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Technical Data

vNet PoE Interface

FEATURE	
Logger Compatibility	v6.00 hardware and higher (Includes Models: VL & SP 1000, 1700, 1200, 1016, 1416, 1400, 2000, 4000)
Ethernet Connectivity	IEEE 802.3af, 10Base-T
Connectivity Cable	Category 5/5e; RJ-45 connector; 1.83 m (6 ft.)
LED Indicators	link, activity, power, logger communications
Device Configuration	HTTP Web Interface, PC-based configuration wizard
Addressing	DHCP/RARP, ARP-Ping, Static IP for IP address assignment, Net BIOS name
Firmware	Field upgradable firmware
viewLinc Aware	Requires one vNet to be programmed with the viewLinc server IP address. Other vNets on the sub-net will automatically self-configure
Power Consumption	
CDL-VNET-P & CDL-VNET-LP	625 mW typical, 700 mW max
CDL-VNET-PC & CDL-VNET-LPC	900 mW typical, 1.35 W max.
Power Supply (Included but not required when using PoE)	North America: 12 VDC/0.5 A max out, 120 VAC in International: 12 VDC/1.66A max out, 100-240 VAC in
Power Input (Optional for use without PoE)	12-30 VDC, plugs into vNet jack labled 12 V
Power Output	
CDL-VNET-P & CDL-VNET-LP	Not available
CDL-VNET-PC & CDL-VNET-LPC	15 VDC nominal, 350 mW max.
Regulatory	FCC Class A, CE, EN 55011, Group 1, Class A; EN 16000-4-2 to -6, RoHS; WEEE
Heating Effect on Measurements	
CDL-VNET-P & CDL-VNET-PC	Temperature rise from electronics (important only for loggers with internal sensors): less than 0.05 °C as seen by the logger sensor
CDL-VNET-LP & CDL-VNET-LPC	Not to be used for loggers with internal sensors.
Environmental Operating Range	-25 °C to 70 °C (-13 °F to 158 °F), 0 to 90 %RH non-condensing and not to exceed a mixing ratio of 38.5 g/kg Storage: -40 °C to 85 °C (-40 °F to 185 °F)
Dimensions/ Weight	Width: 10.2 cm (4.0"); Length: 10.2 cm (4.0"); Height: 4.3 cm (1.7"); Weight: 180 g (6.3 oz)

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

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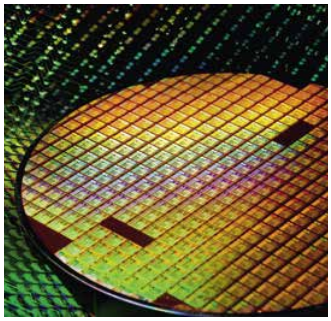
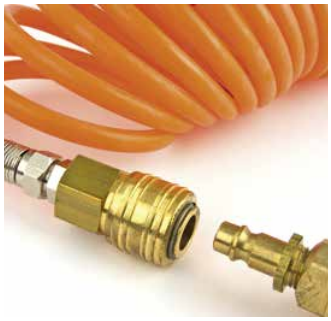
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Vaisala DRYCAP® Sensor for Measuring Dew Point



In 1997 Vaisala introduced DRYCAP®, a new type of dew point sensor based on thin-film polymer technology. Since its launch, the DRYCAP product family has grown to encompass a huge range of applications, from drying processes to compressed air and dry chambers. The DRYCAP sensor is particularly renowned for its reliable performance in hot and very dry environments.

How It Works

DRYCAP's unrivalled performance is based on two innovations: the proven capacitive thin-film polymer sensor and the auto-calibration function.

The sensor's thin-film polymer absorbs or releases water vapor as the surrounding humidity increases or decreases. The dielectric properties of the polymer change as the humidity around the sensor changes, as does the capacitance of the sensor. Capacitance is converted into a humidity reading. The capacitive polymer sensor is bonded together with a temperature sensor, and dew point is calculated from the humidity and temperature readings.

Vaisala's patented auto-calibration function optimizes the measurement stability at low dew points. The sensor is heated at regular intervals during the automated auto-calibration procedure. The humidity and temperature readings are monitored as the sensor cools to ambient temperature, with offset correction compensating for any potential drift. This enables the DRYCAP sensor to deliver accurate measurements in the long term, dramatically reducing the need for maintenance.

Typical Applications for Dew Point Measurement

Vaisala DRYCAP dew point instruments measure dew point in industrial applications, where gas humidity is typically very low. Dew point is often a critical parameter, with inadequate control resulting in problems such as process downtime, damaged process equipment, and deterioration in end-product quality.

Dew point is measured in various drying and heat-treatment processes. It is also controlled in compressed air, where excess moisture can result in poor end-product quality, ice formation, and equipment corrosion.

DRYCAP in Brief

- Thin-film polymer sensor with unique auto-calibration function
- Wide measurement range, dew point measurement down to -80 °C (-112 °F)
- Accuracy ± 2 °C (± 3.6 °F)
- NIST-traceable dew point measurement

DRYCAP's Unique Benefits

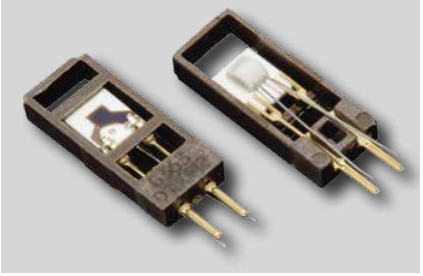
- Excellent long-term stability, with recommended 2-year calibration interval
- Rapid response time
- Withstands condensation and recovers rapidly
- Resistant to particulate contamination, oil vapor, and most chemicals

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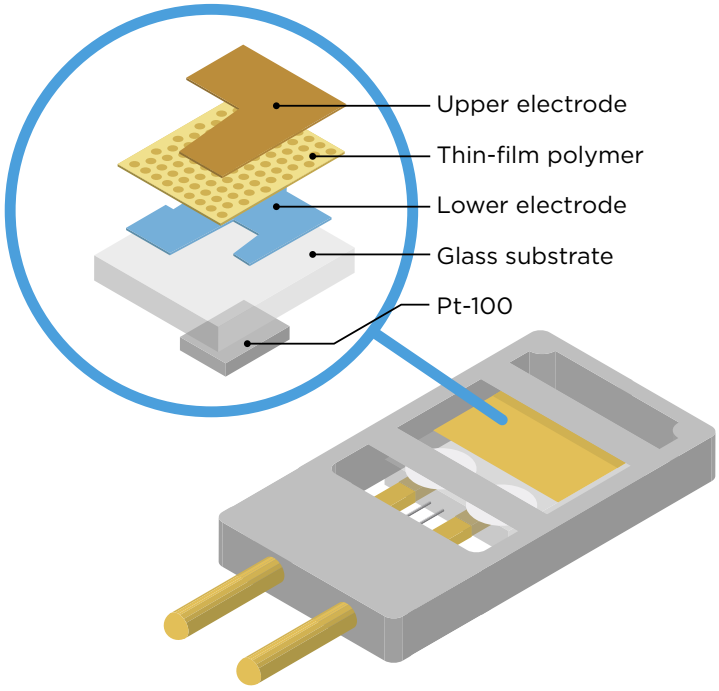
Other typical applications include medical gas, dry environments in lithium battery manufacturing, and gas-insulated high-voltage equipment used in the power industry.

Vaisala DRYCAP Dew Point Products

Vaisala's dew point instruments are suitable for accurate and stable monitoring of dry conditions in a variety of applications from -80 to +100 °C Td. Vaisala's product range includes transmitters for demanding industrial applications, compact instruments for installation in dryers, and hand-held meters for spot checking. Portable sampling systems are also available. View the complete range of dew point products at www.vaisala.com/dewpoint.



DRYCAP sensor.



Structure of the DRYCAP sensor.

The DRYCAP Story

The DRYCAP story began in the mid-1990s following an unresolved measurement challenge. Traditional humidity instruments were not accurate enough at very low humidities, while commonly used aluminum oxide sensors were prone to drift and required frequent calibration. There was strong demand for accurate, easy-to-use, cost-effective, and low-maintenance dew point instruments.

Vaisala's solution was to combine the highest quality polymer technology with a patented key feature – auto-calibration – that would eliminate sensor drift in very dry conditions. The result was the stable, reliable, and accurate DRYCAP sensor.

The first DRYCAP products were launched in 1997, and this highly successful innovation is still going strong today.

DRYCAP also led the way for the next great innovation: the world's first transmitter that monitors both dew point and process pressure simultaneously, aimed at compressed air customers worldwide. The story continues.

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For more information, visit www.vaisala.com or contact us at sales@vaisala.com

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DMT340 Series Dewpoint and Temperature Transmitters for Very Dry Conditions





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

Features/Benefits

- Measures dew point from -70 ... +80 °C (-94 ... +176 °F) with an accuracy of ±2 °C (±3.6 °F)
- Vaisala DRYCAP® sensor provides accurate, reliable measurement with excellent long-term stability and a fast response time
- Condensation-resistant
- Unique auto-calibration feature
- Compatible with Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70
- NIST traceable calibration (certificate included)
- Graphical display and keypad for convenient operation
- Optional alarm relays and mains power supply module
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)

The Vaisala DRYCAP® Dewpoint and Temperature Transmitter Series DMT340 is designed for industrial low-humidity applications such as industrial drying, compressed air systems, semiconductor industry, dry rooms, baking ovens, and metal heat treatment. The transmitters are very reliable, easy to use, and economical to maintain.

Stability at Low Dew Points

The Vaisala DRYCAP® sensor is immune to particulate contamination, water condensation, oil vapor, and most chemicals. 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.

Unique Auto-Calibration Feature

The stability of the DMT340 series is due to its unique auto-calibration function, developed by Vaisala. This feature allows the transmitter to perform calibration and adjustment by itself while the measured process is running. If the measurement accuracy is not confirmed, corrections are made automatically. The procedure is so quick and corrections so minor that it causes no disruption, ensuring easy maintenance and high performance. To maintain high performance, transmitters can be sent to Vaisala for calibration. Calibration intervals depend on the application; in normal conditions it is recommended to have calibration performed every two years.

Graphical Display of Measurement Data and Trends for Convenient Operation

The DMT340 features a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

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

The display alarm allows tracking of any measured parameter, with freely configurable low and high limits.

Versatile Outputs and Data Collection

The DMT340 can support up to three isolated analog outputs. Optional AC mains power and relay outputs are also available.

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

DMT340 is also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provides either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the DMT340 to a PC via the service port.

Easy Installation

DMT340 transmitters are delivered installation-ready, with a variety of installation options to choose from.



The Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 is ideal for field-checking DMT340 transmitters.



The DMT341 is made for installations in dry rooms where the entire dew point transmitter needs to be inside the dry space. The concept is easy to clean and suitable also for cleanrooms.

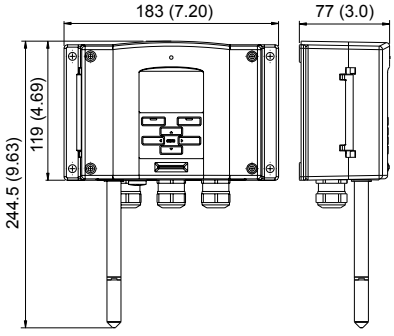
Specifications

DMT341 for Installations in Dry Spaces

Temperature range	
Transmitter body	-40 … +60 °C (-40 … +140 °F)
With display	0 … +60 °C (+32 … +140 °F)

Dimensions

Dimensions in mm (inches)





The DMT342 probe is installed using a flange or sampling cell. The small probe is ideal for integration into larger equipment.

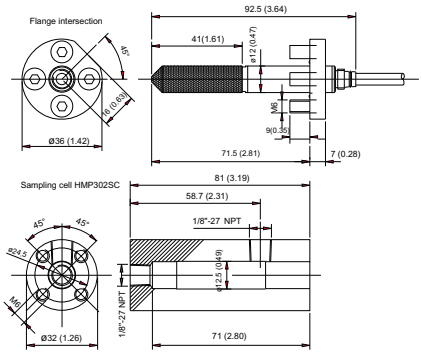
Probe Specifications

DMT342 with Small Size Flanged Probe

Pressure range	0 ... 50 bar/0 ... 725 psia
Mechanical durability	up to 250 bar/ 3625 psia
Probe diameter	12 mm/0.5"
Installation	
Flange	36 mm/1.4"
Sampling cell	HMP302SC

Dimensions

Dimensions in mm (inches)





The DMT344 features a threaded connection for extended pressures with different fitting-body options. It is ideal for permanent installation into pressurized or vacuum processes.

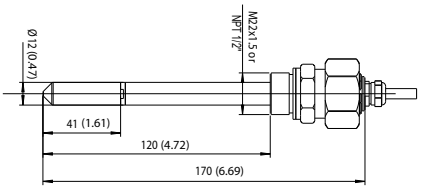
Probe Specifications

DMT344 with Probe for High Pressures

Pressure range	0 ... 50 bar/0 ... 725 psia
Mechanical durability	up to 100 bar/ 1450 psia
Probe diameter	12 mm/0.5"
Installation	
Fitting body	M22 x 1.5
Fitting body	NPT 1/2"

Dimensions

Dimensions in mm (inches)





The DMT347 probe is ideal for tight spaces with a thread connection. The small probe is installed using Swagelok® connectors.

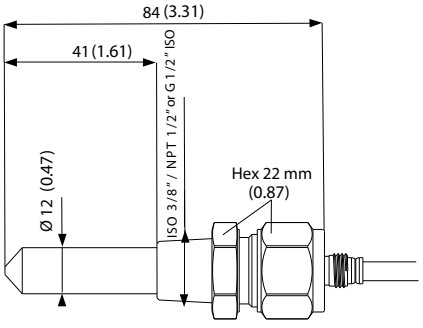
Probe Specifications

DMT347 with Small-Sized Probe

Pressure range	0 ... 10 bar/0 ... 145 psia
Mechanical durability	up to 10 bar/ 145 psia
Probe diameter	12 mm/0.5"
Installation	
Fitting body	R 3/8" ISO
Fitting body	G 1/2" ISO
Fitting body	NPT 1/2"

Dimensions

Dimensions in mm (inches)





The DMT348 is ideal for installation into pressurized processes where the probe needs to be able to be removed while the process is running. The probe depth is adjustable.

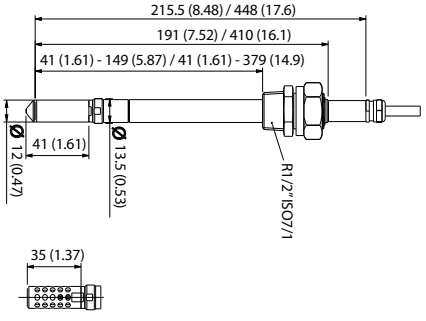
Probe Specifications

DMT348 with Probe for Pipeline Installations

Pressure range	0 ... 40 bar/0 ... 580 psia
Adjustable length	41 ... 149/371 mm/ 1.61 ... 5.87/14.6"
Installation	
Fitting body	R1/2" ISO
Fitting body	NPT 1/2"
Ball-valve set	BALLVALVE-1
Sampling cell	DMT242SC or DMT242SC2

Dimensions

Dimensions in mm (inches)



Optional filter for low pressures (suitable for all models)

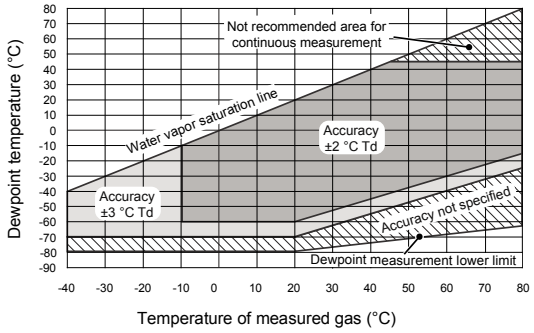
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Technical Data

Measured Parameters

DEW POINT

Sensor	Vaisala DRYCAP®180M
Measurement range	-70 ... +80 °C (-94 ... +176 °F) Td
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)
20 ... 50 bar/290 ... 725 psia	additional inaccuracy +1 °C Td



Dew point accuracy vs. measurement conditions

Response time	63% [90%] at +20 °C gas temperature
Flow rate	1 l/min and 1 bar pressure
-60 ... -20 °C Td (-76 ... -4 °F Td)	5 s [10 s]
-20 ... -60 °C Td (-4 ... -76 °F Td)	45 s [10 min]

TEMPERATURE

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

RELATIVE HUMIDITY

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

PPM

Measurement range (typical)	10 ... 2500 ppm
Accuracy (at + 20 °C, 1 bar)	1 ppm + 20% of reading

Other measurement parameters available (model-dependent): mixing ratio, absolute humidity, pressure dew point calculated to 1 bar, temperature difference (T-Td), water vapor pressure

Operating Environment

Operating temperature	
for probes	-40 ... +80 °C (-40 ... +176 °F)
Mechanical durability	up to +180 °C (+356 °F)
of transmitter body	-40 ... +60 °C (-40 ... +140 °F)
with display	0 ... +60 °C (+32 ... +140 °F)
Storage temperature range	-55 ... +80 °C (-67 ... +176 °F)
Pressure range for probes	see probe specifications
Sample flow rate	no effect
Measured gases	non-corrosive gases
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Industrial environment
	Note: Transmitter with display test impedance of 40 ohm is used in IEC61000-4-5 (Surge immunity)

Inputs and Outputs

Operating voltage	10 ... 35 VDC, 24 VAC ±20 %
with optional power supply module	100 ... 240 VAC 50/60 Hz
Power consumption @ 20 °C (U_{in} 24VDC)	
RS232	max. 25 mA
U_{out} 2 x 0...1V / 0...5V / 0...10V	max. 25 mA
I_{out} 2 x 0...20 mA	max. 60 mA
display and backlight	+ 20 mA
during sensor purge	max. + 110 mA
Analog outputs (2 standard, 3rd optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs at 20 °C	0.05% full scale
Temperature dependence of the analog outputs	± 0.005%/°C full scale
External loads	
current outputs	R_L < 500 ohm
0 ... 1V output	R_L > 2 kohm
0 ... 5V and 0 ... 10V outputs	R_L > 10 kohm
Wire size	0.5 ... 2.5 mm² (AWG 20 ... 14) stranded wires recommended
Digital outputs	RS232, RS485 (optional)
Protocols	ASCII commands, MODBUS RTU
Service connection	RS232, USB
Relay outputs	0.5 A, 250 VAC, SPDT (optional)
Ethernet interface (optional)	
Supported standards	10BASE-T, 100BASE-TX
Connector	8P8C (RJ45)
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
WLAN interface (optional)	DHCP (automatic), static
Supported standards	802.11b
Antenna connector type	RP-SMA
IPv4 address assignment	
Protocols	Telnet, MODBUS TCP/IP
Security	WEP 64/128, WPA 2/802.11i
Authentication / Encryption (WLAN)	
Open / no encryption	
Open / WEP	
WPA Pre-shared key / TKIP	
WPA Pre-shared key / CCMP (a.k.a. WPA2)	
Optional data logger with real-time clock	
Logged parameters	max. three with trend/min./max. values
Logging interval	10 sec. (fixed)
Max. logging period	4 years, 5 months
Logged points	13.7 million points per parameter
Battery lifetime	min. 5 years
Display	LCD with backlight, graphical trend display of any parameter
Menu languages	English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish

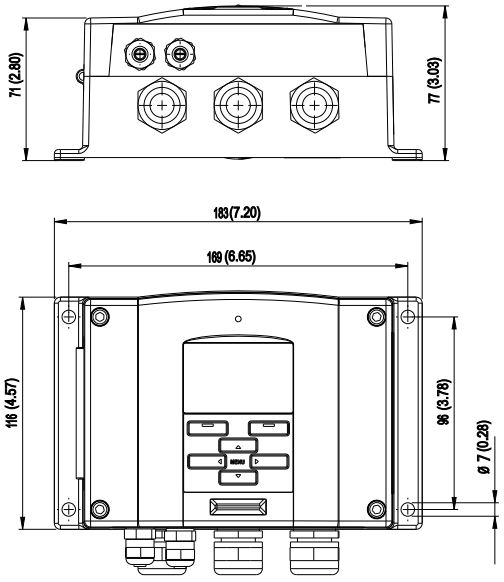
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Mechanics

Cable bushing	M20x1.5 for cable diameter 8 ... 11mm/0.31 ... 0.43"
Conduit fitting	1/2" NPT
User cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft.) black cable
option 2	female plug with screw terminals
USB-RJ45 Serial Connection Cable	219685
Probe cable diameter	5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m (Additional cable lengths available, please see order forms for details)
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 66 IP65 (NEMA4X) with local display
Weight	
depending on selected probe, cable and modules	1.0 – 3.0 kgs

Dimensions

Dimensions in mm (inches)



DRYCAP® is a registered trademark of Vaisala.

TYPE APPROVED PRODUCT
CERTIFICATE NO.: A-13529

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You Compress Air. We Make Sure It's Dry.

Optimize your compressed air quality with the right dew point instrument



What are your system's critical dew points? Our unique sensor technologies cover the full dew point range with optimized instruments for practically any compressed air system.

Vaisala DRYCAP®, HUMICAP® and BAROCAP® sensor technologies ensure accurate, reliable measurements with excellent long-term stability and fast response.



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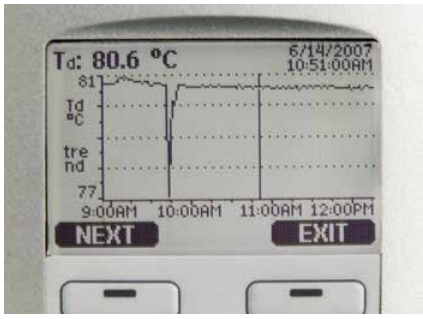
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DMT345 and DMT346 Dewpoint Transmitters for High Temperature Applications



Vaisala DRYCAP® Dewpoint Transmitters DMT345 and DMT346 are designed to measure and control humidity, especially in dry environments with high temperatures.



The large graphical display allows the user to check data at a glance.

The Vaisala DRYCAP® Dewpoint Transmitters DMT345 and DMT346 are designed for humidity measurement in industrial drying applications with particularly high temperatures.

Both transmitters incorporate the Vaisala DRYCAP® sensor, which is accurate, reliable, and stable. The sensor is condensation-resistant and is immune to particulate contamination, oil vapor, and most chemicals. The DRYCAP® sensor is notable for its swift response time and rapid recovery after getting wet.

Measure Humidity Directly in Hot Processes

The DMT345 and DMT346 are built for direct measurement in hot processes. Therefore, there is no need for sampling systems and trace heating. As a result, high measurement accuracy and constancy are maintained.

The accuracy and stability of the DMT345 and the DMT346 are due to their unique auto-calibration function, developed by Vaisala. This feature allows the transmitter to perform calibration and adjustment by itself while the measured process is running. If the measurement accuracy is not confirmed, corrections are made automatically. The procedure is so quick and corrections so minor that it causes no disruption, ensuring easy maintenance and high performance. In normal conditions, it is recommended to have a traceable calibration performed once a year.

DMT345: Accurate in Hot and Dry Environments

The DMT345 is designed for accurate humidity measurement in hot and dry conditions. This model provides unmatched dry-end measurement accuracy at temperatures up to 140 °C; however, it can operate safely at temperatures up to 180 °C.

Features/Benefits

- The DMT345 measures humidity at temperatures up to 180 °C (356 °F)
- The DMT346 measures humidity at temperatures up to 350 °C (+662 °F)
- Dew point accuracy ±2 °C (±3.6 °F)
- Vaisala DRYCAP® sensor provides accurate and reliable measurement with excellent long-term stability and fast response time
- Condensation-resistant
- Unique auto-calibration feature
- NIST traceable calibration (certificate included)
- Graphical display and keypad for convenient operation
- Optional alarm relays and mains power supply module
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)

The stainless steel probe is especially designed for high temperatures and has an optional installation flange for easy adjustment of the probe's installation depth and, therefore, more precise positioning.

DMT346: Reliable in Very Hot Processes

The DMT346 provides the best measurement performance at process temperatures between 140 °C and 350 °C.

The DMT346 includes a cooling set as standard. The cooling effect can be regulated by adding the cooling fins, or they can be removed from the set for optimal measurement performance.

The cooling system has no moving parts, and requires no additional power or cooling utilities, so there is no risk of sensor damage due to mechanical cooling failure.

Additionally, sensor warming minimizes the risk of condensation accumulating on the sensor. In low humidity conditions the combination of auto-calibration and DRYCAP® ensures accurate measurement.

Graphical Display of Measurement Data and Trends for Convenient Operation

The DMT345 and DMT346 transmitters feature a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

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

The display alarm allows tracking of any measured parameter, with freely configurable low and high limits.

Versatile Outputs and Data Collection

DMT345 and DMT346 transmitters can support up to three analog outputs; an isolated galvanic power supply and relay outputs are also available.

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

DMT345 and DMT346 are also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provide either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the DMT345/346 to a PC via the service port.

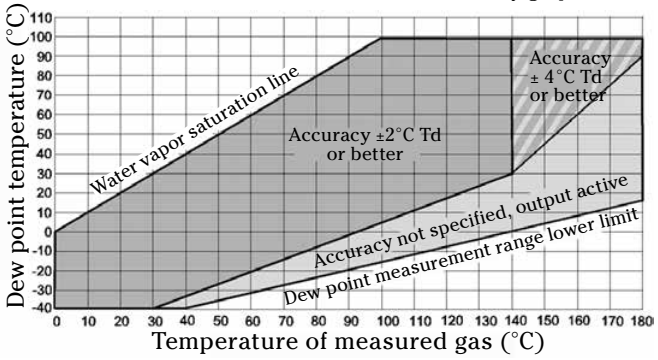
Units are delivered installation-ready.

Technical Data

Measured Variables DMT345

DEW POINT DMT345

Sensor	Vaisala DRYCAP®180S
Measurement range	-40 ... +100 °C (-40 ... +212 °F) Td
Accuracy	±2°C (±3.6 °F) Td
	See the accuracy graph below



Dew point accuracy vs. measurement conditions

Response time 63% [90%] flow rate 1 l/min and 1 bar pressure	
from dry to wet	5 s [10 s]
from wet to dry including auto-calibration	45 s [5 min]

TEMPERATURE DMT345

Measurement range	0 ... +180 °C (+32 ... +356°F)
with sensor warming	upper range limited by humidity (at 80 %RH warming is switched on and T reading not actual process temperature)
Accuracy	±0.4 °C at 100 °C
Temperature sensor	Pt100 RTD Class F0.1 IEC 60751

RELATIVE HUMIDITY DMT345

Measurement range	0 ... 100 %RH
with sensor warming	0 ... 80 %RH
Accuracy	
below 10 %RH	±10% of reading
above 10 %RH	±1.5 %RH + 1.5% of reading

MIXING RATIO DMT345

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

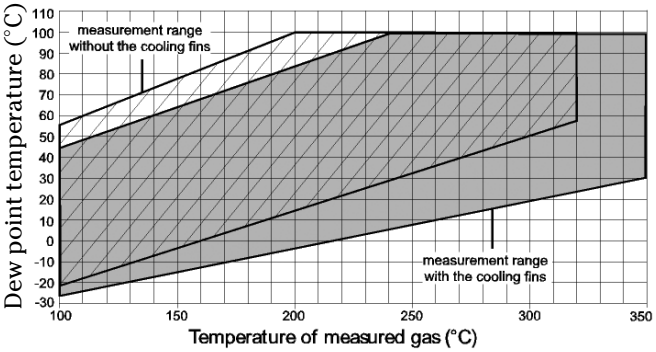
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Technical Data

Measured Variables DMT346

DEW POINT DMT346

Sensor	Vaisala DRYCAP®180S
Measurement range	-25 ... +100 °C (-13 ... +212 °F) Td
Accuracy	±2 °C (±3.6 °F) Td
	See the accuracy graph below



Dew point accuracy vs. measurement conditions

Response time 63% [90%] flow rate 1 l/min and 1 bar pressure	
from dry to wet	5 s [10 s]
from wet to dry including auto-calibration	45 s [5 min]

MIXING RATIO DMT346

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

Operating Environment, DMT345 and DMT346

Mechanical durability	up to +180 °C (+356 °F) for DMT345
of probes	up to +350 °C (+662 °F) for DMT346
of transmitter body	-40 ... +60 °C (-40 ... +140 °F)
with display	0 ... +60 °C (32 … +140 °F)
Storage temperature range	-55 ... +80 °C (-67 … +176 °F)
Pressure range for probes	slight pressure difference (~ 200 mbar)
Measured gases	non-corrosive gases
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Industrial environment
	Note: Transmitter with display test impedance of 40 ohm is used in IEC61000-4-5 (Surge immunity)

Inputs and Outputs, DMT345 and DMT346

Operating voltage	10 ... 35 VDC, 24 VAC ±20%
with optional power supply module	100 ... 240 VAC 50/60 Hz
Default start-up time	
initial reading after power-up	3 s
full operation after sensor purge and autocalibration	about 6 min
Power consumption @ 20 °C (U_{in} 24 VDC)	
U_{out} 2x0 ... 1V/0 ... 5V/0 ... 10V	max. 25 mA
I_{out} 2x0 ... 20mA	max. 60 mA
RS232	max. 25 mA
display and backlight	+ 20 mA
during sensor purge	max. + 110 mA
Analog outputs	(2 standard, 3rd optional)
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs at 20 °C	± 0.05% full scale
Temperature dependence of analog outputs	± 0.005%/°C full scale
External loads	
current outputs	R_L< 500 ohm
0 ... 1V output	R_L > 2 kohm
0 ... 5V and 0 ... 10V outputs	R_L > 10 kohm
Max. wire size	0.5 mm² (AWG 20) stranded wires recommended
Digital outputs	RS232, RS485 (optional)
Protocols	ASCII commands, MODBUS RTU
Service connection	RS232, USB
Relay outputs 2+2 pcs (optional)	0.5 A, 250 VAC, SPDT
Ethernet interface (optional)	
Supported standards	10BASE-T, 100BASE-TX
Connector	8P8C (RJ45)
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
WLAN interface (optional)	DHCP (automatic), static
Supported standards	802.11b
Antenna connector type	RP-SMA
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
Security	WEP 64/128, WPA WPA2/802.11i
Authentication / Encryption (WLAN)	
Open / no encryption	
Open / WEP	
WPA Pre-shared key / TKIP	
WPA Pre-shared key / CCMP (a.k.a. WPA2)	
Optional data logger with real-time clock	
Logged parameters	max. four with trend/min/max values
Logging interval	10 sec. (fixed)
Max. logging period	4 years, 5 months
Logged points	13.7 million points per parameter
Battery lifetime	min. 5 years
Display	LCD with backlight, graphical trend display
Menu languages	English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish

Mechanics, DMT345 and DMT346

Cable bushing	M20x1.5 for cable diameter 8 ... 11mm/0.31 ... 0.43"
Conduit fitting (optional)	1/2"NPT
User cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft.) black cable
option 2	female plug with screw terminals
USB-RJ45 Serial Connection Cable	219685
Probe cable diameter	5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m (Additional cable lengths available, please see order forms for details)
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 66 IP65 (NEMA4X) with local display
Weight depending on selected probe, cable, and modules	1.0 – 3.0 kgs

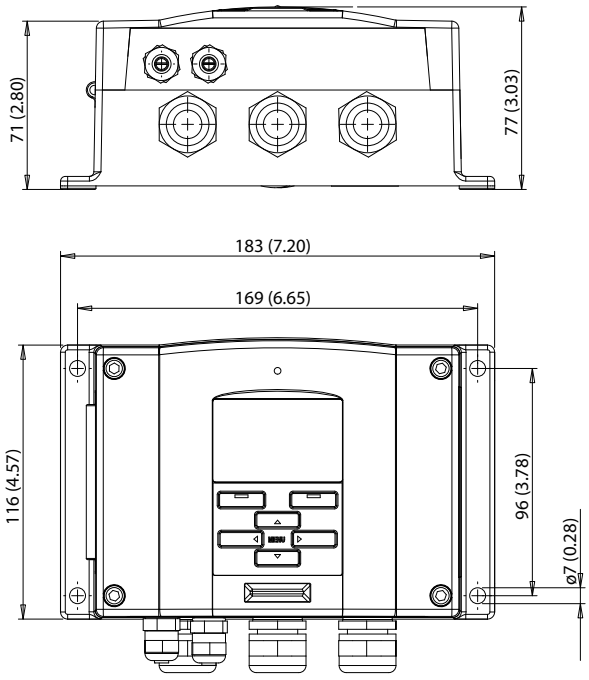
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Technical Data

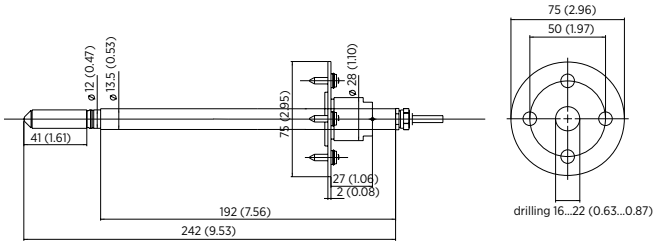
Dimensions

Dimensions in mm (inches)

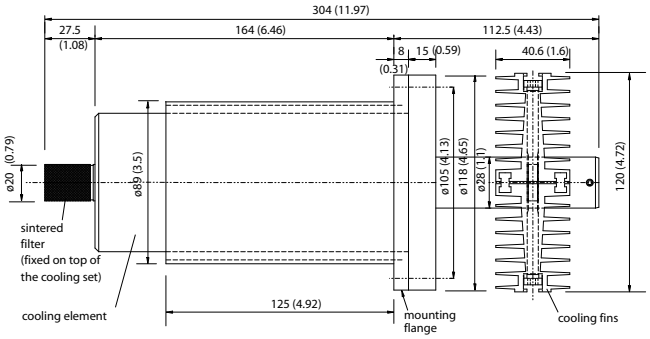
DMT345 and DMT346 transmitter housing



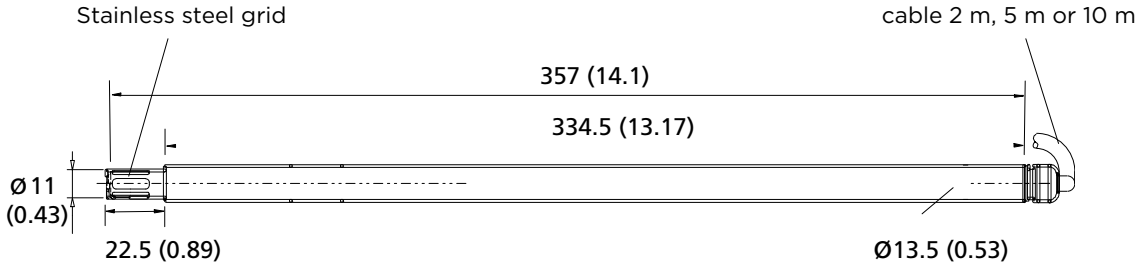
DMT345 probe and mounting flange



DMT346 cooling set



DMT346 probe



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DMT152 Dewpoint Transmitter for Low Dew Point Measurement in OEM Applications



The small and powerful DMT152 measures dew point down to -80 °C.

Features/Benefits

- Compact
- Accurate
- Vaisala DRYCAP® technology with a polymer sensor
- Measures dew point down to -80 °C (-112 °F)
- Reduced maintenance costs due to long calibration interval
- Fast response time
- Withstands condensation
- NIST traceable
- Applications: compressed air, plastics drying, dry chambers, pure gases, and high-voltage circuit breakers

The Vaisala DRYCAP® Dewpoint Transmitter DMT152 is designed for measuring low dew point in OEM applications, even down to -80°C . The excellent long-term stability and reliability of its performance is based on the latest DRYCAP® polymer sensor technology.

Low Maintenance

The DMT152 mechanics have been designed for harsh environments requiring protection against dust, dirt, and splashed water.

The DRYCAP® technology has a low maintenance need due to its excellent long-term stability and durability against condensation.

Applications

The DMT152 is an ideal choice for industrial applications where it is necessary to control very low humidity. Most typical areas of use are air and plastics dryers, dry chambers, pure gases, and highvoltage circuit breakers.

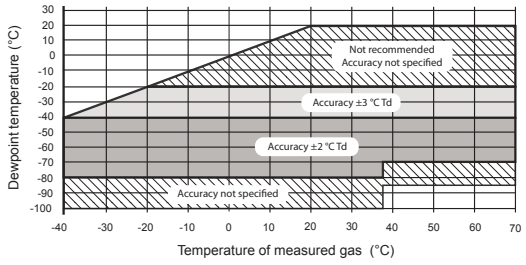
The DMT152 measures accurately and reliably also in the challenging combination of low humidity and hot air, which is typical in plastics drying.

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Technical Data

Measured Variables

DEW POINT TEMPERATURE	
Measurement range	-80 ... -10 °C (-112 ... +14 °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 ... -80 °C, -10 ... +20 °C T_d (-148 ... -112 °F, +14 ... +68 °F T_d)
Analog output scalings	
option 1	-80 ... +20 °C (-112 ... +68 °F) T_d
option 2	-100 ... 0 °C (-148 ... +32 °F) T_d
option 3	user-specified output scaling
when dew point is below 0 °C (32 °F) the transmitter outputs frost point	
Accuracy over temperature range	



Response time 63 % [90 %] at a gas temperature of +20 °C (+68 °F) and pressure of 1 bar	
-10 ... -80 °CTd	0.5 min [7.5 min]
-80 ... -10 °CTd	2 s [5 s]
Typical long-term stability	better than 2 °C (3.6 °F) /year
PPM VOLUME CONCENTRATION	
Measurement range (typical)	0 ... 500 ppm
Accuracy at +20 °C (+68 °F), 1013 mbar	±(0.2 ppm + 20 % of reading)

Operating Environment

Temperature	-40 ... +70 °C (-40 ... +158 °F)
Relative humidity	0 ... 100 %RH (up to + 20 °C/68 °F)
Pressure	0 ... 50 bar (725 psia)
Measured gases	non-corrosive gases
Sample flow rate	no effect on measurement accuracy

Outputs

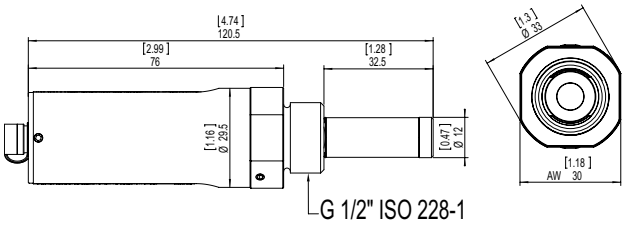
Two analog outputs (scalable)	4 ... 20 mA, 0 ... 20 mA (3 wire) 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs	± 0.01 V / ±0.01 mA
Digital output	RS485 (2-wire)
Alarm-level indication by analog signal	user selectable
Purge information	5 V, 10 V, 20 mA or LED

General

Sensor	Vaisala DRYCAP® 180U Thin-film capacitive polymer sensor
Recommended calibration interval	2 years
Operating voltage with	
RS485 output	11* ... 28 VDC
voltage output	15* ... 28 VDC
current output	21 ... 28 VDC
*For extended temp. down to -40 °C (-40 °F) or pressure up to 50 bar (725 psia), the supply voltage is 21 ... 28 VDC.	
Supply current	
normal measurement	20 mA + load current
during self-diagnostics	max. 220 mA pulsed
Supply voltage fluctuation	max. 0.3 V
External load for	
voltage output	min. 10 kOhm
current output	max. 500 Ohm
Housing material (wetted parts)	AISI316L
Stainless steel mesh filter	Filter body AISI303, mesh AISI316L, grade 18 µm
Mechanical connections	ISO G½", NPT ½", UNF 3/4"- 16"
Housing classification	IP66
Storage temperature range	-40 ... +80 °C (-40 ... +176 °F)
Weight (ISO G½")	190 g (6.70 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirements; Industrial environment	

Accessories

Connection cable for MI70 hand-held indicator	219980
USB cable for pc connection	219690
Sampling cells (available for ISO G½")	
basic sampling cell	DMT242SC
with Swagelok 1/4" male connectors	DMT242SC2
with a quick connector and leak screw	DSC74
two-pressure sampling cell	DSC74B
NW40 flange	225220SP



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

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DMT143 Miniature Dewpoint Transmitter for OEM Applications



The Vaisala DRYCAP® Dewpoint Transmitter DMT143 is an ideal choice for small compressed air dryers, plastic dryers and other OEM applications.

Features/Benefits

- Miniature size dew point transmitter for e.g. small industrial dryer applications
- Vaisala DRYCAP® technology with auto-calibration
- Calibration interval of two years
- Dew point measurement range -70...+60 °C (-94...+140 °F)
- Accuracy ±2 °C (±3.6 °F)
- Withstands condensation
- Fast response time
- Compatible with Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70
- NIST traceable calibration (certificate included)
- Easy servicing and data transfer via the RS485 user interface
- LED alarm for exceeded dew point level

Vaisala DRYCAP®

The Vaisala DRYCAP® Dewpoint Transmitter DMT143 is a miniature dew point measurement instrument. The transmitter can be installed directly into pressurized systems at 50 bar (725 psia) maximum pressure. The long-term high performance is achieved with Vaisala DRYCAP® technology.

The sensor fully withstands getting wet, and therefore, the transmitter performs exceptionally well in applications that occasionally experience process water spikes, such as pipeline condensation during a system failure or start-up. The sensor is also highly resistant to particulate contamination, oil vapor and most chemicals, and is insensitive to the flow rate.

Long Calibration Interval

The calibration interval of the DMT143 is two years. Additionally, the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 can be used to confirm the performance of the DMT143 without disconnecting the transmitter. For any adjustment needs, the transmitter can be sent to Vaisala Service.

The auto-calibration software works on-line while the process is running. If the measurement accuracy is not confirmed, corrections are made automatically.

Easy Installation

The DMT143 has a variety of features to choose from, including different output, installation options and alarm LED.

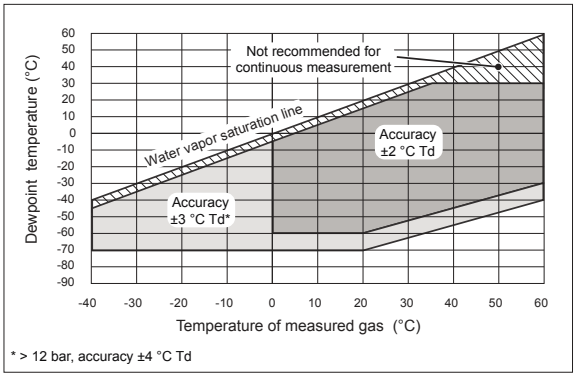
Due to its small size and light weight, the DMT143 is quickly and easily installed in tight spaces or in small-size pipelines. The alarm LED indicates too high dew point in the process. The trigger point is preset at the factory. It can be later adjusted with the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 or a PC.

Technical Data

Measured Parameters

DEW POINT TEMPERATURE	
Measurement range(typical)	-70 ...+60 °C (-94 ...+140 °F) T_d
Analog output scalings	
option 1	-80 ...+20 °C (-112 ...+68 °F) T_d
option 2	-80 ...+20 °C (-112 ...+68 °F) T_d dew point at ambient pressure
option 3	free scaling
Accuracy in air or N2	±2 °C (±3.6 °F) T_d (see graph below)
when the dew point is below 0 °C (32 °F), the transmitter outputs frostpoint	

Technical Data



Dew point accuracy vs. measurement conditions

Response time 63% [90%] at +20 °C gas temperature and 1 bar pressure	
-60 -> -20 °C T_d (-76 -> -4 °F T_d)	5 s [15 s]
-20 -> -60 °C T_d (-4 -> -76 °F T_d)	45 s [10 min]
PPM VOLUME CONCENTRATION	
Measurement range (typical)	10 ... 40000 ppm
Accuracy at +20 °C (+68 °F), 1 bar	1 ppm + 20% of reading

Operating Environment

Measured gases	non-corrosive gases
Temperature *)	-40 ... +60 °C (-40 ... +140 °F)
Relative humidity	0 ... 100 %RH
Pressure *)	0 ... 50 bar_a (725 psia)
Sample flow rate	no effect for measurement accuracy

*) For extended temperature below 0 °C (+32 °F) or pressure above 20 bar_a (290 psia) the supply voltage must be 24 ... 28 VDC.

Outputs

Analog output (scalable)	4 ... 20 mA (3-wire), 0 ... 1 V/5 V, 1 ... 5 V
Resolution for current output	0.002 mA
Resolution for voltage output	0.3 mV
Typical temperature dependence	0.005 % of span / °C
Digital output	RS-485, non-isolated Vaisala Industrial Protocol
Connector	4-pin M8 (IEC 60947-5-2)

General

Sensor	Vaisala DRYCAP® 180D
Recommended calibration interval to confirm the specified accuracy	2 years
Operating voltage with voltage output	12 ... 28 VDC
Operating voltage with current output	18 ... 28 VDC
Supply current	
normal measurement	max 10mA + load current
during self-diagnostics	max. 220 mA pulsed
Load for current output	max. 500 Ohm
Load for voltage output	min. 10 kOhm
Housing material	stainless steel (AISI316L)
Sensor protection	stainless steel sintered filter
Mechanical connection	ISO G1/2" or NPT 1/2
Housing classification	IP66 (NEMA 4)
Storage temperature range	-40 ... +60 °C (-40...+140 °F)
Weight	G-thread version 90g (3.2oz) NPT-thread version 100g (3.5oz)

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

Accessories

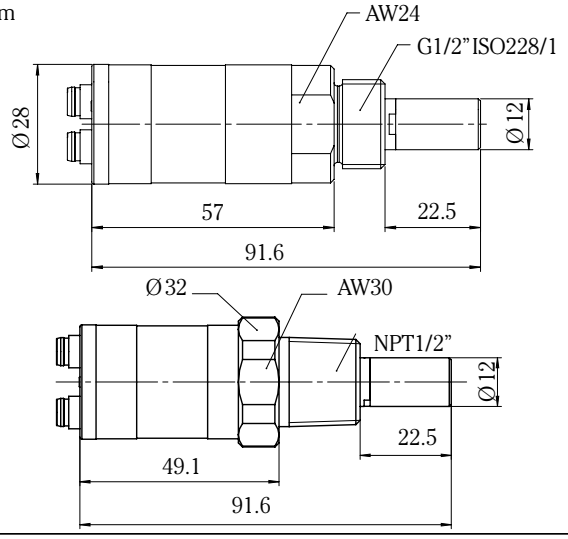
Connection cable for DM70	219980SP
USB connection cable	219690
Sampling cells	
basic sampling cell	DMT242SC
with Swagelok 1/4" male connectors	DMT242SC2
with quick connector and leak screw	DSC74SP
two-pressure sampling cell	DSC74BSP
cooling/venting coil	DMCOILSP

See DM70 / Portable Sampling Systems and Sampling Cells for further information about sampling cells available

Loop powered external display	226476
Loop powered external display with relays	234759

Dimensions

in mm



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DMT143L Dewpoint Transmitter for OEM Applications (DMT242 replacement)



Due to its wide measurement range and high long-term stability, the DMT143L is an ideal choice for low dew point industrial applications such as compressed air dryers, plastic dryers and other OEM applications.

Features/Benefits

- Ideal choice for industrial dryer applications
- Incorporates advanced Vaisala DRYCAP® Sensor and enhanced auto-calibration software
- Long-term stability in low dew points
- Fast response time
- Two sensor options cover dew point measurement range from -60 ... +60 °C (-76 ... +140 °F) with an accuracy of ±2 °C (±3.6 °F)
- Withstands condensation
- Traceable calibration (certificate included)
- Compatible with Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70

Vaisala DRYCAP®

The Vaisala DRYCAP® Dewpoint Transmitter DMT143L provides reliable and stable measurements for industrial dryer applications. It is designed for extreme conditions.

DMT143L incorporates the Vaisala DRYCAP® thin film polymer sensor and auto-calibration software. The standard sensor choice for dry gases and desiccant dryers is DRYCAP® 180M and for more humid applications such as refrigeration dryers, a DRYCAP® 180S sensor.

Both the sensors are immune to particulate contamination, water condensation, oil vapor and most chemicals. Because the sensor withstands condensation, its performance is suitable for low dew point applications that experience process water spikes, such as pipeline condensation during a system failure or start-up.

The auto-calibration software works on-line while the process is running. If the measurement accuracy is not confirmed, corrections are made automatically. The DMT143L adjusts the measurement, corrects dry-end drifts and continues to function. Calibration occurs quickly, and with corrections so minor, it will go unnoticed.

Compact, Rugged and Intelligent

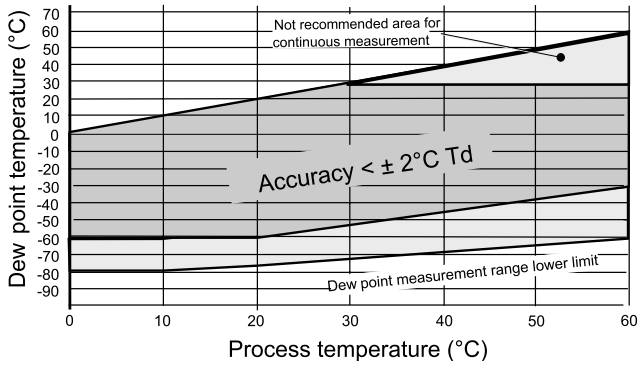
Due to its compact size, DMT143L is quickly and easily installed in tight spaces.

Users can perform a field-check by using the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70. The transmitter can be sent to Vaisala Service for traceable calibration. The recommended calibration interval is every two years.

Technical Data

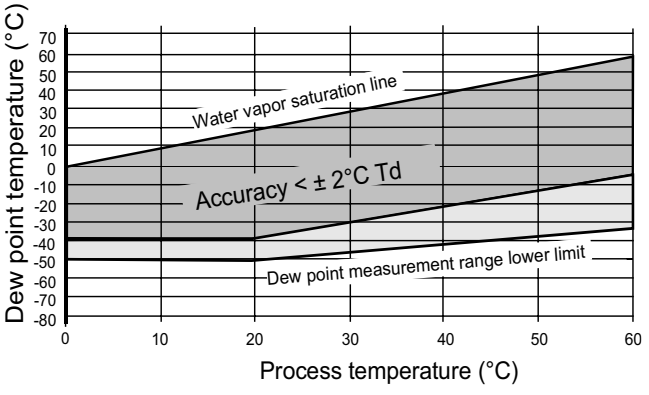
Dew Point Temperature

Measurement range (typical)	-60 ... +60 °C (-76 ... +140 °F)
Different analog output scalings available (when the dew point is below 0 °C (32 °F), the transmitter outputs frost point)	
Accuracy with DRYCAP® 180M	±2 °C (±3.6 °F) (see graph below)



DEW POINT ACCURACY VS. MEASUREMENT CONDITIONS

Response time 63 % [90 %] at +20 °C gas temperature	
Flow rate >1 l/min and 1 bar pressure	
-60 -> -20 °C Td (-76 -> -4 °F Td)	5 s [10 s]
-20 -> -60 °C Td (-4 -> -76 °F Td)	45 s [10 min]
Accuracy with DRYCAP® 180S	±2 °C (±3.6 °F) (see graph below)



Operating Environment

Temperature	0 ... +60 °C (32 ... +140 °F)
higher temperature peaks	Short-term OK
Relative humidity	0 ... 100 %RH
Pressure	0 ... 20 bara (0 ... 290 psia)
Sample flow rate	no effect

Output

Analog output	4 ...20 mA
Resolution for analog output	±0.002 mA
Typical temperature dependence	0.0008 mA/ °C
Serial line for service use	RS485

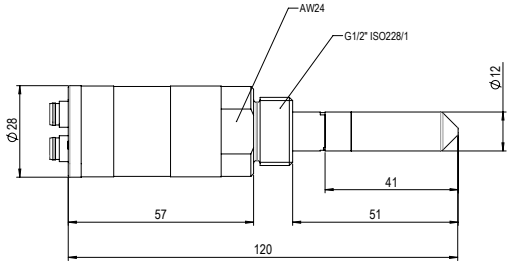
General

Sensor	DRYCAP® 180M
Optimal sensor for refrigeration dryers	DRYCAP® 180S
Operating voltage	18 - 28 VDC
Power consumption at 24 VDC	max. 220 mA
External load for analog output	max. 500 Ω
Probe material (wetted parts)	stainless steel (AISI 316L)
Sensor protection	stainless steel sintered filter (HM47280)
Mechanical connection	G½" ISO228-1 thread with bonded seal ring (U-seal)
Electronics housing material	stainless steel
Housing classification	IP66
Storage temperature range	-40 ... +60 °C, (-40 ... +140 °F)

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

Dimensions

Dimensions in mm (inches)



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DMT132 Dewpoint Transmitter for Refrigerant Dryers



The optional LED warning light tells the user when the defined dew point limit has been exceeded.

Features / Benefits

- Affordable dew point transmitter for refrigerant dryers
- High accuracy ±1°C (±1.8°F) in the measurement range of refrigerant dryers
- Excellent long-term stability - resistant to compressor oil and most other chemicals thanks to HUMICAP® technology
- Low power requirements, 10 ... 28 VDC
- Easy to verify functionality with compatible hand-held meters DM70 or HM70
- Optional LED warning light

The Vaisala HUMICAP® Dewpoint Transmitter DMT132 is an affordable dew point measurement instrument designed to verify the functionality of refrigerant dryers. It is especially well suited for OEM dryer manufacturers.

Direct Measurement Cuts Costs

Direct outlet air dew point measurement provides accurate information about dryer functionality and is more reliable than the traditional method of measuring refrigerator temperature only. Knowledge of the real dew point ensures high quality compressed air at all times and enables customers to optimize dryer capacity. This helps to prevent investment in redundant dryer capacity and avoid unnecessary maintenance and costly malfunctions.

High Accuracy and Long-Term Stability

The DMT132 provides optimal performance in the operating range of refrigerant dryers. In the measurement range of -3 … 20 °C (+26.6 … +68 °F), where the refrigerator dryers typically operate, the Td 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 the DMT132 directly into a dryer or compressed air line through a G1/2" ISO thread. Vaisala sampling cells can also be used. The loop-powered electronics mean that wiring is easy and power requirements are low. The DMT132 operating voltages can be as low as 10 VDC.

Verifying the performance of the DMT132 is easy with the compatible Vaisala hand-held DM70 or HM70 meters. The user can perform possible adjustments with the Vaisala HMK15 Humidity Calibrator.



Demand for dew point sensors to verify refrigerant dryers is increasing. Direct dew point measurement enables energy savings and improved efficiency.

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Technical Data

Performance

DEW POINT

Measurement range	-20 ... +50 °C (-4 ... +122 °F) Td
Accuracy (at +20 °C (+68 °F)	±1 °C for -3...20 °C (+26.6 ... +68 °F) Td
	±2 °C for -15...-3 °C (+5 ... +26.6 °F) Td
	see accuracy graph below

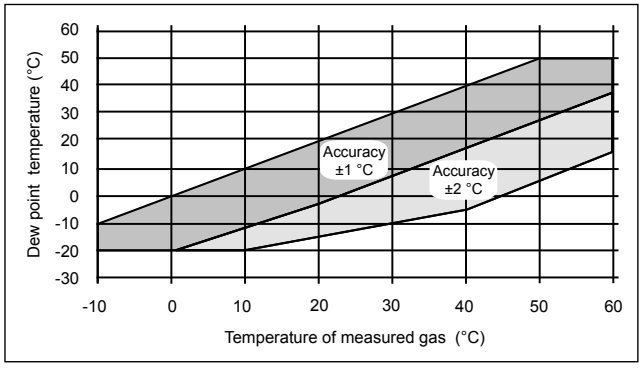
* when dew point is below 0 °C (+32 °F), the transmitter outputs frostpoint

Response time at 20 °C (+68 °F) gas temperature and 1 bar pressure

-14 -> +3 °C (+7 -> +37 °F) Td	17 s (63%)
	40 s (90%)
+3 -> -14 °C (+37 -> +7 °F) Td	33 s (63%)
	85 s (90%)

CALCULATED VARIABLES

Dew point converted to atmospheric pressure	Tdf atm



Operating Environment

Operating temperature	-10 ... + 60 °C (+14 ... +140 °F)
Operating pressure	0 ... 20 bar
Relative humidity	0 ... 100 %RH
Sample flow rate	no effect on measurement accuracy
Measured gases	non-corrosive gases

Outputs

Analog output (scalable)	4...20 mA, 2-wire
Resolution for current output	0.002 mA
Accuracy of analog outputs at +20 °C	±0.05% full scale
Typical temperature dependence	±0.005% of full scale/ °C
Connector	4-pin M8 (IEC 60947-5-2)
LED indication available for defined dew point limit/ error state indication	
RS485 serial line for service use	

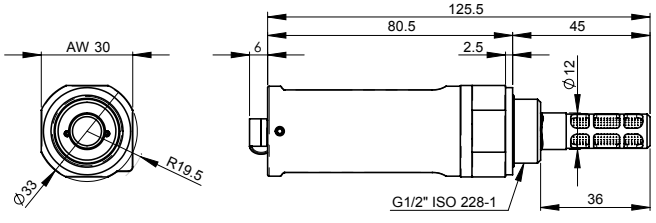
General

Sensor	Vaisala HUMICAP®180R
Recommended calibration interval (in refrigerant dryer application)	2 years
Mechanical connection	G 1/2" ISO
Operating voltage	10 .... 28 VDC
External load	max 100 ohm for supply voltages <20 VDC max 500 ohm for supply voltages 20...28 VDC
Weight	65 g (2.3 oz)
Housing material	PPS + 40% GF
Housing classification	IP65 (NEMA 4)
Storage temperature range	-40 ... + 80 °C (-40 ... +176 °F)
Start-up time	3 s

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

Options and Accessories

Tube filter	230602
Special cover set for HMK15 (calibrator fitting DMT132 and HMP60)	230914
NPT Adapter	210662SP
Sample cells	DMT242SC, DMT242SC2, DSC74, DSC74B, DSC74C, DMCOIL
Duct installation flange	DM240FA
Cables (several lengths available)	HMP50Z032, HMP50Z300SP, HMP50Z500SP, HMP50Z1000SP
Loop powered external display	226476
USB Service cable	219690
Connection cable to DM70/HM70	219980
LED plug	230388
ISO" 1/2 plug	218773
NPT1/2" plug	222507
Sealing ring set (3 pcs U-seal)	221525SP



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DM70 Handheld Dewpoint Meter for Spot-Checking Applications



The Vaisala DRYCAP® Handheld Dewpoint Meter DM70 offers accurate and fast measurement for industrial dew point applications, such as compressed air, metal treatment and plastics drying.

Features/Benefits

- Designed for industrial spot-checking and field calibration
- Three models: accurate measurement ranges from -60 to +60 °C (-76 ... +140 °F)
- Vaisala DRYCAP® Sensor with unique autocalibration function
- Low maintenance need due to superior long-term stability
- Sensor withstands condensation
- Fast response, enhanced by Sensor Purge option
- Intuitive user interface
- Data can be logged and transferred to a PC via MI70 Link software
- Compact, small and light
- NIST traceable calibration (certificate included)

The Vaisala DRYCAP® Handheld Dewpoint Meter DM70 measures dew point temperature accurately over a wide measurement range. The probe may be inserted directly into pressurized processes, and it responds rapidly from ambient to process conditions. The sensor withstands condensation and fully recovers from getting wet. The DM70 meter is suitable for direct process dew point measurement in a wide temperature and pressure range. For more demanding applications, the DM70 can be used with the Vaisala sampling cell adapters, or with the Vaisala DRYCAP® Sampling System DSS70A.

Vaisala DRYCAP® Technology

The DM70 is fitted with the Vaisala DRYCAP® Sensor. The sensor provides reliable, stable and high-performance dew point measurement. Autocalibration detects on-line possible measurement inaccuracies and automatically corrects dry-end drift in the calibration curve.

Three Probes to Choose From

Three probe models, all with auto-calibration, are available. The A and B models are both general purpose probes. The C model is specifically developed for SF_6 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

The DM70 has a versatile and easy-to-use, menu-based user interface, a clear graphical LCD display, and data-logging capability. It can also be used as a tool for reading the output of fixed Vaisala dew point transmitters, like the DMT242, DMT132, DMT143, DMT152 and DMT340.

The DM70 displays one to three parameters at a time, either numerically or graphically. Several humidity units can be selected. In addition, the DM70 includes conversion from gas pressure dew point to ambient pressure dew point. An analog output is also available.

MI70 Link

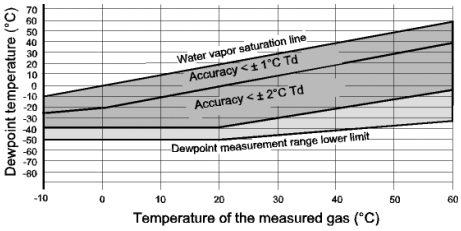
The optional MI70 Link Windows® software and the USB connection cable form a practical tool for transferring logged data and real time measurement data from the DM70 to a PC.

Technical Data

Measured Variables, DMP74A Probe

DEW POINT

Measurement range (typical)	-50 ... +60 °C (-58 ... +140 °F)
Accuracy (A probe) -40...+60 °C	±2 °C (±3.6 °F) (see graph)



Dew point accuracy vs. measurement conditions

Response time

flow rate 0.2 m/s, 1 bar pressure, +20 °C (+68 °F)	63% [90%]
0 -> -40 °C T_d (32 -> -40 °F T_d)	20 s [120 s]
-40 -> 0 °C T_d (-40 -> 32 °F T_d)	10 s [20 s]
Dew point sensor	Vaisala DRYCAP® 180S

TEMPERATURE

Measurement range	-10 ... +60 °C (+14 ... +140 °F)
Accuracy at +20 °C (+68 °F)	±0.2 °C (±0.36 °F)
Typical temperature dependence of electronics	±0.005 °C/°C (±0.005 °F/°F)
Temperature sensor	Pt100 RTD Class F0.1 IEC 60751

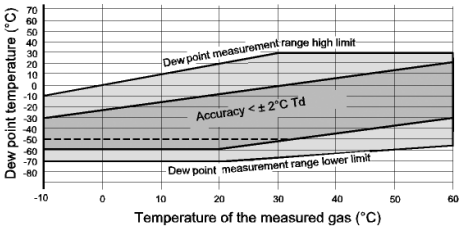
OTHER VARIABLES AVAILABLE

Dew point converted to atmospheric pressure, ppm volume and ppm weight concentration, absolute humidity, mixing ratio, relative humidity

Measured Variables, DMP74B and DMP74C (for SF6 gas) Probes

DEW POINT

Measurement range (typical)	-70 ... +30 °C (-94 ... +86 °F)
Accuracy (B and C probe) -60...+20 °C	±2 °C (±3.6 °F) (see graph)



Dew point accuracy vs. measurement conditions

Dotted line:
For DMP74C the ±2 °C accuracy range is limited to -50 °C T_d when used in SF6 gas.

Response time

flow rate 0.2 m/s, 1 bar pressure, +20 °C (+68 °F)	63% [90%]
0 -> -60 °C T_d (32 -> -76 °F T_d)	50 s [340 s]
-60 -> 0 °C T_d (-76 -> 32 °F T_d)	10 s [20 s]
Dew point sensor	Vaisala DRYCAP® 180M

TEMPERATURE

Measurement range	-10 ... +60 °C (+14 ... +140 °F)
Accuracy at +20 °C (+68 °F)	±0.2 °C (±0.36 °F)
Typical temperature dependence of electronics	±0.005 °C/°C (±0.005 °F/°F)
Temperature sensor	Pt100 RTD Class F0.1 IEC 60751

OTHER VARIABLES AVAILABLE

Dew point converted to atmospheric pressure, ppm volume and ppm weight concentration

All Probe Models

Operating temperature	-10 ... +60 °C (+14 ... +140 °F)
Operating pressure	
DMP74A, DMP74B	0 ... 20 bara (0 ... 290 psia)
DMP74C	0 ... 10 bara (0 ... 150 psia)
Sample flow rate	no effect for measurement accuracy
Measured gases	non-corrosive gases
Probe material (wetted parts)	Stainless steel (AISI 316L)
Sensor protection	Sintered filter (AISI 316L) partno: HM47280
Mechanical connection	G1/2" ISO228-1 thread with bonded seal ring (U-seal)
Housing classification	IP65 (NEMA 4)
Weight	350 g

MI70 Measurement Indicator General

Menu languages	English, Chinese, Spanish, Russian, French, Japanese, German, Swedish, Finnish,
Display	LCD with backlight Graphic trend display of any parameter Character height up to 16 mm
Max. no of probes	2
Power supply	Rechargeable NiMH battery pack with AC-adapter or 4xAA size alkalines, type IEC LR6
Analog output	0...1 VDC
Output resolution	0.6 mV
PC interface	MI70 Link software with USB or serial port cable
Data logging capacity	2700 points
Alarm	Audible alarm function
Operating temperature range	-10...+40 °C (+14…+104 °F)
Storage temperature range	-40 ... +70 °C (-40 ... +158 °F)
Operating humidity range	0 ... 100 % RH, non-condensing
Housing classification	IP54
Housing materials	ABS/PC blend
Weight	400 g
Battery operation time with DMP74 probe	
continuous use	48 h typical at +20 °C (+68 °F)
data logging use	up to a month, depending on logging interval
Electromagnetic compatibility	EN 61326-1, Generic Environment

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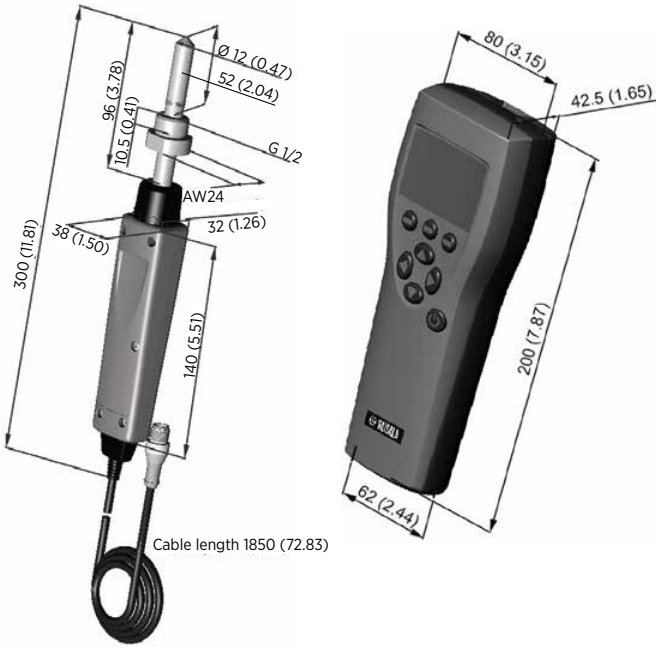
Technical Data

Accessories

Connection cables for fixed Vaisala dew point transmitters	
for DMT242 transmitter	27160ZZ
for DMT340 series	211339
for DMT152, DMT143, and DMT132 transmitters	219980
for DMT142 transmitter	211917ZZ
Weatherproof Carrying Case	MI70CASE3
Soft Carrying Case	MI70SOFTCASE
MI70 Link software with USB cable	219687
MI70 Link software with serial port cable	MI70LINK
Analog output cable	27168ZZ
10 m (32.81 ft) extension cable for probe	213107SP
Portable Sampling System (see separate data sheet)	DSS70A

Dimensions

Dimensions in mm (inches)



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Dew Point Measurement as It Should Be. Longest Calibration Interval – Widest Range.

Fifteen years of leading performance through continuous innovation.

High quality dew point measurement is essential to process efficiency, safety and profitability. In fact, the quality of measurement equals the quality of your process.

Vaisala DRYCAP® sensors provide the highest accuracy over the widest dew point range on the market, plus the fastest response time and extremely rapid recovery from condensation. Its unique auto-calibration function ensures superior stability, giving you the dual benefit of low maintenance and peace of mind.

Choose from a wide range of fixed and handheld instruments for hundreds of applications and dozens of industries, worldwide.

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DSS70A Portable Sampling System and Sampling Cells for DM70



The DSS70A provides a compact solution for field checking dew point where direct measurement is difficult. Typical applications for the sampling system are metal treatment and plastics drying processes. (The DSS70 includes the sampling system and case, but not the MI70.)

DSS70A Portable Sampling System

The DSS70A is designed to provide dew point sampling flexibility for the DM70 hand-held dew point meter. For processes at atmospheric pressure, a battery powered pump is used to extract a gas sample. For pressurized processes up to 20 bar, the sample is measured at process pressure and then reduced to atmospheric pressure for venting or re-direction, bypassing the pump. In all cases, the sample gas passes through a filter to remove particulate contamination before measurement. Flow through the system is controlled and monitored with a needle valve and flow meter.

The DSS70A is easily connected to an appropriate sample point with tubing (typically 1/4" or 6 mm). The measured dew point must be below ambient temperature to avoid condensation in the system. Gas temperatures higher than +40 °C (+104 °F) should be cooled with a short PTFE (included in the DSS70A system) or stainless steel tube prior to entering the DSS70A. DSS70A is an accessory for DM70 Dewpoint Hand-held Meter.

Sampling Cells for Pressurized Processes

The DM70 can easily be connected to pressurized processes. In addition to direct pipeline installation, a variety of sampling cell options are available for gas sampling.

The DSC74 sampling cell is the recommended choice. It has a variety of connection adapters that allow several different ways of installation. The quick connector with a leak screw allows a very fast connection for compressed air lines. Additionally, two thread adapters are available for the inlet port.

The DSC74B is a two-pressure sampling cell, which enables measurements in both process and ambient pressure. This sampling cell is especially suitable for dew point measurements in SF_6 gas with the DMP74C probe.

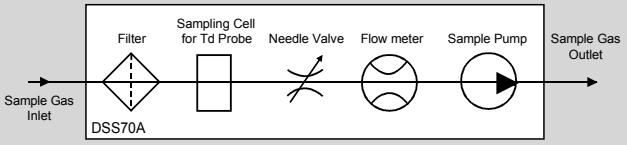
The DMT242SC is a basic sampling cell. The DMT242SC2 is a sampling cell supplied with welded Swagelok connectors for sampling in a 1/4" pipeline.



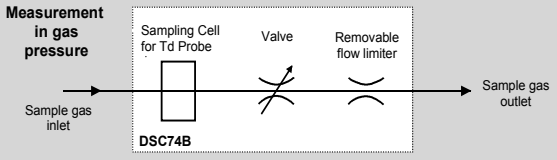
The sampling cells (from the left) DMT242SC2, DMT242SC and DSC74 can be used to connect the DM70 to sample gas flow. The DSC74B (right) is a two-pressure sampling cell that can be used for measurements in either pressurized or ambient pressure. The cooling/venting coil is included in the DSC74C sample cell, but is an option for all sampling cells.

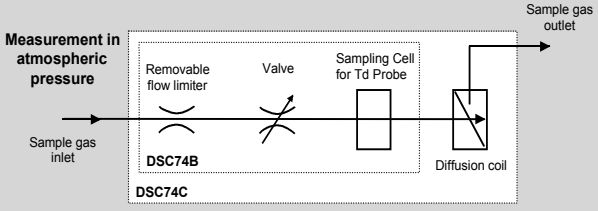
Technical Data

DSS70A Sampling System and DSC74B/C Sampling Cells



The DSS70A sampling system includes a filter to clean the dirty sample gas and a needle valve to control the sample flow rate with the flow meter. A sample pump is used to generate a sample flow from processes at ambient pressure.





The DSC74B sampling cell enables the measurement of the sampled gas either in gas pressure up to 10 bar or in atmospheric pressure depending on the gas inlet and outlet. The DSC74C is like the DSC74B but with an additional coil to avoid back diffusion, the effect of surrounding moisture, in dew point measurements in atmospheric pressure.

Sampling Cells Technical Data

DSC74	sampling cell for pressurized gases
pressure limit	1 MPa (10 barg, 145 psig)
DSC74B	two pressure sampling cell
pressure limit	1 MPa (10 barg, 145 psig)
DSC74C	DSC74B with DMCOIL cooling/venting coil
DMCOIL	cooling/venting coil
DMT242SC	sampling cell
pressure limit	10 MPa (100 barg, 1450 psig)
DMT242SC2	sampling cell with Swagelok connectors
pressure limit	4 MPa (40 barg, 580 psig)
Material for all sampling cells	stainless steel AISI316

DSS70A Sampling System Operating Conditions

Operating gases	air, N2 and other non-toxic, inert gases
Sampled gas dew point	below Tamb
Inlet/outlet connection	1/4" Swagelok
Operating temperature	
ambient temperature	0 ... +40 °C (32 ... +104 °F)
process gas temperature	
with PTFE tube at +20 °C (+68 °F) (included in the DSS70A)	max. +200 °C (+392 °F)
with stainless steel tube	specification according to stainless steel tube specification
maximum gas temperature at inlet	+40 °C (+104 °F)
Operating pressure	
with pump	0.6 ... 1.2 bara (8.7 ... 17.4 psia)
pump disconnected	0 ... 20 bara (0 ... 290 psia)

General

Battery operation time for pump	8 h continuous use
	battery can be recharged using DM70 charger
Filter	7 mm inline filter cartridge 1/4" Swagelok SS-4F-7 (spare part order no. 210801)
Materials	
wetted parts	Stainless steel
carrying case	ABS plastic
Case size (W x D x H)	430 x 330 x 100 mm
Weight	5.5 kg (12 lbs)

Electromagnetic Compatibility

EN61326-1, Generic Environment.

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DPT146 Dewpoint and Pressure Transmitter for Compressed Air



The DPT146 measures both dew point and process pressure. Monitoring compressed air is simpler and quicker, helping you to make more informed decisions.

Features/Benefits

- The first transmitter that monitors both dew point and process pressure
- A simple and convenient transmitter for monitoring of compressed air
- Highly accurate humidity information thanks to dew point data coupled with live pressure input
- Proven sensor technology
- Compatible with the Vaisala Hand-Held DM70 for easy spot checking, local display and data logging
- Pressure: 1 ... 12 bar
- Dew point: -70 ... +30 °C (-94 ... +86 °F)
- Digital output RS-485 with MODBUS

The Vaisala Dewpoint and Pressure Transmitter DPT146 for Compressed Air makes monitoring compressed air simple and convenient. The DPT146 measures both dew point and process pressure simultaneously, and is the ideal choice for anyone using or monitoring compressed air.

Simple and Efficient Installation

One transmitter providing two of the most important compressed air measurements means reduced installation costs and a much easier setup – with only one instrument needing connection and wiring.

Make More Informed Decisions

Dew point measurement combined with process pressure measurement offers further unique advantages. When dew point data is coupled with live pressure input, conversions to atmospheric pressure or ppm are available online, leaving no ambiguity in the information. As an example, regulative requirements of medical gas can be fulfilled easily and quickly.

A Unique Combination of Two World-Class Sensors

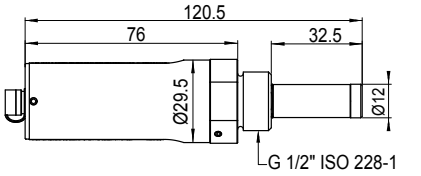
The DPT146 combines the knowledge of more than 20 years of sensor-technology development. Proven measurements from the DRYCAP® sensor for dew point and the BAROCAP® sensor for pressure are now combined into one easy-to-use transmitter.

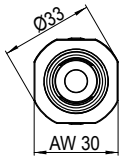
Convenience with Proven Performance

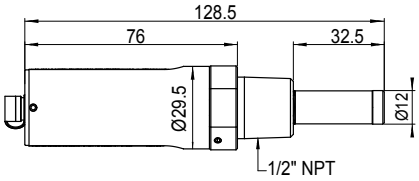
Well-developed technology brings both proven results and convenience. Spot-checking and verification of dew point is easy thanks to fully compatible Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70. The DM70 can also be used as a local display and data logger. Temperature measurement is available when the RS485 is in use.

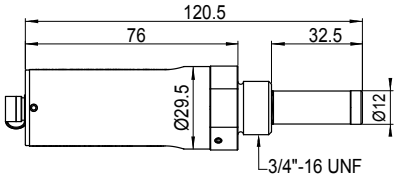
Dimensions

Dimensions in mm (inches)









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Technical Data

Measured Parameters

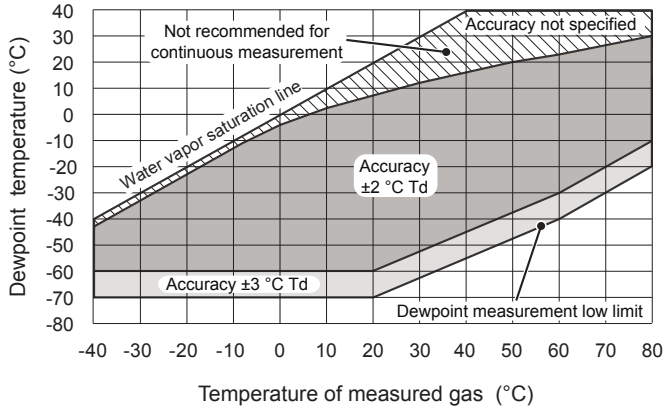
Dew point	-70 ... +30 °C (-94 ... +86 °F)
Pressure, absolute	1 ... 12 bar (14.5 ... 174 psi)
Temperature (available if output RS-485 only selected)	-40 ... +80 °C (-40 ... +176 °F)

Calculated Parameters

ppm moisture, by volume	1 ... 40 000 ppm
Dew point, converted to atmospheric pressure	-75 … +30 °C (-103 ... +86 °F)

Performance

Dew point accuracy	±2 °C (±3.6 °F)
Pressure accuracy at 23 °C (73.4 °F)	±0.4 %FS
Pressure temperature dependence	±0.01 bar / 10 °C (18 °F)
Temperature accuracy	
0 ... 40 °C (+32 ... +104 °F)	±0.5 °C (± 0.9 °F)
-40...80 °C (-40 ... +176 °F)	±1 °C (± 1.8 °F)
PPM accuracy (7 bar)	±(14 ppm + 12% of reading)
Sensor response time:	
Pressure response time	< 1 s
Dew point response time 63% [90%] at 20°C and 1 bar	
-50 -> -10 °C Tdf	5 s [10 s]
-10 -> -50 °C Tdf	10 s [2.5 min]



DPT146 Dewpoint Measurement Accuracy

Operating Environment

Operating temperature of electronics	-40 … +60 °C (-40 ... +140 °F)
Operating Pressure	0 … 50 bar (0…725 psi)
Relative humidity	0...100 %
Measured gases	Air/ non-corrosive gases
Sample flow rate	no effect on measurement accuracy

Outputs

Analog Outputs (2 channels)	
current output	0 … 20 mA, 4 … 20 mA
voltage output	0 … 5V, 0 …10V
Accuracy of analog outputs	± 0.01 V / ± 0.01 mA
Digital output	RS-485, non-isolated, Vaisala protocol,MODBUS RTU protocol
Connector	4-pin M8

General

Sensor	Vaisala MPS1 multiparameter sensor
Operating voltage	21 ... 28 VDC, current output 20 ... 28 VDC, voltage output and/or use in cold temperatures (-40 ... -20 °C (-40 ... -4 °F)) 15 ... 28 VDC, RS485 only
Supply current	
during normal measurement	20 mA + load current
during self-diagnostics	300 mA + load current
External load for	
current output	max. 500 Ohm
voltage output	min. 10 kOhm
Housing material	AISI316L
Housing classification	IP66
Sensor protection	Mesh filter AISI303, grade 18 µm
Storage temperature range	
transmitter only	-40 … +80 °C (-40 ... +176 °F)
shipment package	-20 … +80 °C (-4 ... +176 °F)
Mechanical connection	ISO G1/2", NPT 1/2", UNF 3/4"-16
Recommended calibration interval	2 years
Weight (ISO1/2")	190 g (6.70 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements; Industrial environment	

Accessories

Connection cable for MI70 indicator /DM70 meter	219980
USB connection cable	219690
Sampling cells	DMT242SC, DMT242SC2, DSC74, DSC74B, DSC74C
Flange	DM240FA
Loop-powered external display	226476
ISO 1/2" plug	218773
NPT 1/2" plug	222507

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DPT145 Multiparameter Transmitter for SF6 Gas



The Vaisala Multiparameter Transmitter DPT145 with the DILO DN20 connector.

Features/Benefits

- First transmitter to offer online measurement of seven SF6 parameters in one unit
- Measured parameters: dew point, pressure, temperature
- Calculated parameters: SF6 density, normalized pressure, dew point in atmospheric pressure, ppm
- Saves time and money across the board, from investment and installation to operation and servicing
- More reliable assessment of the condition of SF6 insulation due to online measurement
- Long calibration interval of years
- Digital output RS-485 with MODBUS

The Vaisala Multiparameter Transmitter DPT145 for SF6 Gas is a unique innovation that enables online measurement of dew point, pressure, and temperature. It also calculates four other values, including SF6 density. The DPT145 is especially well suited for integration into OEM systems.

Online Reliability

Online dew point measurement combined with pressure measurement provides an excellent assessment of the condition of the SF6 insulation. Sudden and minor leakages are immediately detected by the direct normalized pressure measurement, while online dew point measurement alerts the user to moisture issues, which can weaken the insulation properties of SF6 and cause rapid deterioration. With the DPT145, it is also easy to build a redundant solution for multiple parameters.

Savings Across the Board

A single transmitter, instead of several, saves time and money across the board, from investment to installation, operation and servicing. Lower assembly costs, fewer cables and connectors, minimized need for on-site visits and field operations - all these translate into cumulative savings. The long calibration interval results in further savings.

Risk-Free, Greener Solution

Online measurement enables gas trends to be followed via a data collection system, making monitoring fast, risk-free, and accurate. Using one instrument for monitoring seven different parameters means also fewer mechanical connections and reduces the risk of leaks. Monitoring is environmentally friendly because there is no need for sampling - no SF6 gas is released into the atmosphere.

The Fruit of Experience

Vaisala has over 70 years of extensive measurement experience and knowledge. The DPT145 brings together the proven DRYCAP® dew point sensor technology and BAROCAP® pressure sensor technology in one package, providing an innovative and convenient solution for monitoring SF6 gas.



The DPT145 with the weather shield.

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Technical Data

Measured Parameters

Dewpoint	-50 ... +30 °C (-58 ... +86 °F)
Pressure, absolute	1 ... 12 bar (14.5 ... 174 psi)
Temperature	-40 ... +80 °C (-40 ... +176 °F)

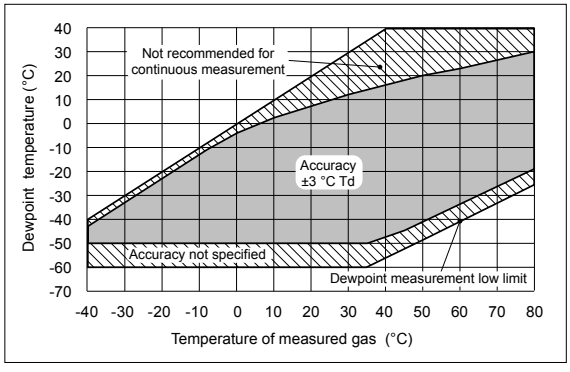
Calculated Parameters

Pressure, normalized to 20 °C (68 °F)	1 ... 12 bar (14.5 … 174 psi)
SF6 or SF6/N2 mixture density	0 ... 100 kg/m^3
ppm moisture, by volume	40 ... 40 000 ppm
Dewpoint, converted to atmospheric pressure	-65 … +30 °C (-85 ... +86 °F)

Performance

Dewpoint accuracy	±3 °C (±5.4 °F), see graph below
Dewpoint stability	typical drift < 2 °C (3.6 °F) /5 years
Pressure accuracy at 23 °C (73.4 °F)	±0.4 %FS
Pressure temperature dependence	±0.01 bar/10 °C (18 °F)
Pressure stability	typical drift < 1 %FS /5 years
Temperature accuracy	
0 ... 40 °C (+32 ... +104 °F)	±0.5 °C (± 0.9 °F)
-40 ... 80 °C (-40 ... +176 °F)	±1 °C (± 1.8 °F)
Density accuracy (pure SF6, 1 ... 12 bara)	
0 ... 40 °C (+32 ... +104 °F)	±1 %FS
-40 ... +60 °C (-40 ... +140 °F)	±2.2 %FS
PPM accuracy, typical (5...1000 ppm, 7 bar)	±(7 ppm + 15% of reading)
Sensor response time:	
Pressure response time	< 1 s
Dewpoint response time* 63% [90%] at 20°C and 1 bar	
-50 -> -10 °C Tdf	5 s [10 s]
-10 -> -50 °C Tdf	10 s [2.5 min]

* system equilibrium related response time is typically longer



DPT145 Dewpoint Measurement Accuracy

Operating Environment

Operating temperature of electronics	-40 … +60 °C (-40 ... +140 °F)
Operating Pressure	0 … 50 bar (0…725 psi)
Relative humidity	0...100 %
Measured gases	SF_6, SF_6/N_2 mixture

Outputs

Digital output	RS-485, non-isolated, Vaisala protocol, MODBUS RTU protocol
Connector	4-pin M8

General

Sensor	Vaisala MPS1 multiparameter sensor
Operating voltage	15 ... 28 VDC
20 ... 28 VDC in cold temperatures (-40 ... -20 °C (-40 ... -4 °F))	
Supply current, during normal measurement	20 mA
during self-diagnostics	max. 300 mA pulsed
Housing material	AISI316L
Housing classification	IP66
Weather shield to be used for continuous outdoor installations	
Storage temperature range	
transmitter only	-40 … +80 °C (-40 ... +176 °F)
shipment package	-20 … +80 °C (-4 ... +176 °F)
Mechanical connection	DILO DN20, DILO DN8, ABB Malmkvist, or Alstom G1/2" compatible connector
Every connection is helium leak tested at the factory.	
Dimensional drawings	See the document B211165EN-B
Weight (with DILO adapter)	765 g (27.0 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements;	
Industrial environment, Tested levels	
EN/IEC 61000-4-2, Electrostatic Discharge	8kV con / 15kV air
EN/IEC 61000-4-3, RF field immunity	10V/m (80MHz-4.2GHz)
EN/IEC 61000-4-4, Electric Fast Transient	±2kV power and signal
EN/IEC 61000-4-5, Surge	±2kV power line to ground / ±1kV signal line to ground and power line to line
EN/IEC 61000-4-6, Conducted RF Immunity	10Vemf power line and digital output
Mechanical vibration	
EN/IEC 60068-2-6, Fc Sinusoidal vibration	± 6 g, 5-500 Hz sweep 60 min/axis, 3-axis

Accessories

Connection cable for the MI70/DM70 hand-held	219980
USB connection cable	219690
Protection plug for connector	218675SP
1.5 m Shielded PUR cable with 90° connector	231519SP
3m Shielded PUR cable with 90° connector	231520SP
5 m Shielded PUR cable with 90° connector	231521SP
10 m Shielded PUR cable with 90° connector	231522SP
3.0m Shielded FEP cable with straight connector	226902SP
Weather shield	ASM210326SP

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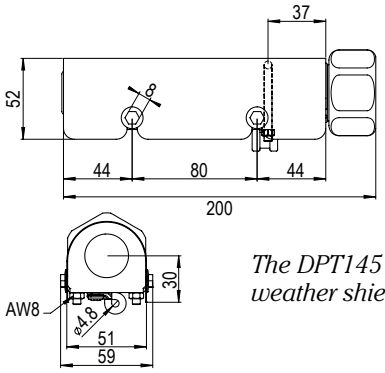
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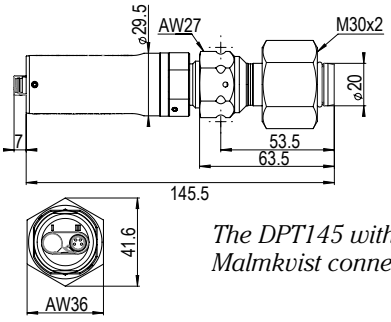
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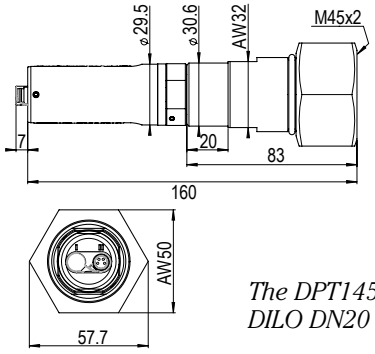
Dimensional Drawings of the DPT145 Multiparameter Transmitter



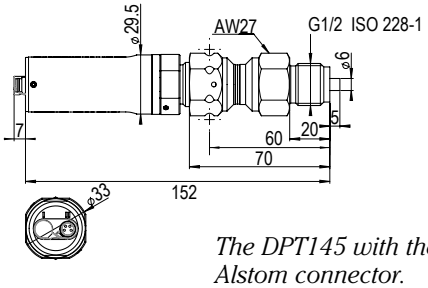
The DPT145 with the weather shield.



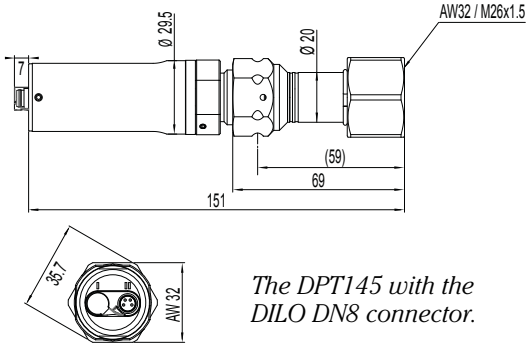
The DPT145 with the ABB Malmkvist connector.



The DPT145 with the DILO DN20 connector.



The DPT145 with the Alstom connector.



The DPT145 with the DILO DN8 connector.

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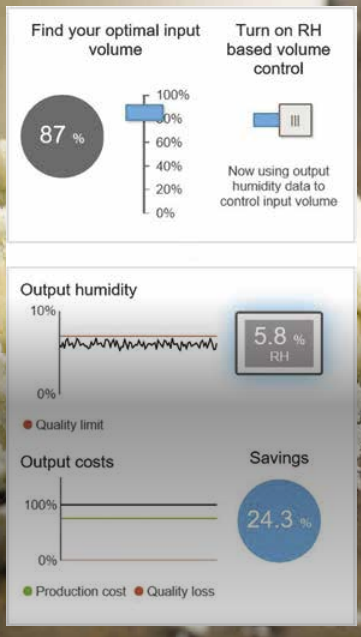
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Vaisala CARBOCAP® Sensor for Measuring Carbon Dioxide






First launched in 1997, the Vaisala CARBOCAP® carbon dioxide (CO_2) sensor features a groundbreaking innovation – the micromachined, electrically tunable Fabry-Perot Interferometer (FPI) filter for built-in reference measurement. This reliable and stable sensor has been delivering accurate CO_2 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

Carbon dioxide has a characteristic absorbance band in the infrared (IR) region at a wavelength of 4.26 µm. This means that when IR radiation is passed through a gas containing CO_2, part of the radiation is absorbed. Therefore, the amount of radiation passing through the gas depends on the amount of CO_2 present, and this can be detected with an IR detector.

The Vaisala CARBOCAP® sensor features an electrically tunable FPI filter. In addition to measuring CO_2 absorption, the micromechanical FPI filter enables a reference measurement at a wavelength where no absorption occurs. When taking the reference measurement, the FPI filter is electrically adjusted to switch the bypass band from the absorption wavelength to a non-absorption wavelength. The reference measurement compensates for any potential changes in the light source intensity, as well as for contamination and dirt accumulation in the optical path. This feature means that CARBOCAP® sensor operation is highly stable over time.

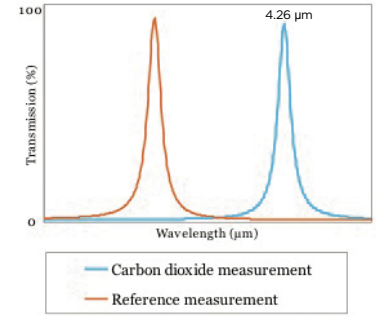
Instruments measuring at both the absorption and the reference wavelength with a single light source are known as single-beam dual-wavelength instruments. The technology is widely applied in costly analyzers. The unique feature of the CARBOCAP® sensor is its micromachined FPI filter, which performs a dual-wavelength measurement using a single detector. The compact size of the sensor means that this advanced technology can be incorporated into small probes, modules, and transmitters.

CARBOCAP® in Brief

- A silicon-based infrared (IR) absorption sensor
- Continuous internal reference measurement
- Both ppm and percentage-level CO_2 measurement
- Providing accurate measurements since the late 1990s

CARBOCAP's Unique Benefits

- Superior stability enabled by built-in reference measurement
- Minimal maintenance and calibration requirements
- Insensitive to dust, water vapor, and most chemicals
- Insensitive to changing air flow



Both absorption and reference are measured with the CARBOCAP® sensor.

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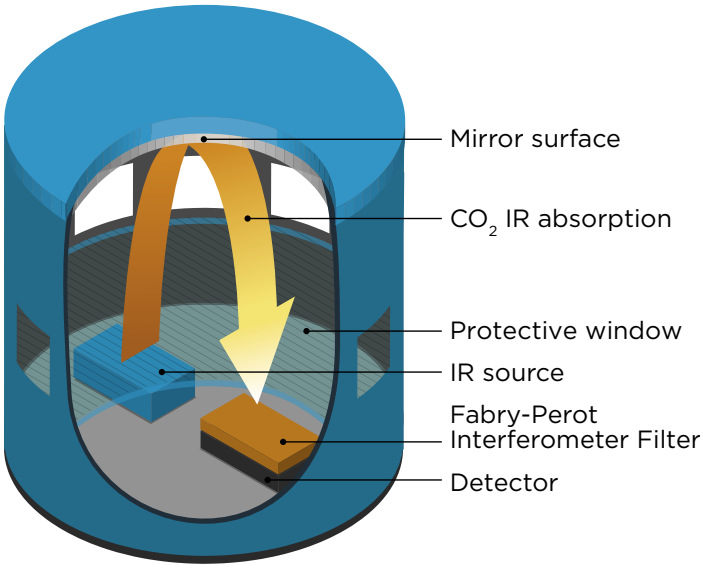
Typical Applications for Carbon Dioxide Measurement

Vaisala CARBOCAP® instruments are well suited to a wide range of applications, from ppm (parts per million) to percentage-level CO_2-measurements. Since CO_2 replaces oxygen, it can be harmful to people in very high concentrations. CO_2 is present at percentage levels only within closed processes such as fermentation and controlled-atmosphere storage environments. Percentage-level measurements are also typical in life-science applications such as CO_2 incubation.

Normal atmospheric air includes CO_2 at ppm levels. Typical CARBOCAP® applications include ventilation control in buildings occupied by people, animal shelters, and greenhouses. In areas where large volumes of CO_2 are handled, reliable CO_2 measurement with alarm control is an important safety precaution. The CARBOCAP® sensor is also a popular choice in ecological measurement applications, where excellent long-term stability and tolerance to harsh conditions are important requirements.

CARBOCAP® CO_2 Products

Vaisala offers instruments for measuring CO_2 at ppm and percentage levels in both indoor and outdoor environments. Vaisala's wide variety of CO_2 instruments ranges from hand-held meters, measurement modules, and industrial transmitters to high-volume, affordable transmitters for volume applications. View the complete range of CO_2 products at www.vaisala.com/carbondioxide.



Structure of the CARBOCAP® sensor.

The CARBOCAP® Story

The CARBOCAP® story began in 1992, when micromechanical sensors were being intensively researched at Vaisala. The groundbreaking idea of miniaturizing the Fabry-Perot Interferometer (FPI) was born, leading to collaborative development work with VTT Technical Research Center of Finland. Later, a patent application was submitted for a single-channel gas concentration measurement method using the FPI.

The driving force behind the innovation of the CARBOCAP® sensor was Vaisala's commitment to developing superior technologies for environmental measurements. And indeed, Vaisala's pioneering work in the field of silicon-based NDIR technology and electrically tunable filters resulted in the compact, simple and high-performance CARBOCAP® sensor. To this day, the long-term stability and reliability of the measurement provided by the FPI is unrivaled.

The first commercial CARBOCAP® products for measuring ppm-level CO_2 in ventilation applications were launched in 1997, with instruments for percentage-level CO_2 measurements following soon after. CARBOCAP® technology is proven in a wide range of applications, including ecological measurements, where it performs reliably in harsh environments such as soil and snow, satisfying the thirst for knowledge that scientists have for understanding nature's processes.

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GMP343 Carbon Dioxide Probe for Demanding Measurements



The GMP343 is available as an open-path diffusion-aspirated model (left) and as a flow-through model (right).

Features/Benefits

- Excellent accuracy and stability
- Vaisala CARBOCAP® Sensor, a silicon-based non-dispersive infrared (NDIR) sensor
- A single-beam, dual-wavelength CO_2 measurement with no moving parts
- Compensation options for temperature, pressure, humidity and oxygen
- Low power consumption and heat emission
- Designed for outdoor use
- Compact and lightweight

The Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 is an accurate and rugged probe-type instrument for ecological measurements. Typical applications include CO_2 soil respiration, ambient CO_2 monitoring, plant growth chambers, and OEM applications.

The GMP343 can output both numerically filtered and raw measurement data and it can also compensate the measurement with an internal temperature measurement and user-set relative humidity, pressure and oxygen values.

In combination with an MI70 indicator, the GMP343 provides a tool for accurate in-situ measurement. The MI70 can be used as a display, communication and data logging device.

Each GMP343 is calibrated using ±0.5 % accurate gases at 0 ppm, 200 ppm, 370 ppm, 600 ppm, 1000 ppm, 4000 ppm and 2 %. Calibration is also done at temperature points of -30 °C, 0 °C, 25 °C and 50 °C. If needed, the customer can recalibrate the instrument using the multipoint calibration (MPC) feature allowing up to 8 user-defined calibration points.

Technical Data

Performance

Measurement range options	0 ... 1000 ppm, 0 ... 2000 ppm, 0 ... 3000 ppm, 0 ... 4000 ppm, 0 ... 5000 ppm, 0 ... 2 %

Accuracy (excluding noise) at 25 °C (77 °F) and 1013 hPa after factory calibration with 0.5 % accurate gases with different range options

0 ... 1000 ppm	±(3 ppm + 1 % of reading)
0 ... 2000 ppm - 0 ... 2 %*	±(5 ppm + 2 % of reading)

*Accuracy below 200 ppm CO_2 not specified for 2 % range option

Noise (repeatability) at 370 ppm CO_2

with no output averaging	±3 ppm CO_2
with 30 s output averaging	±1 ppm CO_2

TEMPERATURE

Effect on accuracy **with** temperature compensation:

CO_2 range options	0 ... 1000 ppm	0 ... 2 000 - 5000 ppm	0 ... 2 %
Temperature °C (°F)	Accuracy (% of reading)*		
+10 ... +40 (+50 ... +104)	±1	±1	±2
+40 ... +60 (+104 ... +140)	±2	±3	±4
-40 ... +10 (-40 ... +50)	±3	±3	±5

* Always at least ±10 ppm CO_2.

Temperature compensation is performed by an integrated Pt1000 element

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Technical Data

PRESSURE

Effect on accuracy **with** pressure compensation:

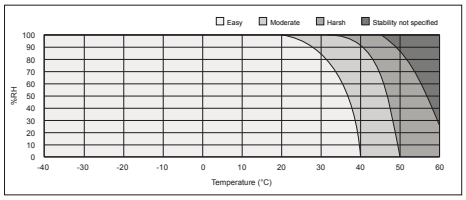
CO_2 range options	0 ... 1000 ppm	0 ... 2000 - 2 %
Pressure (hPa)	Accuracy (% of reading)	
900 ... 1050	±0.5	±1
700 ... 1300	±1	±2

Integrated pressure sensor is **not** included in GMP343

Long term stability	see graph below
easy	±2 % of reading */ year
moderate	±2 % of reading */ 6 months
harsh	±2 % of reading */ 3 months

* Always at least ±10 ppm CO_2.

GMP343 OPERATING CONDITIONS



Response time (90 %)

DIFFUSION MODEL		
Filter attached	Averaging (s)	Response (s)
Yes	0	75
Yes	30	82
No	0	<2
No	30	30

FLOW-THROUGH MODEL		
Gas flow (l/min)	Averaging (s)	Response (s)
0.3	0	26
0.3	30	44
1.2	0	8
1.2	30	23

Warm-up time	
full accuracy ±0.5 %	10 min
full accuracy	30 min

Operating Environment

Temperature	
operating	-40 ... +60 °C (-40 ... +140 °F)
storage	-40 ... +70 °C (-40 ... 158 °F)
Humidity	see graph 'GMP343 Operating Conditions'
Pressure	
compensated range	700 ... 1300 hPa
operating	<5 bar
Gas flow for flow-through model	0 ... 10 liters/min
Electromagnetic compatibility	EN61326, Generic Environment

Inputs and Outputs

Operating voltage	11 ... 36 VDC
Power consumption	
without optics heating	<1 W
with optics heating	<3.5 W
ANALOG OUTPUTS	
Current output	
range	4 ... 20 mA
resolution	14 bits
max. load	800 Ohm @ 24 VDC, 150 Ohm @ 10 VDC
Voltage output	
range	0 ... 2.5 V, 0 ... 5 V
resolution	14 bits (13 bits with 0 ... 2.5 V)
min. load	5 kOhm
DIGITAL OUTPUTS	RS485, RS232

Materials

Housing	anodized aluminium
Filter cover	PC
IP classification	
Housing (cable attached)	IP67
Diffusion filter (weather protection)	IP65
Diffusion filter (sintered PTFE)	IP66
Cable connector type	8-pin M12
Weight (probe only)	360 g

Options and Accessories

Wall mount bracket	GMP343BRACKET
Mounting flange	GMP343FLANGE
Standard diffusion filter (weather protection, IP65) +filter cover	GMP343FILTER
Diffusion filter (sintered PTFE filter, IP66) + filter cover	215521
Calibration adapter (for the diffusion model)	GMP343ADAPTER
Junction box	JUNCTIONBOX-8
Probe cables	
2m	GMP343Z200SP
6m	GMP343Z600SP
10m	GMP343Z1000SP
PC connection cable, 2m	213379
MI70 connection cable, 2m	DRW216050SP
USB adapter (USB-D9 Serial connection cable)	219686
Soil adapter kit for horizontal positioning	215519
Soil adapter kit for vertical positioning	215520

For full specifications, see the GMP343 User's Guide.

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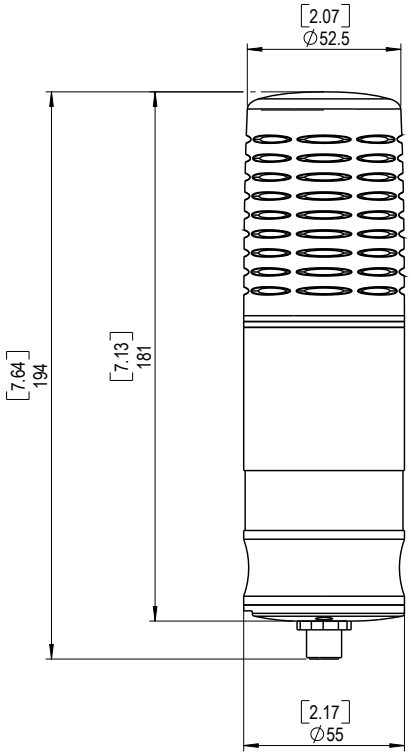
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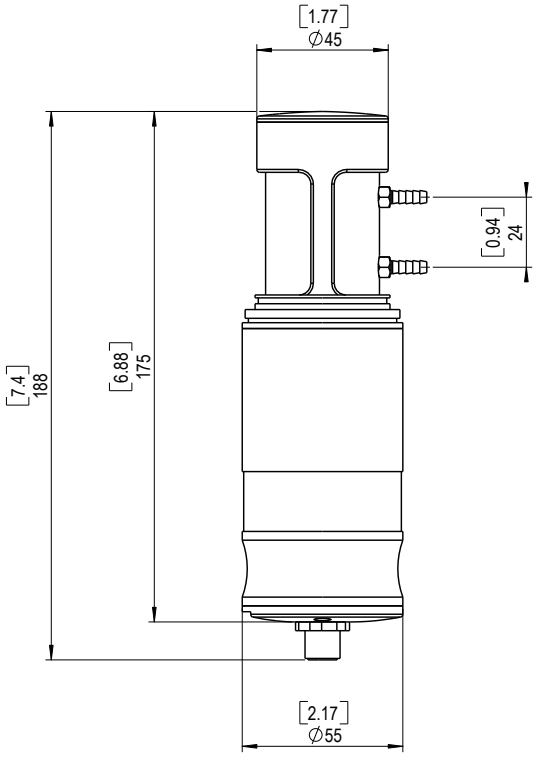
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Dimensional Drawings of the GMP343 Carbon Dioxide Probe

Dimensions in mm (inches)



Diffusion model



Flow-through model

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CO_2 Measurement with Superior Stability and Ability.

Unique built-in reference measurement and robust reliability.

Stability is what everyone promises. But it is exactly what Vaisala CARBOCAP® successfully delivers with its unique built-in reference measurement. Vaisala CARBOCAP® combines the ease and cost efficiency of extra long calibration intervals with leading accuracy on both ppm and percentage level measurements.

Choose from a wide range of fixed and handheld instruments for different applications, requirements and budgets and enjoy superior stability with leading ability.

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GMP251 Carbon Dioxide Probe for %-Level Measurements



The intelligent, stand-alone carbon dioxide probe GMP251.

Features/Benefits

- Measurement range 0 ... 20 %CO_2
- Intelligent, stand-alone probe with analog (V, mA) and digital (RS485) outputs
- Superior long-term stability with the 2nd-gen proprietary CARBOCAP® technology
- Wide operating temperature range -40 ... +60 °C
- IP65 classified housing
- Full temperature and pressure compensations
- Integrated temperature measurement for CO_2 compensation purposes
- Compensations for background gases, O_2, and humidity
- Sensor head heated to prevent condensation
- Calibration certificate included
- Applications: life science incubators, cold storages, fruit and vegetable transportation

The Vaisala CARBOCAP® Carbon Dioxide Probe GMP251 is a new intelligent probe for measuring carbon dioxide. This robust, stand-alone measurement device is designed for use in demanding applications, like life science incubators, where stable, reliable, and accurate performance is required. The GMP251 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 the GMP251.

The GMP251 incorporates an internal temperature sensor for compensation of the CO_2 measurement according to ambient temperature. The effects of pressure and background gas can also be compensated for. The measurement range is 0 ... 20 %CO_2 and the sensor performance is optimized at 5 %CO_2 measurement. The operating temperature range of the probe is wide and the probe housing is classified as IP65. Condensation is prevented as the internal sensor head is heated.

The GMP251 is resistant to dust and most chemicals, such as, H_2O_2 and alcohol-based cleaning agents.

Ease of Use

The GMP251 is a compact probe that is easy and fast to install in a number of ways. It's easy to plug in and plug out. The surface of the probe is smooth, which makes it easy to clean. The probe provides several outputs for the CO_2 measurement, analog current and voltage outputs as well as digital RS485 with Modbus protocol.

Applications

The GMP251 is ideal for life science incubators, cold storages, fruit and vegetable transportation, and for all demanding applications where stable and accurate %-level CO_2 measurements are needed.

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Technical Data

Performance

Measurement range	0 ... 20 %CO_2
Accuracy (including repeatability and non-linearity)	
at 25 °C and 1013 hPa	
at 5 %CO_2	±0.1 %CO_2
0 ... 8 %CO_2	±0.2 %CO_2
8 ... 20 %CO_2	±0.4 %CO_2
Calibration uncertainty	
at 5 %CO_2	±0.07 %CO_2
at 20 %CO_2	±0.22 %CO_2
Long-term stability	
0 ... 8%CO_2	±0.3 %CO_2 / year
8 % ... 12%CO_2	±0.5 %CO_2 / year
12 % ... 20%CO_2	±1.0 %CO_2 / year
Temperature dependence with compensation	
at 5 %CO_2, 0 ... 50 °C	< ±0.05 %CO_2
Pressure dependence with compensation	
at 5 %CO_2, 700 ... 1100 hPa	±0.05 %CO_2
Start-up time at 25 °C	< 10 s
Warm-up time (for full specifications)	< 4 min
Response time (T90) with standard filter	< 1 min
FLOW-THROUGH MODEL/OPTION	
Response time (T90) with > 0.1 l/min	< 1 min
Flow rate dependence	
< 1 l/min flow	no effect
1 ... 10 l/min	< 0.6% of reading/ l/min
Gas flow	
Operating range	< 10 l/min
Recommended range	0.1 ... 0.8 l/min

Operating Environment

Operating temperature	-40 ... +60 °C
Storage temperature	-40 ... +70 °C
Pressure (compensated)	500 ... 1100 hPa
operating	< 1.5 bar
Humidity	0 ... 100 %RH, non-condensing
Condensation prevention	sensor head heating when power is on
Chemical tolerance (temporary exposure during cleaning)	H_2O_2 (2000 ppm) non-condensing; alcohol-based cleaning agents (e.g. ethanol and IPA); acetone; acetic acid
Electromagnetic compatibility	EN61326-1, Generic Environment

Inputs and Outputs

Operating voltage	
when digital output in use	12 ... 30 VDC
when voltage output in use	12 ... 30 VDC
when current output in use	20 ... 30 VDC
Digital output	RS485 (Modbus RTU, Vaisala Protocol)
Analog outputs	0 ... 5/10 V (scalable), min. load 10 kΩ
	0/4 ... 20 mA (scalable), max. load 500 Ω
Power consumption	0.4 W in continuous operation

Mechanics

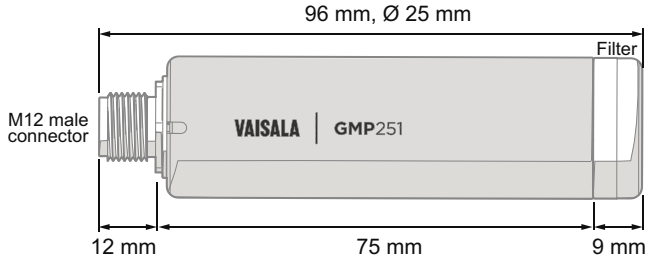
Probe housing material	PBT plastic
Filter material	PTFE membrane, PBT plastic grid
Connector	Nickel plated brass, M12 / 5 pin
Housing classification	IP65
Weight	
probe	45 g

Spare Parts and Accessories

Standard membrane filter	ASM211650SP
Porous sintered PTFE filter, extra protection	DRW243649SP
Flow-through adapter with gas ports	ASM211697SP
Probe cable with open wires (1.5 m)	223263SP
Probe cable with open wires and 90° plug (0.6 m)	244669SP
Probe cable with open wires (10 m)	216546SP
Probe mounting clips (2 pcs)	243257SP
Probe mounting flange	243261SP
USB cable for PC connection	242659
MI70 connection cable for probe	CBL210472
Flat cable	CBL210493SP
Calibration adapter	DRW244827SP

Dimensions

Dimensions in mm



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GMP252 Carbon Dioxide Probe for ppm-Level Measurements



The GMP252 – the intelligent ppm-level probe for measuring CO_2.

Features/Benefits

- Measurement range 0 ... 10 000 ppmCO_2
- Intelligent, stand-alone probe with analog (V, mA) and digital outputs (RS485 with Vaisala protocol or Modbus)
- Can be connected to the Indigo 201 host device
- Superior long-term stability with the 2nd-gen proprietary CARBOCAP® technology
- Wide operating temperature range -40 ... +60 °C
- IP65 classified housing
- Full temperature and pressure compensations
- Integrated temperature measurement for CO_2 compensation purposes
- Compensations for background gases: O_2, and humidity
- Sensor head heated to prevent condensation
- Calibration certificate included
- Applications: agriculture, refrigeration, greenhouses and demanding HVAC applications

The Vaisala CARBOCAP® Carbon Dioxide Probe 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. It is suitable for harsh and humid CO_2 measurement environments where stable and accurate ppm-level CO_2 measurements are needed. The 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 the GMP252.

The GMP252 incorporates an internal temperature sensor for compensation of the CO_2 measurement according to ambient temperature. The effects of pressure and background gas can also be compensated for. The measurement range is 0 … 10 000 ppmCO_2 and the sensor can be used for measurements even up to 30 000 ppm CO_2 with reduced accuracy. The operating temperature range of the probe is wide and the probe housing is classified as IP65. Condensation is prevented as the internal sensor head is heated.

The GMP252 is resistant to dust and most chemicals, such as, H_2O_2 and alcohol-based cleaning agents.

Ease of Use

The GMP252 is a compact probe that is easy and fast to install in a number of ways. It's easy to plug in and plug out. The surface of the probe is smooth, which makes it easy to clean. The probe provides several outputs for the CO_2 measurement, analog current and voltage outputs as well as digital RS485 with Modbus protocol.

The GMP252 probe can also be connected to the Indigo 201 host device to extend its features, for example, for a display or relays.

Applications

The GMP252 is ideal for agriculture, refrigeration, greenhouses and demanding HVAC applications where stable and accurate ppm-level CO_2 measurements are needed.

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Technical Data

Performance

Measurement range	0 ... 10 000 ppmCO_2
with reduced accuracy	0 ... 30 000 ppmCO_2
Accuracy (including repeatability and non-linearity)	
at 25 °C and 1013 hPa	
0 ... 3000 ppmCO_2	±40 ppmCO_2
3000 ... 10 000 ppmCO_2	±2% of reading
Up to 30 000 ppmCO_2	±3.5% of reading
Calibration uncertainty	
at 2000 ppmCO_2	±18 ppmCO_2
at 10 000 ppmCO_2	±66 ppmCO_2
Long-term stability	
0 ... 3000 ppmCO_2	±60 ppmCO_2/year
3000 ... 6000 ppmCO_2	±150 ppmCO_2/year
6000 ... 10 000 ppmCO_2	±300 ppmCO_2/year
Temperature 0 ... 10 000 ppmCO_2	
with compensation, +10 ... +50 °C	< ±0.05% of reading / °C
with compensation, -40 ... +60 °C	< ±0.1% of reading/ °C
Pressure dependence with compensation	
at 0 ... 10 000 ppmCO_2,	
500 ... 1100 hPa	±0.015% of reading / hPa
Start-up time at 25 °C	< 12 s
Warm-up time (for full specifications)	< 2 min
Response time (T90) with standard filter	< 1 min
FLOW-THROUGH OPTION	
Response time (T90) with > 0.1 l/min	30 s
Flow rate dependence	
< 1 l/min flow	no effect
1 ... 10 l/min	< 0.6% of reading l/min
Gas flow	
Operating range	< 10 l/min
Recommended range	0.1 ... 0.8 l/min

Operating Environment

Operating temperature	-40 ... +60 °C
Storage temperature	-40 ... +70 °C
Pressure (compensated)	500 ... 1100 hPa
operating	< 1.5 bar
Humidity	0 ... 100 %RH, non-condensing
Condensation prevention	
	sensor head heating when power is on
Chemical tolerance (temporary exposure during cleaning)	
	H_2O_2 (2000 ppm) non-condensing;
	alcohol-based cleaning agents (e.g. ethanol and IPA);
	acetone;
	acetic acid
Electromagnetic compatibility	EN61326-1, Generic Environment

Inputs and Outputs

Operating voltage	
when digital output in use	12 ... 30 VDC
when voltage output in use	12 ... 30 VDC
when current output in use	20 ... 30 VDC
Digital output	RS485 (Modbus, Vaisala Protocol)
Analog outputs	0 ... 5/10 V (scalable), min. load 10 kΩ
	0/4 ... 20 mA (scalable), max. load 500 Ω
Power consumption	0.4 W in continuous operation

Mechanics

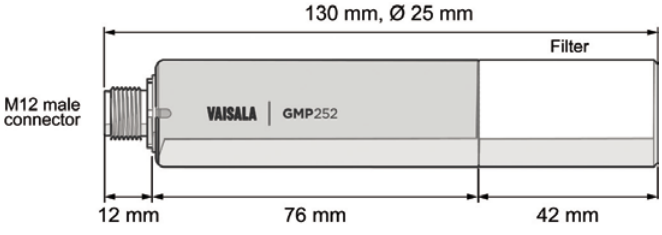
Probe housing material	PBT plastic
Filter material	PTFE
Connector	Nickel plated brass, M12 / 5 pin
Housing classification	IP65
Weight	
probe	58 g

Spare Parts and Accessories

Porous sintered PTFE filter	DRW244221SP
Flow-through adapter	ASM212011SP
Probe cable with open wires (1.5 m)	223263SP
Probe cable with open wires and 90° plug (0.6 m)	244669SP
Probe cable with open wires (10 m)	216546SP
Probe mounting clips (2 pcs)	243257SP
Probe mounting flange	243261SP
USB cable for PC connection	242659
MI70 connection cable for probe	CBL210472
Flat cable	CBL210493SP
Calibration adapter	DRW244827SP

Dimensions

Dimensions in mm



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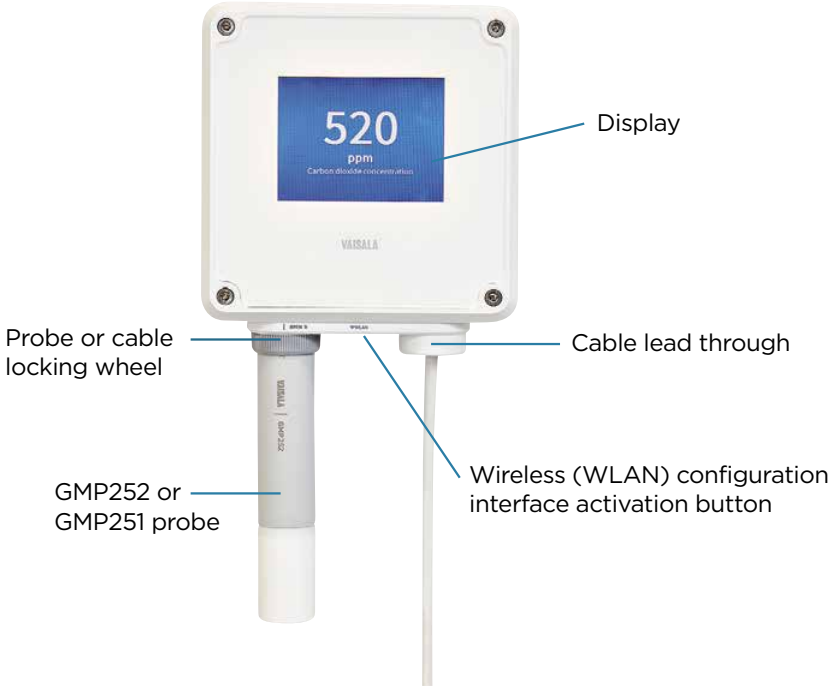
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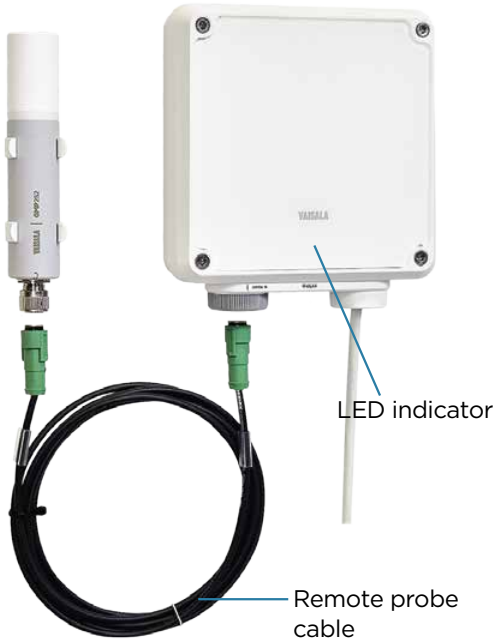
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Vaisala Indigo 201 Analog Output Transmitter for GMP251 and GMP252 probes

Display version



Non-display version



Features

- Plug-and-play probe connection for Vaisala CO_2 probes GMP251 and GMP252
- Wireless interface for configuration and temporary use
- Operating temperature: -40 ... +60 °C, with display -20 ...+60 °C
- LCD color display (optional non-display version)
- IP65 enclosure
- 24 V power supply input
- 3 analog outputs (mA or V)
- 2 configurable relays

Benefits

- Effortless installation saves time
- Minimal downtime with interchangeable probe
- Safe for harsh environments: resistant to dust and most chemicals
- Smooth surface makes cleaning simple
- Easy evaluation and visualization of data, also wirelessly

Typical Applications

- Life Science incubators
- Hatchers and setters
- Greenhouses
- Cold storages & refrigeration
- Food transportation
- CO_2 safety
- Demanding HVAC: animal shelters, swimming halls, parking garages

Note: All GMP251 and GMP252 probes manufactured from 2017 onwards with serial numbers starting with the letter N or latter in alphabetical order have full Indigo compatibility.

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Vaisala Indigo 201 Analog Output Transmitter is a host device where the measurement result of Vaisala Indigo compatible probes is shown on the display and/or converted into other formats, for example, analog output signals and to a level where the relays are activated. These probe hosts are plug-and-play devices for current and future Vaisala Indigo compatible probes. The host device has a color LCD display but it's also available as a non-display version with a LED indicator for notifications.

Vaisala Indigo compatible probes are connected either directly to the host with a probe locking wheel, or by using a cable between Indigo 201 and the probe.

The Indigo 201 has a browser-based wireless (WLAN) configuration interface for a mobile device or computer



An example of a wireless configuration window.

that supports a wireless connection. 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 Indigo 201 enclosure is smooth, which makes it easy to clean. It is also resistant to dust and most chemicals, such as, H_2O_2, and alcohol-based cleaning agents.

Technical Data

General

Supports an Indigo compatible probe:
CO_2 probes GMP251 and GMP252
LCD color display version (optional non-display)
Wireless (WLAN) configuration interface:
connect to the Indigo 201 and use the browser-based user interface for device configuration and measurement data viewing.

Technical Data

Operating voltage	15 ... 30 VDC, (20 ... 22 VAC)
Operating temperature	-40 ... +60 °C, with display -20 ... +60 °C
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 0 … 10 V and 0 … 20mA analog outputs at 20 °C	+-0.1% full scale
Relay contacts x 2	max. switching power 30 W max. switching current 1 A max. switching voltage 40 VDC / 28 VAC
Material	
Housing	PC/ABS plastic
Display window	PMMA plastic
Housing classification	IP65
Screw terminals	wire size 0.2 mm^2 ... 1.5 mm^2
Weight	0.4 kg
Chemical tolerance (temporary exposure during cleaning)	H_2O_2 (6000 ppm) non-condensing; alcohol-based cleaning agents (e.g. ethanol and IPA)
Electromagnetic compatibility	EN61326-1, Generic Environment
Contains	FCC ID QOQ-WGM110, IC 5123A-WGM110, MIC 209-J00197, MSIP-CRM-BGT-WGM110
Safety	IEC/UL/EN 61010-1

Accessories

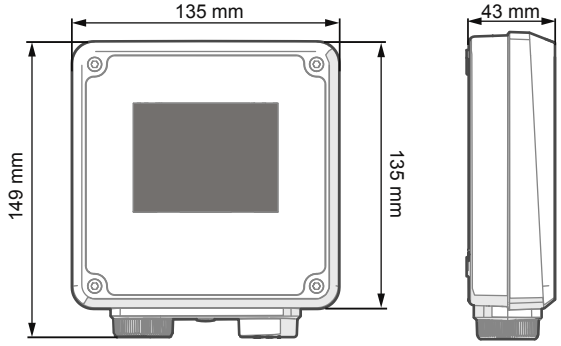
Remote probe cable 1 m	INDIGOCABLE1M
Remote probe cable 3 m	INDIGOCABLE3M
Remote probe cable 5 m	INDIGOCABLE5M
Remote probe cable 10 m	INDIGOCABLE10M

Wireless (WLAN) Configuration Interface

Module with internal chip antenna	
Networking standards	IEEE 802.11 b/g/n compliant

Dimensions

in mm
135 (w) x 149 (h) x 43 (d)



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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).

Features/Benefits

- Proven Vaisala CARBOCAP® reliability
- Two optional sampling methods: diffusion or pump aspiration
- User-friendly meter with multilingual user interface
- Numerical and graphical display of measurements
- Data can be logged and transferred to PC via MI70 Link software
- Wide selection of measurement ranges
- Easy recalibration using the interchangeable probes
- Suitable for field checking of fixed CO_2 instruments
- Short warm-up time
- Compact and versatile

The Vaisala CARBOCAP® Handheld Carbon Dioxide Meter GM70 is a user-friendly meter for demanding spot measurements in laboratories, greenhouses and mushroom farms. The meter can also be used in HVAC and industrial applications, and as a tool for checking fixed CO_2 instruments.

The GM70 has a short warm-up time and is ready for use almost immediately. It has a menu-based interface, a graphical LCD display and data logging capability.

Vaisala CARBOCAP® Technology

The GM70 incorporates the advanced Vaisala CARBOCAP® sensor that has unique reference measurement capabilities. The measurement accuracy is not affected by dust, water vapor or most chemicals. The GM70 has a two-year recommended calibration interval.

Two Sampling Methods

The handle is for hand-held diffusion sampling. The GM70 pump enables pump-aspirated sampling from locations difficult to access otherwise. It is also ideal for comparisons with fixed CO_2 transmitters.

Interchangeable Probes

The 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 CO_2 instruments. GMW90 and GMP220 probes can also be adjusted by using the GM70 meter.

The GM70 has two probe inputs. Vaisala's relative humidity and dewpoint probes can also be used simultaneously with CO_2 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 the GM70 to a PC.

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Technical Data

CO_2 Volume Concentration Measurement

Measurement ranges	
High concentrations	0 ... 2 %
short probe (GMP221)	0 ... 3 %
	0 ... 5 %, 0 ... 10 %, 0 ... 20 %
Low concentrations	0 ... 2000 ppm
long probe (GMP222)	0 ... 3000 ppm, 0 ... 5000 ppm,
	0 ... 7000 ppm, 0 ... 10,000 ppm
Accuracy (including repeatability, non-linearity and calibration uncertainty) at 25 °C and 1013 hPa	
GMP221	±(1.5% of range + 2% of reading)
(applies for concentrations above 2% of full scale)	
GMP222	±(1.5% of range + 2% of reading)
Temperature dependence, typical	-0.3 % of reading / °C
Pressure dependence, typical	+0.15% of reading/hPa
Long-term stability	<±5 %FS/2 years
Response time (63 %)	
GMP221	20 seconds
GMP222	30 seconds
Warm-up time	30 seconds, 15 minute full specifications

Measurement Environment

Temperature	-20 ... +60 °C (-4 ... +140 °F)
Relative humidity	0 ... 100 %RH non-condensing
Operation pressure	700 ... 1300 hPa
Flow range (diffusion sampling)	0 ... 10 m/s

Probe, Handle & Pump General

Sensor	Vaisala CARBOCAP®
Housing material	
GMP221/222 probe	PC plastic
GMH70 handle	ABS/PC blend
GM70 Pump	aluminium casing
Storage temperature	-30 ... +70 °C (-22 ... +158 °F)
Storage humidity	0 ... 100 %RH non-condensing
Weight	
GMH70 with GMP221/222 probe	230 g
GM70 Pump with GMP221/222 probe	700 g

MI70 Measurement Indicator General

Menu languages	English, Chinese, French, Spanish, German, Japanese, Russian, Swedish, Finnish
Display	LCD with backlight, graphic trend display of any parameter, character height up to 16 mm
Max. no. of probes	2
Power supply	Rechargeable NiMH battery pack with AC-adapter
Analog output	0 ... 1 VDC
Output resolution	0.6 mV
PC interface	MI70 Link software with USB or serial port cable
Data logging capacity	2700 points
Alarm	Audible alarm function
Operating temperature range	-10 ... +40 °C (+14 ... +104 °F)
Operating humidity range	non-condensing
Housing material	ABS/PC blend
Housing classification	IP54
Weight	400 g
Battery Operation Time	
Continuous use	
with handle	better than 8h at +20 °C (+68 °F)
with pump	better than 5h at +20 °C (+68 °F) without load
Data logging use	up to a month, depending on logging interval
Electromagnetic Compatibility	EN 61326-1, Portable Equipment

Accessories

Connection cable for fixed CO_2 instruments	
GMT220 and GMD20	GMA70
MI70 Link software with USB cable	219687
MI70 Link software with serial port cable	MI70LINK
Analog output cable for 0 ... 1 VDC	27168ZZ
Calibration adapter	26150GM
Weatherproof Carrying Case	MI70CASE3
Soft Carrying Case for diffusion handle and probe	MI70SOFTCASE
Battery, NiMH 4.8V	26755
Spare probe	GMP221, GMP222
(use the order form to define measurement range etc.)	
Nafion Membrane Tubing	212807GM

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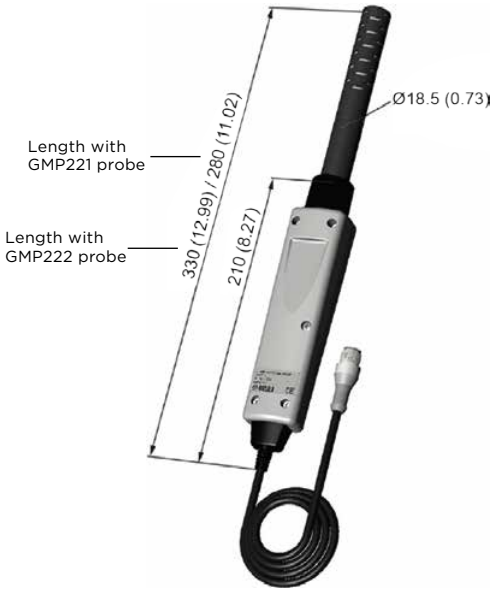
Dimensions

Dimensions in mm (inches)

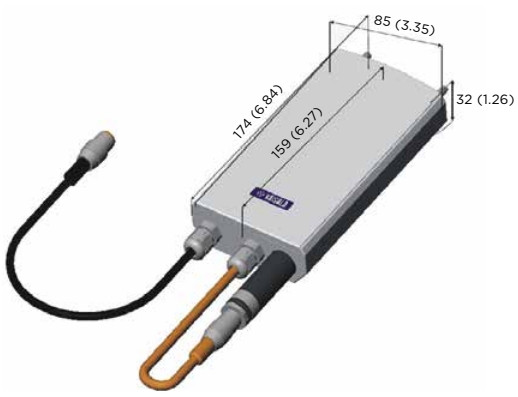
MI70 indicator



Probe handle with probe



GM70 pump with probe



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GMW90 Series Carbon Dioxide, Temperature, and Humidity Transmitters for Demand Controlled Ventilation Applications



GMW90 Series Carbon Dioxide, Temperature and Humidity Transmitters for HVAC are available with either a display opening or a solid front. An optional traffic light indication can also be selected.

Features/Benefits

- Measured parameters: carbon dioxide, temperature, and humidity (optional)
- Superior long-term stability with the next generation Vaisala CARBOCAP® sensor
- Accurate temperature and humidity measurements in a three-parameter instrument due to the low-power microglow infrared source
- Quick and easy installation and maintenance
- Calibrated, user-exchangeable modules for carbon dioxide, temperature and humidity
- 3-point traceable CO_2 calibration (certification included)
- Both analog and digital communication (BACnet/Modbus)

The Vaisala GMW90 Series CARBOCAP® Carbon Dioxide, Temperature, and Humidity Transmitters are based on new measurement technology for improved reliability and stability. With the new technology the transmitter's inspection interval is extended to five years.

Designed for demand controlled ventilation, these transmitters measure carbon dioxide and temperature, with the option for humidity measurements. The instruments come with a calibration certificate that meets traceability and compliance requirements.

Reliability from Unique Measurement Technology

The GMW90 Series Transmitters use advanced Micro-Electro-Mechanical System (MEMS) technology for measuring carbon dioxide. The CARBOCAP® carbon dioxide sensor's continuous reference measurement enables reliable and accurate readings and outstanding long-term stability also in buildings with round-the-clock occupancy.

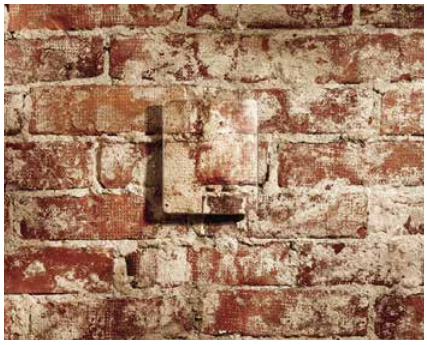
The new generation CARBOCAP® sensor no longer uses an incandescent light bulb, which limits sensor lifetime. This unique sensor consumes very little power compared to other sensors on the market. As a result, instrument self-heating is low and humidity and temperature can be measured correctly.

Convenient Installation

GMW90 Series Transmitters have been designed for quick and easy installation and maintenance. Every model includes a display for easy startup and convenient maintenance. To protect the sensor from dust and dirt during construction and installation, the units can be cabled with back-plate only. Electronics can be snapped on later at an appropriate phase in the construction project. Dip switches make it quick and easy to configure the transmitters.

Easy Calibration

Regular instrument maintenance guarantees a long product lifetime. Calibration is easiest done with the exchangeable measurement modules. Sensor traceability and measurement quality is easily maintained by snapping on a new module calibrated at Vaisala factory. The instrument can also be calibrated using a hand-held meter or reference gas CO_2bottle. 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.



Make the transmitter blend into your interior design with the optional decorative cover.

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Technical Data

Models

GMW93	CO_2+T	3-wire, voltage output
GMW93D	CO_2+T	3-wire, voltage output with display
GMW94	CO_2+T	3-wire, current output
GMW94D	CO_2+T	3-wire, current output with display
GMW93R	CO_2+T+RH	3-wire, voltage output
GMW93RD	CO_2+T+RH	3-wire, voltage output with display
GMW93RA	CO_2+T+RH	3-wire, voltage output with display and CO_2 indicator LEDs
GMW94R	CO_2+T+RH	3-wire, current output
GMW94RD	CO_2+T+RH	3-wire, current output with display
GMW95	CO_2+T	Digital (BACnet/Modbus) model
GMW95D	CO_2+T	Digital (BACnet/Modbus) model with display
GMW95R	CO_2+T+RH	Digital (BACnet/Modbus) model
GMW95RD	CO_2+T+RH	Digital (BACnet/Modbus) model with display
GMW90	CO_2+T	Configurable analog/digital models
GMW90R	CO_2+T+RH	Configurable analog/digital models

Performance

CARBON DIOXIDE	
Measurement range	0 … 5000 ppm
Accuracy	
+20 ... +30 °C (+ 68 ... + 86 °F)	± (30 ppm + 2 % of reading)
+10 ... +20 °C, +30 ... +40 °C (+50 ... +68 °F, +86 ... +104 °F)	± (35 ppm + 2.7 % of reading)
-5 ... +10 °C, +40 ... +55 °C (+23 ... +50 °F, +104 ... +131 °F)	± (45 ppm + 3.8 % of reading)
Stability in typical HVAC applications	Total accuracy at room temperature ±75 ppm at 600 and 1000 ppm incl. 5 years drift*
Carbon dioxide sensor	Vaisala CARBOCAP® GM10
TEMPERATURE	
Measurement range	-5 ... +55 °C (+23 ... +131 °F)
Accuracy	
+20 ... +30 °C (+68 ... +86 °F)	±0.5 °C (± 0.9 °F)
+10 ... +20 °C, +30 ... +40 °C (+50 ... +68 °F, +86 ... +104 °F)	±0.6 °C (± 1.08 °F)
-5 ... +10 °C, +40...+55 °C (+23 ... +50 °F, +104 ... +131 °F)	±0.8 °C (± 1.44 °F)
Temperature sensor	Digital temperature sensor
RELATIVE HUMIDITY	
Measurement range	0 ... 95 %RH
Accuracy	
Temperature range	+10 ... +40 °C (+50 ... +104 °F)
0 ... 60 %RH	±2.5 %RH
60 … 80 %RH	±3.0 %RH
80 ... 95 %RH	±4.0 %RH
Temperature range	-5 ... +10 °C, +40 ... + 55 °C (+23 ... +50 °F, +104 ... +131 °F)
0 ... 60 %RH	±3.5 %RH
60 … 80 %RH	±4.0 %RH
80 ... 95 %RH	±5.0 %RH
Stability in typical HVAC applications	±0.5 %RH/year
Humidity sensor	Vaisala HUMICAP® 180R

*Complies with CEC-400-2008-001-CMF

Operating Environment

Operating temperature range	-5 ... +55 °C (+23 ... +131 °F)
Operating humidity range	0 … 95 %RH Dewpoint <30 °C (+86 °F)
Storage temperature range	-30 ... +60 °C (-22 ... +140 °F)
Electromagnetic compliance	EN61326-1, Industrial Environment

Spare Parts and Accessories

CO_2 module	GM10SP
Temperature Module (CO_2+T models)	TM10SP
Humidity and Temperature Module (CO_2+T+RH models)	HTM10SP
Decorative cover set (10 pcs.)	236285
Connection cable for HM70 hand-held meter	219980
USB cable for PC connection	219690

Mechanics

IP class	IP30
Standard housing color	White (RAL9003*)
Housing material	ABS/PC, UL-V0 approved
Output connector	Screw terminals max. wire size 2 mm² (AWG14)
Service port connector	4-pin M8
Weight	163 g

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

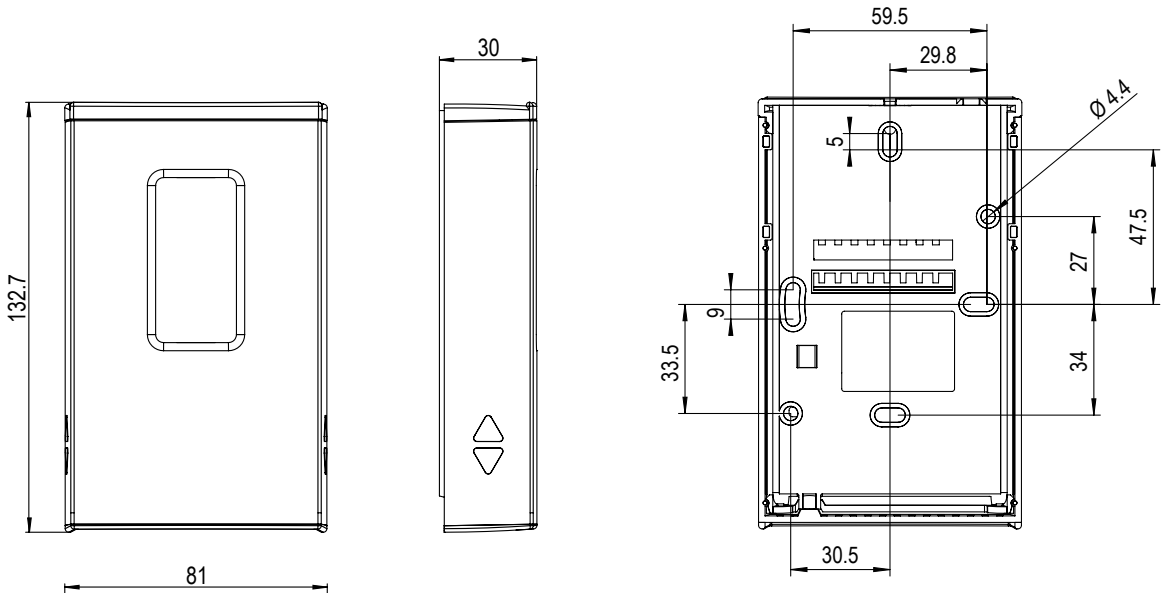
Inputs and Outputs

Supply voltage	18 … 35 VDC, 24 VAC ± 20% 50/60 Hz
Current output models	
Outputs	0/4…20 mA, 2 and 3 channel models available
Loop resistance	0…600 Ω
Power consumption	<2W
Voltage output models	
Outputs	0…5/10 V, 2 and 3 channel models available
Load resistance	10 kΩ min.
Power consumption	<1W
Default analog scales	
CO_2	0…2000 ppm
T	-5…+55°C
RH	0…100 %RH
Digital models	
Power consumption	<1.5W
Output type	RS-485 (galvanic isolation, 1.5 kV)
RS-485 end of line termination	Enable with jumper, 120 Ω
Supported protocols	Selectable by DIP switch
BACnet MS/TP	
Operating mode	Selectable Master/Slave
Address range, master mode	0 … 127
Address range, slave mode	128…255
Modbus RTU	
Address range	0 … 247
Service port	RS-485 line for temporary service use

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Dimensions

Dimensions in mm



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

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Decorative Cover for Vaisala GMW90 and HMW90 Series Transmitters

The decorative cover helps to camouflage the transmitter to the surroundings. Transmitter location can be chosen with optimal measurement in mind without compromising aesthetics.








www.vaisala.com/GMW90
www.vaisala.com/HMW90

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GMW80 Series Carbon Dioxide, Humidity and Temperature Transmitters for DCV



GMW80 series transmitters.

Features/Benefits

- Cost-efficient, affordable
- Reliable and maintenance-free operation up to 15 years
- Superior stability due to 2nd-gen proprietary CARBOCAP® technology
- Improved accuracy due to low self-heating of microglow light source
- Easy to install, easy to use
- Versatile – works well in buildings occupied 24/7
- Ideal for demand-controlled ventilation

The Vaisala CARBOCAP® Carbon Dioxide, Humidity and Temperature Transmitter Series GMW80 is based on a second-generation technology for improved reliability and stability. The transmitters are designed to fulfill the needs for CO_2 measurements in standard demand-controlled ventilation applications. Temperature measurement is always included in the GMW80 series transmitters. The optional temperature set-point potentiometer, humidity measurement, relay and LED CO_2 level indication give you the flexibility needed for a variety of projects.

The CARBOCAP® sensors measure CO_2 accurately immediately when powered on. As they have a built-in reference measurement they do not need a lengthy learning phase before the measured values are correct. Proper operation can be verified immediately after snapping on the device cover.

Easy Installation

With modern buildings often having hundreds of sensors, the installation time per unit can be a significant cost factor. Returning to the building site to check sensor operation adds further costs.

The GMW80 series transmitters include a number of subtle design features that have been introduced to make installation and commissioning quick and easy. The pull-out tab makes opening the transmitter faster than before, while also doubling as a quality check slip and holder for the anti-tamper screw. The backplate can be twisted onto pre-mounted screws, and the wiring can be done easily on the clearly marked backplate. The electronics can be snapped on later when the building automation system is commissioned.

Reliable Operation

The GMW80 series transmitters are optimized for low maintenance. The second-generation, low-power CARBOCAP® technology enables a longer lifetime and superior stability than ever before. As the power consumption is low, the heat generated by the electronics does not distort the temperature inside the sensor. The internal reference in the CO_2 sensor guarantees the best stability and operation even in constantly occupied buildings without frequent readjustments.

The reliable operation and accurate measurement values of the GMW80 series transmitters contribute to the significant cost savings brought by demand-controlled ventilation.

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Technical Data

Models

GMW86P	CO_2	CO_2 current and voltage output, Pt1000
GMW86PT	CO_2	CO_2 current and voltage output, Pt1000, Temp setpoint
GMW83RP*	CO_2+RH+T	Voltage outputs, Pt1000
GMW83DRP*	CO_2+RH+T	Voltage outputs, Pt1000, Display
GMW83	CO_2+T	Voltage outputs
GMW83T	CO_2+T	Voltage outputs, Temp setpoint
GMW83A	CO_2+T	Voltage outputs, CO_2 indicator LED:s
GMW83D	CO_2+T	Voltage outputs, Display
GMW84	CO_2+T	CO_2 current output
GMW84S	CO_2+T	CO_2 current output, Relay

*models with calibration certificate available

Performance

CARBON DIOXIDE	
Measurement range	0 ... 2000 ppm
Accuracy	
+20 ... +30 °C	±(30 ppm +3 % of reading)
+10 ... +20 °C, +30 ... +40 °C	±(35 ppm +3.7 % of reading)
+0 ... +10 °C, +40 ... 50 °C	±(40 ppm +4.8 % of reading)
Stability in typical HVAC conditions	±(15 ppm + 2 % of reading) over 5 years
Warm-up time	1 min; 10 min for full specification
Response time (63 %)	60s
Carbon dioxide sensor	Vaisala CARBOCAP®GM10
TEMPERATURE	
Measurement range	0 ... 50 °C
Sensor (on P models)	Pt1000 RTD Class F0.15 IEC 60751
Sensor (for analog outputs)	Digital temperature sensor
Accuracy (GMW83, GMW84)	
+10 ... +30 °C	±0.5 °C
+0 ... +10 °C, +30 ... 50 °C	±1 °C
HUMIDITY	
Measurement range	0 ... 95 %RH
Temperature range	+10 ... +30 °C
0 ... 80 %RH	±3 %RH
80 ... 95 %RH	±5 %RH
Temperature range	0 ... +10 °C, +30 ... +50 °C
0 ... 95 %RH	±7 %RH
Stability in typical HVAC applications	±2 %RH over 2 years
Product lifetime	>15 years

Operating Environment

Operating temperature range	0 ... +50 °C (+32 ... 122 °F)
Operating humidity range	0 ... 95 %RH
	Dew point <30 °C (+86 °F)
Storage temperature range	-40 ... +70 °C (-40 ... 158 °F)
Display models	-30 ... +70° C (-22 ... 158 °F)
Electromagnetic compliance	EN61326-1, Industrial Environment

Mechanics

IP class	IP30
Housing material	ABS/PC UL-V0 approved
Housing color	White (RAL9003)
Output connector	Screw terminal
	max. wire size 2mm² (AWG14)
Weight	114 g (Plain and LED version)
	120 g (Setpoint version)
	124 g (Display version)

Inputs and Outputs

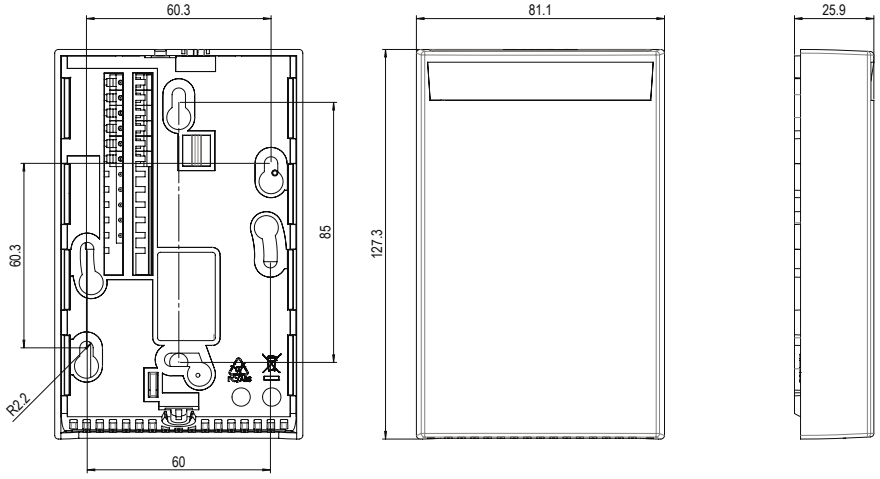
Supply voltage	18 ... 35 VDC, 24 VAC ±20 % 50/60 Hz
Max. current consumption at 18 VDC	
GMW83/86	45 mA
GMW84	70 mA
Max power consumption at 30 VAC	
GMW83	0.7 W
GMW84	1.2 W
GMW86	1 W
Relay (GMW84S)	1 pc (max 50 VDC, 500 mA)
Outputs (see model table)	4 ... 20 mA and/or 0 ... 10V
CO_2 output scale	0 ... 2000 ppm
Temperature output scale	0 ... 50 °C
Humidity output scale	0 ... 100 %RH
Passive temperature sensor (P models)	Pt1000 RTD
Temperature setpoint (T models)	10 KΩ potentiometer
LED CO_2 indicator levels (A model)	
flashing red	>2000 ppm
red	1200 ... 2000 ppm
yellow	800 ... 1200 ppm
green	<800 ppm

Spare Parts and Accessories

CO_2 module	GM10SP80
INTERCAP® sensor	15778HM

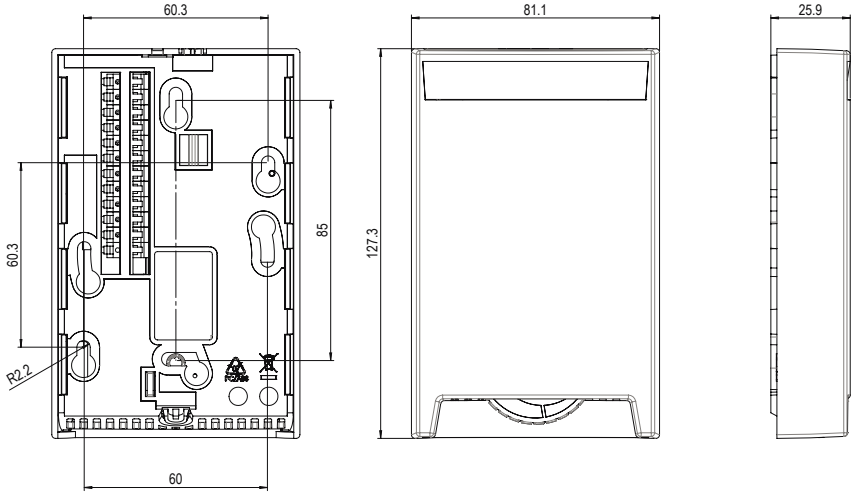
GMW83, GMW83A, GMW83RP, GMW84, GMW84S and GMW86P dimensions

CO_2 4 … 20mA/0 … 10V output
T Pt1000 RTD



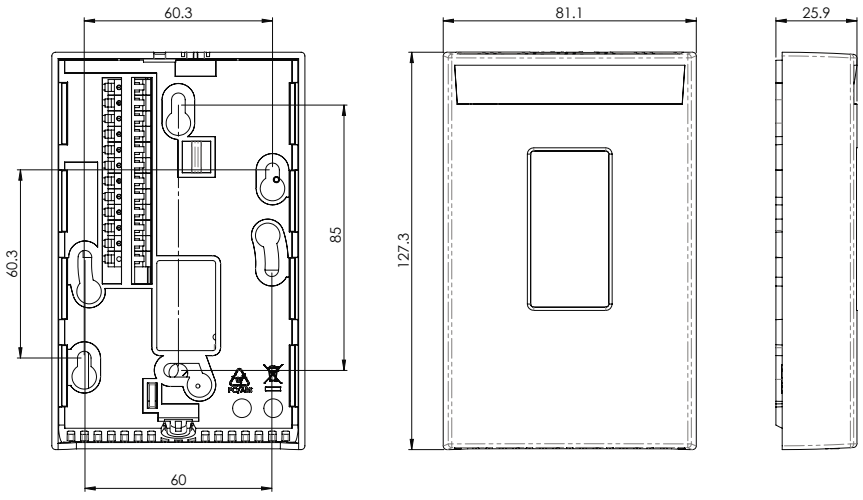
GMW83T and GMW86PT dimensions

CO_2 4 … 20mA/0 … 10V output
T Pt1000 RTD



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GMW83D and GMW83DRP dimensions



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GMD20 Series Carbon Dioxide Transmitters for Demand Controlled Ventilation Applications



The GMD20 series transmitters are designed for use in ventilation-related applications.

Features/Benefits

- Versatile transmitters
- Reliable measurement with sensor inside the duct
- Incorporates Vaisala CARBOCAP® Sensor - the silicon-based NDIR sensor
- Excellent long-term stability
- Negligible temperature dependence
- Ease of installation

The duct mounted Vaisala CARBOCAP® Carbon Dioxide Transmitter Series GMD20 is specially designed for Demand Controlled Ventilation (DCV). They are easy to install and require no maintenance. The recommended calibration interval is five years.

Vaisala CARBOCAP® Technology

The GMD20 Series Transmitters use the silicon-based Vaisala CARBOCAP® Sensor. The simple structure and reference measurement capabilities make this Single-Beam, Dual-Wavelength NDIR sensor extremely stable and reliable.

The temperature and flow dependences of the sensor are negligible. In addition, the measurement accuracy is not affected by dust, water vapor and most chemicals.

Versatile Transmitters

The GMD20 series transmitters can be used independently, or incorporated into building energy management systems. The series consists of duct mount units GMD20 and GMD20D. Version D has a display.

The duct units' compact sensor head design fits inside the ventilation duct, eliminating the risk of leaking gaskets and measurement errors.

In addition to the standard 0 ... 20 mA, 4 ... 20 mA and 0 ... 10 V outputs, there are two other options: one LonWorks® interface and a relay output. The relay output is standard with the display units.

Improve Indoor Air at Minimal Energy Costs

The use of the GMD20 series transmitters ensures the best possible control of air quality and results in considerable savings in energy consumption, maintenance and recalibration costs.

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Technical Data

Performance

CARBON DIOXIDE MEASUREMENT	
Measurement range	0 ... 2000 ppm (nominal; can be calibrated for other ranges: 0 ... 5000 ppm, 0 ... 10,000 ppm, 0 ... 20,000 ppm)
Accuracy (including repeatability, non-linearity and calibration uncertainty)	± (2 % of range + 2% of reading)
Long-term stability	<±5 % of range / 5 years
Response time (63%)	1 minute
Warm-up time	1 minute, 15 minutes full specifications

Inputs and Outputs

Outputs	0 ... 20 or 4 ... 20 mA and 0 ... 10 V
Optional outputs	relay LonWorks® interface
Resolution of analog outputs	8 bits
Recommended external load:	
current output	max. 500 ohm
voltage output	min. 1 kohm
Operating voltage	nominal 24 VAC/DC (18 ... 30 VDC)
Connections	screw terminals, wire size 0.5 ... 1.5 mm²
Power consumption	<2.5 W

Operating Environment

Temperature	-5 ... +45 °C (+23 ... +113 °F)
Humidity	0 ... 85 %RH, non-condensing
Flow velocity (GMD20)	0 ... 10 m/s
Electromagnetic compatibility	EN61326-1, Generic Environment

Mechanics

Housing material	ABS plastic
Housing classification (GMD20 electronics housing)	IP65
Weight: GMD20 (D)	140 g (170 g)

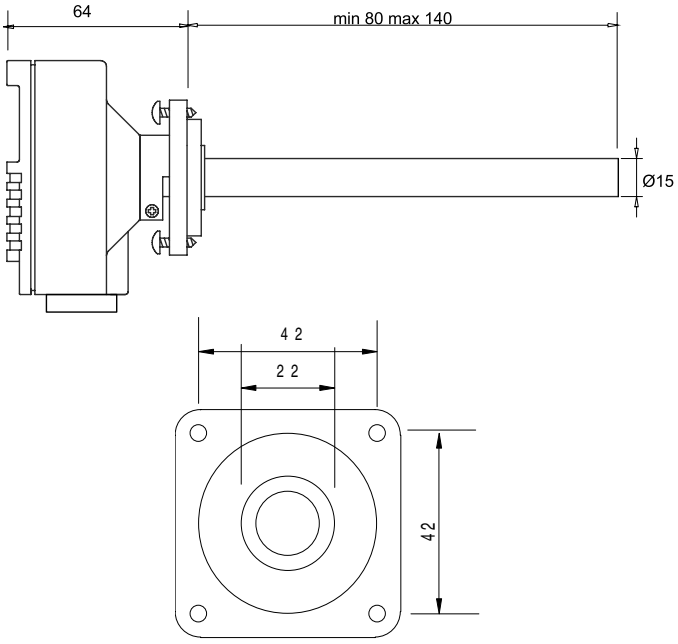
Accessories and Options

Display and relay option for GMD20	GMI21
Relay output option	GMR20
LonWorks® module with CO_2 signal	GML20
(Not available when display option is added)	
Serial COM adapter	19040GM
Hand-held meter for field verification	GM70

Dimensions

Dimensions in mm

GMD20 and GMD20D



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Vaisala HUMICAP® Sensor for Measuring Moisture in Oil







Water is a common contaminant in industrial oils. Water contamination deteriorates the performance of the oil, be it used for lubrication, cooling, insulation or other purposes. High moisture content increases the risk of corrosion, overheating, machine malfunction and other problems and can ultimately lead to costly failure and unscheduled downtime. Monitoring the oil for moisture is a simple way of improving the reliability of industrial machinery and equipment. With time, substantial savings in maintenance costs can be achieved.

Free Water Formation – the Critical Point

Water can dissolve in oil. When the water content of the oil increases, it eventually reaches the saturation point of the oil. Once the fluid has reached its saturation point, any additional water introduced will separate out as free water by forming a distinct layer. Alternatively, the oil can form dispersion with water, which turns the oil cloudy. Since most oils are less dense than water, the water layer will usually settle below the oil with time.

Free water formation is critical in terms of problems related to water in oil. When water is no longer dissolved in the oil, corrosion and wearing of equipment increase rapidly. Therefore it is important to keep the moisture content safely below the saturation point.

The ability of oil to hold dissolved water depends on the type and age of the oil as well as its additives. Two major factors have an effect on the saturation point as the oil ages: temperature fluctuations and changes in the chemical make-up due to the formation of new substances as by-products of the chemical reactions.

Water Activity (a_w) – a Direct Measure of Oil Quality

The conventional measure for water content in oil is ppm (parts per million), which describes the absolute amount of water in the oil. Ppm measurement has, however, a major limitation. It does not account for any variations in the oil's saturation point. In other words, ppm measurement provides no indication 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.

Unique Benefits of HUMICAP in Oil Moisture Measurements

- Fast. Online, real-time detection of moisture in oil without sampling
- Reliable. Tells the true margin to water saturation point in all changing conditions, taking into account e.g. temperature changes and aging of oil
- Highly stable. Excellent pressure and temperature tolerance
- Easy to install through ball valve – no need to shut down the process
- Enables predictive maintenance work. Trends can be quickly identified.

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Water activity measurement indicates directly whether there is a risk of free water formation. With a relative scale from 0 (no water present) to 1 (the oil is saturated with water) it gives a reliable indication of how close the saturation point of water is.

In contrast to traditional measurement techniques, water activity measurement is independent of oil type. Regardless of the saturation point of the fluid, water activity measurement always provides a true indication for the risk of free water formation, even when the saturation point is increasing or decreasing. In its simplicity, water activity value is understandable at a glance. Trends can be quickly identified.

Vaisala HUMICAP® for Measuring Water Activity

The Vaisala transmitters used for measuring moisture in oil feature the HUMICAP® sensor, a capacitive thin-film polymer sensor especially developed for demanding moisture measurements in liquid hydrocarbons.

The HUMICAP sensor consists of four functional layers: glass substrate, lower electrode, water-active polymer layer, and porous upper electrode. The thin-film polymer either absorbs or releases water as the surrounding moisture level changes. Water molecules move to/from the polymer layer until there is moisture equilibrium between the polymer and the oil. The dielectric properties of the polymer depend on the moisture level. As the moisture level changes, the dielectric properties of the polymer film change, and so does the capacitance of the sensor. The instrument's electronics measure the capacitance of the sensor and convert it into water activity.

Oil molecules or additives do not penetrate the electrode. Thus the sensor output is independent of the oil type.

On-line Measurement

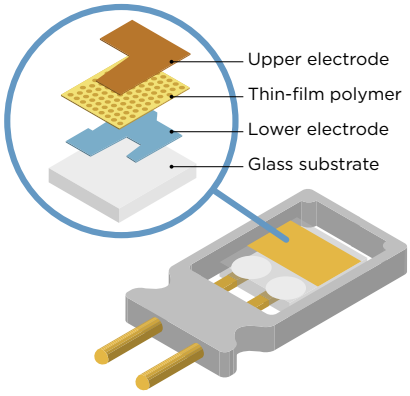
On-line water activity measurement ensures reliable performance of equipment at all times. Time-consuming sampling and laboratory analysis are no longer needed. This not only reduces the risk of human induced error but also provides cost savings in equipment and chemicals.

Typical Applications for Moisture in Oil Measurement

Moisture is an important factor determining the condition of both lubricating and transformer oils. With on-line information on the quality of the oil, preventive actions can be taken and the maintenance costs cut substantially.

HUMICAP in Brief

- A capacitive thin-film polymer sensor
- Water activity (a_w) measurement within range 0...1
- Accurate to +/- 0.02 (a_w)
- 15 years of experience in measuring moisture in oil



Structure of the HUMICAP sensor.

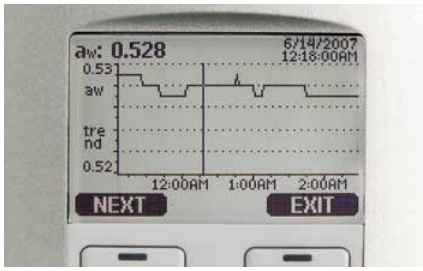
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MMT330 Moisture and Temperature Transmitter Series for Oil



The MMT330 transmitter family offers reliable performance for the demanding measurement of moisture in oil.



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

Features/Benefits

- Continuous online measurement of moisture in oil
- Ball-valve installation – no need to shut down the process or drain the oil
- Proven Vaisala HUMICAP® sensor, used for over 15 years in oil applications
- Easy field calibration and maintenance – compatible with Vaisala HUMICAP® Hand-Held Moisture Meter for Oil MM70
- NIST traceable calibration (certificate included)
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)
- Approved for installation in MAN Diesel & Turbo Two-Stroke Diesel Engines lubrication systems

The Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT330 enables the fast and reliable detection of moisture in oil. MMT330 series transmitters can be used in online moisture monitoring and as control devices, allowing separators and oil driers to be started only when needed.

Proper monitoring saves both oil and the environment. With the MMT330 series it is easy and economical to monitor the changes of moisture in oil.

Reliable Vaisala HUMICAP® Technology

The MMT330 series incorporates the latest-generation Vaisala HUMICAP® sensor, which is the result of over 15 years of field experience. It was developed for demanding moisture measurement in liquid hydrocarbons.

The sensor's excellent chemical tolerance provides accurate and reliable measurement over a wide measurement range.

For Diverse Applications and Demanding Conditions

With a wide variety of probes, the transmitter can be used in lubrication systems, hydraulic systems, and transformers.

Indicates the Margin to Water Saturation

The MMT330 measures moisture in oil in terms of the water activity (aw) and temperature (T). Water activity indicates directly whether there is a risk of free-water formation. The measurement is independent of oil type and age.

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Water Content as ppm Conversion

In addition to water activity, the MMT330 can output ppm, the average mass concentration of water in oil. Vaisala has this conversion readily available for mineral transformer oil.

For other oils, the oil-specific conversion coefficients can be programmed into the transmitter if the water solubility of the oil is known.

Graphical Display of Measurement Data and Trends for Convenient Operation

The MMT330 features a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

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

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

Versatile Outputs and Data Collection

The MMT330 can support up to three analog outputs; an isolated galvanic power supply and relay outputs are also available.

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

MMT330 is also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provides either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the MMT330 to a PC via the service port.

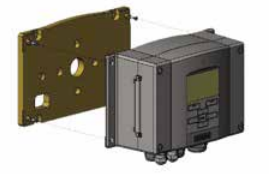


The Vaisala HUMICAP® Hand-Held Moisture for Oil Meter MM70 is designed for field-checking MMT330 transmitters.

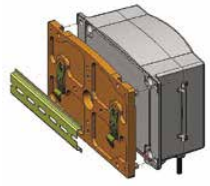
Easy Installation

MMT330 transmitters have several options for transmitter mounting. They are delivered installation-ready, pre-configured with all settings.

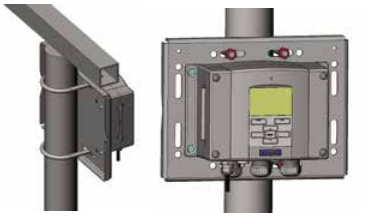
Mounting Options



Mounting with Wall Mounting Kit



Mounting with DIN Rail Installation Kit



Pole Installation with Installation Kit for Pole or Pipeline

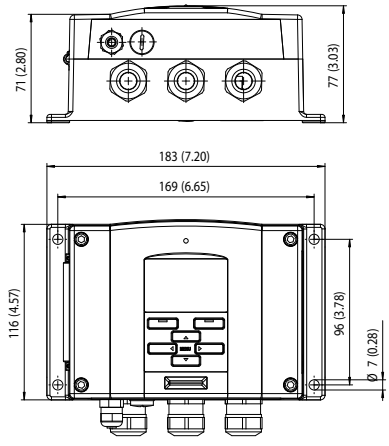


Mounting Rain Shield with Installation Kit

HUMICAP® is a registered trademark of Vaisala.

Dimensions

Dimensions in mm (inches)



TYPE APPROVED PRODUCT
CERTIFICATE NO.: A-13529



The MMT332 probe is installed using a flange. It is designed for high-pressure applications.

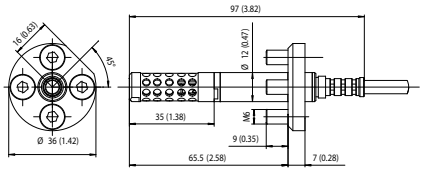
Installation Options

MMT332 for High Pressure Installations

Pressure range	0 ... 250 bar / 0 ... 3625 psia
Probe diameter	12 mm / 0.5"
Installation	
Flange	36 mm / 1.4"
Temperature	
Measurement range	-40 ... +180 °C (-40 ... 356 °F)

Dimensions

Dimensions in mm (inches)





The MMT337 probe, with optional Swagelok® connector, is ideal for tight spaces with a thread connection. The small probe is designed for integration into small diameter lines.

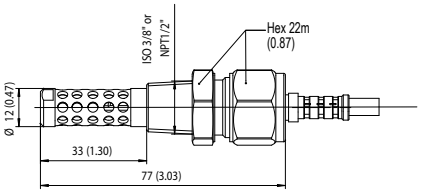
Installation Options

MMT337 with Small-Sized Probe

Pressure range	0 ... 10 bar / 0 ... 145 psia
Probe diameter	12 mm / 0.5"
Installation	
Fitting body	R 3/8" ISO
Fitting body	1/2" ISO
Fitting body	NPT 1/2"
Temperature	
Measurement range	-40 ... +180 °C (-40 ... 356 °F)

Dimensions

Dimensions in mm (inches)





The MMT338 is ideal for installation into pressurized processes where the probe needs to be able to be removed while the process is running. The probe depth is adjustable.

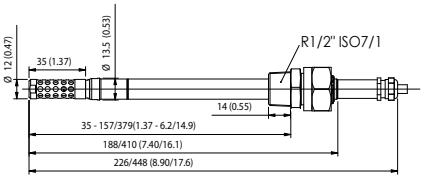
Installation Options

MMT338 with Probe for Pipeline Installations

Pressure range with ball-valve	0 ... 40 bar / 0 ... 580 psia
	up to 120 °C (248 °F) and 40 bar
Adjustable length	35 ... 157/379 mm / 1.37 ... 6.2 /14.9"
Installation	
Fitting body	R1/2" ISO
Fitting body	NPT 1/2"
Ball-valve set	BALLVALVE-1
Sampling cell	DMT242SC2
Temperature	
Measurement range	-40 ... +180 °C (-40 ... 356 °F)

Dimensions

Dimensions in mm (inches)



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Measured Values

WATER ACTIVITY

Measurement range a_w	0 ... 1
Accuracy (including non-linearity, hysteresis and repeatability)	
0 ... 0.9	±0.02
0.9 ... 1.0	±0.03
Response time (90%) at +20 °C in still oil (with stainless steel filter)	10 min.
Sensor	HUMICAP® 180_L2

Performance

TEMPERATURE

Measurement range	
MMT332	-40 ... +180 °C (-40 ... +356 °F)
MMT337	-40 ... +180 °C (-40 ... +356 °F)
MMT338	-40 ... +180 °C (-40 ... +356 °F)
Accuracy at +20 °C (+68 °F)	± 0.2 °C (0.36 °F)

Operating Environment

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

Inputs and Outputs

Operating voltage	10 ... 35 VDC, 24 VAC ± 20%
with optional power supply module	100 ... 240 VAC 50/60 Hz
Power consumption @ 20 °C (U_{in} 24VDC)	
RS232	max. 25 mA
U_{out} 2 x 0...1V / 0...5V / 0...10V	max. 25 mA
I_{out} 2 x 0...20 mA	max. 60 mA
display and backlight	+ 20 mA
Analog outputs (2 standard, 3rd optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs at 20 °C	± 0.05% full scale
Temperature dependence of the analog outputs	± 0.005%/°C full scale
External loads	
current outputs	R_L < 500 ohm
0 ... 1V output	R_L > 2 kohm
0 ... 5V and 0 ... 10V outputs	R_L > 10 kohm
Max. wire size	0.5 mm² (AWG 20) stranded wires recommended
Digital outputs	RS232, RS485 (optional)
Protocols	ASCII commands, MODBUS RTU
Service connection	RS232, USB
Relay outputs	0.5 A, 250 VAC, SPDT, potential-free (optional)
Ethernet interface (optional)	
Supported standards	10BASE-T, 100BASE-TX
Connector	8P8C (RJ45)
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
WLAN interface (optional)	
Supported standards	802.11b
Antenna connector type	RP-SMA
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
Security	WEP 64/128, WPA
Authentication / Encryption	
Open / no encryption	
Open / WEP	
WPA Pre-shared key / TKIP	
WPA Pre-shared key / CCMP (a.k.a. WPA2)	
Optional data logger with real-time clock	
Logged parameters	max. four with trend/min/max values
Logging interval	10 sec. (fixed)
Max. logging period	4 years, 5 months
Logged points	13.7 million points per parameter
Battery lifetime	min. 5 years
Display	LCD with backlight, graphical trend display of any parameter
Menu languages	English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish

Mechanics

Cable bushing	M20x1.5 for cable diameter 8 ... 11mm/0.31 ... 0.43"
Conduit fitting	1/2" NPT
Interface cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft.) black cable
option 2	female plug with screw terminals
USB-RJ45 Serial Connection Cable (incl. Mi70 Link software)	219685
Probe cable diameter	5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m (Additional cable lengths available, please see order forms for details)
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 66 IP65 (NEMA4X) with local display
Weight	
depending on selected probe, cable and modules	1.0 - 3.0 kgs
Sensor protection	Stainless steel grid standard filter/ Stainless steel grid filter for high flow rates (>1 m/s)

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MMT310 Series Moisture and Temperature Transmitters for Oil



Two probe options: MMT318 and MMT317. Optional rain shield is also available.

Features/Benefits

- Continuous measurement of moisture in oil
- Proven Vaisala HUMICAP® sensor, over 15 years in oil applications
- Measurements in lubrication, hydraulic and transformer oils
- Excellent pressure and temperature tolerance
- Measuring water activity - ppm calculation for transformer oil
- Small size, easy to integrate
- NIST traceable calibration (certificate included)
- Applications: e.g. monitoring of transformer oil and of lubrication systems in marine and paper industry

The Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT310 is a fast and reliable on-line detector for moisture in oil.

Reliable Vaisala HUMICAP® Technology

The MMT310 series incorporates the latest generation of the Vaisala HUMICAP® sensor, developed for demanding moisture measurement in liquid hydrocarbons. The sensor's excellent chemical tolerance provides accurate and reliable measurement over the wide measurement range.

Measuring Water Activity

The MMT310 measures moisture in oil in terms of the water activity (a_w) and temperature (T). Water activity indicates directly whether there is a risk of free-water formation. The measurement is independent of oil type, age, and temperature.

Water Content as PPM Calculation for Transformer Oils

PPM units are traditionally used in transformer applications. They indicate the average mass concentration of water in oil. The ppm calculation for mineral oil based transformer oil is optional in the MMT310 series.

Diverse Applications and Demanding Conditions

The MMT310 can be used in lubrication and hydraulic systems as well as in transformers. It can be used for on-line moisture monitoring and as a control function, allowing separators and oil purifiers to be started only when necessary.

Installation Options

The MMT318 has two adjustable probe lengths. The transmitter can be ordered with a ball-valve set that enables the insertion and removal of the moisture probe for calibration, without the need to empty the oil system.

The MMT317 has a small pressure-tight probe with optional Swagelok fittings.

An optional rain shield is available for outdoor installations.

Several Outputs, One Connector

The MMT310 series has two analog outputs and an RS232 serial output. The output signals and the supply power travel in the same cable, the only cable connected to the unit.

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Technical Data

Measured Values

WATER ACTIVITY	
Measurement range a_w	0 ... 1
Accuracy (including non-linearity, hysteresis, and repeatability)	
0 ... 0.9	±0.02
0.9 ... 1.0	±0.03
Response time (90 %) at +20 °C in still oil (with stainless steel filter)	10 min.
Sensor	Vaisala HUMICAP® 180L2
TEMPERATURE	
Measurement range	-40 ... +180 °C (-40 ... +356 °F)
Typical accuracy at +20 °C (68 °F)	±0.2 °C (±0.36 °F)
Sensor	Pt100 RTD Class F0.1 IEC 60751

Electrical Connections

Two analog outputs, selectable and scalable	0 ... 20 mA or 4 ... 20 mA 0 … 5 V or 0 … 10 V 1 … 5 V available through scaling
Typical accuracy of analog output at +20 °C	±0.05 % full scale
Typical temperature dependence of analog output	0.005 %/°C (0.003 %/°F) full scale
Serial output	RS232C
Connections	8-pole connector with RS232C, current/voltage outputs (two channels) and U_{in}
Operating voltage	10 ... 35 VDC
Minimum operating voltage	
RS232C output	10 VDC
Analog output	15 VDC
Pressures above 10 bara (145 psia)	24 VDC
Power consumption	
RS232C	12 mA
U_{out} 10 V (10 kOhm) channel 1 & channel 2	12 mA
I_{out} 20 mA (load 511 Ohm) channel 1 & channel 2	50 mA
External load	R_L < 500 Ohm
Startup time after power-up	3 s

Accessories

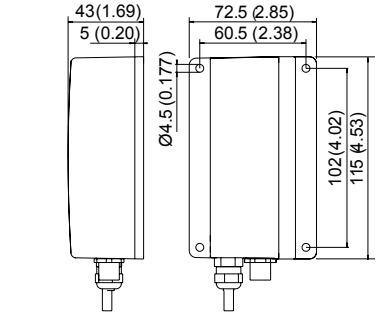
Rain shield	ASM211103
USB cable	238607
Stainless steel filter	HM47453SP
Stainless steel filter (high flow rate)	220752SP

General

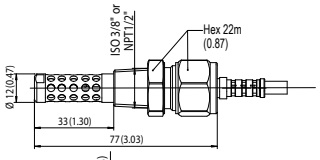
Operating temperature range for electronics	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-55 ... +80 °C (-67 ... +176 °F)
Pressure range for MMT318 with ball-valve up to 120 °C	0 ... 40 bar
Pressure range for MMT317	0 ... 10 bar
Material	
transmitter housing	G-AlSi 10 Mg
transmitter base	PPS
Housing classification	IP66
Cable feed through alternatives	8-pole connector with 5 m cable, female 8-pin connector screw joint for cable diameter 4 ... 8 mm
Sensor protection	stainless steel grid standard filter stainless steel grid filter for high flow rates (>1 m/s)
Probe cable length	
MMT317	2 m, 5 m, or 10 m
MMT318	2 m, 5 m, or 10 m
Weight (depending on selected probe and cable)	
example: MMT317 with 2 m cable	476 g
Probe installation MMT317	
Swagelok®	NPT 1/2", ISO 3/8" or ISO 1/2"
Probe installation MMT318	
Fitting bodies	ISO 1/2", NPT 1/2"
Ball-Valve Set	BALLVALVE-1
Complies with EMC standard EN61326-1, Industrial environment	

Dimensions

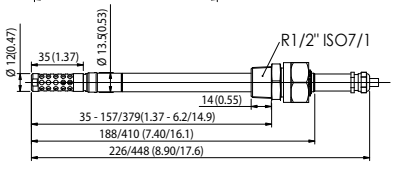
Dimensions in mm (inches)



Transmitter body



MMT317 probe



MMT318 probe

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MMT162 Compact Moisture in Oil and Temperature Transmitter for OEM Applications



The MMT162 enables on-line moisture monitoring in oils even in the most demanding applications.

Features/Benefits

- Continuous measurement of moisture in oil
- Measures in lubrication, hydraulic and transformer oils
- Excellent pressure and temperature tolerance
- Proven Vaisala HUMICAP® Sensor, 15 years in oil applications
- Measures water activity - ppm-calculation available for transformer oil
- Small size, easy to integrate
- Digital output RS-485 with MODBUS
- NIST traceable calibration (certificate included)

The Vaisala HUMICAP® Moisture and Temperature Transmitter for Oil MMT162 is an excellent economical solution for reliable on-line detection of moisture in oil.

Reliable Vaisala HUMICAP® Technology

The MMT162 incorporates the latest generation of the Vaisala HUMICAP® Sensor. The sensor is developed for demanding moisture measurement in liquid hydrocarbons and has been successfully used in oil applications for over a decade. The sensor's excellent chemical tolerance provides accurate and reliable measurement over the measurement range.

Water Activity Measurement

The MMT162 measures moisture in oil in terms of the water activity (aw) and temperature (T). Water activity directly indicates whether there is a risk of free water formation. The measurement is independent of oil type, age and temperature. The ppm calculation for mineral oil based transformer oil is optional in the MMT162.

Several Outputs - One Connector

The MMT162 has two analog outputs that can be scaled and the measurement ranges changed. Additionally, the transmitter has an RS-485 serial output. The signals and the unit power travel in the same cable.

An optional LED-cable enables a visual alarm.

Compact, Rugged and Intelligent

Due to its compact size, the MMT162 is quickly and easily installed in tight spaces. Units are delivered fully assembled, however, you can re-configure them to suit your needs.

MM70

In combination with an MM70 indicator, the MMT162 provides an ideal tool for on site calibration. The MI70 indicator can be used as a display, communication, and data-logging device for the MMT162.

info@metrotecnica.com.mx

Technical Data

Measured Values

WATER ACTIVITY	
Measurement range	0 ... 1 aw
Accuracy (including non-linearity, hysteresis and repeatability)	
0 ... 0.9	± 0.02
0.9 ... 1.0	± 0.03
Response time	
in oil flow (typical)	<1 min (dry-wet)
MOISTURE	
Calculated moisture content in ppm for mineral transformer oil	
TEMPERATURE	
Accuracy at +20 °C (+68 °F)	± 0.2 °C (0.36 °F)

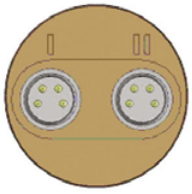
Operating Environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Oil temperature	-40 ... +80 °C (-40 ... +176 °F)
Pressure range	
metal version	up to 200 bar
plastic version	up to 40 bar
Oil flow	some flow recommended

Outputs

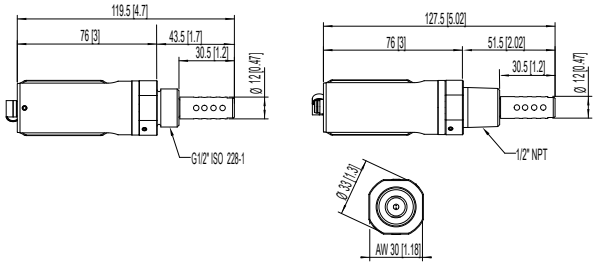
Analog outputs (two channels)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 5 V, 0 ... 10 V
Alarm level indication by analog signal	user selectable
Digital outputs	RS-485, non-isolated, Vaisala protocol, MODBUS RTU protocol

Pin	I	II
1	Vsupply	Vsupply
2	Ch 1	RS-485 - / B
3	GND	GND
4	Ch 2	RS-485 + / A



Dimensions

Dimensions in mm (inches)



General

Sensor	HUMICAP®
Cable connections (2 ports)	M8, 4 pin
Minimum operating voltage with	
RS-485 output	14 ... 28 VDC
voltage output	16 ... 28 VDC
current output	22 ... 28 VDC
Supply current	
normal measurement	20 mA + load current
External load for	
voltage output	min. 10 kOhm
current output	max. 500 Ohm
Housing material	
metal	AISI 316L
plastic	PPS + 40% GF
Mechanical connections with bonded seal ring (washer)	
metal version	G 1/2" ISO or NPT 1/2''
plastic version	G 1/2'' ISO
Housing classification	IP66 (IP65 with plastic housing)
Storage temperature range	-40 ... +80 °C (-40 ... +176 °F)
Weight	
with plastic housing	65 g (2.3 oz)
with metal housing	200 g (7 oz)
Complies with EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirements; Industrial environment	

Options and Accessories

Stainless steel filter (standard)	225356SP
Stainless steel filter for high flow (>1 m/s)	221494SP
Connection cable for MM70 hand-held meter	219980
USB serial interface cable	219690
Sealing ring set (U-seal) ISO G1/2, 3 pcs	221525SP
Sealing ring set (copper) ISO G1/2, 3 pcs	221524SP
ISO 1/2" plug	218773
NPT 1/2" plug	222507
Sampling cell	DMT242SC
Sampling cell w. Swagelok connectors	DMT242SC2
Connection cable	
2 m (6.5 ft), M8 snap-on	211598
0.32 m (1 ft) Shielded, M8 threaded	HMP50Z032
3.0 m (9.8 ft), Shielded, M8 threaded	HMP50Z300SP
5.0 m (16.4 ft), Shielded, M8 threaded	HMP50Z500SP
10 m (32.8 ft), Shielded, M8 threaded	HMP50Z1000SP
3 m, connector 90° angle	221739
5 m, connector 90° angle	221740
M8 threaded, Ch1 signal + Ch2 LED	MP300LEDCBL

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MM70 Handheld Moisture and Temperature Meter for Spot-Checking in Oil



The MM70 is an ideal tool for the preventive maintenance of oil-filled systems. The water activity measurement indicates the margin to free water formation, which causes severe problems in lubrication systems.

Features/Benefits

- Measurement independent of oil type, age and temperature
- In-line process checking through ball valve, no need to drain the oil
- Rugged and reliable construction
- Excellent pressure and temperature tolerance
- Data can be logged and transferred to a PC
- Proven Vaisala HUMICAP® Sensor, over 15 years in oil applications.
- Compatible with Vaisala's fixed oil moisture instruments
- No reference oil needed for recalibration
- NIST traceable calibration (certificate included)

The Vaisala HUMICAP® 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.

The MM70 measures moisture in oil in terms of the water activity (aw) and temperature (T). Water activity directly indicates whether there is a risk of free water formation. The measurement is independent of oil type, age and temperature.

PPM Calculation Included

The MM70 has an embedded model for expressing moisture as ppm in mineral transformer oil. The customer can enter up to three other oil models into the meter's memory.

Numerical and Graphical Display

The MM70 features a multilingual, menu-based user interface and a backlit LCD display. The measurement parameters can be numerically and graphically displayed and logged into the meter's memory at the same time. An analog output option is also available.

Vaisala HUMICAP® Technology

The MM70 incorporates the latest generation of the Vaisala HUMICAP® Sensor, developed for demanding moisture measurements in liquid hydrocarbons. The sensor's excellent chemical tolerance provides accurate and reliable measurement over the measurement range.

Speedy Service - Once a Year

The meter can be recalibrated by sending the probe to Vaisala Service, or customers can calibrate the instrument themselves using a standard relative humidity calibration.

Multi-Probe Operation

One or two probes can be connected simultaneously. Maintenance teams can use additional Vaisala dew point or relative humidity probes for other tasks. For example, a dew point probe is ideal for checking the moisture inside washed and dried oil tanks.

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.

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Technical Data

Performance

WATER ACTIVITY	
Measurement range a_w	0 ... 1
Accuracy (including nonlinearity, hysteresis and repeatability)	
When calibrated against salt solutions (ASTM E104-85):	
0 ... 0.9	±0.02
0.9 ... 1.0	±0.03
Maximum achievable accuracy when calibrated against high-quality, certified humidity standards:	
0 ... 0.9	±0.01
0.9 ... 1.0	±0.02
Response time (90%) at +20 °C (+68 °F)	
in still oil (with stainless steel filter)	10 min.
Sensor	Vaisala HUMICAP® 180L2
Recommended recalibration interval	1 year
TEMPERATURE	
Measurement range	-40 ... +100 °C (-40 ... +212 °F)
Typical accuracy at +20 °C	±0.2 °C (±0.36 °F)
Typical temperature dependence of electronics	±0.005 °C/°C (±0.005 °F/°F)
Sensor	Pt100 RTD Class F0.1 IEC 60751
Typical long-term stability	better than 0.01 aw / year

Operating Environment

PROBE	
Operating temperature range for electronics	-40 ... +60 °C (-40 ... +140 °F)
Operating pressure range	max. 20 bar
during installation through ball valve	max. 10 bar
Oil flow range	max. 1 m/s
INDICATOR	
Operating temperature range	-10 ... +40 °C (+14 ... +104 °F)
Operating humidity range	non-condensing
ELECTROMAGNETIC COMPATIBILITY	
Complies with EMC standard EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements; Portable equipment.	

Inputs and Outputs

Power supply	Rechargeable NiMH battery pack with AC-adapter or 4xAA-size alkalines, type IEC LR6
Battery operation time	
continuous use	48 h typical at +20 °C (+68 °F)
data logging use	up to a month, depending on logging interval
Menu languages	English, Chinese, Spanish, French, German, Japanese, Russian, Swedish, Finnish
Display	LCD with backlight, graphic trend display of any parameter, character height up to 16 mm
Analog output	0 ... 1 VDC
Output resolution	0.6 mV
PC interface	MI70 Link software with USB or serial port cable
Data logging capacity	2700 points
Alarm	Audible alarm function

Mechanics

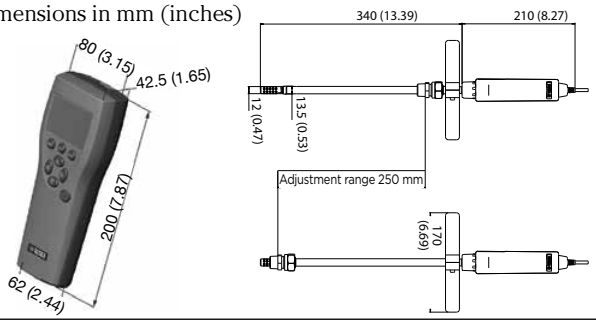
PROBE	
Housing classification	IP65 (NEMA 4)
Housing material	ABS/PC blend
Probe material	Stainless steel (AISI316L)
Cable length between probe and indicator	1.9 m, 10 m extension available
Weight	506 g
INDICATOR	
Housing classification	IP54
Weight	400 g
Probe inputs	1 or 2

Options and Accessories

Weatherproof Carrying Case	MI70CASE4
Ball valve set (incl. fitting body & blanking plug)	HMP228BVS
Probe cable extension, 10 m	213107SP
Transmitter connection cables for	
MMT162	219980
MMT310	DRW216050
MMT330	211339
MI70 Link software with USB cable	219687
MI70 Link software with serial port cable	MI70LINK
Analog output cable	27168ZZ
Sensor protection	HM47453SP
Dew point measurement probes	DMP74A/B
Relative humidity measurement probes	HMP75, HMP76, HMP77

Dimensions

Dimensions in mm (inches)



HUMICAP® is a registered trademark of Vaisala.

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

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Vaisala Moisture, Hydrogen and Temperature Transmitter MHT410 for Online Transformer Condition Monitoring

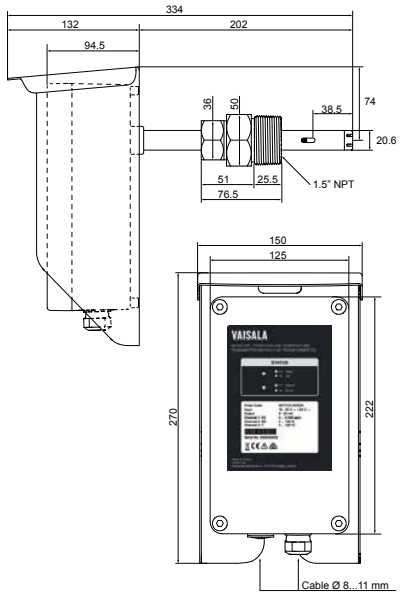


The Vaisala MHT410 Moisture, Hydrogen and Temperature Transmitter provides reliable online monitoring of insulating oil in power transformers. With its unique probe design, the MHT410 delivers accurate measurement and trend data about the health of the transformer in real time.

- Information on transformer fault situations
- Enables timely, proactive maintenance decisions to minimize expensive service shutdowns and outages

Dimensions

Dimensions in mm



Features/Benefits

- Online monitoring of insulating oil transformer
- Measures directly from oil without a need of pumps, membranes etc.
- Moisture and hydrogen sensors are in direct contact with representative oil in the transformer
- Monitors health of the transformer in real time
- Information on transformer fault situations
- Unique probe design, robust and easy to install
- Compact size
- 5 year standard warranty
- Isolated inputs and outputs, EMC tolerant device with IP66 metal housing
- Adjustable probe installation depth fits in a variety of transformers

Technical Data

Measurement Performance

HYDROGEN MEASUREMENT	
Measurement range (in oil)	0 ... 5000 ppm
Accuracy (in oil temp. range -20 ... +60 °C) (-4 ... +140 °F)"	±20% of reading or ±25 ppm(whichever is greater)
Repeatability	±10 % of reading or ±15 ppm (whichever is greater)
Min. detection limit	20 ppm
Typical long-term stability	3 % of reading / year
Cross sensitivity to other gases	< 2 % (CO_2, C_2H_2, C_2H_4, CO)
Response time	63%: 2.5 hours (when sensor is not in reference cycle), 90%: 17 hours
Warm-up time	2 hours, 12 hours for full specification
Sensor	Catalytic palladium-nickel alloy film solid-state sensor
MOISTURE IN OIL MEASUREMENT	
Measurement range (in oil)	0 ... 100 %RS / a_w 0 ... 1
Accuracy (in oil temp. range 0 ... +60 °C) (+32 ... +140 °F) (including non-linearity, hysteresis and repeatability)	
0 ... 90 %RS (a_w 0 ... 0.9)	±2 %RS (a_w ±0.02)
90 ... 100 %RS (a_w 0.9 ... 1.0)	±3 %RS (a_w ±0.03)
Sensor response time (90%, at +20 °C (+68 °F) in still oil)	10 min
Sensor	HUMICAP® 180L2
TEMPERATURE MEASUREMENT	
Measurement range	-40 ... +120 °C (-40 ... +248 °F)
Accuracy at +20 °C (+68 °F)	± 0.2 °C (0.36 °F)
Sensor	Pt1000 RTD Class F0.1 IEC 60751

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Technical Data

Operating Environment

Oil type	Mineral oil
Operating humidity range	0 ... 100 %RH, condensing
Operating temperature range (electronics)	-40 ... +60 °C (-40 ... 140 °F)
Storage temperature range	-40 ... +60 °C (-40 ... 140 °F)
Pressure tolerance (probe, short-term)	Vacuum ... 10 bara
Pressure tolerance (probe, continuous)	Max. 4 bara
Integrated protection for short power outages	> 3 seconds
Electromagnetic compatibility:	
Complies with EMC standard EN61326-1, Industrial environment	
Complies with CISPR22 class B emission limits when DC powered	
Fulfills the requirements of IEC 61000-6-5 in the following tests:	
IEC 61000-4-2	IEC 61000-4-8
IEC 61000-4-3	IEC 61000-4-11
IEC 61000-4-4	IEC 61000-4-12
IEC 61000-4-5	IEC 61000-4-16
IEC 61000-4-6	IEC 61000-4-17

Connections and Outputs

Operating voltage*	15 ... 30 VDC, 24 VAC (±15%) (power supply input is galvanically isolated)
Power consumption	4 W, typical 12 W max.
Analog output (current)*	Three isolated 4 ... 20 mA, loop powering required
External load	Max. 500 Ohm
Error status indication in case of device error	3.5 mA default, user configurable for each channel
Accuracy of analog outputs at +20 °C	± 0.125 % full scale
Temperature dependence of the analog outputs	± 0.006 %/ °C full scale
Digital outputs*	Isolated RS-485 half-duplex, RS-485 (Service Port, non-isolated)
Protocols	MODBUS RTU, serial ASCII commands
Screw terminals	Wire size AWG 22-14
	Single wire (solid) 1.5 mm^2
	Stranded wire (flex.) 1.0 mm^2
	Recommended wire torque 0.4 Nm

*Max. isolation voltage 1.5 kV DC

Mechanics

Mechanical connection on transmitter	1.5" NPT (male)
Cable bushing (optional)	M20x1.5 for cable diameter 8 ... 11mm/0.31 ... 0.43"
Conduit fitting (optional)	1/2" NPT
Interface cable (optional, pre-assembled)	5 meters, 9.2 mm outer diameter
Housing material	AlSi 10 Mg
Housing classification	IP66
Transmitter weight without cables	4.1 kg

Other

Self-diagnostics indication	Status LEDs, analog output, MODBUS
Integrated data logging capabilities	Non-volatile memory up to 44 years storage with default logging
Individual functional test reports	Calibration test reports for moisture, hydrogen and temperature
	Probe leak test report (20 bara)
Factory warranty	5 years

Display with Relays (External Option 242003)

Pre-configured range for hydrogen	0...5000 ppm
Pre-configured alarm relays (user re-configurable)	Relay 1 trigger limit 200 ppm (hi)
	Relay 2 trigger limit 1500 ppm (hihi)
Input	4...20 mA, loop-powered
Accuracy	0.05 % of span (-10...+60 °C)
Relays	2 x solid state (SSR) max. 250 VAC, 150 mA
Display	4-digit red LED, 14.5 mm
Dimensions	100 x 100 x 57 mm (WHD)
Case Protection	IP65
Case material and color	ABS-plastic, grey
Cable glands	2 x M16x1.5

Spare Parts and Accessories

USB cable for PC connection	219690
External din rail power 100 ... 240 Vac to 24 Vdc	242422
5 meter shielded PUR cable	CBL210392-5MSP
10 meter shielded PUR cable	CBL210392-10MSP
Cable gland	214728SP
Detachable screw terminal block	236620SP
Loop-powered external display, Nokeval 302 (with alarm relays)	242003
MI70 connection cable	219980
Conduit fitting	214780SP
1.5" NPT ball valve with welding fitting	BALLVALVE-3SET

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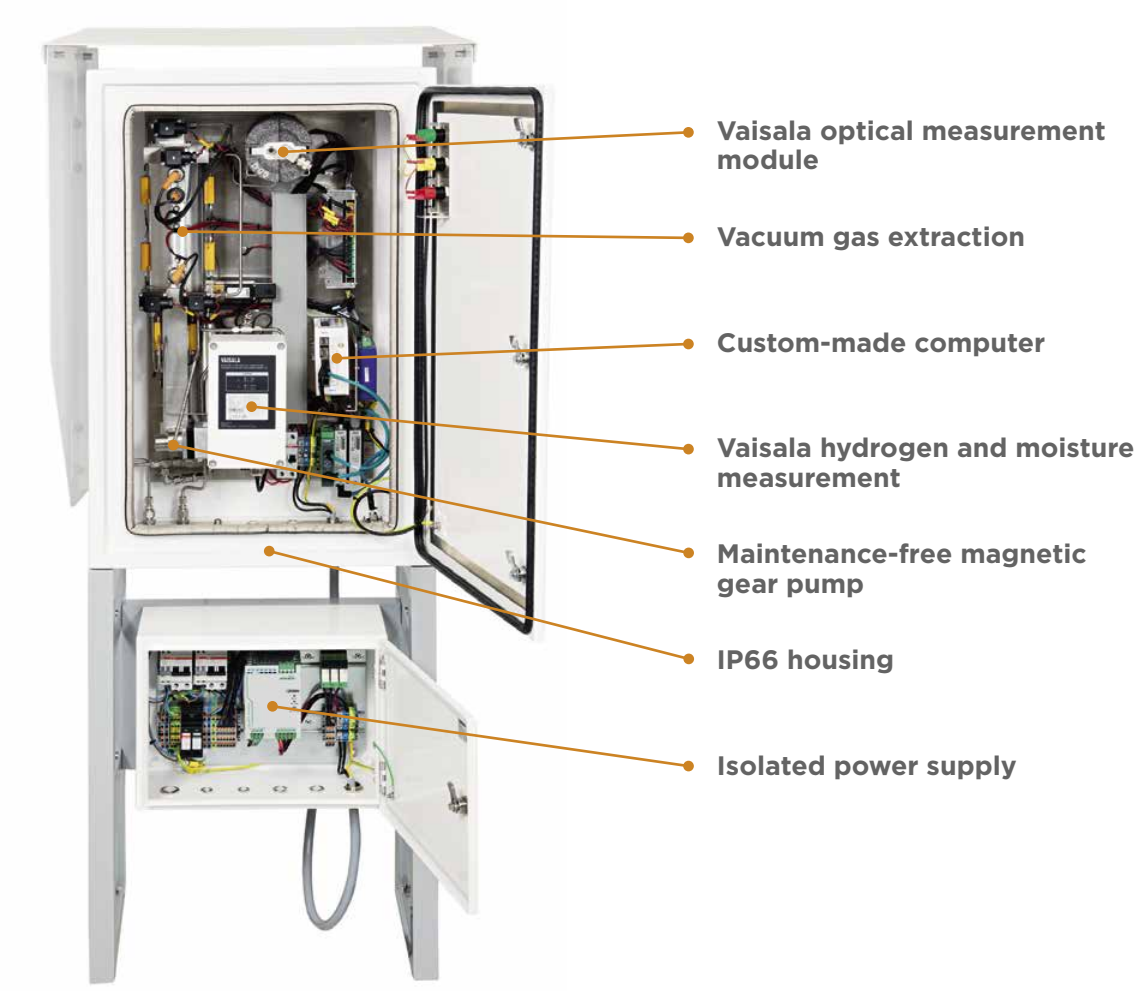
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How is the Vaisala Optimus™ DGA Monitor Different?



Better Measurement Performance

- Optical IR sensors designed and manufactured in Vaisala cleanrooms
- Spectral scanning provides selective gas measurement
- Vacuum gas extraction independent of oil temperature, pressure, and type
- Unique auto-calibration eliminates long-term drifts – no need to recalibrate

More Robust Design

- Hermetically sealed structure tolerates vacuum and pressure variation
- Stainless steel and aluminum components and piping in contact with oil
- No consumables means no regular maintenance
- Magnetic pump and valves for durability

Simplified Installation and Operation

- Installation and commissioning in as little as two hours
- Continuous operation with one-hour output interval – no data averaging needed
- Browser-based user interface to easily view and share data, and change settings
- Self-diagnostics with self-recovery after disturbances

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The Optimus DGA Monitor is the right solution for safe guarding critical transformers in harsh environments

Prevent Power Transformer Failure

There's nothing worse than an unplanned outage, in terms of both lost revenue and the incalculable costs to your reputation and brand. The good news is that over 50 percent of power transformer faults can be detected with the right online monitoring tools, meaning that severe failures can be prevented. But monitors that give false alarms or require regular maintenance can end up wasting considerable amounts of your time and money.

That's why we created the Vaisala Optimus™ DGA Monitor. It provides real-time, trouble free fault gas monitoring for your power transformers – with no false alarms or maintenance.

The two key design drivers have been safety and reliability in demanding operating environments. This is the culmination of decades of listening to customers' needs and researching existing devices, as well as leveraging our 80 years of experience making sensors and measuring equipment for safety-critical industries and harsh environments.

Dependable Data with 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, pressure, or type, while hermetically sealed and protected optics prevent sensor contamination. Moisture is measured directly in the oil with our capacitive thin-film polymer HUMICAP® sensor, which has been used for transformer monitoring for 20 years. Hydrogen is also measured directly in the oil with the same solid-state sensor technology used in the Vaisala MHT410.

Robust Construction

Stainless steel pipes, IP66-rated and temperature-controlled housing, as well as a magnetic 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.

Smart Design

The Vaisala Optimus DGA Monitor has a web-based user interface that completely eliminates the need for additional software. The device is designed to be installed in less than two hours – just connect the oil and power, and it's ready to go. It can be connected to an existing control and monitoring system via digital communication and relays, or used as standalone monitoring device. And in case of a disturbance like a power outage, self-diagnostics allow for self-recovery.

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Technical Data

Measured Parameters in Oil

PARAMETER	RANGE	ACCURACY[1), 2)]	REPEATABILITY[2)]
Methane (CH_4)	0 ... 10000 ppm	10 ppm or 10% of reading	10 ppm or 5% of reading
Ethane (C_2H_6)	0 ... 10000 ppm	10 ppm or 10% of reading	10 ppm or 5% of reading[3)]
Ethylene (C_2H_4)	0 ... 10000 ppm	10 ppm or 10% of reading	10 ppm or 5% of reading
Acetylene (C_2H_2)	0 ... 5000 ppm	2 ppm or 10% of reading	1 ppm or 10% of reading
Carbon monoxide (CO)	0 ... 10000 ppm	10 ppm or 10% of reading	10 ppm or 5% of reading
Carbon dioxide (CO_2)	0 ... 10000 ppm	10 ppm or 10% of reading	10 ppm or 5% of reading
Hydrogen (H_2)	0 ... 5000 ppm	25 ppm or 20% of reading	15 ppm or 10% of reading
Moisture[4)] (H_2O)	0 ... 100 ppm[5)]	± 2 ppm[6)] or ± 10% of reading	Included in accuracy

[1)] Accuracy specified is the accuracy of the sensors during calibration, [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 to saturation, [6)] Calculated ppm value is based on average solubility of mineral oils

Performance

Measurement cycle length	1 hour (typical)
Response time (T63)	One measurement cycle[1)]
Warm-up time to full specification	Three measurement cycles
Data storage	At least 10 years
Expected operating life	>15 years

[1)] Three cycles for ethane

Calculated Parameters

Total dissolved combustible gases (TDCG)	Combined total of H_2, CO, CH_4, C_2H_6, C_2H_4, and C_2H_2
Rate of change (ROC)	Available for single gases and TDCG for 24 hour, 7 day, and 30 day periods
Gas ratios[1)]	Available ratios: CH_4/H_2, C_2H_2/C_2H_4, C_2H_2/CH_4, C_2H_6/C_2H_2, C_2H_4/C_2H_6, and CO_2/CO

[1)] Calculated from 24 h average values. See standard IEC 60599

Operating Environment

Oil type	Mineral oil
Required minimum flash point of oil	+110 °C (+230 °F)
Oil pressure at oil inlet	Max. 2 bar_{abs}, continuous Burst pressure 20 bar_{abs}
Oil temperature at oil inlet	Max. +100 °C (+212 °F)
Ambient humidity range	0 ... 100% RH, condensing
Ambient temperature range in operation	-50...+55 °C (-58 ...+131 °F)
Storage and installation temperature range	-40...+60 °C (-40...+140 °F)
Operating altitude	-1000 ...+2000 m (-3280 ... +6562 ft) relative to sea level

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)	<50 W

Mechanical

Oil connections at DGA monitor	Swagelok® fitting SS-10M0-61 (2 pcs) for 10 mm (0.393 in) outer diameter pipe. For 3/8 inch pipe, use adapter SS-600-R-10M.
Max length of oil pipe to transformer	Max. 10 m (33 ft) for 6 mm (0.24 in) inner diameter pipe. Max. 5 m (16 ft) for 4 mm (0.154 in) inner diameter pipe
Material	Marine aluminum (EN AW-5754), stainless steel AISI 316

Outputs

RS-485 INTERFACE	
Supported protocols	Modbus RTU
Galvanic isolation	2 kV RMS, 1 min
ETHERNET INTERFACE	
Supported protocols	Modbus RTU, TCP, HTTP
Galvanic isolation	4 kV AC, 50Hz, 1 min
RELAY OUTPUTS	
Number of relays	3 pcs, NO or NC user selectable
Trigger type	User selectable: gas level, rate of change, or device status
Max. switching voltage	250 VAC, continuous
Max. switching current	10 A, continuous
USER INTERFACE	
Interface type	Web-based user interface, can be operated with standard web browsers

* Complete list of technical features available in User Guide

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Power Transformer Monitoring That Works

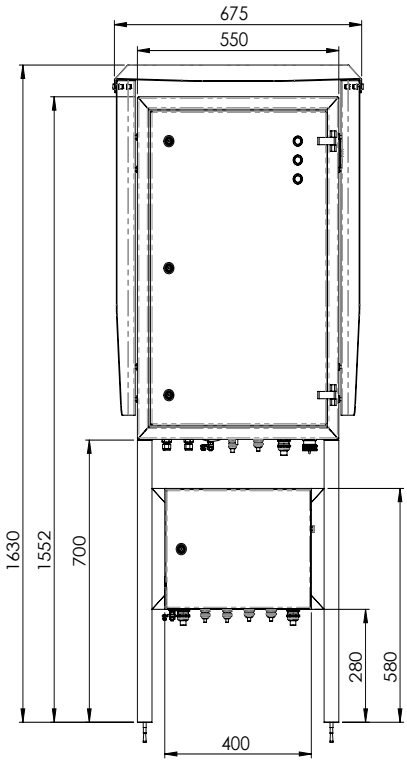
The Vaisala Optimus™ DGA Monitor delivers out-of-the-box performance, eliminates false alarms, and gives you the best long-term stable measurements for the key fault gases used in transformer diagnostics.

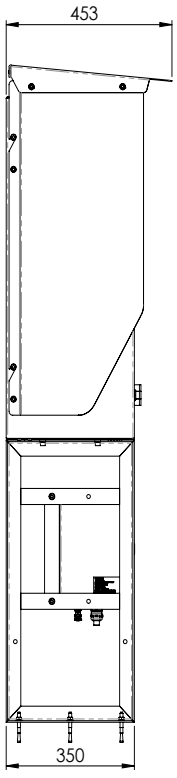
You Can Count on Vaisala

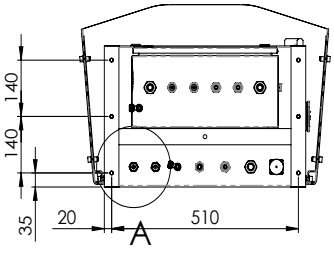
Vaisala has been creating measurement devices for 80 years. Our instruments and systems are used in over 150 countries in industries where failure is not an option, including airports, pharmaceuticals, and power generation. In fact, over 10,000 companies in safety and quality-critical sectors already rely on Vaisala.

Vaisala sensors are so reliable they're used in the harshest places on earth – like arctic, maritime, and tropical environments – and even on Mars.

Dimensions







Safety Information

Tests

CATEGORY	STANDARD	CLASS/LEVEL	TEST
EMC (electromagnetic compatibility)	IEC61000-6-5		Immunity for Power Station and Substation Environments
Environmental	IEC60529	IP66 (equivalent to NEMA 4 rating)	Ingress protection
Safety	IEC/EN61010-1, 3rd edition	Fully compliant	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

Compliance

CATEGORY	STANDARD
CE marking	EMC directive, Low voltage directive, RoHS directive, WEEE directive

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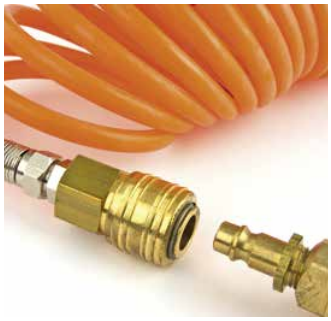
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VAISALA / TECHNOLOGY DESCRIPTION

Vaisala BAROCAP® Sensor for Measuring Pressure



First introduced in 1985, Vaisala BAROCAP® is a silicon-based micromechanical pressure sensor that offers reliable performance in a wide variety of applications, from meteorology to industrial measurements. Combining two powerful technologies – single-crystal silicon material and capacitive measurement – BAROCAP sensors feature low hysteresis combined with excellent accuracy and long-term stability.

How It Works

BAROCAP is a micromechanical sensor that uses dimensional changes in its silicon membrane to measure pressure. As the surrounding pressure increases or decreases, the membrane bends, thereby increasing or decreasing the height of the vacuum gap inside the sensor. The opposite sides of the vacuum gap act as electrodes, and as the distance between the two electrodes changes, the sensor capacitance changes. The capacitance is measured and converted into a pressure reading.

The BAROCAP sensor's properties – good elasticity, low hysteresis, excellent repeatability, low temperature dependence, and superior long-term stability – are the result of its single-crystal silicon material. The capacitive structure gives the sensor its wide dynamic range and provides a built-in mechanism for overpressure blocking.

Typical Applications for Barometric Pressure Measurement

Barometric pressure measurement has a wide variety of applications within meteorology. Pressure data is required for estimating the amount of precipitable water vapor in the atmosphere. Typical applications include weather stations, data buoys, GPS meteorology, and environmental data logging. Barometric pressure measurement is also used in hydrology and agrology applications.

Barometric pressure data is also required in several industrial applications. It is measured in pressure-sensitive industrial equipment, such as laser interferometers and lithography systems, aviation applications, and in exhaust-gas analysis. Metrological applications include laboratory pressure standard measurements and environmental monitoring in calibration laboratories.

BAROCAP in Brief

- Over 25 years of accurate pressure measurement
- Silicon-based capacitive sensor for absolute pressure measurement
- Barometric pressure range 500...1100 hPa
- 50...1100 hPa pressure range available for industrial applications
- Process pressure measurement range 1...10 bar
- NIST-traceable pressure measurement

BAROCAP's Unique Benefits

- Low hysteresis, high repeatability
- Superior long-term stability
- Tolerates harsh conditions

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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.

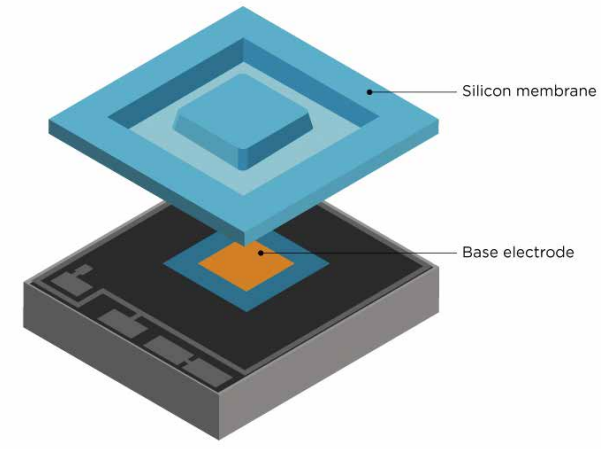
BAROCAP Applications for Measurements in Pressurized Systems

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.

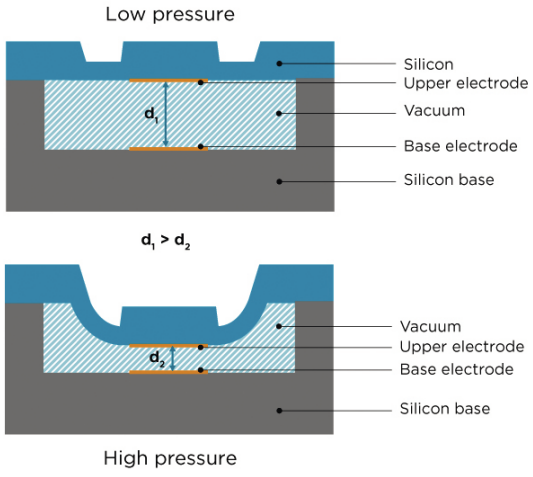
In compressed air, combining dew point measurement with live process pressure data provides a unique advantage: The conversion of measured pressure dew point to atmospheric pressure or ppm unit is available online, eliminating the possibility of any ambiguity in the dew point data. This is important 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.



BAROCAP sensor.



Cross-section of the BAROCAP sensor.

The BAROCAP Story

The story of BAROCAP began in the late 1970s during preliminary micromechanical pressure sensor studies for the new-generation Vaisala Radiosonde RS80. Micromechanics proved to be challenging, and Vaisala worked in close cooperation with universities and research institutes in Finland and internationally to develop a new pressure-sensing technology based on silicon processing. The critical breakthrough came on the brink of the project deadline. The first BAROCAP sensors were delivered to two icebreakers and the Helsinki Telephone Company.

BAROCAP sensors have traveled to places where no human has ever set foot, including as part of several Mars exploration missions and the Cassini-Huygens mission to explore Saturn and its largest moon, Titan. BAROCAP's out-of-this-world journey continues with its inclusion in instruments that form part of NASA's Mars Science Laboratory, launched in November 2011.

VAISALA

For more information, visit www.vaisala.com or contact us at sales@vaisala.com

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PTU300 Combined Pressure, Humidity and Temperature Transmitter for Demanding Applications



The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 is a versatile, multi-purpose instrument.

Features/Benefits

- Barometric pressure, humidity, and temperature measurement in one transmitter
- Available with up to two barometric pressure sensors for added reliability
- RS232C serial interface with NMEA protocol for GPS use
- Graphical display and keypad for convenient operation
- Analog outputs, RS232/485, WLAN/LAN
- MODBUS protocol support (RTU/TCP)
- Optional universal power supply module
- NIST traceable calibration (certificate included)
- HMT330MIK installation kit for outdoor use
- Applications include environmental monitoring in calibration laboratories, industrial applications, GPS meteorology: estimating precipitable water vapor in the atmosphere, weather stations

One Transmitter, Three Measurements

The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 is a unique instrument measuring three parameters simultaneously.

You can choose from the following probe options: PTU301 for laboratories, PTU303 for general use, PTU307 warmed probe for outdoor and demanding meteorology applications, and PTU30T for pressure and temperature measurement only.

Proven Vaisala Sensor Technology

The PTU300 incorporates sensors known for their high accuracy and excellent long-term stability: Vaisala BAROCAP® for pressure measurement and Vaisala HUMICAP® for humidity measurement. The temperature sensor is a platinum RTD sensor.

Graphical Display of Measurement Data and Trends for Convenient Operation

The PTU300 features a large numerical and graphical display with a multilingual menu and keypad. It allows users to easily monitor operational data, measurement trends, and access measurement history for the past 12 months.

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

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

Versatile Outputs and Data Collection

The PTU300 comes with a standard RS232 serial interface. The output format is compatible with major GPS receivers and NMEA-coded messages. An isolated RS485 is available as an option.

The PTU300 is also capable of applying the MODBUS communication protocol and, together with an appropriate connection option, provides either MODBUS RTU (RS485) or MODBUS TCP/IP (Ethernet) communication.

The data logger, with real-time clock and battery backup, guarantees reliable logging of measurement data for over four years. The recorded data can be viewed on the local display or transferred to a PC with Microsoft Windows® software. The transmitter can also be connected to a network with an optional (W)LAN interface, which enables a (wireless) Ethernet connection. A USB service cable makes it easy to connect the PTU300 to a PC via the service port.

Outdoor Installation Kit

Outdoor installation is possible using the optional HMT330MIK installation kit, for applications requiring reliable measurements for meteorological purposes.

Flexible Calibration

Quick, one-point field calibration for humidity is easy using the Vaisala Hand-Held Humidity Meter HM70.

With Vaisala Barometric Pressure Transfer Standard PTB330TS, including optional humidity and temperature probe, field check and calibration can be performed for all three parameters.

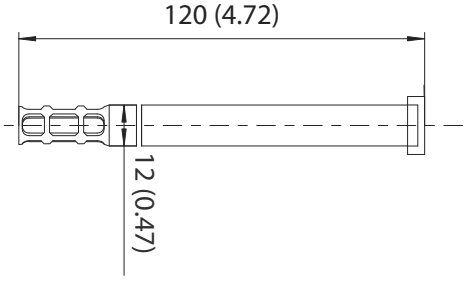
PTU300 Models



PTU301 for wall mounting

Dimensions

Dimensions in mm (inches)

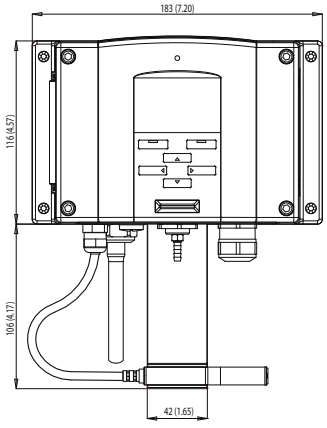




PTU301 short cable probe with optional WLAN

Dimensions

Dimensions in mm (inches)



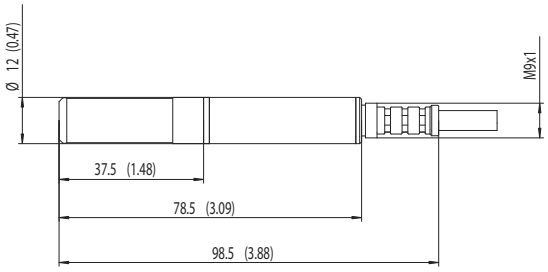
PTU300 Models



PTU303 probe for outdoor use

Dimensions

Dimensions in mm (inches)

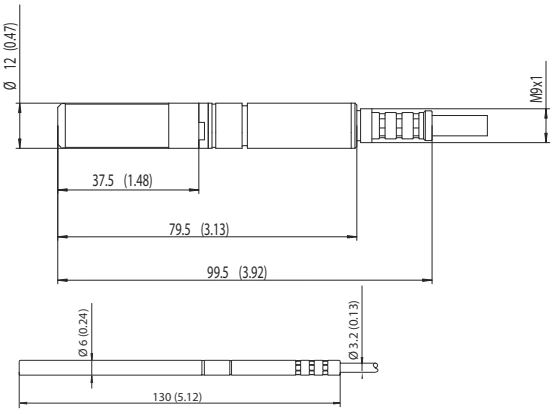




PTU307 warmed probe for demanding meteorological installations

Dimensions

Dimensions in mm (inches)

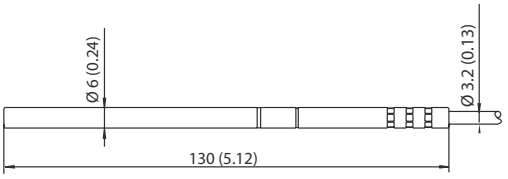




PTU30T for pressure and temperature only measurement

Dimensions

Dimensions in mm (inches)



Technical Data

Performance

BAROMETRIC PRESSURE

Pressure range		500 ... 1100 hPa, 50 ... 1100 hPa	
Accuracy	500 ... 1100 hPa	500 ... 1100 hPa	50 ... 1100 hPa
	CLASS A	CLASS B	
Linearity	±0.05 hPa	±0.10 hPa	±0.20 hPa
Hysteresis*	±0.03 hPa	±0.03 hPa	±0.08 hPa
Repeatability*	±0.03 hPa	±0.03 hPa	±0.08 hPa
Calibration uncertainty**	±0.07 hPa	±0.15 hPa	±0.20 hPa
Accuracy at +20 °C***	±0.10 hPa	±0.20 hPa	±0.30 hPa
Temperature dependence****	±0.1 hPa	±0.1 hPa	±0.3 hPa
Total accuracy (-40 ... +60 °C/ -40 ... +140 °F)	±0.15 hPa	±0.25 hPa	±0.45 hPa
Long-term stability/year	±0.1 hPa	±0.1 hPa	±0.2 hPa
Response time (100 % response)			
one sensor	2 s·	1 s·	1 s·
Pressure units	hPa, mbar, kPa, Pa, inHg, mmH20, mmHg, torr, psia		

* Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis error or repeatability error and calibration.
** Defined as ±2 standard deviation limits of accuracy in the working standard including NIST traceability.
*** Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.
**** Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

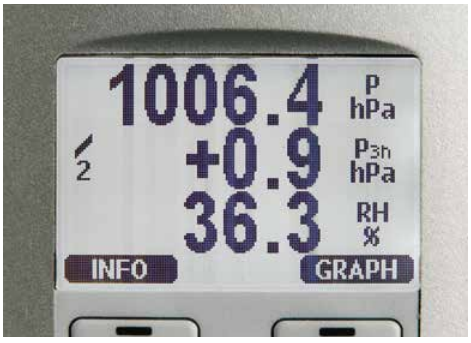
RELATIVE HUMIDITY

Measurement range	0 ... 100 %RH
Accuracy (including non-linearity, hysteresis, and repeatability at	
+15 ... +25 °C	±1 %RH (0 ... 90 %RH)
	±1.7 %RH (90 ... 100 %RH)
at -20 ... +40 °C	±(1.0 + 0.008 x reading) %RH
at -40 ... +60 °C	±(1.5 + 0.015 x reading) %RH
Factory calibration uncertainty (+20 °C)	
(Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.)	± 0.6 %RH (0 ... 40 %RH)
	± 1.0 %RH (40 ... 97 %RH)
Sensor	
for typical applications	Vaisala HUMICAP® 180 or 180R*
for applications with chemical purge/warmed probe	Vaisala HUMICAP® 180C or 180RC*
Response time (90%) at +20 °C (+68 °F) in still air	
with grid filter	8 s / 17 s*
with grid + steel netting filter	20 s / 50 s*
with sintered filter	40 s / 60 s*

* with HUMICAP® 180R or 180RC sensor

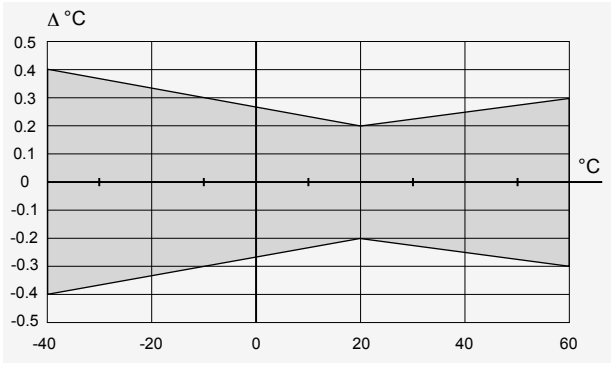
TEMPERATURE

Measurement range, all probes	-40 ... +60 °C (-40 ... +140 °F)
Accuracy at +20 °C (+68 °F)	± 0.2 °C (± 0.4 °F)
Temperature units	°C, °F



The display also shows the WMO pressure trend ΔP 3h and tendency of 0 ... 8.

ACCURACY OVER TEMPERATURE RANGE



Temperature sensor	Pt100 RTD Class F0.1 IEC 60751

Operating Environment

Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
with optional display	0 ... +60 °C (+32 ... +140 °F)
Humidity range	non-condensing
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Industrial Environment
	Note: Transmitter with display test impedance of 40 ohm is used in IEC61000-4-5 (Surge immunity)

Inputs and Outputs

Operating voltage	10 ... 35 VDC, 24 VAC ±20%
with optional power supply module	100 ... 240 VAC, 50/60 Hz
Power consumption at +20 °C (U_{in} 24 VDC)	
RS232	max. 28 mA
U_{out} 3 x 0 ... 1 V/0 ... 5 V/0 ... 10 V	max. 33 mA
I_{out} 3 x 0 ... 20 mA	max. 63 mA
display and backlight	+20 mA
during chemical purge	max. +110 mA
during probe heating	+120 mA
Settling time at power-up (one sensor)	
class A	4 s
class B	3 s
External loads	
current outputs	R_L < 500 ohm
0 ... 1 V output	R_L > 2 kohm
0 ... 5 V and 0 ... 10 V outputs	R_L > 10 kohm

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Recommended wire size	0.5 mm² (AWG 20) stranded wires
Digital outputs	RS232, RS485 (optional)
Protocols	ASCII commands, MODBUS RTU
Service connection	RS232, USB
Relay outputs (optional)	0.5 A, 250 VAC
Ethernet interface (optional)	
Supported standards	10BASE-T, 100BASE-TX
Connector	8P8C (RJ45)
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
WLAN interface (optional)	
Supported standards	802.11b
Antenna connector type	RP-SMA
IPv4 address assignment	DHCP (automatic), static
Protocols	Telnet, MODBUS TCP/IP
Security	WEP 64/128, WPA2
Authentication / Encryption (WLAN)	
Open / no encryption	
Open / WEP	
WPA Pre-shared key / TKIP	
WPA Pre-shared key / CCMP (a.k.a. WPA2)	
Optional data logger with real-time clock	
Logged parameters	max. four with trend/min/max values
Logging interval	10 sec. (fixed)
Max. logging period	4 years, 5 months
Logged points	13.7 million points per parameter
Battery lifetime	min. 5 years
Display	LCD with backlight, graphical trend display of any parameter
Menu languages	English, Chinese, Finnish, French, German, Japanese, Russian, Spanish, Swedish
Analog outputs (optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Humidity and temperature	
accuracy at +20 °C	±0.05% full scale
temperature dependence	±0.005%/°C full scale

Pressure	500 ... 1100 hPa	50 ... 1100 hPa
accuracy at +20 °C	±0.30 hPa	±0.40 hPa
accuracy at -40 ... +60 °C	±0.60 hPa	±0.75 hPa

Mechanics

Cable bushing	M20 x 1.5 for cable diameter 8 ... 11 mm/0.31 ... 0.43"
Conduit fitting	1/2" NPT
User cable connector (optional)	M12 series 8-pin (male)
option 1	female plug with 5 m (16.4 ft) black cable
option 2	female plug with screw terminals

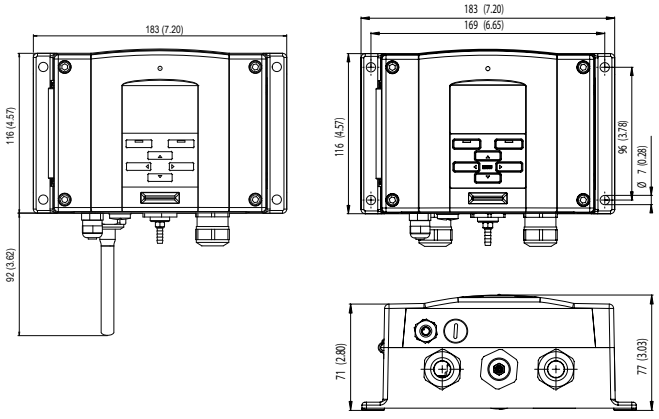
Probe cable diameter	
PTU303	6.0 mm
other probes	5.5 mm
Standard probe cable lengths	2 m, 5 m or 10 m (Additional cable lengths available, please see order form for details)
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 66
	IP65 (NEMA4X) with local display
Weight	
depending on selected probe	1.0 - 3.0 kgs

Accessories

PC software and cable	215005
USB-RJ45 Serial Connection Cable	219685
Connection cable for HM70	211339
Wall mounting plate (plastic)	214829
Pole installation kit with rain shield	215109
DIN rail installation set	211477
Duct installation kit, PTU303/307	210697
Cable gland and AGRO, PTU303/307	HMP247CG
Solar radiation shield, PTU303/307/30T	DTR502B
Meteorological installation kit	HMT330MIK
Duct installation kit (T probe)	215003

Dimensions

Dimensions in mm (inches)



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TYPE APPROVED PRODUCT
CERTIFICATE NO.: A-13529

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

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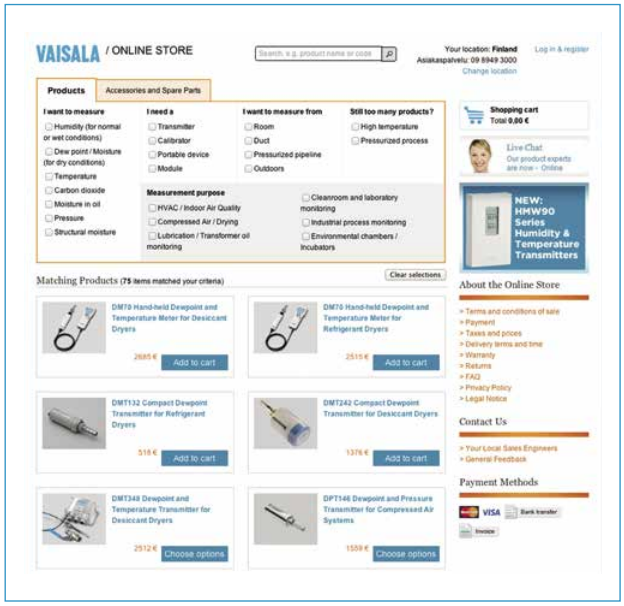
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PTB330 Digital Barometer for Professional Meteorology, Aviation, and Industrial Users



Vaisala BAROCAP® Digital Barometer PTB330 with a new trend display.

Vaisala BAROCAP® Digital Barometer PTB330 is a new generation barometer, designed for a wide range of high-end atmospheric pressure measurement. The pressure measurement of the PTB330 is based on the Vaisala in-house, silicon capacitive, absolute pressure sensor - the Vaisala BAROCAP® Sensor. It provides high measurement accuracy and excellent long-term stability.

Features/Benefits

- Vaisala BAROCAP® sensor
- Accurate measurement
- Excellent long-term stability
- Added reliability through redundancy
- Graphical trend display with 1-year history data
- Height and altitude corrected pressure (QFE, QNH)
- For professional meteorology and aviation, laboratories, demanding industrial applications

Highly Accurate

The PTB330 series is highly accurate. The Class A barometers for the most demanding applications are fine-tuned and calibrated against a high-precision pressure calibrator. Class B barometers are adjusted and calibrated using electronic working standard. All the PTB330 barometers come with a NIST traceable, factory calibration certificate.

Reliability through Redundancy

According to customers' choice, the PTB330 can incorporate one, two or three BAROCAP® sensors. When two or three sensors are used, the barometer continuously compares the readings of the pressure sensors against one another and provides information on whether these are within the set internal difference criteria. This unique feature provides redundancy in pressure measurement.

Thus, users also get a stable and reliable pressure reading at all times as well as a pre-indication of when to service or recalibrate the barometer.

QNH and QFE

The PTB330 can be set to compensate for QNH and QFE pressure used especially in aviation. The QNH represents the pressure reduced to sea level, based on the altitude and temperature of the observation site. The QFE represents the height corrected pressure of small differences in altitude, for example, the air pressure at the airfield elevation.

Graphical Display

The PTB330 features a multi-lingual, graphical display allowing users to monitor measurement trends. The graph is updated automatically while measuring and it provides a one-year measurement history. In addition to instant pressure, the PTB330 also provides the WMO pressure trend and tendency codes.

Applications

The PTB330 can be used successfully for aviation, professional meteorology, and for demanding industrial pressure measurement applications such as accurate laser interferometric measurement and exhaust gas analysis in engine test benches.

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Technical Data

Performance

BAROMETRIC PRESSURE RANGE 500 ... 1100 hPa	Class A	Class B
Linearity*	±0.05 hPa	±0.10 hPa
Hysteresis*	±0.03 hPa	±0.03 hPa
Repeatability*	±0.03 hPa	±0.03 hPa
Calibration uncertainty**	±0.07 hPa	±0.15 hPa
Accuracy at +20 °C (+68 °F) ***	±0.10 hPa	±0.20 hPa

BAROMETRIC PRESSURE RANGE 50 ... 1100 hPa	Class B
Linearity*	±0.20 hPa
Hysteresis*	±0.08 hPa
Repeatability*	±0.08 hPa
Calibration uncertainty**	±0.15 hPa
Accuracy at +20 °C ***	±0.20 hPa
TEMPERATURE DEPENDENCE****	
500 ... 1100 hPa	±0.1 hPa
50 ... 1100 hPa	±0.3 hPa

TOTAL ACCURACY -40 ... +60 °C (-40 ... +140 °F)	Class A	Class B
500 ... 1100 hPa	±0.15 hPa	±0.25 hPa
50 ... 1100 hPa		±0.45 hPa
LONG-TERM STABILITY		
500 ... 1100 hPa		±0.1 hPa/year
50 ... 1100 hPa		±0.1 hPa/year

* Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis or repeatability error.
** Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.
*** Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.
**** Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

Operating Environment

Pressure range	500 ... 1100 hPa, 50 ... 1100 hPa
Temperature range	
operating	-40 ... +60 °C (-40 ... +140 °F)
with local display	0 ... +60 °C (+32 ... +140 °F)

Data Transfer Software

MI70 Link Interface Software	
Requirement:	Microsoft® Windows OS
	Microsoft® Excel

Inputs and Outputs

Supply voltage	10 ... 35 VDC
Supply voltage sensitivity	negligible
Typical power consumption at +20 °C (U_{in} 24 VDC, one pressure sensor)	
RS-232	25 mA
RS-485	40 mA
U_{out}	25 mA
I_{out}	40 mA
display and backlight	+20 mA
Serial I/O	RS232C, RS485/422
Pressure units	hPa, mbar, kPa, Pa inHg, mmH_20, mmHg, torr, psia

	Class A	Class B
Resolution	0.01 hPa	0.1 hPa
Settling time at power-up (one sensor)	4 s	3 s
Response time (one sensor)	2 s	1 s

Acceleration sensitivity	negligible
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8" I.D. tubing or quick connector with shutoff valve for 1/8" hose
Maximum pressure limit	5000 hPa abs.
Compliance	EMC standard EN61326-1:1997 + Am1:1998 + Am2:2001: Industrial Environment

Mechanics

Housing material	G AlSi10 Mg (DIN 1725)
Housing classification	IP66
	IP65 (NEMA4) with local display
Weight	1 - 1.5 kg

Analog Output (optional)

Current output		0 ... 20 mA, 4 ... 20 mA
Voltage output		0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy at pressure range	500 ... 1100 hPa	50 ... 1100 hPa
at +20 °C	±0.30 hPa	±0.40 hPa
at -40 ... +60 °C	±0.60 hPa	±0.75 hPa

Accessories

Serial interface cable	19446ZZ
USB-RJ45 serial connection cable	219685
Software interface kit	215005
Wall mounting kit	214829
Outdoor installation kit (weather shield)	215109
Installation kit for pole or pipeline	215108
Power supply module	POWER-1
Temperature compensated analog output module	AOUT-1T
Isolated RS-485 module	RS485-1
DIN Rail Kit	215094

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

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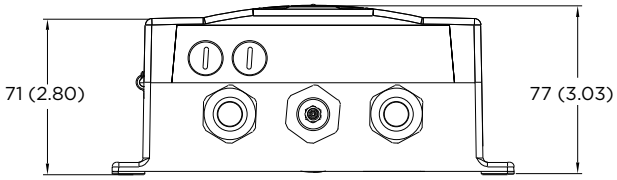
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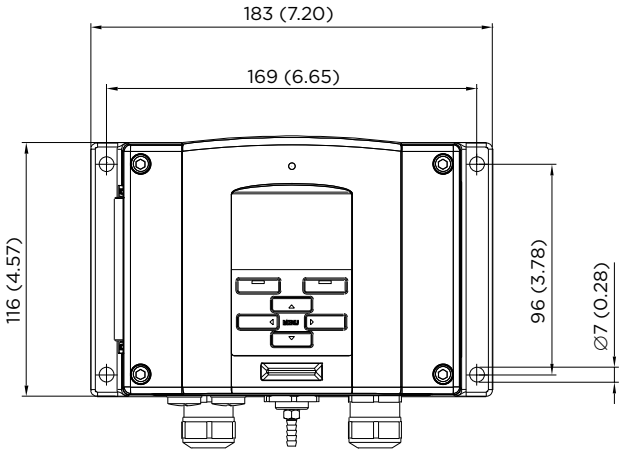
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Dimensional Drawings of the PTB330 Digital Barometer

Dimensions

Dimensions in mm (inches)





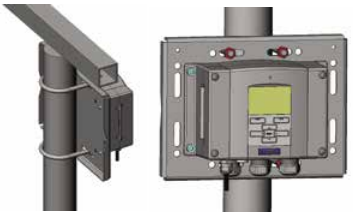
Mounting Options



Mounting with Wall Mounting Kit



Mounting with DIN Rail Installation Kit



Pole Installation with Installation Kit for Pole or Pipeline



Mounting Rain Shield with Installation Kit

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Take the Lab to the Field

Vaisala Barometric Pressure Transfer Standard PTB330TS



Operational PTB330TS unit includes a PTB330 digital barometer, hand-held MI70 indicator, optional HMP155 humidity and temperature probe, optional MI70 Link PC software, a user's guide and a weatherproof transfer case equipped with a shoulder strap.



PTB330TS transport case

Barometric Pressure Transfer Standard PTB330TS makes field inspection accurate and easy. It combines a PTB330 digital barometer with a hand-held MI70 indicator within a portable unit functioning as a transfer standard. The optional HMP155 probe is available for accurate humidity and temperature measurement.

The PTB330TS is suitable for various reference measurements in industrial and meteorological areas.

The PTB330TS comes in a durable and weatherproof transport case that can be easily carried and shipped. The components are placed in a proofing foam interior, with accessories and user's guide placed in the lid organizer. The case includes a separate inner tabletop case in which the barometer is mounted. Shoulder strap is included for convenience. Battery duration is up to 11 hours of continuous use and up to 30 days in data logging use.

Features / Benefits

- Portable, battery operated transfer standard with data logging capability
- Barometric pressure with Vaisala BAROCAP® Digital Barometer PTB330
  - Excellent long term stability
  - Accurate measurements
  - Added reliability through redundancy
- Optional humidity and temperature measurements with HMP155
  - Vaisala HUMICAP®180R sensor - superior long-term stability
  - New, fast temperature probe
  - Chemical purge
- Multilingual user interface, nine languages
- Data can be logged, and transferred to a PC via MI70 Link software
- SO/IEC 17025 Accredited calibration services available
- For professional meteorology, aviation, laboratories and demanding industrial applications

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The PTB330 Digital Barometer



The HMP155 probe



The MI70 hand-held indicator displaying the prevailing pressure in hPa

PTB330 Digital Barometer

Vaisala BAROCAP® Digital Barometer PTB330 is a new generation barometer designed for a wide range of high-end atmospheric pressure measurement. The pressure measurement of the PTB330 is based on the Vaisala in-house, silicon capacitive, absolute pressure sensor – the Vaisala BAROCAP® Sensor. It provides high measurement accuracy and excellent long-term stability.

High Accuracy

The PTB330 series features extremely high accuracy. Class A barometers for the most demanding applications are fine-adjusted and calibrated against a high-precision pressure calibrator. All the PTB330 barometers come with a NIST traceable, factory calibration certificate, also optional ISO/IEC 17025 accreditation calibration services are available.

Reliability through Redundancy

According to customers' choice, the PTB330 can incorporate one, two or three BAROCAP® sensors. When two or three sensors are used, the barometer continuously compares the readings of the pressure sensors against one another and provides information on whether these are within the set internal difference criteria. This unique feature provides redundancy in pressure measurement. Thus, users get a stable and reliable pressure reading at all times as well as a pre-indication of when to service or re-calibrate the barometer.

Optional HMP155 Humidity and Temperature Probe

The new Vaisala HUMICAP® Humidity and Temperature Probe HMP155 provides reliable humidity and temperature measurement.

Long-Term Stability

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

Fast Temperature Measurement

What's more, with its fast response time, the additional temperature probe for the HMP155 is ideal for measurement in environments with rapidly changing temperatures.

MI70 Hand-Held Indicator for Spot-Checking Applications

The Vaisala Measurement Indicator MI70 is a user-friendly indicator for demanding spot-checking measurements. It is ideal for field checking and calibration of Vaisala's fixed instruments.

Easy-to-Use User Interface and Three-Variable Display

The MI70 features a multilingual, menu-based user interface, and a clear graphical LCD display. Overall three measurement parameters can be displayed and logged into the meter's memory at the same time. One or two probes or transmitters can be connected simultaneously.

MI70 Link

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

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Vaisala Barometric Pressure Transfer Standard PTB330TS

Technical Data

These specifications apply when MI70, PTB330 and HMP155 are used together in the PTB330TS product. For individual specifications, please refer to the product documentation and brochures of the PTB330 and HMP155.



General

Operating temperature range	-10 ... +40 °C (+14 ... +104)°F
Operating humidity range	non-condensing
Maximum pressure limit	5000 hPa abs.
Power supply	Rechargeable NiMH battery pack with AC-adapter or 4xAA-size alkalines, type IEC LR6
Operation time (using rechargeable battery pack)	
Continuous use with PTB330	11 h typical at +20 °C (+68 °F)
Datalogging use	up to 30 days
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

PTB330TS is in conformity with the following EU directives:
- EMC Directive (2004/108/EC) Complies with the EMC product family standard EN61326-1, Electrical equipment for measurement control and laboratory use - Basic immunity test requirements.
- Low Voltage Directive (2006/95/EC)
- ROHS Directive (2002/95/EC)

Performance

Barometric Pressure (PTB330)

Measurement range	500 ... 1100 hPa
Linearity*	±0.05 hPa
Hysteresis*	±0.03 hPa
Repeatability*	±0.03 hPa
Calibration uncertainty**	±0.07 hPa
Accuracy at +20 °C (+68 °F) ***	±0.10 hPa
Temperature dependence****	±0.1 hPa
Total accuracy -40... +60 °C (-40...+140 °F)	±0.15 hPa
Long-term stability	±0.1 hPa/year
Settling time at power-up (one sensor)	4 s
Response time (one sensor)	2 s
Acceleration sensitivity	negligible

* Defined as ±2 standard deviation limits of endpoint nonlinearity, hysteresis or repeatability error.
** Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.
*** Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.
**** Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

Relative Humidity (HMP155)

Measurement range	0 ... 100 %RH
Accuracy (incl. non-linearity, hysteresis and repeatability) at +15 ... +25 °C (+59 ... +77 °F)	
	±1 %RH (0 ... 90 %RH)
	±1.7 %RH (90 ... 100 %RH)
-10 ... +40 °C (-4 ... 104 °F)	±(1.0 + 0.008 x reading) %RH
Factory calibration uncertainty (+20 °C /+68 °F)	
	±0.6 %RH (0 ... 40 %RH)*
	±1.0 %RH (40 ... 97 %RH)*
Humidity sensor	HUMICAP180R HUMICAP180RC
Response time at +20 °C in still air with a sintered PTFE filter	
63 %	20 s
90 %	60 s

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

Temperature (HMP155)

Measurement range	-10 ... +40 °C (+14 ... +104 °F)
Accuracy	
-10 ... +20 °C	±(0.176 - 0.0028 x temperature) °C
+20 ... +40 °C	±(0.07 + 0.0025 x temperature) °C
Accuracy over temperature range (see graph overleaf)	
Temperature sensor	Pt100 RTD Class F0.1 IEC 60751
Response time with additional temperature probe in 3 m/s air flow	
63 %	<20 s
90 %	<35 s

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Technical Data

Available Parameters

Pressure parameters	P, P3h, HCP, QFE, QNH
Humidity and temperature parameters	RH, T, Tdf, Td, x, Tw

Inputs and Outputs

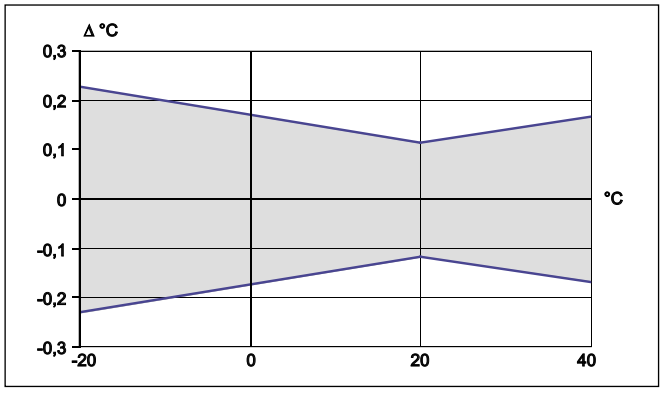
MI70 probe ports	2
MI70 data interface	RS-232 (accessible only with MI70 Link software)
PTB330 supply voltage	10 ... 35 VDC (if not powered by MI70)
PTB330 data interface	RS-232C
PTB330 serial I/O connectors	RJ45 (service port) Male 8-pin M12 (user port)
HMP155 data interface	RS-485
HMP155 serial I/O connector	Male 8-pin M12

Mechanics

PTB330	
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP65
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8" I.D. tubing or quick connector with shutoff valve for 1/8" hose
HMP155	
Housing material	PC
Housing classification	IP66
Additional T-probe cable length	2 m
Cable material	PUR
Sensor protection	Sintered PTFE
MI70 MEASUREMENT INDICATOR	
Housing classification	IP54
Housing material	ABS/PC blend
TRANSPORT CASE	
Housing classification (when closed)	IP67
Plastic parts	TTX01®, PP+SEBS, POM
Metal parts	stainless steel AISI303
Interior foam material	PE and polyether
Weight with all instruments and typical accessories	5.9 kg
Exterior dimensions (LxWxH)	405×330×165 mm (15.94×12.99×6.50) inch

Accessories

PTB330	
MI70 – PTB330 Spiral Cable	223235SP
USB-RJ45 serial connection cable	219685
Serial connection cable	19446ZZ
Barbed fitting 1/8"	19498SP
Quick Connector 1/8"	220186
Transport case with interior foams and tabletop casing for PTB330	224068SP
Tabletop casing for PTB330	224064SP
MI70	
USB cable for MI70, includes MI70 Link software	219687
MI70 Link software	MI70LINK
MI70 connection cable to HMT330, MMT330, DMT340, HMT120/130, HMT100, PTB330	211339
MI70 battery pack	26755
variety of AC adapters available	
HMP155	
HMP155 – MI70 connection cable	221801
Protection set for HMP155 calibration buttons: protective cover, 2 O-rings and protective plug	221318
USB cable for HMP155	221040
Sintered teflon filter + O-ring	219452SP
Humidity sensor	HUMICAP180R
Humidity Calibrator	HMK15



Accuracy of HMP155 temperature measurement over temperature range

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PTB210 Digital Barometer



The Vaisala BAROCAP® Digital Barometer PTB210 is a reliable outdoor barometer that withstands harsh conditions.



The PTB210 paired with the SPH10 Static Pressure Head.

For Harsh Environments

The Vaisala BAROCAP® Digital Barometer PTB210 is ideal for outdoor installations and harsh environments. The barometers are designed to operate in a wide temperature range, and the electronics housing provides IP65 (NEMA 4) standardized protection against sprayed water.

Features/Benefits

- 500 ... 1100 hPa or 50 ... 1100 hPa pressure ranges with serial output
- Different scalings between 500 ... 1100 hPa with analog output
- Electronics housing IP65 protected against sprayed water
- Accurate and stable measurement
- NIST traceable (certificate included)

The PTB210 barometers are ideal for use in applications such as weather stations, data buoys and ships, airports, and agrology. They are also an excellent solution for monitoring barometric pressure in industrial equipment such as laser interferometers and engine test benches.

Several Pressure Ranges

The PTB210 barometers are designed for various pressure ranges. They are available in two basic configurations: serial output for 500 ... 1100 hPa and 50 ... 1100 hPa and analog output with different scalings between 500 ... 1100 hPa.

Accurate and Stable Measurement

All the PTB210 barometers are digitally adjusted and calibrated by using electronic working standards. A higher accuracy barometer, that is fine-tuned and calibrated against a High Precision Pressure Calibrator, is available for the 500 ... 1100 hPa pressure range.

In addition, the PTB210 integrates directly with Vaisala Static Pressure Head Series SPH10/20. This pairing offers accurate measurement in all wind conditions.

Vaisala BAROCAP® Technology

The PTB210 barometers use the Vaisala BAROCAP® Sensor, a silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure applications. The Vaisala BAROCAP® Sensor provides excellent hysteresis and repeatability characteristics and outstanding temperature and long-term stability. All PTB210 barometers are delivered with a factory calibration certificate which is NIST traceable.

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Technical Data

Operating Range (1hPa=1mbar)

Pressure range (order specified)	
serial output	500 ... 1100 hPa
	50 ... 1100 hPa
analog output	500 ... 1100 hPa
	600 ... 1060 hPa
	800 ... 1060 hPa
	900 ... 1100 hPa
Operating temperature range	-40 ... +60 °C (-40 ... +140 °F)
Humidity range	non-condensing

Accuracy

SERIAL OUTPUT (units in hPa)			
Pressure range	500 ... 1100		50 ... 1100
	Class A	Class B	
Non linearity*	± 0.10	± 0.15	± 0.20
Hysteresis*	± 0.05	± 0.05	± 0.10
Repeatability*	± 0.05	± 0.05	± 0.10
Calibration uncertainty**	± 0.07	± 0.15	± 0.20
Accuracy at +20 °C (+68 °F)***	± 0.15	± 0.20	± 0.35
Temperature dependence****	± 0.20	± 0.20	± 0.40
Total accuracy***	± 0.25	± 0.30	± 0.50
-40 ... +60 °C (-40 ... +140 °F)			
Long term stability (hPa/year)	± 0.10	± 0.10	± 0.20

ANALOG OUTPUT	
Non linearity*	± 0.20 hPa
Hysteresis*	± 0.05 hPa
Repeatability*	± 0.05 hPa
Calibration uncertainty**	± 0.15 hPa
Accuracy at +20 °C (+68 °F)***	± 0.30 hPa
Temperature dependence****	± 0.50 hPa
Total accuracy*** -40 ... +60 °C (-40 ... +140 °F)	± 0.60 hPa
Long term stability	± 0.10 hPa/year

* Defined as the ±2 standard deviation limits of end point non-linearity, hysteresis error or repeatability error.
** Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.
*** Defined as the root sum of the squares (RSS) of end point non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.
**** Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

General

(· Factory setting)

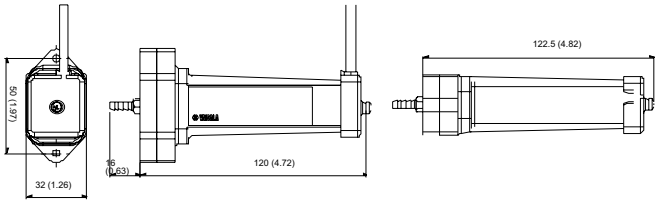
SERIAL OUTPUT	
Current consumption	
normal mode	< 15 mA·
power down mode	< 0.8 mA
shutdown mode	0.2 mA
Shutdown	ON/OFF
Settling time at power up	2 s
Serial I/O (factory setting·)	RS232C
	RS232C /TTL (optional)
	RS485, non isolated (optional)
parity	none, even·, odd
data bits	7·, 8
stop bits	1·, 2
Baud rate	1200, 2400, 4800, 9600·, 19200
Response time	1 s·
Resolution	0.01 hPa (1 measurement/s)
	0.03 hPa (10 measurements/s)

ANALOG OUTPUT	
Outputs	0 ... 5 VDC, 0 ... 2.5 VDC (order specified)
Current consumption	
normal mode	< 8 mA
shutdown mode	0.2 mA
Shutdown	ON/OFF
Response time	500 ms
Resolution	300 µV
Measurement rate	3 measurements/s

ALL MODELS	
Supply voltage (reverse polarity protected)	
with RS232/TTL output	5 ... 28 VDC
with RS485 or analog output	8 ... 18 VDC
Max. pressure	5 000 hPa abs.
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8" I.D. tubing
Housing	
electronics	IP65 (NEMA 4)
sensor	IP53
Housing material	PC plastic
Supply/output cable length	1, 2, 3, 5 or 10 m
Instrument	110 g
Cable	28 g/m
Electromagnetic compatibility	Complies with EMC standard EN61326-1, Generic Environment

Dimensions

Dimensions in mm (inches)



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PTB110 Barometer for Industrial Use



The Vaisala BAROCAP® Barometer PTB110 offers outstanding long-term stability.

Features/Benefits

- Vaisala BAROCAP® sensor
- Several pressure ranges
- Accuracy ±0.3 hPa at +20 °C
- Long-term stability
- On/off control with external trigger
- Output voltage 0 ... 2.5 or 0 ... 5 VDC
- Current consumption less than 4 mA
- Mountable on a (35 mm wide) DIN rail
- NIST traceable (certificate included)

PTB110

The Vaisala BAROCAP® Barometer PTB110 is designed both for accurate barometric pressure measurements at a room temperature and for general environmental pressure monitoring over a wide temperature range.

Vaisala BAROCAP® Technology

The PTB110 barometer uses the Vaisala BAROCAP® Sensor, a silicon capacitive absolute pressure sensor developed by Vaisala for barometric pressure measurement applications.

The sensor combines the outstanding elasticity characteristics and mechanical stability of single-crystal silicon with the proven capacitive detection principle.

Accuracy and Stability

The excellent long-term stability of the barometer minimizes or even removes the need for field adjustment in many applications.

Applications

The PTB110 is suitable for a variety of applications, such as environmental pressure monitoring, data buoys, laser interferometers, and in agriculture and hydrology.

The compact PTB110 is especially ideal for data logger applications as it has low power consumption. Also an external On/Off control is available. This is practical when the supply of electricity is limited.

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Technical Data

Operating Range (1 hPa=1mbar)

Pressure ranges	500 ... 1100 hPa
	600 ... 1100 hPa
	800 ... 1100 hPa
	800 ... 1060 hPa
	600 ... 1060 hPa
Temperature range	-40 ... +60 °C (-40 ... +140 °F)
Humidity range	non-condensing

General

Supply voltage	10 ... 30 VDC
Supply voltage control	with TTL level trigger
Supply voltage sensitivity	negligible
Current consumption	less than 4 mA
in shutdown mode	less than 1 µA
Output voltage	0 ... 2.5 VDC
	0 ... 5 VDC
Output frequency	500 ... 1100 Hz
Resolution	0.1 hPa
Load resistance	minimum 10 kohm
Load capacitance	maximum 47 nF
Settling time	1 s to reach full accuracy after power-up
Response time	500 ms to reach full accuracy after a pressure step
Acceleration sensitivity	negligible
Pressure connector	M5 (10-32) internal thread
Pressure fitting	barbed fitting for 1/8"
Minimum pressure limit	0 hPa abs
Maximum pressure limit	2000 hPa abs
Electrical connector	removable connector for 5 wires (AWG 28 ... 16)
Terminals	Pin 1: external triggering Pin 2: signal ground Pin 3: supply ground Pin 4: supply voltage Pin 5: signal output
Housing material, plastic cover	ABS/PC blend
Housing classification	IP32
Metal mounting plate	Al
Weight	90 g
Electromagnetic compatibility	Complies with EMC standard EN 61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements - for use in industrial locations

Accuracy

Linearity*	±0.25 hPa
Hysteresis*	±0.03 hPa
Repeatability*	±0.03 hPa
Pressure calibration uncertainty**	±0.15 hPa
Voltage calibration uncertainty	± 0.7 mV
Frequency calibration uncertainty	± 0.3 Hz
Accuracy at +20 °C***	±0.3 hPa

* Defined as ±2 standard deviation limits of end-point non-linearity, hysteresis error or repeatability error.

** Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.

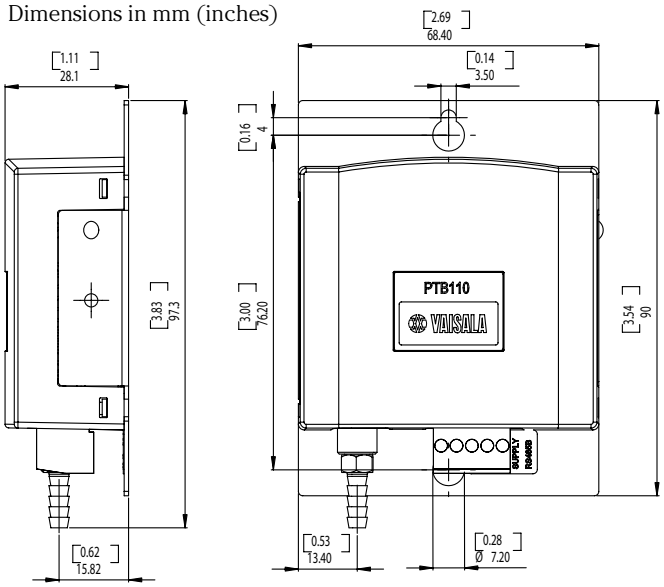
*** Defined as the root sum of the squares (RSS) of end-point non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature when using voltage output.

TOTAL ACCURACY AT

+15 ... +25 °C (+59 ... +77 °F)	±0.3 hPa
0 ... +40 °C (+32 ... +104 °F)	±0.6 hPa
-20 ... +45 °C (-4 ... +113 °F)	±1.0 hPa
-40 ... +60 °C (-40 ... +140 °F)	±1.5 hPa
Long-term stability	±0.1 hPa/year

Dimensions

Dimensions in mm (inches)



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SPH10/20 Static Pressure Heads for Minimizing Wind Induced Error

Wind induced effects are one of the main sources of error when measuring barometric pressure. Variations due to strong and gusty wind can be overcome by using a static pressure head to 'filter out' the effect of dynamic pressure.

The Vaisala Static Pressure Head Series SPH10/20 are designed to minimize the errors caused by wind. The wind tunnel tested structure is both horizontally and vertically symmetrical. This design ensures reliable barometric pressure measurements in all weather.

Ideal for Outdoor Installations

Vaisala's static pressure heads are available in two models: the Vaisala Static Pressure Head SPH10 is a basic version, and the Vaisala Static Pressure Head SPH20 is a heated version for reliable operation in snowy and icy conditions. The warmed SPH20 contains a thermostat that switches on the warming power at temperatures, where the risk of icing may occur.

Composed of ultraviolet stabilized PC plastics and offshore aluminium, the SPH10/20 static pressure heads are durable and weather resistant.

The SPH10/20 protects against rain and condensed water, thus preventing capillary condensation of a water column in the pressure channel which results in pressure error. The drain holes in the lower plate allow rain and water to flow out. The static pressure heads have internal netting which prevents insects and debris from blocking the pressure channel.

Carefree Maintenance

The SPH10/20 static pressure heads are easy to install and disassemble, service and clean – even at the installation site. Vaisala BAROCAP® Digital Barometer PTB210 can be installed directly on top of the SPH10/20 static pressure heads. Other barometers can be connected to the heads with pressure tubing.

SPH10 and SPH20 are a perfect pair for all Vaisala barometers. They ensure an accurate and reliable measurement in all weather conditions.



The SPH10/20 is easy to install and connect. In the picture, a SPH10 is connected to a PTB210 barometer.

Features/Benefits

- Minimizes wind induced error
- Reliable barometric pressure measurement in all weather
- Wind tunnel tested structure
- Easy-to-clean
- Easy-to-install

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Technical Data

General

Operating temperature	-60 ... +80 °C (-76 ... +176 °F)
Weight	
SPH10	800 g
SPH20	1360 g
Material	PC plastic, offshore aluminium
Mounting	with 2 bolts (M6 X 20 mm min)
Hose connection	barbed fitting for 4 mm I.D. hose or Rp1/4 thread (parallel)

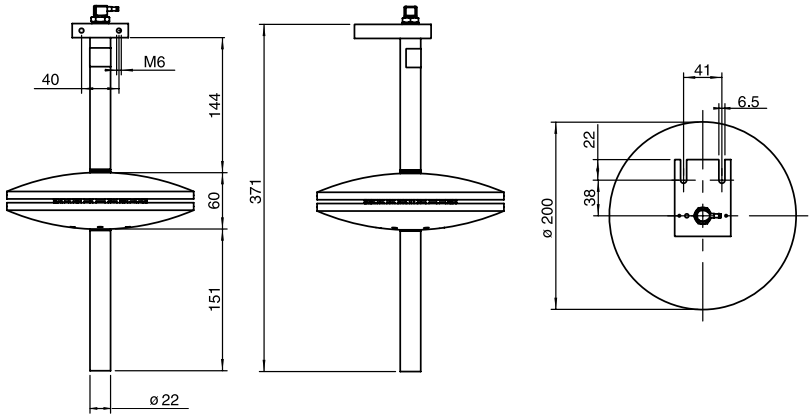
SPH20

Electrical connections	M12 connector
Power supply	factory setting 12 V
	changed connection 24 V
Thermostat switching temperature	
On	+4 °C (±3 °C)
	+39.2 °F (±4.4 °F)
Off	+13 °C (±3 °C)
	+55.4 °F (±4.4 °F)
Power consumption during heating	70 W

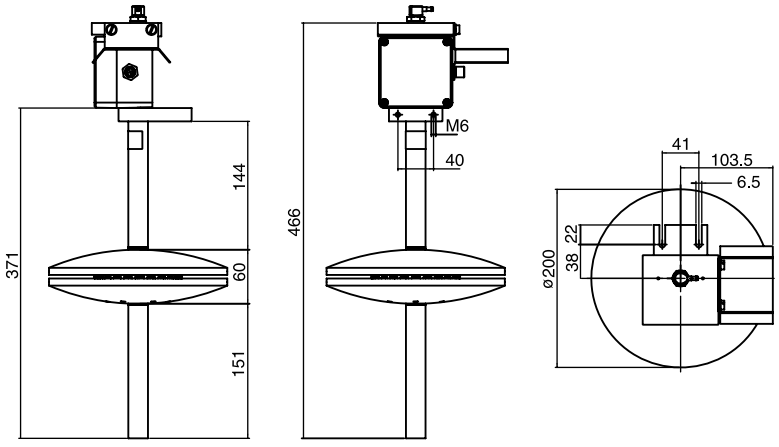
Dimensions

Dimensions in mm

SPH10



SPH20



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Vaisala Differential Pressure Transmitter PDT102



Vaisala Differential Pressure Transmitter PDT102 with process valve actuator and test jacks.

Features

- In-place system calibration and on-line monitoring without disturbing process tubes with optional process valve actuator and test jacks
- Ultrathin profile ideally suited for DIN rail mount reduces installation and calibration costs
- High accuracy, two options; 0.25% or 0.50% of span designed for use in critical monitoring of cleanrooms for pharmaceutical, biotechnology, medical device and semiconductor controlled manufacturing environments
- Extremely robust MEMS silicon sensor technology provides very high accuracy, sensitivity, stability and durability
- NIST traceable 9 point calibration with certificate
- Front side accessible zero and span adjustment potentiometers

Operating Environment

Vaisala Differential Pressure Transmitter PDT102 is a high performance instrument designed primarily for life science and high technology cleanroom applications. The front panel includes zero and span adjustment potentiometers for convenient adjustment. The PDT102 transmitter is ideal for incorporating into the Vaisala Veriteq Continuous Monitoring System to measure and monitor the critical environmental parameters as required in regulated environments.

Performance

The PDT102 offers very high accuracy, sensitivity and stability with two options for accuracy, 0.25% or 0.50% of span providing a highly reliable and repeatable measurement. The sensor uses a micro-machined, ultra-thin silicon diaphragm which provides inherent sensor repeatability and stability. The sensor enables precise measurement and control in high performance cleanrooms. The PDT102 transmitter is available with voltage output (3-wire) or current output (2-wire).

Available Options

Online monitoring of the PDT102 is simple using the optional process valve actuator and the front access test jacks. The front access test jacks provide online process reference signal or calibration signal without disconnecting power supply wiring. Measurements can be made using a standard multimeter.

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Technical Data

Performance

Measurement ranges (bidirectional)	±50 Pa ±0.25 in H_2O
Overpressure	
proof pressure	0.7 bar
burst pressure	1.7 bar
static pressure	1.7 bar
Pressure type	differential, gauge, vacuum and compound
Accuracy (incl. non-linearity, hysteresis, repeatability and zero/span calibration settings)	0.25 % span or 0.5 % span, depending on choice
Repeatability	
for 0.25 % span accuracy	0.03 %
for 0.5 % span accuracy	0.05 %
Electrical resolution	1 x 10^{-4} span
Long-term stability	≤0.5 % span/year
Response time (10 ... 90 %)	250 ms
Warm-up time	15 s
Compensated temperature range	+2 ... +57 °C (+35.6 ... +134.6 °F)
Temperature dependence	±(0.036 Pa + 0.036 % of reading) / °C or ±(0.0001 in H_2O + 0.02% of reading) /°F (reference 21 °C or 70 °F)
Mounting position error (zero adjustable)	≤0.25 %
Adjustments (front accessible)	
zero	±5 % span
span	±3 % span

Operating Environment

Operating temperature	-29 ... +70 °C (-20.2 ... +158 °F)
Storage temperature	-40 ... +82 °C (-40 ... +179.6 °F)
Electromagnetic compatibility (EN 61326-1), basic immunity test requirements	

Note: If used in an electromagnetic field of 3 V/m, with narrow frequency area of 80 - 120 Mhz, it is possible that the current output of PDT102 can deviate max. 0.3% (with accuracy specified 0.25%).

Inputs and Outputs

Process connection	1/8 NPT female according to ANSI/ASME B1.20.1
Output signal	
2-wire	4 ... 20 mA
3-wire	0 ... 5 V
Operating voltage	12 ... 36 VDC
Max. loop resistance for 4 ... 20 mA	≤ (Supply voltage - 12V)/0.022 A
Supply current	
for 0 ... 5 V output	max. 10 mA
for 4 ... 20 mA output	max. 20 mA
Electrical connection	Screw terminals, 12 ... 22 AWG (0.33 up to 3.31 mm^2)

Mechanics

Medium (measured gas)	clean and dry air, non-conducting and non-corrosive gases
Material	
process connection	brass
sensor element	silicon, aluminium, glass
case	Polycarbonate, glass filled (UL94-V-1)
Mounting	DIN rail types EN 50022, EN 50035 and EN 50045
Housing classification	IP30
Weight	0.16 kg

Dimensions

Dimensions in mm

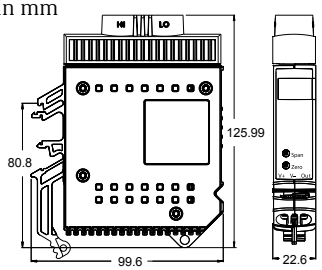


Figure 1

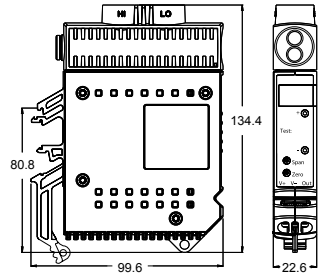


Figure 2 with Process Valve Actuator and Test Jacks

Order Information for PDT102

PDT102 - XXXT

Measurement range:
P (+/-50 Pa) or **W** (+/-0.25 in H_2O)

Accuracy: **2** (0.25 % span) or **5** (0.5 % span)

Output: **C** (current) or **V** (voltage)

Option: (blank) or **T**

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Vaisala Differential Pressure Transmitter PDT101



Vaisala Differential Pressure Transmitter PDT101 with current output (black) and voltage output (green).

Features

- Easy mounting on wall, DIN rail or panel
- 2 pressure ranges (Pa and in H_2O)
- 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)

Operating Environment

Vaisala Differential Pressure Transmitter PDT101 is designed especially for demanding life science and high technology cleanroom applications. The PDT101 transmitter is ideal for incorporating into the Vaisala Veriteq Continuous Monitoring System to measure and monitor the critical environmental parameters as required in regulated environments.

Performance

The PDT101 offers high accuracy, sensitivity and stability with accuracy 0.40% of span providing a highly reliable and repeatable measurement. The sensor uses a micro-machined, ultra-thin silicon diaphragm which provides inherent sensor repeatability and stability. The sensor enables precise measurement and control in high performance cleanrooms. The PDT101 transmitter is available with voltage output (3-wire) or current output (2-wire).

Zero and span adjustment screws are available on every PDT101 model. Both adjustments are accessible from the front of the unit.

Applications

The PDT101 is suitable for high performance cleanroom environments in the life science, semiconductor and electronics industries. As part of a continuous monitoring system, it is highly suitable for regulated environments where continuous, documented and redundant data is a requirement to meet FDA regulations. The compact design is well suited for mounting in a cleanroom or in the adjacent corridor with LED indicator lights for quick and easy power status spotcheck.

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Technical Data

Performance

Measurement ranges (bidirectional)	±60 Pa ±0.25 in H_2O
Overpressure	
proof pressure	1.0 bar
burst pressure	1.7 bar
static pressure	1.7 bar
Pressure type	differential, gauge, vacuum and compound
Accuracy (incl. non-linearity, hysteresis, repeatability and zero/span calibration settings)	0.4 % span
Long-term stability	≤0.5 % span/year
Response time (10 ... 90 %)	250 ms
Warm-up time	15 s
Compensated temperature range	+2 ... +54 °C (+35.6 ... +129.2 °F)
Temperature dependence	±(0.065 Pa + 0.054 % of reading) / °C or ±(0.00015 in H_2O + 0.03 % of reading) / °F (reference 21 °C or 70 °F)
Mounting position error (zero adjustable)	≤1 %/g (calibration in vertical position is standard)
Adjustments (front accessible)	
zero	±5 % span
span	±3 % span

Operating Environment

Operating temperature	-18 ... +70 °C (-0.4 ... +158 °F)
Storage temperature	-40 ... +82 °C (-40 ... +179.6 °F)
Electromagnetic compatibility (EN 61326-1), basic immunity test requirements	

Note: If used in an electromagnetic field of 3 V/m, with narrow frequency area of 80 - 120 Mhz, it is possible that the current output of PDT101 can deviate max. 0.8% (with accuracy specified 0.4%).

Inputs and Outputs

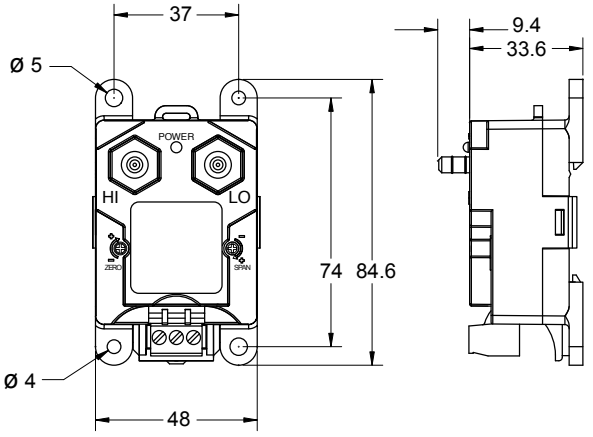
Process connection	1/4" barbed fittings
Output signal	
2-wire	4 ... 20 mA
3-wire	0 ... 5 VDC (user selectable 0 ... 10 VDC)
Operating voltage	
2-wire output 4 ... 20 mA	12 ... 36 VDC
3-wire output 0 ... 5 VDC	11.5 ... 36 VDC
3-wire output 0 ... 10 VDC	14 ... 36 VDC or 24 VAC
Max. loop resistance for 4 ... 20 mA	≤ (Supply voltage - 12V)/0.022 A
Supply current	max. 20 mA for 4 ... 20 mA output signal
Optical process diagnostics	LED visual indicator
Electrical connection	Euro style pluggable terminal block accepts 12...26 AWG wire (0.13 up to 3.31 mm^2)

Mechanics

Medium (measured gas)	clean and dry air, non-conducting and non-corrosive gases
Material	
process connection	brass
sensor element	silicon, aluminium, glass
case	NEMA type 1 fire-retardant ABS 1 (meets UL94-5VA)
Mounting	threaded fastener for wall mounting or DIN rail type EN50022
Housing classification	IP40
Weight	0.07 kg

Dimensions

Dimensions in mm



Order Information for PDT101

PDT101 - XXX

Measurement range: **P** (+/-60 Pa) or **W** (+/-0.25 in H_2O)

Accuracy: **4** (0.4 % span)

Output: **C** (current) or **V** (voltage)

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Vaisala Wind and Weather Sensor Technologies for Measurements in Industrial Applications







Vaisala's long history in wind and weather measurements started already in the 1930s from the development of a radiosonde to measure the conditions in the upper atmosphere. Today, Vaisala wind and weather instruments are used in dozens of applications and industries all over the world.

Industrial Applications for Wind and Weather Measurements

Wind and weather data are required in many activities across industries. For example, in power industry, the efficiency of power lines is a function of wind speed and direction.

Nuclear power plants require wind data for safety reasons to be able to model the dispersion of potentially radioactive leakages. In addition to nuclear power plants, also chemical factories need to gather wind data for dispersion monitoring.

Accurate outdoor measurements are essential in operating modern buildings. Processes such as free cooling, natural ventilation, and automated shading are dependent on real-time weather data. Ventilation control in greenhouses also relies on localized weather data to ensure an optimized environment for plant growth.

Vaisala Wind and Weather Instruments

Vaisala manufactures wind and weather instruments for different applications, requirements and budgets. The wind sensor portfolio for industrial applications includes both mechanical and ultrasonic sensors. View the complete range of wind products at **www.vaisala.com/wind**. Have a look at the multiparameter Vaisala Weather Transmitter WXT530 at **www.vaisala.com/wxt530**.

Vaisala Ultrasonic Wind Sensors in Brief

- Wind sensor with no moving parts
- Unique triangular design for accurate measurements from all directions
- Optional sensor heating available
- Maintance free, no field calibration required
- Measurement range up to 75 m/s

Vaisala Mechanical Wind Sensors in Brief

- Accurate wind speed and direction sensors
- Fast and linear response
- Low measurement starting treshold
- Sensors with heating elements available for cold climates

Vaisala Weather Sensor in Brief

- Measurement of the six essential weather parameters: wind speed and direction, liquid precipitation, barometric pressure, temperature, and relative humidity
- Feature proprietary Vaisala sensor technologies: WINDCAP®, RAINCAP®, HUMICAP®, and BAROCAP®

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Vaisala Sensor Technologies for Wind and Rain Measurements

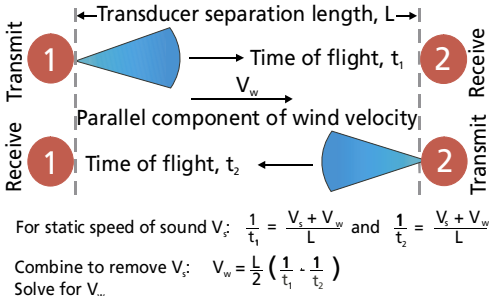
Vaisala WINDCAP® Sensor

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 treshold.

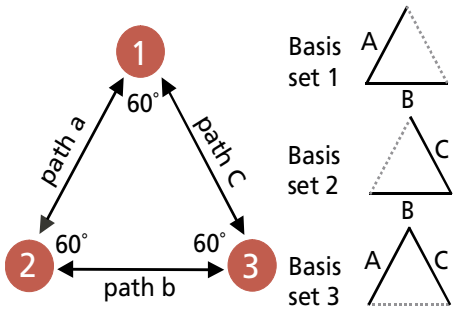
How It Works

WINDCAP® sensor features an array of three ultrasonic transducers oriented to form an equilateral triangle. Wind measurement is based on time of flight (TOF) of the sonic impulse - the time it takes for the signal to travel from one transducer to another. TOF is measured in both directions for each pair of transducer heads. Simple algebra allows solving for the parallel component of wind velocity independently of the static speed of sound.

The equilateral triangle configuration of the three



transducers provides three possible sets of basis vectors. The combinations yield bi-directional measurements on the paths labeled A, B and C. These measurements are used to determine the wind velocity components parallel to each of the three paths.



Vaisala RAINCAP® Sensor

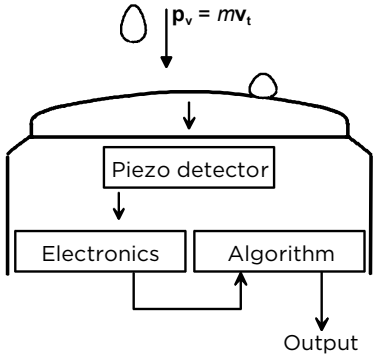
Vaisala RAINCAP® Sensor is an acoustic sensor that measures the impact of individual raindrops on a smooth stainless steel surface using a piezoelectric detector. The sensor provides real time information on rain intensity, duration, and accumulated rainfall.

How It Works

The RAINCAP® sensor consists of a round stainless steel cover, approximately 90 mm in diameter mounted to a rigid frame. A piezoelectric detector is located beneath the cover.

Raindrops hit the RAINCAP® sensor surface at terminal velocity, which is a function of the raindrop diameter. Rain measurement is based on acoustic detection of each individual rain drop as it impacts the sensor cover. Larger drops create a larger acoustic signal than smaller drops.

The piezoelectric detector converts the acoustic signals into voltages. Total rain is calculated from the sum of the individual voltage signals per unit time and the known surface area of the RAINCAP® sensor. In addition, the intensity and duration of rain can be calculated.



Pv = vertical momentum
m = mass of drop
v_t = terminal velocity of drop

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Vaisala Weather Transmitter WXT530 Series



Benefits

- Right parameter combination
- Easy to use and integrate
- Weather parameter hub
- Analog sensors can be added
- Compact, light-weight
- Low power consumption
- mA output suitable for industrial applications
- Cost effective
- DNV GL Type Examination

The Vaisala Weather Transmitter WXT530 is a unique series of sensors with parameter combinations that allows you to choose what is right for your application. The WXT530 Series is the flexible, integrated building block for weather applications. The WXT530 Series improves your grip on weather.

Flexibility

The WXT530 is a series of weather instruments that provides six of the most important weather parameters, which are 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. There is a heated option available. Low power consumption enables solar panel applications. The Vaisala 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 the Weather Transmitter WXT530 into a small, cost effective weather parameter hub. Additional parameters include the solar radiation and external temperature sensor. Further, the analog mA output for wind speed and direction enables wide variety of industrial applications. The WXT530 exceeds IEC60945 maritime standard.

Solid Performance

The WXT530 Series has a unique Vaisala solid state sensor technology. To measure wind the ultrasonic Vaisala WINDCAP 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.

DNV GL TYPE EXAMINATION
CERTIFICATE No. TAA00000VF

WXT530 Weather Transmitter Series





WXT534

MEASURES:

- Air Pressure
- Temperature
- Humidity



WXT535

MEASURES:

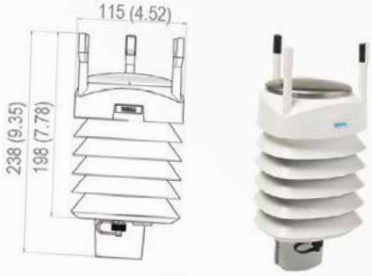
- Air Pressure
- Temperature
- Humidity
- Rainfall



WXT536

MEASURES:

- Air Pressure
- Temperature
- Humidity
- Rainfall
- Wind Speed
- Wind Direction



Analog Inputs





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Technical Data

Wind

WIND SPEED	
Range	0 ... 60 m/s
Response time	0.25 s
Available variables	average, maximum, and minimum
Accuracy	±3 % at 10 m/s
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
Output resolution	1°

Precipitation

RAINFALL	Cumulative accumulation after the latest auto or manual reset
Collecting area	60 cm^2
Output resolution	0.01 mm (0.001 in)
Field accuracy for long-term accumulation	Better than 5 %, weather dependent
RAIN DURATION	Counting each 10-second increment whenever droplet detected
Output resolution	10 s
RAIN INTENSITY	Running 1-minute average in 10-second steps.
Range	0 ... 200 mm/h (broader range with reduced accuracy)
Output resolution	0.1mm/h, 0.01 inches/h
HAIL	counting each 10-second increment whenever hailstone is detected
Output resolution	0.1 hits/cm^2, 0.01 hits/in^2, 1 hits
HAIL DURATION	counting each 10-second increment whenever hailstone is detected
Output resolution	10 s
HAIL INTENSITY	1-minute running average in 10-second steps
Output resolution	0.1 hits/cm^2h, 1 hits/in^2h, 1 hits/h

Barometric Pressure

Range	600 ... 1100 hPa
Accuracy (for sensor element)	±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

Range	-52 ... +60 °C (-60 ... +140 °F)
Accuracy (for sensor element) at +20 °C (+68 °F)	±0.3 °C (0.17 °F)
Output resolution	0.1 °C (0.1 °F)

Relative Humidity

Range	0 ... 100 %RH
Accuracy (for sensor element)	±3 %RH at 0 ... 90 %RH ±5 %RH at 90 ... 100 %RH
Output resolution	0.1 %RH

Inputs and Outputs

Operating voltage	6 ... 24 VDC (-10% ... +30%)
Average current consumption	
Minimum	0.1 mA @ 12 VDC (SDI-12 standby)
Typical	3.5 mA at 12 VDC (with typically measuring intervals)
Maximum	15 mA @ 6 VDC (with constant measurement of all parameters)
Heating	Options: DC, AC, full-wave rectified AC
Typical voltage	12 ... 24 VDC / 12 ... 17 VACrms (-10% ... +30%)
Typical current	0.8 A @ 12 VDC : 0.4 A @ 24 VDC
Digital outputs	SDI-12, RS-232, RS-485, RS-422
Communication protocols	SDI-12 v1.3, ASCII automatic & polled, NMEA 0183 v3.0 with query option

Analog Input Options

Solar radiation	CMP3
Level measurement	IRU-9429
Tipping Bucket Rain Gauge	RG13
Temperature	PT1000

Analog mA Output Options

Wind speed	0 ... 20 mA or 4 ... 20 mA
Wind direction	0 ... 20 mA or 4 ... 20 mA
Load impedance	200 Ω max

General Conditions

Housing protection class	IP65 (without mounting kit) IP66 (with mounting kit attached)
Storage temperature	-60 ... +70 °C (-76 ... 158°F)
Operating temperature	-52 ... +60 °C (-60 ... +140 °F)
Relative humidity	0 ... 100 %RH
Pressure	600 ... 1100 hPa
Wind	0 ... 60 m/s

Test Standards

EMC	IEC61326-1:2013; IEC60945:2008; IEC55022:2010 Class B
Environmental	IEC60068-2-1,2,6,14,30,31,52,78; IEC60529; VDA 621-415
Maritime	DNVGL-CG-0339; IEC60945

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WA15 Wind Set for High Performance Wind Measurement



The WA15 is based on accurate sensors installed on a large crossarm. It is designed for demanding wind measurement applications.

With a proven track record of successful installations, the Vaisala Wind Set WA15 has earned its reputation as the industry standard in the wind sensor market.

The WA15 consists of a Vaisala Anemometer WAA151, a Vaisala Wind Vane WAV151, an optional crossarm, a power supply and cabling.

Anemometer with Excellent Linearity

The WAA151 is a fast response, low-threshold anemometer. Three lightweight, conical cups mounted on the cup wheel, provide excellent linearity over the entire operating range, up to 75 m/s.

A wind-rotated chopper disc attached to the shaft of the cup wheel cuts an infrared light beam 14 times per revolution. This generates a pulse output from the phototransistor.

Features/Benefits

- High-performance wind measurement set
- Long and successful track record in meteorological applications
- Accurate wind speed and direction measurement
- Low measurement starting threshold
- Conical anemometer cups provide excellent linearity
- Heated shaft prevents bearings from freezing

The output pulse rate is directly proportional to wind speed (e.g. 246 Hz = 24.6 m/s). However, for the highest accuracy, the characteristic transfer function should be used to compensate for starting inertia.

Sensitive Wind Vane

The WAV151 is a counter-balanced, low-threshold, optoelectronic wind vane. Infrared LEDs and phototransistors are mounted on six orbits on each side of a 6-bit GRAY-coded disc. Turned by the vane, the disc creates changes in the code received by the phototransistors. The output code resolution is ±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.

The WHP151 power supply provides the operating and heating power needed for the WA15. The power supply, as well as the signal and power cables are available as options.

Technical Data

Vaisala Wind Set WA15

Options and Accessories

Crossarm and termination box	WAC151
16-lead signal cable	ZZ45048
6-lead power cable	ZZ45049
Crossarm and analog transmitter	WAT12
6-lead cable for signal and power	ZZ45049
Crossarm and serial RS485 transmitter	WAC155
Serial RS485 transmitter card	WAC155CB
Power supply	WHP151
Set of bearings and gasket	16644WA
Dimensions	
Junction box	125 x 80 x 57 mm
Crossarm length	800 mm
Mounting to a pole mast with a nominal outside diameter	60 mm
Cup assembly	7150WA
Tail assembly	6389WA

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Technical Data

Vaisala Anemometer WAA151

Wind Speed

Measurement range	0.4 ... 75 m/s
Starting threshold	< 0.5 m/s *
Distance constant	2.0 m
Characteristic transfer function	U = 0.328 + 0.101 × R
(where U = wind speed [m/s], R = output pulse rate [Hz])	
Accuracy (within range 0.4 ... 60 m/s)	
with characteristic transfer function	± 0.17 m/s **
with transfer function U = 0.1 × R	± 0.5 m/s***

General

Operating power supply	U_{in} = 9.5 ... 15.5 VDC, 20 mA typical
Heating power supply	AC or DC 20 V, 500 mA nominal
Output	0 ... 750 Hz square wave
Transducer output level	
with I_{out} < +5 mA	high state > U_{in}-1.5 V
with I_{out} > –5 mA	low state < 2.0 V
Settling time after power turn-on	< 30 µs
Plug 6-PIN	MIL-C-26482 type
Cabling	6-wire cable through crossarm
Recommended connector at cable end	SOURIAU MS3116F10-6P
Operating temperature with heating	-50 ... +55 °C (-58 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Material	
housing	AlMgSi, grey anodized
cups	PA, reinforced with carbon fibre
Dimensions	240 (h) × 90 (Ø) mm
Swept radius of cup wheel	91 mm
Weight	570 g

Test Compliance

Wind tunnel tests	ASTM standard method D5096-90
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3

Complies with EMC standard EN61326-1:1997 + Am1:1998 + Am2:2001; Generic Environment

* Measured with cup wheel in position least favoured by flow direction. Optimum position gives approx. 0.35 m/s threshold.

** Standard Deviation

*** Typical error vs. speed with the "simple transfer function" used.

RANGE (m/s)	0-3	3-10	10-17	17-24	24-31	31-37	37-44	44-51	51-58	58-65
ERROR (m/s)	-0.4	-0.3	-0.2	-0.1	0.0	+0.1	+0.2	+0.3	+0.4	+0.5

Vaisala Wind Vane WAV151

Wind Direction

Measurement range at wind speed 0.4 ... 75 m/s	0 ... 360°
Starting threshold	<0.4 m/s
Resolution	±2.8°
Damping ratio	0.19
Overshoot ratio	0.55
Delay distance	0.4 m
Accuracy	better than ±3°

General

Operating power supply	U_{in} = 9.5 ... 15.5 VDC, 20 mA typical
Heating power supply	AC or DC 20 V, 500 mA nominal
Output code	6-bit parallel GRAY
Output levels	
With I_{out} < +5 mA	high state > U_{in} –1.5 V
With I_{out} > –5 mA	low state < 1.5 V
Settling time after power turn-on	< 100 µs
Plug 10-PIN	MIL-C-26482 type
Cabling	10-wire cable through crossarm
Recommended connector at cable end	SOURIAU MS3116F12-10P
Operating temperature with heating	-50 ... +55 °C (-58 ... +131 °F)
Storage temperature	-60 ... +70 °C (-76 ... +158 °F)
Material	
housing	AlMgSi, grey anodized
wave	Alsi 12 anodized
Dimensions	300 (h) × 90 (Ø) mm
Swept radius of vane	172 mm
Weight	660 g

Test Compliance

Wind tunnel tests	ASTM standard method D5366-93
(for starting threshold, distance constant, transfer function)	
Exploratory vibration test	MIL-STD-167-1
Humidity test	MIL-STD-810E, Method 507.3
Salt fog test	MIL-STD-810E, Method 509.3

Complies with EMC standard EN61326-1:1997 + Am1:1998; Am2:2001; Generic Environment

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Ensure Long-term Data Accuracy

Even the best high-performance measurement instruments require regular calibration and maintenance to ensure they continue providing the most accurate data possible.

Why Calibrate

Vaisala's best-in-class measurement instruments provide the highest accuracy and precision across all types of applications.

But even the highest performing measurement instruments drift over time. Drift can be caused by dirt and chemicals in the ambient air or simply by temperature changes.

Regular calibration protects against incremental sensor drift and verifies that units are operating within the given specifications.

Choosing the right calibration laboratory and service supplier can be as important for lifetime accuracy and reliability as the initial selection of the instrument.

Our high-performance calibration laboratories were established in 1958 and we are continually improving our technology, facilities, and capabilities to provide the high-quality services you expect from Vaisala.





Accredited Calibration

Many industries are required by regulatory bodies to comply with strict quality standards. We offer calibration services accredited by the world's leading accreditation authorities. ISO/IEC 17025 is the international standard used to accredit testing and calibration laboratories for measured quantities.

Standard Calibration

Standard calibration is regularly performed on our instruments before they leave the factory, with the selected calibration points varying by instrument. In order to maintain accuracy and avoid sensor drift over time, the equivalent calibration can also be purchased later.

Our standard calibrations are traceable to national or international

Calibration Terminology

- **Calibration** – comparing the output of a measurement instrument against a reference instrument and reporting the result.
- **Adjustment** – changing the output to correspond to the output of a reference instrument.
- **Traceability** – a traceable measurement can be related to appropriate national or international standards through a documented, unbroken chain of comparisons.
- **Uncertainty** – a doubt that exists about the result of any measurement, calculated via three main sources: the reference used, the unit under calibration, and the calibration process used.
- **Calibration Interval** – the time between successive calibrations of an instrument.

Vaisala Calibration Includes:

- Calibration at Vaisala pre-selected points or customer-selected points within the instrument's measurement range
- Instrument adjustment
- Traceability to industry recognized standards
- Calibration certificate
- Service report
- Wearing parts
- Functionality testing according to manufacturer specification



standards and meet ISO 9001 quality management standards. Calibration services in our laboratory in Boston, USA also meet ANSI/NSCL Z540.1 requirements.

Custom Calibration

If specific calibration points critical to your operation are needed, we also offer custom calibration. Calibrating and adjusting your instrument specifically for the critical points where the product is used will ensure reliable and accurate measurement in your application.

Calibration as Part of Repair Services

If your instrument requires repairing, you can simply let us take care of it. The service includes repairing of the instrument with original parts, functionality testing and the calibration you need. You can be sure to receive the instrument in its original specification.

Premium & Calibration Care Agreements

As your instrument provider, we want to make sure that your instruments get the best possible care and you get the best possible value from your investment. For that reason we are offering two service options; Premium Care and Calibration Care.

Calibration Care:

Calibration Care is a multi-year calibration agreement with several benefits compared to single purchases of services, from discounted cost to priority service.

Premium Care:

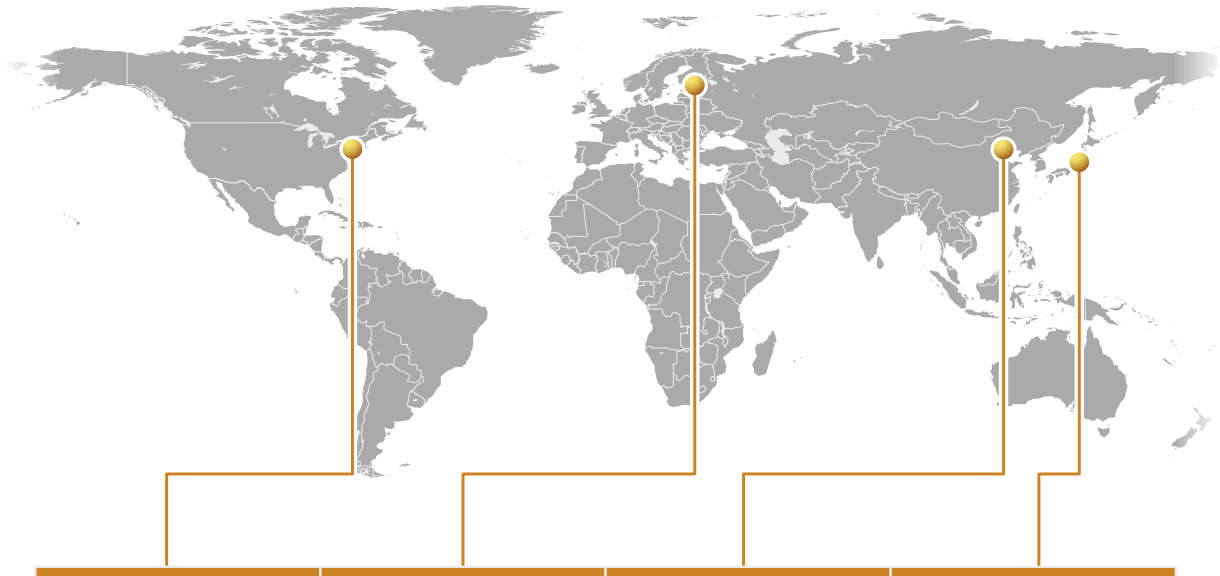
Premium Care protects your investment. If your product is damaged or broken for any reason, return it to us and we will repair or replace it free of charge. It's that simple.

Let us care for and protect your instruments!

Benefits	Calibration Care	Premium Care
Customer loyalty discounted pricing	✓	✓
No price changes during the multi-year agreement	✓	✓
Calibration settings pre-registered for efficient processing of all service orders	✓	✓
Free shipping, both to and from Vaisala	✓	✓
Priority handling of your order	✓	✓
Non-standard or special calibration requirements available	✓	✓
Full service with repairs and maintenance included		✓



Vaisala Service Centers



Boston, USA	Helsinki, Finland	Beijing, China	Tokyo, Japan
STANDARD CALIBRATION SERVICES			
Relative Humidity	Relative Humidity	Relative Humidity	Relative Humidity
Temperature	Temperature	Temperature	Temperature
Dew Point	Dew Point	Dew Point	Dew Point
Barometric Pressure	Barometric Pressure	Barometric Pressure	Barometric Pressure
Carbon Dioxide	Carbon Dioxide	Carbon Dioxide	Carbon Dioxide
ACCREDITED CALIBRATION SERVICES			
Relative Humidity	Relative Humidity		Relative Humidity
Temperature	Temperature		
Dew Point	Dew Point		Dew Point
Barometric Pressure	Barometric Pressure		

For more information about our services and how to order, please go to www.vaisala.com/calibration.

VAISALA

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

www.vaisala.com/requestinfo

Scan the code for more information

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Outages Happen 24/7. So Should Monitoring.

Vaisala Online Measurements for Transformers

- Dissolved Gas Analysis
- Hydrogen in oil
- Moisture in oil
- Temperature
- SF6 Density
- Dew point
- Pressure





MHT410 Moisture, Hydrogen and Temperature Transmitter for Online Transformer Condition Monitoring

- Get reliable alerts of transformer fault situations
- Make educated maintenance decisions
- Minimize unexpected outages

NEW Vaisala Optimus™ OPT100 DGA Monitor for Transformers

- Gives the best long-term stable measurements on the market –with no maintenance
- Out-of-the-box performance
- Completely eliminates false alarms

www.vaisala.com/DGA
www.vaisala.com/requestinfo

VAISALA

Vaisala Filters

Group A: 12 mm Diameter, Standard Length, Female Threads



0195
Brass, sintered filter, 133 microns, ø 12.0 mm
Use with: HMM100, HMP46
Group: A

0195



10159HM
Membrane filter, 0.2 microns, ø 12.0 mm
Use with: HMM100, HM34
Group: A

10159HM



6221
Plastic grid, 2 mm protection, ø 12.0 mm
Use with: HM34, HMM100
Group: A

6221



230727SP
Membrane filter, 0.2 microns, ø 12.0 mm
Use with: HMP155
Group: A

230727SP

Group B: 12 mm Diameter, Long Length, Female Threads (Could be used in place of "A" type filters)



DRW010276SP
PPS plastic grid filter, 6.5 mm, ø 12 mm
Use with: HMT330, HMT360, HMT310, HM70, PTU300
Group: B

DRW010276SP



HM47280SP
Stainless steel sintered filter, 38 µm, ø 12mm
Use with: HMT330, HMT360, HMT310, HM70, HMM100, DMT340, DMT242, DM70, PTU300
Group: B

HM47280SP



DRW010281SP
PPS plastic grid with stainless steel net, 15 µm, ø 12 mm
Use with: HMT330, HMT360, HMT310, HM70, PTU300
Group: B

DRW010281SP



HM47453SP
Stainless steel filter, 3.15 mm, ø 12 mm
Use with: MMT330, MMT310, MM70, HMT330, HMT360, HMT310, DMT340, PTU300
Group: B

HM47453SP



DRW212987SP
Sintered filter, 40 µm, ø 12 mm
Use with: HM70
Group: B

DRW212987SP



220752SP
Stainless steel filter for high oil flow (>1m/s) 2 mm hole size
Use with: MMT330, MMT310, MM70
Group: B

220752SP



220957SP
Stainless steel mesh filter, 18 µm, ø 12 mm
Use with: DMT152, DPT146
Group: B

220957SP



219452SP
Sintered PTFE filter, ø 12 mm
Use with: HMP155, HMM100, HMP63, HMP113
Group: B

219452SP



221494SP
Stainless steel filter for high oil flow (>1 m/s) 2 mm hole size
Use with: MMT162
Group: B

221494SP



225356SP
Stainless steel filter for oil measurements, ø 12 mm, 3 mm holes
Use with: MMT162
Group: B

225356SP


230602

230602
Tube filter
Use with: DMT132
Group: B


231865

231865
Vaporized Hydrogen Peroxide resistant sintered filter
Use with: HMT330, HMT360, HMT310, HM70, PTU300
Group: B

Group C: 12 mm Diameter, Male Threads


HM46670SP

HM46670SP
Sintered stainless steel filter, 38 µm, ø 12.0 mm
Use with: HMT120/130, HMD60/70, HMD42/53, HMP60, HMP110, HMM210
Group: C


DRW010525

DRW010525
Membrane filter, 0.2 µm, ø 12 mm
Use with: HMT120/130, HMP60, HMP110, HMD60/70, HMD42/53
Group: C


DRW010522

DRW010522
Plastic Grid, 2 mm, ø 12 mm
Use with: HMT120/130, HMD60/70, HMD42/53, HMP60, HMP110
Group: C


232637

232637
Vaporized Hydrogen Peroxide resistant sintered filter
Use with: HMT120/130, HMP110, HMP60
Group: C

Stand Alone - Not Interchangeable:


HM46780

HM46780
Stainless steel filter, 38 µm, ø 20 mm
Use with: DMT346 Cooling set


19858HM

19858HM
Membrane filter tube set (5 pcs)
Use with: HMP42


19867HM

19867HM
Steel grid for the HMP42, 1 mm, ø 4 mm

Filters for Discontinued Products

Group C: 12 mm Diameter, Male Threads

- 17039HM — Membrane filter, 0.2 µm, ø 12 mm

Group D: 13.5 mm Diameter, Male Threads

- 16452SP — Sintered filter, stainless steel, 37 microns, ø 13.5 mm
- 16562SP — PPS Grid, 2 mm, ø 13.5 mm
- 16720HMSP — PPS Grid and stainless steel net, 14 µm, ø 13.5 mm
- 17230HMSP — PTFE membrane, 3.5 µm, ø 13.5 mm
- HM46999SP — Sintered stainless steel filter, 2mm, ø 13.5

Group E: 18.5 mm Diameter, Female Threads

- 6597 — Plastic grid, 2.5 mm, ø 18.5 mm
- HM46717 — Plastic grid, 2.5 mm, ø 18.5 mm
- 2787HM — Membrane filter, 0.2 microns, ø 18.5 mm
- 16126HM — Metallized membrane filter, 0.5 µm, ø 18.5 mm

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Quality, Efficiency and Safety

Optimize humidity, temperature and CO_2 levels with truly stable measurement instruments

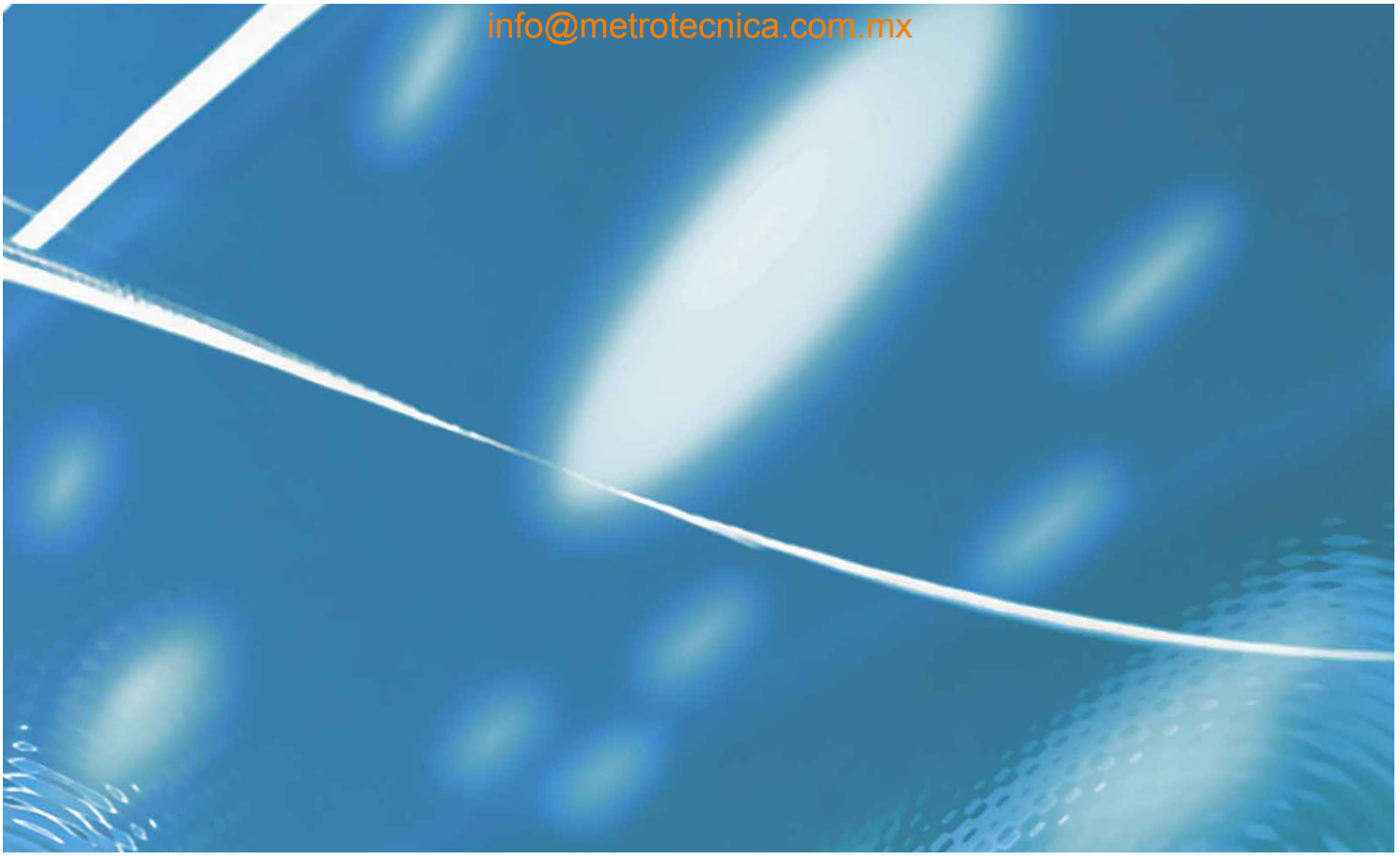
- Produce food products energy-efficiently without over-drying
- Improve environmental conditions in food facilities
- Ensure safe CO_2 levels in fermentation and beverage manufacturing



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