05 % full scale
Typical temperature dependence of analog output	0.005 %/°C (0.003 %/°F) of full scale
Serial output	RS232C
Connections	M12 8-pole connector with RS232C, current/voltage outputs (two channels) and U <sub>in</sub>
Operating voltage	10 ... 35 VDC
Minimum operating voltage	
RS232C output	10 VDC
Analog output	15 VDC
Probe heating and chemical purge	15 VDC
Pressures above 10 bara (145 psia)	24 VDC
Power consumption	
RS232	12 mA
U <sub>out</sub> 10 V (10 kOhm) channel 1 & channel 2	12 mA
I <sub>out</sub> 20 mA (load 511 Ohm) channel 1 & channel 2	50 mA
Chemical purge at 24 VDC	+ 220 mA
Warmed probe at 24 VDC	+ 240 mA
External load	R <sub>L</sub> < 500 Ohm
Startup time after power-up	3 s

## General

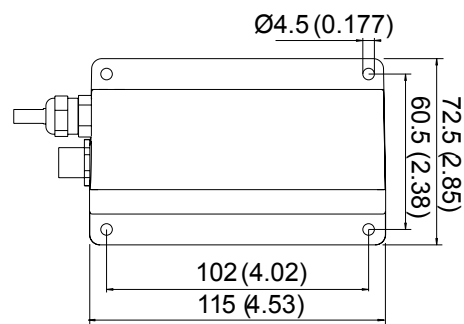
Operating temperature range for electronics	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature range	-55 ... +80 °C (-67 ... +176 °F)
Operating pressure	
HMT314	0 ... 100 bar
HMT318	0 ... 40 bar
HMT315, HMT317	vapor tight
Transmitter housing material	G-AlSi10Mg
Transmitter base material	PPS
Housing classification	IP66
Cable feed through alternatives	8-pole connector with 5 m cable, Female 8-pin connector screw joint for cable diameter 4 ... 8 mm
Probe cable length	2m, 5m, or 10m
Sensor protection	PPS grid with stainless steel net, PPS grid, Sintered filter, Membrane stainless steel filter, H <sub>2</sub> O <sub>2</sub> filter
Complies with EMC standard EN61326-1, Industrial environment	

## Accessories

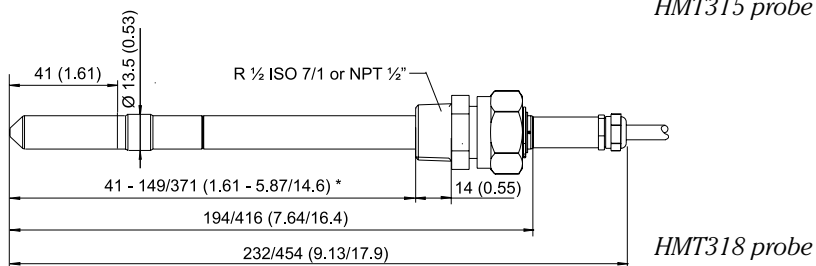
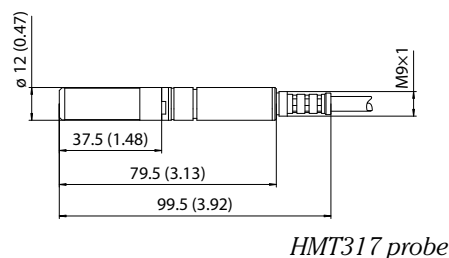
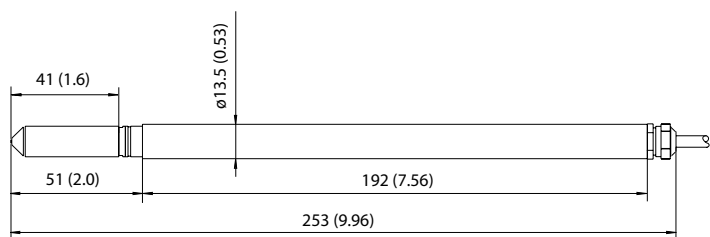
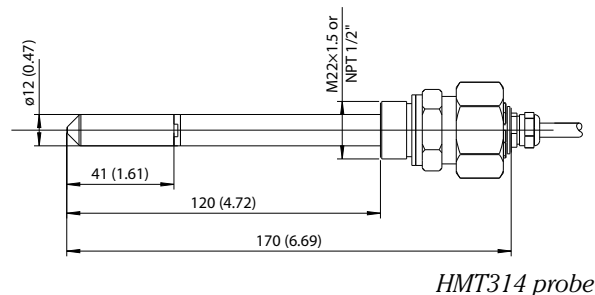
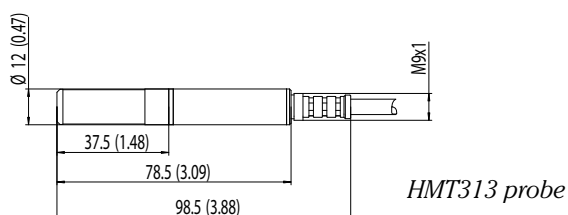
Rain shield	ASM211103
USB cable	238607
PPS Plastic Grid with Stainless Steel Netting	DRW010281SP
PPS Plastic Grid Filter	DRW010276SP
Sintered Filter AISI 316L	HM47280SP
Stainless Steel Filter	HM47453SP
Stainless Steel Filter with Membrane	214848SP
Catalytic H <sub>2</sub> O <sub>2</sub> Filter	231865

## Dimensions

### Transmitter body dimensions in mm (inches)



### Probe dimensions in mm (inches)



Lengths for standard / optional probes  
\* freely user-adjustable length

# VAISALA

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[www.vaisala.com/requestinfo](http://www.vaisala.com/requestinfo)

# Calculate and Convert.

The free web based Vaisala Humidity Calculator allows you to calculate several humidity parameters from one known humidity value. Make unit conversions on the fly, and see the effects of changing ambient conditions, like temperature and pressure.

The calculator works with any device, PC or mobile, and online and offline. It is available in several languages.

Access the Vaisala Humidity Calculator at **[www.vaisala.com/humiditycalculator](http://www.vaisala.com/humiditycalculator)**

**VAISALA** / Humidity Calculator 5.0 English °C ?

Ambient conditions	Value	Unit/Conversion
Temperature	21	°C
Pressure	1013.3	mbar
Gas type	Air	
Psychrometer	Standard	

Fill in the known parameter to calculate other values	Value	Unit/Conversion
Relative humidity (RH)	20	%RH
Dewpoint	-2.8084	°C
Parts per million (ppm)	4949.6	PPMvol
Absolute humidity (a)	3.6761	g/m³
Mixing ratio (x)	3.0785	g/kg
Water content (w)	233.82	lb/MMscf
Vapor pressure (pw)	4.9905	mbar
Wet bulb	10.032	°C
Enthalpy	28.944	kJ/kg
Frostpoint	-2.4825	°C
Saturation vapor pressure (psat)	24.862	mbar
Specific Volume	0.83489	m³/kg
Density	1.1978	kg/m³

## Vaisala HUMICAP® Humidity and Temperature Transmitters HMT120 and HMT130



*The HMT120/130 with and without a display.*

The Vaisala HUMICAP® Humidity and Temperature Transmitters HMT120 and HMT130 are designed for humidity and temperature monitoring in cleanrooms and are also suitable for demanding HVAC and light industrial applications.

### Performance

The HMT120/130 incorporates Vaisala HUMICAP® technology that measures relative humidity accurately and reliably. The Vaisala HUMICAP® is resistant to dust and most chemicals.

The transmitter enclosure is optimized for use in cleanrooms. The smooth surface of the enclosure makes it easy to clean and the enclosure material is chosen to tolerate purifying agents. Furthermore, the cabling can be done through the back wall of the transmitter.

### Interchangeable Probe

The HMT120/130 transmitters use a fully interchangeable relative humidity probe. The probe can be easily removed and replaced with a new one without having to adjust the transmitter, which allows for easy and quick recalibration of the transmitter. The probe can be adjusted using one of Vaisala's portable meters as a reference.

Also available is a constant output probe with fixed RH and T output for convenient inspection of the monitoring system and signal transfer line.

### Available Options

The HMT120 and HMT130 transmitters are available as wall mounted or with remote probe. For high temperature applications or where space is limited, the remote

### Features/Benefits

- Vaisala HUMICAP® technology with humidity sensor HUMICAP® 180R
- Humidity parameter options: relative humidity, dew point/frost point, wet bulb temperature, enthalpy, absolute humidity, mixing ratio, vapor pressure, and saturation vapor pressure
- 2-wire loop-powered or 3-wire voltage output configurations
- Interchangeable probe (easy field calibration)
- Accurate and reliable
- Resistant to dust and most chemicals
- Optional LCD display
- USB cable available for a PC connection for maintenance
- Wall-mounted or with a remote probe
- Constant output probe available
- Can be mounted outdoors using a Vaisala installation kit and the Vaisala Radiation Shield DTR504A
- Enclosure IP65
- 3-point NIST traceable calibration (certificate included)
- Suitable for cleanrooms and demanding HVAC and light industrial applications

probe is ideal. The transmitters come with an optional LCD display, which shows the measurement results of selected parameters in selected units. The parameters are displayed simultaneously at two separate rows on the display.



# Technical Data

## Performance

### RELATIVE HUMIDITY

Measurement range	0 ... 100 %RH
Accuracy including non-linearity, hysteresis, and repeatability	
temperature range	0 °C ... +40 °C
0 ... 90 %RH	±1.5 %RH
90 ... 100 %RH	±2.5 %RH
temperature range	-40 ... 0 °C, +40 ... +80 °C
0 ... 90 %RH	±3.0 %RH
90 ... 100 %RH	±4.0 %RH
Factory calibration uncertainty at +20 °C (+68 °F)	
0 ... 90 %RH	±1.1 %RH
90 ... 100 %RH	±1.8 %RH
Humidity sensor	Vaisala HUMICAP® 180R
Stability	±2 %RH over 2 years
In typical HVAC applications	±0.5 %RH per year

### TEMPERATURE

Measurement range	-40 °C ... +80 °C
Accuracy over temperature range	
at +15 °C ... +25 °C	±0.2 °C
at 0 ... +15 °C and at +25 °C ... +40 °C	±0.25 °C
at -40 °C ... +0 °C and at +40 °C ... +80 °C	±0.4 °C
Temperature sensor	Pt1000 RTD Class F0.1 IEC 60751

### OTHER VARIABLES (OPTIONAL)

dew point/frost point, wet bulb temperature, enthalpy, absolute humidity, mixing ratio, vapor pressure, and saturation vapor pressure

## Inputs and Outputs

### HMT120 TWO-WIRE TRANSMITTER (LOOP POWERED)

Current output signals	4 ... 20 mA
External loop voltage	10 ... 30 VDC ( $R_L = 0$ ohms)
	20 ... 30 VDC ( $R_L < 500$ ohms)

### HMT130 THREE-WIRE TRANSMITTER

Voltage output signals	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
	or user defined between 0 ... 10 V
Min output resistance	1 kohm
Serial output	RS485, non-isolated
Relay output	1 relay (max. 50 VDC, 200 mA)
Supply voltage	10 ... 35 VDC
	15 ... 35 VDC (when output 0 ... 10 V)
	24 VAC (±20 %)
Current consumption at 24 VDC	8 mA, if relay closed 15 mA
Max. additional error caused by the analog outputs after calibration at +20 °C ambient temperature	±0.1 % of FS output signal
Temperature dependence of the analog outputs	±0.005 % of FS output signal

## Operating Environment

Operating temperature range	
transmitter body, no display	-40 °C ... +60 °C
transmitter body, with display	-20 °C ... +60 °C
HMP110 probe	-40 °C ... +80 °C
Storage temperature range	-50 °C ... +70 °C
Electromagnetic compatibility	EN 61326-1 and EN 55022

## Mechanics

Material	
transmitter housing	PBT plastic
display window	PC plastic
probe body	Stainless steel (AISI 316)
probe grid filter	Chrome coated ABS plastic
Housing classification	IP65
Connections	
inputs and outputs	Screw terminals 0.5 ... 1.5 mm <sup>2</sup>
probe interface	4-pin M8 female panel connector
Probe cable lengths	3 m, 5 m, 10 m - up to 50 m
Display (optional)	128 x 64 resolution full graphics
	B&W display without backlight
Weight (including probe)	270 g

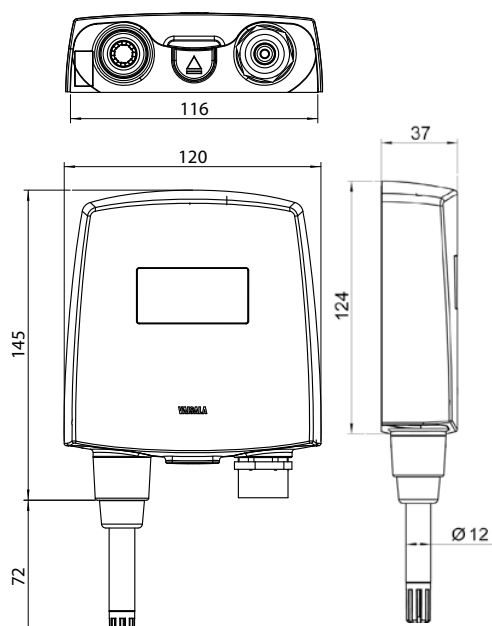
## Accessories

Humidity and temperature probe	HMP110*
Humidity and temperature replacement probe	HMP110R*
Constant output probe	HMP110REF*
Humidity sensor	HUMICAP® 180R
Probe mounting flange	226061
Probe mounting clamps, 10 pcs	226067
HMP110 sensor protection	
plastic grid filter	DRW010522SP
plastic grid with membrane filter	DRW010525SP
stainless steel sintered filter	HM46670SP
Probe cable 3 m	HMT120Z300
Probe cable 5 m	HMT120Z500
Probe cable 10 m	HMT120Z1000
Radiation shield	DTR504A
Rain shield with installation kit	215109
Duct installation kit	215619
HM70 connection cable	211339
USB serial interface cable	219685

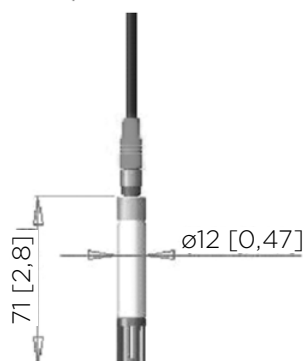
\* See separate order form

## Dimensions

Dimension in mm



### Remote probe dimensions



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[www.vaisala.com/requestinfo](http://www.vaisala.com/requestinfo)

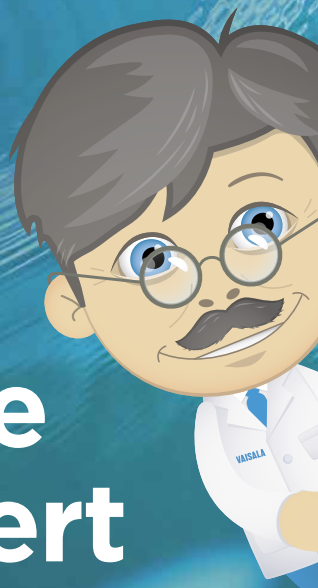


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# Become an Expert in Humidity



**VAISALA** / Humidity Calculator 5.0 English

Ambient conditions	Value	Unit/Conversion
Temperature	21	°C
Pressure	1013.3	mbar
Gas type	Air	
Psychrometer	Standard	

Fill in the known parameter to calculate other values

	Value	Unit/Conversion
Relative humidity (RH)	20	%RH
Dewpoint	-2.8084	°C
Parts per million (ppm)	4949.6	PPMvol
Absolute humidity (a)	3.6761	g/m³
Mixing ratio (x)	3.0785	g/kg
Water content (w)	233.82	lb/MMscf
Vapor pressure (pw)	4.9905	mbar
Wet bulb	10.032	°C
Enthalpy	28.944	kJ/kg
	-2.4825	°C
Saturation vapor pressure (pws)	24.952	mbar
Specific Volume	0.83489	m³/kg
Density	1.1978	kg/m³

The five-step Vaisala Humidity Expert Series will give you all you need to know to become an expert in humidity.

- Convert different humidity parameters
- Make easy calculations with Vaisala Humidity Calculator
- Find out how to choose the right humidity instrument for your application
- Learn the optimal calibration methods for humidity calibration
- Get familiar with the operational principle of your humidity sensor

Getting access to all this expertise is easy – sign up now at [www.vaisala.com/humidityexpert](http://www.vaisala.com/humidityexpert)

## HMW90 Series Humidity and Temperature Transmitters for High Performance HVAC Applications



*The HMW90 Series Humidity and Temperature Transmitters are designed for demanding HVAC applications.*

Wall-mounted Vaisala HMW90 Series HUMICAP® Humidity and Temperature Transmitters measure relative humidity and temperature in indoor HVAC applications, where high accuracy, stability, and reliable operation are required.

The flexible HMW90 series offers a variety of options and features. Transmitters include a display and a sliding cover with either an opening for the display or a solid front. Both analog and digital output options, including special scalings and calculated parameters, are available.

### Quick and Easy to Install

HMW90 series transmitters are quick and easy to install. The wiring is connected through the back plate and the electronics with the sensors can be snapped on easily after the wiring is complete. The transmitter is configured using dip switches, which are accessible when the enclosure is open.

### Digital Communication Brings Benefits

The introduction of digital (BACnet/Modbus) communication to field level devices brings many advantages. For example, all sensors can be centrally accessed and their performance can be easily monitored. Wiring is simple when multiple sensors are installed on the same bus. Sensors can be set up using standardized tools, and the system can be enlarged with additional sensors quickly and conveniently. In addition, parameters influencing measurements, such as pressure or site elevation, can be centrally set and updated.

### Choose from a Wide Variety of Calibration Options

On-site calibration and adjustment is exceptionally easy. The sliding cover exposes offset trimmers for one-point calibration without disturbing measurement. The display instantly indicates the effects of changes,

### Features/Benefits

- Both analog and digital output
- Easy installation, configuration, and field adjustment
- Humidity parameter options: relative humidity, dew point, mixing ratio, enthalpy, wet bulb temperature, dew point depression, and absolute humidity
- Full 0 ... 100%RH measurement range
- Up to  $\pm 1.7\%$  RH accuracy
- User exchangeable humidity and temperature module
- NIST traceable calibration (certificate included)
- Available in four colors

### BACnet in Brief

- A data communication protocol for Building Automation and Control networks
- Used in management, automation and field level communication
- ANSI/ISO/ASHRAE standard controlled by a standardization body
- Adds flexibility by allowing the integration of products and systems from different manufacturers

making it clear and convenient to make adjustments. A service port enables two-point calibration, using either a PC or the Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter HM70. HMW90 series transmitters include a user-exchangeable measurement module, which can be ordered as a spare part. Calibration services are available through all Vaisala Service Centers.



# Technical Data

## Models

TMW92	T-only	2-wire, current output
TMW93	T-only	3-wire, voltage output
TMW90	T-only	configurable analog output model
HMW92	RH+T	2-wire, current output
HMW92D	RH+T	2-wire, current output with display
HMW93	RH+T	3-wire, voltage output
HMW93D	RH+T	3-wire, voltage output with display
HMW90	RH+T	Configurable analog/digital model
HMW95	RH+T	Digital (BACnet, Modbus) model
HMW95D	RH+T	Digital (BACnet, Modbus) model with display

## Performance

### RELATIVE HUMIDITY

Measurement range 0 ... 100 %RH, non-condensing

### Accuracy

Temperature range +10 ... +40 °C (+50 ... +104 °F)

0 ... 90 %RH ±1.7 %RH

90 ... 100 %RH ±2.5 %RH

Temperature range -5 ... +10 °C, +40 ... +55 °C

(+23 ... +50 °F, +104 ... +131 °F)

0 ... 90 %RH ±3 %RH

90 ... 100 %RH ±4 %RH

Stability in typical HVAC applications ±0.5 %RH/year

Humidity sensor Vaisala HUMICAP® 180R

### TEMPERATURE

Measurement range -5 ... +55 °C (+23 ... +131 °F)

### Accuracy

+20 ... +30 °C (+68 ... +86 °F) ±0.2 °C (± 0.36 °F)

+10 ... +20 °C, +30 ... +40 °C

(+50 ... +68 °F, +86 ... +104 °F) ±0.3 °C (± 0.54 °F)

-5 ... +10 °C, +40 ... +55 °C

(+23 ... +50 °F, +104 ... +131 °F) ±0.5 °C (± 0.90 °F)

Temperature sensor Digital temperature sensor

## Operating Environment

Operating temperature range -5 ... +55 °C (+23 ... +131 °F)

Storage temperature range -30 ... +60 °C (-22 ... +140 °F)

Electromagnetic compliance EN61326-1, Industrial Environment

## Spare Parts and Accessories

Humidity and Temperature Module	HTM10SP
Temperature Module (for T-only models)	TM10SP
Decorative cover set (10 pcs.)	236285
Connection cable for HM70 hand-held meter	219980
USB cable for PC connection	219690

## Mechanics

IP class	IP30
Standard housing color	White (RAL9003*)
Optional housing colors	Black (RAL9005*)
(configurable models only)	Grey (RAL7035*)
	Light Ivory (RAL1015*)
Housing material	ABS/PC, UL-V0 approved
Output connector	Screw terminals
	max. wire size 2 mm <sup>2</sup> (AWG14)
Service port connector	4-pin M8
Weight	155 g

\*RAL code is only indicative with potential small variations in color shade

## Inputs and Outputs

### Current output models

Outputs 2 x 4 ... 20 mA, loop powered

Loop resistance 0 ... 600 Ω

Supply voltage 20 ... 28 VDC at 500 Ω load

10 ... 28 VDC at 0 Ω load

Isolation between output channels 500 VDC

### Voltage output models

Outputs 2 x 0...5 V or 2 x 0...10 V

Load resistance 10 kΩ min.

Supply voltage 18 ... 35 VDC, 24 VAC ±20 % 50/60 Hz

Max. current consumption 12 mA

max. with relay 25 mA

Relay 1 pc (max 50VDC/50 VAC, 500 mA)

### Digital models

Supply voltage 18 ... 35 VDC, 24 VAC ± 20% 50/60 Hz

Max. current consumption

(with 120 Ω termination) 30 mA at 24 VDC

Output type RS-485 (galvanic isolation, 1.5 kV)

RS-485 end of line termination Enable with jumper, 120 Ω

Supported protocols Selectable by DIP switch

BACnet MS/TP

Operating mode Selectable Master/Slave

Address range, master mode 0 ... 127

Address range, slave mode 128...255

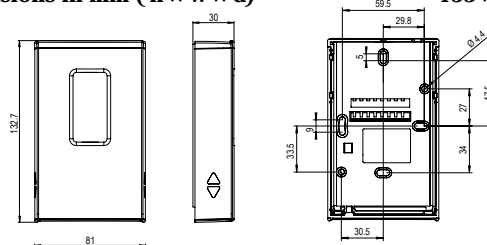
Modbus RTU

Address range 0 ... 247

Service port RS-485 line for temporary service use

## Dimensions in mm (h x w x d)

133 x 81 x 30



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## HMD60/70 Humidity and Temperature Transmitters for Ducts in HVAC Applications



*Vaisala HUMICAP® Humidity and Temperature Transmitters HMD60 and HMD70 are designed for use in air conditioning applications where accurate and stable control of relative humidity and temperature are required.*

The duct mounted Vaisala HUMICAP® Humidity and Temperature Transmitters HMD60 and HMD70 are designed for monitoring relative humidity and temperature in building energy management systems. The combination of high accuracy, stability and reliable operation, make these products the ideal choice for demanding applications.

### Resistant to Chemicals and Dust

The duct mount HMD60 and HMD70 transmitters can also be used in many industrial humidity monitoring applications, where their stability and resistance to chemicals and dust are of great value. A useful feature of these duct mount transmitters is the ability to remove the electronics without removing the unit from the duct.

### Measures both Humidity and Temperature

The HMD60 and HMD70 transmitters are available in three models: U for humidity measurement-only, Y for humidity and temperature measurement, and T for temperature only.

### Fast, On-Site Calibration

The accuracy of the transmitters is simple to check using either the Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter HM70 or the Vaisala HUMICAP® Humidity Indicator HMI41. The calibration can be done in seconds with a single potentiometer without disturbing the operation, resulting in great savings both in maintenance time and costs.

### Features/Benefits

- Full 0 ... 100 %RH measurement
- Accuracy up to  $\pm 2$  %RH
- True two-wire transmitters with 4 ... 20 mA loop powered output (HMD60)
- Selectable signal output of 0 ... 1 V, 0 ... 5 V or 0 ... 10 V (HMD70) with optional current module also 0 ... 20 mA (HMD70)
- Vaisala HUMICAP® Sensor for excellent accuracy and long-term stability, negligible hysteresis and resistance to dust and most chemicals.
- Temperature compensated
- IP65 (NEMA 4) housing
- Also available as temperature-only transmitters HMD 60T/70T
- NIST traceable (certificate included)

# Technical Data

## 60 Series: 2-wire, 4 to 20 mA Output

Duct mount	RH only	HMD60U
	RH & T	HMD60Y
	T only	HMD60T

## 70 Series: 3-wire, Variable Voltage Output

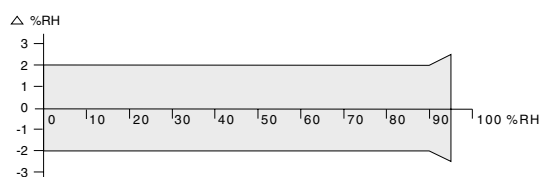
Duct mount	RH only	HMD70U
	RH & T	HMD70Y
	T only	HMD70T

## Relative Humidity

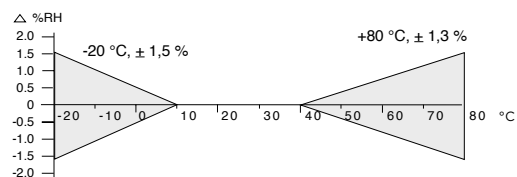
Measurement range

duct mount 0 ... 100 %RH\*

Accuracy at +20 °C



Temperature dependence



Response time at +20 °C (+68 °F),

90% response 15 s (with membrane filter)

Stability  $\pm 2$  %RH / 2 years

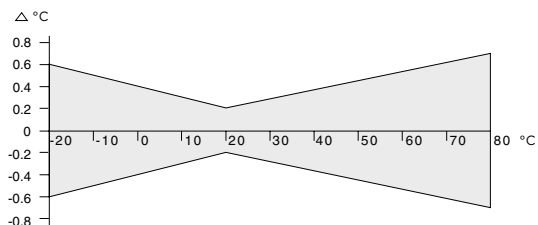
## Temperature (Y and T Models)

Linearity better than 0.1 °C

Sensor Pt 1000 RTD Class F0.3 IEC 60751

Measurement range -20 ... +80 °C (-4 ... 176 °F) \*\*

Accuracy



\*\* Optional temperature scales are available on request.

## General - 60 Series

Supply voltage	10 ... 35 VDC (RL = 0 ohm)
	20 ... 35 VDC (RL = 500 ohm)
Output signal	4 ... 20 mA

## General - 70 Series

Supply voltage range depends on the selected output signal

	DC	AC
0 ... 1V	10 ... 35 V	9 ... 24 V
0 ... 5V	14 ... 35 V	12 ... 24 V
0 ... 10V	19 ... 35 V	16 ... 24 V

WITH OPTIONAL CURRENT MODULE

0 ... 20 mA (RL = 0 ohm)	10 ... 35 V	11 ... 24 V
**0 ... 20 mA (RL = 500 ohm)	20 ... 35 V	17 ... 24 V

Power consumption @ 24 VAC

HMD70U	10 mA typical
HMD70Y	12 mA typical

## General

Operating temperature range

electronics	-5 ... +55 °C (+23 ... +131 °F)
probe	-20 ... +80 °C (-4 ... +176 °F)

Storage temperature range -40 ... +80 °C (-40 ... +176 °F)

Maximum flow speed 50 m/s

Current module part no. 18945 HM

Housing

probe	stainless steel
electronics	cast aluminum

Connections screw terminals 0.5 ... 1.5 mm<sup>2</sup>

Sensor protection

standard	membrane filter (part no. DRW010525)
optional	stainless steel sintered filter (part no. HM46670SP)

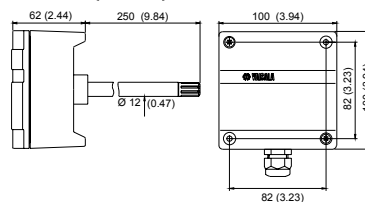
Cable thread-through

bushing for 7 ... 10 mm (PG9)	
bushing for NPT1/2" cable glands	242020
cable housing IP65 (NEMA 4)	part no. 18941HM
armoured cable glands	part no. 10528HM
(must be ordered separately)	

Complies with EMC standard EN61326 and EN55022

## Dimensions

Dimensions in mm (inches)



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## HMDW110 Series Humidity and Temperature Transmitters for High-Accuracy Measurements in HVAC Applications



*HMDW110 Series Humidity and Temperature Transmitters for measurements in ducts, outdoor environments, and humid areas.*

Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMDW110 measure relative humidity and temperature in multiple HVAC applications. The series includes transmitters for duct mounting, IP65-classified wall transmitters, and outdoor transmitters with integrated radiation shields.

### Proven Vaisala HUMICAP® Performance

The cost-efficient HMDW110 series transmitters are equipped with trusted HUMICAP® 180R sensors. The sensor's superior long-term stability minimizes maintenance needs throughout the transmitter's lifetime. If necessary, the transmitter can be field-calibrated using either an HM70 Hand-Held Humidity and Temperature Meter, or a PC connection.

HMDW110 series instruments are individually adjusted and delivered with a calibration certificate. The factory calibration is traceable to NIST.

### Unrivalled Outdoor Humidity Measurements

The integrated radiation shield of the outdoor models HMS110 and HMS112 enables unrivalled measurement performance. It reduces the impact of sunshine on temperature and humidity measurements, and ensures measurement accuracy in outdoor conditions. The most popular control parameters in free cooling – dew point temperature, wet bulb temperature, and enthalpy – are available as output parameters.

### Features/Benefits

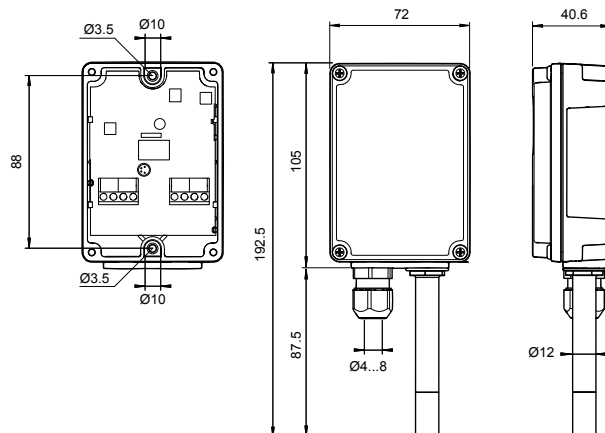
- Accurate humidity and temperature transmitters for measurements in HVAC and cleanroom applications
- Outdoor transmitter with professional-grade radiation shield
- Proven HUMICAP® 180R sensor for superior long-term stability
- $\pm 2$  %RH accuracy
- 3-point NIST traceable calibration (certificate included)
- On-site calibration with HM70 Hand-Held Meter or PC connection
- Current output (4 ... 20 mA)
- Default output parameters are relative humidity and temperature. Dew point temperature, wet bulb temperature, and enthalpy outputs selectable with a PC connection.

### Well-Suited for Cleanroom Monitoring

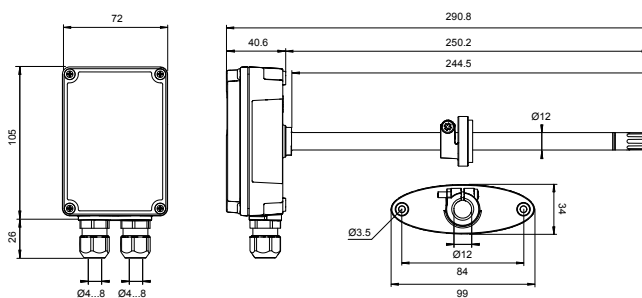
The HMD110 and HMW110 transmitters can be ordered with a catalytic HUMICAP® sensor HUMICAP® 180VHP. The catalytic sensor improves stability especially in hydrogen peroxide sterilized environments where repeated condensation is expected.

An optional panel display can be added for remote monitoring. Transmitters can be installed into difficult-to-reach locations, while measurement data can be read from a more convenient spot.

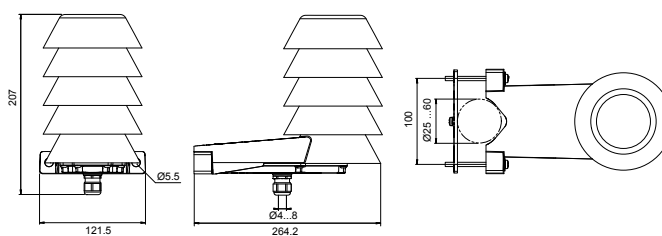




*HMW110/112  
RH+T transmitters  
for measurements  
in wet areas*



*HMD110/112  
RH+T transmitters  
for ducts*



*HMS110/112  
RH+T  
transmitters  
for outdoor  
measurements*

# Technical Data

## Models

Model number	Type	Output	Special Features	Ingress Protection
HMW110	Wall-mount, RH+T	2-wire, current output	Configurable model*	IP65
HMW112	Wall-mount, RH+T	2-wire, current output		IP65
HMD110	Duct-mount, RH+T	2-wire, current output	Configurable model*	IP65
HMD112	Duct-mount, RH+T	2-wire, current output		IP65
HMS110	Outdoor, RH+T	2-wire, current output	Radiation shield, configurable model*	IP65
HMS112	Outdoor, RH+T	2-wire, current output	Radiation shield	IP65

\*Delivered with customer specific output settings, including calculated humidity parameters and special scaling of outputs.

## Performance

### RELATIVE HUMIDITY

Measurement range 0 ... 100 %RH

#### Accuracy

Temperature range +10 ... +30 °C (+50 ... +86 °F)

0 ... 90 %RH ±2 %RH

90 ... 100 %RH ±3 %RH

Temperature range -20 ... +10 °C, +30 ... +60 °C

(-4 ... +50 °F, +86 ... +140 °F)

0 ... 90 %RH ±3 %RH

90 ... 100 %RH ±4 %RH

Temperature range -40 ... -20 °C (-40 ... -4 °F)

0 ... 100%RH ±4 %RH

Stability in typical HVAC applications ±0.5 %RH/year

Humidity sensor Vaisala HUMICAP® 180R

### TEMPERATURE

Measurement range -40 ... +60 °C (-40 ... +140 °F)

#### Accuracy

At +20 °C (+68 °F) ±0.2 °C (±0.36 °F)

Temperature dependence ±0.01 °C/°C

Temperature sensor Pt1000 RTD Class F0.1 IEC 60751

### CALCULATED PARAMETERS

Measurement range for dew

point temperature and wet bulb

temperature -40 ... +60 °C (-40 ... +140 °F)

Measurement range for

enthalpy -40 ... 460 kJ/kg (-10 ... +190 BTU/lb)

Accuracy of the calculated parameters should be calculated at the actual condition based on the RH and temperature specification.

Accuracy at 20°C (68°F) and 80%RH:

Dew point ±0.7 °C (1.2 °F)

Wet bulb temperature ±0.5 °C (0.9 °F)

Enthalpy ±1.6kJ/kg (0.7 BTU/lb)

Factory calibration uncertainty at 20 °C

(+68 °F) ±1.5%RH/±0.2 °C

## Operating Environment (All Models)

Operating temperature range -40 ... +60 °C (-40 ... +140 °F)

Operating humidity range 0 ... 100 %RH

Maximum wind/flow speed 30 m/s

Storage temperature -40 ... +60 °C (-40 ... +140 °F)

Electromagnetic compliance EN61326-1, Industrial Environment

## Mechanics

Max wire size 1.5 mm<sup>2</sup> (AWG 16)

Standard housing color White (RAL9003)

Housing material PC + 10%GF (UL-V0 approved)

## Inputs and Outputs

Analog output 4 ... 20 mA, loop powered

Loop resistance 0 ... 600 Ω

Supply voltage 20 ... 28VDC at 600 Ω load

10 ... 28VDC at 0 Ω load

Data input for RDP100 Remote RS485,

Panel Display Vaisala proprietary protocol

## Spare Parts and Accessories

Remote Panel Display RDP100

Conduit fitting + O-ring (M16x1.5 / NPT1/2 Inch) 210675SP

Conduit fitting + O-ring (M16x1.5 / PG9, RE-MS) 210674SP

Fastening set HMS110 237805

Porous PTFE Filter DRW239993SP

Membrane Filter ASM210856SP

Terminal Block, Blue 236620SP

USB cable for PC connection 219690

Connection cable for HM70 hand-held meter 219980SP

HUMICAP® 180R sensor HUMICAP180R

Catalytic HUMICAP® sensor HUMICAP180VHP

# VAISALA

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EASY INSTALLATION  
EASY MAINTENANCE

STABLE AND  
RELIABLE  
HUMIDITY  
SENSOR

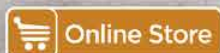
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# VAISALA

## HMS110 Series Humidity and Temperature Transmitters for High-Accuracy Outdoor Measurements in Building Automation Applications



### Features/Benefits

- Reliable outdoor transmitters with integrated radiation shields
- $\pm 2$  %RH accuracy
- Proven HUMICAP® 180R sensor for long-lasting accuracy
- 3-point NIST traceable calibration (certificate included)
- Default output parameters are relative humidity and temperature. Dew point temperature, wet bulb temperature, and enthalpy outputs selectable with a PC connection.
- Current output (4...20 mA)
- On-site calibration with HM70 Hand-Held Meter or PC connection
- Ingress protection IP65

*HMS110 Series Humidity and Temperature Transmitters with HUMICAP® sensor.*

Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMS110 are designed for demanding outdoor measurements in building automation applications. These  $\pm 2$ % transmitters include an integrated radiation shield to reduce the influence of solar radiation on temperature and humidity measurements.

### Proven Vaisala HUMICAP® Performance for Outdoor Measurements

HMS110 transmitters are equipped with the trusted HUMICAP® 180R – a robust, general-purpose humidity sensor that functions well in high humidity. The sensor's superior stability ensures long-lasting accuracy and minimal maintenance throughout the transmitter's lifetime.

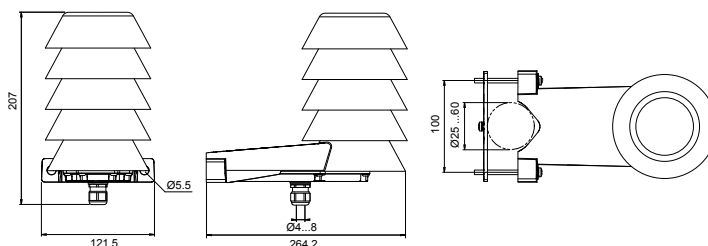
The integrated radiation shield allows unrivaled measurement performance, reducing the impact of sunshine on temperature and humidity measurements and ensuring measurement accuracy in outdoor conditions.

### Easy Installation and Maintenance

HMS110 transmitters are easy to install. They can be mounted directly onto a wall or pole without any extra accessories. There are no loose parts,

screws are retained in the enclosure, all connectors are clearly labeled, and the connectors are within easy reach.

The HUMICAP® sensor's excellent long-term stability and high-quality materials ensure minimal need for maintenance. If necessary, the transmitter can be field-calibrated using either an HM70 Hand-Held Humidity and Temperature Meter, or a PC connection.





# Technical Data

## Models

MODEL NUMBER	TYPE	OUTPUT	SPECIAL FEATURES	INGRESS PROTECTION
HMS110	Outdoor, RH+T	2-wire, current output	Delivered with customer specific output settings, including calculated humidity parameters and special scaling of outputs.	IP65
HMS112	Outdoor, RH+T	2-wire, current output		IP65

## Performance

RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy	
Temperature range	+10 ... +30 °C (+50 ... +86 °F)
0 ... 90 %RH	±2 %RH
90 ... 100 %RH	±3 %RH
Temperature range	-20 ... +10° C, +30 ... +60 °C (-4 ... +50 °F, +86 ... +140 °F)
0 ... 90 %RH	±3 %RH
90 ... 100 %RH	±4 %RH
Temperature range	-40 ... -20 °C (-40 ... -4 °F)
0 ... 100%RH	±4 %RH
Stability in typical HVAC applications	±0.5 %RH/year
Humidity sensor	Vaisala HUMICAP® 180R
TEMPERATURE	
Measurement range	-40 ... +60 °C (-40 ... +140 °F)
Accuracy	
At +20 °C (+68 °F)	±0.2 °C (±0.36 °F)
Temperature dependence	±0.01 °C/ °C
Temperature sensor	Pt1000 RTD Class F0.1 IEC 60751
CALCULATED PARAMETERS	
Measurement range for dew point temperature and wet bulb temperature	-40 ... +60 °C (-40 ... +140 °F)
Measurement range for enthalpy	-40 ... 460 kJ/kg (-10 ... +190 BTU/lb)
Accuracy of the calculated parameters should be calculated at the actual condition based on the RH and temperature specification. Accuracy at 20°C (68°F) and 80%RH:	
Dew point	±0.7°C (1.2°F)
Wet bulb temperature	±0.5°C (0.9°F)
Enthalpy	±1.6kJ/kg (0.7 BTU/lb)
Factory calibration uncertainty at 20 °C (+68 °F)	±1.5%RH/±0.2 °C

## Operating Environment

Operating temperature range	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity range	0 ... 100 %RH
Maximum wind/flow speed	30 m/s
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Electromagnetic compliance	EN61326-1, Industrial Environment

## Mechanics

Max wire size	1.5 mm <sup>2</sup> (AWG 16)
Standard housing color	White (RAL9003)
Housing material	PC + 10%GF (UL-V0 approved)

## Inputs and Outputs

Analog output	4 ... 20 mA, loop powered
Loop resistance	0 ... 600 Ω
Supply voltage	20 ... 28VDC at 600 Ω load 10 ... 28VDC at 0 Ω load
Data input for	RS485,
RDP100 Remote Panel Display	Vaisala proprietary protocol

## Spare Parts and Accessories

Remote Panel Display	RDP100
Conduit fitting + O-ring (M16x1.5 / NPT1/2 Inch)	210675SP
Conduit fitting + O-ring (M16x1.5 / PG9, RE-MS)	210674SP
Fastening set HMS110	237805
Membrane Filter	ASM210856SP
Terminal Block, Blue	236620SP
USB cable for PC connection	219690
Connection cable for HM70 hand-held meter	219980SP
HUMICAP® 180R sensor	HUMICAP180R

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## HMDW80 Series Humidity and Temperature Transmitters for Building Automation Applications



*HMDW80 Series Humidity and Temperature Transmitters for multiple applications within building automation.*

Vaisala INTERCAP® Humidity and Temperature Transmitter Series HMDW80 measure relative humidity and temperature in various building automation applications. Transmitters combine easy installation and reliable operation with a low requirement for maintenance.

The versatile HMDW80 series includes transmitters for wall and duct mounting, IP65-classified transmitters for humid areas, and transmitters with a radiation shield for outdoor use. It also includes temperature-only transmitters and transmitters with an optional display.

Calculated humidity parameters – dew point temperature, wet bulb temperature, and enthalpy – are also available.

### Easy Installation

HMDW80 series transmitters are optimized for easy installation. There are no loose parts, screws are retained in the enclosure, all connectors are clearly labeled, and the connectors are within easy reach. The duct mount transmitters are well suited to a variety of duct sizes, the outdoor transmitters can be mounted directly onto a wall or pole without any extra accessories, and the wall

### Features/Benefits

- Reliable transmitters for basic HVAC humidity measurements
- $\pm 3.0$  %RH accuracy
- Full 0 ... 100 %RH measurement range
- Optimized for easy installation and low maintenance
- User exchangeable INTERCAP® sensor for easy field replacement
- Output parameters: relative humidity and temperature with optional dew point temperature, wet bulb temperature and enthalpy parameters
- UL- VO flammability rating

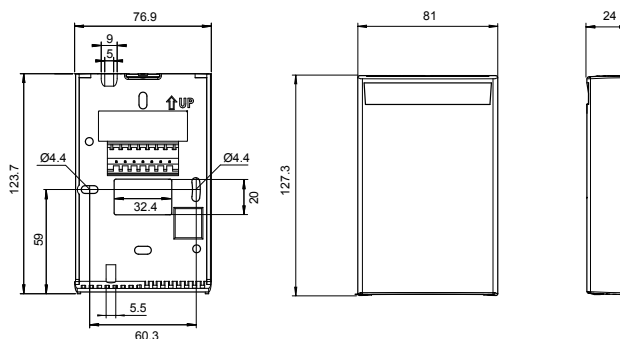
### Typical Installation Locations

- Ventilation ducts
- Walls
- Wash-down areas
- Outdoor locations

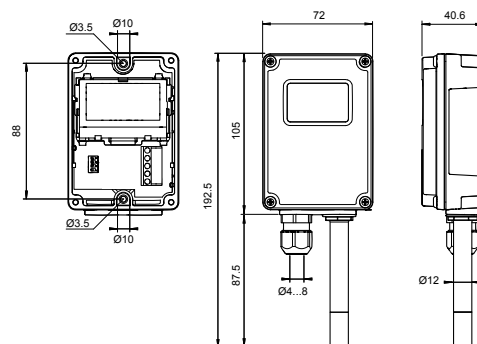
mount transmitters can be installed without the need to make holes in the transmitter enclosure.

### Reliable Operation

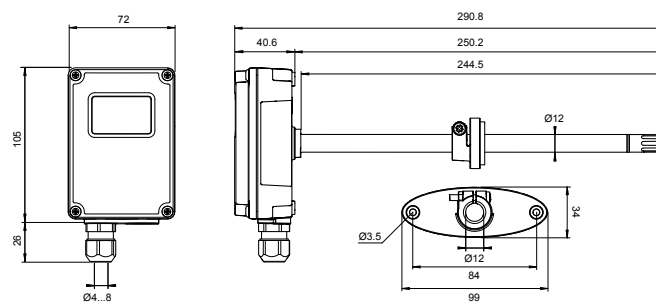
HMDW80 series transmitters require minimal maintenance thanks to their excellent sensor stability and high-quality materials. If necessary, the INTERCAP® sensor can be easily exchanged in the field with minimum downtime.



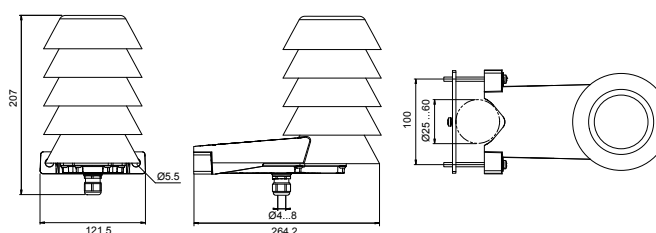
*HMW82/83 RH+T  
and TMW82/83  
T-only  
transmitters  
for wall-mounting*



*HMW88/89(D)  
RH+T transmitters  
for measurements  
in wet areas*



*HMD82/83(D)  
and TMD82/83  
RH+T and  
T-only  
transmitters  
for ducts*



*HMS82/83  
RH+T  
transmitters  
for outdoor  
measurements*

# Technical Data

## Models

Model number	Type	Output	Special Features	Ingress Protection
TMW82	Wall-mount, T-only	2-wire, current output		IP30
TMW83	Wall-mount, T-only	3-wire, voltage output		IP30
HMW82	Wall-mount, RH+T	2-wire, current output		IP30
HMW83	Wall-mount, RH+T	3-wire, voltage output		IP30
HMW88	Wall-mount, RH+T	2-wire, current output	Calculated parameters*	IP65
HMW88D	Wall-mount, RH+T	2-wire, current output	Display, calculated parameters*	IP65
HMW89	Wall-mount, RH+T	3-wire, voltage output	Calculated parameters*	IP65
HMW89D	Wall-mount, RH+T	3-wire, voltage output	Display, calculated parameters*	IP65
TMD82	Duct-mount, T-only	2-wire, current output		IP65
TMD83	Duct-mount, T-only	3-wire, voltage output		IP65
HMD82	Duct-mount, RH+T	2-wire, current output	Calculated parameters*	IP65
HMD82D	Duct-mount, RH+T	2-wire, current output	Display, calculated parameters*	IP65
HMD83	Duct-mount, RH+T	3-wire, voltage output	Calculated parameters*	IP65
HMD83D	Duct-mount, RH+T	3-wire, voltage output	Display, calculated parameters*	IP65
HMS82	Outdoor, RH+T	2-wire, current output	Radiation shield, calculated parameters*	IP65
HMS83	Outdoor, RH+T	3-wire, voltage output	Radiation shield, calculated parameters*	IP65

\*Output parameters for humidity: relative humidity, dew point temperature, wet bulb temperature, and enthalpy.

## Specifications for Models HMW82/83 and TMW82/83

### Performance

Operating temperature range	-5 ... +55 °C (+23 ... +131 °F)
Operating humidity range	0 ... 100 %RH, non-condensing
RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy	
Temperature range	+10 ... +30 °C (+50 ... +86 °F)
0 ... 70 %RH	±3 %RH
70 ... 100 %RH	±5 %RH
Temperature range	-5 ... +10 °C, +30 ... +55 °C (+23 ... +50 °F, +86 ... +131 °F)
0 ... 100 %RH	±7 %RH
Stability in typical HVAC applications	±2 %RH over 2 years
Humidity sensor	Vaisala INTERCAP®
TEMPERATURE	
Measurement range	-5 ... +55 °C (+23 ... +131 °F)
Accuracy	
+10 ... +30 °C (+50 °F ... +86 °F)	±0.5 °C (±0.9 °F)
-5 ... +10 °C, +30 ... +55 °C (+23 ... +50 °F, +86 ... +131 °F)	±1.0 °C (±1.8 °F)
Temperature sensor	Digital temperature sensor

## Specifications for Models HMD82/83, TMD82/83, HMW88/89, and HMS82/83

### Performance

Operating temperature range	-40 ... +60 °C (-40 ... +140 °F)
Operating humidity range	0 ... 100 %RH
RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy	
Temperature range	+10 ... +30 °C (+50 ... +86 °F)
0 ... 90 %RH	±3 %RH
90 ... 100 %RH	±5 %RH
Temperature range	-20 ... +10 °C, +30 ... +60 °C (-4 ... +50 °F, +86 ... +140 °F)
0 ... 90 %RH	±5 %RH
90 ... 100 %RH	±7 %RH
Temperature range	-40 ... -20 °C (-40 ... -4 °F)
0 ... 100 %RH	±7 %RH
Stability in typical HVAC applications	±2 %RH over 2 years
Humidity sensor	Vaisala INTERCAP®
TEMPERATURE	
Measurement range	-40 ... +60 °C (-40 ... +140 °F)
Accuracy	
At +20 °C (+68 °F)	±0.3 °C (±0.54 °F)
Temperature dependence	±0.01 °C/ °C
Temperature sensor	Pt1000 RTD Class F0.1 IEC 60751
CALCULATED PARAMETERS	
Measurement range for dew point temperature and wet bulb temperature	-40 ... +60 °C (-40 ... +140 °F)
Measurement range for enthalpy	-40 ... 460 kJ/kg (-10 ... +190 BTU/lb)



## Specifications for Models HMD82/83D and HMW88/89D

### Performance

Operating temperature range	-5 ... +60 °C (+23 ... +140 °F)
Operating humidity range	0...100 %RH, non-condensing
RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy	
Temperature range	+10 ... +30 °C (+50 ... +86 °F)
0 ... 90 %RH	±3 %RH
90 ... 100 %RH	±5 %RH
Temperature range	-5 ... +10 °C, +30 ... +60 °C (+23 ... +50 °F, +86 ... +140 °F)
0 ... 90 %RH	±5 %RH
90 ... 100 %RH	±7 %RH
Stability in typical HVAC applications	±2 %RH over 2 years
Humidity sensor	Vaisala INTERCAP®
TEMPERATURE	
Measurement range	(Analog output scaling) -40 ... +60 °C (-40 ... +140 °F)
Operating temperature range of the display	+5 ... +60 °C (+23 ... +140 °F)
Accuracy	
At +20 °C (+68 °F)	±0.3 °C (±0.54 °F)
Temperature dependence	±0.01 °C/ °C
Temperature sensor	Pt1000 RTD Class F0.1 IEC 60751
CALCULATED PARAMETERS	
Measurement range for dew point temperature and wet bulb temperature	-40 ... +60 °C (-40 ... +140 °F)
Measurement range for enthalpy	-40...460 kJ/kg (-10...+190 BTU/lb)

### Operating Environment (All Models)

Operating Environment (All Models)	See model specifications
Maximum wind/flow speed	30 m/s
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)
Electromagnetic compliance	EN61326-1, Industrial Environment

### Mechanics

Max wire size	1.5 mm <sup>2</sup> (AWG 16)
Standard housing color	White (RAL9003)
Housing material	
HMW82/83, TMW82/83	ABS/PC (UL-V0 approved)
HMW88/89(D), HMD82/83(D), TMD82/83, HMS82/83	PC + 10%GF (UL-V0 approved)

### Inputs and Outputs

Current output models (2-wire)	
Outputs	4 ... 20 mA, loop powered
Loop resistance	0 ... 600 Ω
Supply voltage	20 ... 28VDC at 600 Ω load 10 ... 28VDC at 0 Ω load
Voltage output models (3-wire)	
Outputs	0...10 V
Load resistance	10 kΩ min
Supply voltage	18 ... 35 VDC 24 VAC ±20 % 50/60 Hz

### Spare Parts and Accessories

INTERCAP® sensor	15778HM
10 pcs of INTERCAP® sensors	INTERCAPSET-10PCS
Conduit fitting + O-ring (M16x1.5 / NPT1/2 Inch)	210675SP
Conduit fitting + O-ring (M16x1.5 / PG9, RE-MS)	210674SP
Fastening set HMS80	237805
Porous PTFE Filter	DRW239993SP
Membrane Filter	ASM210856SP
Terminal Block, Blue	236620SP
HMD80 display lid	ASM210793SP

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## HMS80 Series Humidity and Temperature Transmitters for Outdoor Measurements in Building Automation Applications



### Features/Benefits

- Reliable outdoor transmitters with integrated radiation shields
- $\pm 3$  %RH accuracy
- User-exchangeable INTERCAP® sensor for easy field replacement
- Default output parameters are relative humidity and temperature. Dew point temperature, wet bulb temperature, and enthalpy outputs selectable using dip switches.
- Options for both current and voltage outputs
- Ingress protection IP65

*HMS80 Series Humidity and Temperature Transmitters with integrated radiation shields.*

Vaisala INTERCAP® Humidity and Temperature Transmitter Series HMS80 are designed for outdoor measurements in various building automation applications. These  $\pm 3$ % transmitters include an integrated radiation shield to reduce the influence of solar radiation on temperature and humidity measurements.

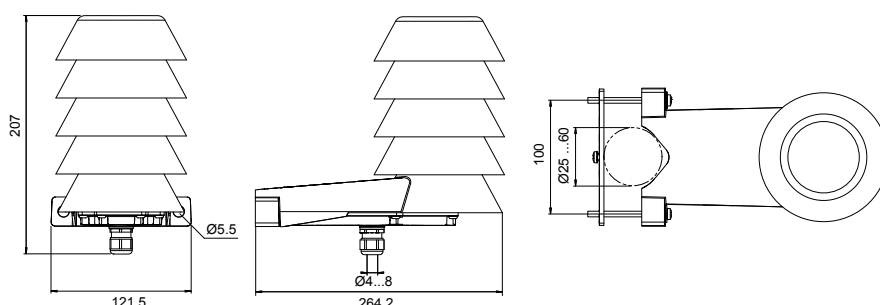
For fast and convenient configuration, the most popular control parameters in free cooling control – dew point temperature, wet bulb temperature, and enthalpy – are selectable using dip switches.

### Low Maintenance

HMS80 series transmitters require minimal maintenance thanks to their excellent sensor stability and high-quality materials. If necessary, the INTERCAP® sensor can easily be replaced in the field with minimum downtime.

### Easy Installation

HMS80 transmitters are easy to install. They can be mounted directly onto a wall or pole without any extra accessories. There are no loose parts, screws are retained in the enclosure, all connectors are clearly labeled, and the connectors are within easy reach.



# Technical Data

## Models

MODEL NUMBER	TYPE	OUTPUT	INGRESS PROTECTION
HMS82	Outdoor, RH+T	2-wire, current output	IP65
HMS83	Outdoor, RH+T	3-wire, voltage output	IP65

## Performance

### RELATIVE HUMIDITY

Measurement range 0 ... 100 %RH

### Accuracy

Temperature range +10 ... +30 °C (+50 ... +86 °F)

0 ... 90 %RH ±3 %RH

90 ... 100 %RH ±5 %RH

Temperature range -20 ... +10 °C, +30 ... +60 °C  
(-4 ... +50 °F, +86 ... +140 °F)

0 ... 90 %RH ±5 %RH

90 ... 100 %RH ±7 %RH

Temperature range -40 ... -20 °C (-40 ... -4 °F)

0 ... 100%RH ±7 %RH

Stability in typical HVAC applications ±2 %RH over 2 years

Humidity sensor Vaisala INTERCAP®

### TEMPERATURE

Measurement range -40 ... +60 °C (-40 ... +140 °F)

### Accuracy

At +20 °C (+68 °F) ±0.3 °C (±0.54 °F)

Temperature dependence ±0.01 °C/ °C

Temperature sensor Pt1000 RTD Class F0.1 IEC 60751

### CALCULATED PARAMETERS

Measurement range for dew point temperature and wet bulb temperature -40 ... +60 °C (-40 ... +140 °F)

Measurement range for enthalpy -40 ... 460 kJ/kg  
(-10 ... +190 BTU/lb)

Accuracy of the calculated parameters should be calculated at the actual condition based on the relative humidity and temperature specification.

Accuracy at 20°C (68°F) and 80%RH:

Dew point ±0.9 °C (1.6 °F)

Wet bulb temperature ±0.7 °C (1.3 °F)

Enthalpy ±2kJ/kg (0.9 BTU/lb)

## Operating Environment

Operating temperature range -40 ... +60 °C (-40 ... +140 °F)

Operating humidity range 0 ... 100 %RH

Maximum wind/flow speed 30 m/s

Storage temperature -40 ... +60 °C (-40 ... +140 °F)

Electromagnetic compliance EN61326-1, Industrial Environment

## Mechanics

Max wire size 1.5 mm<sup>2</sup> (AWG 16)

Standard housing color White (RAL9003)

Housing material PC + 10%GF (UL-V0 approved)

## Inputs and Outputs

### Current output model HMS82 (2-wire)

Outputs 4 ... 20 mA, loop powered

Loop resistance 0 ... 600 Ω

Supply voltage 20 ... 28VDC at 600 Ω load

10 ... 28VDC at 0 Ω load

### Voltage output model HMS83 (3-wire)

Outputs 0...10 V

Load resistance 10 kΩ min

Supply voltage 18 ... 35 VDC

24 VAC ±20 % 50/60 Hz

## Spare Parts and Accessories

INTERCAP® sensor 15778HM

10 pcs of INTERCAP® sensors INTERCAPSET-10PCS

Conduit fitting + O-ring (M16x1.5 / NPT1/2 Inch) 210675SP

Conduit fitting + O-ring (M16x1.5 / PG9, RE-MS) 210674SP

Fastening set HMS80 237805

Membrane Filter ASM210856SP

Terminal Block, Blue 236620SP

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## HMM100 Humidity Module for Environmental Chambers



*The Vaisala HUMICAP® Humidity Module HMM100.*

### Features/Benefits

- Full temperature compensation over the operating temperature range of -70 °C ... +180 °C
- High temperature tolerance, also suitable for heat-sterilization
- Excellent measurement accuracy with Vaisala HUMICAP® 180R sensor
- Durable
- Easy field calibration by trimmers
- Maintenance-free
- Easy to install
- Applications: test chambers, incubators

The Vaisala HUMICAP® Humidity Module HMM100 is an open frame module for integration into environmental chambers. The modules provide a single analog output channel for relative humidity (RH) or dew point ( $T_d$ ).

Two probes are available, one made of plastics, the other of stainless steel. Several cable lengths up to 3 meters are available. Both the probes have the Vaisala HUMICAP® 180R sensor which ensures excellent measurement accuracy.

### Robust and Reliable

The HMM100 probe works in freezing conditions (-70 °C) and also in temperatures up to +180 °C. The HMM100 is easy to install and the

probe can be freely placed in a test chamber as the speed of airflow does not affect the measurement.

### Maintenance-free

Compared to psychrometers, the HMM100 is practically maintenance-free. There is no wick that needs changing and there is no need for a water tank or water pump. Thus, environmental stress screening can be done reliably.

### Accessories

The accessories available are a component board mounting bracket with a lid, probe clamp, USB-cable for service use, a module housing and a probe mounting flange.



# Technical Data

## Performance

RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis and repeatability)	
temperature range	-20 ... +40 °C
0 ... 90 %RH	±2 %RH
90 ... 100 %RH	±3 %RH
temperature range	-40 ... -20 °C, +40 ... +180 °C
0 ... 90 %RH	±2.5 %RH
90 ... 100 %RH	±3.5 %RH
Factory calibration uncertainty (+20 °C)	±1.5 %RH
Humidity sensor	Vaisala HUMICAP® 180R
DEW POINT TEMPERATURE	
Measurement range	-20 ... +100 °C (-4 ... +212 °F) T <sub>d</sub>
Accuracy (incl. non-linearity, hysteresis and repeatability when dew point depression <20 °C (Ambient temperature - dew point))	±2 °C T <sub>d</sub>

## Operating Environment

Operating temperature range	
component board	-5 ... +55 °C (+23 ... +131 °F)
stainless steel and plastic probe	-70 ... +180 °C (-94 ... +356 °F)
porous PTFE filter stainless steel, sintered filter	-70 ... +180 °C (-94 ... +356 °F)
plastic grid, membrane filter	-20 ... +80 °C (-4 ... +176 °F)
Electromagnetic compatibility	Applicable parts of EN61326-1, Generic Environment

## Input and Outputs

Operating voltage	
2-wire model	24 VDC
3-wire model	10 ... 35 VDC or 9 ... 24 VAC
	15 ... 35 VDC or 14 ... 24 VAC when 0 ... 10 V output is used
Power consumption	6 mA
Analog output types (1 output selectable)	
2-wire model	4 ... 20 mA (loop-powered)
3-wire model	0 ... 20 mA, 0 ... 1 V/5 V/10 V
Max. wire size	0.5 ... 1.5 mm <sup>2</sup> (AWG)
Service port	M8 connector for USB cable

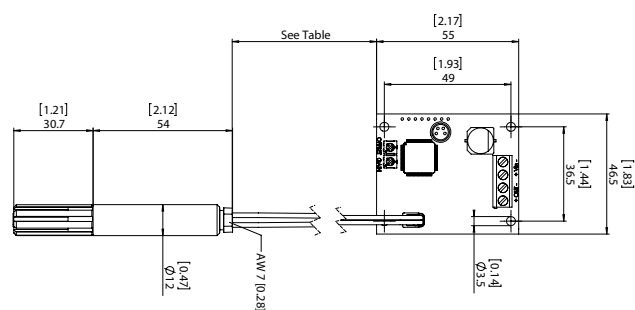
## Mechanics

Service cable connector	M8 series 4-pin (male)
Probe diameter	12 mm
Probe cable lengths	0.6/1.55/2.9 m
Probe material	
plastics	PPS
stainless steel	AISI316/PPS
Probe mounting clamp	AISI316
Mounting bracket material	
lid	ABS/PC
bottom plate	Al
Module housing material	ABS/PC (cover)

## Options and Accessories

Humidity sensor	HUMICAP180R
Membrane filter	10159HM
Plastic grid filter	6221
Porous PTFE filter	219452SP
Stainless steel sintered filter	HM47280SP
Mounting bracket with lid	225979
Module housing (IP65)	226060
Probe mounting flange	226061
Probe mounting clamp set (10 pcs)	226067
USB cable	226068

## Dimensions



# VAISALA

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## Vaisala INTERCAP® Humidity and Temperature Probe HMP60



*The HMP60 for extreme conditions.*

### Features/Benefits

- Miniature-size humidity probe
- Low power consumption
- Measurement range:  
0 ... 100 %RH; -40 ... +60°C
- Cable detachable with  
standard M8 connector
- Rugged metal housing
- Interchangeable Vaisala  
INTERCAP® Sensor
- Optional RS485 digital output
- Optional dew point output
- Applications: volume  
applications, integration  
into other manufacturers'  
equipment, glove boxes,  
greenhouses, fermentation  
chambers, data loggers

### HMP60

The HMP60 is a simple, durable and cost-effective humidity probe. It is suitable for volume applications, integration into other manufacturers' equipment, incubators, glove boxes, greenhouses, fermentation chambers, and data loggers.

### Easy Installation

The probe cable has a screw-on quick connector for easy installation. Different cable lengths are available. Also other compatible M8 series cables can be used. Accessories are available for different installation needs.

### Low Current Consumption

The HMP60 is suitable for battery-powered applications because of its very low current consumption.

### Several Outputs

There are two configurable voltage outputs with relative humidity, temperature or dew point scaling. Four voltage output ranges are available.

### Rugged Design

The HMP60 is designed for extreme conditions. The stainless steel body of the HMP60 is classified as IP65. The probe has a sealed structure and the sensor is protected by a membrane filter and a plastic grid, or optionally by a stainless steel filter.

### Recalibration Not Needed

The Vaisala INTERCAP® Sensor is interchangeable. No recalibration is required; the sensor can simply be replaced, also in the field.

# Technical Data

## Performance

RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Typical accuracy	
temperature range	0 ... +40 °C
0 ... 90 %RH	±3 %RH
90 ... 100 %RH	±5 %RH
temperature range	-40 ... 0 °C, +40 ... +60 °C
0 ... 90 %RH	±5 %RH
90 ... 100 %RH	±7 %RH
Humidity sensor	Vaisala INTERCAP®
TEMPERATURE	
Measurement range	-40 ... +60 °C
Accuracy over temperature range	
+10 ... +30 °C	±0.5 °C
-40 ... +10, +30 ... +60 °C	±0.6 °C
DEW POINT	
Measurement range	-40 ... +60 °C
Typical accuracy	
temperature range	0 ... +40 °C
when dew point depression < 15 °C	±2 °C
temperature range	-40 ... 0 °C, +40 ... +60 °C
when dew point depression < 10 °C	±3 °C
dew point depression = ambient temperature - dew point	
ANALOG OUTPUTS	
Accuracy at 20 °C	±0.2 % of FS
Temperature dependence	±0.01 % of FS/°C

## Inputs and Outputs

Operating voltage	5 ... 28 VDC / 8 ... 28 VDC with
(Use lowest available operating voltage to minimize heating.)	5 V output
	8 ... 28VDC with loop power converter
Current consumption	1 mA average, max. peak 5 mA
Start-up time	
probes with analog output	4 s at operating voltage
	13.5 ... 16.5 VDC
	2 s at other valid operating voltages
probes with digital output	1 s
Outputs	
2 channels	0 ... 1 VDC / 0 ... 2.5 VDC / 0 ... 5 VDC / 1 ... 5 VDC
1-channel loop-power converter (separate module, compatible with humidity accuracy only)	4 ... 20 mA
digital output (optional)	RS485 2-wire half duplex
External loads	
0 ... 1 V	$R_L$ min 10 kΩ
0 ... 2.5 V / 0 ... 5 V	$R_L$ min 50 kΩ

## Operating Environment

Operating temperature	-40 ... +60 °C
Electromagnetic compatibility	EN 61326-1: Electrical equipment for measurement, control and laboratory use – EMC requirements – for use in industrial locations.

## Mechanics

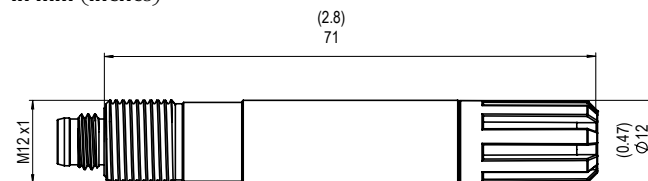
Materials	
body	stainless steel (AISI 316)
grid filter	chrome coated ABS plastic
cable	polyurethane or FEP
Housing classification	IP65
Body thread	M12x1 / 10 mm
Cable connector	4-pin M8 (IEC 60947-5-2)
Weight	
probe	17 g
probe with 0.3 m cable	28 g

## Options and Accessories

Vaisala INTERCAP® Sensor, 1 piece	15778HM
Vaisala INTERCAP® Sensor, 10 pcs	INTERCAPSET-10PCS
Sensor protection	
plastic grid	DRW010522
membrane filter	DRW010525
stainless steel sintered filter	HM46670SP
4 ... 20mA loop power converter	UI-CONVERTER-1CB
Mounting bracket for converter	225979
Plastic M12 installation nuts, pair	18350SP
USB cable for PC connection	219690
Probe mounting clamp set, 10 pcs	226067
Probe mounting flange	226061
Connection cables	
0.3 m PU	HMP50Z032SP
3 m PU	HMP50Z300SP
180 °C 3 m FEP	226902SP

## Dimensions

in mm (inches)



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# Vaisala HUMICAP® Humidity and Temperature Probe HMP110



*The HMP110 with excellent stability and high chemical tolerance.*

## Features/Benefits

- Miniature-size humidity transmitter
- Low power consumption and fast start-up for battery powered applications
- Measurement range: 0 ... 100 %RH; -40 ... +80°C
- Cable detachable with standard M8 quick connector
- Reliable: Latest generation HUMICAP® 180R sensor for best stability and high chemical tolerance. IP65 metal housing.
- Optional RS485 digital output
- Traceable: Comes with calibration certificate.  $\pm 1.5$  %RH measurement accuracy (0 ... 90 %RH)
- HMP110R replacement probe service available for easy maintenance
- Optional dew point calculation

The HMP110 is a trouble-free and cost-effective humidity transmitter with high accuracy and good stability. It is suitable for volume applications or integration into other manufacturers' equipment. The HMP110 is also suitable for glove boxes, greenhouses, fermentation and stability chambers, data loggers, and incubators.

## Easy Installation

The probe cable has a screw-on quick connector for easy installation. Different cable lengths and accessories are available.

## Low Current Consumption

HMP110 is suitable for battery-powered applications because of its very low current consumption. It also has a fast start-up time.

## Several Outputs

The temperature measurement is a standard feature, dew point measurement is optional. Three standard voltage outputs are available. The HMP110D model has RS485 digital output.

## Robust Design

The stainless steel body of the HMP110 is classified as IP65. Thus, it survives rough conditions. The HMP110 has high chemical tolerance because of the HUMICAP® 180R sensor.

## Easy Maintenance

Maintaining measurement traceability is easy using the HMP110R replacement probe. We send you a replacement probe, you detach the old probe and send it back to us. In this way the measurement is available at all times without interruptions.



# Technical Data

## Performance

### RELATIVE HUMIDITY

Measurement range 0 ... 100 %RH  
Accuracy (incl. non-linearity, hysteresis and repeatability)

temperature range 0 ... +40 °C

0 ... 90 %RH ±1.5 %RH

90 ... 100 %RH ±2.5 %RH

temperature range -40 ... 0 °C, +40 ... +80 °C

0 ... 90 %RH ±3.0 %RH

90 ... 100 %RH ±4.0 %RH

Factory calibration uncertainty (+20 °C)

0 ... 90 %RH ±1.1 %RH

90 ... 100 %RH ±1.8 %RH

Humidity sensor Vaisala HUMICAP® 180R

Stability ±2 %RH over 2 years

### TEMPERATURE

Measurement range -40 ... +80 °C

Accuracy over temperature range

0 ... +40 °C, ±0.2 °C

-40 ... 0 °C, +40 ... +80 °C ±0.4 °C

Temperature sensor Pt1000 RTD Class F0.1 IEC 60751

### DEW POINT

Measurement range -40 ... +80 °C

Accuracy (incl. non-linearity, hysteresis and repeatability)

temperature range 0 ... +40 °C

when dew point depression < 15 °C ±1 °C

when dew point depression 15 ... 25 °C ±2 °C

temperature range -40 ... 0 °C, +40 ... +80 °C

when dew point depression < 15 °C - dew point ±2 °C

depression = ambient temperature - dew point

### ANALOG OUTPUTS

Accuracy at 20 °C ±0.2 % of FS

Temperature dependence ±0.01 % of FS/°C

## Inputs and Outputs

Operating voltage 5 ... 28 VDC / 8 ... 28 VDC with

(Use lowest available operating 5 V output

voltage to minimize heating) 8 ... 28 VDC with loop power

converter

Current consumption 1 mA average, max. peak 5 mA

Start-up time

HMP110 probes with analog output 4 s at operating voltage

13.5 ... 16.5 VDC

2 s at other valid operating voltages

HMP110D probes with digital output 1 s

## Outputs

2 channels 0 ... 1 VDC / 0 ... 2.5 VDC / 0 ... 5 VDC / 1 ... 5 VDC

1-channel loop-power converter (separate module,

compatible with humidity accuracy only) 4 ... 20 mA

digital output (HMP110D) RS485 2-wire half duplex

## External loads

0 ... 1 V  $R_L$  min 10 kΩ

0 ... 2.5 V / 0 ... 5 V  $R_L$  min 50 kΩ

## Operating Environment

Operating temperature range -40 ... +80 °C

Electromagnetic compatibility EN 61326-1: Electrical equipment

for measurement, control and laboratory use – EMC

requirements – for use in industrial locations.

## Mechanics

### Materials

body stainless steel (AISI 316)

grid filter chrome coated ABS plastic

cable polyurethane or FEP

Housing classification IP65

Body thread M12x1 / 10 mm

Cable connector 4-pin M8 (IEC 60947-5-2)

### Weight

probe 17 g

probe with 0.3 m cable 28 g

## Options and Accessories

### Sensor protection

plastic grid DRW010522SP

membrane filter DRW010525SP

stainless steel sintered filter HM46670SP

4 ... 20 mA loop power converter UI-CONVERTER-1CB

Mounting bracket for converter 225979

Plastic M12 installation nuts, pair 18350SP

USB cable for PC connection 219690

Probe mounting clamp set, 10 pcs 226067

Probe mounting flange 226061

### Connection cables

standard 0.3 m HMP50Z032SP

standard 3 m HMP50Z300SP

80 °C 1.5 m 225777SP

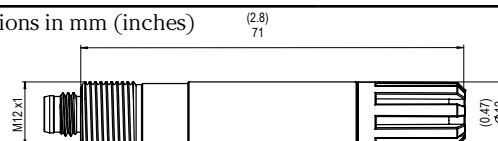
80 °C 3 m 225229SP

180 °C 3 m FEP 226902SP

connection cable for HM70 229980

## Dimensions

Dimensions in mm (inches)



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## HM70 Hand-Held Humidity and Temperature Meter for Spot-Checking Applications



*The Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter HM70 is a high-performance, portable humidity reference. From left to right: MI70 indicator, probes HMP75, HMP76 and HMP77.*

### Features/Benefits

- Designed for spot-checking and field calibration
- Multilingual user interface
- Shows measurement trends graphically
- Proven Vaisala HUMICAP® Sensor technology
- 3 probe alternatives, temperature measurement ranges between -70 and +180 °C
- 2 probes - also dew point and CO<sub>2</sub> probes - can be connected simultaneously
- Displays various humidity parameters
- Sensor preheat and chemical purge options for demanding conditions
- 6-point NIST traceable calibration (certificate included)

The Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter HM70 is designed for demanding humidity measurements in spot-checking applications. It is also ideal for field checking and calibration of Vaisala's fixed humidity instruments.

The HM70 incorporates the latest generation of the Vaisala HUMICAP® Sensor. It is reliable and has better than ever long-term stability. Additionally, it has a sensor that copes well with chemical interference and provides accuracy that lasts in demanding conditions.

The chemical purge option maintains measurement accuracy in environments with high concentrations of chemicals. The sensor preheat option reduces measurement delays as it keeps the sensor dry when the probe is inserted into hot and humid processes.

### Three Probes to Choose from

The HMP75 is a general purpose probe whereas the HMP76 is a long, stainless steel probe especially suitable for spot-checking in ducts. The HMP77 is a small probe at the end of a 5-meter cable. The probe is ideal for difficult-to-reach areas and for on-site calibration of Vaisala's process transmitters.

In addition, the HM70 supports the use of Vaisala's dew point, carbon dioxide and moisture in oil probes, allowing measurements in several multiparameter applications.

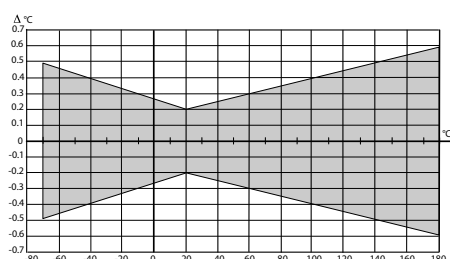
### MI70 Link

The optional MI70 Link Windows® software and the USB connection cable form a practical tool for transferring logged data and real time measurement data from the HM70 to a PC.

# Technical Data

## HMP75, HMP76 and HMP77 Probes Measured Variables

RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy (including non-linearity, hysteresis and repeatability)	
at +15 ... +25 °C (+59 ... +77 °F)	±1 %RH (0 ... 90 %RH)
	±1.7 %RH (90 ... 100 %RH)
at -20 ... +40 °C (-4 ... +104 °F)	±(1.0 + 0.008 x reading) %RH
at -40 ... +180 °C (-40 ... +356 °F)	±(1.5 + 0.015 x reading) %RH
Factory calibration uncertainty (+20 °C / +68 °F)	±0.6 %RH (0 ... 40 %RH)
	±1.0 %RH (40 ... 97 %RH)
(Defined as ±2 standard deviation limits.)	
Response time (90%) at +20 °C (+68 °F) in still air	
HMP75 (with standard plastic grid)	17 s
HMP76 (with standard sintered bronze filter)	60 s
HMP77 (with standard plastic grid and stainless steel netting)	50 s
Sensor	HUMICAP® 180R
	HUMICAP® 180RC (chemical purge, sensor preheat)
Typical long-term stability	better than 1 %RH / year
TEMPERATURE	
Measurement range	
HMP75	-20 ... +60 °C (-4 ... +140 °F)
HMP76	-50 ... +120 °C (-58 ... +248 °F)
short time	-50 ... +180 °C (-58 ... +356 °F)
HMP77	-70 ... +180 °C (-94 ... +356 °F)
Accuracy at +20 °C (+68 °F)	±0.2 °C (±0.36 °F)
Accuracy over temperature range	(see graph)



Temperature sensor	Pt100 RTD Class F0.1 IEC 60751
OTHER VARIABLES AVAILABLE:	
dew point, frost point, absolute humidity, mixing ratio, wet bulb temperature, water content, vapor pressure, saturation vapor pressure, enthalpy, water activity	

### Probe General

Operating temperature range for electronics	-40 ... +60 °C (-40 ... +140 °F)
Housing classification	IP65 (NEMA 4)
Housing material	ABS/PC blend
Probe material	Stainless steel (AISI316L)
Cable length between probe and indicator	1.9 m

## MI70 Measurement Indicator Indicator General

Menu languages	English, Chinese, French, Spanish, German, Russian, Japanese, Swedish, Finnish
Display	LCD with backlight, graphical trend display of any parameter, character height up to 16 mm
Max. no. of probes	2
Power supply	Rechargeable NiMH battery pack with AC-adaptor or 4xAA-size alkalines, type IEC LR6 0
Analog output	0... 1 VDC
Output resolution	0.6 mV
PC interface	MI70 Link software with USB or serial port cable
Data logging capacity	2700 points
Alarm	audible alarm function
Operating temperature range	-10 ... +40 °C (+14 ... +104 °F)
Operating humidity range	non-condensing
Housing classification	IP54
Battery operation time	
Continuous use	48 h typical at +20 °C (+68 °F)
Data logging use	up to a month, depending on logging interval
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Portable Equipment

## MI70 Indicator + Probe = HM70

ACCESSORIES	
Carrying cases	
for MI70 and HMP75/77 probe	MI70CASE3
for MI70 and HMP75/76 probe	MI70CASE4
Transmitter connection cables for	
HMT330 & HMT120/130	211339
HMT310	DRW216050
HMW90 Series, HMDW110 Series & GMW90 Series	219980
HMD/W60/70 Series	HMA6070
MI70 Link software with USB cable	219687
MI70 Link software with serial port cable	MI70LINK
Analog output cable	27168ZZ
10 m (32.81 ft) extension cable for probe	213107SP
Sensor protection HMP75	
Plastic PC grid (HMP75 standard)	6221
Membrane filter	10159HM
Sintered bronze filter	DRW212987SP
HMP76/77	
Plastic PPS grid	DRW010276SP
Sintered stainless steel filter	HM47280SP
Sintered bronze filter (HMP76 standard)	DRW212987SP
PPS grid with SS netting (HMP77 standard)	DRW010281SP

# Technical Data

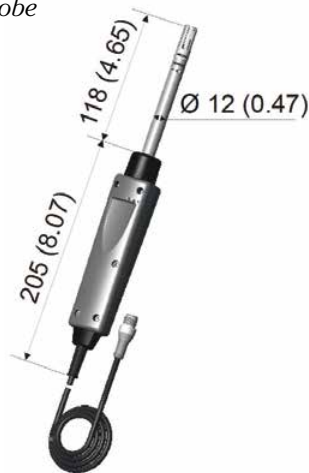
## Dimensions

Dimensions in mm (inches)

MI70 indicator



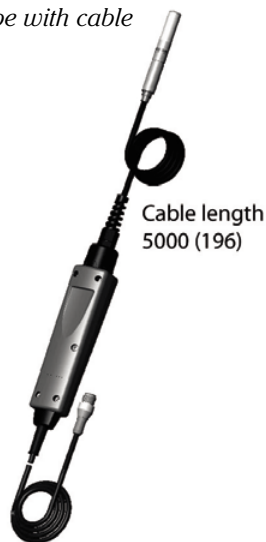
HMP75 probe



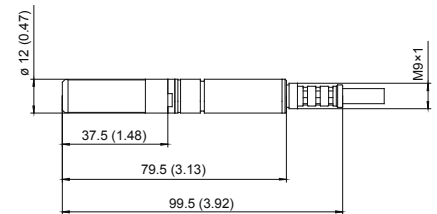
HMP76 probe



HMP77 probe with cable



HMP77 probe



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# Looking for Accurate and Reliable Humidity Instruments? Only Vaisala HUMICAP® Measures Up.

**The quality and profitability of your process equals the quality of your measurement.**

The success of critical operations depends on small things, such as our humidity sensor. The Vaisala HUMICAP® technology has led the market for almost 40 years through unrivaled reliability continually introducing innovative features for better stability and usability.

Resistant to dust, particulate dirt and most chemicals, Vaisala HUMICAP® delivers the most accurate humidity measurements on the market, even in the harshest conditions.

Choose from a wide range of fixed and handheld instruments for different applications, requirements and budgets.

Improve efficiency, quality, safety and profitability. Vaisala HUMICAP® helps deliver them all.

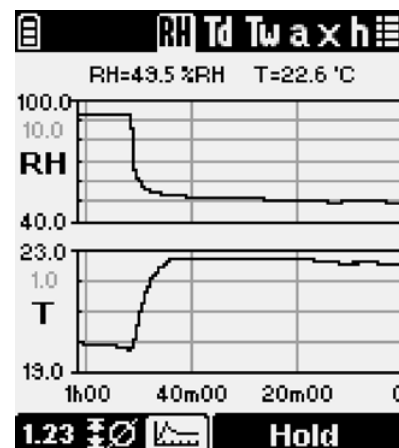




## Vaisala HUMICAP® Hand-Held Humidity and Temperature Meter Series HM40



*The Vaisala HM40 Humidity and Temperature Meter is designed for spot-checking in a wide variety of environments and is available with four different probe options. Left to right: HM41, HM45, HM42, and HM46.*



*The graph clearly indicates when the readings have stabilized.*

The easy-to-use HM40 is a compact and portable humidity meter that provides reliable measurements in a wide range of applications. It is the ideal spot-checking tool for everything from structural moisture measurement and air conditioning systems to humidity measurement in industrial production processes and life science applications. There are four different models available: HM41, HM42, HM45, and HM46.

### Simple and Easy to Use

The HM40 has a large, user-friendly graphical display and easy-to-use push buttons. The user interface is simple and intuitive, and available in 10 languages. Also, many settings can be modified to meet users' individual needs. In addition to relative humidity and temperature, the HM40 provides five calculated humidity

parameters, all of which are available in metric and non-metric units.

The HM40 is powered by 2 AA batteries. An external NiMH charger with USB connection and rechargeable AA sized NiMH batteries are available as an option. Each model also comes with a handy belt clip and case.

### Easy Recalibration

Calibrating the HM40 is easy. The meter or the probe can be sent to a Vaisala Service Center for recalibration. Alternatively, calibration can be completed on site by users with a humidity reference such as the Vaisala Humidity Calibrator HMK15. The indicator includes a calibration reminder function that can be activated by the user.

### Benefits

- Compact, portable, and easy to use
- Versatile meter with wide measurement range and multiple calculated parameters
- Four different models available: HM41, HM42, HM45, and HM46
- Ideal for spot-checking in a wide variety of applications

### Features

- Humidity measurement range 0 ... 100 %RH
- Temperature measurement ranges -40 ... +100 °C (-40 ... +212 °F), depending on probe model. The HM46 can measure up to +180 °C (+356 °F) for a short period of time.
- Incorporates proven Vaisala HUMICAP® sensor technology
- Calibration reminder function
- Probes can be user calibrated using an on-site reference
- Graphical display indicates when measurement has stabilized
- Hold-button to freeze the screen and save the reading
- Multilingual user interface available in 10 languages (EN, DE, FR, JA, ZH, PT, ES, RU, FI, SV)



## Technical Data

### HM41 Humidity and Temperature Meter

Humidity measurement accuracy (including non-linearity, hysteresis, and repeatability):

at 0 ... +40 °C  $\pm 1.5$  %RH (0 ... 90 %RH)

$\pm 2.5$  %RH (90 ... 100 %RH)

at -10 ... 0 °C and  $\pm 3.0$  %RH (0 ... 90 %RH)

+40 ... +60 °C  $\pm 4.0$  %RH (90 ... 100 %RH)

Temperature measurement range -10 ... +60 °C

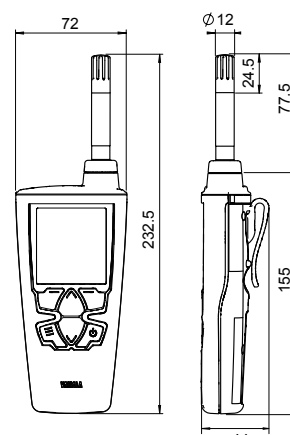
Measurement probe interchangeable  
HMP113 probe

Probe material PC/ABS plastic blend (white)

Housing classification IP54

## Dimensions

Dimensions in mm



## Technical Data

### HM42 Humidity and Temperature Meter for Tight Spaces

Humidity measurement accuracy (including non-linearity, hysteresis, and repeatability):

at 0 ... +40 °C  $\pm 1.5$  %RH (0 ... 90 %RH)

$\pm 2.5$  %RH (90 ... 100 %RH)

at -40 ... 0 °C and  $\pm 3.0$  %RH (0 ... 90 %RH)

+40 ... +80 °C  $\pm 4.0$  %RH (90 ... 100 %RH)

at +80 ... +100 °C  $\pm 4.0$  %RH\*

Probe head temperature measurement range -40 ... +100 °C

Measurement probe HM42PROBE

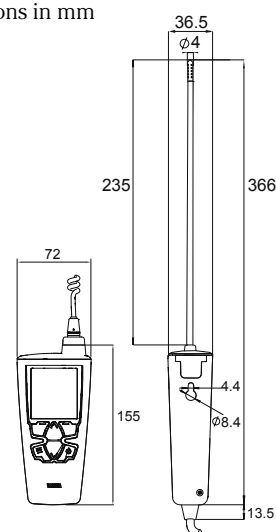
Probe head material Stainless steel

Housing classification IP40 (probe),  
IP54 (indicator)

\*) Not recommended for  $T_d > 85$  °C

## Dimensions

Dimensions in mm



## Technical Data

### HM45 Humidity and Temperature Meter with Remote Probe

Humidity measurement accuracy (including non-linearity, hysteresis, and repeatability):

at 0 ... +40 °C  $\pm 1.5$  %RH (0 ... 90 %RH)

$\pm 2.5$  %RH (90 ... 100 %RH)

at -40 ... 0 °C and  $\pm 3.0$  %RH (0 ... 90 %RH)

+40 ... +60 °C  $\pm 4.0$  %RH (90 ... 100 %RH)

Probe temperature measurement range -40 ... +60 °C

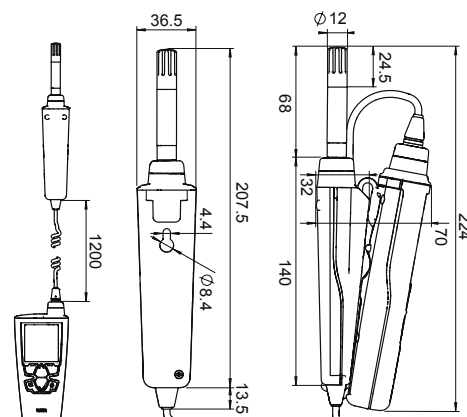
Measurement probe interchangeable  
HMP113 with HM40HANDLE

Probe material PC/ABS plastic blend (white)

Housing classification IP54

## Dimensions

Dimensions in mm





## Technical Data

### HM46 Humidity and Temperature Meter for Mechanical Durability and Extra Reach

Humidity measurement accuracy (including non-linearity, hysteresis, and repeatability):

at 0 ... +40 °C  $\pm 1.5$  %RH (0 ... 90 %RH)

$\pm 2.5$  %RH (90 ... 100 %RH)

at -40 ... 0 °C and  $\pm 3.0$  %RH (0 ... 90 %RH)

+40 ... +80 °C  $\pm 4.0$  %RH (90 ... 100 %RH)

at +80 ... +100 °C  $\pm 4.0$  %RH\*

Probe head temperature -40 ... +100 °C, short-term measurement range term up to +180 °C

Measurement probe HM46PROBE

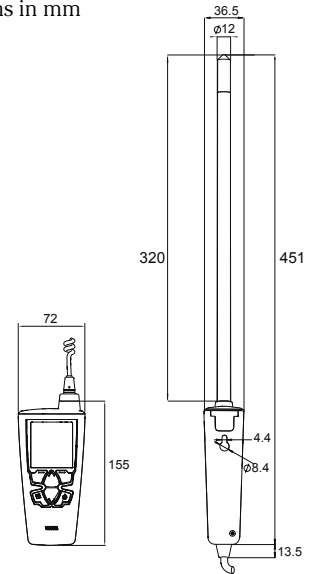
Probe head material Stainless steel, brass filter

Housing classification IP40 (probe), IP54 (indicator)

\*) Not recommended for  $T_d > 85$  °C

## Dimensions

Dimensions in mm



# Technical Data

## Performance

### RELATIVE HUMIDITY

Measurement range 0 ... 100 %RH

Accuracy (including non-linearity, hysteresis, and repeatability) for different models at 0 ... +40 °C  $\pm 1.5$  %RH (0 ... 90 %RH)

(+32 ... +104 °F)  $\pm 2.5$  %RH (90 ... 100 %RH)

Factory calibration uncertainty at +20 °C (+68 °F)  $\pm 1.5$  %RH

Humidity measurement response time

(90 %) with plastic grid filter (HM41 and HM45) 17 s

(90 %) with membrane filter and steel grid (HM42) 26 s

(90 %) with brass sintered filter (HM46) 40 s

Stability  $\pm 2$  %RH over 2 years

Humidity sensor

HM41, HM45, HM46 HUMICAP® 180R

HM42 HUMICAP® 100R-Mini

### TEMPERATURE

Measurement range

HM41 -10 ... +60 °C (+14 ... +140 °F)

HM42 -40 ... +100 °C (-40 ... +212 °F)

HM45 -40 ... +60 °C (-40 ... +140 °F)

HM46 -40 ... +100 °C (-40 ... +212 °F), short-term up to +180 °C (+356 °F)

Accuracy over temperature range:

at 0 ... +40 °C (+32 ... +104 °F)  $\pm 0.2$  °C (0.36 °F)

at -40 ... 0 °C and +40 ... +100 °C

(-40 ... +32 °F and +104 ... +212 °F)  $\pm 0.4$  °C (0.72 °F)

Temperature sensor

HM41, HM45, HM46 Pt1000 RTD Class F0.1 IEC 60751

HM42 Pt1000 RTD Class F0.3 IEC60751

## Mechanics

Weight (with alkaline batteries)

HM41 230 g

HM42 370 g

HM45 330 g

HM46 490 g

Probe cable lengths

HM42, HM46 1500 mm

HM45 1200 mm

Materials

Meter body PC/ABS blend, acrylic display lens

Probe holder PC/ABS blend (gray)

Probe handle PC/ABS blend (white),

PC/ABS blend (gray, HM45)

or PBT (gray, HM42/46)

HMP113 probe or PC/ABS blend (white, HM41/45)

probe measurement head or stainless steel (HM42/46)

Filter

HM41, HM45 PC (glass-reinforced)

HM42 Stainless steel and PTFE membrane

HM46 Sintered brass

Housing classification

HM42 and HM46 probes IP54

# Technical Data

## General

Power-up time	< 3 s
Batteries	2 × AA, 1.5 V
Calculated parameters	Dew point, wet bulb temperature, absolute humidity, mixing ratio, enthalpy
Menu languages	English, Chinese (simplified), Finnish, French, German, Japanese, Portuguese, Russian, Spanish, Swedish
Display	LCD (140 x 160 pixels)
Operation time (typical)	100 hours (without backlight)
Operation temperature range	
indicator	-10 ... +60 °C (+14 ... +140 °F)
probe handle	-40 ... +60 °C (-40 ... +140 °F)
probe head	(see specifications for each probe type, ranges -40 ... +180 °C (-40 ... +356 °F))
Storage temperature range	-30 ... +70 °C (-22 ... +158 °F)
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Portable Equipment

## Accessories and Spare Parts

INDICATOR	
Spare HM40 indicator	HM40INDI
Belt clip (3 pcs)	227710SP
Battery cover (3 pcs)	225688SP
NiMH rechargeable batteries (4 pcs)	229247SP
External battery recharger with USB connection and 2 batteries	229249SP
Case for short HM40 probes	235849SP
Case for long HM40 probes	DRW242351SP

STANDARD PROBE (HM41)	
HMP113 probe for HM40	HMP113 (configuration: V00B2C1A0)
Plastic locking bushing (3 pcs) for attaching HMP113 probe to HM40 indicator	DRW238590SP
Plastic grid filter for HMP113 probe	DRW236214SP
Plastic grid with membrane filter for HMP113 probe	230727SP

HM42 PROBE (HM42)	
Thin 4 mm diameter probe for HM40	HM42PROBE
Steel grid filter for HM42PROBE	19867HM
Membrane tube set (5 pcs) for HM42PROBE	19858HM
Rubber sleeve set (10 pcs) for HM42PROBE	19809HM
Calibration adapter for HM42PROBE	HM37067

REMOTE PROBE (HM45)	
HMP113 probe for HM40	HMP113 (configuration: V00B2C1A0)
Plastic locking bushing (3 pcs) for attaching HMP113 probe to HM40 indicator	DRW238590SP
HM40 handle and cable	HM40HANDLE
Plastic grid filter for HMP113 probe	DRW236214SP
Plastic grid with membrane filter for HMP113 probe	230727SP

HM46 PROBE (HM46)	
Stainless steel 12 mm diameter probe for HM40	HM46PROBE
Sintered filter for HM46PROBE	0195
Optional membrane filter for HM46PROBE (up to +80 °C)	10159HM
Plastic grid filter for HM46PROBE (up to +80 °C)	6221
Disposable sleeve, 50 pcs set	1558
Probe holder	HM36915

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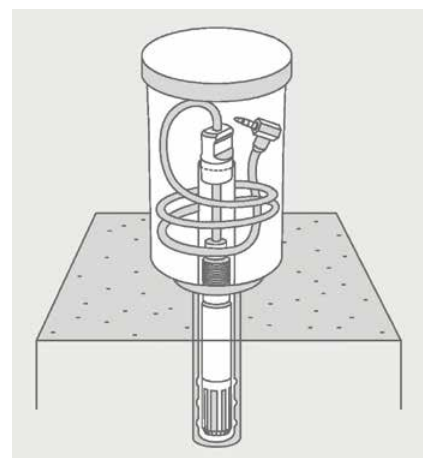
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## SHM40 Structural Humidity Measurement Kit



A borehole in concrete and a measurement probe HMP40S inserted in it.

Vaisala HUMICAP® Structural Humidity Measurement Kit SHM40 offers an easy and reliable solution for humidity measurements in concrete and other structures.

Concrete dries unevenly and is usually drier on the surface, consequently it is important to measure beneath the surface conditions. The borehole method provides information about the humidity profile under the surface. In this method, a humidity probe is left in the borehole until the humidity in the hole has reached an equilibrium state and the stabilized values can be read.

### SHM40 Is All You Need for Borehole Humidity Measurement

The Vaisala HUMICAP® Structural Humidity Measurement Kit SHM40 is an ideal solution for the borehole method. The starter kit is comprised of an HMP40S probe, HM40 indicator and accessories for the borehole method in a weather-proof case, optimized for use in harsh and humid construction sites. Additional accessories for the SHM40 can be used to prepare a moisture measurement hole in fresh concrete. Pre-formed holes eliminate the need for drilling and the risk of damaging

heating elements or tubing embedded in the concrete.

### Easy Measurement with Multiple HMP40S Probes and Quick Connectors

HMP40S measurement probes are interchangeable. The probes connect easily to the HM40 indicator with a snap-on connector enabling convenient use of multiple probes with one indicator. The measurement data can be displayed in numeric, statistic or graph views.



Snapping a connector to the indicator HM40 to read the measurement results.

#### Features or Benefits

- Easy to use
- Truly interchangeable measurement probes
- Durable
- Accurate measurement data in numeric, statistic or graph views
- Conforms to ASTM standard F2170
- IP65 classified measurement probe and case

#### Standard Contents of SHM40

- HM40 indicator with adapter
- 1 piece HMP40S RH&T probe with a cable
- 12 pcs plastic tubes (19266HM)
- 12 pcs rubber plugs (233976)
- 3 pcs protective covers with lid (19268HM)
- NIST traceable certificate
- Weather-proof carrying case with a shoulder strap



# Technical Data

## HMP40S Probe

### Relative Humidity

Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis, and repeatability):	
temperature range	0 °C ... +40 °C
0 ... 90 %RH	± 1.5 %RH
90 ... 100 %RH	± 2.5 %RH
temperature range	-40 °C...0 °C and +40 °C ... +80 °C
0 ... 90 %RH	± 3.0 %RH
90 ... 100 %RH	± 4.0 %RH
Factory calibration uncertainty at +20°C (68°F)	
0 ... 90 %RH	± 1.1 %RH
90 ... 100 %RH	± 1.8 %RH
Humidity sensor	HUMICAP® 180R
Stability	± 2 %RH over 2 years

### Temperature

Measurement range	-40 °C ... +80 °C
Accuracy over temperature range:	
0 ... +40 °C	± 0.2 °C
-40 ... 0 °C, +40 ... +80 °C	± 0.4 °C
Temperature Sensor	Pt1000 RTD Class F0.1 IEC 60751

### General

Operating temperature range for probe	-40 °C ... +80 °C
Probe weight with standard cable	31 g
Probe housing material	stainless steel
Probe filter and sensor protection	membrane filter with chrome coated ABS plastic
Cable material	Wire PVC / jacket PU
Cable connector	TRRS male 3.5 mm
Probe housing classification	IP65
Borehole diameter needed	16 mm
Measurement depth with standard accessories	min. 30 mm, max. 90 mm

## HM40 Indicator

Operation temperature range for indicator	-10 ... +60 °C
Storage temperature range	-30 ... +70 °C
Weight	
Indicator with adapter	240 g
SHM40 case with standard content	3.7 kg
Indicator materials	PC/ABS blend, acrylic display lens
Indicator adapter materials	Nickel plated brass and plastic overmolding

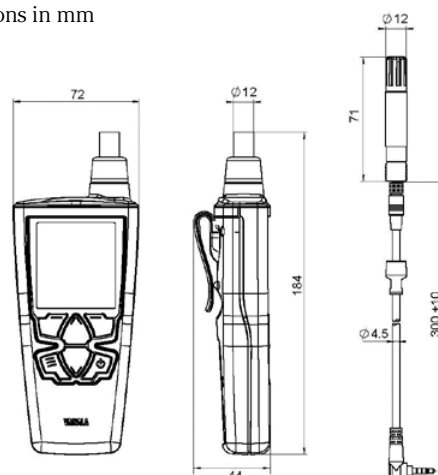
Indicator housing classification	IP54
Mechanical drop endurance	1.0 m without the probe
Power-up time	< 3 s
Alkaline batteries	2 x AA sized, 1.5V (LR6)
Operation time (Alkaline batteries)	typical 100 hours (without backlight)
Calculated variables	Td, Tw, a, x, h
Menu languages	English, German, French, Finnish, Spanish, Swedish, Chinese (simplified), Russian, Japanese
Display	LCD (140 x 160 pixels)
Electromagnetic compatibility (EMC)	European Union directive EN61326-1 for portable equipment

### Accessories and Spare Parts

HM40 indicator with adapter and cable probe	HM40S
RH&T probe with cable	HMP40S
HM40 indicator with adapter	HM40SINDI
Quick connection adapter	HM40SADAPTER
Cable for RH&T probe	HMP40SCABLE
Long cable (2.7 m) for RH&T probe	HMP40SCABLE2
Plastic tube set (12 pcs)	19266HM
Rubber plugs (12 pcs)	233976
Protective cover with lid (3 pcs)	19268HM
Weather-proof carrying case with SHM40 filling	233815
USB recharger for HM40 indicator batteries	229249SP
Plastic grid with membrane filter for HMP40S probe	DRW010525SP
ACCESSORIES FOR WET CONCRETE	
Plastic flange set (12 pcs)	26529HM
Long rubber plug for wet concrete (12 pcs)	26530HM

### Dimensions

Dimensions in mm



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## HMK15 Humidity Calibrator



accepted and reliable method to calibrate humidity instruments. Usually two or three different salt solutions are used. Salts are chosen according to the application.

### Certified Salts

The HMK15 can be ordered with certified and pre-measured salts. A sample calibration is made from each batch in Vaisala's Measurement Standards Laboratory (MSL).

### Calibrated Thermometer

The HMK15 can be ordered with a thermometer, which is used for measuring the temperature during the calibration. It can also be used for checking the temperature measurement accuracy of the transmitter. The thermometer can contain either mercury (accuracy  $\pm 0.3^\circ\text{C}$  ( $\pm 0.54^\circ\text{F}$ )) or red capillary fluid (accuracy  $\pm 1.0^\circ\text{C}$  ( $\pm 1.8^\circ\text{F}$ )).

### FINAS Accredited Measurement Standards Laboratory

Vaisala's Measurement Standards Laboratory is a FINAS accredited calibration laboratory. FINAS is a member of the EA (the European Cooperation for Accreditation).



### Features/Benefits

- Easy and reliable calibration of humidity probes and transmitters
- Based on saturated salt solutions
- Fast temperature equilibration
- No external power required
- Suitable for laboratory use and on-site checks
- Chambers and transit covers make HMK15 easy to transport
- Pre-measured certified salts available
- Vaisala Service Centers offer accredited calibrations for humidity, temperature and barometric pressure.

No measuring instrument stays accurate by itself. It is essential that the functioning of an instrument is periodically checked against a reference. Vaisala has developed the Vaisala Humidity Calibrator HMK15 to make calibration and spot checking of humidity probes and transmitters easy and reliable.

### Method Used by Leading Laboratories

The operating principle of the HMK15 is based on the fact that a saturated salt solution generates a certain relative humidity in the air above it. The reading of the humidity probe or transmitter can then be adjusted accordingly. Many leading laboratories use this generally

# Technical Data

## General

The standard HMK15 consists of the following parts:

Two salt chambers, chamber covers and transit covers

Base plate

Choice of thermometers

mercury thermometer, Vaisala calibrated,  
order code 19728HM

thermometer with red capillary liquid, calibrated by  
manufacturer, order code 25130HM

Measurement cup and mixing spoon

## Options

Certified and ready dosed salts:	Order code:	Total uncertainty*:
-------------------------------------	----------------	------------------------

LiCl salt	11 %RH	19729HM	(±1.3 %RH)
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MgCl <sub>2</sub> salt	33 %RH	19730HM	(±1.2 %RH)
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NaCl salt	75 %RH	19731HM	(±1.5 %RH)
-----------	--------	---------	------------

K <sub>2</sub> SO <sub>4</sub> salt	97 %RH	19732HM	(±2.0 %RH)
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\*Uncertainties given at +20 °C

Ion exchanged water	19767HM
---------------------	---------

Extra salt chambers	19766HM
---------------------	---------

Carrying bag	HM27032
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## HMP155 Humidity and Temperature Probe



*HMP155 with an additional temperature probe and optional Stevenson screen installation kit.*

### Features/Benefits

- Vaisala HUMICAP®180R sensor - superior long-term stability
- Optional warmed humidity probe and chemical purge
- Plug-and-play
- USB connection for service use
- Fits with DTR13 and DTR503 radiation shields and also for a Stevenson screen
- Weather-proof housing IP66
- Optional, fast temperature probe
- Different output possibilities: voltage, RS-485, resistive Pt100
- Applications: meteorology, aviation and road weather, instrumentation

The Vaisala HUMICAP® Humidity and Temperature Probe HMP155 provides reliable humidity and temperature measurement. It is designed especially for demanding outdoor applications.

### Long-term Stability

The HMP155 has the proven Vaisala HUMICAP®180R sensor that has excellent stability and withstands well harsh environments. The probe structure is solid and the sensor is protected by default with a sintered teflon filter, which gives maximum protection against liquid water, dust, and dirt.

### Warmed Probe and High Humidity Environment

Measuring humidity reliably is challenging in environments where humidity is near saturation. Measurements may be corrupted by fog, mist, rain, and heavy dew. A wet probe may not give an accurate measurement in the ambient air.

This is an environment to which Vaisala has designed a patented, warmed probe for reliable measuring. As the sensor head is warmed continuously, the humidity level inside it stays below the ambient level. Thus, it also reduces the risk of condensation forming on the probe.

### Fast Measurements

With its fast response time, the additional temperature probe for the HMP155 is ideal for measurement in environments with changing temperatures. The new membrane filter speeds up the RH measurement.

### Long Lifetime

Protecting the sensor from scattered and direct solar radiation, and precipitation will increase its lifetime. Thus, Vaisala recommends installing the HMP155 in one of the following radiation shields: DTR503, DTR13, or a Stevenson screen. For the additional temperature probe, an installation kit is available to be used with DTR502 radiation shield.

### Easy Maintenance

The probe can be calibrated using a pc with a USB cable, with the push buttons, or with the MI70 indicator.



## Technical Data

## Performance

## RELATIVE HUMIDITY

Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis and repeatability) at	
+15 ... +25 °C (+59 ... +77 °F)	±1 %RH (0 ... 90 %RH)
	±1.7 %RH (90 ... 100 %RH)
-20 ... +40 °C (-4 ... 104 °F)	±(1.0 + 0.008 x reading) %RH
-40 ... -20 °C (-40 ... -4 °F)	±(1.2 + 0.012 x reading) %RH
+40 ... +60 °C (+104 ... +140 °F)	±(1.2 + 0.012 x reading) %RH
-60 ... -40 °C (-76 ... -40 °F)	±(1.4 + 0.032 x reading) %RH
Factory calibration	±0.6 %RH (0 ... 40 %RH)*
uncertainty (+20 °C /+68 °F)	±1.0 %RH (40 ... 97 %RH)*

\* Defined as  $\pm 2$  standard deviation limits. Small variations possible, see also calibration certificate.

Recommended humidity sensor	HUMICAP®180R(C)
Response time at +20 °C in still air with a sintered PTFE filter	
63 %	20 s
90 %	60 s

## TEMPERATURE

Measurement range	-80 ... +60 °C (-112 ... +140 °F)
Accuracy with voltage output at	
-80 ... +20 °C	$\pm(0.226 - 0.0028 \times \text{temperature})\text{ }^{\circ}\text{C}$
+20 ... +60 °C	$\pm(0.055 + 0.0057 \times \text{temperature})\text{ }^{\circ}\text{C}$
passive (resistive) output	
according to IEC 751	$\pm(0.1 + 0.00167 \times  \text{temperature} )\text{ }^{\circ}\text{C}$
1/3 Class B	
RS485 output	
-80 ... +20 °C	$\pm(0.176 - 0.0028 \times \text{temperature})\text{ }^{\circ}\text{C}$
+20 ... +60 °C	$\pm(0.07 + 0.0025 \times \text{temperature})\text{ }^{\circ}\text{C}$

Accuracy over temperature range (opposite)

Temperature sensor	Pt100 RTD Class F0.1 IEC 60751
Response time with additional temperature probe in 3 m/s air flow	
63 %	<20 s
90 %	<35 s

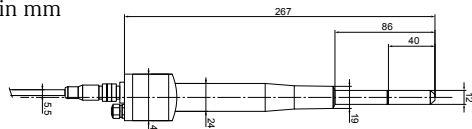
## OTHER VARIABLES

dew point/frost point temperature,  
wet bulb temperature, mixing ratio

## Dimensions

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Dimensions in mm



## General

Operating temperature range	-80 ... +60 °C (-112 ... +140 °F)
Storage temperature range	-80 ... +60 °C (-112 ... +140 °F)
Connection	8-pin male M12 connector
Connection cables	3.5, 10, and 30 m
Cable material	PUR
Wire size	AWG26
Service cables	USB connection cable M170 connection cable

Additional T probe cable length	2 m
Housing material	PC
Housing classification	IP66
Sensor protection	sintered PTFE optional membrane filter

Weight (probe) 86 g

Electromagnetic compatibility: Complies with the EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirement for use in industrial locations

## Inputs and Outputs

Operating voltage	7 ... 28 VDC*
-------------------	---------------

\*Note: minimum operating voltage 12 V with 0 ... 5 V output and 16 V with 0 ... 10 V output, probe heating, chemical purge or XHEAT.

## Outputs

voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
resistive Pt100 (4-wire connection)	

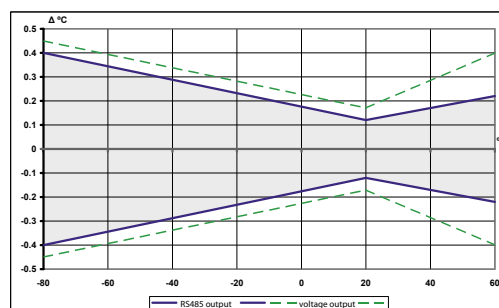
RS485

### Average current consumption

(+15 VDC, load 100 kOhm)	
0 ... 1 V output	<3 mA
0 ... 10 V output	+0.5 mA
RS485	<4 mA
during chemical purge	max. 110 mA
with warmed probe	max. 150 mA

### Settling time at power-up

voltage output	2 s
RS485	3 s



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## DTR500 Solar Radiation and Precipitation Shields



The Vaisala Solar Radiation Shield Series DTR500 are available in either a 5-, 9- or 12-plate models.

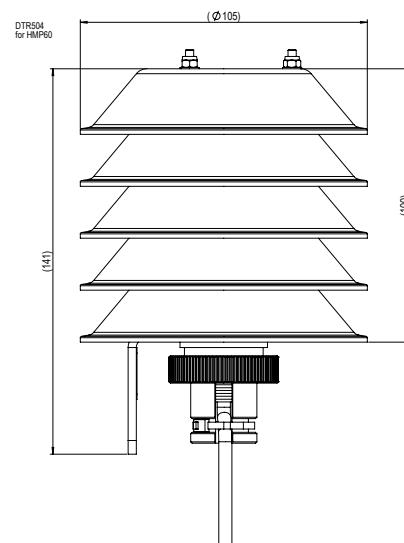
The Vaisala Radiation Shield Series DTR500 are solar radiation and precipitation shields supporting humidity probe installations in outdoor applications.

### Shield Protects Sensor

The maintenance-free DTR500 series shields protect the humidity and temperature sensors from solar radiation and precipitation. They provide excellent ventilation while blocking both direct and reflected solar radiation.

The special plastic used in the plates has excellent thermal characteristics; the white outer surface reflects radiation; the black inside absorbs accumulated heat. The shields can be easily installed on either a vertical pole, horizontal beam, or a flat surface. The DTR Shields can be used with the following Vaisala products:

- **DTR502(A)** with adapter 221072 for Vaisala HUMICAP® Humidity and Temperature Probe HMP155's additional temperature sensor
- **DTR502B** for Vaisala HUMICAP® Humidity and Temperature Transmitters HMT333, HMT337, HMT363 and HMT367 and Vaisala Combined Pressure, Humidity and Temperature Transmitters PTU303 and PTU307
- **DTR503(A)** for Vaisala HUMICAP® Humidity and Temperature Probe HMP155
- **DTR504(A)** for Vaisala HUMICAP® Humidity and Temperature Transmitters HMT120/130, Vaisala HUMICAP® Humidity and Temperature Probe HMP110 and Vaisala INTERCAP® Humidity and Temperature Probe HMP60



DTR504 for HMP60, HMP110 and HMT120/130 remote probes. Refer to drawings of DTR502B for dimensions of DTR504A pole mast installation accessory.

### Features/Benefits

- Protects temperature and humidity probes from scattered, as well as, direct solar radiation and rain.
- Maintenance-free
- Naturally ventilated
- Installs easily on a vertical pole, horizontal beam or flat surface
- Suitable for a wide range of applications
- Choice of shields and mounting accessories

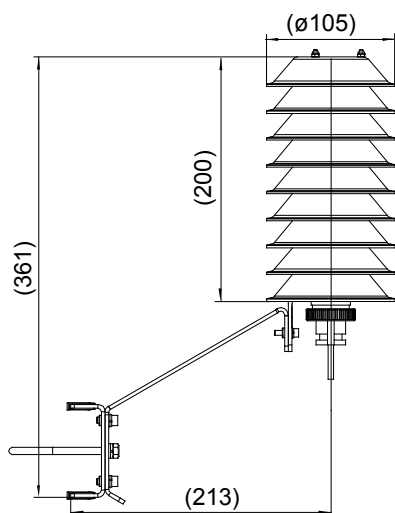
# Technical Data

## Dimensions

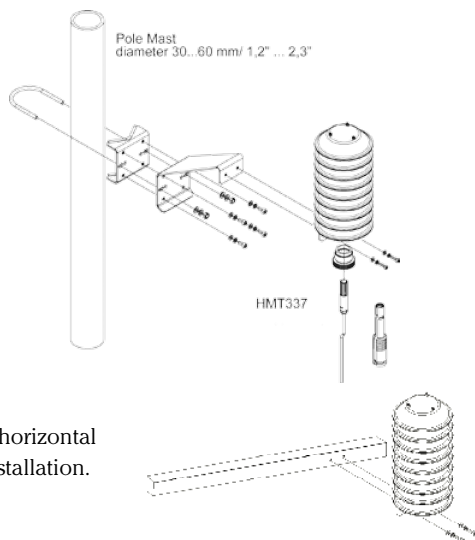
Dimensions in mm.

DTR502B

for HMT333, HMT337, HMT363, HMT367, PTU303 and PTU307



DTR502B pole mast installation.



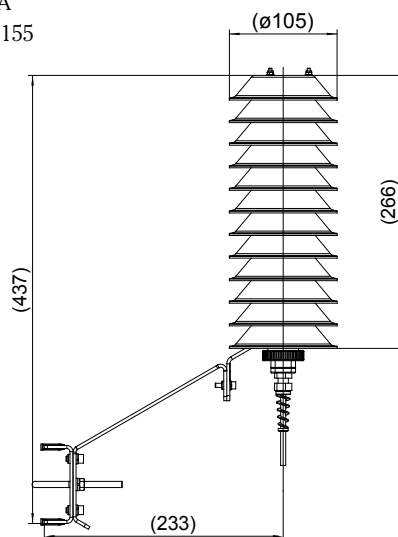
DTR502 horizontal beam installation.

## Dimensions

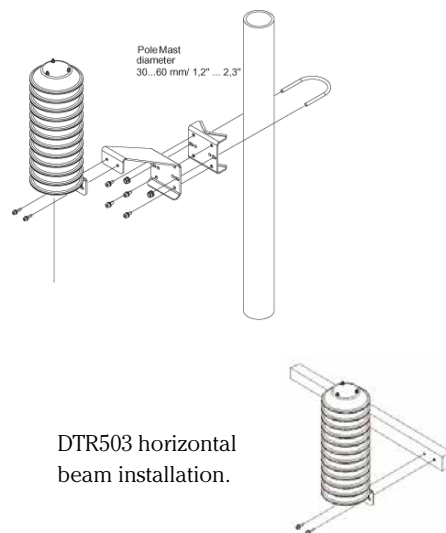
Dimensions in mm.

DTR503A

for HMP155



DTR503A pole mast installation.



DTR503 horizontal beam installation.

- DTR502/503/504 include only horizontal beam assembly
- DTR502A/503A/504A include also pole mast installation kit
- DTR502B include also product specific adapter

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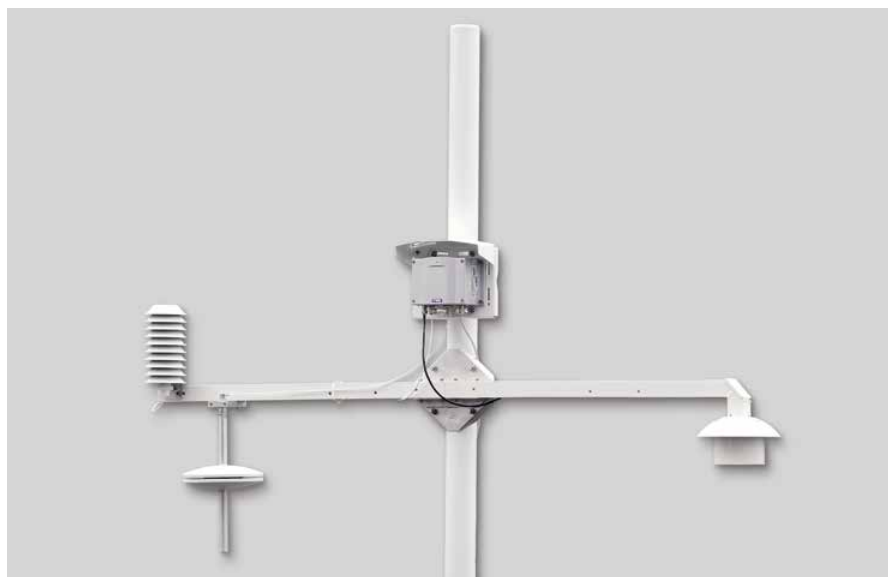


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## HMT330MIK Meteorological Installation Kit



The HMT337 and PTU307 feature warmed probe technology. Installed with the HMT330MIK kit either one forms the right choice for reliable humidity measurement in humid weather conditions.

### Features/Benefits

- For outdoor humidity and temperature measurements
- Can be ordered in a variety of configurations
- Used together with HMT337 transmitter or PTU307
- Vaisala SPH 10/20 Static Pressure Head eliminates effectively pressure variations in the barometer caused by wind

### HMT337/PTU307 Features

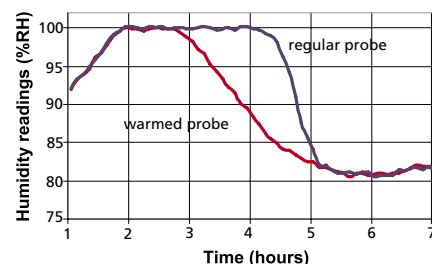
- Warmed probe provides true humidity readings in condensing conditions
- Humidity measurement expressed as relative humidity and/or dew point temperature
- Easy field calibration with the HM70 hand-held meter

The Vaisala Meteorological Installation Kit HMT330MIK enables the Vaisala HUMICAP® Humidity and Temperature Transmitter HMT337 to be installed outdoors to obtain reliable measurements for meteorological purposes.

### True Humidity Readings in Condensing Conditions

In weather observations dew formation makes reliable humidity measurement difficult. When dew has formed on the humidity sensor, it is impossible to obtain a true reading until this dew evaporates.

Both the PTU307 and HMT337 avoid this problem by warming the probe. When warmed, the relative humidity inside the probe stays below the ambient level. With an accurate temperature measurement, the ambient dew point can be calculated precisely. To obtain the ambient relative humidity, an additional probe measures the ambient temperature,



After a period of 100 % relative humidity, the warmed probe measures the true humidity, whereas the non-warmed probe takes time to recover from the condensation.

and the transmitter calculates the relative humidity from the dew point and temperature values.

### Open Shield Prevents Microclimates

The warmed probe of the HMT337/PTU307 is mounted in a shield which is open at the bottom to ensure steady air circulation to the sensor even in calm weather.

In traditional radiation shields sleet or snow can accumulate on the shield and prevent the proper air circulation through the shield, and create a humid microclimate until the snow melts.

### Essential for Critical Weather Measurements

Obtaining a true humidity reading is particularly important e.g. in traffic safety: at airports and at sea as well as on the roads. It is essential, for example, in fog and frost prediction.



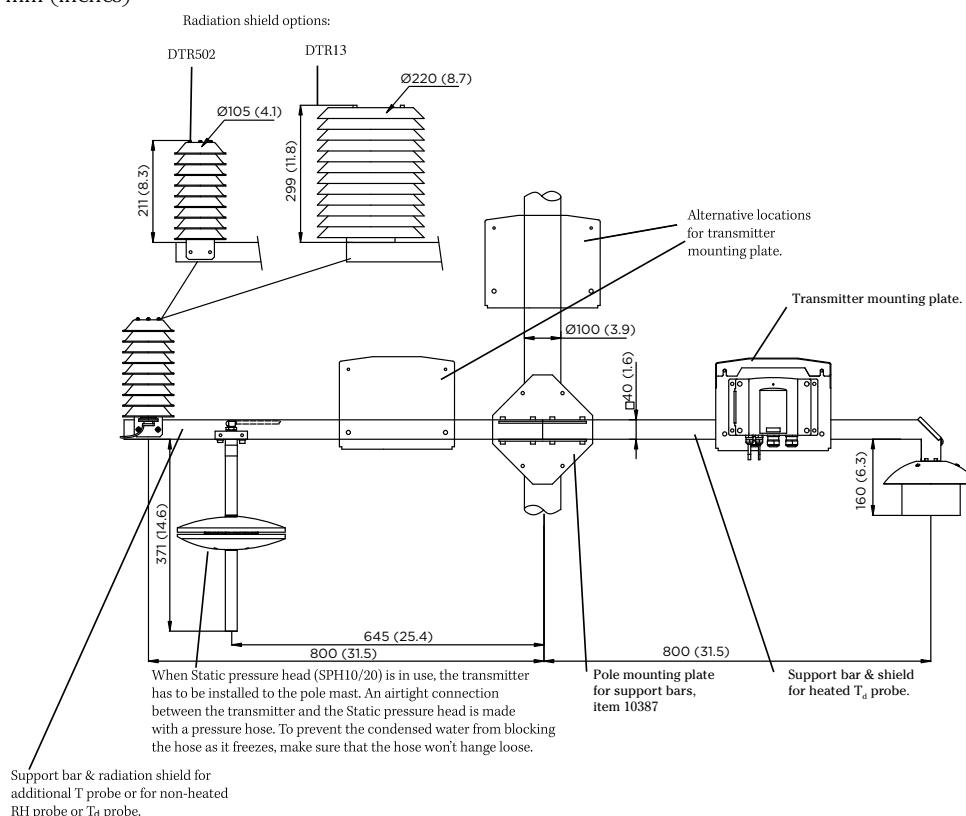
For calibration, a portable HMP77 reference probe is easy to attach beside the HMT337 or PTU307 probe.

## Technical Data

## Dimensions

---

Dimensions in mm (inches)



## Order form

Order Item		1	2	3	4	5	
<b>Vaisala Meteorological Installation Kit</b>		<b>HMT330MIK</b>					<b>PRICE</b>
1	Support bar & shield for warmed Td probe	<b>No support bar &amp; shield for warmed Td probe</b> <i>Support bar &amp; shield for warmed Td probe</i>	<b>0</b> 1				
2	Support bar and radiation shield for additional T probe or for non-warmed RH or Td probe	<b>No support bar or radiation shield</b> <i>Support bar with DTR502 shield for T probe</i> <i>Support bar with DTR13 shield for T probe</i> <i>Support bar with DTR502 shield for non-warmed RH or Td probe</i> <i>Support bar with DTR13 shield for non-warmed RH or Td probe</i>	<b>A</b> B C D E				
3	Support bar mounting plate	<b>No mounting plate</b> <i>Pole mounting plate for support bar/bars (item 10387)</i>	<b>0</b> 1				
4	Additional transmitter mounting plate (incl. rain shield)	<b>No additional transmitter mounting plate</b> <i>Transmitter mounting plate for support bar assembly</i> <i>Transmitter mounting plate for pole assembly</i>	<b>A</b> B C				
5	Static Pressure Head	<b>No Static Pressure Head</b> <i>Static Pressure Head SPH10      Only for the PTU300</i>	<b>0</b> 1				
				<b>TOTAL</b>			
				<b>QTY</b>			
				<b>TOTAL VALUE</b>			

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## HMT300TMK Turbine Mounting Kit for Power Turbine Intake Air Measurement



*The Vaisala HUMICAP® Turbine Mounting Kit HMT300TMK is shown with the cover open and HMT337 Humidity and Temperature Transmitter installed. (Not included in the HMT300TMK.)*

The Vaisala HUMICAP® Turbine Mounting Kit HMT300TMK is developed to monitor the air intake of gas and liquid fueled power turbines. HMT300TMK is used together with HMT337 Temperature and Humidity Transmitter.

### Features/Benefits

- Designed for high humidity applications
- Measurement range: -40 ... +100°C
- Patented, warmed probe
- Incorporates Vaisala HUMICAP® Sensor for excellent accuracy and long-term stability and resistance to dust and most chemicals
- Low maintenance need
- Outer cover provides protection from rain and direct sunlight
- NIST traceable (certificate included)

It is ideal for measuring in water vapor injection applications because the sensor has been optimized for high humidity environments by utilizing a patented, warmed probe. Water vapor is added to the intake of the turbine to increase the mass flow which in turn increases compression and electrical power output.

### Low Maintenance

Power turbines also require exact water vapor injection in the chamber to reduce pollutant emissions. Vaisala's warmed probe technology is ideal because of its reliability in the field. In fact, the only suggested scheduled maintenance is annual calibration.

### Patented, Warmed Probe Prevents Condensation

The HMT300TMK with the HMT337 installed, provides fast and reliable dewpoint measurement especially under high humidity conditions where dew would normally form

on the humidity sensor and thereby cause errors in measurement. The patented warmed probe prevents condensation from forming on the sensor.

### Protective Enclosure

The HMT300TMK includes a white, painted stainless steel enclosure with an installation kit for the probe. The HMT337 Humidity and Temperature Transmitter is installed in the stainless steel enclosure at the factory, when ordered together with HMT300TMK. The instrument can be equipped to be powered with either 24 VDC/VAC or with an internal 110/230 volt power supply unit.

The outer cover protects the transmitter from direct sun light and rain. The installation kit protects the probe from outer water splashes, keeps the sensor dry, and prevents any parts that could vibrate loose from entering the turbine.

The HMT300TMK can be ordered separately for installation with the customer's existing HMT337.

### HUMICAP® Performance

The HMT330 Series Transmitters are fitted with the latest generation of the HUMICAP®, the polymer sensor known for its accuracy, reliability and long-term stability. The sensor has a high tolerance for particulate abrasion and chemical contamination.

### Vaisala HUMICAP® Humidity and Temperature Transmitter HMT337

The HMT337 is intended for demanding industrial humidity measurement applications with a risk of condensation. The stainless steel probe is mechanically durable and preferred for most industrial applications.

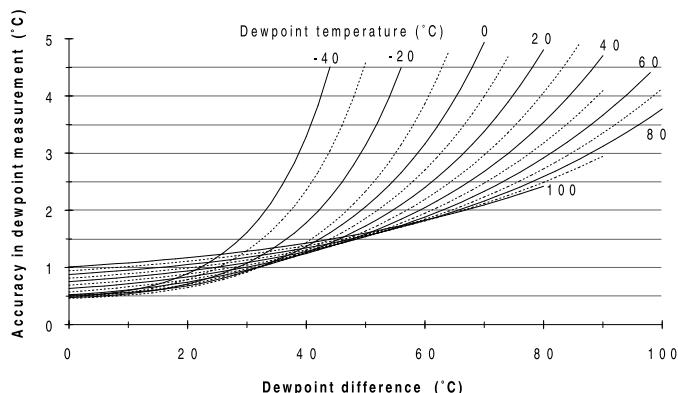


# Technical Data

## Dewpoint Temperature

Measurement range -40 ... +100 °C (-40 ... +212 °F)

Accuracy: find the intersection of the dewpoint temperature curve and the dewpoint difference reading (process temperature - dewpoint temperature) on the x-axis and read the accuracy in dewpoint measurement at the y-axis



Response time (90 %) at +20 °C (68 °F)

in still air (PPS grid with steel netting)

20 s

Sensor

HUMICAP® 180C

## General

Connections screw terminals for 0.5 mm<sup>2</sup> wires (AWG 20),  
stranded wires recommended

Operating voltage 24 VDC/VAC (20...28 V) or 115/230 VAC  
(Must be specified at time of order)

Recommended external load for current outputs < 500 ohm

0...1 V output > 2 kohm (to ground)

0...5 & 0...10 V outputs > 10 kohm (to ground)

Operating temperature range for electronics -40...+60 °C (-40 ... +140 °F)

Storage temperature -55...+80 °C (-67 ... +176 °F)

Housing material G-AlSi10 (DIN 1725)

Housing classification IP65 (NEMA 4)

Bushing 8...11 mm diameter cables (0.31 ... 0.43 inch)

Humidity sensor protection (Ø 12 mm) PPS grid with steel netting

Weight:

HMT300TMK with HMT337 8,7 kg

HMT300TMK with HMT337,

packed in a wooden shipping box 13,3 kg

Electromagnetic compatibility Complies with EMC standard  
EN61326-1, Industrial Environment

## Outputs

Two standard outputs, third optional 0...20 mA, 4...20 mA,  
0 ... 1 V, 0...5 V, 0 ... 10 V

Typical accuracy of analog output

at +20 °C (+68 °F)

±0.05 % full scale

Typical temperature dependence

of analog output

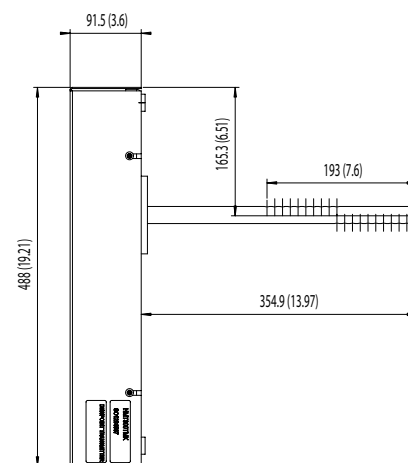
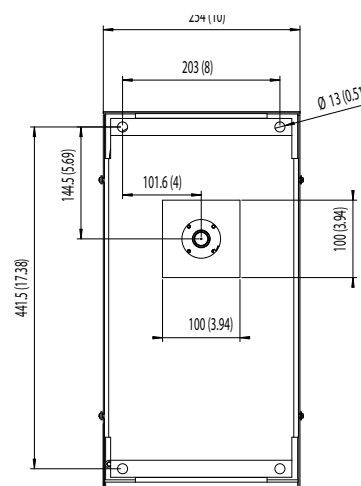
±0.005 %/°C full scale

Serial output available

RS232C (optional RS485)

## Dimensions

Dimensions in mm (inches)



HUMICAP® is a registered trademark of Vaisala.

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## Vaisala Temperature and RH Data Logger Series 2000



### Features/Benefits

- Industry-leading temperature and relative humidity measurement precision
- High accuracy, adjustable time-based digital recording
- Printed reports for any time period
- 10-year battery
- Ability to perform validation and continuous monitoring with the same model
- NIST-traceable, ISO 17025 accredited calibration
- Superior alternative to chart recorders and hard-wired systems
- Integrated high-accuracy RH sensor

Vaisala's 2000 series of data loggers are designed to provide high accuracy measurements for temperature, relative humidity and an analog sensor of your choice. The 2000 logger combines internal temperature and RH sensors with optional external channels for either current or voltage inputs for recording parameters such as differential pressure, CO<sub>2</sub>, level, particles, or conductivity. The 2000

logger can also include a Boolean channel for door switches or alarm contacts.

Ideal for use in standalone or networked applications, the 2000 data logger connects directly to a PC with USB, or installs to an existing network via Ethernet, Power over Ethernet, or WiFi. Each data logger contains a 10-year battery and onboard memory for recording at the point of measurement. With autonomous power and recording capacity, data is immune to network and power interruptions.

The DL2000 data loggers can be used with Vaisala software, either viewLinc or vLog, to download, display, and analyze environmental data. The viewLinc monitoring system provides 24/7 multi-stage alarm notification, remote, real-time monitoring and gap-free data. The vLog software is a simple solution for validation/mapping applications. All reports are customizable and can be exported to spreadsheets and PDF to provide records that meet the requirements of 21 CFR Part 11 and Annex 11.

## Technical Data

### General

Size	85 x 59 x 26mm (3.4 x 2.3 x 1") 76g (2.7 oz.)
Interfaces	RS-232 serial, USB, WiFi, Ethernet and Power over Ethernet (vNet)
Mounting	Magnetic strips; 3M Dual Lock™ fasteners
PC Software	viewLinc for Monitoring, Alarming, Reporting vLog for Validation/Mapping GxP Environments Spectrum for non-GxP Environments OPC Server to add loggers to an existing OPC-compatible monitoring system.
Internal Clock	Accuracy ± 1 min./month@ -25 °C to +70 °C (-13 °F to +158 °F)
Electromagnetic Compatibility	FCC Part 15 and CE, EN 55022:2006, EN 61000-4-2:2001, EN 61000-4-3:2006
Power Source	Internal 10-year lithium battery (Battery life specified with sample interval of 1 min. or longer)

## Memory

Sample Capacity	122,197 12-bit samples
Memory Type	Non-volatile EEROM
Memory Modes	User-selectable wrap (FIFO) or stop when memory is full.
	User-selectable start and stop times.
Sampling Rates	User-selectable from once every 10 seconds to once a day.

## Internal Sensors

INTERNAL TEMPERATURE SENSOR	
Calibrated Measurement Range <sup>1</sup>	-25 °C to +70 °C (-13 °F to +158 °F)
Operating Range	-35 °C to +85 °C (-31 °F to +185 °F)
Initial Accuracy <sup>2</sup>	± 0.10° C over +20 °C to +30 °C (± 0.18° F over +68 °F to +86 °F) ± 0.15° C over -25 °C to +70 °C (± 0.27 °F over -13 °F to +158 °F)
One Year Accuracy <sup>3</sup>	± 0.15 °C over +20 °C to +30 °C (± 0.27 °F over +68 °F to +86 °F) ± 0.25 °C over -25 °C to +70 °C (± 0.45 °F over -13 °F to +158 °F)
Resolution	0.02 °C at +25 °C (0.04 °F at +77 °F)

INTERNAL RH SENSOR	
Calibrated Measurement Range <sup>1</sup>	45 %RH at +10 °C (+50 °F) 10 %RH to 80 %RH at +25 °C (+77 °F) 45 %RH at +45 °C (+113 °F)
Operating Range	0 %RH to 100 %RH (non-condensing)
Initial Accuracy <sup>2</sup>	± 1 %RH over 10 %RH to 90 %RH at +20 °C to +30 °C (+68 °F to +86 °F) ± 2 %RH over 10 %RH to 90 %RH at -20 °C to +70 °C (-4 °F to +158 °F)
One Year Accuracy <sup>3</sup>	± 2 %RH over 10 %RH to 90 %RH at +20 °C to +30 °C (+68 °F to +86 °F) ± 3 %RH over 10 %RH to 90 %RH at -20 °C to +70 °C (-4 °F to +158 °F)
Resolution	0.05 %RH

<sup>1</sup> Custom calibration points available upon request including full ICH coverage.

<sup>2</sup> Initial accuracy includes all known influence quantities present at the time of calibration including calibration uncertainty, mathematical fit, data logger resolution, hysteresis and reproducibility.

<sup>3</sup> One Year Accuracy includes all known influence quantities present during the operation of a data logger over the course of one year including Initial Accuracy and Long Term Drift. Not included is any drift related to atypical contamination or misuse.

## Current Loop and Voltage Inputs

INPUT TYPE	CURRENT LOOP	ANALOG VOLTAGE
Available Ranges	0 to 22 mA	0 to 5 VDC, 0 to 10 VDC
Resolution	5.5 µA	0.025 % F.S.
Accuracy	±0.15 % F.S. at +25 °C (+77 °F)	±0.15 % F.S. at +25 °C (+77 °F)
Input Impedances	75 Ohms <sup>4</sup>	>1 MOhm
Isolation	One common per logger	One common per logger
Overload Protection	40 mA max. (reverse-polarity protected)	±24 VDC max. (reverse-polarity protected)

## Channel Configuration and Recording Span

CHANNEL TYPES				
MODEL NUMBER	CH 1	CH 2	CH 3	CH 4
2000-20R	Temperature	Relative Humidity		
2000-3CR	Temperature	Relative Humidity	Current 4 to 20 mA	
2000-35R	Temperature	Relative Humidity	Voltage 0 to 5 VDC	
2000-3AR	Temperature	Relative Humidity	Voltage 0 to 10 VDC	
2000-4BR	Temperature	Relative Humidity	Boolean	Boolean
NUMBER OF CHANNELS ENABLED <sup>5</sup>				
SAMPLE INTERVAL	1	2	3	4
10 Seconds	14.1 Days	7.1 Days	4.7 Days	3.5 Days
1 Minute	2.8 Months	1.4 Months	23.8 Days	21.2 Days
5 Minutes	1.2 Years	7.1 Months	4.7 Months	3.5 Months
15 Minutes	3.5 Years	1.7 Years	1.2 Years	10.6 Months
1 Hour	13.9 Years	7.0 Years	4.6 Years	3.5 Years

<sup>4</sup> Termination resistance plus approximately 0.4 volt drop through a protection diode.

<sup>5</sup> Temperature channel must be enabled when the RH channel is enabled.

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## Vaisala DL1000-1400 Temperature Data Logger



### Applications

Ideal for Monitoring & Validation of:

- Refrigerators & Freezers (to -90 °C)
- Incubators
- Stability Chambers
- Warehouses
- Ambient conditions

### Features/Benefits

- Industry-leading precision and accuracy
- Ideal for low temperature environments - to -25 °C
- Printed reports for any time period
- 10-year battery
- Validation and continuous monitoring with the same model
- Two year limited warranty
- Superior alternative to chart recorders and hard-wired systems
- NIST-traceable calibration accredited to ISO/IEC 17025
- Timebase calibrated over the operating temperature range
- Adjustable time based recording
- Snap-in logger cradle for easy network connectivity
- Three probe options give high accuracy - from -90 °C to +70 °C

The 1000/1400 temperature data loggers include the VL-series for regulated environments and the SP-series for non FDA/GxP regulated industries. The VL-series of data loggers, together with vLog VL software, provide a superior, high accuracy solution for use in FDA/GxP regulated environments by ensuring tamperproof files and electronic records that meet 21 CFR Part 11 requirements. The SP-series provides a compact, easily deployable, highly

accurate measurement and recording device. Coupled with vLog SP software for downloading, displaying, analyzing and reporting of recorded environmental data, the SP-series was designed for use in non FDA/GxP regulated environments. Optional browser-based viewLinc software provides 24/7 multi-stage alarm notification and remote monitoring for both the VL and SP series of data loggers.

# Technical Data

## General

Size	85 x 59 x 26 mm (3.4 x 2.3 x 1") 76 g (2.7oz)
Interfaces	RS-232 serial, USB, Ethernet, WiFi, PoE network interface available
Mounting	Magnetic strips, 3M Dual Lock™ Fasteners Snap-in connector locks provide secure probe connections
PC Software	Graphing & Reporting Software vLog SP for SP-series vLog VL for VL-series viewLinc for continuous monitoring & alarming OPC Server to add on to existing OPC compatible monitoring systems
Internal Clock	Accuracy ±1 min. /month -25 °C to +70 °C (-13 °F to +158 °F)
Electromagnetic Compatibility	FCC Part 15 and CE
Power Source	Internal 10-year lithium battery (Battery life specified with sample interval of 1 min. or longer)
Logger Operating/Storage Range	-40 °C to +85 °C (-40 °F to +185 °F) 0 %RH to 100 %RH non-condensing

## Internal Temperature Sensor

Series	Sensor Type
1000-21x	Precision-tolerance epoxy-encapsulated NTC thermistor

## Memory

Data Sample Capacity	
1000-2XX	48,100 12-bit samples
1400-44X	85,300 12-bit samples
Memory Type	Non-volatile EEPROM
Memory Modes	User selectable: wrap (FIFO) or stop when memory is full. User selectable start time. User selectable stop time (VL series only).
Sampling Rates	User-selectable (in 10 second intervals) from once every 10 seconds to once a day.

## Recording Span: 1000-2xx

SAMPLE INTERVAL	NUMBER OF CHANNELS ENABLED	
	1	2
10 Seconds	5.5 Days	2.7 Days
1 Minute	1.1 Months	16.7 Days
5 Minutes	5.5 Months	2.7 Months
15 Minutes	1.3 Years	8.3 Months
1 Hour	5.4 Years	2.7 Years



VL-1000-21x



VL-1000-22x

## Recording Span: 1400-44x

SAMPLE INTERVAL	NUMBER OF CHANNELS ENABLED			
	1	2	3	4
10 Seconds	9.8 Days	4.9 Days	3.2 Days	2.4 Days
1 Minute	1.9 Months	29.6 Days	19.7 Days	14.8 Days
5 Minutes	9.8 Months	4.9 Months	3.2 Months	2.4 Months
15 Minutes	2.4 Years	1.2 Years	9.8 Months	7.4 Months
1 Hour	9.7 Years	4.8 Years	3.2 Years	2.4 Years



VL-1400-44x

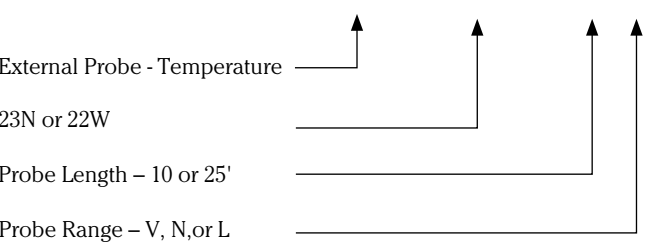


## EPT Series Temperature Probes

### Sensor Models

"N" Range External Probes	EPT-23N-XXN and EPT-22W-XXN
Operating/Storage Range	-40 °C to +95 °C (-40 °F to +203 °F)
Connector Color Code	Black
"L" Range External Probes	EPT-23N-XXL and EPT-22W-XXL
Operating/Storage Range	-60 °C to +95 °C (-76 °F to +203 °F)
Connector Color Code	Green
"V" Range External Probes	EPT-23N-XXV and EPT-22W-XXV
Operating/Storage Range	-95 °C to +95 °C (-139 °F to +203 °F)
Connector Color Code	Blue

### EPT - XXX - XXX



### Sensor Tips

EPT-23N-XXX	Stainless Steel
	Diameter 3.2 mm (1/8")
	Length 38 mm (1.5")
EPT-22W-XXX (liquid submersible)	Sealed Teflon Tip
	Diameter 3 mm (0.12")
	Length 28 mm (1.1")
Probe Lengths	3 m (10') and 7.6 m (25')
Cable Construction	2mm (0.07") Diameter
	Teflon coated cable

### Temperature Probe Accessories

Thermal Dampening Block, for use in refrigerators and freezers, simulates a glycol bottle to reduce viewLinc alarms generated by opening and closing a door.



Product Part Number Legend: Guide for reading the product tables and selecting the most appropriate model for your application.

**XX - 1000 - XXX**

Series Type: VL (Validatable) or SP

Series Number: Series 1000: 2 Channel,  
Series 1400: 4 Channel

Total Number of Channels: 2/4

Number of External Channels: 1/2/4

External Channel Temperature Range:

Please refer to the Temperature Range and Accuracy table below for external probe options.

## Temperature Range and Accuracy

### Internal Sensor

Calibrated	
Measurement Range	-25 °C to +70 °C (-13 °F to +158 °F)
Operating/Storage Range	-40 °C to +85 °C (-40 °F to +185 °F)
Initial Accuracy	0 %RH to 100 %RH non-condensing +/-0.10 °C over +20 °C to +30 °C (+/-0.18 °F over +68 °F to +86 °F) +/- 0.2 °C over -25 °C to +70 °C (+/- 0.36 °F over -13 °F to +158 °F)
One Year Accuracy	+/-0.15 °C over +20 °C to +30 °C (+/-0.27 °F over +68 °F to +86 °F) +/-0.25 °C over -25 °C to +70 °C (+/-0.45 °F over -13 °F to +158 °F)
Resolution	0.02 °C at +25 °C (0.04 °F at +77 °F)

### External Probes - All Models

#### "N" RANGE EXTERNAL PROBE

Calibrated	
Measurement Range	-25 °C to +70 °C (-13 °F to +158 °F)
Operating/Storage Range	-40 °C to +95 °C (-40 °F to +203 °F)
Initial Accuracy*	+/-0.10 °C over +20 °C to +30 °C (+/-0.18 °F over +68 °F to +86 °F) +/-0.15 °C over -25 °C to +70 °C (+/-0.27 °F over -13 °F to +158 °F)
One Year Accuracy*	+/-0.2 °C over +20 °C to +30 °C (+/-0.36 °F over +68 °F to +86 °F) +/-0.25 °C over -25 °C to +70 °C (+/-0.45 °F over -13 °F to +158 °F)
Resolution	0.02 °C at +25 °C (0.04 °F at +77 °F)

#### "L" RANGE EXTERNAL PROBE

Calibrated	
Measurement Range	-50 °C to +10 °C (-58 °F to +50 °F)
Operating/Storage Range	-60 °C to +95 °C (-76 °F to +203 °F)
Initial Accuracy*	+/-0.15 °C over -50 °C to +10 °C (+/-0.27 °F over -58 °F to +50 °F)
One Year Accuracy*	+/-0.25 °C over -50 °C to +10 °C (+/-0.45 °F over -58 °F to +50 °F)
Resolution	0.02 °C at -20 °C (0.04 °F at -4 °F)

#### "V" RANGE EXTERNAL PROBE

Calibrated	
Measurement Range	-90 °C to -40 °C (-130 °F to -40 °F)
Operating/Storage Range	-95 °C to +95 °C (-139 °F to +203 °F)
Initial Accuracy*	+/- 0.2 °C over -90 °C to -40 °C (+/- 0.36 °F over -130 °F to -40 °F)
One Year Accuracy*	+/-0.25 °C over -90 °C to -40 °C (+/-0.45 °F over -130 °F to -40 °F)
Resolution	0.02 °C at -80 °C (0.04 °F at -112 °F)

\*Specification for external channels is for a probe calibrated to the specific channel of the data logger and with the data logger at -25 °C to +70 °C (-13 °F to +158 °F)

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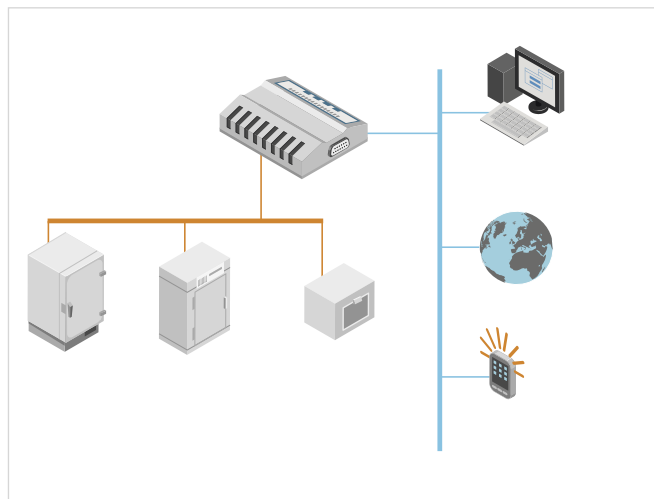


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## Vaisala Multi-application Temperature Data Logger Series 1016/1416



### Features/Benefits

- Industry-leading precision and accuracy
- Real-time monitoring & alarming with viewLinc
- Reliable validation/mapping with vLog
- Easy connectivity to your existing network – wired or wireless
- Validation and continuous monitoring with the same data logger
- Superior alternative to chart recorders and hard-wired systems
- NIST-traceable, ISO 17025 accredited calibration

### MODEL NUMBERS & CHANNELS

- VL-1016-22V  
Two external channels for validatable applications
- VL-1416-44V  
Four external channels for validatable applications
- SP-1016-22V  
Two external channels
- SP-1416-44V  
Four external channels

Vaisala's multi-application temperature data loggers monitor temperatures in up to four applications with one logger – ultra-low temperature freezers, freezer/refrigerators and incubators.

The DL1016-1416 data loggers can be used with Vaisala software, either viewLinc or vLog, to download, display, and analyze environmental data. The viewLinc monitoring system provides 24/7 multi-stage alarm notification, remote, real-time

monitoring and gap-free data.

The vLog software is a simple solution for validation/mapping applications. All reports are customizable and can be exported to spreadsheets and PDF to provide records that meet the requirements of 21 CFR Part 11 and Annex 11.

Choose the DL1016-1416VL data logger for GxP-compliant environments and the DL1016-14160SP for non-GxP applications.

## Technical Data

### General

Size	85 x 59 x 26 mm (3.4 x 2.3 x 1") 76 g (2.7oz)
Interfaces	RS-232 serial, USB, Ethernet, WiFi, PoE network interface available
Mounting	Magnetic strips, 3M Dual Lock™ Fasteners
PC Software	Snap-in connector locks provide secure probe connections vLog Graphing & Reporting Software viewLinc for continuous monitoring & alarming OPC Server to add Vaisala recorders to any OPC-compatible monitoring system
Internal Clock	Accuracy ±1 min. /month 0 °C to +50 °C (32 °F to +122 °F)
Electromagnetic Compatibility	FCC Part 15 and CE
Power Source	Internal 10-year lithium battery (Battery life specified with sample interval of 1 min. or longer)

# Technical Data

## Temperature Range & Accuracy

Sensor	"V" Range External Probe
Calibrated	-90 °C to +50 °C
Measurement Range	(-130 °F to +122 °F)
Operating Range	-95 °C to +70 °C
Range	(-139 °F to +158 °F)
Initial Accuracy*	±0.25 °C over -90 °C to +50 °C (±0.45 °F over -130 °F to +122 °F)
One Year Accuracy*	±0.35 °C over -90 °C to +50 °C (±0.63 °F over -130 °F to +122 °F)
Resolution	0.01 °C at +25 °C (0.02 °F at +77 °F)

## 1016 Series

Data Sample Capacity	68,600 16 bit samples
----------------------	-----------------------

## 1416 series

Data sample Capacity	101,375 16 bit samples
----------------------	------------------------

## 1016 and 1416 series

Memory type	non-volatile EEROM
Memory Modes	User-selectable rates from once every 10 seconds to once per day. (Battery life specified with sample interval of 1 min. or longer)
Sampling Rates	User-selectable rates from once every 10 seconds to once per day. (Battery life specified with sample interval of 1 min. or longer)

## Recording Span: 1016-22V

SAMPLE INTERVAL	NUMBER OF CHANNELS ENABLED	
	1	2
1 Minute	1.5 Months	23.8 Days
5 Minutes	7.6 Months	3.8 Months
15 Minutes	1.9 Years	11.5 Months
1 Hour	7.8 Years	3.9 Years

\*Specification for external channels is for a probe calibrated to the specified channel of the data logger, with the logger at 0 °C to +50 °C (32 °F to +77 °F)

## Recording Span: 1416-44V

SAMPLE INTERVAL	NUMBER OF CHANNELS ENABLED			
	1	2	3	4
1 Minute	2.3 Months	1.1 Months	23.5 Days	17.6 Days
5 Minutes	11.3 Months	5.6 Months	3.7 Months	2.8 Months
15 Minutes	2.8 Years	1.4 Years	11.3 Months	8.5 Months
1 Hour	11.5 Years	5.7 Years	3.8 Years	2.8 Years

## Thermistor Probes

Sensor	"V" Range External Probe
Operating Range	-95 °C to +70 °C (-139 °F to +158 °F)
Connector Color Code	Blue
Sensor Tip	Stainless Steel, Diameter: 3.2 mm (1/8"), Length: 38 mm (1.5") Sealed Teflon Tip Diameter: 3 mm (0.12"), Length: 28 mm (1.1")
Probe Length	3 m (10') and 7.6 m (25') lengths available
Cable Construction	2 mm (0.07") Diameter, Teflon coated cable

## Immersion/Dry Probes

DESCRIPTION/LENGTH	PART NUMBER
Thermistor V Range probe 25'	235139SP
Thermistor V Range probe 10'	235218SP
Thermistor immersion V Range probe 25'	235140SP
Thermistor immersion V Range probe 10'	235217SP

## Temperature Probe Accessories

EPT-TDB-2: Thermal Damping Block, for use in refrigerators and freezers. Simulates a glycol bottle to reduce alarms generated by opening and closing a door.

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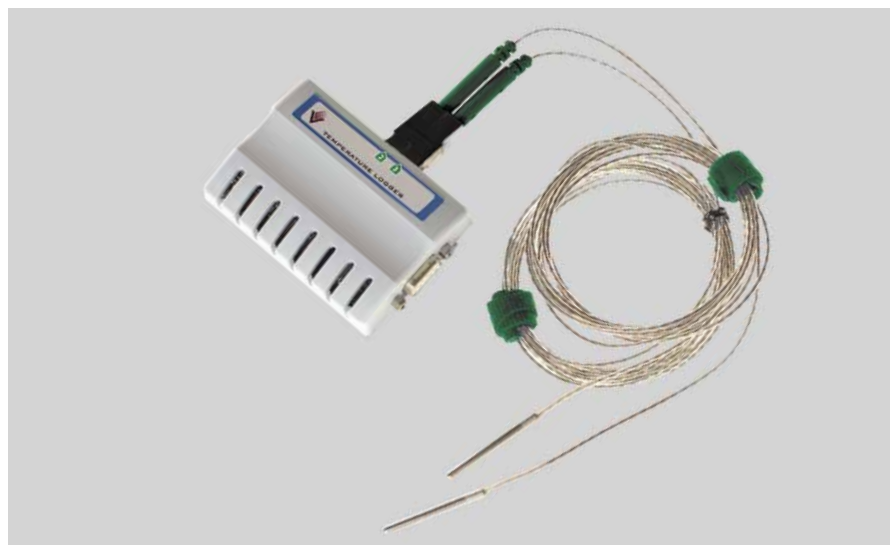


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## Vaisala DL1200 Low Temperature Data Logger



### Applications

- Ideal for in situ cold temperature validation to -55 °C
- Can record with up to 2 external probes calibrated to -55 °C
- Highly accurate for use in GxP low temperature applications

21 CFR Part 11 requirements.

The SP-series of 1200 data recorders provide a compact, easily deployable, measurement and recording device for use in non FDA/GxP regulated industries. The SP recorders are used with Vaisala vLog SP software for downloading, displaying, analyzing and reporting of recorded environmental data.

For applications that require monitoring, alarming and reporting, our viewLinc Continuous Monitoring System combines with both the VL- and SP-series of data recorders to provide 24/7 multi-stage alarm notification, remote, browser-based monitoring, and customizable reporting in an easy to deploy, easy to use solution.

### Features / Benefits

- Equipped with internal temperature sensor, onboard memory and 10-year battery
- Memory at the point of measurement ensures continuous, 21 CFR Part 11-compliant records
- Renders data immune to power failures and network interruptions
- NIST-traceable, A2LA accredited calibration
- Adjustable recording intervals (every minute, every hour, etc) with multi-year data recording capacity
- High-stability temperature sensors provide in-calibration performance between calibration intervals up to a year
- External inputs for remote temperature probes

The 1200 series temperature data loggers include the VL-series for regulated environments and the SP-series for non FDA/GxP industries. The VL-series of data recorders, together with vLog VL software provide a superior, high accuracy solution for validation studies and testing applications in FDA/GxP regulated environments. Hardware is robust and tamper-proof and vLog VL provides electronic records that meet

## Technical Data

### General

Size	85 x 59 x 26 mm (3.4 x 2.3 x 1") 76 g (2.7oz)
Interfaces	RS-232 serial, USB, Ethernet, WiFi, Power over Ethernet
Mounting	Magnetic strips, 3M Dual Lock™ Fasteners; Snap-in connector locks provide secure probe connections
Software	vLog SP for SP-series vLog VL for VL-series viewLinc CMS for SP/VL-series OPC server for data recorder interoperability with OPC-compatible monitoring systems
Internal Clock Accuracy	+/-1 min./month over -55 °C to +40 °C (-67 °F to +104°F)
Electromagnetic Compatibility	FCC Part 15 and CE
Power Source	Internal 10-year lithium battery (Battery life specified with sample interval of 1 min. or longer)



# Technical Data

## Measurement Accuracy

### INTERNAL SENSOR & EXTERNAL PROBE

Calibrated Measuring Range	-55 °C to +40 °C (-67 °F to +104 °F)
Standard Calibration points **	-55°C, -40°C, -20°C, -0°C, +20°C, +40°C (-67°F, -40°F, -4°F, +32°F, +68°F, 104°F)
Resolution	0.02 °C at -20 °C (0.04 °F at -4 °F)
Initial Accuracy*	+/-0.3 °C over -55 °C to +40 °C +/-0.54 °F over -67 °F to +104 °F
One year Accuracy*	+/-0.42 °C over -55 °C to +40 °C (+/-0.76 °F over -67 °F to 104 °F)
Operating/Storage Range	-60 °C to +85 °C (-76 °F to +185 °F)

\*The accuracy specification for external channels is for a probe calibrated to the specific channel of the data logger and with the data logger at -55 °C to +40 °C (-67 °F to +104 °F)

\*\*Customized calibration points are available, from -60°C to +45°C (-76°F to +113°F)

## Internal Temperature Sensor

Type of Sensor	Precision-tolerance epoxy-encapsulated NTC thermistor
----------------	--

## External Temperature Sensor

Sensor Type	L Range Probes
Sensor Tips	<b>Stainless Steel</b> Diameter 3.2 mm (1/8"), Length 38 mm (1.5") <b>Sealed Teflon Tip</b> (Waterproof) Diameter: 3mm (0.12"), Length 28 mm (1.1")
Cable construction	2 mm (0.07") Diameter, Teflon coated cable
Probe length	7.6 m (25')
Connector Color Code	Green

## Recording Span: External Channels

SAMPLE INTERVAL	NUMBER OF CHANNELS ENABLED	
	1	2
10 Seconds	5.5 Days	2.7 Days
1 Minute	1.1 Months	16.7 Days
5 Minutes	5.5 Months	2.7 Months
15 Minutes	1.3 Years	8.3 Months
1 Hour	5.4 Years	2.7 Years

Product Part Number Legend: Guide for reading the product tables and selecting the most appropriate model for your application.

## XX - 1200 - 2XL

Series Type - VL or SP

Series Number - 1200

Total Number of Channels

Number of External Channels

Probe type - "L" range

The 1200 data recorder comes in the following models:

SP or VL 1200-21L	One internal temperature channel and one external temperature channel.
SP or VL 1200-22L	Two External temperature channels.

## Temperature Probe Accessories

Thermal Dampening Block, for use in refrigerators and freezers, simulates a glycol bottle to reduce fluctuations generated by opening and closing a door.

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## Vaisala Universal Input Data Logger Series 4000



### Features/Benefits

- 10-year battery and large onboard memory
- Single and multi-channel models with up to four input channels
- Easily set scaling and measurement units for recording
- Time-based digital recording in a range of sample intervals
- Multiple connectivity options - USB, Ethernet, WiFi
- Optional vNet cradle for Ethernet or Power over Ethernet connectivity
- NIST-traceable, ISO 17025 accredited calibration
- Two year limited warranty

The 4000 series of data loggers are designed to interface with a wide range of transducers, transmitters, and sensors with a DC voltage or 0 - 20 mA current loop output. The 4000 is a simple solution for recording and monitoring pressure, flow, fluid level, PH, electrical properties, moisture and gas concentrations.

Ideal for use in standalone or networked applications, the 4000 Universal Input logger connects directly to a PC with USB or installs to an existing network via Ethernet, Power over Ethernet or WiFi. Each logger contains a 10-year battery and onboard memory for recording a wide range of variables at the point of measurement. With autonomous power and recording capacity, data

is immune to network and power interruptions.

The DL4000 data loggers can be used with Vaisala software, either viewLinc or vLog, to download, display, and analyze environmental data. The viewLinc monitoring system provides 24/7 multi-stage alarm notification, remote, real-time monitoring and gap-free data. The vLog software is a simple solution for validation/mapping applications.

All reports are customizable and can be exported to spreadsheets and PDF to provide records that meet the requirements of 21 CFR Part 11 and Annex 11.

Choose the DL4000VL data logger for GxP-compliant environments and the DL4000SP for non-GxP applications.

# Technical Data

## General

Size	85 x 59 x 26 mm (3.4 x 2.3 x 1") 76 g (2.7 oz)
Operating Range	-40 °C to +85 °C (-40 °F to +185 °F) and 0 %RH to 100 %RH (non-condensing)
Interfaces	RS-232 serial USB Wifi module Ethernet and Power over Ethernet (vNet)
Mounting	Magnetic strips, 3M Dual Lock™ fasteners
PC Software	Graphing & Reporting: vLog SP for non-GxP regulated vLog VL for GxP regulated Monitoring, Alarming, Reporting: viewLinc™
Internal Clock	Accuracy ±1 min./month @ -25 °C to +70 °C (-13 °F to +158 °F)
Electromagnetic Compatibility	FCC Part 15 and CE EN 55022:2006 EN 61000-4-2:2001 EN 61000-4-3:2006
Power Source	Internal 10-year lithium battery (Battery life specified with sample interval of 1 min. or longer)

## Memory

Memory Type	Non-volatile EEROM
Data Sample Capacity	120,000 12-bit samples
Memory Modes	User-selectable wrap (FIFO) or stop when memory is full. User-selectable start and stop times.
Sampling Rates	User-selectable from once every 10 seconds to once a day. (Battery life specified with sample interval of 1 min. or longer)
Recording Span	Recording span depends upon sample interval selected and number of channels enabled. Please see table above.

## Recording Span

SAMPLE INTERVAL	1	2	3	4
10 seconds	13.8 days	6.9 days	4.6 days	3.4 days
1 minute	2.7 months	1.3 months	27.7 days	20.8 days
5 minutes	1.1 years	6.9 months	4.6 months	3.4 months
15 minutes	3.4 years	1.7 years	1.1 years	10.4 months
1 hour	13.6 years	6.8 years	4.5 years	3.4 years

## Current Loop and Voltage Inputs

INPUT TYPE	CURRENT LOOP	ANALOG VOLTAGE
Available Ranges	0 to 20mA	0 to 5 VDC, 0 to 10 VDC
Resolution	5.5 µA	0.025 % F.S.
Accuracy	±0.15 % F.S. at +25 °C (+77 °F)	±0.15 % F.S. at +25 °C (+77 °F)
Input Impedances	75 Ohms	>1 MOhm
Isolation	One common per logger	One common per logger
Overload	40 mA max. (reverse- polarity protected)	±24 VDC max. (reverse- polarity protected)

## Channel Configurations

MODEL	1, 2 OR 4 CHANNELS
4000-405	0 to 5 VDC
4000-40A	0 to 10 VDC
4000-40C	0 to 20 mA

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## Vaisala Thermocouple Data Logger Series DL1700



### Applications

- Ideal for extreme temperatures from -240 °C to 1760 °C
- Accepts type J, K, T, E, R and S thermocouples
- No programming or complicated equations required
- Highly accurate replacement for bulky data acquisition systems
- NIST-traceable calibration

The Vaisala DL1700 series data loggers provide highly accurate temperature data acquisition and are ideal for demanding environments. The DL1700 data loggers can be used with Vaisala software, either viewLinc or vLog, to download, display, and analyze environmental data. The viewLinc monitoring system provides 24/7 multi-stage alarm notification, remote, real-time monitoring and gap-free data. The vLog software is a simple solution for validation/mapping applications. All reports are customizable and can be exported

to spreadsheets and PDF to provide records that meet the requirements of 21 CFR Part 11 and Annex 11.

Easy to use with standard thermocouples, these compact data loggers can offer up to five channels of data in temperatures ranging from -240 °C to +1760 °C.

We offer models for both validated and non-validated applications. Choose the DL1700VL for GxP-compliant environments and the DL1700SP for non-validated applications.

# Technical Data

## General

Size	3.4 x 2.1 x 1" (85x59x26mm); 60g (2.7 oz)
Operating Range	-40 °C to +85 °C (-40 °F to +185 °F) and 0 %RH to 100 %RH (non-condensing)
Interfaces	RS-232 serial, USB, Ethernet, WiFi network interface available
Mounting	Magnetic strips, 3M Dual Lock™ fasteners
Software	viewLinc for Monitoring, Alarming & Reporting vLog for Validation/Mapping GxP environments Spectrum for graphing & reporting non-GxP environments
Internal Clock	Accuracy: ±1 min./month at -25°C to +70°C
Electromagnetic Compatibility	FCC Part 15 and CE
Power Source	Internal 10-year lithium battery (Battery life specified with sample interval of 1 min. or longer)

## Data Logger Inputs

1700 MODEL	NUMBER OF CHANNELS ENABLED		
	Thermocouple	CJT	Total
1700-54T	4	1	5

Note: One channel is designated for Cold Junction Temperature (CJT) reference using an on-board precision-tolerance thermistor.

## Thermocouple Input Channels

COMPATIBLE THERMOCOUPLE TYPES: J, K, T, E, R, S

INITIAL ACCURACY:

Input Range	Resolution	Initial Accuracy
-7.2 to +55.4 mV	0.016 mV	±0.042 mV @ +25 °C (+77 °F)

INPUT IMPEDANCE: 10M OHMS

Input Range	Resolution	1-Year Accuracy
-7.2 to +55.4 mV	0.016 mV	±0.055 mV @ +25 °C (+77 °F)

Additional error at 3 V/m RF field from

450 MHz ... 580 MHz: ±0.350 mV

And at 3 V conducted RF from 3 MHz ... 80 MHz: ±1.0 mV

## Temperature Accuracy

	TYPE K	TYPE J	TYPE T	TYPE E	TYPE R	TYPE S
Temperature Measurement Range	-220 °C to +1370 °C (-364 °F to +2498 °F)	-130 °C to +900 °C (-202 °F to +1652 °F)	-240 °C to +350 °C (-400 °F to +662 °F)	-110 °C to +740 °C (-166 °F to +1364 °F)	-50 °C to +1760 °C (-58 °F to +3200 °F)	-50 °C to +1700 °C (-58 °F to +3092 °F)
Instrument Temperature Accuracy at mid-range*	±1.3 °C (±2.3 °F)	±1.0 °C (±1.8 °F)	±1.2 °C (±2.2 °F)	±0.70 °C (±1.3 °F)	±4.4 °C (±7.9 °F)	±5.1 °C (±9.2 °F)
Resolution at mid-range	0.37 °C (0.67 °F)	0.29 °C (0.52 °F)	0.34 °C (0.61 °F)	0.20 °C (0.36 °F)	1.3 °C (2.3 °F)	1.5 °C (2.7 °F)

\* Listed accuracies are for data logger only at 25°C (+77°F). They do not include the accuracy of the thermocouple probe or cold junction compensation or electromagnetic interference.

## Cold Junction Temperature Channel

Measurement Range	-40 °C to +85 °C (-40 °F to +185 °F)
Accuracy	±0.25 °C over +20 °C to +30 °C (±0.45 °F over +68 °F to +86 °F) ±0.35 °C over -25 °C to +70 °C (±0.63 °F over -13 °F to +158 °F)

## ACCESSORIES:

Thermocouple probe	EPT-22T-20T
Type	T
Conductors	Copper/Constantan
Operating range	-200°C to 200°C (-328°F to 392°F)
Length	6.096 meters
Error	±1°C to ±1.5%

## Memory

Memory Type	Non-volatile EEROM
Data Sample Capacity	135,165 12-bit samples
Memory Modes	User-selectable wrap (FIFO) or stop when memory is full. User-selectable start time.
Sampling Rates	User-selectable from once every 10 seconds to once a day. (Battery life specified with sample interval of 1 min. or longer)
Recording Span	Recording span depends upon sample interval selected and number of channels enabled.

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## Vaisala Wi-Fi Data Logger HMT140 for Multiple Environmental Parameters



The HMT140 with and without a display.

### Features/Benefits

- Wi-Fi connectivity to Vaisala's Continuous Monitoring system
- Connectivity provided through existing Wi-Fi Access Points
- Autonomous operation and local alarms ensure alerting capability regardless of network connectivity
- Local data storage provides continuous fail-safe operation
- 18-month battery operation
- Vaisala HUMICAP® technology with humidity sensor HUMICAP® 180R
- Interchangeable temperature/RH probe for easy field calibration
- Two inputs available: voltage, current, contact, RTDs or temperature & RH
- Accurate and reliable multi-signal measurements
- Resistant to dust and most chemicals
- Optional LCD display
- Wall-mounted or with remote probes
- NIST-traceable (certificate included)
- Ideal for cleanrooms and other life science applications

The Vaisala HMT140 wireless data logger is designed for humidity, temperature and analog signal monitoring in warehouses, freezer and cryogenic farms, laboratories, blood banks and many other life science applications.

### Performance

The HMT140 incorporates Vaisala HUMICAP® technology to measure relative humidity and temperature accurately and reliably. The Vaisala HUMICAP® sensor is resistant to dust and most chemicals. Alternatively, the HMT140 can connect to Resistance Temperature Detectors (RTDs), Voltage, Current and Contact sensors, making the HMT140 the most versatile Vaisala data logger for life science applications. Combining RTD and contact inputs, the HMT140 is ideal for monitoring chamber/door excursions.

Using Wi-Fi connectivity, the HMT140 can connect through any wireless access point. The battery powered logger can operate for 18 months continuously, or longer if using the batteries only as backup to an optional external power source.

Optional local display allows the HMT140 to indicate process parameter values and any limit warnings. All data is logged locally and uploaded to the

Vaisala Continuous Monitoring System (CMS) software at preset intervals and during parameter excursions.

Autonomous operation with audible and visual alarming (beep and flashing LED) ensures that local alerts are indicated independent of active network or server connection.

The data logger's enclosure is optimized for use in cleanrooms with a surface that is easy to clean and tolerates purifying agents.

### Interchangeable Probe

The HMT140 data logger uses a fully interchangeable relative humidity probe. This allows for quick recalibration of the data logger. The probe can be adjusted using one of Vaisala's portable meters as a reference.

### Available Options

The HMT140 data logger is available as wall mounted or with remote probes. For high temperature applications or where space is limited, the remote probe is ideal. The optional LCD display is operated using a power-saving infrared sensor that is motion-activated. When activated, the display indicates the results of selected parameters simultaneously on two rows.

## Technical Data

### Probe Performance

#### HUMICAP® Humidity and Temperature Probe HMP110

RELATIVE HUMIDITY	
Measurement range	0 ... 100 %RH
Accuracy including non-linearity, hysteresis, and repeatability	
Temperature range 0 °C ... +40 °C	
at 0 ... 90 %RH	±1.7 %RH
at 90 ... 100 %RH	±2.5 %RH
Temperature range -40 ... 0 °C, +40 ... +80 °C	
at 0 ... 90 %RH	±3.0 %RH
at 90 ... 100 %RH	±4.0 %RH

Factory calibration uncertainty at +20 °C	±1.5 %RH
Humidity sensor	Vaisala HUMICAP® 180R
Stability	±2 %RH over 2 years
TEMPERATURE	
Measurement range	-40 °C ... +80 °C
Accuracy over temperature range	
at +15 °C ... +25 °C	±0.2 °C
at 0 ... +15 °C and at +25 °C ... +40 °C	±0.25 °C
at -40 °C ... +0 °C and at +40 °C ... +80 °C	±0.4 °C
Temperature sensor	Pt1000 RTD 1/3 Class B IEC 751
HMP110 probe	-40 °C ... +80 °C
Storage temperature range	-50 °C ... +70 °C
Electromagnetic compatibility	EN 61326-1 and EN 55022, Class B

### Analog Inputs

2 Channel Current input signals	0 ... 22 mA
Resolution	0.67 µA
Accuracy	±0.15 % FS. at +25 °C
Input Impedance	62 Ohms
Overload Protection	40 mA
2 Channel Voltage input signals	0 ... 5 V, 0 ... 10 V
Resolution	0.0034% FS.
Accuracy	±0.15 % FS. at +25 °C
Input Impedance	37K Ohms
Overload protection	50 Volts max
Isolation	one common per logger
2 Resistive Temperature input signals	Pt 100 RTD / 4 wire
	Class A IEC 751
	Input Impedance 5.1K Ohms
Measurement range	-196 °C to +90 °C
Accuracy over temperature range	
at -196 ... -90 °C	±2.5 °C
at -90 ... -30 °C	±0.75 °C
at -30 ... 0	±0.5 °C
at 0 ... +50 °C	±0.25 °C
at +50 ... +90 °C	±0.75 °C

Open/Closed with magnetic reed switch cable connections  
(Dry Contact)

### Mechanics

Operating Temperature Range	
Data logger body, no display	-40°C...+60°C
Data logger body, with display	-20°C...+60°C
Material	
Data logger housing	PBT plastic
Display window	PC plastic
HMP110 probe body	Stainless steel (AISI 316)
HMP110 probe grid filter	Chrome coated ABS plastic
Housing classification	IP65 (NEMA 4)
Connections	
Screw terminals	26 AWG ... 20 AWG

HMP110 probe interface	4-pin M8 female panel connector
HMP110 probe cable lengths	3 m, 5 m and 10 m
RTD Temperature Sensor	
Sensor tip material	Stainless steel (AISI 316)
Sensor tip length	50.8 mm
Sensor tip diameter	4.76 mm
Cable length	5 m
Hermetic Door Switch Sensor	
Cable length	7.6 m
Display (optional)	128 x 64 resolution full graphics B&W display without backlight
Weight (with battery/without probe)	300g

### Accessories

HMP110	
Humidity and temperature probe	HMP110*
Humidity and temperature replacement probe	HMP110R*
Humidity sensor	HUMICAP® 180R
Probe mounting flange	226061
Probe mounting clamps, 10 pcs	226067
Sensor protection	
Plastic grid filter	DRW010522SP
Plastic grid with membrane filter	DRW010525SP
Stainless steel sintered filter	HM46670SP
Probe cable 3 m	HMT120Z300
Probe cable 5 m	HMT120Z500
Probe cable 10 m	HMT120Z1000
Duct installation kit	215619
OTHER ACCESSORIES	
Optional External Voltage Supply (15 VDC)	236081SP
Batteries (Packs of 3)	236318SP
RTD Temperature Probe 5 m	ASM210644SP
Hermetic Door Switch Sensor Kit	236319SP
Thermal Dampener Blocks	236310SP
Four Dual Lock™ Strips (3"/76mm)	237217SP

\*See separate order form

### Wireless

Networking Standards	IEEE 802.11 b/g
Data Rates	802.11 b: 1, 2, 5.5, 11 Mbps : 802.11 g: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
Frequency Band	2402 ~ 2480MHz
Modulation	802.11 b: DSSS(CCK-11, CCK-5.5, DQPSK-2, DBPSK-1): 802.11g : OFDM
Wi-Fi Security	WEP (128-bit), WPA, WPA2 (Personal)
Output Power	+18dBm(63mW)
Receiver Sensitivity	-85dBm typical
Antenna	Onboard whip
Certifications	FCC, IC, CE, Wi-Fi Alliance, EN61326-1:2006, EN61326-2-3:2006, EN61000-3-2:2006+A1:2009+A2:2009, EN61000-3-3:2008, EN61326-1:2006, MIC R 201-125765, CMIIT ID: 2013DJ7129

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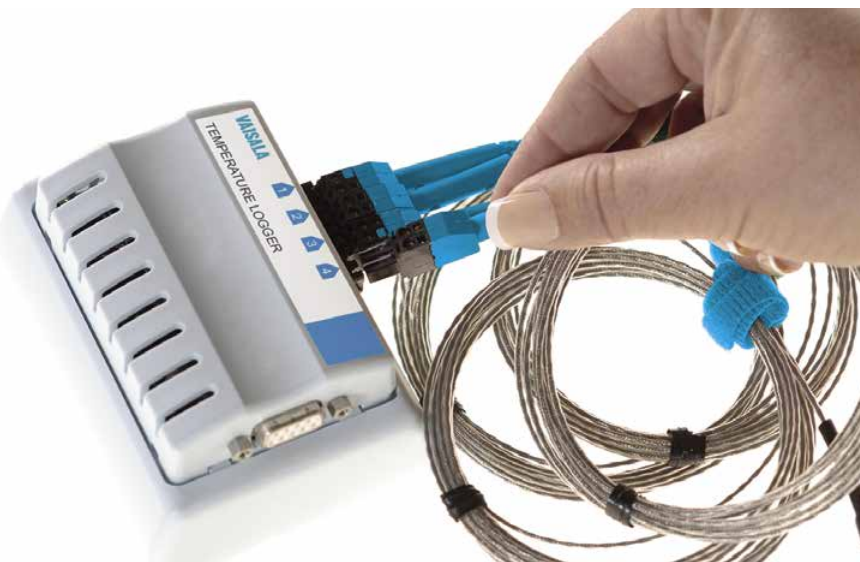
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[www.vaisala.com/requestinfo](http://www.vaisala.com/requestinfo)

## Vaisala Mid-Range Data Loggers for Temperature, Humidity & Contact Channel Measurement



### Designed for Controlled Environments such as:

- Drug Discovery, R&D
- Early Phase Clinical Trials
- Blood & Tissue Banks
- Hospitals & Pharmacies
- Nutraceutical Manufacturing
- Food & Dietary Supplement Applications
- Aerospace
- Semiconductors
- Museums & Archives

Vaisala's Mid-Range data loggers are designed for early phase drug and device development applications where speed and economy are critical. The MR loggers can be used with Vaisala software to monitor and analyze environmental data and provide presentation-quality records that are easily exported to PDF and spreadsheets.

### Simplified Calibration

Easy to install and configure, the MR loggers are calibrated with an abbreviated process that provides reliable accuracy in operating environments between -55 °C to +50 °C.

The MR loggers include NIST-traceable calibration in one of Vaisala's accredited calibration laboratories to ensure cGMP, ISO 9000 and HACCP quality standards. Optional services are available, including extended warranties and onsite calibration.

### Easy Configuration

Connectivity options include USB, wireless, and Power over Ethernet with a vNet PoE network interface. When MR loggers are used with vNet PoE device, installation takes minutes. With the vNet device, loggers are automatically identified on your network by the software.

### Lean Validation

For applications that require validation, we offer efficient and practical protocols that allow for quick verification of data logger functions. See Express IQOQ and Rapid IQOQ under "Accessories" on page 3.

### Software Options

Whether you need multistage alarming sent via text, email, PC display or dial-out, or to perform a comprehensive mapping study, Vaisala has user-friendly software designed for use in regulated environments, including:

- viewLinc Continuous Monitoring and Alarming
- vLogSP for Validation/Mapping applications

### Data Logger Options

Six versions of the MR Loggers are available with up to four channels of Temperature-Only, Temperature + Humidity, or Boolean contact channel for door switches/alarm contact recording:

- DL1000MR - 1 internal temperature channel
- DL1016MR - 2 channel temperature with probes
- DL1016MRB - 2 channel with 1 temperature probe, and 1 contact input
- DL1416MR - 4 channel temperature with probes
- DL1416MRB - 2 channel temperature with probes, and 2 contact inputs
- DL2000MR - 2 internal channels Temperature and RH

# Technical Data

## General

Size	85 x 59 x 26 mm (3.4 x 2.3 x 1") 76 g (2.7 oz.)
Interfaces	RS-232 serial    Ethernet USB                WiFi vNet PoE network interface
Mounting	Magnetic strips 3M Dual Lock™ Fasteners Snap-in connector for secure probe connections
Software	<ul style="list-style-type: none"> <li>• vLog Validation/Mapping</li> <li>• viewLine Continuous Monitoring &amp; Alarming</li> <li>• OPC Server to add Vaisala loggers to any OPC compatible monitoring system</li> </ul>
Internal clock accuracy	±1 min. /month 0 °C to +50 °C (32 °F to +122 °F)
Electromagnetic compatibility	FCC Part 15 and CE
Power source	Internal 10-year lithium battery <sup>1</sup>

<sup>1</sup>Battery life specified with sample interval of 1 min. or longer

## Memory

Data Sample Capacity	
DL1000MR	48,100 12-bit samples
DL1016MR/MRB	68,600 16 bit samples
DL1416MR/MRB	101,375 16 bit samples
DL2000MR	122,197 12-bit samples
Memory type	Non-volatile EEPROM
Memory Mode	User-selectable wrap (FIFO) or stop when memory is full
Sampling Rates	User-selectable rates from once every 10 seconds to once per day (Battery life specified with sample interval of 1 min. or longer)

## Temperature Sensors

Internal Sensor type	Precision-tolerance epoxy encapsulated NTC thermistor
EXTERNAL TEMPERATURE PROBES	
Sensor Tip	Stainless Steel
Diameter	3.2 mm (1/8")
Length	38 mm (1.5")
PROBE CABLE LENGTHS	
DL1016MR/MRB	3 m (10')
DL1416MR/MRB	7.6 m (25')
CABLE CONSTRUCTION	
2 mm (0.07") Diameter, Teflon coated cable	

### DL1000MR Internal Temperature Sensor

#### RANGE AND ACCURACY

Logger Operating Range	-35 °C to +85 °C (-31 °F to +185 °F)
Calibrated Measurement Range	-25 °C to +70 °C (-13 °F to +158 °F)
Accuracy over temperature range <sup>2</sup> at -25 °C ... +70 °C (-13 °F ... +122 °F)	±0.5 °C (±0.9 °F)
Resolution	0.02 °C at +25 °C (0.04 °F at +77 °F)

### DL1016/1416MR External Temperature Sensors

#### RANGE AND ACCURACY

Logger Operating Range	0 °C to +50 °C (32 °F to +122 °F)
Probe Operating Range	-95 °C to +70 °C (-139 °F to +158 °F)
Calibrated Measurement Range	-55 °C to +50 °C (-130 °F to +122 °F)
Accuracy over temperature range <sup>3</sup> at -55 °C ... +50 °C (-67 °F ... +122 °F)	±0.5 °C (±0.9 °F)
Resolution	0.01 °C at +25 °C (0.02 °F at +77 °F)

<sup>2</sup>Initial accuracy includes all known influence quantities present at the time of calibration including calibration uncertainty, mathematical fit, data logger resolution, hysteresis and reproducibility.

Not included is any drift related to atypical contamination or misuse.

<sup>3</sup>Specification for external channels is for a probe calibrated to the specified channel of the data logger, with the logger at 0 °C to +50 °C (32 °F to +122 °F)

### DL2000MR Internal Temperature/ RH Sensor

#### TEMPERATURE RANGE AND ACCURACY

Operating Range	-35 °C to +85 °C (-31 °F to +185 °F)
Calibrated Measurement Range	-25 °C to +70 °C (-13 °F to +158 °F)
Accuracy over temperature range <sup>2</sup> at -25 °C ... +70 °C (-13 °F ... +122 °F)	±0.5 °C (±0.9 °F)
Resolution	0.02 °C at +25 °C (0.04 °F at +77 °F)

#### RELATIVE HUMIDITY RANGE AND ACCURACY

Calibrated Measurement Points	45 %RH at +10 °C (+50 °F) 10 %RH and 80 %RH at +25 °C (+77 °F) 45 %RH at +25 °C (+77 °F) 45 %RH at +45 °C (+113 °F)
Operating Range	0 %RH to 100 %RH (non-condensing)
Temperature range	+20 °C ... +30 °C (68 °F ... 86 °F)
Temperature range	-20 ... +20 °C, +30 ... +70 °C (-4 °F ... 68 °F, 86 °F ... 158 °F)
Resolution	0.05 %RH
Humidity sensor	Vaisala HUMICAP® 180R
Stability	±2 %RH over 2 years

### Accessories

#### TEMPERATURE PROBE

EPT-TDB: Thermal Dampening Block, for use in refrigerators and freezers. The block simulates a glycol bottle to reduce alarms generated by opening and closing doors.

#### BOOLEAN CONTACT CABLES

EPT-DS-25 Available cable with magnetic contact switch – 7.6 m (25') for use with MRB loggers.

#### VALIDATION DOCUMENTS

VL-VPE-VLNC-43 Express Validation	IQ is eight tests, OQ is eleven tests. Testing includes security testing for users.
VL-VPR-VLNC-43 Rapid Validation	IQ is eight tests, OQ is six tests. Only tests that challenge the basic operation of GxP processes (i.e.: alarming and data collection).

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# Calculate and Convert.

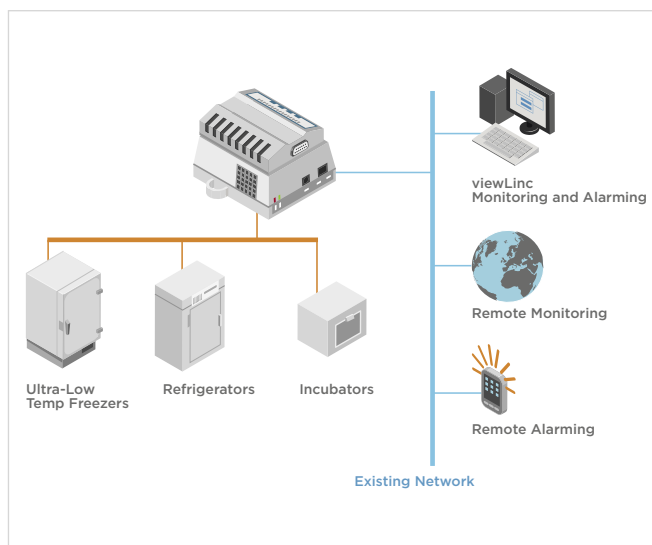
The free web based Vaisala Humidity Calculator allows you to calculate several humidity parameters from one known humidity value. Make unit conversions on the fly, and see the effects of changing ambient conditions, like temperature and pressure.

The calculator works with any device, PC or mobile, and online and offline. It is available in several languages.

Access the Vaisala Humidity Calculator at [www.vaisala.com/humiditycalculator](http://www.vaisala.com/humiditycalculator)

VAISALA / Humidity Calculator 5.0		
English		
°C		
Ambient conditions		
Temperature	21	°C
Pressure	1013.3	mbar
Gas type	Air	
Psychrometer	Standard	
Fill in the known parameter to calculate other values		
Relative humidity (RH)	20	%RH
Dewpoint	-2.8084	°C
Parts per million (ppm)	4949.6	PPMvol
Absolute humidity (a)	3.6761	g/m³
Mixing ratio (x)	3.0785	g/kg
Water content (w)	233.82	lb/MMscf
Vapor pressure (pw)	4.9905	mbar
Wet bulb	10.032	°C
Enthalpy	28.944	kJ/kg
Frostpoint	-2.4825	°C
Saturation vapor pressure (pws)	24.862	mbar
Specific Volume	0.83489	m³/kg
Density	1.1978	kg/m³

## Vaisala vNet Power over Ethernet Data Logger Interface



*vNet Power over Ethernet interface with VL-2000 temperature and humidity logger.*

### Benefits

- Eliminates the cost of wiring AC power to each monitored point.
- Data loggers can be installed wherever a LAN cable can be run.
- Increased data communication protection from power outage because the server room's UPS can provide backup power.
- Plug and Play connectivity when using viewLinc Aware function.

Wherever reliable network communications and cost are important, more companies are using Power over Ethernet (PoE) devices. The Vaisala vNet PoE network interface brings easy connectivity with data loggers at a lower cost than alternative networking devices.

The snap-in design streamlines logger connectivity into a small footprint, eliminating wires between normally separate loggers and PoE devices. When power and data are carried over the same cable, you can also eliminate the cost of installing an AC power source.

The vNet PoE integrates VL and SP data loggers without compromising their high accuracy. It brings greater flexibility and simplicity to deploying the Vaisala Continuous Monitoring system.

The viewLinc Aware function in viewLinc monitoring software allows you to quickly configure data loggers,

alone or in batches. Simply place data loggers in a vNet cradle, connect to a Local Area Network, and viewLinc discovers and configures loggers.

The vNet PoE interface comes in four models:

- CDL-VNET-P with a fan inside the cradle for data loggers with an internal temperature channel
- CDL-VNET-LP without a fan for data loggers without an internal temperature channel
- CDL-VNET-PC with 15V output to power external sensors and transmitters; includes internal fan
- CDL-VNET-LPC with 15V output to power external sensors and transmitters; without internal fan

There is also an option to power the vNet device with AC. Select the model that fits your application to monitor and record temperature, humidity, CO<sub>2</sub>, differential pressure, door switches and many other parameters.

# Technical Data

## vNet PoE Interface

	FEATURE
Logger Compatibility	v6.00 hardware and higher (Includes Models: VL & SP 1000, 1700, 1200, 1016, 1416, 1400, 2000, 4000)
Ethernet Connectivity	IEEE 802.3af, 10Base-T
Connectivity Cable	Category 5/5e; RJ-45 connector; 1.83 m (6 ft.)
LED Indicators	link, activity, power, logger communications
Device Configuration	HTTP Web Interface, PC-based configuration wizard
Addressing	DHCP/RARP, ARP-Ping, Static IP for IP address assignment, Net BIOS name
Firmware	Field upgradable firmware
viewLinc Aware	Requires one vNet to be programmed with the viewLinc server IP address. Other vNets on the sub-net will automatically self-configure
Power Consumption	
CDL-VNET-P & CDL-VNET-LP	625 mW typical, 700 mW max
CDL-VNET-PC & CDL-VNET-LPC	900 mW typical, 1.35 W max.
Power Supply (Included but not required when using PoE)	
	North America: 12 VDC/0.5 A max out, 120 VAC in
	International: 12 VDC/1.66A max out, 100-240 VAC in

Power Input (Optional for use without PoE)  
12-30 VDC, plugs into vNet jack labeled 12 V

Power Output  
CDL-VNET-P & CDL-VNET-LP Not available  
CDL-VNET-PC & CDL-VNET-LPC 15 VDC nominal, 350 mW max.

Regulatory FCC Class A, CE, EN 55011, Group 1, Class A;  
EN 16000-4-2 to -6, RoHS; WEEE

Heating Effect on Measurements  
CDL-VNET-P & CDL-VNET-PC Temperature rise from electronics  
(important only for loggers with  
internal sensors): less than 0.05 °C  
as seen by the logger sensor  
CDL-VNET-LP & CDL-VNET-LPC Not to be used for loggers  
with internal sensors.

Environmental Operating Range  
-25 °C to 70 °C (-13 °F to 158 °F), 0 to 90 %RH  
non-condensing and not to exceed  
a mixing ratio of 38.5 g/kg  
Storage: -40 °C to 85 °C (-40 °F to 185 °F)

Dimensions/ Weight  
Width: 10.2 cm (4.0");  
Length: 10.2 cm (4.0");  
Height: 4.3 cm (1.7");  
Weight: 180 g (6.3 oz)

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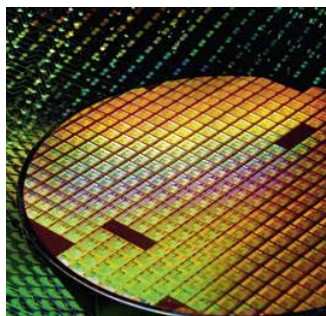
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# Vaisala DRYCAP® Sensor for Measuring Dew Point



*In 1997 Vaisala introduced DRYCAP®, a new type of dew point sensor based on thin-film polymer technology. Since its launch, the DRYCAP product family has grown to encompass a huge range of applications, from drying processes to compressed air and dry chambers. The DRYCAP sensor is particularly renowned for its reliable performance in hot and very dry environments.*

## How It Works

DRYCAP's unrivalled performance is based on two innovations: the proven capacitive thin-film polymer sensor and the auto-calibration function.

The sensor's thin-film polymer absorbs or releases water vapor as the surrounding humidity increases or decreases. The dielectric properties of the polymer change as the humidity around the sensor changes, as does the capacitance of the sensor. Capacitance is converted into a humidity reading. The capacitive polymer sensor is bonded together with a temperature sensor, and dew point is calculated from the humidity and temperature readings.

Vaisala's patented auto-calibration function optimizes the measurement stability at low dew points.

The sensor is heated at regular intervals during the automated auto-calibration procedure. The humidity and temperature readings

are monitored as the sensor cools to ambient temperature, with offset correction compensating for any potential drift. This enables the DRYCAP sensor to deliver accurate measurements in the long term, dramatically reducing the need for maintenance.

## Typical Applications for Dew Point Measurement

Vaisala DRYCAP dew point instruments measure dew point in industrial applications, where gas humidity is typically very low. Dew point is often a critical parameter, with inadequate control resulting in problems such as process downtime, damaged process equipment, and deterioration in end-product quality.

Dew point is measured in various drying and heat-treatment processes. It is also controlled in compressed air, where excess moisture can result in poor end-product quality, ice formation, and equipment corrosion.

## DRYCAP in Brief

- Thin-film polymer sensor with unique auto-calibration function
- Wide measurement range, dew point measurement down to -80 °C (-112 °F)
- Accuracy  $\pm 2$  °C ( $\pm 3.6$  °F)
- NIST-traceable dew point measurement

## DRYCAP's Unique Benefits

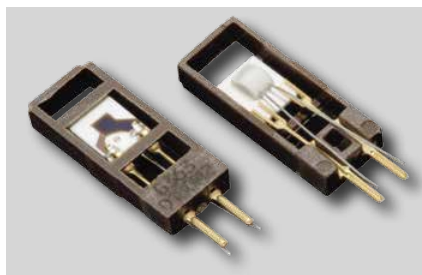
- Excellent long-term stability, with recommended 2-year calibration interval
- Rapid response time
- Withstands condensation and recovers rapidly
- Resistant to particulate contamination, oil vapor, and most chemicals



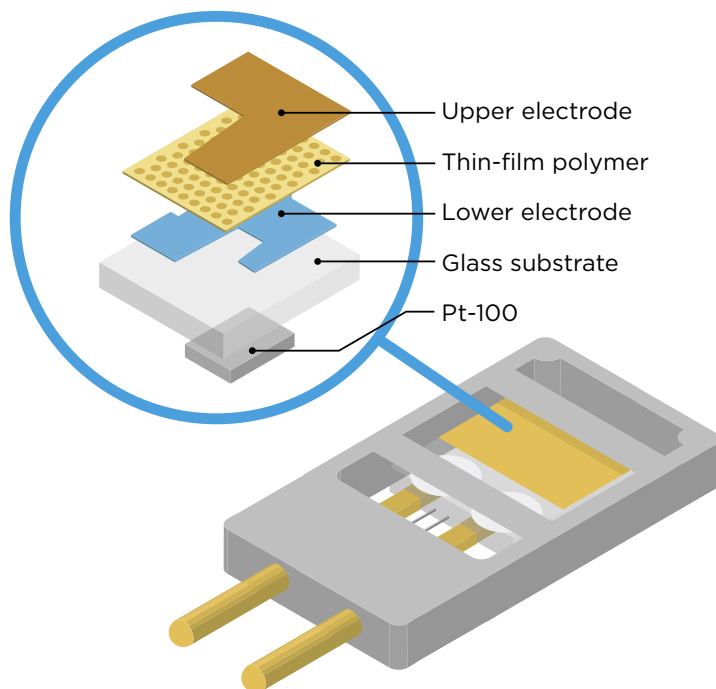
Other typical applications include medical gas, dry environments in lithium battery manufacturing, and gas-insulated high-voltage equipment used in the power industry.

## Vaisala DRYCAP Dew Point Products

Vaisala's dew point instruments are suitable for accurate and stable monitoring of dry conditions in a variety of applications from -80 to +100 °C Td. Vaisala's product range includes transmitters for demanding industrial applications, compact instruments for installation in dryers, and hand-held meters for spot checking. Portable sampling systems are also available. View the complete range of dew point products at [www.vaisala.com/dewpoint](http://www.vaisala.com/dewpoint).



*DRYCAP sensor.*



*Structure of the DRYCAP sensor.*

## The DRYCAP Story

The DRYCAP story began in the mid-1990s following an unresolved measurement challenge. Traditional humidity instruments were not accurate enough at very low humidities, while commonly used aluminum oxide sensors were prone to drift and required frequent calibration. There was strong demand for accurate, easy-to-use, cost-effective, and low-maintenance dew point instruments.

Vaisala's solution was to combine the highest quality polymer technology with a patented key feature – auto-calibration – that would eliminate sensor drift in very dry conditions. The result was the stable, reliable, and accurate DRYCAP sensor.

The first DRYCAP products were launched in 1997, and this highly successful innovation is still going strong today.

DRYCAP also led the way for the next great innovation: the world's first transmitter that monitors both dew point and process pressure simultaneously, aimed at compressed air customers worldwide. The story continues.

# VAISALA

For more information, visit [www.vaisala.com](http://www.vaisala.com) or contact us at [sales@vaisala.com](mailto:sales@vaisala.com)

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## DMT340 Series Dewpoint and Temperature Transmitters for Very Dry Conditions



*The display shows measurement trends, real-time data, and measurement history.*

### Features/Benefits

- Measures dew point from -60 °C to +80 °C (-76 ... +176 °F) with an accuracy of  $\pm 2$  °C ( $\pm 3.6$  °F)
- Vaisala DRYCAP® sensor provides accurate, reliable measurement with excellent long-term stability and a fast response time
- Condensation-resistant
- Unique auto-calibration feature
- Compatible with Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70
- NIST traceable calibration (certificate included)
- Graphical display and keypad for convenient operation
- Optional alarm relays and mains power supply module
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)

The Vaisala DRYCAP® Dewpoint and Temperature Transmitter Series DMT340 is designed for industrial low-humidity applications such as compressed air drying and metal treatment. The transmitters are very reliable, easy to use, and economical to maintain.

### Stability at Low Dew Points

The Vaisala DRYCAP® sensor is immune to particulate contamination, water condensation, oil vapor, and most chemicals. Since the sensor is condensation-resistant, its performance is unmatched in low dew point applications where water spikes occur in the process. The sensor recovers rapidly from contact with free water.

### Unique Auto-Calibration Feature

The stability of the DMT340 series is due to its unique auto-calibration function, developed by Vaisala. This

feature allows the transmitter to perform calibration and adjustment by itself while the measured process is running. If the measurement accuracy is not confirmed, corrections are made automatically. The procedure is so quick and corrections so minor that it causes no disruption, ensuring easy maintenance and high performance. To maintain high performance, transmitters can be sent to Vaisala for calibration. Calibration intervals depend on the application; in normal conditions it is recommended to have calibration performed every two years.

### Graphical Display of Measurement Data and Trends for Convenient Operation

The DMT340 features a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

The optional data logger, with real-time clock, makes it possible to generate over four years of measurement history and zoom in on any desired time or time frame.

The display alarm allows tracking of any measured parameter, with freely configurable low and high limits.

## Versatile Outputs and Data Collection

The DMT340 can support up to three analog outputs; an isolated galvanic power supply and relay outputs are also available.

For serial interface the USB connection, RS232, and RS485 can be used.

DMT340 is also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provides either MODBUS RTU (RS485) or MODBUS

TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the DMT340 to a PC via the service port.

## Easy Installation

DMT340 transmitters are delivered installation-ready, with a variety of installation options to choose from.



*The Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 is ideal for field-checking DMT340 transmitters.*



*The DMT341 is made for installations in dry rooms where the entire dew point transmitter needs to be inside the dry space. The concept is easy to clean and suitable also for cleanrooms.*

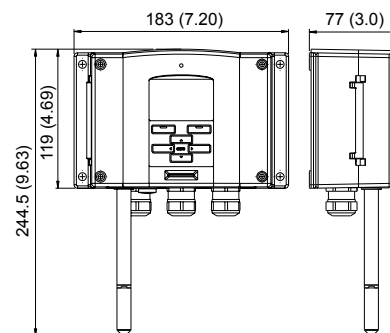
## Specifications

### DMT341 for Installations in Dry Spaces

Temperature range	
Transmitter body	-40 ... +60 °C (-40 ... +140 °F)
With display	0 ... +60 °C (+32 ... +140 °F)

## Dimensions

Dimensions in mm (inches)



*The DMT342 probe is installed using a flange or sampling cell. The small probe is ideal for integration into larger equipment.*

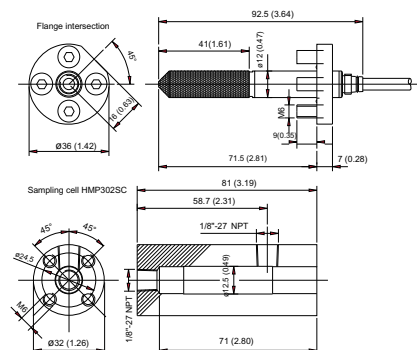
## Probe Specifications

### DMT342 with Small Size Flanged Probe

Pressure range	0 ... 50 bar/0 ... 725 psia
Mechanical durability	up to 250 bar/ 3625 psia
Probe diameter	12 mm/0.5"
Installation	
Flange	36 mm/1.4"
Sampling cell	HMP302SC

## Dimensions

Dimensions in mm (inches)





The DMT344 features a threaded connection for extended pressures with different fitting-body options. It is ideal for permanent installation into pressurized or vacuum processes.

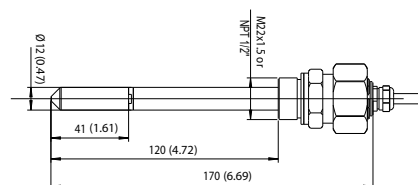
### Probe Specifications

#### DMT344 with Probe for High Pressures

Pressure range	0 ... 50 bar/0 ... 725 psia
Mechanical durability	up to 100 bar/ 1450 psia
Probe diameter	12 mm/0.5"
Installation	
Fitting body	M22 x 1.5
Fitting body	NPT 1/2"

### Dimensions

Dimensions in mm (inches)



The DMT347 probe is ideal for tight spaces with a thread connection. The small probe is installed using Swagelok® connectors.

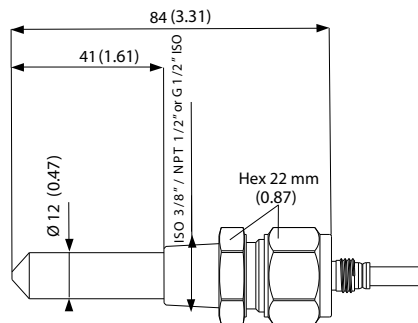
### Probe Specifications

#### DMT347 with Small-Sized Probe

Pressure range	0 ... 10 bar/0 ... 145 psia
Mechanical durability	up to 10 bar/ 145 psia
Probe diameter	12 mm/0.5"
Installation	
Fitting body	R 3/8" ISO
Fitting body	G 1/2" ISO
Fitting body	NPT 1/2"

### Dimensions

Dimensions in mm (inches)



The DMT348 is ideal for installation into pressurized processes where the probe needs to be able to be removed while the process is running. The probe depth is adjustable.

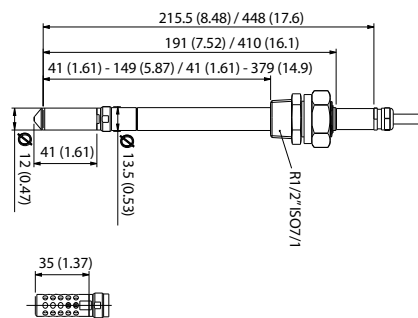
### Probe Specifications

#### DMT348 with Probe for Pipeline Installations

Pressure range	0 ... 40 bar/0 ... 580 psia
Adjustable length	41 ... 149/371 mm/ 1.61 ... 5.87/14.6"
Installation	
Fitting body	R1/2" ISO
Fitting body	NPT 1/2"
Ball-valve set	BALLVALVE-1
Sampling cell	DMT242SC or DMT242SC2

### Dimensions

Dimensions in mm (inches)



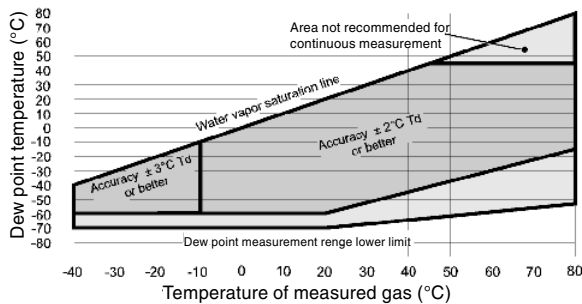
Optional filter for low pressures  
(suitable for all models)

# Technical Data

## Measured Parameters

### DEW POINT

Sensor	Vaisala DRYCAP®180M
Measurement range	-60 ... +80 °C (-76 ... +176 °F) Td
For continuous use	-60 ... +45 °C (-76 ... +113 °F) Td
Accuracy	up to 20 bar/290 psia $\pm 2$ °C/ $\pm 3.6$ °F
	(see the accuracy graph below)
	20 ... 50 bar/290 ... 725 psia additional inaccuracy +1 °C Td



### Dew point accuracy vs. measurement conditions

Response time	63% [90%] at +20 °C gas temperature
Flow rate	1 l/min and 1 bar pressure
-60 ... -20 °C Td (-76 ... -4 °F Td)	5 s [10 s]
-20 ... -60 °C Td (-4 ... -76 °F Td)	45 s [10 min]

### TEMPERATURE

Measurement range	0 ... +80 °C (+32 ... +176 °F)
Accuracy	$\pm 0.2$ °C at room temperature
Temperature sensor	Pt100 RTD Class F0.1 IEC 60751

### RELATIVE HUMIDITY

Measurement range	0 ... 70 %RH
Accuracy (RH < 10 %RH, at +20 °C)	$\pm 0.004$ %RH + 20% of reading
PPM	
Measurement range (typical)	10 ... 2500 ppm
Accuracy (at +20 °C, 1 bar)	1 ppm + 20% of reading
Other measurement parameters available (model-dependent): mixing ratio, absolute humidity, pressure dew point calculated to 1 bar, temperature difference (T-Td), water vapor pressure	

## Operating Environment

Operating temperature	
for probes	-40 ... +80 °C (-40 ... +176 °F)
Mechanical durability	up to +180 °C (+356 °F)
of transmitter body	-40 ... +60 °C (-40 ... +140 °F)
with display	0 ... +60 °C (+32 ... +140 °F)
Storage temperature range	-55 ... +80 °C (-67 ... +176 °F)
Pressure range for probes	see probe specifications
Sample flow rate	no effect
Measured gases	non-corrosive gases
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Industrial environment
Note: Transmitter with display test impedance of 40 ohm is used in IEC61000-4-5 (Surge immunity)	

## Inputs and Outputs

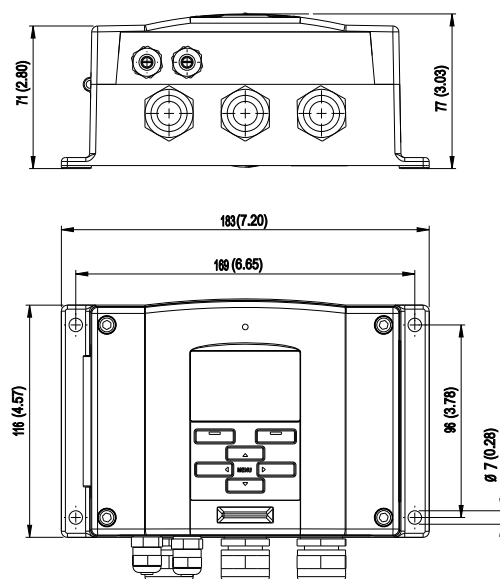
Operating voltage	10 ... 35 VDC, 24 VAC $\pm 20$ %
with optional power supply module	100 ... 240 VAC 50/60 Hz
Power consumption @ 20 °C (U <sub>in</sub> 24VDC)	
RS232	max. 25 mA
U <sub>out</sub> 2 x 0...1V / 0...5V / 0...10V	max. 25 mA
I <sub>out</sub> 2 x 0...20 mA	max. 60 mA
display and backlight	+ 20 mA
during sensor purge	max. + 110 mA
Analogue outputs (2 standard, 3rd optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy of analogue outputs at 20 °C	0.05% full scale
Temperature dependence of the	
analogue outputs	$\pm 0.005$ %/°C full scale
External loads	
current outputs	R <sub>L</sub> < 500 ohm
0 ... 1V output	R <sub>L</sub> > 2 kohm
0 ... 5V and 0 ... 10V outputs	R <sub>L</sub> > 10 kohm
Max. wire size	0.5 mm <sup>2</sup> (AWG 20) stranded wires recommended
Digital outputs	RS232, RS485 (optional)
Service connection	RS232, USB
Relay outputs	0.5 A, 250 VAC, SPDT (optional)
Ethernet interface (optional)	
Supported standards	10/100Base-T
Connector	RJ45
Protocols	Telnet
WLAN interface (optional)	
Supported standards	802.11b
Antenna connector type	RP-SMA
Protocols	Telnet
Security	WEP 64/128, WPA
Authentication / Encryption	
Open / no encryption	
Open / WEP	
WPA Pre-shared key / TKIP	
WPA Pre-shared key / CCMP (a.k.a. WPA2)	
Optional data logger with real-time clock	
Logged parameters	max. three with trend/min./max. values
Logging interval	10 sec. (fixed)
Max. logging period	4 years, 5 months
Logged points	13.7 million points per parameter
Battery lifetime	min. 5 years
Display	LCD with backlight, graphical trend display of any parameter
Menu languages	English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish

## Mechanics

Cable bushing	M20x1.5 for cable diameter 8 ... 11mm/0.31 ... 0.43"
Conduit fitting	1/2" NPT
User cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft.) black cable
option 2	female plug with screw terminals
USB-RJ45 Serial Connection Cable	219685
Probe cable diameter	5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m
	(Additional cable lengths available, please see order forms for details)
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 66
	IP65 (NEMA4X) with local display
Weight	
depending on selected probe, cable and modules	1.0 – 3.0 kgs

## Dimensions

Dimensions in mm (inches)



DRYCAP® is a registered trademark of Vaisala.

# VAISALA

Vaisala takes pride in professional and comprehensive specifications that are based on scientific test methods and known standards. The accuracy specification takes into account repeatability, non-linearity, and hysteresis, and is given for the full measurement range, unless otherwise stated. This means our customers get truly reliable information with no gaps, helping them make the right decisions.



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TYPE APPROVED PRODUCT  
CERTIFICATE NO.: A-13529

[www.vaisala.com/requestinfo](http://www.vaisala.com/requestinfo)



# You Compress Air. We Make Sure It's Dry.

Optimize your compressed air quality  
with the right dew point instrument

Fastest wet-to-dry response  
time on the market - just minutes



Product range from  $-80^{\circ}\text{C}$  to  
 $+60^{\circ}\text{C}$  Td with  $\pm 2^{\circ}\text{C}$  accuracy



Long, 2-year  
calibration interval



High resistance to contamination  
- immune to compressor oil



Complete recovery from  
saturated conditions



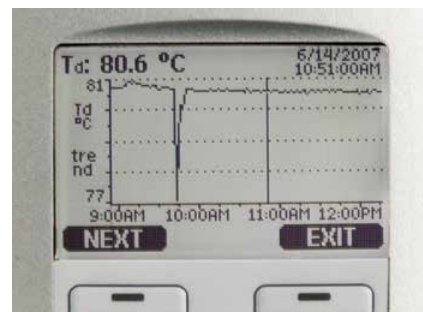
For more information, please visit:

[www.vaisala.com/compressedair](http://www.vaisala.com/compressedair)

[www.vaisala.com/compressedair](http://www.vaisala.com/compressedair)  
[sales@vaisala.com](mailto:sales@vaisala.com)

# VAISALA

## DMT345 and DMT346 Dewpoint Transmitters for High Temperature Applications



*The large graphical display allows the user to check data at a glance.*

*Vaisala DRYCAP® Dewpoint Transmitters DMT345 and DMT346 are designed to measure and control humidity, especially in dry environments with high temperatures.*

The Vaisala DRYCAP® Dewpoint Transmitters DMT345 and DMT346 are designed for humidity measurement in industrial drying applications with particularly high temperatures.

Both transmitters incorporate the Vaisala DRYCAP® sensor, which is accurate, reliable, and stable. The sensor is condensation-resistant and is immune to particulate contamination, oil vapor, and most chemicals. The DRYCAP® sensor is notable for its swift response time and rapid recovery after getting wet.

### Measure Humidity Directly in Hot Processes

The DMT345 and DMT346 are built for direct measurement in hot processes. Therefore, there is no need for sampling systems and trace heating. As a result, high measurement accuracy and constancy are maintained.

The accuracy and stability of the DMT345 and the DMT346 are due to their unique auto-calibration function, developed by Vaisala. This feature allows the transmitter to perform calibration and adjustment by itself while the measured process is running. If the measurement accuracy is not confirmed, corrections are made automatically. The procedure is so quick and corrections so minor that it causes no disruption, ensuring easy maintenance and high performance. In normal conditions, it is recommended to have a traceable calibration performed once a year.

### DMT345: Accurate in Hot and Dry Environments

The DMT345 is designed for accurate humidity measurement in hot and dry conditions. This model provides unmatched dry-end measurement accuracy at temperatures up to 140 °C; however, it can operate safely at temperatures up to 180 °C.

### Features/Benefits

- The DMT345 measures humidity at temperatures up to 180 °C (356 °F)
- The DMT346 measures humidity at temperatures up to 350 °C (+662 °F)
- Dew point accuracy  $\pm 2$  °C ( $\pm 3.6$  °F)
- Vaisala DRYCAP® sensor provides accurate and reliable measurement with excellent long-term stability and fast response time
- Condensation-resistant
- Unique auto-calibration feature
- NIST traceable calibration (certificate included)
- Graphical display and keypad for convenient operation
- Optional alarm relays and mains power supply module
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)

The stainless steel probe is especially designed for high temperatures and has an optional installation flange for easy adjustment of the probe's installation depth and, therefore, more precise positioning.

### DMT346: Reliable in Very Hot Processes

The DMT346 provides the best measurement performance at process temperatures between 140 °C and 350 °C.

The DMT346 includes a cooling set as standard. The cooling effect can be regulated by adding the cooling fins, or they can be removed from the set for optimal measurement performance.

The cooling system has no moving parts, and requires no additional power or cooling utilities, so there is no risk of sensor damage due to mechanical cooling failure.

Additionally, sensor warming minimizes the risk of condensation accumulating on the sensor. In low humidity conditions the combination of auto-calibration and DRYCAP® ensures accurate measurement.

### Graphical Display of Measurement Data and Trends for Convenient Operation

The DMT345 and DMT346 transmitters feature a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

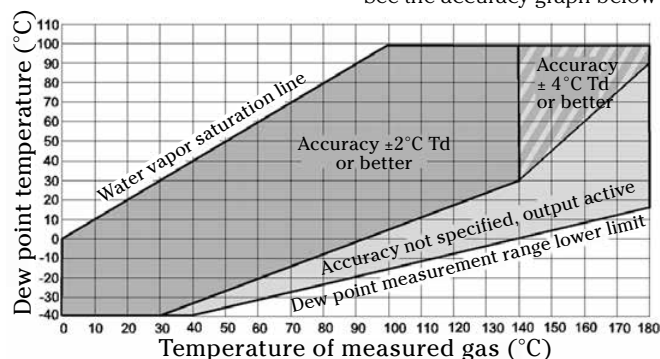
## Technical Data

### Measured Variables DMT345

#### DEW POINT DMT345

Sensor	Vaisala DRYCAP®180S
Measurement range	-40 ... +100 °C (-40 ... +212 °F) Td
Accuracy	±2°C (±3.6 °F) Td

See the accuracy graph below



Dew point accuracy vs. measurement conditions

Response time 63% [90%] flow rate 1 l/min and 1 bar pressure	
from dry to wet	5 s [10 s]
from wet to dry including auto-calibration	45 s [5 min]

The optional data logger, with real-time clock, makes it possible to generate over four years of measurement history and zoom in on any desired time or time frame.

The display alarm allows tracking of any measured parameter, with freely configurable low and high limits.

### Versatile Outputs and Data Collection

DMT345 and DMT346 transmitters can support up to three analog outputs; an isolated galvanic power supply and relay outputs are also available.

For serial interface the USB connection, RS232, and RS485 can be used.

DMT345 and DMT346 are also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provide either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the DMT345/346 to a PC via the service port.

Units are delivered installation-ready.

#### TEMPERATURE DMT345

Measurement range	0 ... +180 °C (+32 ... +356°F)
with sensor warming	upper range limited by humidity (at 80 %RH warming is switched on and T reading not actual process temperature)
Accuracy	±0.4 °C at 100 °C
Temperature sensor	Pt100 RTD Class F0.1 IEC 60751

#### RELATIVE HUMIDITY DMT345

Measurement range	0 ... 100 %RH
with sensor warming	0 ... 80 %RH
Accuracy	
below 10 %RH	±10% of reading
above 10 %RH	±1.5 %RH + 1.5% of reading

#### MIXING RATIO DMT345

Measurement range (typical)	0 ... 1000 g/kg (0 ... 7000 gr/lbs)
Accuracy (typical)	±12% of reading



# Technical Data

## Measured Variables DMT346

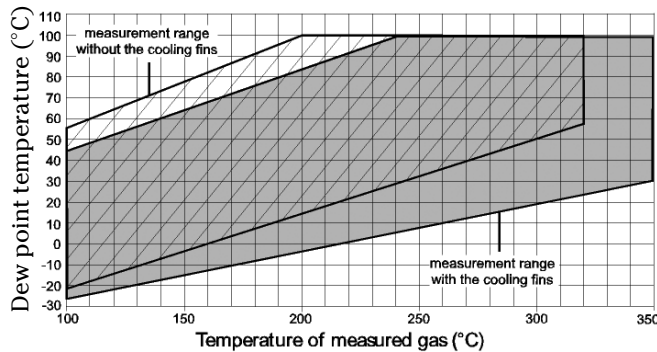
DEW POINT DMT346

Sensor Vaisala DRYCAP®180S

Measurement range -25 ... +100 °C (-13 ... +212 °F) Td

Accuracy  $\pm 2$  °C ( $\pm 3.6$  °F) Td

See the accuracy graph below



*Dew point accuracy vs. measurement conditions*

Response time 63% [90%] flow rate 1 l/min and 1 bar pressure

from dry to wet 5 s [10 s]

from wet to dry including auto-calibration 45 s [5 min]

MIXING RATIO DMT346

Measurement range (typical) 0 ... 1000 g/kg (0 ... 7000 gr/lbs)

Accuracy (typical)  $\pm 12\%$  of reading

## Operating Environment, DMT345 and DMT346

Mechanical durability up to +180 °C (+356 °F) for DMT345  
of probes up to +350 °C (+662 °F) for DMT346

of transmitter body -40 ... +60 °C (-40 ... +140 °F)

with display 0 ... +60 °C (32 ... +140 °F)

Storage temperature range -55 ... +80 °C (-67 ... +176 °F)

Pressure range for probes slight pressure difference (~ 200 mbar)

Measured gases non-corrosive gases

Electromagnetic compatibility Complies with EMC standard  
EN61326-1, Industrial environment

Note: Transmitter with display test impedance of  
40 ohm is used in IEC61000-4-5 (Surge immunity)

## Inputs and Outputs, DMT345 and DMT346

Operating voltage 10 ... 35 VDC, 24 VAC  $\pm 20\%$   
with optional power supply module 100 ... 240 VAC 50/60 Hz

Default start-up time  
initial reading after power-up 3 s  
full operation after sensor purge and autocalibration about 6 min

Power consumption @ 20 °C ( $U_{in}$  24 VDC)

$U_{out}$  2x0 ... 1V/0 ... 5V/0 ... 10V max. 25 mA

$I_{out}$  2x0 ... 20mA max. 60 mA

RS232 max. 25 mA

display and backlight + 20 mA

during sensor purge max. + 110 mA

Analog outputs (2 standard, 3rd optional)

current output 0 ... 20 mA, 4 ... 20 mA

voltage output 0 ... 1 V, 0 ... 5 V, 0 ... 10 V

Accuracy of analog outputs at 20 °C  $\pm 0.05\%$  full scale

Temperature dependence of

analog outputs  $\pm 0.005\%$ /°C full scale

External loads

current outputs  $R_L < 500$  ohm

0 ... 1V output  $R_L > 2$  kohm

0 ... 5V and 0 ... 10V outputs  $R_L > 10$  kohm

Max. wire size 0.5 mm<sup>2</sup> (AWG 20) stranded

wires recommended

Digital outputs RS232, RS485 (optional)

Protocols ASCII commands, MODBUS RTU

Service connection RS232, USB

Relay outputs 2+2 pcs (optional) 0.5 A, 250 VAC, SPDT

Ethernet interface (optional)

Supported standards 10BASE-T, 100BASE-TX

Connector 8P8C (RJ45)

IPv4 address assignment DHCP (automatic), static

Protocols Telnet, MODBUS TCP/IP

WLAN interface (optional) DHCP (automatic), static

Supported standards 802.11b

Antenna connector type RP-SMA

IPv4 address assignment DHCP (automatic), static

Protocols Telnet, MODBUS TCP/IP

Security WEP 64/128, WPA WPA2/802.11i

Authentication / Encryption (WLAN)

Open / no encryption

Open / WEP

WPA Pre-shared key / TKIP

WPA Pre-shared key / CCMP (a.k.a. WPA2)

Optional data logger with real-time clock

Logged parameters max. four with trend/min/max values

Logging interval 10 sec. (fixed)

Max. logging period 4 years, 5 months

Logged points 13.7 million points per parameter

Battery lifetime min. 5 years

Display LCD with backlight, graphical trend display

Menu languages English, Chinese, Finnish, French, German,  
Japanese, Russian, Spanish, Swedish

## Mechanics, DMT345 and DMT346

Cable bushing M20x1.5 for cable diameter  
8 ... 11mm/0.31 ... 0.43"

Conduit fitting (optional) 1/2"NPT

User cable connector (optional) M12 series 8-pin (male)

option 1 female plug with 5 m (16.4 ft.) black cable

option 2 female plug with screw terminals

USB-RJ45 Serial Connection Cable 219685

Probe cable diameter 5.5 mm

Standard probe cable lengths 2 m, 5 m or 10 m  
(Additional cable lengths available, please  
see order forms for details)

Housing material G-AlSi 10 Mg (DIN 1725)

Housing classification IP 66

IP65 (NEMA4X) with local display

Weight

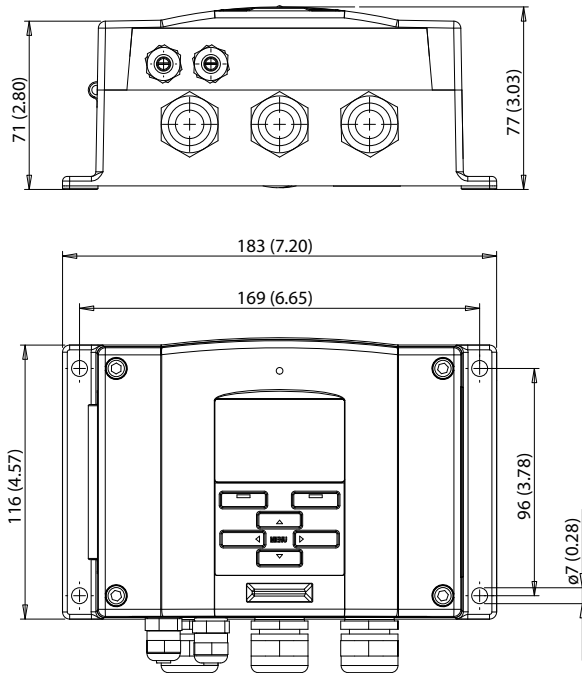
depending on selected probe, cable, and modules 1.0 – 3.0 kgs

# Technical Data

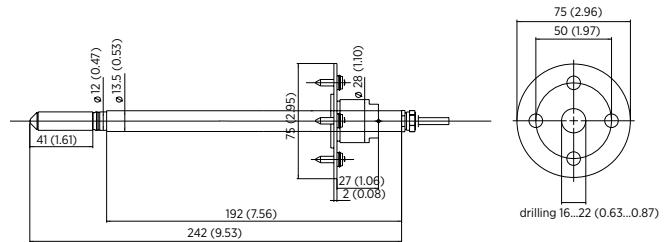
## Dimensions

Dimensions in mm (inches)

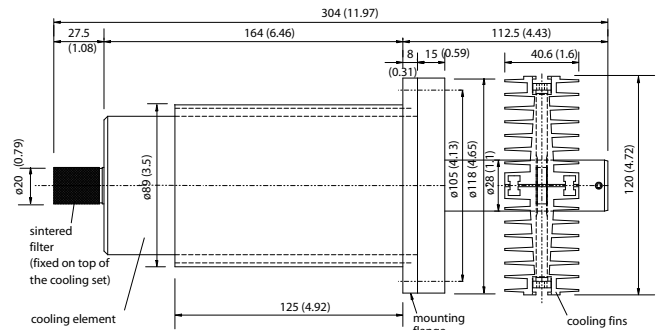
DMT345 and DMT346 transmitter housing



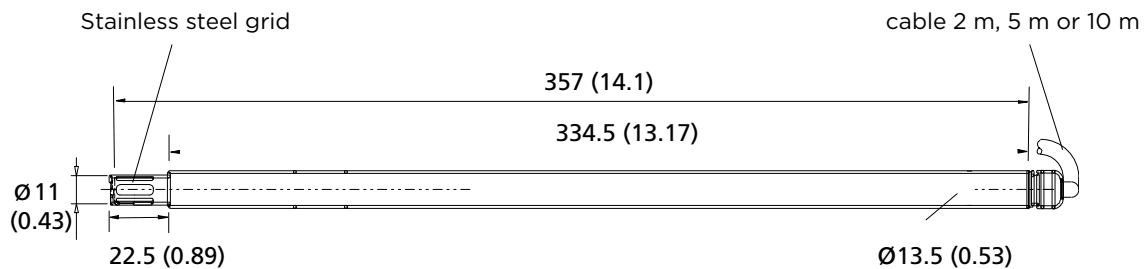
DMT345 probe and mounting flange



DMT346 cooling set



DMT346 probe



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## DMT242 Dewpoint Transmitter for OEM Applications



*Due to its wide measurement range and high long-term stability, the DMT242 is an ideal choice for low dew point industrial applications such as compressed air dryers, plastic dryers and other OEM applications.*

### Vaisala DRYCAP®

The Vaisala DRYCAP® Dewpoint Transmitter DMT242 provides reliable and stable measurements for industrial dryer applications. It is designed for extreme conditions.

DMT242 incorporates the Vaisala DRYCAP® thin film polymer sensor and auto-calibration software. The standard sensor choice for dry gases and desiccant dryers is DRYCAP® 180M and for more humid applications such as refrigeration dryers, a DRYCAP® 180S sensor.

Both the sensors are immune to particulate contamination, water condensation, oil vapor and most chemicals. Because the sensor withstands condensation, its performance is unmatched for low dew point applications that experience process water spikes, such as pipeline condensation during a system failure or start-up.

The auto-calibration software works on-line while the process is running. If the measurement accuracy is not confirmed, corrections are made automatically. The DMT242 adjusts the measurement, corrects dry-end drifts and continues to function. Calibration occurs quickly, and with corrections so minor, it will go unnoticed.

### Compact, Rugged and Intelligent

Due to its compact size, DMT242 is quickly and easily installed in tight spaces.

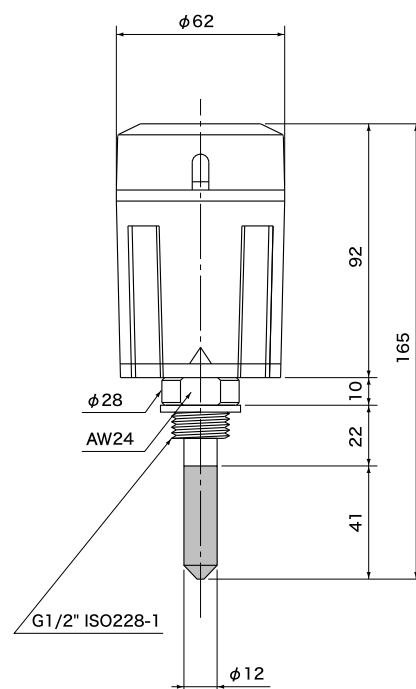
Users can perform a field-check by using the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70. The transmitter can be sent to Vaisala Service for NIST traceable calibration. The recommended calibration interval is every two years.

### Features/Benefits

- Ideal choice for industrial dryer applications
- Incorporates advanced Vaisala DRYCAP® Sensor and enhanced auto-calibration software
- Long-term stability in low dew points
- Fast response time
- Two sensor options cover dew point measurement range from -60 ... +60 °C (-76 ... +140 °F) with an accuracy of  $\pm 2$  °C ( $\pm 3.6$  °F)
- Withstands condensation
- NIST traceable (certificate included)
- Compatible with Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70

### Dimensions

Dimensions in mm (inches)



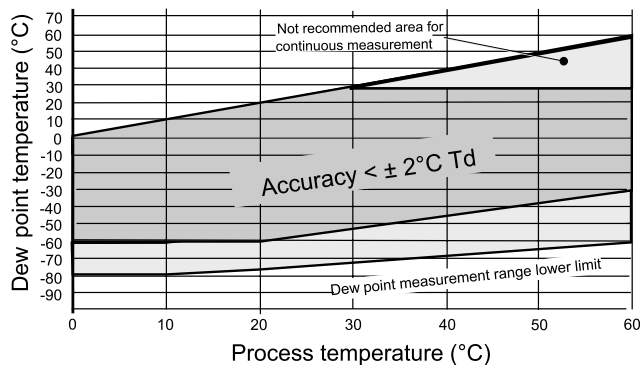
# Technical Data

## Dew Point Temperature

Measurement range (typical)	-60 ... +60 °C (-76 ... +140 °F)
Analog output scalings	
Option A	-80 ... +20 °C (-112 ... +68 °F) $T_d$
Option B	-60 ... +60 °C (-76 ... +140 °F) $T_d$
Option X	free scaling

(when the dew point is below 0 °C (32 °F), the transmitter outputs frost point)

Accuracy with DRYCAP® 180M  $\pm 2$  °C ( $\pm 3.6$  °F)  
(see graph below)



### DEW POINT ACCURACY VS. MEASUREMENT CONDITIONS

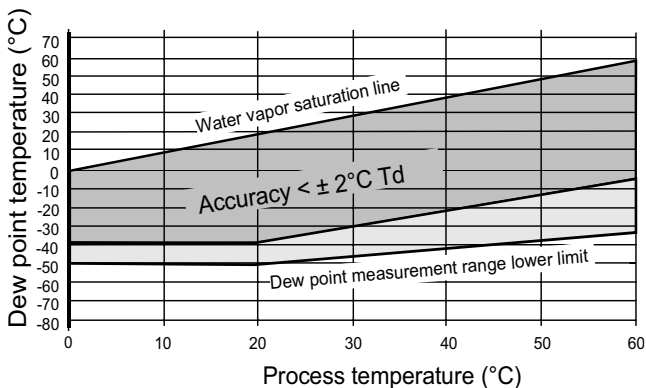
Response time 63 % [90 %] at +20 °C gas temperature

Flow rate >1 l/min and 1 bar pressure

-60 → -20 °C  $T_d$  (-76 → -4 °F  $T_d$ ) 5 s [10 s]

-20 → -60 °C  $T_d$  (-4 → -76 °F  $T_d$ ) 45 s [10 min]

Accuracy with DRYCAP® 180S  $\pm 2$  °C ( $\pm 3.6$  °F)  
(see graph below)



## Operating Environment

Temperature	0 ... +60 °C (32 ... +140 °F)
higher temperature peaks	Short-term OK
Relative humidity	0 ... 100 %RH
Pressure	0 ... 20 bara (0 ... 290 psia)
Sample flow rate	no effect

## Output

Analog output	4 ... 20 mA
Resolution for analog output	$\pm 0.002$ mA
Typical temperature dependence	0.0008 mA/ °C
Serial line for service use	RS232

## General

Sensor	DRYCAP® 180M
Optimal sensor for refrigeration dryers	DRYCAP® 180S
Operating voltage	18 - 35 VDC, 20 - 28 VAC
Power consumption at 24 VDC	max. 220 mA
External load for analog output	max. 500 $\Omega$
Optional connection cable with DMT242 connector	2 m or 10 m
Connector for supply voltage and signal output	
max. wire size	0.75 mm <sup>2</sup>
max. cable diameter	6.5 mm / PG7
Service cable for serial interface RS232	product code DMT242RS

Probe material (wetted parts)	stainless steel (AISI 316L)
Sensor protection	stainless steel sintered filter (HM47280)
Mechanical connection	G½" ISO228-1 thread with bonded seal ring (U-seal)
Electronics housing material	plastic (ABS/PC)
Housing classification	IP65 (NEMA4)
Weight	225 g
Storage temperature range	-40 ... +70 °C, (-40 ... +158 °F)
Complies with the EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements; Industrial environment.	

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## DMT152 Dewpoint Transmitter for Low Dew Point Measurement in OEM Applications



*The small and powerful DMT152 measures dew point down to -80 °C.*

### Features/Benefits

- Compact
- Accurate
- Vaisala DRYCAP® technology with a polymer sensor
- Measures dew point down to -80 °C (-112 °F)
- Reduced maintenance costs due to long calibration interval
- Fast response time
- Withstands condensation
- NIST traceable
- Applications: compressed air, plastics drying, dry chambers, pure gases, and high-voltage circuit breakers

The Vaisala DRYCAP® Dewpoint Transmitter DMT152 is designed for measuring low dew point in OEM applications, even down to -80°C . The excellent long-term stability and reliability of its performance is based on the latest DRYCAP® polymer sensor technology.

### Low Maintenance

The DMT152 mechanics have been designed for harsh environments requiring protection against dust, dirt, and splashed water.

The DRYCAP® technology has a low maintenance need due to its excellent long-term stability and durability against condensation.

### Applications

The DMT152 is an ideal choice for industrial applications where it is necessary to control very low humidity. Most typical areas of use are air and plastics dryers, dry chambers, pure gases, and high-voltage circuit breakers.

The DMT152 measures accurately and reliably also in the challenging combination of low humidity and hot air, which is typical in plastics drying.

# Technical Data

## Measured Variables

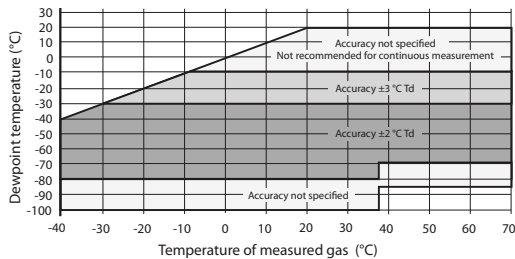
### DEW POINT TEMPERATURE

Measurement range	-80 ... -10 °C (-112 ... +14 °F) T <sub>d</sub>
Accuracy	
-80 ... -30 °C (-112 ... -22 °F)	±2 °C (3.6 °F) T <sub>d</sub>
-30 ... -10 °C (-22 ... +14 °F)	±3 °C (5.4 °F) T <sub>d</sub>
Non-calibrated range	-100 ... -80 °C, -10 ... +20 °C T <sub>d</sub> (-148 ... -112 °F, +14 ... +68 °F T <sub>d</sub> )

### Analog output scalings

option 1	-80 ... +20 °C (-112 ... +68 °F) T <sub>d</sub>
option 2	-100 ... 0 °C (-148 ... +32 °F) T <sub>d</sub>
option 3	user-specified output scaling
when dew point is below 0 °C (32 °F) the transmitter outputs frost point	

### Accuracy over temperature range



Response time 63 % [90 %] at a gas temperature of +20 °C (+68 °F) and pressure of 1 bar

-10 ... -80 °C T <sub>d</sub>	0.5 min [7.5 min]
-80 ... -10 °C T <sub>d</sub>	2 s [5 s]

Typical long-term stability better than 2 °C (3.6 °F) /year

### PPM VOLUME CONCENTRATION

Measurement range (typical)	0 ... 500 ppm
Accuracy at +20 °C (+68 °F), 1013 mbar	±(0.2 ppm + 20 % of reading)

## Operating Environment

Temperature	-40 ... +70 °C (-40 ... +158 °F)
Relative humidity	0 ... 100 %RH (up to +20 °C/68 °F)
Pressure	0 ... 50 bar (725 psia)
Measured gases	non-corrosive gases
Sample flow rate	no effect on measurement accuracy

## Outputs

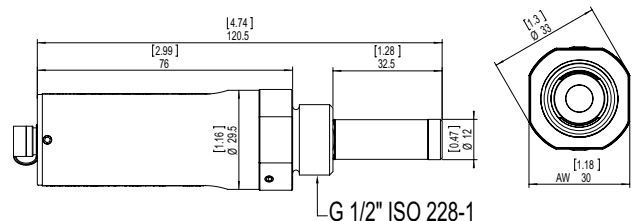
Two analog outputs (scalable)	4 ... 20 mA, 0 ... 20 mA (3 wire) 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs	±0.01 V / ±0.01 mA
Digital output	RS485 (2-wire)
Alarm-level indication by analog signal	user selectable
Purge information	5 V, 10 V, 20 mA or LED

## General

Sensor	Vaisala DRYCAP® 180U
	Thin-film capacitive polymer sensor
Recommended calibration interval	2 years
Operating voltage with RS485 output	11* ... 28 VDC
voltage output	15* ... 28 VDC
current output	21 ... 28 VDC
*For extended temp. down to -40 °C (-40 °F) or pressure up to 50 bar (725 psia), the supply voltage is 21 ... 28 VDC.	
Supply current	
normal measurement	20 mA + load current
during self-diagnostics	max. 220 mA pulsed
Supply voltage fluctuation	max. 0.3 V
External load for	
voltage output	min. 10 kOhm
current output	max. 500 Ohm
Housing material (wetted parts)	AISI316L
Stainless steel mesh filter	Filter body AISI303, mesh AISI316L, grade 18 µm
Mechanical connections	ISO G½", NPT ½", UNF 3/4" - 16"
Housing classification	IP65 (NEMA 4)
Storage temperature range	-40 ... +80 °C (-40 ... +176 °F)
Weight (ISO G½")	190 g (6.70 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirements;	
Industrial environment	

## Accessories

Connection cable for MI70 hand-held indicator	219980
USB cable for pc connection	219690
Sampling cells (available for ISO G½")	
basic sampling cell	DMT242SC
with Swagelok 1/4" male connectors	DMT242SC2
with a quick connector and leak screw	DSC74
two-pressure sampling cell	DSC74B
NW40 flange	225220SP



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## DMT143 Miniature Dewpoint Transmitter for OEM Applications



*The Vaisala DRYCAP® Dewpoint Transmitter DMT143 is an ideal choice for small compressed air dryers, plastic dryers and other OEM applications.*

### Vaisala DRYCAP®

The Vaisala DRYCAP® Dewpoint Transmitter DMT143 is a miniature dew point measurement instrument. The transmitter can be installed directly into pressurized systems at 50 bar (725 psia) maximum pressure. The long-term high performance is achieved with Vaisala DRYCAP® technology.

The sensor fully withstands getting wet, and therefore, the transmitter performs exceptionally well in applications that occasionally experience process water spikes, such as pipeline condensation during a system failure or start-up. The sensor is also highly resistant to particulate contamination, oil vapor and most chemicals, and is insensitive to the flow rate.

### Long Calibration Interval

The calibration interval of the DMT143 is two years. Additionally, the Vaisala

DRYCAP® Hand-Held Dewpoint Meter DM70 can be used to confirm the performance of the DMT143 without disconnecting the transmitter. For any adjustment needs, the transmitter can be sent to Vaisala Service.

The auto-calibration software works on-line while the process is running. If the measurement accuracy is not confirmed, corrections are made automatically.

## Technical Data

### Measured Parameters

DEW POINT TEMPERATURE	
Measurement range(typical)	-70 ...+60 °C (-94 ...+140 °F) T <sub>d</sub>
Analog output scalings	
option 1	-80 ...+20 °C (-112 ...+68 °F) T <sub>d</sub>
option 2	-80 ...+20 °C (-112 ...+68 °F) T <sub>d</sub> dew point at ambient pressure
option 3	free scaling
Accuracy in air or N <sub>2</sub>	±2 °C (±3.6 °F) T <sub>d</sub> (see graph below)
when the dew point is below 0 °C (32 °F), the transmitter outputs frostpoint	

### Features/Benefits

- Miniature size dew point transmitter for e.g. small industrial dryer applications
- Vaisala DRYCAP® technology with auto-calibration
- Calibration interval of two years
- Dew point measurement range -70...+60 °C (-94...+140 °F)
- Accuracy ±2 °C (±3.6 °F)
- Withstands condensation
- Fast response time
- Compatible with Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70
- NIST traceable calibration (certificate included)
- Easy servicing and data transfer via the RS485 user interface
- LED alarm for exceeded dew point level

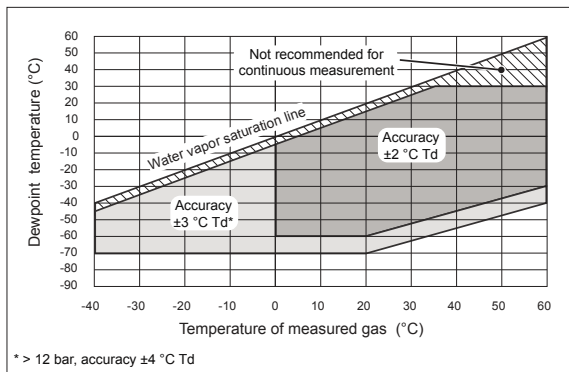
### Easy Installation

The DMT143 has a variety of features to choose from, including different output, installation options and alarm LED.

Due to its small size and light weight, the DMT143 is quickly and easily installed in tight spaces or in small-size pipelines. The alarm LED indicates too high dew point in the process. The trigger point is preset at the factory. It can be later adjusted with the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 or a PC.



# Technical Data



*Dew point accuracy vs. measurement conditions*

Response time 63% [90%] at +20 °C gas temperature and 1 bar pressure

-60 → -20 °C T<sub>d</sub> (-76 → -4 °F T<sub>d</sub>) 5 s [15 s]  
 -20 → -60 °C T<sub>d</sub> (-4 → -76 °F T<sub>d</sub>) 45 s [10 min]

PPM VOLUME CONCENTRATION

Measurement range (typical) 10 ... 40000 ppm  
 Accuracy at +20 °C (+68 °F), 1 bar 1 ppm + 20% of reading

## Operating Environment

Measured gases non-corrosive gases  
 Temperature \*) -40 ... +60 °C (-40 ... +140 °F)  
 Relative humidity 0 ... 100 %RH  
 Pressure \*) 0 ... 50 bar<sub>a</sub> (725 psia)  
 Sample flow rate no effect for measurement accuracy

\*) For extended temperature below 0 °C (+32 °F) or pressure above 20 bar<sub>a</sub> (290 psia) the supply voltage must be 24 ... 28 VDC.

## Outputs

Analog output (scalable) 4 ... 20 mA (3-wire), 0 ... 1 V/5 V, 1 ... 5 V  
 Resolution for current output 0.002 mA  
 Resolution for voltage output 0.3 mV  
 Typical temperature dependence 0.005 % of span / °C  
 Digital output RS-485, non-isolated  
 Vaisala Industrial Protocol  
 Connector 4-pin M8 (IEC 60947-5-2)

## General

Sensor Vaisala DRYCAP® 180D  
 Recommended calibration interval to confirm the specified accuracy 2 years  
 Operating voltage with voltage output 12 ... 28 VDC  
 Operating voltage with current output 18 ... 28 VDC

## Supply current

normal measurement	max 10mA + load current
during self-diagnostics	max. 220 mA pulsed
Load for current output	max. 500 Ohm
Load for voltage output	min. 10 kOhm
Housing material	stainless steel (AISI316L)
Sensor protection	stainless steel sintered filter
Mechanical connection	ISO G1/2" or NPT 1/2
Housing classification	IP66 (NEMA 4)
Storage temperature range	-40 ... +60 °C (-40 ... +140 °F)
Weight	G-thread version 90g (3.2oz) NPT-thread version 100g (3.5oz)

Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements - Industrial environment.

## Accessories

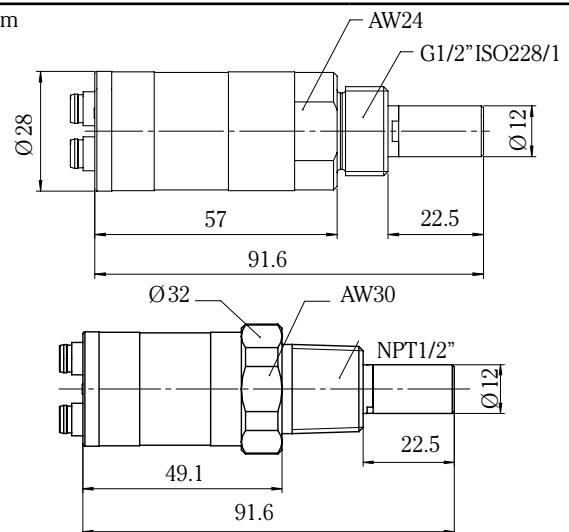
Connection cable for DM70	219980SP
USB connection cable	219690
Sampling cells	
basic sampling cell	DMT242SC
with Swagelok 1/4" male connectors	DMT242SC2
with quick connector and leak screw	DSC74SP
two-pressure sampling cell	DSC74BSP
cooling/venting coil	DMCOILSP

See DM70 / Portable Sampling Systems and Sampling Cells for further information about sampling cells available

Loop powered external display	226476
Loop powered external display with relays	234759

## Dimensions

in mm



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## DMT132 Dewpoint Transmitter for Refrigerant Dryers



### Features / Benefits

- Affordable dew point transmitter for refrigerant dryers
- High accuracy  $\pm 1^{\circ}\text{C}$  ( $\pm 1.8^{\circ}\text{F}$ ) in the measurement range of refrigerant dryers
- Excellent long-term stability - resistant to compressor oil and most other chemicals thanks to HUMICAP® technology
- Low power requirements, 10 ... 28 VDC
- Easy to verify functionality with compatible hand-held meters DM70 or HM70
- Optional LED warning light

*The optional LED warning light tells the user when the defined dew point limit has been exceeded.*

The Vaisala HUMICAP® Dewpoint Transmitter DMT132 is an affordable dew point measurement instrument designed to verify the functionality of refrigerant dryers. It is especially well suited for OEM dryer manufacturers.

### Direct Measurement Cuts Costs

Direct outlet air dew point measurement provides accurate information about dryer functionality and is more reliable than the traditional method of measuring refrigerator temperature only. Knowledge of the real dew point ensures high quality compressed air at all times and enables customers to optimize dryer capacity. This helps to prevent investment in redundant dryer capacity and avoid unnecessary maintenance and costly malfunctions.

### High Accuracy and Long-Term Stability

The DMT132 provides optimal performance in the operating range of refrigerant dryers. In the measurement range of  $-3 \dots 20^{\circ}\text{C}$  ( $+26.6 \dots +68^{\circ}\text{F}$ ), where the refrigerator dryers typically operate, the Td accuracy is  $\pm 1^{\circ}\text{C}$  ( $\pm 1.8^{\circ}\text{F}$ ). The instrument incorporates the proven Vaisala HUMICAP® sensor, which is resistant to compressor oil and most other chemicals, thereby providing excellent long-term stability.

### Quick Installation and Easy Field Checking

It takes just a few minutes to install the DMT132 directly into a dryer or compressed air line through a G1/2" ISO thread. Vaisala sampling cells can also be used. The loop-powered electronics mean that wiring is easy and power requirements are low. The

DMT132 operating voltages can be as low as 10 VDC.

Verifying the performance of the DMT132 is easy with the compatible Vaisala hand-held DM70 or HM70 meters. The user can perform possible adjustments with the Vaisala HMK15 Humidity Calibrator.



*Demand for dew point sensors to verify refrigerant dryers is increasing. Direct dew point measurement enables energy savings and improved efficiency.*

# Technical Data

## Performance

### DEW POINT

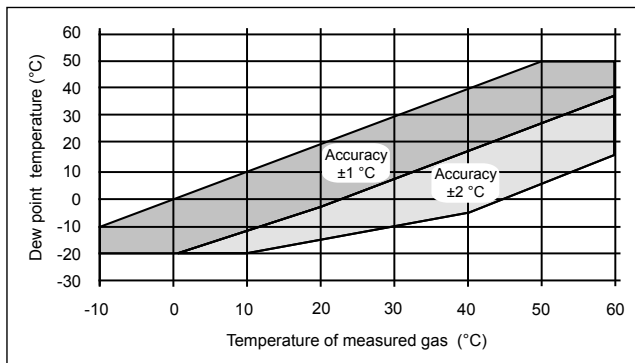
Measurement range	-20 ... +50 °C (-4 ... +122 °F) Td
Accuracy (at +20 °C (+68 °F))	±1 °C for -3...20 °C (+26.6 ... +68 °F) Td ±2 °C for -15...3 °C (+5 ... +26.6 °F) Td see accuracy graph below

\* when dew point is below 0 °C (+32 °F), the transmitter outputs frostpoint

Response time at 20 °C (+68 °F) gas temperature and 1 bar pressure	
-14 → +3 °C (+7 → +37 °F) Td	17 s (63%)
	40 s (90%)
+3 → -14 °C (+37 → +7 °F) Td	33 s (63%)
	85 s (90%)

### CALCULATED VARIABLES

Dew point converted to atmospheric pressure	Tdf atm
---	---------



## Operating Environment

Operating temperature	-10 ... +60 °C (+14 ... +140 °F)
Operating pressure	0 ... 20 bar
Relative humidity	0 ... 100 %RH
Sample flow rate	no effect on measurement accuracy
Measured gases	non-corrosive gases

## Outputs

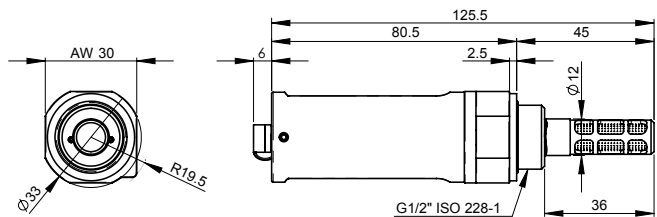
Analog output (scalable)	4...20 mA, 2-wire
Resolution for current output	0.002 mA
Accuracy of analog outputs at +20 °C	±0.05% full scale
Typical temperature dependence	±0.005% of full scale/ °C
Connector	4-pin M8 (IEC 60947-5-2)
LED indication available for defined dew point limit/ error state indication	
RS485 serial line for service use	

## General

Sensor	Vaisala HUMICAP®180R
Recommended calibration interval	2 years
(in refrigerant dryer application)	
Mechanical connection	G 1/2" ISO
Operating voltage	10 ... 28 VDC
External load	max 100 ohm for supply voltages <20 VDC max 500 ohm for supply voltages 20...28 VDC
Weight	65 g (2.3 oz)
Housing material	PPS + 40% GF
Housing classification	IP65 (NEMA 4)
Storage temperature range	-40 ... +80 °C (-40 ... +176 °F)
Start-up time	3 s
Complies with EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirements; Industrial environment	

## Options and Accessories

Tube filter	230602
Special cover set for HMK15 (calibrator fitting DMT132 and HMP60)	230914
NPT Adapter	210662SP
Sample cells	DMT242SC, DMT242SC2, DSC74, DSC74B, DSC74C, DMCOIL
Duct installation flange	DM240FA
Cables (several lengths available)	HMP50Z032, HMP50Z300SP, HMP50Z500SP, HMP50Z1000SP
Loop powered external display	226476
USB Service cable	219690
Connection cable to DM70/HM70	219980
LED plug	230388
ISO" 1/2 plug	218773
NPT1/2" plug	222507
Sealing ring set (3 pcs U-seal)	221525SP



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## DM70 Hand-Held Dewpoint Meter for Spot-Checking Applications



*The Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 offers accurate and fast measurement for industrial dew point applications, such as compressed air, metal treatment and plastics drying.*

### Features/Benefits

- Designed for industrial spot-checking and field calibration
- Three models: accurate measurement ranges from -60 to +60 °C (-76 ... +140 °F)
- Vaisala DRYCAP® Sensor with unique autocalibration function
- Low maintenance need due to superior long-term stability
- Sensor withstands condensation
- Fast response, enhanced by Sensor Purge option
- Easy-to-use user interface
- Data can be logged and transferred to a PC via MI70 Link software
- Compact, small and light
- NIST traceable calibration (certificate included)

The Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 measures dew point temperature accurately over a wide measurement range. The probe may be inserted directly into pressurized processes, and it responds rapidly from ambient to process conditions. The sensor withstands condensation and fully recovers from getting wet.

Three probe models, all with auto-calibration, are available. The A and B models are both general purpose probes. The C model is specifically developed for SF<sub>6</sub> gas. The B and C probe models have an additional Sensor Purge feature that heats and dries the sensor, making the response from ambient to dry conditions exceptionally fast.

The DM70 is fitted with the Vaisala DRYCAP® Sensor. The

sensor provides reliable, stable and high-performance dew point measurement. Autocalibration detects on-line possible measurement inaccuracies and automatically corrects dry-end drift in the calibration curve.

The DM70 has a versatile and easy-to-use, menu-based user interface, a clear graphical LCD display, and data-logging capability. It can also be used as a tool for reading the output of fixed Vaisala dew point transmitters, like the DMT242, DMT132, DMT143, DMT152 and DMT340.

The DM70 displays one to three parameters at a time, either numerically or graphically. Several humidity units can be selected. In addition, the DM70 includes conversion from gas pressure dew point to ambient pressure dew point.

An analog output is also available.

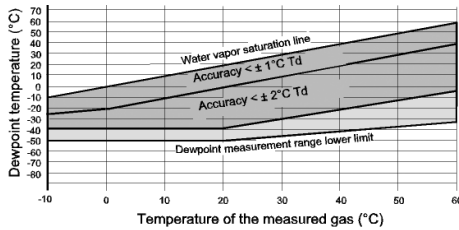
The DM70 meter is suitable for direct process dew point measurement in a wide temperature and pressure range. For more demanding applications, the DM70 can be used with the Vaisala sampling cell adapters, or with the Vaisala DRYCAP® Sampling System DSS70A.

# Technical Data

## Measured Variables, DMP74A Probe

### DEW POINT

Measurement range (typical) -50 ... +60 °C (-58 ... +140 °F)  
Accuracy (A probe) -40...+60 °C  $\pm 2$  °C ( $\pm 3.6$  °F)  
(see graph)



*Dew point accuracy  
vs. measurement  
conditions*

### Response time

flow rate 0.2 m/s, 1 bar pressure, +20 °C (+68 °F) 63% [90%]  
0 → -40 °C  $T_d$  (32 → -40 °F  $T_d$ ) 20 s [120 s]  
-40 → 0 °C  $T_d$  (-40 → 32 °F  $T_d$ ) 10 s [20 s]

Dew point sensor Vaisala DRYCAP® 180S

### TEMPERATURE

Measurement range -10 ... +60 °C (+14 ... +140 °F)  
Accuracy at +20 °C (+68 °F)  $\pm 0.2$  °C ( $\pm 0.36$  °F)  
Typical temperature dependence of electronics  $\pm 0.005$  °C/°C ( $\pm 0.005$  °F/°F)

Temperature sensor Pt100 RTD Class F0.1 IEC 60751

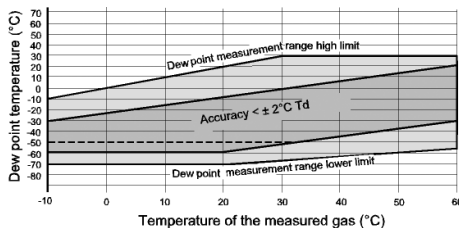
### OTHER VARIABLES AVAILABLE

Dew point converted to atmospheric pressure, ppm volume and ppm weight concentration, absolute humidity, mixing ratio, relative humidity

## Measured Variables, DMP74B and DMP74C (for SF6 gas) Probes

### DEW POINT

Measurement range (typical) -70 ... +30 °C (-94 ... +86 °F)  
Accuracy (B and C probe) -60...+20 °C  $\pm 2$  °C ( $\pm 3.6$  °F)  
(see graph)



*Dew point accuracy  
vs. measurement  
conditions*

### Dotted line:

For DMP74C the  $\pm 2$  °C accuracy range is limited to -50 °C  $T_d$  when used in SF6 gas.

### Response time

flow rate 0.2 m/s, 1 bar pressure, +20 °C (+68 °F) 63% [90%]  
0 → -60 °C  $T_d$  (32 → -76 °F  $T_d$ ) 50 s [340 s]  
-60 → 0 °C  $T_d$  (-76 → 32 °F  $T_d$ ) 10 s [20 s]

Dew point sensor Vaisala DRYCAP® 180M  
TEMPERATURE  
Measurement range -10 ... +60 °C (+14 ... +140 °F)  
Accuracy at +20 °C (+68 °F)  $\pm 0.2$  °C ( $\pm 0.36$  °F)  
Typical temperature dependence of electronics  $\pm 0.005$  °C/°C ( $\pm 0.005$  °F/°F)  
Temperature sensor Pt100 RTD Class F0.1 IEC 60751  
OTHER VARIABLES AVAILABLE  
Dew point converted to atmospheric pressure, ppm volume and ppm weight concentration

## All Probe Models

Operating temperature -10 ... +60 °C (+14 ... +140 °F)  
Operating pressure  
DMP74A, DMP74B 0 ... 20 bara (0 ... 290 psia)  
DMP74C 0 ... 10 bara (0 ... 150 psia)  
Sample flow rate no effect for measurement accuracy  
Measured gases non-corrosive gases  
Probe material (wetted parts) Stainless steel (AISI 316L)  
Sensor protection Sintered filter (AISI 316L)  
partno: HM47280  
Mechanical connection G1/2" ISO228-1 thread  
with bonded seal ring (U-seal)  
Housing classification IP65 (NEMA 4)  
Weight 350 g

## MI70 Indicator, General

Menu languages English, Chinese, Spanish, Russian, French, Japanese, German, Swedish, Finnish,  
Display LCD with backlight  
Graphic trend display of any parameter  
Character height up to 16 mm  
Max. no of probes 2  
Power supply Rechargeable NiMH battery pack with AC-adaptor  
or 4xAA size alkalines, type IEC LR6  
Analog output 0...1 VDC  
Output resolution 0.6 mV  
PC interface MI70 Link software with USB or serial port cable  
Data logging capacity 2700 points  
Alarm Audible alarm function  
Operating temperature range -10...+40 °C (+14...+104 °F)  
Storage temperature range -40 ... +70 °C (-40 ... +158 °F)  
Operating humidity range 0 ... 100 % RH, non-condensing  
Housing classification IP54  
Housing materials ABS/PC blend  
Weight 400 g  
Battery operation time with DMP74 probe  
continuous use 48 h typical at +20 °C (+68 °F)  
data logging use up to a month, depending on logging interval  
Electromagnetic compatibility EN 61326-1, Generic Environment



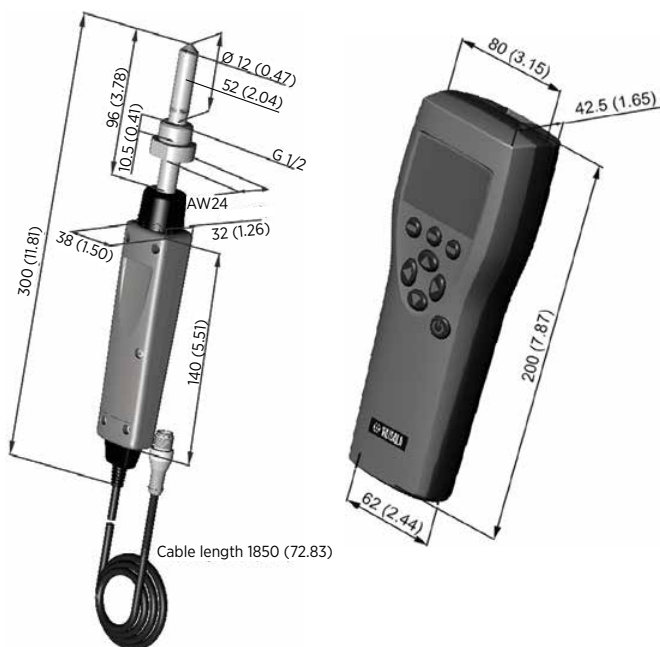
# Technical Data

## Accessories

Connection cables for fixed Vaisala dew point transmitters	
for DMT242 transmitter	27160ZZ
for DMT340 series	211339
for DMT152, DMT143, and DMT132 transmitters	219980
for DMT142 transmitter	211917ZZ
MI70 Link software with USB cable	219687
MI70 Link software with serial port cable	MI70LINK
Analog output cable	27168ZZ
10 m (32.81 ft) extension cable for probe	213107SP
Portable Sampling System	DSS70A
(see separate data sheet)	

## Dimensions

Dimensions in mm (inches)



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# Dew Point Measurement as It Should Be. Longest Calibration Interval – Widest Range.

**Fifteen years of leading performance through continuous innovation.**

High quality dew point measurement is essential to process efficiency, safety and profitability. In fact, the quality of measurement equals the quality of your process.

Vaisala DRYCAP® sensors provide the highest accuracy over the widest dew point range on the market, plus the fastest response time and extremely rapid recovery from condensation. Its unique auto-calibration function ensures superior stability, giving you the dual benefit of low maintenance and peace of mind.

Choose from a wide range of fixed and handheld instruments for hundreds of applications and dozens of industries, worldwide.



## DSS70A Portable Sampling System and Sampling Cells for DM70



*The DSS70A provides a compact solution for field checking dew point where direct measurement is difficult. Typical applications for the sampling system are metal treatment and plastics drying processes. (The DSS70 includes the sampling system and case, but not the MI70.)*

### DSS70A Portable Sampling System

The DSS70A is designed to provide dew point sampling flexibility for the DM70 hand-held dew point meter. For processes at atmospheric pressure, a battery powered pump is used to extract a gas sample. For pressurized processes up to 20 bar, the sample is measured at process pressure and then reduced to atmospheric pressure for venting or re-direction, bypassing the pump. In all cases, the sample gas passes through a filter to remove particulate contamination before measurement. Flow through the system is controlled and monitored with a needle valve and flow meter.

The DSS70A is easily connected to an appropriate sample point with tubing (typically 1/4" or 6 mm). The measured dew point must be below ambient temperature to avoid condensation in the system. Gas temperatures higher than +40 °C

(+104 °F) should be cooled with a short PTFE (included in the DSS70A system) or stainless steel tube prior to entering the DSS70A. DSS70A is an accessory for DM70 Dewpoint Hand-held Meter.

### Sampling Cells for Pressurized Processes

The DM70 can easily be connected to pressurized processes. In addition to direct pipeline installation, a variety of sampling cell options are available for gas sampling.

The DSC74 sampling cell is the recommended choice. It has a variety of connection adapters that allow several different ways of installation. The quick connector with a leak screw allows a very fast connection for compressed air lines. Additionally, two thread adapters are available for the inlet port.

The DSC74B is a two-pressure sampling cell, which enables measurements in both process and

ambient pressure. This sampling cell is especially suitable for dew point measurements in SF<sub>6</sub> gas with the DMP74C probe.

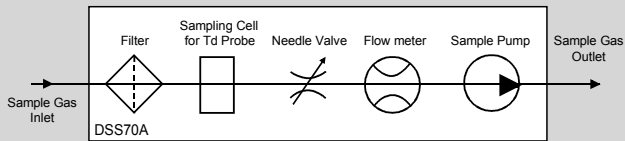
The DMT242SC is a basic sampling cell. The DMT242SC2 is a sampling cell supplied with welded Swagelok connectors for sampling in a 1/4" pipeline.



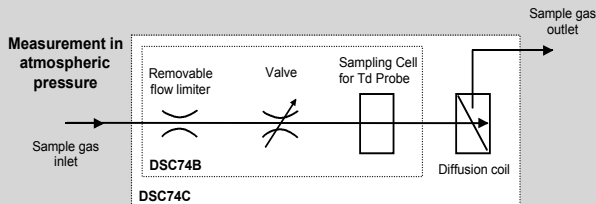
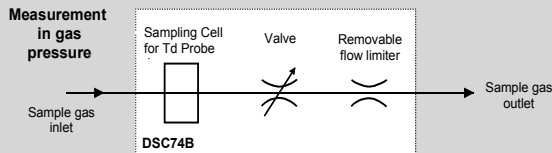
*The sampling cells (from the left) DMT242SC2, DMT242SC and DSC74 can be used to connect the DM70 to sample gas flow. The DSC74B (right) is a two-pressure sampling cell that can be used for measurements in either pressurized or ambient pressure. The cooling/venting coil is included in the DSC74C sample cell, but is an option for all sampling cells.*

# Technical Data

## DSS70A Sampling System and DSC74B/C Sampling Cells



The DSS70A sampling system includes a filter to clean the dirty sample gas and a needle valve to control the sample flow rate with the flow meter. A sample pump is used to generate a sample flow from processes at ambient pressure.



The DSC74B sampling cell enables the measurement of the sampled gas either in gas pressure up to 10 bar or in atmospheric pressure depending on the gas inlet and outlet. The DSC74C is like the DSC74B but with an additional coil to avoid back diffusion, the effect of surrounding moisture, in dew point measurements in atmospheric pressure.

## Sampling Cells Technical Data

DSC74	sampling cell for pressurized gases
pressure limit	1 MPa (10 barg, 145 psig)
DSC74B	two pressure sampling cell
pressure limit	1 MPa (10 barg, 145 psig)
DSC74C	DSC74B with DMC0IL cooling/venting coil

DMC0IL	cooling/venting coil
DMT242SC	sampling cell
pressure limit	10 MPa (100 barg, 1450 psig)
DMT242SC2	sampling cell with Swagelok connectors
pressure limit	4 MPa (40 barg, 580 psig)
Material for all sampling cells	stainless steel AISI316

## DSS70A Sampling System Operating Conditions

Operating gases	air, N2 and other non-toxic, inert gases
Sampled gas dew point	below Tamb
Inlet/outlet connection	1/4" Swagelok
Operating temperature	
ambient temperature	0 ... +40 °C (32 ... +104 °F)
process gas temperature	
with PTFE tube at +20 °C (+68 °F)	max. +200 °C (+392 °F)
(included in the DSS70A)	
with stainless steel tube	specification according to stainless steel tube specification
maximum gas temperature at inlet	+40 °C (+104 °F)
Operating pressure	
with pump	0.6 ... 1.2 bara (8.7 ... 17.4 psia)
pump disconnected	0 ... 20 bara (0 ... 290 psia)

## General

Battery operation time for pump	8 h continuous use
	battery can be recharged using DM70 charger
Filter	7 mm inline filter cartridge 1/4" Swagelok SS-4F-7 (spare part order no. 210801)
Materials	
wetted parts	Stainless steel
carrying case	ABS plastic
Case size (W x D x H)	430 x 330 x 100 mm
Weight	5.5 kg (12 lbs)

## Electromagnetic Compatibility

EN61326-1, Generic Environment.

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## DPT146 Dewpoint and Pressure Transmitter for Compressed Air



*The DPT146 measures both dew point and process pressure. Monitoring compressed air is simpler and quicker, helping you to make more informed decisions.*

The Vaisala Dewpoint and Pressure Transmitter DPT146 for Compressed Air makes monitoring compressed air simple and convenient. The DPT146 measures both dew point and process pressure simultaneously, and is the ideal choice for anyone using or monitoring compressed air.

### Simple and Efficient Installation

One transmitter providing two of the most important compressed air measurements means reduced installation costs and a much easier setup – with only one instrument needing connection and wiring.

### Make More Informed Decisions

Dew point measurement combined with process pressure measurement offers further unique advantages. When dew point data is coupled with live pressure input, conversions to atmospheric pressure or ppm are available online, leaving no ambiguity

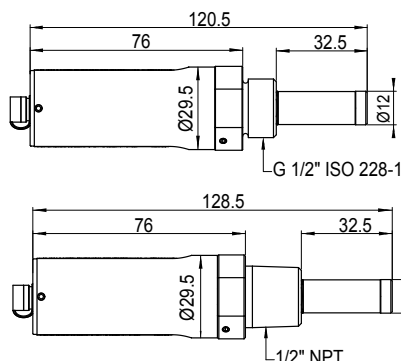
in the information. As an example, regulative requirements of medical gas can be fulfilled easily and quickly.

### A Unique Combination of Two World-Class Sensors

The DPT146 combines the knowledge of more than 20 years of sensor-technology development. Proven measurements from the DRYCAP® sensor for dew point and the BAROCAP® sensor for pressure are now combined into one easy-to-use transmitter.

### Dimensions

Dimensions in mm (inches)

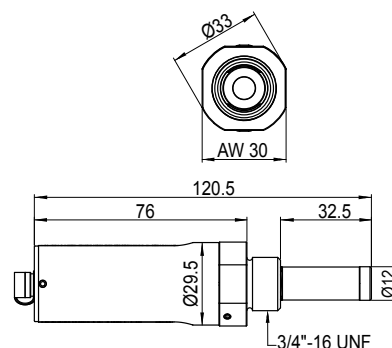


### Features/Benefits

- The first transmitter that monitors both dew point and process pressure
- A simple and convenient transmitter for monitoring of compressed air
- Highly accurate humidity information thanks to dew point data coupled with live pressure input
- Proven sensor technology
- Compatible with the Vaisala Hand-Held DM70 for easy spot checking, local display and data logging
- Pressure: 1 ... 12 bar
- Dew point: -70 ... +30 °C (-94 ... +86 °F)
- Digital output RS-485 with MODBUS

### Convenience with Proven Performance

Well-developed technology brings both proven results and convenience. Spot-checking and verification of dew point is easy thanks to fully compatible Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70. The DM70 can also be used as a local display and data logger. Temperature measurement is available when the RS485 is in use.





# Technical Data

## Measured Parameters

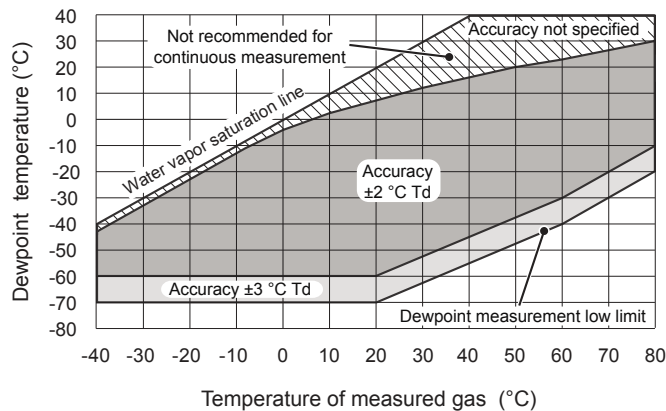
Dew point	-70 ... +30 °C (-94 ... +86 °F)
Pressure, absolute	1 ... 12 bar (14.5 ... 174 psi)
Temperature (available if output RS485 only selected)	-40 ... +80 °C (-40 ... +176 °F)

## Calculated Parameters

ppm moisture, by volume	1 ... 40 000 ppm
Dew point, converted to atmospheric pressure	-75 ... +30 °C (-103 ... +86 °F)

## Performance

Dew point accuracy	±2 °C (±3.6 °F)
Pressure accuracy at 23 °C (73.4 °F)	±0.4 %FS
Pressure temperature dependence	±0.01 bar / 10 °C (18 °F)
Temperature accuracy	
0 ... 40 °C (+32 ... +104 °F)	±0.5 °C (± 0.9 °F)
-40 ... 80 °C (-40 ... +176 °F)	±1 °C (± 1.8 °F)
PPM accuracy (7 bar)	±(14 ppm + 12% of reading)
Sensor response time:	
Pressure response time	< 1 s
Dew point response time 63% [90%] at 20°C and 1 bar	
-50 → -10 °C Tdf	5 s [ 10 s]
-10 → -50 °C Tdf	10 s [ 2.5 min]



DPT146 Dewpoint Measurement Accuracy

## Operating Environment

Operating temperature of electronics	-40 ... +60 °C (-40 ... +140 °F)
Operating Pressure	0 ... 50 bar (0...725 psi)

Relative humidity	0...100 %
Measured gases	Air/ non-corrosive gases
Sample flow rate	no effect on measurement accuracy

## Outputs

Analog Outputs (2 channels)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 5V, 0 ... 10V
Accuracy of analog outputs	± 0.01 V / ± 0.01 mA
Digital output	RS-485, non-isolated, Vaisala protocol, MODBUS RTU protocol
Connector	4-pin M8

## General

Sensor	Vaisala MPS1 multiparameter sensor
Operating voltage	21 ... 28 VDC, current output 20 ... 28 VDC, voltage output and/or use in cold temperatures (-40 ... -20 °C (-40 ... -4 °F)) 15 ... 28 VDC, RS485 only
Supply current	
during normal measurement	20 mA + load current
during self-diagnostics	300 mA + load current
External load for	
current output	max. 500 Ohm
voltage output	min. 10 kOhm
Housing material	AISI316L
Housing classification	IP65 (NEMA4)
Sensor protection	Mesh filter AISI303, grade 18 µm
Storage temperature range	
transmitter only	-40 ... +80 °C (-40 ... +176 °F)
shipment package	-20 ... +80 °C (-4 ... +176 °F)
Mechanical connection	ISO G1/2", NPT 1/2", UNF 3/4"-16
Recommended calibration interval	2 years
Weight (ISO1/2")	190 g (6.70 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements; Industrial environment	

## Accessories

Connection cable for MI70 indicator /DM70 meter	219980
USB connection cable	219690
Sampling cells	DMT242SC, DMT242SC2, DSC74, DSC74B, DSC74C
Flange	DM240FA
Loop-powered external display	226476
ISO 1/2" plug	218773
NPT 1/2" plug	222507

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## DPT145 Multiparameter Transmitter for SF6 Gas



### Features/Benefits

- First transmitter to offer online measurement of seven SF6 parameters in one unit
- Measured parameters: dew point, pressure, temperature
- Calculated parameters: SF6 density, normalized pressure, dew point in atmospheric pressure, ppm
- Saves time and money across the board, from investment and installation to operation and servicing
- More reliable assessment of the condition of SF6 insulation due to online measurement
- Long calibration interval of years
- Digital output RS-485 with MODBUS

*The Vaisala Multiparameter Transmitter DPT145 with the DILO DN20 connector.*

The Vaisala Multiparameter Transmitter DPT145 for SF6 Gas is a unique innovation that enables online measurement of dew point, pressure, and temperature. It also calculates four other values, including SF6 density. The DPT145 is especially well suited for integration into OEM systems.

### Online Reliability

Online dew point measurement combined with pressure measurement provides an excellent assessment of the condition of the SF6 insulation. Sudden and minor leakages are immediately detected by the direct normalized pressure measurement, while online dew point measurement alerts the user to moisture issues, which can weaken the insulation properties of SF6 and cause rapid deterioration. With the DPT145, it is also easy to build a redundant solution for multiple parameters.

### Savings Across the Board

A single transmitter, instead of several, saves time and money across the

board, from investment to installation, operation and servicing. Lower assembly costs, fewer cables and connectors, minimized need for on-site visits and field operations - all these translate into cumulative savings. The long calibration interval results in further savings.

### Risk-Free, Greener Solution

Online measurement enables gas trends to be followed via a data collection system, making monitoring fast, risk-free, and accurate. Using one instrument for monitoring seven different parameters means also fewer mechanical connections and

reduces the risk of leaks. Monitoring is environmentally friendly because there is no need for sampling - no SF6 gas is released into the atmosphere.

### The Fruit of Experience

Vaisala has over 70 years of extensive measurement experience and knowledge. The DPT145 brings together the proven DRYCAP® dew point sensor technology and BAROCAP® pressure sensor technology in one package, providing an innovative and convenient solution for monitoring SF6 gas.



*The DPT145 with the weather shield.*

# Technical Data

## Measured Parameters

Dewpoint	-50 ... +30 °C (-58 ... +86 °F)
Pressure, absolute	1 ... 12 bar (14.5 ... 174 psi)
Temperature	-40 ... +80 °C (-40 ... +176 °F)

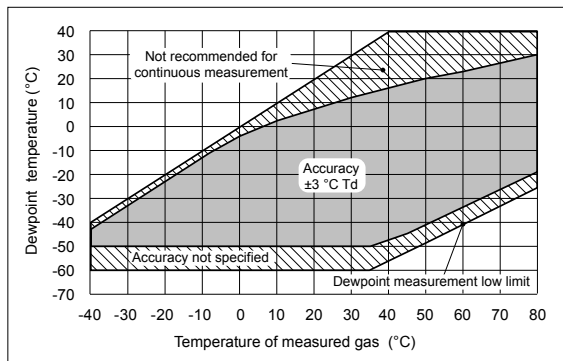
## Calculated Parameters

Pressure, normalized to 20 °C (68 °F)	1 ... 12 bar (14.5...174 psi)
SF <sub>6</sub> or SF <sub>6</sub> /N <sub>2</sub> mixture density	0 ... 100 kg/m <sup>3</sup>
ppm moisture, by volume	40 ... 40 000 ppm
Dewpoint, converted to atmospheric pressure	-65 ... +30 °C (-85 ... +86 °F)

## Performance

Dewpoint accuracy	±3 °C (±5.4 °F), see graph below
Dewpoint stability	typical drift < 2 °C (3.6 °F) /5 years
Pressure accuracy at 23 °C (73.4 °F)	±0.4 %FS
Pressure temperature dependence	±0.01 bar/10 °C (18 °F)
Pressure stability	typical drift < 1 %FS /5 years
Temperature accuracy	
0 ... 40 °C (+32 ... +104 °F)	±0.5 °C (± 0.9 °F)
-40...80 °C (-40 ... +176 °F)	±1 °C (± 1.8 °F)
Density accuracy (pure SF <sub>6</sub> , 1 ... 12 bara)	
0 ... 40 °C (+32 ... +104 °F)	±1 %FS
-40 ... +60 °C (-40 ... +140 °F)	±2.2 %FS
PPM accuracy, typical (5...1000 ppm, 7 bar)	±(7 ppm + 15% of reading)
Sensor response time:	
Pressure response time	< 1 s
Dewpoint response time* 63% [90%] at 20°C and 1 bar	
-50 -> -10 °C Tdf	5 s [ 10 s]
-10 -> -50 °C Tdf	10 s [ 2.5 min]

\* system equilibrium related response time is typically longer



DPT145 Dewpoint Measurement Accuracy

## Operating Environment

Operating temperature of electronics	-40 ... +60 °C (-40 ... +140 °F)
Operating Pressure	0 ... 50 bar (0...725 psi)
Relative humidity	0...100 %
Measured gases	SF <sub>6</sub> , SF <sub>6</sub> /N <sub>2</sub> mixture

## Outputs

Digital output	RS-485, non-isolated, Vaisala protocol, MODBUS RTU protocol
Connector	4-pin M8

## General

Sensor	Vaisala MPS1 multiparameter sensor
Operating voltage	15 ... 28 VDC
	20 ... 28 VDC in cold temperatures (-40 ... -20 °C (-40 ... -4 °F))
Supply current, during normal measurement	20 mA
	during self-diagnostics max. 300 mA pulsed
Housing material	AlSi316L
Housing classification	IP65 (NEMA4)
	Weather shield to be used for continuous outdoor installations
Storage temperature range	
	transmitter only -40 ... +80 °C (-40 ... +176 °F)
	shipment package -20 ... +80 °C (-4 ... +176 °F)
Mechanical connection	DILO DN20, DILO DN8, ABB Malmkvist, or Alstom G1/2" compatible connector

Every connection is helium leak tested at the factory.

Dimensional drawings	See the document B211165EN-B
Weight (with DILO adapter)	765 g (27.0 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements;	
Industrial environment, Tested levels	
EN/IEC 61000-4-2, Electrostatic Discharge	8kV con / 15kV air
EN/IEC 61000-4-3, RF field immunity	10V/m (80MHz-4.2GHz)
EN/IEC 61000-4-4, Electric Fast Transient	±2kV power and signal
EN/IEC 61000-4-5, Surge	±2kV power line to ground / ±1kV signal line to ground and power line to line
EN/IEC 61000-4-6, Conducted RF	10Vemf power line and digital output
Immunity	
Mechanical vibration	
EN/IEC 60068-2-6, Fc Sinusoidal vibration	± 6 g, 5-500 Hz sweep 60 min/axis, 3-axis

## Accessories

Connection cable for the MI70/DM70 hand-held	219980
USB connection cable	219690
Protection plug for connector	218675SP
1.5 m Shielded PUR cable with 90° connector	231519SP
3m Shielded PUR cable with 90° connector	231520SP
5 m Shielded PUR cable with 90° connector	231521SP
10 m Shielded PUR cable with 90° connector	231522SP
3.0m Shielded FEP cable with straight connector	226902SP
Weather shield	ASM210326SP

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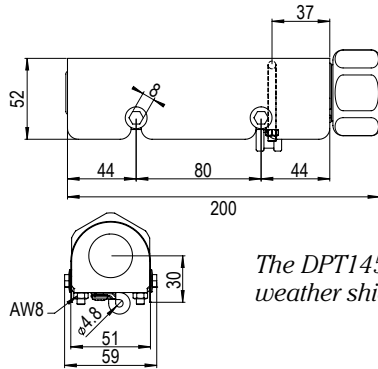
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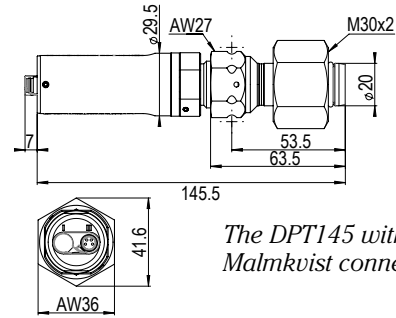
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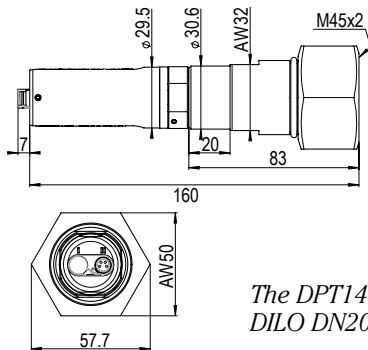
# Dimensional Drawings of the DPT145 Multiparameter Transmitter



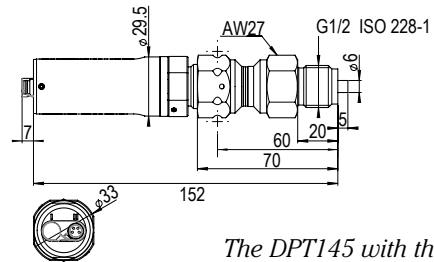
*The DPT145 with the weather shield.*



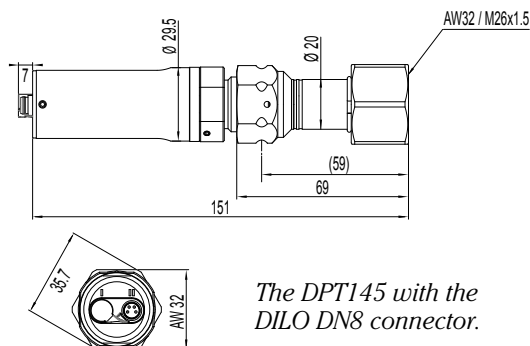
*The DPT145 with the ABB Malmkvist connector.*



*The DPT145 with the DILO DN20 connector.*



*The DPT145 with the Alstom connector.*



*The DPT145 with the DILO DN8 connector.*

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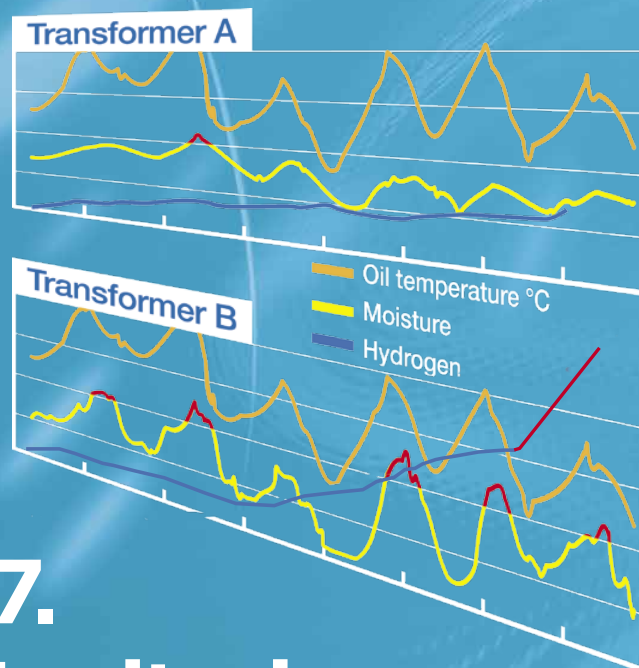
# Outages Happen 24/7. So Should Monitoring.

## Vaisala Online Measurements for Transformers

### Hydrogen-in-oil / Moisture-in-oil / Temperature

- Get reliable alerts of transformer fault situations
- Make educated maintenance decisions
  - You see moisture fluctuations in varying temperature and load conditions
  - You can avoid sampling and waiting for lab results
- Minimize unexpected outages

Intuitive installation into a live transformer in minutes. Easy to operate. Maintenance-free. Let's talk more.





# Vaisala HUMICAP® Sensor for Measuring Moisture in Oil



Water is a common contaminant in industrial oils. Water contamination deteriorates the performance of the oil, be it used for lubrication, cooling, insulation or other purposes. High moisture content increases the risk of corrosion, overheating, machine malfunction and other problems and can ultimately lead to costly failure and unscheduled downtime. Monitoring the oil for moisture is a simple way of improving the reliability of industrial machinery and equipment. With time, substantial savings in maintenance costs can be achieved.

## Free Water Formation – the Critical Point

Water can dissolve in oil. When the water content of the oil increases, it eventually reaches the saturation point of the oil. Once the fluid has reached its saturation point, any additional water introduced will separate out as free water by forming a distinct layer. Alternatively, the oil can form dispersion with water, which turns the oil cloudy. Since most oils are less dense than water, the water layer will usually settle below the oil with time.

Free water formation is critical in terms of problems related to water in oil. When water is no longer dissolved in the oil, corrosion and wearing of equipment increase rapidly. Therefore it is important to keep the moisture content safely below the saturation point.

The ability of oil to hold dissolved water depends on the type and age of the oil as well as its additives. Two major factors have an effect on the saturation point as the oil ages: temperature fluctuations and changes in the chemical make-up due to the formation of new substances as by-products of the chemical reactions.

## Water Activity ( $a_w$ ) – a Direct Measure of Oil Quality

The conventional measure for water content in oil is ppm (parts per million), which describes the absolute amount of water in the oil. Ppm measurement has, however, a major limitation. It does not account for any variations in the oil's saturation point. In other words, ppm measurement provides no indication

## Unique Benefits of HUMICAP in Oil Moisture Measurements

- Fast. Online, real-time detection of moisture in oil without sampling
- Reliable. Tells the true margin to water saturation point in all changing conditions, taking into account e.g. temperature changes and aging of oil
- Highly stable. Excellent pressure and temperature tolerance
- Easy to install through ball valve – no need to shut down the process
- Enables predictive maintenance work. Trends can be quickly identified.

of how close the moisture level is to the saturation point in a dynamic system with fluctuating saturation point. By measuring water activity instead of ppm, the risk of actually exceeding the saturation point can be avoided.

Water activity measurement indicates directly whether there is a risk of free water formation. With a relative scale from 0 (no water present) to 1 (the oil is saturated with water) it gives a reliable indication of how close the saturation point of water is.

In contrast to traditional measurement techniques, water activity measurement is independent of oil type. Regardless of the saturation point of the fluid, water activity measurement always provides a true indication for the risk of free water formation, even when the saturation point is increasing or decreasing. In its simplicity, water activity value is understandable at a glance. Trends can be quickly identified.

## Vaisala HUMICAP® for Measuring Water Activity

The Vaisala transmitters used for measuring moisture in oil feature the HUMICAP® sensor, a capacitive thin-film polymer sensor especially developed for demanding moisture measurements in liquid hydrocarbons.

The HUMICAP sensor consists of four functional layers: glass substrate, lower electrode, water-active polymer layer, and porous upper electrode. The thin-film polymer either absorbs or releases water as the surrounding moisture level changes. Water molecules move to/from the

polymer layer until there is moisture equilibrium between the polymer and the oil. The dielectric properties of the polymer depend on the moisture level. As the moisture level changes, the dielectric properties of the polymer film change, and so does the capacitance of the sensor. The instrument's electronics measure the capacitance of the sensor and convert it into water activity.

Oil molecules or additives do not penetrate the electrode. Thus the sensor output is independent of the oil type.

## On-line Measurement

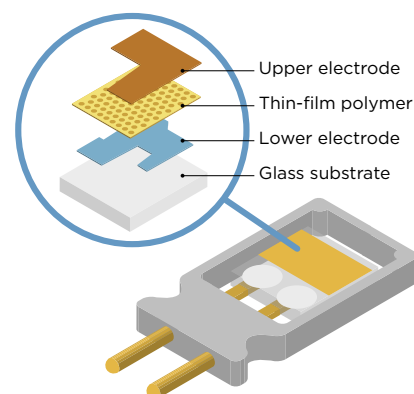
On-line water activity measurement ensures reliable performance of equipment at all times. Time-consuming sampling and laboratory analysis are no longer needed. This not only reduces the risk of human induced error but also provides cost savings in equipment and chemicals.

## Typical Applications for Moisture in Oil Measurement

Moisture is an important factor determining the condition of both lubricating and transformer oils. With on-line information on the quality of the oil, preventive actions can be taken and the maintenance costs cut substantially.

### HUMICAP in Brief

- A capacitive thin-film polymer sensor
- Water activity ( $a_w$ ) measurement within range 0...1
- Accurate to  $\pm 0.02$  ( $a_w$ )
- 15 years of experience in measuring moisture in oil



Structure of the HUMICAP sensor.

## Vaisala Moisture, Hydrogen and Temperature Transmitter MHT410 for Online Transformer Condition Monitoring

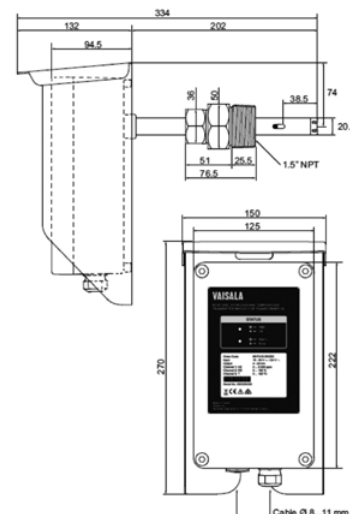


The Vaisala MHT410 moisture, hydrogen and temperature transmitter provides reliable online monitoring of insulating oil in power transformers. With its unique probe design, the MHT410 delivers accurate measurement and trend data about the health of the transformer in real time.

- Information on transformer fault situations
- Enables timely, proactive maintenance decisions to minimize expensive service shutdowns and outages

### Dimensions

Dimensions in mm



### Features/Benefits

- Online monitoring of insulating oil
- Measures directly from oil without a need of pumps, membranes etc.
- Moisture and hydrogen sensors are in direct contact with representative oil in the transformer
- Monitor health of the transformer in real time
- Information on transformer fault situations
- Unique probe design, robust and easy to install
- Compact size
- 5 year standard warranty
- Isolated inputs and outputs, EMC tolerant device with IP66 metal housing
- Adjustable probe installation depth fits in a variety of transformers

## Technical Data

### Measurement Performance

#### HYDROGEN MEASUREMENT

Measurement range (in oil)	0 ... 5000 ppm
Accuracy (in oil temp. range -20 ... +60 °C) (-4 ... +140 °F)	±20% of reading or ±25 ppm (whichever is greater)
Repeatability	±10 % of reading or ±15 ppm (whichever is greater)
Min. detection limit	20 ppm
Typical long-term stability	3 % of reading / year
Cross sensitivity to other gases	< 2 % (CO <sub>2</sub> , C <sub>2</sub> H <sub>2</sub> , C <sub>2</sub> H <sub>4</sub> , CO)
Response time	63%: 2.5 hours (when sensor is not in reference cycle), 90%: 17 hours
Warm-up time	2 hours, 12 hours for full specification
Sensor	Catalytic palladium-nickel alloy film solid-state sensor

#### MOISTURE IN OIL MEASUREMENT

Measurement range (in oil)	0 ... 100 %RS / a <sub>w</sub> 0 ... 1
Accuracy at 20 °C (+68 °F) (including non-linearity, hysteresis and repeatability)	
0 ... 90 %RS / a <sub>w</sub> 0 ... 0.9	±2 %RS (a <sub>w</sub> ±0.02)
90 ... 100 %RS (a <sub>w</sub> 0.9 ... 1.0)	±3 %RS (a <sub>w</sub> ±0.03)
Sensor response time	10 min
Sensor	HUMICAP® 180L2

#### TEMPERATURE MEASUREMENT

Measurement range	-40 ... +120 °C (-40 ... +248 °F)
Accuracy at +20 °C (+68 °F)	±0.2 °C (0.36 °F)
Sensor	Pt1000 RTD Class F0.1 IEC 60751

# Technical Data

## Operating Environment

Oil type	Mineral oil
Operating humidity range	0 ... 100 %RH, condensing
Operating temperature range (electronics)	-40 ... +60 °C (-40 ... 140 °F)
Storage temperature range	-40 ... +60 °C (-40 ... 140 °F)
Pressure tolerance (probe, short-term)	Vacuum ... 10 bara
Pressure tolerance (probe, continuous)	Max. 4 bara
Integrated protection for short power outages	> 3 seconds
Electromagnetic compatibility:	
Complies with EMC standard EN61326-1, Industrial environment	
Complies with CISPR22 class B emission limits when DC powered	
Fulfills the requirements of IEC 61000-6-5 in the following tests:	
	IEC 61000-4-2
	IEC 61000-4-3
	IEC 61000-4-4
	IEC 61000-4-5
	IEC 61000-4-6
	IEC 61000-4-8 (100 A/m continuous)
	IEC 61000-4-11
	IEC 61000-4-12
	(The list will be continuously updated)

## Connections And Outputs

Operating voltage*	15 ... 30 VDC, 24 VAC (±15%) (power supply input is galvanically isolated)
Power consumption	4 W, typical 12 W max.
Analog output (current)*	Three isolated 4 ... 20 mA, passive (sinks current)
External load	Max. 500 Ohm
Error status indication in case of device error	3.5 mA default, user configurable for each channel
Accuracy of analog outputs at +20 °C	± 0.125 % full scale
Temperature dependence of the analog outputs	± 0.006 %/ °C full scale
Digital outputs*	Isolated RS-485 half-duplex, RS-485 (Service Port, non-isolated)
Protocols	MODBUS RTU, serial ASCII commands
Screw terminals	Wire size AWG 22-14 Single wire (solid) 1.5 mm² Stranded wire (flex.) 1.0 mm² Recommended wire torque 0.4 Nm

\*Max. isolation voltage 1.5 kV DC

## Mechanics

Mechanical connection on transmitter	1.5" NPT (male)
Cable bushing (optional)	M20x1.5 for cable diameter 8 ... 11mm/0.31 ... 0.43"
Conduit fitting (optional)	1/2" NPT
Interface cable (optional, pre-assembled)	5 meters, 9.2 mm outer diameter
Housing material	AlSi 10 Mg
Housing classification	IP66
Transmitter weight without cables	4.1 kg

## Other

Self-diagnostics indication	Status LEDs, analog output, MODBUS
Integrated data logging capabilities	Non-volatile memory up to 44 years storage with default logging
Individual functional test reports	Calibration test reports for moisture, hydrogen and temperature Probe leak test report (5 bara)
Factory warranty	5 years

## Display with Relays (External Option)

Pre-configured range for hydrogen	0... 5000 ppm
Pre-configured alarm relays (user re-configurable)	Relay 1 trigger limit 200 ppm (hi) Relay 2 trigger limit 1500 ppm (hihi)
Input	4... 20 mA, loop-powered
Accuracy	0.05 % of span (-10... +60 °C)
Relays	2 x solid state (SSR) max. 250 VAC, 150 mA
Display	4-digit red LED, 14.5 mm
Dimensions	100 x 100 x 57 mm (WHD)
Case Protection	IP65
Case material and color	ABS-plastic, grey
Cable glands	2 x M16x1.5

## Spare Parts and Accessories

USB cable for PC connection	219690
External din rail power 100 ... 240 Vac to 24 Vdc	242422
5 meter shielded PUR cable	CBL210392-5MSP
10 meter shielded PUR cable	CBL210392-10MSP
Cable gland	214728SP
Detachable screw terminal block	236620SP
Loop-powered external display, Nokeval	
302 (with alarm relays)	242003
MI70 connection cable	219980
Conduit fitting	214780SP

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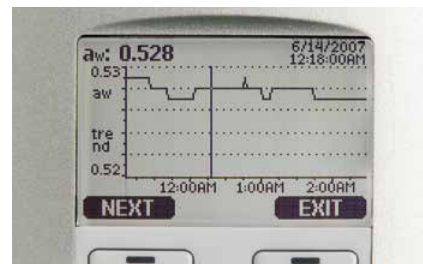
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## MMT330 Moisture and Temperature Transmitter Series for Oil



The display shows measurement trends, real-time data, and measurement history.

The MMT330 transmitter family offers reliable performance for the demanding measurement of moisture in oil.

### Features/Benefits

- Continuous online measurement of moisture in oil
- Ball-valve installation – no need to shut down the process or drain the oil
- Proven Vaisala HUMICAP® sensor, used for over 15 years in oil applications
- Easy field calibration and maintenance – compatible with Vaisala HUMICAP® Hand-Held Moisture Meter for Oil MM70
- NIST traceable calibration (certificate included)
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)
- Approved for installation in MAN Diesel & Turbo Two-Stroke Diesel Engines lubrication systems

The Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT330 enables the fast and reliable detection of moisture in oil. MMT330 series transmitters can be used in online moisture monitoring and as control devices, allowing separators and oil driers to be started only when needed.

Proper monitoring saves both oil and the environment. With the MMT330 series it is easy and economical to monitor the changes of moisture in oil.

### Reliable Vaisala HUMICAP® Technology

The MMT330 series incorporates the latest-generation Vaisala HUMICAP® sensor, which is the result of over 15 years of field experience. It was developed for demanding moisture measurement in liquid hydrocarbons.

The sensor's excellent chemical tolerance provides accurate and reliable measurement over a wide measurement range.

### For Diverse Applications and Demanding Conditions

With a wide variety of probes, the transmitter can be used in lubrication systems, hydraulic systems, and transformers.

### Indicates the Margin to Water Saturation

The MMT330 measures moisture in oil in terms of the water activity (aw) and temperature (T). Water activity indicates directly whether there is a risk of free-water formation. The measurement is independent of oil type and age.



## Water Content as ppm Conversion

In addition to water activity, the MMT330 can output ppm, the average mass concentration of water in oil. Vaisala has this conversion readily available for mineral transformer oil.

For other oils, the oil-specific conversion coefficients can be programmed into the transmitter if the water solubility of the oil is known.

## Graphical Display of Measurement Data and Trends for Convenient Operation

The MMT330 features a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

The optional data logger, with real-time clock, makes it possible to generate over four years of measurement history and zoom in on any desired time or time frame.

The display alarm allows any measured parameter to be tracked, with freely configurable low and high limits.

## Versatile Outputs and Data Collection

The MMT330 can support up to three analog outputs; an isolated galvanic power supply and relay outputs are also available.

For serial interface the USB connection, RS232, and RS485 can be used.

MMT330 is also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provides either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN



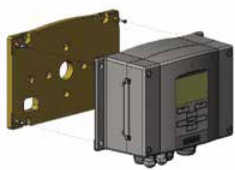
*The Vaisala HUMICAP® Hand-Held Moisture for Oil Meter MM70 is designed for field-checking MMT330 transmitters.*

interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the MMT330 to a PC via the service port.

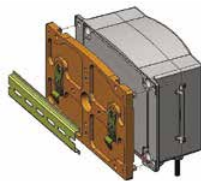
## Easy Installation

MMT330 transmitters have several options for transmitter mounting. They are delivered installation-ready, pre-configured with all settings.

### Mounting Options



Mounting with Wall Mounting Kit



Mounting with DIN Rail Installation Kit



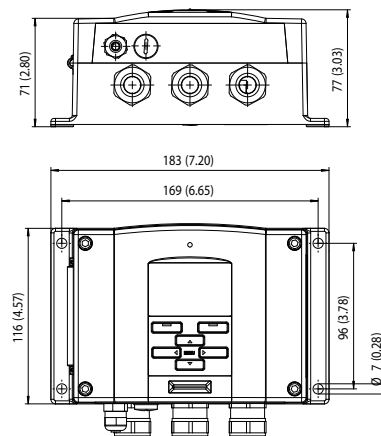
Pole Installation with Installation Kit for Pole or Pipeline



Mounting Rain Shield with Installation Kit

### Dimensions

Dimensions in mm (inches)



HUMICAP® is a registered trademark of Vaisala.



TYPE APPROVED PRODUCT  
CERTIFICATE NO.: A-13529



The MMT332 probe is installed using a flange. It is designed for high-pressure applications.

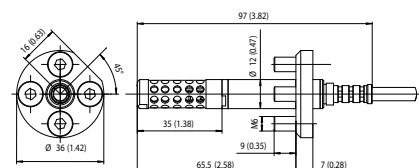
### Installation Options

#### MMT332 for High Pressure Installations

Pressure range	0 ... 250 bar / 0 ... 3625 psia
Probe diameter	12 mm / 0.5"
Installation	
Flange	36 mm / 1.4"
Temperature	
Measurement range	-40 ... +180 °C (-40 ... 356 °F)

### Dimensions

Dimensions in mm (inches)



The MMT337 probe, with optional Swagelok® connector, is ideal for tight spaces with a thread connection. The small probe is designed for integration into small diameter lines.

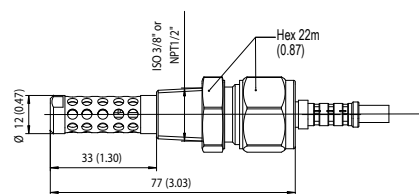
### Installation Options

#### MMT337 with Small-Sized Probe

Pressure range	0 ... 10 bar / 0 ... 145 psia
Probe diameter	12 mm / 0.5"
Installation	
Fitting body	R 3/8" ISO
Fitting body	1/2" ISO
Fitting body	NPT 1/2"
Temperature	
Measurement range	-40 ... +180 °C (-40 ... 356 °F)

### Dimensions

Dimensions in mm (inches)



The MMT338 is ideal for installation into pressurized processes where the probe needs to be able to be removed while the process is running. The probe depth is adjustable.

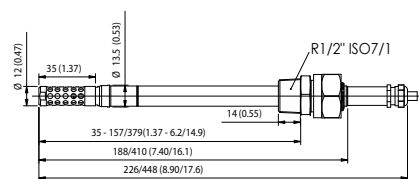
### Installation Options

#### MMT338 with Probe for Pipeline Installations

Pressure range with ball-valve	0 ... 40 bar / 0 ... 580 psia
	up to 120 °C (248 °F) and 40 bar
Adjustable length	35 ... 157/379 mm / 1.37 ... 6.2 / 14.9"
Installation	
Fitting body	R1/2" ISO
Fitting body	NPT 1/2"
Ball-valve set	BALLVALVE-1
Sampling cell	DMT242SC2
Temperature	
Measurement range	-40 ... +180 °C (-40 ... 356 °F)

### Dimensions

Dimensions in mm (inches)



# Technical Data

## Measured Values

WATER ACTIVITY	
Measurement range $a_w$	0 ... 1
Accuracy (including non-linearity, hysteresis and repeatability)	
0 ... 0.9	±0.02
0.9 ... 1.0	±0.03
Response time (90%) at +20 °C in still oil (with stainless steel filter)	10 min.
Sensor	HUMICAP® 180,2

## Performance

TEMPERATURE	
Measurement range	
MMT332	-40 ... +180 °C (-40 ... +356 °F)
MMT337	-40 ... +180 °C (-40 ... +356 °F)
MMT338	-40 ... +180 °C (-40 ... +356 °F)
Accuracy at +20 °C (+68 °F)	± 0.2 °C (0.36 °F)

## Operating Environment

Operating temperature	
for probes	same as measurement ranges
for transmitter body	-40 ... +60 °C (-40 ... +140 °F)
with display	0 ... +60 °C (+32 ... +140 °F)
Pressure range for probes	see probe specifications
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Industrial environment
Note: Transmitter with display test impedance of 40 ohm is used in IEC61000-4-5 (Surge immunity)	

## Inputs and Outputs

Operating voltage	10 ... 35 VDC, 24 VAC ± 20%
with optional power supply module	100 ... 240 VAC 50/60 Hz
Power consumption @ 20 °C ( $U_{in}$ 24VDC)	
RS232	max. 25 mA
$U_{out}$ 2 x 0...1V / 0...5V / 0...10V	max. 25 mA
$I_{out}$ 2 x 0...20 mA	max. 60 mA
display and backlight	+ 20 mA
Analog outputs (2 standard, 3rd optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs at 20 °C	± 0.05% full scale
Temperature dependence of the analog outputs	± 0.005%/°C full scale
External loads	
current outputs	$R_L < 500$ ohm
0 ... 1V output	$R_L > 2$ kohm
0 ... 5V and 0 ... 10V outputs	$R_L > 10$ kohm
Max. wire size	0.5 mm <sup>2</sup> (AWG 20) stranded wires recommended
Digital outputs	RS232, RS485 (optional)

Protocols	ASCII commands, MODBUS RTU
Service connection	RS232, USB
Relay outputs	0.5 A, 250 VAC, SPDT, potential-free (optional)
Ethernet interface (optional)	
Supported standards	10BASE-T, 100BASE-TX
Connector	8P8C (RJ45)
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
WLAN interface (optional)	
Supported standards	802.11b
Antenna connector type	RP-SMA
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
Security	WEP 64/128, WPA
Authentication / Encryption	
Open / no encryption	
Open / WEP	
WPA Pre-shared key / TKIP	
WPA Pre-shared key / CCMP (a.k.a. WPA2)	
Optional data logger with real-time clock	
Logged parameters	max. four with trend/min/max values
Logging interval	10 sec. (fixed)
Max. logging period	4 years, 5 months
Logged points	13.7 million points per parameter
Battery lifetime	min. 5 years
Display	LCD with backlight, graphical trend display of any parameter
Menu languages	English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish

## Mechanics

Cable bushing	M20x1.5 for cable diameter 8 ... 11mm/0.31 ... 0.43"
Conduit fitting	1/2" NPT
Interface cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft.) black cable
option 2	female plug with screw terminals
USB-RJ45 Serial Connection Cable	219685
(incl. Mi70 Link software)	
Probe cable diameter	5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m
	(Additional cable lengths available, please see order forms for details)
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 66
	IP65 (NEMA4X) with local display
Weight	depending on selected probe, cable and modules 1.0 - 3.0 kgs
Sensor protection	Stainless steel grid standard filter/ Stainless steel grid filter for high flow rates (>1 m/s)

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## MMT310 Series Moisture and Temperature Transmitters for Oil



Two probe options: MMT318 and MMT317. Optional rain shield is also available.

### Features/Benefits

- Continuous measurement of moisture in oil
- Proven Vaisala HUMICAP® sensor, over 15 years in oil applications
- Measurements in lubrication, hydraulic and transformer oils
- Excellent pressure and temperature tolerance
- Measuring water activity - ppm calculation for transformer oil
- Small size, easy to integrate
- NIST traceable calibration (certificate included)
- Applications: e.g. monitoring of transformer oil and of lubrication systems in marine and paper industry

The Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT310 is a fast and reliable on-line detector for moisture in oil.

### Reliable Vaisala HUMICAP® Technology

The MMT310 series incorporates the latest generation of the Vaisala HUMICAP® sensor, developed for demanding moisture measurement in liquid hydrocarbons. The sensor's excellent chemical tolerance provides accurate and reliable measurement over the wide measurement range.

### Measuring Water Activity

The MMT310 measures moisture in oil in terms of the water activity ( $a_w$ ) and temperature (T). Water activity indicates directly whether there is a risk of free-water formation. The measurement is independent of oil type, age, and temperature.

### Water Content as PPM Calculation for Transformer Oils

PPM units are traditionally used in transformer applications. They indicate the average mass concentration of water in oil. The ppm calculation for mineral oil based transformer oil is optional in the MMT310 series.

### Diverse Applications and Demanding Conditions

The MMT310 can be used in lubrication and hydraulic systems as well as in transformers. It can be used for on-line moisture monitoring and as a control function, allowing separators and oil purifiers to be started only when necessary.

### Installation Options

The MMT318 has two adjustable probe lengths. The transmitter can be ordered with a ball-valve set that enables the insertion and removal of the moisture probe for calibration, without the need to empty the oil system.

The MMT317 has a small pressure-tight probe with optional Swagelok fittings.

An optional rain shield is available for outdoor installations.

### Several Outputs, One Connector

The MMT310 series has two analog outputs and an RS232 serial output. The output signals and the supply power travel in the same cable, the only cable connected to the unit.

# Technical Data

## Measured Values

### WATER ACTIVITY

Measurement range $a_w$	0 ... 1
Accuracy (including non-linearity, hysteresis, and repeatability)	
0 ... 0.9	±0.02
0.9 ... 1.0	±0.03
Response time (90 %) at +20 °C in still oil (with stainless steel filter)	10 min.

Sensor Vaisala HUMICAP® 180L2

### TEMPERATURE

Measurement range	-40 ... +180 °C (-40 ... +356 °F)
Typical accuracy at +20 °C (68 °F)	±0.2 °C (±0.36 °F)
Sensor	Pt100 RTD Class F0.1 IEC 60751

## Electrical Connections

Two analog outputs, selectable and scalable	0 ... 20 mA or 4 ... 20 mA 0 ... 5 V or 0 ... 10 V
	1 ... 5 V available through scaling
Typical accuracy of analog output at +20 °C	±0.05 % full scale
Typical temperature dependence of analog output	0.005 %/°C (0.003 %/°F)
Serial output	full scale
Connections	RS232C
	8-pole connector with RS232C, current/voltage outputs (two channels) and $U_{in}$
Operating voltage	10 ... 35 VDC
Minimum operating voltage	
RS232C output	10 VDC
Analog output	15 VDC
Pressures above 10 bara (145 psia)	24 VDC
Power consumption	
RS232C	12 mA
$U_{out}$ 10 V (10 kOhm)	12 mA
channel 1 & channel 2	
$I_{out}$ 20 mA (load 511 Ohm)	50 mA
channel 1 & channel 2	
External load	$R_L < 500$ Ohm
Startup time after power-up	3 s

## Accessories

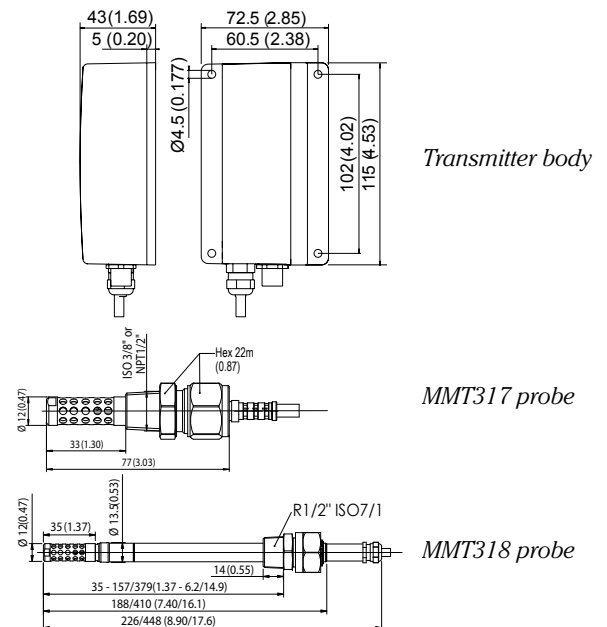
Rain shield	ASM211103
USB cable	238607
Stainless steel filter	HM47453SP
Stainless steel filter (high flow rate)	220752SP

## General

Operating temperature range for electronics	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-55 ... +80 °C (-67 ... +176 °F)
Pressure range for MMT318 with ball-valve up to 120 °C	0 ... 40 bar
Pressure range for MMT317	0 ... 10 bar
Material	
transmitter housing	G-AISI 10 Mg
transmitter base	PPS
Housing classification	IP66
Cable feed through alternatives	8-pole connector with 5 m cable, female 8-pin connector screw joint for cable diameter 4 ... 8 mm
Sensor protection	stainless steel grid standard filter stainless steel grid filter for high flow rates (>1 m/s)
Probe cable length	
MMT317	2 m, 5 m, or 10 m
MMT318	2 m, 5 m, or 10 m
Weight (depending on selected probe and cable)	
example: MMT317 with 2 m cable	476 g
Probe installation MMT317	
Swagelok®	NPT 1/2", ISO 3/8" or ISO 1/2"
Probe installation MMT318	
Fitting bodies	ISO 1/2", NPT 1/2"
Ball-Valve Set	BALLVALVE-1
Complies with EMC standard EN61326-1, Industrial environment	

## Dimensions

Dimensions in mm (inches)



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## MMT162 Compact Moisture in Oil and Temperature Transmitter for OEM Applications



*The MMT162 enables on-line moisture monitoring in oils even in the most demanding applications.*

### Features/Benefits

- Continuous measurement of moisture in oil
- Measures in lubrication, hydraulic and transformer oils
- Excellent pressure and temperature tolerance
- Proven Vaisala HUMICAP® Sensor, 15 years in oil applications
- Measures water activity - ppm-calculation available for transformer oil
- Small size, easy to integrate
- Digital output RS-485 with MODBUS
- NIST traceable calibration (certificate included)

The Vaisala HUMICAP® Moisture and Temperature Transmitter for Oil MMT162 is an excellent economical solution for reliable on-line detection of moisture in oil.

### Reliable Vaisala HUMICAP® Technology

The MMT162 incorporates the latest generation of the Vaisala HUMICAP® Sensor. The sensor is developed for demanding moisture measurement in liquid hydrocarbons and has been successfully used in oil applications for over a decade. The sensor's excellent chemical tolerance provides accurate and reliable measurement over the measurement range.

### Water Activity Measurement

The MMT162 measures moisture in oil in terms of the water activity (aw) and temperature (T). Water activity directly indicates whether there is a risk of free water formation. The measurement is independent of oil type, age and temperature. The ppm calculation for mineral oil based transformer oil is optional in the MMT162.

### Several Outputs - One Connector

The MMT162 has two analog outputs that can be scaled and the measurement ranges changed. Additionally, the transmitter has an RS-485 serial output. The signals and the unit power travel in the same cable.

An optional LED-cable enables a visual alarm.

### Compact, Rugged and Intelligent

Due to its compact size, the MMT162 is quickly and easily installed in tight spaces. Units are delivered fully assembled, however, you can re-configure them to suit your needs.

### MM70

In combination with an MM70 indicator, the MMT162 provides an ideal tool for on site calibration. The MM70 indicator can be used as a display, communication, and data-logging device for the MMT162.

# Technical Data

## Measured Values

WATER ACTIVITY	
Measurement range	0 ... 1 aw
Accuracy (including non-linearity, hysteresis and repeatability)	
0 ... 0.9	± 0.02
0.9 ... 1.0	± 0.03
Response time	
in oil flow (typical)	<1 min (dry-wet)
MOISTURE	
Calculated moisture content in ppm for mineral transformer oil	
TEMPERATURE	
Accuracy at +20 °C (+68 °F)	± 0.2 °C (0.36 °F)

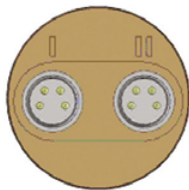
## Operating Environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Oil temperature	-40 ... +80 °C (-40 ... +176 °F)
Pressure range	
metal version	up to 200 bar
plastic version	up to 40 bar
Oil flow	some flow recommended

## Outputs

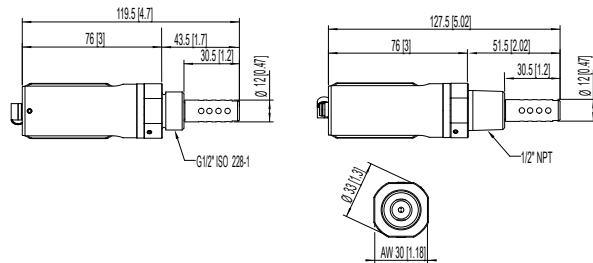
Analog outputs (two channels)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 5 V, 0 ... 10 V
Alarm level indication by analog signal	user selectable
Digital outputs	RS-485, non-isolated, Vaisala protocol, MODBUS RTU protocol

Pin	I	II
1	V <sub>supply</sub>	V <sub>supply</sub>
2	Ch 1	RS-485 - / B
3	GND	GND
4	Ch 2	RS-485 + / A



## Dimensions

Dimensions in mm (inches)



## General

Sensor	HUMICAP®
Cable connections (2 ports)	M8, 4 pin
Minimum operating voltage with	
RS-485 output	14 ... 28 VDC
voltage output	16 ... 28 VDC
current output	22 ... 28 VDC
Supply current	
normal measurement	20 mA + load current
External load for	
voltage output	min. 10 kOhm
current output	max. 500 Ohm
Housing material	
metal	AISI 316L
plastic	PPS + 40% GF
Mechanical connections with bonded seal ring (washer)	
metal version	G 1/2" ISO or NPT 1/2"
plastic version	G 1/2" ISO
Housing classification	IP65 (NEMA 4)
Storage temperature range	-40 ... +80 °C (-40 ... +176 °F)
Weight	
with plastic housing	65 g (2.3 oz)
with metal housing	200 g (7 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirements; Industrial environment	

## Options and Accessories

Stainless steel filter (standard)	225356SP
Stainless steel filter for high flow (>1 m/s)	221494SP
Connection cable for MM70 hand-held meter	219980
USB serial interface cable	219690
Sealing ring set (U-seal) ISO G1/2, 3 pcs	221525SP
Sealing ring set (copper) ISO G1/2, 3 pcs	221524SP
ISO 1/2" plug	218773
NPT 1/2" plug	222507
Sampling cell	DMT242SC
Sampling cell w. Swagelok connectors	DMT242SC2
Connection cable	
2 m (6.5 ft), M8 snap-on	211598
0.32 m (1 ft) Shielded, M8 threaded	HMP50Z032
3.0 m (9.8 ft), Shielded, M8 threaded	HMP50Z300SP
5.0 m (16.4 ft), Shielded, M8 threaded	HMP50Z500SP
10 m (32.8 ft), Shielded, M8 threaded	HMP50Z1000SP
3 m, connector 90° angle	221739
5 m, connector 90° angle	221740
M8 threaded, Ch1 signal + Ch2 LED	MP300LEDCBL

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## MM70 Hand-Held Moisture and Temperature Meter for Spot-Checking in Oil



*The MM70 is an ideal tool for the preventive maintenance of oil-filled systems. The water activity measurement indicates the margin to free water formation, which causes severe problems in lubrication systems.*

### Features/Benefits

- Measurement independent of oil type, age and temperature
- In-line process checking through ball valve, no need to drain the oil
- Rugged and reliable construction
- Excellent pressure and temperature tolerance
- Data can be logged and transferred to a PC
- Proven Vaisala HUMICAP® Sensor, over 15 years in oil applications.
- Compatible with Vaisala's fixed oil moisture instruments
- No reference oil needed for recalibration
- NIST traceable calibration (certificate included)

The Vaisala HUMICAP® Hand-held Moisture Meter for Oil MM70 enables reliable detection of moisture in oil.

### In-Line Process Checking Through Ball Valve

The probe can be inserted directly into the process pipe through a ball valve without draining the oil in the system.

### Water Activity Measurement

The MM70 measures moisture in oil in terms of the water activity (aw) and temperature (T). Water activity directly indicates whether there is a risk of free water formation. The measurement is independent of oil type, age and temperature.

### PPM Calculation Included

The MM70 has an embedded model for expressing moisture as ppm in mineral transformer oil. The customer can enter up to three other oil models into the meter's memory.

### Numerical and Graphical Display

The MM70 features a multilingual, menu-based user interface and a backlit LCD display. The measurement parameters can be numerically and graphically displayed and logged into the meter's memory at the same time. An analog output option is also available.

### Connection to PC

The optional MI70 Link Windows® software in combination with a USB connection cable is used to transfer logged data and real time measurement data from the MM70 to a PC.

### Proven Vaisala HUMICAP® Technology

The MM70 incorporates the latest generation of the Vaisala HUMICAP® Sensor, developed for demanding moisture measurements in liquid hydrocarbons. The sensor's excellent chemical tolerance provides accurate and reliable measurement over the measurement range.

### Speedy Service - Once a Year

The meter can be recalibrated by sending the probe to Vaisala Service, or customers can calibrate the instrument themselves using a standard relative humidity calibration.

### Multi-Probe Operation

One or two probes can be connected simultaneously. Maintenance teams can use additional Vaisala dew point or relative humidity probes for other tasks. For example, a dew point probe is ideal for checking the moisture inside washed and dried oil tanks.

# Technical Data

## Performance

### WATER ACTIVITY

Measurement range $a_w$	0 ... 1
Accuracy (including nonlinearity, hysteresis and repeatability)	
When calibrated against salt solutions (ASTM E104-85):	
0 ... 0.9	±0.02
0.9 ... 1.0	±0.03
Maximum achievable accuracy when calibrated against high-quality, certified humidity standards:	
0 ... 0.9	±0.01
0.9 ... 1.0	±0.02

Response time (90%) at +20 °C (+68 °F)	
in still oil (with stainless steel filter)	10 min.
Sensor	Vaisala HUMICAP® 180L2
Recommended recalibration interval	1 year

### TEMPERATURE

Measurement range	-40 ... +100 °C (-40 ... +212 °F)
Typical accuracy at +20 °C	±0.2 °C (±0.36 °F)
Typical temperature dependence of electronics	±0.005 °C/°C (±0.005 °F/°F)
Sensor	Pt100 RTD Class F0.1 IEC 60751
Typical long-term stability	better than 0.01 $a_w$ / year

## Operating Environment

### PROBE

Operating temperature range for electronics	-40 ... +60 °C (-40 ... +140 °F)
Operating pressure range	max. 20 bar
during installation through ball valve	max. 10 bar
Oil flow range	max. 1 m/s

### INDICATOR

Operating temperature range	-10 ... +40 °C (+14 ... +104 °F)
Operating humidity range	non-condensing

### ELECTROMAGNETIC COMPATIBILITY

Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements; Portable equipment.

## Inputs and Outputs

Power supply	Rechargeable NiMH battery pack with AC-adaptor or 4xAAA-size alkalines, type IEC LR6
Battery operation time	
continuous use	48 h typical at +20 °C (+68 °F)
data logging use	up to a month, depending on logging interval
Menu languages	English, Chinese, Spanish, French, German, Japanese, Russian, Swedish, Finnish

Display	LCD with backlight, graphic trend display of any parameter, character height up to 16 mm
Analog output	0 ... 1 VDC
Output resolution	0.6 mV
PC interface	MI70 Link software with USB or serial port cable
Data logging capacity	2700 points
Alarm	Audible alarm function

## Mechanics

### PROBE

Housing classification	IP65 (NEMA 4)
Housing material	ABS/PC blend
Probe material	Stainless steel (AISI316L)
Cable length between probe and indicator	1.9 m, 10 m extension available
Weight	506 g

### INDICATOR

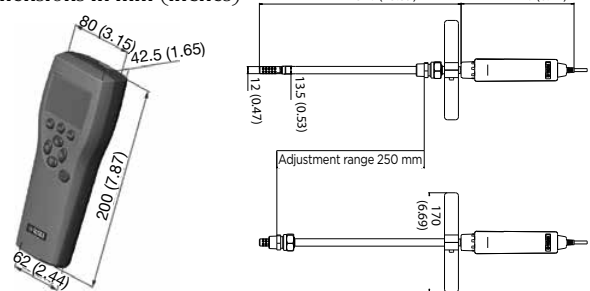
Housing classification	IP54
Weight	400 g
Probe inputs	1 or 2

## Options and Accessories

Carrying case	MI70CASE2
Ball valve set (incl. fitting body & blanking plug)	HMP228BVS
Probe cable extension, 10 m	213107SP
Transmitter connection cables for	
MMT162	219980
MMT310	DRW216050
MMT330	211339
MI70 Link software with USB cable	219687
MI70 Link software with serial port cable	MI70LINK
Analog output cable	27168ZZ
Sensor protection	HM47453SP
Dew point measurement probes	DMP74A/B
Relative humidity measurement probes	HMP75, HMP76, HMP77

## Dimensions

Dimensions in mm (inches)



HUMICAP® is a registered trademark of Vaisala.

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# Vaisala CARBOCAP® Sensor for Measuring Carbon Dioxide



*First launched in 1997, the Vaisala CARBOCAP® carbon dioxide (CO<sub>2</sub>) sensor features a groundbreaking innovation – the micromachined, electrically tunable Fabry-Perot Interferometer (FPI) filter for built-in reference measurement. This reliable and stable sensor has been delivering accurate CO<sub>2</sub> measurements for over 15 years across a wide range of industries and applications, from building automation and safety to life sciences and ecological research.*

### CARBOCAP in Brief

- A silicon-based infrared (IR) absorption sensor
- Continuous internal reference measurement
- Both ppm and percentage-level CO<sub>2</sub> measurement
- Providing accurate measurements for over 15 years

### CARBOCAP's Unique Benefits

- Superior stability enabled by built-in reference measurement
- Minimal maintenance and calibration requirements
- Insensitive to dust, water vapor, and most chemicals
- Insensitive to changing air flow

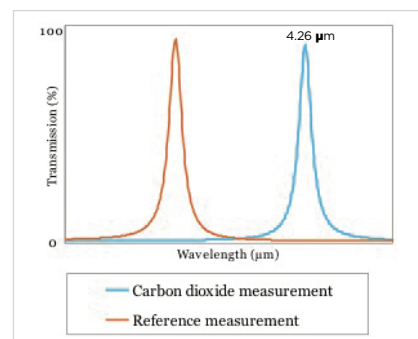
### How It Works

Carbon dioxide has a characteristic absorbance band in the infrared (IR) region at a wavelength of 4.26  $\mu\text{m}$ . This means that when IR radiation is passed through a gas containing CO<sub>2</sub>, part of the radiation is absorbed. Therefore, the amount of radiation passing through the gas depends on the amount of CO<sub>2</sub> present, and this can be detected with an IR detector.

The Vaisala CARBOCAP sensor features an electrically tunable FPI filter located in front of the IR detector. In addition to measuring CO<sub>2</sub> absorption, the micromechanical FPI filter enables a reference measurement at a wavelength where no absorption occurs. When taking the reference measurement, the FPI filter is electrically adjusted to switch the bypass band from the absorption wavelength to a non-

absorption wavelength. The reference measurement compensates for any potential changes in the light source intensity, as well as for contamination and dirt accumulation in the optical path. This feature means that CARBOCAP sensor operation is highly stable over time.

Instruments measuring at both the absorption and the reference wavelength with a single light source are known as single-beam dual-wavelength instruments. The technology is widely applied in costly analyzers. The unique feature of the CARBOCAP sensor is its micromachined FPI filter, which performs a dual-wavelength measurement using a single detector. The compact size of the sensor means that this advanced technology can be incorporated into small probes, modules, and transmitters.



*Both absorption and reference are measured with the CARBOCAP sensor.*



## Typical Applications for Carbon Dioxide Measurement

Vaisala CARBOCAP instruments are well suited to a wide range of applications, from ppm (parts per million) to percentage-level CO<sub>2</sub> measurements. Since CO<sub>2</sub> is harmful in high concentrations, it is present at percentage levels only within closed processes such as fermentation and controlled-atmosphere storage environments. Percentage-level measurements are also typical in life-science applications such as CO<sub>2</sub> incubation.

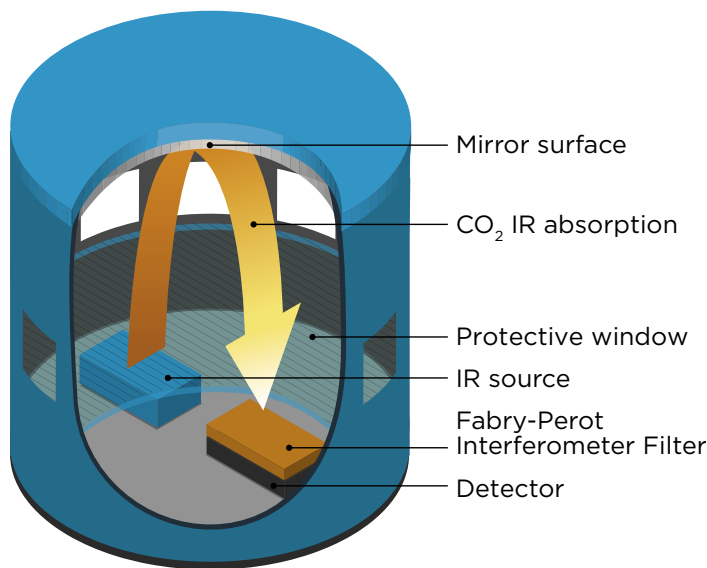
Normal atmospheric air includes CO<sub>2</sub> at ppm levels. Typical CARBOCAP applications include ventilation control in buildings occupied by people, animal shelters, and greenhouses. In areas where large volumes of CO<sub>2</sub> are handled, reliable CO<sub>2</sub> measurement with alarm control is an important safety precaution. The CARBOCAP sensor is also a popular choice in ecological

measurement applications, where excellent long-term stability and tolerance to harsh conditions are important requirements.

## CARBOCAP CO<sub>2</sub> Products

Vaisala offers instruments for measuring CO<sub>2</sub> at ppm and percentage levels in both indoor and

outdoor environments. Vaisala's wide variety of CO<sub>2</sub> instruments ranges from hand-held meters, measurement modules, and industrial transmitters to high-volume, affordable transmitters for volume applications. View the complete range of CO<sub>2</sub> products at [www.vaisala.com/carbondioxide](http://www.vaisala.com/carbondioxide).



*Structure of the CARBOCAP sensor.*

## The CARBOCAP® Story

The CARBOCAP story began in 1992, when micromechanical sensors were being intensively researched at Vaisala. The groundbreaking idea of miniaturizing the Fabry-Perot Interferometer (FPI) was born, leading to collaborative development work with VTT Technical Research Center of Finland. Later, a patent application was submitted for a single-channel gas concentration measurement method using the FPI.

The driving force behind the innovation of the CARBOCAP sensor was Vaisala's commitment to developing superior technologies for environmental measurements. And indeed, Vaisala's pioneering work in the field of silicon-based NDIR technology and electrically tunable filters resulted in the compact, simple and high-performance CARBOCAP sensor. To this day, the long-term stability and reliability of the measurement provided by the FPI is unrivaled.

The first commercial CARBOCAP products for measuring ppm-level CO<sub>2</sub> in ventilation applications were launched in 1997, with instruments for percentage-level CO<sub>2</sub> measurements following soon after. CARBOCAP technology is proven in a wide range of applications, including ecological measurements, where it performs reliably in harsh environments such as soil and snow, satisfying the thirst for knowledge that scientists have for understanding nature's processes.

# VAISALA

For more information, visit  
[www.vaisala.com](http://www.vaisala.com) or contact  
us at [sales@vaisala.com](mailto:sales@vaisala.com)

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## GMP343 Carbon Dioxide Probe for Demanding Measurements



### Features/Benefits

- Excellent accuracy and stability
- Vaisala CARBOCAP® Sensor, a silicon-based non-dispersive infrared (NDIR) sensor
- A single-beam, dual-wavelength CO<sub>2</sub> measurement with no moving parts
- Compensation options for temperature, pressure, humidity and oxygen
- Low power consumption and heat emission
- Designed for outdoor use
- Compact and lightweight

The GMP343 is available as an open-path diffusion-aspirated model (left) and as a flow-through model (right).

The Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 is an accurate and rugged probe-type instrument for ecological measurements. Typical applications include CO<sub>2</sub> soil respiration, ambient CO<sub>2</sub> monitoring, plant growth chambers, and OEM applications.

The GMP343 can output both numerically filtered and raw measurement data and it can also compensate the measurement with an internal temperature measurement and user-set relative humidity, pressure and oxygen values.

In combination with an MI70 indicator, the GMP343 provides a tool for accurate in-situ measurement. The MI70 can be used as a display, communication and data logging device.

Each GMP343 is calibrated using  $\pm 0.5$  % accurate gases at 0 ppm, 200 ppm, 370 ppm, 600 ppm, 1000 ppm, 4000 ppm and 2 %. Calibration is also done at temperature points of -30 °C, 0 °C, 25 °C and 50 °C. If needed, the customer can recalibrate the instrument using the multipoint calibration (MPC) feature allowing up to 8 user-defined calibration points.

### Technical Data

#### Performance

Measurement range options 0 ... 1000 ppm, 0 ... 2000 ppm, 0 ... 3000 ppm, 0 ... 4000 ppm, 0 ... 5000 ppm, 0 ... 2 %

Accuracy (excluding noise) at 25 °C (77 °F) and 1013 hPa after factory calibration with 0.5 % accurate gases with different range options

0 ... 1000 ppm  $\pm(3 \text{ ppm} + 1 \% \text{ of reading})$

0 ... 2000 ppm - 0 ... 2 %\*  $\pm(5 \text{ ppm} + 2 \% \text{ of reading})$

\*Accuracy below 200 ppm CO<sub>2</sub> not specified for 2 % range option

Noise (repeatability) at 370 ppm CO<sub>2</sub>

with no output averaging  $\pm 3 \text{ ppm CO}_2$

with 30 s output averaging  $\pm 1 \text{ ppm CO}_2$

#### TEMPERATURE

Effect on accuracy **with** temperature compensation:

CO <sub>2</sub> range options	0 ... 1000 ppm	0 ... 2 000 - 5000 ppm	0 ... 2 %
Temperature °C (°F)	Accuracy (% of reading)*		
+10 ... +40 (+50 ... +104)	$\pm 1$	$\pm 1$	$\pm 2$
+40 ... +60 (+104 ... +140)	$\pm 2$	$\pm 3$	$\pm 4$
-40 ... +10 (-40 ... +50)	$\pm 3$	$\pm 3$	$\pm 5$

\* Always at least  $\pm 10 \text{ ppm CO}_2$ .

Temperature compensation is performed by an integrated Pt1000 element

# Technical Data

## PRESSURE

Effect on accuracy **with** pressure compensation:

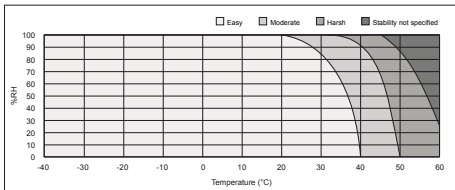
CO <sub>2</sub> range options	0 ... 1000 ppm	0 ... 2000 - 2 %
Pressure (hPa)	Accuracy (% of reading)	
900 ... 1050	±0.5	±1
700 ... 1300	±1	±2

Integrated pressure sensor is **not** included in GMP343

Long term stability	see graph below
easy	±2 % of reading * / year
moderate	±2 % of reading * / 6 months
harsh	±2 % of reading * / 3 months

\* Always at least ±10 ppm CO<sub>2</sub>.

## GMP343 OPERATING CONDITIONS



### Response time (90 %)

DIFFUSION MODEL		
Filter attached	Averaging (s)	Response (s)
Yes	0	75
Yes	30	82
No	0	<2
No	30	30

FLOW-THROUGH MODEL		
Gas flow (l/min)	Averaging (s)	Response (s)
0.3	0	26
0.3	30	44
1.2	0	8
1.2	30	23

Warm-up time	
full accuracy ±0.5 %	10 min
full accuracy	30 min

## Operating Environment

Temperature	
operating	-40 ... +60 °C (-40 ... +140 °F)
storage	-40 ... +70 °C (-40 ... 158 °F)
Humidity	see graph 'GMP343 Operating Conditions'
Pressure	
compensated range	700 ... 1300 hPa
operating	<5 bar
Gas flow for flow-through model	0 ... 10 liters/min
Electromagnetic compatibility	EN61326, Generic Environment

## Inputs and Outputs

Operating voltage	11 ... 36 VDC
Power consumption	
without optics heating	<1 W
with optics heating	<3.5 W
ANALOG OUTPUTS	
Current output	
range	4 ... 20 mA
resolution	14 bits
max. load	800 Ohm @ 24 VDC, 150 Ohm @ 10 VDC
Voltage output	
range	0 ... 2.5 V, 0 ... 5 V
resolution	14 bits (13 bits with 0 ... 2.5 V)
min. load	5 kOhm
DIGITAL OUTPUTS	RS485, RS232

## Materials

Housing	anodized aluminium
Filter cover	PC
IP classification	
Housing (cable attached)	IP67
Diffusion filter (weather protection)	IP65
Diffusion filter (sintered PTFE)	IP66
Cable connector type	8-pin M12
Weight (probe only)	360 g

## Options and Accessories

Wall mount bracket	GMP343BRACKET
Mounting flange	GMP343FLANGE
Standard diffusion filter (weather protection, IP65) +filter cover	GMP343FILTER
Diffusion filter (sintered PTFE filter, IP66) + filter cover	215521
Calibration adapter (for the diffusion model)	GMP343ADAPTER
Junction box	JUNCTIONBOX-8
Probe cables	
2m	GMP343Z200SP
6m	GMP343Z600SP
10m	GMP343Z1000SP
PC connection cable, 2m	213379
MI70 connection cable, 2m	DRW216050SP
USB adapter (USB-D9 Serial connection cable)	219686
Soil adapter kit for horizontal positioning	215519
Soil adapter kit for vertical positioning	215520

For full specifications, see the GMP343 User's Guide.

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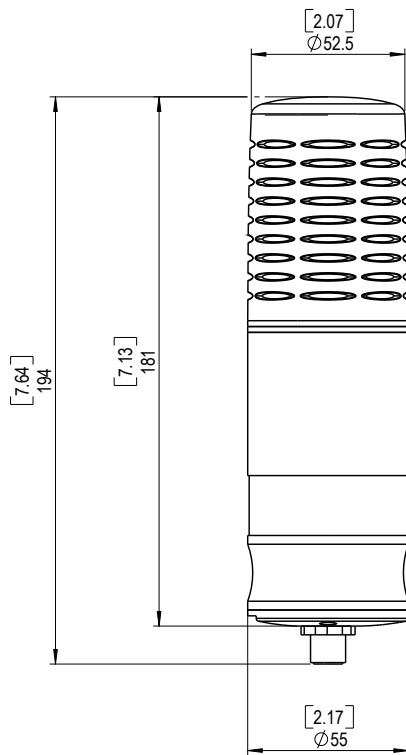
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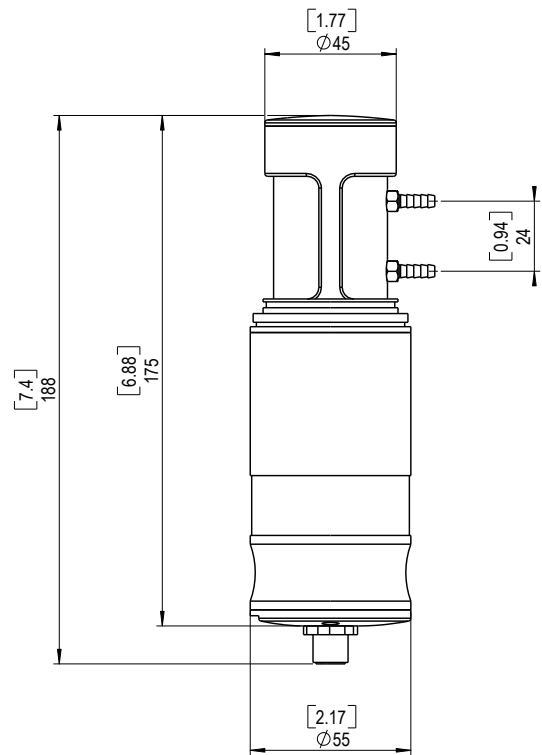
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# Dimensional Drawings of the GMP343 Carbon Dioxide Probe

Dimensions in mm (inches)



*Diffusion model*



*Flow-through model*

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# Carbon Dioxide Measurement with Superior Stability and Ability.

**Unique built-in reference measurement and robust reliability.**

Stability is what everyone promises. But it is exactly what Vaisala CARBOCAP® successfully delivers with its unique built-in reference measurement. Vaisala CARBOCAP® combines the ease and cost efficiency of extra long calibration intervals with leading accuracy on both ppm and percentage level measurements.

While highly sensitive to carbon dioxide, CARBOCAP® is insensitive to water vapor, dust and most chemicals. This has made it the trusted sensor for harsh and humid environments. Proven for over 15 years in hundreds of applications and dozens of industries, worldwide.

Choose from a wide range of fixed and handheld instruments for different applications, requirements and budgets and enjoy superior stability with leading ability.



[www.vaisala.com/carbondioxide](http://www.vaisala.com/carbondioxide)  
[sales@vaisala.com](mailto:sales@vaisala.com)

# VAISALA



## GMT220 Series Carbon Dioxide Transmitters for Industrial Applications



*The GMT220 transmitters withstand harsh and humid environments.*

### Features/Benefits

- Incorporates Vaisala CARBOCAP® - the silicon-based NDIR sensor
- IP65 protected against dust and spray water
- Several measurement ranges
- Easy installation
- Standard analog outputs and two configurable relays available

Applications include:

- Horticulture and fruit storage
- Greenhouses and mushroom farming
- Safety alarming and leakage monitoring
- Demand controlled ventilation in harsh environments

The Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMT220 is designed to measure carbon dioxide in harsh and humid environments. The housing is dust- and waterproof to IP65 standards.

The GMT220 series transmitters incorporate the advanced Vaisala CARBOCAP® Sensor. The patented sensor has unique reference measurement capabilities. Its critical parts are made of silicon; this gives the sensor outstanding stability over both time and temperature. By lengthening the calibration intervals, the user saves both time and money.

### Interchangeable Probes

The user has a choice of measurement ranges up to 20% of CO<sub>2</sub>. The GMT221 is for higher concentrations of CO<sub>2</sub> and the

GMT222 for lower concentrations of CO<sub>2</sub>. The GMT220 probes are interchangeable. They can be removed and reattached or replaced at any time – without the need for calibration and adjustment. The probes can be attached directly to the transmitter body or, when used with a cable, installed remotely into hard-to-reach places or areas with dangerously high levels of CO<sub>2</sub>.

The interchangeability of the GMT220 transmitter's probes truly facilitates field maintenance.

The end user can carry out field maintenance without any additional equipment or heavy and expensive calibration gas bottles by simply replacing a probe.

Probes that have been replaced can be sent to Vaisala for recalibration.

# Technical Data

## Performance

Measurement Ranges	
GMT221	0 ... 2 %
for high concentrations	0 ... 3 %
	0 ... 5 %
	0 ... 10 %
	0 ... 20 %
GMT222	0 ... 2000 ppm
for low concentrations	0 ... 3000 ppm
	0 ... 5000 ppm
	0 ... 7000 ppm
	0 ... 10 000 ppm
Accuracy (including repeatability, non-linearity and calibration uncertainty) at 25 °C and 1013 hPa	
GMT221	±(1.5 % of range + 2 % of reading)
(applies for concentrations above 2 % of full scale)	
GMT222	±(1.5 % of range + 2 % of reading)
Temperature dependence, typical	-0.3 % of reading / °C
Pressure dependence, typical	+0.15 % of reading/hPa
Long-term stability	<±5 %FS/2 years
Response time (63 %)	
GMT221	20 seconds
GMT222	30 seconds
Warm-up time	30 seconds, 15 minutes full specifications

## Inputs and Outputs

Outputs	0 ... 20 or 4 ... 20 mA
	and 0 ... 10 V
Resolution of analog outputs	12 bits
Recommended external load:	
current output	max. 400 Ohm
voltage output	min. 1 kOhm
Two pre- or user-defined relay outputs	
Relay contacts	max. 30VAC/60VDC, 0.5A
Connections	screw terminals, 0.5 ... 1.5 mm <sup>2</sup>
Operating voltage	16 ... 35 VDC or 24 VAC (±20%)
Power consumption	<4 W

## Operating Environment

Operating temperature	-20 ... +60 °C (-4 ... +140 °F)
with display	0 ... +50 °C (+32 ... +122 °F)
Storage temperature	-30 ... +70 °C (-22 ... +158 °F)
Operating pressure (compensated range)	700 ... 1300 hPa
Humidity	0 ... 100 %RH, non-condensing
Electromagnetic compatibility	EN61326-1, Generic Environment

## Mechanics

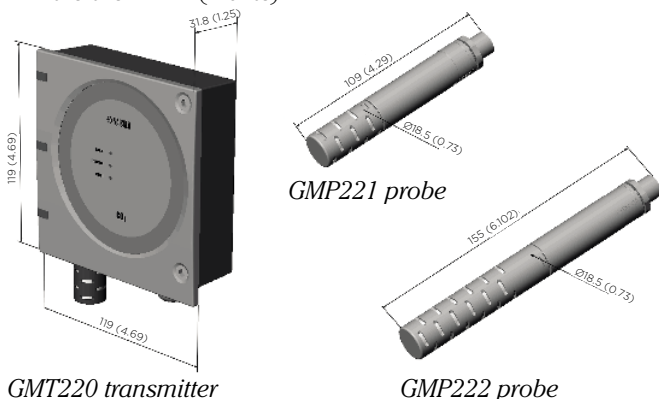
Housing material	
transmitter body	ABS plastic
probe	PC plastic
Housing classification	IP65
Weight:	
GMT221	max. 280 g
GMT222	max. 300 g
Probe cable length	2 m and 10 m (optional)

## Accessories

Spare probe	GMP221, GMP222
(use the order form to define measurement range etc.)	
Clips (2 pcs) for attaching the probe	25245GM
Mounting flange for the probe	GM45156SP
Probe cables	
2 m	25665GMSP
10 m	210848GMSP
Calibrator for interchangeable probes	GMK220
Wall Assembly Plate	GM45160
In-soil adapter for probe	211921GM
Serial COM adapter	19040GM
Calibration adapter for probe	26150GM

## Dimensions

Dimensions in mm (inches)



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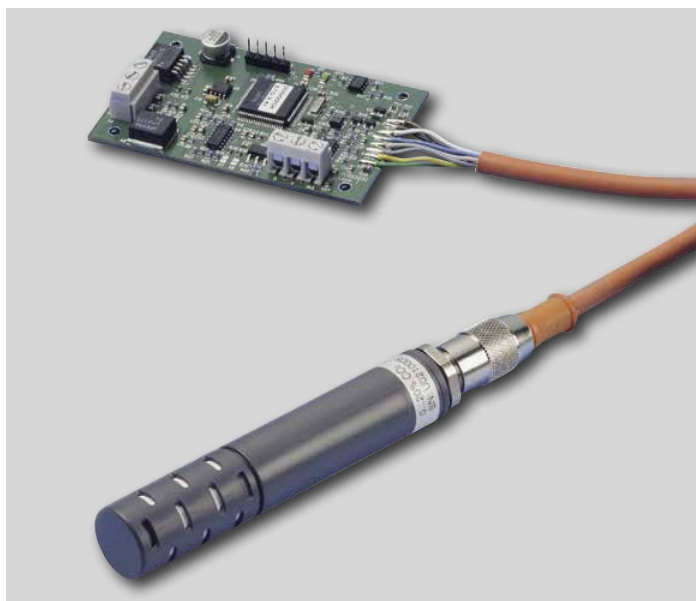


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## GMM220 Carbon Dioxide Modules for Demanding OEM Applications



*The Vaisala CARBOCAP® Carbon Dioxide Module Series GMM220 withstand harsh conditions. They provide high carbon dioxide measurement accuracy over wide temperature and relative humidity ranges.*

### Features/Benefits

- Incorporates Vaisala CARBOCAP® - the silicon based CO<sub>2</sub> sensor
- Choice of several measurement ranges
- IP65 protected probe against dust and spray water
- Interchangeable probes provide easy maintenance
- Modules optimized for integration into equipment for greenhouse control, incubators, fermentors, safety alarming and integrated systems.

### For Harsh Environments

The Vaisala CARBOCAP® Carbon Dioxide Module Series GMM220 are designed for Original Equipment Manufacturers (OEM's) requiring carbon dioxide measurements in harsh and demanding applications.

### Vaisala CARBOCAP®

The GMM220 series modules incorporate the industrial Vaisala CARBOCAP® Sensor. The patented sensor has unique reference measurement capabilities. Its critical parts are made of silicon; this gives the sensor outstanding stability over both time and temperature.

Since water vapor, dust, and most chemicals do not affect the measurement, the GMM220 series modules can be used in harsh and humid environments.

### Interchangeable Probes

The GMP220 probes are interchangeable. They can be removed, reattached or replaced at any time – without the need for calibration and adjustment. The interchangeable probes make calibration and field service easy. In addition, the measurement range can be changed simply by replacing one probe with another.

### Different Configurations

The user has a choice of measurement ranges up to 20 % CO<sub>2</sub>: the Vaisala CARBOCAP® Carbon Dioxide Module GMM221 for higher and the Vaisala CARBOCAP® Carbon Dioxide Module GMM222 for lower concentrations of CO<sub>2</sub>.

Different power supply voltages, output options, as well as cable lengths, connectors, and mounting gear are also available.

# Technical Data

## Carbon Dioxide

### Measurement ranges

GMM221 for high concentrations	0 ... 2 %, 0 ... 3 %, 0 ... 5 %, 0 ... 10 %, 0 ... 20 %
GMM222 for low concentrations	0 ... 2000 ppm, 0 ... 3000 ppm, 0 ... 5000 ppm, 0 ... 7000 ppm, 0 ... 10 000 ppm

Accuracy (including repeatability, non-linearity and calibration uncertainty) at 25 °C and 1013 hPa

GMM221  $\pm(1.5\% \text{ of range} + 2\% \text{ of reading})$   
(applies for concentrations above 2% of full scale)

GMM222  $\pm(1.5\% \text{ of range} + 2\% \text{ of reading})$

Temperature dependence, typical -0.3 % of reading / °C

Pressure dependence, typical +0.15% of reading hPa

Long-term stability  $\leq \pm 5\% \text{ FS/2 years}$

Response time (63 %)

GMM221 20 seconds

GMM222 30 seconds

Warm-up time 30 seconds, 15 minutes  
full specifications

## Inputs and Outputs

Outputs 0 ... 20 or 4 ... 20 mA, 0 ... 1 V, 0 ... 2V, 0 ... 2.5 V, or 0 ... 5 V

Resolution of analog outputs 12 bits

Recommended external load:

current output max. 200 Ohm

voltage output min. 1 kOhm

Operating voltage 11 ... 20 VDC or 18 ... 30 VDC

Connections screw terminals, wire size 0.5 ... 1.5 mm<sup>2</sup>

Power consumption  $\leq 2.5 \text{ W}$

## Operating Environment

Operating temperature -20 ... +60 °C (-4 ... +140 °F)

Storage temperature -30 ... +70 °C (-22 ... +158 °F)

Operating pressure 700 ... 1300 hPa

Humidity

probe 0 ... 100 %RH, non-condensing

mother board 0 ... 85 %RH, non-condensing

Electromagnetic compatibility Applicable parts of EN61326-1,  
Generic Environment

## Mechanics

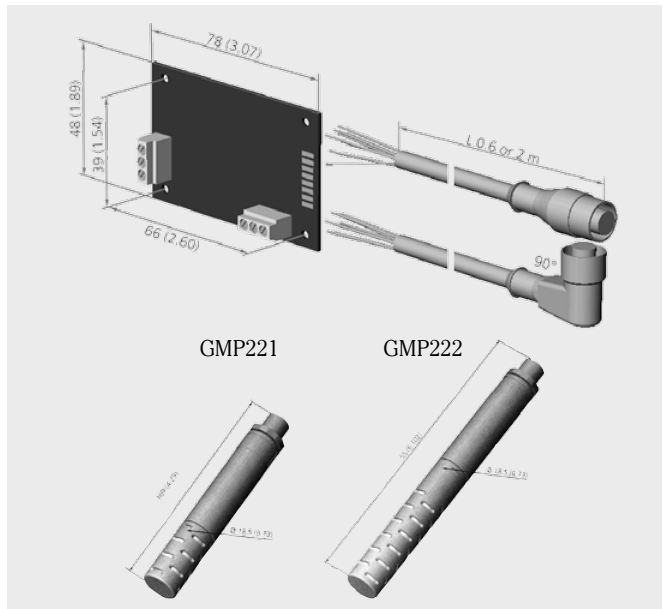
Probe housing material	PC plastic
Housing classification (probe only)	IP65
Weight: GMM221 (w/2m cable)	max. 180 g
Weight: GMM222 (w/2m cable)	max. 200 g
Probe cable length	0.6 m, 1 m (high temperature cable), 2 m, 6 m or 10 m (optional)

## Accessories

Spare probe	GMP221, GMP222 (use the order form to define measurement range etc.)
Clips (2 pcs) for attaching the probe	25245GM
Mounting flange for the probe	GM45156SP
Calibrator for interchangeable probes	GMK220
Probe cables	
1 m high temperature probe cable (180 °C / 365 °F)	GMM220Z100SP
2 m probe cable	GMM220Z200SP
6 m probe cable	GMP343Z600SP
10.0 m probe cable	GMP343Z1000SP
Serial COM adapter	19040GM
Calibration adapter for probe	26150GM

## Dimensions

Dimensions in mm (inches)



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## GMM111 Carbon Dioxide Module



*The Vaisala CARBOCAP® Carbon Dioxide Module GMM111 is a CO<sub>2</sub> measurement module with flow-through aspiration.*

### Features/Benefits

- Compact CO<sub>2</sub> module with flow-through aspiration
- Ideal for control of CO<sub>2</sub> concentrations in incubators
- Incorporates Vaisala CARBOCAP®, the silicon based NDIR sensor with unique internal referencing
- Advanced single-beam, dual wavelength measurement with no moving parts
- Measurement range options 0 ... 5 %, 0 ... 10 % and 0 ... 20 % CO<sub>2</sub>
- Excellent long-term stability

The Vaisala CARBOCAP® Carbon Dioxide Module GMM111 is designed especially for control of biological processes where high CO<sub>2</sub> concentrations are used. It has 3 optional measurement ranges 0 ... 5/10/20 % CO<sub>2</sub>. The GMM111 is a flow-through model and has barbed connectors for attaching the in and out flow tubes. As the module is not mounted in the chamber, the chamber can be heatsterilized without removing the module.

The Vaisala CARBOCAP® CO<sub>2</sub> sensors have been proven to be accurate and durable. They have an excellent long-term stability, which decreases maintenance. The superior performance of Vaisala CARBOCAP® sensors results largely

from the stable reference provided by the electrically tunable Fabry-Perot Interferometer(FPI).

The tunable FPI filter measures CO<sub>2</sub> absorption, and simultaneously a reference wavelength. This internal reference measurement compensates effectively for any changes in the optical path, such as light source intensity changes and contamination. In the HVAC market, this type of reference measurement is a unique feature to Vaisala CARBOCAP® products.

The true internal reference measurement of Vaisala CARBOCAP® CO<sub>2</sub> transmitters provides years of stable CO<sub>2</sub> measurements.



# Technical Data

## Performance

CO <sub>2</sub> measurement range	0 ... 5 %, 0 ... 10 % or 0 ... 20 %
Accuracy (including repeatability, non-linearity and calibration uncertainty)	±(1.5% of range + 3 % of reading)
Long-term stability	
0 ... 8 %CO <sub>2</sub>	±0.5 %CO <sub>2</sub> /year
8 ... 12 %CO <sub>2</sub>	±1 %CO <sub>2</sub> /year
12 ... 20 %CO <sub>2</sub>	±2 %CO <sub>2</sub> /year
Response time T <sub>90</sub>	< 1 min, when flow > 0.2 l/min
Flow rate dependence	
< 1 l/min flow	no effect
1 ... 10 l/min flow	4 % of reading/ l/min
Temperature dependence, typical	-0.3 % of reading/°C
Pressure dependence, typical	+0.15 % of reading/hPa
Warm-up time	1 min, 10 min for full specifications

## Operating Environment

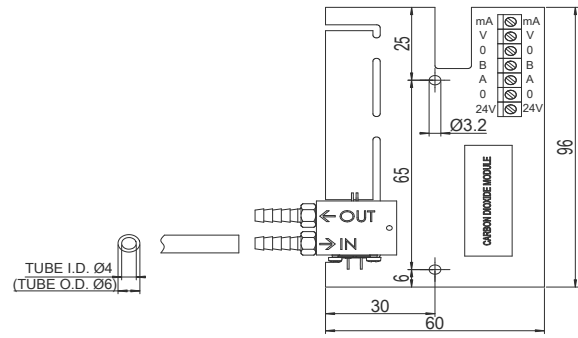
Temperature	+5 ... +55 °C (+41 ... +131 °F)
Humidity	0 ... 99 %RH non-condensing
Pressure	700 ... 1200 hPa
Gas flow	
operating range	< 10 l/min
recommended range	0.2 ... 0.8 l/min
Electromagnetic compatibility	Applicable parts of EN61326-1, Generic Environment

## Inputs and Outputs

Outputs	4 ... 20 mA, 0 ... 10 V
	RS485, 2-wire, non-isolated
Operating voltage	24 V (±20 %) AC/DC
Power consumption	<2 W

## Dimensions

Dimensions in mm



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## GM70 Hand-Held Carbon Dioxide Meter for Spot-Checking Applications



*The Vaisala CARBOCAP® Hand-Held Carbon Dioxide Meter GM70 is the demanding professional's choice for hand-held carbon dioxide measurement. The meter consists of the indicator (center) and probe, used either with the handle (left) or pump (right).*

### Features/Benefits

- Proven Vaisala CARBOCAP® reliability
- Two optional sampling methods: diffusion or pump aspiration
- User-friendly meter with multilingual user interface
- Numerical and graphical display of measurements
- Data can be logged and transferred to PC via MI70 Link software
- Wide selection of measurement ranges
- Easy recalibration using the interchangeable probes
- Suitable for field checking of fixed CO<sub>2</sub> instruments
- Short warm-up time
- Compact and versatile

The Vaisala CARBOCAP® Hand-Held Carbon Dioxide Meter GM70 is a user-friendly meter for demanding spot measurements in laboratories, greenhouses and mushroom farms. The meter can also be used in HVAC and industrial applications, and as a tool for checking fixed CO<sub>2</sub> instruments. The GM70 has a short warm-up time and is ready for use almost immediately. It has a menu-based interface, a graphical LCD display and data logging capability. The optional MI70 Link Windows® software in combination with a USB connection cable provides an easy way to handle data in a PC environment.

### Vaisala CARBOCAP® Technology

The GM70 incorporates the advanced Vaisala CARBOCAP® sensor that has unique reference measurement capabilities. The measurement

accuracy is not affected by dust, water vapor or most chemicals. The GM70 has a two-year recommended calibration interval.

### Two Sampling Methods

The handle is for hand-held diffusion sampling. The GM70 pump enables pump-aspirated sampling from locations difficult to access otherwise. It is also ideal for comparisons with fixed CO<sub>2</sub> transmitters.

### Interchangeable Probes

The GM70 uses the same probes as Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMT220 and Modules Series GMM220. By plugging different probes into the handle or pump, the user can easily change the measurement range of the GM70.

The meter can also be used as a calibration check instrument for Vaisala's GM20 and series, GMT/M220 fixed CO<sub>2</sub> instruments. GMP220 probes can even be adjusted by using the GM70 meter.

The GM70 has two probe inputs. Vaisala's relative humidity and dewpoint probes can also be used simultaneously with CO<sub>2</sub> measurement.

# Technical Data

## CO<sub>2</sub> Volume Concentration Measurement

Measurement ranges	
High concentrations	0 ... 2 %
short probe (GMP221)	0 ... 3 %
	0 ... 5 %, 0 ... 10 %, 0 ... 20 %
Low concentrations	0 ... 2000 ppm
long probe (GMP222)	0 ... 3000 ppm, 0 ... 5000 ppm, 0 ... 7000 ppm, 0 ... 10,000 ppm
Accuracy (including repeatability, non-linearity and calibration uncertainty) at 25 °C and 1013 hPa	
GMP221	±(1.5% of range + 2% of reading)
(applies for concentrations above 2% of full scale)	
GMP222	±(1.5% of range + 2% of reading)
Temperature dependence, typical	-0.3 % of reading / °C
Pressure dependence, typical	+0.15% of reading/hPa
Long-term stability	<±5 %FS/2 years
Response time (63 %)	
GMP221	20 seconds
GMP222	30 seconds
Warm-up time	
	30 seconds, 15 minute full specifications

## Measurement Environment

Temperature	-20 ... +60 °C (-4 ... +140 °F)
Relative humidity	0 ... 100 %RH non-condensing
Operation pressure	700 ... 1300 hPa
Flow range (diffusion sampling)	0 ... 10 m/s

## Probe, Handle & Pump General

Sensor	Vaisala CARBOCAP®
Housing material	
GMP221/222 probe	PC plastic
GMH70 handle	ABS/PC blend
GM70 Pump	aluminium casing
Storage temperature	-30 ... +70 °C (-22 ... +158 °F)
Storage humidity	0 ... 100 %RH non-condensing
Weight	
GMH70 with GMP221/222 probe	230 g
GM70 Pump with GMP221/222 probe	700 g

## MI70 Indicator General

Menu languages	English, Chinese, French, Spanish, German, Japanese, Russian, Swedish, Finnish
Display	LCD with backlight, graphic trend display of any parameter, character height up to 16 mm
Max. no. of probes	2
Power supply	Rechargeable NiMH battery pack with AC-adapter
Analog output	0 ... 1 VDC
Output resolution	0.6 mV
PC interface	MI70 Link software with USB or serial port cable
Data logging capacity	2700 points
Alarm	Audible alarm function
Operating temperature range	-10 ... +40 °C (+14 ... +104 °F)
Operating humidity range	non-condensing
Housing material	ABS/PC blend
Housing classification	IP54
Weight	400 g

## Battery Operation Time

Continuous use	
with handle	better than 8h at +20 °C (+68 °F)
with pump	better than 5h at +20 °C (+68 °F) without load
Data logging use	up to a month, depending on logging interval

## Electromagnetic Compatibility

EN 61326-1, Portable Equipment.

## Accessories

Connection cable for fixed CO <sub>2</sub> instruments	
GMT220, GMM220, GMD20 and GMW20	GMA70
MI70 Link software with USB cable	219687
MI70 Link software with serial port cable	MI70LINK
Analog output cable for 0 ... 1 VDC	27168ZZ
Calibration adapter	26150GM
Carrying case	MI70CASE
Battery, NiMH 4.8V	26755
Spare probe	GMP221, GMP222
(use the order form to define measurement range etc.)	
Nafion Membrane Tubing	212807GM

# Technical Data

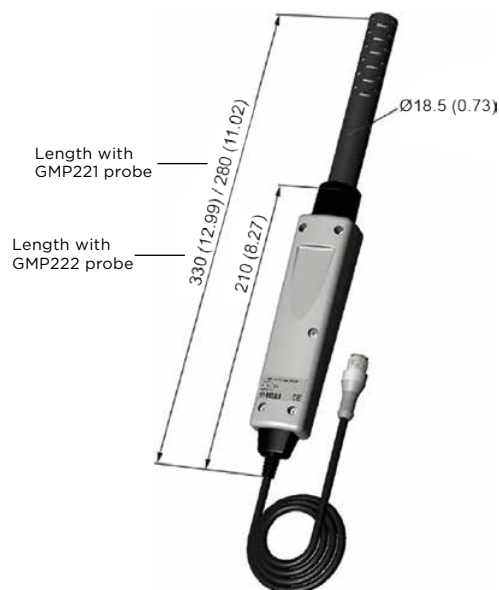
## Dimensions

Dimensions in mm (inches)

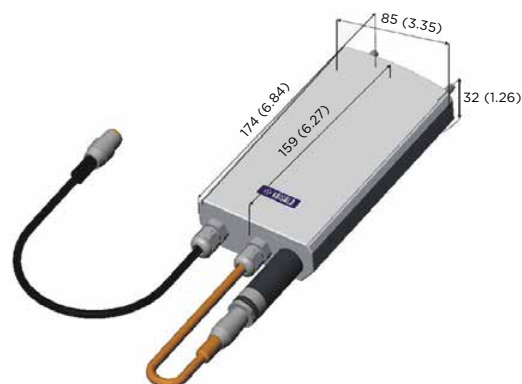
*MI70 indicator*



*Probe handle with probe*



*GM70 pump with probe*



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### Life Science Spotlight

Get information about instrumentation and measurement in controlled environments such as cleanrooms, laboratories, incubators, and other critical environments. Topics include humidity monitoring in cleanrooms or test chambers, CO<sub>2</sub> monitoring in incubators and more.



### What's New at Vaisala

Stay on top of the current news and developments at Vaisala.



## GMW90 Series Carbon Dioxide, Temperature, and Humidity Transmitters for Demand Controlled Ventilation Applications



*GMW90 Series Carbon Dioxide, Temperature and Humidity Transmitters for HVAC are available with either a display opening or a solid front. An optional traffic light indication can also be selected.*

### Features/Benefits

- Measured parameters: carbon dioxide, temperature, and humidity (optional)
- Superior long-term stability with the next generation Vaisala CARBOCAP® sensor
- Accurate temperature and humidity measurements in a three-parameter instrument due to the low-power microglow infrared source
- Quick and easy installation and maintenance
- Calibrated, user-exchangeable modules for carbon dioxide, temperature and humidity
- 3-point traceable CO<sub>2</sub> calibration (certification included)
- Both analog and digital communication (BACnet/Modbus)

The Vaisala GMW90 Series CARBOCAP® Carbon Dioxide, Temperature, and Humidity Transmitters are based on new measurement technology for improved reliability and stability. With the new technology the transmitter's inspection interval is extended to five years.

Designed for demand controlled ventilation, these transmitters measure carbon dioxide and temperature, with the option for humidity measurements. The instruments come with a calibration certificate that meets traceability and compliance requirements.

### Reliability from Unique Measurement Technology

The GMW90 Series Transmitters use advanced Micro-Electro-Mechanical System (MEMS) technology for measuring carbon dioxide. The CARBOCAP® carbon dioxide sensor's continuous reference measurement enables reliable and accurate readings and outstanding long-term stability also in buildings with round-the-clock occupancy.

The new generation CARBOCAP® sensor no longer uses an incandescent light bulb, which limits sensor lifetime. This unique sensor consumes very little power compared to other sensors on the market. As a result, instrument self-heating is low and humidity and temperature can be measured correctly.

### Convenient Installation

GMW90 Series Transmitters have been designed for quick and easy installation and maintenance. Every model includes a display for easy startup and convenient maintenance. To protect the sensor from dust and dirt during construction and installation, the units can be cabled with back-plate only. Electronics can be snapped on later at an appropriate phase in the construction project. Dip switches make it quick and easy to configure the transmitters.

### Easy Calibration

Regular instrument maintenance guarantees a long product lifetime. Calibration is easiest done with the



*Make the transmitter blend into your interior design with the optional decorative cover.*

exchangeable measurement modules. Sensor traceability and measurement quality is easily maintained by snapping on a new module calibrated at Vaisala factory. The instrument can also be calibrated using a hand-held meter or reference gas CO<sub>2</sub> bottle. The service interfaces are easy to reach by simply sliding the cover down. The closed cover keeps the measurement environment stable during calibration and ensures a top-quality final result.

# Technical Data

## Models

GMW93	CO <sub>2</sub> +T	3-wire, voltage output
GMW93D	CO <sub>2</sub> +T	3-wire, voltage output with display
GMW94	CO <sub>2</sub> +T	3-wire, current output
GMW94D	CO <sub>2</sub> +T	3-wire, current output with display
GMW93R	CO <sub>2</sub> +T+RH	3-wire, voltage output
GMW93RD	CO <sub>2</sub> +T+RH	3-wire, voltage output with display
GMW93RA	CO <sub>2</sub> +T+RH	3-wire, voltage output with display and CO <sub>2</sub> indicator LEDs
GMW94R	CO <sub>2</sub> +T+RH	3-wire, current output
GMW94RD	CO <sub>2</sub> +T+RH	3-wire, current output with display
GMW95	CO <sub>2</sub> +T	Digital (BACnet/Modbus) model
GMW95D	CO <sub>2</sub> +T	Digital (BACnet/Modbus) model with display
GMW95R	CO <sub>2</sub> +T+RH	Digital (BACnet/Modbus) model
GMW95RD	CO <sub>2</sub> +T+RH	Digital (BACnet/Modbus) model with display
GMW90	CO <sub>2</sub> +T	Configurable analog/digital models
GMW90R	CO <sub>2</sub> +T+RH	Configurable analog/digital models

## Performance

### CARBON DIOXIDE

Measurement range 0 ... 5000 ppm

#### Accuracy

+20 ... +30 °C (+68 ... +86 °F)	± (30 ppm + 2 % of reading)
+10 ... +20 °C, +30 ... +40 °C (+50 ... +68 °F, +86 ... +104 °F)	± (35 ppm + 2.7 % of reading)
-5 ... +10 °C, +40 ... +55 °C (+23 ... +50 °F, +104 ... +131 °F)	± (45 ppm + 3.8 % of reading)

Stability in typical HVAC applications Total accuracy at room temperature ±75 ppm at 600 and 1000 ppm incl. 5 years drift\*

Carbon dioxide sensor Vaisala CARBOCAP® GM10

### TEMPERATURE

Measurement range -5 ... +55 °C (+23 ... +131 °F)

#### Accuracy

+20 ... +30 °C (+68 ... +86 °F)	±0.5 °C (±0.9 °F)
+10 ... +20 °C, +30 ... +40 °C (+50 ... +68 °F, +86 ... +104 °F)	±0.6 °C (±1.08 °F)
-5 ... +10 °C, +40 ... +55 °C (+23 ... +50 °F, +104 ... +131 °F)	±0.8 °C (±1.44 °F)

Temperature sensor Digital temperature sensor

### RELATIVE HUMIDITY

Measurement range 0 ... 95 %RH

#### Accuracy

Temperature range	+10 ... +40 °C (+50 ... +104 °F)
0 ... 60 %RH	±2.5 %RH
60 ... 80 %RH	±3.0 %RH
80 ... 95 %RH	±4.0 %RH
Temperature range	-5 ... +10 °C, +40 ... +55 °C (+23 ... +50 °F, +104 ... +131 °F)
0 ... 60 %RH	±3.5 %RH
60 ... 80 %RH	±4.0 %RH
80 ... 95 %RH	±5.0 %RH

Stability in typical HVAC applications ±0.5 %RH/year

Humidity sensor Vaisala HUMICAP® 180R

\*Complies with CEC-400-2008-001-CMF

## Operating Environment

Operating temperature range	-5 ... +55 °C (+23 ... +131 °F)
Operating humidity range	0 ... 95 %RH Dewpoint <30 °C (+86 °F)
Storage temperature range	-30 ... +60 °C (-22 ... +140 °F)
Electromagnetic compliance	EN61326-1, Industrial Environment

## Spare Parts and Accessories

CO <sub>2</sub> module	GM10SP
Temperature Module (CO <sub>2</sub> +T models)	TM10SP
Humidity and Temperature Module (CO <sub>2</sub> +T+RH models)	HTM10SP
Decorative cover set (10 pcs.)	236285
Connection cable for HM70 hand-held meter	219980
USB cable for PC connection	219690

## Mechanics

IP class	IP30
Standard housing color	White (RAL9003*)
Housing material	ABS/PC, UL-V0 approved
Output connector	Screw terminals max. wire size 2 mm <sup>2</sup> (AWG14)
Service port connector	4-pin M8
Weight	163 g

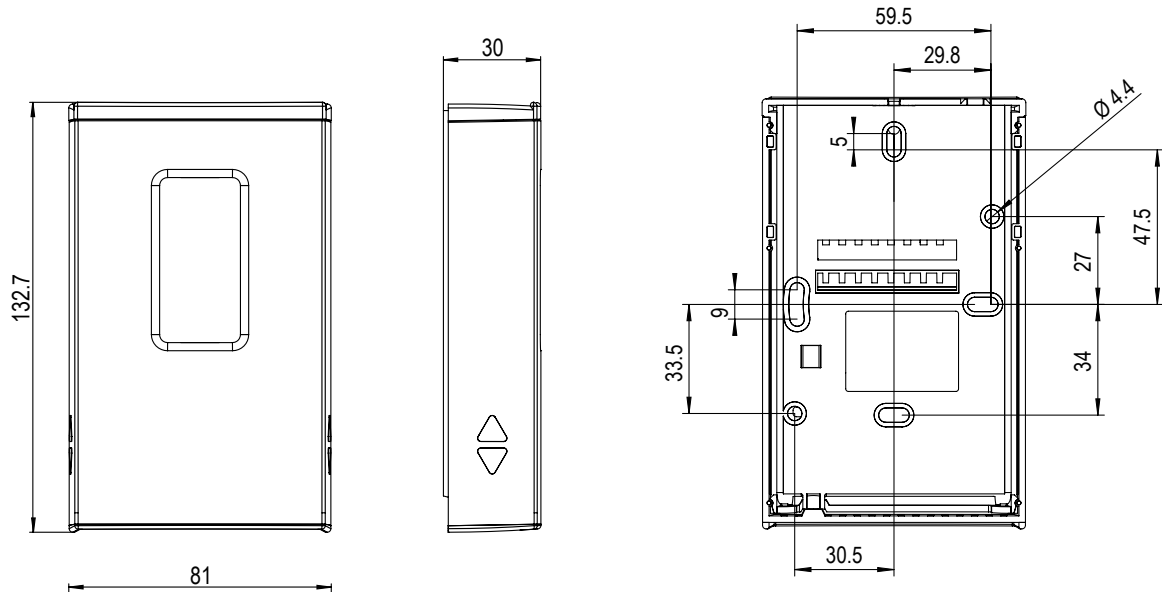
\*RAL code is only indicative with potential small variations in color shade

## Inputs and Outputs

Supply voltage	18 ... 35 VDC, 24 VAC ± 20% 50/60 Hz
Current output models	
Outputs	0/4...20 mA, 2 and 3 channel models available
Loop resistance	0...600 Ω
Power consumption	<2W
Voltage output models	
Outputs	0...5/10 V, 2 and 3 channel models available
Load resistance	10 kΩ min.
Power consumption	<1W
Default analog scales	
CO <sub>2</sub>	0...2000 ppm
T	-5...+55 °C
RH	0...100 ppm
Digital models	
Power consumption	<1.5W
Output type	RS-485 (galvanic isolation, 1.5 kV)
RS-485 end of line termination	Enable with jumper, 120 Ω
Supported protocols	Selectable by DIP switch
BACnet MS/TP	
Operating mode	Selectable Master/Slave
Address range, master mode	0 ... 127
Address range, slave mode	128...255
Modbus RTU	
Address range	0 ... 247
Service port	RS-485 line for temporary service use

## Dimensions

Dimensions in mm



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# Decorative Cover for Vaisala GMW90 and HMW90 Series Transmitters

The decorative cover helps to camouflage the transmitter to the surroundings. Transmitter location can be chosen with optimal measurement in mind without compromising aesthetics.



Carbon Dioxide

[www.vaisala.com/GMW90](http://www.vaisala.com/GMW90)  
[www.vaisala.com/HMW90](http://www.vaisala.com/HMW90)

**VAISALA**



## GMW80 Series Carbon Dioxide, Humidity and Temperature Transmitters for DCV



### Features/Benefits

- Cost-efficient, affordable
- Reliable and maintenance-free operation up to 15 years
- Superior stability due to 2nd-gen proprietary CARBOCAP® technology
- Improved accuracy due to low self-heating of microglow light source
- Easy to install, easy to use
- Versatile – works well in buildings occupied 24/7
- Ideal for demand-controlled ventilation

GMW80 series transmitters.

The Vaisala CARBOCAP® Carbon Dioxide, Humidity and Temperature Transmitter Series GMW80 is based on a second-generation technology for improved reliability and stability. The transmitters are designed to fulfill the needs for CO<sub>2</sub> measurements in standard demand-controlled ventilation applications. Temperature measurement is always included in the GMW80 series transmitters. The optional temperature set-point potentiometer, humidity measurement, relay and LED CO<sub>2</sub> level indication give you the flexibility needed for a variety of projects.

The CARBOCAP® sensors measure CO<sub>2</sub> accurately immediately when powered on. As they have a built-in reference measurement they do not need a lengthy learning phase before the measured values are correct. Proper operation can be verified immediately after snapping on the device cover.

### Easy Installation

With modern buildings often having hundreds of sensors, the installation time per unit can be a significant cost factor. Returning to the building site to check sensor operation adds further costs.

The GMW80 series transmitters include a number of subtle design features that have been introduced to make installation and commissioning quick and easy. The pull-out tab makes opening the transmitter faster than before, while also doubling as a quality check slip and holder for the anti-tamper screw. The backplate can be twisted onto pre-mounted screws, and the wiring can be done easily on the clearly marked backplate. The electronics can be snapped on later when the building automation system is commissioned.

### Reliable Operation

The GMW80 series transmitters are optimized for low maintenance. The second-generation, low-power CARBOCAP® technology enables a longer lifetime and superior stability than ever before. As the power consumption is low, the heat generated by the electronics does not distort the temperature inside the sensor. The internal reference in the CO<sub>2</sub> sensor guarantees the best stability and operation even in constantly occupied buildings without frequent readjustments.

The reliable operation and accurate measurement values of the GMW80 series transmitters contribute to the significant cost savings brought by demand-controlled ventilation.



# Technical Data

## Models

GMW86P	CO <sub>2</sub>	CO <sub>2</sub> current and voltage output, Pt1000
GMW86PT	CO <sub>2</sub>	CO <sub>2</sub> current and voltage output, Pt1000, Temp setpoint
GMW83RP	CO <sub>2</sub> +RH+T	Voltage outputs, Pt1000
GMW83DRP	CO <sub>2</sub> +RH+T	Voltage outputs, Pt1000, Display
GMW83	CO <sub>2</sub> +T	Voltage outputs
GMW83T	CO <sub>2</sub> +T	Voltage outputs, Temp setpoint
GMW83A	CO <sub>2</sub> +T	Voltage outputs, CO <sub>2</sub> indicator LED:s
GMW83D	CO <sub>2</sub> +T	Voltage outputs, Display

## Performance

CARBON DIOXIDE		
Measurement range	0 ... 2000 ppm	
Accuracy		
+20 ... +30 °C	±(30 ppm +3 % of reading)	
+10 ... +20 °C, +30 ... +40 °C	±(35 ppm +3.7 % of reading)	
+0 ... +10 °C, +40 ... 50 °C	±(40 ppm +4.8 % of reading)	
Stability in typical HVAC conditions	±(15 ppm + 2 % of reading) over 5 years	
Warm-up time	1 min; 10 min for full specification	
Response time (63 %)	60s	
Carbon dioxide sensor	Vaisala CARBOCAP®GM10	
TEMPERATURE		
Measurement range	0 ... 50 °C	
Sensor (on P models)	Pt1000 RTD Class F0.15 IEC 60751	
Sensor (for analog outputs)	Digital temperature sensor	
Accuracy (GMW83)		
+10 ... +30 °C	±0.5 °C	
+0 ... +10 °C, +30 ... 50 °C	±1 °C	
HUMIDITY		
Measurement range	0 ... 95 %RH	
Temperature range	+10 ... +30 °C	
0 ... 80 %RH	±3 %RH	
80 ... 95 %RH	±5 %RH	
Temperature range	0 ... +10 °C, +30 ... +50 °C	
0 ... 95 %RH	±7 %RH	
Stability in typical HVAC applications	±2 %RH over 2 years	
Product lifetime	>15 years	

## Operating Environment

Operating temperature range	0 ... +50 °C ( +32 ... 122 °F)
Operating humidity range	0 ... 95 %RH
	Dew point <30 °C (+86 °F)
Storage temperature range	-40 ... +70 °C (-40 ... 158 °F)
Display models	-30 ... +70 °C (-22 ... 158 °F)
Electromagnetic compliance	EN61326-1, Industrial Environment

## Mechanics

IP class	IP30
Housing material	ABS/PC UL-V0 approved
Housing color	White (RAL9003)
Output connector	Screw terminal
	max. wire size 2mm <sup>2</sup> (AWG14)
Weight	114 g (Plain and LED version)
	120 g (Setpoint version)
	124 g (Display version)

## Inputs and Outputs

Supply voltage	18 ... 35 VDC, 24 VAC ±20 % 50/60 Hz
Max. current consumption at 18 VDC	
GMW83/86	45 mA
Max power consumption at 30 VAC	
GMW83	0.7 W
GMW86	1 W
Outputs (see model table)	4 ... 20 mA and/or 0 ... 10V
CO <sub>2</sub> output scale	0 ... 2000 ppm
Temperature output scale	0 ... 50 °C
Humidity output scale	0 ... 100 %RH
Passive temperature sensor (P models)	Pt1000 RTD
Temperature setpoint (T models)	10 KΩ potentiometer
LED CO <sub>2</sub> indicator levels (A model)	
flashing red	>2000 ppm
red	1200 ... 2000 ppm
yellow	800 ... 1200 ppm
green	<800 ppm

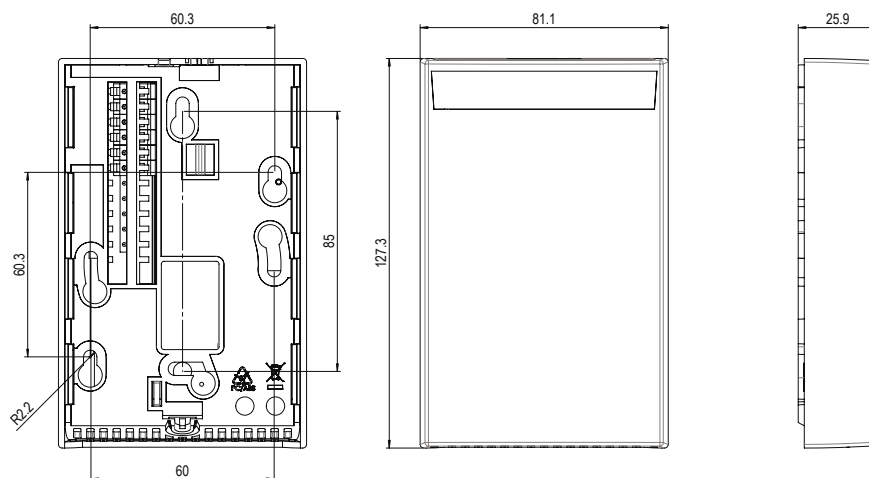
## Spare Parts and Accessories

CO <sub>2</sub> module	GM10SP80
INTERCAP® sensor	15778HM

## GMW86P

CO<sub>2</sub> 4 ... 20mA/0 ... 10V output

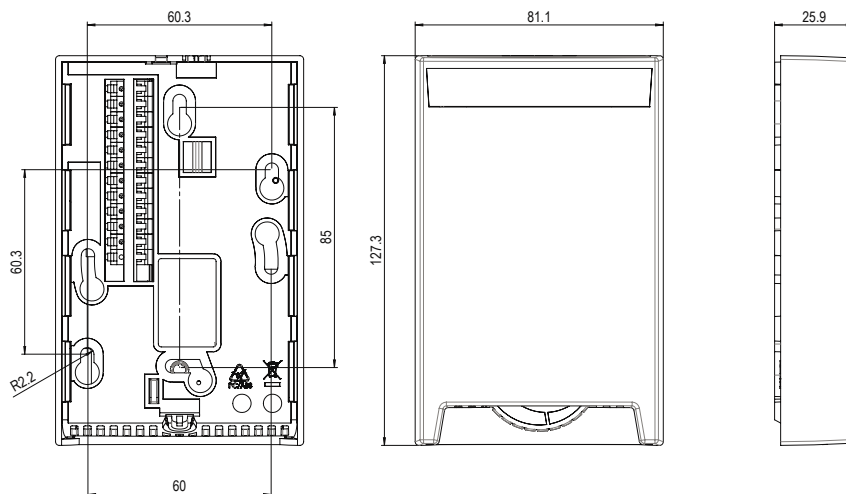
T Pt1000 RTD



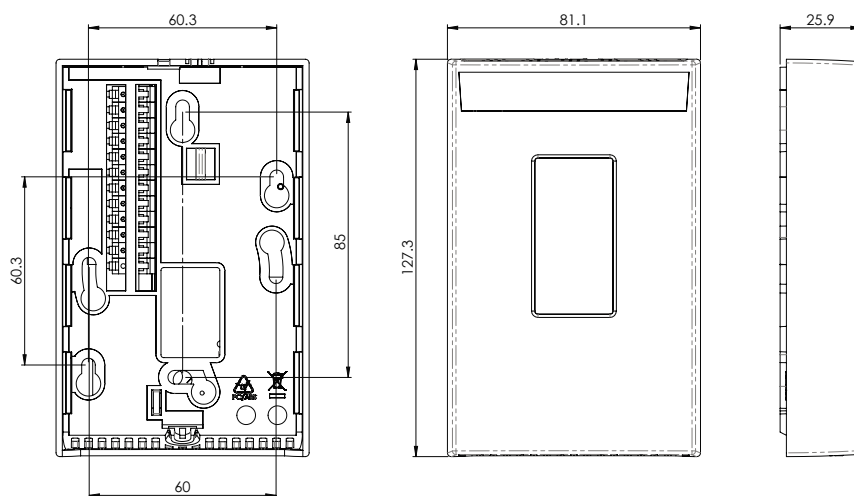
## GMW86PT

CO<sub>2</sub> 4 ... 20mA/0 ... 10V output

T Pt1000 RTD



## GMW83D dimensions



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Vaisala takes pride in professional and comprehensive specifications that are based on scientific test methods and known standards. The accuracy specification takes into account repeatability, non-linearity, and hysteresis, and is given for the full measurement range, unless otherwise stated. This means our customers get truly reliable information with no gaps, helping them make the right decisions.

[www.vaisala.com/requestinfo](http://www.vaisala.com/requestinfo)



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## GMD20 Series Carbon Dioxide Transmitters for Demand Controlled Ventilation Applications



*The GMD20 series transmitters are designed for use in ventilation-related applications.*

### Features/Benefits

- Versatile transmitters
- Reliable measurement with sensor inside the duct
- Incorporates Vaisala CARBOCAP® Sensor - the silicon-based NDIR sensor
- Excellent long-term stability
- Negligible temperature dependence
- Ease of installation

The duct mounted Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMD20 is specially designed for Demand Controlled Ventilation (DCV). They are easy to install and require no maintenance. The recommended calibration interval is five years.

### Vaisala CARBOCAP® Technology

The GMD20 Series Transmitters use the silicon-based Vaisala CARBOCAP® Sensor. The simple structure and reference measurement capabilities make this Single-Beam, Dual-Wavelength NDIR sensor extremely stable and reliable.

The temperature and flow dependences of the sensor are negligible. In addition, the measurement accuracy is not affected by dust, water vapor and most chemicals.

### Versatile Transmitters

The GMD20 series transmitters can be used independently, or incorporated into building energy management systems. The series consists of duct mount units GMD20 and GMD20D. Version D has a display. The duct units' compact sensor head design fits inside the ventilation duct, eliminating the risk of leaking gaskets and measurement errors.

In addition to the standard 0 ... 20 mA, 4 ... 20 mA and 0 ... 10 V outputs, there are two other options: one LonWorks® interface and a relay output. The relay output is standard with the display units.

### Improve Indoor Air at Minimal Energy Costs

The use of the GMD20 series transmitters ensures the best possible control of air quality and results in considerable savings in energy consumption, maintenance and recalibration costs.

# Technical Data

## Performance

### CARBON DIOXIDE MEASUREMENT

Measurement range	0 ... 2000 ppm (nominal; can be calibrated for other ranges: 0 ... 5000 ppm, 0 ... 10,000 ppm, 0 ... 20,000 ppm)
Accuracy (including repeatability, non-linearity and calibration uncertainty)	$\pm (2 \% \text{ of range} + 2\% \text{ of reading})$
Long-term stability	$\leq \pm 5 \% \text{ of range} / 5 \text{ years}$
Response time (63%)	1 minute
Warm-up time	1 minute, 15 minutes full specifications

## Inputs and Outputs

Outputs	0 ... 20 or 4 ... 20 mA and 0 ... 10 V
Optional outputs	relay LonWorks® interface
Resolution of analog outputs	8 bits
Recommended external load:	
current output	max. 500 ohm
voltage output	min. 1 kohm
Operating voltage	nominal 24 VAC/DC (18 ... 30 VDC)
Connections	screw terminals, wire size 0.5 ... 1.5 mm <sup>2</sup>
Power consumption	$\leq 2.5 \text{ W}$

## Operating Environment

Temperature	-5 ... +45 °C (+23 ... +113 °F)
Humidity	0 ... 85 %RH, non-condensing
Flow velocity (GMD20)	0 ... 10 m/s
Electromagnetic compatibility	EN61326-1, Generic Environment

## Mechanics

Housing material	ABS plastic
Housing classification (GMD20 electronics housing)	IP65
Weight: GMD20 (D)	140 g (170 g)

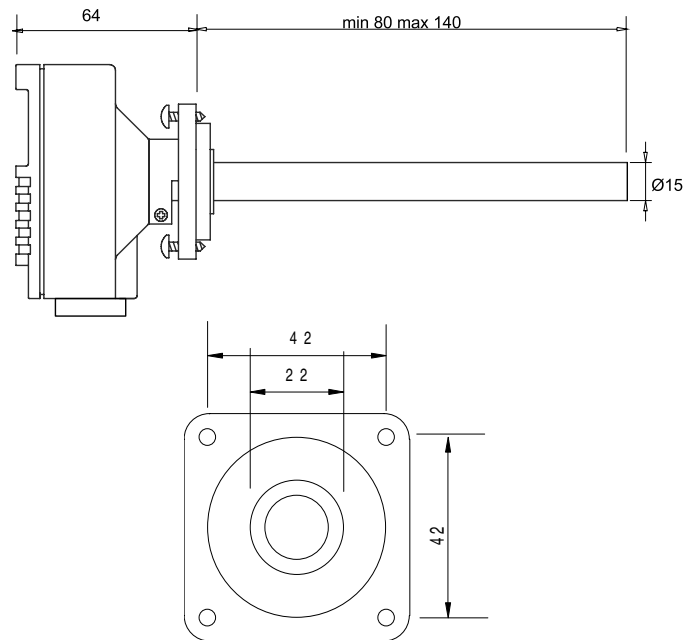
## Accessories and Options

Display and relay option for GMD20	GMI21
Relay output option	GMR20
LonWorks® module with CO <sub>2</sub> signal (Not available when display option is added)	GML20
Serial COM adapter	19040GM
Hand-held meter for field verification	GM70

## Dimensions

Dimensions in mm

GMD20 and GMD20D



CARBOCAP® is a registered trademark of Vaisala.

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## GMM112 Carbon Dioxide Module for HVAC Applications



*The Vaisala CARBOCAP® Carbon Dioxide Module GMM112 is a basic CO<sub>2</sub> measurement module.*

### Features/Benefits

- Compact OEM module for demand controlled ventilation and other CO<sub>2</sub> measurement applications
- Incorporates Vaisala CARBOCAP®, the silicon based NDIR sensor with unique internal referencing
- Advanced, single-beam, dual wavelength measurement with no moving parts
- Excellent long-term stability
- Ideal for ventilation control in all types of occupied spaces

The Vaisala CARBOCAP® Carbon Dioxide Module GMM112 is a compact module for measuring ppm (parts per million) levels of carbon dioxide. The GMM112 module is designed for indoor use in demand controlled ventilation and other applications requiring carbon dioxide control.

The GMM112 has three optional ranges to select from: 0...2 000 ppm, 0...5 000 ppm and 0...10 000 ppm. The selectable analog (current and voltage) and digital outputs make it easy to integrate to various control systems. The GMM112 modules are easy to install and need practically no maintenance.

### Proven Performance with the Vaisala CARBOCAP® Sensor

The GMM112 module includes Vaisala CARBOCAP® carbon dioxide sensor, a silicon-based infrared (IR) absorption sensor. The excellent long-term stability of the CARBOCAP® sensor results from its unique measurement technology. The sensor features an electrically tunable Fabry-Perot Interferometer for built-in reference measurement. The sensor not only measures CO<sub>2</sub> absorption but also a reference, which makes it possible to compensate for potential light intensity variations and contamination and dirt accumulation

in the optical path, making the sensor extremely stable over time.

CARBOCAP sensor has no need for any compensation algorithms that are used in more simple sensors to compensate for their drift. In applications with constant elevated levels of carbon dioxide and in buildings with around-the-clock occupancy (e.g. hospitals, manufacturing facilities, residential buildings, and retirement homes) the compensations based on assumed background carbon dioxide level simply do not work.

# Technical Data

## Performance

CO <sub>2</sub> -measurement range	0 ... 2000 ppm 0 ... 5000 ppm 0 ... 10000 ppm
Accuracy (including repeatability, non-linearity and calibration uncertainty)	± (2 % of range + 2 % of reading)
Long-term stability	± 5 % of range/5 years
Response time T90	1 min
Temperature dependence, typical	-0,35 % of reading / °C
Pressure dependence, typical	+0,15 % of reading/hPa
Warm-up time	1 min, 10 min for full specification
Product lifetime	> 10 years

## Operating Environment

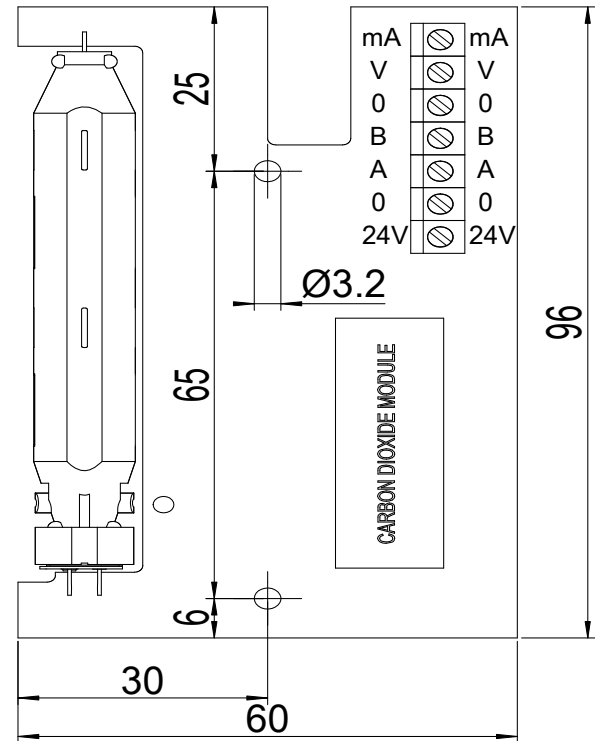
Temperature	-5 ... +45 °C (23 ... 113 °F)
Humidity	0 ... 85 %RH
Pressure	700 ... 1200 hPa
Electromagnetic compatibility	Complies with EMS standard EN61326-1:1997 + Am1:1998, Generic Environment

## Inputs and Outputs

Operating voltage	24 V (±20 %) AC/DC
Power consumption	<2 W
Outputs	4 ... 20 mA, 0 ... 10 V, RS-485, 2-wire, non-isolated

## Dimensions

Dimensions in mm



Carbon Dioxide

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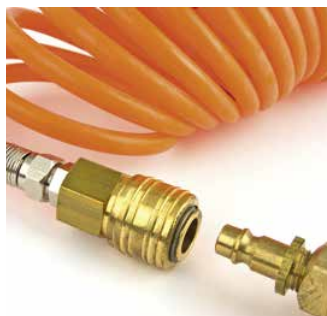
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# Vaisala BAROCAP® Sensor for Measuring Pressure



*First introduced in 1985, Vaisala BAROCAP® is a silicon-based micromechanical pressure sensor that offers reliable performance in a wide variety of applications, from meteorology to industrial measurements. Combining two powerful technologies – single-crystal silicon material and capacitive measurement – BAROCAP sensors feature low hysteresis combined with excellent accuracy and long-term stability.*

## How It Works

BAROCAP is a micromechanical sensor that uses dimensional changes in its silicon membrane to measure pressure. As the surrounding pressure increases or decreases, the membrane bends, thereby increasing or decreasing the height of the vacuum gap inside the sensor. The opposite sides of the vacuum gap act as electrodes, and as the distance between the two electrodes changes, the sensor capacitance changes. The capacitance is measured and converted into a pressure reading. The BAROCAP sensor's properties – good elasticity, low hysteresis, excellent repeatability, low temperature dependence, and superior long-term stability – are the result of its single-crystal silicon material. The capacitive structure gives the sensor its wide dynamic range and provides a built-in mechanism for overpressure blocking.

## Typical Applications for Barometric Pressure Measurement

Barometric pressure measurement has a wide variety of applications within meteorology. Pressure data is required for estimating the amount of precipitable water vapor in the atmosphere. Typical applications include weather stations, data buoys, GPS meteorology, and environmental data logging. Barometric pressure measurement is also used in hydrology and agrology applications.

Barometric pressure data is also required in several industrial applications. It is measured in pressure-sensitive industrial equipment, such as laser interferometers and lithography systems, aviation applications, and in exhaust-gas analysis. Metrological applications include laboratory pressure standard measurements and environmental monitoring in calibration laboratories.

## BAROCAP in Brief

- Over 25 years of accurate pressure measurement
- Silicon-based capacitive sensor for absolute pressure measurement
- Barometric pressure range 500...1100 hPa
- 50...1100 hPa pressure range available for industrial applications
- Process pressure measurement range 1...10 bar
- NIST-traceable pressure measurement

## BAROCAP's Unique Benefits

- Low hysteresis, high repeatability
- Superior long-term stability
- Tolerates harsh conditions

Vaisala offers a range of professional-grade barometers for both indoor and outdoor use. BAROCAP barometers operate over a wide temperature range and perform reliably even in highly demanding applications such as professional meteorology and aviation. View the complete range of Vaisala barometers at [www.vaisala.com/pressure](http://www.vaisala.com/pressure).

## BAROCAP Applications for Measurements in Pressurized Systems

Vaisala DRYCAP® dew point instruments have a long history of providing reliable and stable measurements in compressed air systems and SF6 insulation

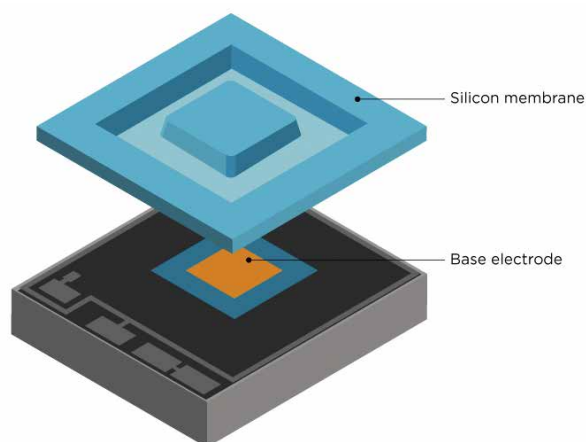
gas monitoring in high-voltage equipment. In addition to the need for dew point measurement, these two applications also share the need for accurate and stable pressure measurement. Vaisala has integrated its DRYCAP and BAROCAP technologies into a range of products that offer a unique combination of pressure and dew point measurement for pressurized systems.

In compressed air, combining dew point measurement with live process pressure data provides a unique advantage: The conversion of measured pressure dew point to atmospheric pressure or ppm unit is available online, eliminating the possibility of any ambiguity in the dew

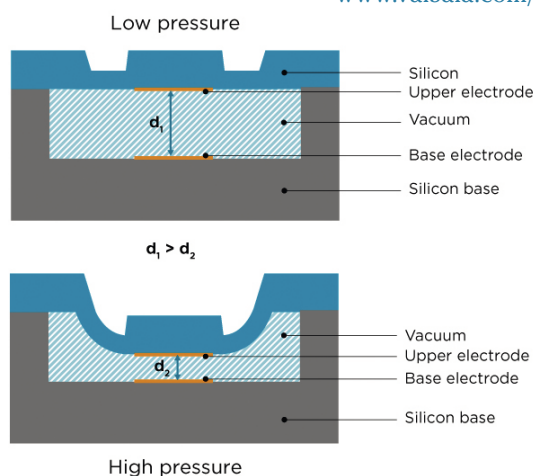
point data. This is important because changes in the pressure of the gas being monitored alter its dew point.

Combined dew point and pressure measurement in SF6 gas monitoring of high-voltage equipment provides a superior tool for assessing the condition of SF6 insulation. Leakages can be immediately detected and early warning is given for moisture issues. Measuring dew point, pressure, and temperature enables the calculation of SF6 gas density, normalized pressure, dew point at atmospheric pressure, and ppm – all essential elements in SF6 monitoring.

View the complete range of Vaisala products for combined pressure and dew point measurement at [www.vaisala.com/pressure](http://www.vaisala.com/pressure).



*BAROCAP sensor.*



*Cross-section of the BAROCAP sensor.*

## The BAROCAP Story

The story of BAROCAP began in the late 1970s during preliminary micromechanical pressure sensor studies for the new-generation Vaisala Radiosonde RS80. Micromechanics proved to be challenging, and Vaisala worked in close cooperation with universities and research institutes in Finland and internationally to develop a

new pressure-sensing technology based on silicon processing. The critical breakthrough came on the brink of the project deadline. The first BAROCAP sensors were delivered to two icebreakers and the Helsinki Telephone Company.

BAROCAP sensors have traveled to places where no human has ever

set foot, including as part of several Mars exploration missions and the Cassini-Huygens mission to explore Saturn and its largest moon, Titan. BAROCAP's out-of-this-world journey continues with its inclusion in instruments that form part of NASA's Mars Science Laboratory, launched in November 2011.

# VAISALA

For more information, visit [www.vaisala.com](http://www.vaisala.com) or contact us at [sales@vaisala.com](mailto:sales@vaisala.com)

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## PTU300 Combined Pressure, Humidity and Temperature Transmitter for Demanding Applications



*The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 is a versatile, multi-purpose instrument.*

### Features/Benefits

- Barometric pressure, humidity, and temperature measurement in one transmitter
- Available with up to two barometric pressure sensors for added reliability
- RS232C serial interface with NMEA protocol for GPS use
- Graphical display and keypad for convenient operation
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)
- Optional universal power supply module
- NIST traceable calibration (certificate included)
- HMT330MIK installation kit for outdoor use
- Applications include environmental monitoring in calibration laboratories, industrial applications, GPS meteorology: estimating precipitable water vapor in the atmosphere, weather stations

### One Transmitter, Three Measurements

The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 is a unique instrument measuring three parameters simultaneously.

You can choose from the following probe options: PTU301 for laboratories, PTU303 for general use, PTU307 warmed probe for outdoor and demanding meteorology applications, and PTU30T for pressure and temperature measurement only.

### Proven Vaisala Sensor Technology

The PTU300 incorporates sensors known for their high accuracy and excellent long-term stability: Vaisala BAROCAP® for pressure measurement and Vaisala HUMICAP® for humidity measurement. The temperature sensor is a platinum RTD sensor.

### Graphical Display of Measurement Data and Trends for Convenient Operation

The PTU300 features a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

The optional data logger, with real-time clock, makes it possible to generate over four years of measurement history and zoom in on any desired time or time frame.

The display alarm allows any measured parameter to be tracked, with freely configurable low and high limits.



## Versatile Outputs and Data Collection

The PTU300 comes with a standard RS232 serial interface. The output format is compatible with major GPS receivers and NMEA-coded messages. An isolated RS485 is available as an option.

The PTU300 is also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provides either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data

can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the PTU300 to a PC via the service port.

## Outdoor Installation Kit

Outdoor installation is possible using the optional HMT330MIK installation kit, for applications requiring reliable measurements for meteorological purposes.

## Flexible Calibration

Quick, one-point field calibration for humidity is easy using the Vaisala Hand-Held Humidity Meter HM70.

With Vaisala Barometric Pressure Transfer Standard PTB330TS, including optional humidity and temperature probe, field check and calibration can be performed for all three parameters.

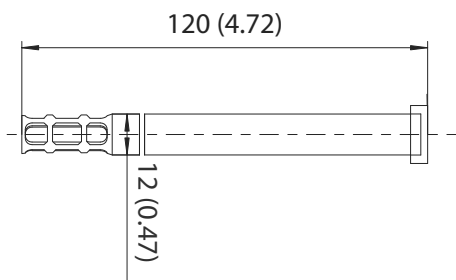
# PTU300 Models



*PTU301 for wall mounting*

### Dimensions

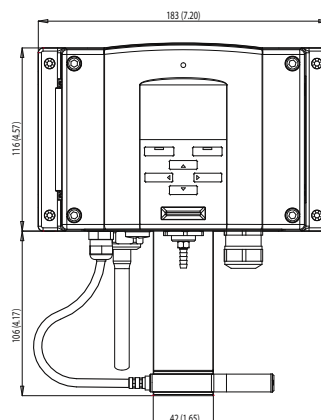
Dimensions in mm (inches)



*PTU301 short cable probe with optional WLAN*

### Dimensions

Dimensions in mm (inches)



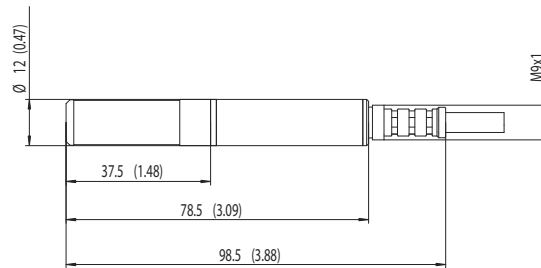
# PTU300 Models



*PTU303 probe for outdoor use*

## Dimensions

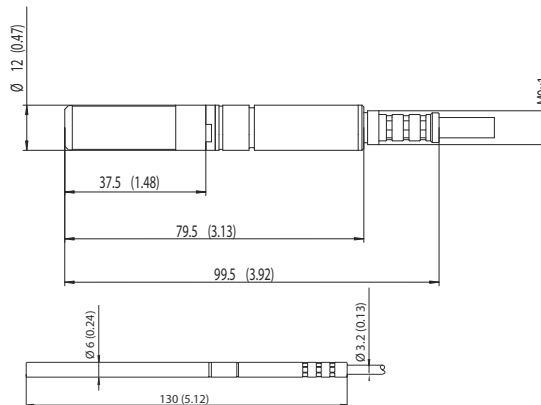
Dimensions in mm (inches)



*PTU307 warmed probe for demanding meteorological installations*

## Dimensions

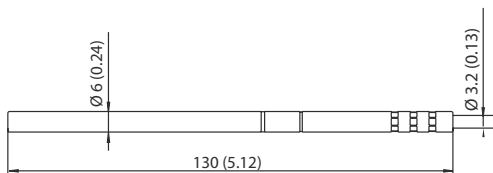
Dimensions in mm (inches)



*PTU30T for pressure and temperature only measurement*

## Dimensions

Dimensions in mm (inches)



# Technical Data

## Performance

### BAROMETRIC PRESSURE

Pressure range	500 ... 1100 hPa	500 ... 1100 hPa	50 ... 1100 hPa
Accuracy	500 ... 1100 hPa	500 ... 1100 hPa	50 ... 1100 hPa
	CLASS A	CLASS B	
Linearity	±0.05 hPa	±0.10 hPa	±0.20 hPa
Hysteresis*	±0.03 hPa	±0.03 hPa	±0.08 hPa
Repeatability*	±0.03 hPa	±0.03 hPa	±0.08 hPa
Calibration uncertainty**	±0.07 hPa	±0.15 hPa	±0.20 hPa
Accuracy at +20 °C***	±0.10 hPa	±0.20 hPa	±0.30 hPa
Temperature dependence****	±0.1 hPa	±0.1 hPa	±0.3 hPa
Total accuracy (-40 ... +60 °C/-40 ... +140 °F)	±0.15 hPa	±0.25 hPa	±0.45 hPa
Long-term stability/year	±0.1 hPa	±0.1 hPa	±0.2 hPa
Response time (100 % response)			
one sensor	2 s	1 s	1 s
Pressure units	hPa, mbar, kPa, Pa, inHg, mmH2O, mmHg, torr, psia		

\* Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis error or repeatability error and calibration.

\*\* Defined as ±2 standard deviation limits of accuracy in the working standard including NIST traceability.

\*\*\* Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.

\*\*\*\* Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

### RELATIVE HUMIDITY

Measurement range	0 ... 100 %RH
Accuracy (including non-linearity, hysteresis, and repeatability at +15 ... +25 °C)	±1 %RH (0 ... 90 %RH) ±1.7 %RH (90 ... 100 %RH)
at -20 ... +40 °C	±(1.0 + 0.008 x reading) %RH
at -40 ... +60 °C	±(1.5 + 0.015 x reading) %RH
Factory calibration uncertainty (+20 °C)	
(Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.)	±0.6 %RH (0 ... 40 %RH) ±1.0 %RH (40 ... 97 %RH)

### Sensor

for typical applications Vaisala HUMICAP® 180 or 180R\*  
for applications with chemical purge/warmed probe Vaisala HUMICAP® 180C or 180RC\*

Response time (90%) at +20 °C (+68 °F) in still air

with grid filter	8 s / 17 s*
with grid + steel netting filter	20 s / 50 s*
with sintered filter	40 s / 60 s*

\* with HUMICAP® 180R or 180RC sensor

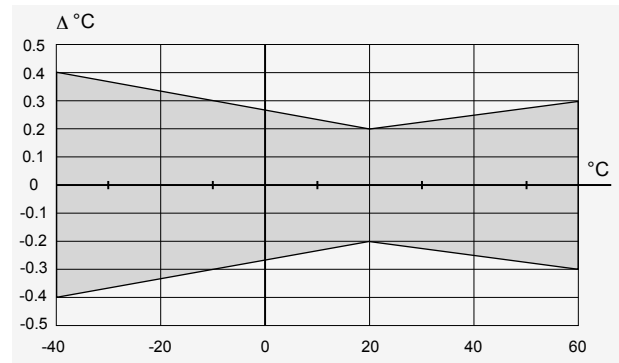
### TEMPERATURE

Measurement range, all probes	-40 ... +60 °C (-40 ... +140 °F)
Accuracy at +20 °C (+68 °F)	±0.2 °C (±0.4 °F)
Temperature units	°C, °F



The display also shows the WMO pressure trend  $\Delta P$  3h and tendency of 0 ... 8.

### ACCURACY OVER TEMPERATURE RANGE



Temperature sensor

Pt100 RTD Class F0.1 IEC 60751

## Operating Environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
with optional display	0 ... +60 °C (+32 ... +140 °F)
Humidity range	non-condensing
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Industrial Environment
Note:	Transmitter with display test impedance of 40 ohm is used in IEC61000-4-5 (Surge immunity)

## Inputs and Outputs

Operating voltage	10 ... 35 VDC, 24 VAC ±20%
with optional power supply module	100 ... 240 VAC, 50/60 Hz
Power consumption at +20 °C ( $U_{in}$ 24 VDC)	
RS232	max. 28 mA
$U_{out}$ 3 x 0 ... 1 V/0 ... 5 V/0 ... 10 V	max. 33 mA
$I_{out}$ 3 x 0 ... 20 mA	max. 63 mA
display and backlight	+20 mA
during chemical purge	max. +110 mA
during probe heating	+120 mA
Settling time at power-up (one sensor)	
class A	4 s
class B	3 s
External loads	
current outputs	$R_L < 500 \text{ ohm}$
0 ... 1 V output	$R_L > 2 \text{ kohm}$
0 ... 5 V and 0 ... 10 V outputs	$R_L > 10 \text{ kohm}$

Recommended wire size	0.5 mm <sup>2</sup> (AWG 20) stranded wires
Digital outputs	RS232, RS485 (optional)
Protocols	ASCII commands, MODBUS RTU
Service connection	RS232, USB
Relay outputs (optional)	0.5 A, 250 VAC
Ethernet interface (optional)	
Supported standards	10BASE-T, 100BASE-TX
Connector	8P8C (RJ45)
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
WLAN interface (optional)	
Supported standards	802.11b
Antenna connector type	RP-SMA
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
Security	WEP 64/128, WPA2
Authentication / Encryption (WLAN)	
Open / no encryption	
Open / WEP	
WPA Pre-shared key / TKIP	
WPA Pre-shared key / CCMP (a.k.a. WPA2)	
Optional data logger with real-time clock	
Logged parameters	max. four with trend/min/max values
Logging interval	10 sec. (fixed)
Max. logging period	4 years, 5 months
Logged points	13.7 million points per parameter
Battery lifetime	min. 5 years
Display	LCD with backlight, graphical trend display of any parameter
Menu languages	English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish
Analog outputs (optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Humidity and temperature	
accuracy at +20 °C	±0.05% full scale
temperature dependence	±0.005%/°C full scale
Pressure	500 ... 1100 hPa    50 ... 1100 hPa
accuracy at +20 °C	±0.30 hPa    ±0.40 hPa
accuracy at -40 ... +60 °C	±0.60 hPa    ±0.75 hPa

## Mechanics

Cable bushing	M20 x 1.5 for cable diameter 8 ... 11 mm/0.31 ... 0.43"
Conduit fitting	1/2" NPT
User cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft) black cable
option 2	female plug with screw terminals

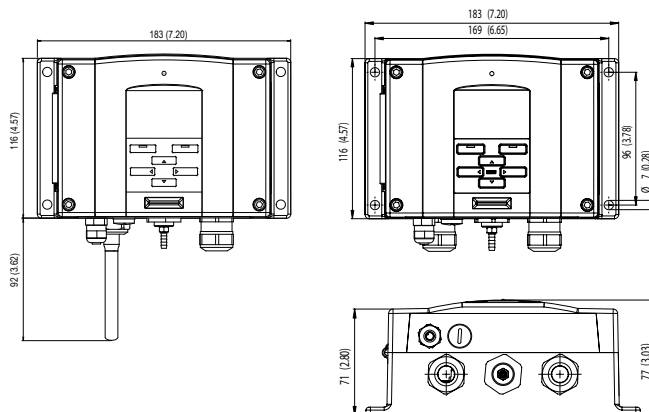
Probe cable diameter	PTU303 other probes	6.0 mm 5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m (Additional cable lengths available, please see order form for details)	
Housing material	G-AlSi 10 Mg (DIN 1725)	
Housing classification	IP 66 IP65 (NEMA4X) with local display	
Weight	depending on selected probe	1.0 - 3.0 kgs

## Accessories

PC software and cable	215005
USB-RJ45 Serial Connection Cable	219685
Connection cable for HM70	211339
Wall mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
DIN rail installation set	211477
Duct installation kit, PTU303/307	210697
Cable gland and AGRO, PTU303/307	HMP247CG
Solar radiation shield, PTU303/307/30T	DTR502B
Meteorological installation kit	HMT330MIK
Duct installation kit (T probe)	215003

## Dimensions

Dimensions in mm (inches)



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TYPE APPROVED PRODUCT  
CERTIFICATE NO.: A-13529

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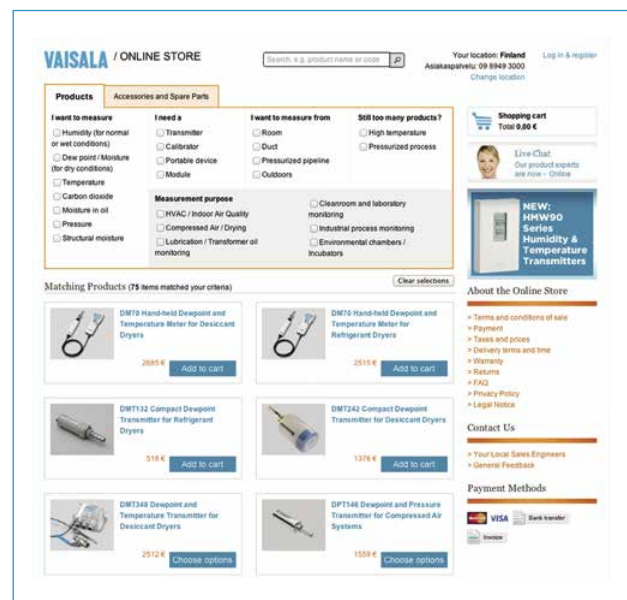
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## PTB330 Digital Barometer for Professional Meteorology, Aviation, and Industrial Users



*Vaisala BAROCAP® Digital Barometer PTB330 with a new trend display.*

Vaisala BAROCAP® Digital Barometer PTB330 is a new generation barometer, designed for a wide range of high-end atmospheric pressure measurement. The pressure measurement of the PTB330 is based on the Vaisala in-house, silicon

capacitive, absolute pressure sensor - the Vaisala BAROCAP® Sensor. It provides high measurement accuracy and excellent long-term stability.

### Highly Accurate

The PTB330 series is highly accurate. The Class A barometers for the most demanding applications are fine-tuned and calibrated against a high-precision pressure calibrator. Class B barometers are adjusted and calibrated using electronic working standard. All the PTB330 barometers come with a NIST traceable, factory calibration certificate.

### Reliability through Redundancy

According to customers' choice, the PTB330 can incorporate one, two or three BAROCAP® sensors. When two or three sensors are used, the barometer continuously compares the readings of the pressure sensors

against one another and provides information on whether these are within the set internal difference criteria. This unique feature provides redundancy in pressure measurement.

Thus, users also get a stable and reliable pressure reading at all times as well as a pre-indication of when to service or recalibrate the barometer.

### QNH and QFE

The PTB330 can be set to compensate for QNH and QFE pressure used especially in aviation. The QNH represents the pressure reduced to sea level, based on the altitude and temperature of the observation site. The QFE represents the height corrected pressure of small differences in altitude, for example, the air pressure at the airfield elevation.

### Graphical Display

The PTB330 features a multi-lingual, graphical display allowing users to monitor measurement trends. The graph is updated automatically while measuring and it provides a one-year measurement history. In addition to instant pressure, the PTB330 also provides the WMO pressure trend and tendency codes.

### Applications

The PTB330 can be used successfully for aviation, professional meteorology, and for demanding industrial pressure measurement applications such as accurate laser interferometric measurement and exhaust gas analysis in engine test benches.

#### Features/Benefits

- Vaisala BAROCAP® sensor
- Accurate measurement
- Excellent long-term stability
- Added reliability through redundancy
- Graphical trend display with 1-year history data
- Height and altitude corrected pressure (QFE, QNH)
- For professional meteorology and aviation, laboratories, demanding industrial applications

# Technical Data

## Performance

BAROMETRIC PRESSURE RANGE 500 ... 1100 hPa

	Class A	Class B
Linearity*	±0.05 hPa	±0.10 hPa
Hysteresis*	±0.03 hPa	±0.03 hPa
Repeatability*	±0.03 hPa	±0.03 hPa
Calibration uncertainty**	±0.07 hPa	±0.15 hPa
Accuracy at +20 °C (+68 °F) ***	±0.10 hPa	±0.20 hPa

BAROMETRIC PRESSURE RANGE 50 ... 1100 hPa

	Class B
Linearity*	±0.20 hPa
Hysteresis*	±0.08 hPa
Repeatability*	±0.08 hPa
Calibration uncertainty**	±0.15 hPa
Accuracy at +20 °C ***	±0.20 hPa

TEMPERATURE DEPENDENCE\*\*\*\*

500 ... 1100 hPa	±0.1 hPa
50 ... 1100 hPa	±0.3 hPa

TOTAL ACCURACY -40 ... +60 °C (-40 ... +140 °F)

	Class A	Class B
500 ... 1100 hPa	±0.15 hPa	±0.25 hPa
50 ... 1100 hPa		±0.45 hPa

LONG-TERM STABILITY

500 ... 1100 hPa	±0.1 hPa/year
50 ... 1100 hPa	±0.1 hPa/year

\* Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis or repeatability error.

\*\* Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.

\*\*\* Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.

\*\*\*\* Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

## Operating Environment

Pressure range	500 ... 1100 hPa, 50 ... 1100 hPa
Temperature range	
operating	-40 ... +60 °C (-40 ... +140 °F)
with local display	0 ... +60 °C (+32 ... +140 °F)

## Data Transfer Software

MI70 Link Interface Software

Requirement:	Microsoft® Windows OS
	Microsoft® Excel

## Inputs and Outputs

Supply voltage	10 ... 35 VDC
Supply voltage sensitivity	negligible
Typical power consumption at +20 °C (U <sub>in</sub> 24 VDC, one pressure sensor)	
RS-232	25 mA
RS-485	40 mA
U <sub>out</sub>	25 mA
I <sub>out</sub>	40 mA
display and backlight	+20 mA
Serial I/O	RS232C, RS485/422
Pressure units	hPa, mbar, kPa, Pa inHg, mmHg, torr, psia
	Class A
Resolution	0.01 hPa
Settling time at power-up (one sensor)	4 s
Response time (one sensor)	2 s
Acceleration sensitivity	negligible
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8" I.D. tubing or quick connector with shutoff valve for 1/8" hose
Maximum pressure limit	5000 hPa abs.
Compliance	EMC standard EN61326-1:1997 + Am1:1998 + Am2:2001: Industrial Environment

## Mechanics

Housing material	G AlSi10 Mg (DIN 1725)
Housing classification	IP66
	IP65 (NEMA4) with local display
Weight	1 - 1.5 kg

## Analog Output (optional)

Current output	0 ... 20 mA, 4 ... 20 mA
Voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy at pressure range	500 ... 1100 hPa 50 ... 1100 hPa
at +20 °C	±0.30 hPa ±0.40 hPa
at -40 ... +60 °C	±0.60 hPa ±0.75 hPa

## Accessories

Serial interface cable	19446ZZ
USB-RJ45 serial connection cable	219685
Software interface kit	215005
Wall mounting kit	214829
Outdoor installation kit (weather shield)	215109
Installation kit for pole or pipeline	215108
Power supply module	POWER-1
Temperature compensated analog output module	AOUT-1T
Isolated RS-485 module	RS485-1
DIN Rail Kit	215094

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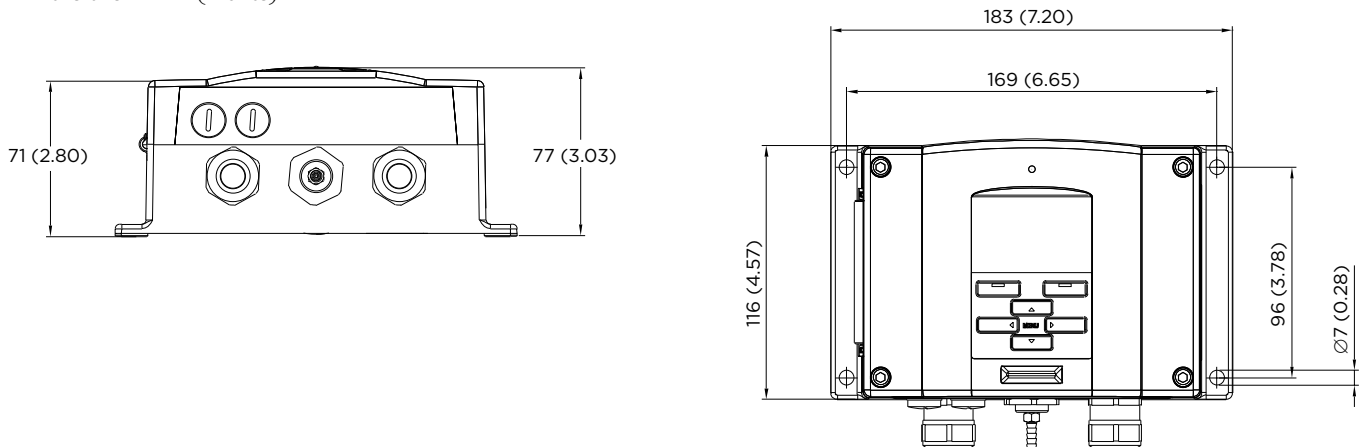
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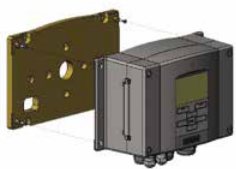
# Dimensional Drawings of the PTB330 Digital Barometer

## Dimensions

Dimensions in mm (inches)



## Mounting Options



Mounting with Wall Mounting Kit



Mounting with DIN Rail Installation Kit



Pole Installation with Installation Kit for Pole or Pipeline



Mounting Rain Shield with Installation Kit

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## Take the Lab to the Field

### Vaisala Barometric Pressure Transfer Standard PTB330TS



Barometric Pressure Transfer Standard PTB330TS makes field inspection accurate and easy. It combines a PTB330 digital barometer with a hand-held MI70 indicator within a portable unit functioning as a transfer standard. The optional HMP155 probe is available for

accurate humidity and temperature measurement.

The PTB330TS is suitable for various reference measurements in industrial and meteorological areas.

The PTB330TS comes in a durable and weatherproof transport case that can be easily carried and

*Operational PTB330TS unit includes a PTB330 digital barometer, hand-held MI70 indicator, optional HMP155 humidity and temperature probe, optional MI70 Link PC software, a user's guide and a weatherproof transfer case equipped with a shoulder strap.*



*PTB330TS transport case*

shipped. The components are placed in a proofing foam interior, with accessories and user's guide placed in the lid organizer. The case includes a separate inner tabletop case in which the barometer is mounted. Shoulder strap is included for convenience. Battery duration is up to 11 hours of continuous use and up to 30 days in data logging use.

#### Features / Benefits

- Portable, battery operated transfer standard with data logging capability
- Barometric pressure with Vaisala BAROCAP® Digital Barometer PTB330
  - Excellent long term stability
  - Accurate measurements
  - Added reliability through redundancy
- Optional humidity and temperature measurements with HMP155
  - Vaisala HUMICAP®180R sensor
  - superior long-term stability
  - New, fast temperature probe
  - Chemical purge
- Multilingual user interface, nine languages
- Data can be logged, and transferred to a PC via MI70 Link software
- SO/IEC 17025 Accredited calibration services available
- For professional meteorology, aviation, laboratories and demanding industrial applications





*The PTB330 Digital Barometer*



*The HMP155 probe*



*The MI70 hand-held indicator displaying the prevailing pressure in hPa*

## PTB330 Digital Barometer

Vaisala BAROCAP® Digital Barometer PTB330 is a new generation barometer designed for a wide range of high-end atmospheric pressure measurement. The pressure measurement of the PTB330 is based on the Vaisala in-house, silicon capacitive, absolute pressure sensor – the Vaisala BAROCAP® Sensor. It provides high measurement accuracy and excellent long-term stability.

### High Accuracy

The PTB330 series features extremely high accuracy. Class A barometers for the most demanding applications are fine-adjusted and calibrated against a high-precision pressure calibrator. All the PTB330 barometers come with a NIST traceable, factory calibration certificate, also optional ISO/IEC 17025 accreditation calibration services are available.

### Reliability through Redundancy

According to customers' choice, the PTB330 can incorporate one, two or three BAROCAP® sensors. When two or three sensors are used, the barometer continuously compares the readings of the pressure sensors

against one another and provides information on whether these are within the set internal difference criteria. This unique feature provides redundancy in pressure measurement. Thus, users get a stable and reliable pressure reading at all times as well as a pre-indication of when to service or re-calibrate the barometer.

## Optional HMP155 Humidity and Temperature Probe

The new Vaisala HUMICAP® Humidity and Temperature Probe HMP155 provides reliable humidity and temperature measurement.

### Long-Term Stability

The HMP155 has a new generation Vaisala HUMICAP®180R sensor that has excellent stability and withstands harsh environments well. The probe structure is solid and the sensor is protected with a sintered teflon filter, which gives maximum protection against liquid water, dust, and dirt.

### Fast Temperature Measurement

What's more, with its fast response time, the additional temperature

probe for the HMP155 is ideal for measurement in environments with rapidly changing temperatures.

## MI70 Hand-Held Indicator for Spot-Checking Applications

The Vaisala Measurement Indicator MI70 is a user-friendly indicator for demanding spot-checking measurements. It is ideal for field checking and calibration of Vaisala's fixed instruments.

### Easy-to-Use User Interface and Three-Variable Display

The MI70 features a multilingual, menu-based user interface, and a clear graphical LCD display. Overall three measurement parameters can be displayed and logged into the meter's memory at the same time. One or two probes or transmitters can be connected simultaneously.

### MI70 Link

The optional MI70 Link Windows® software and the USB connection cable form a practical tool for transferring logged data and real time measurement data from the MI70 to a PC.

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## Vaisala Barometric Pressure Transfer Standard PTB330TS

### Technical Data

These specifications apply when MI70, PTB330 and HMP155 are used together in the PTB330TS product. For individual specifications, please refer to the product documentation and brochures of the PTB330 and HMP155.

### General

Operating temperature range	-10 ... +40 °C (+14 ... +104 °F)
Operating humidity range	non-condensing
Maximum pressure limit	5000 hPa abs.
Power supply	Rechargeable NiMH battery pack with AC-adaptor or 4xAA-size alkalines, type IEC LR6
Operation time (using rechargeable battery pack)	11 h typical at +20 °C (+68 °F)
Continuous use with PTB330	up to 30 days
Datalogging use	English, Chinese, French, Spanish, German, Russian, Japanese, Swedish, Finnish
Menu languages	LCD with backlight, graphic trend display of any parameter, character height up to 16 mm
Display	2700 points
Data logging capacity	audible alarm function
Alarm	

PTB330TS is in conformity with the following EU directives:  
 - EMC Directive (2004/108/EC) Complies with the EMC product family standard EN61326-1, Electrical equipment for measurement control and laboratory use - Basic immunity test requirements.  
 - Low Voltage Directive (2006/95/EC)  
 - ROHS Directive (2002/95/EC)

### Performance

#### Barometric Pressure (PTB330)

Measurement range	500 ... 1100 hPa
Linearity*	±0.05 hPa
Hysteresis*	±0.03 hPa
Repeatability*	±0.03 hPa
Calibration uncertainty**	±0.07 hPa
Accuracy at +20 °C (+68 °F) ***	±0.10 hPa
Temperature dependence****	±0.1 hPa
Total accuracy -40... +60 °C (-40...+140 °F)	±0.15 hPa
Long-term stability	±0.1 hPa/year
Settling time at power-up (one sensor)	4 s
Response time (one sensor)	2 s
Acceleration sensitivity	negligible

\* Defined as ±2 standard deviation limits of endpoint nonlinearity, hysteresis or repeatability error.

\*\* Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.

\*\*\* Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.

\*\*\*\* Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.



### Relative Humidity (HMP155)

Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis and repeatability) at +15 ... +25 °C (+59 ... +77 °F)	±1 %RH (0 ... 90 %RH) ±1.7 %RH (90 ... 100 %RH)
-10 ... +40 °C (-4 ... 104 °F)	±(1.0 + 0.008 x reading) %RH
Factory calibration uncertainty (+20 °C /+68 °F)	±0.6 %RH (0 ... 40 %RH)* ±1.0 %RH (40 ... 97 %RH)*
Humidity sensor	HUMICAP180R HUMICAP180RC

Response time at +20 °C in still air with a sintered PTFE filter	
63 %	20 s
90 %	60 s

\* Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.

### Temperature (HMP155)

Measurement range	-10 ... +40 °C (+14 ... +104 °F)
Accuracy	
-10 ... +20 °C	±(0.176 - 0.0028 x temperature) °C
+20 ... +40 °C	±(0.07 + 0.0025 x temperature) °C

Accuracy over temperature range (see graph overleaf)

Temperature sensor	Pt100 RTD Class F0.1 IEC 60751
Response time with additional temperature probe in 3 m/s air flow	
63 %	<20 s
90 %	<35 s

# Technical Data

## Available Parameters

Pressure parameters	P, P3h, HCP, QFE, QNH
Humidity and temperature parameters	RH, T, Tdf, Td, x, Tw

## Inputs and Outputs

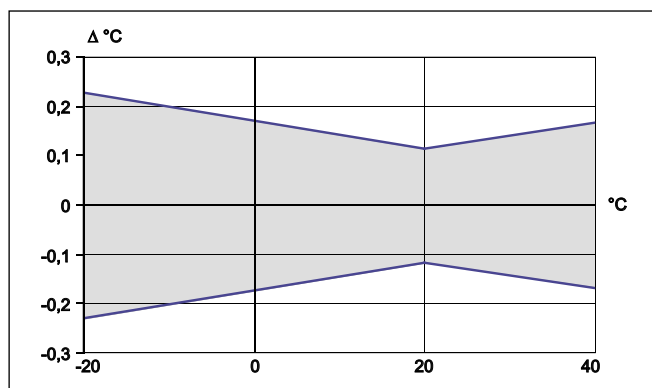
MI70 probe ports	2
MI70 data interface	RS-232 (accessible only with MI70 Link software)
PTB330 supply voltage	10 ... 35 VDC (if not powered by MI70)
PTB330 data interface	RS-232C
PTB330 serial I/O connectors	RJ45 (service port) Male 8-pin M12 (user port)
HMP155 data interface	RS-485
HMP155 serial I/O connector	Male 8-pin M12

## Mechanics

PTB330	
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP65
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8" I.D. tubing or quick connector with shutoff valve for 1/8" hose
HMP155	
Housing material	PC
Housing classification	IP66
Additional T-probe cable length	2 m
Cable material	PUR
Sensor protection	Sintered PTFE
MI70 MEASUREMENT INDICATOR	
Housing classification	IP54
Housing material	ABS/PC blend
TRANSPORT CASE	
Housing classification (when closed)	IP67
Plastic parts	TTX01®, PP+SEBS, POM
Metal parts	stainless steel AISI303
Interior foam material	PE and polyether
Weight with all instruments and typical accessories	5.9 kg
Exterior dimensions (LxWxH)	405x330x165 mm (15.94x12.99x6.50) inch

## Accessories

PTB330	
MI70 – PTB330 Spiral Cable	223235SP
USB-RJ45 serial connection cable	219685
Serial connection cable	19446ZZ
Barbed fitting 1/8"	19498SP
Quick Connector 1/8"	220186
Transport case with interior foams and tabletop casing for PTB330	224068SP
Tabletop casing for PTB330	224064SP
MI70	
USB cable for MI70, includes MI70 Link software	219687
MI70 Link software	MI70LINK
MI70 connection cable to HMT330, MMT330, DMT340, HMT120/130, HMT100, PTB330	211339
MI70 battery pack	26755
variety of AC adapters available	
HMP155	
HMP155 – MI70 connection cable	221801
Protection set for HMP155 calibration buttons: protective cover, 2 O-rings and protective plug	221318
USB cable for HMP155	221040
Sintered teflon filter + O-ring	219452SP
Humidity sensor	HUMICAP180R
Humidity Calibrator	HMK15



Accuracy of HMP155 temperature measurement over temperature range

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## PTB210 Digital Barometer



*The PTB210 paired with the SPH10 Static Pressure Head.*

*The Vaisala BAROCAP® Digital Barometer PTB210 is a reliable outdoor barometer that withstands harsh conditions.*

### For Harsh Environments

The Vaisala BAROCAP® Digital Barometer PTB210 is ideal for outdoor installations and harsh environments. The barometers are designed to operate in a wide temperature range, and the electronics housing provides IP65 (NEMA 4) standardized protection against sprayed water.

#### Features/Benefits

- 500 ... 1100 hPa or 50 ... 1100 hPa pressure ranges with serial output
- Different scalings between 500 ... 1100 hPa with analog output
- Electronics housing IP65 protected against sprayed water
- Accurate and stable measurement
- NIST traceable (certificate included)

The PTB210 barometers are ideal for use in applications such as weather stations, data buoys and ships, airports, and agrology. They are also an excellent solution for monitoring barometric pressure in industrial equipment such as laser interferometers and engine test benches.

### Several Pressure Ranges

The PTB210 barometers are designed for various pressure ranges. They are available in two basic configurations: serial output for 500 ... 1100 hPa and 50 ... 1100 hPa and analog output with different scalings between 500 ... 1100 hPa.

### Accurate and Stable Measurement

All the PTB210 barometers are digitally adjusted and calibrated by using electronic working standards. A higher accuracy barometer, that is fine-tuned and calibrated against a

High Precision Pressure Calibrator, is available for the 500 ... 1100 hPa pressure range.

In addition, the PTB210 integrates directly with Vaisala Static Pressure Head Series SPH10/20. This pairing offers accurate measurement in all wind conditions.

### Vaisala BAROCAP® Technology

The PTB210 barometers use the Vaisala BAROCAP® Sensor, a silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure applications. The Vaisala BAROCAP® Sensor provides excellent hysteresis and repeatability characteristics and outstanding temperature and long-term stability. All PTB210 barometers are delivered with a factory calibration certificate which is NIST traceable.



# Technical Data

## Operating Range (1hPa=1mbar)

Pressure range (order specified)	
serial output	500 ... 1100 hPa 50 ... 1100 hPa
analog output	500 ... 1100 hPa 600 ... 1060 hPa 800 ... 1060 hPa 900 ... 1100 hPa
Operating temperature range	-40 ... +60 °C (-40 ... +140 °F)
Humidity range	non-condensing

## Accuracy

SERIAL OUTPUT (units in hPa)

Pressure range	500 ... 1100	50 ... 1100
	Class A	Class B
Non linearity*	± 0.10	± 0.15
Hysteresis*	± 0.05	± 0.05
Repeatability*	± 0.05	± 0.05
Calibration uncertainty**	± 0.07	± 0.15
Accuracy at +20 °C (+68 °F)***	± 0.15	± 0.20
Temperature dependence****	± 0.20	± 0.20
Total accuracy***	± 0.25	± 0.30
-40 ... +60 °C (-40 ... +140 °F)		
Long term stability (hPa/year)	± 0.10	± 0.10

ANALOG OUTPUT

Non linearity*	± 0.20 hPa
Hysteresis*	± 0.05 hPa
Repeatability*	± 0.05 hPa
Calibration uncertainty**	± 0.15 hPa
Accuracy at +20 °C (+68 °F)***	± 0.30 hPa
Temperature dependence****	± 0.50 hPa
Total accuracy*** -40 ... +60 °C (-40 ... +140 °F)	± 0.60 hPa
Long term stability	± 0.10 hPa/year

- \* Defined as the ±2 standard deviation limits of end point non-linearity, hysteresis error or repeatability error.
- \*\* Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.
- \*\*\* Defined as the root sum of the squares (RSS) of end point non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.
- \*\*\*\* Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

## General

(• Factory setting)	
SERIAL OUTPUT	
Current consumption	
normal mode	< 15 mA•
power down mode	< 0.8 mA
shutdown mode	0.2 mA

Shutdown	ON/OFF
Settling time at power up	2 s
Serial I/O (factory setting•)	RS232C
	RS232C /TTL (optional)
	RS485, non isolated (optional)
parity	none, even•, odd
data bits	7•, 8
stop bits	1•, 2
Baud rate	1200, 2400, 4800, 9600•, 19200
Response time	1 s•
Resolution	0.01 hPa (1 measurement/s) 0.03 hPa (10 measurements/s)

ANALOG OUTPUT

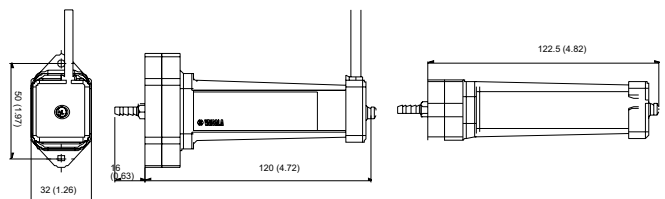
Outputs	0 ... 5 VDC, 0 ... 2.5 VDC (order specified)
Current consumption	
normal mode	< 8 mA
shutdown mode	0.2 mA
Shutdown	ON/OFF
Response time	500 ms
Resolution	300 µV
Measurement rate	3 measurements/s

ALL MODELS

Supply voltage (reverse polarity protected)	
with RS232/TTL output	5 ... 28 VDC
with RS485 or analog output	8 ... 18 VDC
Max. pressure	5 000 hPa abs.
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8" I.D. tubing
Housing	
electronics	IP65 (NEMA 4)
sensor	IP53
Housing material	PC plastic
Supply/output cable length	1, 2, 3, 5 or 10 m
Instrument	110 g
Cable	28 g/m
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Generic Environment

## Dimensions

Dimensions in mm (inches)



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## PTB110 Barometer for Industrial Use



*The Vaisala BAROCAP® Barometer PTB110 offers outstanding long-term stability.*

### Features/Benefits

- Vaisala BAROCAP® sensor
- Several pressure ranges
- Accuracy  $\pm 0.3$  hPa at  $+20$  °C
- Long-term stability
- On/off control with external trigger
- Output voltage 0 ... 2.5 or 0 ... 5 VDC
- Current consumption less than 4 mA
- Mountable on a (35 mm wide) DIN rail
- NIST traceable (certificate included)

### PTB110

The Vaisala BAROCAP® Barometer PTB110 is designed both for accurate barometric pressure measurements at a room temperature and for general environmental pressure monitoring over a wide temperature range.

### Vaisala BAROCAP® Technology

The PTB110 barometer uses the Vaisala BAROCAP® Sensor, a silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure measurement applications. The sensor combines the outstanding elasticity characteristics and mechanical stability of single-crystal silicon with the proven capacitive detection principle.

### Accuracy and Stability

The excellent long-term stability of the barometer minimizes or even removes the need for field adjustment in many applications.

### Applications

The PTB110 is suitable for a variety of applications, such as environmental pressure monitoring, data buoys, laser interferometers, and in agriculture and hydrology.

The compact PTB110 is especially ideal for data logger applications as it has low power consumption. Also an external On/Off control is available. This is practical when the supply of electricity is limited.

# Technical Data

## Operating Range (1 hPa=1mbar)

Pressure ranges	500 ... 1100 hPa
	600 ... 1100 hPa
	800 ... 1100 hPa
	800 ... 1060 hPa
	600 ... 1060 hPa
Temperature range	-40 ... +60 °C (-40 ... +140 °F)
Humidity range	non-condensing

## General

Supply voltage	10 ... 30 VDC
Supply voltage control	with TTL level trigger
Supply voltage sensitivity	negligible
Current consumption	less than 4 mA
in shutdown mode	less than 1 µA
Output voltage	0 ... 2.5 VDC
	0 ... 5 VDC
Output frequency	500 ... 1100 Hz
Resolution	0.1 hPa
Load resistance	minimum 10 kohm
Load capacitance	maximum 47 nF
Settling time	1 s to reach full accuracy after power-up
Response time	500 ms to reach full accuracy after a pressure step
Acceleration sensitivity	negligible
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8"
Minimum pressure limit	0 hPa abs
Maximum pressure limit	2000 hPa abs
Electrical connector	removable connector for 5 wires (AWG 28 ... 16)
Terminals	Pin 1: external triggering
	Pin 2: signal ground
	Pin 3: supply ground
	Pin 4: supply voltage
	Pin 5: signal output

Housing material, plastic cover	ABS/PC blend
Housing classification	IP32
Metal mounting plate	Al
Weight	90 g
Electromagnetic compatibility	Complies with EMC standard EN 61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements - for use in industrial locations

## Accuracy

Linearity*	±0.25 hPa
Hysteresis*	±0.03 hPa
Repeatability*	±0.03 hPa
Pressure calibration uncertainty**	±0.15 hPa
Voltage calibration uncertainty	± 0.7 mV
Frequency calibration uncertainty	± 0.3 Hz
Accuracy at +20 °C***	±0.3 hPa

\* Defined as ±2 standard deviation limits of end-point non-linearity, hysteresis error or repeatability error.

\*\* Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.

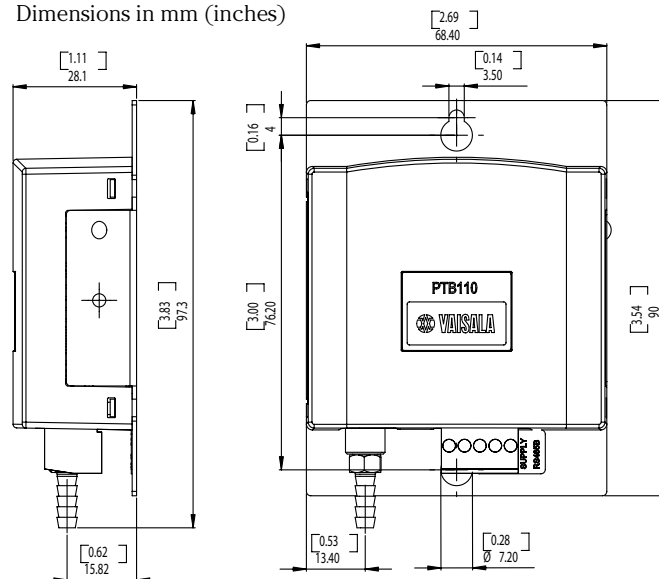
\*\*\* Defined as the root sum of the squares (RSS) of end-point non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature when using voltage output.

## TOTAL ACCURACY AT

+15 ... +25 °C (+59 ... +77 °F)	±0.3 hPa
0 ... +40 °C (+32 ... +104 °F)	±0.6 hPa
-20 ... +45 °C (-4 ... +113 °F)	±1.0 hPa
-40 ... +60 °C (-40 ... +140 °F)	±1.5 hPa
Long-term stability	±0.1 hPa/year

## Dimensions

Dimensions in mm (inches)



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## SPH10/20 Static Pressure Heads for Minimizing Wind Induced Error

Wind induced effects are one of the main sources of error when measuring barometric pressure. Variations due to strong and gusty wind can be overcome by using a static pressure head to 'filter out' the effect of dynamic pressure.

The Vaisala Static Pressure Head Series SPH10/20 are designed to minimize the errors caused by wind. The wind tunnel tested structure is both horizontally and vertically symmetrical. This design ensures reliable barometric pressure measurements in all weather.

### Ideal for Outdoor Installations

Vaisala's static pressure heads are available in two models: the Vaisala Static Pressure Head SPH10 is a basic version, and the Vaisala Static Pressure Head SPH20 is a heated version for reliable operation in snowy and icy conditions. The warmed SPH20 contains a thermostat that switches on the warming power at temperatures, where the risk of icing may occur.

Composed of ultraviolet stabilized PC plastics and offshore aluminium, the

SPH10/20 static pressure heads are durable and weather resistant.

The SPH10/20 protects against rain and condensed water, thus preventing capillary condensation of a water column in the pressure channel which results in pressure error. The drain holes in the lower plate allow rain and water to flow out. The static pressure heads have internal netting which prevents insects and debris from blocking the pressure channel.

### Carefree Maintenance

The SPH10/20 static pressure heads are easy to install and disassemble, service and clean – even at the installation site. Vaisala BAROCAP® Digital Barometer PTB210 can be installed directly on top of the SPH10/20 static pressure heads. Other barometers can be connected to the heads with pressure tubing. SPH10 and SPH20 are a perfect pair for all Vaisala barometers. They ensure an accurate and reliable measurement in all weather conditions.



*The SPH10/20 is easy to install and connect. In the picture, a SPH10 is connected to a PTB210 barometer.*

### Features/Benefits

- Minimizes wind induced error
- Reliable barometric pressure measurement in all weather
- Wind tunnel tested structure
- Easy-to-clean
- Easy-to-install

# Technical Data

## General

Operating temperature	-60 ... +80 °C (-76 ... +176 °F)
Weight	
SPH10	800 g
SPH20	1360 g
Material	PC plastic, offshore aluminium
Mounting	with 2 bolts (M6 X 20 mm min)
Hose connection	barbed fitting for 4 mm I.D. hose or Rp1/4 thread (parallel)

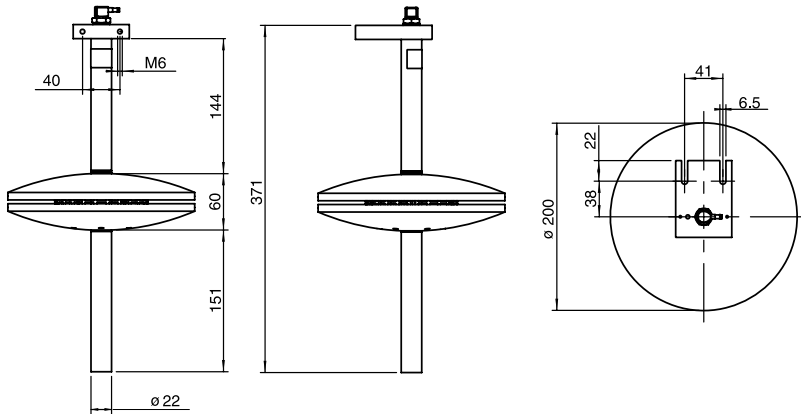
## SPH20

Electrical connections	M12 connector
Power supply	factory setting 12 V changed connection 24 V
Thermostat switching temperature	
On	+4 °C (±3 °C) +39.2 °F (±4.4 °F)
Off	+13 °C (±3 °C) +55.4 °F (±4.4 °F)
Power consumption during heating	70 W

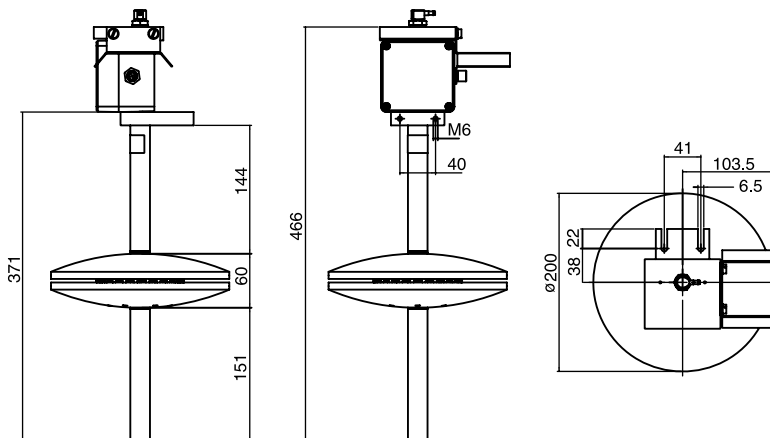
## Dimensions

Dimensions in mm

SPH10



SPH20



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## Vaisala Differential Pressure Transmitter PDT102



*Vaisala Differential Pressure Transmitter PDT102 with process valve actuator and test jacks.*

### Features

- In-place system calibration and on-line monitoring without disturbing process tubes with optional process valve actuator and test jacks
- Ultrathin profile ideally suited for DIN rail mount reduces installation and calibration costs
- High accuracy, two options; 0.25% or 0.50% of span designed for use in critical monitoring of cleanrooms for pharmaceutical, biotechnology, medical device and semiconductor controlled manufacturing environments
- Extremely robust MEMS silicon sensor technology provides very high accuracy, sensitivity, stability and durability
- NIST traceable 9 point calibration with certificate
- Front side accessible zero and span adjustment potentiometers

### Operating Environment

Vaisala Differential Pressure Transmitter PDT102 is a high performance instrument designed primarily for life science and high technology cleanroom applications. The front panel includes zero and span adjustment potentiometers for convenient adjustment. The PDT102 transmitter is ideal for incorporating into the Vaisala Veriteq Continuous Monitoring System to measure and monitor the critical environmental parameters as required in regulated environments.

### Performance

The PDT102 offers very high accuracy, sensitivity and stability with two options for accuracy, 0.25% or 0.50% of span providing a highly

reliable and repeatable measurement. The sensor uses a micro-machined, ultra-thin silicon diaphragm which provides inherent sensor repeatability and stability. The sensor enables precise measurement and control in high performance cleanrooms. The PDT102 transmitter is available with voltage output (3-wire) or current output (2-wire).

### Available Options

Online monitoring of the PDT102 is simple using the optional process valve actuator and the front access test jacks. The front access test jacks provide online process reference signal or calibration signal without disconnecting power supply wiring. Measurements can be made using a standard multimeter.



# Technical Data

## Performance

Measurement ranges (bidirectional)	$\pm 50$ Pa $\pm 0.25$ in H <sub>2</sub> O
Overpressure	
proof pressure	0.7 bar
burst pressure	1.7 bar
static pressure	1.7 bar
Pressure type	differential, gauge, vacuum and compound
Accuracy (incl. non-linearity, hysteresis, repeatability and zero/span calibration settings)	0.25 % span or 0.5 % span, depending on choice
Repeatability	
for 0.25 % span accuracy	0.03 %
for 0.5 % span accuracy	0.05 %
Electrical resolution	1 x 10 <sup>-4</sup> span
Long-term stability	$\leq 0.5$ % span/year
Response time (10 ... 90 %)	250 ms
Warm-up time	15 s
Compensated temperature range	+2 ... +57 °C (+35.6 ... +134.6 °F)
Temperature dependence	$\pm(0.036 \text{ Pa} + 0.036 \text{ \% of reading}) / ^\circ\text{C}$ or $\pm(0.0001 \text{ in H}_2\text{O} + 0.02 \text{ \% of reading}) / ^\circ\text{F}$ (reference 21 °C or 70 °F)
Mounting position	
error (zero adjustable)	$\leq 0.25$ %
Adjustments (front accessible)	
zero	$\pm 5$ % span
span	$\pm 3$ % span

## Operating Environment

Operating temperature	-29 ... +70 °C (-20.2 ... +158 °F)
Storage temperature	-40 ... +82 °C (-40 ... +179.6 °F)
Electromagnetic compatibility (EN 61326-1), basic immunity test requirements	
Note: If used in an electromagnetic field of 3 V/m, with narrow frequency area of 80 - 120 Mhz, it is possible that the current output of PDT102 can deviate max. 0.3% (with accuracy specified 0.25%).	

## Inputs and Outputs

Process connection	1/8 NPT female according to ANSI/ASME B1.20.1
Output signal	
2-wire	4 ... 20 mA
3-wire	0 ... 5 V
Operating voltage	12 ... 36 VDC
Max. loop resistance for 4 ... 20 mA	$\leq (\text{Supply voltage} - 12\text{V}) / 0.022 \text{ A}$

Supply current	
for 0 ... 5 V output	max. 10 mA
for 4 ... 20 mA output	max. 20 mA
Electrical connection	Screw terminals, 12 ... 22 AWG (0.33 up to 3.31 mm <sup>2</sup> )

## Mechanics

Medium (measured gas)	clean and dry air, non-conducting and non-corrosive gases
Material	
process connection	brass
sensor element	silicon, aluminium, glass
case	Polycarbonate, glass filled (UL94-V-1)
Mounting	DIN rail types EN 50022, EN 50035 and EN 50045
Housing classification	IP30
Weight	0.16 kg

## Dimensions

Dimensions in mm

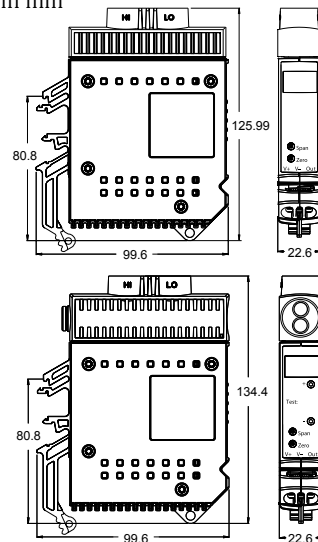


Figure 1

Figure 2 with Process Valve Actuator and Test Jacks

## Order Information for PDT102

### PDT102 - XXXT

Measurement range:	
<b>P</b> (+/-50 Pa) or <b>W</b> (+/-0.25 in H <sub>2</sub> O)	↑
Accuracy: <b>2</b> (0.25 % span) or <b>5</b> (0.5 % span)	↑
Output: <b>C</b> (current) or <b>V</b> (voltage)	↑
Option: (blank) or <b>T</b>	↑

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## Vaisala Differential Pressure Transmitter PDT101



Vaisala Differential Pressure Transmitter PDT101 with current output (black) and voltage output (green).

### Features

- Easy mounting on wall, DIN rail or panel
- 2 pressure ranges (Pa and in H<sub>2</sub>O)
- Accessible zero and span adjustment potentiometers
- 1/4" brass tubing connections
- LED status indicator
- Specially designed for critical and regulated environments
- Euro style detachable connector
- NIST traceable (certificate included)

### Operating Environment

Vaisala Differential Pressure Transmitter PDT101 is designed especially for demanding life science and high technology cleanroom applications. The PDT101 transmitter is ideal for incorporating into the Vaisala Veriteq Continuous Monitoring System to measure and monitor the critical environmental parameters as required in regulated environments.

### Performance

The PDT101 offers high accuracy, sensitivity and stability with accuracy 0.40% of span providing a highly reliable and repeatable measurement. The sensor uses a micro-machined, ultra-thin silicon diaphragm which provides inherent sensor repeatability and stability. The sensor enables precise measurement and control in high performance

cleanrooms. The PDT101 transmitter is available with voltage output (3-wire) or current output (2-wire).

Zero and span adjustment screws are available on every PDT101 model. Both adjustments are accessible from the front of the unit.

### Applications

The PDT101 is suitable for high performance cleanroom environments in the life science, semiconductor and electronics industries. As part of a continuous monitoring system, it is highly suitable for regulated environments where continuous, documented and redundant data is a requirement to meet FDA regulations. The compact design is well suited for mounting in a cleanroom or in the adjacent corridor with LED indicator lights for quick and easy power status spotcheck.

# Technical Data

## Performance

Measurement ranges (bidirectional)	±60 Pa ±0.25 in H <sub>2</sub> O
Overpressure	
proof pressure	1.0 bar
burst pressure	1.7 bar
static pressure	1.7 bar
Pressure type	differential, gauge, vacuum and compound
Accuracy (incl. non-linearity, hysteresis, repeatability and zero/span calibration settings)	0.4 % span
Long-term stability	≤0.5 % span/year
Response time (10 ... 90 %)	250 ms
Warm-up time	15 s
Compensated temperature range	+2 ... +54 °C (+35.6 ... +129.2 °F)
Temperature dependence	±(0.065 Pa + 0.054 % of reading) / °C or ±(0.00015 in H <sub>2</sub> O + 0.03 % of reading) / °F (reference 21 °C or 70 °F)
Mounting position	
error (zero adjustable)	≤1 %/g (calibration in vertical position is standard)
Adjustments (front accessible)	
zero	±5 % span
span	±3 % span

## Operating Environment

Operating temperature	-18 ... +70 °C (-0.4 ... +158 °F)
Storage temperature	-40 ... +82 °C (-40 ... +179.6 °F)
Electromagnetic compatibility (EN 61326-1), basic immunity test requirements	
Note: If used in an electromagnetic field of 3 V/m, with narrow frequency area of 80 - 120 Mhz, it is possible that the current output of PDT101 can deviate max. 0.8% (with accuracy specified 0.4%).	

## Inputs and Outputs

Process connection	1/4" barbed fittings
Output signal	
2-wire	4 ... 20 mA
3-wire	0 ... 5 VDC (user selectable 0 ... 10 VDC)
Operating voltage	
2-wire output 4 ... 20 mA	12 ... 36 VDC
3-wire output 0 ... 5 VDC	11.5 ... 36 VDC
3-wire output 0 ... 10 VDC	14 ... 36 VDC or 24 VAC
Max. loop resistance	
for 4 ... 20 mA	≤ (Supply voltage - 12V)/0.022 A
Supply current	max. 20 mA for 4 ... 20 mA output signal

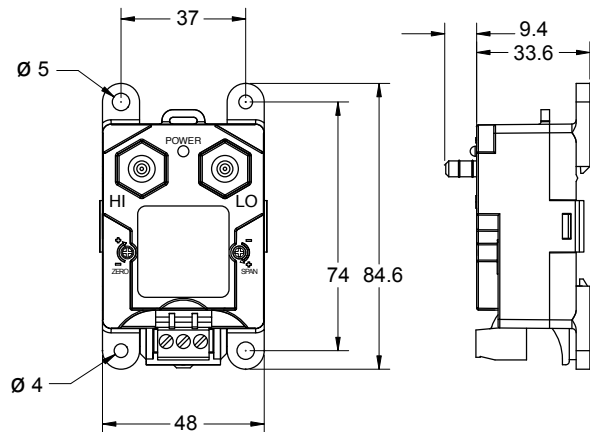
Optical process diagnostics	LED visual indicator
Electrical connection	Euro style pluggable terminal block accepts 12...26 AWG wire (0.13 up to 3.31 mm <sup>2</sup> )

## Mechanics

Medium (measured gas)	clean and dry air, non-conducting and non-corrosive gases
Material	
process connection	brass
sensor element	silicon, aluminium, glass
case	NEMA type 1 fire-retardant ABS 1 (meets UL94-5VA)
Mounting	threaded fastener for wall mounting or DIN rail type EN50022
Housing classification	IP40
Weight	0.07 kg

## Dimensions

Dimensions in mm



## Order Information for PDT101

### PDT101 - XXX

Measurement range: **P** (+/-60 Pa) or **W** (+/-0.25 in H<sub>2</sub>O)

Accuracy: **4** (0.4 % span)

Output: **C** (current) or **V** (voltage)

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# Vaisala Wind and Weather Sensor Technologies for Measurements in Industrial Applications



Vaisala's long history in wind and weather measurements started already in the 1930s from the development of a radiosonde to measure the conditions in the upper atmosphere. Today, Vaisala wind and weather instruments are used in dozens of applications and industries all over the world.

## Industrial Applications for Wind and Weather Measurements

Wind and weather data are required in many activities across industries. For example, in power industry, the efficiency of power lines is a function of wind speed and direction.

Nuclear power plants require wind data for safety reasons to be able to model the dispersion of potentially radioactive leakages. In addition to nuclear power plants, also chemical factories need to gather wind data for dispersion monitoring.

Accurate outdoor measurements are essential in operating modern buildings. Processes such as free cooling, natural ventilation, and automated shading are dependent on real-time weather data. Ventilation control in greenhouses also relies on localized weather data to ensure an optimized environment for plant growth.

## Vaisala Wind and Weather Instruments

Vaisala manufactures wind and weather instruments for different applications, requirements and budgets. The wind sensor portfolio for industrial applications includes both mechanical and ultrasonic sensors. View the complete range of wind products at [www.vaisala.com/wind](http://www.vaisala.com/wind). Have a look at the multiparameter Vaisala Weather Transmitter WXT520 at [www.vaisala.com/wxt520](http://www.vaisala.com/wxt520).

### Vaisala Ultrasonic Wind Sensors in Brief

- Wind sensor with no moving parts
- Unique triangular design for accurate measurements from all directions
- Optional sensor heating available
- Maintenance free, no field calibration required
- Measurement range up to 75 m/s

### Vaisala Mechanical Wind Sensors in Brief

- Accurate wind speed and direction sensors
- Fast and linear response
- Low measurement starting threshold
- Sensors with heating elements available for cold climates

### Vaisala Weather Sensor in Brief

- Measurement of the six essential weather parameters: wind speed and direction, liquid precipitation, barometric pressure, temperature, and relative humidity
- Feature proprietary Vaisala sensor technologies: WINDCAP®, RAINCAP®, HUMICAP®, and BAROCAP®

# Vaisala Sensor Technologies for Wind and Rain Measurements

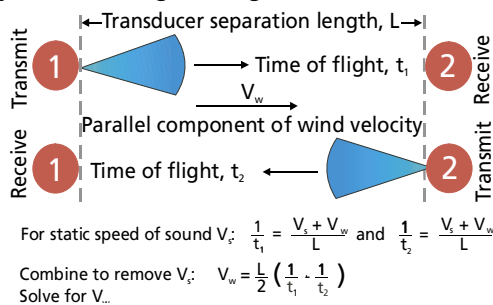
## Vaisala WINDCAP® Sensor

Vaisala WINDCAP® Ultrasonic Wind Sensor uses ultrasound to determine wind speed and direction. The sensor has no moving parts, which makes it independent of the limitations of mechanical wind sensors such as friction, inertia, time constant, over-speeding, and starting threshold.

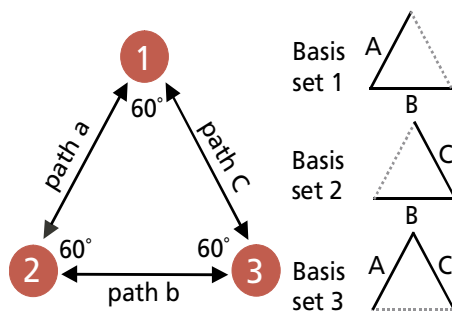
### How It Works

WINDCAP® sensor features an array of three ultrasonic transducers oriented to form an equilateral triangle. Wind measurement is based on time of flight (TOF) of the sonic impulse - the time it takes for the signal to travel from one transducer to another. TOF is measured in both directions for each pair of transducer heads. Simple algebra allows solving for the parallel component of wind velocity independently of the static speed of sound.

The equilateral triangle configuration of the three



transducers provides three possible sets of basis vectors. The combinations yield bi-directional measurements on the paths labeled A, B and C. These measurements are used to determine the wind velocity components parallel to each of the three paths.



## Vaisala RAINCAP® Sensor

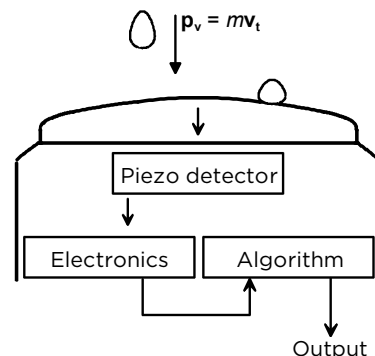
Vaisala RAINCAP® Sensor is an acoustic sensor that measures the impact of individual raindrops on a smooth stainless steel surface using a piezoelectric detector. The sensor provides real time information on rain intensity, duration, and accumulated rainfall.

### How It Works

The RAINCAP® sensor consists of a round stainless steel cover, approximately 90 mm in diameter mounted to a rigid frame. A piezoelectric detector is located beneath the cover.

Raindrops hit the RAINCAP® sensor surface at terminal velocity, which is a function of the raindrop diameter. Rain measurement is based on acoustic detection of each individual rain drop as it impacts the sensor cover. Larger drops create a larger acoustic signal than smaller drops.

The piezoelectric detector converts the acoustic signals into voltages. Total rain is calculated from the sum of the individual voltage signals per unit time and the known surface area of the RAINCAP® sensor. In addition, the intensity and duration of rain can be calculated.



$P_v$  = vertical momentum  
 $m$  = mass of drop  
 $v_t$  = terminal velocity of drop

**VAISALA**

For more information, visit  
[www.vaisala.com](http://www.vaisala.com) or contact  
 us at [sales@vaisala.com](mailto:sales@vaisala.com)

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## Vaisala Weather Transmitter WXT520

### Access to Real Time Weather Data



*The WXT520 has an automatic control circuit that switches the heating on at low temperatures.*

#### Features/Benefits

- Measures 6 most essential weather parameters
- Applications: weather stations, dense networks, harbors, marinas
- Low power consumption – works also with solar panels
- Compact, light-weight
- Easy to install with one-bolt mounting method
- No moving parts
- Heating available
- Vaisala Configuration Tool for pc
- USB connection
- IP66 housing with mounting kit

#### WXT520

The Vaisala Weather Transmitter WXT520 measures barometric pressure, humidity, precipitation, temperature, and wind speed and direction.

To measure wind speed and direction, the WXT520 has the Vaisala WINDCAP® Sensor that uses ultrasound to determine horizontal wind speed and direction.

The array of three equally spaced transducers on a horizontal plane is a Vaisala specific design. Barometric pressure, temperature, and humidity measurements are combined in the PTU module using capacitive measurement for each parameter. It is easy to change the module without any contact with the sensors.

The WXT520 is immune to flooding clogging, wetting, and evaporation losses in the rain measurement.

#### Measuring Acoustic Precipitation

The WXT520 precipitation measurement is based on the unique Vaisala RAINCAP® Sensor, which detects the impact of individual rain drops. The signals exerting from the impacts are proportional

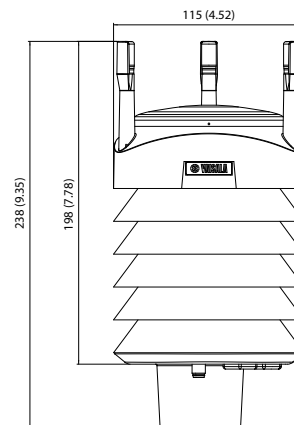
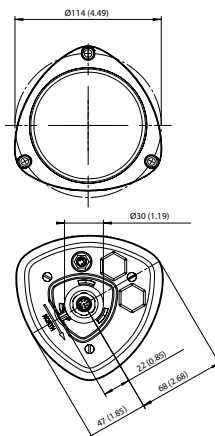
to the volume of the drops.

Hence, the signal from each drop can be converted directly to the accumulated rainfall.

The WXT520 measures accumulated rainfall, rain intensity and duration of the rain – all in real time.

#### Dimensions

Dimensions in mm (inches)



# Technical Data

## Wind

SPEED	
range	0 ... 60 m/s
response time	250 ms
accuracy	±3% at 10m/s
output resolutions and units	0.1 m/s, 0.1km/h, 0.1 mph, 0.1 knots
DIRECTION	
azimuth	0 ... 360°
response time	250 ms
accuracy	±3°
output resolution and unit	1°

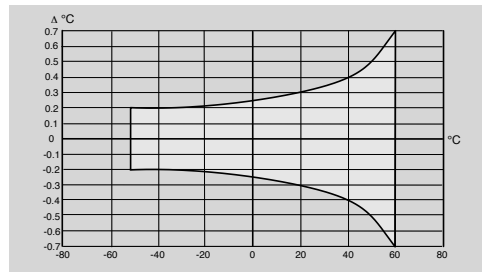
## Liquid Precipitation

RAINFALL	cumulative accumulation after the latest automatic or manual reset
output resolutions and units	0.01 mm, 0.001 inches
accuracy	5%*
RAINFALL DURATION	counting each ten-second increment whenever water droplet is detected
output resolution and unit	10 s
RAIN INTENSITY	one-minute running average in ten-second steps
range	0 ... 200 mm/h (broader range with reduced accuracy)
output resolutions and units	0.1 mm/h, 0.01 inches/h
HAIL	cumulative amount of hits against the collecting surface
output resolutions and units	0.1 hits/cm <sup>2</sup> , 0.01 hits/in <sup>2</sup> , 1 hits
HAIL DURATION	counting each ten-second increment whenever hailstone is detected
output resolution and unit	10 s
HAIL INTENSITY	one-minute running average in ten-second steps
output resolutions and units	0.1 hits/cm <sup>2</sup> h, 1 hits/in <sup>2</sup> h, 1 hits/h

\* Due to the nature of the phenomenon, deviations caused by spatial variations may exist in precipitation readings, especially in a short time scale. The accuracy specification does not include possible wind induced errors.

## Air Temperature

Range	-52 ... +60 °C (-60 ... +140 °F)
Accuracy for sensor at +20 °C	±0.3 °C (±0.5 °F)
Accuracy over temperature range (see graph below)	



Output resolutions and units	0.1 °C, 0.1 °F
------------------------------	----------------

## Barometric Pressure

Range	600 ... 1100 hPa
Accuracy	±0.5 hPa at 0 ... +30 °C (+32 ... +86 °F) ±1 hPa at -52 ... +60 °C (-60 ... +140 °F)
Output resolutions and units	0.1 hPa, 10 Pa, 0.0001 bar, 0.1 mmHg, 0.01 inHg

## Relative Humidity

Range	0 ... 100 %RH
Accuracy	±3 %RH within 0 ... 90 %RH ±5 %RH within 90 ... 100 %RH
Output resolution and unit	0.1 %RH

## General

Operating temperature	-52 ... +60 °C (-60 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Operating voltage	5 ... 32 VDC
Typical power consumption	3 mA at 12 VDC (with defaults)
Heating voltage	5 ... 32 VDC / 5 ... 30 VAC <sub>RMS</sub>
Serial data interface	SDI-12, RS-232, RS-485, RS-422, USB connection
Weight	650 g (1.43 lb)
Housing	IP65
Housing with mounting kit	IP66

## Electromagnetic Compatibility

Complies with EMC standard EN61326-1; Industrial Environment	
IEC standards	IEC 60945/61000-4-2 ... 61000-4-6

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Vaisala takes pride in professional and comprehensive specifications that are based on scientific test methods and known standards. The accuracy specification takes into account repeatability, non-linearity, and hysteresis, and is given for the full measurement range, unless otherwise stated. This means our customers get truly reliable information with no gaps, helping them make the right decisions.



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## WMT52 Ultrasonic Wind Sensor



The Vaisala WINDCAP® Ultrasonic Wind Sensor WMT52.

### Features/Benefits

- Measures horizontal wind speed and wind direction
- Triangular design ensures excellent data availability
- No moving parts
- Maintenance-free
- Optional heating available
- Compact, durable and robust
- Low power consumption
- IP66 housing with mounting kit
- Applications: marine, wind energy, environmental monitoring

### Proven Vaisala Performance

The Vaisala WINDCAP® Ultrasonic Wind Sensor WMT52 incorporates decades of Vaisala experience in wind measurement using ultrasound to determine horizontal wind speed and direction.

With no moving parts, the WMT52 has high sensitivity as the measurement time constant and starting threshold are virtually zero. This makes it superior to the conventional mechanical wind sensors.

The WMT52 is designed to operate without periodic field calibration and maintenance.

### Applications

The WMT52 is ideal for use in marine applications as the housing with the mounting kit is water resistant. The WMT52 is also suitable for wind energy and environmental monitoring, for example, for measuring the distribution of air pollution and road tunnel ventilation.

### Easy to Install

The WMT52 is delivered fully assembled and configured from the factory. With the Vaisala Configuration Software Tool you can change the settings, such as averaging times, output mode, update intervals, measured variables and message contents.

The WMT52 can be mounted either on top of a pole mast or on a cross arm.

When using the optional mounting kit, the north alignment needs to be performed only once.

### Heating

The optional heating available in the WMT52 assists measurements in the freezing weather conditions and during snowfall.

As the heating circuit is independent of the operational power, separate supplies can be used. Heating is switched on automatically at low temperatures, well before the freezing point.

### Low Power Consumption

The WMT52 has very low power consumption; during the idle mode the device typically consumes about 2 ... 3 mW.

# Technical Data

## Wind

WIND SPEED	
Range	0 ... 60 m/s
Response time	250 ms
Available variables	average, maximum, and minimum
Accuracy	±3% at 10m/s
Output resolution	0.1 m/s (km/h, mph, knots)
WIND DIRECTION	
Azimuth	0 ... 360°
Response time	250 ms
Available variables	average, maximum, and minimum
Accuracy	±3°
Output resolution	1°
MEASUREMENT FRAME	
Averaging time	1 ... 3600 s (=60 min), at one second steps on the basis of samples taken at 4 Hz rate (configurable)
Update interval	1 ... 3600 s (=60 min), at one-second steps

## General

Self-diagnostics	separate supervision message, unit/status fields to validate measurement quality
Start-up	automatic, <10 s from power on to the first valid output
Serial data interface	SDI-12, RS-232, RS-485, RS-422, USB connection
Communication protocols	SDI-12 v1.3, ASCII automatic & polled, NMEA 0183 v. 3.0 with query option
Baud rate	1200 ... 115 200
Operating temperature	-52 ... +60 °C (-60 ... +140 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Dimensions	
height	139 mm (5.7")
diameter	114 mm (4.49")
weight	510 g (1.12 lb)
Housing	IP65
Housing with mounting kit	IP66
Vibration	IEC 60945 paragraph 8

## Power Supply

Operating voltage	5 ... 32 VDC
Power consumption on average	
minimum	0.1 mA at 12 VDC
maximum	14 mA at 5 VDC
typical	3 mA at 12 VDC (default measuring intervals)
Heating voltage	5 ... 32 VDC / 5 ... 30 VAC <sub>RMS</sub>

## Accessories

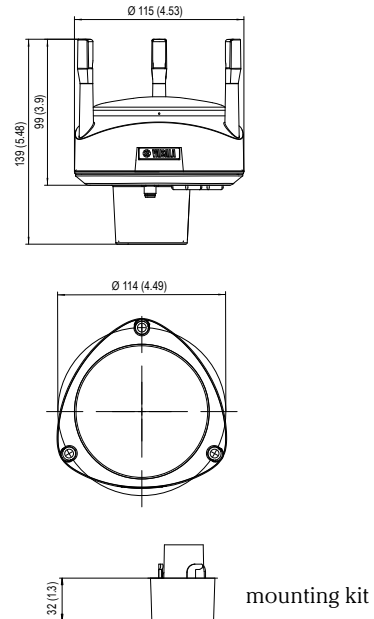
Mounting kit	212792
Bird spike kit	212793
Surge protector for sensor	WSP150

## Electromagnetic Compatibility

Complies with EMC standard: EN61326-1, Industrial Environment	
IEC standards	IEC 60945/61000-4-2 ... 61000-4-6

## Dimensions

Dimensions in mm (inches)



WINDCAP® is a registered trademark of Vaisala.

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## WA15 Wind Set for High Performance Wind Measurement



*The WA15 is based on accurate sensors installed on a large crossarm. It is designed for demanding wind measurement applications.*

With a proven track record of successful installations, the Vaisala Wind Set WA15 has earned its reputation as the industry standard in the wind sensor market.

The WA15 consists of a Vaisala Anemometer WAA151, a Vaisala Wind Vane WAV151, an optional crossarm, a power supply and cabling.

### Anemometer with Excellent Linearity

The WAA151 is a fast response, low-threshold anemometer. Three lightweight, conical cups mounted on the cup wheel, provide excellent linearity over the entire operating range, up to 75 m/s.

A wind-rotated chopper disc attached to the shaft of the cup wheel cuts an infrared light beam 14 times per revolution. This generates a pulse output from the phototransistor.

#### Features/Benefits

- High-performance wind measurement set
- Long and successful track record in meteorological applications
- Accurate wind speed and direction measurement
- Low measurement starting threshold
- Conical anemometer cups provide excellent linearity
- Heated shaft prevents bearings from freezing

The output pulse rate is directly proportional to wind speed (e.g. 246 Hz = 24.6 m/s). However, for the highest accuracy, the characteristic transfer function should be used to compensate for starting inertia.

### Sensitive Wind Vane

The WAV151 is a counter-balanced, low-threshold, optoelectronic wind vane. Infrared LEDs and phototransistors are mounted on six orbits on each side of a 6-bit GRAY-coded disc. Turned by the vane, the disc creates changes in the code received by the phototransistors. The output code resolution is  $\pm 2.8^\circ$ .

### Heated Bearings Withstand Cold Weather

Heating elements in the shaft tunnels of both the anemometer and vane keep the bearings above freezing in cold climates.

### Complete Package Available

The anemometer and vane are designed to be mounted on Vaisala crossarms.

The WHP151 power supply provides the operating and heating power needed for the WA15. The power supply, as well as the signal and power cables are available as options.

## Technical Data

### Vaisala Wind Set WA15

#### Options and Accessories

Crossarm and termination box	WAC151
16-lead signal cable	ZZ45048
6-lead power cable	ZZ45049
Crossarm and analog transmitter	WAT12
6-lead cable for signal and power	ZZ45049
Crossarm and serial RS485 transmitter	WAC155
Serial RS485 transmitter card	WAC155CB
Power supply	WHP151
Set of bearings and gasket	16644WA
Dimensions	
Junction box	125 x 80 x 57 mm
Crossarm length	800 mm
Mounting to a pole mast with a nominal outside diameter	60 mm
Cup assembly	7150WA
Tail assembly	6389WA



# Technical Data

## Vaisala Anemometer WAA151

### Wind Speed

Measurement range	0.4 ... 75 m/s
Starting threshold	< 0.5 m/s *
Distance constant	2.0 m
Characteristic transfer function	$U = 0.328 + 0.101 \times R$ (where U = wind speed [m/s], R = output pulse rate [Hz])
Accuracy (within range 0.4 ... 60 m/s)	
with characteristic transfer function	$\pm 0.17 \text{ m/s}^{**}$
with transfer function $U = 0.1 \times R$	$\pm 0.5 \text{ m/s}^{***}$

### General

Operating power supply	$U_{in} = 9.5 \dots 15.5 \text{ VDC}$ , 20 mA typical
Heating power supply	AC or DC 20 V, 500 mA nominal
Output	0 ... 750 Hz square wave
Transducer output level	
with $I_{out} < +5 \text{ mA}$	high state $> U_{in} - 1.5 \text{ V}$
with $I_{out} > -5 \text{ mA}$	low state $< 2.0 \text{ V}$
Settling time after power turn-on	< 30 $\mu\text{s}$
Plug 6-PIN	MIL-C-26482 type
Cabling	6-wire cable through crossarm
Recommended connector at cable end	SOURIAU MS3116F10-6P
Operating temperature with heating	-50 ... +55 °C (-58 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Material	
housing	AlMgSi, grey anodized
cups	PA, reinforced with carbon fibre
Dimensions	240 (h) $\times$ 90 (Ø) mm
Swept radius of cup wheel	91 mm
Weight	570 g

### Test Compliance

Wind tunnel tests	ASTM standard method D5096-90
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3

Complies with EMC standard EN61326-1:1997 + Am1:1998 + Am2:2001; Generic Environment

\* Measured with cup wheel in position least favoured by flow direction. Optimum position gives approx. 0.35 m/s threshold.

\*\* Standard Deviation

\*\*\* Typical error vs. speed with the "simple transfer function" used.

RANGE (m/s)	0-3	3-10	10-17	17-24	24-31	31-37	37-44	44-51	51-58	58-65
ERROR (m/s)	-0.4	-0.3	-0.2	-0.1	0.0	+0.1	+0.2	+0.3	+0.4	+0.5

## Vaisala Wind Vane WAV151

### Wind Direction

Measurement range at wind speed 0.4 ... 75 m/s	0 ... 360°
Starting threshold	< 0.4 m/s
Resolution	$\pm 2.8^\circ$
Damping ratio	0.19
Overshoot ratio	0.55
Delay distance	0.4 m
Accuracy	better than $\pm 3^\circ$

### General

Operating power supply	$U_{in} = 9.5 \dots 15.5 \text{ VDC}$ , 20 mA typical
Heating power supply	AC or DC 20 V, 500 mA nominal
Output code	6-bit parallel GRAY
Output levels	
With $I_{out} < +5 \text{ mA}$	high state $> U_{in} - 1.5 \text{ V}$
With $I_{out} > -5 \text{ mA}$	low state $< 1.5 \text{ V}$
Settling time after power turn-on	< 100 $\mu\text{s}$
Plug 10-PIN	MIL-C-26482 type
Cabling	10-wire cable through crossarm
Recommended connector at cable end	SOURIAU MS3116F12-10P
Operating temperature with heating	-50 ... +55 °C (-58 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Material	
housing	AlMgSi, grey anodized
wave	Alsi 12 anodized
Dimensions	300 (h) $\times$ 90 (Ø) mm
Swept radius of vane	172 mm
Weight	660 g

### Test Compliance

Wind tunnel tests	ASTM standard method D5366-93 (for starting threshold, distance constant, transfer function)
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3

Complies with EMC standard EN61326-1:1997 + Am1:1998; Am2:2001; Generic Environment

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# Confidence on Day 1, Confidence for Years

## Calibration Maintains Reliability

Regular calibration ensures your high-precision instruments continue to provide accurate, high-quality data. Choosing the right calibration laboratory can be as important for lifetime accuracy and reliability as the initial selection of the instrument. Identifying and setting calibration intervals are based on the application, product usage and the company's quality system. Our experts are ready to help with these important criteria.

## Over 50 Years of Expertise Working for You

Our high-performance calibration laboratories started in 1958 and we continually improve our technology, facilities and capabilities to provide the high quality and scope of services that you expect from Vaisala.

## Calibration Services to Meet Your Needs

Our regional Calibration Service Centers are ready with answers, options and flexibility to meet your requirements and budget.

Scope of calibration includes temperature, relative humidity, dew point, barometric pressure and carbon dioxide.

Standard calibrations are traceable to national or international standards and meet ISO9001 quality management standards. Calibration services in our laboratories in the U.S. and Canada also meet ANSI/NSCL Z540.1 requirements.

Pre-paid calibration plans offer savings and convenience with discounts on calibration services, no

changes in pricing during the term of the plan, and no purchase order needed for every calibration.

Custom calibration plans are available for customers with unique calibration needs or a high volume of calibrations.

Vaisala Calibration Service Centers are located in Canada, United States, Finland, China and Japan.

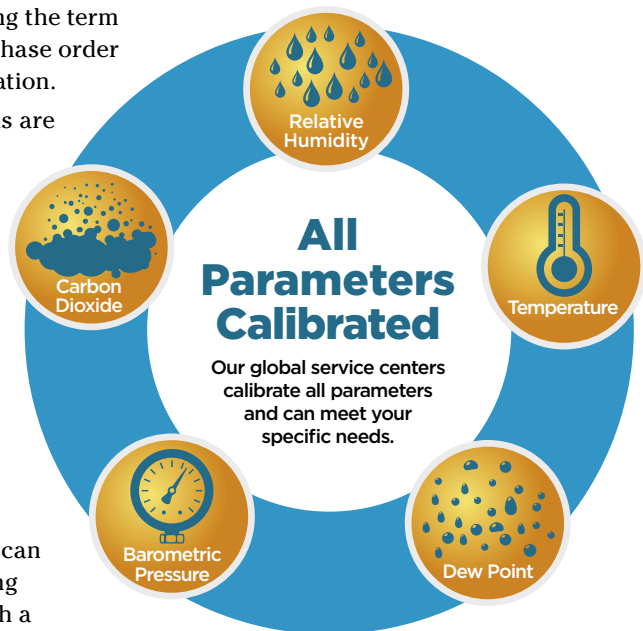
## Accredited Calibrations

Accredited calibrations can be required by regulating bodies or to comply with a company's quality standards. For example, accredited calibration may be required for instruments used as reference standards or to meet various demands from different authorities. Accredited calibrations are available for selected parameters. Calibrations are traceable to national or international standards. Calibration certificates are issued in compliance with the requirements of the ISO/IEC 17025 and are recognized by all the major international accreditation organizations.

## Preventive Maintenance

Both product lifespan and uptime can be improved with regular preventive maintenance, decreasing the need for unforeseen repairs and spare parts while lowering life cycle costs and ensuring the continual supply of high-quality data.

Maintenance is carried out by our qualified technicians. All



maintenance tasks and schedules will be made to suit your needs and minimize any possible downtime. Preventive maintenance service requires a service agreement.

## Repair Services

Our professional repair services help extend the life of your Vaisala equipment. We will repair your equipment at the most convenient location – either at your premises or at one of our Regional Service Centers. Repairs include fault tracing and repair or replacement of failed components, as well as final testing to ensure your equipment is functioning according to specifications.

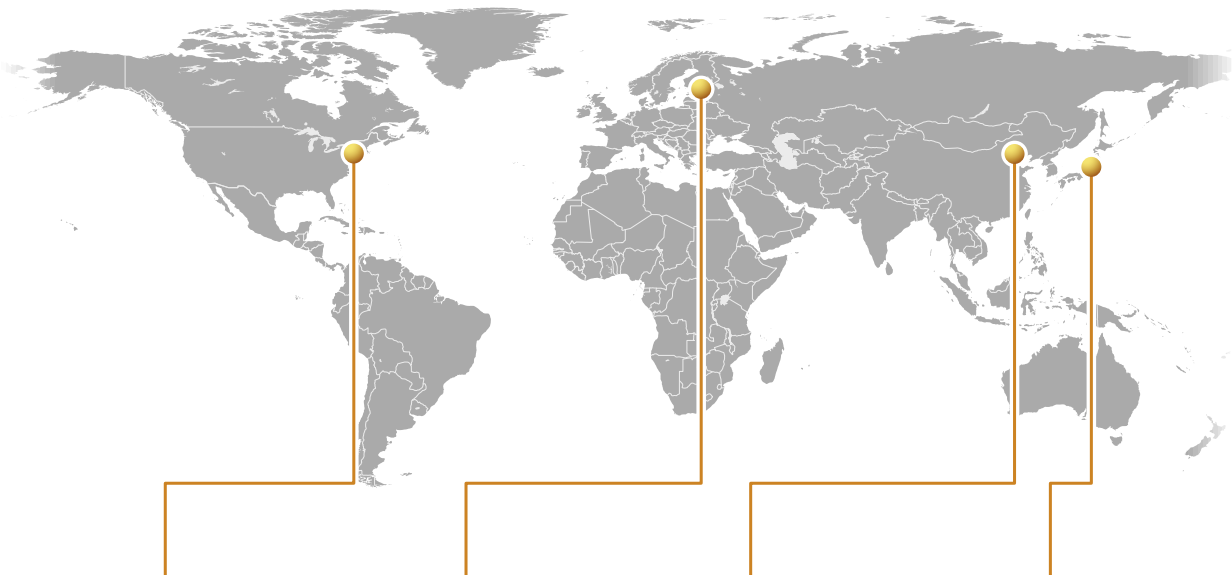
If your equipment requires repair, please first contact our technical support for instructions on how to return products for repair.


# Calibration Maintains and Documents Accuracy

Vaisala offers both standard service center calibrations and calibration services that have been accredited by the world's leading accreditation authorities. Accrediting bodies audit management, quality systems and technical competence and

formally recognize compliance by issuing a certificate of accreditation. ISO/IEC 17025 is the international standard used to accredit testing and calibration laboratories for measured quantities. Accredited calibrations can be required by

regulating bodies or to comply with a company's quality standards. For example, accredited calibration may be required for instruments used as reference standards or to meet various demands from different authorities.



Boston, USA	Helsinki, Finland	Beijing, China	Tokyo, Japan
STANDARD CALIBRATION SERVICES			
Relative Humidity	Relative Humidity	Relative Humidity	Relative Humidity
Temperature	Temperature		Temperature
Dew Point	Dew Point	Dew Point	Dew Point
Barometric Pressure	Barometric Pressure	Barometric Pressure	Barometric Pressure
Carbon Dioxide	Carbon Dioxide	Carbon Dioxide	Carbon Dioxide
ACCREDITED CALIBRATION SERVICES			
  CALIBRATION LABORATORY CERTIFICATE # 208381	  FINAS Finnish Accreditation Service K008 (EN ISO/IEC 17025)		   JCSS 0123
Relative Humidity	Relative Humidity		Relative Humidity
Temperature	Temperature		
Dew Point			Dew Point
Barometric Pressure	Barometric Pressure		

# Vaisala Filters

## Group A: 12 mm Diameter, Standard Length, Female Threads



0195

**0195**  
Brass, sintered filter, 133 microns, ø 12.0 mm  
Use with: HMM100, HMP46  
Group: A



10159HM

**10159HM**  
Membrane filter, 0.2 microns, ø 12.0 mm  
Use with: HMM100, HM34  
Group: A



6221

**6221**  
Plastic grid, 2 mm protection, ø 12.0 mm  
Use with: HM34, HMM100  
Group: A



230727SP

**230727SP**  
Membrane filter, 0.2 microns, ø 12.0 mm  
Use with: HMP155  
Group: A

## Group B: 12 mm Diameter, Long Length, Female Threads (Could be used in place of "A" type filters)



DRW010276SP

**DRW010276SP**  
PPS plastic grid filter, 6.5 mm, ø 12 mm  
Use with: HMT330, HMT360, HMT310, HM70, PTU300  
Group: B



HM47280SP

**HM47280SP**  
Stainless steel sintered filter, 38 µm, ø 12mm  
Use with: HMT330, HMT360, HMT310, HM70, HMM100, DMT340, DMT242, DM70, PTU300  
Group: B



DRW010281SP

**DRW010281SP**  
PPS plastic grid with stainless steel net, 15 µm, ø 12 mm  
Use with: HMT330, HMT360, HMT310, HM70, PTU300  
Group: B



HM47453SP

**HM47453SP**  
Stainless steel filter, 3.15 mm, ø 12 mm  
Use with: MMT330, MMT310, MM70, HMT330, HMT360, HMT310, DMT340, PTU300  
Group: B



DRW212987SP

**DRW212987SP**  
Sintered filter, 40 µm, ø 12 mm  
Use with: HM70  
Group: B



220752SP

**220752SP**  
Stainless steel filter for high oil flow (>1m/s) 2 mm hole size  
Use with: MMT330, MMT310, MM70  
Group: B



220957SP

**220957SP**  
Stainless steel mesh filter, 18 µm, ø 12 mm  
Use with: DMT152, DPT146  
Group: B



219452SP

**219452SP**  
Sintered PTFE filter, ø 12 mm  
Use with: HMP155, HMM100, HMP63, HMP113  
Group: B



221494SP

**221494SP**  
Stainless steel filter for high oil flow (>1 m/s) 2 mm hole size  
Use with: MMT162  
Group: B



225356SP

**225356SP**  
Stainless steel filter for oil measurements, ø 12 mm, 3 mm holes  
Use with: MMT162  
Group: B



**230602**  
Tube filter  
Use with: DMT132  
Group: B

230602



**231865**  
Vaporized Hydrogen Peroxide resistant  
sintered filter  
Use with: HMT330, HMT360, HMT310,  
HM70, PTU300  
Group: B

231865

### Group C: 12 mm Diameter, Male Threads



**HM46670SP**  
Sintered stainless steel filter, 38 µm,  
ø 12.0 mm  
Use with: HMT120/130, HMD60/70,  
HMD42/53, HMP60, HMP110, HMM210  
Group: C

HM46670SP



**DRW010525**  
Membrane filter, 0.2 µm, ø 12 mm  
Use with: HMT120/130, HMP60, HMP110,  
HMD60/70, HMD42/53  
Group: C

DRW010525



**DRW010522**  
Plastic Grid, 2 mm, ø 12 mm  
Use with: HMT120/130, HMD60/70,  
HMD42/53, HMP60, HMP110  
Group: C

DRW010522



**232637**  
Vaporized Hydrogen Peroxide resistant  
sintered filter  
Use with: HMT120/130, HMP110, HMP60  
Group: C

232637

### Stand Alone - Not Interchangeable:



**HM46780**  
Stainless steel filter, 38 µm, ø 20 mm  
Use with: DMT346 Cooling set

HM46780



**19858HM**  
Membrane filter tube set (5 pcs)  
Use with: HMP42

19858HM



**19867HM**  
Steel grid for the HMP42,  
1 mm, ø 4 mm

19867HM

### Filters for Discontinued Products

#### Group C: 12 mm Diameter, Male Threads

- 17039HM Membrane filter, 0.2 µm, ø 12 mm

#### Group D: 13.5 mm Diameter, Male Threads

- 16452SP Sintered filter, stainless steel, 37 microns, ø 13.5 mm
- 16562SP PPS Grid, 2 mm, ø 13.5 mm
- 16720HMSP PPS Grid and stainless steel net, 14 µm, ø 13.5 mm
- 17230HMSP PTFE membrane, 3.5 µm, ø 13.5 mm
- HM46999SP Sintered stainless steel filter, 2mm, ø 13.5

#### Group E: 18.5 mm Diameter, Female Threads

- 6597 Plastic grid, 2.5 mm, ø 18.5 mm
- HM46717 Plastic grid, 2.5 mm, ø 18.5 mm
- 2787HM Membrane filter, 0.2 microns, ø 18.5 mm
- 16126HM Metallized membrane filter, 0.5 µm, ø 18.5 mm



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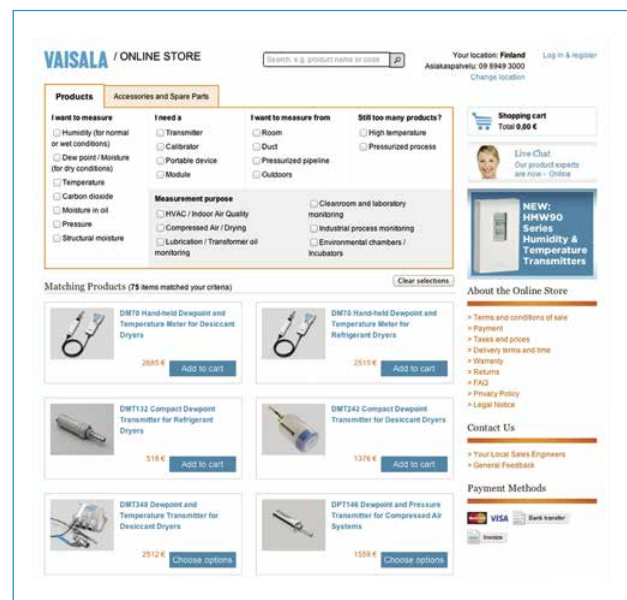
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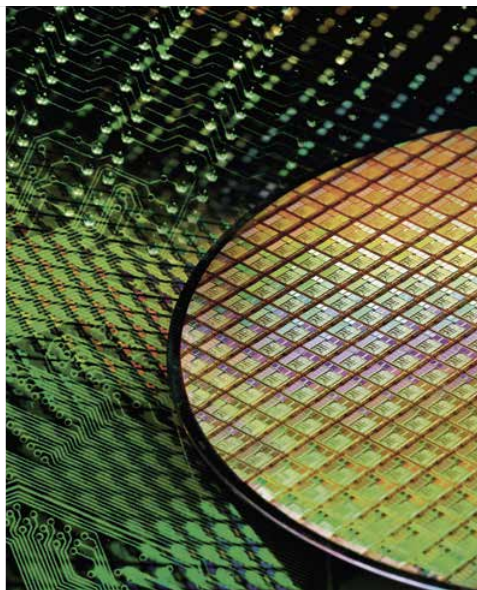
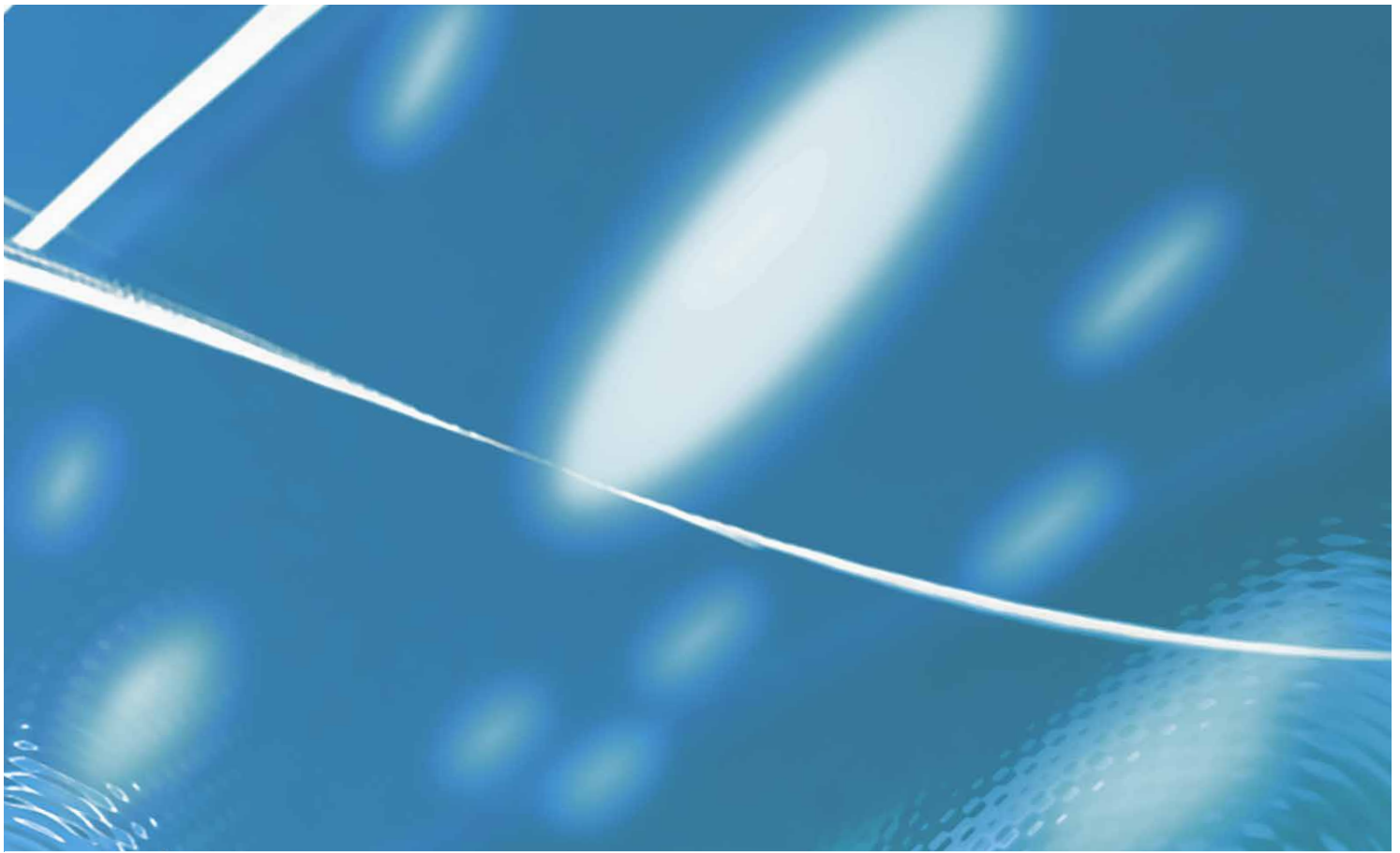
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