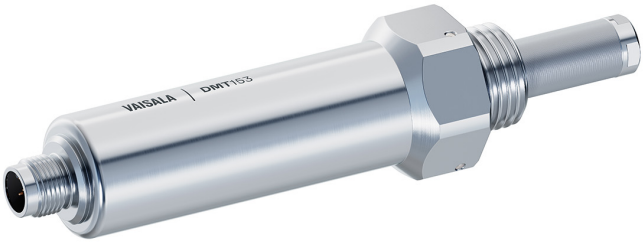
M213149EN-B

User Guide

Vaisala DRYCAP® Dew Point Transmitter

DMT153



VAISALA

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1. About this document

1.1 Version information

This document provides information for installing, operating, and maintaining Vaisala DRYCAP® Dew Point Transmitter DMT153.

Table 1 Document versions (English)

Document code	Date	Description
M213149EN-B	June 2026	Added sections: • User adjustment requirements and limitations (page 123) Sections with minor updates: • Problems and their possible solutions (page 87) • Calibration registers (page 113) • DMT152 serial commands and corresponding DMT153 Modbus registers (page 126)
M213149EN-A	May 2026	First version.

1.2 Related manuals



For the latest versions of these documents, see docs.vaisala.com.

Table 2 Related manuals

Document code	Name
M213152EN	Vaisala DMT153 Dew Point Transmitter Quick Guide
M210865EN	Vaisala DMT152 Dew Point Transmitter User Guide
M213334EN	Wiring Connector 285482SP Installation Note
B212382EN	Vaisala Dew Point Sampling Cells for DRYCAP® Products Technical Note
M212722EN	Vaisala Indigo80 Handheld Indicator User Guide
M212842EN	Vaisala Indigo201 Analog Output Transmitter User Guide
M212843EN	Vaisala Indigo202 Digital Transmitter User Guide
M212849EN	Vaisala Indigo300 Transmitter User Guide
M212287EN	Vaisala Indigo500 Series Transmitters User Guide

1.3 Documentation conventions

WARNING! Alerts you to a hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION! Alerts you to a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTICE! Alerts you to a situation that, if not avoided, could result in the product to be damaged, or important data to be lost.

Highlights important information on using the product.

1.4 Trademarks

Vaisala® and DRYCAP® are registered trademarks of Vaisala Oyj.

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2. Product overview

2.1 Introduction to DMT153 Dew Point Transmitter

Vaisala DRYCAP® DMT153 Dew Point Transmitter is a dew point temperature measurement device with 2 analog output channels and digital output (Modbus® RTU protocol). The transmitter is designed for measurements in demanding low-humidity industrial applications such as semiconductor and battery manufacturing, pure gas production, demanding compressed air systems, and applications utilizing pure gases.

The DRYCAP sensor used in DMT153 tolerates condensing environments and is highly resistant to contamination, thanks to the sensor's purge functionality. The unique autocalibration feature minimizes drift and ensures long-term measurement accuracy.

DMT153 transmitters are compatible with Vaisala Indigo transmitters and Vaisala Indigo80 Handheld Indicator. DMT153 transmitters can also be connected to Vaisala Insight PC software for configuration, calibration, diagnostics, and temporary online monitoring.

2.2 DMT153 transmitter structure

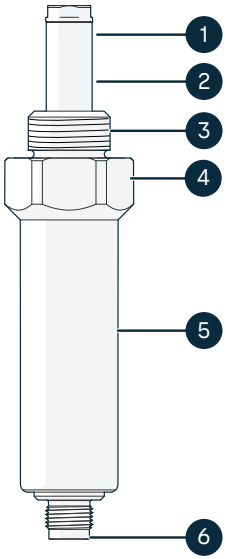


Figure 1 DMT153 transmitter parts (model with ISO G1/2″ thread shown)

1 Stainless steel mesh filter
2 DRYCAP sensor located inside the filter
3 Connection thread. Alternatives:
   - ISO G1/2″
   - 3/4″-16 UNF
   - 1/2″-14 NPT
4 Tightening nut (30 mm)
5 Probe body with type label. Contains component board and electronics housing.
6 M12 5-pin A-coded male connector for digital output (RS-485), analog outputs, and operating power

NOTICE! The transmitter body does not have user serviceable parts inside, and is not designed to be opened. Opening the transmitter will void the warranty.

When the DMT153 transmitter is delivered, the filter is protected by a yellow transport protection cap that keeps the sensor dry. The transport protection cap should be left on the transmitter during storage. Remove the transport protection cap before installing the transmitter.

More information

- Dimensions (page 96)

2.3 DMT153 basic features and options

- Calibrated dew point measurement range −80 ... −20 °C (−112 ... −4 °F) $T_{d/f}$, output range −100 ... +20 °C (−148 ... +68 °F) $T_{d/f}$
- Dew point measurement accuracy up to ±2 °C (±3.6 °F) $T_{d/f}$
- Output parameters:
  - Dew/frost point temperature (°C or °F)
  - Dew point temperature (°C or °F)
  - Water concentration (ppm_v or ppb_v)
  - Water mass fraction (ppm_w)
- DRYCAP polymer sensor with autocalibration and sensor purge ensures long-term stability
- Two analog output channels (scalable)[1], selectable from:
  - 4–20 mA / 0–20 mA and
  - 0–5 V / 0–10 V
- Configurable alarm modes for analog outputs
- Digital output: standalone Modbus RTU over RS-485 [1]
- Compatible with Indigo transmitters and Indigo80 handheld indicator [2]
- Can be connected to Vaisala Insight PC software for configuration, calibration, diagnostics, and temporary online monitoring
- Small size to fit in tight installations
- Three connection thread alternatives: ISO G1/2", 1/2"-14 NPT, and 3/4"-16 UNF
- Sampling cells with different installation options available as optional accessories

1) *DMT153 can be used either in digital output mode or analog output mode. Simultaneous use of analog and digital modes is not supported.*
2) *DMT153 is not backward compatible with the discontinued Vaisala MI70 Handheld Indicator.*

2.3.1 Output parameters

Table 3 Output parameters of DMT153

Parameter	Abbreviation	Metric unit	Non-metric unit
Dew/frost point temperature	$T_{d/f}$	°C	°F
Dew point temperature	T_d	°C	°F
Water concentration	ppm_v or ppb_v	ppm	ppm
Water mass fraction	ppm_w	ppm	ppm

- $T_{d/f}$ shows dew point temperature above the freezing point (0 °C/32 °F) and frost point temperature T_f (dew point over ice) below the freezing point. This is considered as the industry standard.
- T_d shows dew point over water throughout the entire measurement range.

Values of all available output parameters are locked (showing the latest valid value) when the sensor purge function is active.

More information

- Functional description (page 19)
- Operation in analog output mode (page 27)
- Modbus (page 34)
- Installing the transmitter (page 35)
- Vaisala Insight PC software (page 52)
- Using DMT153 with Indigo transmitters (page 61)
- Using DMT153 with Indigo80 indicator (page 65)
- DMT153 specifications (page 93)
- Dimensions (page 96)

2.4 Additional features with Indigo transmitters

Connecting DMT153 to an Indigo transmitter provides a wide range of additional options for outputs, measurement viewing, status monitoring, and access to configuration interface.

Examples of additional features available with Indigo520 transmitters:

- Touchscreen display for real-time data viewing and configuration
- Support for connecting 2 DMT153 transmitters simultaneously
- 4 configurable analog outputs

- 2 configurable relays
- 2-wire current loop analog input
- Barometer module for barometric pressure measurement (optional module)
- Ethernet connection with web interface for remote access
- Modbus TCP/IP protocol
- Service port for connecting to Indigo80 handheld indicator

Examples of additional features available with Indigo300 transmitters:

- Numerical and graphical display for real-time data viewing
- 3 pre-configurable analog outputs
- Service port on the front for connecting to Vaisala Insight PC software or Indigo80 handheld indicator for easy configuration access

Examples of additional features available with Indigo200 series transmitters:

- 3.5" TFT LCD color display or non-display model with LED indicator
- Digital output or 3 analog outputs (depending on the transmitter model)
- 2 configurable relays
- USB-C connection to Vaisala Insight PC software for easy configuration access

Available features vary depending on the Indigo transmitter model. For more information on Indigo transmitters, see vaisala.com/indigo.

More information

- Using DMT153 with Indigo transmitters (page 61)

2.5 Safety

If any instructions in this document conflict with your local or state legislation or regulations, always follow the local or state legislation or regulations.

Consult local authorities and electricity professionals on decisions that relate to grounding, safe installation, and power supply.

WARNING! The transmitter has not been designed for use in hazardous areas with potentially explosive atmospheres created by gases or ignitable dusts. Make sure no part of the transmitter is placed in a potentially explosive atmosphere.

CAUTION! Use only shielded cables when installing the device. If shielded cables and the installation practices described in this manual are not followed, electromagnetic emissions and immunity performance can be impaired, and the installation may not meet the EMC requirements applicable to this product.

CAUTION! Only power the transmitter with one of the following:
- An approved/certified Class 2 power supply. The output of the power supply may not exceed 100 VA with operating voltage not more than 30 V_{rms}, 42.4 V_{peak} or 60 V DC.
- An approved/certified Limited Power Source (LPS) (CAN/CSA-C22.2 No. 60950-1 or UL 60950-1).
- Power source fulfilling requirements of Limited Energy Circuit in accordance with IEC/EN/UL/CSA 61010-1.

CAUTION! Make sure to use the power supply unit only in its specified environmental conditions.

CAUTION! Using components that do not meet Vaisala specifications can result in injury or damage the product. Use only accessories and spare parts that meet the specifications.

CAUTION! The process threads of the DMT153 transmitter can have sharp edges. To avoid injury when touching the threads, wear protective gloves.

NOTICE! Risk of thread galling
The DMT153 transmitter is manufactured from austenitic stainless steel EN 1.4404 (AISI 316L). When the transmitter is installed in austenitic stainless steel AISI 316/316L process connections, the threaded joint can gall (cold weld), which may cause seizure.
Take care when installing, tightening, and removing the DMT153 transmitter to avoid damage to the threads and the transmitter.

Follow the safety regulations of the installation site.

2.5.1 ESD protection

Electrostatic discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering an electrostatic discharge when touching, removing or inserting any objects inside the equipment housing.

Avoid touching component contacts or connectors when working with the device.

2.6 DMT153 and DMT152 product comparison

The changes listed below may affect how you use the DMT153 transmitter compared to your existing DMT152 transmitter. In each case, alternative solutions or migration paths are available.

Product specifications for the DMT152 transmitter are available in DMT152 User Guide (M210865EN) at docs.vaisala.com, and for DMT153 in DMT153 specifications (page 93).

2.6.1 Use with handheld indicator

DMT153 is not backward compatible with the discontinued MI70 Handheld Indicator. For portable use, DMT153 is supported with the Indigo80 Handheld Indicator, which provides an up-to-date platform for field use and compatibility with other modern Vaisala probes. For more information, see Using DMT153 with Indigo80 indicator (page 65).

2.6.2 Analog and digital output channels

When used as a standalone transmitter, DMT153 offers one current and one voltage output channel. For applications requiring multiple current or voltage outputs, DMT153 can be combined with an Indigo transmitter to provide additional channels. For more information, see Additional features with Indigo transmitters (page 15) and Using DMT153 with Indigo transmitters (page 61).

DMT153 includes one M12 5-pin connector instead of the two M8 4-pin connectors in DMT152. The single M12 connector supports either analog or digital output, but a standalone DMT153 cannot provide analog output to a system and digital access to a handheld simultaneously.

- Using the DMT153 with an Indigo300 or Indigo500 series transmitter restores this capability by providing simultaneous analog outputs and handheld access via the transmitter service port.
- For instructions on replacing the M8 cable connector of DMT152 with an M12 cable connector, see document Wiring Connector 285482SP Installation Note (M213334EN) at docs.vaisala.com.

2.6.3 Mechanical connections

The DMT153 is not offered with a 5/8″-18 UNF process connection. Available process connections are ISO G1/2″, 1/2″-14 NPT, and 3/4″-16 UNF. Additional installation options are available using Vaisala dew point sampling cells, which mate with the ISO G1/2″ process connection. For more information, see Sampling accessories (page 44).

3. Functional description

3.1 Startup sequence

When the transmitter is powered up, it performs a self-diagnostic startup sequence, consisting of sensor purge and autocalibration functions. This takes several minutes, during which time the output is frozen: it displays the last measured values before the sensor purge began. During the startup sequence, the text **Unreliable** is displayed in, for example, the Indigo80 indicator that DMT153 is connected to.

The autocalibration function may be postponed if the measurement environment is not suitable. For example, the environment may be changing rapidly or have too high humidity.

Normal operation and output is typically achieved within 10–15 minutes after startup. Devices stored in, for example, a warm and humid environment may take longer to output a stable reading.

The transmitter always performs the self-diagnostic procedure and sensor purge when starting up. Keep the transmitter continuously powered to optimize its measurement performance and availability.

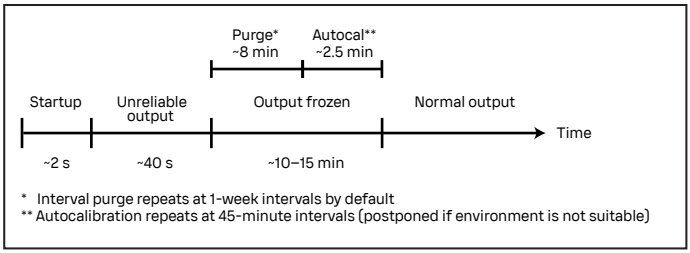


Figure 2 DMT153 statuses during startup sequence



Figure 3 Icon and text in Indigo80 showing status of DMT153 during startup sequence

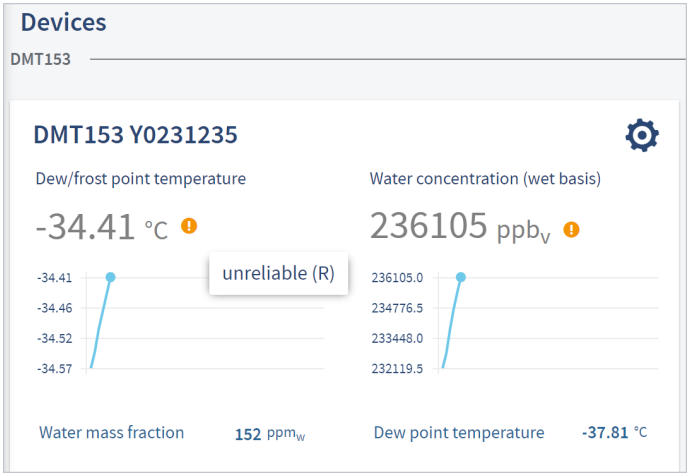


Figure 4 Icon and text in Insight showing status of DMT153 during startup sequence

More information

- Autocalibration (page 20)
- Startup purge and interval purge (page 22)

3.2 Autocalibration

The autocalibration feature of the DMT153 transmitter is an automatic procedure that reduces the possible drift in the dry end of the dew point measurement.

Autocalibration is performed:

- at 45-minute intervals
- at shorter intervals if $T_{d/f}$ is near the dry end of the measurement range
- when the transmitter is powered up
- after rapid changes in the measurement environment.

During autocalibration the sensor is warmed for a short period (< 1 min) and the sensor capacitance values are evaluated at the elevated temperature. The possible dry end drift is then corrected to correspond to the calibrated values.

Measurement and output remain active during autocalibration. See Figure 5 (page 21) for the effect of autocalibration on the measurement signal.

The autocalibration function may be postponed if the measurement environment is not suitable. For example, the environment may be changing rapidly or have too high humidity. If the conditions for autocalibration are not fulfilled, the function is postponed until satisfactory conditions are reached.

The transmitter's power supply should maintain the voltage for all load conditions. Voltage fluctuations must be smaller than 0.3 V, as continuous supply voltage fluctuation may interfere with the autocalibration function.

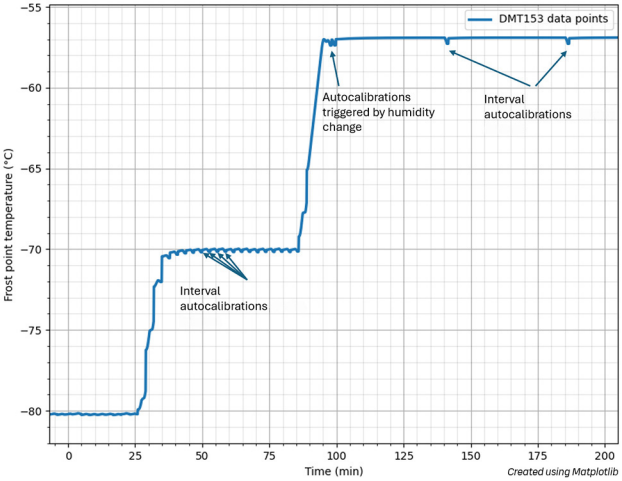


Figure 5 Effect of autocalibration on DMT153 measurement signal

3.3 Startup purge and interval purge

Sensor purge is also an automatic procedure that minimizes sensor drift. The transmitter performs sensor purge when it is powered on (known as **startup purge**), and at one-week intervals (known as **interval purge**). The sensor is heated for several minutes, which will then evaporate all excess molecules out of the sensor polymer. This, together with autocalibration, results in very small drift. The measurement output of the transmitter is frozen to the last measured value for the duration of the sensor purge.

During sensor purge, the statuses **Value locked** and/or **Unreliable** will be shown in Insight software, Indigo80 indicator, and in Modbus status registers.

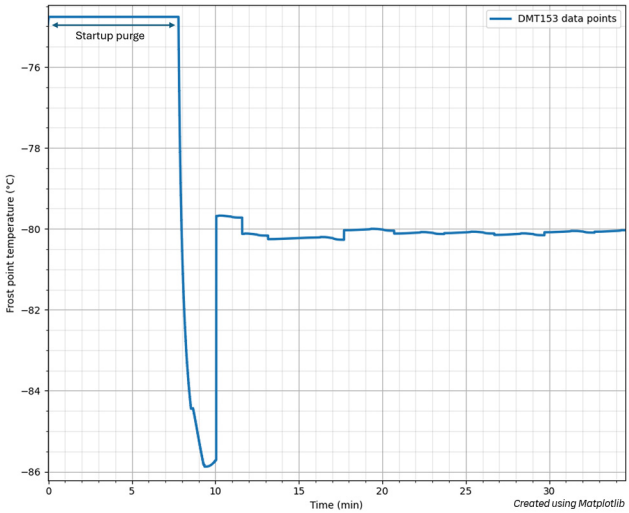


Figure 6 Effect of sensor purge on DMT153 measurement signal

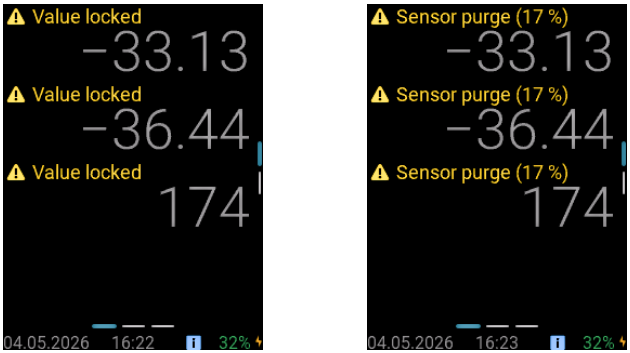


Figure 7 Icon and text in Indigo80 showing statuses of DMT153 during sensor purge

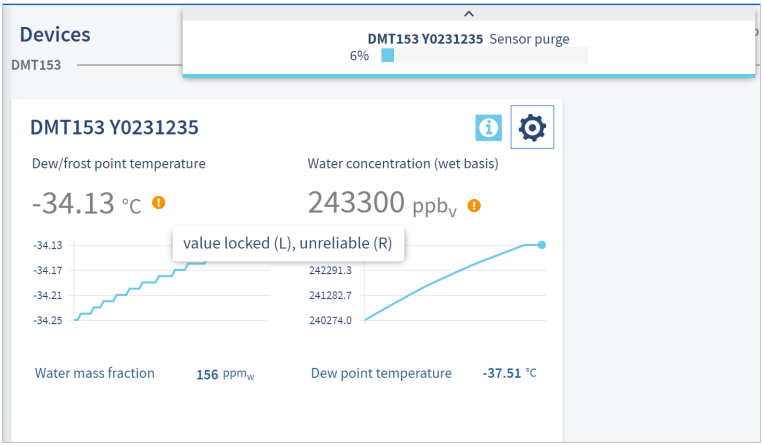


Figure 8 Icon and text in Insight showing status of DMT153 during sensor purge

3.3.1 Enabling or disabling sensor purge

NOTICE! The recommended sensor purge interval is 1 week. Excessive purging can lead to increased drift in the wet end of the sensor measurement range and impair measurement performance. Use the sensor purge function only as needed to maintain measurement performance.

If necessary, you can start sensor purge and configure interval purge settings with the Insight software, the Indigo80 handheld indicator, or using the Modbus protocol. However, Vaisala recommends leaving the interval purge settings at their default values, as disabling the sensor purge will affect the measurement performance of the transmitter.

The following settings are available in Insight software, in Indigo80 indicator, or through Modbus registers:

Interval purge on/off
On: interval purge will be performed at the preset interval, once a week.
Off: purge is disabled until the transmitter is reset, restarted, or when the **Interval purge on/off** setting is changed back to **On**.

Start sensor purge
Starts the sensor purge function immediately. This setting is independent of the **Interval purge on/off** setting, meaning that sensor purge can still be started manually even if **Interval purge on/off** has been set to **Off**.

More information

- Configuring sensor purge in analog output mode (page 31)
- Configuration options with Insight (page 53)
- Configuring transmitter features with Indigo80 handheld indicator (page 69)
- Configuration registers (page 104)

3.4 Control pin functionality

Pin 5 in the M12 connector of DMT153 is a digital control input used for two main purposes:

Operating mode selection
At power-up, the state of pin 5 determines whether the transmitter starts in analog output mode or digital (serial) mode. For more information, see Operating mode selection (page 24).

Purge control in analog mode
When the transmitter is operating in analog mode, pin 5 can be used to control the sensor purge functions according to the configured behavior. Depending on the selected setting, activating pin 5 can start a sensor purge or prevent sensor purges for a defined duration. For more information, see Configuring sensor purge in analog output mode (page 31).

3.4.1 Operating mode selection



See also the wiring guidance for DMT153 in Wiring (page 38).

To be able to control the operating mode of DMT153, do not connect pin 5 in the transmitter's M12 connector to ground permanently. Instead, use a relay or a switch to control pin 5. A short disconnection (≥ 50 ms) and reconnection of pin 5 is interpreted as a control event.

The transmitter reads the state of pin 5 at device startup. Depending on whether the pin is grounded or not, DMT153 will enter analog or digital output mode, respectively.

Table 4 DMT153 operating mode selection with control pin 5

Control pin (pin 5) state at power-up	Resulting operating mode	Result if pin 5 grounded after operating mode selection	Result if pin 5 disconnected after operating mode selection
Connected to GND (pin 3)	Analog output mode	(no change)	Depending on the selected configuration[1], either: • Trigger sensor purge • Prevent sensor purge for a preset time • (no effect)
Not connected (floating)	Digital mode (RS-485 / Modbus)	Temporarily enable analog outputs, for example, to check their status	(no change)

1) *See also Configuring sensor purge in analog output mode (page 31).*

To switch between analog and digital modes, change the pin 5 connection and power-cycle the transmitter.

When pin 5 is used for purge control in analog mode, do not leave the pin floating for a long time. If the transmitter is reset while pin 5 is floating, the device will go into digital mode instead of analog mode.

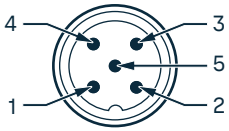


Figure 9 Pinout of DMT153 M12 connector in **analog output mode**

1 Power supply
2 Voltage output
3 Power and signal GND
4 Current output
5 Control of purge action

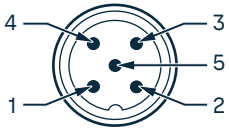


Figure 10 Pinout of DMT153 M12 connector in **digital output mode**

1 Power supply
2 RS-485–
3 RS-485 common
4 RS-485+
5 Output mode control (pin 5 floating at startup = digital output mode)

3.5 Filtering factor

The filtering factor determines how quickly the results of measurement cycles are reflected in the values of output parameters. You can use the filtering factor to slow down the response time of the measurement, filtering out rapid changes and measurement noise.

- Maximum value (1) = No filtering, fastest measurement. Output shows 100 % of the most recent measured value.
- Less than maximum value = Filtering is applied and measurement response time is reduced. For example, defining a value that is 90 % of the maximum value means that the filtered output reading = 90 % of the most recent measured value + 10 % of the previous reading.

Filtering factor settings can be configured with the Insight software, the Indigo80 handheld indicator, or using the Modbus protocol.

More information

▸ Configuring filtering factor with Indigo80 (page 71)

4. Operation in analog output mode

The DMT153 transmitter has 2 scalable analog output channels (1 current, 1 voltage) on the same M12 connector that also carries power and RS-485 signal.

DMT153 can be operated either:

- In **analog mode** with 1 or 2 analog channels active at the same time. The analog output channels are selectable as 4–20 mA / 0–20 mA (current use) or 0–5 V / 0–10 V (voltage use).
- In **digital mode** as a Modbus RTU over RS-485 device.

Simultaneous use of analog and digital modes is not supported.

For instructions on selecting the operating mode, see Operating mode selection (page 24).

When ordering the transmitter, 1 output parameter can be chosen for 1 of the analog output channels. The other analog output channel is disabled by default. You can configure the other channel for use with the Insight software, the Indigo80 indicator, or through Modbus registers.

See the calibration certificate delivered with the transmitter to check the output channel and its parameter chosen when the transmitter was ordered.

4.1 Analog output overrange behavior

The analog outputs of the DMT153 transmitter have a defined behavior when the values measured by the transmitter are outside the scaled analog output range. At first, the output is clipped when the measurement exceeds a set limit (clipping limit): the measurement continues, but the output does not change from the clipped value.

When the measurement exceeds the second limit (error limit), the analog output switches to the error state defined for the output.

The clipping and error limits are configured separately for the low and high ends of the measurement scale. By default, the clipping limits are set to 0 %, and the error limits are Off (= not in use).

Table 5 Analog output overrange clipping and error limits

Output (current / voltage)	Default clipping limit	Default error limit	Default error output level
4–20 mA	0 %	Off	3.6 mA
0–20 mA	0 %	Off	23 mA
0–10 V	0 %	Off	11 V
0–5 V	0 %	Off	5.5 V

You can change or disable the clipping and error limits using the Insight software, Indigo80 indicator, or through Modbus registers. Changing the limits does not affect the scaling of the outputs. The definable range for each limit is 0–20 %.

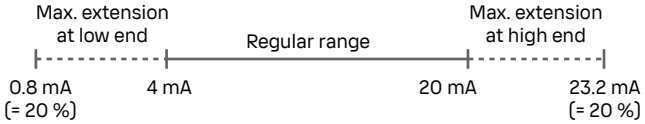


Figure 11 Maximum extensions to 4-20 mA analog output range

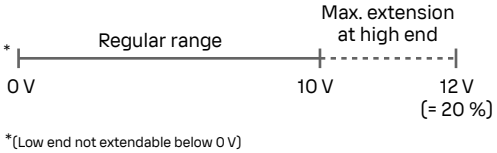


Figure 12 Maximum extension to 0-10 V analog output range

The same clipping and error limits are applied when the measured value drops back to the scaled range: at first the output returns to the clipped value from the error state, and then to normal output.

More information

- Analog output configuration example using Insight (page 58)
- Analog output error state (page 91)

4.1.1 Analog output overrange examples

Consider a DMT153 transmitter with analog output channel 1 (4–20 mA) configured to output H_2O concentration, scaled to 0–2000 ppb.

Example: Clip the high end of the output at 2100 ppb, and enter the error state at 2200 ppb

Configure the high-end clipping limit and error limit as follows:

- Clipping limit, high end: 5 % of scale (= 2100 ppb, clipped at 20.8 mA)
- Error limit, high end: 10 % of scale (= 2200 ppb)

When the measured H_2O concentration rises above 2000 ppb, the output rises above 20 mA. The output keeps rising until the measurement is 2100 ppb, at which point the transmitter outputs 20.8 mA. If the H_2O concentration rises above 2100 ppb, the output still remains at 20.8 mA. If the H_2O concentration rises above 2200 ppb, the output enters the error state (by default, 3.6 mA).

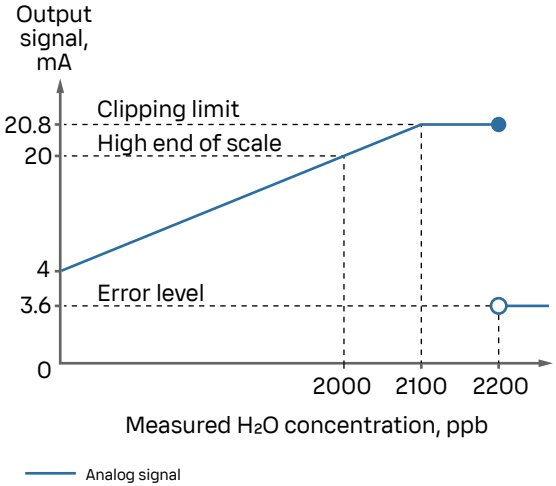


Figure 13 Analog output overrange example with clipping and error limits

Example: Clip the high end of the output at 2100 ppb, but do not enter the error state at all

Configure the high-end clipping limit and error limit as follows:

- Clipping limit, high end: 5 % of scale (= 2100 ppb, clipped at 20.8 mA)
- Error limit, high end: empty (or in Modbus: "NaN")

When the measured H_2O concentration rises above 2000 ppb, the output rises above 20 mA. The output keeps rising until the measurement is 2100 ppb, at which point the transmitter outputs 20.8 mA. If the H_2O concentration rises above 2100 ppb, the output still remains at 20.8 mA.

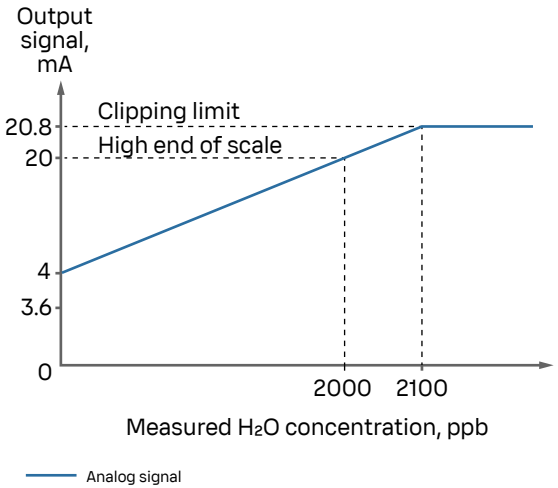


Figure 14 Analog output overrange example with clipping only

Example: Do not clip the output at all, but enter the error state at 2200 ppb

Configure the high-end clipping limit and error limit as follows:

- Clipping limit, high end: empty (or in Modbus: "NaN")
- Error limit, high end: 10 % of scale (= 2200 ppb, 21.6 mA)

When the measured H_2O concentration rises above 2000 ppb, the output rises above 20 mA. The output keeps rising until the measurement exceeds 2200 ppb (21.6 mA), at which point the output enters the error state (by default, 3.6 mA).

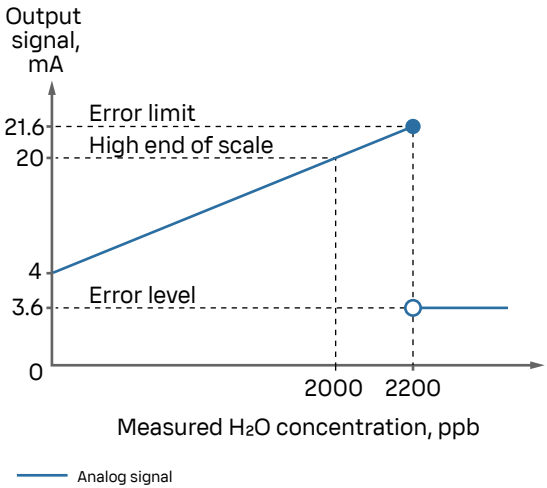


Figure 15 Analog output overrange example with no clipping, only error state when error limit is exceeded

4.2 Configuring sensor purge in analog output mode

NOTICE! The recommended sensor purge interval is 1 week. Excessive purging can lead to increased drift in the wet end of the sensor measurement range and impair measurement performance. Use the sensor purge function only as needed to maintain measurement performance.

In the analog output mode, pin 5 in the DMT153 transmitter's M12 male connector is connected to ground. Additionally, pin 5 is used for controlling the following sensor purge functions when DMT153 is used in analog output mode:

- **Start sensor purge**: this is useful, for example, after exposure to condensation or chemicals, or before a critical measurement where you want to ensure a recently purged sensor.
- **Prevent sensor purge**: in some applications, you may need to ensure that a sensor purge does not occur during a predefined time window, so the analog outputs do not enter the locked state associated with purge.

To be able to start a purge or to prevent the purge for a defined time, do not connect pin 5 to ground permanently. Instead, use for example a relay or a switch to control pin 5. A short (≥ 50 ms) disconnection and reconnection of pin 5 (for example, de-energizing and re-energizing the relay) is interpreted as a trigger event.

The trigger event causes one of the following actions to be performed:

- **Start sensor purge**: Selecting this option means that the trigger event on DMT153's pin 5 will start a sensor purge immediately.
- **Prevent sensor purge**: Selecting this option means that the trigger event on DMT153's pin 5 will start a time period during which all sensor purge operations, including startup purge and interval purge, will be blocked. The time period is set with the **Purge prevention duration** setting.
- **None**: This is the default setting. A trigger event on DMT153's pin 5 will have no effect on the purge functionality. Startup purge and interval purge will be performed as configured.

The **Function in analog mode** setting, with the 3 options listed above, is configured in Insight software, Indigo80, or through Modbus registers.

For a wiring example of DMT153 in analog output mode showing the relay/switch control, see Figure 18 (page 40).

For instructions on using Indigo80 to configure the control pin settings, see Configuring purge-related control pin functions with Indigo80 (page 73).

More information

- Enabling or disabling sensor purge (page 23)
- Configuration options with Insight (page 53)
- Configuring transmitter features with Indigo80 handheld indicator (page 69)
- Configuration registers (page 104)

4.3 Limit alarm

The limit alarm is activated when the output of the measured parameter goes below the set low limit or above the high limit. By default, the limit alarm setting is off for both analog output channels.

The alarm can be configured with the **Limit alarm 1** and **Limit alarm 2** settings in Insight software and Indigo80 handheld indicator, or using the Modbus protocol.

A limit alarm can be set for each analog output channel.

- For analog output channel 1 (current), an active alarm is indicated by the current being at the maximum of the scale (20 mA) when **Scale low end** is set to 0 and **Scale high end** is set to 1.
- For analog output channel 2 (voltage), an active alarm is indicated by the voltage being at the maximum of the selected scale when **Scale low end** is set to 0 and **Scale high end** is set to 1.
  - If the voltage output scale is 0–5 V, an output of 5 V indicates the alarm is active.
  - If the voltage output scale is 0–10 V, an output of 10 V indicates the alarm is active.

You can also set a hysteresis value to prevent the repeated triggering of the alarm when the measurement fluctuates around a limit value.

More information

- Configuration options with Insight (page 53)
- Limit alarm configuration example using Indigo80 (page 73)
- Configuration registers (page 104)

4.4 Error output level

The transmitter sets the analog output to a predefined error level instead of the measured result in the following situations:

- The transmitter detects a measurement or device malfunction. This means an actual measurement problem, such as sensor damage, or unsuitable environmental conditions.
- The measured value(s) are outside the error limits defined for the outputs.

Error output level can be configured in the transmitter's **Analog output 1** and **Analog output 2** settings in Insight software, the Indigo80 handheld indicator, or using the Modbus protocol.

The error output value must be within the valid range for the selected output mode:

- For **Analog output 1** output mode 0-20 mA or 4-20 mA, the valid range of error output level is 0-25 mA.
- For **Analog output 2** output mode 0-5 V or 0-10 V, the valid range of error output level is 0-11 V.

The error output level is active in the analog output channel when any error or critical error is active in the transmitter. For a description of error types, see Error messages (page 89).

More information

- Analog output configuration example using Insight (page 58)

5. Modbus

The DMT153 transmitter can be accessed using the Modbus serial communication protocol. The supported Modbus variant is Modbus RTU (Serial Modbus) over RS-485 interface.

The Modbus serial communication settings can also be configured with DMT153 connected to Vaisala Insight PC software or the Indigo80 indicator.

More information

- Modbus reference (page 101)

6. Installation

6.1 Selecting installation location

It is important that the conditions at the point of installation represent well the gas to be measured. Avoid installation close to heat sources and points with large temperature gradients. Maintain stable pressure and representative, steady flow rate through the transmitter so that the gas sample reflects the true process conditions. All leaks in the system must be eliminated to avoid ambient humidity affecting the measurement.

For the DMT153 dew/frost point measurement, temperature or pressure compensation is not needed. However, the water concentration (ppm_v/ppb_v) and water mass fraction (ppm_w) values are calculated from the measured dew/frost point and the pressure value entered in the transmitter. Make sure that the pressure setting for DMT153 is representative of the actual measurement environment.

Direct installation to the measured gas is the recommended installation method if the temperature of the gas is suitable for DMT153 and no additional filtering is needed due to very dusty or oily gas. Oil as such is not harmful for the DRYCAP sensor, but response time may be slower if there are oil particles in the system, or if oil is collected to the filter over a longer period of time. The maximum measurement pressure is 50 bar / 725 psi (absolute pressure) for direct measurement.

If the gas temperature is higher than the specified maximum operating temperature of the transmitter, gas sampling and cooling it to ambient temperature (for example, to 20 °C (68 °F)) is recommended. Note that the dew point temperature must be clearly lower than the ambient temperature to avoid condensation in the sampling line. Sampling from the process is easy by using Vaisala sampling cell options.

DMT153 is light in weight, which means that it can be installed in a sample pipeline in the sampling cells without the need for any additional mechanical support.

More information

- Sampling accessories (page 44)
- Configuring pressure settings with Indigo80 (page 69)
- DMT153 specifications (page 93)
- Dimensions (page 96)

6.2 Installing the transmitter



CAUTION! The process threads of the DMT153 transmitter can have sharp edges. To avoid injury when touching the threads, wear protective gloves.

NOTICE! Risk of thread galling
The DMT153 transmitter is manufactured from austenitic stainless steel EN 1.4404 (AISI 316L). When the transmitter is installed in austenitic stainless steel AISI 316/316L process connections, the threaded joint can gall (cold weld), which may cause seizure.
Take care when installing, tightening, and removing the DMT153 transmitter to avoid damage to the threads and the transmitter.

The following installation tools and equipment are needed:
- For transmitter models with ISO G1/2″ or 3/4″-16 UNF threads:
  - Sealing ring (provided)
  - 30-mm wrench, 1 3/16″ wrench, or adjustable wrench (not provided)
- For transmitter models with 1/2″-14 NPT threads:
  - PTFE tape (not provided) [1)]
  - 30-mm wrench, 1 3/16″ wrench, or adjustable wrench (not provided)

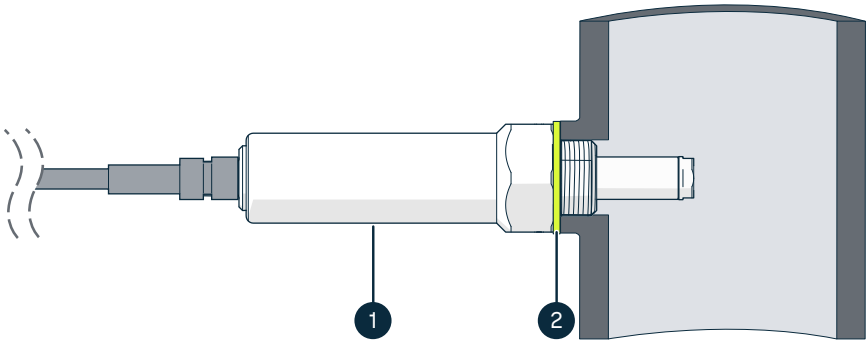


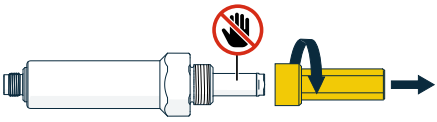
Figure 16 DMT153 installed directly to pipeline (max. 50 bar)

1 DMT153 transmitter (model with ISO G1/2″ connection thread)
2 Sealing ring

After selecting a suitable measurement location, install the transmitter as instructed below. Note the maximum operating process pressure for the transmitter, 50 bar (725 psi), absolute.

1) *Vaisala recommends Unipak Multitape PTFE Threaded Tape (Unipak item no. 1000600) or Swagelok PTFE Tape Thread Sealant (Swagelok item no. MS-STR-8). Follow the manufacturer's instructions when applying the tape.*

1. Remove the yellow transport protection cap from the transmitter. Do not touch the filter with your hands.



2. Prepare the sealing of the connection.
   a. Transmitter with ISO G1/2″ thread or 3/4″-16 UNF thread: place the sealing ring at the base of the thread.

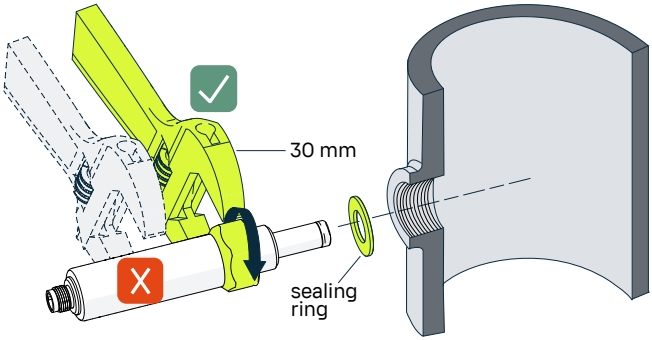
      Always use a new sealing ring; do not reuse a previously installed one.

   b. Transmitter with 1/2″-14 NPT thread: do not use a sealing ring. Instead, apply high-density PTFE tape on the thread.
3. Make sure that the threads on the mounting point are of the correct type, and fasten the transmitter to the mounting point. Tighten the transmitter to hand-tightness.

Do not use excessive force at this point, and check that the sealing ring (if used) remains centered.

4. Use a 30-mm wrench to tighten the connection. If you do not have a 30-mm wrench, use a 1 3/16″ wrench or an adjustable wrench.

   Tightening torques for different thread types:
   - ISO G1/2″: 25 Nm with plastic sealing rings (for example, PTFE), and 25 Nm with metal sealing rings (for example, copper or aluminum).
   - 3/4″-16 UNF: 25 Nm with plastic sealing rings (for example, PTFE), and 25 Nm with metal sealing rings (for example, copper or aluminum).
   - 1/2″-14 NPT: 25 Nm, or tighten 2–3 turns past finger-tightness.



CAUTION! Only tighten the transmitter from the 30-mm tightening nut. Do NOT apply force to other points in the transmitter body.

5. Connect the DMT153 transmitter's connection cable to a Vaisala Indigo transmitter, Indigo80 indicator, or to your automation system. When using an open-ended cable, see also the wiring instructions in this document.

More information

- Wiring (page 38)
- Environmental compensation settings (page 42)
- Mounting accessories (page 43)
- Sampling accessories (page 44)

6.3 Wiring

If you are replacing your existing Vaisala DMT152 transmitter with DMT153, see the wiring instructions in document Wiring Connector 285482SP Installation Note (M213334EN).

CAUTION! Only power the transmitter with one of the following:
- An approved/certified Class 2 power supply. The output of the power supply may not exceed 100 VA with operating voltage not more than 30 V_{rms}, 42.4 V_{peak} or 60 V DC.
- An approved/certified Limited Power Source (LPS) (CAN/CSA-C22.2 No. 60950-1 or UL 60950-1).
- Power source fulfilling requirements of Limited Energy Circuit in accordance with IEC/EN/UL/CSA 61010-1.

CAUTION! Make sure to use the power supply unit only in its specified environmental conditions.

CAUTION! Use only shielded cables when installing the device. If shielded cables and the installation practices described in this manual are not followed, electromagnetic emissions and immunity performance can be impaired, and the installation may not meet the EMC requirements applicable to this product.

See also the DMT153 power supply specifications in Table 9 (page 94).

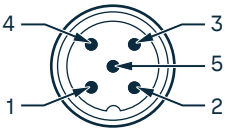


Figure 17 Pinout of M12 5-pin A-coded male connector of DMT153

Pin #	Function	Notes	Wire colors [1]
1	Power supply	Operating voltage: • With RS-485 output: 11–28 V DC • With analog output: 15–28 V DC • At low temperature or high pressure: 21–28 V DC	Brown
2	RS-485– or voltage output		White
3	• Power and signal GND • RS-485 common		Blue
4	RS-485+ or current output		Black

Pin #	Function	Notes	Wire colors [1]
5	Output mode control and purge control in analog mode	Floating (not connected) = RS-485 Grounded = Analog outputs If you want to be able to trigger or prevent sensor purge manually in analog mode, do not connect pin #5 permanently to ground. Instead, use for example a relay or a switch to control the pin. For more information on the purge-related functionality of pin #5, see Configuring sensor purge in analog output mode (page 31).	Gray

1) Wire colors in Vaisala cables with open wires.

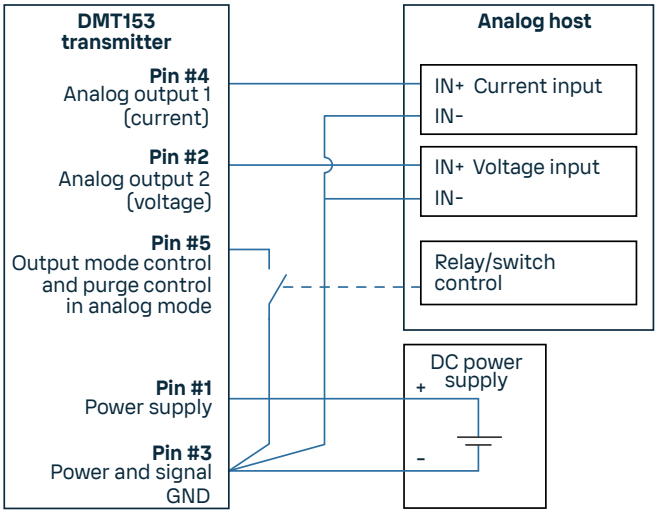


Figure 18 DMT153 wiring example with analog host

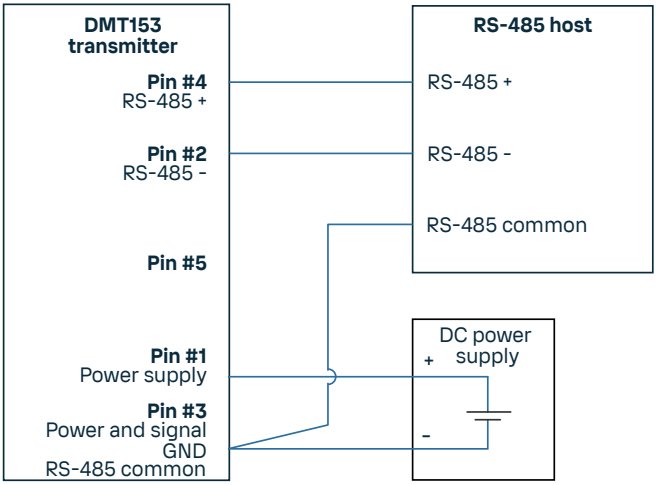


Figure 19 DMT153 wiring example with RS-485 host

6.3.1 Power supply requirements

In typical measurement conditions, the DMT153 transmitters are designed to operate with a supply voltage of 11–28 V DC (with RS-485 output) or 15–28 V DC (with analog output).

When measuring at temperatures below 0 °C (32 °F) or at process pressure above 20 bar (290 psi), absolute, a supply voltage of 21–28 V DC is required.

The transmitter's power supply should maintain the voltage for all load conditions. Voltage fluctuations must be smaller than 0.3 V, as continuous supply voltage fluctuation may interfere with the autocalibration function.

6.3.2 Voltage output noise minimization

DMT153 has a single 5-pin M12 connector, where pin 3 serves as a shared ground for both the power supply and the voltage output signal. There is no dedicated pin for an analog output ground.

The sensor and autocalibration functionalities of DMT153 require periodic pulsed heating current that flows through the shared ground conductor of the M12 connector. The pulsed current creates a small voltage drop across the cable's ground wire resistance. This voltage drop appears as periodic noise on the voltage output of the transmitter.

Characteristics of the noise:

- The noise is visible only on the voltage output (pin 2). It is not present on the current output (pin 4) or the digital RS-485 output.
- Sensor purge produces the largest current pulses and therefore the most visible noise. Autocalibration heating causes smaller, but still measurable, interference.

- The noise amplitude increases with cable length.
- The noise amplitude is proportional to the output voltage range. A wider output scale (for example, 0–10 V) produces smaller noise relative to the measurement scale than a narrower output scale (for example, 0–5 V).

The voltage output noise occurs as part of the transmitter's normal operation. If the effect is too large for the requirements of your application, you can eliminate or reduce the noise by using one or more of the measures listed below:

- Use the shortest practical cable length for voltage output installations.
- Use an M12 Y-splitter cable at the DMT153 transmitter end to separate the power supply wiring from the analog output wiring. The splitter cable gives the voltage output its own return path, and as a result reduces noise.
- Use a longer ADC integration (averaging) time to reduce input noise and suppress short noise spikes.
- Use the current output instead of the voltage output, and resistor if voltage signal cannot be avoided. The 4–20 mA / 0–20 mA current output is immune to ground conductor resistance; a precision shunt resistor at the receiver end can convert it back to a voltage signal if needed.
- Use a Vaisala Indigo transmitter for voltage outputs. Connect DMT153 to a Vaisala Indigo200, Indigo300, or Indigo500 transmitter using the digital interface. The Indigo transmitter provides galvanically isolated analog outputs with a dedicated output ground, which eliminates the shared-ground interference.
- Use the digital RS-485 output instead of the voltage output. The digital output is not affected by the shared ground.

6.4 Environmental compensation settings

After installation, configure the pressure compensation setting, if relevant to your transmitter and its measurement environment.

For example, when you have installed the transmitter in a process with a pressure differing from normal atmospheric pressure, update the correct pressure into the pressure compensation setpoint parameter or register of the transmitter. This allows the transmitter to apply the appropriate pressure compensation into its measurement results.

The DMT153 transmitter has two types of pressure settings:

Pressure
Temporary pressure compensation value that is cleared at device restart. Use this value when you want to temporarily match the process pressure during a measurement session. At device restart, the value is replaced with the power-up default value.

Pressure, power-up default value
Persistent default value that is restored at device restart.
For installations where the process pressure is known and stays fixed.

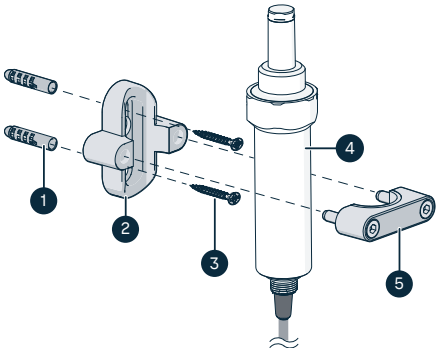
You can configure the setting with the Insight software, the Indigo80 handheld indicator, or using the Modbus protocol.

More information

- Configuration options with Insight (page 53)
- Configuring pressure settings with Indigo80 (page 69)
- Configuration registers (page 104)

6.5 Mounting accessories

6.5.1 Probe holder ASM213582



1. Wall plugs (2 pcs included, 6×30 nylon)
2. Base of the probe holder
3. Screws (2 pcs included, 4.8×25 DIN7981C PZ A4)
4. Ø 25 mm (0.98 in) transmitter body
5. Top of the probe holder with 2 hex screws (4-mm socket)

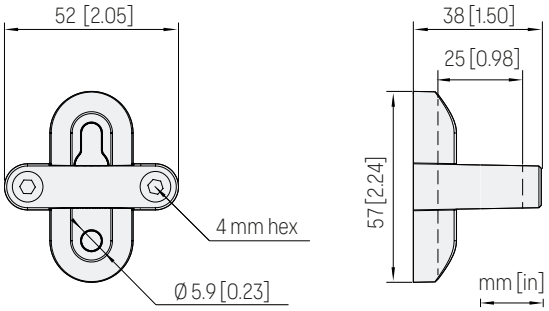


Figure 20 Probe holder ASM213582 dimensions

6.5.1.1 Mounting the device using probe holder ASM213582

Probe holder ASM213582 is designed for attaching a 25-mm probe or transmitter body to a wall or other surface with screws.

1. Use a 4-mm Allen key to open the hex screws and remove the top part of the probe holder.
2. Hold the base part against the mounting surface and mark the locations of the 2 screw holes.
3. Drill holes at the marked locations using a 6-mm drill bit. Make the holes at least 30 mm deep.
4. Insert the wall plugs in the holes.
5. Mount the base part using screws.
6. Insert the transmitter body in the holder.
7. Place the top part on the base and tighten the hex screws with a 4-mm Allen key.

6.6 Sampling accessories

Sampling cells are needed when direct measurement of the air or gas is not possible or desirable. This may be related to, for example, a high process temperature, protecting the sensor from water spikes, the need to easily detach the instrument from a pressurized process without running the whole process down, or wanting to make the measurement at a more convenient location.

6.6.1 DMT242SC sampling cell

DMT242SC is a basic sampling cell with only the main sampling cell body. The inlet and outlet are female threaded sample connectors (inlet ISO G3/8″, outlet ISO G1/4″). The flow direction can be reversed, if needed. Figure 21 (page 44) shows the default direction.

DMT242SC is suitable for users requiring only a sampling cell to fit the measurement probe or transmitter into and doing further assembly (piping into inlet and outlet, valves, possible flow meter) by themselves.

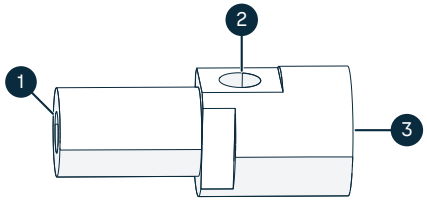


Figure 21 DMT242SC sampling cell

1 Gas inlet, ISO G3/8″
2 Gas outlet, ISO G1/4″
3 Connection point for probe/ transmitter, ISO G1/2″

6.6.2 DMT242SC2 sampling cell with Swagelok connectors

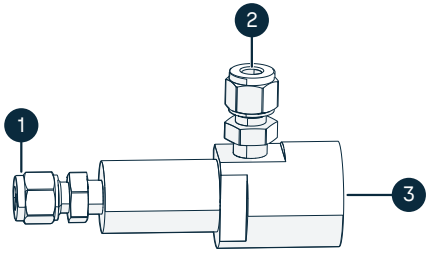


Figure 22 DMT242SC2 sampling cell

1 Gas inlet, 1/4″ Swagelok connector (two-ferrule)
2 Gas outlet, 1/4″ Swagelok connector (two-ferrule)
3 Connection point for probe/ transmitter, ISO G1/2″

For easy installation, the DMT242SC2 sampling cell includes welded Swagelok connectors at both the inlet and outlet. The connectors fit directly to 1/4″ tubing with Swagelok's two-ferrule mechanical grip design.

To fit 6-mm tubing to the connectors, an adapter such as Swagelok Reducer SS-6M0-R-4 (not supplied by Vaisala) can be used.

DMT242SC2 is the suitable choice in, for example, plastics drying systems, where the measurement is made by tapping off the dryer system and bringing a small air stream to the sensor.

The Swagelok connectors of DMT242SC2 connect easily to a cooling coil or tubing, providing the essential function of cooling the dry air to ambient temperature before it reaches the sensor.

6.6.3 DSCVCR14 sampling cell with 1/4" Swagelok VCR connectors

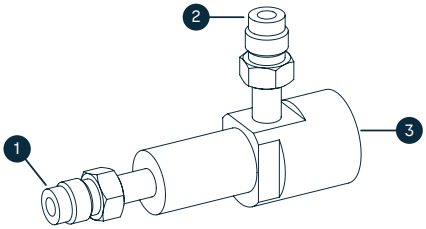


Figure 23 DSCVCR14 sampling cell with 1/4″ Swagelok VCR connectors

1 Gas inlet, 1/4″ Swagelok VCR connector
2 Gas outlet, 1/4″ Swagelok VCR connector
3 Connection point for probe/ transmitter, ISO G1/2″

For easy installation, the DSCVCR14 sampling cell includes welded Swagelok VCR metal gasket face seal fittings at both the inlet and outlet. The 1/4″ VCR end connections enable a reliable, metal-to-metal, make-and-break seal suitable for high-purity welded systems.

DSCVCR14 is a suitable choice for high-purity gas lines and applications requiring high cleanliness, such as semiconductor manufacturing and ultra-high-purity gas distribution. VCR connections are designed to be reassembled with a fresh metal gasket, so the DSCVCR14 is particularly well suited for installations that may need to be modified or reconfigured over time.

6.6.4 DSC74 sampling cell with quick connector and leak screw

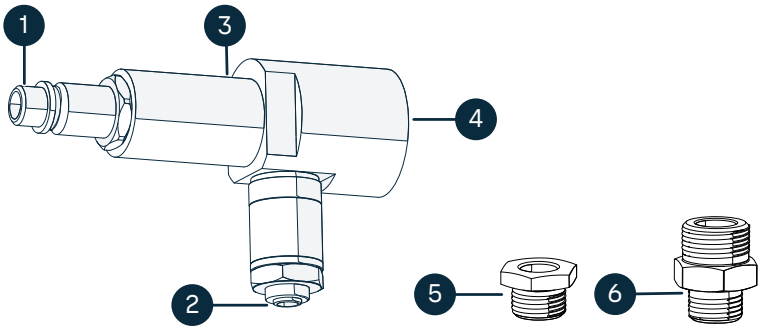


Figure 24 DSC74 sampling cell with accessories

1 Quick connector
2 Leak screw
3 Sampling cell body (DMT242SC)
4 Connection point for probe/transmitter, ISO G1/2″
5 Thread adapter, type G3/8″ - G1/4″
6 Thread adapter, type R3/8″ - R1/2″

The DSC74 has been designed especially for compressed air lines. The sampling cell contains an adjustable leak screw that maintains process pressure while allowing airflow past the sensor for a representative measurement.

The leak screw is opened and closed with a screwdriver. The leak screw should be 1/2 turn open. This can be verified by first closing the leak screw, then turning 1/2 turn to open it. The air coming out will make a barely audible hiss and can be lightly felt when putting a hand in front of the air stream.

Do not open the leak screw more than 1/2 turn to avoid reducing the pressure in the sampling cell.

The DSC74 comes with a quick connector that fits to industry standard compressed air line connectors (suitable for type D, Quick08, NIP08). This allows for easy installation and detachment of the dew point transmitter without having to shut down the process. Alternative ways to connect are through the two different thread adapters (R3/8″ to R1/2″ and G3/8″ to G1/4″ ISO) that are supplied with each DSC74 unit.

When using the DSC74, seal the threads of the quick connector or thread adapter carefully with PTFE thread seal tape. Tighten with an open-end wrench.

6.6.5 DSC74B and DSC74C sampling cells

The DSC74B and DSC74C sampling cells are enhanced versions of the DSC74. The body is designed in a way that it is possible to measure at both process and atmospheric pressure.

6.6.5.1 DSC74B two-pressure sampling cell

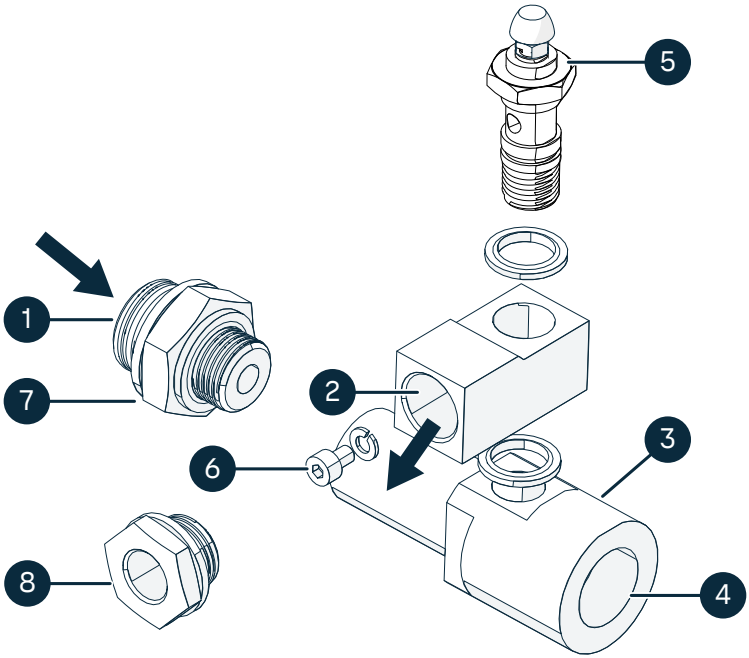


Figure 25 DSC74B sampling cell assembly for measurements at process pressure

1 Gas inlet
2 Gas outlet
3 Sampling cell body
4 Connection point for probe/transmitter, ISO G1/2″
5 Valve (flow regulator)
6 Integrated leak screw
7 Reducing nipple (thread adapter), G3/8″ - G1/2″
8 Reducing adapter (thread adapter), G3/8″ - G1/4″

The DSC74B sampling cell assembly limits the flow rate with a fixed leak screw. The flow is optimized for pressures 3 ... 10 bar (43.5 ... 145 psi), gauge. The fixed leak screw eliminates the risk of opening the leak screw fully by accident and this way emptying a gas vessel. The maximum flow can be increased, if needed, by removing the leak screw and adjusting the flow manually with the valve.

In the basic operation of the DSC74B, the gas flows to the sensor from the front and the outlet is on the side. To have the measurement done at atmospheric pressure, the inlet and outlet are reversed. Then the reducing parts supplied (G3/8″ - G1/2″ or G3/8″ - G1/4″) on the outlet side help to protect the sensor from ambient humidity coming in.



Figure 26 Removing the leak screw

6.6.5.2 DSC74C two-pressure sampling cell with coil

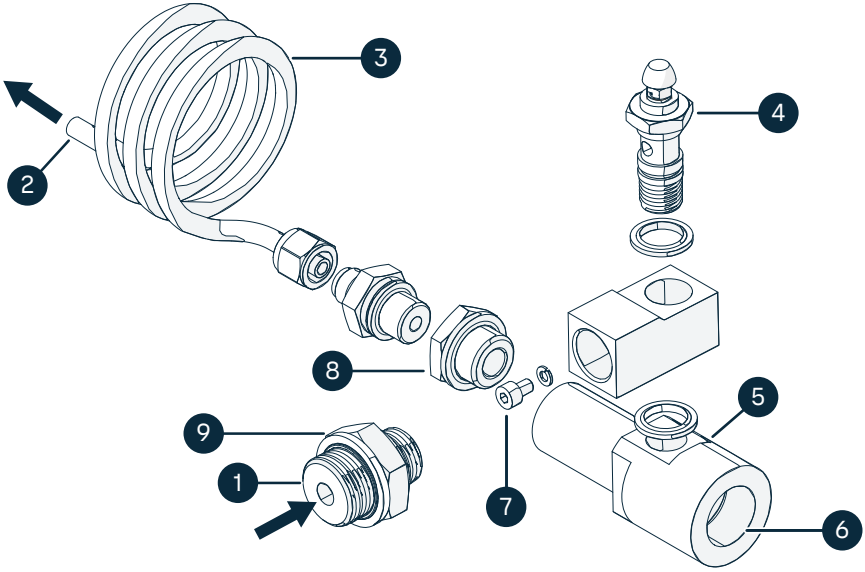


Figure 27 Setup with DSC74C for measurements at atmospheric pressure

1 Gas inlet. The coil can also be used here.
2 Gas outlet
3 DMCOIL used as venting coil
4 Valve (flow regulator)
5 Sampling cell body
6 Connection point for probe/transmitter, ISO G1/2″
7 Integrated leak screw
8 Reducing nipple (thread adapter), G3/8″ - G1/4″
9 Reducing nipple (thread adapter), G3/8″ - G1/2″

The DSC74C sampling cell consists of the DSC74B sampling cell and the DMCOIL cooling/venting coil. DSC74C is designed for the most demanding measurements at atmospheric pressure.

The coil acts as a venting coil in the gas outlet (Figure 27 (page 49)) to prevent ambient humidity from disturbing low dew point measurements in applications where the gas pressure is reduced to ambient pressure before entering the sampling cell.

When sampling from high-temperature processes, the coil can be used at the gas inlet to cool down the sample gas before it reaches the sensor (Figure 28 (page 50)).

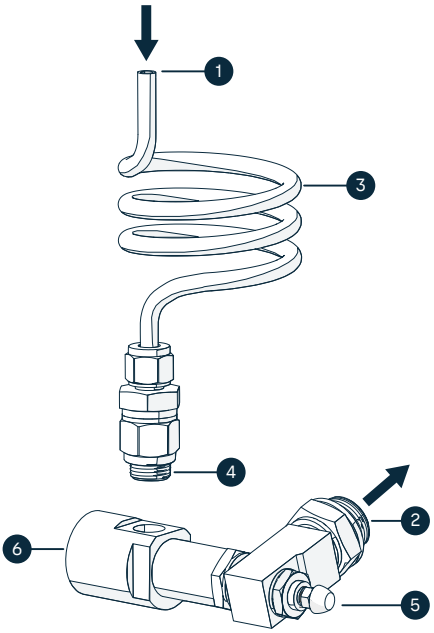


Figure 28 Alternative assembly of DSC74C for tight spaces, with DMCOIL used for cooling the sample

1 Gas inlet
2 Gas outlet
3 DMCOIL used as cooling coil
4 Thread, max. size 7 mm. Use the provided adapter to avoid damage to the measurement probe/transmitter.
5 Valve (flow regulator)
6 Connection point for probe/transmitter, ISO G1/2"

6.6.6 DMCOIL cooling/venting coil

The stainless steel DMCOIL works as a cooling coil in gas inlet in high temperature processes to cool down the sample gas temperature. It also acts as a venting coil in gas outlet to prevent ambient humidity from disturbing low dew point measurements in applications where the gas pressure is reduced to ambient pressure before entering the sampling cell.

DMCOIL is included in the DSC74C sampling cell assembly. The coil can also be purchased separately, and it is compatible with sampling cells DMT242SC, DMT242SC2, DSC74, and DSC74B.

The coil has ISO G1/4" female-threaded connector and comes with a G3/8" - G1/4" thread adapter.



Figure 29 DSC74B sampling cell and DMCOIL cooling/venting coil, which together make up the DSC74C assembly

7. Using DMT153 with Insight PC software

7.1 Vaisala Insight PC software

Vaisala Insight PC software is a configuration and calibration software for Vaisala devices. Insight is available for the Windows operating system (64-bit only). For a full list of supported operating system versions, see vaisala.com/insight.

With Insight, you can:

- See information and status of the connected measurement device.
- See real-time measurement data.
- Configure transmitter features such as environment settings, measurement filtering, analog outputs, and sensor purge.
- Record measurement data for up to 48 hours and export the data files in CSV format.
- Calibrate and adjust the $T_{d/f}$ measurement of the transmitter.

To ensure support for your device, download the latest version of Insight at vaisala.com/insight.

The DMT153 transmitter can be connected to Insight using a Vaisala Indigo USB adapter (item code USB2) or a Vaisala USB cable (item code 242659).

More information

‣ Spare parts and accessories (page 97)

7.2 Connecting to Insight software

- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- Indigo USB adapter (item code USB2) or USB connection cable (item code 242659)

When connecting several devices at the same time, note that your computer may not be able to supply enough power through its USB ports. Use an externally powered USB hub that can supply >2 W for each port.

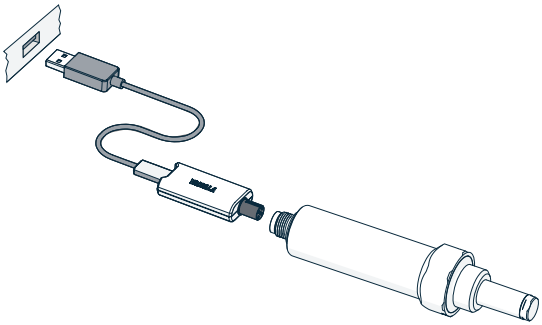


Figure 30 Connecting DMT153 to Insight using Indigo USB adapter

1. Open the Insight software on your computer.
2. Verify the current operating mode of Insight from the **Settings** menu and change it if appropriate:
   - **Basic mode** is suitable for most use cases.
   - **Advanced mode** provides access to additional configuration options. Use **Advanced mode** only when instructed to do so by product documentation or Vaisala technical support.
3. Connect the USB adapter to a free USB port on the computer or USB hub.
4. Connect DMT153 to the USB adapter.
5. Wait for the Insight software to detect the transmitter.

7.3 Configuration options with Insight

The complete DMT153 transmitter configuration is accessible via the Insight software. After connecting the transmitter, select **> Configure device** to access the configuration options in Insight software.

The available configuration options include all of the Modbus configuration registers and several additional options. Insight software is the recommended way to change the device configuration.

You can restore the device back to its default settings using the **Factory default settings > Restore factory settings** function in Insight. Doing this will also revert the latest entered calibration information to the information that was stored with the factory calibration.

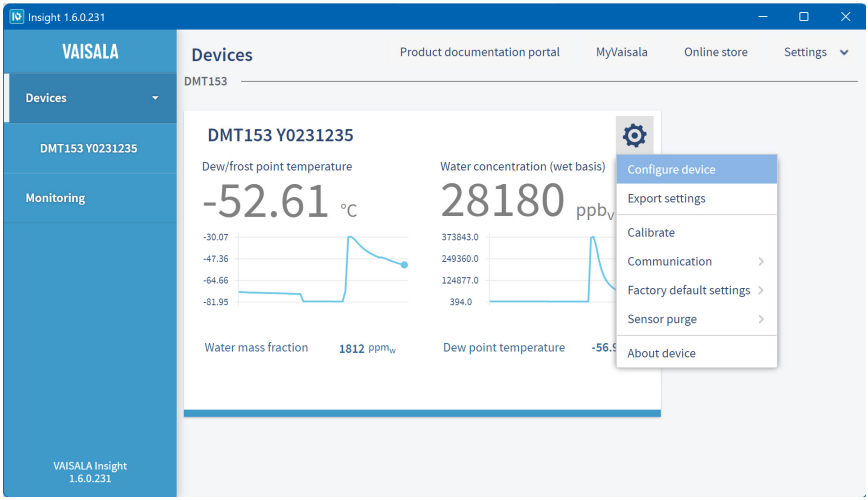


Figure 31 DMT153 shown in the **Devices** view of Insight

More information

- Enabling or disabling sensor purge (page 23)
- Configuring sensor purge in analog output mode (page 31)
- Configuring analog output settings in Insight (page 57)
- Adjustment using Insight PC software (page 78)

7.4 Diagnostics in Insight

Messages sent by the connected DMT153 transmitter are shown automatically in Insight. Additional diagnostic data is available on the **Diagnostics** page. The diagnostic files can be very useful, for example, when diagnosing issues together with Vaisala technical support.

To access the **Diagnostics** page in Insight, select **Devices > <your device>** in the left-hand navigation pane of Insight, then select the **Diagnostics** tab.

The left side of the **Diagnostics** page shows the **Diagnostics data** panel, which displays real-time status and output information read from the connected DMT153 transmitter.

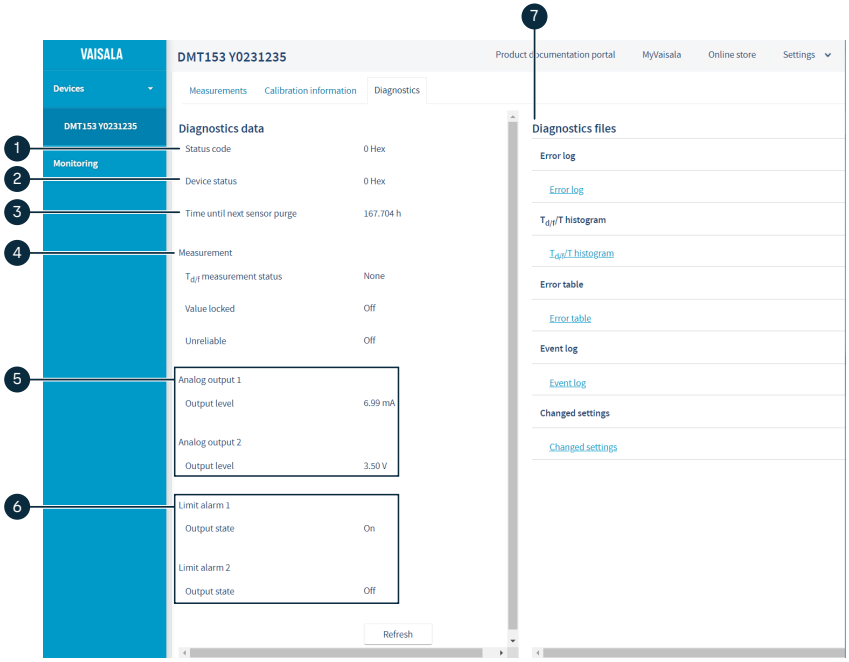


Figure 32 DMT153 Insight **Diagnostics** view example

1

Status code: shows the currently active error code of the transmitter as a hexadecimal value. A value of **0 Hex** indicates normal operation with no active errors.
For more information on the status and error codes and their meanings, see Error messages (page 89) and Status registers (page 116).

2

Device status: shows the overall operational state of the transmitter as a hexadecimal value. A value of **0 Hex** indicates normal operation with no active errors. Non-zero values indicate conditions such as an active error, a warning, a notification, or calibration mode being active.
See device statuses in Status registers (page 116), Table 23 (page 116).

3

Time until next sensor purge: shows the remaining time, in hours, until the next automatic sensor purge cycle. By default, the interval purge repeats once a week. During sensor purge, the measurement output values are locked to their last valid readings.
For more information, see Startup purge and interval purge (page 22).

4

Measurement: this section shows status information related to the $T_{d/f}$ measurement:

- **Td/f measurement status**: indicates the overall status of the measurement. The value **None** means that no status conditions are active, and the measurement is operating normally. Other possible values include **Value locked** (the output is held at the last valid value, for example, during sensor purge) and **Unreliable** (the measurement may not be accurate, for example, during the startup sequence or due to a sensor error). See $T_{d/f}$ measurement statuses in Status registers (page 116), Table 23 (page 116).
- **Value locked**: shows whether the measurement output is currently locked (**On** or **Off**). When **Value locked** is **On**, the transmitter holds and outputs the last known valid measurement value. This occurs, for example, during sensor purge.
- **Unreliable**: shows whether the measurement is currently marked as unreliable (**On** or **Off**). The **Unreliable** status is active, for example, during the transmitter's startup sequence.

5

Analog output 1 and **Analog output 2**: shows the current **Output level** of each analog output channel. The values shown reflect the actual signal levels being output by the transmitter, based on the current measurement result and the configured output scaling. If an error condition is active, the output level may show the configured error output level instead of a measurement-based value.

6

Limit alarm 1 and **Limit alarm 2**: shows the current **Output state** (**On** or **Off**) of each configurable limit alarm. A limit alarm activates when the measured parameter falls below the configured low limit or exceeds the configured high limit.
For more information on configuring limit alarms, see Limit alarm (page 32).

7

Diagnostics files: see the section below.

Diagnostics files

In Insight, you can retrieve the following diagnostic files from the connected transmitter:

- **Error log**: Chronological list of the error and status events tracked by the transmitter. When contacting Vaisala technical support, it is recommended to include an up-to-date export of the error log with the support request
- **Td/f/T histogram**: Table of dew/frost point temperature and temperature conditions measured by the transmitter.
- **Error table**: Error counter with timestamps for the first and the last incidence of each error.
- **Event log**: List of calibration related events, for example, changes made to the **Calibration information** tab of the device or adjustments saved on the **Td/f adjustment** tab. The log contains the 30 latest events, after which the log is cleared and reset.
- **Changed settings**: Any changes made to the transmitter's configuration that differ from the factory default settings are listed in this file. The file shows the latest current value for a device setting and the original factory value.

The files contain data from since the transmitter was manufactured.

The files are in comma separated value (CSV) format. They can be opened for viewing in spreadsheet programs such as Microsoft Excel or in text editors.

More information

- Error messages (page 89)
- Technical support (page 99)
- Status registers (page 116)

7.5 Configuring analog output settings in Insight

The DMT153 transmitter has 2 analog outputs that can be configured with the Insight PC software. The most relevant configuration menus for the analog outputs are shown in the example below.

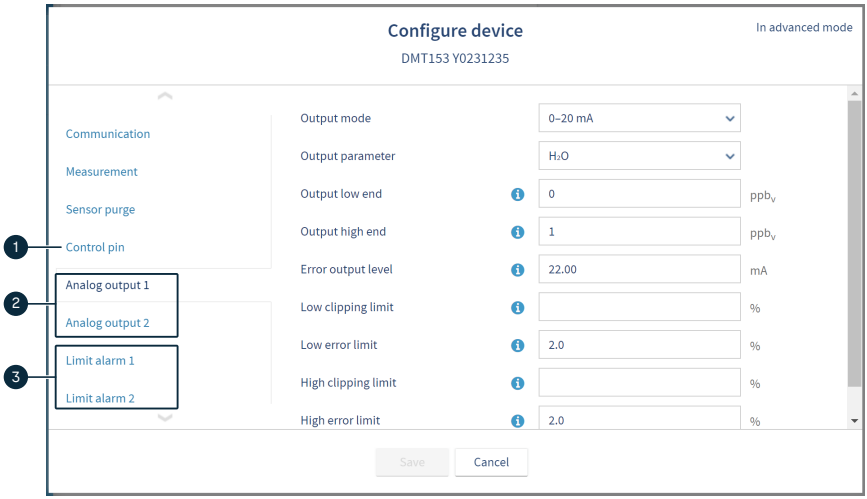


Figure 33 Analog output configuration options example in Insight

1 **Control pin** menu for configuring sensor purge functions. For more information, see Configuring sensor purge in analog output mode (page 31).
2 **Analog output 1** and **Analog output 2** menus with identical configuration options for the current and voltage outputs.
3 **Limit alarm 1** and **Limit alarm 2** menus, where you can set an alarm for both analog output channels. For more information, see Limit alarm (page 32).

7.5.1 Analog output configuration example using Insight

- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- Indigo USB adapter (item code USB2) or USB connection cable (item code 242659)

The current and voltage output of DMT153 can be used simultaneously to output different measurement parameters.

This example shows how to use Insight software to configure the transmitter's analog outputs to use the following settings:

For **Analog output 1** (current):
Output mode: 4–20 mA
Output parameter: Dew/frost point temperature ($T_{d/f}$)
Error output level: 3.6 mA
Clipping limits: 5 % (low), 5 % (high)
Error limits: 8 % (low), 10 % (high)

For **Analog output 2** (voltage):
Output mode: 0–10 V
Output parameter: water concentration (H_2O (ppm_v))
Error output level: 11 V
Clipping limits: 0 % (low), 5 % (high)
Error limits: NaN (low), 8 % (high)

1. Connect the transmitter to Insight. See Connecting to Insight software (page 52).
2. Select > **Configure device**.
3. Open the **Analog output 1** menu to configure the current output.
   a. Select **Output mode > 4–20 mA**.
   b. Select **Output parameter > Td/f**.
   c. Set the value for **Error output level**: 3.6 mA.
   d. Set the value for **Low clipping limit**: 5 %.
   e. Set the value for **High clipping limit**: 5 %.
   f. Set the value for **Low error limit**: 8 %.
   g. Set the value for **High error limit**: 10 %.
   h. Select **Save** to take the configuration into use.

4. Open the **Analog output 2** menu to configure the voltage output.
   a. Select **Output mode > 0–10 V**.
   b. Select **Output parameter > H_2O**.
   c. Set the value for **Error output level**: 11 V.
   d. Set the value for **Low clipping limit**: 0 %.
   e. Set the value for **High clipping limit**: 5 %.
   f. Leave the value for **Low error limit** blank.
   g. Set the value for **High error limit**: 8 %.
   h. Select **Save** to take the configuration into use.

More information

- Analog output overrange behavior (page 27)
- Error output level (page 33)

7.6 Setting calibration reminder in Insight

The DMT153 transmitter is fully calibrated and adjusted as shipped from the factory, and a calibration reminder with a 24-month interval is activated by default in the device.

The calibration expiry date does not affect the functionality of the sensor or the DMT153 transmitter.

You can add a calibration reminder for DMT153 using the Insight PC software, Indigo80 indicator, or Modbus configuration registers. The suitable calibration interval depends on the requirements of your measurement environment.

1. Connect the transmitter to Insight. See Connecting to Insight software (page 52).
2. In Insight main view, select **> Calibrate > Yes** to open the calibration menu.
3. In the **Calibrate device** view, select the **Calibration information** tab, where you can add relevant information and verify that the calibration reminder is on.
4. Select **Close** to save your settings and exit the view.



Figure 34 DMT153 Insight **Calibration information** view example

More information

- Calibration and adjustment overview (page 75)
- Calibration registers (page 113)

8. Using DMT153 with Indigo transmitters

Indigo transmitters are host devices that extend the feature set of connected measurement devices with a range of additional options for outputs, configuration access, measurement viewing, and status monitoring.

Available features vary depending on the Indigo transmitter model. Models without display use a LED indicator for notifications.

For more information on the features of the different Indigo transmitter models, see www.vaisala.com/indigo.



For instructions on installing and configuring Indigo transmitters, and the measurement devices connected to them, see the applicable Indigo transmitter user documentation at the Vaisala documentation portal docs.vaisala.com.



CAUTION! The process threads of the DMT153 transmitter can have sharp edges. To avoid injury when touching the threads, wear protective gloves.



NOTICE! The IP classification of DMT153 is valid only when it is connected to the connection cable, or to the cable connector inside the locking wheel of the Indigo transmitter.

More information

- Related manuals (page 11)

8.1 Connecting DMT153 to Indigo200 series transmitters

Indigo200 series transmitters have a probe connector where compatible probes or transmitters can be attached directly. A cable may also be used to connect the probe. Cables are available to order at store.vaisala.com.

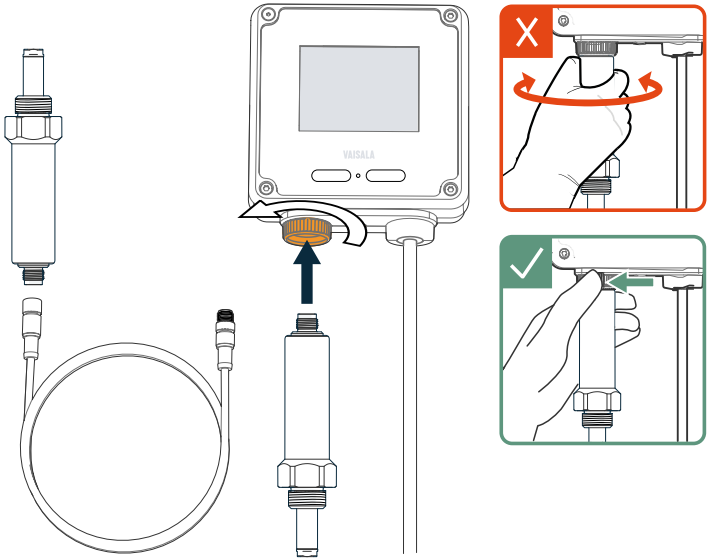


Figure 35 Connecting DMT153 to Indigo200 series transmitter

1. Insert the DMT153 transmitter or the cable into the Indigo transmitter's connector.
2. Turn the locking wheel of the Indigo transmitter to lock the DMT153 transmitter or the cable in place. **Do not turn DMT153 or the cable itself**, as that will damage the connectors.
3. If you are using a cable, connect DMT153 to the cable.
4. When the Indigo transmitter recognizes the connected DMT153 transmitter, it shows a notification message on the display.

8.2 Connecting DMT153 to Indigo300 transmitter

Indigo300 transmitters have a probe connector where compatible probes or transmitters can be attached directly. A cable may also be used to connect the measurement device. Cables are available to order at store.vaisala.com.

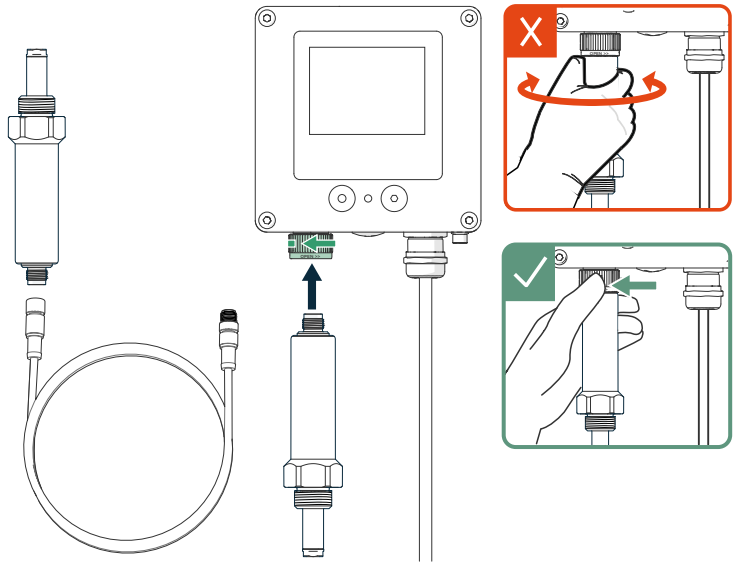


Figure 36 Connecting DMT153 to Indigo300 transmitter

1. Insert the DMT153 transmitter or the cable into the Indigo transmitter's connector.
2. Turn the locking wheel of the Indigo transmitter to lock the DMT153 transmitter or the cable in place. **Do not turn DMT153 or the cable itself**, as that will damage the connectors.
3. If you are using a cable, connect DMT153 to the cable.
4. When the Indigo transmitter recognizes the connected DMT153 transmitter, it shows a notification message on the display.

8.3 Connecting DMT153 to Indigo500 series transmitters

If your Indigo transmitter was delivered with preconfigured analog outputs, make sure that you connect the measurement devices accordingly.

Measurement devices are connected to Indigo500 series transmitters using a cable. Connections are made to the screw terminals inside the housing. The Indigo520 model allows 2 probes or transmitters to be connected. After connecting a measurement device, use the touchscreen interface or the web user interface to configure the Indigo transmitter.

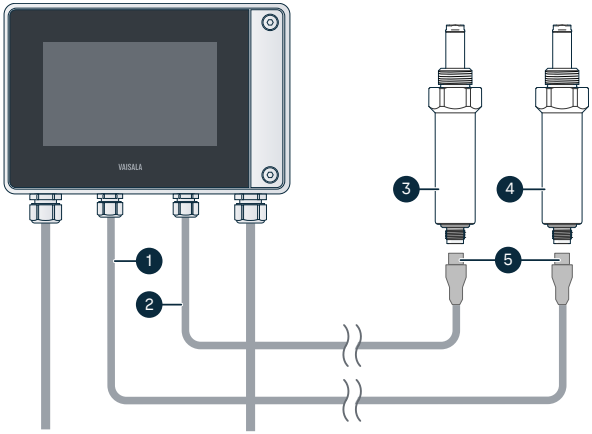


Figure 37 Connecting DMT153 to Indigo520 transmitter

1 Connection cable for measurement device 1
2 Connection cable for measurement device 2 (dual-device support in Indigo520)
3 DMT153 transmitter to be connected as device 2
4 DMT153 transmitter to be connected as device 1
5 Cable connector (M12-5F)

9. Using DMT153 with Indigo80 indicator

9.1 Indigo80 handheld indicator

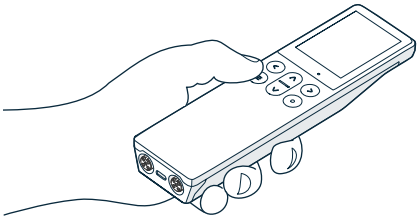


Figure 38 Indigo80 handheld indicator

Vaisala Indigo80 Handheld Indicator is a portable diagnostics tool that accommodates up to two compatible Vaisala devices for measuring a wide range of parameters.

With the indicator, you can:

- See real-time measurements and device and status information
- Log measurement data
- Update calibration information of the connected measurement device
- Configure the features and settings of the connected measurement device, such as sensor purge, environmental compensation, filtering factor, serial communication, and analog output. The available options depend on the model and firmware version of the measurement device.

The help tours in the indicator's user interface guide you through the key features of the indicator. You can access the tours in the **Help** menu by pressing the ☰ button.

For more information on using the indicator, for example, editing the measurement views and performing data logging, see Indigo80 User Guide (M212722EN).

More information

- Configuring pressure settings with Indigo80 (page 69)
- Analog output configuration example using Indigo80 (page 72)
- Adjustment with Indigo80 handheld indicator (page 82)

9.1.1 Indigo80 keypad

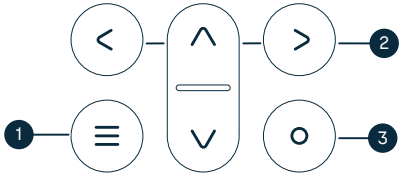


Figure 39 Indigo80 keypad

1 Power on/off and main menu button
2 Arrow buttons for navigating menus and scrolling views
3 Select button for selecting items in the user interface

9.1.2 Indigo80 main menu

Pressing the ☰ button while navigating the Indigo80 menus and views opens the main menu.

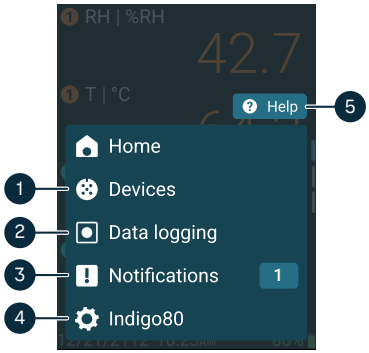


Figure 40 Indigo80 main menu

1 **Devices** menu contains, for example, options related to sensor purge, calibration, and environment settings (depending on the connected device).
2 **Data logging** menu for setting logging interval and duration, and browsing data files.
3 **Notifications** menu displays notifications related to Indigo80 and the connected devices.
4 **Indigo80** menu for changing the settings of Indigo80 (for example, date, time, and language) and viewing device information.
5 **Help** menu contains tours showing the key features of Indigo80, as well as instructions for sending devices to Vaisala for calibration and maintenance.

9.2 Connecting DMT153 to Indigo80 handheld indicator

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

Up to two Vaisala Indigo-compatible measurement devices can be connected to the ports located on the bottom of Indigo80. You can connect and disconnect devices both when the indicator is powered on and when it is off.

Vaisala recommends using cables provided by Vaisala when connecting devices to the indicator. Cables and other accessories are available to order at store.vaisala.com.

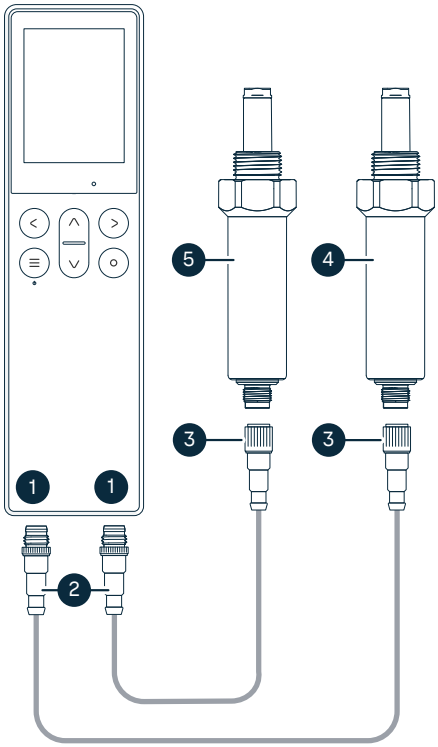
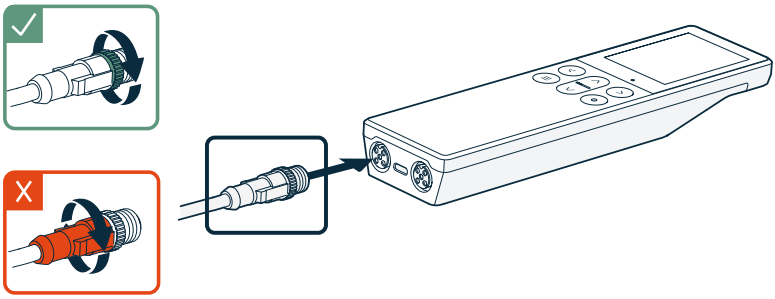


Figure 41 Example of connecting devices to Indigo80

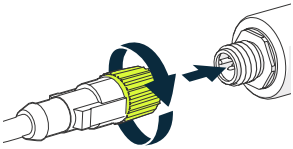
1 M12-5F ports on the bottom of Indigo80 for connecting compatible Vaisala devices. Ports are labeled ❶ (left) and ❷ (right) on Indigo80.
2 M12-5M cable connector
3 M12-5F cable connector
4 DMT153 transmitter, displayed as ❶ by Indigo80
5 DMT153 transmitter, displayed as ❷ by Indigo80

1. If the indicator is powered and no devices are connected to it, the text **Please connect a measurement device** will be shown on the display.

2. Insert the probe connection cable in one of the ports on the bottom of the indicator.
   - **Note the orientation of the cable connector when inserting it**
   - **Hold the connector in place while turning its locking ring clockwise – never twist the connector body!**



3. Connect the DMT153 transmitter to the M12-5F end of the probe connection cable.



When the indicator recognizes the connected device, it shows a notification on the display. A device connected to the leftmost port in the indicator is labeled ❶ on the indicator's display, while the device in the rightmost port is labeled ❷.

4. To change devices, simply detach the cable from the connected device and connect the cable to a new device.

When DMT153 is powered up, it performs a startup sequence consisting of sensor purge and autocalibration. Measurement output remains frozen during the startup sequence. Indigo80 will display the last measured values before the sensor purge began. The text **Unreliable** will be shown on the display during the startup sequence.
The duration of the startup sequence depends on the conditions of the measurement environment. Devices stored in, for example, a warm and humid environment before taking them to the measurement environment may take longer to output a stable reading.
For more information, see Startup sequence (page 19).

9.3 Configuring transmitter features with Indigo80 handheld indicator

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

You can use the Indigo80 handheld indicator to configure DMT153 transmitter features such as sensor purge settings, filtering factor, and analog outputs.

Accessing certain configuration options for your transmitter is possible only using the free Insight PC software, downloadable at vaisala.com/insight.

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings** to access and change the features available for your transmitter.
5. Exit the menu by pressing ⟵ or return to the main menu by pressing ☰.

More information

- Enabling or disabling sensor purge (page 23)
- Configuring sensor purge in analog output mode (page 31)

9.3.1 Configuring pressure settings with Indigo80

For the DMT153 dew/frost point measurement, temperature or pressure compensation is not needed. However, the water concentration (ppm_v/ppb_v) and water mass fraction (ppm_w) values are calculated from the measured dew/frost point and the pressure value entered in the transmitter. Make sure that the pressure setting for DMT153 is representative of the actual measurement environment.
If you did not specify pressure compensation when ordering the transmitter, you can use the Indigo80 indicator, the Insight software, or Modbus configuration registers to set the pressure value that will be used in the measurement.

The DMT153 transmitter has two types of pressure settings:

Pressure
Temporary pressure compensation value that is cleared at device restart. Use this value when you want to temporarily match the process pressure during a measurement session. At device restart, the value is replaced with the power-up default value.

Pressure, power-up default value
Persistent default value that is restored at device restart.
For installations where the process pressure is known and stays fixed.

9.3.1.1 Setting temporary pressure compensation value with Indigo80

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

Follow the procedure below to set a pressure compensation value for DMT153 using the Indigo80 indicator. The **Pressure** setting is a temporary value for pressure compensation. When the DMT153 transmitter is restarted, the compensation value changes back to the power-up default value.

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Environment settings > Pressure**.
   a. Select the unit (**hPa**, **bar (abs.)**, **bar (gauge)**, **psi (abs.)**, or **psi (gauge)**).
   b. Use the arrow buttons to set the desired value, and then select **Set**.
5. Exit the menu by pressing ⮜ or return to the main menu by pressing ☰.

The pressure setting in Indigo80 menu **Environment settings > Pressure** is interconnected to **Settings > Measurement > Pressure**: the value set in either menu is applied to both.

9.3.1.2 Setting power-up default pressure value with Indigo80

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

Follow the procedure below to set a default pressure value for DMT153 using the Indigo80 indicator. The **Pressure, power-up default value** is the value that is restored when the device is restarted.

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings > Measurement > Pressure, power-up default value**.
   a. Select the unit (**hPa**, **bar (abs.)**, **bar (gauge)**, **psi (abs.)**, or **psi (gauge)**).
   b. Use the arrow buttons to set the desired value, and then select **Set**.
5. Exit the menu by pressing ⟲ or return to the main menu by pressing ☰.

9.3.2 Configuring filtering factor with Indigo80



- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

The filtering factor allows averaging the output if the measurement environment produces occasional exceptionally high or low readings.

This example shows how to configure the filtering factor as **0.9** using the Indigo80 handheld indicator.

This means that the new measurement output is a combination of the latest measurement (90 %) and the previous measurement (10 %).

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings > Measurement**.
5. Select **Filtering factor**.
   a. Use the arrow buttons to set the value as **0.9**.
   b. Select **Set**.
6. Select **Filtering on/off > On** to enable measurement filtering using the filtering factor defined in the previous step.
7. Exit the menu by pressing ⟲ or return to the main menu by pressing ☰.

9.3.3 Configuring analog output settings with Indigo80

The DMT153 analog output channels can be configured with the Indigo80 indicator. You can use Indigo80 to:

- Enable or disable the analog output
- Select the output parameter and its scaling
- Set analog output error levels and clipping limits
- Configure limit alarms for the analog outputs

9.3.3.1 Analog output configuration example using Indigo80



- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

This example shows how to use Indigo80 to configure the transmitter's analog output 1 to use the following settings:

- 4–20 mA current output enabled
- Dew/frost point temperature measurement scaled to −80 ... −30 °C $T_{d/f}$
- Error output level set to 2 mA

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings**.
5. Scroll down and select **Analog output 1**.
6. In **Output mode**, select **4–20 mA**.
7. In **Output parameter**, select **Dew/frost point temperature**.
8. Select **Output low end** (**Scale low end** in Indigo80 devices with firmware version 1.3.2 or earlier).
9. Use the arrow buttons to set the value as **−80.00 °C**, then select **Set**.
10. Select **Output high end** (**Scale high end** in Indigo80 devices with firmware version 1.3.2 or earlier).
11. Use the arrow buttons to set the value as **−30.00 °C**, then select **Set**.
12. Select **Error output level**. Use the arrow buttons to set the value as **2.000 mA**, then select **Set**.

    Your configuration is now in use.
13. Exit the menu by pressing ⟨ or return to the main menu by pressing ☰.

9.3.3.2 Configuring purge-related control pin functions with Indigo80

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

This example shows how to use the Indigo80 indicator to configure the purge-related control pin settings of a DMT153 transmitter used in analog output mode. For a description of the sensor purge functionality in analog output mode and the meaning of the trigger event, see Configuring sensor purge in analog output mode (page 31).

For a description of startup purge and interval purge functions, see Startup purge and interval purge (page 22).

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings**.
5. Scroll down and select **Control pin > Function in analog mode**. The menu shows the following options:
   - **None**: This is the default setting. A trigger event on DMT153's pin 5 (for example, de-energizing and re-energizing the relay) will have no effect on the purge functionality. Startup purge and interval purge will be performed as configured.
   - **Start sensor purge**: Selecting this option means that the trigger event on DMT153's pin 5 will start a sensor purge immediately.
   - **Prevent sensor purge**: Selecting this option means that the trigger event on DMT153's pin 5 will start a time period during which all sensor purge operations, including startup purge and interval purge, will be blocked.
6. In **Purge prevention duration**, set the time during which sensor purge operation will be blocked (if activated with **Prevent sensor purge**). The range for the setting is 1 hour – 7 days.
7. Exit the menu by pressing ⟲ or return to the main menu by pressing ☰.

9.3.3.3 Limit alarm configuration example using Indigo80

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

This example shows how to use Indigo80 to set a limit alarm for the transmitter's analog output 2 (voltage output, 0–10 V) with $T_{d/f}$ as the output parameter and hysteresis set to 1 °C. The alarm will be activated when the $T_{d/f}$ output goes below −80 °C or above −20 °C.

1. Connect the transmitter to the indicator.

2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Settings**.
5. Scroll down and select **Analog output 2**.
6. In **Output mode**, select **0–10 V**.
7. In **Output parameter**, select **Limit alarm 1**: **Output state**.
8. Set **Scale low end** to 0 and **Scale high end** to 1.
9. Press ⟵ to go back to **Settings**, scroll down and select **Limit alarm 1**.
10. Select **Dew/frost point temperature** as the output parameter.
11. Set the value for **Activate below**: −80 °C.
12. Set the value for **Activate above**: −20 °C.
13. Set the value for **Hysteresis**: 1.00 °C.

    Your configuration is now in use.
14. Exit the menu by pressing ⟵ or return to the main menu by pressing ☰.

The limit alarm, relevant to analog outputs, is different from the measurement limit alarm feature available in Indigo80. The setting for measurement limit alarm is available in the **Home** view of Indigo80, and you can set the alarm for any type of device connected to Indigo80, both analog and digital output devices.
For more information on the measurement limit alarm, see Indigo80 User Guide (M212722EN).

More information

- Limit alarm (page 32)

10. Calibration and adjustment

10.1 Calibration and adjustment overview

The DMT153 adjustment feature is designed primarily for professional users with suitable calibration facilities, stable reference conditions, and metrology expertise. It is *not* intended to replace factory calibration for typical end-user installations with a small number of transmitters. In most cases, relying on factory calibration and using field checks only for verification provides the lowest overall risk and lifecycle cost.
When considering adjusting the transmitter, see first User adjustment requirements and limitations (page 123).

Calibration means comparing the measurement output of the device to a known reference, such as a known environment in a calibration chamber or the output of a reference instrument. Correcting the reading of the device so that it measures accurately is referred to as **adjustment**.

The DMT153 transmitter is fully calibrated and adjusted as shipped from the factory, and a calibration reminder with a 24-month interval is activated in the device.

To maintain the accuracy of the measurement, calibrate and adjust the transmitter as indicated by the calibration reminder. Your measurement environment and accuracy requirements also affect the optimal calibration frequency. If the transmitter is used in the wet end of the measurement range, calibration should be done every year. Calibration should also be done if there is a reason to believe that the device is not within its accuracy specifications.

Vaisala recommends sending the transmitter regularly to Vaisala for factory calibration. The transmitter is calibrated and adjusted at multiple points along its measurement range. Factory calibration always includes a traceable calibration certificate and adjustment, if needed.

WARNING! Chemical hazard
Devices removed from process may have been contaminated, which can cause injury to the persons handling them. When returning a device for calibration or repair, make sure you send only devices that are safe to handle without special precautions.

It is also possible to calibrate and adjust the DMT153 transmitter on the field using Insight PC software, the Indigo80 handheld indicator, or via an Indigo transmitter that is connected to Insight or Indigo80. You can also modify the DMT153 transmitter's calibration information and reminder using the above-mentioned tools.

If you think the device is not measuring correctly, calibration and adjustment is not the first thing to do. Check the following first:

- Make sure that the location for the measurement device represents well the area of interest, and nothing is interfering with the measurement: heat sources, temperature fluctuations, condensation, or leakages.
- Check that there is no moisture on the probe. If the sensor has become wet, wait for it to dry.
- Always wait for the measurement to stabilize fully.

More information

- Setting calibration reminder in Insight (page 59)
- Adjustment using Insight PC software (page 78)
- Adjustment with Indigo80 handheld indicator (page 82)
- User adjustment requirements and limitations (page 123)

10.2 Adjustment points and environments

Measurement devices can be **calibrated** in any environment that is within their operating range. For example, output from the DMT153 transmitter can be checked and compared at any temperature in the range −80 ... −20 °C (−112 ... −4 °F) $T_{d/f}$. However, measurement devices should only be **adjusted** in conditions for which their measurement accuracy is optimized. Therefore the DMT153 transmitter only accepts user adjustment at −30 °C (−22 °F) frost point or below. The device will not accept the adjustment if the adjustment points are unsuitable.

The DMT153 transmitter can be adjusted in 2 points.
When adjusting the $T_{d/f}$ output of DMT153, the following restrictions apply:

- Both reference points must be within the range −80 ... −30 °C (−112 ... −22 °F) $T_{d/f}$.
- The difference between the 2 reference points must be at least 30 °C (54 °F) $T_{d/f}$.

10.3 Calibration and adjustment procedures

A simple way to check the measurement accuracy of the DMT153 transmitter is to perform a field calibration using a reference instrument. This method does not require the transmitter to be disconnected, and a separate reference environment is not needed either. See Field calibration using a reference instrument (page 77).

Disconnected DMT153 transmitters can be connected to a computer or a handheld device for calibration and adjustment. See the following sections for calibration and adjustment procedures:

- Adjustment using Insight PC software (page 78)
- Adjustment with Indigo80 handheld indicator (page 82)

For connection cable options, see Spare parts and accessories (page 97).

10.3.1 Field calibration using a reference instrument

- Calibrated reference instrument that measures the parameter(s) being calibrated

When the DMT153 transmitter is connected to an Indigo transmitter or a data logger that has a display, you can easily perform a field calibration of DMT153 using a second dew point temperature instrument that has a display.

Before starting the procedure, check that the filter protecting the DMT153 sensor is clean. If the filter is contaminated, replace it. See Changing the filter (page 85).

Perform sensor purge on the transmitter before calibrating or adjusting it. Allow the device to settle for a minimum of 2 hours after the purge before starting the calibration or adjustment procedure.
Sensor purge is not necessary before adjusting the transmitter using previously measured values (for example, from a calibration certificate).

1. Place the probe of the reference instrument (or the entire instrument) in the same environment, next to the DMT153 transmitter that you are checking. The environment should be as stable as possible.
2. Wait for the measurement to stabilize. This may take up to several hours. Verify that measurements are no longer changing at the end of the stabilization period. Stabilization time depends on the conditions of the measurement environment.
3. Record the readings from both instruments.

10.3.2 Adjustment using Insight PC software

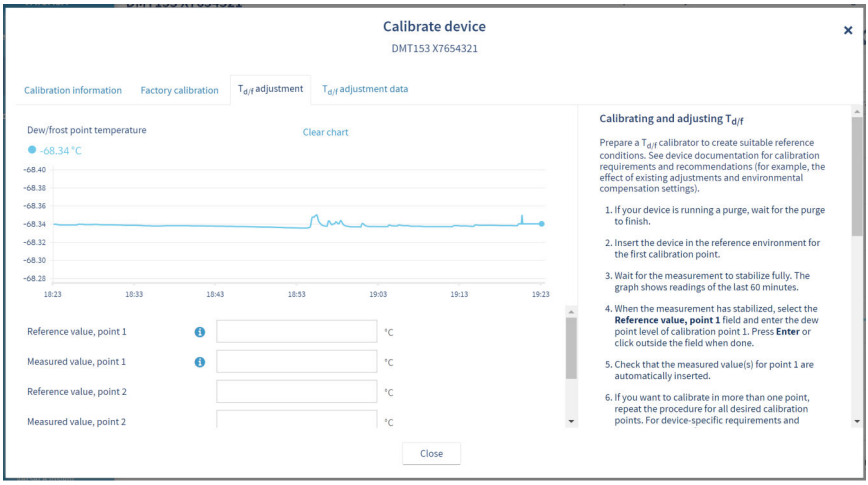


Figure 42 DMT153 $T_{d/f}$ calibration view example in Insight

You can perform a 2-point $T_{d/f}$ adjustment of DMT153 by connecting the transmitter to Vaisala Insight PC software using the Indigo USB adapter (Vaisala item code USB2). Insight software is available for download at vaisala.com/insight and you can order cables and accessories from store.vaisala.com.

If you have a list of previously collected calibration readings (for example, from a 3rd party laboratory calibration), you can adjust the device with the Insight PC software without having to generate the calibration conditions and wait for stabilization. For instructions, see Adjustment in Insight using previously measured values (page 80).

10.3.2.1 2-point $T_{d/f}$ adjustment in Insight

- Indigo USB adapter (Vaisala item code USB2) for connecting the transmitter to Insight PC software
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- Two $T_{d/f}$ reference conditions (for example, known reliable measurement equipment as references)

Prepare a dew point calibrator to create suitable reference conditions. See Adjustment points and environments (page 76) for calibration requirements and recommendations.

Because stabilization of dew point temperature takes time and depends on the conditions of the measurement environment, you should expect the adjustment procedure to take at least 60 minutes for each adjustment point.

Before starting the procedure, check that the filter protecting the DMT153 sensor is clean. If the filter is contaminated, replace it. See Changing the filter (page 85).

Perform sensor purge on the transmitter before calibrating or adjusting it. Allow the device to settle for a minimum of 2 hours after the purge before starting the calibration or adjustment procedure.
Sensor purge is not necessary before adjusting the transmitter using previously measured values (for example, from a calibration certificate).

1. Install DMT153 to the dew point calibrator you are using as the first calibration reference.
2. Open the Insight software on your computer.
3. Connect your transmitter to the PC with Indigo USB adapter and wait for Insight to detect the device.
4. Wait for the startup purge to finish and the transmitter to settle for a minimum of 2 hours.
5. In Insight, select **> Calibrate > Yes** to open the calibration menu and switch the transmitter to calibration mode.

   In calibration mode, the transmitter will not use functions that may interfere with calibration and adjustment.
6. Open the **Td/f adjustment** tab.
7. Adjust the dew point calibrator you are using as reference to the first adjustment point.
8. Wait for the DMT153 measurement to stabilize fully. The graph shows readings of the last 60 minutes.
9. When the measurement has stabilized, click the **Reference value, point 1** field and enter the $T_{d/f}$ level of the first adjustment reference. Press **Enter** or click outside the field when done.
10. Check that the measured value(s) for point 1 are automatically inserted.
11. Repeat step 7– step 10 for the second adjustment point.
12. Check the difference between each reference and measured value. Very large differences may be due to insufficient stabilization time or unsuitable calibration setup. If the reference and measured values are too far apart, you will get an error notification. Contact Vaisala support if the adjustment fails despite sufficient stabilization time and correct calibration setup.
13. If you want to save the adjustment into the device, select **Activate adjustment**.

    To exit without taking the adjustment in use, select **Close**.
14. After adjusting your device, update the information in the **Calibration information** tab.

10.3.2.2 Adjustment in Insight using previously measured values

- Indigo USB adapter (Vaisala item code USB2) for connecting the transmitter to Insight
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed
- Previously collected measurement values that are entered in the adjustment

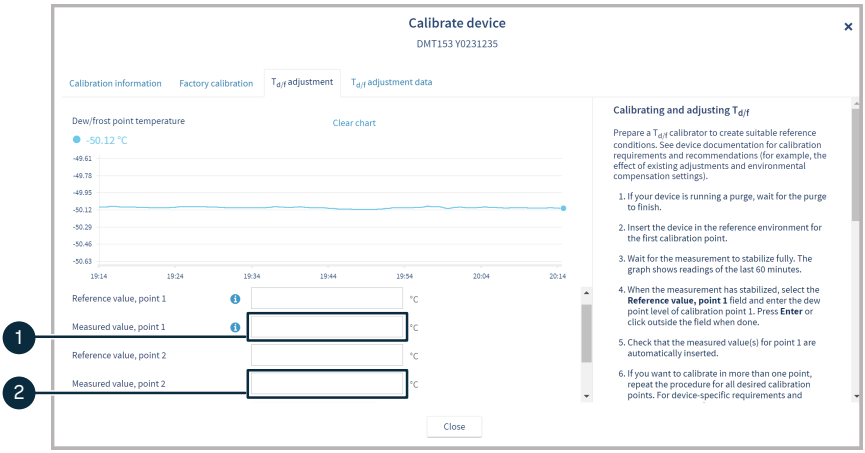


Figure 43 Example $T_{d/f}$ adjustment view when entering previously measured values

1 Measured $T_{d/f}$ value for point 1
2 Measured $T_{d/f}$ value for point 2

If you have a list of previously collected calibration readings (for example, from a 3rd party laboratory calibration), you can adjust the transmitter without having to generate the calibration conditions and wait for stabilization.

If you adjust the transmitter using previously measured values, the device readings will be corrected and **your previous calibration certificate will not be valid anymore**. If an up-to-date calibration certificate is still needed, you must perform the calibration again to detect any remaining measurement error after the adjustment.

Before you start, familiarize yourself with information on adjustment points and requirements for your dew point transmitter. See Adjustment points and environments (page 76).

The following example describes a 2-point $T_{d/f}$ adjustment in Insight using previously measured values:

1. Open the Insight software on your computer.
2. Connect your transmitter to the PC with Indigo USB adapter and wait for Insight to detect the device.
3. Wait for the startup purge to finish.
4. Select ⚙ **> Calibrate > Yes** to open the calibration menu and switch the transmitter to calibration mode.

   In calibration mode, the transmitter will not use functions that may interfere with calibration and adjustment.
5. Open the **Td/f adjustment** tab.
6. When entering previously measured values, there is no need to insert the device in a reference environment or wait for stabilization. Enter the $T_{d/f}$ level of your first reference in the **Reference value, point 1** field.
7. Replace the automatically inserted value in the **Measured value, point 1** field with the value that you have measured previously.
8. Repeat step 6 and step 7 for the second adjustment point.

   If you want to save the adjustment into the device, select **Activate adjustment**. Verify the result from the message that appears at the top of the screen.
   To exit without taking the adjustment in use, select **Close**.
9. After adjusting your device, update the information in the **Calibration information** tab.

10.3.2.3 Restoring factory adjustment with Insight software

- Indigo USB adapter (Vaisala item code USB2)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed

If needed, you can restore the factory adjustment for your transmitter's output parameters using Insight software. Any user adjustment will be cleared and the latest adjustment performed by Vaisala will be restored in the device.

Note that restoring the factory adjustment is not necessary before a new adjustment: you can just perform the new adjustment on top of the old adjustment. However, you can select to do the restore procedure if your adjustment fails for some reason, or if you want to return to the factory adjustment.

1. Open the Insight software on your computer.
2. Connect your transmitter to the PC with Indigo USB adapter and wait for Insight to detect the device.
3. Select ⚙ **> Calibrate > Yes** to open the calibration menu and switch the transmitter to calibration mode.
4. Open the **Td/f adjustment** tab and scroll down to the bottom of the view.

5. To restore the adjustment, select **Restore factory adjustment**.
6. Select **Close** to exit the calibration mode.

10.3.3 Adjustment with Indigo80 handheld indicator

10.3.3.1 Performing manual adjustment with Indigo80 handheld indicator using previously measured values

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))
- Previously collected calibration readings, for example, a calibration certificate from a third party calibration laboratory

This procedure tells you how to use the Indigo80 handheld indicator to adjust your transmitter's dew point measurement in 2 points when you have a list of previously collected calibration readings available (for example, in a calibration certificate from a third party laboratory calibration). You can adjust the transmitter without having to generate the calibration conditions and wait for stabilization.

If you adjust the transmitter using previously measured values, the device readings will be corrected and **your previous calibration certificate will not be valid anymore**. If an up-to-date calibration certificate is still needed, you must perform the calibration again to detect any remaining measurement error after the adjustment.

Before you start, familiarize yourself with information on adjustment points and requirements for your dew point transmitter. See Adjustment points and environments (page 76).

1. Connect the DMT153 transmitter to the Indigo80 indicator.
2. Wait for the startup purge to finish. During the startup purge, the text **Unreliable** will be shown on the display and the measurement readings stay frozen.
3. Open the indicator main menu by pressing ☰.
4. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
5. Select **Calibrate / Adjust**.
6. Acknowledge any notifications by selecting **OK**.
7. Select **Td/f adjustment**.
8. Acknowledge the notification by selecting **OK**.
9. If you have **two measurement devices** connected to Indigo80, the options **Read from device** and **Enter manually** will be visible at this point.

   Select **Enter manually**.

10. Select **Reference value, point 1**.
    a. Select the unit, **°C** or **°F**.
    b. Use the arrow buttons to set a valid reference value (for example, the reference dew point temperature value from your calibration certificate), and then select **Set**.
11. Scroll down and select the **Measured value, point 1** field.
    a. Select the unit, **°C** or **°F**.
    b. Replace the automatically inserted value with your previously measured calibration reading (for example, the observed dew point temperature value from your calibration certificate), and then select **Set**.
12. Scroll down and repeat step 10 and step 11 for the second adjustment point in the **Reference value, point 2** and **Measured value, point 2** menus.
13. You can now choose to activate the adjustments in the transmitter or exit the calibration menu without taking the adjustments into use.
    a. To activate the adjustments:
        - Scroll down and select **Activate adjustment > OK**.
        - Confirm by selecting **OK**.
        - Continue from step 14.
    b. To exit the calibration menu without taking the adjustments into use:
        - Press ☰ to end calibration, exit the calibration menu, and return to the Indigo80 home view.
14. After activating the adjustments, update the calibration information in **Calibrate / Adjust > Calibration information**. Navigate to the **Calibration information** menu by pressing <.
15. Press ☰ **> End calibration** to exit the calibration menu and return to the DMT153 settings menu.

10.3.3.2 Restoring factory adjustment with Indigo80 handheld indicator

- Probe connection cable (M12-M12, for example, Vaisala item INDIGOCABLE1M (see list of accessories in this document))

If needed, you can restore the factory adjustment for your transmitter's output parameters using the Indigo80 handheld indicator. Any user adjustment will be cleared and the latest adjustment performed by Vaisala will be restored in the device.

Note that restoring the factory adjustment is not necessary before a new adjustment: you can just perform the new adjustment on top of the old adjustment. However, you can select to do the restore procedure if your adjustment fails for some reason, or if you want to return to the factory adjustment.

1. Connect the DMT153 transmitter to the Indigo80 indicator.

2. Open the indicator main menu by pressing ☰.
3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.
4. Select **Calibrate / Adjust**.
5. Acknowledge any notifications by selecting **OK** or pressing ↩.
6. Select **Td/f adjustment**.
7. Scroll down and acknowledge the notification by selecting **OK**.
8. If you have **two measurement devices** connected to Indigo80, the options **Read from device** and **Enter manually** will be visible at this point.

   Select **Enter manually**.
9. To restore the factory adjustment, scroll down and select **Restore factory adjustment > OK > OK**.
10. Confirm by selecting **Close**.
11. Press ☰ **> End calibration** to exit the calibration menu and return to the DMT153 settings menu.

11. Maintenance and troubleshooting

CAUTION! If the transmitter is installed in a pressurized chamber, always make sure that the pressure of the chamber is equalized with the ambient pressure prior to removing the transmitter. When the transmitter is removed for maintenance, cap the hole with a capped nut. This way, the process can be running although the transmitter is not in place.
Plugs are available from Vaisala for ISO G1/2″-threaded connections (Vaisala item code 218773) and 1/2″-14 NPT-threaded connections (Vaisala item code 222507).

11.1 Cleaning the transmitter

The body of the DMT153 transmitter can be cleaned by wiping with a lint-free cloth moistened with water.

When cleaning the transmitter, follow these precautions:

- Do not immerse the transmitter in liquid.
- Do not use cleaning agents or solvents.
- Do not attempt to clean the filter or the sensor element. If the filter is contaminated, replace it with a new one.

11.2 Changing the filter

- Replacement filter (Vaisala item code 220957SP)
- Clean, lint-free gloves
- 11-mm socket wrench

If the filter is contaminated, it should be replaced. New filters can be ordered from Vaisala. Be careful when changing the filter, since it is easy to break the sensor when the filter is removed.

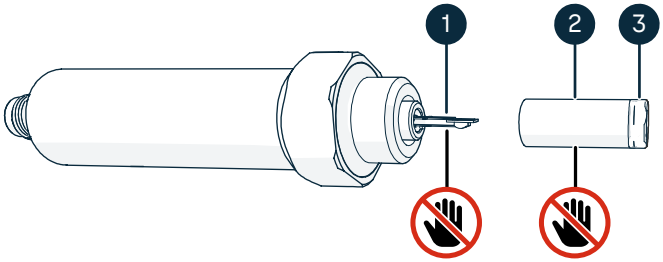


Figure 44 Filter structure

1 Vaisala DRYCAP sensor
2 Stainless steel mesh filter
3 Top of filter

When replacing the filter, note the following:

- The pores of the steel mesh may become blocked if touched. Do not touch the filtering surface with your hands or any tools. Always handle the filter from the top of the filter body.
- Touching the filter with your fingers will also deposit oil and dirt on the filter, which may affect the measurement. Always wear gloves when handling the filter.
- Transmitters with ISO G1/2″ or 3/4″-16 UNF threads only: always use a new sealing ring when installing the transmitter after a filter change.

Replace the filter as follows:

1. Grip the old filter from the top of the filter body using an 11-mm socket wrench. Turn the filter counterclockwise until it is loose.
2. Pull the filter straight out carefully so as not to damage the sensor.
3. Insert the new filter in the filter threads.

   The spring washer included with the spare filter is not needed with DMT153.
4. Tighten the new filter by turning it clockwise with the socket wrench. Tighten to 5 Nm.

11.3 Troubleshooting

11.3.1 Troubleshooting checklist

When troubleshooting, check the questions listed in Technical support (page 99) before contacting Vaisala technical support.

11.3.2 Problems and their possible solutions

If you have a problem with using the DMT153 transmitter, check the problems and solutions listed below and Table 6 (page 90) before contacting Vaisala. If the problem you have is not listed, or if the proposed solution does not fix the problem, contact Vaisala technical support.

You can check the transmitter diagnostics and status with the Insight software and Modbus status registers (see Diagnostics in Insight (page 54) and Status registers (page 116)).

Problem: DMT153 indicates the measurement status as 'Unreliable' instead of showing a normal live measurement value.	
Possible cause:	**Solution:**
DMT153 has been powered up and is performing a self-diagnostic startup sequence.	Wait for the startup sequence to finish and normal measurement to start. See Startup sequence (page 19).

Problem: DMT153 indicates the measurement status as 'Value locked' instead of showing a normal live measurement value.	
Possible cause:	**Solution:**
DMT153 is performing either the scheduled interval purge or purge started by the user.	Wait for the sensor purge to finish and normal measurement to resume. See Startup sequence (page 19) and Startup purge and interval purge (page 22).

Problem: Measurement output seems incorrect	
Possible cause:	**Solution:**
Installation location is not representative of the actual conditions you want to measure.	Verify the installation setup: • Check that there are no leaks in the system that would allow ambient humidity into the sample • Gas flow and pressure are representative of the process • Make sure to measure only gases suitable for DMT153. See operating environment specifications in DMT153 specifications (page 93). Reinstall or relocate DMT153 if necessary. See Selecting installation location (page 35).
DMT153 is in need of adjustment.	Send DMT153 to Vaisala for calibration and adjustment. See Calibration and adjustment overview (page 75).

Problem: Values of measurement parameters stop changing or change slowly for a few minutes	
Possible cause:	**Solution:**
DMT153 is performing a sensor heating function such as interval purge.	Wait for the function to complete and measurement parameters to be available again. See Startup sequence (page 19) and Startup purge and interval purge (page 22).

Problem: Analog output is stuck at a constant error output level (for example, 3.6 mA, 23 mA, 5.5 V, or 11 V)	
Possible cause:	**Solution:**
DMT153 has an active error or critical error condition, or the measured value is outside the configured error limits.	Check error messages in Insight software, Indigo80, or Modbus status registers. Check the configured error output level and error limits of the analog outputs and correct settings if necessary. See Error output level (page 33).
Supply voltage may be outside the specified range.	Verify that the supply voltage and wiring meet the requirements for the device. See Wiring (page 38).

Problem: No analog output signal or output is at 0 mA / 0 V	
Possible cause:	**Solution:**
Analog output is disabled.	Check with Insight or Indigo80 that the analog output channel is enabled and correctly configured.
DMT153 is operating in digital mode (pin 5 floating at power-up).	Check the state of pin 5 in the M12 connector at device power-up. For analog output mode, pin 5 must be grounded. See Operating mode selection (page 24).
Wiring or load is incorrect.	Make sure wiring and external loads meet device specifications.
Supply voltage is out of range for analog output operation.	

Problem: No Modbus response from DMT153	
Possible cause:	**Solution:**
DMT153 is operating in analog mode (pin 5 grounded at power-up).	Check the state of pin 5 in the M12 connector at device power-up. For digital (Modbus) mode, pin 5 must be floating. See Operating mode selection (page 24).

Problem: No Modbus response from DMT153	
RS-485 wiring is incorrect.	Verify RS-485 wiring (see Wiring (page 38)).
Modbus serial settings or address do not match between the host and DMT153.	Check that the Modbus address, bit rate, parity, data bits, and stop bits match on both the host and DMT153. If the Modbus settings are unknown, connect to DMT153 using Insight or Indigo80 and check the **Communication** settings, or restore the factory default settings.

Problem: Vaisala MI70 indicator does not detect DMT153	
Cause:	**Solution:**
MI70 does not support DMT153.	Use the Indigo80 handheld indicator for configuring DMT153 and for logging measurement data.

11.3.3 Error messages

See also Problems and their possible solutions (page 87).

Measurement devices can communicate with error messages when they are connected to an Indigo transmitter, Indigo80 indicator, or Insight software. The messages are categorized according to the severity of the status:

- **Critical errors** are fatal to the operation of the device. It may not be able to respond to communication at all, and will not measure correctly.
- **Errors** prevent normal operation of the device. Depending on the problem, errors may resolve themselves. For example, a completely wet humidity sensor may cause a humidity measurement error.
- **Warnings** do not prevent normal operation but may indicate possible problems.
- **Status** indicates a known state of the device.

The error messages listed in Table 6 (page 90) correspond to the Modbus error codes listed in Table 24 (page 117).

Table 6 DMT153 error messages displayed in Indigo transmitter, Indigo80, or Insight software

Error message	Description	Recommended action
Critical errors		
Device settings corrupted. [50]	Parameter memory is corrupted.	Contact Vaisala technical support.
Errors		
Temperature sensor failure (open circuit). [327]	Readings from sensor(s) are missing or out of range.	Inspect transmitter head and sensors visually. If the transmitter is completely wet, allow it to dry out. If the sensors are damaged or missing and the error message(s) stay active, contact Vaisala to have the device repaired.
Temperature sensor failure (short circuit). [328]		
Humidity sensor failure (open circuit). [325]		
Humidity sensor failure (short circuit). [326]		
Supply voltage too low. [2942]	Transmitter's supply voltage is too high or low.	Check and correct the supply voltage.
Supply voltage too high. [331]		
Warnings		
Ambient temperature out of range. [48]	Transmitter body is too hot or cold.	Relocate the transmitter so that its ambient temperature is within the specified operating range.
Calibration has expired. [353]	This warning is displayed by the calibration reminder functionality on the day the calibration expires if the calibration interval has been exceeded.	Calibrate the device and update the calibration date information.
Status messages		
Sensor purge in progress. [287]	Sensor purge is ongoing.	Wait for sensor purge to complete.
Calibration is about to expire. [352]	This message is displayed by the calibration reminder functionality 30 days before the calibration expires.	Calibrate the device and update the calibration date information.

More information

- Diagnostics in Insight (page 54)

11.3.4 Analog output error state

The DMT153 transmitter sets the analog output channel into a defined error level instead of the measured result in the following situations:

- The transmitter detects a measurement malfunction. This means an actual measurement problem, such as sensor damage, or unsuitable environmental conditions.
- The measured value(s) are outside the error limits defined for the outputs.

The default error levels for the analog outputs are listed below.

- Analog output 1 (defaults for devices ordered with 4–20 mA or 0–20 mA output mode):
  - 4–20 mA: 3.6 mA
  - 0–20 mA: 23 mA
- Analog output 2 (defaults for devices ordered with 0–5 V or 0–10 V output mode):
  - 0–5 V: 5.5 V
  - 0–10 V: 11 V

You can change the error level (range 0–25 mA / 0–11 V) with the Insight software, Indigo80 indicator, or through Modbus registers.

More information

‣ Analog output overrange behavior (page 27)

11.3.5 Restoring factory default settings with Insight software



- Indigo USB adapter (Vaisala item code USB2)
- Computer with a Microsoft Windows® operating system (64-bit version) and Vaisala Insight PC Software installed

If needed, you can restore the transmitter back to its factory default settings using the Insight software. Doing this will also clear any user adjustment and restore the latest adjustment performed by Vaisala.

1. Open the Insight software on your computer.
2. Connect your transmitter to the PC with Indigo USB adapter and wait for Insight to detect the device.
3. Select ⚙ **> Factory default settings > Restore factory settings**.
4. Wait for Insight to re-detect the transmitter.

11.3.6 Restoring factory default settings with Indigo80 handheld indicator

1. Connect the transmitter to the indicator.
2. Open the indicator main menu by pressing ☰.

3. Select **Devices**. If you have more than one device connected to the indicator, make a further selection between the devices.

   In this case, select **DMT153**.
4. Select **Settings**.
5. Select **Factory default settings > Restore factory settings > OK**.
6. Confirm by selecting **OK**.
7. Exit the menu by pressing ⓒ or return to the main menu by pressing ☰.

12. Technical data

12.1 DMT153 specifications

Table 7 DMT153 measurement performance

Property	Description/Value
Sensor	DRYCAP® 180U
Dew point / frost point temperature [1]	
Measurement range	−80 … −20 °C (−112 … −4 °F) $T_{d/f}$ (non-calibrated range −100 … +20 °C (−148 … +68 °F) $T_{d/f}$)
Accuracy: [2]	
−80 … −40 °C (−112 … −40 °F)	±2 °C (3.6 °F) $T_{d/f}$
−40 … −20 °C (−40 … −4 °F)	±3 °C (5.4 °F) $T_{d/f}$
Typical response time 63 % [90 %] at gas temperature +20 °C (+68 °F) and pressure of 1 bar:	
−20 … −80 °C $T_{d/f}$	30 s [7.5 min]
−80 … −20 °C $T_{d/f}$	2 s [5 s]
Typical long-term stability	Better than ±2 °C (3.6 °F) $T_{d/f}$/ year
Available output parameters	
Dew point / frost point temperature (°C or °F) Dew point temperature (°C or °F) Water concentration (ppm_v or ppb_v) [3] Water mass fraction (ppm_w) [3]	
Other	
Start-up time	1 min
Warm-up time	10 min (15 min to full specification)
Measurement cycle	1 s
Resolution	0.01 °C $T_{d/f}$ at digital output
SI-traceable calibration certificate	Yes, for range −80 … −20 °C (−112 … −4 °F) $T_{d/f}$

1) *When the dew point temperature is below 0 °C, the transmitter outputs frost point temperature for $T_{d/f}$.*
2) *Including calibration uncertainty, hysteresis, non-linearity, and repeatability.*

3) *Calculated on a wet basis.*

Table 8 DMT153 operating environment

Property	Description/Value
Operating environment	Indoor use
Use in wet location	No
Operating temperature	−40 ... +70 °C (−40 ... +158 °F)
Operating humidity	0–100 %RH (up to +20 °C (+68 °F)) [1]
Operating process pressure	0–50 bar (0–725 psi), absolute
Measurement environment	For air, nitrogen, argon, helium, oxygen, and vacuum [2] [3]
Sample flow rate	No effect on measurement accuracy
Storage temperature	−40 ... +60 °C (−40 ... +140 °F)
Storage humidity	0–90 %RH
IP rating	IP66: Dust-tight. Protected from powerful water jets from any direction. [1]

1) *Applicable to the transmitter body (excluding the sensor), with the probe connection cable properly connected.*
2) *Consult Vaisala if other chemicals are present. Consider safety regulations with flammable gases. DMT153 is not Ex-certified for use in potentially explosive environments.*
3) *Not suitable for measurements in pure carbon dioxide or sulfur hexafluoride.*

Table 9 DMT153 powering

Property	Description/Value
Operating voltage	With RS-485 output: 11–28 V DC With analog output: 15–28 V DC At low temperature or high pressure: 21–28 V DC
Nominal voltage	24 V
Current consumption	Normal operation: 20 mA + load current During self diagnostics: max. 220 mA pulsed
Supply voltage fluctuation	Max 0.3 V 50/60 Hz AC rms

Table 10 DMT153 analog outputs

Property	Description/Value
Number of analog outputs	2 (1 voltage, 1 current)

Property	Description/Value
Selectable output types	0–5 V, 0–10 V, scalable 4–20 mA, 0–20 mA, scalable
Accuracy of analog outputs at +20 °C (+68 °F)	±0.01 V / ±0.01 mA
Temperature dependence	±0.005 %/°C
External loads	Current output: R_L < 500 Ω Voltage output: R_L > 10 kΩ

Table 11 DMT153 digital communication

Property	Description/Value
Serial communication	RS-485
Communication protocol	Modbus RTU

Table 12 DMT153 compliance

Property	Description/Value
EU directives and regulations	EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU) as amended by 2015/863
Electromagnetic compatibility (EMC) [1]	IEC/EN 61326-1, industrial environment CISPR 11 / EN 55011, Class B, Group 1 FCC part 15 B, Class B CAN ICES-3(B)/NMB-3(B)
Compliance marks	CE, China RoHS, RCM, KC [2]

1) Compliance is specified for installations using shielded cables.
2) www.rra.go.kr/selform/rws-DMT153

Table 13 DMT153 mechanical specifications

Property	Description/Value
Connector type	M12 5-pin A-coded male
Weight [1]	190 g (6.7 oz)
Dimensions (H × W × L)	30 × 33 × 136.5 mm (1.18 × 1.3 × 5.37 in)

Property	Description/Value
Mechanical connection options	ISO G1/2″ 1/2″-14 NPT 3/4″-16 UNF
Materials	
Transmitter body	Stainless steel (AISI 316L)
Stainless steel mesh filter	AISI 303 (filter body), AISI 316L grade 18 µm (mesh)

1) Model with ISO G1/2″ thread.

12.2 Dimensions

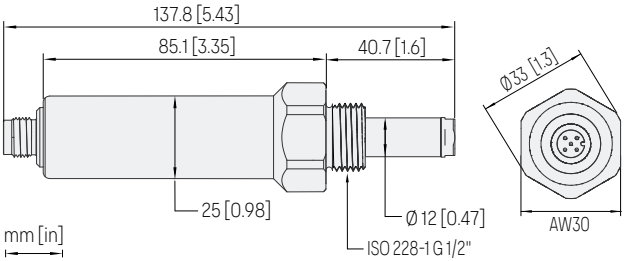


Figure 45 DMT153 dimensions, model with ISO G1/2″ thread

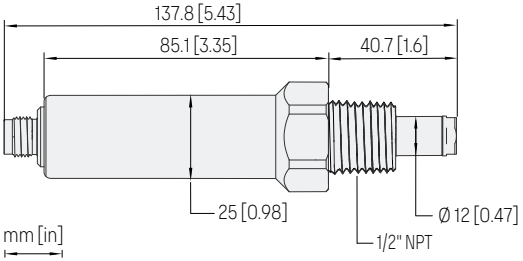


Figure 46 DMT153 dimensions, model with 1/2″-14 NPT thread

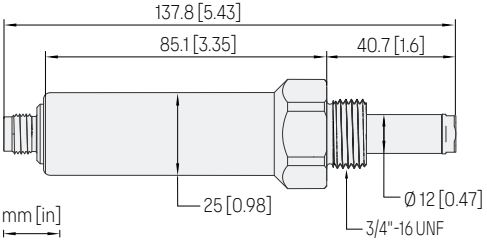


Figure 47 DMT153 dimensions, model with 3/4"-16 UNF thread

12.3 Spare parts and accessories

Information on spare parts, accessories, and calibration products is available online at vaisala.com and store.vaisala.com.

Table 14 DMT153 spare parts and accessories

Description	Item code
Filter	
Mesh filter 18um + washer, stainless steel	220957SP
Sealing rings	
Sealing ring set, 3 pcs D21/28×1.5 Cu for ISO G1/2" thread	221524SP
Sealing ring set, 3 pcs D19/25×1.5 Cu for 3/4"-16 UNF thread	221563SP
Cables and cable accessories	
Connector, M12-5F for 4-8 mm shielded cable [1)]	285482SP
Probe connection cable, M12-5F - open wires, 0.3 m (12 in)	CBL210896-03MSP
Probe connection cable, M12-5F - open wires, 1.5 m (4 ft 11 in)	223263SP
Probe connection cable, M12-5F - open wires, 3 m (9 ft 10 in)	26719SP
Instrumentation cable, M12-5F - open wires, 5 m (16 ft 5 in)	26720
Probe connection cable, M12-5F - open wires, 10 m (32 ft 10 in)	216546SP
Probe connection cable, M12-5F - open wires, 90° connector, 0.6 m (1 ft 12 in)	244669SP
Probe connection cable, M12-5F - open wires, 90° connector, 1.5 m (4 ft 11 in)	255102
Probe connection cable, M12-5F - M12-5M, 1 m (3 ft 3 in) [2)]	INDIGOCABLE1M

Description	Item code
Probe connection cable, M12-5F - M12-5M, 3 m (9 ft 10 in)	INDIGOCABLE3M
Probe connection cable, M12-5F - M12-5M, 5 m (16 ft 5 in)	INDIGOCABLE5M
Probe connection cable, M12-5F - M12-5M, 10 m (32 ft 10 in)	INDIGOCABLE10M
Indigo USB adapter	USB2
Sampling cells	
Sampling cell with female connectors, inlet G3/8″, outlet G1/4″ ISO	DMT242SC
Sampling cell with Swagelok male connectors for 1/4″ tubing	DMT242SC2
Sampling cell with 1/4″ Swagelok VCR connectors	DSCVCR14
Sampling cell with quick connector and leak screw	DSC74SP
Two pressure sampling cell	DSC74BSP
Two pressure sampling cell with coil	DSC74CSP
Service kit for DSC74 sampling cells	DSC74SERVICEKIT
Cooling/venting coil for sampling cell	DMCOILSP
Mounting accessories and plugs	
Probe holder assembly	ASM213582
NW40 mounting flange	225220SP
ISO G1/2″ plug with sealing ring	218773
1/2″-14 NPT plug	222507

1) Connector for retrofitting an existing installed Vaisala DMT152 transmitter cable.
2) Recommended for connection to Indigo80.

13. Vaisala services

13.1 Service centers

Vaisala offers comprehensive customer care throughout the life cycle of our products. Our service centers offer maintenance, calibration, upgrade, and repair services. All the services are provided worldwide with fast deliveries. For more information, go to vaisala.com/services.

The services are available from:

- Vaisala Online Store, store.vaisala.com
- Vaisala Services, helpdesk@vaisala.com

The provided services vary product by product.

13.2 Technical support



You can contact Vaisala technical support at vaisala.my.site.com/myvaisala or helpdesk@vaisala.com. You can find all our support channels at vaisala.com/support.

When contacting technical support, provide the following as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information
- Diagnostics package for the application

If applicable, also provide the following details:

- What failed (what worked / did not work)?
- Where did it fail (location and environment)?
- When did it fail (date, immediately / after a while / periodically / randomly)?
- How many failed (only one defect / other same or similar defects / several failures in one unit)?
- What was done when the failure was noticed?
- What was connected to the product and to which connectors?
- What is the input power source type, voltage, and what else (such as lighting, heaters, and motors) was connected to the same power output?
- Are all parts connected and grounded properly? Take a photo to help the troubleshooting.

13.3 Warranty

For warranty terms and conditions and the warranty claim process, see vaisala.com/warranty.

Note that warranty coverage may not apply if the product is damaged due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. See the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Appendix A. Modbus reference

A.1 Default communication settings

Table 15 Default Modbus serial communication settings

Property	Description/Value
Serial bit rate	19200
Parity	None
Number of data bits	8
Number of stop bits	2
Flow control	None
Modbus device address	240

You can use up to 16 transmitters on the same RS-485 line. You must configure each transmitter on the line to have a different Modbus address.

A.2 Function codes

Table 16 Modbus function codes

Function code (decimal)	Function code (hexadecimal)	Name	Notes
03	0x03	Read Holding Registers	Class 0
16	0x10	Write Multiple Registers	Class 0
43 / 14	0x2B / 0x0E	Read Device Identification	

A.3 Data encoding

In the data registers, the numeric values are available in one or two formats with separate register addresses: 32-bit IEEE floating point format and/or 16-bit signed integer format.



For values that have both 32-bit and 16-bit register available, use of the 32-bit register is recommended. Some values may exceed the signed 16-bit range even in normal operation.

A.3.1 32-bit floating point or 32-bit integer format

Registers using **32-bit float** data format are encoded using the **binary32** encoding defined in IEEE 754. The format is also known as "single-precision floating point format".

The least significant 16 bits of a floating point number are placed at the Modbus register listed in the table, while the most significant 16 bits are placed in the register with number/address + 1, as specified in Open Modbus TCP Specification, Release 1.0. This is also known as "little-endian" or "Modicon" word order.

Despite the specification, some Modbus clients[1)] may expect a "big-endian" word order (most significant word first). In such case, you must select "word-swapped" floating point format in your Modbus client for the Modbus registers of the device.

A complete 32-bit floating point or 32-bit integer value should be read and written in a single Modbus transaction.

NOTICE! Reading the measurement data registers with incorrect floating point format setting may occasionally result in correct-looking, but nevertheless incorrect values.

It is highly recommended to verify that you have configured the floating point format correctly on your Modbus host system by reading a floating point value from a test value register.

A.3.2 16-bit integer format

Some 16-bit integer values in the data registers are scaled to include the necessary decimals. The scaling factors for those values are shown in the register tables.

Table 17 Interpretation of 16-bit signed integer values

Value (decimal)	Value (hexadecimal)	Description
0–32766	0x0000–0x7FFE	Value in range 0–32766
32767	0x7FFF	Value is 32767 or larger
32768	0x8000	Value is not available
32769	0x8001	Value is –32767 or smaller
32770–65535	0x8002–0xFFFF	Value in range –32766 ... –1 (2's complement)

1) Formerly 'master'.

A.4 Modbus registers

Registers are numbered in decimal, starting from 1. Register addresses in actual Modbus messages (Modbus Protocol Data Unit (PDU)) are in hexadecimal and start from zero. Register number 1 corresponds to address 0x0 in the actual Modbus message.

NOTICE! Reading the wrong register(s) may result in correct-looking values. Check the reference documentation of your Modbus host (PLC) to verify which notation it uses for Modbus register addresses.

A.4.1 Measurement data registers

Table 18 Floating point measurement data registers (read-only)

Register number	Address	Description	Data format	Unit
1	0x0000	Dew/frost point temperature	32-bit float	$T_{d/f}$ °C
3	0x0002	Water concentration (wet basis)	32-bit float	ppb_v
5	0x0004	Water mass fraction	32-bit float	ppm_w
7	0x0006	Dew point temperature	32-bit float	T_d °C

A.4.2 Diagnostic data registers

Table 19 Diagnostic data registers (read-only)

Register number	Address	Description	Data format	Unit
1809	0x0710	Output level of analog output 1	32-bit float	mA
2065	0x0810	Output level of analog output 2	32-bit float	V
641	0x0280	Time until next sensor purge	32-bit signed integer	s
3594	0x0E09	Output state of limit alarm 1	16-bit boolean	
3850	0x0F09	Output state of limit alarm 2	16-bit boolean	
625	0x0270	Value locked	16-bit boolean	1 = Value locked

Register number	Address	Description	Data format	Unit
626	0x0271	Unreliable	16-bit boolean	1 = Measurement not ready

A.4.3 Configuration registers

Table 20 Modbus configuration data registers (writable)

Register number	Address	Description	Data format	Notes
General				
2561	0x0A00	Device tag	Text	Text string of 24 bytes in UTF-8 encoding
1542	0x0605	Restart device	16-bit function status	When writing to register: 1 = Restart device
Compensation setpoints				
769	0x0300	Volatile value for pressure compensation (the value is cleared at probe reset). Used for compensating the measurement for pressure.	32-bit float	Unit: hPa Range: 1–50 000 hPa Default 1013.25 hPa Init copied from power-up value
771	0x0302	Power-up value for pressure compensation	32-bit float	Unit: hPa Range: 1–50 000 hPa Default: 1013.25 hPa
801	0x0320	Molar mass of gas	32-bit float	Unit: g/mol Default: 28.02 g/mol Used for viewing and setting the molar mass of the gas in the measurement environment. The molar mass parameter is used in calculating H_2O ppm_w.
Sensor purge				

Register number	Address	Description	Data format	Notes
1285	0x0504	Start sensor purge	16-bit function status	When reading from register: 1–100 = Purge is in progress (progress shown as 1–100 %) 0 = Previous purge completed successfully, purge is not in progress When writing to register: 1 = Start sensor purge
1286	0x0505	Interval purge on/off	16-bit boolean	0 = Off (purge disabled) 1 = On (purge enabled) Value 0 disables interval purge temporarily. Purge is enabled again at device restart.
Control pin functions				
1297	0x0510	Function in analog mode	enum	0 = None 1 = Start sensor purge 2 = Prevent sensor purge The selection of this function is available when DMT153 is used in analog mode, with pin 5 of DMT153's M12 connector connected to ground. See also Configuring sensor purge in analog output mode (page 31).
817	0x0330	Purge prevention duration	32-bit float	Unit: h Range: 1–168 Default: 1 Time during which sensor purge is prevented, if set in register 0x0510 (2 = Prevent sensor purge). See also Configuring sensor purge in analog output mode (page 31).
Filtering				

Register number	Address	Description	Data format	Notes
795	0x031A	Filtering factor	32-bit float	Range: 0.000–1.000 1.000 = Reading shows 100 % of the most recent measured value (no filtering, default) 0.01–0.99 = Reading shows 1–99 % of the most recent measured value and part of the previous reading (filtering is applied). For example, "0.9" means that the filtered measurement reading = 90 % of the most recent measured value + 10 % of the previous reading. See also Filtering factor (page 26).
1282	0x0501	Filtering on/off Enable or disable measurement filtering using the user-defined filtering factor (register 0x031A)	16-bit boolean	0 = Off (default) 1 = On
Communication				
1537	0x0600	Modbus address	16-bit integer	Range: 1–247 Default: 240
1538	0x0601	Bit rate	enum	0 = 300 1 = 600 2 = 1200 3 = 2400 4 = 4800 5 = 9600 6 = 19200 7 = 38400 8 = 57600 9 = 115200 Default: 6 = 19200

Register number	Address	Description	Data format	Notes
1539	0x0602	Parity, data, stop bits	enum	0 = None, 8, 1 1 = None, 8, 2 2 = Even, 8, 1 3 = Even, 8, 2 4 = Odd, 8, 1 5 = Odd, 8, 2 Default: 1 = None, 8, 2
1540	0x0603	Response delay	16-bit integer	Unit: ms Range: 0–1000 Default: 0 ms
Analog output 1				
1793	0x0700	Output mode	enum	0 = Off 1 = 4–20 mA 2 = 0–20 mA
1794	0x0701	Output parameter	16-bit register address	0x0000 (Dew/frost point temperature) 0x0002 (Water concentration (wet basis)) 0x0004 (Water mass fraction) 0x0006 (Dew point temperature) 0x0270 (Value locked) 0x0271 (Unreliable) 0x0E09 (Output state of limit alarm 1), or 0x0F09 (Output state of limit alarm 2)

Register number	Address	Description	Data format	Notes
1795	0x0702	Scale low end	32-bit float	Set the lower limit of the measurement scale for the output parameter chosen in register 0x0701 (Output parameter). Set the value as 0 for binary output parameters (0x0270, 0x0271, 0x0E09, and 0x0F09).
1797	0x0704	Scale high end	32-bit float	Set the upper limit of the measurement scale for the output parameter chosen in register 0x0701 (Output parameter). Set the value as 1 for binary output parameters (0x0270, 0x0271, 0x0E09, and 0x0F09).
1799	0x0706	Error output level	32-bit float	Range: 0–25 mA Default if ordered with output mode 4–20 mA: 3.6 mA Default if ordered with output mode 0–20 mA: 23 mA
1801	0x0708	Low clipping limit	32-bit float	Percentage of scaled range Default: 0 % 0–20 = Clip the output when the measurement goes this many percent below the low end of the scale NaN = Disable clipping limit at low end

Register number	Address	Description	Data format	Notes
1803	0x070A	Low error limit	32-bit float	Percentage of scaled range 0–20 = Set the output in error state when the measurement goes this many percent below the low end of the scale NaN (default) = Disable error limit at low end
1805	0x070C	High clipping limit	32-bit float	Percentage of scaled range Default: 0 % 0–20 = Clip the output when the measurement goes this many percent above the high end of the scale NaN = Disable clipping limit at high end
1807	0x070E	High error limit	32-bit float	Percentage of scaled range 0–20 = Set the output in error state when the measurement goes this many percent above the high end of the scale NaN (default) = Disable error limit at high end
Analog output 2				
2049	0x0800	Output mode	enum	0 = Off 1 = 0–10 V 2 = 0–5 V

Register number	Address	Description	Data format	Notes
2050	0x0801	Output parameter	16-bit register address	0x0000 (Dew/frost point temperature) 0x0002 (Water concentration (wet basis)) 0x0004 (Water mass fraction) 0x0006 (Dew point temperature) 0x0270 (Value locked) 0x0271 (Unreliable) 0x0E09 (Output state of limit alarm 1), or 0x0F09 (Output state of limit alarm 2)
2051	0x0802	Scale low end	32-bit float	Set the lower limit of the measurement scale for the output parameter chosen in register 0x0801 (Output parameter). Set the value as 0 for binary output parameters (0x0270, 0x0271, 0x0E09, and 0x0F09).
2053	0x0804	Scale high end	32-bit float	Set the upper limit of the measurement scale for the output parameter chosen in register 0x0801 (Output parameter). Set the value as 1 for binary output parameters (0x0270, 0x0271, 0x0E09, and 0x0F09).

Register number	Address	Description	Data format	Notes
2055	0x0806	Error output level	32-bit float	Range: 0–11 V Default if ordered with output mode 0–5 V: 5.5 V Default if ordered with output mode 0–10 V: 11 V
2057	0x0808	Low clipping limit	32-bit float	Percentage of scaled range Default: 0 % 0–20 = Clip the output when the measurement goes this many percent below the low end of the scale NaN = Disable clipping limit at low end
2059	0x080A	Low error limit	32-bit float	Percentage of scaled range 0–20 = Set the output in error state when the measurement goes this many percent below the low end of the scale NaN (default) = Disable error limit at low end
2061	0x080C	High clipping limit	32-bit float	Percentage of scaled range Default: 0 % 0–20 = Clip the output when the measurement goes this many percent above the high end of the scale NaN = Disable clipping limit at high end

Register number	Address	Description	Data format	Notes
2063	0x080E	High error limit	32-bit float	Percentage of scaled range 0–20 = Set the output in error state when the measurement goes this many percent above the high end of the scale NaN (default) = Disable error limit at high end
Limit alarm 1				
3586	0x0E01	Output parameter	16-bit register address	0x0000 (Dew/frost point temperature) 0x0002 (Water concentration (wet basis)) 0x0004 (Water mass fraction) 0x0006 (Dew point temperature)
3587	0x0E02	Activate below	32-bit float	Unit: °C, ppb_v , or ppm_w The limit alarm is activated if the measurement output falls below the given alarm level.
3589	0x0E04	Activate above	32-bit float	Unit: °C, ppb_v , or ppm_w The limit alarm is activated if the measurement output exceeds the given alarm level.
3591	0x0E06	Hysteresis	32-bit float	Unit: °C, ppb_v , or ppm_w Setting a hysteresis value prevents the repeated triggering of the alarm when the measurement fluctuates around a limit value.
Limit alarm 2				

Register number	Address	Description	Data format	Notes
3842	0x0F01	Output parameter	16-bit register address	0x0000 (Dew/frost point temperature) 0x0002 (Water concentration (wet basis)) 0x0004 (Water mass fraction) 0x0006 (Dew point temperature)
3843	0x0F02	Activate below	32-bit float	Unit: °C, ppb_v , or ppm_w The limit alarm is activated if the measurement output falls below the given alarm level.
3845	0x0F04	Activate above	32-bit float	Unit: °C, ppb_v , or ppm_w The limit alarm is activated if the measurement output exceeds the given alarm level.
3847	0x0F06	Hysteresis	32-bit float	Unit: °C, ppb_v , or ppm_w Setting a hysteresis value prevents the repeated triggering of the alarm when the measurement fluctuates around a limit value.
Factory default settings				
7681	0x1E00	Restore factory settings	16-bit function status	1 = Restore factory settings

A.4.4 Calibration registers

Table 21 Modbus calibration registers (writable)

Register number	Address	Description	Data format	Notes
General				

Register number	Address	Description	Data format	Notes
8193	0x2000	Calibration passcode	16-bit integer	1300 = calibration mode enabled Any other value = calibration mode disabled
8194	0x2001	Calibration year	16-bit integer	These 3 registers must be written in a single transaction. It is not possible to change only year/month/day alone; such an attempt will be ignored.
8195	0x2002	Calibration month	16-bit integer	
8196	0x2003	Calibration day	16-bit integer	
8197	0x2004	Calibration text	text	Text string in UTF-8 encoding, maximum 24 bytes. When writing a new calibration text, all Modbus registers in this range must be written, even if the text is shorter. The written text must be filled with NUL bytes so that it is exactly 12 registers (24 bytes) long. Any write attempts not writing all these registers in one transaction will be ignored.
	0x2005			
	0x2006			
	0x2007			
	0x2008			
	0x2009			
	0x200A			
	0x200B			
	0x200C			
	0x200D			
	0x200E			
	0x200F			
8209	0x2010	Calibration interval	16-bit integer	Unit: months Range: 1–120 Default: 24
8210	0x2011	Calibration expiry year	16-bit integer	These 3 registers must be written in a single transaction. It is not possible to change only year/month/day alone; such an attempt will be ignored.
8211	0x2012	Calibration expiry month	16-bit integer	
8212	0x2013	Calibration expiry day	16-bit integer	
8213	0x2014	Calibration reminder on/off	16-bit boolean	0 = Off 1 = On Default: 1 = On

Register number	Address	Description	Data format	Notes
User $T_{d/f}$ adjustment				
8449	0x2100	Reference value, point 1	32-bit float	Range: −80 ...−30 °C
8451	0x2102	Measured value, point 1	32-bit float	Unit: °C Any $T_{d/f}$ value can be entered as the measured value (also outside of the measurement range).
8453	0x2104	Reference value, point 2	32-bit float	Range: −80 ...−30 °C
8455	0x2106	Measured value, point 2	32-bit float	Unit: °C Any $T_{d/f}$ value can be entered as the measured value (also outside of the measurement range).
8481	0x2120	Activate adjustment	16-bit function status	1 = Activate adjustment
8482	0x2121	Restore factory adjustment	16-bit function status	1 = Restore factory adjustment

Table 22 Modbus calibration registers (read-only)

Register number	Address	Description	Data format	Notes
8214	0x2015	Factory calibration year	16-bit integer	
8215	0x2016	Factory calibration month	16-bit integer	
8216	0x2017	Factory calibration day	16-bit integer	

Register number	Address	Description	Data format	Notes
8217	0x2018	Factory calibration text	text	Text string in UTF-8 encoding, maximum 24 bytes
8218	0x2019			
8219	0x201A			
8220	0x201B			
8221	0x201C			
8222	0x201D			
8223	0x201E			
8224	0x201F			
8225	0x2020			
8226	0x2021			
8227	0x2022			
8228	0x2023			
Td/f adjustment data				
8961	0x2300	Reference value, point 1	32-bit float	Unit: °C
8963	0x2302	Measured value, point 1	32-bit float	Unit: °C
8965	0x2304	Reference value, point 2	32-bit float	Unit: °C
8967	0x2306	Measured value, point 2	32-bit float	Unit: °C

A.4.5 Status registers

Table 23 Modbus status data registers (read-only)

Register number	Address	Description	Data format	Notes
516	0x0203	Error code	32-bit signed integer	See Table 24 (page 117).

Register number	Address	Description	Data format	Notes
522	0x0209	$T_{d/f}$ measurement status	16-bit signed integer	**0x0000**: Status OK **0x0001**: Measurement is not available **0x0002**: Measurement is not reliable **0x0004**: Under range **0x0008**: Over range **0x0020**: Value locked **0x0080**: Sensor failure **0x0100**: Measurement not ready
523	0x020A	Device status	16-bit signed integer	**0x0000**: Status OK **0x0001**: Critical error, maintenance needed **0x0002**: Error, device may recover automatically **0x0004**: Warning **0x0008**: Notification **0x0010**: Calibration mode active.

See also Error messages (page 89) in section Troubleshooting (page 86) for more information on the error states and recommended actions in each case.

Table 24 Error codes in register 0x0203

Bitmask	Error message	Severity
0x0000	(Indicates that the device status is OK)	–
0x0001	Device settings corrupted.	Critical error
0x0002	Sensor purge in progress.	Information
0x0004	Ambient temperature out of range.	Warning
0x0008	Supply voltage too low.	Error
0x0010	Supply voltage too high.	Error
0x0020	Temperature sensor failure (short circuit).	Error
0x0040	Temperature sensor failure (open circuit).	Error

Bitmask	Error message	Severity
0x0080	Humidity sensor failure (open circuit).	Error
0x0100	Humidity sensor failure (short circuit).	Error
0x0200	Calibration has expired.	Warning
0x0400	Calibration is about to expire.	Information

A.4.6 Test value registers

Read the known test values from the test registers to verify the functionality of your Modbus implementation.

Table 25 Modbus test registers (read-only)

Register number	Address	Description	Data format	Test value
7937	0x1F00	Signed integer	16-bit integer	-12345
7938	0x1F01	Floating point	32-bit float	-123.45
7940	0x1F03	Text string	7-character ASCII string	Text string "-123.45"

A.5 Device identification objects

Table 26 Device identification objects

Object ID	Object ID (hexadecimal)	Object name	Example contents
0	0x00	VendorName	"Vaisala"
1	0x01	ProductCode	"DMT153"
2	0x02	MajorMinorVersion	"1.2.3" Software version of the device.
3	0x03	VendorUrl	"https://www.vaisala.com/"
4	0x04	ProductName	"DMT153 Dew Point Transmitter "
5	0x05	ModelName	"7E2A2A0A000" Configuration code of the device. Length and content of the code are model-specific.
6	0x06	UserApplicationName	User definable information text (see configuration register 0x0A00)

Object ID	Object ID (hexadecimal)	Object name	Example contents
128	0x80	SerialNumber [1)]	"K0710040"
129	0x81	CalibrationDate [1)]	"2026-04-24" Calibration date in YYYY-MM-DD format. Empty string if not set/valid.
130	0x82	CalibrationText [1)]	"Vaisala/HEL" Calibration information text. Empty string if not set/valid.

1) Vaisala-specific device information.

A.6 Exception responses

Table 27 Modbus exception responses

Code	Name	Reason
01	Illegal function	Unsupported function code
02	Illegal data address	Register address or Object ID out of valid ranges
03	Illegal data value	Otherwise invalid request

Accessing unavailable (temporarily missing) measurement data does not generate a Modbus exception. “Unavailable” value (a quiet NaN for floating point data or 0x8000 for integer data) is returned instead. An exception is generated only for any access outside the applicable register ranges.

A.7 Modbus communication examples

Reading dew/frost point temperature value

Device address used in the following examples is 240 (0xF0).
Measurement values returned by the device change depending on ambient conditions and/or device settings.

Request		Response	
Bytes on the line (hexadecimal)	**Description**	**Bytes on the line (hexadecimal)**	**Description**
(silence for 3.5 bytes)	Start of Modbus RTU frame	(silence for 3.5 bytes)	Start of Modbus RTU frame
0xF0	Device address	0xF0	Device address
0x03	Function (Read Holding Registers)	0x03	Function (Read Holding Registers)
0x00	Register address	0x04	Number of data bytes
0x00		0x7E	Value of first register (least significant word)
0x00	Number of 16-bit registers to read (2)	0x7E	
0x02		0xC2	Value of second register (most significant word)
0xD1	Modbus RTU checksum	0x66	
0x2A		0xB3	Modbus RTU checksum
(silence for 3.5 bytes)	End of Modbus RTU frame	0x86	
		(silence for 3.5 bytes)	End of Modbus RTU frame

Communication description	
Register address	1 (1-based Modbus documentation format) = 0x0000 (0-based format used in actual communication).
Data format	Two 16-bit Modbus registers interpreted as IEEE 754 binary32 floating point value, least significant word first.
Returned value	0x7E7EC266, which is binary32 representation of −57.623 (°C $T_{d/f}$).

Writing volatile compensation pressure value

Request		Response	
Bytes on the line (hexadecimal)	**Description**	**Bytes on the line (hexadecimal)**	**Description**
(silence for 3.5 bytes)	Start of Modbus RTU frame	(silence for 3.5 bytes)	Start of Modbus RTU frame
0xF0	Device address	0xF0	Device address
0x10	Function (Write Multiple Registers)	0x10	Function (Write Multiple Registers)
0x03	Register address	0x03	Register address
0x00		0x00	
0x00	Number of registers to write (2)	0x00	Number of 16-bit registers written (2)
0x02		0x02	
0x04	Number of data bytes	0x54	Modbus RTU checksum
0x6E	Value for first register (least significant word)	0xAD	
0x14			
0x44	Value for second register (least significant word)	(silence for 3.5 bytes)	End of Modbus RTU frame
0x75			
0x4E	Modbus RTU checksum		
0xAB			
(silence for 3.5 bytes)	End of Modbus RTU frame		

The response to a write function informs that the function was correctly received by the device. It does not guarantee that the written value was accepted by the device (for example, in case out-of-range values).

To verify that the value was really accepted by the device, read the register value after writing.

Communication description	
Register address	769 (1-based Modbus documentation format) = 0x0300 (0-based format used in actual communication).

Communication description	
Data format	Two 16-bit Modbus registers interpreted as IEEE 754 binary32 floating point value, least significant word first.
Value to write	0x44756E14 = 981.72 (hPa)

Appendix B. User adjustment requirements and limitations

This section provides additional information related to DMT153 user adjustment procedures, described in Calibration and adjustment overview (page 75) and its subchapters.

The DMT153 adjustment feature is designed primarily for professional users with suitable calibration facilities, stable reference conditions, and metrology expertise. It is *not* intended to replace factory calibration for typical end-user installations with a small number of transmitters. In most cases, relying on factory calibration and using field checks only for verification provides the lowest overall risk and lifecycle cost.

If there is any doubt about meeting the conditions and requirements for user-performed adjustment, the safest and most reliable choice is to use Vaisala factory calibration services. For more information, see Service centers (page 99).

After adjustment carried out by the user, responsibility for verifying the performance and suitability of the device for its intended use rests with the user. Vaisala is not responsible for measurement errors, performance issues, or damages that result from user-performed adjustments.

B.1 2-point adjustment at customer or service provider facilities

2-point adjustment is for professional calibration environments, not for typical end-user sites. It is intended for users who maintain their own low dew point calibration capability and handle larger numbers of instruments.

Intended users

- Calibration and metrology laboratories with existing accredited or traceable low dew point calibration capabilities.
- Pure gas producers and similar organizations that maintain in-house low dew point standards and require full control of calibration scheduling and logistics.

Required expertise and setup

- Dedicated metrology expertise in low dew point / trace moisture calibration, including uncertainty analysis and traceability.
- Low dew point generator, humidity generator, or gas-mixing system capable of producing stable conditions at several target dew points across the relevant range.
- Established procedures for low dew point gas handling, stabilization, and safety.
- A test station design that ensures the same gas sample at essentially the same conditions is supplied to both DMT153 and the reference, for example:
  - Short, well-designed flow paths between generator, reference, and DMT153.
  - Use of appropriate materials (such as electropolished stainless steel) to minimize adsorption and contamination.
  - Controlled flow, pressure, and temperature to avoid gradients and instability.

Important notes

- The user's calibration conditions and the uncertainties of their reference standards determine the final measurement uncertainty of the user-adjusted product.
- Drift is not necessarily linear across the measurement range. A 2-point user adjustment primarily corrects transmitter readings at the selected adjustment points and does not ensure improved accuracy between or beyond those points.
- If user-performed adjustments lead to unsatisfactory performance, DMT153 can always be reset to its most recent factory adjustment.

If any of the above conditions cannot be met, or if the number of units is small, 2-point adjustment should not be implemented. In such cases, sending instruments to Vaisala factory calibration and adjustment, and using field checks for verification only, is strongly preferred.

B.2 Factory calibration and adjustment as a Vaisala service

Factory calibration and adjustment is the default and recommended option for all users and applications, especially demanding applications such as:

- Critical processes where measurement risk must be minimized.
- Harsh or contaminating environments (for example, chemical exposure) with higher risk of drift.
- Applications that use a wide or dynamic low dew point range and wide ambient temperature range, where performance is needed across much of the transmitter's range.
- Applications in regulated industries where internal documentation, audits, or quality systems require accredited or traceable calibration.

Practical use model

- Many users operate with one DMT153 in process and one spare unit. When the in-process transmitter is sent for factory calibration and adjustment, the spare is installed to minimize downtime.
- Users who wish to verify performance can perform field checks against a reference (for example, a DMT153 installed in a dedicated sampling point and read with an Indigo80). Only when the comparison shows the process DMT153 to be out of tolerance is it sent for factory calibration and adjustment.
- For small numbers of instruments and typical industrial installations, this approach is usually more reliable and cost-effective than full calibration and adjustment by the end user.

More information

- Calibration and adjustment overview (page 75)
- Service centers (page 99)

Appendix C. DMT152 serial commands and corresponding DMT153 Modbus registers

Table 28 (page 126) maps the most relevant serial commands used with the DMT152 transmitter to their DMT153 Modbus register equivalents and explains any differences in behavior.

The Modbus registers of DMT153 are listed in Modbus reference (page 101).

See DMT152 User Guide (M210865EN) for more information on the DMT152 serial commands.

Table 28 DMT152 serial commands and corresponding DMT153 Modbus registers

DMT152 serial command	Description	DMT153 behavior using Modbus	DMT153 Modbus register
?	Show device information	Same information readable from Modbus registers	**Device identification registers**: see Table 26 (page 118). **Calibration registers**: Calibration year: 0x2001 Calibration month: 0x2002Calibration date: 0x2003 Calibration text: 0x2004 **Configuration registers**: Bit rate: 0x0601 Parity, data, stop bits: 0x0602 Modbus address: 0x0600 Power-up value for pressure compensation: 0x0302 Measurement filtering factor: 0x031A Filtering on/off: 0x0501 Output mode (Ch1): 0x0700 Output parameter (Ch1): 0x0701 Scale low end (Ch1): 0x0702 Scale high end (Ch1): 0x0704 Output mode (Ch2): 0x0800 Output parameter (Ch2): 0x0801 Scale low end (Ch2): 0x0802 Scale high end (Ch2): 0x0804
??	Show device information (overrides **POLL** mode)		
ADDR [0...99]	Set the transmitter address for **POLL** mode	Transmitter has address for Modbus use. Range 1–247, default 240.	Modbus address: 0x0600

DMT152 serial command	Description	DMT153 behavior using Modbus	DMT153 Modbus register
AERR	Set analog output device malfunction error mode	Same behavior using Modbus register. If the transmitter is malfunctioning, the channel output is set to a predefined level. For a description of the feature, see Error output level (page 33).	Error output level (mA): 0x0706 Error output level (V): 0x0806
ALARM	Set analog output limit alarm modes	Same behavior with Modbus registers. Available for all output parameters of DMT153. For a description of the feature, see Limit alarm (page 32).	**Limit alarm 1**: Output parameter: 0x0E01 Activate below: 0x0E02 Activate above: 0x0E04 Hysteresis: 0x0E06 Register and values to configure analog output 1: Output parameter: 0x0E09 Output low end: 0 Output high end: 1 **Limit alarm 2**: Output parameter: 0x0F01 Activate below: 0x0F02 Activate above: 0x0F04 Hysteresis: 0x0F06 Register and values to configure analog output 2: Output parameter: 0x0F09 Output low end: 0 Output high end: 1

DMT152 serial command	Description	DMT153 behavior using Modbus	DMT153 Modbus register
AMODE	Set analog output mode	Same behavior using Modbus registers. Analog output modes for current output: Off 4–20 mA 0–20 mA Analog output modes for voltage output: Off 0–5 V 0–10 V	Output mode (Ch1, current): 0x0700 Output mode (Ch2, voltage): 0x0800
AOVER [ON/OFF]	Allow analog outputs to exceed their range 10 %		Low clipping limit (Ch1): 0x0708 High clipping limit (Ch1): 0x070C Low error limit (Ch1): 0x070A High error limit (Ch1): 0x070E Low clipping limit (Ch2): 0x0808 High clipping limit (Ch2): 0x080C Low error limit (Ch2): 0x080A High error limit (Ch2): 0x080E
ASEL	Configure analog output parameter and scaling	Same behavior using Modbus register	Output parameter (Ch1): 0x0701 Scale low end (Ch1): 0x0702 Scale high end (Ch1): 0x0704 Output parameter (Ch2): 0x0801 Scale low end (Ch2): 0x0802 Scale high end (Ch2): 0x0804 Alarm parameters: Value locked: 0x0270 Unreliable: 0x0271 Output state of limit alarm 1: 0x0E09 Output state of limit alarm 2: 0x0F09
ERRS	Display the currently active errors	Same behavior using Modbus register	Error code: 0x0203
FRESTORE	Restore factory settings	Same behavior using Modbus register	Restore factory settings: 0x1E00

DMT152 serial command	Description	DMT153 behavior using Modbus	DMT153 Modbus register
MOL	Set the molar mass of the process gas (used in ppm_w calculation)	Same behavior using Modbus register	Molar mass of gas: 0x0320
PRES	Set value for pressure compensation	Same behavior using Modbus register. Minimum value 0.1 bar (absolute).	Power-up value for pressure compensation: 0x0302
RESET	Reset the transmitter	Same behavior using Modbus register	Restart device: 0x0605
SDELAY [0...255]	Set response sending delay in milliseconds	Same behavior using Modbus register	Response delay: 0x0603
SERI	Set the serial interface settings	Same behavior using Modbus register	Bit rate: 0x0601 Parity, data, stop bits: 0x0602
STAT	Display transmitter status	Separate registers for statuses When reading from register 0x0504: 1–100 = Purge progress shown as 1–100 %)	Start sensor purge: 0x0504 Sensor purge: 0x0203
STATUS	Set analog output purge status alarm	Same behavior using Modbus register. An active alarm status is indicated by the current or voltage output being at the maximum of the scale (20 mA for analog output 1, 5 V / 10 V for analog output 2). Purge is indicated by the 'Value locked' status. Configure 'Value locked' as output parameter of the analog output.	**Configure analog output**: Output parameter: 0x0270 (Value locked) or 0x0271 (Unreliable) Output low end: 0 Output high end: 1

DMT152 serial command	Description	DMT153 behavior using Modbus	DMT153 Modbus register
VERS	Display transmitter software version	Same behavior using Modbus register	Device identification ('MajorMinorVersion'): 0x02
XPRES	Set value for pressure compensation (temporarily, is cleared at reset)	Same behavior using Modbus register. Minimum value 1 hPa.	Volatile value for pressure compensation: 0x0300
XPUR [ON/OFF]	Enable or disable sensor purge (temporarily, is enabled at reset)	Same behavior using Modbus register	Interval purge on/off: 0x0505

Appendix D. Regulatory statements

D.1 Korean conformity information

Company name: Vaisala Oyj

Name of equipment: DEW POINT TRANSMITTER DMT153

Country of manufacture: Finland

Link to RRA registration information: www.rra.go.kr/selform/rws-DMT153

D.2 FCC Part 15 compliance statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that the interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

CAUTION! This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

D.3 Canada ICES-3 / NMB-3 compliance statement

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de classe B est conforme à la norme canadienne NMB-003.

D.4 China RoHS information table

Information table on names and contents of hazardous substances in products						
Hazardous substances 		**Component name**				
		Housing	**Cabling**	**Electronics**	**Accessories**	**Packaging**
Lead (Pb)		O	X	X	X	O
Mercury (Hg)		O	O	O	O	O
Cadmium (Cd)		O	O	O	O	O
Hexavalent chromium (Cr (VI))		O	O	O	O	O
Polybrominated biphenyls (PBB)		O	O	O	O	O
Polybrominated diphenyl ethers (PBDE)		O	O	O	O	O
Dibutyl phthalate (DBP)		O	O	O	O	O
Diisobutyl phthalate (DIBP)		O	O	O	O	O
Butyl benzyl phthalate (BBP)		O	O	O	O	O
Bis(2-ethylhexyl) phthalate (DEHP)		O	O	O	O	O

This table is prepared in accordance with the provisions of GB 26572-2025.

NOTE 1:

O: Indicates that the content of the hazardous substance in all homogeneous materials of the component does not exceed the requirements of the national standard for the restricted use of hazardous substances in electrical and electronic products.

X: Indicates that the content of the hazardous substance in at least one homogeneous material of the component exceeds the requirements of the national standard for the restricted use of hazardous substances in electrical and electronic products.

NOTE 2: Components not listed above indicate that the content of the hazardous substances in these components does not exceed the requirements of the national standard for the restricted use of hazardous substances in electrical and electronic products.

产品中有害物质的名称及含有的信息表

有害物质 	**部件名称**				
	外壳	**线缆**	**电子部件**	**附件**	**包装**
铅（Pb）	O	X	X	X	O
汞（Hg）	O	O	O	O	O
镉（Cd）	O	O	O	O	O
六价铬（Cr (VI)）	O	O	O	O	O
多溴联苯（PBB）	O	O	O	O	O
多溴二苯醚（PBDE）	O	O	O	O	O
邻苯二甲酸二正丁酯（DBP）	O	O	O	O	O
邻苯二甲酸二异丁酯（DIBP）	O	O	O	O	O
邻苯二甲酸丁苄酯（BBP）	O	O	O	O	O
邻苯二甲酸二（2-乙基）己酯（DEHP）	O	O	O	O	O

本表依据 GB 26572-2025 的规定编制。

注 1：

O：表示该有害物质在该部件所有均质材料中的含量均不超出电器电子产品有害物质限制使用国家标准要求。

X：表示该有害物质至少在该部件的某一均质材料中的含量超出电器电子产品有害物质限制使用国家标准要求。

注 2：

以上未列出的部件,表明其有害物质含量均不超出电器电子产品有害物质限制使用国家标准要求。

Appendix E. Recycling instructions

These recycling instructions guide you on the end-of-life treatment of this Vaisala product. As waste regulations and infrastructure vary in each country, these instructions only indicate the different components to be separated and common ways to handle them. Always follow local requirements when disposing of the product. Vaisala encourages to use the best available recycling practices to minimize related environmental impacts.

Vaisala is committed to meeting the requirements of the EU Waste Electrical and Electronic Equipment (WEEE) Directive. This directive aims to minimize the impact of electrical and electronic goods on the environment, by increasing reuse and recycling, and reducing the amount of WEEE going to landfill. This symbol indicates that the product should be collected separately from other waste streams and treated appropriately.

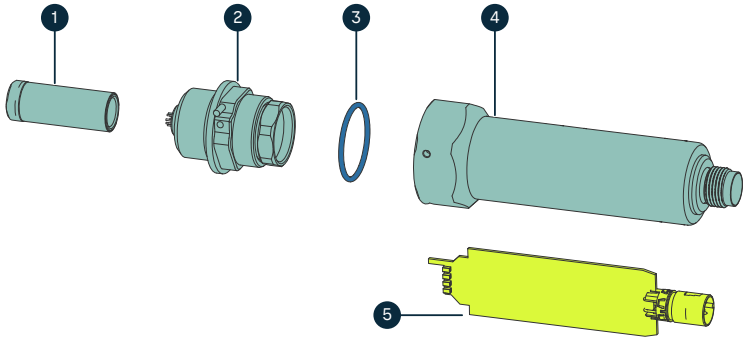


Table 29 DMT153 materials for recycling

Recycling	Part	Material
Electrical and electronic waste	5	Various
Metal waste	1, 2, 4	Stainless steel (AISI 316L)
Plastic waste	3	Rubber (EPDM)

Appendix F. Open source software (OSS) licenses

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OSS license texts

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Texas Instruments MSPM0 SDK

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