Product Catalog

Humidity | Temperature | Dew point | Carbon dioxide
Biogas quality | Moisture in oil | Continuous data logging
Continuous monitoring | Dissolved gas analysis
Hydrogen peroxide | Pressure | Weather | Service offering

Industrial Measurements

VAISALA
Observations for a better world

Vaisala Industrial Measurements business area serves customers in multiple industries with over 40 years of industry knowledge. Our products improve quality, productivity, energy efficiency, and help our customers fulfill regulatory compliance. Our customers operate in different types of environments from semi-conductor factories and high-rise buildings to power plants and small incubators where reliable measuring and monitoring of the conditions are a prerequisite for successful operations.

**Industrial measurement solutions**
Vaisala’s measurement products are used by a variety of industries, such as electronics, automotive, maritime, lithium battery manufacturing and food processing. The stable real-time measurements extend equipment lifetime, and improve processes, productivity and end-product quality.

**Heating, ventilation, and air conditioning (HVAC)**
Vaisala offers industry benchmark HVAC transmitters for measuring humidity, temperature, and carbon dioxide indoors and outdoors. Customers use these instruments to optimize heating ventilation and air conditioning controls, for example, in offices, hospitals, data centers, factories, and cooling towers. Our transmitters help in maintaining good indoor air quality and saving costs through improved efficiency.

**Life science and GxP regulated environments**
For over 50 of the world’s top life science companies, Vaisala provides measurement devices and monitoring systems for continuous records, reports, and alarms. These solutions are used to monitor temperature and humidity conditions in research and development, production, and storage environments. With our solutions and services, life science companies ensure the quality and safety of their products, and maintain compliance with global regulations.

**Power generation and transmission**
For power generation and transmission industry, Vaisala provides unique measurement equipment for online monitoring of transformer insulation oil. Our reliable solutions support in planning and optimizing the preventive maintenance of power transformers, and thus help to extend their lifetime and reduce the risk of unexpected and costly outages.

This product catalog gives an overview of our products to help you select what suits your needs best. For more information, visit us at www.vaisala.com or contact us at www.vaisala.com/requestinfo.
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Vaisala Indigo200 series transmitters are host devices for displaying measurement values from Vaisala Indigo compatible probes and/or transmitting them to automation systems through analog signals, Modbus RTU communication, or relays.

These probe hosts are plug-and-play devices for current and future Vaisala Indigo compatible probes. The host device has a color LCD display; Indigo201 is also available as a non-display version that uses an LED indicator for notifications.

Vaisala Indigo compatible probes are connected either directly to the host or by using a cable between Indigo200 and the probe. Indigo200 has a browser-based wireless configuration interface for mobile devices and computers that support a wireless connection (IEEE 802.11 b/g/n WLAN). The host device and the probes connected to it can be configured using the wireless user interface. It also allows for temporary viewing of the measurement data.

The surface of the Indigo200 enclosure is smooth, which makes it easy to clean. It is also resistant to dust and most chemicals, such as H₂O₂ and alcohol-based cleaning agents.
Technical data

General
• LCD color display (Indigo201: optional non-display version)
• Wireless (WLAN) configuration interface: connect to Indigo200 and use the browser-based user interface for device configuration and measurement data viewing

Indigo compatible smart probes
<table>
<thead>
<tr>
<th>Measurement type</th>
<th>Probe models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity and temperature</td>
<td>HMP1, HMP3, HMP4, HMP5, HMP7, HMP8, HMP9</td>
</tr>
<tr>
<td>Temperature</td>
<td>TMP1</td>
</tr>
<tr>
<td>Dew point</td>
<td>DMP5, DMP6, DMP7, DMP8</td>
</tr>
<tr>
<td>CO2</td>
<td>GMP251, GMP252 1)</td>
</tr>
<tr>
<td>Vaporized hydrogen peroxide</td>
<td>HPP271, HPP272</td>
</tr>
<tr>
<td>Moisture in oil</td>
<td>MMP8</td>
</tr>
</tbody>
</table>

1) All DMP251 and DMP252 probes manufactured from 2017 onwards (serial numbers starting with the letter N or later in alphabetical order) have full Indigo compatibility.

Operating environment
Operating temperature
- With display: -20 ... +60 °C (-4 ... +140 °F)
- Without display: -40 ... +60 °C (-40 ... +140 °F)
Storage temperature
- -40 ... +70 °C (-40 ... 158 °F)
Chemical tolerance
- Temporary exposure during cleaning:
  - H₂O₂ (6000 ppm, non-condensing)
  - Alcohol-based cleaning agents such as ethanol and IPA (max. 70 % concentrate)

Inputs and outputs
Power supply input
- 15 ... 30 VDC 1)
- 24 VAC ±10 % 50/60 Hz
Relay contacts x 2
- Max. switching power 30 W
- Max. switching current 1 A
- Max. switching voltage 40 VDC / 28 VAC

Indigo201 model
Three analog outputs (voltage or current)
- Voltage: 0 ... 1 V, 0 ... 5 V, 0 ... 10 V, 1 ... 5 V, scalable, min. load 1 kΩ
- Current: 4 ... 20 mA, 0 ... 20 mA, scalable, max. load 500 Ω
Accuracy of analog outputs at 20 °C
- ±0.1 % full scale for 0 ... 10 V and 0 ... 20 mA

Indigo202 model
Digital communications
- RS-485, Modbus RTU

1) When used with the HMP7 probe, the minimum required power supply input is 18 VDC.

Mechanical specifications
| Housing classification         | IP65                      |
| Housing material               | PC/ABS plastic            |
| Display window material        | PMMA plastic              |
| Connection screw terminals     | 26 AWG ... 20 AWG         |
| Weight                         | 402 g (14.2 oz)           |
| Dimensions (H×W×D)             | 149 x 135 x 43 mm (5.87 x 5.31 x 1.7 in) |

Compliance
Safety standard                  | IEC/UL/EN 61010-1          |
Networking standards (wireless configuration interface WLAN access point) | IEEE 802.11 b/g/n compliant |
EMC compliance                   | EN61326-1, Generic Environment |
Contains                          | FCC ID QOQ-WGM110, IC 5123A-WGM110, MIC 209-J00197, MSIP-CRM-BGT-WGM110 |

Spare parts and accessories
| Probe connection cable, 1 m     | INDIGOCABLE1M             |
| Probe connection cable, 3 m     | INDIGOCABLE3M             |
| Probe connection cable, 5 m     | INDIGOCABLE5M             |
| Probe connection cable, 10 m    | INDIGOCABLE10M            |

Indigo200 series dimensions
Indigo520 Transmitter
For Vaisala smart probes

**Features**
- Universal transmitter for Vaisala Indigo compatible probes
- Supports 2 detachable probes simultaneously
- Touchscreen display
- IP66 and NEMA 4 rated metal enclosure
- 4 configurable galvanically isolated analog outputs
- 2 relays
- Ethernet connection with web interface for remote access
- Modbus TCP/IP protocol
- Multiple powering options, including Power over Ethernet and AC (mains) power

Vaisala Indigo520 transmitter is an industrial-grade, robust transmitter that accommodates 1 or 2 Vaisala Indigo compatible probes for humidity, temperature, dew point, carbon dioxide, hydrogen peroxide, and moisture in oil measurements. The transmitter can display measurements on the spot as well as transmit them to automation systems through analog signals, relays, or Modbus TCP/IP protocol.

**Variety of probe options**
Indigo520 transmitters are the most versatile option for use with Indigo compatible smart probes.
- Humidity and temperature probes: HMP1, HMP3, HMP4, HMP5, HMP7, HMP8, HMP9, and TMP1
- Dew point probes: DMP5, DMP6, DMP7, DMP8
- CO₂ probes: GMP251, GMP252
- Vaporized hydrogen peroxide probes: HPP271, HPP272
- MMP8 moisture in oil probe

The probes are interchangeable, self-contained measurement instruments that are easily detachable from the transmitter for calibration and maintenance. The probes are connected using a cable that can be extended with a standard instrumentation cable to allow up to 30 m (98 ft) distance between the transmitter and the probe.

The Indigo520 transmitter can also be connected to the MHT410 transmitter for display of measurement data and automation system connectivity.

For more information on the Indigo product family, see [www.vaisala.com/indigo](http://www.vaisala.com/indigo).

**Robust design**
The transmitter has a wide operating temperature range, an IP66-rated corrosion-resistant metal enclosure and a touchscreen display made of chemically strengthened (IK08) glass. The transmitter withstands commonly used cleaning chemicals and performs even in the harshest conditions.

The standard mounting options include mounting on a wall and on a DIN rail. With an adapter plate, the transmitter can be installed to replace an HMT330, DMT340, and MMT330 series transmitter. A pole mounting kit is also available as an accessory.

**Analog and digital interfaces**
The transmitter has 4 analog channels that can be configured to mA or voltage type, and 2 configurable relays. Any of the output parameters from the connected probes can be assigned to control the analog channels and relays.

The digital output protocol is Modbus TCP/IP over Ethernet.

Besides Modbus TCP/IP, the transmitter’s Ethernet connection provides a web interface and cybersecurity that meets modern standards.
## Technical data

### Indigo compatible smart probes

<table>
<thead>
<tr>
<th>Measurement type</th>
<th>Probe models</th>
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</tr>
<tr>
<td>CO₂</td>
<td>GMP251, GMP252 ¹</td>
</tr>
<tr>
<td>Vaporized hydrogen peroxide</td>
<td>HPP271, HPP272</td>
</tr>
<tr>
<td>Moisture in oil</td>
<td>MMP8</td>
</tr>
</tbody>
</table>

### Other compatible devices

<table>
<thead>
<tr>
<th>Device or series</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHT410 Moisture, Hydrogen and Temperature Transmitter</td>
<td>MHT410</td>
</tr>
</tbody>
</table>

### Inputs and outputs

#### Operating power

- **Protective extra-low voltage (PELV) version** ¹: 15 ... 35 VDC, 24 VAC ±20 %, max. current 2 A; Fuse size for power supply: 3 A.
- **AC (mains) power version** ¹: 100 ... 240 VAC 50/60 Hz, max. current 1 A; Fuse size for power supply: 10 A.
- **Power over Ethernet version** ¹: 50 VDC, 600 mA PoE+, IEEE 802.3 at PD; Fuse size for power supply: 2 A.

#### Analog outputs

- **Number of analog outputs**: 4, galvanically isolated from power supply.
- **Selectable voltage output types**: 0 ... 1 V, 0 ... 5 V, 0 ... 10 V, scalable.
- **Selectable current output types**: 4 ... 20 mA, 0 ... 20 mA, scalable.
- **External loads**:
  - **Current outputs**: \( R_L < 500 \Omega \)
  - **0 ... 1 V output**: \( R_L > 2 \text{k} \Omega \)
  - **0 ... 5 V and 0 ... 10 V outputs**: \( R_L > 10 \text{k} \Omega \)
- **Max. wire size**: 2.5 mm² (14 AWG).
- **Accuracy of analog outputs at +20 °C (+68 °F)**: ±0.05 % full scale.
- **Temperature dependence**: ±0.005 % / °C full scale.

#### Relay outputs

- **Number and type of relays**: 2 pcs, SPDT.
- **Max. switching power, current, voltage**: 30 W, 1 A, 40 VDC / 28 VAC.
- **Max. wire size in PELV version**: 2.5 mm² (14 AWG).
- **Max. wire size in AC (mains) version**: 1.5 mm² (16 AWG).

### Ethernet interface

- **Supported standards**: 10BASE-T, 100BASE-TX.
- **Connector**: 8P8C (RJ45).
- **Supported protocols**: Modbus TCP/IP (port 502), HTTPS (port 8443).

¹ The power supply option is selected when ordering the transmitter.

### Mechanical specifications

| Housing classification         | IP66, NEMA 4, IK08, DIN EN ISO 11997-1: Cycle B |
| Housing material               | AISI10Mg (DIN 1725)                           |
| Display window material        | Chemically strengthened glass (IK08)         |
| Weight                         | 1.5 kg (3.3 lb)                               |
| Dimensions (H × W × D)         | 142 × 182 × 67 mm (5.63 × 7.17 × 2.64 in)     |

<table>
<thead>
<tr>
<th>Cable diameters for cable glands</th>
</tr>
</thead>
<tbody>
<tr>
<td>M20×1.5 glands</td>
</tr>
<tr>
<td>M20×1.5 glands with split bushing</td>
</tr>
<tr>
<td>M16×1.5 glands</td>
</tr>
</tbody>
</table>

#### Operating environment

- **Operating temperature**: -20 ... +55 °C (-4 ... +131 °F).
- **Storage temperature**: -40 ... +70 °C (-40 ... 158 °F).
- **Operating humidity**: 0 ... 100 %RH.
- **Maximum operating altitude**: 3000 m (9843 ft).

### Compliance

- **Safety standard**: IEC/UL/EN 61010-1.
- **EMC compliance**: EN 61326-1, Industrial Environment.
- **FCC compliance**: FCC Part 15, Class B.

### Accessories

- **Adapter plate**: DRW252186SP.
- **Installation kit for pole or pipeline**: 215108.

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**Indigo520 dimensions and lead-through sizes**

**Indigo520 adapter plate dimensions**
VAISALA

HUMICAP® sensor for measuring relative humidity

HUMICAP in brief

- A capacitive thin-film polymer sensor
- Full measurement range 0 ... 100 %RH
- Accurate to ±0.8 %RH
- Traceable humidity measurement
- On the market since 1973

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.

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

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
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.

Family of HUMICAP sensors

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 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 ±3 %RH accuracy
How to select the right humidity instrument for your high-humidity application

High-humidity environments are tough for humidity measurement. Saturation in the environment causes condensation to form on all surfaces including measurement sensors, which can be fatal for some technologies. While Vaisala HUMICAP® technology can withstand condensation, it still needs time to recover from the effects of moisture before it can once again provide reliable measurements. Typical applications where high humidity or occasional condensing are expected include drying processes, test chambers, combustion air humidifiers, meteorological measurements, and fuel cells. Keeping measurements accurate and reliable even in condensing environments calls for Vaisala’s probe warming technology. A warmed probe keeps the sensor continuously above the ambient temperature, ensuring condensation never forms. The disadvantage of probe heating is that relative humidity can no longer be measured because the sensor will not know the ambient temperature. However, this does not prevent other temperature independent parameters from being measured, such as dew point or mixing ratio. It is also possible to measure relative humidity using an additional temperature sensor.

Operating principle
The heating element inside the probe body heats the entire probe. In the illustration above, the probe and filter are glowing red to illustrate how the probe warming keeps the microclimate inside the filter at an elevated temperature. The actual temperature is only a few degrees above the ambient temperature, as seen in the following example:

Ambient temperature:
• $T_a = 14 \, ^\circ C$
• $RHA = 97 \, %RH$
• $Td_a = 13 \, ^\circ C$

Humidity sensor:
• $T_s = 16 \, ^\circ C$
• $RH_s = 83 \, %RH$
• $Tds = 13 \, ^\circ C$ (calculated)

As shown in this example, heating does not affect dew point. If relative humidity or another temperature-related parameter is needed, then the ambient temperature can be measured with a separate temperature probe, allowing these parameters to be calculated as well.
**Products**

Several Vaisala solutions include warmed probe technology. All of the following products are configurable when ordering: HMM170, HMT317, HMT337, and HMP7. The following table will help you find the right solution for your high-humidity industrial application.

<table>
<thead>
<tr>
<th>Product</th>
<th>HMP7</th>
<th>HMT317</th>
<th>HMT337</th>
<th>HMM170</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe warming</td>
<td>Yes</td>
<td>Configurable</td>
<td>Configurable</td>
<td>Configurable</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP66</td>
<td>IP66</td>
<td>IP66/IP65</td>
<td>N/A</td>
</tr>
<tr>
<td>Ambient temperature sensor allows RH calculation</td>
<td>Possible with external temperature measurement ¹</td>
<td>No</td>
<td>Configurable ²</td>
<td>Possible with external temperature measurement ¹</td>
</tr>
<tr>
<td>Available measurement parameters</td>
<td>$T_d$, $T_{df}$, $x$, ppm, $p_w$ ¹ ($RH$, $T$, $a$, $T_w$, $p_{ws}$, $h$, $dT$)</td>
<td>$T_d$, $T_{df}$, $x$, $p_w$ ¹ ($RH$, $T$, $a$, $T_w$, $p_{ws}$, $h$, $dT$)</td>
<td>$T_d$, $T_{df}$, $x$, ppm, $p_w$ ¹ ($RH$, $T$, $a$, $T_w$, $p_{ws}$, $h$, $dT$)</td>
<td>$T_d$, $T_{df}$, $x$, $p_w$ ¹ ($RH$, $T$, $a$, $T_w$, $p_{ws}$, $h$, $dT$)</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>18 ... 30 VDC</td>
<td>10 ... 35 VDC</td>
<td>Configurable: 10 ... 35 VDC, 24 VAC, 100 ... 240 VAC, 50/60 Hz</td>
<td>15 ... 35 VDC</td>
</tr>
<tr>
<td>Digital output</td>
<td>RS-485: Modbus RTU</td>
<td>RS-232: serial ASCII</td>
<td>Configurable RS-485: Modbus RTU or serial ASCII Ethernet: Modbus TCP or serial ASCII</td>
<td>RS-485: Modbus RTU</td>
</tr>
<tr>
<td>Analog output</td>
<td>Requires additional Indigo transmitter</td>
<td>2 x</td>
<td>2 x (3rd optional)</td>
<td>3 x</td>
</tr>
<tr>
<td>Display</td>
<td>No</td>
<td>Configurable</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Parametrization</td>
<td>Insight software</td>
<td>Terminal program (e.g. PuTTY)</td>
<td>Terminal program (e.g. PuTTY)</td>
<td>Insight software</td>
</tr>
<tr>
<td>USB cable (sold separately)</td>
<td>242659</td>
<td>238607</td>
<td>219685</td>
<td>219690</td>
</tr>
</tbody>
</table>

¹ Relative humidity calculation is possible by writing external temperature information on a Modbus register.
² Configurable: additional temperature probe needed.
Probe installation

All the products listed in the table on the previous page share the same 12 mm sensor head. Depending on the application, there are different mounting accessories available:

**Duct installation kit 10697**
(215003 for HMT337 temperature probe)

**Pressure-tight Swagelok installation kits**
SWG12ISO38 with ISO3/8” or SWG12NPT12 with NPT1/2” thread (SWG6ISO18 with ISO1/8” or SWG6NPT18 with NPT1/8” thread for HMT337 temperature probe)

**HMP247CG**: Vapor-tight installation with cable gland
Insulation and leak-proof process connections

Choosing where to install a humidity probe can be challenging when there is high humidity combined with temperature variation.

For example, in a drying application where the exhaust air humidity is close to saturation (95 %RH) and the temperature is 40 °C, what happens when the sensor head is installed so that the filter is in the process and half of the sensor is in the 25 °C ambient temperature? In this situation even probe warming may not be able to compensate for the heat loss caused by thermal conduction through the metallic probe body; the heat loss will form a cold spot on the process side and condensation will result in inaccurate measurement. The solution here is to thoroughly insulate the probe.

If the process gas is colder than the ambient air it is critical to have a tight process connection for the probe. A leaking connection will allow warm and possibly humid air into the system, which can condensate near the sensor and cause measurement problems.

Extreme conditions, such as PEM fuel cell applications

There are also extreme applications where warming just few degrees above the ambient temperature is just not enough. One example of such application is a Polymer Electrode Membrane (PEM) Fuel cell. Application specific configurations can be found in the order forms of HMT330- and HMT310-series. These configuration versions are designed to withstand the extreme conditions by heating the probe head at a higher power. It is also possible to use HMP7 and HMM170 in these applications, since the heating functionalities are freely configurable with the Insight PC software.

Summary

Sensor saturation can be avoided in high-humidity and condensing conditions by using an instrument that has probe warming technology. In addition to this, proper insulation and leak-free installation guarantees the best possible environment for reliable humidity measurement.

The comparison table in this document will help you to choose the right product for your application. More detailed product information and features can be found in datasheets, user manuals, and order forms.
Insight PC software
For easy access to Indigo compatible probes

Features
• Easy access to configuration settings and measurement data of compatible devices
• Simple setup, diagnostics, and field calibration and adjustment
• Supports Indigo compatible smart probes and a selection of other Vaisala devices
• Connect up to 6 devices simultaneously

Calibration is needed for verifying and maintaining measurement accuracy over time and ensuring the quality and reliability of the measurement. Vaisala Insight PC software gives quick access to the configuration and calibration of Indigo compatible smart probes and other compatible devices.

Indigo product family
Vaisala Indigo compatible smart probes are self-contained, interchangeable measurement probes. The probes can be used as standalone digital Modbus RTU devices, or together with Indigo series transmitters that provide flexibility in terms of system interface: display, service interface, and powering options. The Indigo product family provides various ways to interact with the device. The probe settings and calibration can be done through the Indigo transmitter, using a Wi-Fi connection or local display, or the probes can be detached from the process and connected to a PC with a USB cable for setup and field calibration using Insight PC software.

High-quality field calibration
Field calibration is a quick way to check and validate the measurement. The simplest form of field calibration is comparison with a portable instrument. However, when more accuracy is needed or more than one point has to be calibrated, the calibration should be made using a calibrator in the controlled environment of a laboratory or a workshop. When a high-quality calibration in a controlled environment is needed, just detach the probe from the process, bring it to the laboratory, connect to the USB cable, and launch the Insight PC software. Up to 6 devices can be connected to Insight simultaneously. The software automatically detects the connected devices, and makes calibrating easy with an intuitive graphical user interface.

Diagnostics and more
Vaisala Insight PC software provides access to diagnostics data and device specific advanced features, such as event logs, parameter backup copy, or electronic copy of the calibration certificate. It also allows easy testing and evaluation – the 48-hour data logging functionality allows recording data from up to 6 devices simultaneously, with easy export to Excel readable format.

Technical requirements
Vaisala Insight PC software is available in English and Japanese, and it operates on 64-bit Windows 7, Windows 8.1 and Windows 10 operating systems. One product specific USB cable (type A connector) per connected probe is needed. Vaisala Insight software is available for download from www.vaisala.com/insight.
## Devices compatible with Insight software

### Indigo compatible smart probes

<table>
<thead>
<tr>
<th>Measurement type</th>
<th>Probe models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity and temperature</td>
<td>HMP1, HMP3, HMP4, HMP5, HMP7, HMP8, HMP9</td>
</tr>
<tr>
<td>Temperature</td>
<td>TMP1</td>
</tr>
<tr>
<td>Dew point</td>
<td>DMP5, DMP6, DMP7, DMP8</td>
</tr>
<tr>
<td>CO$_2$</td>
<td>GMP251, GMP252 $^1$</td>
</tr>
<tr>
<td>Vaporized hydrogen peroxide</td>
<td>HPP271, HPP272</td>
</tr>
<tr>
<td>Moisture in oil</td>
<td>MMP8</td>
</tr>
</tbody>
</table>

### Other compatible devices

<table>
<thead>
<tr>
<th>Device or series</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMT143 dew point transmitter</td>
<td>DMT143 and DMT143L</td>
</tr>
<tr>
<td>HMD60 series humidity and temperature transmitters</td>
<td>HMD62, HMD65, and TMD62</td>
</tr>
<tr>
<td>HMDW110 series humidity and temperature transmitters</td>
<td>HMDW110, HMDW112, HMD110, HMD112, HMS110, and HMS112</td>
</tr>
<tr>
<td>HMM170 humidity measurement module</td>
<td>HMM170</td>
</tr>
<tr>
<td>HMP110 series humidity and temperature probes</td>
<td>HMP110, HMP110T, HMP113, HMP115, HMP115T, and TMD115</td>
</tr>
<tr>
<td>HMP60 series humidity and temperature probes</td>
<td>HMP60 and HMP63</td>
</tr>
<tr>
<td>MGP261 multigas probe</td>
<td>MGP261</td>
</tr>
</tbody>
</table>

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$^1$ GMP251 and GMP252 are compatible with Insight software version 3.1 and later.
HMP1 Wall-Mounted Humidity and Temperature Probe

Vaisala HUMICAP® Humidity and Temperature Probe HMP1 is designed for ambient measurement in indoor spaces. Its probe head and body are integrated into a single unit with no cable between them. HMP1 can be directly connected to Indigo200 series transmitters to form a single wall-mounted unit.

Flexible connectivity
The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.

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.

Mounting with probe holder
HMP1 probe is delivered with probe holder for wall mounting. The probe holder provides a secure attachment that allows the probe to be removed without removing the base of the holder.

Use with Indigo200
With an Indigo200 series transmitter, HMP1 forms a single wall mounted unit with no probe cable or probe holder needed. Just push the probe directly into the connector on the Indigo200 transmitter and turn the locking wheel to hold the probe in place. Probe settings can be configured through the transmitter.

Features

- Compact size
- RH accuracy up to ±1.0 %RH
- Temperature accuracy up to ±0.2 °C (0.36 °F)
- Temperature measurement range −40 ... +60 °C (−40 ... +140 °F)
- Chemical purge provides superior chemical resistance
- Modbus RTU over RS-485
- Compatible with Indigo series of transmitters and Insight PC software
- Traceable calibration certificate: 6 points for humidity, 1 point for temperature
**Technical data**

**Measurement performance**

**Relative humidity**

- **Measurement range**: 0 … 100 %RH
- **Accuracy at +23 °C (+73.4 °F)**: ±1.0 %RH (0 … 90 %RH)
- **Factory calibration uncertainty**: ±0.7 %RH (40 … 95 %RH)

**Temperature**

- **Measurement range**: −40 … +60 °C (−40 … +140 °F)
- **Accuracy at +23 °C (+73.4 °F)**: ±0.2 °C (±0.36 °F)
- **Factory calibration uncertainty**: ±0.1 °C (±0.18 °F) at +23 °C (+73.4 °F)

1) Defined against calibration reference. Including non-linearity, hysteresis, and repeatability.
2) In typical room conditions.
3) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.

**HMP1 humidity measurement accuracy as a function of temperature**

**HMP1 temperature measurement accuracy over full range**

**Output parameters**

- **Absolute humidity (g/m³)**
- **Relative humidity (%)RH**
- **Absolute humidity at NTP (g/m³)**
- **Relative humidity (dew/frost) (%)RH**
- **Dew point temperature (°C)**
- **Temperature (°C)**
- **Dew/frost point temperature (°C)**
- **Water concentration (ppmv)**
- **Dew/frost point temperature at 1 atm (°C)**
- **Water concentration (wet basis) (vol-%)**
- **Dew point temperature at 1 atm (°C)**
- **Water mass fraction (ppmw)**
- **Dew point temperature difference (°C)**
- **Water vapor pressure (hPa)**
- **Enthalpy (kJ/kg)**
- **Water vapor saturation pressure (hPa)**
- **Mixing ratio (g/kg)**
- **Wet-bulb temperature (°C)**

**Operating environment**

- **Operating temperature**: −40 … +60 °C (−40 … +140 °F)
- **Storage temperature**: −40 … +60 °C (−40 … +140 °F)
- **Measurement environment**: For air, nitrogen, hydrogen, argon, helium, and oxygen
- **EMC compliance**: EN 61326-1, industrial electromagnetic environment

**Inputs and outputs**

- **Operating voltage**: 15 … 30 VDC
- **Current consumption**: 2 mA typical, 200 mA max.
- **Digital output**: RS-485, non-isolated
- **Protocol**: Modbus RTU

**Mechanical specifications**

**Connector**: M12 5-pin A-coded male
**Weight**: 38 g (1.34 oz)

**Materials**

- **Probe**: AISI316
- **Probe body**: PBT

**HMP1 probe dimensions**

**Probe holder ASM213582 dimensions**

**Accessories**

- **Indigo USB adapter**: 1) USB2
- **Vaisala Insight software for Windows**: available at www.vaisala.com/insight

1) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.
VAISALA

HMP3 General Purpose Humidity and Temperature Probe

Features
- Available with field replaceable HUMICAP® R2 sensor
- RH accuracy up to 0.8 %RH
- Temperature accuracy up to 0.1 °C (0.18 °F)
- Temperature measurement range −40 ... +120 °C (~−40 ... +248 °F)
- Compatible with Indigo series of transmitters and Insight PC software

Vaisala HUMICAP® Humidity and Temperature Probe HMP3 is a general purpose probe designed for various industrial processes. The probe structure allows for replacing the sensor without tools, making it suitable for applications such as paint booths and other industrial applications where periodic recalibration alone is not sufficient for maintaining the probe performance. Other suitable applications include, for example, industrial HVAC systems, cleanrooms, and environmental chambers.

Designed for field maintenance
Probe design allows for several operating environments and flexible field maintenance. Filter and HUMICAP® R2 sensor element are field replaceable for applications which require frequent replacements. Calibration and adjustment of humidity measurement is also needed if the HUMICAP® R2 sensor is replaced. The following filter types are recommended for HMP3:
- Stainless steel mesh filter (12 µm mesh size) for typical applications such as air handling units
- Sintered stainless steel filter for applications where maximal protection from dust ingress is essential
- PPS plastic grid filter for best humidity response time

Chemical purge available with composite sensors
If purchased with a composite sensor instead of the field replaceable HUMICAP® R2 sensor, HMP3 can use the chemical purge feature. 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.

Flexible connectivity
The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.
Technical Data

Measurement performance

Relative humidity
Measurement range 0 … 100 %RH
Accuracy at +23 °C (+73.4 °F) \(\pm 0.8 \%\)RH (0 … 90 %RH)
Factory calibration uncertainty \(\pm 0.5 \%\)RH (0 … 40 %RH) \(\pm 0.8 \%\)RH (40 … 95 %RH)
\(T_{30}\) response time 15 s
Sensor options HUMICAP® R2
HUMICAP® R2C 3)
HUMICAP® 180VC 3) 4)

Temperature
Sensor Pt100 RTD Class F0.1 IEC 60751
Measurement range −40 … +120 °C (−40 … +248 °F)
Accuracy \(\pm 0.1 \°\)C \(\pm 0.18 \°\)F\)
Factory calibration uncertainty \(\pm 0.1 \°\)C \(\pm 0.18 \°\)F at +23 °C (+73.4 °F)

1) Defined against calibration reference, including non-linearity, hysteresis, and repeatability.
2) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.
3) Chemical purge feature available with this sensor
4) \(\text{H}_2\text{O}_2\) resistant. With HUMICAP® 180VC sensor, accuracy is not specified below −20 °C (−4 °F) operating temperature.

HMP3 humidity measurement accuracy as a function of temperature

HMP3 temperature measurement accuracy over full range

Inputs and outputs
Operating voltage \(15 \ldots 30\ \text{VDC}\)
Current consumption 10 mA typical, 500 mA max.
Digital output RS-485, non-isolated
Protocols Modbus RTU

Operating environment
Operating temperature of probe head −40 ... +120 °C (−40 ... +248 °F)
Operating temperature of probe body −40 ... +60 °C (−40 ... +140 °F)
Storage temperature −40 ... +80 °C (−40 ... +176 °F)
Operating environment Suitable for outdoor use
Measurement environment For air, nitrogen, hydrogen, argon, helium, and oxygen
IP rating of probe body IP66
EMC compliance EN61326-1, industrial environment

1) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.

Mechanical specifications
Connector M12 5-pin A-coded male
Weight 302 g (10.65 oz)
Materials
Probe AISI316L
Probe body AISI316L
Cable jacket FEP

HMP3 probe dimensions

Accessories
Duct installation kit 210697
Solar radiation shield DTR502B DTR502B
USB PC connection cable \(\text{1)}\) 242659
1) Vaisala Insight software for Windows available at www.vaisala.com/insight

www.vaisala.com
Vaisala HUMICAP® Humidity and Temperature Probe HMP4 is designed for high-pressure applications such as compressed air systems in maritime, breathing air, and industrial applications, where measurement performance and chemical tolerance are essential.

Proven Vaisala HUMICAP® performance

Vaisala is the original innovator of the thin-film capacitive humidity measurement technology, which has now become the industry standard in humidity measurement. HUMICAP® technology results from Vaisala’s 40-year experience in industrial humidity measurement, providing the best stability, fast response time, and low hysteresis in a wide range of applications.

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.

Flexible connectivity

The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.

Vaisala Indigo product family

Indigo transmitters extend the capabilities of Indigo compatible measurement probes. The transmitters can display measurements on the spot as well as transmit them to automation systems through analog signals, digital outputs, and relays. Cable length between probe and transmitter can be extended to up to 30 meters. For more information, see www.vaisala.com/indigo.

Features

- RH accuracy up to ±0.8 %RH
- Temperature accuracy up to ±0.1 °C (±0.18 °F)
- Temperature measurement range −70 ... +180 °C (−94 ... +356 °F)
- Operating pressure 0 ... 10 MPa (0 ... 100 bar)
- Sensor purge provides superior chemical resistance
- Modbus RTU over RS-485
- Compatible with Indigo transmitters and Insight PC software
- Traceable calibration certificate: 6 points for humidity, 1 point for temperature
Technical Data

**Measurement performance**

**Relative humidity**
- Measurement range: 0 ... 100 %RH
- Accuracy at +23 °C (+73.4 °F): ±0.8 %RH (0 ... 90 %RH)
- Factory calibration uncertainty: ±0.5 %RH (0 ... 40 %RH), ±0.8 %RH (40 ... 95 %RH)
- T<sub>63</sub> response time: 15 s
- Sensor options: HUMICAP<sup>®</sup> R2, HUMICAP<sup>®</sup> R2C<sup>3)</sup>

**Temperature**
- Measurement range: −70 ... +180 °C (−94 ... +356 °F)
- Accuracy: ±0.1 °C (±0.18 °F)
- Factory calibration uncertainty: ±0.1 °C (±0.18 °F) at +23 °C (+73.4 °F)
- Sensor: Pt100 RTD Class F0.1 IEC 60751

1) Defined against calibration reference. Including non-linearity, hysteresis, and repeatability.
2) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.
3) Chemical purge feature available with this sensor.

**HMP4 humidity measurement accuracy as a function of temperature**

**HMP4 temperature measurement accuracy over full range**

**Inputs and outputs**

- Operating voltage: 15 ... 30 VDC
- Current consumption: 10 mA typical, 500 mA max.
- Digital output: RS-485, non-isolated
- Protocols: Modbus RTU

**Mechanical specifications**

- Connector: M12 5-pin A-coded male
- Fitting body: M22×1.5 or NPT1/2"
- Weight: 530 g (18.7 oz)
- Materials:
  - Probe: AISI316
  - Probe body: AISI316
  - Cable jacket: FEP

**Operating environment**

- Operating temperature of probe body: −40 ... +80 °C (−40 ... +176 °F)
- Operating temperature of probe head: −70 ... +180 °C (−94 ... +356 °F)
- Operational pressure: < 100 bar
- Operational environment: Suitable for outdoor use
- Measurement environment: For air, nitrogen, hydrogen, argon, helium, oxygen, and vacuum<sup>1)</sup>
- IP rating of probe body: IP66

1) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.

**HMP4 probe dimensions**

**Accessories**

- USB PC connection cable: 242659

Vaisala Insight software for Windows available at www.vaisala.com/insight
Vaisala HUMICAP® Humidity and Temperature Probe HMP5 is designed for high-temperature applications such as baking ovens, pasta dryers, and industrial drying kilns, where measurement performance and chemical tolerance are essential.
Technical Data

Measurement performance

Relative humidity
- Measurement range: 0 ... 100 %RH
- Accuracy at +23 °C (+73.4 °F) 1) ±0.8 %RH (0 ... 90 %RH)
- Factory calibration uncertainty 2) ±0.5 %RH (0 ... 40 %RH)
- ±0.8 %RH (40 ... 95 %RH)
- T63 response time: 15 s

Sensor options
- HUMICAP® R2
- HUMICAP® R2C 3)

Temperature
- Measurement range: −70 ... +180 °C (−94 ... +356 °F)
- Accuracy at +23 °C (+73.4 °F) 1) ±0.1 °C (±0.18 °F)
- Factory calibration uncertainty 2) ±0.1 °C (±0.18 °F) at +23 °C (+73.4 °F)

Sensor
- Pt100 RTD Class F0.1 IEC 60751

1) Defined against calibration reference. Including non-linearity, hysteresis, and repeatability.
2) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.
3) Chemical purge feature available with this sensor.

HMP5 humidity measurement accuracy as a function of temperature

HMP5 temperature measurement accuracy over full range

Operating environment

- Operating temperature of probe body: −40 ... +80 °C (−40 ... +176 °F)
- Operating temperature of probe head: −70 ... +180 °C (−94 ... +356 °F)
- Operating environment: Suitable for outdoor use
- IP rating of probe body: IP66
- EMC compliance: EN61326-1, Industrial environment

Inputs and outputs

- Operating voltage: 15 ... 30 VDC
- Current consumption: 10 mA typical, 500 mA max.
- Digital output: RS-485, non-isolated
- Protocols: Modbus RTU

Mechanical specifications

- Connector: M12 5-pin A-coded male
- Weight: 436 g (15.37 oz)

Materials
- Probe: AISI316L
- Probe body: AISI316L
- Cable jacket: FEP

HMP5 probe dimensions

Accessories

- Mounting flange: 210696
- USB PC connection cable 1): 242659

VAISALA

www.vaisala.com
Vaisala HUMICAP® Humidity and Temperature Probe HMP7 is designed for applications that involve constant high humidity or rapid changes in humidity, such as drying and test chambers, combustion air, and other humidifiers and meteorological measurements, where measurement performance and chemical tolerance are essential.

**Proven Vaisala HUMICAP® performance**

Vaisala is the original innovator of the thin-film capacitive humidity measurement technology, which has now become the industry standard in humidity measurement. HUMICAP® technology results from Vaisala’s 40-year experience in industrial humidity measurement, providing the best stability, fast response time, and low hysteresis in a wide range of applications.

**Avoiding condensation at extreme humidity**

Probe heating functionality heats up not only the sensor, but the whole probe head. When probe temperature is heated above dew point temperature, condensation on the probe can be avoided while measuring the dew point temperature of the process. By setting the temperature compensation value obtained, for example, with the TMP1 temperature probe, true relative humidity at process temperature can be measured while avoiding condensation by elevated probe temperature.

**Vaisala Indigo product family**

Indigo transmitters extend the capabilities of Indigo compatible measurement probes. The transmitters can display measurements on the spot as well as transmit them to automation systems through analog signals, digital outputs, and relays. Cable length between probe and transmitter can be extended to up to 30 meters. For more information, see www.vaisala.com/indigo.

**Flexible connectivity**

The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.
Technical Data

Measurement performance

Relative humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy at +23 °C (+73.4 °F)</td>
<td>±0.8 %RH (0 ... 90 %RH)</td>
</tr>
<tr>
<td>Factory calibration uncertainty</td>
<td>±0.5 %RH (0 ... 40 %RH)</td>
</tr>
<tr>
<td>T&lt;sub&gt;63&lt;/sub&gt; response time</td>
<td>15 s</td>
</tr>
</tbody>
</table>

Sensor options

- HUMICAP® R2
- HUMICAP® R2C (3)
- HUMICAP® 180VC (3)(4)

Temperature

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>−70 ... +180 °C (−94 ... +356 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy at +23 °C (+73.4 °F)</td>
<td>±0.1 °C (±0.18 °F)</td>
</tr>
<tr>
<td>Factory calibration uncertainty</td>
<td>±0.1 °C (±0.18 °F) at +23 °C (+73.4 °F)</td>
</tr>
</tbody>
</table>

Sensor

Pt100 RTD Class F0.1 IEC 60751

1) Defined against calibration reference, including non-linearity, hysteresis, and repeatability.
2) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.
3) Chemical purge feature available with this sensor.
4) H<sub>2</sub>O<sub>2</sub> resistant. With HUMICAP® 180VC sensor, accuracy is not specified below −20 °C (−4 °F) operating temperature.

Operating environment

- Operating temperature of probe body | −40 ... +80 °C (−40 ... +176 °F) |
- Operating temperature of probe head | −70 ... +180 °C (−94 ... +356 °F) |
- Operational pressure | < 10 bar |
- Operating environment | Suitable for outdoor use |
- Measurement environment | For air, nitrogen, hydrogen, argon, helium, oxygen, and vacuum |
- IP rating of probe body | IP66 |
- EMC compatibility | EN61326-1, industrial environment |

Inputs and outputs

- Operating voltage | 18 ... 30 VDC |
- Current consumption | 10 mA typical, 500 mA max. |
- Digital output | RS-485, non-isolated |
- Protocols | Modbus RTU |

HMP7 humidity measurement accuracy as function of temperature

HMP7 temperature measurement accuracy over full range

Mechanical specifications

- Connector | M12 5-pin A-coded male |
- Weight | 310 g (10.9 oz) |
- Materials
  - Probe | AISI316L |
  - Probe body | AISI316L |
  - Cable jacket | FEP |

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Vaisala HUMICAP® Humidity and Temperature Probe HMP8 is designed for pressurized applications in compressed air systems, refrigerant dryers, and other pressurized industrial applications, where easy insertion and removal of the probe and adjustable installation depth into the pipeline are needed.

**Proven Vaisala HUMICAP® performance**
Vaisala is the original innovator of the thin-film capacitive humidity measurement technology, which has now become the industry standard in humidity measurement.

HUMICAP® technology results from Vaisala’s 40-year experience in industrial humidity measurement, providing the best stability, fast response time, and low hysteresis in a wide range of applications.

**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.

**Flexible connectivity**
The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.

**Vaisala Indigo product family**
Indigo transmitters extend the capabilities of Indigo compatible measurement probes. The transmitters can display measurements on the spot as well as transmit them to automation systems through analog signals, digital outputs, and relays. Cable length between probe and transmitter can be extended to up to 30 meters. For more information, see www.vaisala.com/indigo.
Technical Data

Measurement performance

Relative humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy at +23 °C (+73.4 °F) 1)</th>
<th>Factory calibration uncertainty 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 … 100 %RH</td>
<td>±0.8 %RH (0 … 90 %RH)</td>
<td>±0.5 %RH (0 … 40 %RH)</td>
</tr>
<tr>
<td></td>
<td>±0.8 %RH (40 … 95 %RH)</td>
<td></td>
</tr>
</tbody>
</table>

T_{63} response time 15 s

Sensor options HUMICAP® R2, HUMICAP® R2C 3).

Temperature

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy at +23 °C (+73.4 °F) 1)</th>
<th>Factory calibration uncertainty 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>−70 … +180 °C</td>
<td>±0.1 °C (±0.18 °F)</td>
<td>±0.1 °C (±0.18 °F)</td>
</tr>
</tbody>
</table>

Factory calibration uncertainty 2) ±0.5 °C (0 … 40 °C) ±0.1 °C (40 … 95 °C)

Sensor Pt100 RTD Class F0.1 IEC 60751

1) Defined against calibration reference. Including non-linearity, hysteresis, and repeatability.
2) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.
3) Chemical purge feature available with this sensor.

HMP8 humidity measurement accuracy as a function of temperature

HMP8 temperature measurement accuracy over full range

Input and outputs

Operating voltage 15 … 30 VDC
Current consumption 10 mA typical, 500 mA max.
Digital output RS-485, non-isolated
Protocols Modbus RTU

Mechanical specifications

Connector M12 5-pin A-coded male
Probe fitting ISO1/2" and NPT1/2" fittings included
Weight 512 g (18.1 oz)
Materials Probe AISI316L
Probe body AISI316L
Cable jacket FEP

HMP8 probe dimensions

Accessories

Ball valve 1/2" with ISO 1/2" welding joint BALLVALVE-1
USB PC connection cable 1) 242659

1) Vaisala Insight software for Windows available at www.vaisala.com/insight

www.vaisala.com
Vaisala HUMICAP® Humidity and Temperature Probe HMP9 is designed for easy installation into rapidly changing environments where fast response time, measurement performance, and chemical tolerance are essential.

**Miniature probe head with HUMICAP® performance**

The main feature of HMP9 is its 5 mm (0.2 in) diameter miniature probe head. Despite the small footprint, the probe head contains a HUMICAP® sensor that provides its industry standard humidity measurement performance. HMP9 has great stability, fast response time, and low hysteresis in a wide range of applications. This makes it the superior choice in applications where the mechanical properties or replaceable filters of the heavier probes are not needed.

**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.

**Flexible connectivity**

The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.
Measurement performance

Relative humidity

- **Measurement range**: 0 … 100 %RH
- **Accuracy at +23 °C (+73.4 °F)**: ±0.8 %RH (0 … 90 %RH)
- **Factory calibration uncertainty**: ±0.7 %RH (0 … 40 %RH), ±1 %RH (40 … 95 %RH)
- **T63 response time**: 15 s
- **Sensor**: HUMICAP®

Temperature

- **Measurement range**: −40 … +120 °C (−40 … +248 °F)
- **Accuracy at +23 °C (+73.4 °F)**: ±0.1 °C (±0.18 °F)
- **Factory calibration uncertainty**: ±0.1 °C (±0.18 °F) at +23 °C (+73.4 °F)
- **T63 response time**: 70 s

*1) Defined against calibration reference, including non-linearity, hysteresis, and repeatability.
*2) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.
*3) In still air

HMP9 humidity measurement accuracy as a function of temperature

HMP9 temperature measurement accuracy over full range

Inputs and outputs

- **Operating voltage**: 15 ... 30 VDC
- **Current consumption**: 5 mA typical, 400 mA max.
- **Digital output**: RS-485, non-isolated
- **Default serial settings**: 19200 bps N 8 2
- **Protocol**: Modbus RTU

Mechanical specifications

- **Connector**: M12 5-pin A-coded male
- **Weight**: 68 g (2.40 oz)
- **Materials**:
  - Probe: AISI316
  - Probe body: PBT
  - Cable overmolds: FEP

HMP9 probe dimensions

Operating environment

- **Operating temperature of probe body**: −40 ... +60 °C (−40 ... +140 °F)
- **Operating temperature of probe head**: −40 ... +120 °C (−40 ... +248 °F)
- **Storage temperature**: −40 ... +60 °C (−40 ... +140 °F)
- **Operating environment**: Suitable for outdoor use when protected from rain
- **Measurement environment**: For air, nitrogen, hydrogen, argon, helium, and oxygen

- **IP rating**: IP65 for probe body
- **EMC compliance**: EN 61326-1, industrial electromagnetic environment

*1) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.
Vaisala Temperature Probe TMP1 is designed for demanding temperature measurements in industrial applications such as pharmaceutical industry and calibration laboratories, where accuracy and robustness are essential.

**Flexible connectivity**
The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.

**Vaisala Indigo product family**
Indigo transmitters extend the capabilities of Indigo compatible measurement probes. The transmitters can display measurements on the spot as well as transmit them to automation systems through analog signals, digital outputs, and relays. Cable length between probe and transmitter can be extended to up to 30 meters. For more information, see www.vaisala.com/indigo.

**Relative humidity measurements in high humidities**
When the TMP1 probe is connected to a control system in parallel with HMP7 Relative Humidity and Temperature Probe, it is possible to have relative humidity measurement in actual process temperature while using probe heating in the relative humidity probe. Probe heating helps to avoid condensation in situations where the dew point temperature of the process is close to the ambient temperature. When the humidity probe is heated above dew point temperature, condensation can be avoided and the relative humidity in the actual process temperature can be back-calculated based on the true process temperature measurement received from TMP1.

### Features
- Temperature accuracy up to ±0.1 °C (±0.18 °F)
- Temperature measurement range −70 ... +180 °C (−94 ... +356 °F)
- Modbus RTU over RS-485
- Compatible with Indigo transmitters and Insight PC software
- Traceable 2-point calibration certificate with calibration points at +20 and +70 °C (+68 and +158 °F)
## Technical data

### Measurement performance

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>−70 ... +180 °C (−94 ... +356 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy at +23 °C (+73.4 °F) 1)</td>
<td>±0.1 °C (±0.18 °F)</td>
</tr>
<tr>
<td>Factory calibration uncertainty 2)</td>
<td>±0.1 °C (±0.18 °F) at +23 °C (+73.4 °F)</td>
</tr>
</tbody>
</table>

---

1) Defined against calibration reference. Including non-linearity, hysteresis, and repeatability.
2) Defined as ±2 standard deviation limits. Small variations possible; see calibration certificate.

### Operating environment

- Operating temperature of probe body: −40 ... +80 °C (−40 ... +176 °F)
- Operating temperature of probe head: −70 ... +180 °C (−94 ... +356 °F)
- Operating environment: Suitable for outdoor use
- EMC compatibility: EN61326-1, industrial environment

### Inputs and outputs

- Operating voltage: 15 ... 30 VDC
- Current consumption: 10 mA typical
- Digital output: RS-485, non-isolated
- Protocols: Modbus RTU
- Output parameters:
  - Temperature (°C)
  - Water vapor saturation pressure (hPa)

### Mechanical specifications

- Connector: M12 5-pin A-coded male
- Weight: 224 g (7.9 oz)
- **Materials**
  - Probe: AISI316L
  - Probe body: AISI316L
  - Cable jacket: FEP

### Accessories

- Duct installation kit for T probe: 215003
- Swagelok® for 6 mm probe 1/8" ISO thread: SWG6ISO18
- Swagelok® for 6 mm probe 1/8" NPT thread: SWG6NPT18
- USB PC connection cable 1): 242659

1) Vaisala Insight software for Windows available at www.vaisala.com/insight
Vaisala HMT330 Series HUMICAP® Humidity and Temperature Transmitters are 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 and is pre-configured for each delivery.

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.

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

With multiple options to choose from, including local display, the HMT330 series can be tailored to meet the specific needs of each individual application and is pre-configured for each delivery. Also the HUMICAP® sensor itself can be selected according to specific measurement application needs.

Features
• 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
• Corrosion-resistant IP65/IP66 housing
• Excellent performance in harsh conditions; good chemical tolerance
• Traceable calibration for measurement and analog outputs (certificates included)
• 10-year warranty when annually calibrated at the Vaisala Service Center

Connectivity
• RS-232/485/422 LAN
• Modbus® protocol support (RTU/TCP)
• Optional graphical display and keypad for convenient operation
• Multilingual user interface
• Compatible with Vaisala viewLinc software
HMT330 Series Humidity and Temperature Transmitters

Graphical display of measurement data and trends for convenient operation

The HMT330 series features an optional numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history of up to 4 years.

The display shows measurement trends and over four years of real-time measurement history. 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 up to four relay outputs are also available.

For serial interface, the USB service cable, RS-232, and RS-485/422 can be used.

HMT330 is also capable of applying the Modbus communication protocol and, together with an appropriate connection option, provides either Modbus RTU (RS-485) 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 LAN interface, which enables an Ethernet connection. A USB service cable makes it easy to connect the HMT330 to a PC via the service port.

Flexible calibration

HMT330 instruments are calibrated at five 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 handheld 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 ISO/IEC 17025 calibrations and special calibrations are available.

Handheld Humidity and Temperature Meter HM70 is ideal for field checking HMT330 transmitters.

Chemical purge minimizes effects of contaminant

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.

<table>
<thead>
<tr>
<th>HMT331</th>
<th>HMT333</th>
<th>HMT334</th>
<th>HMT335</th>
<th>HMT337</th>
<th>HMT338</th>
</tr>
</thead>
<tbody>
<tr>
<td>For</td>
<td>Measurement within rooms</td>
<td>General purposes</td>
<td>High pressure and vacuum applications</td>
<td>High temperatures</td>
<td>High humidity applications</td>
</tr>
<tr>
<td>Temperature measurement range</td>
<td>−40 ... +60 °C (&lt;−40 ... +140 °F)</td>
<td>−40 ... +80 °C (&lt;−40 ... +176 °F) or −40 ... +120 °C (&lt;−40 ... +248 °F)</td>
<td>−70 ... +180 °C (&lt;−94 ... +356 °F)</td>
<td>−70 ... +180 °C (&lt;−94 ... +356 °F) or −70 ... +120 °C (&lt;−94 ... +248 °F)</td>
<td>−70 ... +180 °C (&lt;−94 ... +356 °F)</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>0 ... 10 MPa (0 ... 100 bar)</td>
<td>0 ... 1 MPa (0 ... 10 bar)</td>
<td>0 ... 4 MPa (0 ... 40 bar)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HMT330 Series Technical Data

**Measurement performance**

<table>
<thead>
<tr>
<th>Relative humidity</th>
<th>Measurement range</th>
<th>Accuracy 1) 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 ... 100 %RH</td>
<td>±1 %RH (0 ... 90 %)</td>
</tr>
<tr>
<td></td>
<td>±1.7 %RH (90 ... 100 %RH)</td>
<td></td>
</tr>
<tr>
<td>at +15 ... +25 °C</td>
<td>±1.0 ... +0.008% x reading %RH</td>
<td></td>
</tr>
<tr>
<td>at −20 ... +40 °C</td>
<td>±(1.5 ... 0.015% x reading) %RH</td>
<td></td>
</tr>
<tr>
<td>at −40 ... +180 °C</td>
<td>±0.6 %RH (0 ... 40 %RH)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>±1.0 %RH (40 ... 97 %RH)</td>
<td></td>
</tr>
<tr>
<td>Factory calibration uncertainty 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(+20 °C)</td>
<td>±0.6 %RH (0 ... 40 %RH)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>±1.0 %RH (40 ... 97 %RH)</td>
<td></td>
</tr>
</tbody>
</table>

Humidity sensor types:
- HUMICAP 180
- HUMICAP 180C
- HUMICAP 180R
- HUMICAP 180RC
- HUMICAP 180VC

**Response time** (90 %) with HUMICAP 180 or 180C sensor at +20 °C (+68 °F) in still air:
- with grid filter: 8 s
- with grid + steel netting filter: 20 s
- with sintered filter: 40 s

**Response time** (90 %) with HUMICAP 180R, 180RC, or 180VC sensor at +20 °C (+68 °F) in 0.1 m/s air flow:
- with grid filter: 17 s
- with grid + steel netting filter: 50 s
- with sintered filter: 60 s

**Temperature**

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

Accuracy over temperature range (measurement range depends on model)

| Temperature sensor | P100 RTD Class F0.1 IEC / EN / BS EN 60751 |

Other available variables (model-dependent)
- Dew point temperature
- Mixing ratio
- Absolute humidity
- Wet bulb temperature
- Enthalpy
- Water vapor pressure

1) Including non-linearity, hysteresis, and repeatability.
2) With HUMICAP 180VC sensor, accuracy is not specified below −20 °C (−4 °F) operating temperature.
3) Defined as ±2 standard deviation limits. Small variations possible; see also calibration certificate.

**Compliance**

- **EMC compatibility**: IEC / EN / BS EN 61326-1, industrial environment
- **Note**: Transmitter with display test impedance of 40 Ω is used in IEC / EN / BS EN 61000-4-5 (surge immunity)

- **Compliance marks**: CE, RCM, WEEE

**Mechanical specifications**

- **Cable bushing**: M20 × 1.5 for cable diameter 8 ... 11 mm (0.31 ... 0.43 in)
- **Conduit fitting**: 1/2" NPT
- **User cable connector (optional)**:
  - **Option 1**: M12 8-pin male
  - **Option 2**: Female plug with screw terminals
- **Housing material**: G-AlSi 10 Mg (DIN1725)
- **IP rating**: IP66
- **Temperature sensor**: P100 RTD Class F0.1 IEC / EN / BS EN 60751

**Operating temperature**

- **Probe with cable**: Same as measurement range
- **Transmitter body, no display**: −40 ... +60 °C (−40 ... 140 °F)
- **Transmitter body with display**: 0 ... +60 °C (32 ... 140 °F)
- **Storage temperature**: −55 ... +80 °C (−67 ... 176 °F)

**Dimensions in mm (inches)**

- 183 (7.20)
- 119 (4.69)
- 77 (3.0)
**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 (Uin 24 VDC)**

<table>
<thead>
<tr>
<th>RS-232</th>
<th>Max. 25 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uin, 2 × 0 … 5 V / 0 … 10 V</td>
<td>Max. 25 mA</td>
</tr>
<tr>
<td>Iout, 2 × 0 … 20 mA</td>
<td>Max. 60 mA</td>
</tr>
<tr>
<td>Display and backlight</td>
<td>+ 20 mA</td>
</tr>
<tr>
<td>During chemical purge</td>
<td>Max. 110 mA</td>
</tr>
<tr>
<td>During probe heating (HMT337)</td>
<td>+ 120 mA</td>
</tr>
</tbody>
</table>

**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: Ri < 500 Ω
- 0 … 1 V output: Ri > 2 kΩ
- 0 … 5 V and 0 … 10 V outputs: Ri > 10 kΩ

**Max. wire size**

0.5 mm² (AWG 20)

**Digital outputs**

- RS-232, RS-485 (optional)
- Protocols: ASCII commands, Modbus RTU

**Service connection**

- RS-232, 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

**Optional data logger with real-time clock**

- Logged parameters: Max. four with trend/min./max. values
- Logging interval: 10 seconds (fixed)
- Max. logging period with max. temporal resolution: 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

**Mounting options**

- Mounting with Wall Mounting Kit (not mandatory for wall installations)
- Mounting with DIN Rail Installation Kit
- Pole Installation with Installation Kit for Pole or Pipeline
- Mounting Rain Shield with Installation Kit

Vaisala Meteorological Installation Kit HMT330MIK enables HMT337 to be installed outdoors to obtain reliable measurements for meteorological purposes.
HMT331 for wall mounting

Typical applications
- Cleanrooms
- Pharmaceutical processes
- Indoor swimming pools
- Data centers
- Archives

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

Technical data
Temperature measurement range: −40 ... +60 °C (−40 ... +140 °F)

Dimensions in mm (inches)

Accessories
- USB service port cable with PC software 219685
- 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

HMT331 with short cable probe
HMT333 with short probe for confined spaces and ducts

Typical applications
- Cleanrooms
- Industrial HVAC systems
- Environmental chambers
- Processes with moderate temperature and humidity

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 219685
- 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

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.

HMT333 has two probe cable options – a flexible rubber cable that withstands temperatures of up to +80 °C (+176 °F), and a durable FEP cable that withstands temperatures of up to +120 °C (+248 °F). Both cable options are available in lengths of 2, 5, and 10 meters (6.6, 16, and 33 ft). Additionally, flexible rubber cable (+80 °C (+176 °F)) is available in 20-meter (66 ft) 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.

Duct installation kit for HMT333. The flange allows easy adjustment of probe installation depth.
HMT334 with threaded connection for high pressure, vacuum, and/or high temperatures

**Typical applications**
- Test chambers
- High-pressure and vacuum processes

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.

**Technical data**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature measurement range</td>
<td>−70 ... +180 °C (−94 ... +356 °F)</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>0 ... 10 MPa (0 ... 100 bar)</td>
</tr>
</tbody>
</table>

**Accessories**

- Fitting body NPT 1/2" 17225SP
- USB service port cable with PC software 219685
- 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
- Fitting body ISO M22 x 1.5 17223SP

**Dimensions in mm (inches)**
HMT335 with long probe for high temperatures

Typical applications
• Hot drying processes
• Food processes, for example baking ovens

Robust probe ideal for high flow rates
Vaisala HUMICAP® Humidity and Temperature Transmitter HMT335 has a long stainless steel probe designed for high temperatures.

With high tolerance for mechanical stress and high flow rates, HMT335 is ideal for duct measurements. The stainless steel installation flange allows easy adjustment of the probe’s installation depth. Long, robust probe allows easy installation through insulation in ovens and similar applications.

Technical data
Temperature measurement range: −70 ... +180 °C (−94 ... +356 °F)

Dimensions in mm (inches)

Accessories
<table>
<thead>
<tr>
<th>Mounting flange</th>
<th>210696</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB service port cable with PC software</td>
<td>219685</td>
</tr>
<tr>
<td>Connection cable for HMT70</td>
<td>211339</td>
</tr>
<tr>
<td>Wall-mounting plate (plastic)</td>
<td>214829</td>
</tr>
<tr>
<td>Pole installation kit with rain shield</td>
<td>215109</td>
</tr>
<tr>
<td>DIN rail installation set</td>
<td>215094</td>
</tr>
<tr>
<td>PPS plastic grid filter with stainless steel net</td>
<td>DRW010281SP</td>
</tr>
<tr>
<td>PPS plastic grid filter</td>
<td>DRW010276SP</td>
</tr>
<tr>
<td>Stainless steel sintered filter</td>
<td>HM47280SP</td>
</tr>
<tr>
<td>Stainless steel grid filter</td>
<td>HM47453SP</td>
</tr>
</tbody>
</table>

Installation flange dimensions in mm (inches)
HMT337 with short probe for high humidity and/or temperature

Typical applications
- Professional meteorology
- Intake air monitoring of engines and gas turbines
- Timber drying kilns

HMT337 configurations
Vaisala HUMICAP® Humidity and Temperature Transmitter HMT337 is ideal for the most demanding process and meteorological measurements in high-humidity condensing environments.

HMT337 is delivered in one of three configurations:
1. Basic HMT337, with a non-warmed probe for applications where humidity levels are not constantly near condensation
2. HMT337 with a warmed probe, for dew point temperature measurement under constant near-condensing conditions
3. HMT337 with a warmed probe and an additional temperature sensor, for relative humidity measurement under constant near-condensing conditions

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

If the relative humidity value is needed, an optional temperature sensor is used (configuration option 3). The measured ambient temperature provides the compensation for calculating relative humidity and other temperature-dependent humidity parameters.

Installation options
A pressure and vapor tight installation up to 10 bars through a process wall can be achieved by sealing with Swagelok® fittings from the probe, or sealing from the cable with a gland. The optional HMT330MIK Installation Kit is available for outdoor installations; duct installation kits are also available.

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

Accessories
- Cable gland for probe cable: 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): DTR502B
- Meteorological installation kit: HMT330MIK
- USB service port cable with PC software: 219685
- Connection cable for HMT70: 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: DRW0028BISP
- PPS plastic grid filter: DRW0027BISP
- Stainless steel sintered filter: HM47280SP
- Stainless steel grid filter: HM47453SP

For more installation accessories, check the order form.

1) For an image of the duct installation kit, see HMT333 page.
HMT338 with adjustable insertion depth for high pressure, vacuum, and/or high temperatures

**Typical applications**
- Process lines
- Environmental chambers
- Vacuum-drying processes
- Compressed air lines with refrigerant dryers

Vaisala HUMICAP® Humidity and Temperature Transmitter

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

**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 hold the probe in place temporarily.

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.

**Technical data**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature measurement range</td>
<td>−70 ... +180 °C (−94 ... +356 °F)</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>0 ... 4MPa (0 ... 40 bar)</td>
</tr>
</tbody>
</table>

**Accessories**

<table>
<thead>
<tr>
<th>Item</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball-valve set</td>
<td>BALLVALVE-1</td>
</tr>
<tr>
<td>Pressure fitting ISO 1/2 to NPT 1/2</td>
<td>210662</td>
</tr>
<tr>
<td>USB service port cable with PC software</td>
<td>29685</td>
</tr>
<tr>
<td>Connection cable for HM70</td>
<td>211339</td>
</tr>
<tr>
<td>Wall-mounting plate (plastic)</td>
<td>214829</td>
</tr>
<tr>
<td>Pole installation kit with rain shield</td>
<td>21509</td>
</tr>
<tr>
<td>DIN rail installation set</td>
<td>215094</td>
</tr>
</tbody>
</table>
| 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 in mm (inches)

www.vaisala.com
HMT360 Series Intrinsically Safe Humidity and Temperature Transmitters
For operation in up to zone 0/20

Features
- Measures humidity and temperature, outputs also dew point, mixing ratio, absolute humidity and wet bulb temperature
- Intrinsically safe
- Vaisala HUMICAP® Sensor features high accuracy, excellent long-term stability, and negligible hysteresis
- Six probe options
- Traceable calibration (certificate included)

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, such as zone 0. The HMT360 transmitters’ proven performance and technology conform with rigorous international standards.

Operating Conditions
- 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)
- Designed for harsh conditions
- Temperature range between -70 ... +180 °C (-94 ... +356 °F) depending on the probe option

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 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
HMT360 offers six probe options for various applications:
- HMT361 - wall mount
- HMT363 - confined spaces
- HMT364 - pressurized spaces
- HMT365 - high temperature
- HMT367 - high humidity
- HMT368 - 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

**HMT361 for Wall Mounting**
- Temperature range: -40 … +60 °C (-40 … +140 °F)
- Probe diameter: 12 mm (0.47 in)

The HMT361 probe in this picture has a stainless steel netting filter.

**HMT363 for Confined Spaces**
- Temperature range with teflon cable: -40 … +120 °C (-40 … +248 °F)
- Temperature range with rubber cable: -40 … +80 °C (-40 … +176 °F)
- Probe cable length: 2, 5 or 10 meters (6 ft 7 in, 16 ft 5 in, 32 ft 10 in)
- Probe diameter: 12 mm (0.47 in)

**Installation**
- Duct installation kit: 210697
- Cable gland M20x1.5 with splitting seal: HMP247CG
- Swagelok for 12mm probe, 1/2" NPT thread: SWG12NPT12

The HMT363 probe is small and fits into tight spaces. This one is connected with a teflon cable.

Dimensions in mm (inches)

Left: Installation kit for duct mounting. Right: Installation flange. Aluminum or stainless steel.
HMT364 for High Pressure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature range</td>
<td>-70 … +180 °C (-94 … +356 °F)</td>
</tr>
<tr>
<td>Pressure range</td>
<td>0 … 10 MPa</td>
</tr>
<tr>
<td>Probe cable length</td>
<td>2, 5 or 10 meters (6 ft 7 in, 16 ft 5 in, 32 ft 10 in)</td>
</tr>
<tr>
<td>Probe diameter</td>
<td>12 mm (0.47 in)</td>
</tr>
<tr>
<td>Fitting body M22x1.5</td>
<td>17223</td>
</tr>
<tr>
<td>Fitting body NPT/2</td>
<td>17225</td>
</tr>
</tbody>
</table>

The HMT364 probe is designed for measurement in pressurized spaces or vacuum chambers.

HMT365 for High Temperature

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature range</td>
<td>-70 … +180 °C (-94 … +356 °F)</td>
</tr>
<tr>
<td>Probe cable length</td>
<td>2, 5 or 10 meters (6 ft 7 in, 16 ft 5 in, 32 ft 10 in)</td>
</tr>
<tr>
<td>Probe diameter</td>
<td>13.5 mm (0.53 in)</td>
</tr>
<tr>
<td>Installation</td>
<td></td>
</tr>
<tr>
<td>Mounting flange</td>
<td>210696</td>
</tr>
<tr>
<td>Cable gland M20x1.5</td>
<td>with splitting seal HMP247CG</td>
</tr>
</tbody>
</table>

The HMT365 probe is designed for high temperature environments.
**HMT367 for High Humidities**

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

Probe cable length  
2, 5 or 10 meters (6 ft 7 in, 16 ft 5 in, 32 ft 10 in)

Probe diameter  
12 mm (0.47 in)

**Installation**

Duct installation kit  
210697

Cable gland M20x1.5 with splitting seal  
HMP247CG

Swagelok for 12 mm probe, 3/8" ISO thread  
SWG12ISO38

Swagelok for 12 mm probe, 1/2" NPT thread  
SWG12NPT12

The HMT367 probe is constructed to be installed in environments with high humidities.

**HMT368 for Pressurized Pipelines**

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

Pressure range  
0 ... 4 MPa

Probe cable length  
2, 5 or 10 meters (6 ft 7 in, 16 ft 5 in, 32 ft 10 in)

Probe diameter  
13.5 mm/12 mm (0.53 in/0.47 in)

Available probe lengths  
226 mm/448 mm (8.90 in/17.6 in)

**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

The HMT368 probe enables flexible installation in pressurized pipelines.
# HMT360 Series Technical Data

## Measurement 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)**: ±1.0 %RH (0 ... 90 %RH), ±1.7 %RH (90 ... 100 %RH)
  - **At -20 ... +40 °C (-4 ... +104 °F)**:
    - **Factory calibration uncertainty** (+20 °C):
      - ±0.6 %RH (0 ... 40 %RH), ±1.0 %RH (40 ... 97 %RH)
  - **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)
- **Typical accuracy of electronics at +20 °C**: ±0.2 °C (0.36 °F)
- **Typical temperature dependence of electronics**:
  - **Sensor**: Pt1000 RTD Class F0.1 IEC 60751
  - **Typical accuracy of analog outputs at +20 °C**: ±0.05 % full scale
  - **Typical temperature dependence of analog outputs**: 0.005 %/°C (0.005 %/°F) full scale

## Operating Environment
- **Operating temperature for electronics**: -40 ... +60 °C (-40 ... +140 °F)
- **Operating temperature with display**: -20 ... +60 °C (-4 ... +140 °F)
- **Storage temperature**: -40 ... +70 °C (-40 ... +158 °F)
- **Pressure range**: See probe specifications

## Inputs and Outputs
- **Operating voltage**:
  - With serial port (service mode): 12 ... 28 V
  - 15 ... 28 V
- **Analog outputs**: Two-wire 4 ... 20 mA, one standard, one optional
  - Connection via safety barriers
- **RS-232C serial output for service use** (requires cable accessory 25905ZZ)
  - Connector type RJ45
- **Display**: Two-line LCD

## Mechanical Specifications
- **Connections**: Screw terminals, 0.33 ... 2.0 mm² wires (AWG 14-22)
- **Cable bushings**: For 7.5 ... 12 mm or 10 ... 15 mm cable diameters (M20)
- **Conduit fitting**: NPT 1/2"
- **Housing material**: G-AlSi10Mg (DIN 1725)
- **Housing weight**: 950 g (2.1 lb)

## Compliance
- **IP rating**: IP66 (NEMA4X)
Accessory Availability

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Part number</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball valve ISO 1/2 with welding joint</td>
<td>BALLVALVE-1</td>
<td>HMT368</td>
</tr>
<tr>
<td>• Pressure range at +20 °C (+68 °F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 … 20 bar (0 … 290 psia) during</td>
<td></td>
<td></td>
</tr>
<tr>
<td>installation max. 10 bar (145 psia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cable gland M20 x 1.5 with splitting</td>
<td>HMP247CG</td>
<td>HMT363, HMT365,</td>
</tr>
<tr>
<td>seal</td>
<td></td>
<td>HMT367</td>
</tr>
<tr>
<td>Duct installation kit</td>
<td>210697</td>
<td>HMT363, HMT367</td>
</tr>
<tr>
<td>Fitting body ISO1/2 solid structure</td>
<td>DRW212076SP</td>
<td>HMT368</td>
</tr>
<tr>
<td>Fitting body M22 x 1.5</td>
<td>17223</td>
<td>HMT364</td>
</tr>
<tr>
<td>Fitting body NPTI/2</td>
<td>17225</td>
<td>HMT364</td>
</tr>
<tr>
<td>Fitting body NPTI/2 solid structure</td>
<td>NPTFITBODASP</td>
<td>HMT368</td>
</tr>
<tr>
<td>Mounting flange</td>
<td>210696</td>
<td>HMT365</td>
</tr>
<tr>
<td>Swagelok for 12mm probe, 1/2&quot; NPT</td>
<td>SWG12NPT12</td>
<td>HMT363, HMT367</td>
</tr>
<tr>
<td>thread</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swagelok for 12mm probe, 3/8&quot; ISO</td>
<td>SWG12ISO38</td>
<td>HMT363, HMT367</td>
</tr>
<tr>
<td>Galvanic isolator</td>
<td>212483</td>
<td>All models</td>
</tr>
<tr>
<td>Zener barrier</td>
<td>210664</td>
<td>All models</td>
</tr>
<tr>
<td>Calibration adapter for HMK15</td>
<td>211302</td>
<td>HMT361, HMT363,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HMT364, HMT363,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial interface cable for PC connectors RJ45 - D9 female</td>
<td>25905ZZ</td>
<td>All models</td>
</tr>
<tr>
<td>Protection cover (for use in the presence of combustible dust, ATEX)</td>
<td>214101</td>
<td>All models</td>
</tr>
</tbody>
</table>

Dimensions in mm (inches)

Classification with Current Outputs

**Europe / VTT**

- **EU (94/9/EC, ATEX100a)**
  - Ex ia IIC T4 Ga
  - Certificate No. VTT 09 ATEX 028 X
- **Safety factors**
  - \( U_i = 28 \, V \), \( I_i = 100 \, mA \), \( P_i = 700 \, mW \)
  - \( C_i = 1 \, nF \), \( L_i \) negligibly low
- **Environmental specifications**
  - \( T_{amb} = -40 \ldots +60 \, ^\circ C \) \((-40 \ldots +140 \, ^\circ F)\)
  - \( P_{amb} = 0.8 \ldots 11 \) bar
- **Dust classification (with protection cover 110101)**
  - Ex II D (IP65 T=+80 °C (+176 °F))
  - VTT 04 ATEX 02X

**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**
  - \( U_{max} = 28 \, VDC \), \( I_{max} = 100 \, mA \), \( C_i = 1 \, nF \), \( P_i = 0.7 \, W \), \( T_{amb} = +60 \, ^\circ C \) \((+140 \, ^\circ F)\)

**Japan (TIISS)**

- Ex ia IIC T4
- Code number: TC20238

- **Safety factors**
  - \( U_i = 28 \, VDC \), \( I_i = 100 \, mA \), \( C_i = 1 \, nF \), \( P_i = 0.7 \, W \), \( T_{amb} = +60 \, ^\circ C \) \((+140 \, ^\circ F)\)

**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**
  - \( T_{amb} = +60 \, ^\circ C \) \((+140 \, ^\circ F)\)

- **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
  - Certificate No. IECEx VTT 09.0002X

- **Safety factors**
  - \( U_i = 28 \, V \), \( I_i = 100 \, mA \), \( P_i = 700 \, mW \)
  - \( C_i = 1 \, nF \), \( L_i \) negligibly low

- **Environmental specifications**
  - \( T_{amb} = -40 \ldots +60 \, ^\circ C \) \((-40 \ldots +140 \, ^\circ F)\)
  - \( P_{amb} = 0.8 \ldots 11 \) bar
  - Dust classification (with protection cover 110101)
  - Ex Ta IIIC T500 80 °C Da
  - IECEx VTT 12.0016X

**EAC (Russia, Kazakhstan, Belarus) (T RCU)**

- OEx ia IIC T4 Ga X
- Certificate No. RU C-FI.MU06.B.00068

- **Environmental specifications**
  - \( T_{amb} = -40 \ldots +60 \, ^\circ C \) \((-40 \ldots +140 \, ^\circ F)\)
  - \( P_{amb} = 0.8 \ldots 11 \) bar

**Korea (KOSHA)**

- Ex ia IIC T4
- Certificate No. 17-AV4BO-0419X

- **Safety factors**
  - \( U_i = 28 \, V \), \( I_i = 100 \, mA \), \( P_i = 700 \, mW \)
  - \( C_i = 1 \, nF \), \( L_i \) negligibly low

- **Environmental specifications**
  - \( T_{amb} = -40 \ldots +60 \, ^\circ C \) \((-40 \ldots +140 \, ^\circ F)\)
  - \( P_{amb} = 0.8 \ldots 11 \) bar
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. HMT310 has various options for different environments and measurements.

### Several Outputs, One Connector
HMT310 is powered up with 10 ... 35 VDC. It has two analog outputs and an RS-232 serial output in one M12 8-pin connector. 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.

### A Variety of Features to Choose From
The following optional features and accessories are available for the HMT310 series:
- Warmed probe and sensor heating for high humidity conditions
- Chemical purge for applications risking an interference with chemicals in the measuring environment
- Calculated humidity quantities
- Sensor protection options and probe cable lengths
- Mounting kits
- Rain shield

### Six Models for Demanding Applications
The HMT310 series includes:
- HMT311 for wall mounting
- HMT313 for duct mounting and tight spaces
- HMT314 for high pressures up to 100 bar and vacuum conditions
- HMT315 for high temperatures
- HMT317 for high humidity applications, warmed probe option
- HMT318 for pressurized pipelines up to 40 bar
### Technical Data

#### Measurement Performance

**Relative Humidity**
- **Measurement range**: 0 … 100 %RH
- **Response time** (90 %) at +20 °C (+68 °F) in 0.1 m/s air flow:
  - 17 s with grid filter
  - 50 s with grid and steel, netting filter
  - 60 s with sintered filter

**Factory calibration uncertainty** (+20 °C):
- ±0.6 %RH (0 … 40 %RH)
- ±1.0 %RH (40 … 97 %RH)

**Accuracy**
- 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

**Humidity Sensor Types**
- **HUMICAP® 180R** Typical applications
- **HUMICAP® 180RC** Applications with chemical purge/warmed probe
- **HUMICAP® 180V** Catalytic sensor for H₂O₂ environments
- **HUMICAP® 180VC** Catalytic sensor with chemical purge for H₂O₂ environments

**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)

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

**Temperature sensor**
- Pt100 RTD Class F0.1 IEC 60751

---

**Accuracy Over Temperature Range**

---

**Operating Environment**
- **Operating temperature for electronics**: −40 … +60 °C (−40 … +140 °F)
- **Storage temperature**: −55 … +80 °C (−67 … +176 °F)

**Operating Pressure**
- **HMT314**: 0 … 100 bar
- **HMT315**: 0 … 40 bar
- **HMT337**: 0 … 10 bar

**EMC compliance**
- EN61326-1, Industrial environment

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**Inputs and Outputs**

**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**
- RS-232C

**Connections**
- MI2 8-pin male connector with RS-232C, current/voltage outputs (two channels) and U₁,₀

**Power Consumption**
- **RS-232C output**: 12 mA
- **U₁,₀**: 10 V (10 kΩ) channel 1 & channel 2
- **I₀**: 20 mA (load 511 Ω) channel 1 & channel 2
- **Chemical purge at 24 VDC**: + 220 mA
- **Warmed probe at 24 VDC**: + 240 mA

**Mechanical Specifications**
- **Transmitter housing material**: G-AlSi10Mg
- **Transmitter base material**: PPS
- **IP rating**: IP66
- **Probe length**: 2, 5, or 10 m (6 ft 7 in, 16 ft 5 in, 32 ft 10 in)
- **Cable feed through alternatives**: MI2 8-pin male connector with 5 m cable, or 8-pin female screw terminal connector for cable diameter 4 … 8 mm

**Spare Parts and 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 H₂O₂ filter**: 231865

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**Accuracy Over Temperature Range**

---

**Operating Environment**
- **Operating temperature for electronics**: −40 … +60 °C (−40 … +140 °F)
- **Storage temperature**: −55 … +80 °C (−67 … +176 °F)

**Operating Pressure**
- **HMT314**: 0 … 100 bar
- **HMT315**: 0 … 40 bar
- **HMT337**: 0 … 10 bar

**EMC compliance**
- EN61326-1, Industrial environment

---

**Inputs and Outputs**

**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**
- RS-232C

**Connections**
- MI2 8-pin male connector with RS-232C, current/voltage outputs (two channels) and U₁,₀

**Power Consumption**
- **RS-232C output**: 12 mA
- **U₁,₀**: 10 V (10 kΩ) channel 1 & channel 2
- **I₀**: 20 mA (load 511 Ω) channel 1 & channel 2
- **Chemical purge at 24 VDC**: + 220 mA
- **Warmed probe at 24 VDC**: + 240 mA

**Mechanical Specifications**
- **Transmitter housing material**: G-AlSi10Mg
- **Transmitter base material**: PPS
- **IP rating**: IP66
- **Probe length**: 2, 5, or 10 m (6 ft 7 in, 16 ft 5 in, 32 ft 10 in)
- **Cable feed through alternatives**: MI2 8-pin male connector with 5 m cable, or 8-pin female screw terminal connector for cable diameter 4 … 8 mm

**Spare Parts and 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 H₂O₂ filter**: 231865
### Dimensions in mm [in]

**HMT313 Probe**

- Ø12.0 [0.47]
- 37.5 [1.48]
- 78.5 [3.09]
- 98.5 [3.88]

**HMT315 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 51 [2.0]
- 192 [7.56]
- 253 [9.96]

**HMT317 Probe**

- Ø12.0 [0.47]
- 37.5 [1.48]
- 79.5 [3.13]
- 99.5 [3.92]

**HMT318 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 41 - 149/371 [1.61 - 5.87/14.6]*
- 194/416 [7.64/16.4]
- 232/454 [9.13/17.9]

**HMT310 Transmitter Body**

- Ø4.5 [0.177]
- 60.5 [2.38]
- 102 [4.02]
- 11.5 [4.53]

*Lengths for standard/optional probes
* Freely user-adjustable length

**HMT314 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 120 [4.72]
- 170 [6.69]

**HMT316 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 51 [2.0]
- 192 [7.56]
- 253 [9.96]

**HMT319 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 41 - 149/371 [1.61 - 5.87/14.6]*
- 194/416 [7.64/16.4]
- 232/454 [9.13/17.9]

**HMT311 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 41 - 149/371 [1.61 - 5.87/14.6]*
- 194/416 [7.64/16.4]
- 232/454 [9.13/17.9]

**HMT312 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 41 - 149/371 [1.61 - 5.87/14.6]*
- 194/416 [7.64/16.4]
- 232/454 [9.13/17.9]

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- 170 [6.69]

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- Ø12.0 [0.47]
- 41 [1.61]
- 51 [2.0]
- 192 [7.56]
- 253 [9.96]

**HMT317 Probe**

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- 37.5 [1.48]
- 79.5 [3.13]
- 99.5 [3.92]

**HMT318 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
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**HMT319 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
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**HMT311 Probe**

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**HMT312 Probe**

- Ø12.0 [0.47]
- 41 [1.61]
- 41 - 149/371 [1.61 - 5.87/14.6]*
- 194/416 [7.64/16.4]
- 232/454 [9.13/17.9]
**Features**

- Accurate and reliable measurement with Vaisala HUMICAP® humidity sensor technology
- Interchangeable probe (easy field calibration)
- Resistant to dust and most chemicals
- Enclosure IP65
- 3-point traceable calibration (certificate included)
- Suitable for cleanrooms and demanding HVAC and light industrial applications

**Options**

- 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
- 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

**Performance**

The HMT120 and HMT130 transmitters incorporate Vaisala HUMICAP® sensor technology that measures relative humidity accurately and reliably. Vaisala HUMICAP® sensors are resistant to dust and most chemicals.

The HMT120 and HMT130 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, cabling can be done through the back wall of the transmitter.

**Interchangeable Probe**

The HMT120 and HMT130 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 handheld 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 a remote probe. For high temperature applications or where space is limited, the remote probe is ideal. The optional LCD display shows the measurement results of selected parameters in selected units. The parameters are displayed simultaneously at two separate rows on the display.
### Technical Data

#### Measurement Performance

**Relative Humidity**
- **Measurement range**: 0 ... 100 %RH
- **Accuracy**: 1) Including non-linearity, hysteresis, and repeatability.
  - At 0 … +40 °C (+32 … +104 °F) ±1.5 %RH (0 … 90 %RH)
  - ±2.5 %RH (90 … 100 %RH)
  - With HUMICAP 180V sensor, accuracy is specified only in operating temperature −20 ... +80 °C (−4 ... +176 °F).
- **Factory calibration uncertainty at +20 °C (+68 °F)**
  - ±1.1 %RH (0 … 90 %RH)
  - ±1.8 %RH (90 … 100 %RH)

**Stability**
- ±2 %RH over 2 years
- Stability in typical HVAC applications ±0.5 %RH per year

**Temperature**
- **Measurement range**: −40 ... +80 °C (−40 ... +176 °F)
- **Accuracy over Temperature Range**: 1) Including non-linearity, hysteresis, and repeatability.
  - At +15 … +25 °C (+59 … +77 °F) ±0.1 °C (±0.18 °F)
  - At 0 … +15 °C and +25 … +40 °C (+32 … +59 °F and +77 … +104 °F) ±0.15 °C (±0.27 °F)
  - At −40 … +0 °C and +40 … +80 °C (−40 … +32 °F and +104 … +176 °F) ±0.4 °C (±0.72 °F)
- **Temperature sensor**: Pt1000 RTD Class F0.1 IEC 60751

#### Mechanical Specifications

<table>
<thead>
<tr>
<th>IP rating</th>
<th>IP65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>270 g (9.5 oz)</td>
</tr>
<tr>
<td>Probe cable lengths</td>
<td>3 m, 5 m, 10 m - up to 50 m (9.8 ft, 16 ft, 33 ft - up to 164 ft)</td>
</tr>
<tr>
<td>Display (optional)</td>
<td>128 x 64 resolution full graphics B&amp;W display without backlight</td>
</tr>
<tr>
<td>Material</td>
<td>Transmitter housing: PBT plastic</td>
</tr>
<tr>
<td>Display window</td>
<td>PC plastic</td>
</tr>
<tr>
<td>Probe body</td>
<td>Stainless steel (AISI 316)</td>
</tr>
<tr>
<td>Probe grid filter</td>
<td>Chrome coated ABS plastic</td>
</tr>
</tbody>
</table>

#### Inputs and Outputs

**HMT120 2-Wire Transmitter (Loop-Powered)**
- **Current output signals**: 4 ... 20 mA
- **External loop voltage**: 10 ... 30 VDC (RL = 0 Ω)
  - 20 ... 30 VDC (RL < 500 Ω)

**HMT130 3-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 kΩ
- **Serial output**: RS-485, 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 (+68 °F) ambient temperature**: ±0.1 % of FS output signal
- **Temperature dependence of the analog outputs**: ±0.005 % of FS output signal

#### Operating Environment

- **Operating temperature of transmitter body, no display**: −40 ... +60 °C (−40 ... +140 °F)
- **Operating temperature of transmitter body with display**: −20 ... +60 °C (−4 ... +140 °F)
- **Operating temperature, HMP110 probe**: −40 ... +80 °C (−40 ... +176 °F)
- **Storage temperature**: −50 ... +70 °C (−58 ... +158 °F)
- **EMC compliance**: EN 61326-1 and EN 55022

#### Mechanical Specifications

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<tr>
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</tr>
<tr>
<td>Probe grid filter</td>
<td>Chrome coated ABS plastic</td>
</tr>
</tbody>
</table>

#### Spare Parts and Accessories

**HMT120**
- Humidity and temperature probe HUMICAP 180R
- Humidity and temperature replacement probe HUMICAP 180V
- Constant output probe HUMICAP 180REF
- Standard humidity sensor HUMICAP 180R
- Catalytic humidity sensor for H2O2 HUMICAP 180V
- Probe mounting flange 226061
- Probe mounting clamps, 10 pcs 226067
- Probe cable 3 m (9.8 ft) HMT120Z300
- Probe cable 5 m (16 ft) HMT120Z500
- Probe cable 10 m (33 ft) HMT120Z1000
- Probe cable 20 m (66 ft) HMT120Z2000
- Radiation shield DTR504A
- Rain shield with installation kit Z1509
- Duct installation kit Z1569
- HM70 connection cable Z11339
- USB serial interface cable 299685

**HMP110 Sensor Protection**
- Plastic grid filter DRW010522SP
- Plastic grid with membrane filter DRW010525SP
- Stainless steel sintered filter HM46670SP
- Teflon sintered filter DRW244938SP

1) See separate order form.
HMW90 Series Humidity and Temperature Transmitters
For high-performance 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.

Features

- 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 ±1.7 %RH accuracy
- User exchangeable humidity and temperature module
- Traceable calibration (certificate included)
- Available in two colors

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 expanded 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, making it clear and convenient to make adjustments. A service port enables two-point calibration, using either a PC or Vaisala HUMICAP® Handheld Humidity and Temperature Meter HM70. HMW90 series transmitters include a user-exchangeable measurement module, which can be ordered as a spare part.
## Transmitter models

<table>
<thead>
<tr>
<th>Model</th>
<th>Measurements</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMW92</td>
<td>T-only</td>
<td>2-wire, current output</td>
</tr>
<tr>
<td>TMW93</td>
<td>T-only</td>
<td>3-wire, voltage output</td>
</tr>
<tr>
<td>TMW90</td>
<td>T-only</td>
<td>Configurable analog output model</td>
</tr>
<tr>
<td>HMW92</td>
<td>RH+T</td>
<td>2-wire, current output</td>
</tr>
<tr>
<td>HMW92D</td>
<td>RH+T</td>
<td>2-wire, current output with display</td>
</tr>
<tr>
<td>HMW93</td>
<td>RH+T</td>
<td>3-wire, voltage output</td>
</tr>
<tr>
<td>HMW93D</td>
<td>RH+T</td>
<td>3-wire, voltage output with display</td>
</tr>
<tr>
<td>HMW90</td>
<td>RH+T</td>
<td>Configurable analog/digital model</td>
</tr>
<tr>
<td>HMW95</td>
<td>RH+T</td>
<td>Digital (BACnet, Modbus) model</td>
</tr>
<tr>
<td>HMW95D</td>
<td>RH+T</td>
<td>Digital (BACnet, Modbus) model with display</td>
</tr>
</tbody>
</table>
### Measurement performance

#### Relative humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy at temperature range +10 °C to +40 °C (+50 °F to +104 °F):</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±1.7 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±2.5 %RH</td>
</tr>
</tbody>
</table>

Accuracy at temperature range +5 °C to +10 °C, +40 °C to +55 °C (+23 °F to +50 °F, +104 °F to +131 °F):

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy at temperature range +10 °C to +40 °C (+50 °F to +104 °F):</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±3 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±4 %RH</td>
</tr>
</tbody>
</table>

Stability in typical HVAC applications ±0.5 %RH/year

Humidity sensor HUMICAP® 180R

#### Temperature

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

Accuracy at +20 °C to +30 °C (+68 °F to +86 °F)

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy at temperature range +10 °C to +40 °C (+50 °F to +104 °F):</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±0.2 °C (±0.36 °F)</td>
</tr>
</tbody>
</table>

Accuracy at +10 °C to +20 °C, +30 °C to +40 °C (+50 °F to +68 °F, +86 °F to +104 °F)

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy at temperature range +10 °C to +40 °C (+50 °F to +104 °F):</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±0.3 °C (±0.54 °F)</td>
</tr>
</tbody>
</table>

Accuracy at -5 °C to +10 °C, +40 °C to +55 °C (+23 °F to +50 °F, +104 °F to +131 °F)

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±0.5 °C (±0.90 °F)</td>
</tr>
</tbody>
</table>

Temperature sensor Digital temperature sensor

#### Inputs and outputs

- **Service port**: RS-485 line for temporary service use
  - **Current output models**
    - Outputs: 2 × 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 × 0 ... 5 V or 2 × 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 50 VDC/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: BACnet MS/TP or Modbus RTU (selectable by DIP switch)
    - BACnet MS/TP Operating mode: Slave
    - Address range, slave mode: 128 ... 255
    - Modbus RTU address range: 1 ... 247

- **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 handheld meter: 219980
  - USB cable for PC connection: 219690

### Operating environment

- **Operating temperature**: -5 ... +55 °C (+23 ... +131 °F)
- **Storage temperature**: -30 ... +60 °C (-22 ... +140 °F)

### Compliance

- **EMC compatibility**: IEC / EN / BS EN 61326-1, industrial environment
- **Compliance marks**: CE, RCM, WEEE

### Mechanical specifications

- **IP rating**: IP30
- **Weight**: 155 g (5.5 oz)
- **Standard housing color**: White (RAL9003)
- **Optional housing color (configurable models only)**: Black (RAL9005)
- **Housing material**: ABS/PC, UL-V0 approved
- **Output connector**: Screw terminals
  - Max. wire size: 2 mm² (AWG14)
  - Max. with relay: 25 mA
- **Relay**: 1 pc (max 50 VDC/50 VA C, 500 mA)
- **Service port connector**: 4-pin M8

- **Dimensions of HMW90 series transmitter cover (left) and mounting base (right)**

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1. RAL code is only indicative with potential small variations in color shades.

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Dimensions of HMW90 series transmitter cover (left) and mounting base (right)
VAISALA

HMD60 Series Humidity and Temperature Transmitters

For demanding HVAC and light industrial applications

Features

• Measurement accuracy up to ±1.5 %RH and ±0.1 °C (±0.18 °F)
• 4 ... 20 mA analog outputs: HMD62 (RH and T) and TMD62 (T-only)
• 0 ... 10 V analog outputs: HMD65 (RH and T)
• BACnet MS/TP and Modbus RTU: HMD65
• All common humidity parameters available, including RH, dew point, enthalpy, and wet bulb temperature
• Resistant to chemicals and dust
• IP66-rated body
• Traceable calibration certificate
• Easy field adjustment and output configuration with quick access to electronics also when installed
• Compatible with Vaisala Insight PC software

The duct mounted HMD60 series HUMICAP® transmitters HMD62, TMD62, and HMD65 are designed for light industrial applications and demanding HVAC applications such as museums, cleanrooms, and laboratories.

Analog or Digital Output with 3 Transmitter Options

HMD60 series transmitter options:
• HMD62: RH and T measurement, 4 ... 20 mA analog output
• TMD62: T-only transmitter, 4 ... 20 mA analog output
• HMD65: RH and T measurement, 0 ... 10 V analog output, Modbus RTU, and BACnet MS/TP

Robust Design, Stability, and Reliability

The all-metal body is suitable for building sites and industrial settings. HMD60 series transmitters provide state-of-the-art stability and environmental resistance, thanks to the Vaisala HUMICAP® R2 sensor.

For applications where hydrogen peroxide disinfection is used, the HUMICAP® 180V catalytic sensor option provides improved stability during H₂O₂ exposure.

Traceable Accuracy

HMD60 series transmitters are always delivered with a traceable (ISO9001) calibration certificate. Upon request, accredited (ISO17025) calibration certificates can also be provided.

Field Configurable Outputs

The analog HMD62 and TMD62 transmitter models use floating 4 ... 20 mA loop powered outputs. The HMD65 model has two 0 ... 10 V outputs in addition to BACnet MS/TP and Modbus RTU interfaces (RS-485). The analog outputs are field configurable with easy humidity parameter selection using DIP switches.

For special scaling and other additional configuration and adjustment options, you can use the convenient Vaisala Insight PC software for Windows® (see www.vaisala.com/insight).

When required, HMD60 series transmitters can also be intuitively field adjusted using trimmers or with the Vaisala HM70 handheld meter.
### Technical Data

#### Relative Humidity Measurement Performance

##### Humidity Sensor Options

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Description</th>
<th>Measurement range</th>
<th>Stability</th>
<th>Accuracy at 0 °C to +40 °C (+32 °F to +104 °F) 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUMICAP R2</td>
<td>Latest generation industrial sensor with improved corrosion resistance</td>
<td>0 … 100 %RH</td>
<td>±0.5 %RH/year in typical HVAC applications</td>
<td></td>
</tr>
<tr>
<td>HUMICAP 180V</td>
<td>Humidity sensor with a catalytic surface for processes with H₂O₂</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### HUMICAP 180V

- Latest generation industrial sensor with improved corrosion resistance.
- Humidity sensor with a catalytic surface for processes with H₂O₂.

#### Measurement Range

- 0 … 100 %RH

#### Stability

- ±0.5 %RH/year in typical HVAC applications

#### Accuracy

- At 0 °C to +40 °C (+32 °F to +104 °F): ±1.5 %RH
- At 90 °C to 100 %RH: ±2.5 %RH

#### Start-up and Response Time

- Start-up time at +20 °C (+68 °F): 8 s
- Response time (T63) at +20 °C (+68 °F): 15 s

### Temperature Measurement Performance

<table>
<thead>
<tr>
<th>Temperature sensor</th>
<th>Measurement range</th>
<th>Default analog output scale</th>
<th>Accuracy at +20 °C (+68 °F)</th>
<th>Temperature dependence</th>
<th>Factory calibration uncertainty</th>
<th>Response time (T63) with free convection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt1000 RTD Class F.0.1</td>
<td>-40 … +80 °C (+40 °C to +176 °F)</td>
<td>-20 … +80 °C (+4 °C to +176 °F)</td>
<td>±0.1 °C (±0.18 °F)</td>
<td>±0.005 °C/°C</td>
<td>±0.1 °C (±0.18 °F)</td>
<td>8 min (±0.18 °F)</td>
</tr>
</tbody>
</table>

### Analog Output Performance

- Accuracy at +20 °C (68 °F): ±0.01 mA (HMD62 and TMD62), ±5 mV (HMD65)
- Temperature dependence: ±0.0008 mA/°C (HMD62 and TMD62), ±0.2 mV/°C (HMD65)

### Operating Environment

- Operating temperature, electronics: -40 … +60 °C (-40 … +140 °F)
- Operating temperature, probe: -40 … +80 °C (-40 … +176 °F)
- Storage temperature range: -40 … +80 °C (-40 … +176 °F)
- Maximum flow speed: 50 m/s with sintered filter
- Electromagnetic compatibility: EN61326-1, Industrial Environment

### Inputs and Outputs

- Power supply input: HMD62 and TMD62:
  - 10 … 35 VDC (RL = 0 Ω)
  - 20 … 35 VDC (RL = 600 Ω)
  - 16 … 24 VAC

- Power consumption (HMD65): 1.0 W (typical, for both AC and DC)

#### Analog Outputs

- HMD62: 1 × RH output 4 … 20 mA
- HMD65: 1 × RH output 0 … 10 V

#### Digital Output

- RS-485: HMD65: Isolated, supports Modbus RTU and BACnet MS/TP protocols

### Mechanical Specification

- Housing material: Cast aluminum
- Probe material: Stainless steel
- IP rating: IP66 (NEMA 4X)
- Weight: 511 g (18 oz)

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**Spare Parts and Accessories**

- **USB cable for PC operation (Vaisala Insight software)**: 219690
- **Connection cable for HM70 (M170) handheld meter**: 219980SP
- **Membrane filter**: ASM216525P
- **Sintered filter**: HM466705P
- **Sintered teflon filter**: DRW244938SP
- **Conduit fitting and O-ring (M16×1/5 NPT/2")**: 210675SP

---

1) Including non-linearity, hysteresis, and repeatability
2) With HUMICAP 180V sensor, accuracy is not specified below -20 °C (-4 °F) operating temperature
3) Calculated output parameters for HMD62 and HMD65 include T_d, T_df, A, X, T_w, and H.
<table>
<thead>
<tr>
<th>Model</th>
<th>Measurement Parameters</th>
<th>Outputs and Scaling</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMD62</td>
<td>Humidity and Temperature</td>
<td>2 analog outputs, 4 ... 20 mA</td>
</tr>
<tr>
<td>TMD62</td>
<td>Temperature</td>
<td>1 analog output, 4 ... 20 mA</td>
</tr>
<tr>
<td>HMD65</td>
<td>Humidity and Temperature</td>
<td>2 analog outputs, 0 ... 10 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Digital output: BACnet MS/TP, Modbus RTU</td>
</tr>
<tr>
<td>HMD60</td>
<td>Humidity and Temperature</td>
<td>Configurable outputs and scale, short probe option</td>
</tr>
<tr>
<td>TMD60</td>
<td>Temperature</td>
<td>1 analog output (4 ... 20 mA, configurable scale), short probe option</td>
</tr>
</tbody>
</table>
HMDW110 Series Humidity and Temperature Transmitters
For high-accuracy measurements in HVAC applications

Features
- Accurate humidity and temperature transmitters for measurements in HVAC and cleanroom applications
- Outdoor transmitter with professional-grade radiation shield
- Proven Vaisala HUMICAP® 180R sensor for superior long-term stability
- ±2 %RH accuracy
- 3-point traceable calibration (certificate included)
- On-site calibration with Vaisala Handheld Meter HM70 or Vaisala Insight PC software
- Current (4 … 20 mA) or Modbus RTU output variants

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-rated wall transmitters, and outdoor transmitters with integrated radiation shields.

Optional output parameters are dew point temperature, wet bulb temperature, and enthalpy, which are selectable with Vaisala Insight PC software.

Proven Vaisala HUMICAP® Performance
The cost-efficient HMDW110 series transmitters are equipped with the trusted HUMICAP® 180R sensor. 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 a Vaisala Handheld Humidity and Temperature Meter HM70 or Vaisala Insight PC software.

HMDW110 series instruments are individually adjusted and delivered with a traceable calibration certificate.

Unrivaled Outdoor Humidity Measurements
The integrated radiation shield of the outdoor models HMS110 and HMS112 enables unrivaled 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.

Well-Suited for Cleanroom Monitoring
The HMD110 and HMW110 transmitters can be ordered with the catalytic HUMICAP® 180V sensor. The catalytic sensor improves stability especially in hydrogen peroxide sterilized environments where repeated condensation is expected.
Technical Data

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

Dimensions in mm

HMD110/112 RH+T transmitters for ducts

Dimensions in mm

HMS110/112 RH+T transmitters for outdoor measurements

Dimensions in mm
### Models

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Type</th>
<th>Output</th>
<th>Special Features</th>
<th>Ingress Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMW110</td>
<td>Wall-mount, RH+T</td>
<td>2-wire current or Modbus RTU output</td>
<td>Configurable model 1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMW112</td>
<td>Wall-mount, RH+T</td>
<td>2-wire current output</td>
<td></td>
<td>IP65</td>
</tr>
<tr>
<td>HMD110</td>
<td>Duct-mount, RH+T</td>
<td>2-wire current or Modbus RTU output</td>
<td>Configurable model 1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMD112</td>
<td>Duct-mount, RH+T</td>
<td>2-wire current output</td>
<td></td>
<td>IP65</td>
</tr>
<tr>
<td>HMS110</td>
<td>Outdoor, RH+T</td>
<td>2-wire current or Modbus RTU output</td>
<td>Radiation shield, configurable model 1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMS112</td>
<td>Outdoor, RH+T</td>
<td>2-wire current output</td>
<td></td>
<td>IP65</td>
</tr>
</tbody>
</table>

1) Delivered with customer specific output settings, including calculated humidity parameters and custom scaling of outputs.

### Measurement Performance

#### Relative Humidity
- **Measurement range:** 0 … 100 %RH
- **Accuracy:**
  - at +10 … +30 °C (+50 … +86 °F): ±2 %RH (0 … 90 %RH) ±3 %RH (90 … 100 %RH)
  - at −20 … +10 °C, +30 … +60 °C (−4 … +50 °F, +86 … +140 °F): ±3 %RH (0 … 90 %RH) ±4 %RH (90 … 100 %RH)
  - at −40 … −20 °C (−40 … −4 °F): ±4 %RH (0 … 100 %RH)
- **Stability in typical HVAC applications:** ±0.5 %RH/year
- **Humidity sensor types:** HUMICAP® 180R, HUMICAP® 180V

#### 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:** −40 … +60 °C (−40 … +140 °F)
- **Accurancy at +20 °C (+68 °F) and 80 %RH:** 1)
- **Dew point:** ±0.7 °C (±1.3 °F)
- **Wet bulb temperature:** ±0.5 °C (±0.9 °F)
- **Enthalpy:** ±16 kJ/kg (±17 … 198 BTU/lb)
- **Factory calibration uncertainty at +20 °C (+68 °F):** ±1.5 %RH/±0.2 °C

1) With HUMICAP® 180V sensor, accuracy is not specified below −20 °C (−4 °F) operating temperature.
2) Accuracy of the calculated parameters should be calculated at the actual condition based on the RH and temperature specification.

### Operating Environment (All Models)
- **Operating temperature:** −40 … +60 °C (−40 … +140 °F)
- **Operating humidity:** 0 … 100 %RH
- **Maximum wind / flow speed:** 30 m/s
- **Storage temperature:** −40 … +60 °C (−40 … +140 °F)
- **Electromagnetic compliance:** EN61326-1, Industrial Environment

### Inputs and Outputs

#### Devices Ordered with Analog Output
- **Outputs:** 4 … 20 mA, loop powered
- **Loop resistance:** 0 … 600 Ω
- **Supply voltage:** 20 … 28 VDC at 600 Ω load
- **Supply voltage:** 10 … 28 VDC at 0 Ω load

#### Devices Ordered with Modbus Output
- **Interface:** RS-485, not isolated, no line termination
- **Default serial settings:** 19200 bps N 8 2
- **Protocols:** Modbus RTU
- **Supply voltage:** 10 … 28 VDC

### Spare Parts and Accessories

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>210674SP</td>
<td>Conduit fitting + O-ring (M16 × 1.5 / PG9, RE-MS)</td>
</tr>
<tr>
<td>210675SP</td>
<td>Conduit fitting + O-ring (M16 × 1.5 / NPT1/2&quot;)</td>
</tr>
<tr>
<td>237805</td>
<td>Fastening set HMS110</td>
</tr>
<tr>
<td>238620SP</td>
<td>Fastening flange assembly (screws included)</td>
</tr>
<tr>
<td>219690</td>
<td>Porous PTFE filter</td>
</tr>
<tr>
<td>219980SP</td>
<td>Membrane filter</td>
</tr>
<tr>
<td>236620SP</td>
<td>Membrane filter</td>
</tr>
<tr>
<td>219660</td>
<td>Terminal block, blue</td>
</tr>
<tr>
<td>219980SP</td>
<td>USB cable for PC connection</td>
</tr>
<tr>
<td>218900</td>
<td>Connection cable for HM70 handheld meter</td>
</tr>
<tr>
<td>HUMICAP® 180R</td>
<td>HUMICAP® 180R sensor (catalytic)</td>
</tr>
<tr>
<td>HUMICAP® 180V</td>
<td>HUMICAP® 180V sensor</td>
</tr>
</tbody>
</table>

### Mechanical Specifications
- **Maximum wire size:** 1.5 mm² (AWG 16)
- **Standard housing color:** White (RAL9003)
- **Housing material:** PC + 10 %GF (UL-V0 approved)

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HMS110 Series Humidity and Temperature Transmitters
For high-accuracy outdoor measurements in building automation applications

Features
- Reliable outdoor transmitters with integrated radiation shields
- ±2 %RH accuracy
- Proven HUMICAP® 180R sensor for long-lasting accuracy
- 3-point 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

Vaisala HMS110 Series HUMICAP® Humidity and Temperature Transmitters are designed for demanding outdoor measurements in building automation applications. These ±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 HM70 Hand-Held Humidity and Temperature Meter, or a PC connection.
Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Output</th>
<th>IP Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMS110</td>
<td>Outdoor, RH+T</td>
<td>2-wire, current output</td>
<td>IP65</td>
</tr>
<tr>
<td>HMS112</td>
<td>Outdoor, RH+T</td>
<td>2-wire, current output</td>
<td>IP65</td>
</tr>
</tbody>
</table>

HMS110 is delivered with customer specific output settings, including calculated humidity parameters and special scaling of outputs.

Measurement Performance

Relative Humidity
- Measurement range: 0 ... 100 %RH
- Stability in typical HVAC applications: ±0.5 %RH/year
- Humidity sensor: Vaisala HUMICAP® 180R
- Accuracy at temperature range +10 ... +30 °C (+50 ... +86 °F):
  - 0 ... 90 %RH: ±2 %RH
  - 90 ... 100 %RH: ±3 %RH
- Accuracy at temperature range -20 ... +10 °C, +30 ... +60 °C (<-4 ... +50 °F, +86 ... +140 °F):
  - 0 ... 90 %RH: ±3 %RH
  - 90 ... 100 %RH: ±4 %RH
- Accuracy at temperature range -40 ... -20 °C (-40 ... -4 °F):
  - 0 ... 100 %RH: ±4 %RH

Temperature
- Measurement range: -40 ... +60 °C (-40 ... +140 °F)
- Accuracy at +20 °C (+68 °F): ±0.1 °C/°C
- Temperature sensor: Pi1000 RTD Class F0.1 IEC 60751

Calculated Parameters
- Factory calibration uncertainty at 20 °C (+68 °F): ±1.5 %RH/±0.2 °C
- Measurement range for dew point temperature and wet bulb temperature:
  - -40 ... -20 °C (-40 ... -4 °F)
- Measurement range for enthalpy: -40 ... ±460 kJ/kg (-40 ... ±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 (1.3 °F)
  - Wet bulb temperature: ±0.5 °C (0.9 °F)
  - Enthalpy: ±1.6 kJ/kg (0.7 BTU/lb)

Inputs and Outputs

Analog 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
Data input for RDP100 Remote Panel Display: RS-485
Vaisala proprietary protocol

Mechanical Specifications

Max. wire size: 1.5 mm² (AWG 16)
Standard housing color: White (RAL 9003)
Housing material: PC + 10 %GF (UL-V0 approved)

Spare Parts and Accessories

- Remote Panel Display: RDP100
- Conduit fitting + O-ring (M16 × 1.5 / NPT1/2 Inch): 210675SP
- Conduit fitting + O-ring (M16 × 1.5 / 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

Operating Environment

- Operating temperature: -40 ... +60 °C (-40 ... +140 °F)
- Operating humidity: 0 ... 100 %RH
- Maximum wind/flow speed: 30 m/s (67 mph)
- Storage temperature: -40 ... +60 °C (-40 ... +140 °F)
- EMC compliance: EN61326-1, Industrial Environment
VAISALA

HMDW80 Series Humidity and Temperature Transmitters
For building automation applications

Features

• Reliable transmitters for basic HVAC humidity measurements
• ±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
• UL-V0 flammability rating
• Output parameters: relative humidity and temperature with optional dew point temperature, wet bulb temperature and enthalpy parameters

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

**Typical installation locations**
- Ventilation ducts
- Walls
- Wash-down areas
- Outdoor locations

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 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.
<table>
<thead>
<tr>
<th>Model number</th>
<th>Type</th>
<th>Output</th>
<th>Special features</th>
<th>IP rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMW82</td>
<td>Wall-mount, T-only</td>
<td>2-wire, current output</td>
<td>IP30</td>
<td></td>
</tr>
<tr>
<td>HMW82</td>
<td>Wall-mount, RH+T</td>
<td>2-wire, current output</td>
<td>IP30</td>
<td></td>
</tr>
<tr>
<td>HMW82P100</td>
<td>Wall mount, RH+T</td>
<td>2-wire, current output</td>
<td>Additional Pt100 sensor</td>
<td>IP30</td>
</tr>
<tr>
<td>HMW83</td>
<td>Wall-mount, RH+T</td>
<td>3-wire, voltage output</td>
<td>IP30</td>
<td></td>
</tr>
<tr>
<td>TMW88</td>
<td>Wall-mount, T-only</td>
<td>2-wire, current output</td>
<td>IP65</td>
<td></td>
</tr>
<tr>
<td>HMW88</td>
<td>Wall-mount, RH+T</td>
<td>2-wire, current output</td>
<td>Calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMW88D</td>
<td>Wall-mount, RH+T</td>
<td>2-wire, current output</td>
<td>Display, calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMW89</td>
<td>Wall-mount, RH+T</td>
<td>3-wire, voltage output</td>
<td>Calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMW89D</td>
<td>Wall-mount, RH+T</td>
<td>3-wire, voltage output</td>
<td>Display, calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>TMD82</td>
<td>Duct-mount, T-only</td>
<td>2-wire, current output</td>
<td>IP65</td>
<td></td>
</tr>
<tr>
<td>HMD82</td>
<td>Duct-mount, RH+T</td>
<td>2-wire, current output</td>
<td>Calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMD82D</td>
<td>Duct-mount, RH+T</td>
<td>2-wire, current output</td>
<td>Display, calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMD83</td>
<td>Duct-mount, RH+T</td>
<td>3-wire, voltage output</td>
<td>Calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMD83D</td>
<td>Duct-mount, RH+T</td>
<td>3-wire, voltage output</td>
<td>Display, calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMS82</td>
<td>Outdoor, RH+T</td>
<td>2-wire, current output</td>
<td>Radiation shield, calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMS82C</td>
<td>Outdoor, RH+T</td>
<td>2-wire, current output</td>
<td>HMS82 with NPT ½” conduit fitting(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMS83</td>
<td>Outdoor, RH+T</td>
<td>3-wire, voltage output</td>
<td>Radiation shield, calculated parameters(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>HMS83C</td>
<td>Outdoor, RH+T</td>
<td>3-wire, voltage output</td>
<td>HMS83 with NPT ½” conduit fitting(^1)</td>
<td>IP65</td>
</tr>
<tr>
<td>TMS82</td>
<td>Outdoor, T-only</td>
<td>2-wire, current output</td>
<td>Radiation shield</td>
<td>IP65</td>
</tr>
</tbody>
</table>

\(^{1}\) Output parameters for humidity: relative humidity, dew point temperature, wet bulb temperature, and enthalpy.
Dimensions

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

**HMS82/83 RH+T and TMS82 T-only transmitters for outdoor measurements**

**HMW88/89(D) RH+T and TMW88 T-only transmitters for measurements in wet areas**

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

**Measurement performance, models HMW82/83 and TMW82**

**Relative humidity**
- **Measurement range**: 0 … 100 %RH
- **Accuracy in temperature range**:
  - +10 … +30 °C (+50 … +86 °F): ±3 %RH (0 … 70 %RH)
  - +5 … +10 °C, +30 … +55 °C (+23 … +50 °F, +86 … +131 °F): ±7 %RH (0 … 100 %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 at** +10 … +30 °C (+50 °F … +86 °F): ±0.5 °C (±0.9 °F)
- **Accuracy at** −5 … +10 °C, +30 … +55 °C (+23 … +50 °F, +86 … +131 °F): ±1.0 °C (±1.8 °F)
- **Temperature sensor**: Digital temperature sensor

**Measurement performance, models HMD82/83, TMD82, HMW88/89, TMW88, HMS82/83, and TMS82**

**Relative humidity**
- **Measurement range**: 0 … 100 %RH
- **Accuracy in temperature range**:
  - +10 … +30 °C (+50 … +86 °F): ±3 %RH (0 … 90 %RH)
  - +5 … +10 °C, +30 … +60 °C (+23 … +50 °F, +86 … +140 °F): ±5 %RH (0 … 90 %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)

**Inputs and outputs**

**Current output models (2-wire)**
- **Outputs**: 4 … 20 mA, loop powered
- **Supply voltage**: 20 … 28 VDC at 600 Ω load
- **Voltage output models (3-wire)**
  - **Outputs**: 0 … 10 V
  - **Load resistance**: 10 kΩ min
  - **Supply voltage**: 18 … 35 VDC

**Mechanical specifications**
- **Max wire size**: 1.5 mm² (AWG 16)
- **Standard housing color**: White (RAL 9003)
- **Material of housing**: HMW82/83, TMW82 ABS/PC (UL-V0 approved)
  - HMW88/89(D), HMD82/83(D), TMW88, TMD82, HMS82/83, TMS82
    - PC + 10 %GF (UL-V0 approved)

**Spare parts and accessories**
- **INTERCAP sensor**: 15778HM
- **10 pcs of INTERCAP sensors**: INTERCAPSET-10PCS
- **Conduit fitting + O-ring** (M16×1.5 / NPT ½ “): 20675SP
- **Conduit fitting + O-ring** (M16×1.5 / PG9, RE-MS): 20674SP
- **Fastening set HMS80**: 237805
- **Porous PTFE filter**: DRW239993SP
- **Membrane filter**: ASM210856SP
- **HMD80 display lid**: ASM210793SP

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HMS80 Series Humidity and Temperature Transmitters
For outdoor measurements in building automation applications

Features

• Reliable outdoor transmitters with integrated radiation shields
• ±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

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

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.

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.
Technical Data

Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Output</th>
<th>IP Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMS82</td>
<td>Outdoor, RH+T</td>
<td>2-wire, current output</td>
<td>IP65</td>
</tr>
<tr>
<td>HMS83</td>
<td>Outdoor, RH+T</td>
<td>3-wire, voltage output</td>
<td>IP65</td>
</tr>
</tbody>
</table>

Measurement Performance

Relative Humidity
- Measurement range: 0 ... 100 %RH
- Accuracy at temperature range +10 ... +30 °C (+50 ... +86 °F):
  - 0 ... 90 %RH: ±3 %RH
  - 90 ... 100 %RH: ±5 %RH
- Accuracy at temperature range -20 ... +10 °C, +30 ... +60 °C:
  - (-4 ... +50 °F, +68 ... +140 °F):
    - 0 ... 90 %RH: ±5 %RH
    - 90 ... 100 %RH: ±7 %RH
- Accuracy in 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 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: ±2 kJ/kg (0.9 BTU/lb)

Inputs and Outputs

Current Output Model HMS82 (2-wire)
- Outputs: 4 ... 20 mA, loop powered
- Loop resistance: 0 ... 600 Ω
- Supply voltage: 20 ... 28 VDC at 600 Ω load
  - 10 ... 28 VDC 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

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Operating Environment

- Operating temperature: -40 ... +60 °C (-40 ... +140 °F)
- Operating humidity: 0 ... 100 %RH
- Maximum wind/flow speed: 30 m/s (67 mph)
- Storage temperature: -40 ... +60 °C (-40 ... +140 °F)
- EMC compliance: EN61326-1, Industrial Environment

Mechanical Specifications

- Max. wire size: 1.5 mm² (AWG 16)
- Standard housing color: White (RAL9003)
- Housing material: PC + 10 %GF (UL-V0 approved)

Spare Parts and Accessories

- INTERCAP® sensor: 1577BHM
- 10 pcs of INTERCAP® sensors: INTERCAPSET-10PCS
- Conduit fitting + O-ring (M16 × 1.5 / NPT1/2 Inch): 210675SP
- Conduit fitting + O-ring (M16 × 1.5 / PG9, RE-MS): 210674SP
- Fastening set HMS80: 237805
- Membrane Filter: ASM210856SP
- Terminal Block, Blue: 236620SP

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

**Features**

- Full temperature compensation over the operating temperature range of -70 °C ... +180 °C (-94 °F ... +356 °F)
- High temperature tolerance, also suitable for heat sterilization
- Vaisala HUMICAP® 180R sensor
- Easy field calibration by trimmers
- Applications: test chambers, incubators

**Benefits**

- Excellent measurement accuracy
- Low-maintenance
- Easy to install
- Durable

Two types of probes are available, one made of stainless steel, the other of plastics. The plastic probe comes in two sizes, a standard one and an extended 400-mm-long option. Several cable lengths up to 3 meters are available. Both probes use the Vaisala HUMICAP® 180R sensor which ensures excellent measurement accuracy.

**Robust and Reliable**

The HMM100 probe works in freezing conditions (-70 °C (-94 °F)) and also in temperatures up to +180 °C (+356 °F). 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.

**Low-Maintenance**

Compared to psychrometers, HMM100 requires very little maintenance. 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

Measurement Performance

Relative Humidity
Measurement range 0 … 100 %RH
Factory calibration uncertainty (+20 °C / +68 °F) ±1.5 %RH
Humidity sensor types HUMICAP™180R, HUMICAP™180
Accuracy 1)

- at -20 ... +40 °C (-4 ... +104 °F) ±2 %RH (0 ... 90 %RH)
  ±3 %RH (90 ... 100 %RH)
- at -40 ... -20 °C and +40 ... +180 °C (-40 ... -4 °F and +104 ... +356 °F) ±2.5 %RH (0 ... 90 %RH)
  ±3.5 %RH (90 ... 100 %RH)

Dew Point Temperature
Measurement range -20 ... +100 °C (-4 ... +212 °F)
Accuracy 2)

±2 °C (±3.6 °F) when dew point depression is < +20 °C (+68 °F)

1) Including non-linearity, hysteresis, and repeatability.
2) Including non-linearity, hysteresis, and repeatability, when dew point depression is < +20 °C (+68 °F)
   (ambient temperature - dew point).

Inputs and Outputs

Power consumption 6 mA
Operating Voltage
2-wire model 24 VDC
3-wire model 10 ... 35 VDC or 24 VAC ±20 %

Analog Output Types (1 Output Selectable)
2-wire model 4 ... 20 mA (loop-powered)
3-wire model 0 ... 20 mA, 0 ... 1/5/10 V, 1 ... 5 V
Max. wire size 0.5 ... 1.5 mm² (AWG)
Service port MB connector for USB cable

Spare Parts and Accessories

HUMICAP™180R sensor HUMICAP180R
Plastic grid filter 6221
Membrane filter 10159HM
Porous PTFE filter 219452SP
Stainless steel sintered filter HM47280SP
PPS plastic grid with stainless steel net filter DRW010281SP
Mounting bracket with lid 225979
Module housing (IP65) 226060
Probe mounting flange 226061
Probe mounting clamp set (10 pcs) 226067
USB cable 226068

1) Spare part item name: Vaisala INTERCAP™ humidity sensor.

Operating Environment

EMC compliance Applicable parts of EN61326-1, generic environment
Operating Temperature
Component board -5 ... +55 °C (+23 ... +131 °F)
Stainless steel probe -70 ... +180 °C (-94 ... +356 °F)
Plastic probe (standard body) -70 ... +180 °C (-94 ... +356 °F)
Plastic probe (extended 400-mm (16-in) body) -70 ... +120 °C (-94 ... +248 °F)
Plastic grid and membrane filter -20 ... +80 °C (-4 ... +176 °F)
Porous PTFE, stainless steel sintered, and PPS plastic grid with stainless steel net filter
-70 ... +180 °C (-94 ... +356 °F)

Dew Point Temperature
Measurement range -20 ... +100 °C (-4 ... +212 °F) Td
Accuracy 2)

±2 °C (±3.6 °F) Td

1) Including non-linearity, hysteresis, and repeatability.
2) Including non-linearity, hysteresis, and repeatability, when dew point depression is < +20 °C (+68 °F)
   (ambient temperature - dew point).

Mechanical Specifications

Service cable connector MB 4-pin male
Probe diameter 12 mm (0.5 in)
Probe Cable Lengths
Stainless steel probe 0.6/1.55/2.9 m (2/5.1/9.5 ft)
Plastic probe (standard body) 0.6/1.55/2.9 m (2/5.1/9.5 ft)
Plastic probe (extended 400-mm (16-in) body) 1.55 m (5.1 ft)
Probe Material
Stainless steel probe AISI316
Plastic probe PPS
Extension tube for 400-mm probe POM
Probe mounting clamp AISI316
Mounting Bracket Material
Lid ABS/PC
Bottom plate Al
Module housing material ABS/PC (cover)

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Vaisala HUMICAP® Digital Humidity Module HMM105 is an open frame module for integration into environmental chambers. The modules provide an I²C output for relative humidity (RH) or dew point (T_d).

**Features**
- Digital I²C communication interface available
- Full temperature compensation over the operating temperature range of -40 °C ... +180 °C
- High temperature tolerance, suitable for heat sterilization up to +200 °C
- Vaisala HUMICAP® 180R sensor
- Detachable probe assembly
- Probe head with M10x1 threads
- Applications: test chambers, incubators

**Benefits**
- Easy installation
- Excellent measurement accuracy
- Maintenance-free

The module consists of a detachable probe assembly – a probe head with M10x1 threads and a flex cable – and the module circuit board. The probe assembly is 30 cm in length. The module incorporates the Vaisala HUMICAP® 180R sensor which ensures excellent measurement accuracy.

**Reliable for OEM’s**
The HMM105 probe head works in freezing conditions (-40 °C) and also in temperatures up to +180 °C in continuous use. In short term use, the probe head can be exposed to temperatures up to +200 °C. HMM105 is intended for OEM chamber manufacturers for integration into test chambers and incubators.

**Maintenance-free**
Compared to psychrometers, HMM105 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.

**I2C interface for better usability**
HMM105 has an I²C interface for communicating with the incubator’s controller. HMM105 implements I²C slave functionality, with the incubator’s controller acting as the master. The interface can be used to read measurement values and status information, set operation parameters, and make adjustments.
## Technical Data

### Relative Humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Factory calibration uncertainty (+20 °C)</th>
<th>Humidity sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 100 %RH</td>
<td>±1.5 %RH</td>
<td>Vaisala HUMICAP® 180R</td>
</tr>
</tbody>
</table>

### Accuracy (incl. Non-Linearity, Hysteresis and Repeatability)

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Accuracy</th>
<th>Temperature</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±2 %RH</td>
<td>90 ... 100 %RH</td>
<td>±3 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>-40 ... -20 °C, +40 ... +180 °C</td>
<td>90 ... 100 %RH</td>
<td>±3.5 %RH</td>
</tr>
</tbody>
</table>

### Dew Point Temperature

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy (incl. non-linearity, hysteresis and repeatability) when dew point depression &lt; 20 °C (Ambient temperature - dew point)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20 ... +100 °C (-4 ... +212 °F)TD</td>
<td>±2 °C TD</td>
</tr>
</tbody>
</table>

### Operating Environment

<table>
<thead>
<tr>
<th>EMC compliance</th>
<th>Applicable parts of EN61326-1, Industrial Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature</td>
<td>-40 ... +75 °C (-40 ... +167 °F)</td>
</tr>
</tbody>
</table>

### Operating Temperature

<table>
<thead>
<tr>
<th>Component board</th>
<th>Intrinsically safe (-5 ... +55 °C (+23 ... +131 °F))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe (continuous use)</td>
<td>-40 ... +180 °C (-40 ... +356 °F)</td>
</tr>
<tr>
<td>Probe (short term peak)</td>
<td>+200 °C (+392 °F)</td>
</tr>
<tr>
<td>Plastic grid, membrane filter</td>
<td>-20 ... +80 °C (-4 ... +176 °F)</td>
</tr>
<tr>
<td>PTFE sintered filters, stainless steel sintered filter</td>
<td>-40 ... +200 °C (-40 ... +392 °F)</td>
</tr>
</tbody>
</table>

### Inputs and Outputs

<table>
<thead>
<tr>
<th>Supply voltage</th>
<th>10 ... 35 VDC, 24 VAC (±20 %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>5 V</td>
</tr>
<tr>
<td>Power consumption (DC/AC)</td>
<td>&lt; 15/25 mA</td>
</tr>
<tr>
<td>Connector for supply voltage and PC bus</td>
<td>Molex 87832-1007, 10-pin header</td>
</tr>
</tbody>
</table>

### Mechanical Specifications

<table>
<thead>
<tr>
<th>Probe diameter</th>
<th>12 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe flex cable length</td>
<td>0.3 m</td>
</tr>
<tr>
<td>Probe lead-through material</td>
<td>PPS plastic</td>
</tr>
</tbody>
</table>

### Dimensions in millimeters

![Dimensions Diagram](image)

### Spare Parts and Accessories

<table>
<thead>
<tr>
<th>Humidity sensor</th>
<th>HUMICAP® 180R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short PTFE sintered filter</td>
<td>DRW239993SP</td>
</tr>
<tr>
<td>Plastic grid filter</td>
<td>6221</td>
</tr>
<tr>
<td>Plastic grid and membrane filter</td>
<td>10159HM</td>
</tr>
<tr>
<td>PTFE sintered filter</td>
<td>219452SP</td>
</tr>
<tr>
<td>Stainless steel sintered filter</td>
<td>HM47280SP</td>
</tr>
<tr>
<td>0.6 m cable with Molex milli-grid connectors</td>
<td>ASM210962SP</td>
</tr>
</tbody>
</table>

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Vaisala HUMICAP® Humidity and Temperature Module HMM170 is an open frame OEM module for integration into demanding environmental chambers and harsh conditions. The module provides a digital RS-485/Modbus RTU output and three freely configurable analog output channels. The module provides relative humidity, temperature, dew point, and other calculated parameters.

**Designed for harsh environments**
HMM170 probe covers the full temperature range −70 ... +180 °C (−94 ... +356 °F) used in climate chambers and the whole humidity range up to condensation. The small probe and compact component board offer easy and flexible installation. The probe cable options (2, 5, or 10 m (6.5, 16.4, or 32.8 ft)) offer excellent cost optimization and flexibility to any OEM application. By ordering HMM170 with the appropriate sensor, you can use the module in environments that are frequently sterilized with vaporized hydrogen peroxide (H₂O₂) or to measure humidity in oil medium, for example, for transformer and engine monitoring applications.

**Robust sensor technology**
The latest general purpose HUMICAP® R2 sensor has improved corrosion resistance. The sensor can tolerate typical chemicals, such as cleaning agents used in climate chambers. The automatic sensor chemical purge function keeps the sensor clean from typical chemical fumes and the additional probe warming function prevents condensation. In case HMM170 gets in contact with water, the automatic heating rapidly dries the sensor to enable fast and accurate humidity measurement.

**Convenient to use**
HMM170 is easy to install and convenient to use. It provides both digital and analog outputs for multiple needs. An integrated service port enables a quick and simple way to configure, check, and calibrate the module with the help of a USB cable and Vaisala Insight PC software. In addition, the footprint of the HMM170 component board enables easy update for Vaisala HMM100 users.
Measurement performance

Relative humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy 1, 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 … 100 %RH</td>
<td>±1 %RH (0 … 90 %RH)</td>
</tr>
<tr>
<td></td>
<td>±1.7 %RH (90 … 100 %RH)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>at +15 … +25 °C (59 … +77 °F)</td>
<td>±1.0 + 0.008 × reading %RH</td>
</tr>
<tr>
<td>at −20 … +40 °C (−4 … +104 °F)</td>
<td>± (1.5 + 0.015 × reading) %RH</td>
</tr>
<tr>
<td>at −40 … +180 °C (−40 … +356 °F)</td>
<td>±0.6 %RH (0 … 90 %RH)</td>
</tr>
<tr>
<td></td>
<td>±1.0 %RH (40 … 90 %RH)</td>
</tr>
<tr>
<td></td>
<td>±1.1 %RH (90 … 95 %RH)</td>
</tr>
</tbody>
</table>

Factory calibration uncertainty at

+20 °C (+68 °F) 3

| Operating environment |

<table>
<thead>
<tr>
<th>Digital output</th>
<th>RS-485 serial, Modbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service port</td>
<td>M8 connector for USB cable</td>
</tr>
<tr>
<td>Start-up time</td>
<td>3 s at power-up</td>
</tr>
<tr>
<td>Wire size</td>
<td>0.5 … 1.5 mm² (20 … 16 AWG)</td>
</tr>
</tbody>
</table>

Supply voltage

when condensation prevention and chemical purge features are not used

12 … 35 VDC

when all features are available

18 … 35 VDC or 24 VAC ±10 %

Power consumption

<table>
<thead>
<tr>
<th>Analog outputs</th>
<th>12 mA (voltage), 50 mA (current)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical purge at 24 VDC</td>
<td>+220 mA</td>
</tr>
<tr>
<td>Warmed probe at 24 VDC</td>
<td>+240 mA</td>
</tr>
</tbody>
</table>

Inputs and outputs

Accuracy of analog output at +20 °C (+68 °F)

±0.05 % full scale

Typical temperature dependence of analog output

0.005 %/˚C (0.003 %/°F) full scale

External load

R<sub>L</sub> < 500 Ω

HMM170 component board dimensions

HMM170 probe head dimensions

Operating environment

| Operating temperature for component board | +40 … +60 °C (+40 … +140 °F) |
| Operating humidity for component board | 0 … 100 %RH, non-condensing |
| Storage temperature | −55 … +80 °C (−67 … +176 °F) |
| Operating pressure | 0 … 10 bar |

Temperature measurement accuracy over temperature range

1) Including non-linearity, hysteresis and repeatability.
2) HMM170 component board dimensions

3) With HUMICAP® R2C sensor, accuracy is not specified below −20 °C (−4 °F) operating temperature.
4) HMM170 probe head dimensions

5) Defined as ±2 standard deviation limits. Small variations possible; see also calibration certificate.
6) Vaisala Insight software for Windows available at www.vaisala.com/insight
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**
HMP60 is suitable for battery-powered applications because of its very low current consumption.

**Several outputs**
Temperature measurement is a standard feature in HMP60, with dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy as optional calculated parameters. Four voltage output ranges are available. An optional RS-485 output with Modbus support is also available.

**Recalibration not needed**
The Vaisala INTERCAP® sensor is interchangeable. No recalibration is required; the sensor can simply be replaced, also in the field.

**Features**
- Miniature-size humidity probe
- Low power consumption
- Measurement range: 0 ... 100 %RH; −40 … +60 °C (−40 … +140 °F)
- Cable detachable with standard M8 connector
- Rugged metal housing
- Interchangeable Vaisala INTERCAP® sensor
- Optional RS-485 digital output supports Modbus® RTU
- Optional dew point, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy output
Technical data

**Measurement performance**

**Relative humidity**

**Measurement range** 0 ... 100 %RH

**Typical accuracy:**

- At 0 ... +40 °C (+32 ... +140 °F) ±3 %RH (0 ... 90 %RH)
- ±5 %RH (90 ... 100 %RH)

- At −40 ... 0 °C and +40 ... +60 °C (−40 ... +32 °F and +104 ... +140 °F) ±5 %RH (0 ... 90 %RH)
- ±7 %RH (90 ... 100 %RH)

**Humidity sensor** Vaisala INTERCAP®

**Temperature**

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

**Accuracy:**

- At +10 ... +30 °C (+50 ... +86 °F) ±0.5 °C (±32.9 °F)
- ±0.6 °C (±33.08 °F)

**Analog outputs**

- Accuracy at +20 °C (68 °F) ±0.2 % of FS
- Temperature dependence ±0.01 % of FS/°C (±0.006 % of FS/°F)

**Operating environment**

**Operating temperature** −40 ... +60 °C (−40 ... +140 °F)

**EMC compliance** EN 61326-1, industrial environment

**Inputs and outputs**

**Power consumption** 1 mA average, max. peak 5 mA

**Operating voltage**

- With 1 V / 2.5 V output 5 ... 28 VDC
- With 5 V output 8 ... 28 VDC
- With loop power converter 8 ... 28 VDC
- With digital output 5 ... 28 VDC

**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) RS-485 2-wire half duplex, supports Modbus RTU

**External loads**

- 0 ... 1 V R_l min. 10 kΩ
- 0 ... 2.5 V / 0 ... 5 V R_l min. 50 kΩ

**Output parameters**

Relative humidity, temperature, dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, enthalpy

- Use lowest available operating voltage to minimize heating.

**Mechanical specifications**

**IP rating** IP65 ¹

**Body thread** M12x1 / 10 mm (0.4 in)

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

**Materials**

- **Body** Stainless steel (AISI 316)
- **Grid filter** Chrome coated ABS plastic
- **Cable** Polyurethane or FEP

**Weight**

- Probe 17 g (0.6 oz)
- Probe with 0.3 m (1 ft) cable 28 g (1 oz)

**Spare parts and accessories**

**Sensors**

- Vaisala INTERCAP® sensor, 1 pc 15778HM
- Vaisala INTERCAP® sensor, 10 pcs INTERCAPSET-10PCS

**Sensor protection**

- Plastic grid filter DRW010522SP
- Membrane filter DRW010525SP
- Stainless steel sintered filter HM46670SP
- PTFE membrane filter with stainless steel grid ASMI24252SP
- PTFE sintered filter DRW449385SP

**Probe installation**

- Probe mounting clamp set, 10 pcs 226067
- Probe mounting flange 226061
- Probe holder, 5 pcs ASM213382SP
- Plastic M12 installation nuts, pair 18350SP
- Flat extension cable 1 m (3 ft) ¹

**Connection adapters**

- 4 ... 20 mA loop power converter UI-CONVERTER-ICB
- Mounting bracket for converter 225979
- USB cable for PC connection 219690
- Connection cable for MI70 indicator 219980SP
- Connection cables with open wires
- +60 °C 0.3 m (+140 °F 1 ft) HMP50Z032SP
- +60 °C 1.2 m (+140 °F 4 ft) HMP50Z120SP
- +60 °C 3 m (+140 °F 9.8 ft) HMP50Z300SP
- +80 °C 1.5 m (+176 °F 5 ft) 225777SP
- +80 °C 3 m (+176 °F 10 ft) 225229SP
- +180 °C 1.5 m (+356 °F 5 ft) FEP 238025
- +180 °C 3 m (+356 °F 10 ft) FEP 226902SP

**Dimensions in mm (inches)**

- Ø12 (0.47)
- 71 (2.8)
- M12 x1

¹ Applicable with stainless steel sintered filter and PTFE sintered filter only.
HMP63 Humidity and Temperature Probe

Features

- Fast thermal response time
- Low power consumption
- Start-up time < 2 s
- Measurement range: 0 ... 100 %RH; −40 ... +60 °C (−40 ... +140 °F)
- Detachable cable with standard 4-pin M8 connector
- Plastic enclosure with IP54 classification
- Interchangeable Vaisala INTERCAP® sensor
- Optional RS-485 digital output supports Modbus® RTU
- Optional dew point, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy output

Vaisala INTERCAP® Humidity and Temperature Probe HMP63 is a cost-effective humidity probe with plastic enclosure. It is designed for noncondensing indoor environments or integration into other manufacturers’ equipment.

Easy installation
The probe fits into tight spaces. The cable has a threaded M8 connector for easy installation. Different cable lengths are available and other compatible M8-series cables can also be used. Accessories are available for different installation needs.

Low power consumption
HMP63 is suitable for battery powered applications thanks to its very low power consumption and fast start-up time.

Several outputs
Temperature measurement is a standard feature in HMP113, with dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy as optional calculated parameters. Four voltage output ranges are available. An alternative RS-485 output with Modbus support is also available.

Fast thermal response time
HMP63 has a PC/ABS plastic enclosure. It is ideal for environments with fast temperature changes where standard measurement accuracy is sufficient.

No recalibration required
HMP63 includes an interchangeable Vaisala INTERCAP® sensor. No recalibration is required – the humidity sensor can simply be replaced, even in the field.
Measurement performance

Relative humidity
Measurement range 0 ... 100 %RH
Typical accuracy:

at 0 ... +20 °C (+32 ... +68 °F)
± 3 %RH (0 ... 90 %RH)
± 5 %RH (90 ... 100 %RH)

at −40 ... 0 °C and +40 ... +60 °C
(−40 ... +32 °F and +104 ... +140 °F)
± 5 %RH (0 ... 90 %RH)
± 7 %RH (90 ... 100 %RH)

Humidity sensor Vaisala INTERCAP®

Temperature
Measurement range −40 ... +60 °C (−40 ... +140 °F)
Accuracy:

at +10 ... +30 °C (+50 ... +86 °F)
at −40 ... +10 and +30 ... +60 °C
(−40 ... +50 and +86 ... +140 °F)
± 0.5 °C (±32.9 °F)
± 0.6 °C (±33.08 °F)

Analog outputs
Accuracy at 20 °C (±38 °F)
± 0.2 % of FS
Temperature dependence
± 0.01 % of FS/°C (±0.006 % of FS/°F)

Inputs and outputs

Power consumption 1 mA average, max. peak 5 mA

Operating voltage
With 1 V / 2.5 V output 5 ... 28 VDC
With 5 V output 8 ... 28 VDC
With loop power converter 8 ... 28 VDC
With digital output 5 ... 28 VDC

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) RS-485 2-wire half duplex, supports Modbus RTU

External loads
0 ... 1 V
 Ri min. 10 kΩ
0 ... 2.5 V / 0 ... 5 V
 Ri min. 50 kΩ

Output parameters
Relative humidity, temperature, dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, enthalpy

1) Use lowest available operating voltage to minimize heating.

Mechanical specifications

IP rating IP54 1)

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

Materials
Body PC/ABS blend
Grid filter PC (glass reinforced)
Cable Polyurethane or FEP

Weight
Probe 9 g (0.3 oz)
Probe with 0.3 m (1 ft) cable 20 g (0.7 oz)

Spare parts and accessories

Sensors
Vaisala INTERCAP® sensor, 1 pc 1S77BHM
Vaisala INTERCAP® sensor, 10 pcs INTERCAPSET-10PCS

Sensor protection
Plastic grid filter DRW240185SP
Plastic grid with membrane filter ASM210856SP
Stainless steel sintered filter HM472805SP
Porous PTFE filter 219452SP

Probe installation
Probe mounting clamp set, 10 pcs 226067
Probe mounting flange 226061
Probe holder, 5 pcs ASM213382SP
Plastic locking bushing (3 pcs) for attaching probe to HM40 DRW238590SP

Connection adapters
4 ... 20 mA loop power converter UI-CONVERTER-1CB
Mounting bracket for converter 225979
USB cable for PC connection 219690
Connection cable for HM70 219980SP
Connection cables with open wires
+60 °C 0.3 m (+140 °F 1 ft) HMP50Z032SP
+60 °C 1.2 m (+140 °F 4 ft) HMP50Z120
+60 °C 3 m (+140 °F 9 ft) HMP50Z300SP
+80 °C 1.5 m (+176 °F 5 ft) 225777SP
+80 °C 3 m (+176 °F 10 ft) 225229SP
+180 °C 1.5 m (+356 °F 5 ft) FEP 238025
+180 °C 3 m (+356 °F 10 ft) FEP 226802SP

Dimensions in mm (inches)
HMP110 Humidity and Temperature Probe

**Features**

- Miniature-size humidity transmitter
- Low power consumption and fast start-up for battery-powered applications
- Measurement range: 0 ... 100 %RH; −40 ... +80 °C (−40 ... +176 °F)
- Cable detachable with standard M8 quick connector
- IP65 metal housing
- Optional RS-485 digital output supports Modbus® RTU
- ±1.5 %RH measurement accuracy (0 ... 90 %RH)
- Temperature-only model HMP110T also available

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. HMP110 is also suitable for glove boxes, greenhouses, fermentation and stability chambers, data loggers, and incubators.

**Benefits**

- Latest generation Vaisala HUMICAP® 180R sensor for best stability and high chemical tolerance
- HMP110R replacement probe service available for easy maintenance
- Comes with calibration certificate
- Optional dew point, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy calculation

**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**

Temperature measurement is a standard feature in the HMP110, with dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy as optional calculated parameters. Three standard voltage outputs are available. An optional RS-485 output with Modbus support is also available.

**Robust design**

The stainless steel body of HMP110 is classified as IP65, making it ideal for rough conditions. HMP110 has high chemical tolerance thanks to 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. This way the measurement is available at all times without interruptions.
Technical data

Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Output</th>
<th>Special features</th>
</tr>
</thead>
<tbody>
<tr>
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<td>RH+T</td>
<td></td>
</tr>
<tr>
<td>HMP110T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>HMP110R</td>
<td>RH+T</td>
<td>Replacement probe for HMP110</td>
</tr>
<tr>
<td>HMP110REF</td>
<td>–</td>
<td>Fixed output probe for validation of HMT120 and HMT130 transmitters</td>
</tr>
</tbody>
</table>

Measurement performance

Relative humidity

Measurement range 0 … 100 %RH

Accuracy:

1) ±1.5 %RH (0 … 90 %RH)
±2.5 %RH (90 … 100 %RH)

at 0 … +40 °C (+32 … +104 °F)

±3.0 %RH (0 … 90 %RH)
±4.0 %RH (90 … 100 %RH)

at −40 … 0 °C (−40 … +32 °F)

±11 %RH (0 … 90 %RH)
±18 %RH (90 … 100 %RH)

Factory calibration uncertainty

at +20 °C (+68 °F)

±2 %RH over 2 years

Temperature

Accuracy (probes with analog output):

at 0 … +40 °C (+32 … +104 °F)
±0.2 °C (±0.36 °F)

at −40 … 0 °C (−40 … +32 °F)

±0.4 °C (±0.72 °F)

Accuracy (probes with digital output):

at +15 … +25 °C (+59 … +77 °F)
±0.1 °C (±0.18 °F)

at 0 … +15 °C (+32 … +59 °F) and
+25 … +40 °C (+77 … +104 °F)

±0.15 °C (±0.27 °F)

at −40 … 0 °C (−40 … +32 °F) and
+40 … +80 °C (+104 … +176 °F)

±0.4 °C (±0.72 °F)

Accuracy (probes with digital output):

at +15 … +25 °C (+59 … +77 °F)
±0.1 °C (±0.18 °F)

at 0 … +15 °C (+32 … +59 °F) and
+25 … +40 °C (+77 … +104 °F)

±0.15 °C (±0.27 °F)

at −40 … 0 °C (−40 … +32 °F) and
+40 … +80 °C (+104 … +176 °F)

±0.4 °C (±0.72 °F)

Humidity sensor types HUMICAP 180R

Stability ±2 %RH over 2 years

Mechanical specifications

IP rating IP65

Body thread M12x1 / 10 mm (0.4 in)

Cable connector MB 4-pin female (IEC 60947-5-2)

Materials

Body Stainless steel (AISI 316)

Grid filter Chrome coated ABS plastic

Cable Polyurethane or FEP

Weight Probe 17 g (0.6 oz)

Probe with 0.3 m (1 ft) cable 28 g (1 oz)

Inputs and outputs

Power consumption 1 mA average, max. peak 5 mA

Operating voltage 1)

With 1 V / 2.5 V output 5 … 28 VDC
With 5 V output 8 … 28 VDC
With loop power converter 8 … 28 VDC
With digital output 5 … 28 VDC

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

HMP110 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 (HMP110 probes with digital output) RS-485 2-wire half duplex, supports Modbus RTU

External loads

0 … 1 V \( R_L \) min 10 kΩ

0 … 2.5 V /0 … 5 V \( R_L \) min 50 kΩ

Output parameters

Relative humidity, temperature, dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, enthalpy

1) Use lowest available operating voltage to minimize heating

Operating environment

Operating temperature −40 … +80 °C (−40 … +176 °F)

EMC compliance EN 61326-1, industrial environment

1) Including non-linearity, hysteresis, and repeatability.

External dimensions

Width 71 [2.8]

Depth 14.4 [0.56]
Spare parts and accessories

**Sensors**
- Vaisala HUMICAP® 180R
- Vaisala HUMICAP® 180V

**Sensor protection**
- Plastic grid filter: DRW010522SP
- Membrane filter: DRW010525SP
- Stainless steel sintered filter: HM48670SP
- PTFE membrane filter with stainless steel grid: ASM212652SP
- PTFE sintered filter: DRW244938SP

**Probe installation**
- Probe mounting clamp set, 10 pcs: 226067
- Probe mounting flange: 226061
- Probe holder, 5 pcs: ASM213382SP
- Plastic M12 installation nuts, pair: 18350SP
- Flat extension cable 1 m (3 ft): CBL210649SP

**Connection adapters**
- 4 ... 20 mA loop power converter: UI-CONVERTER-1CB
- Mounting bracket for converter: 225979
- USB cable for PC connection: 219690
- Connection cable for MI70 indicator: 219980SP

**Connection cables with open wires**
- +60 °C 0.3 m (+140 °F 1 ft): HMP50Z032SP
- +60 °C 1.2 m (+140 °F 4 ft): HMP50Z120
- +60 °C 3.0 m (+140 °F 9.8 ft): HMP50Z300SP
- +80 °C 1.5 m (+176 °F 5 ft): 225777SP
- +80 °C 3.0 m (+176 °F 10 ft): 225229SP
- +180 °C 1.5 m (+356 °F 5 ft) FEP: 238025
- +180 °C 3.0 m (+356 °F 10 ft) FEP: 226902SP

1) Connection cable 219980SP is also needed if this cable is used with MI70 indicator.
HMP113 Humidity and Temperature Probe

Vaisala HUMICAP® Humidity and Temperature Probe HMP113 is a highly accurate and cost-effective humidity probe with plastic enclosure. It is designed for indoor environments, integration into other manufacturers’ equipment, or use with Vaisala HUMICAP® Handheld Humidity and Temperature Meter HM40.

Easy installation
The compact probe fits into tight spaces. The cable has a threaded M8 connector for easy installation. Different cable lengths and a selection of accessories are available.

Low power consumption
HMP113 is suitable for battery powered applications due to its very low power consumption. It also has an extremely fast start-up time.

Several outputs
Temperature measurement is a standard feature in HMP113, with dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy as optional calculated parameters. Four voltage output ranges are available. An optional RS-485 output with Modbus support is also available.

High performance
HMP113 has a PC/ABS plastic enclosure and is suitable for noncondensing environments with fast temperature changes and a need for high-accuracy measurements with traceability. HMP113 also has a high chemical tolerance thanks to the proven Vaisala HUMICAP® 180R sensor.

Variety of calibration options
A quick field calibration can easily be carried out using a handheld meter, for example Vaisala Handheld Meter HM40. Alternatively, the probe can be calibrated using a PC with USB cable or sent to a Vaisala Service Center.

Features
- Fast thermal response time
- Low power consumption
- Start-up time < 2 s
- Measurement range: 0 ... 100 %RH; −40 ... +60 °C (−40 ... +140 °F)
- Detachable cable with standard 4-pin M8 connector
- Plastic enclosure with IP54 classification
- Proven Vaisala HUMICAP® 180R sensor for excellent stability
- Optional RS-485 digital output supports Modbus® RTU
- Optional dew point, wet bulb temperature, absolute humidity, mixing ratio, and enthalpy output
- Comes with calibration certificate: ±1.5 %RH measurement accuracy (0 ... 90 %RH)
**Technical data**

### Measurement performance

**Relative humidity**

- **Measurement range**: 0 … 100 %RH
- **Accuracy (incl. non-linearity, hysteresis, and repeatability):**
  - at 0 … +40 °C (+32 … +104 °F) ±1.5 %RH (0 … 90 %RH)
  - ±2.5 %RH (90 … 100 %RH)
  - at −40 … 0 °C (−40 … +32 °F) and +40 … +60 °C (+104 … +140 °F) ±3.0 %RH (0 … 90 %RH)
  - ±4.0 %RH (90 … 100 %RH)
- **Factory calibration uncertainty at +20 °C (+68 °F):**
  - ±1.1 %RH (0 … 90 %RH)
  - ±1.8 %RH (90 … 100 %RH)

**Humidity sensor** HUMICAP® 180R

**Stability** ±2 %RH over 2 years

### Temperature

- **Measurement range**: −40 … +60 °C (−40 … +140 °F)
- **Accuracy:**
  - at 0 … +40 °C (+32 … +104 °F) ±0.2 °C (±0.36 °F)
  - at −40 … 0 °C (−40 … +32 °F) and +40 … +60 °C (+104 … +140 °F) ±0.4 °C (±0.72 °F)

**Temperature sensor** Pt1000 RTD Class F0.1 IEC 60751

### Analog outputs

- **Accuracy at +20 °C (+68 °F):** ±0.2 % of FS
- **Temperature dependence:** ±0.01 % of FS/°C (±0.006 % of FS/°F)

### Operating environment

- **Operating temperature**: −40 … +60 °C (−40 … +140 °F)
- **EMC compliance**: EN 61326-1, basic immunity test requirements

### Inputs and outputs

- **Power consumption**: 1 mA average, max. peak 5 mA
- **Operating voltage ²**:
  - With 1 V / 2.5 V output 5 … 28 VDC
  - With 5 V output 8 … 28 VDC
  - With loop power converter 8 … 28 VDC
  - With digital output 5 … 28 VDC
- **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)**
  - RS-485 2-wire half duplex, supports Modbus RTU

### External loads

- **0 … 1 V**: R<sub>1</sub> min 10 kΩ
- **0 … 2.5 V / 0 … 5 V**: R<sub>1</sub> min 50 kΩ

### Output parameters

- Relative humidity, temperature, dew point temperature, wet bulb temperature, absolute humidity, mixing ratio, enthalpy

### Mechanical specifications

- **IP rating**: IP54 ¹
- **Cable connector**: 4-pin M8 (IEC 60947-5-2)
- **Materials**
  - **Body**: PC/ABS blend
  - **Grid filter**: PC (glass reinforced)
  - **Cable**: Polyurethane or FEP
- **Weight**
  - Probe: 9 g (0.3 oz)
  - Probe with 0.3 m (1 ft) cable: 20 (0.7 oz)

### Spare parts and accessories

#### Sensors

- Vaisala HUMICAP® 180R
- Vaisala HUMICAP® 180V

#### Sensor protection

- Plastic grid filter DRW240185SP
- Plastic grid with membrane filter ASM210856SP
- Stainless steel sintered filter HM47280SP
- Porous PTFE filter 219452SP

#### Probe installation

- Probe mounting clamp set, 10 pcs 226067
- Probe mounting flange 226061
- Probe holder, 5 pcs ASM213382SP
- Plastic locking bushing (3 pcs) for attaching probe to HM40 DRW238590SP

#### Connection adapters ³

- 4 … 20 mA loop power converter UI-CONVERTER-1CB
- Mounting bracket for converter 225979
- USB cable for PC connection 219690
- Connection cable for HM70 219980SP

#### Connection cables with open wires

- +60 °C 0.3 m (+140 °F 1 ft) HMP50Z032SP
- +60 °C 1.2 m (+140 °F 4 ft) HMP50Z120
- +60 °C 3 m (+140 °F 9.8 ft) HMP50Z300SP
- +80 °C 1.5 m (+176 °F 5 ft) 225777SP
- +80 °C 3 m (+176 °F 10 ft) 225229SP
- +180 °C 1.5 m (+356 °F 5 ft) FEP 238025
- +180 °C 3 m (+356 °F 10 ft) FEP 226902SP

³ No separate adapter is needed for HM40 compatibility.

### Dimensions in mm (inches)

- Dimensions: 79.5 (3.1) 24.5 (0.96)
- Dimensions: Ø12 (0.47)
- Dimensions: Ø21.6 (0.85)
- Dimensions: (0.14)

[¹] Use lowest available operating voltage to minimize heating.

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VAISALA

www.vaisala.com
HM70 Handheld Humidity and Temperature Meter
For spot-checking and field calibration

**Features**
- Designed for spot-checking and field calibration
- Multilingual user interface
- Shows measurement trends graphically
- Proven Vaisala HUMICAP® sensor technology
- 3 probe alternatives, temperature measurement range 
  −70 … +180 °C (−94 … +356 °F)
- 2 probes: also dew point and CO₂ probes can be connected simultaneously
- Displays various humidity parameters
- Sensor preheat and chemical purge options for demanding conditions
- Data can be logged and transferred to a PC via MI70 Link software
- 6-point traceable calibration (certificate included)

Vaisala HUMICAP® Handheld Humidity and Temperature Meter HM70 is designed for demanding humidity measurements in spot-checking applications. It is also ideal as an on-site calibrator for Vaisala’s fixed humidity instruments.

**Vaisala HUMICAP® technology**
HM70 incorporates the world-class HUMICAP® sensor, one of the most reliable and stable sensors on the market. The HUMICAP® sensor copes well with chemical interference and provides accuracy that lasts in demanding conditions.

**Chemical purge**
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**
HMP75 is a general purpose probe, whereas HMP76 is a long, stainless steel probe especially suitable for spot-checking in ducts. 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, HM70 supports the use of Vaisala’s dew point, carbon dioxide, and moisture in oil probes, allowing measurements in several multiparameter applications.

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

On-site calibration with HM70 Handheld Meter
**HMP75, HMP76, and HMP77 measurement performance**

**Relative humidity**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy: 1) 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 … 100 %RH</td>
<td>±1 %RH (0 … 90 %RH)</td>
</tr>
<tr>
<td></td>
<td>±1.7 %RH (90 … 100 %RH)</td>
</tr>
</tbody>
</table>

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

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

Typical long-term stability

Better than 1 %RH / year

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy at +20 °C (+68 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>−20 … +60 °C (+4 … +140 °F)</td>
<td>±0.2 °C (±0.36 °F), see the graph below</td>
</tr>
</tbody>
</table>

**Output parameters**

Dew point, frost point, absolute humidity, mixing ratio, wet bulb temperature, water content, vapor pressure, saturation vapor pressure, enthalpy, water activity

1) Including non-linearity, hysteresis, and repeatability.

2) Defined as ±2 standard deviation limits.

**Temperature measurement accuracy over temperature range**

**HMP75, HMP76, and HMP77 general specifications**

**Humidity sensor**

HUMICAP® 180R

HUMICAP® 180RC (chemical purge, sensor preheat)

**Temperature sensor**

Pt100 RTD Class F0.1 IEC 60751

**Operating temperature range for electronics**

−40 … +60 °C (−40 … +140 °F)

**Standard sensor protection**

- HMP75: Plastic grid
- HMP76: Sintered bronze filter
- HMP77: Grid with SS netting

**HMP75, HMP76, and HMP77 mechanical specifications**

**IP rating**

IP65 (NEMA 4)

**Housing material**

ABS/PC blend

**Probe material**

Stainless steel (AIS316L)

**Probe cable length (between indicator and probe handle)**

1.9 m (6.2 ft)

**Probe cable length of HMP77 (from handle to the root of probe)**

5.0 m (16 ft)

**Probe diameter**

12 mm (0.47 in)

**Weight**

- HMP75: 250 g (8.8 oz)
- HMP76: 350 g (12 oz)
- HMP77: 500 g (18 oz)

**M170 measurement indicator**

**Operating environment**

- Operating temperature: −10 … +40 °C (+14 … +104 °F)
- Operating humidity: 0 … 100 %RH, non-condensing
- Storage temperature: −40 … +70 °C (-40 … +158 °F)

**Inputs and outputs**

- Max. no of probes: 2
- PC interface: MI70 Link software with USB or serial port cable
- Analog output: 0 … 1 VDC
- Power supply: Rechargeable NiMH battery pack with AC adapter or 4 × AA size alkalines, type IEC LR6
- Output resolution: 0.6 mV
- Accuracy: 0.2 % full scale
- Temperature dependence: 0.002 %/˚C (0.01 %/˚F) full scale
- Minimum load resistor: 10 kΩ to ground

**Mechanical specifications**

- Housing classification: IP54
- Housing materials: ABS/PC blend
- Weight: 400 g (14 oz)

**EMC compliance**

EN 61326-1, portable equipment

**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 (0.63 in)

**Alarm**

Audible alarm function

**Data logging capacity**

2700 real time data points

**Logging interval**

1 s to 12 h

**Logging duration**

1 min ... memory full

**Resolution**

- 0.01 %RH, 0.01 °C/°F, 0.01 hPa, 0.01 aw, 10 ppm / 0.01 %CO₂
- 10 ppm / 0.01 %CO₂

**Battery operation time**

- Continuous use: 48 h typical at +20 °C (+68 °F)
- Data logging use: Up to a month

**Typical charging time**

4 hours
**MI70 battery operation time**

Typical charging time 4 hours

<table>
<thead>
<tr>
<th>Operation times</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous use</td>
<td>48 h typical at +20 °C (+68 °F)</td>
</tr>
<tr>
<td>Data logging use</td>
<td>Up to a month</td>
</tr>
</tbody>
</table>

**Spare parts and accessories**

**Cables**
- Analog output signal cable: 27168ZZ
- Connection cable for HMT310 series: DRW216050SP
- Connection cable for HMP55: 221801
- Connection cable for TMP110, HMD60 series, HMP60 and HMP110 series, HMKW90 series, HMIDW110 series, and GMW90 series: 219980SP
- 1-m (3.3-ft) flat extension cable for 219980SP: CBL2106495P
- Probe extension cable (10 m): 211307SP
- Connection cable for HMT330 and HMT120/130: 211359

**Carrying cases**
- Weatherproof carrying case for MI70 and short probe (HMP75/77): MI70CASE3
- Weatherproof carrying case for MI70 and long probe (HMP76): MI70CASE4
- Soft carrying case for MI70 and short probe (HMP75/77): MI70SOFTCASE

**Probe accessories**
- Plastic PC grid filter (HMP75): 6221
- Membrane filter (HMP75): 10159HM
- Sintered bronze filter (HMP75): DRW219687SP
- Plastic PPS grid filter (HMP76/77): DRW010276SP
- Sintered stainless steel filter (HMP76/77): HM47280SP
- Sintered bronze filter (HMP76 standard): DRW219878SP
- PPS grid with SS netting (HMP77 standard): DRW010281SP
- Probe holder (only for HMP76): HM36915

**Others**
- Measurement indicator MI70
- USB PC connection cable (for use with MI70 Link software): 219687
- Rechargeable battery for MI70: 26755

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1 Vaisala MI70 Link software for Windows is available at [www.vaisala.com/mi70link](http://www.vaisala.com/mi70link).

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**HMP77 probe dimensions in mm (inches)**

![HMP76 and HMP77 probe with cable, dimensions in mm (inches)](image)

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**VAISALA**

[www.vaisala.com](http://www.vaisala.com)
HM40 Series Handheld Humidity and Temperature Meter

Features

- Humidity measurement range 0 ... 100 %RH
- Temperature measurement ranges -40 ... +100 °C (-40 ... +212 °F), depending on probe model. The HM46 model 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)

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.

Benefits

- Compact, portable, and easy to use
- Versatile meter with wide measurement range and multiple calculated parameters
- Ideal for spot-checking in a wide variety of applications

Simple and Easy to Use

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, HM40 provides five calculated humidity parameters, all of which are available in metric and non-metric units. HM40 is powered by 2 AA batteries. An external USB-charger 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 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 another hand-held meter or Vaisala Humidity Calibrator HMK15. The indicator includes a calibration reminder function that can be activated by the user.

The Graph Clearly Indicates When Readings Have Stabilized.
HM40 Hand-Held Humidity and Temperature Meter Series

HM41 Technical Data

Humidity Measurement Accuracy (Including Non-linearity, Hysteresis, and Repeatability):

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Humidity Measurement Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 0 … +40 °C</td>
<td>±1.5 %RH (0 … 90 %RH)</td>
</tr>
<tr>
<td>At -10 … 0 °C and +40 … +60 °C</td>
<td>±2.5 %RH (90 … 100 %RH)</td>
</tr>
<tr>
<td>At -10 … 0 °C and +40 … +60 °C</td>
<td>±3.0 %RH (90 … 100 %RH)</td>
</tr>
<tr>
<td></td>
<td>±4.0 %RH (90 … 100 %RH)</td>
</tr>
</tbody>
</table>

Humidity sensor: HUMICAP* 180R

Temperature measurement range: -10 … +60 °C (-14 … +140 °F)

Temperature sensor: Pt1000 RTD Class F0.1 IEC 60751

Measurement probe: Interchangeable HMP113 probe

Probe material: PC/ABS plastic blend (white)

IP rating: IP54

Weight (with alkaline batteries): 230 g (8.1 oz)

Filter material: PC (glass-reinforced)

HM42 Technical Data

Humidity Measurement Accuracy (Including Non-linearity, Hysteresis, and Repeatability):

<table>
<thead>
<tr>
<th>Temperature Range</th>
<th>Humidity Measurement Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>At 0 … +40 °C</td>
<td>±1.5 %RH (0 … 90 %RH)</td>
</tr>
<tr>
<td>At -40 … 0 °C and +40 … +80 °C</td>
<td>±2.5 %RH (90 … 100 %RH)</td>
</tr>
<tr>
<td>At +80 … +100 °C</td>
<td>±3.0 %RH (90 … 100 %RH)</td>
</tr>
<tr>
<td></td>
<td>±4.0 %RH (90 … 100 %RH)</td>
</tr>
</tbody>
</table>

Humidity sensor: HUMICAP* 100R-Mini

Temperature measurement range: -40 … +100 °C (-40 … +212 °F)

Temperature sensor: Pt1000 RTD Class F0.3 IEC60751

Measurement probe: HM42PROBE

Probe head material: Stainless steel

IP rating: IP40 (probe), IP54 (indicator)

Weight (with alkaline batteries): 370 g (13.1 oz)

Filter material: Stainless steel and PTFE membrane

Probe cable length: 1500 mm (59 in)

Note: Not recommended for Td > 85 °C

Dimensions in mm:

- HM40: 232.5 mm x 72.5 mm x 13.5 mm
- HM41: 235 mm x 155 mm x 77.5 mm
- HM42: 366 mm x 24.5 mm x 232.5 mm
**HM45 Technical Data**

Humidity Measurement Accuracy (Including Non-linearity, Hysteresis, and Repeatability):

- **At 0 ... +40 °C**
  - ±1.5 %RH (0 ... 90 %RH)
  - ±2.5 %RH (90 ... 100 %RH)

- **At -40 ... 0 °C and +40 ... +60 °C**
  - ±3.0 %RH (0 ... 90 %RH)
  - ±4.0 %RH (90 ... 100 %RH)

Humidity sensor: Humicap® 180R

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

Temperature sensor: Pt1000 RTD Class F0.1 IEC 60751

Measurement probe: Interchangeable HMP113 with HMP40HANDLE

Probe material: PC/ABS plastic blend (white)

IP rating: IP54

Weight (with alkaline batteries): 330 g (11.6 oz)

Filter material: PC (glass-reinforced)

Probe cable length: 1200 mm (47 in)

---

**HM46 Technical Data**

Humidity Measurement Accuracy (Including Non-linearity, Hysteresis, and Repeatability):

- **At 0 ... +40 °C**
  - ±1.5 %RH (0 ... 90 %RH)
  - ±2.5 %RH (90 ... 100 %RH)

- **At -40 ... 0 °C and +40 ... +80 °C**
  - ±3.0 %RH (0 ... 90 %RH)
  - ±4.0 %RH (90 ... 100 %RH)

- **At +80 ... +100 °C**
  - ±4.0 %RH

Humidity sensor: Humicap® 180R

Temperature measurement range: -40 ... +100 °C (-40 ... +212 °F), short-term up to +180 °C (+356 °F)

Temperature sensor: Pt1000 RTD Class F0.1 IEC 60751

Measurement probe: HM46PROBE

Probe head material: Stainless steel, brass filter

IP rating: IP40 (probe), IP54 (indicator)

Weight (with alkaline batteries): 490 g (17.3 oz)

Filter material: Sintered brass

Probe cable length: 1500 mm (59 in)

*Not recommended for Td > 85 °C*
# HM40 Series Technical Data

## Measurement Performance

<table>
<thead>
<tr>
<th>Calculated parameters</th>
<th>Dew point, wet bulb temperature, absolute humidity, mixing ratio, enthalpy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative Humidity</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Measurement range</strong></td>
<td>0 ... 100 %RH</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±1.5 %RH (0 ... 90 %RH)</td>
</tr>
<tr>
<td><strong>(including non-linearity, hysteresis, and repeatability)</strong> for different models at 0 ... +40 °C (+32 ... +104 °F)</td>
<td>±2.5 %RH (90 ... 100 %RH)</td>
</tr>
<tr>
<td><strong>Factory calibration uncertainty at +20 °C (+68 °F):</strong></td>
<td>±2 %RH over 2 years</td>
</tr>
<tr>
<td>HM42 and HM46</td>
<td>±1.5 %RH</td>
</tr>
<tr>
<td>HM41 and HM45</td>
<td>±1.1 %RH (0 ... 90 %RH)</td>
</tr>
<tr>
<td><strong>Stability</strong></td>
<td>±1.8 %RH (90 ... 100 %RH)</td>
</tr>
<tr>
<td><strong>Humidity Measurement Response Time:</strong></td>
<td></td>
</tr>
<tr>
<td>(90 %) with plastic grid filter (HM41 and HM45)</td>
<td>17 s</td>
</tr>
<tr>
<td>(90 %) with membrane filter and steel grid (HM42)</td>
<td>26 s</td>
</tr>
<tr>
<td>(90 %) with brass sintered filter (HM46)</td>
<td>40 s</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy over temperature range:</strong></td>
<td></td>
</tr>
<tr>
<td>At 0 ... +40 °C (+32 ... +104 °F)</td>
<td>±0.2 °C (0.36 °F)</td>
</tr>
<tr>
<td>At -40 ... 0 °C and +40 ... +100 °C (-40 ... +32 °F and +104 ... +212 °F)</td>
<td>±0.4 °C (0.72 °F)</td>
</tr>
<tr>
<td><strong>Operating Environment</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td></td>
</tr>
<tr>
<td>Indicator</td>
<td>-10 ... +60 °C (+14 ... +140 °F)</td>
</tr>
<tr>
<td>Probe handle</td>
<td>-40 ... +60 °C (+40 ... +140 °F)</td>
</tr>
<tr>
<td>Probe head</td>
<td>Range -40 ... +180 °C (+40 ... +356 °F) See probe specifications</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-30 ... +70 °C (-22 ... +158 °F)</td>
</tr>
<tr>
<td><strong>EMC compliance</strong></td>
<td>EN61326-1, Portable Equipment</td>
</tr>
</tbody>
</table>

## Mechanical Specifications

<table>
<thead>
<tr>
<th>Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator body</td>
<td>PC/AABS blend, acrylic display lens</td>
</tr>
<tr>
<td>Probe holder</td>
<td>PC/AABS blend (gray)</td>
</tr>
<tr>
<td>Probe handle</td>
<td>PC/AABS blend (white), PC/AABS blend (gray, HM45) or PBT (gray, HM42/46)</td>
</tr>
<tr>
<td>HMP113 probe or probe measurement head</td>
<td>PC/AABS blend (white, HM41/45) or stainless steel (HM42/46)</td>
</tr>
<tr>
<td><strong>IP rating, HM40</strong></td>
<td>IP54</td>
</tr>
</tbody>
</table>

## Indicator

<table>
<thead>
<tr>
<th>Display</th>
<th>LCD (140 x 160 pixels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power-up time</td>
<td>&lt; 3 s</td>
</tr>
<tr>
<td>Batteries</td>
<td>2 x AA, 1.5 V</td>
</tr>
<tr>
<td>Operation time (typical)</td>
<td>100 hours (without backlight)</td>
</tr>
<tr>
<td>Menu languages</td>
<td>English, Chinese (simplified), Finnish, French, German, Japanese, Portuguese, Russian, Spanish, Swedish</td>
</tr>
</tbody>
</table>

## Spare Parts and Accessories

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Spare HM40 indicator HM40INDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery clip (3 pcs)</td>
<td>227710SP</td>
</tr>
<tr>
<td>Battery cover (3 pcs)</td>
<td>225688SP</td>
</tr>
<tr>
<td>NIMH rechargeable batteries (4 pcs)</td>
<td>229247SP</td>
</tr>
<tr>
<td>External battery charger with USB connection and 4 batteries</td>
<td>229249SP</td>
</tr>
<tr>
<td><strong>Case for short HM40 probes</strong></td>
<td>235849SP</td>
</tr>
<tr>
<td><strong>Case for long HM40 probes</strong></td>
<td>DRW242351SP</td>
</tr>
<tr>
<td><strong>Standard Probe (HM41)</strong></td>
<td></td>
</tr>
<tr>
<td>HMP113 probe for HM40</td>
<td>HMP113 (configuration: V00B2C1A0)</td>
</tr>
<tr>
<td>Plastic locking bushing (3 pcs) for attaching HMP113 probe to HM40 indicator</td>
<td>DRW238590SP</td>
</tr>
<tr>
<td>Plastic grid filter for HMP113 probe</td>
<td>DRW236214SP</td>
</tr>
<tr>
<td>Plastic grid with membrane filter for HMP113 probe</td>
<td>230727SP</td>
</tr>
<tr>
<td><strong>HM42 Probe (HM42)</strong></td>
<td></td>
</tr>
<tr>
<td>Thin 4 mm diameter probe for HM40</td>
<td>HM42PROBE</td>
</tr>
<tr>
<td>Steel grid filter for HM42PROBE</td>
<td>19867HM</td>
</tr>
<tr>
<td>Membrane tube set (5 pcs) for HM42PROBE</td>
<td>19858HM</td>
</tr>
<tr>
<td>Rubber sleeve set (10 pcs) for HM42PROBE</td>
<td>19809HM</td>
</tr>
<tr>
<td><strong>HMP113 probe for HM40</strong></td>
<td>HMP113 (configuration: V00B2C1A0)</td>
</tr>
<tr>
<td>Plastic locking bushing (3 pcs) for attaching HMP113 probe to HM40 indicator</td>
<td>DRW238590SP</td>
</tr>
<tr>
<td>Plastic grid filter for HMP113 probe</td>
<td>DRW236214SP</td>
</tr>
<tr>
<td>Plastic grid with membrane filter for HMP113 probe</td>
<td>230727SP</td>
</tr>
<tr>
<td><strong>HM46 Probe (HM46)</strong></td>
<td></td>
</tr>
<tr>
<td>Stainless steel 12 mm diameter probe for HM40</td>
<td>HM46PROBE</td>
</tr>
<tr>
<td>Sintered filter for HM46PROBE</td>
<td>0195</td>
</tr>
<tr>
<td>Optional membrane filter for HM46PROBE (up to +80 °C)</td>
<td>10159HM</td>
</tr>
<tr>
<td>Plastic grid filter for HM46PROBE (up to +80 °C)</td>
<td>6221</td>
</tr>
<tr>
<td>Disposable sleeve, 50 pcs set</td>
<td>1558</td>
</tr>
<tr>
<td>Probe holder</td>
<td>HM36915</td>
</tr>
</tbody>
</table>
Vaisala HUMICAP® Structural Humidity Measurement Kit SHM40 offers an easy and reliable solution for humidity measurements in concrete and other structures.

**Measuring Humidity Under the Surface**

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 HM40 indicator to read the measurement results.
Technical Data

**HMP40S Probe Measurement Performance**

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>Measurement range</th>
<th>0 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (incl. non-linearity, hysteresis, and repeatability) over temperature range:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 ... +40 °C</td>
<td>0 ... 90 %RH: ±1.5 %RH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>90 ... 100 %RH: ±2.5 %RH</td>
<td></td>
</tr>
<tr>
<td>−40 ... 0 °C and +40 ... +80 °C</td>
<td>0 ... 90 %RH: ±3.0 %RH</td>
<td></td>
</tr>
<tr>
<td></td>
<td>90 ... 100 %RH: ±4.0 %RH</td>
<td></td>
</tr>
<tr>
<td>Factory calibration uncertainty at +20 °C:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 ... 90 %RH</td>
<td>±1.1 %RH</td>
<td></td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±1.8 %RH</td>
<td></td>
</tr>
<tr>
<td>Humidity sensor</td>
<td>HUMICAP® 180R</td>
<td></td>
</tr>
<tr>
<td>Stability</td>
<td>±2 %RH over 2 years</td>
<td></td>
</tr>
</tbody>
</table>

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>−40 ... +80 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy over temperature range:</td>
<td></td>
</tr>
<tr>
<td>0 ... +40 °C</td>
<td>±0.2 °C</td>
</tr>
<tr>
<td>−40 ... 0 °C, +40 ... +80 °C</td>
<td>±0.4 °C</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt1000 RTD Class F0.1 IEC 60751</td>
</tr>
</tbody>
</table>

**HMP40S Probe Mechanical Specifications**

| 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 IP rating | IP65 |
| Borehole diameter needed | 16 mm |
| Measurement depth with standard accessories | Min. 30 mm, max. 90 mm |

**Operating Environment**

| Operating temperature range for probe | −40 ... +80 °C |
| Operating temperature range for indicator | −10 ... +60 °C |
| Storage temperature range | −30 ... +70 °C |

**HM40 Indicator Mechanical Specifications**

| Weight | 240 g |
| Indicator with adapter | 3.7 kg |
| SHM40 case with standard content | |
| Indicator materials | PC/ABS blend, acrylic display lens |
| Indicator adapter materials | Nickel plated brass and plastic overmolding |
| Indicator housing IP rating | IP54 |
| Mechanical drop endurance | 1.0 m without the probe |

**HM40 Indicator General Specifications**

| Power-up time | < 3 s |
| Alkaline batteries | 2 × AA size, 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 × 160 pixels) |
| Electromagnetic compatibility (EMC) | EN 61326-1, Portable equipment |

**Spare Parts and Accessories**

| 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 |
| Long (200 mm) plastic tube set (12 pcs) | 245789 |
| Rubber plugs (12 pcs) | 233976 |
| Protective cover with lid (3 pcs) | 19268HM |
| Weather-proof carrying case for SHM40 kit | CASEFORSHM40SP |
| 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 |
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 Vaisala Humidity Calibrator HMK15 to make calibration and spot checking of humidity probes and transmitters easy and reliable.

**Benefits**
- Easy to use
- Reliable calibration
- Certified and pre-measured salts available on order form of HMK15

**Method used by leading laboratories**

The operating principle of 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 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**

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).

**Features**
- 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

**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).
Technical data

Operating environment
Operating temperature range +0 ... +50 °C (+32 ... +122 °F)

Mechanical specifications
Dimensions (H × W × L) 90 × 230 × 200 mm (3.54 × 9.06 × 7.87 in)
Weight 1 kg (2.20 lb) without salt solutions
Material Anodized aluminum

Parts
Standard contents of HMK15 Calibrator
- Base plate
- Two salt chambers, chamber covers, and transit covers
- Thermometer
- Measurement cup and mixing spoon

Optional items
See table Spare parts and accessories.

Spare parts and accessories
Rubber plug set 19746HM
Salt chamber 19766HM
Ion exchanged water 19767HM
Adapter fitting for 12 mm probes 211302SP
Thermometer with red capillary liquid 25130HM
Transit bag HM27032
Cover set for DMT132/HMP110 with filter 230914
HMK15 chamber lid for 4 × HMP110 with filter 253277SP
Adapter for HMP42 probe HM37067

Certified and ready dosed salts
1)
- Ready-dosed LiCl salt package (LiCl salt 11 %RH, total uncertainty ±1.3 %RH) 2)
  19729HM
- Ready-dosed MgCl₂ salt package (MgCl₂ salt 33 %RH, total uncertainty ±1.2 %RH) 2)
  19730HM
- Ready-dosed NaCl salt package (NaCl salt 75 %RH, total uncertainty ±1.5 %RH) 2)
  19731HM
- Ready-dosed KCl salt package (KCl salt 85 %RH, total uncertainty ±2.0 %RH) 2)
  251377HM
- Ready-dosed K₂SO₄ salt package (K₂SO₄ salt 97 %RH, total uncertainty ±2.0 %RH) 2)
  19732HM

1) Calibration certificate included with each salt package.
2) Uncertainties given at +20 °C (+68 °F).
**HMP155 Humidity and Temperature Probe**

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

### Features

- Vaisala HUMICAP®180R sensor: superior long-term stability
- Optional warmed humidity probe and chemical purge
- Plug-and-play
- USB connection for service use
- Use with DTR13 and DTR503 radiation shields and 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

### Long-term stability

HMP155 uses 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 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 this patented, warmed probe for reliable measurements. 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 HMP155 is ideal for measuring in environments with changing temperatures. The membrane filter speeds up the relative humidity measurement.

### Long lifetime

Protecting the sensor from precipitation, and scattered and direct solar radiation increases its lifetime. Thus, Vaisala recommends installing HMP155 in one of the following radiation shields: DTR503, DTR13, or Stevenson screen. For the additional temperature probe, an installation kit is available for Vaisala DTR502 Radiation Shield.

### Calibration

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

Humidity measurement performance

Sensor
HUMICAP®180R and 180R2 for typical applications
HUMICAP®180C and 180R2C for applications with chemical purge and/or warmed probe

Observation range
0 … 100 %RH

Response time at +20 °C (+68 °F) in still air with sintered Teflon filter
63 %: 20 s
90 %: 60 s

Factory calibration uncertainty at +20 °C (+68 °F)\(^1\)
±0.6 %RH (0 … 40 %RH)
±1.0 %RH (40 … 95 %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 × reading) %RH

At −40 … +40 °C (−40 … +140 °F)
±(1.2 + 0.012 × reading) %RH

At −60 … +40 °C (−76 … +140 °F)
±(1.4 + 0.032 × reading) %RH

\(^1\) Defined as ±2 standard deviation limits. Small variations possible (see also the calibration certificate).

Temperature measurement performance

Sensor
Pt100 RTD element, Class F 0.1 IEC 60751

Observation range
−80 … +60 °C (−112 … +140 °F)

Response time for additional temperature probe in 3 m/s (7 mph) air flow
63 %: < 20 s
90 %: < 35 s

Other measured variables
Dew point / frost point temperature, wet bulb temperature, mixing ratio

Accuracy with voltage output
At +80 … +20 °C (+112 … +68 °F)
±(0.226 - 0.0028 × temperature) °C

At +20 … +60 °C (+68 … +140 °F)
±(0.055 + 0.0057 × temperature) °C

Accuracy with passive (resistive) output
According to Tolerance Class AA IEC 60751\(^1\)
±(0.1 + 0.0017 × |temperature|) °C

Accuracy with RS-485 output
At +80 … +20 °C (+112 … +68 °F)
±(0.176 - 0.0028 × temperature) °C

At +20 … +60 °C (+68 … +140 °F)
±(0.07 + 0.0025 × temperature) °C

\(^1\) Tolerance Class AA IEC 60751 corresponds to IEC 751 1/3 Class B

Operating environment

Operating temperature for humidity measurement
−80 … +60 °C (−112 … +140 °F)

Storage temperature
−80 … +60 °C (−112 … +140 °F)

Operating humidity
0 … 100 %RH

IP rating
IP66

EMC compatibility
IEC 61326-1, industrial environment
EN 55022

 Inputs and outputs

Operating voltage
7 … 28 VDC

Minimum operating voltage
0 … 1 V output or RS-485: 7 V
0 … 5 V output, or warmed probe: 12 V
0 … 10 V output, chemical purge, or XHEAT: 16 V

Outputs
Voltage output: 0 … 1 V, 0 … 5 V, 0 … 10 V
Resistive Pt100 4-wire connection RS-485

Average power consumption (+15 VDC, load 100 kΩ)
0 … 1 V output: < 3 mA
0 … 10 V output: +0.5 mA
RS-485: < 4 mA
During chemical purge: Maximum 110 mA
With warmed probe: Maximum 150 mA

Settling time at startup
Voltage output: 2 s
RS-485: 3 s

Mechanical specifications

Dimensions (H × W)
279 × 40 mm (10.9 × 1.6 in)

Weight
86 g (3.0 oz)

Length of additional T-probe cable
2 m (6 ft 7 in)

Connection
8-pin male M12 connector

Connection cables
3.5 m (11 ft 6 in), 10 m (32 ft 10 in),
30 m (98 ft 5 in)

Maximum wire size
0.129 mm\(^2\) (26 AWG)

Service cables
USB connection cable
MI70 connection cable

Materials
Filter
Sintered Teflon or membrane

Housing
Polycarbonate (PC)

Additional temperature probe
Stainless steel AISI 316L

Cable
PUR

Dimensions in mm (inches)

---

HMP155 accuracy over temperature range: voltage and RS-485

www.vaisala.com
DTR500 Solar Radiation and Precipitation Shields

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

**Sensor Protection**

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, and the black inside absorbs accumulated heat. The shields can be easily installed on a vertical pole, horizontal beam, or flat surface.

The DTR Shields can be used with the following Vaisala products:

- **DTR502(A)** with adapter 221072:
  - Vaisala HUMICAP® Humidity and Temperature Probe HMP155’s additional temperature sensor
- **DTR503(A):**
  - Vaisala HUMICAP® Humidity and Temperature Transmitters HMT333, HMT337, HMT363, and HMT367
  - Vaisala HUMICAP® Humidity and Temperature Probe HMP7
  - Vaisala Combined Pressure, Humidity and Temperature Transmitters PTU303 and PTU307
- **DTR504(A):**
  - Vaisala HUMICAP® Humidity and Temperature Transmitters HMT120/130
  - Vaisala HUMICAP® Humidity and Temperature Probe HMP110
  - Vaisala INTERCAP® Humidity and Temperature Probe HMP60

**Features**

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

### DTR502B for HMT333, HMT337, HMT363, HMT367, HMP7, PTU303, and PTU307

<table>
<thead>
<tr>
<th>Dimensions (H × W)</th>
<th>200 × 105 mm (7.87 × 4.13 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td>Product specific adapter</td>
</tr>
</tbody>
</table>

### DTR504 for HMT120/130 remote probes, HMP110, and HMP60

<table>
<thead>
<tr>
<th>Dimensions (H × W)</th>
<th>141 × 105 mm (5.55 × 4.13 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td>Horizontal beam assembly</td>
</tr>
<tr>
<td></td>
<td>Pole mast installation kit</td>
</tr>
</tbody>
</table>

### DTR503A for HMP155

<table>
<thead>
<tr>
<th>Dimensions (H × W)</th>
<th>266 × 105 mm (10.47 × 4.13 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessories</td>
<td>Horizontal beam assembly</td>
</tr>
<tr>
<td></td>
<td>Pole mast installation kit</td>
</tr>
</tbody>
</table>

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**VAISALA**

www.vaisala.com
HMT330MIK Meteorological Installation Kit

HMT330MIK 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.

**Vaisala Meteorological Installation Kit HMT330MIK enables 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 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, and the transmitter calculates the relative humidity from the dew point and temperature values.

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.

**Open Shield Prevents Microclimates**
The warmed probe of 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.

**Features**
- 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 HM70 hand-held meter

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.
Technical Data

Dimensions in mm (inches)

When Static Pressure Head (SPH10/20) is in use, the transmitter has to be installed to the pole mast. An airtight connection between the transmitter and the Static Pressure Head is made with a pressure hose. To prevent the condensed water from blocking the hose as it freezes, make sure that the hose won’t hang loose.

Order form

VAISALA
www.vaisala.com
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 (not included in the HMT300TMK).

HMT300TMK 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**
HMT300TMK, with 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**
HMT300TMK includes a white, painted stainless steel enclosure with an installation kit for the probe. 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 sunlight 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.

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

**HUMICAP® Performance**
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**
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

Measurement Performance

Dew point 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) 20 s
in still air (PPS grid with steel netting)

Inputs and Outputs

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

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 RS-232C (optional RS-485)

Recommended external load for current outputs < 500 Ω

For 0 ... 1 V output > 2 kΩ (to ground)

For 0 ... 5 and 0 ... 10 V outputs > 10 kΩ (to ground)

Mechanical Specifications

Connections Screw terminals for 0.5 mm² wires (AWG 20), stranded wires recommended

Housing material G-AlSi10 (DIN 1725)

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

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

Weight

HMT300TMK with HMT337 8.7 kg (19.2 lb)

HMT300TMK with HMT337, packed in a wooden shipping box 13.3 kg (29.3 lb)

Compliance

IP rating IP65

NEMA rating NEMA 4

Operating Environment

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

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

EMC compliance EN61326-1, Industrial Environment

Dimensions in mm (inches)
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 in dry environments. 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 such as plastic drying, baking ovens, and food drying. It is also controlled in compressed air, where excess moisture can result in poor end-product quality, ice formation, and equipment corrosion.

Other typical applications include medical gas, dry environments in lithium battery manufacturing, and gas-insulated high-voltage equipment used in the power industry.

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
Vaisala DRYCAP humidity 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 handheld meters for spot checking. Portable sampling systems are also available. View the complete range of dew point products at www.vaisala.com/dewpoint.

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.

Structure of the DRYCAP sensor

www.vaisala.com
DMP5 Dew Point and Temperature Probe
For high-temperature applications

Features

• Measures humidity at temperatures up to +180 °C (+356 °F)
• Dew point measurement range −40 ... +100 °C (−40 ... +212 °F) $T_d/f$
• Dew point measurement accuracy up to ±2 °C (±3.6 °F) $T_d/f$
• Sensor purge provides superior chemical resistance
• Condensation-tolerant
• Modbus RTU over RS-485
• Compatible with Indigo transmitters and Insight PC software
• Traceable calibration certificate

Vaisala DRYCAP® Dew Point and Temperature Probe DMP5 is designed for humidity measurement in applications with high temperatures. The long and robust steel probe and an optional installation flange allow easy installation with adjustable depth through insulation, for example, in ovens.

Measure Humidity Directly in Hot Processes

DMP5 is built for direct measurement in hot and dry processes, up to +180 °C (+356 °F). As the probe can be directly placed in the process, there is no need for a sampling system or trace heating. As a result, high measurement accuracy and constancy are maintained. DMP5 provides unmatched dry-end measurement accuracy at temperatures up to 140 °C; however, it can operate safely at temperatures up to 180 °C. DMP5 incorporates the Vaisala DRYCAP® sensor, which is accurate, reliable, and stable. The sensor is condensation-tolerant and is immune to particulate contamination, oil vapor, and most chemicals. Sensor warming minimizes the risk of condensation accumulating on the sensor. If the DRYCAP® sensor does get wet, it will rapidly dry and recover its swift response time. In low humidity conditions the sensor will auto-calibrate to ensure accurate measurement.

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.

Services you can count on

Each probe is manufactured and individually calibrated in Vaisala’s world-class facility in Finland. The traceable factory calibration certificate is included also in electronic format in the probe. The interchangeable probes minimize the downtime associated with maintenance. Validate and maintain the accuracy by calibrating the instrument on the field or use the easy and thorough calibration service in Vaisala’s service facilities in Helsinki, Boston, Beijing and Tokyo.
Technical Data

**Measurement performance**

**Dew point**

- **Sensor**: DRYCAP® 180S
- **Measurement range**: −40 ... +100 °C (−40 ... +212 °F) Td/f
- **Accuracy**: ±2 °C (±3.6 °F) Td/f
  
  See accuracy graph
- **Response time**: 63% [90%] 1)  
  - From dry to wet: 5 s [10 s]
  - From wet to dry: 45 s [5 min]

**Temperature**

- **Measurement range**: 0 ... +180 °C (+32 ... +356 °F) 2)
- **Accuracy**: ±0.4 °C (±0.72 °F)
- **Temperature sensor**: Pt100 RTD Class F0.1 IEC 60751

**Mixing ratio**

- **Measurement range (typical)**: 0 ... 1000 g/kg (0 ... 7000 gr/lbs)
- **Accuracy (typical)**: ±12 % of reading

**Absolute humidity**

- **Measurement range**: 0 ... 600 g/m³
- **Accuracy**: ±10 % of reading (typical)

1) Tested with sintered filter.
2) If sensor warming is enabled; temperature measurement is locked when humidity rises above 80 %RH and warming is switched on.

**Dew point accuracy vs. measurement conditions**

**Inputs and outputs**

- **Operating voltage**: 15 ... 30 VDC
- **Current consumption**: 10 mA typical, 500 mA max.
- **Digital output**: RS-485, non-isolated
- **Protocols**: Modbus RTU

**Output parameters**

Relative humidity, temperature, dew point temperature, absolute humidity, mixing ratio, water concentration, water vapor pressure, water vapor saturation pressure, enthalpy

**Operating environment**

- **Operating temperature range for probe head**: −40 ... +180 °C (−40 ... +356 °F)
- **Operating temperature range for probe body**: −40 ... +80 °C (−40 ... +176 °F)
- **Storage temperature**: −40 ... +80 °C (−40 ... +176 °F)
- **Measurement environment**: For air, nitrogen, hydrogen, argon, helium, and oxygen 1)
- **IP rating for probe body**: IP66
- **EMC compliance**: EN61326-1, Industrial environment

1) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.

**Mechanical specifications**

- **Connector**: M12 5-pin A-coded male
- **Weight**: 436 g (15.37 oz)
- **Probe cable length**: 2 m (6.56 ft) or 10 m (32.8 ft)
- **Materials**
  - **Probe**: AISI316L
  - **Probe body**: AISI316L
  - **Cable jacket**: FEP

**DMP5 dimensions**

**Accessories**

- **Mounting flange**: 210696
- **USB PC connection cable** 1): 242659

1) Vaisala Insight software for Windows available at www.vaisala.com/insight

www.vaisala.com
**VAISALA**

**DMP6 Dew Point Probe**
For very high-temperature applications

**Features**

- Measures humidity at high temperatures up to +350 °C (+662 °F)
- Dew point measurement range -25 ... +100 °C (-13 ... +212 °F) T_d/f
- Dew point measurement accuracy up to ±2 °C (±3.6 °F) T_d/f
- Sensor purge provides superior chemical resistance
- Condensation-tolerant
- Modbus RTU over RS-485
- Compatible with Indigo transmitters and Insight PC software
- Traceable calibration certificate

Vaisala DRYCAP® Dew Point Probe DMP6 is designed for humidity measurement in industrial applications with very high temperatures. High temperature tolerance is achieved using a passive cooling set that conducts heat away from the probe and reduces temperature to optimal range for the sensor.

**Measure Humidity Directly in Very Hot Processes**

DMP6 is built for direct measurement in temperature range 0 ... +350 °C (+32 ... +662 °F). There is no need for a sampling system or trace heating. To tolerate these high temperatures the probe head is inserted inside a cooling set that provides passive cooling. The cooling set has removable cooling fins that allow the operating temperature profile of the probe to be adjusted so that adequate cooling is provided for each application. 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.

DMP6 incorporates the Vaisala DRYCAP® sensor, which is accurate, reliable, and stable. The sensor is condensation-tolerant and is immune to particulate contamination, oil vapor, and most chemicals. Sensor warming minimizes the risk of condensation accumulating on the sensor. If the DRYCAP® sensor does get wet, it will rapidly dry and recover its swift response time.

**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.

**Services you can count on**

Each probe is manufactured and individually calibrated in Vaisala’s world-class facility in Finland. The traceable factory calibration certificate is included also in electronic format in the probe. The interchangeable probes minimize the downtime associated with maintenance. Validate and maintain the accuracy by calibrating the instrument on the field or use the easy and thorough calibration service in Vaisala’s service facilities in Helsinki, Boston, Beijing and Tokyo.
**Technical Data**

**Measurement performance**

**Dew point**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>DRYCAP® 180S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>−25 ... +100 °C (−13 ... +212 °F) Td/f</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±2 °C (±3.6 °F) Td/f</td>
</tr>
</tbody>
</table>

Response time 63% [90%]
- From dry to wet: 5 s [10 s]
- From wet to dry: 45 s [5 min]

**Mixing ratio**

<table>
<thead>
<tr>
<th>Measurement range (typical)</th>
<th>0 ... 1000 g/kg (0 ... 7000 gr/lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (typical)</td>
<td>±12 % of reading</td>
</tr>
</tbody>
</table>

**Operating environment**

- **Operating temperature range of probe head:** 0 ... +350 °C (+32 ... +662 °F)
- **Operating temperature range of probe body:** −40 ... +80 °C (−40 ... +176 °F)
- **Storage temperature:** −40 ... +80 °C (−40 ... +176 °F)
- **Measurement environment:** For air, nitrogen, hydrogen, argon, helium, and oxygen

**IP rating:** IP66

**EMC compliance:** EN61326-1, Industrial environment

1) Installation of cooling fins on the cooling set affects the operating temperature range. See the operating range graph.

2) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.

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**Inputs and outputs**

- **Operating voltage:** 15 ... 30 VDC
- **Current consumption:** 10 mA typical, 500 mA max.
- **Digital output:** RS-485, non-isolated
- **Protocols:** Modbus RTU

**Output parameters**

- Dew point temperature, mixing ratio, water concentration, water vapor pressure, water mass fraction

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**DMP6 dimensions with Cooling Set DMP246CS**

- **Cooling set DMP246CS**
- **USB PC connection cable:** 1) 242659

1) Vaisala Insight software for Windows available at www.vaisala.com/insight

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**Mechanical specifications**

<table>
<thead>
<tr>
<th>Connector</th>
<th>MI2 5-pin A-coded male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe weight</td>
<td>500 g (110 lb)</td>
</tr>
<tr>
<td>Cooling set weight</td>
<td>3.50 kg (7.72 lb)</td>
</tr>
<tr>
<td>Probe cable length</td>
<td>2 m (6.56 ft)</td>
</tr>
</tbody>
</table>

**Materials**

- **Probe:** AISI316L
- **Probe body:** AISI316L
- **Cable jacket:** FEP
- **Cooling set:** Stainless steel and aluminum

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**Accessories**

- **Cooling set:** DMP246CS
- **USB PC connection cable:** 1) 242659

1) Vaisala Insight software for Windows available at www.vaisala.com/insight

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**VAISALA**

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114
VAISALA

DMP7 Dew Point and Temperature Probe
For installations in tight spaces

Features

• Dew point measurement range −70 ... +80 °C (−94 ... +176 °F) T

• Dew point measurement accuracy up to ±2 °C (±3.6 °F) T

• Sensor purge provides superior chemical resistance

• Tolerates condensation, oils, dust, and most chemicals

• Modbus RTU over RS-485

• Compatible with Indigo transmitters and Insight PC software

• Traceable calibration certificate

Vaisala DRYCAP® Dew Point and Temperature Probe DMP7 is designed for low-humidity applications. Thanks to its short probe length, it fits in installations with limited space such as semiconductor manufacturing equipment. Other applications include industrial drying, compressed air systems, dry rooms, and blanket gases in metal heat treatment.

Stability at low dew points

Vaisala DRYCAP® sensor is immune to particulate contamination, water condensation, oil vapor, and most chemicals. The sensor tolerates condensation and recovers perfectly if exposed to liquid water. Fast reaction time and stability make its performance unmatched also in dynamic and low dew point applications.

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.

Pressure-Tight Installation

Optional pressure-tight Swagelok fitting is available for DMP7. When installed using the fitting DMP7 is suitable for installations with pressure in range 0 ... 10 bar (0 ... 145 psia).

Flexible connectivity

The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus. For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.
# Technical Data

## Measurement performance

**Dew point**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>DRYCAP® 180M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>−70 ... +80 °C (−94 ... +176 °F) Td/f</td>
</tr>
<tr>
<td>Measurement range for continuous use</td>
<td>−70 ... +45 °C (−94 ... +113 °F) Td/f</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Up to ±2 °C (±3.6 °F) Td/f</td>
</tr>
<tr>
<td>See accuracy graph</td>
<td></td>
</tr>
</tbody>
</table>

Response time 63 % [90 %] ¹)

- From dry to wet: 5 s [5.1 s]
- From wet to dry: 45 s [8 min]

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... +80 °C (+32 ... +176 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±0.2 °C at room temperature</td>
</tr>
</tbody>
</table>

**Relative humidity**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 70 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±0.004 %RH + 20% of reading</td>
</tr>
</tbody>
</table>

**Concentration by volume (ppm)**

<table>
<thead>
<tr>
<th>Measurement range (typical)</th>
<th>10 ... 2500 ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>1 ppm + 20% of reading</td>
</tr>
</tbody>
</table>

¹) Tested with sintered filter.

### Operating point accuracy vs. measurement conditions

### Operating environment

- Operating temperature for probe head: −40 ... +80 °C (−40 ... +176 °F)
- Operating temperature for probe body: −40 ... +80 °C (−40 ... +176 °F)
- Storage temperature: −40 ... +80 °C (−40 ... +176 °F)
- Operating pressure for probe head: 0 ... 10 bar (0 ... 145 psia)
- Measurement environment: For air, nitrogen, hydrogen, argon, helium, oxygen ¹), and vacuum

**IP rating for probe body**: IP66

**EMC compatibility**: EN61326-1, Industrial environment

**Mechanical durability of probe head**: Up to +180 °C (+356 °F)

**Accessories**

- Swagelok ISO 3/8”: SWG12ISO38
- Swagelok ISO 1/2”: SWG12ISO12
- Swagelok NPT 1/2”: SWG12NPT12
- USB PC connection cable ¹): 242659

¹) Vaisala Insight software for Windows available at www.vaisala.com/insight

## Inputs and outputs

- **Operating voltage**: 15 ... 30 VDC
- **Current consumption**: 10 mA typical, 500 mA max.
- **Digital output**: RS-485, non-isolated
- **Protocols**: Modbus RTU

### Output parameters

- Relative humidity, temperature, dew point temperature, absolute humidity, mixing ratio, water concentration, water vapor pressure, water vapor saturation pressure, enthalpy

## Mechanical specifications

- **Connector**: M12 5-pin A-coded male
- **Weight**: 310 g (10.9 oz) with 2 m (6.56 ft) cable
- **Probe cable length**: 2 m (6.56 ft) or 10 m (32.8 ft)
- **Materials**: Probe AISI316L

# Accessories

- Swagelok ISO 3/8”
- Swagelok ISO 1/2”
- Swagelok NPT 1/2”
- USB PC connection cable ¹)

¹) Vaisala Insight software for Windows available at www.vaisala.com/insight

**VAISALA**

www.vaisala.com

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DMP8 Dew Point and Temperature Probe
For pressurized pipelines

Vaisala DRYCAP® Dew Point and Temperature Probe DMP8 is designed for industrial low-humidity applications such as industrial drying, compressed air systems, and semiconductor industry. It can be installed in a 1/2” NPT or ISO thread with adjustable insertion depth.

**Stability at Low Dew Points**
The Vaisala DRYCAP® sensor is immune to particulate contamination, water condensation, oil vapor, and most chemicals. The sensor tolerates condensation and recovers perfectly if exposed to liquid water. Fast reaction time and stability make its performance unmatched also in dynamic and low dew point applications. Outstanding stability provides a long calibration interval.

**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.

**Easy Installation**
Thanks to its sliding sealing, it is easy to adjust the installation depth of the DMP8 probe head.

An optional ball-valve installation kit allows for inserting or detaching the probe from a pressurized line.

**Flexible connectivity**
The probe is compatible with Vaisala Indigo series of transmitters, and it can be used as a standalone digital Modbus RTU transmitter over RS-485 serial bus.

For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight software for Windows®. For more information, see www.vaisala.com/insight.

---

**Features**

- Dew point measurement range -70 ... +80 °C (−94 ... +176 °F) T<sub>d/f</sub>
- Dew point measurement accuracy up to ±2 °C (±3.6 °F) T<sub>d/f</sub>
- Operating pressure of probe head 0 ... 4 MPa (0 ... 40 bar)
- Adjustable installation depth
- Tolerates condensation, oils, dust, and most chemicals
- Sensor purge provides superior chemical resistance
- Modbus RTU over RS-485
- Compatible with Indigo transmitters and Insight PC software
- Traceable calibration certificate
Technical Data

Measurement performance

**Dew point**

- **Sensor:** DRYCAP® 180M
- **Measurement range:** -70 ... +80 °C (-94 ... +176 °F) Td/f
- **Measurement range for continuous use:** -70 ... +45 °C (-94 ... +113 °F) Td/f
- **Accuracy:** ±2 °C/±3.6 °F Td/f [See accuracy graph]
- **Response time:**
  - From dry to wet: 5 s [35 s]
  - From wet to dry: 45 s [8 min]

**Temperature**

- **Measurement range:** 0 ... +80 °C (+32 ... +176 °F)
- **Accuracy:** ±0.2 °C at room temperature
- **Temperature sensor:** Pt100 RTD Class F0.1 IEC 60751

**Relative humidity**

- **Measurement range:** 0 ... 70 %RH
- **Accuracy:** ≤±0.004 %RH + 20% of reading
  - (RH <10 %RH, at + 20 °C)

**Concentration by volume (ppm)**

- **Measurement range (typical):** 10 ... 2500 ppm
- **Accuracy:** 1 ppm + 20% of reading

**Response time**

63 % [90 %] 1)
- From dry to wet: 5 s [35 s]
- From wet to dry: 45 s [8 min]

1) Tested with sintered filter.

**Inputs and outputs**

- **Operating voltage:** 15 ... 30 VDC
- **Current consumption:** 10 mA typical, 500 mA max.
- **Digital output:** RS-485, non-isolated
- **Protocols:** Modbus RTU
- **Output parameters:** Relative humidity, temperature, dew point temperature, absolute humidity, mixing ratio, water concentration, water vapor pressure, water vapor saturation pressure, enthalpy

**Operating environment**

- **Operating temperature for probe head:** -40 ... +80 °C (-40 ... +176 °F)
- **Operating temperature for probe body:** -40 ... +80 °C (-40 ... +176 °F)
- **Storage temperature:** -40 ... +80 °C (-40 ... +176 °F)
- **Operating pressure for probe head:** 0 ... 40 bar (0 ... 580 psia)
- **Measurement environment:** For air, nitrogen, hydrogen, argon, helium, oxygen 1), and vacuum
- **IP rating:** IP66
- **EMC compatibility:** EN61326-1, Industrial environment
- **Mechanical durability of probe head:** Up to +180 °C (+356 °F)
- **Up to 70 bar/1015 psia**

1) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.

**Dew point accuracy vs. measurement conditions**

**Operating environment**

**Dew point accuracy vs. measurement conditions**

**Inputs and outputs**

- **Accessories**
  - **Fitting body R 1/2” ISO with leak screw:** ISOFITBODASP
  - **Fitting body R 1/2” ISO (no leak screw):** DRW22076SP
  - **Fitting body NPT1/2” (no leak screw):** NPTFITBODASP
  - **Sampling cell:** DMT242SC
  - **Sampling cell with Swagelok connectors:** DMT242SC2
  - **Ball valve set for pressurized pipelines:** BALLVALVE-1
  - **Duct installation flange for R1/2” ISO thread:** DM240FASP
  - **Thread adapter ISO 1/2” to NPT 1/2”:** 210662SP
  - **Blind plug ISO 1/2”:** 218773
  - **USB PC connection cable:** 242659

1) Vaisala Insight software for Windows available at www.vaisala.com/insight

**Mechanical specifications**

- **Connector:** M12 5-pin A-coded male
- **Weight:** 512 g (18.1 oz)
- **Probe cable length:** 2 m (6.56 ft)
- **Materials**
  - **Probe:** AISI316L
  - **Probe body:** AISI316L
  - **Cable jacket:** FEP

**DMP8 dimensions**

**Measurements**

- **Temperature of measured gas (°C)**
- **Dew point temperature (°C)**
- **Water vapor saturation line**

**Accuracy**

- **±2 °C Td/f**
- **±3 °C Td/f**

**Accessories**

- **Ball valve set for pressurized pipelines:** BALLVALVE-1
- **Duct installation flange for R1/2” ISO thread:** DM240FASP
- **Thread adapter ISO 1/2” to NPT 1/2”:** 210662SP
- **Blind plug ISO 1/2”:** 218773
- **USB PC connection cable:** 242659
DMT340 Series Dew Point and Temperature Transmitters
For very dry conditions

Vaisala DRYCAP® Dew Point and Temperature Transmitter Series DMT340 is designed for industrial low-humidity applications such as industrial drying, compressed air systems, semiconductor industry, dry rooms, baking ovens, and metal heat treatment.

Features

• Measures dew point from -70 ... +80 °C (-94 ... +176 °F) with an accuracy of ±2 °C (±3.6 °F)
• Condensation-resistant
• Unique auto-calibration feature maintains accuracy over long term
• Compatible with Vaisala DRYCAP® Handheld Dew Point Meter DM70
• Traceable calibration to measurements and analog outputs (certificates included)
• Graphical display and keypad for convenient operation
• Optional alarm relays and mains power supply module
• Up to three analog outputs, RS-232/485, LAN
• Modbus protocol support (RTU/TCP)

Vaisala DRYCAP® Sensor Benefits

• Accurate and reliable measurement
• Excellent long-term stability
• Fast response time
• Resistant to environmental factors and condensation

Stability at Low Dew Points

The Vaisala DRYCAP® sensor is immune to particulate contamination, water condensation, oil vapor, and most chemicals. The sensor is condensation resistant and recovers perfectly if exposed to liquid water. Fast reaction time and stability make its performance unmatched also in dynamic and low dew point applications.

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.

Versatile Outputs and Data Collection

The DMT340 can support up to three isolated analog outputs. Optional AC mains power and relay outputs are also available.
In addition to the analog outputs, the DMT340 supports Modbus RTU and TCP/IP communication protocol. The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over 4 years. The display alarm allows tracking of any measured parameter, with freely configurable low and high limits. 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 LAN interface, which enables an Ethernet connection. A USB service cable makes it easy to connect the DMT340 to a PC via the service port for modifying settings or reading logged data.

**Easy Installation**

With multiple options to choose from, the instrument can be tailored to meet the specific needs of each individual application and is delivered installation-ready and pre-configured for each delivery. Quick delivery time and global service network make DMT340 a perfect choice for any project.

The Vaisala DRYCAP® Handheld Dew Point Meter DM70 is ideal for field checking DMT340 transmitters.

<table>
<thead>
<tr>
<th></th>
<th>DMT342</th>
<th>DMT344</th>
<th>DMT347</th>
<th>DMT348</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>0 ... 50 bar/0 ... 725 psia</td>
<td>0 ... 50 bar/0 ... 725 psia</td>
<td>0 ... 10 bar/0 ... 145 psia</td>
<td>0 ... 40 bar/0 ... 580 psia</td>
</tr>
<tr>
<td>Mechanical durability</td>
<td>Up to 250 bar/3625 psia</td>
<td>Up to 100 bar/1450 psia</td>
<td>Up to 10 bar/145 psia</td>
<td>Up to 70 bar/1015 psia</td>
</tr>
<tr>
<td>Probe diameter</td>
<td>12 mm/0.5 in</td>
<td>12 mm/0.5 in</td>
<td>12 mm/0.5 in</td>
<td>12 mm/0.5 in</td>
</tr>
<tr>
<td>Installation</td>
<td>Flange 36 mm/1.4 in</td>
<td>Fitting body M22 x 1.5</td>
<td>Fitting body R 3/8 in ISO</td>
<td>Fitting body R1/2 in ISO</td>
</tr>
<tr>
<td></td>
<td>Fitting body NPT 1/2 in</td>
<td>Fitting body G 1/2 in ISO</td>
<td>Fitting body NPT 1/2 in</td>
<td></td>
</tr>
<tr>
<td>Ball-valve set</td>
<td>BALLVALVE-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sampling cell</td>
<td>HMP302SC</td>
<td></td>
<td>DMT242SC or DMT242SC2</td>
<td></td>
</tr>
</tbody>
</table>
DMT340 Series Dew Point and Temperature Transmitters for Very Dry Conditions

**DMT341 for Installations in Dry Spaces**

DMT341 display shows measurement trends, real-time data, and measurement history. 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.

**DMT342 with Small Size Flanged Probe**

The DMT342 probe is installed using a flange or sampling cell. The small probe is ideal for integration into larger equipment or applications with high pressures.
DMT344 with Probe for High Pressures

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.

DMT347 with Small-Sized Probe

The DMT347 probe is ideal for pressurized or vacuum applications in tight spaces. The small probe is installed using Swagelok® connectors.

DMT348 with Probe for Pipeline Installations

The DMT348 is ideal for installation into pressurized or vacuum processes where the probe needs to be able to be removed while the process is running. The probe depth is adjustable.

Optional filter for low pressures, suitable for all models, dimensions in mm (inches). Optional filter provides faster gas exchange to the sensor in applications where protection from particulates is not needed.
DMT340 Series Technical Data

Measurement Performance

Dew Point
Sensor
Vaisala DRYCAP® 180M
Measurement range
-70 ... +80 °C (-94 ... +176 °F) Td
Measurement range for continuous use
-70 ... +45 °C (-94 ... +113 °F) Td
Accuracy up to 20 bar/290 psia
±2 °C/±3.6 °F (see the accuracy graph below)
Accuracy, 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
163 [T90] response times at 20 °C and 1 l/min flow:
-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
±0.2 °C at room temperature
Temperature sensor
Pt100 RTD Class F0.1 IEC 60751

Relative Humidity
Measurement range
0 ... 70 %RH
Accuracy
±0.004 %RH + 20% of reading

Concentration by Volume (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

Dew Point Accuracy vs. Measurement Conditions

Dew Point Measurement Temperature (°C)
Temperature of measured gas (°C)
0 10 20 30 40 50 60 70 80
-60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60 70 80
Water vapor saturation line
Dew point measurement lower limit
Accuracy ±3 °C Td
Accuracy not specified
Dew point
Not recommended area for continuous measurement

Operating Environment
Operating temperature for probes
-40 ... +80 °C (-40 ... +176 °F)
Mechanical durability
Up to +180 °C (+356 °F)
Mechanical durability of transmitter body
40 ... + 60 °C (-40 ... +140 °F)
Mechanical durability 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 Ω is used in IEC60000-4-5 (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 (Uin 24VDC)
RS-232
Max. 25 mA
Uout 2 x 0 ... 1V / 0 ... 5 V / 0 ... 10 V
Max. 25 mA
Iout 2 x 0 ... 20 mA
Max. 60 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 ... 1V, 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
RL < 500 Ω
0 ... 1 V output
RL > 2 kΩ
0 ... 5 V and 0 ... 10V outputs
RL > 10 kΩ

Wire size
0.5 ... 2.5 mm² (AWG 20 ... 14)
stranded wires recommended

Digital outputs
RS-232, RS-485 (optional)
Protocols
ASCII commands, Modbus RTU
Service connection
RS-232, USB
Relay outputs
0.5 A, 250 VAC, SPDT (optional)

Ethernet Interface (Optional)
Supported standards
10BASE-T, 100BASE-TX
Connector
8P8C (RJ45)
IPv4 address assignment
DHCP (automatic), static
Protocols
Telnet, Modbus TCP/IP

Optional Data Logger with Real-time Clock
Logged parameters
Max. three with trend/min./max. values
Logging interval
10 sec (fixed)
Max. logging period with max. temporal resolution
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

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**Mechanical Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable bushing</td>
<td>M20 x 1.5 for cable diameter 8 … 11 mm/0.31 … 0.43 in</td>
</tr>
<tr>
<td>Conduit fitting</td>
<td>1/2” NPT</td>
</tr>
<tr>
<td>User cable connector (optional)</td>
<td>M12 series 8-pin (male)</td>
</tr>
<tr>
<td>Option 1</td>
<td>Female plug with 5 m (16.4 ft) black cable</td>
</tr>
<tr>
<td>Option 2</td>
<td>Female plug with screw terminals</td>
</tr>
<tr>
<td>USB-RJ45 Serial Connection Cable</td>
<td>219685</td>
</tr>
<tr>
<td>Probe cable diameter</td>
<td>5.5 mm (0.22 in)</td>
</tr>
<tr>
<td>Standard probe cable lengths</td>
<td>2 m, 5 m, or 10 m (6.6 ft, 16 ft, or 33 ft)</td>
</tr>
<tr>
<td>Housing material</td>
<td>G-AlSi 10 Mg (DIN 1725)</td>
</tr>
<tr>
<td>Housing classification</td>
<td>IP66</td>
</tr>
<tr>
<td>IP65 (NEMA4X) with local display</td>
<td></td>
</tr>
<tr>
<td>Weight (depending on selected probe, cable, and modules)</td>
<td>1.0 … 3.0 kg (2.2 … 6.6 lb)</td>
</tr>
</tbody>
</table>

Dimensions in mm (inches)
DMT345 and DMT346 Dew Point Transmitters
For high-temperature applications

Features

• DMT345 measures humidity at temperatures up to 180 °C (356 °F)
• DMT346 measures humidity at temperatures up to 350 °C (+662 °F)
• Dew point accuracy ±2 °C (±3.6 °F)
• Condensation-resistant
• Unique auto-calibration feature
• Analog outputs, RS-232/485, WLAN/LAN
• Modbus protocol support (RTU/TCP)

Vaisala DRYCAP® Dewpoint Transmitters DMT345 and DMT346 are designed for humidity measurement in industrial drying applications with particularly high temperatures.

Benefits

• Vaisala DRYCAP® sensor provides accurate and reliable measurement with excellent long-term stability and fast response time
• Graphical display and keypad for convenient operation
• Optional alarm relays and mains power supply module

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

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 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.

DMT345: Accurate in Hot and Dry Environments

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.

The long and robust steel probe and an optional installation flange allow easy, adjustable installation depth through insulation for example in ovens.

DMT346: Reliable in Very Hot Processes

DMT346 provides the best measurement performance at process temperatures between 140 °C and 350 °C.

DMT346 includes a cooling set as standard. The cooling set provides passive cooling by conducting heat away from the probe and thus reduces temperature to optimal range for the sensor.

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

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.

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, RS-232, and RS-485 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 (RS-485) 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 LAN interface, which enables an Ethernet connection. A USB service cable makes it easy to connect DMT345/346 to a PC via the service port.

With multiple options to choose from, the instrument can be tailored to meet the specific needs of each individual application and is delivered installation-ready and pre-configured for each delivery. Quick delivery time and global service network make DMT340 series a perfect choice for any project.

The large graphical display allows the user to check data at a glance.
## Technical Data

### Measurement Performance, DMT345

**Dew Point**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Vaisala DRYCAP 180S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>-40 ... +100 °C (-40 ... +212 °F) Td</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±2 °C (±3.6 °F) Td</td>
</tr>
</tbody>
</table>

See the accuracy graph below

**Response time** 63 % [90 %] in 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]

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... +180 °C (+32 ... +356 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range with sensor warming</td>
<td>Upper range limited by humidity (at 80 %RH warming is switched on and T reading not actual process temperature)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.4 °C at 100 °C</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Pt100 RTD Class F0.1 IEC 60751</td>
</tr>
</tbody>
</table>

**Relative Humidity**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range with sensor warming</td>
<td>0 ... 80 %RH</td>
</tr>
<tr>
<td>Accuracy below 10 %RH</td>
<td>±10 % of reading</td>
</tr>
<tr>
<td>Accuracy above 10 %RH</td>
<td>±1.5 %RH + 1.5 % of reading</td>
</tr>
</tbody>
</table>

**Mixing Ratio**

<table>
<thead>
<tr>
<th>Measurement range (typical)</th>
<th>0 ... 1000 g/kg (0 ... 7000 gr/lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (typical)</td>
<td>±12 % of reading</td>
</tr>
</tbody>
</table>

### Measurement Performance, DMT346

**Dew Point**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Vaisala DRYCAP 180S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>-25 ... +100 °C (-13 ... +212 °F) Td</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±2 °C (±3.6 °F) Td</td>
</tr>
</tbody>
</table>

See the accuracy graph below

**Response time** 63 % [90 %] in 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**

<table>
<thead>
<tr>
<th>Measurement range (typical)</th>
<th>0 ... 1000 g/kg (0 ... 7000 gr/lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (typical)</td>
<td>±12 % of reading</td>
</tr>
</tbody>
</table>
Inputs and Outputs, DMT345 and DMT346

Accuracy of analog outputs at 20 °C  ± 0.05% full scale
Temperature dependence of analog outputs  ± 0.005%/°C full scale
Max. wire size  0.5 mm² (AWG 20) stranded wires recommended
Digital outputs  RS-232, RS-485 (optional)
Protocols  ASCII commands, Modbus RTU
Service connection  RS-232, USB
Relay outputs  2+2 pcs (optional) 0.5 A, 250 VAC, SPDT
Operating voltage  10 ... 35 VDC, 24 VAC ±20%
Operating voltage 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  Approx. 6 min

Power Consumption at 20 °C (Uin 24 VDC)
Uout 2x0 ... 1V/0 ... 5V/0 ... 10V  max. 25 mA
Iout 2x0 ... 20mA  max. 60 mA
RS-232  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

External Loads
Current outputs  Rl < 500 Ω
0 ... 1V output  Rl > 2 kΩ
0 ... 5V and 0 ... 10V outputs  Rl > 10 kΩ

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 WPA2/802.11i
Authentication / Encryption (WLAN)  Open / no encryption
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

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

Operating Environment, DMT345 and DMT346

Storage temperature  -55 ... +80 °C (-67 ... +176 °F)
Pressure range for probes  Slight pressure difference (~ 200 mbar)
Measured gases  Non-corrosive gases
EMC compliance  EN61326-1, Industrial environment\(^1\)

Mechanical Durability
Of probes  Up to +180 °C (+356 °F) for DMT345
Up to +350 °C (+662 °F) for DMT346
Of transmitter body  -40 ... +60 °C (+32 ... +140 °F)
With display  0 ... +60 °C (32 ... +140 °F)

Mechanical Specifications, DMT345 and DMT346

Cable bushing  M20 x 1.5 for cable diameter 8 ... 11 mm / 0.31 ... 0.43"
Conduit fitting (optional)  1/2"NPT
Housing material  G-AlSi 10 Mg (DIN 1725)
IP rating  IP65 (NEMA4X) with local display
Weight (depending on selected probe, cable, and modules)  1.0 - 3.0 kgs (2.2-6.6 lbs)
USB-RJ45 Serial Connection Cable  29968S
Probe cable diameter  5.5 mm (0.2 in)
Standard probe cable lengths  2 m, 5 m or 10 m (Additional cable lengths available, please see order forms for details)
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

\(^1\) Note: Transmitter with display test impedance of 40 ohm is used in IEC60000-4-5 (Surge immunity)
Vaisala DRYCAP® Dew Point Transmitter DMT152 is designed for measuring low dew point in OEM applications, even down to −80 °C (−112 °F). 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, dry 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.

**Features**
- Vaisala DRYCAP® technology with a polymer sensor
- Measures dew point down to −80 °C (−112 °F)
- Withstands condensation
- Traceable calibration (certificate included)
- Applications: dry chambers, dry gases, semiconductor manufacturing, research and testing, and compressed air

**Benefits**
- Accurate
- Compact
- Fast response time
- Reduced maintenance costs due to long calibration interval
Measurement performance

Sensor
Vaisala DRYCAP® 180U
Thin-film capacitive polymer sensor

Recommended calibration interval
2 years

Dew point temperature

Measurement range
−80 ... +20 °C (−112 ... −4 °F) T_d

Accuracy
−80 ... −40 °C (−112 ... −40 °F) ±2 °C (3.6 °F) T_d
−40 ... −20 °C (−40 ... −4 °F) ±3 °C (5.4 °F) T_d

Non-calibrated range
−100 ... +20 °C (−148 ... +68 °F) T_d

Typical response time
63 % [90 %] at a gas temperature of +20 °C (+68 °F) and pressure of 1 bar:
−20 ... −80 °C T_d
0.5 min [7.5 min]
−80 ... −20 °C T_d
2 s [5 s]

Typical long-term stability
Better than 2 °C (3.6 °F) / year

Concentration by volume (ppm)

Measurement range (typical)
0 ... 500 ppm

Accuracy at +20 °C (+68 °F), 1013 mbar
±(0.2 ppm + 20 % of reading)

1) When the dew point is below 0 °C, the transmitter outputs frost point for T_d.

Inputs and outputs

Two analog outputs (scalable)
4 ... 20 mA, 0 ... 20 mA (3-wire)
0 ... 5 V, 0 ... 10 V

Digital output
RS-485 (2-wire)

Alarm-level indication by analog signal
User selectable

Purge information
5 V, 10 V, 20 mA, or LED

Accuracy of analog outputs
±0.01 V / ±0.01 mA

Operating voltage
RS-485 output
11 ... 28 VDC
Voltage output
15 ... 28 VDC
Current output
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
Voltage output
Min. 10 kΩ
Current output
Max. 500 Ω

Accuracy over temperature range

1) For extended temp. down to −40 °C (−40 °F) or pressure up to 50 bar (725 psia), the supply voltage is 21 ... 28 VDC.

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)

Measurement environment
For air, nitrogen, argon, helium, and oxygen
Not suitable for measurements in hydrogen or pure carbon dioxide

Sample flow rate
No effect on measurement accuracy

EMC compliance
EN61326-1, Industrial environment

Accessories

Connection cable for Mi70 handheld indicator
219980
USB cable for PC connection
219690
Loop-powered external display
(Nokeval 301)
226476
Loop-powered external display with relays (Nokeval 302)
234759
NW40 flange
225220
Sampling cells (available for ISO G1/2")
Basic sampling cell
DMT242SC
With Swagelok 1/4" male connectors
DMT242SC2
With a quick connector and leak screw
DSC74
Two-pressure sampling cell
DSC74B

Mechanical specifications

Housing material (wetted parts)
AISI316L

Stainless steel mesh filter
Filter body AISI303, mesh AISI316L, grade 18 μm

Mechanical connections
ISO G1/2", NPT 1/2", UNF 3/4"-16", UNF 5/8"-18"

IP rating
IP66

Storage temperature range
−40 ... +180 °C (−40 ... +356 °F)

Weight (ISO G1/2")
190 g (6.70 oz)

DMT152 dimensions

Diameter 120.5 (4.76"
Height 32.5 (1.28"
Thickness 6 (0.24"

www.vaisala.com
Technical Data

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Due to its wide measurement range and excellent long-term stability, Vaisala DRYCAP® Dew Point Transmitter DMT143 is an ideal choice for small compressed air dryers, plastic dryers, and other OEM applications.

Vaisala DRYCAP® technology
Vaisala DRYCAP® Dew Point 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 DMT143 is 2 years. Additionally, Vaisala DRYCAP® Handheld Dew Point Meter DM70 can be used to confirm the performance of DMT143 without disconnecting the transmitter. For any adjustment needs, the transmitter can be sent to Vaisala Service.

The unique autocalibration function, developed by Vaisala, detects possible measurement inaccuracies and automatically corrects dry-end drift in the calibration curve. This ensures accurate measurements and long calibration intervals.

Easy installation
DMT143 has a variety of features to choose from, including different output and installation options, and alarm LED.

Due to its small size and light weight, 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 Vaisala DRYCAP® Handheld Dew Point Meter DM70, or the convenient Vaisala Insight PC software for Windows®. Insight PC software can also be used for other configuration options (see www.vaisala.com/insight).
Technical data

Measurement performance

<table>
<thead>
<tr>
<th>Sensor</th>
<th>DRYCAP® 180D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor protection</td>
<td>Stainless steel sintered filter</td>
</tr>
<tr>
<td>Recommended calibration interval to confirm the specified accuracy</td>
<td>2 years</td>
</tr>
</tbody>
</table>

Dew point temperature

| Measurement range (typical) | −70 … +60 °C (−94 … +140 °F) Td |
| Accuracy in air or N₂ | ±2 °C (±3.6 °F) Td (see graph below) |

Dew point temperature (°C)

Temperature of measured gas (°C)

Accuracy

±3 °C Td*

Not recommended for continuous measurement

Water vapor saturation line

* > 12 bar, accuracy ±4 °C Td

Analog output scalings:

Option 1

−80 … +20 °C (−112 … +68 °F) Td

Option 2

−80 … +20 °C (−112 … +68 °F) Td
dew point at ambient pressure

Option 3

Free scaling

Response time 63 % (90 %): 2)

−70 → −20 °C Td (−94 → −4 °F Td) 5 s [15 s] (typical)

−20 → −70 °C Td (−4 → −94 °F Td) 45 s [10 min] (typical)

Water concentration by volume (ppm)

Measurement range (typical) 10 … 40 000 ppm

Accuracy at +20 °C (+68 °F), 1 bar 1 ppm + 20 % of reading

Inputs and 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

Accuracy for current output at +20 °C ±0.05 mA

Accuracy for voltage output at +20 °C ±0.01 V

Operating voltage with digital output 12 … 28 VDC

Operating voltage with voltage output 12 … 28 VDC

Operating voltage with current output 18 … 28 VDC

Load for current output Max. 500 Ω

Load for voltage output Min. 10 kΩ

Typical temperature dependence 0.005 % of span/°C

Digital output RS-485, non-isolated

Supported protocols Vaisala industrial protocol Modbus RTU

Connector 4-pin M8 (IEC 60947-5-2)

Supply current at +20 °C (Uᵢₒ 24 VDC)

Normal measurement 10 mA + load current (typical)

During self-diagnostics 220 mA pulsed (typical)

Mechanical specifications

Mechanical connection ISO 228-1 G1/2" 1/2" NPT 3/4"-16 UNF 5/8"-18 UNF

Housing material Stainless steel (AISI316L)

Weight:

G thread and UNF thread versions 90 g (3.2 oz)

NPT thread version 100 g (3.5 oz)

Compliance

IP rating IP66

EMC compliance EN 61326-1, industrial electromagnetic environment

Spare parts and accessories

Connection cable for DM70 219980SP

USB cable for PC connection 219960

Loop powered external display 226476

Loop powered external display with relays 234759

Cooling/venting coil DMCOILSP

See the DSS70A product page at www.vaisala.com for further information about the sampling cells available for DM70.

Sampling cells

Basic sampling cell DMT242SC

With Swagelok 1/4" male connectors DMT242SC2

With quick connector and leak screw DSC74SP

Two-pressure sampling cell DSC748SP

Cooling/venting coil DMCOILSP

1) Vaisala Insight software for Windows is available at www.vaisala.com/insight.

1) Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases.

2) For extended temperature below 0 °C (32 °F), the transmitter outputs frost point.
DMT143 with ISO 228-1 G1/2" thread

DMT143 with 1/2" NPT thread

DMT143 with 3/4"-16 UNF thread

DMT143 with 5/8"-18 UNF thread
DMT143L Dew Point Transmitter
For OEM applications (DMT242 replacement)

Features

• Vaisala DRYCAP® technology with auto-calibration
• Calibration interval of two years
• Two sensor options cover a dew point measurement range of -60 ... +60 °C (-76 ... +140 °F)
• Accuracy ±2 °C (±3.6 °F)
• Compatible with Vaisala DRYCAP® Handheld Dew Point Meter DM70
• Compatible with Vaisala Insight PC software
• Traceable calibration (certificate included)
• Analog current (mA) output and RS-485 digital output with Modbus RTU support
• LED alarm for exceeded dew point level
• Fast response time

Due to its wide measurement range and excellent long-term stability, Vaisala DRYCAP® Dew Point Transmitter DMT143L is an ideal choice for low dew point industrial applications, such as compressed air dryers, plastic dryers, and other OEM applications.

Vaisala DRYCAP®
Vaisala DRYCAP® Dew Point Transmitter DMT143L is a miniature dew point measurement instrument. The transmitter can be installed directly into pressurized systems at 20 bar (290 psia) maximum pressure. It is designed for extreme conditions.
DMT143L incorporates Vaisala DRYCAP® thin film polymer sensor and auto-calibration software. The standard sensor choice for dry gases and desiccant dryers is the DRYCAP® 180M, and for more humid applications such as refrigeration dryers, the DRYCAP® 180S is optimal.
The sensors fully withstand 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 sensors are also highly resistant to particulate contamination, oil vapor, and most chemicals, and insensitive to the flow rate.

Long Calibration Interval
The calibration interval of DMT143L is two years. Additionally, Vaisala DRYCAP® Handheld Dew Point Meter DM70 can be used to confirm the performance of DMT143L without disconnecting the transmitter. For any adjustment needs, the transmitter can be sent to Vaisala Service.
The auto-calibration software works online while the process is running. If the measurement accuracy is not confirmed, corrections are made automatically.

Easy Installation
DMT143L has a variety of features to choose from, including different output and installation options, and alarm LED. Due to its small size and light weight, DMT143L 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 Vaisala DRYCAP® Handheld Dew Point Meter DM70, or the convenient Vaisala Insight PC software for Windows®. Insight PC software can also be used for other configuration options (see www.vaisala.com/insight).
Technical Data

Measurement Performance

Sensors
- DRYCAP® 180M
- DRYCAP® 180S (optimal for refrigeration dryers)

Sensor protection
- Stainless steel sintered filter
- Stainless steel filter for vacuum

Recommended calibration interval to confirm the specified accuracy
- 2 years

Measurement range (typical)
- -60 ... +60 °C (-76 ... +140 °F)

Different analog output scalings available.

Accuracy with DRYCAP® 180M
- ±2 °C (±3.6 °F)
  (see the graph below)

Accuracy with DRYCAP® 180S
- ±2 °C (±3.6 °F)
  (see the graph below)

1) For more information, see the DMT143L Order Form.
2) When the dew point is below 0 °C (32 °F), the transmitter outputs frost point.

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

Inputs and Outputs

- Analog current output: 4 ... 20 mA (3-wire)
- Digital output: RS-485, non-isolated
- Supported protocols: Vaisala industrial protocol, Modbus RTU
- Resolution for current output: ±0.002 mA
- Accuracy for current output at +20 °C: ±0.05 mA
- External load for current output: Max. 500 Ω
- Operating voltage with current output: 18 ... 28 VDC
- Operating voltage with digital output: 12 ... 28 VDC
- Typical temperature dependence: 0.0008 mA/°C
- Power consumption: Max. 220 mA

Mechanical Specifications

- Mechanical connection: G1/2" ISO228-1 with bonded seal ring (U-seal) or NPT1/2" thread
- Housing material: Stainless steel (AISI 316L)
- Weight: G thread model: 90 g (3.2 oz), NPT thread model: 100 g (3.5 oz)

Compliance

- IP rating: IP66
- EMC compliance: EN61326-1, industrial environment

www.vaisala.com
Vaisala HUMICAP® Dew Point 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**
DMT132 provides optimal performance in the operating range of refrigerant dryers. In the measurement range of -3 ... 20 °C (+26.6 ... +68 °F), where the refrigerator dryers typically operate, the $T_d$ accuracy is ±1 °C (±1.8 °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 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. DMT132 operating voltages can be as low as 10 VDC.

Verifying the performance of DMT132 is easy with the compatible Vaisala DM70 or HM70 hand-held meters. The user can perform possible adjustments with 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**

### Measurement Performance

**Measurement range**
-30 ... +50 °C (-22 ... +122 °F) $T_d$

**Accuracy**
- at +20 °C (+68 °F) ±1 °C for -3 ... 20 °C (+26.6 ... +68 °F) $T_d$
- ±2 °C for -15 ... -3 °C (+5 ... +26.6 °F) $T_d$

See accuracy graph below

**Typical Response Time at 20 °C (+68 °F)**
- Gas Temperature and 1 Bar Pressure
  - -14 → +3 °C (+7 → +37 °F): 17 s (63 %), 40 s (90 %)
  - +3 → +34 °C (+37 → +7 °F): 33 s (63 %), 85 s (90 %)

### Calculated Variables

Dew point converted to atmospheric pressure $T_d/f\text{ atm}$

1) When dew point is below 0 °C (+32 °F), the transmitter outputs frost point.

### Operating Environment

**Operating temperature**
-30 ... +50 °C (-22 ... +122 °F)

**Operating pressure**
0 ... 20 bar

**Relative humidity**
0 ... 100 %RH

**Sample flow rate**
No effect on measurement accuracy

**Measured gases**
Non-corrosive gases

**EMC compliance**
EN61326-1, Industrial Environment

### 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**
RS-485 serial line for service use

### Mechanical Specifications

**Sensor**
Vaisala HUMICAP® 180R

**Recommended calibration interval (in refrigerant dryer application)**
2 years

**Mechanical connection**
G1/2" ISO

**Operating voltage**
10 ... 28 VDC

**External load**
- Max. 100 Ω for supply voltages < 20 VDC
- Max. 500 Ω for supply voltages 20 ... 28 VDC

**Weight**
65 g (2.3 oz)

**Housing material**
PPS + 40 % GF

**IP rating**
IP65 (NEMA 4)

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

**Start-up time**
3 s

### Spare Parts 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**
  29690
- **Connection cable to DM70/HM70**
  29980
- **LED plug**
  230388
- **ISO 1/2" plug**
  218773
- **NPT 1/2" plug**
  222507
- **Sealing ring set (3 pcs U-seal)**
  221525SP

### Dimensions in mm

![Dimensions in mm](image)
Vaisala DRYCAP® Handheld Dew Point Meter DM70 offers accurate and fast measurement for industrial dew point applications, such as compressed air, metal treatment, and plastics drying.

**Features**
- 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
- Sensor withstands condensation
- Data can be logged and transferred to a PC via MI70 Link software
- Traceable calibration (certificate included)
- Fast response, enhanced by sensor purge option
- Variety of sampling cell options for connection to pressurized processes

**Vaisala DRYCAP® technology**
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.

**Three probes to choose from**
Three probe models, all with autocalibration, are available. The DMP74A and DMP74B models are both general purpose probes. The DMP74C model is specifically developed for SF₆ 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.

**Intuitive user interface**
DM70 has a versatile and easy-to-use, menu-based user interface, a clear graphical LCD display, and datalogging capability. It can also be used as a tool for reading the output of fixed Vaisala dew point transmitters, such as DMT242, DMT132, DMT143, DMT152, and DMT340. DM70 displays one to three parameters at a time, either numerically or graphically. Several humidity units can be selected. In addition, DM70 includes conversion from gas pressure dew point to ambient pressure dew point. An analog output is also available.

**MI70 Link Windows® software**
The optional Vaisala MI70 Link Windows® software and the USB connection cable form a practical tool for transferring logged data and real time measurement data from DM70 to a PC.
Technical data

**DMP74A measurement performance**

**Dew point**
- Measurement range (typical) −50 ... +60 °C (−58 ... +140 °F)

**Dew point accuracy vs. measurement conditions**

<table>
<thead>
<tr>
<th>Temperature of measured gas (°C)</th>
<th>Dew point temperature (°C)</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10 to 0</td>
<td>-10 ... +60 °C (+14 ... +140 °F)</td>
<td>±2 °C (±3.6 °F) (see graph)</td>
</tr>
</tbody>
</table>

**Temperature**
- Measurement range −10 ... +60 °C (+14 ... +140 °F)
- Accuracy at +20 °C (+68 °F) ±0.2 °C (±0.36 °F)
- Typical temperature dependence of electronics ±0.005 °C/°C (±0.005 °F/°F)

**Dew point sensor**
- Vaisala DRYCAP® 180S

**Other variables available**
- Dew point converted to atmospheric pressure, ppm volume and ppm weight concentration, absolute humidity, mixing ratio, relative humidity

**Operating environment, all probe models**
- Operating temperature −10 ... +60 °C (+14 ... +140 °F)
- Operating pressure for DMP74A, DMP74B
  - 0 ... 20 bara (0 ... 290 psia)
- Operating pressure for DMP74C
  - 0 ... 10 bara (0 ... 150 psia)
- Sample flow rate: No effect on measurement accuracy
- Measured gases: Non-corrosive gases
- EMC compliance: EN 61326-1, Basic environment

**Mechanical specifications, all probe models**
- Probe material (wetted parts): Stainless steel (AISI 316L)
- Sensor protection: Sintered filter (AISI 316L)
- Mechanical connection: G1/2” ISO228-1 thread with bonded seal ring (U-seal)
- IP rating: IP65 (NEMA 4)
- Weight: 350 g (12 oz)

---

**DMP74B and DMP74C (for SF₆ gas) measurement performance**

**Dew point**
- Measurement range (typical) −70 ... +30 °C (−94 ... +86 °F)

**Dew point accuracy vs. measurement conditions**

<table>
<thead>
<tr>
<th>Temperature of measured gas (°C)</th>
<th>Dew point temperature (°C)</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10 to 0</td>
<td>−70 ... +30 °C (−94 ... +86 °F)</td>
<td>±2 °C (±3.6 °F) (see graph)</td>
</tr>
</tbody>
</table>

**Temperature**
- Measurement range −10 ... +60 °C (+14 ... +140 °F)
- Accuracy at +20 °C (+68 °F) ±0.2 °C (±0.36 °F)
- Typical temperature dependence of electronics ±0.005 °C/°C (±0.005 °F/°F)

**Dew point sensor**
- Vaisala DRYCAP® 180M

**Other variables available**
- Dew point converted to atmospheric pressure, ppm volume and ppm weight concentration

---

Dashed line:
For DMP74C the ±2 °C accuracy range is limited to −50 °C T_d when used in SF₆ gas.

**Accuracy (B and C probe)**
- −60 ... +20 °C (−76 ... +68 °F)
- ±2 °C (±3.6 °F)

**Response time**
- Flow rate 0.2 m/s, 1 bar pressure, +20 °C (+68 °F)
- 63 % [90 %]
- 0 → −60 °C T_d (32 → −40 °F T_d) 50 s [340 s]
- −60 → 0 °C T_d (−76 → 32 °F T_d) 10 s [20 s]

---

For DMP74C the ±2 °C accuracy range is limited to −50 °C T_d when used in SF₆ gas.
MI70 measurement indicator

Operating environment

- Operating temperature: −10 ... +40 °C (+14 ... +104 °F)
- Operating humidity: 0 ... 100 %RH, non-condensing
- Storage temperature: −40 ... +70 °C (-40 ... +158 °F)

Inputs and outputs

- Max. no of probes: 2
- PC interface: MI70 Link software with USB or serial port cable
- Analog output: 0 ... 1 VDC
- Power supply: Rechargeable NiMH battery pack with AC adapter or 4 × AA size alkalines, type IEC LR6
- Output resolution: 0.6 mV
- Accuracy: 0.2 % full scale
- Temperature dependence: 0.002 %/˚C (0.01 %/˚F) full scale
- Minimum load resistor: 10 kΩ to ground

Mechanical specifications

- Housing classification: IP54
- Housing materials: ABS/PC blend
- Weight: 400 g (14 oz)

Compatibility

- EMC compliance: EN 61326-1, portable equipment

Other

- 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 (0.63 in)
- Alarm: Audible alarm function
- Data logging capacity: 2700 real time data points
- Logging interval: 1 s to 12 h
- Logging duration: 1 min ... memory full
- Resolution: 0.01 %RH, 0.01 °C/°F, 0.01 hPa, 0.01 a, 10 ppm / 0.01 %CO₂

Battery operation time

- Typical charging time: 4 hours
- Operation times: Continuous use: 48 h typical at +20 °C (+68 °F)
  Data logging use: Up to a month

Spare parts and accessories

- Weatherproof hard plastic carrying case: MI70CASE3
- Soft carrying case: MI70SOFTCASE
- MI70 USB PC connection cable (for use with MI70 Link software) 1: 219687
- Analog output signal cable: 271682Z
- Extension cable for probe (10 m (33 ft)): 213107SP
- Portable sampling system with case (see separate DSS70A datasheet): DSS70A

Connection cables for fixed Vaisala dew point transmitters

- For DMT242 transmitter: 271602Z
- For DMT340 series: 211339
- For DMT152, DMT132, DMT143, DPT145, and DPT146 transmitters: 219980SP

1) Vaisala MI70 Link software for Windows is available at www.vaisala.com/mi70link.
DSS70A Portable Sampling System
and sampling cells for DM70

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.

**DSS70A Portable Sampling System**

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.

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 DSS70A. DSS70A is an accessory for DM70 Dewpoint Handheld Meter.

**Sampling Cells for Pressurized Processes**

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.

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.

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 SF6 gas with the DMP74C probe.

DMT242SC is a basic sampling cell. 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. DSC74C is like DSC74B but with an additional coil to avoid back diffusion, the effect of surrounding moisture, in dew point measurements in atmospheric pressure.

**DSS70A Operating Environment**

- **Operating gases**: Air, N₂, and other non-toxic, inert gases
- **Sampled gas dew point**: Below Tamb
- **Inlet/outlet connection**: 1/4” Swagelok
- **Operating ambient temperature**: 0 ... +40 °C (+32 ... +104 °F)
- **Operating process gas temperature with PTFE tube at +20 °C (+68 °F)**: Max. +200 °C (+392 °F)
- **Operating temperature 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)
- **Operating pressure with pump disconnected**: 0 ... 20 bara (0 ... 290 psia)

**Mechanical Specifications**

- **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)
- **Case dimensions (W × D × H)**: 430 × 330 × 100 mm
- **Weight**: 5.5 kg (12 lbs)

**Materials**

- **Wetted parts**: Stainless steel
- **Carrying case**: ABS plastic

**Sampling Cell Options**

- **DSC74**: Sampling cell for pressurized gases
- **DSC74 pressure limit**: 1 MPa (10 barg, 145 psig)
- **DSC74B**: Two pressure sampling cell
- **DSC74B pressure limit**: 1 MPa (10 barg, 145 psig)
- **DSC74C**: DSC74B with DMCOIL cooling/venting coil
- **DMCOIL**: Cooling/venting coil
- **DMT242SC**: Sampling cell
- **DMT242SC pressure limit**: 10 MPa (100 barg, 1450 psig)
- **DMT242SC2**: Sampling cell with Swagelok connectors
- **DMT242SC2 pressure limit**: 4 MPa (40 barg, 580 psig)

**Compliance**

- **EMC**: EN61326-1, Generic Environment
Vaisala Dew Point and Pressure Transmitter DPT146 for compressed air makes monitoring compressed air simple and convenient. 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
DPT146 combines the knowledge of more than 20 years of sensor technology development. Proven measurements from DRYCAP® sensor for dew point and BAROCAP® sensor for pressure are now combined into one easy-to-use transmitter.

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® Handheld Dew Point Meter DM70. The meter can also be used as a local display and data logger. Temperature measurement is available when RS-485 is in use.

Output and performance
- Pressure: 1 ... 12 bar
- Dew point: −70 ... +30 °C (−94 ... +86 °F)
- Digital output RS-485 with Modbus

Features
- 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 Vaisala Handheld Meter DM70 for easy spot-checking, local display, and data logging

Vaisala Dew Point and Pressure Transmitter DPT146 for compressed air
Technical data

**Parameters**

### Measured parameters

- **Dew point**: −70 … +30 °C (−94 … +86 °F)
- **Pressure, absolute**: 1 … 12 bar (14.5 … 174 psi)
- **Temperature (available if output RS-485 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)

**Measurement performance**

- **Sensor**: Vaisala MPS1 multiparameter sensor
- **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)
- **ppm accuracy (7 bar)**: ±(14 ppm + 12 % of reading)
- **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)
- **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]

**Operating environment**

- **Operating temperature of electronics**: −40 … +60 °C (−40 … +140 °F)
- **Operating pressure**: 1 … 12 bar (14.5 … 174 psi)
- **Mechanical durability**: 0 … 50 bar (0 … 725 psi)
- **Relative humidity**: 0 … 100 %
- **Measured gases**: Air/non-corrosive gases
- **Sample flow rate**: No effect on measurement accuracy
- **Storage temperature**: −40 … +80 °C (−40 … +176 °F)
- **Transmitter only**: −20 … +80 °C (−4 … +176 °F)
- **Shipment package**: −20 … +80 °C (−4 … +176 °F)

**Compliance**

- **IP rating**: IP66
- **EMC compliance**: EN 61326-1, Basic electromagnetic environment

**Inputs and outputs**

- **Accuracy of analog outputs**: ±0.01 V / ±0.01 mA
- **Digital output**: RS-485, non-isolated, Vaisala protocol, Modbus RTU protocol
- **Connector**: MB 4-pin male
- **Operating voltage**
  - **Current output**: 21 … 28 VDC
  - **Voltage output and/or use in cold temperatures**: −40 … −20 °C (−40 … −4 °F)
  - **RS-485 only**: 15 … 28 VDC
- **Analog outputs (2 channels)**
  - **Current output**: 0 … 20 mA, 4 … 20 mA
  - **Voltage output**: 0 … 5 V, 0 … 10 V
- **Supply current**
  - **During normal measurement**: 20 mA + load current
  - **During self-diagnostics**: 300 mA + load current
- **External load for**
  - **Current output**: Max. 500 Ω
  - **Voltage output**: Min. 10 kΩ

**Mechanical specifications**

- **Housing material**: AISI316L
- **Mechanical connection**: ISO G1/2", NPT 1/2", UNF 3/4"-16
- **Recommended calibration interval**: 2 years
- **Sensor protection**: Mesh filter AISI303, grade 18 µm
- **Weight (ISO1/2")**: 190 g (6.70 oz)

**Spare parts and accessories**

- **Connection cable for MI70 indicator / DM70 meter**: 299980
- **USB connection cable**: 299690
- **Sampling cells**: DMT242SC, DMT242SC2, DSC74, DSC74B, DSC74C
- **Flange**: DM240FA
- **Loop-powered external display**: 226476
- **ISO 1/2" plug**: 287773
- **NPT 1/2" plug**: 222507

**Dimensions in mm (inches)**
DPT145 Multiparameter Transmitter
For SF6 gas

features
- The 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
- More reliable assessment of the condition of SF6 insulation due to online measurement
- Digital output: RS-485 with Modbus®
- Long calibration interval of years

vaisala multiparameter transmitter DPT145 with DILO DN20 connector

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. 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 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 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. 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.
## Technical data

### Measured parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dew point</td>
<td>−50 ... +30 °C (−58 ... +86 °F)</td>
</tr>
<tr>
<td>Pressure, absolute</td>
<td>1 ... 12 bar (14.5 ... 174 psi)</td>
</tr>
<tr>
<td>Temperature</td>
<td>−40 ... +80 °C (−40 ... +176 °F)</td>
</tr>
</tbody>
</table>

### Calculated parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure, normalized to +20 °C (+68 °F)</td>
<td>1 ... 12 bar (14.5 ... 174 psi)</td>
</tr>
<tr>
<td>SF₆ or SF₆/N₂ mixture density</td>
<td>0 ... 100 kg/m³</td>
</tr>
<tr>
<td>Moisture by volume, ppm</td>
<td>40 ... 40 000 ppm</td>
</tr>
<tr>
<td>Dew point, converted to atmospheric pressure</td>
<td>−65 ... +30 °C (−85 ... +86 °F)</td>
</tr>
</tbody>
</table>

### Measurement performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dew point accuracy</td>
<td>±3 °C (±5.4 °F), see graph below</td>
</tr>
<tr>
<td>Dew point stability</td>
<td>Typical drift &lt; 2 °C (3.6 °F) / 5 years</td>
</tr>
<tr>
<td>Pressure accuracy at +23 °C (+73.4 °F)</td>
<td>±0.4 %FS</td>
</tr>
<tr>
<td>Pressure temperature dependence</td>
<td>±0.01 bar/10 °C (±18 °F)</td>
</tr>
<tr>
<td>Pressure stability</td>
<td>Typical drift &lt; 1 %FS / 5 years</td>
</tr>
<tr>
<td>Temperature accuracy</td>
<td>0 ... +40 °C (±32 ... ±104 °F): ±0.5 °C (± 0.9 °F); −40 ... +80 °C (−40 ... +176 °F): ±1 °C (± 1.8 °F)</td>
</tr>
<tr>
<td>Density accuracy (pure SF₆, 1 ... 12 bar)</td>
<td>0 ... +40 °C (±32 ... ±104 °F): ±1 %FS; −40 ... +60 °C (−40 ... ±140 °F): ±2.2 %FS</td>
</tr>
<tr>
<td>Typical ppm accuracy</td>
<td>±(7 ppm + 15 % of reading)</td>
</tr>
<tr>
<td>Sensor</td>
<td>Vaisala MPS1 multiparameter sensor</td>
</tr>
<tr>
<td>Sensor response time</td>
<td>&lt; 1 s</td>
</tr>
<tr>
<td>Dew point response time</td>
<td>−50 → −10 °C Tdf: 5 s [10 s]</td>
</tr>
<tr>
<td>Dew point response time</td>
<td>−10 → −50 °C Tdf: 10 s [2.5 min]</td>
</tr>
</tbody>
</table>

### Inputs and outputs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital outputs</td>
<td>RS-485, non-isolated, Vaisala protocol</td>
</tr>
<tr>
<td>Connector</td>
<td>Modbus™ RTU protocol</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>15 ... 28 VDC</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>1 ... 12 bar (14.5 ... 174 psi)</td>
</tr>
<tr>
<td>Mechanical durability</td>
<td>0 ... 50 bar (0 ... 725 psi)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0 ... 100 %</td>
</tr>
<tr>
<td>Measured gases</td>
<td>SF₆, SF₆/N₂ mixture</td>
</tr>
<tr>
<td>Storage temperature, transmitter only</td>
<td>−40 ... +80 °C (−40 ... +176 °F)</td>
</tr>
<tr>
<td>Storage temperature, shipment package</td>
<td>−20 ... +80 °C (−4 ... +176 °F)</td>
</tr>
</tbody>
</table>

### Operating environment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature of electronics</td>
<td>−40 ... +60 °C (−40 ... +140 °F)</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>1 ... 12 bar (14.5 ... 174 psi)</td>
</tr>
<tr>
<td>Mechanical durability</td>
<td>0 ... 50 bar (0 ... 725 psi)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0 ... 100 %</td>
</tr>
<tr>
<td>Measured gases</td>
<td>SF₆, SF₆/N₂ mixture</td>
</tr>
<tr>
<td>Supply current, during normal measurement</td>
<td>20 mA</td>
</tr>
<tr>
<td>Supply current, during self-diagnostics</td>
<td>Max. 300 mA pulsed</td>
</tr>
</tbody>
</table>

### Mechanical specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing material</td>
<td>AISI316L</td>
</tr>
<tr>
<td>Weather shield to be used for continuous outdoor installations</td>
<td></td>
</tr>
<tr>
<td>Mechanical connection</td>
<td>DILO DN20, DILO DN8, ABB Malmoquist, or Alstom G1/2 in compatible connector</td>
</tr>
<tr>
<td>Every connection is helium leak tested at the factory.</td>
<td></td>
</tr>
<tr>
<td>Weight (with DILO adapter)</td>
<td>765 g (27.0 oz)</td>
</tr>
</tbody>
</table>

### Compliance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP rating</td>
<td>IP66</td>
</tr>
<tr>
<td>EMC compliance</td>
<td>EN 61326-1, Basic electromagnetic environment</td>
</tr>
<tr>
<td>Mechanical vibration</td>
<td>EN/IEC 60068-2-6, Fc Sinusoidal vibration</td>
</tr>
</tbody>
</table>

### Spare parts and accessories

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection cable for the MI70/DM70 handheld</td>
<td>219980</td>
</tr>
<tr>
<td>USB connection cable</td>
<td>219690</td>
</tr>
<tr>
<td>Protection plug for connector</td>
<td>218675SP</td>
</tr>
<tr>
<td>1.5 m shielded PUR cable with 90° connector</td>
<td>231519SP</td>
</tr>
<tr>
<td>3 m shielded PUR cable with 90° connector</td>
<td>231520SP</td>
</tr>
<tr>
<td>5 m shielded PUR cable with 90° connector</td>
<td>231525SP</td>
</tr>
<tr>
<td>10 m shielded PUR cable with 90° connector</td>
<td>231522SP</td>
</tr>
<tr>
<td>3 m shielded FEP cable with straight connector</td>
<td>226902SP</td>
</tr>
<tr>
<td>Weather shield</td>
<td>ASM2103265P</td>
</tr>
</tbody>
</table>
Technical data

DPT145 with DILO DN8 connector

DPT145 with ABB Malmquist connector

DPT145 with Alstom connector

DPT145 with DILO DN20 connector

DPT145 with weather shield
First launched in 1997, the Vaisala CARBOCAP carbon dioxide (CO2) sensor features a groundbreaking innovation – the micromachined, electrically tunable Fabry-Pérot Interferometer (FPI) filter for built-in reference measurement. This reliable and stable sensor has been delivering accurate measurements since the late 1990s across a wide range of industries and applications, from building automation and safety to life sciences and ecological research.

**How it works**

Gases have a characteristic absorbance band in the infrared (IR) region, each at a unique wavelength. When IR radiation is passed through a gas containing another gas we are measuring, part of the radiation is absorbed. Therefore, the amount of radiation passing through the gas depends on the amount of the measured gas present, and this can be detected with an IR detector.

The Vaisala CARBOCAP sensor features an electrically tunable FPI filter. In addition to measuring gas 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.

**CARBOCAP's unique benefits**

- Superior stability enabled by autocalibration
- Insensitive to harsh conditions
- Minimal maintenance and calibration requirements

**Example of carbon dioxide measurement.** Both reference and CO2 absorption are measured in the same optical path.

**Typical applications**

Vaisala CARBOCAP sensor technology is well suited to a wide range of applications, but since the final customer value for each industrial application is unique, it depends on the product line how the CARBOCAP sensor technology is implemented.
In carbon dioxide measurement products, the technology is utilized for both ppm (parts per million) and percentage level measurements. Since CO2 replaces oxygen, it can be harmful to people in very high concentrations. CO2 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 CO2 incubators.

Normal atmospheric air includes CO2 at ppm levels. Typical CARBOCAP applications include ventilation control in buildings occupied by people, animal shelters, and greenhouses. In areas where large volumes of CO2 are handled, reliable CO2 measurement with alarm control is an important safety precaution. The CARBOCAP sensor is also a popular choice in ecological measurement applications such as biogas process lines, where excellent long-term stability and tolerance to harsh conditions are important requirements. For biogas applications, the technology is applied for multigas measurements, as it also helps improve the methane quality in the process.

**Product examples**

Vaisala's instruments including the CARBOCAP sensor technology range from hand-held meters, measurement modules, and industrial transmitters for CO2 measurements to multigas measurement solutions. View the complete range at www.vaisala.com/carbondioxide.

**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-Pérot 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, launched in 1997, were developed for measuring ppm-level CO2 in ventilation applications. They were soon followed by percentage-level measurement products. Since 2011, Vaisala has developed its 2nd generation CARBOCAP sensor technology with improved features. The new sensor technology is incorporated in several product lines that are targeted for demanding applications. Typical examples are greenhouses, air control units, biogas lines and life science incubators.
Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 is an accurate and rugged probe-type instrument for ecological measurements. Typical applications include CO₂ soil respiration, ambient CO₂ monitoring, plant growth chambers, and OEM applications.

Features

- Vaisala CARBOCAP® sensor, a silicon-based non-dispersive infrared (NDIR) sensor
- Single-beam, dual wavelength CO₂ measurement with no moving parts
- Compensation options for temperature, pressure, humidity, and oxygen
- Designed for outdoor use

Benefits

- Low power consumption and heat emission
- Compact and lightweight
- Excellent accuracy and stability

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, GMP343 provides a tool for accurate in-situ measurement. MI70 can be used as a display, communication, and data logging device.

Each GMP343 is calibrated using ±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 (-22 °F), 0 °C (32 °F), 25 °C (77 °F), and 50 °C (122 °F).

If needed, the customer can recalibrate the instrument using the multipoint calibration (MPC) feature allowing up to 8 user-defined calibration points.
Technical data

### Measurement 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: ±(3 ppm + 1 % of reading)
- 0 ... 2000 ppm: ±(5 ppm + 2 % of reading)

**Noise (repeatability) at 370 ppmCO₂**
- With no output averaging: ±3 ppmCO₂
- With 30 s output averaging: ±1 ppmCO₂

**Long-term stability (see graph ‘GMP343 operating conditions’)**
- Easy: ±2 % of reading
- Moderate: ±2 % of reading
- Harsh: ±2 % of reading

**Warm-up time**
- To full accuracy: ±0.5 %, 10 min
- To full accuracy: ±0.5 %, 30 min

**Effect on accuracy with temperature compensation**

<table>
<thead>
<tr>
<th>CO₂ range options</th>
<th>0 ... 1000 ppm</th>
<th>0 ... 2000 - 5000 ppm</th>
<th>0 ... 2 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature °C (°F)</td>
<td>Accuracy (% of reading)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+10 ... +40 (+50 ... +104)</td>
<td>±1 ±1 ±2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+40 ... +60 (+104 ... +140)</td>
<td>±2 ±3 ±4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>−40 ... +10 (−40 ... +50)</td>
<td>±3 ±3 ±5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Accuracy below 200 ppmCO₂ not specified for 2 % range option.
2) Always at least ±10 ppmCO₂.

**Response time (90 %)**

<table>
<thead>
<tr>
<th><strong>Diffusion model</strong></th>
<th>Filter attached</th>
<th>Averaging (s)</th>
<th>Response (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>0</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>30</td>
<td>82</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**Flow-through model**

<table>
<thead>
<tr>
<th>Gas flow (l/min)</th>
<th>Averaging (s)</th>
<th>Response (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>0</td>
<td>26</td>
</tr>
<tr>
<td>0.3</td>
<td>30</td>
<td>44</td>
</tr>
<tr>
<td>1.2</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>1.2</td>
<td>30</td>
<td>23</td>
</tr>
</tbody>
</table>

### Operating environment

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

**Storage temperature**
- −40 ... +70 °C (−40 ... 158 °F)

**Operating humidity**
- See graph ‘GMP343 operating conditions’

**Compensated pressure range**
- 700 ... 1300 hPa

**Operating pressure**
- < 5 bar

**Gas flow for flow-through model**
- 0 ... 10 liters/min

**EMC compliance**
- IEC/EN 61326-1, Basic environment

(1) Compliance with IEC/EN 61000-4-3: At 3 V/m RF field test within frequency range 300 ... 400 MHz may cause additional deviation of 150 ppmCO₂.

### Inputs and outputs

**Operating voltage**
- 11 ... 36 VDC

**Power consumption**
- Without optics heating: < 1 W
- With optics heating: < 3.5 W

**Digital outputs**
- RS-485, RS-232

**Analog outputs**

<table>
<thead>
<tr>
<th>Current output range</th>
<th>4 ... 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current output resolution</td>
<td>14 bits</td>
</tr>
<tr>
<td>Current output maximum load</td>
<td>800 Ω at 24 VDC, 150 Ω at 10 VDC</td>
</tr>
<tr>
<td>Voltage output range</td>
<td>0 ... 2.5 V, 0 ... 5 V</td>
</tr>
<tr>
<td>Voltage output resolution</td>
<td>14 bits (13 bits with 0 ... 2.5 V)</td>
</tr>
<tr>
<td>Voltage output minimum load</td>
<td>5 kΩ</td>
</tr>
</tbody>
</table>

### Mechanical specifications

<table>
<thead>
<tr>
<th>Housing</th>
<th>Anodized aluminium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter cover</td>
<td>PC</td>
</tr>
<tr>
<td>Cable connector type</td>
<td>8-pin M12</td>
</tr>
<tr>
<td>Weight (probe only)</td>
<td>360 g (12.7 oz)</td>
</tr>
<tr>
<td>IP rating</td>
<td></td>
</tr>
</tbody>
</table>

(1) Compliance with IEC/EN 61000-4-3: At 3 V/m RF field test within frequency range 300 ... 400 MHz may cause additional deviation of 150 ppmCO₂.

Integrated pressure sensor not included in GMP343.
<table>
<thead>
<tr>
<th><strong>Spare parts and accessories</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall mount bracket</td>
<td>GMP343BRACKET</td>
</tr>
<tr>
<td>Mounting flange</td>
<td>GMP343FLANGE</td>
</tr>
<tr>
<td>Standard diffusion filter (weather protection, IP65) with filter cover</td>
<td>GMP343FILTER</td>
</tr>
<tr>
<td>Diffusion filter (sintered PTFE filter, IP66) with filter cover</td>
<td>215521</td>
</tr>
<tr>
<td>Calibration adapter (for the diffusion model)</td>
<td>GMP343ADAPTER</td>
</tr>
<tr>
<td>Junction box</td>
<td>JUNCTIONBOX-B</td>
</tr>
<tr>
<td><strong>Probe cables</strong></td>
<td></td>
</tr>
<tr>
<td>PC connection cable, 2 m (6 ft 7 in)</td>
<td>219687</td>
</tr>
<tr>
<td>Interface cable for Mi70, 2 m (6 ft 7 in)</td>
<td>DRW216050SP</td>
</tr>
<tr>
<td>Soil adapter kit for horizontal positioning</td>
<td>215519</td>
</tr>
<tr>
<td>Soil adapter kit for vertical positioning</td>
<td>215520</td>
</tr>
</tbody>
</table>

| **Cable options**              |  |
| 2 m (6 ft 7 in)                | GMP343Z200SP  |
| 6 m (19 ft 8 in)               | GMP343Z2600SP |
| 10 m (32 ft 10 in)             | GMP343Z1000SP |

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**GMP343 dimensions (diffusion model)**

**GMP343 dimensions (flow-through model)**

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www.vaisala.com
Vaisala CARBOCAP® Carbon Dioxide Probe GMP231 withstands high temperature sterilization.

GMP231 is designed to provide incubator manufacturers with accurate and reliable carbon dioxide measurements and sterilization durability at high temperatures. The probe is based on Vaisala’s patented CARBOCAP® technology and a new type of infrared (IR) light source. These technologies allow for continuous sterilization temperatures of up to 180 °C (+356 °F), enabling easier and more complete sterilization without the risk of cross-contamination. Maximum temperature durability of +195 °C (+383 °F) provides a comfortable operating margin.

The probe is installed through the incubator wall, ensuring that only the IR sensor and optical components are exposed to the incubation environment. This allows the incubator to be sterilized with the probe in place, removing the need to decontaminate the probe separately. This saves time and reduces the risk of contamination.

The probe’s sensor performance is optimized at 5 % CO₂, but the sensor measures CO₂ up to 20 % with high accuracy. In addition, GMP231 can measure pressure and temperature for CO₂ measurement compensation purposes, ensuring the product remains stable and accurate in all CO₂ incubation conditions. The sensor is made of highly durable materials to achieve outstanding stability over both time and temperature.

Since water vapor, dust, and most chemicals do not affect measurements, GMP231 module is ideal for CO₂ incubator environments.

Features
- Maximum temperature durability +195 °C (+383 °F)
- Incubator can be heat sterilized with probe in place, saving time and reducing risk of cross-contamination
- Heat durability and excellent long-term stability with next generation CARBOCAP® sensor
- Designed for OEM use in CO₂ incubators – installation options available
- CO₂ sensor measurement optimized for 5 % CO₂, measurement range up to 20 % CO₂
- 4-point traceable calibration for CO₂

Benefits
- Internal pressure and temperature measurement improves accuracy and stability
- Full temperature and pressure compensations available
- Sensor head heating for condensation prevention
Measurement performance

Measurement range 0 … 20 %CO₂
Calibration uncertainty at 5 %CO₂ ±0.1 %CO₂
Start-up time < 20 s
Warm-up time for full spec. < 3 min
Response time
T₆₃ < 30 s
T₉₀ < 50 s
Accuracy at 37 °C, 1013 hPa
Repeatability at:
0 … 8 %CO₂ ±0.1 %CO₂
8 … 12 %CO₂ ±0.2 %CO₂
12 … 20 %CO₂ ±0.4 %CO₂
Non-linearity at 0 … 20 %CO₂ ±0.1 %CO₂
Temperature dependence
With compensation at 3 … 12 %CO₂, 20 … 60 °C ±0.1 %CO₂
Without compensation (typical) -0.4 % of reading/°C
Pressure dependence
With compensation at 3 … 12 %CO₂, 700 … 1100 hPa ±0.015 % of reading/hPa
Without compensation (typical) +0.15 % of reading/hPa
Humidity dependence
With compensation at 0 … 20 %CO₂, 0 … 100 %RH ±0.9 % of reading (at 37 °C)
0 … 100 %RH ±0.05 % of reading/%RH
O₂ dependence
With compensation at 0 … 20 %CO₂, 0 … 90 %O₂ ±0.6 % of reading
Without compensation (typical) -0.08 % of reading/%O₂
Long-term stability
0 … 8 %CO₂ < ±0.2 %CO₂/year
8 % … 12 %CO₂ < ±0.5 %CO₂/year
12 % … 20 %CO₂ < ±1.0 %CO₂/year

Operating environment

Operating temperature for CO₂ measurement 0 … +70 °C (+32 … +158 °F)
Max. temperature durability in standby mode (sensor head only) Max. +195 °C (+383 °F)
Heat sterilization 180 °C durability At least 120 cycles
Storage temperature -40 … +75 °C (-40 … +167 °F)
Pressure (compensated) 500 … 1100 hPa
Pressure (operating) < 1500 hPa
Humidity 0 … 100 %, non-condensing
Condensation prevention Sensor head heating when power on
Chemical tolerance DMSO, IPA (70 %), H₂O₂ (2000 ppm, non-condensing), ethanol, acetic acid
Electromagnetic compatibility EN61326-1, Generic Environment

Inputs and outputs

Digital outputs I²C 5 V, RS-485 (2-wire with Vaisala Industrial Protocol)
Analog output 0 … 20 mA (scalable) max. load 600 Ω
Power consumption < 1 W (pulsed)
Operating voltage 11 … 30 VDC 20 … 30 VDC (with analog output)

Accessories

M12 Connection Cable 0.9 m with open ends
M12 Connection Cable 0.6 m with Milli-Grip connector
Silicone plug DRW240015SP
Attachment bracket DRW240247SP
PTFE filter DRW240977SP
USB PC connection cable 221040
MI70 connection cable 22180
Calibration adapter for GMP231 39523

Mechanical specifications

Connector M12/8 pin
Weight 150 g (5.29 oz) without cable
IP rating IP54 (sensor head) IP20 (electronics housing)
Materials
Housing Metal coated plastic ABS+PC
Inner tube Aluminum
Probe tube PPSU
Filter PTFE
Dimensions
Probe tube max. diameter 30.2 mm (1.19 in)
Probe tube length 118.5 mm (4.67 in)
Sensor filter length 12 mm (0.47 in)

GMP231 dimensions

www.vaisala.com
GMP251 Carbon Dioxide Probe
For %-level measurements

Features

• Measurement range 0 ... 20 %CO₂
• Intelligent, standalone probe with analog and digital outputs
• Compatible with Indigo transmitters and Insight PC software
• Wide operating temperature range (−40 ... +60 °C)
• IP65-classified housing
• Integrated temperature measurement for CO₂ compensation purposes
• Compensations also for pressure, oxygen, and humidity
• Sensor head heated to prevent condensation

Benefits

• Superior long-term stability
• Reliable and accurate
• Calibration certificate included

Vaisala CARBOCAP® Carbon Dioxide Probe GMP251 is a new intelligent probe for measuring carbon dioxide. This robust, standalone measurement device is designed for use in demanding applications, such as life science incubators, where stable, reliable, and accurate performance is required.

The operating temperature range of the probe is wide (−40 ... +60 °C (−40 ... +140 °F)), and the probe housing is classified as IP65. Condensation is prevented as the internal sensor head is heated. GMP251 is resistant to dust and most chemicals, such as H₂O₂ and alcohol-based cleaning agents.

Ease of use

GMP251 is a compact probe with easy and fast plug-in, plug-out installation. The surface of the probe is smooth, which makes it easy to clean. The probe provides several output options, including analog current and voltage outputs and digital RS-485 output with Modbus® protocol.

GMP251 can be connected to Indigo series transmitters for an extended range of output and configuration options. See www.vaisala.com/indigo.

For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight PC software. See www.vaisala.com/insight.

Applications

GMP251 is ideal for life science incubators, cold storages, fruit and vegetable transportation, and for all demanding applications where stable and accurate %-level CO₂ measurements are needed.

A flow-through adapter with gas ports is available as an accessory, enabling tubing for easy and flexible remote measurement with a separate pump. A multiplexer can also be added for sampling gas from several locations. ¹)

¹) Third-party pump and multiplexer not provided by Vaisala.
Technical data

### Measurement performance

**Measurement range**

<table>
<thead>
<tr>
<th>Range</th>
<th>%CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 20</td>
<td>±0.2%</td>
</tr>
</tbody>
</table>

**Accuracy**

<table>
<thead>
<tr>
<th>Range</th>
<th>%CO</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 8</td>
<td>±0.1%</td>
<td></td>
</tr>
<tr>
<td>8 ... 20</td>
<td>±0.4%</td>
<td></td>
</tr>
</tbody>
</table>

**Calibration uncertainty**

<table>
<thead>
<tr>
<th>Range</th>
<th>%CO</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 8</td>
<td>±0.07%</td>
<td></td>
</tr>
<tr>
<td>8 ... 20</td>
<td>±0.27%</td>
<td></td>
</tr>
</tbody>
</table>

**Long-term stability**

<table>
<thead>
<tr>
<th>Range</th>
<th>%CO</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 8</td>
<td>±0.3%/year</td>
<td></td>
</tr>
<tr>
<td>8 ... 12</td>
<td>±0.5%/year</td>
<td></td>
</tr>
<tr>
<td>12 ... 20</td>
<td>±1.0%/year</td>
<td></td>
</tr>
</tbody>
</table>

**Temperature dependence**

- With compensation at 5 %CO2, 0 ... +50 °C (+32 ... +122 °F):
  - ±0.05 % of reading/°C
- Without temperature compensation at 5 %CO2 (typical):
  - -0.25 % of reading/°C

**Pressure dependence**

- With compensation at 5 %CO2, 700 ... 1100 hPa:
  - ±0.05 % of reading/hPa
- Without compensation (typical):
  - +0.15 % of reading/hPa

**Humidity dependence**

- With compensation, 0 ... 20 %CO2, 0 ... 100 %RH:
  - ±0.7 % of reading (at +25 °C (+77 °F))
- Without compensation (typical):
  - +0.05 % of reading / %RH

**O2 dependence**

- With compensation, 0 ... 20 %CO2, 0 ... 90 %O2:
  - ±0.6 % of reading (at +25 °C (+77 °F))
- Without compensation (typical):
  - -0.08 % of reading / %O2

**Start-up, warm-up, and response time**

- Start-up time at +25 °C (+77 °F):
  - < 10 s
- Warm-up time for full spec.:
  - < 4 min
- Response time (T90):
  - < 1 min
- With standard filter:
  - < 1 min
- Flow-through option with > 0.1 l/min:
  - < 1 min
- With spray shield:
  - < 2 min

**Flow rate dependence**

- < 0.6 % of reading/ l/min

**Compliance**

**Compliance marks**

- CE, RCM, WEEE

**EMC compatibility**

- IEC / EN / BS EN 61326-1, basic electromagnetic environment

### Operating environment

**Operating temperature of CO2 measurement**

- -40 ... +60 °C (-40 ... +140 °F)

**Storage temperature**

- -40 ... +70 °C (-40 ... +158 °F)

**Humidity**

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

**Condensation prevention**

- Sensor head heating, when power on
  - O2: (2000 ppm, non-condensing)
  - Alcohol-based cleaning agents (for example ethanol and IPA)
  - Acetone
  - Acetic acid

**Pressure**

- Compensated 500 ... 1100 hPa
- Operating < 1.5 bar

**Gas flow (for flow-through option)**

- Operating range:<  10 l/min
- Recommended range: 0.1 ... 0.8 l/min

**Mechanical specifications**

- Weight, probe:
  - 45 g (1.59 oz)

**Materials**

- Probe housing: PBT polymer
- Filter: PTFE membrane, PBT polymer grid
- Connector: Nickel plated brass, M12 / 5-pin
- IP rating, probe body: IP65
- Connector: M12 5-pin male

**Dimensions**

- Probe diameter: 25 mm (0.98 in)
- Probe length: 96 mm (3.78 in)

### GMP251 dimensions

- Diameter: 96 mm (3.78 in)
- Filter: 75 mm, Ø 25 mm
- M12 male connector: 12 mm
- Probe length: 96 mm (3.78 in)

---

1) At 25 °C (77 °F) and 1013 hPa (incl. repeatability and non-linearity).

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### Compliance

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- CE, RCM, WEEE

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**Inputs and outputs**

**Analog outputs**
- 0 ... 5/10 V (scalable), min. load 10 kΩ
- 0/4 ... 20 mA (scalable), max. load 500 Ω

**Digital output**
- Over RS-485:
  - Modbus
  - Vaisala Industrial Protocol

**Operating voltage**
- With digital output in use: 12 ... 30 VDC
- With voltage output in use: 12 ... 30 VDC
- With current output in use: 20 ... 30 VDC

**Power consumption**
- Typical (continuous operation): 0.4 W
- Maximum: 0.5 W

**Spare parts and accessories**

<table>
<thead>
<tr>
<th>Item</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard membrane filter</td>
<td>ASM211650SP</td>
</tr>
<tr>
<td>Porous sintered PTFE filter</td>
<td>DRW244649SP</td>
</tr>
<tr>
<td>Probe cable with open wires (1.5 m)</td>
<td>223263SP</td>
</tr>
<tr>
<td>Probe cable with open wires (1.5 m), shielded</td>
<td>2542945SP</td>
</tr>
<tr>
<td>Probe cable with open wires (3 m)</td>
<td>267195SP</td>
</tr>
<tr>
<td>Probe cable with open wires (10 m)</td>
<td>2165465SP</td>
</tr>
<tr>
<td>Probe cable with open wires and 90° plug (0.6 m)</td>
<td>2446695SP</td>
</tr>
<tr>
<td>Probe cable with open wires and 90° plug (1.5 m)</td>
<td>255102</td>
</tr>
<tr>
<td>Flow-through adapter with gas ports</td>
<td>ASM211697SP</td>
</tr>
<tr>
<td>USB cable for PC connection (15)</td>
<td>242659</td>
</tr>
<tr>
<td>M170 connection cable for probe</td>
<td>CBL210472</td>
</tr>
<tr>
<td>Flat cable for GMP250 probes, M12 5-pin</td>
<td>CBL210493SP</td>
</tr>
<tr>
<td>Probe mounting clips (2 pcs)</td>
<td>243257SP</td>
</tr>
<tr>
<td>Probe mounting flange</td>
<td>243261SP</td>
</tr>
<tr>
<td>Calibration adapter</td>
<td>DRW244827SP</td>
</tr>
<tr>
<td>Spray shield</td>
<td>ASM212017SP</td>
</tr>
</tbody>
</table>

0 Vaisala Insight software for Windows available at www.vaisala.com/insight

**Probe mounting flange dimensions**

**Probe mounting flange dimensions, cross section**

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VAISALA

www.vaisala.com
VAISALA

GMP252 Carbon Dioxide Probe
For ppm-level measurements

Features

- Measurement range 0 ... 10 000 ppmCO₂
- Intelligent, stand-alone probe with analog and digital outputs
- Compatible with Indigo transmitters and Insight PC software
- Wide operating temperature range (-40 ... +60 °C)
- IP65-classified housing
- 2nd-generation proprietary CARBOCAP® technology
- Full temperature and pressure compensations
- Integrated temperature measurement for CO₂ compensation purposes
- Compensations for background gases, O₂, and humidity
- Sensor head heated to prevent condensation

Benefits

- Superior long-term stability
- Reliable and accurate
- Calibration certificate included

GMP252 is a new intelligent probe for measuring carbon dioxide. This robust, stand-alone measurement device is designed for use in agriculture, refrigeration, greenhouses, and demanding HVAC applications.

GMP252 is suitable for harsh and humid CO₂ measurement environments where stable and accurate ppm-level CO₂ measurements are needed. GMP252 is based on Vaisala’s unique, second-generation CARBOCAP technology that enables exceptional stability. A new type of infrared (IR) light source is used instead of the traditional incandescent light bulb, which extends the lifetime of GMP252.

GMP252 incorporates an internal temperature sensor for compensation of the CO₂ measurement according to ambient temperature. The effects of pressure and background gas can also be compensated for. The measurement range is 0 ... 10 000 ppmCO₂ (measurements up to 30 000 ppmCO₂ are available with reduced accuracy). The operating temperature range of the probe is wide (-40 ... +60 °C (-40 ... +140 °F)), and the probe housing is classified as IP65. Condensation is prevented as the internal sensor head is heated.

GMP252 is resistant to dust and most chemicals, such as, H₂O₂ and alcohol-based cleaning agents.

Ease of use

GMP252 is a compact probe with easy and fast plug-in, plug-out installation. The surface of the probe is smooth, which makes it easy to clean. The probe provides several output options, including analog current and voltage outputs and digital RS-485 output with Modbus protocol.

GMP252 can be connected to Indigo series transmitters for an extended selection of outputs and configuration options. See www.vaisala.com/indigo.

For easy-to-use access to field calibration, device analytics, and configuration functionality, the probe can be connected to Vaisala Insight PC software. See www.vaisala.com/insight.

Applications

GMP252 is ideal for agriculture, refrigeration, greenhouses, and demanding HVAC applications where stable and accurate ppm-level CO₂ measurements are needed.
## Technical data

### Measurement performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>0 ... 10 000 ppmCO₂</td>
<td>±40 ppmCO₂</td>
</tr>
<tr>
<td>3000 ... 10 000 ppmCO₂</td>
<td>±2 % of reading</td>
<td></td>
</tr>
<tr>
<td>Up to 30 000 ppmCO₂</td>
<td>±3.5 % of reading</td>
<td></td>
</tr>
</tbody>
</table>

**Accuracy at 25 °C and 1013 hPa (incl. repeatability and non-linearity)**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 3000 ppmCO₂</td>
<td>±38 ppmCO₂</td>
</tr>
<tr>
<td>3000 ... 10 000 ppmCO₂</td>
<td>±105 ppmCO₂</td>
</tr>
</tbody>
</table>

**Long-term stability**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Long-term stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 3000 ppmCO₂</td>
<td>±60 ppmCO₂/year</td>
</tr>
<tr>
<td>3000 ... 6000 ppmCO₂</td>
<td>±150 ppmCO₂/year</td>
</tr>
<tr>
<td>6000 ... 10 000 ppmCO₂</td>
<td>±300 ppmCO₂/year</td>
</tr>
</tbody>
</table>

**Temperature dependence 0 ... 10 000 ppmCO₂**

<table>
<thead>
<tr>
<th>Temperature range</th>
<th>Temperature dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>with compensation, -10 ... +50 °C</td>
<td>±0.05 % of reading/°C</td>
</tr>
<tr>
<td>without temperature compensation at 2000 ppmCO₂ (typical)</td>
<td>-0.5 % of reading/°C</td>
</tr>
</tbody>
</table>

**Pressure dependence**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Pressure dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 10 000 ppmCO₂, 500 ... 1100 hPa</td>
<td>±0.015 % of reading/hPa</td>
</tr>
<tr>
<td>0 ... 10 000 ppmCO₂, 0 ... 100 %RH</td>
<td>±0.7 % of reading (at +25 °C (+77 °F))</td>
</tr>
<tr>
<td>without compensation (typical)</td>
<td>±0.15 % of reading/hPa</td>
</tr>
<tr>
<td>without compensation (typical)</td>
<td>±0.05 % of reading/°C</td>
</tr>
</tbody>
</table>

**Humidity dependence**

<table>
<thead>
<tr>
<th>Humidity range</th>
<th>Humidity dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 10 000 ppmCO₂, 0 ... 90 %O₂</td>
<td>±0.6 % of reading (at +25 °C (+77 °F))</td>
</tr>
<tr>
<td>without compensation (typical)</td>
<td>-0.08 % of reading/%O₂</td>
</tr>
</tbody>
</table>

**O₂ dependence**

<table>
<thead>
<tr>
<th>O₂ range</th>
<th>O₂ dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 10 000 ppm</td>
<td>±0.05 % of reading/°C</td>
</tr>
<tr>
<td>without compensation (typical)</td>
<td>-0.08 % of reading/%O₂</td>
</tr>
</tbody>
</table>

**Start-up, warm-up and response time**

<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up time at +25 °C</td>
<td>&lt; 12 s</td>
</tr>
<tr>
<td>Warm-up time for full spec.</td>
<td>&lt; 2 min</td>
</tr>
<tr>
<td>Response time (T90) with standard filter</td>
<td>&lt; 1 min</td>
</tr>
<tr>
<td>Response time (T90) with spray shield</td>
<td>&lt; 3 min</td>
</tr>
</tbody>
</table>

**Flow-through option**

<table>
<thead>
<tr>
<th>Flow rate</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response time (T90) with &gt; 0.1 l/min</td>
<td>30 s</td>
</tr>
<tr>
<td>Flow rate dependence &lt; 1 l/min flow</td>
<td>no effect</td>
</tr>
<tr>
<td>Flow rate dependence 1 ... 10 l/min flow</td>
<td>&lt; 0.6 % of reading l/min</td>
</tr>
<tr>
<td>Gas flow operating range</td>
<td>&lt; 10 l/min</td>
</tr>
<tr>
<td>Gas flow recommended range</td>
<td>0.1 ... 0.8 l/min</td>
</tr>
</tbody>
</table>

### Operating environment

- **Operating temperature of CO₂ measurement**: -40 ... +60 °C (-40 ... +140 °F)
- **Storage temperature**: -40 ... +70 °C (-40 ... +158 °F)
- **Humidity**: 0 ... 100 %RH, non-condensing
- **Condensation prevention**: Sensor head heating when power on
- **EMC compliance**: EN61326-1, Generic environment
- **Chemical tolerance (temporary exposure during cleaning)**:
  - H₂O₂ (2000 ppm, non-condensing)
  - Alcohol-based cleaning agents (for example ethanol and IPA)
  - Acetone
  - Acetic acid
- **Pressure**: Compensated 500 ... 1100 hPa
- **Operating**: < 1.5 bar

### Mechanical specifications

- **Weight, probe**: 58 g (2.05 oz)
- **Connector type**: M12 5-pin male
- **IP rating, probe body**: IP65
- **Probe housing material**: PBT polymer
- **Filter**: PTFE
- **Connector**: Nickel plated brass
- **Dimensions**:
  - Probe diameter: 25 mm (0.98 in)
  - Probe length: 130 mm (5.12 in)

![Mechanical Specifications Diagram]
Spare parts and accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porous sintered PTFE filter for GMP252</td>
<td>DRW244221SP</td>
</tr>
<tr>
<td>Probe cable with open wires (1.5 m)</td>
<td>233263SP</td>
</tr>
<tr>
<td>Probe cable with open wires and 90° plug (0.6 m)</td>
<td>244669SP</td>
</tr>
<tr>
<td>Probe cable with open wires (10 m)</td>
<td>216546SP</td>
</tr>
<tr>
<td>Flow-through adapter with gas ports</td>
<td>ASM212011SP</td>
</tr>
<tr>
<td>USB cable for PC connection (^1)</td>
<td>242659</td>
</tr>
<tr>
<td>M170 connection cable for probe</td>
<td>CBL210472</td>
</tr>
<tr>
<td>Flat cable for GMP250 probes, M12 5-pin</td>
<td>CBL210493SP</td>
</tr>
<tr>
<td>Probe mounting clips (2 pcs)</td>
<td>243257SP</td>
</tr>
<tr>
<td>Probe mounting flange</td>
<td>243261SP</td>
</tr>
<tr>
<td>Calibration adapter</td>
<td>DRW244827SP</td>
</tr>
<tr>
<td>Spray shield</td>
<td>ASM212017SP</td>
</tr>
<tr>
<td>Radiation shield DTR250</td>
<td>DTR250</td>
</tr>
<tr>
<td>Radiation shield DTR250 with pole mounting kit</td>
<td>DTR250A</td>
</tr>
</tbody>
</table>

\(^1\) Vaisala Insight software for Windows available at www.vaisala.com /insight

Inputs and outputs

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital output</td>
<td>Over RS-485:</td>
</tr>
<tr>
<td></td>
<td>• Modbus</td>
</tr>
<tr>
<td></td>
<td>• Vaisala Industrial Protocol</td>
</tr>
<tr>
<td>Analog output</td>
<td>• 0 ... 5/10 V (scalable), min load 10 kΩ</td>
</tr>
<tr>
<td></td>
<td>• 0/4 ... 20 mA (scalable), max load 500 Ω</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>With digital output in use 12 ... 30 VDC</td>
</tr>
<tr>
<td></td>
<td>With voltage output in use 12 ... 30 VDC</td>
</tr>
<tr>
<td></td>
<td>With current output in use 20 ... 30 VDC</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Typical (continuous operation) 0.4 W</td>
</tr>
<tr>
<td></td>
<td>Maximum 0.5 W</td>
</tr>
</tbody>
</table>

www.vaisala.com
GM70 Handheld Carbon Dioxide Meter
For spot-checking applications

The Vaisala CARBOCAP® Handheld 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).

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 CO₂ instruments.

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.

**Vaisala CARBOCAP® Technology**
GM70 incorporates the advanced CARBOCAP sensor that has unique reference measurement capabilities. The measurement accuracy is not affected by dust, water vapor or most chemicals. The meter has a two-year recommended calibration interval.

**Two Sampling Methods**
The handle is for hand-held diffusion sampling. GM70 pump enables pump-aspirated sampling from locations difficult to access otherwise. It is also ideal for comparisons with fixed CO₂ transmitters.

**Interchangeable Probes**
GM70 uses the same probes as Vaisala CARBOCAP Carbon Dioxide Transmitter Series GMT220. 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 fixed CO₂ instruments. GMW90 and GMP220 probes can also be adjusted by using the GM70 meter. GM70 has two probe inputs. Vaisala’s relative humidity and dewpoint probes can also be used simultaneously with CO₂ measurement.

**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 GM70 to a PC.

**Features**
- 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

**Benefits**
- Proven Vaisala CARBOCAP® reliability
- Wide selection of measurement ranges
- Easy recalibration using the interchangeable probes
- Suitable for field checking of fixed CO₂ instruments
- Short warm-up time
- Compact and versatile
Technical Data

**CO₂ Volume Concentration Measurement Performance, GMH70 Probe**

**Response Time (63 %)**

- GMP221: 20 s
- GMP222: 30 s

**Measurement Ranges**

- **High concentrations, short probe (GMP221):**
  - 0 ... 2 %
  - 0 ... 5 %, 0 ... 10 %, 0 ... 20 %
- **Low concentrations, long probe (GMP222):**
  - 0 ... 2000 ppm, 0 ... 3000 ppm, 0 ... 5000 ppm, 0 ... 7000 ppm, 0 ... 10 000 ppm

**Accuracy at 25 °C and 1013 hPa**

- GMP221: ±(1.5 % of range + 2 % of reading)
- GMP222: ±(1.5 % of range + 2 % of reading)

**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 Mechanical Specifications**

- Sensor: Vaisala CARBOCAP®
- Housing Material:
  - GMP221/222 probe: PC plastic
  - GMH70 handle: ABS/PC blend
  - GM70 Pump: Aluminium casing
- Weight:
  - GM70 with GMP221/222 probe: 230 g
  - GM70 Pump with GMP221/222 probe: 700 g

**Probe, Handle & Pump Operating Environment**

- Storage temperature: -30 ... +70 °C (-22 ... +158 °F)
- Storage humidity: 0 ... 100 %RH, non-condensing

**MI70 measurement indicator**

**Operating environment**

- Operating temperature: -10 ... +40 °C (+14 ... +104 °F)
- Operating humidity: 0 ... 100 %RH, non-condensing
- Storage temperature: -40 ... +70 °C (-40 ... +158 °F)

**Inputs and outputs**

- Max. no of probes: 2
- PC interface: MI70 Link software with USB or serial port cable
- Analog output: Rechargeable NiMH battery pack with AC adapter or 4 × AA size alkalines, type IEC LR6
- Power supply: 0 ... 1 VDC
- Output resolution: 0.6 mV
- Accuracy: 0.2 % full scale
- Temperature dependence: 0.002 %/°C (0.01 %/°F) full scale
- Minimum load resistor: 10 kΩ to ground

**Mechanical specifications**

- Housing classification: IP54
- Housing materials: ABS/PC blend
- Weight: 400 g (14 oz)

**Compatibility**

- EMC compliance: EN 61326-1, portable equipment
- Other:
  - Menu languages: English, Chinese, Spanish, Russian, French, Japanese, German, Swedish, Finnish
  - Display:
    - LCD with backlight
    - Graphical trend display of any parameter
    - Character height up to 16 mm (0.63 in)
  - Alarm: Audible alarm function
- Data logging capacity: 2700 real time data points
- Logging interval: 1 s to 12 h
- Logging duration: 1 min ... memory full
- Resolution:
  - 0.01 %RH, 0.01 °C/°F, 0.01 hPa, 0.01 %FS, 10 ppm / 0.01 %CO₂
- Battery operation time:
  - Typical charging time: 4 hours
  - Operation times:
    - Continuous use: 48 h typical at +20 °C (+68 °F)
    - Data logging use: Up to a month

**MI70 battery operation time**

- Typical charging time: 4 hours
- Operation times:
  - Continuous use (with handle): Better than 8 h at +20 °C (+68 °F)
  - Continuous use (with pump): Better than 5 h at +20 °C (+68 °F) without load
  - Data logging use (one probe): Up to 30 days depending on logging interval
### Spare Parts and Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>MI70 Link software with USB cable</td>
<td>219687</td>
</tr>
<tr>
<td>MI70 Link software with serial port cable</td>
<td>MI70LINK</td>
</tr>
<tr>
<td>Analog output cable for 0 ... 1 VDC</td>
<td>27168ZZ</td>
</tr>
<tr>
<td>Calibration adapter</td>
<td>26150GM</td>
</tr>
<tr>
<td>Weatherproof carrying case</td>
<td>MI70CASE3</td>
</tr>
<tr>
<td>Soft carrying case for diffusion handle and probe</td>
<td>MI70SOFTCASE</td>
</tr>
<tr>
<td>Battery, NiMH 4.8 V</td>
<td>26755</td>
</tr>
<tr>
<td>Spare probe (use the order form to define measurement range etc.)</td>
<td>GMP221, GMP222</td>
</tr>
<tr>
<td>Nafion Membrane Tubing</td>
<td>212807GM</td>
</tr>
</tbody>
</table>

### Connection Cable for Fixed CO₂ Instruments

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMT220, GMD20</td>
<td>GMA70</td>
</tr>
<tr>
<td>GMP343</td>
<td>DRW216050SP</td>
</tr>
<tr>
<td>GMW90 series</td>
<td>219980SP</td>
</tr>
</tbody>
</table>
GMW90 Series Carbon Dioxide, Humidity, and Temperature Transmitters for DCV

Features

• Measured parameters: carbon dioxide, temperature, and humidity (optional)
• Superior long-term stability with the next generation Vaisala CARBOCAP® sensor
• Accurate temperature and humidity measurements due to the low-power microglow infrared source
• Quick and easy installation and maintenance
• Calibrated, user-exchangeable measurement modules
• 3-point traceable CO₂ calibration (certification included)
• Both analog and digital communication (BACnet®/Modbus®)

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.

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

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 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 CO₂ 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

### Dimensions in mm

![Diagram of dimensions](image)

### Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Measurements</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMW93</td>
<td>CO₂+T</td>
<td>3-wire, voltage output</td>
</tr>
<tr>
<td>GMW93D</td>
<td>CO₂+T</td>
<td>3-wire, voltage output with display</td>
</tr>
<tr>
<td>GMW94</td>
<td>CO₂+T</td>
<td>3-wire, current output</td>
</tr>
<tr>
<td>GMW94D</td>
<td>CO₂+T</td>
<td>3-wire, current output with display</td>
</tr>
<tr>
<td>GMW93R</td>
<td>CO₂+T+RH</td>
<td>3-wire, voltage output</td>
</tr>
<tr>
<td>GMW93RD</td>
<td>CO₂+T+RH</td>
<td>3-wire, voltage output with display</td>
</tr>
<tr>
<td>GMW93RA</td>
<td>CO₂+T+RH</td>
<td>3-wire, voltage output with display and CO₂ indicator LEDs</td>
</tr>
<tr>
<td>GMW94R</td>
<td>CO₂+T+RH</td>
<td>3-wire, current output</td>
</tr>
<tr>
<td>GMW94RD</td>
<td>CO₂+T+RH</td>
<td>3-wire, current output with display</td>
</tr>
<tr>
<td>GMW95</td>
<td>CO₂+T</td>
<td>Digital (BACnet/Modbus) model</td>
</tr>
<tr>
<td>GMW95D</td>
<td>CO₂+T</td>
<td>Digital (BACnet/Modbus) model with display</td>
</tr>
<tr>
<td>GMW95R</td>
<td>CO₂+T+RH</td>
<td>Digital (BACnet/Modbus) model</td>
</tr>
<tr>
<td>GMW95RD</td>
<td>CO₂+T+RH</td>
<td>Digital (BACnet/Modbus) model with display</td>
</tr>
<tr>
<td>GMW90</td>
<td>CO₂+T</td>
<td>Configurable analog/digital models</td>
</tr>
<tr>
<td>GMW90R</td>
<td>CO₂+T+RH</td>
<td>Configurable analog/digital models</td>
</tr>
</tbody>
</table>
Technical Data

**Measurement Performance**

**Carbon Dioxide**
- **Measurement range**: 0 … 5000 ppm
- **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
  - **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 … +113 °F): ±(45 ppm + 3.8 % of reading)

**Temperature**
- **Measurement range**: -5 … +55 °C (+23 … +131 °F)
- **Temperature sensor**: Digital temperature sensor
  - **Accuracy**: (at +20 … +30 °C (+68 … +86 °F)) ±0.5 °C (±0.9 °F)
  - (at +10 … +20 °C, +30 … +40 °C (+50 … +68 °F, +86 … +104 °F)) ±0.6 °C (±1.08 °F)
  - (at -5 … +10 °C, +40 … +55 °C (+23 … +50 °F, +104 … +113 °F)) ±0.8 °C (±1.44 °F)

**Relative Humidity**
- **Measurement range**: 0 … 95 %RH
- **Humidity sensor**: Vaisala HUMICAP® 180R
  - **Accuracy at 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
  - **Accuracy at temperature range -5 … +10 °C, +40 … +55 °C (+23 … +50 °F, +104 … +113 °F)**:
    - 0 … 60 %RH: ±3.5 %RH
    - 60 … 80 %RH: ±4.0 %RH
    - 80 … 95 %RH: ±5.0 %RH

1) Complies with CEC-400-2008-001-CMF

**Inputs and Outputs**

- **Supply voltage**: 18 ... 35 VDC, 24 VAC ± 20\% 50/60 Hz
- **Service port**: RS-485 line for temporary service use

**Current Output Models**
- **Outputs**: 0/4 ... 20 mA, 2 and 3 channel models
- **Loop resistance**: 0 … 600 Ω
- **Power consumption**: < 2 W

**Voltage Output Models**
- **Outputs**: 0 … 5/10 V, 2 and 3 channel models
- **Load resistance**: 10 kΩ min.
- **Power consumption**: < 1 W

**Default Analog Scales**
- **CO₂**: 0 … 2000 ppm
- **T**: -5 … +55 °C
- **RH**: 0 … 100  %RH

**Digital Models**
- **Power consumption**: < 1.5 W
- **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 (selectable Master/Slave)
    - Address range, master mode: 0 … 127
    - Address range, slave mode: 128 … 255
- **Modbus® RTU**: Address range: 0 … 247

**Mechanical Specifications**

- **Standard housing color**: White (RAL9003)
- **Housing material**: ABS/PC, UL-V0 approved
- **Output connector**: Screw terminals
  - Max. wire size 2 mm² (AWG14)
- **Service port connector**: 4-pin M8
- **Weight**: 163 g (5.75 oz)

1) RAL code is only indicative with potential small variations in color shade

**Spare Parts and Accessories**

- **CO₂ module**: GM10SP
- **Temperature Module (CO₂+T models)**: TM10SP
- **Humidity and Temperature Module (CO₂+T+RH models)**: HTM10SP
- **Decorative cover set (10 pcs)**: 236285
- **Connection cable for MI70**: 219980
- **USB cable for PC connection**: 219690

**Compliance**

- **EMC compliance**: EN61326-1, Industrial Environment
- **IP rating**: IP50

Optional decorative cover blends the transmitter into your interior design.
GMW80 Series Carbon Dioxide, Humidity, and Temperature Transmitters for DCV

Features

- Superior stability with the advanced proprietary CARBOCAP® technology
- Improved accuracy due to low self-heating of microglow light source
- Modbus® RTU support over RS-485 with model GMW87

Vaisala CARBOCAP® Carbon Dioxide, Humidity, and Temperature Transmitter Series GMW80 is based on Vaisala’s patented latest-generation CARBOCAP technology with improved reliability and stability.

The GMW80 series transmitters are designed to fulfill the needs for CO₂ measurements in standard demand-controlled ventilation applications. Temperature measurement is included in most GMW80 series transmitters. Combined with humidity measurement, relay, and LED CO₂ level indication, GMW80 series provides you the flexibility needed for a variety of projects.

The CARBOCAP sensors measure CO₂ 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, 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.

For measurements in more demanding conditions (for example, dusty or humid installation locations), the GMW87 and GMW88 models provide an IP64-rated enclosure with a cable gland.

Reliable operation

The GMW80 series transmitters are optimized for low maintenance. The unique, low-power CARBOCAP technology enables a longer lifetime and better 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 CO₂ sensor guarantees superior stability and flawless operation even in constantly occupied buildings, without the need for 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.

Benefits

- Cost-efficient, affordable
- Reliable and maintenance-free operation for up to 15 years
- Easy to install, easy to use
- Versatile – works well in buildings occupied 24/7
- Ideal for demand-controlled ventilation
Technical data

Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Measurements</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>GMW86P</td>
<td>CO₂+T</td>
<td>Current and voltage output, Pt1000</td>
</tr>
<tr>
<td>GMW83RP</td>
<td>CO₂+RH+T</td>
<td>Voltage outputs, Pt1000, Display with metric scale output</td>
</tr>
<tr>
<td>GMW83DRP</td>
<td>CO₂+RH+T</td>
<td>Voltage outputs, Pt1000, Display with metric scale output</td>
</tr>
<tr>
<td>GMW83</td>
<td>CO₂+T</td>
<td>Voltage outputs</td>
</tr>
<tr>
<td>GMW83A</td>
<td>CO₂+T</td>
<td>Voltage outputs, CO₂ indicator LEDs</td>
</tr>
<tr>
<td>GMW83D</td>
<td>CO₂+T</td>
<td>Voltage outputs, Display with metric scale output</td>
</tr>
<tr>
<td>GMW84</td>
<td>CO₂+T</td>
<td>Current output</td>
</tr>
<tr>
<td>GMW84S</td>
<td>CO₂+T</td>
<td>Current output, Relay</td>
</tr>
<tr>
<td>GMW87</td>
<td>CO₂</td>
<td>RS-485 Modbus RTU output</td>
</tr>
<tr>
<td>GMW88</td>
<td>CO₂</td>
<td>Current and voltage output</td>
</tr>
</tbody>
</table>

1) Models with calibration certificate available (GMW83RPC/GMW83DRPC).

Measurement performance

Carbon dioxide

Measurement range 0 … 2000 ppm (GMW87)
Accuracy:
- at +20 °C (+68 °F): ±(30 ppm +3 % of reading)
- at +10 °C (+50 °F) and +30 °C (+86 °F): ±(35 ppm +3.7 % of reading)
- at +10 °C (+50 °F) and +40 °C (+104 °F): ±(40 ppm +4.8 % of reading)
Stability in typical HVAC applications ±(15 ppm + 2 % of reading) over 5 years
Warm-up time 1 min, 10 min for full specification
Response time (63 %) 60 s, 7 min (GMW87 and GMW88)
Carbon dioxide sensor Vaisala CARBOCAP GM10

Temperature

Measurement range 0 … +50 °C (+32 ... +122 °F)
Temperature sensor On P models: Pt1000 RTD Class F0.15 IEC 60751
For analog outputs: Digital temperature sensor
Accuracies (GMW83 and GMW84):
- at +10 °C (+32 °F) and +30 °C (+86 °F): ±0.5 °C (0.9 °F)
- at +0 °C (+32 °F) and +50 °C (+122 °F): ±1 °C (1.8 °F)

Humidity

Measurement range 0 … 95 %RH
Accuracy at temperature range +10 °C (+32 °F) +50 °C (+122 °F):
- 0 … 80 %RH: ±3 %RH
- 80 … 95 %RH: ±5 %RH
Accuracy at temperature ranges 0 … +10 °C (+32 °C +50 °C) +30 … +50 °C (+86 … +122 °F):
- 0 … 95 %RH: ±7 %RH
Stability in typical HVAC applications ±2 %RH over 2 years
Product lifetime > 15 years

Compliance

EMC compatibility IEC / EN / BS EN 61326-1, industrial environment
Compliance marks CE, RCM, WEEE

Operating environment

Operating temperature 0 … +50 °C (+32 … +122 °F)
Operating humidity 0 … 95 %RH
Dew point < 30 °C (+86 °F)
Storage temperature Models without display: −40 … +70 °C (−40 … +158 °F)
Models with display: −30 … +70 °C (−22 … +158 °F)

Inputs and outputs

Supply voltage 18 … 35 VDC 24 VAC ±20 % 50/60 Hz
Max. current consumption at 18 VDC 45 mA 70 mA (GMW84 models)
Max. power consumption at 30 VAC 0.7 W (GMW83 models) 1 W (GMW86 models, GMW87, and GMW88) 1.2 W (GMW84 models)

Outputs

4 … 20 mA and/or 0 … 10 V (1)

Current loop resistance (4 … 20 mA) 0 … 600 Ω
Voltage output load resistance Min. 10 kΩ
CO₂ output scale 0 … 2000 ppm
Temperature output scale 0 … + 50 °C (+32 … +122 °F)
Humidity output scale 0 … 100 %RH
Passive temperature sensor (P models) Pt1000 RTD
Temperature setpoint (T models) 10 kΩ potentiometer
Relay (S models) 1 pc, SPST-NO Max. 50 VDC / 50 VAC, 500 mA

1) Analog outputs are not available in model GMW87.

Mechanical specifications

IP rating IP30
Housing material ABS/PC UL-V0 approved
PC (GMW87 and GMW88)
Housing color White (RAL9003)
Output connector Screw terminal
Max. wire size 2 mm² (AWG14)

Weight Plain and LED version: 114 g (4.02 oz) Display version: 124 g (4.37 oz) GMW87 and GMW88: 160 g (5.64 oz)
Spare parts and accessories

<table>
<thead>
<tr>
<th>CO₂ module</th>
<th>GM90SP80</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCAP® sensor</td>
<td>15778HM</td>
</tr>
</tbody>
</table>

GMW83, GMW83A, GMW83RP, GMW84, GMW84S, GMW86P, GMW83D, and GMW83DRP dimensions (display in models with the letter D)

GMW87 and GMW88 dimensions
GMD20 Series Carbon Dioxide Transmitters
For demand-controlled ventilation applications

The duct mounted Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMD20 is specially designed for demand controlled ventilation (DCV). The transmitters 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 dependencies 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 is equipped with a display. The compact sensor head design of the duct units fits inside the ventilation duct, eliminating the risk of leaking gaskets and measurement errors.

Features
- 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

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 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

### Measurement Performance

**Carbon Dioxide**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 2000 ppm (Nominal; can be calibrated for other ranges: 0 ... 5000 ppm, 0 ... 10 000 ppm, 0 ... 20 000 ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (including repeatability, non-linearity and calibration uncertainty)</td>
<td>± (2 % of range + 2 % of reading)</td>
</tr>
<tr>
<td>Long-term stability</td>
<td>&lt; ±5 % of range / 5 years</td>
</tr>
<tr>
<td>Response time (63 %)</td>
<td>1 minute</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>1 minute, 15 minutes full specifications</td>
</tr>
</tbody>
</table>

### Operating Environment

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>−5 ... +45 °C (+23 ... +113 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating humidity</td>
<td>0 ... 85 %RH, non-condensing</td>
</tr>
<tr>
<td>Flow velocity</td>
<td>0 ... 10 m/s</td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>EN61326-1, Generic Environment</td>
</tr>
</tbody>
</table>

### Inputs and Outputs

<table>
<thead>
<tr>
<th>Outputs</th>
<th>0 ... 20 or 4 ... 20 mA and 0 ... 10 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional outputs</td>
<td>• Relay</td>
</tr>
<tr>
<td></td>
<td>• LonWorks® interface</td>
</tr>
<tr>
<td>Resolution of analog outputs</td>
<td>8 bits</td>
</tr>
<tr>
<td>Recommended external load</td>
<td>• Current output: max. 500 Ω</td>
</tr>
<tr>
<td></td>
<td>• Voltage output: min. 1 kΩ</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>Nominal 24 VAC/DC (18 ... 30 VDC)</td>
</tr>
<tr>
<td>Connections</td>
<td>Screw terminals, wire size 0.5 ... 1.5 mm²</td>
</tr>
<tr>
<td>Power consumption</td>
<td>&lt; 2.5 W</td>
</tr>
</tbody>
</table>

### Mechanical Specifications

<table>
<thead>
<tr>
<th>Housing material</th>
<th>ABS plastic</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP rating (housing)</td>
<td>IP65</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
</tr>
<tr>
<td>GMD20</td>
<td>140 g (5 oz)</td>
</tr>
<tr>
<td>GMD20D</td>
<td>170 g (6 oz)</td>
</tr>
</tbody>
</table>

### Spare Parts and Accessories

<table>
<thead>
<tr>
<th>Display and relay option for GMD20</th>
<th>GM21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relay output option</td>
<td>GMR20</td>
</tr>
<tr>
<td>LonWorks® module with CO₂ signal (not available when display option is added)</td>
<td>GML20</td>
</tr>
<tr>
<td>Serial COM adapter</td>
<td>19040GM</td>
</tr>
<tr>
<td>Hand-held meter for field verification</td>
<td>GM70</td>
</tr>
</tbody>
</table>

**GMD20 Dimensions**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>42 mm</td>
</tr>
<tr>
<td>Height</td>
<td>22 mm</td>
</tr>
</tbody>
</table>

**GMD20 Mounting Plate Dimensions**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>42 mm</td>
</tr>
</tbody>
</table>

**VAISALA**

www.vaisala.com
MGP261 Multigas Probe
For methane, carbon dioxide, and humidity measurement

Features
- Compact in situ probe with CH₄, CO₂, and H₂O vapor measurement
- Superior long-term stability and repeatability with proprietary infrared technology — no calibration gases needed
- Direct installation into process: no sample treatment needed
- Certified for Ex Zone 0/1
- Probe heating eliminates condensation in wet processes
- Corrosion-resistant stainless steel housing (IP66)
- Standalone probe with digital Modbus RTU over RS-485 or 3 analog outputs (4 ... 20 mA)
- Compatible with Vaisala Insight PC software

Vaisala CARBOCAP® MGP261 Multigas Probe for Methane, Carbon Dioxide, and Humidity Measurement is designed for in situ measurements in demanding biogas processing conditions where repeatable, stable, and accurate measurement is essential. MGP261 is Ex certified for use in Ex Zone 0 (parts inserted into process) and Ex Zone 1 (parts outside the process).

Up to three measurements in one compact unit
MGP261 measures the main components of biogas and landfill gas: methane (CH₄), carbon dioxide (CO₂), and humidity. These gases make up the bulk of biogas, and measuring all three parameters gives you a 100% picture of the process. MGP261 measures CH₄, CO₂, and humidity in vol-% units, or alternatively dewpoint temperature (T_d) in °C.

Methane measurement for biogas quality and process control
Methane concentration measurement tells you the calorific value of the gas produced in real time. With internal temperature measurement for compensation purposes and an option for external pressure or temperature compensation input, the patented CARBOCAP® measurement gives unparalleled stability and reliability without calibration gases. Application areas include anaerobic digestion and landfill gas monitoring, activated carbon filter monitoring in biogas treatment process, and CHP engine feed gas monitoring.

Direct in situ measurement without sample treatment
MGP261 measures gases directly in the process pipeline without a need for moisture removal. This simplifies the measurement both in situ and as part of an extractive system with optional flow through cell accessory. The heated optical elements provide reliable measurements even in most demanding process conditions with condensate in the process gas.

Robust, weatherproof, and Ex certified for zones 0 and 1
MGP261 is Ex certified for use in Ex Zone 0 (parts inserted into process) and Ex Zone 1 (parts outside the process). The electronics and optics of the IP66-rated instrument are protected by encapsulation in a potting compound to ensure maximum resistance to weather, dust, and ingress of process gases in the probe. Materials exposed to process gas are carefully selected for good chemical resistance against hydrogen sulfide: they include stainless 316L steel and polytetrafluoroethylene (PTFE).
Technical data

Measurement performance

<table>
<thead>
<tr>
<th>Property</th>
<th>Methane CH₄</th>
<th>Carbon dioxide CO₂</th>
<th>Water vapor H₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td>CARBOCAP</td>
<td>CARBOCAP</td>
<td>CARBOCAP</td>
</tr>
<tr>
<td>Measurement unit</td>
<td>Volume-%</td>
<td>Volume-%</td>
<td>Volume-%, dew point °C</td>
</tr>
<tr>
<td>Measurement range</td>
<td>0 ... 100 vol-%</td>
<td>0 ... 100 vol-%</td>
<td>0 ... 25 vol-%, -10 ... +60 °C (14 ... +140 °F)</td>
</tr>
</tbody>
</table>

Accuracy specification at 25 °C (+77 °F) and 1013 mbar including non-linearity, calibration uncertainty, and repeatability; temperature and pressure compensated

- Accuracy at +25 °C (+77 °F) and 1013 mbar
  - 0 ... 40 vol-%: ±2 vol-%
  - 40 ... 70 vol-%: ±1 vol-%
  - 70 ... 100 vol-%: ±1 vol-%

Repeatability
- ±0.5 vol-% at 60 vol-%
- ±0.3 vol-% at 40 vol-%
- ±0.1 vol-% at 10 vol-%

Temperature dependence
- Compensated, 0 ... 100 vol-%: ±0.1 % of reading/°C
- Uncompensated, 0 ... 100 vol-%: ±0.9 % of reading/°C

Pressure dependence
- Compensated, 0 ... 100 vol-%: ±0.015 % of reading/mbar
- Uncompensated, 0 ... 100 vol-%: ±0.2 % of reading/mbar

Long-term stability
- ±2 vol-%/year

Start-up time
- 30 s

Warm-up time
- 2 min

Response time
- 90 s

Response time with flow-through adapter
- 90 s at ≥ 0.5 l/min (recommended: 0.5 ... 1 l/min)

Inputs and outputs

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>18 ... 30 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>Typical: 3 W Maximum: 6 W</td>
</tr>
<tr>
<td>Digital output</td>
<td>RS-485 (Modbus RTU)</td>
</tr>
<tr>
<td>Analog output</td>
<td>3 × 4 ... 20 mA scalable, isolated</td>
</tr>
<tr>
<td>Analog output load</td>
<td>Minimum: 0 Ω Maximum: 500 Ω</td>
</tr>
<tr>
<td>Analog output accuracy</td>
<td>±0.2 % of full scale at 25 °C (77 °F)</td>
</tr>
<tr>
<td>Analog output temperature dependence</td>
<td>0.005 %/°C (0.003 %/°F)</td>
</tr>
<tr>
<td>Analog input (optional)</td>
<td>1 × 4 ... 20 mA (Ex ia) for external pressure or temperature sensor</td>
</tr>
</tbody>
</table>

Compliance

Electromagnetic compatibility (EMC) EN61326-1, Industrial environment
Ex classification Ex II 1/2 (T) I Ex eb mb [ia] IIB T3 Ga/Gb -40 °C ≤ Tamb ≤ +60 °C
IP rating IP66

Operating environment

- Operating temperature range: -40 ... +60 °C (-40 ... +140 °F)
- Operating humidity range: 0 ... 100 %RH
- Storage temperature range: -40 ... +60 °C (-40 ... +140 °F)
- Storage humidity range: 0 ... 90 %RH
- Process pressure range: -500 ... +500 mbar (g)
- Process temperature range: +0 ... +60 °C (+32 ... +140 °F)
- Process flow range: 0 ... 20 m/s

Mechanical specification

- Weight: 3 kg (6.6 lb)
- Thread type: 1.5” male NPT
- Cable lead-throughs: 1 × M16x1.5, 2 x M20x1.5

Materials

- Probe body: AISI316L stainless steel, PPS
- Filter cap: Sintered PTFE

Options and accessories

Configuration cable (RS485/USB) | 257295 |
Flow-through adapter | 258877 |
Sintered PTFE filter (includes O-ring) | DRW249991SP |
NPT 1.5” thread test plug | 257525SP |

1) Excluding cross-interferences to other gases.
2) Time to first reading
3) Time to specified accuracy
4) At +20 °C (+68 °F) ambient temperature
5) With standard PTFE filter

Vaisala Insight software for Windows® available at www.vaisala.com/insight
MGP261 dimensions
Vaisala uses HUMICAP sensor technology for measuring moisture in oil. The HUMICAP sensors are the first ever sensors that can measure moisture in oil online. The sensor materials are specifically developed to measure even very low moisture levels in oils, whether mineral, vegetable or synthetic.

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 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.
Vaisala HUMICAP® Moisture in Oil Probe MMP8 enables fast and reliable measurement of moisture in oil. It uses proven Vaisala HUMICAP® sensor that was developed for demanding dissolved moisture measurements in transformer and lubrication oils, hydraulic fluids, and other liquids.

**Reliable Vaisala HUMICAP® technology**
MMP8 incorporates the latest-generation Vaisala HUMICAP® 180L2 sensor, which is the result of over 15 years of field experience. It was developed for demanding moisture measurement in transformer and lubrication oils and other liquids.

The sensor’s excellent chemical tolerance provides accurate and reliable measurement over a wide measurement range. The HUMICAP® 180L2 sensor has excellent sensitivity in the dry end of the range which is typically needed in transformer applications.

**Measure the margin to water saturation**
MMP8 measures dissolved moisture in oil in terms of the water activity ($a_w$), relative saturation (%RS), and temperature (T). Water activity or relative saturation indicate directly whether there is a risk of free water formation. This data is relevant in lubrication oil applications where detecting water ingress and preventing free water formation is crucial. The measurement is independent of oil type and age.

MMP8 can also output ppm, the average mass concentration of water in oil. Vaisala has this conversion readily available for specific oils, including mineral transformer oil. This allows continuous measurement of ppm concentration in power transformer condition monitoring.

For other oils, the oil-specific conversion coefficients can be calculated if the water solubility of the oil is known and the solubility characteristic remains constant.

**Easy installation**
When installed with the ball valve kit, the MMP8 is ideal for installation into processes where the probe needs to be installed or removed while the process is running. Probe installation depth is adjustable. Pressure fitting options are ISO 1/2” and NPT 1/2”. MMP8 is delivered with a manual pressing handle that allows the probe to be pushed against process pressure.
Technical Data

Measurement performance

Water activity

Measurement range 0 ... 1 \( a_w \)

\( T_{90} \) response time 1) 10 min

Sensor HUMICAP® 180L2

Accuracy 2) \( \pm 0.01 a_w (\pm 1 \%RS) \)

Temperature

Measurement range -40 ... +180 °C (−40 ... +356 °F)

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

1) At +20 °C (+68 °F) in still oil.
2) In range 0 ... 0.5 \( a_w \), including non-linearity, hysteresis, and repeatability. See accuracy graph below.

MMP8 \( a_w \) measurement accuracy

Operating environment

Operating temperature of probe head -40 ... +180 °C (−40 ... +356 °F)

Operating temperature of probe body -40 ... +80 °C (−40 ... +176 °F)

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

Operating pressure range 0 ... 40 bar (0 ... 580 psia)

Installation pressure Up to 10 bar (145 psia)

IP rating of probe body IP66

EMC compliance EN61326-1, Industrial environment

Ball valve

Operating pressure Up to +120 °C (+248 °F)

Operating pressure Up to 40 bar (0 ... 580 psia)

Inputs and outputs

Operating voltage 15 ... 30 VDC

Current consumption 10 mA typical

Digital output RS-485, non-isolated

Protocols Modbus RTU

Output parameters Relative saturation (%RS)

Temperature (°C)

Water activity

Water mass fraction (ppm \( w \))

Mechanical specifications

Connector M12 5-pin A-coded male

Weight 510 g (18.0 oz)

Filter options Stainless steel grid standard filter

Stainless steel grid filter for high flow rates (> 1 m/s)

Probe cable length 2 m (6.56 ft)

Adjustable installation depth 35 ... 179 mm (1.37 ... 7.05 in)

Materials

Probe AISI316L

Probe body AISI316L

Cable jacket FEP

MMP8 dimensions

Accessories

Ball valve ISO 1/2" with welding joint BALLVALVE-1

Ball valve ISO 1/2" with thread joint ISO 3/4” BALLVALVE-2

USB PC connection cable 1) 242659

1) Vaisala Insight software for Windows available at www.vaisala.com/insight

MMP8 A\( w \) measurement accuracy

![MMP8 A\( w \) measurement accuracy graph]

![MMP8 dimensions diagram]

![MMP8 accessories diagram]
**MMT330 Series Moisture and Temperature Transmitters for Oil**

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.

**Features**
- 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
- Analog outputs, RS-232/485, LAN
- Modbus protocol support (RTU/TCP)

**Benefits**
- Easy field calibration and maintenance – compatible with Vaisala HUMICAP® Hand-Held Moisture Meter for Oil MM70
- Approved for installation in MAN Diesel & Turbo Two-Stroke Diesel Engines lubrication systems

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**

MMT330 measures moisture in oil in terms of the water activity (aw), relative saturation (%RS), and temperature (T). Water activity or relative saturation indicate 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, 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**

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.
The display shows measurement trends, real-time data, and measurement history.

**Versatile Outputs and Data Collection**

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, RS-232, and RS-485 can be used.

In addition to the analog outputs, MMT330 provides Modbus RTU and TCP/IP communication protocol.

The data recorded by the data logger 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 LAN interface, which enables an Ethernet connection. A USB service cable makes it easy to connect the MMT330 to a PC via the service port.

**Easy Installation**

With multiple options to choose from, the instrument can be tailored to meet the specific needs of each individual application and is delivered installation-ready and pre-configured for each delivery. Quick delivery time and global service network make MMT330 a perfect choice for any project.

Vaisala HUMICAP Hand-Held Moisture for Oil Meter MM70 is designed for field-checking MMT330 transmitters.
Installation Options

The MMT332 probe is installed using a flange. It is designed for high-pressure applications.

**MMT332 for High Pressure Installations**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>0… 250 bar / 0… 3625 psia</td>
</tr>
<tr>
<td>Probe diameter</td>
<td>12 mm (0.5 in)</td>
</tr>
<tr>
<td>Installation flange</td>
<td>36 mm (1.4 in)</td>
</tr>
<tr>
<td>Temperature measurement range</td>
<td>-40 … +180 °C (-40 … 356 °F)</td>
</tr>
</tbody>
</table>

**MMT337 with Small-sized Probe**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>0… 10 bar / 0… 145 psia</td>
</tr>
<tr>
<td>Probe diameter</td>
<td>12 mm (0.5 in)</td>
</tr>
<tr>
<td>Temperature measurement range</td>
<td>-40 … +180 °C (-40 … 356 °F)</td>
</tr>
</tbody>
</table>

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.

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.

**MMT338 with Probe for Pipeline Installations**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range with ball-valve</td>
<td>0… 40 bar / 0… 580 psia</td>
</tr>
<tr>
<td>Adjustable length</td>
<td>35 … 157/379 mm (1.37 … 6.2 /14.9 in)</td>
</tr>
<tr>
<td>Temperature measurement range</td>
<td>-40 … +180 °C (-40 … 356 °F)</td>
</tr>
</tbody>
</table>

**Installation**

| Fitting body               | R 3/8” ISO                |
| Ball-valve set             | BALLVALVE-1               |
| Sampling cell              | DMT242SC2                 |

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**Technical Data**

**Measurement Performance**

**Water Activity**
- Measurement range $a_w$ 0 … 1
- Response time (90 %) at +20 °C in still oil (with stainless steel filter) 10 min

**Sensor** HUMICAP® 180L2

**Accuracy (Including Non-linearity, Hysteresis, and Repeatability):**
- 0 … 0.9 ±0.02
- 0.9 … 1.0 ±0.03

**Temperature**
- Measurement range -40 ... +180 °C (-40 ... +356 °F)
- Accuracy at +20 °C (+68 °F) ±0.2 °C (0.36 °F)

**Operating Environment**

**EMC compliance** EN61326-1, Industrial environment

**Pressure range for probes** See probe specifications

**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)

1) Note: Transmitter with display test impedance of 40 Ω is used in IEC61000-4-5 (Surge immunity)

**Inputs and Outputs**

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

**Operating voltage with optional power supply module** 100 ... 240 VAC 50/60 Hz

**Power Consumption at 20 °C ($I_{In}$ 24 VDC)**
- RS-232 Max. 25 mA
- $U_{out}$ 2 x 0 ... 1 V / 0 ... 5 V / 0 ... 10 V 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 $R_L < 500$ Ω
- 0 ... 1 V output $R_L > 2$ kΩ
- 0 ... 5 V and 0 ... 10 V outputs $R_L > 10$ kΩ
- Max. wire size 0.5 mm² (AWG 20) stranded wires recommended

**Digital outputs**
- RS-232, RS-485 (optional)
- Protocols ASCII commands, Modbus RTU
- Service connection RS-232, 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

**General**

**Display** LCD with backlight, graphical trend display of any parameter

**Menu languages** English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish

**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

**Mechanical Specifications**

**Weight** 1.0 - 3.0 kg (depends on selected probe, cable, and modules)

**Sensor protection** Stainless steel grid standard filter/ Stainless steel grid filter for high flow rates (> 3 m/s)

**Cable bushing** M20x1.5 for cable diameter 8 ... 11 mm (0.31 ... 0.43 in)

**Conduit fitting** 1/2" NPT

**USB-RJ45 Serial Connection Cable** (incl. M70 Link software) 219685

**Probe cable diameter** 5.5 mm (0.2 in)

**Standard probe cable lengths** 2 m, 5 m or 10 m (6.6 ft, 16.4 ft, 32.8 ft)

2) Additional cable lengths available, please see order forms for details

**Housing material** G-AlSi 10 Mg (DIN 1725)

**Interface cable connector (optional)**
- Option 1 Female plug with 5 m (16.4 ft) black cable
- Option 2 Female plug with screw terminals

**Compliance**

**IP rating** IP66

**IP rating with local display** IP65

**NEMA rating with local display** 4X
Dimensions

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

www.vaisala.com
Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT310 is a fast and reliable online 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**
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**
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**
MMT310 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.

**Several Outputs, One Connector**
MMT310 transmitters have two analog outputs and an RS-232 serial output. The output signals and the supply power travel in the same cable, the only cable connected to the unit.
Technical Data

Measurement Performance

**Water Activity**

<table>
<thead>
<tr>
<th>Range</th>
<th>Accuracy (Including Non-Linearity, Hysteresis, and Repeatability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 0.9 (0 ... 90%)</td>
<td>±0.02</td>
</tr>
<tr>
<td>0.9 ... 1.0</td>
<td>±0.03</td>
</tr>
</tbody>
</table>

Response time (90%) at +20 °C in still oil (with stainless steel filter): 10 min

Sensor: Vaisala HUMICAP® 180L2

**Temperature**

<table>
<thead>
<tr>
<th>Range</th>
<th>Accuracy at +20 °C (68 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 ... +180 °C (-40 ... +356 °F)</td>
<td>±0.2 °C (±0.36 °F)</td>
</tr>
</tbody>
</table>

Sensor: Pt100 RTD Class F0.1 IEC 60751

Mechanical Specifications

<table>
<thead>
<tr>
<th>IP rating</th>
<th>Weight example: MMT317 with 2 m cable (Weight depends on selected probe and cable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP66</td>
<td>476 g</td>
</tr>
</tbody>
</table>

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)

Materials

<table>
<thead>
<tr>
<th>Transmitter housing</th>
<th>Transmitter base</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-AlSi 10 Mg</td>
<td>PPS</td>
</tr>
</tbody>
</table>

**Probe Cable Length**

<table>
<thead>
<tr>
<th>Probe</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMT317</td>
<td>2 m, 5 m, or 10 m</td>
</tr>
<tr>
<td>MMT318</td>
<td>2 m, 5 m, or 10 m</td>
</tr>
</tbody>
</table>

**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"

**Inputs and Outputs**

Two analog outputs, selectable and scalable:
- 0 ... 20 mA or 4 ... 20 mA
- 0 ... 5 V or 0 ... 10 V

Typical accuracy of analog output at +20 °C: ±0.05 % full scale

Typical temperature dependence of analog output: 0.005 %/°C (0.003 %/°F) full scale

Serial output: RS-232C

Connections: 8-pole connector with RS232C, current/ voltage outputs (two channels) and U_out

Operating voltage: 10 ... 35 VDC

External load: R_L < 500 Ω

Startup time after power-up: 3 s

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 kΩ): 12 mA

Channel 1 & channel 2: 50 mA

Inputs and Outputs

<table>
<thead>
<tr>
<th>Operating temperature for electronics</th>
<th>Storage temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 ... +60 °C (-40 ... +140 °F)</td>
<td>-55 ... +80 °C (-67 ... +176 °F)</td>
</tr>
</tbody>
</table>

Pressure range for MMT318 with ball-valve up to 120 °C

Pressure range for MMT317: 0 ... 10 bar

EMC compliance: EN61326-1, Industrial environment

Operating Environment

Spare Parts and Accessories

<table>
<thead>
<tr>
<th>Rain shield</th>
<th>USB cable</th>
<th>Stainless steel filter</th>
<th>Stainless steel filter (high flow rate)</th>
<th>Ball-Valve Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASM21103</td>
<td>238607</td>
<td>HM47453SP</td>
<td>220752SP</td>
<td>BALLVALVE-1</td>
</tr>
</tbody>
</table>
Transmitter body, dimensions in mm (inches)

MMT317 probe, dimensions in mm (inches)

MMT318 probe, dimensions in mm (inches)
VAISALA

MMT162 Moisture and Temperature Transmitter for Oil
For OEM applications

Features
- Continuous measurement of moisture in oil
- Measures in lubrication, hydraulic, and transformer oils
- Excellent pressure and temperature tolerance
- Proven Vaisala HUMICAP® sensor: over 20 years in oil applications
- Measures water activity - ppm calculation available for transformer oil
- Digital output RS-485 with Modbus
- Traceable calibration (certificate included)

Vaisala HUMICAP® Moisture and Temperature Transmitter for Oil MMT162 is an excellent economical solution for reliable on-line detection of moisture in oil.

Benefits
- Reliable
- Durable
- Small size, easy to integrate

Reliable Vaisala HUMICAP® technology
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 two decades. The sensor’s excellent chemical tolerance provides accurate and reliable measurement over the measurement range.

Water activity measurement
MMT162 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. The ppm calculation for mineral oil based transformer oil is optional in MMT162.

Several outputs - one connector
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, MMT162 is quickly and easily installed in tight spaces. Units are delivered fully assembled - however, you can reconfigure them to suit your needs.

MM70 moisture and temperature meter
In combination with an MM70 Handheld Moisture and Temperature Meter, the MMT162 provides an ideal tool for on-site calibration. MI70 Handheld Measurement Indicator (included in the MM70 package) can be used as a communication and datalogging device and display for the MMT162.
Technical data

Measurement performance

**Water activity**
- Measurement range: 0 … 1 \( a_w \)
- Accuracy (including non-linearity, hysteresis, and repeatability):
  - 0 … 0.9 \( a_w \): ± 0.02 \( a_w \)
  - 0.9 … 1.0 \( a_w \): ± 0.03 \( a_w \)
- Response time in oil flow (typical): < 1 min (dry-wet)

**Temperature**
- Accuracy at +20 °C (+68 °F): ± 0.2 °C (0.36 °F)

**Moisture**
- Calculated moisture content in ppm for mineral transformer oil

Operating environment

- EMC compliance: EN61326-1, Industrial environment
- Operating temperature: −40 … +60 °C (~−40 … +140 °F)
- Storage temperature: −40 … +80 °C (~−40 … +176 °F)
- Oil temperature: −40 … +80 °C (~−40 … +176 °F)
- Oil flow: Some flow recommended
- Pressure range: Up to 200 bar

Inputs and outputs

- Alarm level indication by analog signal: User selectable
- Digital outputs: RS-485, non-isolated, Vaisala protocol, Modbus RTU protocol
- Analog current output: 0 … 20 mA, 4 … 20 mA
- Analog voltage output: 0 … 5 V, 0 … 10 V

Spare parts and accessories

- Stainless steel filter (standard): 225356SP
- Stainless steel filter for high flow (> 1 m/s): 221494SP
- Connection cable for MM70 handheld 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 with Swagelok connectors: DMT242SC2
- Connection cables:
  - 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, shielded, connector 90° angle: 231520SP
  - 5 m, shielded, connector 90° angle: 231521SP
  - M8 threaded, Ch1 signal + Ch2 LED: MP300LEDCTRL

Mechanical specifications

- Sensor: HUMICAP®
- Cable connections (2 ports): MB 4-pin male
- Mechanical connections with bonded seal ring (washer): G 1/2” ISO or NPT 1/2”
- Weight: 200 g (7 oz)
- 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 kΩ
    - Current output: Max. 500 Ω
- Housing:
  - Probe body material: Stainless steel (AISI 316L)
- IP rating: IP66

MMT162 dimensions

www.vaisala.com

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Vaisala HUMICAP® Handheld Moisture Meter for Oil MM70 enables reliable detection of moisture in oil. The probe can be inserted directly into the process pipe through a ball valve without draining the oil in the system.

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**
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**
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.

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**Vaisala HUMICAP® Technology**
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.

**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.
### Measurement Performance, MMP78 Probe

**Water Activity**

<table>
<thead>
<tr>
<th>Measurement range $a_w$</th>
<th>Accuracy (including nonlinearity, hysteresis and repeatability) when calibrated against salt solutions (ASTM E104-85):</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 1</td>
<td>$0.9 \pm 0.0$</td>
</tr>
<tr>
<td>0.9 ... 1.0</td>
<td>$0.02 \pm 0.03$</td>
</tr>
</tbody>
</table>

Maximum achievable accuracy (including nonlinearity, hysteresis and repeatability) when calibrated against high-quality, certified humidity standards:

| 0 ... 0.9   | $0.01 \pm 0.02$ |
| 0.9 ... 1.0 | $0.02 \pm 0.02$ |

Response time (90%) at +20 °C (+68 °F) in still oil (with stainless steel filter) 10 min

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Typical accuracy at +20 °C (±0.5 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 ... +100 °C (-40 ... +212 °F)</td>
<td>±0.2 °C (±0.36 °F)</td>
</tr>
</tbody>
</table>

Sensor: Vašala HUMICAP® 180L2

Recommended recalibration interval: 1 year

Typical long-term stability: better than 0.01 $a_w$ / year

**Probe Operating Environment**

<table>
<thead>
<tr>
<th>Operating temperature for electronics</th>
<th>max. 20 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating pressure range during installation through ball valve</td>
<td>max. 10 bar</td>
</tr>
<tr>
<td>Oil flow range</td>
<td>max. 1 m/s</td>
</tr>
<tr>
<td>Typical temperature dependence of electronics</td>
<td>±0.005 °C/°C (±0.005 °F/°F)</td>
</tr>
</tbody>
</table>

EMC compliance: EN61326-1, Portable Equipment

**Probe Mechanical Specifications**

<table>
<thead>
<tr>
<th>Housing classification</th>
<th>IP65 (NEMA 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe material</td>
<td>Stainless steel (AISI316L)</td>
</tr>
<tr>
<td>Housing material</td>
<td>APS/PC Blend</td>
</tr>
<tr>
<td>Cable length between probe and indicator</td>
<td>1.9 m, 10 m extension available</td>
</tr>
<tr>
<td>Weight</td>
<td>506 g</td>
</tr>
</tbody>
</table>

### MI70 measurement indicator

**Operating environment**

| Operating temperature | -10 ... +40 °C (+14 ... +104 °F) |
| Operating humidity    | 0 ... 100 %RH, non-condensing |
| Storage temperature   | -40 ... +70 °C (-40 ... +158 °F) |

**Inputs and outputs**

| Max. no of probes | 2 |
| PC interface      | MI70 Link software with USB or serial port cable |
| Analog output     | 0 ... 1 VDC |
| Power supply      | Rechargeable NiMH battery pack with AC adapter or 4 × AA size alkalines, type IEC LR6 |

| Output resolution | 0.6 mV |
| Accuracy          | 0.2 % full scale |
| Temperature dependence | 0.002 %/°C (0.01 %/°F) full scale |
| Minimum load resistor | 10 kΩ to ground |

**Mechanical specifications**

| Housing classification | IP54 |
| Housing materials      | ABS/PC blend |
| Weight                 | 400 g (14 oz) |

**Compatibility**

| EMC compliance | EN 61326-1, portable equipment |

**Other**

| 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 (0.63 in) |
| Alarm          | Audible alarm function |
| Data logging capacity | 2700 real time data points |
| Logging interval | 1 s to 12 h |
| Logging duration | 1 min ... memory full |
| Resolution     | 0.01 %RH, 0.01 °C/°F, 0.01 hPa, 0.01 $a_w$, 10 ppm / 0.01 %CO$_2$ |

**Battery operation time**

| Typical charging time | 4 hours |
| Operation times       | Continuous use: 48 h typical at +20 °C (+68 °F)  
Data logging use: Up to a month |

**MI70 battery operation time**

| Typical charging time | 4 hours |

| Operation times       | Continuous use: 48 h typical at +20 °C (+68 °F)  
Data logging use: Up to a month |
**Spare Parts and Accessories**

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weatherproof Carrying Case</td>
<td>MI70CASE4</td>
</tr>
<tr>
<td>Ball valve set (incl. fitting body &amp; blanking plug)</td>
<td>HMP228BV5</td>
</tr>
<tr>
<td>Probe cable extension, 10 m</td>
<td>213107SP</td>
</tr>
<tr>
<td>M70 Link software with USB cable</td>
<td>219687</td>
</tr>
<tr>
<td>M70 Link software with serial port cable</td>
<td>MI70LINK</td>
</tr>
<tr>
<td>Analog output cable</td>
<td>27168ZZ</td>
</tr>
<tr>
<td>Sensor protection</td>
<td>HM47453SP</td>
</tr>
<tr>
<td>Dew point measurement probes</td>
<td>DMP74A/B</td>
</tr>
<tr>
<td>Relative humidity measurement probes</td>
<td>HMP75, HMP76, HMP77</td>
</tr>
<tr>
<td><strong>Transmitter Connection Cables</strong></td>
<td></td>
</tr>
<tr>
<td>MMT162</td>
<td>219980SP</td>
</tr>
<tr>
<td>MMT310</td>
<td>DRW216050SP</td>
</tr>
<tr>
<td>MMT330</td>
<td>211339</td>
</tr>
</tbody>
</table>

**Probe dimensions in mm (inches)**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>250mm</th>
<th>340 (13.39)</th>
<th>210 (8.27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>340 (13.39)</td>
<td>210 (8.27)</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>170 (6.69)</td>
<td>12 (0.47)</td>
<td></td>
</tr>
<tr>
<td>Depth</td>
<td>13.5 (0.53)</td>
<td>12 (0.47)</td>
<td></td>
</tr>
</tbody>
</table>

**Indicator dimensions in mm (inches)**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>250mm</th>
<th>340 (13.39)</th>
<th>210 (8.27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>200 (7.87)</td>
<td>13.5 (0.53)</td>
<td>12 (0.47)</td>
</tr>
<tr>
<td>Width</td>
<td>82 (3.24)</td>
<td>12 (0.47)</td>
<td>12 (0.47)</td>
</tr>
<tr>
<td>Depth</td>
<td>62 (2.44)</td>
<td>12 (0.47)</td>
<td>12 (0.47)</td>
</tr>
</tbody>
</table>

VAISALA

www.vaisala.com

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Vaisala Jade Smart Cloud is a convenient cloud-based data service for managing measurement data. The application can be accessed through a web browser on your mobile phone, tablet, or computer, making it ideal for professionals who want access to quality measurement data anywhere and at any time.

**Features**

- Online service for monitoring of measurement parameters such as humidity and temperature
- Secure cloud storage of data for the duration of your subscription
- Management of measurement locations using an intuitive system of sites and locations
- Connect using a web browser on your mobile phone, tablet or computer
- Add devices and users based on your needs
- No device pairing needed, as devices are associated with a specific cloud account when they are purchased

**Easy setup**

The system is very easy to get started with. No device pairing is needed, as the devices are associated with a Jade Smart Cloud account when they are purchased. New devices become automatically available in the system. With the intuitive user interface, users can assign devices to measurement locations. Measurement locations can then be organized into measurement groups and sites for easy navigation.

**Licensing**

Access to the user interface, as well as features that are enabled, are based on license tiers. Basic tier provides the essential management features. Additional tiers will be made available later.

The number of active devices that can send their data to the cloud is controlled using device connection subscriptions. All data is safely stored in the cloud.

**Web application**

The web application user interface is built on modern web technologies and supported by all major desktop and mobile browsers. There is no app to install and maintain. The user interface is always available online at: https://jade.vaisala.com
## Technical data

### Web application

<table>
<thead>
<tr>
<th>Feature</th>
<th>Basic tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web address</td>
<td></td>
</tr>
<tr>
<td>Web interface protocol</td>
<td>TLS 1.2</td>
</tr>
<tr>
<td>Recommended Internet browsers</td>
<td>Google Chrome™, Mozilla Firefox®, Safari®</td>
</tr>
<tr>
<td>User interface languages</td>
<td>English and Finnish</td>
</tr>
</tbody>
</table>

### Supported devices

<table>
<thead>
<tr>
<th>Device type</th>
<th>Connection requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWL100 Cloud Wireless Data Logger</td>
<td>Connects wirelessly through a CA10 access point. The access point must be associated with the same customer account.</td>
</tr>
<tr>
<td>CA10 Cloud Access Point</td>
<td>Cabled Ethernet network with Internet connection (can be provided using a cellular modem)</td>
</tr>
</tbody>
</table>

### License tiers

<table>
<thead>
<tr>
<th>Feature</th>
<th>Basic tier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live measurement data</td>
<td></td>
</tr>
<tr>
<td>Trend graph</td>
<td></td>
</tr>
<tr>
<td>Organizing measurement locations under groups and sites</td>
<td></td>
</tr>
<tr>
<td>Device and probe details, including calibration date</td>
<td></td>
</tr>
<tr>
<td>Download measurement data in CSV format</td>
<td></td>
</tr>
</tbody>
</table>
Cloud Access Point CA10 is a wireless networking hardware device for connecting CWL100 data loggers to Vaisala Jade Smart Cloud service.

**CA10 and Jade Smart Cloud**
CA10 access point transfers measurement data from wireless CWL100 data loggers to Jade Smart Cloud service, and enables management of the data loggers from the cloud interface. Data is encrypted during transfers to protect against eavesdropping, data tampering, and transfer errors.

CA10 access points and CWL100 data loggers are associated with a specific cloud account when they are purchased, so there is no need for the user to do any device pairing. CA10 always requires power and Internet connection for operation.

**Redundancy**
Redundancy of the wireless connection is achieved through use of multiple access points and free connection capacity in the system. If a data logger has a connection problem, it will automatically connect to another available nearby access point in the system. At least two access points with free capacity are needed for failover to function.

In case of temporary network disruptions, the CWL100 data loggers can record up to 30 days of measurements. Recorded data can be downloaded directly from the data logger through the USB port.

**Time synchronization**
CA10 requires accurate time to operate its LoRa wireless connection, and to maintain correct time on the connected data loggers. To achieve the accurate time, CA10 automatically synchronizes with Network Time Protocol (NTP) servers over the Internet.

**Features**
- Connects up to 32 CWL100 wireless data loggers to Vaisala Jade Smart Cloud
- Display shows connection status of data loggers and cloud service
- Long range LoRa™ radio with over 100 m (328 ft) typical indoor range
- End-to-end encryption ensures secure data transmission and storage
- Powered by Power over Ethernet (PoE) or DC adapter
- Requires Internet connection through cabled Ethernet network or cellular modem
# Technical data

## Wireless

<table>
<thead>
<tr>
<th>Networking standards</th>
<th>LoRa™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
<td>LoRa chirp spread spectrum modulation</td>
</tr>
<tr>
<td>Output power</td>
<td>13 dBm (20 mW)</td>
</tr>
<tr>
<td>Antenna</td>
<td>Non-removable external antenna</td>
</tr>
<tr>
<td>Typical range (indoors)</td>
<td>At least 100 m (328 ft)</td>
</tr>
<tr>
<td>Maximum number of access points in an area</td>
<td>8</td>
</tr>
<tr>
<td>Frequency bands</td>
<td>868 and 915 MHz</td>
</tr>
</tbody>
</table>

### Radio standards and approvals

- **868 MHz model**
  - ETSI EN 300 220-2
- **915 MHz model**
  - FCC ID: 2AO39-AP10A
  - IC ID: 23830-AP10A

## General

<table>
<thead>
<tr>
<th>Compatible host systems</th>
<th>Vaisala Jade Smart Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported devices</td>
<td>Up to 32 CWL100 data loggers</td>
</tr>
<tr>
<td>Display language</td>
<td>English</td>
</tr>
<tr>
<td>Internal clock</td>
<td>Synchronizes with Network Time Protocol (NTP) servers over the Internet</td>
</tr>
<tr>
<td>Safety</td>
<td>EN/UL/IEC 61010-1</td>
</tr>
</tbody>
</table>

### Requirements for connectivity

- Cabled Ethernet network with Internet connection (can be provided using a cellular modem)
- Network provides IP address through DHCP
- CA10 must be able to access TCP port 443 and UDP port 123

## Operating environment

<table>
<thead>
<tr>
<th>Operating environment</th>
<th>Indoor use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>(-20 \ldots +60 , ^\circ \text{C} ) ((-4 \ldots +140 , ^\circ \text{F}) )</td>
</tr>
<tr>
<td>Operating humidity</td>
<td>0 \ldots 90 % RH, non-condensing</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>(-20 \ldots +60 , ^\circ \text{C} ) ((-4 \ldots +140 , ^\circ \text{F}) )</td>
</tr>
<tr>
<td>EMC compliance</td>
<td>EN/IEC 61326-1, industrial environment</td>
</tr>
</tbody>
</table>

## Mechanical specifications

<table>
<thead>
<tr>
<th>IP rating</th>
<th>IP30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing color</td>
<td>White</td>
</tr>
<tr>
<td>Mounting methods</td>
<td>Screws, tie wrap</td>
</tr>
<tr>
<td>Weight</td>
<td>386 g (13.6 oz)</td>
</tr>
<tr>
<td>Dimensions (H × W × D)</td>
<td>311 × 133 × 37 mm (12.24 × 5.24 × 1.46 in)</td>
</tr>
</tbody>
</table>

### Materials

- **Housing**
  - PC/ABS blend
- **Display window**
  - Chemically strengthened glass
- **Antenna**
  - ABS

## Inputs and outputs

### Operating voltage using dedicated power supply connector

- 10 ... 30 VDC

### PoE power class

- Class 0

### Power consumption

- Max. 13 W

### Ethernet interface

- Supported standards: 10BASE-T, 100BASE-TX
- IPv4 address assignment: DHCP (automatic)

### Connectors

- Power supply connector: 2.0 mm center pin locking type DC power jack
- Service port: Micro-USB (2.0)
- Expansion port: USB type A (2.0)
- Ethernet: 8P8C (RJ-45)

---

**CA10 access point dimensions**
CWL100 Cloud Wireless Data Logger uses long range LoRa™ wireless technology. It can be used to monitor temperature and humidity in a wide range of environments such as warehouses, production areas, cleanrooms, and laboratories. CWL100 is also suitable for construction moisture measurement.

**LoRa wireless**
CWL100 connects wirelessly to Vaisala Jade Smart Cloud service, which provides real-time data and trend graphs. The LoRa modulation technique provides a robust wireless signal that is extremely reliable over long distances and in complex, obstructed conditions. This wireless technology allows the data logger’s signal to travel over 100 m (328 ft) indoors without the aid of signal amplifiers or repeaters. Wireless communications are encrypted to ensure data integrity and security. Measurements are updated on the local display and stored on the data logger’s local memory every 60 seconds, and sent through the wireless connection every 4 minutes. Jade Smart Cloud service stores the data in the original 1-minute resolution.

In case of a temporary network disruption the data logger can record up to 30 days of measurements. Recorded data can be downloaded directly from CWL100 through the USB port.

**Versatility and convenience**
CWL100 requires no startup configuration, and the included mounting bracket supports several installation methods. Detailed custom display shows the latest measurement results, battery status, and signal strength of the current access point connection. The housing is classified IP54 to protect the device from dust and cleaning.

CWL100 is powered by 2 standard AA size 1.5 V batteries (LR6 alkaline or FR6 lithium) for 18 months of operation at approximately 20 °C (68 °F). There is no need for costly battery replacements between recommended calibrations.

**Detachable probe**
CWL100 supports several probe types for humidity and temperature measurement. Models with plastic housing are suitable for ambient measurements and provide a fast temperature response time. Stainless steel probes are robust and suitable for demanding applications such as construction moisture measurement using the borehole method.

The probes use Vaisala HUMICAP® humidity sensors and platinum temperature sensors for superior stability. Probes can be integrated with the CWL100 housing or connected using a cable.

The probe is detachable, and easy to switch out for calibration. Jade Smart Cloud service detects the changed probe information automatically and maintains accurate and complete historical records.
## Probe options

<table>
<thead>
<tr>
<th>Probe model</th>
<th>Measurement</th>
<th>Application</th>
<th>Measurement temperature</th>
<th>Mounting</th>
<th>Calibration certificate</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMP63</td>
<td>RH + T</td>
<td>General purpose humidity and temperature probe. Ideal for ambient measurement.</td>
<td>-40 ... +60 °C (-40 ... +140 °F)</td>
<td>Integrated or cable probe</td>
<td>No</td>
</tr>
<tr>
<td>HMP110</td>
<td>RH + T</td>
<td>Robust probe for demanding conditions. Suitable for structural humidity measurement using the borehole method.</td>
<td>-40 ... +80 °C (-40 ... +176 °F)</td>
<td>Cable probe only</td>
<td>Yes</td>
</tr>
<tr>
<td>HMP115</td>
<td>RH + T</td>
<td>Calibrated probe for high accuracy general purpose humidity and temperature measurement.</td>
<td>-40 ... +60 °C (-40 ... +140 °F)</td>
<td>Integrated or cable probe</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Item code</th>
<th>HMP63</th>
<th>HMP110</th>
<th>HMP115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe cable 1.5 m</td>
<td>CBL210555-1M5SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe cable 3 m</td>
<td>CBL210555-3MSP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe cable 10 m</td>
<td>CBL210555-10MSP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Flat cable 3 m</td>
<td>CBL210647SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe holder (5 pcs)</td>
<td>ASM213382SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Mounting nuts (2 pcs), hex M12×1 Pa 6.6</td>
<td>18350SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe mounting clamps (10 pcs)</td>
<td>226067</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Duct installation kit</td>
<td>215619</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Solar radiation shield DTR504</td>
<td>DTR504</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Solar radiation shield with pole installation kit DTR504A</td>
<td>DTR504A</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

### Accessories for concrete moisture measurement

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Item code</th>
<th>HMP63</th>
<th>HMP110</th>
<th>HMP115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic tube set (12 pcs)</td>
<td>19266HM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Long (200 mm) plastic tube set (12 pcs)</td>
<td>245789</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Rubber plugs (12 pcs)</td>
<td>233976</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Plastic flange set (12 pcs)</td>
<td>26529HM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Long rubber plug for wet concrete (12 pcs)</td>
<td>26530HM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
Technical data

**Wireless**

<table>
<thead>
<tr>
<th>Networking standards</th>
<th>LoRa™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
<td>LoRa chirp spread spectrum modulation</td>
</tr>
<tr>
<td>Output power</td>
<td>13 dBm (20 mW)</td>
</tr>
<tr>
<td>Antenna</td>
<td>Internal</td>
</tr>
<tr>
<td>Typical range (indoors)</td>
<td>At least 100 m (328 ft)</td>
</tr>
<tr>
<td>Range with line-of-sight</td>
<td>Over 500 m (1640 ft)</td>
</tr>
<tr>
<td>Frequency bands</td>
<td>868 MHz and 915 MHz</td>
</tr>
</tbody>
</table>

**Radio standards and approvals**

- 868 MHz model: ETSI EN 300 220-2
- 915 MHz model: FCC ID: 2AO39-RFL100A, IC ID: 23830-RFL100A

**Memory**

<table>
<thead>
<tr>
<th>Sample capacity</th>
<th>30 days (43200 samples per channel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memory type</td>
<td>Non-volatile EEPROM</td>
</tr>
<tr>
<td>Memory mode</td>
<td>Ring buffer (FIFO)</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>One sample / channel / minute (non-changeable)</td>
</tr>
</tbody>
</table>

**Operating environment**

- **Storage temperature**: −40 ... +60 °C (−40 ... +140 °F)
- **Operating humidity**: 0 ... 100 %RH, non-condensing
- **EMC compliance**: EN/IEC 61326-1, industrial environment

**Operating temperature**

- with alkaline batteries: +2 ... +60 °C (+35.6 ... +140 °F)
- with lithium batteries: −20 ... +60 °C (−4 ... +140 °F)

1) For both alkaline and lithium, battery temperature operating specifications apply.

**General**

<table>
<thead>
<tr>
<th>Compatible probes</th>
<th>HMP63, HMP110, HMP115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batteries</td>
<td>2 × AA sized, 1.5 V (LR6 or FR6)</td>
</tr>
<tr>
<td>Operation time at 20 °C (68 °F) without external power supply</td>
<td>18 months</td>
</tr>
<tr>
<td>Internal clock accuracy</td>
<td>±30 s/month Synchronizes time from CA10 access point</td>
</tr>
<tr>
<td>Safety</td>
<td>EN/UL/IEC 61010-1</td>
</tr>
</tbody>
</table>

**Mechanical specifications**

<table>
<thead>
<tr>
<th>Housing color</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting methods</td>
<td>Screws, tie-wrap, hook, or magnetic mounting bracket (optional accessory)</td>
</tr>
<tr>
<td>Probe interface</td>
<td>4-pin female M8 connector</td>
</tr>
<tr>
<td>Service port</td>
<td>USB 2.0 with micro-USB connector</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP54</td>
</tr>
</tbody>
</table>

**Dimensions (H × W × D) with HMP115 probe**

- Without mounting bracket: 158 × 62 × 31 mm (6.22 × 2.4 × 1.22 in)
- With mounting bracket: 186 × 68 × 36.5 mm (7.32 × 2.68 × 1.44 in)

**Weight**

- With batteries (2 pcs alkaline), HMP115 probe, and magnetic mounting bracket: 254 g (8.96 oz)

**Materials**

- Housing: PC/ABS blend
- Display window: PMMA (acrylic)
- Sealings: TPE
### HMP110 probe measurement performance

#### Relative humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy in temperature range 0 °C → 40 °C (+32 °F → +104 °F) (^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±1.5 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±2.5 %RH</td>
</tr>
</tbody>
</table>

#### Accuracy in temperature range

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 °C → 40 °C (+32 °F → +104 °F)</td>
<td>±0.4 °C (±0.72 °F)</td>
</tr>
<tr>
<td>−40 °C → +40 °C (-40 °F → +104 °F)</td>
<td>±0.4 °C (±0.72 °F)</td>
</tr>
</tbody>
</table>

#### Factory calibration uncertainty

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±2.5 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±4.0 %RH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humidity sensor</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUMICAP (^1) 180R</td>
<td>±2 %RH over 2 years</td>
</tr>
</tbody>
</table>

---

### HMP115 probe measurement performance

#### Relative humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy in temperature range 0 °C → 40 °C (+32 °F → +104 °F) (^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±1.5 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±2.5 %RH</td>
</tr>
</tbody>
</table>

#### Accuracy in temperature range

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 °C → 40 °C (+32 °F → +104 °F)</td>
<td>±0.4 °C (±0.72 °F)</td>
</tr>
<tr>
<td>−40 °C → +60 °C (-40 °F → +140 °F)</td>
<td>±0.4 °C (±0.72 °F)</td>
</tr>
</tbody>
</table>

#### Factory calibration uncertainty

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±3.0 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±4.0 %RH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humidity sensor</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUMICAP (^1) 180R</td>
<td>±2 %RH over 2 years</td>
</tr>
</tbody>
</table>

---

### HMP63 probe measurement performance

#### Relative humidity

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Typical accuracy in temperature range 0 °C → 40 °C (+32 °F → +104 °F) (^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±3 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±5 %RH</td>
</tr>
</tbody>
</table>

#### Typical accuracy in temperature range

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 °C → 60 °C (-40 °F → +140 °F)</td>
<td>±0.6 °C (±1.08 °F)</td>
</tr>
</tbody>
</table>

#### Factory calibration uncertainty

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 90 %RH</td>
<td>±5 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±7 %RH</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humidity sensor</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCAP (^1) 40</td>
<td>±2 %RH over 2 years</td>
</tr>
</tbody>
</table>

#### Temperature

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>Accuracy in temperature range 0 °C → 40 °C (+32 °F → +104 °F) (^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 °C → 30 °C (+32 °F → +86 °F)</td>
<td>±0.5 °C (±0.9 °F)</td>
</tr>
<tr>
<td>−40 °C → +10 °C (-40 °F → +50 °F)</td>
<td>±0.6 °C (±1.08 °F)</td>
</tr>
</tbody>
</table>

#### Factory calibration uncertainty

<table>
<thead>
<tr>
<th>Temperature sensor</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10000 RTD Class F0.1 IEC 60751</td>
<td>±0.1 °C (±0.18 °F)</td>
</tr>
</tbody>
</table>

---

### HMP63 and HMP115 probe mechanical specifications

#### IP rating

- HMP63: IP54
- HMP115: IP65

#### Diameter

- HMP63: 14 mm (0.55 in)
- HMP115: 12 mm (0.47 in)

#### Length

- HMP63: 79 mm (3.11 in)
- HMP115: 78 mm (3.07 in)

#### Materials

- Probe body: PC/ABS blend
- Grid filter: PC (glass reinforced)
- Sleeve: PC/ABS blend

---

### HMP110 probe mechanical specifications

#### IP rating

- IP65 \(^1\)

#### Body thread

- M12×1 / 10 mm (0,4 in)

#### Diameter

- 12 mm (0.47 in)

#### Length

- 78 mm (3.07 in)

#### Materials

- Probe body: Stainless steel (AISI 316)
- Grid filter: Chrome coated ABS plastic

---

\(^1\) Includes non-linearity, hysteresis, and repeatability.

\(^2\) Small variations possible; see also calibration certificate.

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**VAISALA**

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Vaisala viewLinc Enterprise Server software allows you to network several types of Vaisala data loggers or Modbus devices, using a combination of wired and wireless connections. It supports small installations of one or two measurement points, or large systems that monitor thousands of locations. Designed for regulated and critical environmental monitoring, viewLinc ensures data integrity with a secure audit trail, access controls, encryption, and authorization levels that fulfill regulatory requirements.

### Continuous reliability
viewLinc runs as a Microsoft® Windows® service. If you are required to reboot your server, the viewLinc service restarts automatically. Users log in to viewLinc on any network computer or mobile device with a supported browser and can display viewLinc in several languages: English, German, French, Portuguese, Spanish, Swedish, Finnish, Chinese, and Japanese. viewLinc supports UTF-8 compliant multi-byte character sets.

### Licensing
A license key is required for each viewLinc Enterprise Server or Device Host installation (the number of devices permitted is defined by the license key). Obtain additional licenses to enable voice or SMS web notifications, to integrate with Vaisala OPC UA Server or the viewLinc REST API, or to add third-party Modbus devices.

### Upgrading
Previous versions of viewLinc, 3.6.1 and higher, can upgrade to 5.1 directly. Depending on the server/database size, upgrade may take a few minutes or several hours (4 to 6).

### System requirements
- A dedicated server continuously available 24/7 to run viewLinc Enterprise Server software.
- One or more Vaisala data loggers, Vaisala wireless data loggers, or Vaisala HMT300 series transmitters.
- Vaisala cables, for connecting data loggers and setting up wireless transmitters.

### Optional requirements
- Vaisala or third-party Modbus-enabled devices
- A dedicated or shared server to manage devices at multiple sites (running viewLinc Device Host software).
- Remote display terminals to monitor sites without user PCs.
- vNet, single or multi-port devices, to connect data loggers, transmitters or probes through Ethernet.
- Voice/SMS web service provider account (Twilio). Voice call delivery requires an Internet-accessible port (service limited in some regions).
## Technical data

### Requirements based on system size

<table>
<thead>
<tr>
<th>System size in data points</th>
<th>1… 20</th>
<th>21… 400</th>
<th>400+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated or shared server</td>
<td>Either</td>
<td>Either</td>
<td>Dedicated</td>
</tr>
<tr>
<td>CPU</td>
<td>1.6 GHz dual core</td>
<td>1.6 GHz dual core</td>
<td>3.2 GHz quad core</td>
</tr>
<tr>
<td>RAM</td>
<td>8 GB</td>
<td>12 GB</td>
<td>16 GB</td>
</tr>
<tr>
<td>Disk space increase/year</td>
<td>1.5 GB/year for 20 data points</td>
<td>15 GB/year for 200 data points</td>
<td>75 GB/year for 1000 data points</td>
</tr>
<tr>
<td>Continuous free disk space for reports</td>
<td>2 GB</td>
<td>4 GB</td>
<td>10 GB</td>
</tr>
</tbody>
</table>

1) 1 month duration with 1 minute scan/sample

### Wireless device connectivity

- **RFL100 series**: Connects using Vaisala VaiNet protocol. Requires installation of an AP10 access point.
- **HMT140 series**: Connects using Wi-Fi protocol. Requires configuration with an HMT140 configuration cable.
- **300-series transmitter**: Connects using WLAN or LAN interface.

### Wired device connectivity

- **DL series using vNet device**: vNet Power-over-Ethernet devices are 802.3af compliant and work with both end-point and mid-span systems. viewLinc automatically detects and configures vNet devices.

- **DL series using single or multi-port Ethernet device**: Ethernet connectivity devices must be configured with static or reserved IP addresses. If the devices are being installed on different subnets, they need to be configured before being installed. Ethernet device drivers must be installed on each server used to connect Vaisala devices.

- **DL series using USB cable**: Connect devices directly to viewLinc Device Hosts using a USB-to-logger cable. Requires USB ports.

- **Modbus devices (RTU or TCP)**: Connect devices directly to viewLinc Device Hosts using a USB-to-device cable (TCP) or Ethernet-to-serial device drivers and serial connector cables. RTU devices require serial COM ports. TCP devices require a static IP address.

- **Signal tower (light and/or buzzer)**: Connect devices according to manufacturer directions. Preconfigured device settings are selectable in viewLinc.

### Network ports

<table>
<thead>
<tr>
<th>Default</th>
<th>Type</th>
<th>Used by</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>TCP</td>
<td>300-series transmitters</td>
</tr>
<tr>
<td>80</td>
<td>TCP</td>
<td>Signal towers</td>
</tr>
<tr>
<td>443</td>
<td>TCP</td>
<td>viewLinc web interface</td>
</tr>
<tr>
<td>502</td>
<td>TCP</td>
<td>Modbus TCP-enabled devices</td>
</tr>
<tr>
<td>771</td>
<td>TCP</td>
<td>vNet and multi-port Ethernet devices</td>
</tr>
<tr>
<td>950</td>
<td>TCP</td>
<td>Moxa serial-to-Wi-Fi devices</td>
</tr>
<tr>
<td>6767</td>
<td>UDP</td>
<td>HMT140</td>
</tr>
<tr>
<td>12500</td>
<td>TCP</td>
<td>Twilio web services</td>
</tr>
<tr>
<td>12600</td>
<td>TCP/UDP</td>
<td>VaNet access points, viewLinc Enterprise Server connection with vNet or Device Host</td>
</tr>
<tr>
<td>55000</td>
<td>TCP</td>
<td>Vaisala OPC UA Server</td>
</tr>
</tbody>
</table>

### Client requirements

- **Internet browser**: Google Chrome™, Microsoft® Edge™

### Server requirements

- **Availability**: Dedicated server available 24 hours a day, 7 days a week

- **Server management**
  - Connected to an uninterruptible power supply (UPS)
  - Backup solution with support for open file backup
  - Synchronizes time with a Network Time Protocol (NTP) server

- **Operating system**
  - Windows Server® 2019
  - Windows Server® 2019 Datacenter Edition
  - Windows Server® 2016
  - Windows Server® 2016 Datacenter Edition
  - Windows Server® 2012 R2 (64-bit)
  - Windows® 10 Enterprise (64-bit)

### Virtual server support

- VMware

### Application disk space

- 350 MB

### Database disk space

- 200 KB/data point/day

### Network traffic

- Approx. 100 KB/minute/device

### Web interface protocol

- TLS 1.3

### Security certificate for web interface

- Authorized TLS certificate and key

### Email encoding

- RFC 2047

### Secure email protocol

- TLS 1.3

### Network ports

1) Not applicable to Device Host installation.
2) Data points are device channels monitoring and recording data.
3) Depends on number of devices, system configuration and type of communication devices used.
4) viewLinc 5.1 includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit.
5) viewLinc-signed certificate and key can be generated during installation.

### Client requirements

- **Computer clients**: Any network computer with a supported Internet browser, a minimum 2.4 GHz CPU, and 4 GB of RAM.

### Display and tablet clients

- Touchscreen or mouse-operated panel with a supported Internet browser. Must be connected to the same network as viewLinc Enterprise Server.
VaiNet Access Point AP10 is a wireless networking hardware device for Vaisala’s proprietary wireless technology: VaiNet. AP10 can connect up to 32 wireless RFL100 data loggers to Vaisala viewLinc Monitoring System.

**AP10 in viewLinc Monitoring System**

AP10 access point transfers measurement data from wireless VaiNet data loggers to the viewLinc Enterprise Server, and enables the remote configuration and management of VaiNet data loggers by the viewLinc administrator. A wired Ethernet network connection between AP10 and viewLinc Enterprise Server is required. Registration of new data loggers is handled by viewLinc Enterprise Server software. Whenever a new data logger is added to the system, AP10 automatically identifies it and forwards its information to viewLinc. Once accepted in viewLinc, VaiNet data loggers stay synchronized, even in situations where other nearby VaiNet networks overlap.

**Data integrity**

Data is encrypted during VaiNet transfers to protect against eavesdropping, data tampering, and transfer errors. Both the access point and the viewLinc Enterprise Server software verify that the data has been received correctly. Once the data is verified, it is stored to viewLinc’s secure database and protected from tampering and loss.

**Redundancy**

Redundancy of the wireless connection is achieved through use of multiple VaiNet access points and free connection capacity in the system. If a VaiNet data logger has a connection problem, it will automatically connect to another available access point in the system.

At least two access points with free capacity are needed for failover to function.

**Time synchronization**

AP10 requires accurate time to operate its VaiNet wireless connection, and to maintain correct time on the connected data loggers. To achieve the accurate time, AP10 synchronizes with Network Time Protocol (NTP) servers. AP10 synchronizes with default NTP servers over the Internet. To allow AP10 to operate without an Internet connection, configure it to use your local NTP server.
Technical data

### Wireless

<table>
<thead>
<tr>
<th>Networking standards</th>
<th>Vaisala VaiNet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
<td>LoRa® chirp spread spectrum modulation</td>
</tr>
<tr>
<td>Output power</td>
<td>13 dBm (20 mW)</td>
</tr>
<tr>
<td>Antenna</td>
<td>Non-removable external antenna</td>
</tr>
<tr>
<td>Typical range</td>
<td>At least 100 m (328 ft)</td>
</tr>
<tr>
<td>Maximum number of access points in an area</td>
<td>8</td>
</tr>
</tbody>
</table>

#### Frequency bands

- Model AP10E: 868 MHz
- Model AP10A: 915 MHz
- Model AP10J: 920 MHz

#### Radio standards and approvals

- Model AP10E: ETSI EN 300 220-2
  - TRA No: ER67585/18
  - IMDA No: DB105576
- Model AP10A: FCC ID: 2AO39-AP10A
  - IC ID: 23830-AP10A
  - Anatel ID: 04763-19-12322
  - NOM ID: 190C000393
  - AS/NZS 4268
- Model AP10J: MIC ID: 012-200006

### General

- Compatible viewLinc versions: 5.0 and above
- Supported devices: Up to 32 VaiNet compatible data loggers
- User interfaces: Web browser interface, Local touchscreen interface
- User interface languages: English, German, French, Portuguese, Spanish, Swedish, Chinese, Japanese
- Internal clock: Synchronizes with Network Time Protocol (NTP) server. NTP server connection required for operation.
- Safety: EN/UL/IEC 61010-1

### Inputs and outputs

- Operating voltage using dedicated power supply connector: 10 ... 30 VDC
- PoE power class: Class 0
- Power consumption: Max. 13 W

#### Ethernet interface

- Supported standards: 10BASE-T, 100BASE-TX
- IPv4 address assignment: DHCP (automatic), static

#### Connectors

- Power supply connector: 2.0 mm center pin locking type DC power jack
- Service port: Micro-USB (2.0)
- Expansion port: USB type A (2.0)
- Ethernet: 8P8C (RJ-45)

### Mechanical specifications

- IP rating: IP30
- Housing color: White
- Mounting methods: Screws, tie wrap
- Weight: 386 g (13.6 oz)
- Dimensions (H x W x D): 311 x 133 x 37 mm (12.24 x 5.24 x 1.46 in)

#### Materials

- Housing: PC/ABS blend
- Display window: Chemically strengthened glass
- Antenna: ABS

### Operating environment

- Operating environment: Indoor use
- Operating temperature: -20 ... +60 °C (-4 ... +140 °F)
- Operating humidity: 0 ... 90 %RH, non-condensing
- Storage temperature: -20 ... +60 °C (-4 ... +140 °F)
- EMC compliance: EN/IEC 61326-1, industrial environment

![APIO access point dimensions](image-url)
RFL100 Data Logger uses Vaisala’s proprietary VaiNet wireless technology. It can be used to monitor temperature and humidity in a wide range of environments: warehouses, production areas, cleanrooms, laboratories, fridges, cold storage areas, and freezers down to −196 °C (−320.8 °F).

VaiNet wireless
RFL100 connects wirelessly to Vaisala viewLinc Monitoring System, which provides real-time trends, alarms, and historical reporting. VaiNet wireless technology is based on the LoRa® modulation technique to provide a robust wireless signal that is extremely reliable over long distances and in complex, obstructed conditions. This wireless technology allows the data logger’s signal to travel over 100 m (328 ft) indoors without the aid of signal amplifiers or repeaters. Wireless communications are encrypted to ensure data integrity and security. Measurements are updated and stored every 60 seconds, and sent from the data logger every four minutes. In case of temporary network disruptions, the data logger can record up to 30 days of measurements that are automatically transmitted to the viewLinc Enterprise Server software when communications are restored. Recorded data can also be downloaded directly from RFL100 through the USB port.

Versatility and convenience
RFL100 requires no startup configuration, and the included mounting bracket supports several installation methods. Detailed custom display shows the latest measurement results, alarm and battery status, and signal strength of the current access point connection. The housing is classified IP54 to protect the device from dust and cleaning.

RFL100 is powered by two standard AA size 1.5 V batteries (LR6 alkaline or FR6 lithium) for 18 months of operation at approximately 20 °C (68 °F). There is no need for costly battery replacements between recommended calibrations.

Detachable probe
RFL100 supports several probe types for humidity and temperature measurement. The probes use Vaisala HUMICAP® humidity sensors and platinum temperature sensors (Pt100 and Pt1000 type) for superior stability. Probes can be integrated with the RFL100 housing or connected using a cable. The probe is detachable, and easy to switch out for calibration. viewLinc Enterprise Server detects the changed probe information automatically and maintains accurate and complete historical records.

Features
• Industry-leading temperature and relative humidity measurement precision
• Detachable high-accuracy RH and temperature probes
• 30-day First In First Out (FIFO) memory buffer
• Optional magnetic mounting bracket available
• Typical battery life of 18 months
• Uses standard alkaline batteries
• Traceable to SI units through national metrology institutes
  1) Measurement results are traceable to the International System of Units (SI) through national metrology institutes (NIST USA, MIKES Finland, or an equivalent) or accredited calibration laboratories.

1) Measurement results are traceable to the International System of Units (SI) through national metrology institutes (NIST USA, MIKES Finland, or an equivalent) or accredited calibration laboratories.
Probe options

**HMP110 probe**
Robust stainless steel probe for humidity and temperature measurement in demanding conditions. Suitable for measurement inside chambers, fridges, and freezers. Cable probe option only. Versatile mounting options using accessories.

Plastic grid filter provides the fastest response time. For added protection, select the membrane filter, the PTFE filter, or the stainless steel sintered filter.

<table>
<thead>
<tr>
<th>Probe model</th>
<th>Measurement</th>
<th>Measurement temperature range</th>
<th>Mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMP110</td>
<td>RH + T</td>
<td>−40 ... +80 °C (−40 ... +176 °F)</td>
<td>Cable probe only</td>
</tr>
<tr>
<td>HMP110T</td>
<td>T</td>
<td>−40 ... +80 °C (−40 ... +176 °F)</td>
<td>Cable probe only</td>
</tr>
<tr>
<td>HMP115</td>
<td>RH + T</td>
<td>−40 ... +60 °C (−40 ... +140 °F)</td>
<td>Integrated or cable probe</td>
</tr>
<tr>
<td>HMP115T</td>
<td>T</td>
<td>−40 ... +60 °C (−40 ... +140 °F)</td>
<td>Integrated or cable probe</td>
</tr>
<tr>
<td>TMP115</td>
<td>T</td>
<td>−196 ... +90 °C (−320.8 ... +194 °F)</td>
<td>Integrated or cable probe</td>
</tr>
</tbody>
</table>

1) Operating temperature range of the probe body is −40 ... +60 °C (−40 ... +140 °F).

**HMP115 probe**
Probe for general purpose humidity and temperature measurement. Ideal choice for ambient measurement. Designed to be integrated with RFL100 housing for minimum footprint, but can be connected using a cable as well.

Plastic grid filter provides the fastest response time. For added protection, select the membrane filter or the PTFE filter.

**TMP115 probe**
Wide-range temperature-only probe for measurement in extreme conditions. Can be integrated with the RFL100 housing or connected using a cable. Available as 50 cm (1 ft 7.7 in) and 3 m (9.8 ft) long versions.

Sensor tip withstands immersion in glycol and liquid nitrogen. Insert the sensor tip into the thermal dampener block accessory for added thermal mass.
## Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Item code</th>
<th>HMP110</th>
<th>HMP110T</th>
<th>HMP115</th>
<th>HMP115T</th>
<th>TMP115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe cable for RFL100, 1.5 m</td>
<td>CBL210555-1MSSP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe cable for RFL100, 3 m</td>
<td>CBL210555-3MSP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe cable for RFL100, 10 m</td>
<td>CBL210555-10MSP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Flat cable for RFL100, 3 m</td>
<td>CBL210647SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe holder (5 pcs)</td>
<td>ASM213382SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Mounting nuts (2 pcs), hex M12 × 1 Pa 6.6</td>
<td>18350SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe mounting clamps, heavy duty (10 pcs)</td>
<td>226067</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Duct installation kit</td>
<td>215619</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Thermal dampener block for 3/16” probes (4.8 mm)</td>
<td>236310SP</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Probe splitter for connecting two T probes 1)</td>
<td>CBL210834</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

1) Requires at least RFL100 firmware version 1.2.0, AP10 firmware version 3.0, and viewLinc 5.0.2.

![Probe splitter with TMP115 probes](image-url)
## Technical data

### Wireless

<table>
<thead>
<tr>
<th>Networking standards</th>
<th>Vaisala VaiNet</th>
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</thead>
<tbody>
<tr>
<td>Modulation</td>
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</tr>
<tr>
<td>Output power</td>
<td>13 dBm (20 mW)</td>
</tr>
<tr>
<td>Antenna</td>
<td>Internal</td>
</tr>
<tr>
<td>Typical range (indoors)</td>
<td>At least 100 m (328 ft)</td>
</tr>
<tr>
<td>Range with line-of-sight</td>
<td>Over 500 m (1640 ft)</td>
</tr>
<tr>
<td>Frequency bands</td>
<td>868 MHz, 915 MHz, and 920 MHz</td>
</tr>
</tbody>
</table>

### Radio standards and approvals

<table>
<thead>
<tr>
<th>868 MHz model</th>
<th>ETSI EN 300 220-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRA No:</td>
<td>67584/18</td>
</tr>
<tr>
<td>IMDA No:</td>
<td>DB105</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>915 MHz model</th>
<th>FCC ID: 2AO39-RFL100A</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC ID:</td>
<td>23830-RFL100A</td>
</tr>
<tr>
<td>Anatel ID:</td>
<td>04761-19-12322</td>
</tr>
<tr>
<td>NOM ID:</td>
<td>1901C00493</td>
</tr>
<tr>
<td>AS/NZS 4268</td>
<td></td>
</tr>
</tbody>
</table>

| 920 MHz model | MIC ID: 012-2000007   |

### Memory

| Sample capacity | 30 days (43200 samples per channel) |
| Memory type     | Non-volatile EEPROM |
| Memory mode     | Ring buffer (FIFO) |
| Sampling rate   | One sample / channel / minute (non-changeable) |

### Operating environment

| Storage temperature | −40 ... +60 °C (−40 ... +140 °F) |
| Operating humidity  | 0 ... 100 %RH, non-condensing |
| EMC compliance      | EN/IEC 61326-1, industrial environment |

- **Operating temperature**
  - with alkaline batteries: +2 ... +60 °C (+35.6 ... +140 °F)
  - with lithium batteries: −20 ... +60 °C (−4 ... +140 °F)

1) For both alkaline and lithium, battery temperature operating specifications apply.

### General

| Compatible probes | HMP110, HMP110T, HMP115, HMP115T, TMP115 |
| Compatible viewLinc versions | 5.0 and above |
| Batteries          | 2 × AA sized, 1.5 V (LR6 or FR6) |
| Operation time at 20 °C (68 °F) | 18 months |
| without external power supply |  |
| Internal clock accuracy | ±30 s/month |
| Safety              | EN/UL/IEC 61010-1 |

### Mechanical specifications

| Housing color | White |
| Mounting methods | Screws, tie-wrap, hook, or magnetic mounting bracket (optional accessory) |
| Probe interface | 4-pin female M8 connector |
| Service port | USB 2.0 with micro-USB connector |
| IP rating | IP54 |

#### Dimensions (H × W × D) with HMP115 probe

- Without mounting bracket: 158 × 62 × 31 mm (6.22 × 2.4 × 1.22 in)
- With mounting bracket: 186 × 68 × 36.5 mm (7.32 × 2.68 × 1.44 in)

### Weight

- With batteries (2 pcs alkaline), HMP115 probe, and magnetic mounting bracket: 254 g (8.96 oz)

### Materials

- Housing: PC/ABS blend
- Display window: PMMA (acrylic)
- Sealing: TPE

---

![RFL100 dimensions with HMP115 probe](image-url)
### HMP110/T probe measurement performance

**Relative humidity**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy in temperature range 0 ... +40 °C (+32 ... +104 °F)</td>
<td>±1.5 %RH</td>
</tr>
<tr>
<td>0 ... 90 %RH</td>
<td>±2.5 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±4.0 %RH</td>
</tr>
</tbody>
</table>

**Accuracy in temperature range ~40 ... 0 °C, +40 ... +80 °C (~40 ... +32 °F, +104 ... +176 °F)**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 90 %RH</th>
<th>90 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±3.0 %RH</td>
<td>±4.0 %RH</td>
</tr>
</tbody>
</table>

**Factory calibration uncertainty at +20 °C (68 °F)**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 90 %RH</th>
<th>90 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±1.1 %RH</td>
<td>±1.8 %RH</td>
</tr>
</tbody>
</table>

**Humidity sensor** HUMICAP® 180R

**Stability** ±2 %RH over 2 years

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>~40 ... +80 °C (~40 °F ... +176 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy in temperature range</td>
<td>±0.4 °C (0.72 °F)</td>
</tr>
<tr>
<td>at 0 ... +40 °C (+32 ... +104 °F)</td>
<td>±0.2 °C (0.36 °F)</td>
</tr>
</tbody>
</table>

**Factory calibration uncertainty**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 40 %RH</th>
<th>40 ... 75 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±0.6 %RH</td>
<td>±1.0 %RH</td>
</tr>
</tbody>
</table>

**Temperature sensor** Pt1000 RTD Class F0.1 IEC 60751

---

### HMP115/T probe measurement performance

**Relative humidity**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy in temperature range 0 ... +40 °C (+32 ... +104 °F)</td>
<td>±1.5 %RH</td>
</tr>
<tr>
<td>0 ... 90 %RH</td>
<td>±2.5 %RH</td>
</tr>
<tr>
<td>90 ... 100 %RH</td>
<td>±4.0 %RH</td>
</tr>
</tbody>
</table>

**Accuracy in temperature range ~40 ... 0 °C, +40 ... +60 °C (~40 ... +32 °F, +104 ... +140 °F)**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 90 %RH</th>
<th>90 ... 100 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±3.0 %RH</td>
<td>±4.0 %RH</td>
</tr>
</tbody>
</table>

**Factory calibration uncertainty at +20 °C (68 °F)**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 40 %RH</th>
<th>40 ... 75 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±0.6 %RH</td>
<td>±1.0 %RH</td>
</tr>
</tbody>
</table>

**Humidity sensor** HUMICAP® 180R

**Stability** ±2 %RH over 2 years

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>~40 ... +60 °C (~40 °F ... +140 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy in temperature range</td>
<td>±0.4 °C (0.72 °F)</td>
</tr>
<tr>
<td>at 0 ... +40 °C (+32 ... +104 °F)</td>
<td>±0.2 °C (0.36 °F)</td>
</tr>
</tbody>
</table>

**Factory calibration uncertainty**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>0 ... 40 %RH</th>
<th>40 ... 75 %RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>±0.6 %RH</td>
<td>±1.0 %RH</td>
</tr>
</tbody>
</table>

**Temperature sensor** Pt1000 RTD Class F0.1 IEC 60751

---

### TMP115 probe measurement performance

**Temperature**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>~196 ... +90 °C (~320.8 ... +194 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy in temperature range</td>
<td>±2.5 °C (4.5 °F)</td>
</tr>
<tr>
<td>at ~196 ... ~90 °C (~320.8 ... ~130 °F)</td>
<td>±2.5 °C (4.5 °F)</td>
</tr>
<tr>
<td>at ~90 ... ~30 °C (~130 ... ~22 °F)</td>
<td>±0.75 °C (1.35 °F)</td>
</tr>
<tr>
<td>at ~30 ... 0 °C (~22 ... +32 °F)</td>
<td>±0.5 °C (0.9 °F)</td>
</tr>
<tr>
<td>at 0 ... +50 °C (+32 ... +122 °F)</td>
<td>±0.25 °C (0.45 °F)</td>
</tr>
<tr>
<td>at +50 ... +90 °C (+122 ... +194 °F)</td>
<td>±0.75 °C (1.35 °F)</td>
</tr>
</tbody>
</table>

**Factory calibration uncertainty**

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>±0.08 °C (0.128 °F)</th>
</tr>
</thead>
</table>

**Temperature sensor** Pt1000 RTD Class A IEC 751

---

### HMP110 probe mechanical specifications

**IP rating** IP65

**Body thread** M12×1 / 10 mm (0.4 in)

**Diameter** 12 mm (0.47 in)

**Length** 78 mm (3.07 in)

**Materials**

- Probe body: Stainless steel (AISI 316)
- Grid filter: Chrome coated ABS plastic

---

### HMP115 probe mechanical specifications

**IP rating** IP54

**Diameter** 14 mm (0.55 in)

**Length** 79 mm (3.11 in)

**Materials**

- Probe body: PC/ABS blend
- Grid filter: PC (glass reinforced)
- Sleeve: PC/ABS blend

---

### TMP115 probe mechanical specifications

**IP rating** IP67 for sensor tip

**IP65 for probe body**

**Materials**

- Probe body: PC/ABS blend
- Cable: FEP
- Sensor tip: Stainless steel (AISI 316)

**Dimensions**

- Probe length including cable and sensor tip: 0.5 m (1 ft 7.7 in) or 3 m (9 ft 10.1 in)
- Probe body diameter: 14 mm (0.55 in)
- Sensor tip length: 50.8 mm (2 in)
- Sensor tip diameter: 4.76 mm (0.19 in)

---

www.vaisala.com
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, CO2, level, particles, or conductivity. The 2000 logger can also include a Boolean channel for door switches or alarm contacts. The 2000 logger includes calibrations traceable to SI units through national metrology institutes.1)

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.

The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or ISO/IEC 17025 accredited calibration laboratories.

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.

1) The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or ISO/IEC 17025 accredited calibration laboratories.
Technical Data

General
- **Size**: 85 × 59 × 26 mm (3.4 × 2.3 × 1 in)
- **Weight**: 76 g (2.7 oz.)
- **Interfaces**: RS-232 serial, USB, WiFi, Ethernet and Power over Ethernet (vNet)
- **Mounting**: 3M Dual Lock™ fasteners
- **Power source**: Internal 10-year lithium battery (Battery life specified at +23 °C with sample interval of 1 min or longer)
- **Internal clock**: Accuracy ±1 min/month at -25 °C...+70 °C (-13...+158 °F)
- **RoHS compliance**: 2011/65/EU

PC Software
- **Monitoring, alarming and reporting**: viewLinc
- **Validation/mapping GxP environments**: vLog VL for validated, vLog SP for non validated
- **Adding loggers to an existing OPC-compatible monitoring system**: OPC Server

Channel Configuration and Recording Span

<table>
<thead>
<tr>
<th>Model</th>
<th>Channel Types</th>
<th>CH 1</th>
<th>CH 2</th>
<th>CH 3</th>
<th>CH 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-20R</td>
<td>T RH</td>
<td>4...20 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-3CR</td>
<td>T RH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-35R</td>
<td>T RH</td>
<td>0...5 VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-3AR</td>
<td>T RH</td>
<td>0...10 VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-4BR</td>
<td>T RH</td>
<td>Boolean</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Number of Channels Enabled**: 1)
- **Sample Interval**: 10 seconds, 1 minute, 5 minutes, 15 minutes, 1 hour
- **Resolution**: 0.05 %RH

Internal Sensors

Internal Temperature Sensor
- **Calibrated measurement range**: -25 ... +70 °C (-13 ... +158 °F)
- **Operating range**: -35 ... +85 °C (-31 ... +185 °F)
- **Initial accuracy**: ±0.10 %F.S. at +20 °C (±0.18 %F.S. at +68 °F)
- **One Year Accuracy**: ±0.15 %F.S. at +20 °C (±0.27 %F.S. at +68 °F)

Internal RH Sensor
- **Calibrated measurement range**: 0...90 %RH (non-condensing)
- **Operating range**: 0...100 %RH
- **Initial accuracy**: ±1 %RH at +20 °C (±1.5 %RH at +68 °F)
- **One Year Accuracy**: ±2 %RH at +20 °C (±3 %RH at -20 °C)

Current Loop and Voltage Inputs

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Current Loop</th>
<th>Analog Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Available ranges</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>0...22 mA</td>
<td>0...5 VDC, 0...10 VDC</td>
</tr>
<tr>
<td>Resolution</td>
<td>5.5 μA</td>
<td>0.025 % F.S.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.15 % F.S. at +25 °C (±77 °F)</td>
<td>±0.15 % F.S. at +25 °C (±77 °F)</td>
</tr>
<tr>
<td>Input impedances</td>
<td>75 Ω</td>
<td>&gt;1 MΩ</td>
</tr>
</tbody>
</table>

Memory
- **Sample capacity**: 122 197 12-bit samples
- **Memory type**: Non-volatile EEPROM
- **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.
DL4000 Universal Data Logger

**Features**

- 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
- Traceable to SI units through national metrology institutes.
- Two year limited warranty

DL4000 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.

DL4000 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 DL4000 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. The DL4000 data loggers include calibrations traceable to SI units through national metrology institutes.2)

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 DL4000 VL series data logger for GxP-compliant environments and the DL4000 SP series for non-GxP applications.

---

2) Measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or ISO/IEC 17025 accredited calibration laboratories.
Technical Data

**General specifications**

- **Operating range**: −40 ... +85 °C (−40 ... +185 °F) and 0 ... 100 %RH (non-condensing)
- **Interfaces**: RS-232 serial, USB, Wi-Fi module, Ethernet and Power over Ethernet (vNet)
- **Weight**: 76 g (2.7 oz)
- **Size**: 85 × 59 × 26 mm (3.4 × 2.3 × 1 in)
- **Mounting**: 3M Dual Lock™ fasteners
- **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 at −25 ... +70 °C (−13 ... +158 °F)
- **RoHS compliance**: 2011/65/EU
- **Power source**: Internal 10-year lithium battery (Battery life specified with sample interval of 1 min or longer)

**Memory specifications**

- **Memory type**: Non-volatile EEPROM
- **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**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 seconds</td>
<td>13.8 days</td>
<td>6.9 days</td>
<td>4.6 days</td>
<td>3.4 days</td>
</tr>
<tr>
<td>1 minute</td>
<td>2.7 months</td>
<td>1.3 months</td>
<td>27.7 days</td>
<td>20.8 days</td>
</tr>
<tr>
<td>5 minutes</td>
<td>11 years</td>
<td>6.9 months</td>
<td>4.6 months</td>
<td>3.4 months</td>
</tr>
<tr>
<td>15 minutes</td>
<td>3.4 years</td>
<td>1.7 years</td>
<td>11 years</td>
<td>10.4 months</td>
</tr>
<tr>
<td>1 hour</td>
<td>13.6 years</td>
<td>6.8 years</td>
<td>4.5 years</td>
<td>3.4 years</td>
</tr>
</tbody>
</table>

**Current loop and voltage inputs**

- **Available ranges**: 0 ... 20mA, 0 ... 5 VDC, 0 ... 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 Ω, >1 MΩ
- **Isolation**: One common per logger, One common per logger
- **Overload protection**: 40 mA max. (reverse-polarity protected), ±24 VDC max. (reverse-polarity protected)

**Channel configurations**

- **4000-40S**: 0 ... 5 VDC
- **4000-40A**: 0 ... 10 VDC
- **4000-40C**: 0 ... 20 mA
The 1000/1400 temperature data loggers include the VL series for regulated environments and the SP series for non FDA/GxP regulated industries.

**VL series and SP series dataloggers**

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 1000/1400 temperature data loggers include calibrations traceable to SI units through national metrology institutes.

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.

**Applications**

The 1000/1400 temperature data loggers are ideal for monitoring and validation of:

- Refrigerators and freezers (to -90 °C)
- Incubators
- Stability Chambers
- Warehouses
- Ambient conditions

**Autonomous Power and Recording Capacity**

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.

---

3) Measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or ISO/IEC 17025 accredited calibration laboratories.
Technical Data

General

Interfaces RS-232 serial, USB, Ethernet, WiFi, PoE network interface available

PC software Graphing & Reporting Software
vLog SP for SP series
vLog VL for VL series
viewLinc for continuous monitoring and alarming
OPC Server to add on to existing OPC compatible monitoring systems

Internal clock Accuracy ±1 min/month
-25 °C ... +70 °C
(-13 °F ... +158 °F)

Logger operating/
Storage range
-40 °C ... +85 °C (-40 °F ... +185 °F)
0 ... 100 %RH non-condensing

Power source Internal 10-year lithium battery
(Battery life specified with sample interval of 1 min or longer)

Electromagnetic compatibility FCC Part 15 and CE
EN 50581:2012
EN 55032:2012/AC:2013 Class B
EN 61326-1:2013

RoHS compliance 2011/65/EU

Mechanical Specifications

Size 85 × 59 × 26 mm (3.4 × 2.3 × 1 in)
Weight 76 g (2.7 oz)
Mounting 3M Dual Lock™ fasteners
Snap-in connector locks provide secure probe connections

Internal Temperature Sensor

1000-21x series Precision-tolerance epoxy-encapsulated NTC thermistor

Memory

1000-2XX series 48 100 12-bit samples
1400-44X series 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

<table>
<thead>
<tr>
<th>Number of Channels Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample Interval</strong></td>
</tr>
<tr>
<td>10 seconds</td>
</tr>
<tr>
<td>1 minute</td>
</tr>
<tr>
<td>5 minutes</td>
</tr>
<tr>
<td>15 minutes</td>
</tr>
<tr>
<td>1 hour</td>
</tr>
</tbody>
</table>
Technical Data

Recording Span: 1400-44x

<table>
<thead>
<tr>
<th>Sample Interval</th>
<th>Number of Channels Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>10 seconds</td>
<td>9.8 days</td>
</tr>
<tr>
<td>1 minute</td>
<td>1.9 months</td>
</tr>
<tr>
<td>5 minutes</td>
<td>9.8 months</td>
</tr>
<tr>
<td>15 minutes</td>
<td>2.4 years</td>
</tr>
<tr>
<td>1 hour</td>
<td>9.7 years</td>
</tr>
</tbody>
</table>

VL-1400-44x

EPT Series Temperature Probes

Sensor Models

<table>
<thead>
<tr>
<th>&quot;N&quot; range external probes</th>
<th>Operating/storage range</th>
<th>Connector color code</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPT-23N-XXN and EPT-22W-XXN</td>
<td>-40 °C ... +95 °C (-40 ... +203 °F)</td>
<td>Black</td>
</tr>
<tr>
<td>&quot;V&quot; range external probes</td>
<td>Operating/storage range</td>
<td>Connector color code</td>
</tr>
<tr>
<td>EPT-23N-XXV and EPT-22W-XXV</td>
<td>-95 °C ... +95 °C (-139 ... +203 °F)</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Sensor Tips

<table>
<thead>
<tr>
<th>EPT-23N-XXX</th>
<th>Stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter 3.2 mm (0.13 in)</td>
<td></td>
</tr>
<tr>
<td>Length 38 mm (1.5 in)</td>
<td></td>
</tr>
<tr>
<td>EPT-22W-XXX (liquid submersible)</td>
<td>Sealed teflon tip</td>
</tr>
<tr>
<td>Diameter 3 mm (0.12 in)</td>
<td></td>
</tr>
<tr>
<td>Length 28 mm (1.1 in)</td>
<td></td>
</tr>
</tbody>
</table>

Probe lengths: 3 m (10 ft) and 7.6 m (25 ft)
Cable construction: 2 mm (0.08 in) 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.
## Technical Data

### Temperature Range and Accuracy

#### Internal Sensor

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibrated measurement range</td>
<td>-25 ... +70 °C (-13 ... +158 ºF)</td>
</tr>
<tr>
<td>Operating/storage range</td>
<td>-40 ... +85 °C (-40 ... +185 ºF) 0 ... 100 %RH non-condensing</td>
</tr>
<tr>
<td>Initial accuracy</td>
<td>±0.10 °C over +20 ... +30 °C (±0.18 °F over +68 ... +86 ºF) ±0.20 °C over -25 ... +70 °C (±0.36 °F over -13 ... +158 ºF)</td>
</tr>
<tr>
<td>One year accuracy</td>
<td>±0.15 °C over +20 ... +30 °C (±0.27 °F over +68 ... +86 ºF) ±0.25 °C over -25 ... +70 °C (±0.45 °F over -13 ... +158 ºF)</td>
</tr>
</tbody>
</table>

#### External Probes - All Models

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>“N” Range External Probe</strong></td>
<td></td>
</tr>
<tr>
<td>Calibrated measurement range</td>
<td>-25 ... +70 °C (-13 ... +158 ºF)</td>
</tr>
<tr>
<td>Operating/storage range</td>
<td>-40 ... +95 °C (-40 ... +203 ºF)</td>
</tr>
<tr>
<td>Initial accuracy</td>
<td>±0.10 °C over +20 ... +30 °C (±0.18 °F over +68 ... +86 ºF) ±0.15 °C over -25 ... +70 °C (±0.27 °F over -13 ... +158 ºF)</td>
</tr>
<tr>
<td>One year accuracy</td>
<td>±0.20 °C over +20 ... +30 °C (±0.36 °F over +68 ... +86 ºF) ±0.25 °C over -25 ... +70 °C (±0.45 °F over -13 ... +158 ºF)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 °C at +25 °C (0.04 °F at +77 ºF)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>“V” Range External Probe</strong></td>
<td></td>
</tr>
<tr>
<td>Operating/storage range</td>
<td>-95 ... +95 °C (-139 ... +203 ºF)</td>
</tr>
<tr>
<td>Initial accuracy</td>
<td>±0.20 °C over -90 ... -40 °C (±0.36 °F over -130 ... -40 ºF)</td>
</tr>
<tr>
<td>One year accuracy</td>
<td>±0.25 °C over -90 ... -40 °C (±0.45 °F over -130 ... -40 ºF)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 °C at -80 °C (0.04 °F at -112 ºF)</td>
</tr>
</tbody>
</table>

1) 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 ... +70 °C (-13 °F ... +158 °F)

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### Product Part Number Legend

Guide for reading the product tables and selecting the most appropriate model for your application.

**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:**

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217
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.

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.

DL1016-1416 data loggers include calibrations traceable to SI units through national metrology institutes.

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

**Features**

- 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
- Traceable to SI units through national metrology institutes

**Model Numbers and 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

**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.

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4) Measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or ISO/IEC 17025 accredited calibration laboratories.
Technical Data

**General**

**Interfaces**
- RS-232 serial, USB, Ethernet, WiFi, PoE network interface available

**PC software**
- 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 ... +50 °C (+32 ... +122 °F)

**Power source**
- Internal 10-year lithium battery (with sample interval of ≥ 1 min.)

**EMC compliance**
- FCC Part 15 and CE EN 50581:2012
- EN 55032:2012/AC:2013 Class B
- EN 61326-1:2013

**RoHS compliance**
- 2011/65/EU

**Measurement Performance**

**Sensor**
- “V” Range External Probe

**Calibrated measurement range**
- -90 ... +50 °C (-130 ... +122 °F)

**Operating range**
- -95 ... +70 °C (-139 ... +158 °F)

**Initial accuracy**
- ±0.25 °C over -90 ... +50 °C
- ±0.45 °F over -130 ... +122 °F

**One year accuracy**
- ±0.35 °C over -90 ... +50 °C
- ±0.63 °F over -130 ... +122 °F

**Resolution**
- 0.01 °C at +25 °C (0.02 °F at +77 °F)

**Data Logger Operating Environment**

**Operating temperature**
- 0 ... +50 °C (+32 ... +122 °F)

**Operating humidity**
- 0 ... 100 %RH non-condensing

**Storage temperature**
- -40 ... +85 °C (-40 ... +185 °F)

**Storage humidity**
- 0 ... 100 %RH non-condensing

**Mechanical Specifications**

**Dimensions**
- 85 × 59 × 26 mm (3.4 × 2.3 × 1 in)

**Weight**
- 76 g (2.7 oz)

**Mounting**
- 3M Dual Lock™ fasteners
- Snap-in connector locks provide secure probe connections

**Memory**

**1016 Series**
- 68 600 16-bit samples

**1416 Series**
- 101 375 16-bit samples

**Memory type**
- Non-volatile EEPROM

**Memory modes and sampling rates**
- User-selectable rates from once every 10 seconds to once per day (with sample interval of ≥ 1 min.)

**Recording Span: 1016-22V**

<table>
<thead>
<tr>
<th>Sample Interval</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute</td>
<td>1.5 months</td>
<td>23.8 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 minutes</td>
<td>7.6 months</td>
<td>3.8 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 minutes</td>
<td>1.9 years</td>
<td>11.5 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 hour</td>
<td>7.8 years</td>
<td>3.9 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Recording Span: 1416-44V**

<table>
<thead>
<tr>
<th>Sample Interval</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 minute</td>
<td>2.3 months</td>
<td>1.1 months</td>
<td>23.5 days</td>
<td>17.6 days</td>
</tr>
<tr>
<td>5 minutes</td>
<td>11.3 months</td>
<td>5.6 months</td>
<td>3.7 months</td>
<td>2.8 months</td>
</tr>
<tr>
<td>15 minutes</td>
<td>2.8 years</td>
<td>1.4 years</td>
<td>11.3 months</td>
<td>8.5 months</td>
</tr>
<tr>
<td>1 hour</td>
<td>11.5 years</td>
<td>5.7 years</td>
<td>3.8 years</td>
<td>2.8 years</td>
</tr>
</tbody>
</table>

**Thermistor Probes**

**Sensor**
- “V” Range External Probe

**Operating Temperature**
- -95 ... +70 °C (-139 ... +158 °F)

**Connector Color Code**
- Blue

**Probe Length**
- 3 m (10 ft) and 7.6 m (25 ft) lengths available

**Cable Construction**
- 2 mm (0.07 in) Diameter, Teflon coated cable

**Stainless Steel Sensor Tip**
- Diameter 3.2 mm (1/8 in)
- Length 38 mm (1.5 in)

**Sealed Teflon Sensor Tip**
- Diameter 3 mm (0.12 in)
- Length 28 mm (1 in)

**Spare Parts and Accessories**

**Immersion/Dry Probes**

- 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**

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

www.vaisala.com
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.

**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
- Traceable to SI units through national metrology institutes

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 DL1700 VL series for GxP-compliant environments and the DL1700 SP series for non-validated applications. DL1700 series data loggers include calibrations traceable to SI units through national metrology institutes. 5)

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5) Measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or ISO/IEC 17025 accredited calibration laboratories.
Technical Data

General

Interfaces
RS-232 serial, USB, Ethernet, WiFi network interface available

Internal clock
Accuracy: ±1 min/month at -25 °C to +70 °C

Software
viewLinc for Monitoring, Alarming and Reporting
vLogVL for Validation/Mapping GxP environments
vLogSP for graphing and reporting non-GxP environments
OPC Server to add Vaisala loggers to any OPC-compatible monitoring system

Temperature Accuracy

<table>
<thead>
<tr>
<th>Type</th>
<th>Temperature Measurement Range</th>
<th>Accuracy at Mid-range</th>
<th>Resolution at Mid-range</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>-220 ... +1370 °C (-364 ... +2498 °F)</td>
<td>±1.3 °C (±2.3 °F)</td>
<td>0.37 °C (0.67 °F)</td>
</tr>
<tr>
<td>J</td>
<td>-300 ... +900 °C (-202 ... +1652 °F)</td>
<td>±1.0 °C (±1.8 °F)</td>
<td>0.29 °C (0.52 °F)</td>
</tr>
<tr>
<td>T</td>
<td>-240 ... +350 °C (-400 ... +662 °F)</td>
<td>±1.2 °C (±2.2 °F)</td>
<td>0.34 °C (0.61 °F)</td>
</tr>
<tr>
<td>E</td>
<td>-110 ... +740 °C (-166 ... +1364 °F)</td>
<td>±0.70 °C (±1.3 °F)</td>
<td>0.20 °C (0.36 °F)</td>
</tr>
<tr>
<td>R</td>
<td>-50 ... +1760 °C (-58 ... +3200 °F)</td>
<td>±4.4 °C (±7.9 °F)</td>
<td>1.3 °C (2.3 °F)</td>
</tr>
<tr>
<td>S</td>
<td>-50 ... +1700 °C (-58 ... +3092 °F)</td>
<td>±5.1 °C (±9.2 °F)</td>
<td>1.5 °C (2.7 °F)</td>
</tr>
</tbody>
</table>

Operating Environment

Operating temperature
-40 °C to +85 °C (-40 °F to +185 °F)

Operating humidity
0% to 100%RH (non-condensing)

EMC compliance
FCC Part 15 and CE
EN 50581:2012
EN 55032:2012/AC:2013 Class B
EN 61326-1:2013

RoHS compliance
2011/65/EU

Mechanical Specifications

Dimensions
85 × 59 × 26 mm (3.4 × 2.1 × 1 in)

Weight
60 g (2.7 oz)

Mounting
3M Dual Lock™ fasteners

Power source
Internal 10-year lithium battery (Battery life specified with sample interval of 1 min. or longer)

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 °C over +68 °C to +86 °F
±0.35 °C over -25 °C to +70 °C
±0.63 °C over -13 °C to +58 °F

Data Logger Inputs

<table>
<thead>
<tr>
<th>1700 Model</th>
<th>Number of Channels Enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple</td>
<td>CJT</td>
</tr>
<tr>
<td>170-54T</td>
<td>4</td>
</tr>
</tbody>
</table>

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
-72 ... +55.4 mV
Resolution
0.016 mV
Initial Accuracy
±0.042 mV at +25 °C (+77 °F)
Input Impedance: 10M Ω
Input range
-72 ... +55.4 mV
Resolution
0.016 mV
1-Year Accuracy
±0.055 mV at +25 °C (+77 °F)
Additional Error
At 3 V/m RF field from 450 MHz ... 580 MHz
±0.350 mV
At 3 V conducted RF from 3 MHz ... 80 MHz
±1.0 mV

Memory

Memory type
Non-volatile EEPROM
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.

Spare Parts and 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 m (20 ft)
Error
±1 °C to ±1.5 %
Vaisala 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 to +50 °C (-67 to 122 °F).
The MR loggers include calibrations traceable to SI units through national metrology institutes to ensure cGMP, ISO 9000, and HACCP quality standards.6) Optional services are available, including extended warranties and onsite calibration.

**Easy Configuration**
Connectivity options include USB, wireless, and Power over Ethernet with the vNet PoE network interface. When MR loggers are used with the 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 information on IQOQ documents 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

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6) Measurement results are traceable to the International System of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or an equivalent) or ISO/IEC 17025 accredited calibration laboratories.
Technical Data

**General**

| Interfaces | RS-232 serial, Ethernet, USB, Wi-Fi, vNet PoE network interface |
| Software | • vLog Validation/Mapping  
• viewLinc Continuous Monitoring & Alarming  
• OPC Server to add Vaisala loggers to any OPC compatible monitoring system |
| Internal clock accuracy | ±1 min/month  
0 to +50 °C (+32 to +122 °F) |
| Power source | Internal 10-year lithium battery ¹ |
| EMC compliance | FCC Part 15 and CE  
EN 50581:2012  
EN 55032:2012/AC:2013 Class B  
EN 61326-1:2013 |
| RoHS compliance | 2011/65/EU |

¹ Typical battery life specified with sample interval of 1 min or longer.

**Memory**

| 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  
(Typical battery life specified with sample interval of 1 min or longer) |

**Data Sample Capacity**

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL1000MR</td>
<td>48 100 12-bit samples</td>
</tr>
<tr>
<td>DL1016MR/MRB</td>
<td>68 600 16-bit samples</td>
</tr>
<tr>
<td>DL1416MR/MRB</td>
<td>101 375 16-bit samples</td>
</tr>
<tr>
<td>DL2000MR</td>
<td>122 197 12-bit samples</td>
</tr>
</tbody>
</table>

**Mechanical Specifications**

| Dimensions | 85 × 59 × 26 mm (3.4 × 2.3 × 1 in) |
| Weight | 76 g (2.7 oz) |
| Mounting | 3M Dual Lock™ Fasteners  
Snap-in connector for secure probe connections |

**Temperature Sensors**

| Internal sensor type | Precision-tolerance epoxy encapsulated NTC thermistor |
| Cable construction | 2 mm (0.07 in) Diameter, Teflon coated cable |

**External Temperature Probes**

| Sensor tip | Stainless steel |
| Diameter | 3.2 mm (1/8 in) |
| Length | 38 mm (1.5 in) |

**Probe Cable Lengths**

<table>
<thead>
<tr>
<th>Model</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>DL1016MR/MRB</td>
<td>3 m (10 ft)</td>
</tr>
<tr>
<td>DL1416MR/MRB</td>
<td>7.6 m (25 ft)</td>
</tr>
</tbody>
</table>
Technical Data

DL1000MR Internal Temperature Sensor

Range and Accuracy

Logger operating range: -35 ... +85 °C (-31 ... +185 °F)
Calibrated measurement range: -25 ... +70 °C (-13 ... +158 °F)
Resolution: 0.02 °C at +25 °C (0.04 °F at +77 °F)
Accuracy over temperature range: ±0.5 °C (±0.9 °F)

Resolution and Accuracy

1) 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.

DL1016/1416MR External Temperature Sensors

Range and Accuracy

Logger operating range: 0 ... +50 °C (32 ... +122 °F)
Probe operating range: -95 ... +70 °C (-139 ... +158 °F)
Calibrated measurement range: -55 ... +50 °C (-67 ... +122 °F)
Resolution: 0.01 °C at +25 °C (0.02 °F at +77 °F)
Accuracy over temperature range: ±0.5 °C (±0.9 °F)

Resolution and Accuracy

1) 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 ... +85 °C (-31 ... +185 °F)
Calibrated Measurement Range: -25 ... +70 °C (-13 ... +158 °F)
Accuracy over temperature range: ±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 ... 100 %RH (non-condensing)
Temperature range: +20 ... +30 °C (68 ... 86 °F)
Temperature range: -20 ... +20 °C, +30 ... +70 °C (-4 ... 68 °F, 86 ... 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.

www.vaisala.com
Wherever reliable network communications and cost are important, more companies are using Power over Ethernet (PoE) devices. Vaisala vNet PoE network interface brings easy connectivity with Vaisala DL series data loggers at a lower cost than alternative networking devices.

The snap-in design streamlines data logger connectivity into a small footprint, eliminating wires between normally separate data 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. vNet PoE integrates VL and SP data loggers without compromising their high accuracy. It brings greater flexibility and simplicity to the deployment of Vaisala Continuous Monitoring system.

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 15 V output to power external sensors and transmitters; includes internal fan
- CDL-VNET-LPC with 15 V output to power external sensors and transmitters; without internal fan

There is also an option to power the interface with AC. Select the model that fits your application to monitor and record temperature, humidity, CO₂, differential pressure, door switches, and many other parameters.

Features
- 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
# Technical Data

## Measurement performance

### Heating effect on measurements
- **CDL-VNET-P and CDL-VNET-PC**: Temperature rise from electronics (important only for data loggers with internal sensors): < 0.05 °C as seen by the data logger sensor.
- **CDL-VNET-LP and CDL-VNET-LPC**: Not to be used for data loggers with internal sensors.

## Operating environment

### Operating temperature
- −25 ... +70 °C (−13 ... +158 °F)

### Storage temperature
- −40 ... +85 °C (−40 ... +185 °F)

### Operating humidity
- 0 ... 90 %RH (non-condensing and not to exceed a mixing ratio of 38.5 g/kg)

## Inputs and outputs

### Ethernet connectivity
- IEEE 802.3af (Class 1)
- Bandwidth 10Base-T

### Connectivity cable
- Category 5/5e RJ-45 connector
- 1.83 m (6 ft)

### Operating voltage
- 12 ... 30 VDC
- Plugs into vNet jack labeled 12 V

### Output voltage
- **CDL-VNET-P and CDL-VNET-LP**: Not available
- **CDL-VNET-PC and CDL-VNET-LPC**: Nominal: 15 VDC
  - Maximum: 350 mW

### Power consumption
- **CDL-VNET-P and CDL-VNET-LP**: Typical: 625 mW
  - Maximum: 700 mW
- **CDL-VNET-PC and CDL-VNET-LPC**: Typical: 900 mW
  - Maximum: 1.35 W

### Power supply
- **North America**: 12 VDC / 0.5 A max. out
  - 120 VAC in
- **International**: 12 VDC / 1.66 A max. out
  - 100 ... 240 VAC in

---

1) Max. PSE power reservation is 4.00 W.
2) Optional for use without PoE.
3) Included but not required when using PoE.

## Mechanical specifications

- **Dimensions (H × W × L)**: 43 × 102 × 102 mm (1.7 × 4.0 × 4.0 in)
- **Weight**: 180 g (6.3 oz)

## General specifications

### Data logger compatibility
- v6.00 hardware and higher
- Includes models VL and SP 1000, 1700, 1200, 1016, 1416, 1400, 2000, 4000

### LED indicators
- Link, activity, power, data logger communications

### Device configuration
- HTTP Web Interface
- PC-based configuration wizard

### viewLinc Aware
- Requires one vNet to be programmed with the viewLinc server IP address.
- Other vNets on the subnet will automatically self-configure.

### Addressing
- DHCP/RARP
- ARP-Ping
- Static IP for IP address assignment
- Net BIOS name

### Firmware
- Field upgradable firmware

### Compliance
- Emissions/Immunity
  - FCC Part 15 and CE
  - EN 50581:2012
  - EN 55032:2012/AC:2013 Class B
  - EN 61326-1:2013

- Conformity
  - RoHS, 2011/65/EU
  - WEEE

### Existing Network

- viewLinc Monitoring and Alarming
- Remote Monitoring
- Remote Alarming

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[Ultra-Low Temp Freezers](#)
[Refrigerators](#)
[Incubators](#)

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[226](#)
HMT140 Wi-Fi Data Logger
For multiple environmental parameters

Vaisala Wi-Fi Data Logger HMT140 is designed for humidity, temperature, and analog signal monitoring in warehouses, freezer and cryogenic farms, laboratories, blood banks, and many other applications.

Performance
HMT140 incorporates Vaisala HUMICAP technology to measure relative humidity and temperature accurately and reliably. The HUMICAP sensor is resistant to dust and most chemicals. Alternatively, HMT140 can connect to Resistance Temperature Detectors (RTDs) or Voltage, Current, and Door Contact sensors, making HMT140 an extremely versatile Wi-Fi data logger. Combining RTD and contact inputs, HMT140 is ideal for monitoring chamber / door contact excursions.

Using Wi-Fi connectivity, HMT140 can connect through any wireless access point. The battery-powered logger can operate for 18 months continuously. Optional local display allows HMT140 to indicate process parameter values and any limit warnings. The LCD display is operated using a power-saving infrared sensor that is motion-activated. When activated, the display indicates the current measurements. All data is logged locally and uploaded to the Vaisala viewLinc monitoring system software at preset intervals and during any 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
HMT140 data logger uses an easily replaceable relative humidity and temperature probe. This allows for quick recalibration of the data logger. The probe can be adjusted using one of Vaisala portable meters as a reference.

Available options
HMT140 data logger is available as wall mounted or with remote probes. For extreme temperature applications or where space is limited, the remote probe is ideal.

Options
- Two inputs available: voltage, current, door contact, RTDs, or relative humidity and temperature
- Optional LCD display
- Wall-mounted or with remote probes

Features
- Wi-Fi connectivity to Vaisala viewLinc environmental monitoring system software
- 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 relative humidity and temperature probe for easy field calibration
- Accurate and reliable multi-signal measurements
- Resistant to dust and most chemicals
- Traceable to SI units through national metrology institutes 1)
- Ideal for cleanrooms and other life science applications

1) Measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA, MIKES Finland, or equivalent) or ISO/IEC 17025 accredited calibration laboratories.
Technical data

**HUMICAP® Humidity and Temperature Probe HMP110**

**Relative humidity**

- **Measurement range**: 0 ... 100 %RH
- **Accuracy (incl. non-linearity, hysteresis, and repeatability):**
  - At temperature range 0 ... +40 °C (+32 ... +104 °F):
    - 0 ... 90 %RH ±1.5 %RH
    - 90 ... 100 %RH ±2.5 %RH
  - At temperature range −40 ... 0 °C, +40 ... +80 °C
    - (<−40 ... +32 °F, +104 ... +176 °F):
      - 0 ... 90 %RH ±3.0 %RH
      - 90 ... 100 %RH ±4.0 %RH

**Stability** ±2 %RH over 2 years

**Temperature**

- **Measurement range**: −40 ... +80 °C (−40 ... +176 °F)
- **Accuracy over temperature range:**
  - +15 ... +25 °C (+59 ... +77 °F): ±0.2 °C (±0.36 °F)
  - 0 ... +15 °C, +25 ... +40 °C (+32 ... +59 °F, +77 ... +104 °F): ±0.25 °C (±0.45 °F)
  - −40 ... +80 °C (−40 ... +176 °F): ±0.4 °C (±0.72 °F)

**Humidity sensor** Vaisala HUMICAP® 180R

**Temperature sensor** Pt1000 RTD 1/3 Class B IEC 751

**Storage temperature** −50 ... +70 °C (−58 ... +158 °F)

**Resistive temperature input signals**

- **Input impedance**: 5.1K Ω
- **Measurement range**: −196 ... −90 °C (−320.8 ... −130 °F)
- **Accuracy over temperature range:**
  - −196 ... −90 °C (−320.8 ... −130 °F): ±2.5 °C (±4.5 °F)
  - −90 ... −30 °C (−130 ... −22 °F): ±0.75 °C (±1.35 °F)
  - −30 ... 0 °C (−22 ... +32 °F): ±0.5 °C (±0.9 °F)
  - 0 ... +50 °C (−32 ... +122 °F): ±0.25 °C (±0.45 °F)
  - +50 ... +90 °C (+122 ... +194 °F): ±0.75 °C (±1.35 °F)

**Current input signals**

- **Resolution**: 0.67 μA
- **Accuracy**: ±0.15 % F.S. at +25 °C (+77 °F)
- **Input impedance**: 62 Ω
- **Overload protection**: 40 mA

**Voltage input signals**

- **Resolution**: 0.0034 % F.S.
- **Accuracy**: ±0.15 % F.S. at +25 °C (+77 °F)
- **Input impedance**: 37K Ω
- **Overload protection**: 50 V max.
- **Isolation**: One common per logger

**Contact inputs**

- Open/Closed with magnetic reed switch cable connections (dry contact)

**Measurement variants**

- HMT141: 1 temperature and 1 humidity channel
- HMT143: 2 RTD temperature channels
- HMT144: 2 voltage inputs (0 ... 5 VDC)
- HMT145: 2 voltage inputs (0 ... 10 VDC)
- HMT146: 2 current inputs (0 ... 20 mA)
- HMT147: 2 door contacts
- HMT148: 1 RTD temperature and 1 door contact
- HMT14D: 1 RTD temperature and 1 current input (0 ... 20 mA)
- HMT14E: 1 RTD temperature and 1 voltage input (0 ... 5 VDC)
- HMT14F: 1 RTD temperature and 1 voltage input (0 ... 10 VDC)

**Operating environment**

**Operating temperature**

- Data logger body, no display: −40 ... +60 °C (−40 ... +140 °F)
- Data logger body, with display: −20 ... +60 °C (−4 ... +140 °F)

**IP rating**: IP65

**Maximum operating altitude**: 2000 m (6 500 ft)

**General specifications**

- **Memory**: 3,060 samples
- **Sample rate**: User selectable (interval: 2 ... 60 minutes)
- **Display (optional)**: 128 × 64 resolution full graphics
  B&W display without backlight

**Mechanical specifications**

- **Weight (with battery/without probe)**: 300 g (10.6 oz)
- **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 (9.8 ft, 16.4 ft, and 32.8 ft)
- **Hermetic door switch sensor cable length**: 7.6 m (24.9 ft)

**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

**RTD temperature sensor**

- **Sensor tip material**: Stainless steel (AISI 316)
- **Sensor tip length**: 50.8 mm (2 in)
- **Sensor tip diameter**: 4.76 mm (0.19 in)
- **Cable length**: 5 m (16.4 ft)

**Contact inputs**

- Open/Closed with magnetic reed switch cable connections (dry contact)
**Wireless**

<table>
<thead>
<tr>
<th>Networking standards</th>
<th>IEEE 802.11b/g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data rates</td>
<td>802.11b: up to 11 Mbps&lt;br&gt;802.11g: up to 54 Mbps</td>
</tr>
<tr>
<td>Frequency band</td>
<td>2.402 - 2.480 MHz</td>
</tr>
<tr>
<td>Wi-Fi security</td>
<td>WEP (128-bit), WPA, WPA2 (Personal)</td>
</tr>
<tr>
<td>Output power</td>
<td>+18 dBm (63 mW)</td>
</tr>
<tr>
<td>Receiver sensitivity</td>
<td>~85 dBm typical</td>
</tr>
<tr>
<td>Antenna</td>
<td>Onboard whip</td>
</tr>
<tr>
<td>Contains</td>
<td>FCC ID: U3O-G2M5477&lt;br&gt;IC ID: B169A-G2M5477&lt;br&gt;NCC ID: CCAFILP0240T6</td>
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**Standards and approvals**

<table>
<thead>
<tr>
<th>Electromagnetic compatibility</th>
<th>EN 61326-1, EN 301 489-1, EN 300 328 V2.11</th>
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</thead>
<tbody>
<tr>
<td>Safety</td>
<td>EN 61010-1</td>
</tr>
<tr>
<td>Radio transmission equipment type approval</td>
<td>CMIT ID: 2019DJ5109</td>
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</tbody>
</table>

**Spare parts and accessories**

<table>
<thead>
<tr>
<th>HMP110</th>
<th>Humidity and temperature probe HMP110 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMP110R</td>
<td>Humidity and temperature replacement probe</td>
</tr>
<tr>
<td></td>
<td>Vaisala HUMICAP® 180R</td>
</tr>
<tr>
<td>Probe mounting flange</td>
<td>226061</td>
</tr>
<tr>
<td>Probe mounting clamps, 10 pcs</td>
<td>226067</td>
</tr>
<tr>
<td>Probe cable 3 m (9.8 ft)</td>
<td>HMT120Z300</td>
</tr>
<tr>
<td>Probe cable 5 m (16.4 ft)</td>
<td>HMT120Z500</td>
</tr>
<tr>
<td>Probe cable 10 m (32.8 ft)</td>
<td>HMT120Z1000</td>
</tr>
<tr>
<td>Duct installation kit</td>
<td>215619</td>
</tr>
</tbody>
</table>

**Sensor protection**

- Plastic grid filter | DRW010522SP |
- Plastic grid with membrane filter | DRW010525SP |
- Stainless steel sintered filter | HM46670SP |

**Other accessories**

- RTD temperature probe 5 m (16.4 ft) | ASM210644SP |
- Hermetic door switch sensor kit | 236319SP |
- Thermal dampener blocks | 236310SP |
- Four Dual Lock™ strips (76 mm/3 in) | 237217SP |

1) See separate order form.
CAB100 CMS Industrial Cabinet
For data collection in cleanrooms and industrial settings

Vaisala CMS Industrial Cabinet CAB100 integrates Vaisala’s world-class instruments for monitoring differential pressure and other parameters into a simple, pre-configured instrument panel. In combination with the Vaisala viewLinc Enterprise Server Software, the cabinet provides pre-installed real-time monitoring of your critical environments.

**Easy Data Collection with Quality & Compliance**
Cabinets are configurable to your application requirements, with options for differential pressure transmitters, analog inputs for the connection of remote transmitters, and safety barriers or galvanic isolators for hazardous areas that require intrinsically safe devices. CAB100 enables you to combine differential pressure and other transmitters with data loggers in a single enclosure for centralized monitoring and reliable alarming.

**Configured for Your Cleanroom**
CAB100 is designed to ensure regulatory compliance in multiple cleanroom applications, including: pharmaceutical, healthcare, biotechnology, medical device, aerospace, automotive, and semiconductor manufacturing. Select from two cabinet sizes: small and large. Small cabinets can contain up to four analog inputs which can also be intrinsically safe, or four differential pressure transmitters. Large cabinets can accommodate up to 12 differential pressure transmitters and up to 32 analog input channels with intrinsically safe options.

**The Benefits of Centralization**
It is often impossible or impractical to run power or network cables to each desired point of measurement. With CAB100 you can centralize and economize by running a single power and network cable to the cabinet to support numerous transmitters, while also reducing the number of network adapters needed. Centralization of measurement devices also simplifies serviceability. With multiple transmitters and data loggers located together, regular maintenance activities like calibration are easy and efficient.
# CAB100 Configuration Options

<table>
<thead>
<tr>
<th>Cabinet Size</th>
<th>Small (model CAB100A)</th>
<th>400 × 300 × 200 mm (15.75 × 11.81 × 7.87 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large (model CAB100B)</td>
<td>600 × 500 × 200 mm (23.62 × 19.69 × 7.87 in)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power</th>
<th>Power supply</th>
<th>Within cabinet: 24 VDC / 2.5 A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>To cabinet: 110 … 240 VAC</td>
</tr>
<tr>
<td>Power over Ethernet</td>
<td>Power over Ethernet, with loop power, without fan</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog Channels</th>
<th>4 … 32 channels</th>
<th>4 … 20 mA</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Safety Barrier</th>
<th>1 … 16 pieces</th>
<th>1 barrier per channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Galvanic Isolator</td>
<td>1 … 12 pieces</td>
<td>1 isolator per channel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Differential Pressure</th>
<th>1 … 12 pieces</th>
<th>±60 Pa or ±0.25 in H₂O</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Ethernet Communication</th>
<th>Large cabinet</th>
<th>Up to 2 serial-to-Ethernet devices via RJ45 (DIGI PortServer TS4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small cabinet</td>
<td>Vaisala vNet Ethernet interface for DL series data loggers with PoE option via RJ45 connector</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethernet</th>
<th>Ethernet switch</th>
<th>+4 PoE IEEE 802.3af/at</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Standards</th>
<th>EN/IEC61326-1 (Basic electromagnetic environment)</th>
<th>EN55032 Class B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IEC/UL/EN 61010-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IP66/NEMA 4 (large CAB100) / IP54 (small CAB100)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Safety listed in USA and Canada ²)</td>
<td></td>
</tr>
</tbody>
</table>

1) Only with PDTs and small CAB100.
2) Safety listing pending.

For accuracy specifications, see devices on [www.vaisala.com](http://www.vaisala.com)
- DL4000 data loggers for multiple parameters
- PDT101 differential pressure transmitter
- HMT360 series transmitters for intrinsically safe temperature and humidity measurement
- HMT120/130 series transmitters analog inputs

CAB100 supports internal differential pressure transmitters, analog inputs, and safety barriers or galvanic isolators.
On-site calibration
For Continuous Monitoring Systems

Features
- Achieve time and cost savings by preventing production downtime
- Ensure highly accurate measurements
- Provide certification and mandatory documentation for instrument calibration standards
- Free up staff to focus on primary work assignments
- Enjoy peace of mind with Vaisala-certified calibration expertise and components
- Take advantage of a wide array of available calibrations

Calibrating Vaisala Continuous Monitoring Systems (CMS) on-site helps to maximize reliability and profitability by minimizing costly equipment downtime, removing the need for in-house or factory calibration, and allowing your staff to focus on what is truly important: your business.

Reliable On-site Calibration for Life Science Applications
On-site Calibration Service offers a range of benefits over the conventional options of either shipping equipment back to the manufacturer or calibrating in-house. Reliable on-site calibration minimizes downtime by keeping your monitoring system in place and operational.
Certain calibrations require removal of the device from process. For these situations Vaisala offers rental devices and device swap services to ensure continuity of monitoring and gap-free data. By outsourcing calibration to Vaisala, you remove the need to invest in specialized calibration equipment and training – allowing staff to focus on their primary tasks.
We provide you with a range of single- and multi-point calibration options using application-specific reference instruments, complete with a certificate of NIST traceability. To maintain the high levels of accuracy and optimal performance of your CMS, the system sends a reminder when calibration is due.

Complete Documentation
On-site Calibration Service provides a thorough analysis with comprehensive paper and digital documentation, including a calibration certificate to ensure verification and standards compliance. Calibration reports, data sheets, and calibration labels can be supplied on-site, with digital backup files saved to disk. Our highly accurate calibrations fulfill international standards and make it easy to comply with regulatory requirements.
## Single-point Calibration

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Range</th>
<th>Unit Under Test acceptance limits</th>
<th>Calibration points</th>
<th>Adjustment</th>
<th>Certificate</th>
<th>Traceability</th>
<th>Available for the following devices</th>
<th>Reference instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-90 ... +70 °C</td>
<td>±1 °C</td>
<td>One point at point of use</td>
<td>Not available</td>
<td>Includes as-found/as-left data</td>
<td>NIST</td>
<td>Vaisala Temperature Data Loggers DL1000, DL1016, DL1400, DL1416, DL2000, HMT140</td>
<td>Vaisala Temperature Data Logger</td>
</tr>
<tr>
<td>Temperature for Liquid Nitrogen Applications</td>
<td>Range</td>
<td>Unit Under Test acceptance limits</td>
<td>Calibration points</td>
<td>Adjustment</td>
<td>Certificate</td>
<td>Traceability</td>
<td>Available for the following devices</td>
<td>Reference instrument</td>
</tr>
<tr>
<td>Range</td>
<td>-196 °C</td>
<td>±3 °C</td>
<td>One point at point of use</td>
<td>Not available</td>
<td>Includes as-found/as-left data</td>
<td>NIST</td>
<td>Vaisala Temperature Data Loggers DL1700</td>
<td>Vaisala Temperature Data Logger</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>Range</td>
<td>Unit Under Test acceptance limits</td>
<td>Calibration points</td>
<td>Adjustment</td>
<td>Certificate</td>
<td>Traceability</td>
<td>Available for the following devices</td>
<td>Reference instrument</td>
</tr>
<tr>
<td>Range</td>
<td>Ambient RH (within range of 10 ... 90 %RH) at any temperature within range of +10 ... +45 °C</td>
<td>±5 %RH</td>
<td>One point at point of use</td>
<td>Not available</td>
<td>Includes as-found/as-left data</td>
<td>NIST</td>
<td>Vaisala Humidity Data Logger DL2000, HMT140</td>
<td>Vaisala Humidity Data Logger</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>Range</td>
<td>Unit Under Test acceptance limits</td>
<td>Calibration points</td>
<td>Adjustment</td>
<td>Certificate</td>
<td>Traceability</td>
<td>Available for the following devices</td>
<td>Reference instrument</td>
</tr>
<tr>
<td>Range</td>
<td>0 ... 20 % at point of use</td>
<td>Application dependent</td>
<td>One point at point of use</td>
<td>Not available</td>
<td>Includes as-found/as-left data</td>
<td>NIST</td>
<td>Vaisala Carbon Dioxide Transmitter Series GMT220</td>
<td>Vaisala GM70</td>
</tr>
</tbody>
</table>

## Multi-point Calibration

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Range</th>
<th>Unit Under Test acceptance limits</th>
<th>Calibration points</th>
<th>Adjustment</th>
<th>Certificate</th>
<th>Traceability</th>
<th>Available for the following devices</th>
<th>Reference instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-90 ... +90 °C</td>
<td>±0.5 °C</td>
<td>Application-dependent</td>
<td>Available on 3+ point calibrations</td>
<td>Includes as-found/as-left data and uncertainties</td>
<td>NIST</td>
<td>Vaisala Temperature Data Loggers with Probes DL1000, DL1016, DL1400, DL1416, HMT143, HMT148</td>
<td>Vaisala HMT330</td>
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<tr>
<td>Relative Humidity</td>
<td>Range</td>
<td>Unit Under Test acceptance limits</td>
<td>Calibration points</td>
<td>Adjustment</td>
<td>Certificate</td>
<td>Traceability</td>
<td>Available for the following devices</td>
<td>Reference instrument</td>
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<tr>
<td>Range</td>
<td>10 ... 90 %RH at ambient temperature</td>
<td>Vaisala Relative Humidity Data Loggers HMT141, DL2000</td>
<td>Application-dependent</td>
<td>Available on 3+ point calibrations</td>
<td>Includes as-found/as-left data and uncertainties</td>
<td>NIST</td>
<td>Vaisala Relative Humidity Data Loggers HMT141, DL2000</td>
<td>Vaisala HMT330</td>
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<tr>
<td>Differential Pressure</td>
<td>Range</td>
<td>Unit Under Test acceptance limits</td>
<td>Calibration points</td>
<td>Adjustment</td>
<td>Certificate</td>
<td>Traceability</td>
<td>Available for the following devices</td>
<td>Reference instrument</td>
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<tr>
<td>Range</td>
<td>-15 ... 200 psi</td>
<td>Range-dependent</td>
<td>Application-dependent</td>
<td>Available on 3+ point calibrations</td>
<td>Includes as-found/as-left data</td>
<td>NIST</td>
<td>Vaisala Differential Pressure Transmitter Series PDT100</td>
<td>Fluke Process Calibrator / Pressure Modules</td>
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<tr>
<td>Current and Voltage</td>
<td>Range</td>
<td>Unit Under Test acceptance limits</td>
<td>Calibration points</td>
<td>Adjustment</td>
<td>Certificate</td>
<td>Traceability</td>
<td>Available for the following devices</td>
<td>Reference instrument</td>
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<tr>
<td>Range</td>
<td>0 ... 5 VDC</td>
<td>±0.15 %FS at +25 °C</td>
<td>Match Factory Calibration</td>
<td>Yes</td>
<td>Includes as-found/as-left data and uncertainties</td>
<td>NIST</td>
<td>Vaisala Relative Data Loggers HMT140, DL4000, DL2000</td>
<td>National Instruments PHIe-4141</td>
</tr>
</tbody>
</table>
VAISALA

OPT100 Optimus DGA Monitor

- Vaisala optical measurement module
- Vacuum gas extraction
- Vaisala industrial-grade computer
- Vaisala hydrogen and moisture measurement
- Maintenance-free magnetic gear pump
- IP66 housing, fully dust and spray-proof
- Isolated power supply

Patented Vaisala measurement technology
• Optical IR sensors designed and manufactured in Vaisala cleanrooms
• Spectral scanning provides selective gas measurement
• Vacuum gas extraction independent of oil temperature and pressure
• Autocalibration eliminates long-term drift – no need to recalibrate
• Total gas pressure measurement – the most reliable method for detecting air leaks

Robust design – made to last
• Hermetically sealed structure tolerates vacuum and pressure changes
• Stainless steel and aluminum components and piping used in contact with oil
• No consumables required – no regular maintenance needed
• Magnetic drive gear pump and high quality valves provide enhanced durability

Simplified installation and operation
• Install and commission in as little as two hours
• Continuous operation with ca. one-hour output interval – no data averaging needed
• Clear browser-based interface – easily view and share data, change settings, and more
• Self-diagnostics with automatic self-recovery after disturbances
Prevent transformer failure
There is nothing worse than an unplanned outage. Lost revenue. Incalculable damage to your reputation and brand. All of it avoidable. Over 50 percent of serious power transformer faults can be detected with the right online monitoring tools, meaning that severe failures can be prevented.

But monitors are not made equal. That’s why we created the Vaisala Optimus™ DGA Monitor. With realtime, trouble-free fault gas monitoring. No false alarms, no maintenance and no consumables required.

Made with the ultimate safety and reliability in mind, ready for the most demanding operating environments. Optimus™ is the culmination of decades of experience, extensive research, and listening to real-life customer needs.

Dependable data – no false alarms
The IR sensor is based on Vaisala core measurement technology and components manufactured in our own cleanroom. Vacuum gas extraction means no data fluctuation due to oil temperature or pressure, while hermetically sealed and protected optics prevent sensor contamination. Moisture is measured directly in the oil with our capacitive thin-film polymer HUMICAP® sensor – used for transformer monitoring for over 20 years. Hydrogen is also measured directly in the oil with the same solid-state sensor used in Vaisala MHT410.

Air leak detection using total gas pressure
Air leaks accelerate the aging of transformers. Using a new, groundbreaking method, Vaisala Optimus™ DGA Monitor measures the total dissolved gas pressure of the sampled oil volume and detects any air leaks on sealed transformers. In case of an air leak into the transformer’s tank, majority of the dissolved gases are nitrogen and oxygen, and the proportion of fault gases in the pressure value is negligible. The pressure trend of the dissolved gasses gives a reliable indication of a leak, as nitrogen is the dominant component, and it is not formed or consumed in reactions inside the transformer.

DGA diagnostics with Duval Triangles
The publicly available and commonly used dissolved gas analysis method for transformer fault diagnostics purposes, Duval Triangles (IEC 60599, Annex B), is available as an optional feature. User interface displays the progression of data points from the past year overlaid on top of Duval Triangles number 1, 4, and 5. Data point selection is automatically performed by the DGA monitor based on reliability and gas concentration criteria.

Robust construction
Stainless steel pipes, IP66-rated and temperature-controlled housing, as well as a magnetic drive gear pump and valves mean superb performance and durability – from the arctic to the tropics. What’s more, there are no consumables to service or replace.

Smooth and smart design
The web-based user interface completely eliminates the need for additional software. The monitor can be installed in less than two hours: connect oil, power, and data – and you’re set. It can be connected to an existing control and monitoring system via digital communication and relays, or used as a standalone monitoring device. And in case of a disturbance such as a power outage, self-diagnostics allow for automatic self-recovery.
Technical data

Measurement specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Accuracy 1) 2)</th>
<th>Repeatability 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethane (C₂H₆)</td>
<td>0 ... 10 000 ppmv</td>
<td>±10 ppm or ±5 % of reading</td>
<td>10 ppm or 5 % of reading</td>
</tr>
<tr>
<td>Acetylene (C₂H₂)</td>
<td>0 ... 5000 ppmv</td>
<td>±15 ppm or ±5 % of reading</td>
<td>5 ppm or 5 % of reading</td>
</tr>
<tr>
<td>Hydrogen (H₂)</td>
<td>0 ... 5000 ppmv</td>
<td>±15 ppm or ±10 % of reading</td>
<td>10 ppm or 10 % of reading</td>
</tr>
<tr>
<td>Moisture (H₂O)</td>
<td>0 ... 100 ppmv</td>
<td>±2 ppm or ±10 % of reading</td>
<td>Included in accuracy</td>
</tr>
<tr>
<td>Total gas pressure</td>
<td>0 ... 2000 hPa</td>
<td>±0.5 hPa or ±2 % of reading</td>
<td>±0.1 hPa or 5 % of reading</td>
</tr>
</tbody>
</table>

1) Accuracy specified as the accuracy of the sensors during calibration gas measurements.
2) Whichever is greater.
3) Repeatability of ethane measurement is specified with averaging of five measurements.
4) Measured as relative saturation (%RS).
5) Upper range limited by saturation.
6) Calculated ppm value is based on average solubility of mineral oils.

Measurement operation

- Measurement cycle duration: 1 ... 15 h (typical)
- Warm-up time until first measurement data available: Two measurement cycles
- Initialization time to full accuracy: Two days
- Data storage: At least 10 years
- Expected operating life: > 15 years

Field performance

- Acetylene (C₂H₂): ±1 ppm or ±10 % of reading
- Hydrogen (H₂): ±15 ppm or ±15 % of reading
- Other measured gases: ±10 ppm or ±10 % of reading
- Moisture (H₂O): ±2 ppm or ±10 % of reading

1) Compared with gas chromatography result from an oil sample considering also laboratory uncertainty. Performance of the gas-in-oil measurement may also be affected by oil properties and other chemical compounds dissolved in oil.

Calculated parameters

- Total dissolved combustible gases (TDCG) Average values for single gases, moisture, TDCG, and total gas pressure
- Rate of change (ROC) Available for single gases and TDCG for 24 h, 7 d, and 30 d periods
- Gas ratios 1) Available ratios:
  - CH₄/H₂
  - C₂H₆/C₂H₄
  - C₂H₂/C₂H₆
  - C₂H₆/H₂
  - CO₂/CO

1) Calculated from 24 h average values. See standard IEC 60599.

Operating environment

- Transformer oil type: Mineral oil
- Required minimum fire point of transformer oil: +125 °C (+257 °F)
- Transformer oil pressure at oil inlet: Max. 2 bar abs, continuous Burst pressure 20 bar abs
- Transformer oil temperature at oil inlet: Max. +100 °C (+212 °F)
- Ambient humidity range: 0 ... 100 %RH, condensing
- Ambient temperature range in operation: -40 ... +55 °C (-40 ... +131 °F)
- Storage temperature range: -40 ... +60 °C (-40 ... +140 °F)

1) The fire point of transformer oil is normally approximately 10 °C (18 °F) higher than the closed flash point. See, for example, Heathcote, Martin J. The J & P Transformer Book. 13th ed. Elsevier, 2007.

Power supply

- Operating voltage: 100 ... 240 VAC, 50 ... 60 Hz, ±10 %
- Overvoltage category: III
- Maximum current consumption: 10 A
- Maximum power consumption: 500 W
- Typical power consumption at +25 °C (+77 °F): 100 W

Outputs

- RS-485 Interface
  - Supported protocols: Modbus RTU, DNP3 (optional feature)
  - Galvanic isolation: 2 kV RMS, 1 min

- Ethernet Interface
  - Supported protocols: Modbus TCP, HTTP, HTTPS, DNP3 (optional feature), IEC 61850 (optional feature)
  - Galvanic isolation: 4 kV AC (50 Hz, 1 min)

- Relay outputs
  - Number of relays: 3 pcs, normally open (NO) or normally closed (NC), user selectable
  - Trigger type: Gas alert with user selectable limits
  - Max. switching current: 6 A (at 250 VAC) 2 A (at 24 VDC) 0.2 A (at 250 VDC)

- User interface
  - Interface type: Web based user interface, can be operated with standard web browsers

Mechanical specifications

- Oil fitting: Stainless steel Swagelok® fitting for 10 mm (0.39 in) outer diameter tubing.
- Max. length of oil pipe to transformer: Max. 10 m (33 ft) with 7 mm (0.28 in) inner diameter tubing Max. 5 m (16 ft) with 4 mm (0.15 in) inner diameter tubing
- Material: Marine aluminum (EN AW-5754), stainless steel AISI 316
**Type tests**

<table>
<thead>
<tr>
<th>Category</th>
<th>Standard</th>
<th>Class/Level</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMC compliance</td>
<td>IEC61000-6-5</td>
<td>Class 4</td>
<td>Immunity for Power Station and Substation Environments</td>
</tr>
<tr>
<td></td>
<td>IEC61226-1</td>
<td>Industrial</td>
<td>Electrical equipment for measurement, control, and laboratory use - EMC requirements</td>
</tr>
<tr>
<td></td>
<td>FCC 47 CFR 15, section 15.107</td>
<td>Class A</td>
<td>Limits for conducted emissions</td>
</tr>
<tr>
<td></td>
<td>ISED ICES-003, section 5(a)(i)</td>
<td>Class A</td>
<td>Limits for conducted emissions</td>
</tr>
<tr>
<td>Environmental</td>
<td>IEC60529</td>
<td>IP66</td>
<td>Ingress protection</td>
</tr>
<tr>
<td></td>
<td>SFS-EN ISO 6270-1:2017</td>
<td>+40 °C / 100 %RH for 480 h</td>
<td>Constant humidity condensation atmosphere (C5-M class)</td>
</tr>
<tr>
<td></td>
<td>SFS-ISO 9227:2017</td>
<td>Neutral Salt Spray (NSS), 35 °C, 5 %, PH 6-7, 1000 h</td>
<td>Salt fog (C5-M class)</td>
</tr>
</tbody>
</table>

**Compliance**

- CE marking
- EMC directive, Low voltage directive, RoHS directive, WEEE directive

**You can count on Vaisala**

Vaisala has created measurement devices for 80 years. Our instruments and systems are used in over 150 countries in industries where failure is not an option, including airports, pharmaceuticals, and power generation. Over 10,000 companies in safety and quality-critical sectors rely on Vaisala.

Vaisala sensors are used in the harshest places on Earth – Arctic, maritime, and tropical environments – and even on Mars.

**Power transformer monitoring that works**

Vaisala Optimus™ DGA Monitor delivers out-of-the-box performance, eliminates false alarms, and gives you the best long-term stable measurements for the key fault gases used in transformer diagnostics.
MHT410 Moisture, Hydrogen, and Temperature Transmitter
For online transformer condition monitoring

Vaisala MHT410 Moisture, Hydrogen, and Temperature Transmitter provides reliable online monitoring of insulating oil in power transformers.

**Real-time measurement**

Vaisala Moisture, Hydrogen, and Temperature Transmitter MHT410 provides an accurate real-time measurement result for critical parameters measured in oil, enabling reliable conclusions on the transformer’s condition. With its unique probe design, MHT410 delivers accurate measurement and trend data about the health of the transformer in real time.

**Enabling proactive maintenance decisions**

All of the transmitter’s measured parameters are available through digital and analog outputs, providing information on transformer fault situations and enabling timely, proactive maintenance decisions to minimize expensive service shutdowns and outages.

MHT410 is also compatible with the Vaisala Indigo 500 series transmitters. With its local graphical display, Indigo 520 is a great addition to MHT410. It helps you to identify data trends at the site, as well as power the MHT410 with a single-wire solution.

**Robust and maintenance-free operation**

MHT410 is designed for ease of use in demanding environments. It has undergone extensive testing to ensure it withstands wide temperature changes, vibration, and harsh outdoor conditions. The transmitter has no consumables or moving parts that could break, and is encased in an IP66-rated metal housing equipped with a weather shield.

Every unit is individually tested for a pressure of at least 10 bar and also withstands vacuum conditions. Special attention has been given to EMC tolerance: for example, all electrical connections are isolated. MHT410 can also tolerate short-term power outages.

Features and benefits

- Measures moisture and hydrogen directly in transformer oil
- Compatible with mineral oil, natural ester oil, and synthetic ester oil
- Easy to install
- Provides early warning on potential transformer faults
- Unique probe design allows for direct measurement in oil
- 5-year standard warranty
- Robust design providing reliable operation and no false alarms
- Maintenance-free operation
- No cross-sensitivity to other gases
- Indigo 520 compatible, with easy access to measurement data

Vaisala MHT410 Moisture, Hydrogen, and Temperature Transmitter provides reliable online monitoring of insulating oil in power transformers.
Technical Data

Measurement performance

Hydrogen

Measurement range (in oil) 0 … 5000 ppm

Accuracy 1) ±10 % of reading or ±15 ppm (whichever is greater)

Repeatability ±10 % of reading or ±15 ppm (whichever is greater)

Minimum detection limit 15 ppm

Typical long-term stability 3 % of reading / year

Cross sensitivity to other gases < 2 % (CO₂, C₂H₂, C₂H₄, CO)

Response time 63 % of full response: 2.5 h (when sensor is not in reference cycle)

Warm-up time 2 h, 12 h for full specification

Sensor Catalytic palladium-nickel alloy film

Solid-state sensor

Moisture in oil

Measurement range (in oil) 0 … 100 %RS / aw

Response time (90 % of full response at +20 °C (+68 °F) in still oil) 10 min

Sensor HUMICAPâ”¢ 180L2

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

0 … 90 %RS ±2 %RS (aw ± 0.02)

90 … 100 %RS ±3 %RS (aw ± 0.03)

Temperature

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

1) Accuracy specified is the accuracy during calibration against gas in oil standard. Field performance may be affected, for example, by variation in hydrogen solubility (partition coefficients) between different mineral oils.

Mechanical specifications

Mechanical connection on transmitter 1.5” NPT (male)

Cable gland (optional, for use with Indigo 520) M20×1.5 for cable diameter 5 … 9 mm (0.20 … 0.35 in)

Cable gland (optional) M20×1.5 for cable diameter 8 … 11 mm (0.31 … 0.43 in)

Cable gland (optional) M20×1.5 for cable diameter 11 … 14.5 mm (0.43 … 0.57 in)

Conduit fitting (optional) 1/2” NPT

Interface cable (optional, pre-assembled) 5 m (16 ft 5 in), 9.2 mm (0.36 in) outer diameter

Interface cable (optional) 10 m (33 ft), 9.2 mm (0.36 in) outer diameter

Interface cable (optional, for use with Indigo 520) 10 m (33 ft), 6.2 mm (0.24 in) outer diameter

Housing material AISI 10 Mg

IP rating IP66

Transmitter weight without cables 4.1 kg (9.04 lb)

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 nominal)

Factory warranty 5 years

Operating environment

Oil type Mineral oil / Natural ester oil / Synthetic ester oil

Oil temperature −20 … +75 °C (−4 … +167 °F)

Operating temperature (electronics) −40 … +60 °C (-40 … +140 °F)

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

Operating humidity 0 … 100 %RH, condensing

Pressure tolerance (probe, short-term) Max. 10 bara

Pressure tolerance (probe, continuous) Max. 4 bara

Temperature tolerance, sensor head −40 … +120 °C (−40 … +248 °F)

Integrated protection for short power outages > 3 s

EMC standard EN 61326-1, Industrial environment; 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, IEC 61000-4-11, IEC 61000-4-12, IEC 61000-4-16, IEC 61000-4-17.

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Inputs and outputs

Operating voltage 15 … 30 VDC, 24 VAC (±15 %) (power supply input is galvanically isolated) 1)

Power consumption Typical 4 W, maximum 12 W

Analog output (current) 1)

Channels 3 isolated 4 … 20 mA (loop powering)

External load Max. 500 Ω

Error status indication in case of device error 3.5 mA default, user-configurable for each channel

mA output accuracy at +20 °C (+68 °F) ±0.125 % full scale

Temperature dependence of the analog outputs ±0.006 °C / °C full scale

Digital outputs 1)

Interfaces Isolated RS-485 half-duplex

RS-485 (Service Port, non-isolated)

Protocols Modbus RTU, DNP3, serial ASCII

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

1) Max. isolation voltage 1.5 kV DC.

VAISALA
VAISALA

PEROXCAP® sensor for measuring vaporized hydrogen peroxide, relative saturation and relative humidity

**Unique capacitive thin-film polymer sensor for repeatable measurement**

PEROXCAP sensor technology works using measurements from two HUMICAP® sensors. Vaisala HUMICAP sensors guarantee quality and reliability, with their reputation for repeatability, accuracy, excellent long-term stability, and negligible hysteresis, even in the most demanding high-concentration H₂O₂ applications in atmospheric pressure.

HUMICAP is a thin-film polymer sensor consisting of an Alumina substrate on with a thin polymer film between two electrodes. The polymer film absorbs or releases vapor according to humidity changes in the environment. As the humidity 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. **The upper electrode** is made of corrosion resistant conductive material and functions as one of the two electrodes in the capacitor. It protects the active material of the sensor from dust, dirt and conductive particles.

The thin film polymer is sandwiched between the two electrodes. This conductive layer absorbs water and H₂O₂ vapor. The advanced upper electrode is one of the secrets behind a cutting-edge humidity sensor. The amount of vapor absorbed is proportional to the ambient relative humidity (sensor with catalytic layer) or relative saturation. The thin film polymer layer amplifies the amount of water and H₂O₂ in the air. We synthesize our own polymers in order to optimize sensor performance. **The lower electrode** is made of corrosion resistant conductive material and functions as one of the two electrodes in the capacitor.

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**PEROXCAP’s unique benefits**

- Repeatable measurement
- Excellent long-term stability
- In addition to H₂O₂ ppm measurement, the sensor also measures humidity and temperature when combined with an additional temperature sensor
- Unique Relative Saturation parameter indicates the combined humidity of both H₂O₂ vapor and water vapor
- Tolerates high humidity and measures accurately even in 100% relative saturation
- Accurate measurement with a traceable H₂O₂ factory calibration
- Long product lifetime and annual calibration interval
- Optional on-site calibration
Operating principle of PEROXCAP measurement

Multi-parameter measurement
Combining the PEROXCAP sensor with an additional temperature sensor allows up to three measurement parameters: hydrogen peroxide vapor concentration, temperature, and humidity, referring to both relative humidity and relative saturation.

Water and hydrogen peroxide have a very similar molecular structure; both affect the humidity of the air in which they are present
- Relative saturation indicates the humidity of the air caused by both H₂O₂ vapor and water vapor. When relative saturation reaches 100 %RS, the vapor mixture starts to condense.
- Relative humidity is a parameter that indicates the humidity of the air caused only by water vapor.

Traceable H₂O₂ factory calibration
Every PEROXCAP sensor is manufactured in Vaisala’s own cleanroom and individually calibrated at the Vaisala factory. Both H₂O₂ and RH calibrations are traceable to international SI units, which ensures that the measured values represent the real environment.

The effect of H₂O and H₂O₂ on relative saturation (RS) and relative humidity (RH)

Intelligent PEROXCAP measurement technology
PEROXCAP measurement uses two HUMICAP sensors: one HUMICAP sensor with a catalytic layer and the other one without the catalytic layer. The catalytic layer catalyzes hydrogen peroxide from the vapor mixture. Therefore, the HUMICAP sensor with the catalytic layer only senses water vapor, providing a measurement of partial water pressure, i.e. relative humidity (RH). The other HUMICAP sensor without the catalytic layer senses the air mixture with both hydrogen peroxide vapor and water vapor. The difference between the readings from these two sensors indicates the vapor concentration of H₂O₂.

Repeatability measurement even in high humidity
The PEROXCAP sensor is warmed using a chemical purge function. This purging process involves rapid heating of the sensor to remove possible impurities and condensation. This allows the sensor to provide reliable measurement, even in environments where the humidity is near saturation because the heating prevents condensation on the sensor.

PEROXCAP’s intelligent measurement technology, including the chemical purge function, helps maintain measurement accuracy between calibration intervals in challenging environments. The unique PEROXCAP technology was developed to provide stable and repeatable measurements.

For example, at 20 °C and 500 ppm hydrogen peroxide, the humidity level 25 %RH is equivalent to 60 %RS. When this gas mixture starts to condense (relative saturation being 100 %), relative humidity is 45 %.
HPP270 Series Probes
For hydrogen peroxide, humidity, and temperature measurement

Features

• Basic probe option HPP271 for \( \text{H}_2\text{O}_2 \) vapor concentration measurement
• Advanced probe option HPP272: compact 3-in-1 probe with real-time measurement of \( \text{H}_2\text{O}_2 \) vapor concentration, humidity, and temperature
• Superior long-term stability and repeatability with proprietary PEROXCAP® technology
• Corrosion-resistant stainless steel housing (IP65)
• Traceable calibration certificate
• Standalone probe with digital Modbus RTU over RS-485 or 2 analog outputs
• Compatible with Vaisala Insight PC software and Indigo transmitters

The Vaisala PEROXCAP® Hydrogen Peroxide, Humidity, and Temperature Probes HPP271 and HPP272 are designed for demanding hydrogen peroxide bio-decontamination where repeatable, stable, and accurate measurement is essential. The HPP270 series probes are suitable for a variety of applications such as isolator, material transfer hatch, and room bio-decontamination.

Up to three measurements in one compact unit
The advanced HPP272 probe option provides all the parameters you need to measure during bio-decontamination processes: hydrogen peroxide vapor, temperature, and humidity as relative saturation and relative humidity.

Repeatable measurement for highly condensing environments
Intelligent measurement technology including the chemical purge function helps to maintain accuracy between calibrations in challenging \( \text{H}_2\text{O}_2 \) environments. The purging process involves rapid heating of the sensor to remove possible contamination.

The PEROXCAP® sensor used in the HPP270 series probes is warmed, which prevents condensation from forming on the sensor. This provides reliable measurement even in condensing conditions.

Relative saturation for comprehensive humidity monitoring
Similar to water, \( \text{H}_2\text{O}_2 \) vapor affects the humidity level of decontaminated air. The advanced HPP272 probe option enables the measurement of relative saturation, which indicates the total humidity level caused by water vapor and \( \text{H}_2\text{O}_2 \) vapor together. This tells you reliably when the bio-decontaminated air starts to condense.

Indigo and Insight compatible
Vaisala Indigo transmitters provide additional features such as analog and digital outputs, relays, and a smartphone configuration interface. For easy-to-use access to configuration, calibration, and adjustment, the probe can be connected to Vaisala Insight PC software. See www.vaisala.com/indigo and www.vaisala.com/insight

Traceable calibration at Vaisala
Every probe and sensor is manufactured and individually calibrated at Vaisala world-class facilities. Available traceable calibration certificates: 2 points for \( \text{H}_2\text{O}_2 \), 3 points for humidity, 1 point for temperature.
HPP271 technical data

Measurement performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hydrogen peroxide</strong></td>
<td></td>
</tr>
<tr>
<td>Sensor</td>
<td>PEROXCAP®</td>
</tr>
<tr>
<td>Measurement range</td>
<td>0 … 2000 ppm</td>
</tr>
<tr>
<td>Measurement temperature range</td>
<td>+5 … +50 °C (+41 … +122 °F)</td>
</tr>
<tr>
<td>Repeatability at +25 °C (+77 °F) up to 500 ppm</td>
<td>±10 ppm</td>
</tr>
<tr>
<td><strong>Accuracy at +10 … +25 °C</strong></td>
<td>±10 ppm or 5 % of reading</td>
</tr>
<tr>
<td>(±50 … +77 °F), 10 … 2000 ppm H₂O₂</td>
<td>(whichever is greater)</td>
</tr>
<tr>
<td>Factory calibration uncertainty at +25 °C</td>
<td>±10 ppm</td>
</tr>
<tr>
<td>(+77 °F), 500 ppm H₂O₂</td>
<td>(2)</td>
</tr>
<tr>
<td><strong>Response time (T_{63})</strong></td>
<td>70 s</td>
</tr>
<tr>
<td><strong>Other parameters</strong></td>
<td></td>
</tr>
<tr>
<td>H₂O ppm by volume</td>
<td></td>
</tr>
</tbody>
</table>

1) Including non-linearity, hysteresis, and repeatability.
2) Defined as ±2 standard deviation limits. See also calibration certificate.

Inputs and outputs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating voltage</strong></td>
<td>Digital output: 15 … 30 VDC</td>
</tr>
<tr>
<td><strong>Current consumption at +25 °C (+77 °F)</strong></td>
<td>Analog output: 15 … 25 VDC</td>
</tr>
<tr>
<td>In digital mode</td>
<td>Max. 10 mA</td>
</tr>
<tr>
<td>In analog mode</td>
<td>Max. 50 mA</td>
</tr>
<tr>
<td>During purge</td>
<td>Max. 250 mA</td>
</tr>
<tr>
<td><strong>Digital output</strong></td>
<td>RS-485, not isolated; do not use termination on the RS-485 line</td>
</tr>
<tr>
<td><strong>Analog output</strong></td>
<td>Modbus RTU v1.02</td>
</tr>
<tr>
<td>Outputs</td>
<td>2 × 4 … 20 mA 3-wire current outputs</td>
</tr>
<tr>
<td>Max. load</td>
<td>500 Ω</td>
</tr>
<tr>
<td><strong>Accuracy (typical)</strong></td>
<td>±0.1 % of full scale</td>
</tr>
<tr>
<td><strong>Analog output temperature dependence</strong></td>
<td>0.005 %/°C (0.003 %/°F) full scale dependence</td>
</tr>
</tbody>
</table>

Operating environment

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>+0 … +70 °C (+32 … +158 °F)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>−20 … +70 °C (−4 … +158 °F)</td>
</tr>
<tr>
<td>Ambient pressure</td>
<td>Normal atmospheric pressure</td>
</tr>
<tr>
<td>EMC compliance</td>
<td>EN/IEC 61326-1, Industrial Environment</td>
</tr>
</tbody>
</table>

Mechanical specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IP rating</strong></td>
<td>IP65</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>M12/5 male</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Probe body AISI316L stainless steel</td>
</tr>
<tr>
<td>Filter cap</td>
<td>Porous PTFE</td>
</tr>
</tbody>
</table>

Spare parts and accessories

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB cable for PC connection 1)</td>
<td>242659</td>
</tr>
<tr>
<td>Probe cable with open wires, 1.5 m (4.9 ft)</td>
<td>254294SP</td>
</tr>
<tr>
<td>Probe cable with open wires, 3 m (9.8 ft)</td>
<td>254295SP</td>
</tr>
<tr>
<td>Probe cable with open wires, 5 m (16 ft)</td>
<td>254296SP</td>
</tr>
<tr>
<td>Probe cable with open wires, 10 m (33 ft)</td>
<td>254297SP</td>
</tr>
<tr>
<td><strong>Filter</strong></td>
<td>DRW246363SP</td>
</tr>
<tr>
<td><strong>Gland set for through-wall installation, HPP271</strong></td>
<td>HPP271MOUNTINGSET1</td>
</tr>
<tr>
<td><strong>Flange for through-wall installation, HPP271</strong></td>
<td>HPP271MOUNTINGSET2</td>
</tr>
<tr>
<td><strong>Wall mount for HPP271 and HPP272</strong></td>
<td>HPP272WALLMOUNT</td>
</tr>
<tr>
<td><strong>Transmitters</strong></td>
<td>Indigo transmitters See <a href="http://www.vaisala.com/indigo">www.vaisala.com/indigo</a></td>
</tr>
</tbody>
</table>

Measurement performance

**Hydrogen peroxide**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>PEROXCAP®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>0 ... 2000 ppm</td>
</tr>
<tr>
<td>Measurement temperature range</td>
<td>+5 ... +50 °C (+41 ... +122 °F)</td>
</tr>
<tr>
<td>Repeatability at +25 °C (+77 °F) up to 500 ppm</td>
<td>≤10 ppm</td>
</tr>
<tr>
<td>Accuracy at +10 ... +25 °C (+50 ... +77 °F), 0 ... 2000 ppm H₂O₂</td>
<td>±10 ppm or 5% of reading (whichever is greater)</td>
</tr>
<tr>
<td>Factory calibration uncertainty at +25 °C (+77 °F), 500 ppm H₂O₂</td>
<td>±10 ppm</td>
</tr>
<tr>
<td>Response time (T₆₃)</td>
<td>70 s</td>
</tr>
<tr>
<td>Relative saturation</td>
<td></td>
</tr>
<tr>
<td>Measurement range</td>
<td>0 ... 100 %RS</td>
</tr>
<tr>
<td>Measurement temperature range</td>
<td>+5 ... +70 °C (+41 ... +158 °F)</td>
</tr>
<tr>
<td>Repeatability at +25 °C (+77 °F), 500 ppm H₂O₂</td>
<td>±0.5 %RS</td>
</tr>
<tr>
<td>Accuracy at +25 °C (+77 °F)</td>
<td>±4 %RS</td>
</tr>
<tr>
<td>Factory calibration uncertainty at +25 °C (+77 °F), 500 ppm H₂O₂</td>
<td>±2 %RS</td>
</tr>
</tbody>
</table>

**Relative humidity**

| Measurement range       | 0 ... 100 %RH                   |
| Measurement temperature range | +5 ... +70 °C (+41 ... +158 °F) |
| Accuracy: 1)            |                                |
| at +25 °C (77 °F), 0 ppm H₂O₂, 0 ... 90 %RH | ±1 %RH |
| over full temperature measurement and H₂O₂ range | ±2 %RH |
| Response time (T₆₃)     | 20 s                           |
| Factory calibration uncertainty at +25 °C (77 °F), 0 ppm H₂O₂, 0 ... 95 %RH 2) | ±1 %RH |

**Temperature**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Pt1000 RTD Class F0.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy over temperature range</td>
<td>±0.2 °C (±0.36 °F)</td>
</tr>
</tbody>
</table>

**Other parameters**

Absolute H₂O and H₂O₂ ppm by volume, water vapor saturation pressure (H₂O and H₂O+H₂O₂), dew point temperature, vapor pressure (H₂O and H₂O₂)

1) Including non-linearity, hysteresis, and repeatability.

2) Defined as ±2 standard deviation limits. See also calibration certificate.

Inputs and outputs

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>Digital output: 15 ... 30 VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current consumption at +25 °C (+77 °F)</td>
<td>Analog output: 15 ... 25 VDC</td>
</tr>
</tbody>
</table>

- In digital mode: Max. 10 mA
- In analog mode: Max. 50 mA
- During purge: Max. 250 mA

**Digital output**

<table>
<thead>
<tr>
<th>Interface</th>
<th>RS-485, not isolated; do not use termination on the RS-485 line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication protocol</td>
<td>Modbus RTU v1.02</td>
</tr>
</tbody>
</table>

**Analog output**

<table>
<thead>
<tr>
<th>Outputs</th>
<th>2 × 4 ... 20 mA 3-wire current outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. load</td>
<td>500 Ω</td>
</tr>
<tr>
<td>Accuracy (typical)</td>
<td>±0.1% of full scale</td>
</tr>
<tr>
<td>Analog output temperature dependence</td>
<td>0.005 %/°C (0.003 %/°F) full scale dependence</td>
</tr>
</tbody>
</table>

Mechanical specifications

**IP rating** | IP65

**Connector** | M12/5 male

**Materials**

- Probe body: AISI316L stainless steel
- Filter cap: Porous PTFE
- Temperature probe: AISI316L stainless steel
- Temperature probe cable: PTFE

**Spare parts and accessories**

- USB cable for PC connection 1) 242659
- Probe cable with open wires, 1.5 m (4.9 ft) 254294SP
- Probe cable with open wires, 3 m (9.8 ft) 254295SP
- Probe cable with open wires, 5 m (16 ft) 254296SP
- Probe cable with open wires, 10 m (33 ft) 254297SP
- Filter: DRW246363SP
- Gland set for through-wall installation, HPP272: HPP272MOUNTINGSET1
- Flange for through-wall installation, HPP272: HPP272MOUNTINGSET2
- Wall mount for HPP271 and HPP272: HPP272WALLMOUNT
- Indigo transmitters: See www.vaisala.com/indigo


Operating environment

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>+0 ... +70 °C (+32 ... +158 °F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage temperature</td>
<td>-20 ... +70 °C (-4 ... +158 °F)</td>
</tr>
<tr>
<td>Ambient pressure</td>
<td>Normal atmospheric pressure</td>
</tr>
<tr>
<td>EMC compliance</td>
<td>EN/IEC 61326-1, Industrial Environment</td>
</tr>
</tbody>
</table>

HPP272 dimensions

**Spare parts and accessories**

- USB cable for PC connection 1) 242659
- Probe cable with open wires, 1.5 m (4.9 ft) 254294SP
- Probe cable with open wires, 3 m (9.8 ft) 254295SP
- Probe cable with open wires, 5 m (16 ft) 254296SP
- Probe cable with open wires, 10 m (33 ft) 254297SP
- Filter: DRW246363SP
- Gland set for through-wall installation, HPP272: HPP272MOUNTINGSET1
- Flange for through-wall installation, HPP272: HPP272MOUNTINGSET2
- Wall mount for HPP271 and HPP272: HPP272WALLMOUNT
- Indigo transmitters: See www.vaisala.com/indigo

HPP271 and HPP272 installation accessories
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.

**BAROCAP in brief**
- Over 35 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

**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.

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.

**BAROCAP’s unique benefits**
- Low hysteresis, high repeatability
- Superior long-term stability
- Tolerates harsh conditions

**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.

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.
PTU300 Combined Pressure, Humidity, and Temperature Transmitter
For demanding applications

Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 is a unique instrument measuring three parameters simultaneously.

Options

- Available with up to two barometric pressure sensors for added reliability
- Optional universal power supply module
- HMT330MIK installation kit for outdoor use

You can choose from the following probe options: PTU301 for wall mounting for example in laboratories or engine rooms, 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

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

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

PTU300 comes with a standard RS-232 serial interface. The output format is compatible with major GPS receivers and NMEA-coded messages. An isolated RS-485 interface is available as an option.

PTU300 is also capable of applying the Modbus communication protocol and, together with an appropriate connection option, provides either Modbus RTU (RS-485) or Modbus TCP/IP (Ethernet) communication.

The data logger records data that 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 LAN interface, which enables an Ethernet connection. A USB service cable makes it easy to connect 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 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.

**Applications**

- Environmental monitoring in calibration laboratories
- Industrial applications in semiconductor industry, engine testing and maritime sector
- GPS meteorology: estimating precipitable water vapor in the atmosphere, weather stations

The display also shows the WMO pressure trend $\Delta P_{3h}$ and tendency of 0 ... 8.

**Model Dimensions in mm**

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTU301 for wall mounting</td>
<td>120 (4.72)</td>
</tr>
<tr>
<td></td>
<td>12 (0.47)</td>
</tr>
<tr>
<td></td>
<td>183 (7.20)</td>
</tr>
<tr>
<td></td>
<td>116 (4.57)</td>
</tr>
<tr>
<td></td>
<td>Ø 7 (0.28)</td>
</tr>
<tr>
<td></td>
<td>109 (4.29)</td>
</tr>
<tr>
<td></td>
<td>96 (3.78)</td>
</tr>
</tbody>
</table>
### Model Dimensions in mm

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PTU303 probe for outdoor use</strong></td>
<td>Ø 12 (0.47)</td>
</tr>
<tr>
<td></td>
<td>37.5 (1.48)</td>
</tr>
<tr>
<td></td>
<td>78.5 (3.09)</td>
</tr>
<tr>
<td></td>
<td>98.5 (3.88)</td>
</tr>
<tr>
<td><strong>PTU307 warmed probe for demanding meteorological installations</strong></td>
<td>Ø 12 (0.47)</td>
</tr>
<tr>
<td></td>
<td>37.5 (1.48)</td>
</tr>
<tr>
<td></td>
<td>79.5 (3.13)</td>
</tr>
<tr>
<td></td>
<td>99.5 (3.92)</td>
</tr>
<tr>
<td><strong>PTU30T for pressure and temperature only measurement</strong></td>
<td>Ø 3.2 (0.13)</td>
</tr>
<tr>
<td></td>
<td>Ø 6 (0.24)</td>
</tr>
<tr>
<td></td>
<td>130 (5.12)</td>
</tr>
</tbody>
</table>

HMT330MIK Meteorological Installation Kit enables PTU307 to be installed outdoors to obtain reliable measurements for meteorological purposes.
### Technical Data

#### Measurement Performance

**Barometric Pressure**

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure range</td>
<td>500 … 1100 hPa</td>
</tr>
<tr>
<td>Accuracy (Class A)</td>
<td>500 ... 1100 hPa</td>
</tr>
<tr>
<td>Accuracy (Class B)</td>
<td>500 ... 1100 hPa</td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05 hPa</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>±0.03 hPa</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.03 hPa</td>
</tr>
<tr>
<td>Calibration Uncertainty</td>
<td>±0.07 hPa</td>
</tr>
<tr>
<td>Accuracy at +20 °C / +68 °F</td>
<td>±0.10 hPa</td>
</tr>
</tbody>
</table>

**Temperature dependence**

- ±0.1 hPa
- ±0.3 hPa

**Total accuracy**

- (-40 ... +60 °C / -40 ... +140 °F)

**Operating Environment**

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-40 ... +60 °C (-40 ... +140 °F)</td>
</tr>
<tr>
<td>Operating temperature with optional display</td>
<td>0 ... +60 °C (+32 ... +140 °F)</td>
</tr>
</tbody>
</table>

**Relative Humidity**

**Measurement range**

- 0 ... 100 %RH

**Accuracy**

- At +15 ... +25 °C / +59 ... +77 °F
- ±1 %RH (0 ... 90 %RH) ±1.7 %RH (90 ... 100 %RH)
- ±(1.0 + 0.008 x reading) %RH ±(1.5 + 0.015 x reading) %RH

**Factory calibration uncertainty**

- ±0.6 %RH (0 ... 40 %RH)
- ±1.0 %RH (40 ... 97 %RH)

**Sensor for typical applications**

- Vaisala HUMICAP 180 or 180R

**Sensor for applications with chemical purge/warmed probe**

- Vaisala HUMICAP 180C or 180RC

**Response Time (90 % Response)**

- With grid filter
- 8 s / 17 s
- 20 s / 50 s
- 40 s / 60 s

**Temperature**

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range, housing (barometric pressure measurement limit)</td>
<td>-40 ... +60 °C (-40 ... +140 °F)</td>
</tr>
<tr>
<td>Measurement range, probes (operational limit when measuring RH or T)</td>
<td>PTU30T: -40 ... +60 °C (-40 ... +140 °F)</td>
</tr>
<tr>
<td>PTU30T: -40 ... +60 °C (-40 ... +140 °F)</td>
<td></td>
</tr>
<tr>
<td>PTU30T: -40 ... +80 °C (-40 ... +176 °F)</td>
<td></td>
</tr>
<tr>
<td>PTU30T: -40 ... +180 °C (-40 ... +356 °F)</td>
<td></td>
</tr>
<tr>
<td>PTU30T: -70 ... +180 °C (-94 ... +356 °F)</td>
<td></td>
</tr>
</tbody>
</table>

**Accuracy at +20 °C (+68 °F)**

- PTU30T, PTU30S, PTU30H: ±0.2 °C (±0.4 °F)
- PTU30T: ±0.1 °C (±0.2 °F)

**Temperature units**

- °C, °F

**Temperature sensor**

- P1000 RTD Class F01 IEC 60751

**Optional Data Logger with Real-time Clock**

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logged parameters</td>
<td>Max. four with trend/min/max values</td>
</tr>
<tr>
<td>Logging interval</td>
<td>10 s (fixed)</td>
</tr>
<tr>
<td>Maximum logging period with maximum temporal resolution</td>
<td>4 years 5 months</td>
</tr>
<tr>
<td>Logged points</td>
<td>13.7 million points per parameter</td>
</tr>
<tr>
<td>Battery lifetime</td>
<td>Min. 5 years</td>
</tr>
</tbody>
</table>

**Display**

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>LCD with backlight, graphical trend display of any parameter</td>
</tr>
<tr>
<td>Menu languages</td>
<td>English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish</td>
</tr>
</tbody>
</table>

---

1) WRN HUMICAP 80H or 80RC sensor
2) Note that the operational temperature limits of the PTU30T, PTU30S, and PTU30H probes are higher than for the PTU300 transmitter itself. The transmitter's temperature limit is based on the upper temperature limit for barometric pressure measurement, +60 °C (+140 °F)
3) PTU30T is used for T and P measurements only, RH measurement not in use.

---

**Accuracy over Temperature Range**

<table>
<thead>
<tr>
<th>Description</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable bushing</td>
<td>M20 x 1.5 for cable diameter</td>
</tr>
<tr>
<td>Conduit fitting</td>
<td>1/2&quot; NPT</td>
</tr>
<tr>
<td>User cable connector (optional)</td>
<td>M12 series 8-pin (male)</td>
</tr>
<tr>
<td>Option 1</td>
<td>Female plug with 5 m (16.4 ft) black cable</td>
</tr>
<tr>
<td>Option 2</td>
<td>Female plug with screw terminals</td>
</tr>
<tr>
<td>Cable diameter, PTU303</td>
<td>6.0 mm</td>
</tr>
<tr>
<td>Cable diameter, other probes</td>
<td>5.5 mm</td>
</tr>
<tr>
<td>Standard probe cable lengths</td>
<td>2 m, 5 m or 10 m 1)</td>
</tr>
<tr>
<td>Housing material</td>
<td>G-AlSi 10 Mg (DIN 1725)</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP66</td>
</tr>
<tr>
<td>Weight (depending on selected probe)</td>
<td>1.0 - 3.0 kg / 2.2 - 6.6 lb</td>
</tr>
</tbody>
</table>

---

1) Additional cable lengths available, please see order form for details.
### Inputs and Outputs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage with optional power supply module</td>
<td>10 … 35 VDC, 24 VAC ±20 %</td>
</tr>
<tr>
<td>Settling time at power-up (one sensor)</td>
<td>Class A: 4 s</td>
</tr>
<tr>
<td>Class B: 3 s</td>
<td></td>
</tr>
<tr>
<td>Recommended wire size</td>
<td>0.5 mm² (AWG 20) stranded wires</td>
</tr>
<tr>
<td>Digital outputs</td>
<td>RS-232, RS-485 (optional)</td>
</tr>
<tr>
<td>Protocols</td>
<td>ASCII commands, Modbus RTU</td>
</tr>
<tr>
<td>Service connection</td>
<td>RS-232, USB</td>
</tr>
<tr>
<td>Relay outputs (optional)</td>
<td>0.5 A, 250 VAC</td>
</tr>
<tr>
<td>Power Consumption at +20 °C (+68 °F) (U_in 24 VDC)</td>
<td></td>
</tr>
<tr>
<td>RS-232</td>
<td>Max. 28 mA</td>
</tr>
<tr>
<td>U_out x 3 0 … 1 V / 0 … 5 V / 0 … 10 V</td>
<td>Max. 33 mA</td>
</tr>
<tr>
<td>I_out x 3 0 … 20 mA</td>
<td>Max. 63 mA</td>
</tr>
<tr>
<td>Display and backlight</td>
<td>+20 mA</td>
</tr>
<tr>
<td>During chemical purge</td>
<td>Max. +110 mA</td>
</tr>
<tr>
<td>During probe heating</td>
<td>+120 mA</td>
</tr>
<tr>
<td>External Loads</td>
<td></td>
</tr>
<tr>
<td>Current outputs</td>
<td>R_i &lt; 500 Ω</td>
</tr>
<tr>
<td>0 … 1 V output</td>
<td>R_i &gt; 2 kΩ</td>
</tr>
<tr>
<td>0 … 5 V and 0 … 10 V outputs</td>
<td>R_i &gt; 10 kΩ</td>
</tr>
<tr>
<td>Analog Outputs (Optional)</td>
<td></td>
</tr>
<tr>
<td>Current output</td>
<td>0 … 20 mA, 4 … 20 mA</td>
</tr>
<tr>
<td>Voltage output</td>
<td>0 … 1 V, 0 … 5 V, 0 … 10 V</td>
</tr>
<tr>
<td>Humidity and Temperature:</td>
<td></td>
</tr>
<tr>
<td>Accuracy of analog outputs at +20 °C (+68 °F)</td>
<td>±0.05 %/°C full scale</td>
</tr>
<tr>
<td>Temperature dependence of analog outputs</td>
<td>±0.005 %/°C (0.003 %/°F) full scale</td>
</tr>
<tr>
<td>Pressure:</td>
<td></td>
</tr>
<tr>
<td>Accuracy of analog outputs at +20 °C (+68 °F)</td>
<td>±0.30 hPa (500 … 1100 hPa)</td>
</tr>
<tr>
<td>±0.40 hPa (50 … 1100 hPa)</td>
<td></td>
</tr>
<tr>
<td>Accuracy of analog outputs at -40 … +60 °C / -40 … +140 °F</td>
<td>±0.60 hPa (500 … 1100 hPa)</td>
</tr>
<tr>
<td>±0.75 hPa (50 … 1100 hPa)</td>
<td></td>
</tr>
</tbody>
</table>

### Spare Parts and Accessories

- PC software and cable: 215005
- USB-RJ45 Serial Connection Cable: 219685
- Connection cable for HM70: 211379
- 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 in mm (inches)

![Dimensions Diagram](image-url)
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 PTB330 is based on the Vaisala 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. 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 an electronic working standard. All PTB330 barometers come with a traceable factory calibration certificate.

**Reliability through Redundancy**

According to your choice, PTB330 can incorporate 1, 2, or 3 BAROCAP sensors. When 2 or 3 sensors are used, the barometer continuously compares the readings of the pressure sensors against one another and reports if they are within the set internal difference criteria. This unique feature provides redundancy in pressure measurement.

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**

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.

**Applications**

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.

**Graphical Display**

PTB330 features a multilingual, graphical display allowing users to monitor measurement trends. PTB330 updates the graph automatically during measurement and it provides a one-year measurement history. In addition to instant pressure, PTB330 provides the WMO pressure trend and tendency codes.
Technical Data

### Measurement performance

<table>
<thead>
<tr>
<th>Property</th>
<th>Description/Value</th>
<th>Description/Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Barometric pressure range 500 ... 1100 hPa</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05 hPa</td>
<td>±0.10 hPa</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>±0.03 hPa</td>
<td>±0.03 hPa</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.03 hPa</td>
<td>±0.03 hPa</td>
</tr>
<tr>
<td>Calibration uncertainty</td>
<td>±0.07 hPa</td>
<td>±0.15 hPa</td>
</tr>
<tr>
<td>Accuracy at +20 °C (+68 °F)</td>
<td>±0.10 hPa</td>
<td>±0.20 hPa</td>
</tr>
<tr>
<td><strong>Barometric pressure range 50 ... 1100 hPa</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.20 hPa</td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>±0.08 hPa</td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.08 hPa</td>
<td></td>
</tr>
<tr>
<td>Calibration uncertainty</td>
<td>±0.15 hPa</td>
<td></td>
</tr>
<tr>
<td>Accuracy at +20 °C (+68 °F)</td>
<td>±0.20 hPa</td>
<td></td>
</tr>
<tr>
<td><strong>Temperature dependence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 ... 1100 hPa</td>
<td>±0.1 hPa</td>
<td></td>
</tr>
<tr>
<td>50 ... 1100 hPa</td>
<td>±0.3 hPa</td>
<td></td>
</tr>
<tr>
<td><strong>Total accuracy –40 ... +60 °C (−40 ... +140 °F)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 ... 1100 hPa</td>
<td>±0.15 hPa</td>
<td>±0.25 hPa</td>
</tr>
<tr>
<td>50 ... 1100 hPa</td>
<td>±0.45 hPa</td>
<td></td>
</tr>
<tr>
<td><strong>Long-term stability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500 ... 1100 hPa</td>
<td>±0.1 hPa/year</td>
<td></td>
</tr>
<tr>
<td>50 ... 1100 hPa</td>
<td>±0.1 hPa/year</td>
<td></td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure units</td>
<td>hPa, mbar, kPa, Pa</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 hPa</td>
<td>0.11 hPa</td>
</tr>
<tr>
<td>Settling time at startup (one sensor)</td>
<td>4 s</td>
<td>3 s</td>
</tr>
<tr>
<td>Response time (one sensor)</td>
<td>2 s</td>
<td>1 s</td>
</tr>
<tr>
<td>Acceleration sensitivity</td>
<td>Negligible</td>
<td></td>
</tr>
<tr>
<td>Maximum pressure limit</td>
<td>–</td>
<td>5000 hPa absolute</td>
</tr>
</tbody>
</table>

1) Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis, or repeatability error.
2) Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to international standards.
3) Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error, and calibration uncertainty at room temperature.
4) Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

### Mechanical specifications

**Pressure fitting**
- Barbed fitting for ¼-inch I.D. tubing or quick connector with shutoff valve for ⅛-inch hose

**Pressure connector**
- M5 (10-32) internal thread

**Housing material**
- G AlSi10 Mg (DIN 1725)

**IP rating**
- IP66
- IP65 (NEMA4) with local display

**Weight**
- 1 ... 1.5 kg (2.2 ... 3.3 lb)

### Inputs and outputs

**Property**
- **Supply voltage**
  - 10 ... 35 VDC

**Supply voltage sensitivity**
- Negligible

**Typical power consumption at +20 °C (68 °F)**
- **U<sub>out</sub**: 25 mA
- **I<sub>out</sub**: 40 mA
- Display and backlight: +20 mA

**Serial I/O**
- RS-232C, RS-485, RS-422

### 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: ±0.30 hPa ±0.40 hPa
- 50 ... 1100 hPa: ±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

### Operating environment

**Pressure range**
- 500 ... 1100 hPa, 50 ... 1100 hPa

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

**Operating temperature with local display**
- 0 ... +60 °C (+32 ... +140 °F)

**Compliance**

### Data transfer software

**MI70 Link Interface software**
- Requirements: Microsoft® Windows OS, Microsoft® Excel

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PTB330TS Barometric Pressure Transfer Standard
For portable use

**Features**
- PTB330 digital barometer for accurate pressure measurement
- Handheld MI70 indicator with a user-friendly, multilingual display
- Service port for MI70 Link software or computer
- Vaisala HUMICAP® humidity and temperature probe HMP155
- Weatherproof transport case

Barometric Pressure Transfer Standard PTB330TS combines a PTB330 digital barometer with a handheld MI70 indicator into a portable unit that can be used as a transfer standard.

**Barometer for Portable Use**
PTB330TS uses a PTB330 series digital barometer that is housed in a tabletop casing. PTB330TS is designed to be operated using the handheld MI70 indicator. The MI70 indicator also provides the operation power for the barometer. Optional HMP155 probe is available for accurate humidity and temperature measurement.

**For Measurements in Industrial and Meteorological Areas**
PTB330TS is suitable for reference measurements in industrial and meteorological areas. PTB330TS is housed in a durable and weatherproof transport case that can be easily carried and shipped. The components of the PTB330TS are placed in a foam interior with accessories and User Guide in the lid organizer. The case includes a shoulder strap.

**Available Options**
- ISO/IEC 17025 Accredited calibration for PTB330
- HMP155 options: additional temperature probe, manually controlled chemical purge feature
- MI70 Link software and USB or RS-232 cable for downloading measurement data to a computer
- USB service cable for connecting to PTB330 service port
Technical Data

These specifications apply when MI70, PTB330, and HMP155 are used together in PTB330TS. For PTB330 and HMP155 specifications, see the product documentation.

### General

<table>
<thead>
<tr>
<th>Operating temperature</th>
<th>MI70</th>
<th>PTB330</th>
<th>HMP155</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>−10 ... +40 °C (+14 ... +104 °F)</td>
<td>−40 ... +60 °C (−40 ... +140 °F)</td>
<td>−80 ... +60 °C (−112 ... +140 °F)</td>
</tr>
</tbody>
</table>

| Operating humidity | Non-condensing |

| Power supply | Rechargeable NiMH battery pack with AC-adapter or 4xAA-size alkalines, type IEC LR6 |

| Menu languages | English, Chinese, French, Spanish, German, Russian, Japanese, Swedish, Finnish |

| Display | LCD with backlight, graphic trend display of any parameter, character height up to 16 mm |

| Data logging capacity | 2700 points |

| Alarm | Audible alarm function |

| Compliance | • 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) |

### Operation Time (Using Rechargeable Battery Pack)

| Continuous use with PTB330 | 11 h typical at +20 °C (+68 °F) |
| Datalogging use | Up to 30 days |

### Measurement 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 |

#### Relative Humidity (HMP155)

| Measurement range | 0 ... 100 %RH |
| Accuracy (incl. non-linearity, hysteresis and repeatability) | ±1 %RH (0 ... 90 %RH)  
±1.7 %RH (90 ... 100 %RH) |
| Factory calibration uncertainty at +20 °C (+68 °F) | ±0.6 %RH (0 ... 40 %RH)  
±1.0 %RH (40 ... 97 %RH) |

#### Temperature (HMP155)

| Measurement range | −10 ... +40 °C (+14 ... +104 °F) |
| Accuracy | −10 ... +20 °C (+14 ... +68 °F) ±(0.176 - 0.0028 x temperature) °C  
+20 ... +40 °C (+68 ... +104 °F) ±(0.07 + 0.0025 x temperature) °C |
| 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 |

### 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 |

Accuracy of HMP155 temperature measurement over temperature range

#### Barometric Pressure (PTB330)

- Measurement range: 500 to 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 to +60 °C (−40 to +140 °F) ±0.15 hPa
- Long-term stability: ±0.1 hPa/year
- Relative Humidity (HMP155)
  - Measurement range: 0 to 100 %RH
  - Accuracy (incl. non-linearity, hysteresis, and repeatability): ±1 %RH (0 to 90 %RH), ±1.7 %RH (90 to 100 %RH)
- Factory calibration uncertainty at +20 °C (+68 °F): ±0.6 %RH (0 to 40 %RH), ±1.0 %RH (40 to 97 %RH)
- Temperature (HMP155)
  - Measurement range: −10 to +40 °C (+14 to +104 °F)
  - Accuracy: −10 to +20 °C (+14 to +68 °F) ±(0.176 - 0.0028 x temperature) °C, +20 to +40 °C (+68 to +104 °F) ±(0.07 + 0.0025 x temperature) °C
  - 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

Accuracy of HMP155 temperature measurement over temperature range

1) Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis, or repeatability error.
2) Defined as ±2 standard deviation limits of linearity of the working standard including traceability to NIST.
3) Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.
4) Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.
5) Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.

Accuracy of HMP155 temperature measurement over temperature range

#### Menu languages:
- English
- Chinese
- French
- Spanish
- German
- Russian
- Japanese
- Swedish
- Finnish

#### Display:
- LCD with backlight, graphic trend display of any parameter, character height up to 16 mm

#### Data logging capacity:
- 2700 points

#### Alarm:
- Audible alarm function

#### Compliance:
- 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)

#### Operation Time (Using Rechargeable Battery Pack):
- Continuous use with PTB330: 11 h typical at +20 °C (+68 °F)
- Datalogging use: Up to 30 days

#### 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

Accuracy of HMP155 temperature measurement over temperature range

#### Measurement Performance:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measurement Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barometric Pressure (PTB330)</td>
<td>500 ... 1100 hPa</td>
<td>±0.05 hPa</td>
</tr>
<tr>
<td>Linearity</td>
<td>±0.05 hPa</td>
<td>±0.03 hPa</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>±0.03 hPa</td>
<td>±0.03 hPa</td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.03 hPa</td>
<td>±0.07 hPa</td>
</tr>
<tr>
<td>Calibration uncertainty</td>
<td>±0.07 hPa</td>
<td>±0.10 hPa</td>
</tr>
<tr>
<td>Accuracy at +20 °C (+68 °F)</td>
<td>±0.10 hPa</td>
<td>±0.1 hPa</td>
</tr>
<tr>
<td>Temperature dependence</td>
<td>±0.1 hPa</td>
<td>±0.15 hPa</td>
</tr>
<tr>
<td>Total accuracy</td>
<td>−40 ... +60 °C (−40 ... +140 °F)</td>
<td>±0.15 hPa</td>
</tr>
</tbody>
</table>

Accuracy of HMP155 temperature measurement over temperature range

1) Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis, or repeatability error.
2) Defined as ±2 standard deviation limits of linearity of the working standard including traceability to NIST.
3) Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.
4) Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.
5) Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.
Mechanical Specifications

**PTB330**
- **Housing material**: G-AlSi 10 Mg (DIN 1725)
- **IP rating**: IP65
- **Pressure connector**: M5 (10-32) internal thread
- **Pressure fitting**: Barbed fitting for 1/8 inch I.D. tubing or quick connector with shutoff valve for 1/8 inch hose

**HMP155**
- **Housing material**: PC
- **IP rating**: IP66
- **Additional T-probe cable length**: 2 m (6 ft 6 in)
- **Cable material**: PUR
- **Sensor protection**: Sintered PTFE

**MI70 Measurement Indicator**
- **IP rating**: IP54
- **Housing material**: ABS/PC blend

**Transport Case**
- **IP rating (when closed)**: IP67
- **Plastic parts**: TTX01², PP+SEBS, POM
- **Metal parts**: Stainless steel AISI303
- **Interior foam material**: Polyethylene and polyether
- **Weight with all instruments and typical accessories**: 5.9 kg (13 lb)
- **Exterior dimensions (L × W × H)**: 405 × 330 × 165 mm (15.94 × 12.99 × 6.50 in)

Spare Parts and Accessories

**PTB330**
- **MI70 – PTB330 spiral cable**: 223235SP
- **USB-RJ45 serial connection cable**: 219685
- **Serial connection cable**: 194462Z
- **Barbed fitting 1/8 in**: 194985SP
- **Quick connector 1/8 in**: 220185
- **Transport case with interior foams and tabletop casing for PTB330**: 224068SP

**MI70**
- **USB cable for MI70, includes MI70 Link software**: 219687
- **MI70 Link software**: MI70LINK
- **MI70 connection cable to HMT330, MMT330, DMT340, HMT100, PTB330**: 211339
- **MI70 battery pack variety of AC adapters available**: 26755

**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

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Vaisala BAROCAP® Digital Barometer PTB210 is a reliable outdoor barometer for harsh conditions.

**For Harsh Environments**
PTB210 is ideal for outdoor installations and harsh environments. PTB210 is designed to operate in a wide temperature range, and the electronics housing provides IP65 (NEMA 4) standardized protection against sprayed water.

PTB210 is 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**
PTB210 is designed for various pressure ranges. They are available in two basic configurations:
- Serial output for 500 ... 1100 hPa
- Serial output for 50 ... 1100 hPa
- Analog output with different scalings between 500 ... 1100 hPa

**Accurate and Stable Measurement**
PTB210 is 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, PTB210 integrates directly with Vaisala Static Pressure Head Series SPH10/20. This pairing offers accurate measurement in all wind conditions.

**Vaisala BAROCAP Technology**
PTB210 uses 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. PTB210 is delivered with a traceable factory calibration certificate.
Technical Data

Measurement Performance

| Pressure Range          | Serial output 500 ... 1100 hPa 50 ... 1100 hPa | Analog output 500 ... 1100 hPa 600 ... 1060 hPa 800 ... 1060 hPa 900 ... 1100 hPa |

Serial Output (Units in hPa), Accuracy

<table>
<thead>
<tr>
<th>Pressure range</th>
<th>500 ... 1100</th>
<th>50 ... 1100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>± 0.10</td>
<td>± 0.15</td>
</tr>
<tr>
<td>Class B</td>
<td>± 0.20</td>
<td>± 0.20</td>
</tr>
</tbody>
</table>

Non-linearity

| -40 ... +60 °C | ± 0.10 hPa |
| (-40 ... +140 °F) | ± 0.15 hPa |
| Total accuracy | ± 0.20 hPa |
| Long term stability | ± 0.10 hPa/year |

Analog Output, Accuracy

| 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 | ± 0.60 hPa |
| Long term stability | ± 0.10 hPa/year |

Inputs and Outputs

Serial Output

| Shutdown | ON/OFF |
| Settling time at startup | 2 s |
| Serial I/O | RS-232C /TTL (optional) |
| RS-485, 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) |
| Current consumption, normal mode | < 15 mA (factory setting) |
| Current consumption, power down mode | < 0.8 mA |
| Current consumption, shutdown mode | 0.2 mA |

Analog Output

| Outputs | 0 ... 5 VDC, 0 ... 2.5 VDC (order specified) |
| Shutdown | ON/OFF |
| Response time | 500 ms |
| Resolution | 300 μV |
| Measurement rate | 3 measurements/s |
| Current consumption, normal mode | < 8 mA |
| Current consumption, shutdown mode | 0.2 mA |

All Models

| Max. pressure | 5 000 hPa abs. |
| Pressure connector | M5 (10-32) internal thread |
| Pressure fitting | Barbed fitting for 1/8 in. I.D. tubing |
| Supply voltage (reverse polarity protected), with RS-232/TTL output | 5 ... 28 VDC |
| Supply voltage (reverse polarity protected), with RS-485 or analog output | 8 ... 18 VDC |

Operating Environment

| Operating temperature | -40 ... +60 °C (-40 ... +140 °F) |
| Operating humidity | Non-condensing |
| EMC compliance | EN61326-1, Generic Environment |

Mechanical Specifications

| Housing material | PC Plastic |
| IP rating, electronics | IP65 (NEMA 4) |
| IP rating, sensor | IP63 |
| Instrument weight | 110 g (3.9 oz) |
| Cable weight | 28 g/m (1.0 oz) |
Vaisala BAROCAP® Barometer PTB110 is designed both for accurate barometric pressure measurements at room temperature and for general environmental pressure monitoring over a wide temperature range.

Vaisala BAROCAP Technology
PTB110 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.

Applications
PTB110 is suitable for a variety of applications, such as environmental pressure monitoring, data buoys, laser interferometers, and agriculture and hydrology. The compact PTB110 is ideal for data logger applications as it has low power consumption. The external On/Off control is practical when electricity supply is limited.

Accuracy and Stability
The excellent long-term stability of the barometer minimizes or even removes the need for field adjustment in many applications.
Technical Data

Measurement performance

<table>
<thead>
<tr>
<th>Pressure range (1 hPa=1 mbar)</th>
<th>500 ... 1100 hPa</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>600 ... 1100 hPa</td>
</tr>
<tr>
<td></td>
<td>800 ... 1100 hPa</td>
</tr>
<tr>
<td></td>
<td>800 ... 1060 hPa</td>
</tr>
<tr>
<td></td>
<td>600 ... 1060 hPa</td>
</tr>
</tbody>
</table>

| Resolution                     | 0.1 hPa         |
| Load resistance                | 10 000 Ω minimum |
| Load capacitance               | 47 nF maximum   |
| Settling time to full accuracy after startup | 1 s           |
| Response time to full accuracy after a pressure step | 500 ms       |
| Acceleration sensitivity       | Negligible      |

Accuracy

| Linearity                      | ±0.25 hPa       |
| Hysteresis                     | ±0.05 hPa       |
| Repeatability                  | ±0.05 hPa       |
| Pressure calibration uncertainty | ±0.15 hPa     |
| Voltage calibration uncertainty | ±0.7 mV       |
| Frequency calibration uncertainty | ±0.3 Hz        |
| Accuracy at +20 °C (+68 °F)    | ±0.3 hPa        |
| Total accuracy at              | ±0.3 hPa        |

| +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 |

1) Defined as ±2 standard deviation limits of end-point non-linearity, hysteresis error, or repeatability error.
2) Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to international standards.
3) Defined as the root sum of the squares (RSS) of end-point non-linearity, hysteresis error, repeatability error, and calibration uncertainty at room temperature.

Inputs and outputs

| Supply voltage                  | 10 ... 30 VDC     |
| Supply voltage control          | With TTL-level (Transistor-Transistor-Logic) trigger |
| Supply voltage sensitivity      | Negligible        |
| Average power consumption       | 0.10 W at 12 V    |
| Output voltage                  | 0 ... 2.5 VDC     |
| Output frequency                | 0 ... 5 VDC       |
| Output frequency                | 500 ... 1100 Hz   |
| Pressure connector              | M5 (10 ... 32) internal thread |
| Pressure fitting                | Barbed fitting for ¼ in |
| Minimum pressure limit          | 0 hPa abs         |
| Maximum pressure limit          | 2000 hPa abs      |
| Electrical connector            | A 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: Voltage/Frequency output |

Operating environment

| Operating temperature           | −40 ... +60 °C (−40 ... +140 °F) |
| Storage temperature             | −40 ... +60 °C (−40 ... +140 °F) |
| Operating humidity              | Non-condensing                |
| IP rating                       | IP32                         |
| EMC compatibility               | IEC 61326-1, industrial environment |

Mechanical specifications

| Dimensions (H × W × D)          | 97.3 × 68.4 × 28.1 mm |
|                                | (3.83 × 2.69 × 1.10 in) |
| Weight                         | 90 g (3.2 oz)          |
| Housing cover                  | Plastic ABS/PC blend   |
| Mounting plate                 | Aluminum               |

Dimensions
SPH10/20 Static Pressure Heads
For minimizing wind induced error

SPH10/20 Static Pressure Heads minimize the effects of wind on barometric pressure readings.

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 reduce the effect of dynamic pressure. Vaisala Static Pressure Head Series SPH10/20 are designed to minimize the errors caused by wind. Their wind tunnel tested structure is both horizontally and vertically symmetrical. This design ensures reliable barometric pressure measurements in all weather.

**Features**
- Minimizes wind induced error
- Reliable barometric pressure measurement in all weather
- Wind tunnel tested structure
- Easy to clean
- Easy to install

**Ideal for Outdoor Installations**
Vaisala static pressure heads are available in two models: Vaisala Static Pressure Head SPH10 is a basic version, and Vaisala Static Pressure Head SPH20 is a heated version for reliable operation in snowy and icy conditions. The heated SPH20 contains a thermostat that switches on the warming power at temperatures where the risk of icing may occur.

SPH10/20 protects against rain and condensed water. This prevents capillary condensation of a water column in the pressure channel resulting in a pressure error. The drain holes in the lower plate allow rain and water to flow out. The static pressure heads have internal netting that prevents insects and debris from blocking the pressure channel.

**Carefree Maintenance**
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 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.
Technical Data

Operating Environment

Operating temperature -60 ... +80 °C (-76... +176 °F)

Mechanical Specifications

Weight
- SPH10: 800 g (1.76 lb)
- SPH20: 1360 g (3.0 lb)

Materials
- PC plastic, offshore aluminium

Mounting
- With 2 bolts (M6 × 20 mm min.)

Hose connection
- Barbed fitting for 4 mm i.D. hose or Rp1/4 thread (parallel)

SPH20 Inputs and Outputs

Electrical connections
- M12 connector

Power supply
- Factory setting: 12 V
- Changed connection: 24 V

Power consumption during heating
- 70 W

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)

Dimensions in mm (inches)

SPH10

SPH20

www.vaisala.com
Vaisala Differential Pressure Transmitter PDT101 offers precise measurement and control of very low pressures.

**Operating Environment**

PDT101 is designed especially for demanding life science and high technology cleanroom applications. The 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**

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**

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 spot check.

**Features**

- Easy mounting on wall, DIN rail or panel
- 2 pressure ranges (Pa and in H₂O)
- Accessible zero and span adjustment potentiometers
- ¼” brass tubing connections
- LED status indicator
- Specially designed for critical and regulated environments
- Euro style detachable connector
- NIST traceable (certificate included)
Technical Data

Measurement performance

Measurement ranges (bidirectional) ±60 Pa
±0.25 in H₂O

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 ±0.0005 in H₂O + 0.03 % of reading) / °F
(reference 21 °C or 70 °F)

Pressure type Differential, gauge, vacuum and compound

Overpressure

Proof pressure 1.0 bar
Burst pressure 1.7 bar
Static pressure 1.7 bar

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)

EMC compliance 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 %)

Mechanical specifications

Medium (measured gas) Clean and dry air, non-conducting and non-corrosive gases

Mounting Threaded fastener for wall mounting or DIN rail type EN50022

IP rating IP40

Weight 0.07 kg

Material Process connection Brass
Sensor element Silicon, aluminium, glass
Case NEMA type 1 fire-retardant ABS 1 (meets UL94-5VA)

Inputs and outputs

Process connection 1/4" barbed fittings

Max. loop resistance for 4 ... 20 mA ≤ (Supply voltage - 12 V)/0.022 A

Supply current Max. 20 mA for 4 ... 20 mA output signal

Optical process diagnostics LED visual indicator

Electrical connection Euro style plugable terminal block accepts 12 ... 26 AWG wire (0.13 up to 3.31 mm²)

Output signal

2-wire 4 ... 20 mA
3-wire 0 ... 5 VDC
3-wire output 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

Order information for PDT101

www.vaisala.com

Dimensions in mm

PDT101 - XXX

Measurement range: P (+/−60 Pa) or W (+/−0.25 in H₂O)

Accuracy: 4 (0.4 % span)

Output: (current) or V (voltage)
Vaisala Differential Pressure Transmitter PDT102 offers ultra low pressure measurement for cleanroom control and monitoring applications.

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
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 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.

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
- 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

Applications
PDT102 is designed for use in critical monitoring of cleanrooms for pharmaceutical, biotechnology, medical device and semiconductor controlled manufacturing environments.
## Measurement Data

### Measurement Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement ranges (bidirectional)</td>
<td>±50 Pa</td>
</tr>
<tr>
<td></td>
<td>±0.25 in H&lt;sub&gt;2&lt;/sub&gt;O</td>
</tr>
<tr>
<td>Accuracy (incl. non-linearity, hysteresis,</td>
<td>0.25 % span or 0.5 % span,</td>
</tr>
<tr>
<td>repeatability and zero/span calibration</td>
<td>depending on choice</td>
</tr>
<tr>
<td>Repeatability for 0.25 % span accuracy</td>
<td>0.03 %</td>
</tr>
<tr>
<td>Repeatability for 0.5 % span accuracy</td>
<td>0.05 %</td>
</tr>
<tr>
<td>Electrical resolution</td>
<td>1 x 10&lt;sup&gt;-4&lt;/sup&gt; span</td>
</tr>
<tr>
<td>Long-term stability</td>
<td>&lt;0.5 % span/year</td>
</tr>
<tr>
<td>Response time (10 ... 90 %)</td>
<td>250 ms</td>
</tr>
<tr>
<td>Warm-up time</td>
<td>15 s</td>
</tr>
<tr>
<td>Compensated temperature range</td>
<td>+2 ... +57 °C (±35.6 ... +134.6 °F)</td>
</tr>
<tr>
<td>Temperature dependence</td>
<td>±(0.036 Pa + 0.036 % of reading) / °C</td>
</tr>
<tr>
<td></td>
<td>or ±(0.0001 in H&lt;sub&gt;2&lt;/sub&gt;O + 0.02 % of reading) / °F</td>
</tr>
<tr>
<td>(reference 21 °C or 70 °F)</td>
<td></td>
</tr>
<tr>
<td>Pressure type</td>
<td>Differential, gauge, vacuum and compound</td>
</tr>
<tr>
<td>Overpressure</td>
<td></td>
</tr>
<tr>
<td>Proof pressure</td>
<td>0.7 bar</td>
</tr>
<tr>
<td>Burst pressure</td>
<td>1.7 bar</td>
</tr>
<tr>
<td>Static pressure</td>
<td>1.7 bar</td>
</tr>
<tr>
<td>Mounting Position</td>
<td></td>
</tr>
<tr>
<td>Error (zero adjustable)</td>
<td>≤0.25 %</td>
</tr>
</tbody>
</table>

### Electrical connection

- 2-wire: 4 ... 20 mA
- 3-wire: 0 ... 5 V

### Order information for PDT102

- Process connection 1/8 NPT female according to ANSI/ASME B1.20.1
- Operating voltage 12 ... 36 VDC
- Max. loop resistance for 4 ... 20 mA ≤ (Supply voltage - 12V)/0.022 A
- Electrical connection Screw terminals, 12 ... 22 AWG (0.35 up to 3.31 mm²)
- Output Signal
  - 2-wire: 4 ... 20 mA
  - 3-wire: 0 ... 5 V
- Supply Current
  - For 0 ... 5 V output Max. 10 mA
  - For 4 ... 20 mA output Max. 20 mA

### Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium (measured gas)</td>
<td>Clean and dry air, non-conducting and non-corrosive gases</td>
</tr>
<tr>
<td>Mounting</td>
<td>DIN rail types EN 50022, EN 50035 and EN 50045</td>
</tr>
<tr>
<td>IP rating</td>
<td>IP30</td>
</tr>
<tr>
<td>Weight</td>
<td>0.16 kg</td>
</tr>
<tr>
<td>Process connection</td>
<td>Brass</td>
</tr>
<tr>
<td>Sensor element</td>
<td>Silicon, aluminium, glass</td>
</tr>
<tr>
<td>Case</td>
<td>Polycarbonate, glass filled (UL94-V-1)</td>
</tr>
</tbody>
</table>

### Order information for PDT102

- Measurement range: P (±50 Pa) or W (±0.25 in H<sub>2</sub>O)
- Accuracy: 2 (0.25 % span) or 5 (0.5 % span)
- Output: C (current) or V (voltage)
- Option: (blank) or T

---

**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. 0.3 % (with accuracy specified 0.25 %).
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.

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. Have a look at the multiparameter Vaisala Weather Transmitter WXT530 at www.vaisala.com/wxt530.
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.

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.

\[
\begin{align*}
L & = \text{Transducer separation length} \\
\text{Time of flight, } t_1 & = \text{Transmit Time for path A} \\
\text{Time of flight, } t_2 & = \text{Transmit Time for path B} \\
\end{align*}
\]

For static speed of sound \(V_s\):

\[
\begin{align*}
\frac{t_1}{L} & = \frac{V_s + V_w}{V_s} \\
\frac{t_2}{L} & = \frac{V_s + V_w}{V_s} \\
\end{align*}
\]

Combine to remove \(V_s\):

\[
V_w = \frac{t_2 - t_1}{t_2 (t_2 - t_1)}
\]

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.

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 raindrop 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.

\[
\begin{align*}
P_v & = m v_t \\
E & = \text{Output} \\
\end{align*}
\]
WA15 Wind Set
For high-performance wind measurement

Features
• 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

WA15 is based on accurate sensors installed on a crossarm. It is designed for demanding wind measurement applications.

With a proven track record of successful installations, Vaisala Wind Set WA15 has earned its reputation as the industry standard in the wind sensor market. WA15 consists of Vaisala Anemometer WAA151, Vaisala Wind Vane WAV151, an optional crossarm, a power supply, and cabling.

Anemometer with Excellent Linearity
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 (168 mph). 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.

The output pulse rate is directly proportional to wind speed (for example, 246 Hz = 24.6 m/s (55 mph)). However, for the highest accuracy, the characteristic transfer function must be used to compensate for starting inertia.

Sensitive Wind Vane
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 ±2.8°.

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. WHP151 power supply provides the operating and heating power needed for WA15. The power supply, as well as the signal and power cables are available as options.
Technical Data

### WAA151 measurement performance

<table>
<thead>
<tr>
<th>Sensor/Transducer type</th>
<th>Cup anemometer/opto-chopper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation range</td>
<td>0.4 ... 75 m/s (0.9 ... 168 mph)</td>
</tr>
<tr>
<td>Starting threshold</td>
<td>&lt; 0.5 m/s (1.1 mph)</td>
</tr>
<tr>
<td>Distance constant</td>
<td>2.0 m (6 ft 7 in)</td>
</tr>
<tr>
<td><strong>Transducer output</strong></td>
<td></td>
</tr>
<tr>
<td>0 ... 75 m/s (0 ... 168 mph)</td>
<td></td>
</tr>
<tr>
<td>Characteristic transfer function</td>
<td>$U_f$ (wind speed) = $0.328 + 0.101 \times R$ (output pulse rate)</td>
</tr>
<tr>
<td><strong>Transducer output level</strong></td>
<td></td>
</tr>
<tr>
<td>($I_{in} &lt; +5 mA$) High state &gt; $U_{in} -1.5 V$</td>
<td></td>
</tr>
<tr>
<td>($I_{in} &gt; -5 mA$) Low state &lt; 2.0 V</td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy within 0.4 ... 60 m/s (0.9 ... 134 mph)</strong></td>
<td>$\pm 0.17$ m/s (0.38 mph)</td>
</tr>
<tr>
<td>With simple transfer function</td>
<td>$U_f = 0.1 \times R$</td>
</tr>
<tr>
<td><strong>Accuracy within 0.4 ... 60 m/s (0.9 ... 134 mph)</strong></td>
<td>$\pm 0.5$ m/s (1.2 mph)</td>
</tr>
</tbody>
</table>

1) Measured with the cup wheel in position least favored by flow direction. The optimum position yields a < 0.35 m/s (0.8 mph) starting threshold.

2) Typical error vs. speed with the simple transfer function used.

### WAV151 measurement performance

<table>
<thead>
<tr>
<th>Sensor/Transducer type</th>
<th>Optical code disc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation range at wind speed</td>
<td>0 ... 360°</td>
</tr>
<tr>
<td>Starting threshold</td>
<td>&lt; 0.4 m/s (0.9 mph)</td>
</tr>
<tr>
<td>Resolution</td>
<td>$\pm 2.8^\circ$</td>
</tr>
<tr>
<td>Damping ratio</td>
<td>0.19</td>
</tr>
<tr>
<td>Overshoot ratio</td>
<td>0.55</td>
</tr>
<tr>
<td>Delay distance</td>
<td>0.4 m (1 ft 4 in)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Better than $\pm 3^\circ$</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td>6-bit parallel GRAY code</td>
</tr>
</tbody>
</table>

### WAV151 inputs and outputs

<table>
<thead>
<tr>
<th>Electrical connections</th>
<th>MIL-C-26482 type, 10-wire cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabling</td>
<td>10-wire cable through cross arm</td>
</tr>
<tr>
<td>Recommended connector at cable end</td>
<td>SOURIAU UT651CU2E10P</td>
</tr>
<tr>
<td>Operating power supply</td>
<td>$U_{in} = 9.5 ... 15.5$ VDC, 20 mA typical</td>
</tr>
<tr>
<td>Heating power supply</td>
<td>AC or DC 20 V, 500 mA nominal</td>
</tr>
<tr>
<td>Settling time after power-up</td>
<td>&lt; 100 µs</td>
</tr>
</tbody>
</table>

### WAV151 operating environment

| Operating temperature            | $-50 ... +55^\circ C (-58 ... +131^\circ F)$       |
| Storage temperature              | $-60 ... +70^\circ C (-76 ... +158^\circ F)$       |
| Operating humidity               | 0 ... 100 %RH                                       |
| IP rating                        | IP65                                               |

1) With shaft heating.

### WAV151 mechanical specifications

| Dimensions (H × Ø)               | 300 × 90 mm (11.81 × 3.54 in)                      |
| Swept radius of vane             | 172 mm (6.77 in)                                    |
| Weight                           | 660 g (1.46 lb)                                     |

### WAV151 mechanical specifications

| Dimensions (H × Ø)               | 240 × 90 mm (9.45 × 3.54 in)                      |
| Swept radius of cup wheel        | 91 mm (3.58 in)                                    |
| Weight                           | 570 g (1.26 lb)                                    |

### WA15 mechanical specifications

| Dimensions                         | 125 × 80 × 57 mm (4.92 × 3.15 × 2.24 in)          |
| Crossarm length                    | 800 mm (31.50 in)                                  |
| Mounting to a pole mast with a nominal outside diameter | 60 mm (2.36 in)                                    |
## WA15 spare parts and accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service kit for one WA15/25 sensor (a set of bearings and gasket)</td>
<td>16644WA</td>
</tr>
<tr>
<td>Cup assembly WAA151</td>
<td>7150WA</td>
</tr>
<tr>
<td>Tail assembly WAV151</td>
<td>6389WA</td>
</tr>
<tr>
<td>Sensor board WAA151</td>
<td>1433WA</td>
</tr>
<tr>
<td>Sensor board WAV151</td>
<td>1434WA</td>
</tr>
<tr>
<td>Attachment hardware for WAA151/252 and WAV151/252</td>
<td>16546WA</td>
</tr>
<tr>
<td>Crossarm and serial RS-485 transmitter WAC155</td>
<td></td>
</tr>
<tr>
<td>Component board for WAC155</td>
<td>WAC155CB</td>
</tr>
<tr>
<td>Crossarm and termination box WAC151</td>
<td></td>
</tr>
<tr>
<td>16-lead signal cable 10 m for WA15/25, open leads on both ends</td>
<td>ZZ45048</td>
</tr>
<tr>
<td>6-lead heating power cable 10 m for WA15/25, open leads on both ends</td>
<td>ZZ45049</td>
</tr>
<tr>
<td>Special length 16-lead signal cable for WA15/25, open leads on both ends</td>
<td>ZZ45048SPEC</td>
</tr>
<tr>
<td>Special length 6-lead heating power cable for WA15/25, open leads on both ends</td>
<td>ZZ45049SPEC</td>
</tr>
<tr>
<td>Sensor cable for WAA151/252 0.8 m (31.5 in), open lead on one end (6 wires), connector 230118 on another end</td>
<td>ZZ45036</td>
</tr>
<tr>
<td>Sensor cable for WAV151/252 0.8 m (31.5 in), open lead on one end (10 wires), connector 230119 on another end</td>
<td>ZZ45037</td>
</tr>
<tr>
<td>Special length sensor cable for WAA151/252, open lead in one end (6 wires), connector 230118 on another end</td>
<td>ZZ45038SPEC</td>
</tr>
<tr>
<td>Special length sensor cable for WAV151/252, open lead in one end (10 wires), connector 230119 on another end</td>
<td>ZZ45037SPEC</td>
</tr>
<tr>
<td>Connector WAA151, WAA252</td>
<td>230118</td>
</tr>
<tr>
<td>Connector WAV151, WAV252</td>
<td>230119</td>
</tr>
<tr>
<td>Crossarm and analog transmitter WAT12</td>
<td>WAT12</td>
</tr>
<tr>
<td>Component board for WAT12</td>
<td>16637WA</td>
</tr>
<tr>
<td>Power supply for WA15</td>
<td>WHP151</td>
</tr>
<tr>
<td>Power board for WHP15 supply</td>
<td>WA35120</td>
</tr>
</tbody>
</table>
WMT700 Ultrasonic Wind Sensor Series

WMT700 Series has been designed for professional use in meteorology, aviation, maritime, wind energy, and many other applications.

Vaisala WINDCAP® Ultrasonic Wind Sensor WMT700 Series is a robust and reliable ultrasonic anemometer. It measures surface wind, which is one of the key parameters for meteorology and aviation.

WMT700 series meets WMO CIMO Guide (WMO-No.8) and ICAO requirements.

**Features**

- WMO and ICAO compliant
- Data output rate 4 Hz and 8 Hz
- Stainless steel structure
- Maintenance-free
- 3-transducer layout provides accurate data
- Data format outputs: polar coordinates and vectors
- Fully compensates effects of temperature, humidity, and pressure
- Measurement range up to 90 m/s (201 mph)
- Heating up to 250 W
- IP66 and IP67
- Large transducers provide high ultrasound power
- Optional bird prevention kit
- Wind gust calculated according to WMO guidelines
- US National Weather Service and the FAA rely on Vaisala WINDCAP® technology

**Accurate and Maintenance-free**

WMT700 series has a durable full steel structure with welded arms, clear North indication, and one-point, quick bayonet-style mounting. It has no moving parts, and it is resistant to contamination and corrosion.

It measures accurately and produces reliable data in demanding wind conditions and climates without periodic or on-demand maintenance. Self-diagnostics and measurement validation are standard features. The 60-minute average is available for polar coordinates and vectors.

**Measurement Based on Ultrasound**

WMT700 series uses ultrasound to determine the horizontal wind speed and direction. The measurement is based on transit time, the time it takes for the ultrasound to travel from one transducer to another, depending on the wind speed.

The transit time is measured in both directions for a pair of transducer heads. Using 2 measurements for each of the 3 ultrasonic paths at 60° angles to each other, WMT700 computes the wind speed and direction.

The wind measurement is calculated in a way that completely eliminates the effects of altitude, temperature, and humidity.

**Standard and Heated Models**

WMT700 series operates with a power supply of 9 ... 36 VDC. For the heated model, an additional heating power supply of 24 ... 36 VDC is required. Thermostatically controlled heaters in the transducer heads and arms of the heated model prevent build-up of freezing rain and snow. A model with a heated transducer, arms, and body is available for operation in the harshest and coldest environments.

In addition, accessories are available for mounting and connecting WMT700. To minimize interference from birds, a bird prevention kit is available.

---

**DNV GL TYPE EXAMINATION CERTIFICATE No. TAA0000US**

WMT700 Series has been designed for professional use in meteorology, aviation, maritime, wind energy, and many other applications.
Technical Data

Wind speed measurement performance

<table>
<thead>
<tr>
<th>Measurement range</th>
<th>WMT701: 0 ... 40 m/s (89 mph)</th>
<th>WMT702: 0 ... 65 m/s (145 mph)</th>
<th>WMT703: 0 ... 75 m/s (168 mph)</th>
<th>WMT704: 0 ... 90 m/s (201 mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting threshold</td>
<td>0.01 m/s (0.0223 mph)</td>
<td>0.01 m/s (0.0223 mph)</td>
<td>0.01 m/s (0.0223 mph)</td>
<td>0.01 m/s (0.0223 mph)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 m/s (0.0223 mph)</td>
<td>0.01 m/s (0.0223 mph)</td>
<td>0.01 m/s (0.0223 mph)</td>
<td>0.01 m/s (0.0223 mph)</td>
</tr>
<tr>
<td>Response time</td>
<td>250 ms</td>
<td>250 ms</td>
<td>250 ms</td>
<td>250 ms</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.1 m/s (0.2 mph) or 2 % of reading, whichever is greater</td>
<td>±0.1 m/s (0.2 mph) or 2 % of reading, whichever is greater</td>
<td>±0.1 m/s (0.2 mph) or 2 % of reading, whichever is greater</td>
<td>±0.1 m/s (0.2 mph) or 2 % of reading, whichever is greater</td>
</tr>
</tbody>
</table>

Wind direction measurement performance

<table>
<thead>
<tr>
<th>Observation range</th>
<th>0 ... 360°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting threshold</td>
<td>0.1 m/s (0.2 mph)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01°</td>
</tr>
<tr>
<td>Response time</td>
<td>250 ms</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±2°</td>
</tr>
</tbody>
</table>

Powering specifications

<table>
<thead>
<tr>
<th>Operating voltage</th>
<th>9 ... 36 VDC (absolute max. 40 VDC) 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating voltage</td>
<td>24 ... 36 VDC (absolute max. 40 VDC) 1)</td>
</tr>
</tbody>
</table>

Heating power supply requirement 2)

<table>
<thead>
<tr>
<th>Heated transducers</th>
<th>Average 32 W</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Peak 40 W</td>
</tr>
<tr>
<td>Heated transducers and arms</td>
<td>Average 152 W</td>
</tr>
<tr>
<td></td>
<td>Peak 200 W</td>
</tr>
<tr>
<td>Heated transducers, arms, and body</td>
<td>Average 252 W</td>
</tr>
<tr>
<td></td>
<td>Peak 350 W at 24 VDC</td>
</tr>
</tbody>
</table>

1) In maritime environments, the normal input voltage ranges are: operating voltage 10 ... 30 VDC (-10 ... +30 %) and heating voltage 24 ... 30 VDC (-10 ... +30 %), as defined in the maritime standard IEC 60945.
2) The actual power consumption depends on the temperature.

Messaging specifications

<table>
<thead>
<tr>
<th>Readout update interval</th>
<th>4 Hz (default) and 8 Hz (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units available</td>
<td>m/s, knots, mph, km/h, V, mA, Hz</td>
</tr>
<tr>
<td>Operating mode</td>
<td>Automatic message or poll mode</td>
</tr>
<tr>
<td>Virtual temperature</td>
<td>Celsius degrees</td>
</tr>
</tbody>
</table>

Mechanical specifications

<table>
<thead>
<tr>
<th>Dimensions (H × W × Ø) 1)</th>
<th>348 × 250 × 285 mm (13.70 × 9.84 × 11.22 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>1.8 kg (4.0 lb)</td>
</tr>
</tbody>
</table>

Materials

<table>
<thead>
<tr>
<th>Body and arms, mounting kit</th>
<th>Stainless steel AISI 316</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transducers</td>
<td>Silicone</td>
</tr>
<tr>
<td>Connector housing surface</td>
<td>Nickel-plated brass</td>
</tr>
</tbody>
</table>
1) Diameter of area covered by transducers.

Analog outputs

| Wind speed                  | Voltage, current, frequency |
| Wind direction              | Voltage, current, potentiometer |

Accessories

<table>
<thead>
<tr>
<th>Verifier</th>
<th>WMT70Verifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird cage</td>
<td>WMT70BirdKit</td>
</tr>
<tr>
<td>Bird perch</td>
<td>WS425BirdPerch</td>
</tr>
<tr>
<td>Cable tightener tool</td>
<td>237888SP</td>
</tr>
<tr>
<td>Junction Box with Cable 2 m (connected)</td>
<td>ASM210791SP</td>
</tr>
<tr>
<td>Cable 2 m (connector and open leads)</td>
<td>227567SP</td>
</tr>
<tr>
<td>Cable 10 m (connector and open leads)</td>
<td>227568SP</td>
</tr>
<tr>
<td>Cable 15 m (connector and open leads)</td>
<td>237890SP</td>
</tr>
<tr>
<td>RS48S Cable 2 m (connector and open leads)</td>
<td>228295SP</td>
</tr>
<tr>
<td>RS48S Cable 10 m (connector and open leads)</td>
<td>228260SP</td>
</tr>
<tr>
<td>MAWS cable 10 m</td>
<td>227565SP</td>
</tr>
<tr>
<td>AWS520 cable 10 m, shield connected to PE pin</td>
<td>229807SP</td>
</tr>
<tr>
<td>AWS520 cable 10 m, shield not connected to PE pin</td>
<td>227566SP</td>
</tr>
<tr>
<td>Adapter cable for WS425 serial</td>
<td>227569SP</td>
</tr>
<tr>
<td>Adapter cable for WS425 analog frequency output</td>
<td>227570SP</td>
</tr>
<tr>
<td>Adapter cable for WS425 analog voltage output</td>
<td>227571SP</td>
</tr>
<tr>
<td>Adapter for FIX70</td>
<td>228869</td>
</tr>
<tr>
<td>Fix70 (suitable also for inverted mounting)</td>
<td>WMT70FSP</td>
</tr>
<tr>
<td>Mounting adapter 60 mm POM</td>
<td>WMT700FIX60-POM</td>
</tr>
<tr>
<td>Mounting adapter 60 mm RST</td>
<td>WMT700FIX60-RST</td>
</tr>
<tr>
<td>Adapter for FIX30/FIX60</td>
<td>228777</td>
</tr>
<tr>
<td>FIX30</td>
<td>WS425Fix30</td>
</tr>
<tr>
<td>FIX60</td>
<td>WS425Fix60</td>
</tr>
</tbody>
</table>

Operating environment

| Heating 1) | 0 W, 30 W, 150 W, or 250 W |
| Operating temperature 1) | -10 °C ... +60 °C (+14 ... +140 °F) |
| Storage temperature | -60 ... +80 °C (+76 ... +176 °F) |
| IP rating | IP66 and IP67 |
1) For freezing conditions, select appropriate combination of heating and temperature ranges.

Digital outputs

| Communication interfaces | COM1: RS-485 |
| COM2: RS-485, RS-422, RS-232, SDI-12 |
| Communication profiles | WMT700, WS425 ASCII, NMEA Standard and Extended (version 0183), SDI-12 (version 1.3), WS425 ASOS, ROSA MES 12, customized |
| Bit rate | 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200 |
| Available averages | Max. 3600 s |
Vaisala Weather Transmitter WXT530 is a unique series of sensors with parameter combinations that allow you to choose what is right for your application. WXT530 is a flexible, integrated building block for weather applications. WXT530 series improves your grip on weather.

**Flexibility**
WXT530 is a series of weather instruments that provides 6 of the most important weather parameters: air pressure, temperature, humidity, rainfall, wind speed and direction through various combinations. You can select the transmitter with the needed parameter(s) into your weather application, with a large variety of digital communication modes and wide range of voltages. A heated option is available. Low power consumption enables solar panel applications. WXT530 Series focuses on maintenance-free operations in a cost-effective manner.

**Integration**
The series offers analog input options for additional third-party analog sensors. With the help of the built-in analog-to-digital converters, you can turn WXT530 into a small, cost-effective weather parameter hub.

Additional parameters include solar radiation and external temperature sensor. Further, the analog mA output for wind speed and wind direction enables a wide variety of industrial applications. WXT530 exceeds IEC60945 maritime standard.

**Solid performance**
WXT530 Series has a unique Vaisala solid state sensor technology. To measure wind, Vaisala WINDCAP® ultrasonic wind sensors are applied to determine horizontal wind speed and direction. Barometric pressure, temperature, and humidity measurements are combined in the PTU module using capacitive measurement for each parameter. This module is easy to change without any contact with the sensors. The precipitation measurement is based on the unique acoustic Vaisala RAINCAP® Sensor without flooding, clogging, wetting, and evaporation losses.

<table>
<thead>
<tr>
<th>Option</th>
<th>Rain</th>
<th>Wind</th>
<th>PTU 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WXT531</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WXT532</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>WXT533</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>WXT534</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>WXT535</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>WXT536</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

1) PTU is a compact changeable module. Vaisala recommends changing it every 2 years.
### Technical data

#### Barometric pressure measurement performance
- **Observation range**: 500 ... 1100 hPa
- **Accuracy (for sensor element) at 600 ... 1100 hPa**: ±0.5 hPa at 0 ... +30 °C (+32 ... +86 °F), ±1 hPa at -52 ... +60 °C (-60 ... +140 °F)
- **Output resolution**: 0.1 hPa / 10 Pa / 0.001 bar / 0.1 mmHg / 0.01 inHg

#### Air temperature measurement performance
- **Observation range**: -52 ... +60 °C (-60 ... +140 °F)
- **Accuracy (for sensor element) at +20 °C (+68 °F)**: ±0.3 °C (±0.54 °F)
- **Output resolution**: 0.1 °C (0.1 °F)

#### Relative humidity measurement performance
- **Observation range**: 0 ... 100 %RH
- **Accuracy (for sensor element) at 0 ... 90 %RH**: ±3 %RH
- **Output resolution**: 0.1 %RH

#### Wind measurement performance
- **Wind speed**
  - **Observation range**: 0 ... 60 m/s (134 mph)
  - **Reporting range**: 0 ... 75 m/s (168 mph)
  - **Response time**: 0.25 s
  - **Available variables**: Average, maximum, and minimum
  - **Accuracy**: ±3 % at 10 m/s (22 mph)
  - **Output resolution**: 0.1 m/s (km/h, mph, knots)
- **Wind direction**
  - **Azimuth**: 0 ... 360°
  - **Response time**: 0.25 s
  - **Available variables**: Average, maximum, and minimum
  - **Accuracy**: ±3.0° at 10 m/s (22 mph)
  - **Output resolution**: 1°
  - **Averaging time**: 1 to 3600 s, sample rate 1, 2, or 4 Hz (configurable)

#### Precipitation measurement performance
- **Collecting area**: 60 cm² (9.3 in²)
- **Rainfall**
  - **Output resolution**: 0.01 mm (0.001 in)
  - **Field accuracy for daily accumulation**: Better than 5 %, weather-dependent
  - **Duration**: Counting each 10-second increment whenever droplet detected
  - **Duration output resolution**: 10 s
  - **Intensity**: Running 1-minute average, 10 s steps
  - **Intensity observation range**: 0 ... 200 mm/h (0 ... 7.87 in/h) (broader with reduced accuracy)
  - **Intensity output resolution**: 0.1 mm/h (0.01 in/h)
  - **Duration output resolution**: 10 s
- **Intensity output resolution**: 0.1 hits/cm² (1 hits/in²), 1 hit/10 s
  - **Intensity output resolution**: 0.1 hits/cm² (1 hits/in²), 1 hit/h

#### Inputs and outputs
- **Operating voltage**: 6 ... 24 VDC (−10 ... +30 %)
- **Average power consumption**: Minimum: 0.1 mA at 12 VDC (SDI-12 standby)
  - **Typical**: 3.5 mA at 12 VDC (typical measuring intervals)
  - **Maximum**: 15 mA at 6 VDC (constant measurement of all parameters)
- **Heating voltage**: DC, AC, or full-wave rectified AC
  - **Typical heating current**: 12 VDC: 800 mA, 24 VDC: 400 mA
- **Digital outputs**
  - SDI-12, RS-232, RS-485, RS-422
- **Communication protocols**
  - SDI-12 v1.3, Modbus RTU, ASCII automatic and polled, NMEA 0183 v3.0 with query option

#### WXT536 analog input options
- **Solar radiation**: 0 ... 25 mV
- **Voltage input**: 0 ... 2.5 V, 0 ... 5 V, 0 ... 10 V
- **Tipping bucket rain gauge**: 0 ... 100 Hz
- **Temperature (PT1000)**: 800 ... 1330 °C

#### WXT532 analog mA output options
- **Wind speed**: 0 ... 20 mA or 4 ... 20 mA
- **Wind direction**: 0 ... 20 mA or 4 ... 20 mA
- **Load impedance**: Max. 200 Ω

#### Mechanical specifications
- **Weight**
  - WXT534, WXT535, WXT536: 0.7 kg (1.54 lbs)
  - WXT531, WXT532, WXT533: 0.5 kg (1.1 lbs)

#### Operating environment
- **Operating temperature**: -52 ... +60 °C (-60 ... +140 °F)
- **Storage temperature**: -60 ... +70 °C (-76 ... +158 °F)
- **Relative humidity**: 0 ... 100 %RH
- **Pressure**: 600 ... 1100 hPa
- **Wind**
  - 0 ... 60 m/s (0 ... 134 mph)
- **IP rating**: IP65, with mounting kit: IP66

### Compliance
- **EMC compatibility**: IEC 61326-1, industrial environment
- **Environmental**: IEC 60068-2-1, 2, 6, 14, 30, 31, 52, 78
- **Maritime**: IEC 60945 (Exposed)

### Notes
1) Due to the measurement frequency used in the sonic transducers, RF interference in the 200 ... 400 kHz range can disturb wind measurement.

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www.vaisala.com
Life cycle services
For instruments

Benefits of using our services

• Original accuracy and performance guaranteed
• Only original parts and procedures are used
• All services come with a warranty
• Transparent pricing and terms
• Fast service turnaround times and easy logistics
• One-stop-shop for all life cycle services

Comprehensive customer care
As a manufacturer, we are dedicated to offering comprehensive customer care throughout the entire life cycle of Vaisala measurement devices and systems.

Why use Vaisala’s services?
We offer the most comprehensive services for you. Over 100 Vaisala service and technical support experts are dedicated to ensuring that we will meet the highest quality expectations and audit requirements. Our services are available worldwide with fast deliveries and convenient logistics options. Simply select the order channel best for you and let us take care of the rest.
Calibration services

Using our calibration services is the most convenient way to ensure that your device will meet the original accuracy specifications. Our calibration options are available for you 24/7 from our Online store throughout the life cycle of your instrument.

Original factory calibration performed on new instruments
In compliance with ISO 9001 requirements
Predefined calibration points

Calibration for regulated industries and reference instruments
In compliance with ISO/IEC 17025 requirements
Predefined/ selectable calibration points

Configurable calibration for customer-specific needs
In compliance with ISO 9001 requirements
Selectable calibration points

Much more than a calibration

All of our calibration options include:

• Functional testing
• Traceable calibration
• Accuracy adjustment as needed
• Filter replacement as needed
• Calibration certificate with as-found and as-left results
• Service report
• Calibration due-date update

Learn more at www.vaisala.com/calibration
Calibration Care agreement

Our Care agreement includes planned calibrations for multiple years. It is the most convenient and economical way to maintain the accuracy of your Vaisala measurement instrument year after year.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Care Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned calibrations for multiple years</td>
<td>✔</td>
</tr>
<tr>
<td>Fixed pricing</td>
<td>✔</td>
</tr>
<tr>
<td>Free shipping to and from Vaisala</td>
<td>✔</td>
</tr>
<tr>
<td>Priority order handling at the Service Center</td>
<td>✔</td>
</tr>
<tr>
<td>Easy return process from the online portal</td>
<td>✔</td>
</tr>
</tbody>
</table>

Personalize your agreement by choosing

1. Calibration
   • Standard ISO 9001
   • Accredited ISO/IEC 17025

2. Number of calibrations
   • Three or more

3. Duration of the agreement
   • Three or more years

4. Payment options
   • Advance payment
   • Annual invoicing

How the Care return process works

1. Use the Online return portal or form to get the pre-filled waybill.
2. Send your instrument to Vaisala Service Center by using our free shipping.
3. Calibration is performed at a Service Center with a priority status.
4. Your instrument is returned with a calibration certificate and service report.
# Extended warranty

Provides additional years of coverage beyond the factory warranty:

- Up to five years of additional warranty over the standard warranty period
- Allows for fast and easy use of the warranty process

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# Training services

Our training services are based on customers’ needs to ensure efficient and accurate measuring operations.

Contact us for training services related to product and system operations, measuring procedures, and maintenance.

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# Maintenance and repair

When your instrument requires repair or component changes, select maintenance and repair services that include:

- Fixed pricing
- Performed by professionals using original parts
- Completed with a calibration to meet the original specifications
Technical support

We are dedicated to providing global technical support to all our customers during the lifetime of their Vaisala products.

- Remote support
- Vaisala experts to help you
- Fast response
- Multiple channels to contact us 24/7
- On-site support on request

Frequently asked questions about calibration

**Why is calibration important?**
- All electronics and sensors drift over time.
- It is important to verify accuracy and make adjustments if needed.
- A calibration certificate is often required by internal or external quality standards.

**Calibration versus adjustment?**
- Calibration refers to comparing the output of a measurement instrument against a reference instrument and only reporting the result.
- Adjustment refers to changing the output to correspond the output of a reference instrument.

**How often should I calibrate?**
- The most common calibration interval is 12 months but the interval depends on your accuracy requirements, operating environment, and your system’s quality requirements.
How to order our services?

View and order 24/7 from the Vaisala Online Store
- Open 24/7/365
- Easily find and purchase services
- Visit us at Vaisala online store store.vaisala.com

Contact your local service expert
- Our experts are available to answer all your questions
- Quick and easy quoting according to your specific needs
- Contact us at www.vaisala.com/support

At your service worldwide
- Four service centers • Global technical support • Field service

Our service centers are accredited according to world’s leading authorities.
## Vaisala contact information

### EUROPE

<table>
<thead>
<tr>
<th>Country</th>
<th>Location</th>
<th>Address</th>
<th>Phone</th>
<th>Fax</th>
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### AMERICAS

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<tr>
<td>10-D Gill Street</td>
<td>200-15225 104 Avenue</td>
<td>Ladeira da Gloria 26</td>
<td>Sócrates 140</td>
</tr>
<tr>
<td>Woburn, MA 01801</td>
<td>Surrey BC, V3R 6Y8</td>
<td>Bloco 3 – Studio 206</td>
<td>Col. Polanco Sección II</td>
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<td>USA</td>
<td>CANADA</td>
<td>Glória, Rio de Janeiro</td>
<td>Del. Miguel Hidalgo</td>
</tr>
<tr>
<td>Tel. +1 781 933 4500</td>
<td>Tel. +1 604 273 6850</td>
<td>RJ 22211-120</td>
<td>CP 11540, CDMX</td>
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<tr>
<td>Toll free 1-888-VAISALA (824-7252)</td>
<td>Toll free 1-800 683 8374</td>
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<td>Tel: +52 (55) 5557 3917</td>
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<tr>
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<tr>
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<tr>
<td>Tel: +(61 3) 9815 6700</td>
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<td>Fax +(61 3) 9815 6799</td>
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<tr>
<td>ABN 58 006 500 616</td>
<td>Sales hotline: 400 810 0126</td>
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ASIA AND PACIFIC (Cont.)

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