

User Guide

Vaisala DRYCAP[®] Dew Point Transmitter

DMT143



PUBLISHED BY

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1. About This Document

1.1 Version Information

This manual provides information for installing, operating, and maintaining Vaisala DRYCAP® Dewpoint Transmitter DMT143.

Table 1 Document Versions (English)

Document Code	Date	Description
M211435EN-J	February 2019	This manual. Modbus protocol added. Added information about Vaisala Insight PC software. Removed the TIME command. Added a cautionary note about changing stainless steel filter. Updated section <i>Troubleshooting</i> . Updated section <i>DMT143 Specifications</i> .
M211435EN-H	June 2017	Previous version. DRYCAP® 180S sensor option for DMT143L added. Analog output accuracy specification added. Accuracy specification updated for DMT143L variant with DRYCAP® 180M sensor. Filter spare part information updated.
M211435EN-G	January 2017	New probe model DMT143L (DMT242 replacement with DRYCAP® 180M sensor) added. SF6 gas selections removed.

1.2 Related Manuals

Table 2 Related Manuals

Document Code	Name
M010091EN	<i>Vaisala DRYCAP® Handheld Dew Point Meter DM70 User's Guide</i>
M211434EN	<i>Vaisala DRYCAP® Dew Point Transmitter DMT143 Quick Guide</i>
M211634EN	<i>Nokeval 301/302 Display Wiring Diagram</i>

1.3 Documentation Conventions



WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.



CAUTION! Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.



Note highlights important information on using the product.



Tip gives information for using the product more efficiently.



Lists tools needed to perform the task.



Indicates that you need to take some notes during the task.

1.4 Trademarks

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

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2. Product Overview

2.1 Introduction to DMT143

Vaisala DRYCAP® Dew Point Transmitter DMT143 is a small and lightweight dew point transmitter suitable for a wide range of OEM applications. DMT143 is easy to install and the mechanics have been designed for harsh environments requiring protection against dust, dirt and splashed water.

There are 2 variants of the DMT143 transmitter, DMT143 and DMT143L. DMT143 and DMT143L offer different sensor, installation and output options to meet the requirements of varying dew point measurement applications.

- DMT143 with DRYCAP® 180D sensor
 - either G1/2" ISO228/1 or NPT1/2" mechanical connection
 - measurement range -70 ... +60 °C (-94 ... +140 °F)
 - operating pressure up to 50 bar_a (725 psi_a)
 - voltage (V) or current (mA) analog output ¹⁾
 - RS-485 digital output with Modbus RTU support
- DMT143L with DRYCAP® 180M sensor
 - G1/2" ISO228/1 mechanical connection
 - measurement range -70 ... + 60 °C (-94 ... +140 °F)
 - operating pressure 0 ... 20 bar_a (0 ... 290 psi_a)
 - current (mA) analog output ¹⁾
 - RS-485 digital output with Modbus RTU support
- DMT143L with DRYCAP® 180S sensor
 - G1/2" ISO228/1 mechanical connection
 - measurement range -50 ... + 60 °C (-58 ... +140 °F)
 - operating pressure 0 ... 20 bar_a (0 ... 290 psi_a)
 - current (mA) analog output ¹⁾
 - RS-485 digital output with Modbus RTU support

The accuracies of the different sensors used in DMT143 and DMT143L have been optimized for different parts of the sensors' measurement ranges.

DMT143 transmitters use the Vaisala DRYCAP® polymer sensor for dew point measurement. DRYCAP® technology has low maintenance needs due to its excellent long term stability and durability against condensation. The calibration interval of DMT143 transmitters is 2 years.

Table 3 Output Parameters of the DMT143

Parameter	Abbreviation	Metric Unit	Non-Metric Unit
Dew point/frost point temperature	T _{d/f}	°C	°F
Dew point/frost point temperature, converted to atmospheric pressure	T _{d/f@atm}	°C	°F

1) The analog output is not available in devices ordered with digital output only.

Parameter	Abbreviation	Metric Unit	Non-Metric Unit
ppm moisture, by volume	H ₂ O	ppm	ppm



When dew point is below 0 °C, the transmitter outputs frost point for Td.

Dew point temperature in atmospheric pressure ($T_{d/f \text{ atm}}$) is a calculated parameter that presents the dew point the gas would have at atmospheric pressure. For this calculation to provide accurate results, it is important to have the correct pressure setting stored in the transmitter. This setting is specified on the order form, and it can be changed using the RS-485 line or DM70 handheld dew point meter.

More Information

- [DMT143 and DMT143L Transmitter Parts \(page 12\)](#)
- [DMT143 Specifications \(page 69\)](#)

2.2 Basic Features and Options

- Maximum dew point measurement range of -70 ... + 60 °C (-94 ... +140 °F)
- Dew point measurement accuracy up to ± 2 °C (± 5.4 °F) T_d in air or N₂
- Operating pressure range:
 - DMT143: 0 ... 50 bar_a (725 psi_a)
 - DMT143L: 0 ... 20 bar_a (0 ... 290 psi_a)
- Configurable for optimum dew point measurement accuracy: Pressure compensation (fixed pressure setting or live pressure input through RS-485)
- Analog output: one output channel, selectable from:
 - 0 ... 1 V (DMT143 only)
 - 0 ... 5 V (DMT143 only)
 - 1 ... 5 V (DMT143 only)
 - 4 ... 20 mA (DMT143 and DMT143L)
 - None (DMT143 and DMT143L, digital output only)
- Digital output: RS-485 (non-isolated). The following protocols are supported:
 - Modbus RTU
 - Vaisala Industrial Protocol
- LED for dew point level alarm and transmitter diagnostics
- DRYCAP® polymer sensor:
 - Autocalibration ensures accuracy in changing measurement conditions
 - Sensor warming keeps the sensor dry in high humidity
 - Sensor purge ensures long term stability
- NIST traceable (certificate included)
- Field check suitability with DM70 handheld dew point meter

- Optional accessories:
 - Stainless steel grid filter for vacuum applications
 - Sampling cells with various installation options
 - Loop-powered external display
 - Connection cable for DM70 handheld dew point meter
 - Plastic shipping case to avoid contamination during shipping

More Information

- [Operation with DM70 Handheld Dew Point Meter \(page 38\)](#)
- [Modbus Communication \(page 40\)](#)
- [Connecting to the Serial Interface \(page 41\)](#)
- [DMT143 Specifications \(page 69\)](#)

2.2.1 Connectivity to Vaisala Insight Software

The transmitter can be connected to Vaisala Insight software using a Vaisala USB cable (order code 219690). With the Insight software, you can:

- See device information and status.
- See real-time measurement.
- Configure serial communication settings, filtering factor, alarm LED, and analog output parameters and scaling.

More Information

- [Connecting to Insight Software \(page 37\)](#)

2.3 DMT143 and DMT143L Transmitter Parts

2.3.1 DMT143 with G1/2" ISO228/1 Thread

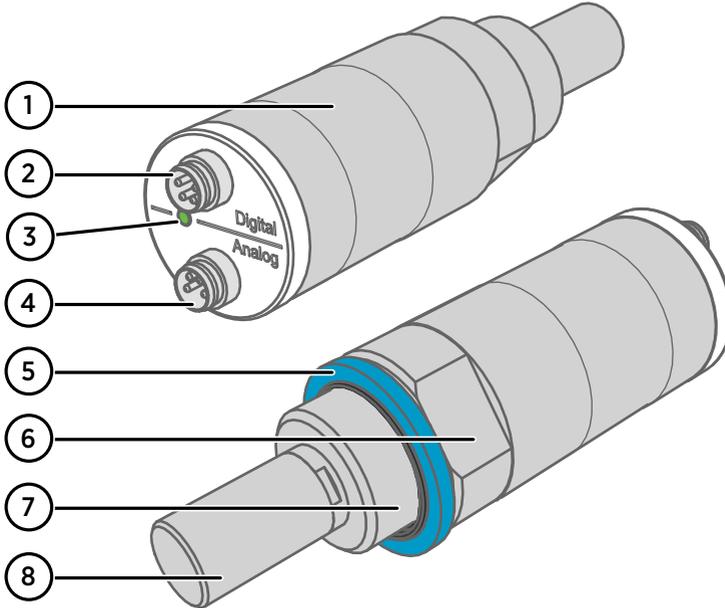


Figure 1 DMT143 Parts – Model with ISO Thread

- 1 Transmitter body. Type label is applied here.
- 2 Digital output: non-isolated RS-485
- 3 Alarm LED
- 4 Analog output
- 5 Sealing ring. Must be used with the G1/2" ISO228/1 connection thread.
- 6 24 mm nut
- 7 Connection thread: G1/2" ISO228/1
- 8 DRYCAP® 180D sensor protected with sintered filter



When the 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.

2.3.2 DMT143 with NPT Thread

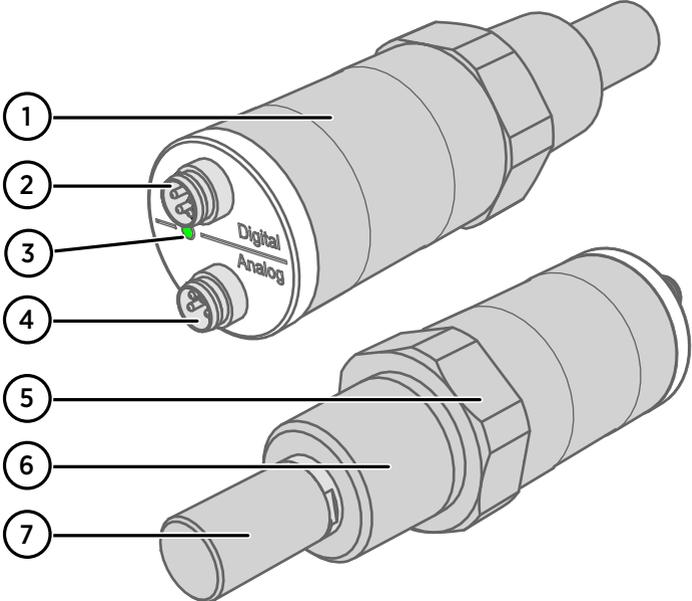


Figure 2 DMT143 Parts – Model with NPT Thread

- 1 Transmitter body. Type label is applied here.
- 2 Digital output: non-isolated RS-485
- 3 Alarm LED
- 4 Analog output
- 5 30 mm nut
- 6 Connection thread: NPT 1/2"
- 7 DRYCAP® 180D sensor protected with sintered filter

2.3.3 DMT143L with G1/2" ISO228/1 Thread

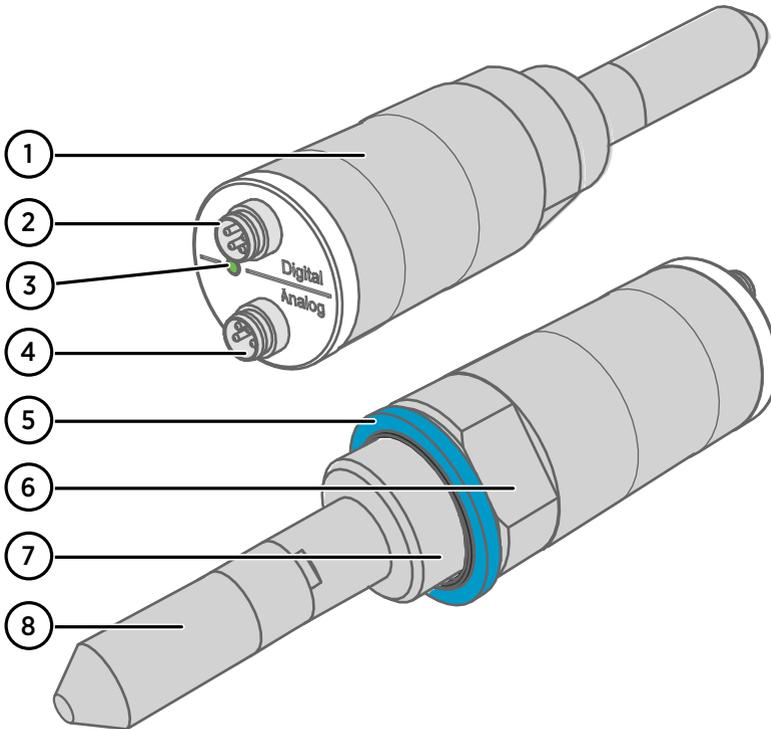


Figure 3 DMT143L Parts

- 1 Transmitter body. Type label is applied here.
- 2 Digital output: non-isolated RS-485
- 3 Alarm LED
- 4 Analog output
- 5 Sealing ring. Must be used with the G1/2" ISO228/1 connection thread.
- 6 24 mm nut
- 7 Connection thread: G1/2" ISO228/1
- 8 DRYCAP® 180M or DRYCAP® 180S sensor protected with sintered filter

2.4 Loop-powered Display

DMT143 can be connected to a loop-powered external LED display. The display provides a reading of the output parameter. The display is powered by the 4 ... 20 mA current signal, so there is no need for an external power supply.

Two models are available:

- Nokeval 301
- Nokeval 302 (with alarm relays)

The display is delivered at its default settings. Configure the display functions and scaling according to the documentation delivered with the display. For a wiring example, see Nokeval 301/302 Display Wiring Diagram (document code M211634EN).



Figure 4 Nokeval 301 Loop-powered Display



The loop resistance of the display must be included in the loop resistance calculation for the complete current loop. For the loop resistance of the display, refer to the manufacturer's documentation.

More Information

- [Spare Parts and Accessories \(page 73\)](#)

2.5 Connection Cables

Vaisala supplies shielded cables with M8 female straight threaded connector. Standard cables are available in four lengths:

- 0.3 m (1.0 ft)
- 3 m (9.8 ft)
- 5 m (16.4 ft)
- 10 m (32.8 ft)

Heavy duty cables are available in two lengths:

- 1.5 m (4.9 ft)
- 3 m (9.8 ft)

Also available are the following cables for service and field check use:

- USB service cable
- MI70 connection cable

More Information

- [Spare Parts and Accessories \(page 73\)](#)

2.6 Sampling Accessories

DMT143 is compatible with various sampling accessories.

More Information

- [Sampling Accessories \(page 28\)](#)
- [Spare Parts and Accessories \(page 73\)](#)

2.7 Safety

This product has been tested for safety. Note the following precautions:



CAUTION! Do not modify the unit. Improper modification can damage the product or lead to malfunction.



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

2.7.1 ESD Protection

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

To avoid delivering high static voltages to the product:

- Handle ESD-sensitive components on a properly grounded and protected ESD workbench or by grounding yourself to the equipment chassis with a wrist strap and a resistive connection cord.

- If you are unable to take either precaution, touch a conductive part of the equipment chassis with your other hand before touching ESD-sensitive components.
- Hold component boards by the edges and avoid touching component contacts.

2.8 Regulatory Compliances

This product is in conformity with the provisions of the following EU directives:

- EMC-Directive
- RoHS-Directive

Conformity is shown by compliance with the following standards:

- EN 61326-1: Electrical equipment for measurement, control, and laboratory use – EMC requirements – for use in industrial locations.
- EN 550022: Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement



3. Functional Description

3.1 DRYCAP Technology

Vaisala DRYCAP® dew point measurement technology ensures accurate measurement with excellent long term stability. This results in very low maintenance requirements for the transmitter. The lasting performance is achieved with microprocessor technology and software that automatically performs self-diagnostic functions in addition to the normal dew point measurement. The self-diagnostic procedures that are conducted are called autocalibration, sensor purge, and sensor warming.

DMT143 and DMT143L use different versions of the Vaisala DRYCAP® sensor:

- DMT143 uses the DRYCAP® 180D sensor designed for applications such as plastic dryers and small industrial compressed air dryer (sensor filter length 22.5 mm, probe length 91.6 mm).
- DMT143L can be ordered with two versions of the DRYCAP®180 sensor: either the 180M sensor designed for standard dry gas and desiccant dryer applications, or the 180S sensor designed for more humid applications such as refrigeration dryers. The sensor filter length of both DMT143L variants is 51 mm, probe length 120 mm.

3.1.1 Autocalibration

The autocalibration feature of the DMT143 transmitter is an automatic procedure which greatly reduces the possible drift in the dry end of the dew point measurement. It is performed at 1-hour intervals, and when the power is switched on. When measuring very dry conditions, the transmitter performs the autocalibration at shorter intervals. A significant change in dew point or temperature may also trigger the autocalibration.

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. During the autocalibration the transmitter outputs the T_d value prior to the procedure.

Autocalibration is carried out only if several criteria for the measurement environment are fulfilled. This ensures the reliability of the adjustments, and maintains the excellent long term stability that the patented technology offers. These criteria include for example a stable enough moisture level in the measured atmosphere. If the conditions are not fulfilled, the autocalibration function is postponed until satisfactory conditions are reached.

3.1.2 Sensor Purge

Sensor purge is also an automatic procedure that minimizes the drift at the wet end readings of the dew point measurement. Sensor purge is performed once a day or when the power is switched on. 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 a very small drift of the sensor due to the very linear behaviour of the polymer technology. During the sensor purge the transmitter outputs the T_d value prior to the procedure.

3.1.3 Sensor Warming in High Humidities and Freezing Conditions

DMT143 has a sensor warming feature that improves the sensor's performance in high humidities and freezing conditions. Sensor warming does not interrupt the transmitter's T_d value output.

In high humidity, sensor warming prevents the sensor and filter from becoming wet. High humidity may be present when the dew point temperature rises close to the gas temperature.

Sensor warming is switched on automatically when the humidity in the measured gas increases to a level where dew can start to form. The advantage of sensor warming is the rapid response of dew point measurement. A wet sensor and filter would otherwise result in a dew point equal to ambient temperature (that is, RH = 100 %).

If in spite of sensor warming the sensor gets soaked, it will recover fully back to normal operation after it dries out.

In freezing conditions, DMT143 uses sensor warming to maintain the sensor temperature above 0 °C.



When measuring in temperatures below 0 °C, the supply voltage must be 24 ... 28 VDC.

More Information

- [Power Supply Requirements \(page 25\)](#)

3.2 DMT143 Startup Sequence

When the transmitter is powered up, it will perform the sequence (applicable from software version 1.1.5 onward) shown in [Figure 5 \(page 20\)](#). After a 2-second startup, the transmitter will measure normally for 40 seconds, after which it will perform the sensor purge and autocalibration functions. This can take up to 5 minutes, during which time the output is frozen: it will display the last measured values before the sensor purge began.

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 no later than 6 minutes after startup. The sensor purge repeats every 24 hours (12 h default interval for the DMT143L variant with DRYCAP® 180S sensor if used with purge), and autocalibration every hour. The output will again be frozen for their duration.

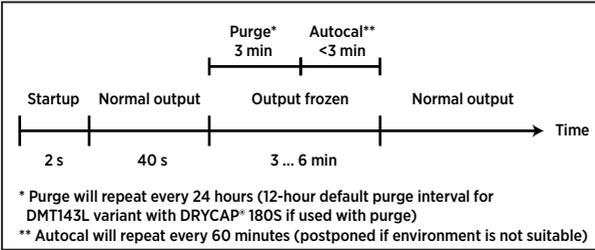


Figure 5 DMT143 Startup Sequence



The transmitter always performs this sequence when starting up. Keep the transmitter continuously powered to optimize its measurement performance and availability.



The DMT143L variant with DRYCAP® 180S sensor can be used as a replacement of the DMT242 transmitter and ordered without the purge functionality. If you use purge with the DMT143L variant with DRYCAP® 180S, the default purge interval is 12 hours.

3.3 Alarm LED

The alarm LED at the back of the transmitter provides a visual indication of the transmitter's status. The alarm LED functionality is preset at the factory according to order form. You can configure it as follows:

- You can use Vaisala Insight software or the **ALARM** command on the serial line to change the alarm limit, enable/disable the dew point alarm, or turn on/off the LED completely.
- You can change the alarm limit using the DM70 handheld dew point meter.

Table 4 Alarm LED States

LED Color	Meaning
Not lit	Power off or LED functionality disabled.
Green	Power on, normal measurement.
Green and blinking	Purge or autocalibration in progress, measurement frozen.
Red	Dew point above limit.
Red and blinking	Transmitter error.

More Information

- [Vaisala Insight Software \(page 36\)](#)
- [Operation with DM70 Handheld Dew Point Meter \(page 38\)](#)
- [Configure the Alarm LED \(page 60\)](#)

4. Installation

4.1 Configuring Transmitter Before Installation

You may wish to configure your transmitter before physically installing it. For easy access to configuration options, use either Vaisala Insight PC software with the USB service cable (Vaisala order code 219690), or connect to the serial line using the USB service cable and a terminal program on a PC.

Some configuration settings can also be changed using the DM70 handheld meter.

Examples of configurable settings for analog output:

1. Analog output parameter and scaling.
2. Analog output error level.

Examples of configurable settings for RS-485 output:

1. By default, DMT143 transmitters are configured for single transmitter operation. Serial operation mode is **STOP** and address is **0**.
To configure transmitters for operation on a common line, you must give each transmitter a unique address (range 0 ... 255) and set their serial operation mode to POLL.
2. The default serial line settings may not be right for your RS-485 line.
3. You may need to change the transmitter's serial output format to suit your needs.

More Information

- [Vaisala Insight Software \(page 36\)](#)
- [Operation with DM70 Handheld Dew Point Meter \(page 38\)](#)
- [Connecting to the Serial Interface \(page 41\)](#)

4.2 Selecting the Location

It is important that the point of installation represents well the gas to be measured. Temperature changes do not affect the dew point measurement, but pressure changes will have an effect on the measurement. All leaks in the system must be eliminated to avoid ambient humidity affecting the measurement.

Direct installation to the measured gas is the recommended installation method if the temperature of the gas is suitable for DMT143 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_a / 725 psi_a (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, 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.

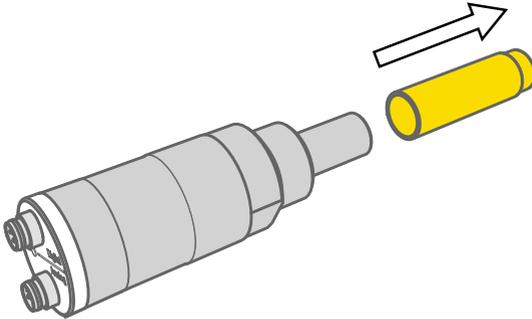
The DMT143 is light in weight, which means that it can be installed in a sample pipeline in the sampling cells without the need of any additional mechanical support. You can use a standard G1/2" T-shaped pipe fitting (not available from Vaisala) when installing DMT143 into a pipeline.

More Information

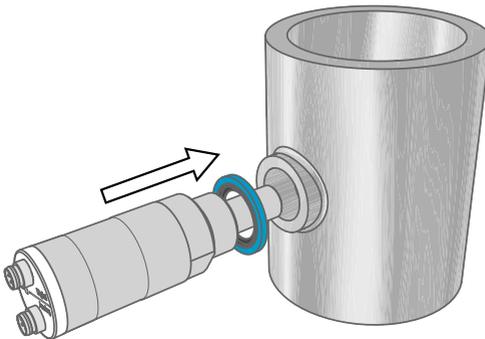
- [Sampling Accessories \(page 28\)](#)

4.3 Installing the Transmitter

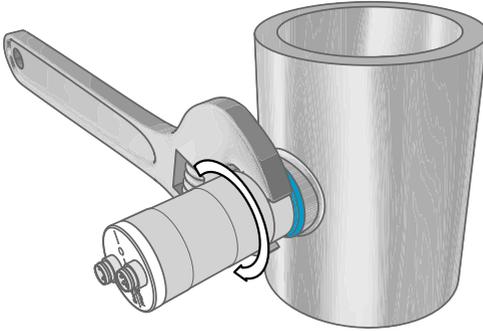
1. Remove the yellow transport protection cap from the transmitter.



2. The DMT143 models with a parallel thread (G1/2" ISO 228/1) require a sealing ring for a tight connection. Use the sealing ring that is provided with the transmitter. Make sure the threads on the mounting point match your transmitter. For the model with NPT thread, do not use a sealing ring.



3. Tighten the connection by turning with a wrench (max. 50 Nm). Wrench size is 24 mm for ISO threaded transmitters, 30 mm for NPT threaded model.



4. Connect the signal and power cable to the DMT143.

More Information

- [Wiring \(page 24\)](#)
- [Power Supply Requirements \(page 25\)](#)

4.4 Wiring



CAUTION! The power supply lines are internally connected. You can use either one of them, but do not connect more than one supply voltage in permanent installations. Temporary simultaneous use with the USB service cable or DM70 handheld dew point meter (which also provides power) is fine.

Table 5 Connector Pinouts

Pin	Analog connector	Digital connector	Wire color
1	VDC supply+	VDC supply+	Brown
2	Ch-	RS-485 D0-	White
3	GND	GND	Blue
4	Ch+	RS-485 D1+	Black

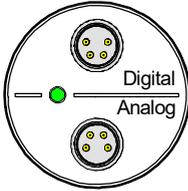


Figure 6 DMT143 Digital and Analog Connectors

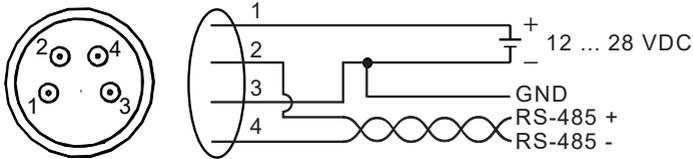


Figure 7 Wiring the Digital Connector

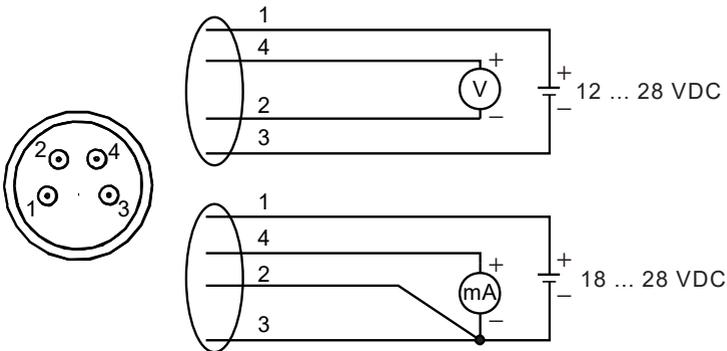


Figure 8 Wiring the Analog Connector

4.4.1 Power Supply Requirements

The minimum supply voltage required by the DMT143 transmitter depends on the analog output type that is used:

- For voltage output: 12 ... 28 VDC.
- For current output: 18 ... 28 VDC. The maximum load is 500 Ω .

The power supply should maintain the voltage for all load conditions.

If measuring in pressures above 20 bar_a (290 psi_a) or temperatures below 0 °C, the supply voltage must be 24 ... 28 VDC.

Current consumption during normal operation is <10 mA. The consumption increases during the sensor self-diagnostics (autocalibration and sensor purge). Typical current consumption is 220 mA pulsed current.



The DMT143 can be powered by the MI70 indicator or the USB service cable. You can plug in the MI70 indicator or the USB service cable to the digital port while the transmitter is powered from the analog port.

The following figure shows a typical duty cycle during sensor purge at room temperature with 24 VDC supply voltage. Sensor purge current varies with supply voltage and operating temperature. The peak value is the highest in the lowest temperature.

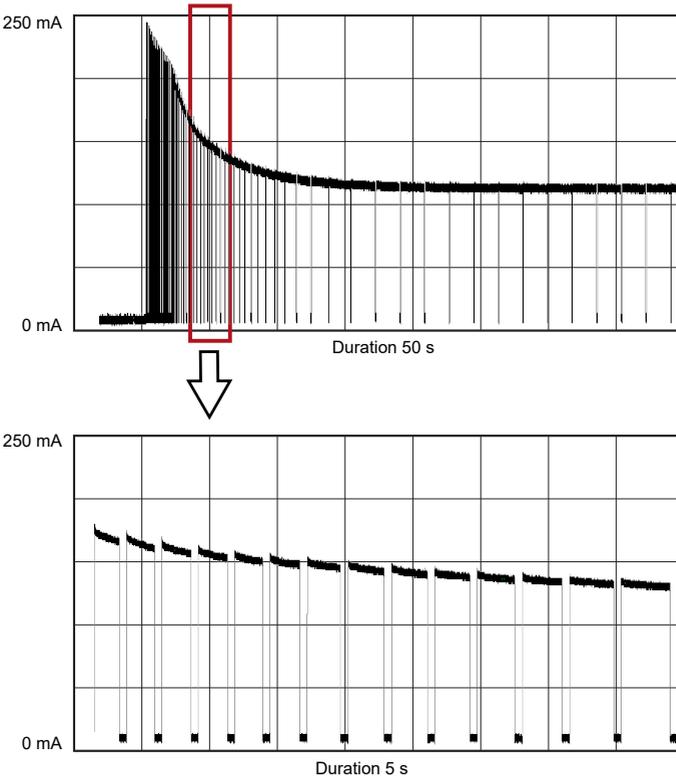


Figure 9 Example of Current Consumption During Purge

The following figure shows a typical duty cycle during autocalibration at room temperature with 24 VDC supply voltage. Also the autocalibration current varies with supply voltage and operating temperature.

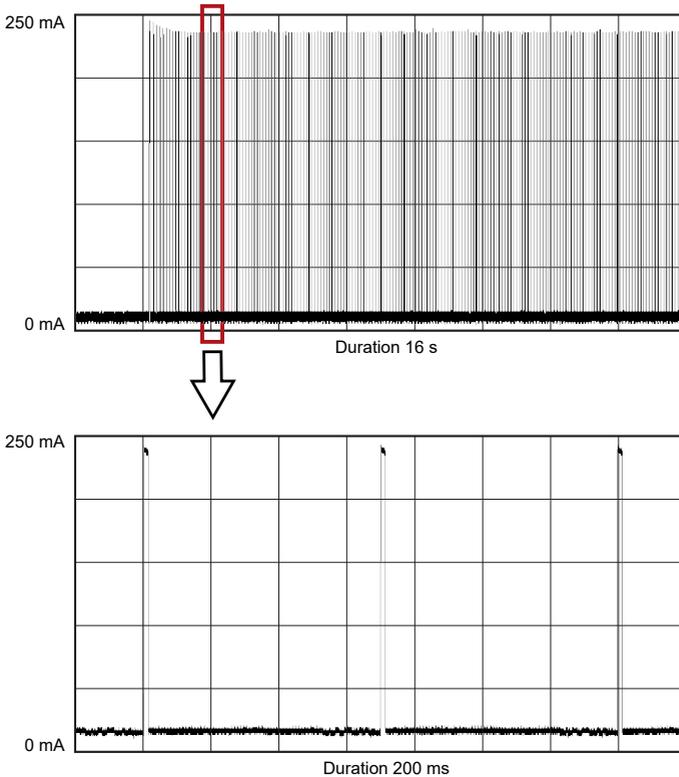


Figure 10 Example of Current Consumption During Autocalibration

4.5 Sampling from a Process

Sampling is 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.

It is important to keep in mind that changing the pressure of a gas changes the dew point temperature of the gas. If the sensor is at a different pressure than the process itself, there may be an error of several tens of degrees in the dew point measurement.

Make sure there is sufficient flow of gas to the sensor (for example, 1 l/min) to give a representative sample.

To simulate the effect of pressure change to dew point, you can use the Vaisala Humidity Calculator at: www.vaisala.com/humiditycalculator.

4.6 Sampling Accessories

4.6.1 DMT242SC Sampling Cell

The DMT242SC is a basic sampling cell with only the main sampling cell body. The inlet and outlet are female threaded sample connectors (inlet G3/8", outlet G1/4" ISO).

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

4.6.2 DMT242SC2 Sampling Cell with Swagelok Connectors

The DMT242SC2 is similar to DMT242SC, but connections are made easy. The sampling cell includes welded swagelok connectors at both the inlet and outlet that fit directly to 1/4" tubing.

To fit 6 mm tubing to the connectors, an adapter such as Swagelok® Reducer SS-6MO-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 easily connect to a cooling coil or tubing providing the essential function of cooling the dry air to ambient temperature before it reaches the sensor.

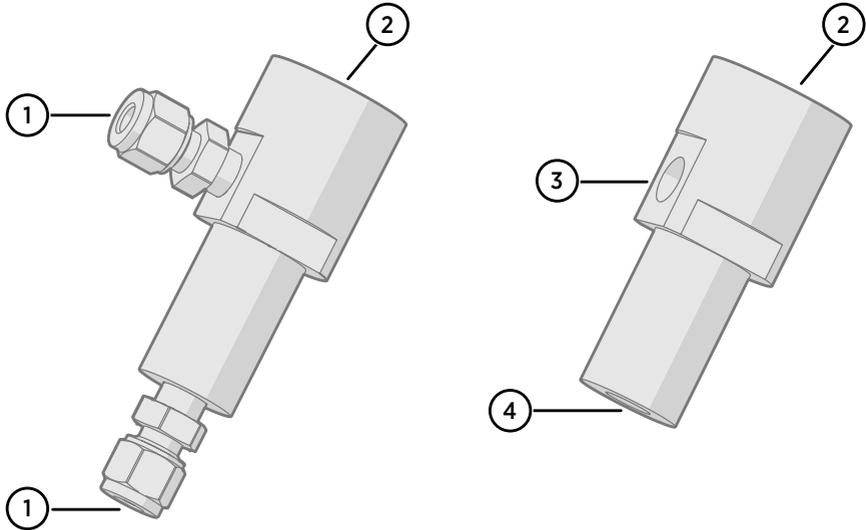


Figure 11 Sampling Cells DMT242SC2 (left) and DMT242SC (right)

- 1 Male pipe welded connector Swagelok 1/4"
- 2 G1/2"
- 3 G1/4"
- 4 G3/8"

4.6.3 DSC74 Sampling Cell with Quick Connector and Leak Screw

The DSC74 has been designed especially for compressed air lines. The sampling cell contains an adjustable leak screw that allows keeping up the pipeline pressure at the sensor. 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. Then the air coming out will make a barely audible little hiss and it 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 (G3/8" to G1/2" 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.

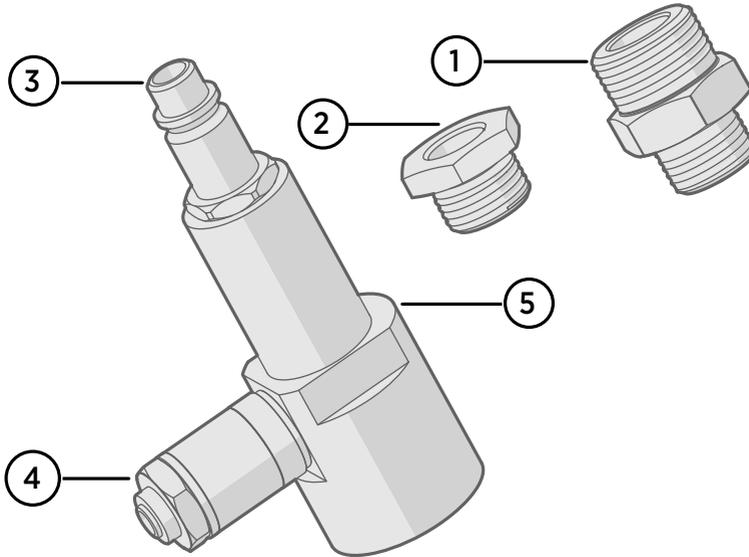


Figure 12 DSC74 Sampling Cell with Accessories

- 1 Thread adapter type G3/8" - G1/2"
- 2 Thread adapter type G3/8" - G1/4"
- 3 Quick connector
- 4 Leak screw
- 5 Sampling cell body (DMT242SC)

4.6.4 DSC74B Two-Pressure Sampling Cell

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 system pressure and atmospheric pressure.

The DSC74B limits the flow rate with a fixed leak screw. The flow is optimized for pressures 3 ... 10 barg. 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. Harmful gases can be recovered by connecting a collection system at the outlet (not available from Vaisala).

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.

DSC74B parts are:

- Sampling cell, thread G3/8"
- Connection part with a needle valve and an integrated leak screw
- Reducing Nipple (thread adapter), G3/8" - G1/2"
- Reducing Adapter (thread adapter), G3/8" - G1/4"

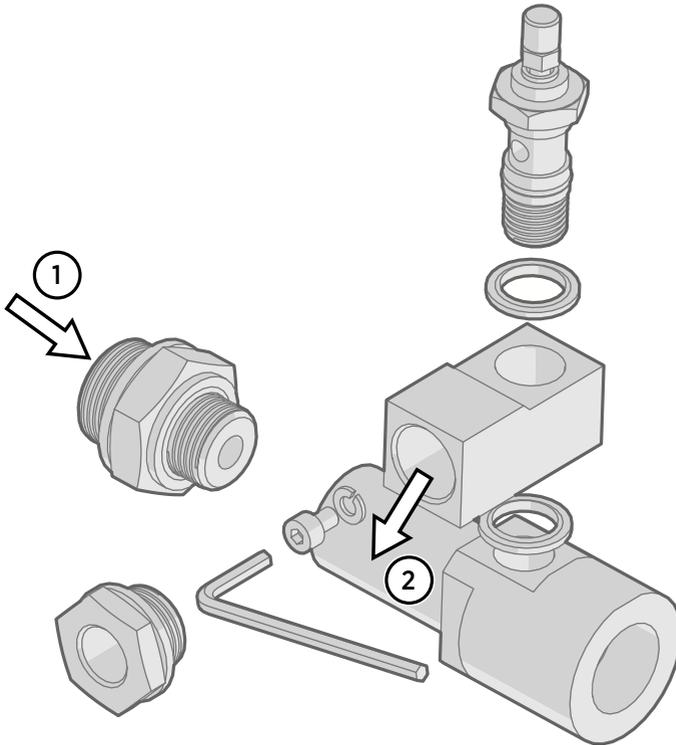


Figure 13 DSC74B

- 1 Gas goes in
- 2 Gas comes out



Figure 14 Removing the Leak Screw

4.6.4.1 DSC74C Two-Pressure Sampling Cell with Coil

The DSC74C with an outlet coil is designed for the most critical measurements at atmospheric pressure. In the DSC74C, the coil is connected to the sampling cell outlet to protect the sensor from ambient humidity disturbing the measurement. The coil can also be used as a cooling coil for sampling from high temperature processes.

DSC74C parts are:

- Sampling cell, thread G3/8"
- Connection part with a needle valve and an integrated leak screw
- Reducing Nipple (thread adapter), G3/8" - G1/2"
- Reducing Adapter (thread adapter), G3/8" - G1/4"
- Diffusion coil (for measurements in atmospheric pressure)

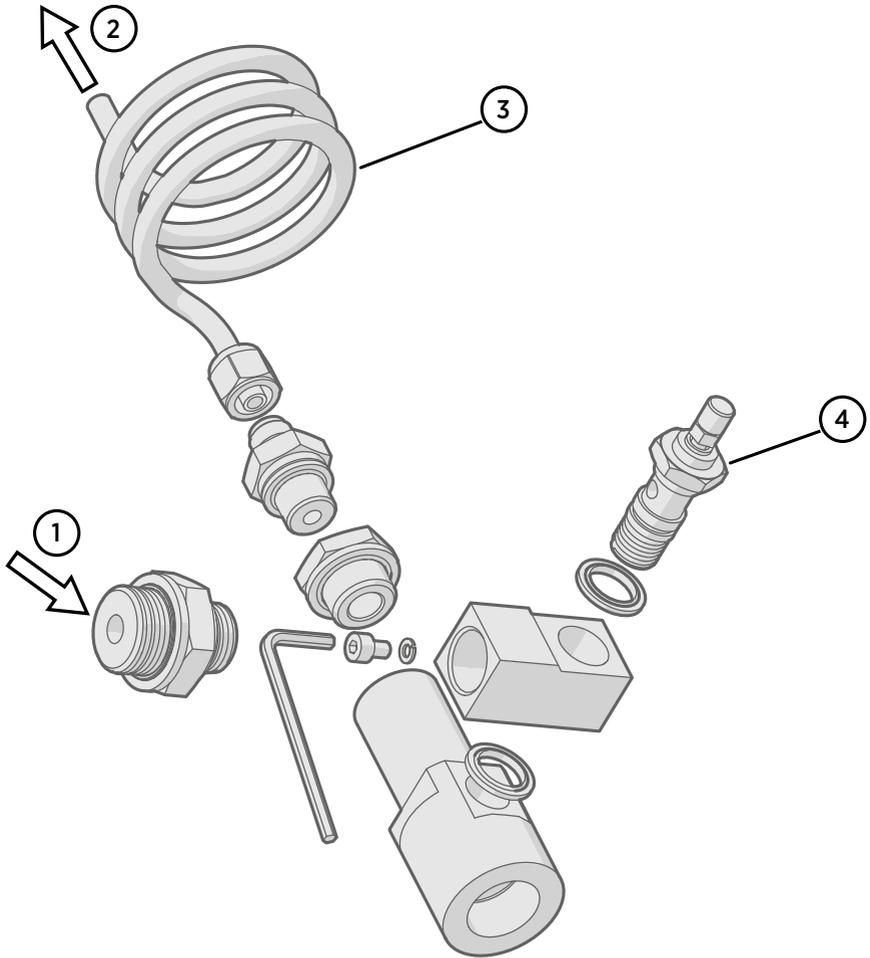


Figure 15 Default Assembly of DSC74C

- 1 Gas goes in. The coil can also be used here.
- 2 Gas comes out
- 3 Coil
- 4 Valve

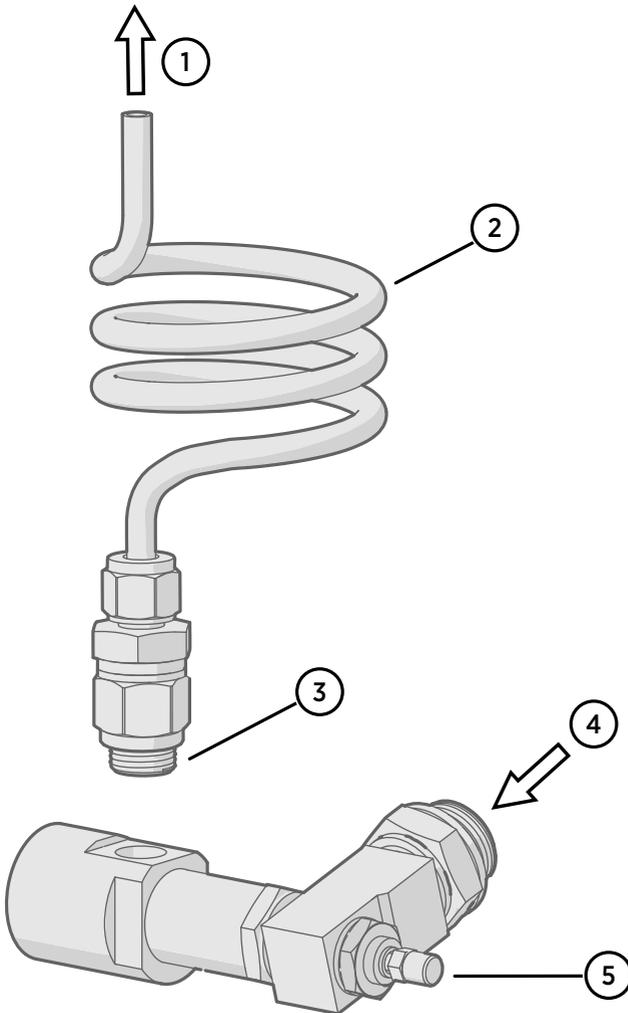


Figure 16 Alternative Assembly of DSC74C (for Tight Spaces)

- 1 Gas comes out
- 2 Coil
- 3 Thread, max. size 7 mm
- 4 Gas goes in
- 5 Valve

The thread size cannot exceed 7 mm. Use the provided adapter to avoid damage to the transmitter.

4.6.4.2 DM240FA Duct Installation Flange

DMT143 models with a G1/2" ISO228/1 connection thread can be installed directly in the process wall through a DM240FA duct installation flange. When the transmitter is installed directly on the process wall or pipe, note that a closing valve may be needed on both sides of the installed transmitter so that the sensor head can be removed from the process for calibration or maintenance.

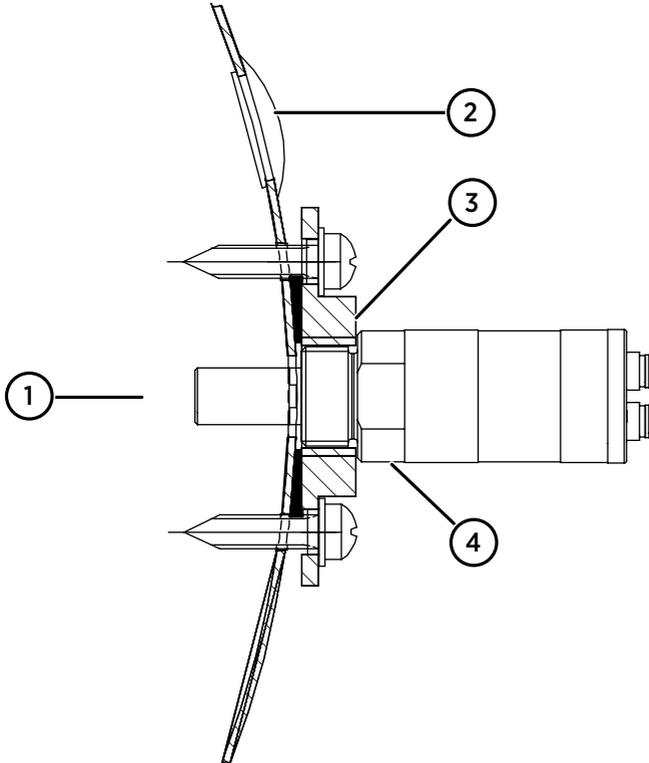


Figure 17 DM240FA with DMT143

- 1 Measured gas
- 2 Recommended additional hole (plugged) for T_d field check reference measurement probe (for example, Vaisala DM70)
- 3 DM240FA flange (thread G1/2" ISO228/1)
- 4 DMT143 transmitter

5. Operation

5.1 Transmitter Start-up

When the transmitter is connected to power supply, there is a delay of 2 seconds as the transmitter starts up. After the start-up is complete, the measurement data is available from the analog output and serial line.

If serial line output is used, note that the transmitter will behave according to the configured serial mode:

- In STOP mode, the transmitter outputs the transmitter model and software version. This is the default mode.
- In RUN mode a measurement output starts immediately.
- In POLL mode the transmitter does not output anything after power-up.
- In MODBUS mode, the device does not output anything after power-up.

More Information

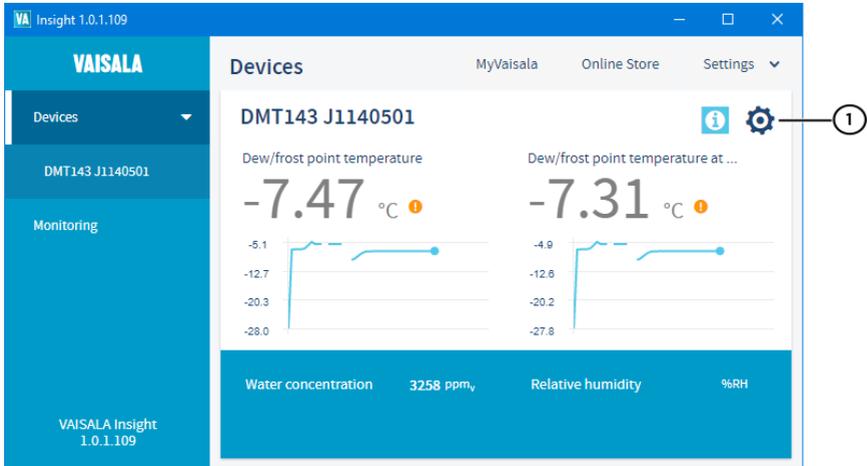
- [DMT143 Startup Sequence \(page 19\)](#)
- [Power Supply Requirements \(page 25\)](#)
- [Set Serial Line Operating Mode \(page 57\)](#)

5.2 Vaisala Insight Software

You can use Vaisala Insight PC software to check and configure DMT143 transmitters intuitively, without typing any serial commands. The software guides you when changing the settings on the transmitter. The transmitter can be connected to Insight software using a Vaisala USB cable for computer connection (order code 219690).

With the Insight software, you can:

- See device information and status.
- See real-time measurement.
- Configure serial communication settings, filtering factor, alarm LED, and analog output parameters and scaling.



- 1 DMT143 settings are available through the settings wheel in the Insight **Devices** view.



DMT143 transmitters support Insight from transmitter software version 1.4.4 onwards.

Download Insight software at www.vaisala.com/insight.

5.2.1 Connecting to Insight Software



- Computer with Vaisala Insight software installed
- USB connection cable (order code 219690)



Before connecting the transmitter to a PC, disconnect the cables from both the analog and digital ports of the transmitter.

1. Open the Insight software.
2. Connect the USB cable to a free USB port on the PC.
3. Connect the USB cable to the digital port of the transmitter.
4. Wait for Insight software to detect the transmitter.
If the transmitter is not detected, disconnect and reconnect the Vaisala USB cable to the digital port connector of the transmitter.

5.3 Operation with DM70 Handheld Dew Point Meter

You can connect the DMT143 to the MI70 indicator (the handheld measurement display included in the DM70 package) using the MI70 connection cable (order code 219980SP). This allows you to view and use the measurement data with the MI70 indicator. You can, for example, perform a field check of the measurement accuracy.

When connecting or disconnecting the MI70 indicator, always make sure the MI70 indicator is powered off. Connecting or disconnecting the MI70 when it is powered on may cause incorrect values to be displayed.

If you have altered the serial port settings of the DMT143, always make sure you switch off the other power supply (disconnect the "Analog" cable if in use) before powering up the MI70 indicator.



When the transmitter's power supply is disconnected, it will carry out the startup sequence when powered on again.

You can adjust the following DMT143 settings in the MI70 **Measurement Settings** menu:

- Transmitter address in POLL mode.
- Alarm LED dew point limit (not shown if dew point alarm is disabled or LED is completely turned off).
- Offset correction for dew point measurement. The maximum offset you can set is ± 5 °C.



Figure 18 Settings Menu

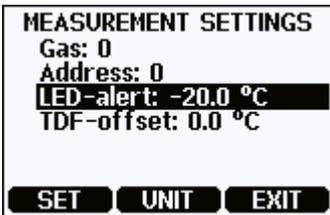


Figure 19 Measurement Settings Menu



You can also return the DMT143 to its factory configuration by using the **Factory settings** option in the **Settings** menu. This option is equivalent to using the **FRESTORE** command on the serial line. Note that also the MI70 indicator will revert to its factory configuration when using the **Factory settings** option on the MI70.

More Information

- [DMT143 Startup Sequence \(page 19\)](#)
- [Field Check Using DM70 Handheld Dew Point Meter \(page 63\)](#)

6. Modbus Communication

Transmitters ordered with the Modbus configuration option are accessed using the Modbus serial communication protocol. The supported Modbus variant is Modbus RTU (Serial Modbus) over RS-485 interface.

The supported Modbus functions and registers are described in [Modbus Reference \(page 75\)](#).

The following table lists the default Modbus serial settings of devices ordered with the Modbus configuration option.

Table 6 Default Modbus Serial Communication Settings

Description	Default Value
Serial bit rate	19200
Parity	N
Number of data bits	8
Number of stop bits	2
Modbus device address	240
Serial delay	0
Communication mode	Modbus RTU

Use Vaisala Insight software to change the Modbus serial communication settings if needed.

More Information

- [Vaisala Insight Software \(page 36\)](#)

7. Serial Communication

7.1 Connecting to the Serial Interface

To interface with DMT143 using Vaisala Industrial Protocol with a terminal application, the transmitter can be connected to a PC using the RS-485 line on the Digital port. It is recommended that you use the USB service cable (Vaisala order code 219690) for the connection, since the cable also provides the operating power from the USB port. If you have not used the USB service cable before, install first the driver that came with the cable.

7.2 Terminal Application Settings

Table 7 Default Serial Interface Settings

Property	Description / Value
Baud rate	19200
Parity	None
Data bits	8
Stop bits	1
Flow control	None

The following steps describe how to connect to the DMT143 using the PuTTY terminal application for Windows (available for download at www.vaisala.com/software) and a USB serial interface cable:

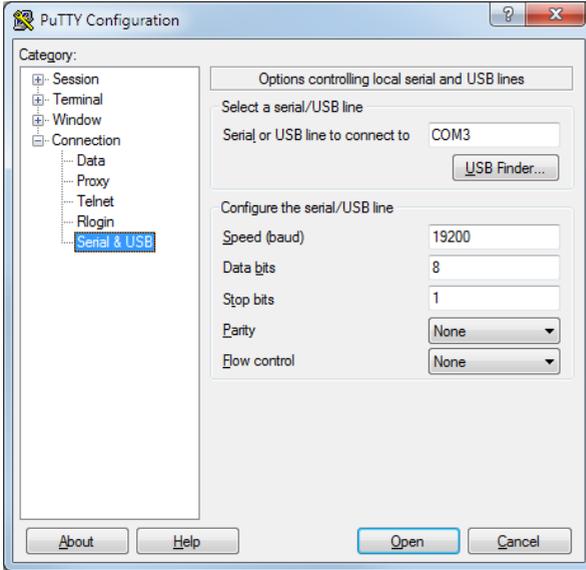
1. Connect the USB serial interface cable between your PC and the RS-485 port of the DMT143 (Digital port).
2. Start the PuTTY application.
3. Select the **Serial** settings category, and check that the correct COM port is selected in the **Serial line to connect to** field.



You can check which port the USB cable is using with the **Vaisala USB Instrument Finder program** that has been installed in the Windows Start menu.

4. Check that the other serial settings are correct for your connection, and change if necessary. **Flow control** should be set to **None** unless you have a reason to change it.
5. Click the **Open** button to open the connection window and start using the serial line. If PuTTY is unable to open the serial port you selected, it will show you an error message instead. If this happens, restart PuTTY and check the settings.

- 6. You may need to adjust the **Local echo** setting in the **Terminal** category to see what you are typing on the serial line. To access the configuration screen while a session is running, click the right mouse button over the session window, and select **Change Settings...** from the pop-up menu.



7.3 Accessing Serial Interface in Devices with Modbus Output

Follow the steps below to connect to the serial line with a transmitter with Modbus output. You can also use the procedure to retrieve the communication settings of your device, if you do not know them. You must use the Vaisala USB cable (Vaisala order code 219690) for the connection.



- Computer with
 - Windows operating system
 - Terminal application
 - Free USB port
 - Driver for Vaisala USB cable installed
- Vaisala USB cable for computer connection (219690)

- ▶ 1. Connect the USB cable to the PC and install the driver, if necessary. Do not connect the cable to the transmitter yet.

2. Open the terminal program and open a connection to the corresponding COM port using the default settings **19200, 8, N, 1**, no flow control.
3. Keep the **Enter** key pressed down and connect the other end of the USB cable to the transmitter. This will cause the transmitter to start in serial mode, using the default serial settings.

You can now use the transmitter with the terminal program.

To prevent Modbus mode from being restored on the next power-up, select a different serial mode with the **smode** command.

7.4 List of Serial Commands

All commands can be issued either in uppercase or lowercase. In the command examples, the keyboard input by the user is in **bold** type.

The notation <cr> refers to pressing the carriage return (**Enter**) key on your computer keyboard. Enter a <cr> to clear the command buffer before starting to enter commands.

Table 8 List of Serial Commands

Command	Description
<ESC>	Stop the continuous outputting of RUN mode or R command
?	Show device information
??	Show device information (overrides poll mode)
ADDR [0 ... 255]	Show or set transmitter address
AERR	Set analog output error level
ALARM	Set dew point level for LED alarm
AMODE	Show analog output mode
AOUT [ON/OFF]	Enable or disable analog output
AOVER [ON/OFF]	Allow analog outputs to exceed their range 10 %
ASEL	Set analog output parameter and scaling
ATEST	Test analog output
CLOSE	Close the temporary connection and return the device to POLL mode
ERRS	Display the currently active errors
FILT [0 ... 1]	Set output filtering level
FORM [modifier string]	Set output format
FRESTORE	Restore factory settings
HELP	Show list of currently available serial commands

Command	Description
INTV [0 ... 255 S/MIN/H]	Set the continuous output interval (for RUN mode and R command)
L	Show user adjustment values
LI	Set user adjustment values
OPEN [0 ... 255]	Open a line to transmitter at defined address
PRES [0.001 ... 50]	Set permanent pressure compensation value
R	Start the continuous outputting
RESET	Reset the transmitter
SDELAY [0 ... 255]	Set response sending delay
SEND [0 ... 255]	Output readings once (specify address for transmitters in POLL mode)
SERI [baud p d s]	Show or set the serial interface settings
SMODE [mode]	Show or set startup serial mode: RUN, STOP, POLL, or MODBUS
SNUM	Display transmitter serial number
SYSTEM	Show transmitter firmware information
UNIT [m/n]	Select metric or non-metric units
VERS	Show transmitter firmware version
XPRES [0.001 ... 50]	Set temporary pressure compensation value

7.5 Device Information

7.5.1 Show Device Information

The **?** command outputs a listing of device information.

?<cr>

Command **??** is similar to the **?** command. It is designed to be used if the transmitter is in POLL mode but its address is unknown. The transmitter will respond to the **??** command even while in POLL mode. Do not use the **??** command if you have more than one transmitter on an RS-485 line.

Example:

```

?
DMT143 1.0.2
Serial number : H1220011
Batch number  : H1210003
Sensor number : G3320000
Sensor model  : DRYCAP180D
Cal. date    : 20120412
Cal. info    : VAISALA/HEL
Time        : 01:38:00
Serial mode  : STOP
SCI Baud P D S: 19200 N 8 1
Output interval: 1 S
Serial delay : 30
Address      : 0
Pressure    : 1.013 bar
Filter      : 0.100

```

7.5.2 Show Analog Output Mode

Use the **AMODE** command to show the analog output mode:

AMODE<cr>

Example:

```

amode
Ch1 output : 4 ... 20 mA

```

7.5.3 Show Firmware Version

VERS<cr>

Example:

```

vers
DMT143 1.0.2

```

7.5.4 Show Firmware Information

SYSTEM<cr>

Example:

```

system
Device Name      : DMT143
Copyright       : Copyright (c) Vaisala Oyj 2012. All rights reserved.
SW Name         : DMT143
SW date        : 2012-05-10
SW version      : 1.0.2

```

7.5.5 Show Currently Active Errors

Use the **ERRS** command to display the currently active transmitter error messages.

ERRS<cr>

Example:

```
errs
No errors
```

Example (one active error, caused by physical damage to the sensor):

```
errs
T MEAS error
```

Table 9 Error Messages on ERRS Command

ERRS Command Response	Corresponding Error
T MEAS error	Temperature measurement error. [44]
F meas error	Humidity measurement error. [45]
Flash crc failure	Firmware checksum mismatch. [49]
Parameter flash check sum error	Device settings corrupted. [50]
INFOA check sum error	Additional configuration settings corrupted. [51]
SCOEFS check sum error	Sensor coefficients corrupted. [52]
CURRENT check sum error	Main configuration settings corrupted. [53]
Voltage error	Supply voltage out of range. [55]
General flash failure w/r	Non-volatile memory read/write failure. [57]

Refer to [Error Messages in Insight Software \(page 67\)](#) for more information about the error states.

7.5.6 Show Serial Number

SNUM<cr>

Example:

```
snum
Serial number : G4060003
```

7.5.7 Show Command List

Use the **HELP** command to show a list of serial commands:

HELP<cr>

Example:

```
help
?  
ADDR  
AERR  
ALARM  
AMODE  
AOVER  
AOUT  
ASEL  
ATEST  
CLOSE  
ERRS  
FILT  
FORM  
FRESTORE  
GAS  
HELP  
INTV  
L  
LI  
OPEN  
PRES  
R  
RESET  
SDELAY  
SEND  
SERI  
SMODE  
SNUM  
SYSTEM  
TIME  
UNIT  
VERS  
XPRES
```

7.6 Configuring Analog Output

7.6.1 Set Analog Output Parameters and Scaling

Use the **ASEL** command to show or set the output parameter and the scaling of the analog output.

ASEL [parameter] [lowlimit highlimit]<cr>

Syntax	Description
<code>parameter</code>	Parameter that is output on analog channel. Available parameters are TDF, TDFA, H2O. If the transmitter has been ordered from Vaisala with a relative humidity output on the analog channel, also parameter RH is available.
<code>lowlimit</code>	Lower limit of parameter scaling.
<code>highlimit</code>	Higher limit of parameter scaling.

Example (show current settings):

```

asel
Ch1 Tdf lo   :  -80.00 'C ?
Ch1 Tdf hi   :   20.00 'C ?

```

Example (change output parameter to H2O, set low and high limits):

```

asel h2o 0 6000
Ch1 H2O lo   :    0.00 ppm
Ch1 H2O hi   :  6000.00 ppm

```

7.6.2 Set Analog Output Error Notification

If the transmitter is malfunctioning, the analog output is set to a specified level. This overrides the normal measurement output of the channel. The default level is 0 mA or 0V, according to the output type. You can set the level using the **AERR** command.

AERR [`level`] <cr>

Syntax	Description
<code>level</code>	Error level for the analog output channel. Available range depends on the output type (check with AMODE command).

Example (check settings):

```

amode
Ch1 output   :  4 ... 20 mA

aerr
Ch1 error out :   0.000 mA

```

Example (set analog channel error level to 20 mA):

```

aerr 20
Ch1 error out :  20.000 mA

```



The error output value is displayed only when there are minor electrical faults such as a sensor damage. When there is a severe device malfunction, the error output value is not necessarily shown.

7.6.3 Extend Analog Output Range

Use the **AOVER** command to allow the analog output channels to exceed their specified range by 10 %. The scaling of the parameter remains as before; the extra range is used for additional measurement range in the high end of the scale.

AOVER [ON/OFF] <cr>

Example (turning AOVER on):

```

aover on
AOVER           :      ON

```

The following example illustrates how the analog output is affected. The channel outputs T_d with voltage output 0 ... 5 V (-80 ... -30 °C). After giving the **AOVER ON** command, the range is 0 ... 5.5 V (-80 ... -25 °C). Note that the -30 °C T_d point is still at 5 V.

7.6.4 Test Analog Output

You can test the operation of the analog output with the **ATEST** command by forcing the output to a given value. You can then measure the output with a calibrated multimeter. After testing the output, give the **ATEST** command again to exit the test mode.

ATEST [Level] <cr>

Syntax	Description
Level	Level for analog output channel. Analog output type determines if the value is V or mA.

The command output shows the test value of the analog output as well as diagnostic information that may be useful to Vaisala Service Center if there is a problem with the analog output.

Example (enabling analog output test mode, setting level to 20 mA):

```

atest 20
20.000    27407

```

Example (disabling analog output test mode, resuming normal output):

```

atest
0.000    15831

```

7.6.5 Enable or Disable Analog Output

Use the **AOUT** command to enable or disable the analog output channel.

AOUT [ON/OFF]<cr>

Example (turn analog output off):

```
aout off
AOUT : OFF
```

7.7 Serial Line Output Commands

7.7.1 Start Measurement Output

Use the **R** command to start the continuous outputting of measurement values as an ASCII text string to the serial line. The format of the measurement message is set with the **FORM** command.

R<cr>

Example (measurement message in default format):

```
r
Tdf= 17.75 'F Tdfatm= -5.25 'F H2O= 954 ppm
Tdf= 17.23 'F Tdfatm= -5.72 'F H2O= 930 ppm
Tdf= 17.06 'F Tdfatm= -5.88 'F H2O= 922 ppm
Tdf= 16.97 'F Tdfatm= -5.96 'F H2O= 918 ppm
...
```

Outputting the results continues in intervals issued with the command **INTV** until stopped.

7.7.2 Stop Measurement Output

You can stop the measurement output by pressing the **ESC** key.

7.7.3 Set Output Interval

Use the **INTV** command to change the output interval of the automatically repeating measurement messages. The measurement messages are repeated in the RUN mode, or after the **R** command has been given.

INTV [n xxx]<cr>

Syntax	Description
n	time interval, range 0 ... 255
xxx	time unit = "S", "MIN", or "H"

The shortest output interval (with $n = 0$) outputs the measurement messages as quickly as the transmitter's internal measurement cycle produces them, without additional delay.

Example:

```
intv 1 min
Output interval:      1 MIN
```

7.7.4 Output a Reading Once

Use the **SEND** command to output a single measurement message. The output message is sent in the format that has been set using the **FORM** command.

SEND [address]<cr>

Syntax	Description
address	Address of the transmitter, range 0 ... 255. Specifying the address is only necessary if the target transmitter is in POLL mode, and has not been accessed with the OPEN command.

Example:

```
send
Tdf= 16.71 'F Tdfatm= -6.19 'F H2O= 907 ppm
```

7.8 Configuring Measurement Parameters

7.8.1 Set Measurement Output Format

Use the serial line command **FORM** to change the measurement message sent by the transmitter. You can freely define the output message to include the desired parameters, formatting options, text strings, and additional fields.

FORM [modifier string]<cr>

Syntax	Description
modifier string	String of parameters and modifiers that defines the output format, length 1 ... 153 characters. Maximum length may be shorter when text strings are used.

Table 10 FORM Command Parameters

Measured Parameter	Abbreviation in FORM Command
Dew point/frost point temperature	Tdf
Dew point/frost point temperature, converted to atmospheric pressure	Tdfa
ppm moisture, by volume	H20
Relative humidity	RH RH is available only if transmitter has been ordered from Vaisala with a relative humidity output on the analog channel.

Table 11 FORM Command Modifiers

Modifier	Description
x.y	Length modifier (number of digits and decimal places)
#t	Tabulator
#r	Carriage return
#n	Line feed
""	String constant, length 1 ... 15 characters
#xxx	ASCII code value (decimal) of a special character; for example, #027 for ESC
ADDR	Transmitter address (0 ... 255)
ERR	Currently active transmitter errors in a four-bit field: bit0bit1bit2bit3bit4 <ul style="list-style-type: none"> • bit0 T MEAS error • bit1 N/A • bit2 Fmeas error • bit3 Flash csum error
SN	Transmitter serial number
STAT	Transmitter status in a one-character field: <ul style="list-style-type: none"> • h – sensor heating active • H – purge active • A – autocalibration active
Ux	Shows the name of the measurement unit using “x” number of characters. For example, U3 shows the name of the measurement unit with 3 characters

Modifier	Description
CS2	Modulus-256 checksum of message sent so far, ASCII encoded hexadecimal notation
CS4	Modulus-65536 checksum of message sent so far, ASCII encoded hexadecimal notation
CSX	NMEA xor-checksum of message sent so far, ASCII encoded hexadecimal notation

FORM Command Examples

You can return to the default format using the "**FORM /**" command.

Example of default output (continuous output from RUN mode):

```
Tdf= -9.80 'C Tdfatm= -9.80 'C H2O= 2618 ppm
Tdf= -9.80 'C Tdfatm= -9.80 'C H2O= 2617 ppm
...
```

Command to set output format as Tdf and ppm with Modulus-256 checksum:

```
form 3.2 "Tdf=" Tdf U3 6.0 "H2O=" H2O " " U5 CS2 \r \n
```

Output example:

```
Tdf= -9.74'C H2O= 2632 ppm C4
Tdf= -9.72'C H2O= 2636 ppm C6
...
```

Command to set output format as Tdf and ppm, with **start of text** (ASCII character 002) and **end of text** (003) ASCII codes, and without line feed and carriage return at the end:

```
form #002 3.2 "Tdf="Tdf U3 6.0 "H2O=" H2O " " U5 #003
```

Output example (ASCII codes not visible here):

```
Tdf= -9.57'C H2O= 2671 ppm Tdf= -9.59'C H2O= 2666 ppm
Tdf= -9.61'C H2O= 2662 ppm Tdf= -9.62'C H2O= 2660 ppm
...
```

7.8.2 Set Measurement Filtering

Use the **FILT** command to view or set the speed at which the latest measurement result is integrated into the output readings. The command affects both analog output and serial line output.

FILT [a.aaaaa]<cr>

Syntax	Description
a.aaaaa	Range 0.00001 ... 1.0 1.0 = No filtering, latest measurement is output without averaging 0.5 = Average of last two measurements 0.1 = Average of approx. 16 measurements (default)

Example (show current setting):

```
filt
Filter      :    0.10000    ?
```

Example (set filtering to 0.5):

```
filt 0.5
Filter      :    0.50000
```

7.8.3 Set Pressure Compensation Value

The pressure of the measured system must be known for accurate dew point and ppm measurement. The pressure compensation value has been set at the factory according to the order form. You can view and set a new value using the **PRES** command.

Command **XPRES** should be used if the value is changed frequently. The value set using the **XPRES** command overrides the **PRES** value, but it is not retained at reset. When the **XPRES** is set to 0, the last value set with **PRES** is used instead.



It is enough to set an approximate pressure value (± 1 bar) to meet the accuracy specification of the DMT143.

PRES [pp.ppppp]<cr>

XPRES [pp.ppppp]<cr>

Syntax	Description
pp.ppppp	Absolute pressure (bar _a) in the measuring point. Range 0.001 ... 50 bar.

Example (set pressure compensation value to 3 bar):

```
pres 3
Pressure : 3.000 bar
```

The pressure conversion coefficients from other pressure units to bars is given in the table below.

Table 12 Pressure Conversion Coefficients

From	To bar _a
PaN/m ²	0.00001
mmHg torr	0.001333224
inHg	0.03386388
mmH ₂ O	0.00009806650
inH ₂ O	0.002490889
atm	1.01325
at	0.980665
psi _a	0.06894757

For example: 29.9213 inHg = 29.9213 × 0.03386388 = 1.01325 bar_a.

7.8.4 Select Unit

Use the **UNIT** command to select metric or non-metric output units.

UNIT [x] <cr>

Syntax	Description
x	Selects the unit type to output: m = metric units, for example, Celsius n = nonmetric units, for example, Fahrenheit

Example:

```
unit m
Units      : Metric
```

7.8.5 View User Adjustment Parameters

Use the **L** command to view the current user adjustment parameters that are affected by the **LI** command and the MI70 indicator (Tdf offset only). This command is useful for checking the currently applied correction.

L<cr>

The output values are as follows:

- RH offset and gain
- T offset and gain
- Tdf offset and gain

Example (shows default values, no user adjustment done):

```

l
RH offset : 0.00000000E+00
RH gain   : 1.00000000E+00
T offset  : 0.00000000E+00
T gain    : 1.00000000E+00
Tdf offset: 0.00000000E+00
Tdf gain  : 1.00000000E+00

```

Example (shows that a -1.2 °C Tdf offset has been applied by the user):

```

l
RH offset : 0.00000000E+00
RH gain   : 1.00000000E+00
T offset  : 0.00000000E+00
T gain    : 1.00000000E+00
Tdf offset: -1.20000000E+00
Tdf gain  : 1.00000000E+00

```

7.8.6 Set User Adjustment Parameters

Use the **LI** command to set the user adjustment parameters directly. This command is useful for restoring the desired adjustments, and removing the effects of user adjustment without having to perform the factory reset.



CAUTION! This command is provided primarily for applying an offset to the Tdf measurement. Do not adjust the other parameters unless instructed to do so by a Vaisala Service Center.

LI<cr>

After entering the command, you will be prompted to enter new values one at a time. Press ENTER without giving a value to move to the next parameter.

Example (shows a +0.8 °C Tdf offset being applied):

```

li
RH offset : 0.00000000E+00 ?
RH gain   : 1.00000000E+00 ?
T offset  : 0.00000000E+00 ?
T gain    : 1.00000000E+00 ?
Tdf offset: 0.00000000E+00 ?
Tdf gain  : 1.00000000E+00 ?

```

7.9 Configuring Serial Line Operation

7.9.1 Set Serial Line Operating Mode

Use the **SMODE** command to set the start-up operating mode of the serial line.

SMODE [mode] <cr>

Syntax	Description
mode	STOP, RUN, POLL, or MODBUS.

Table 13 Selection of Output Modes

Mode	Measurement Output	Available Commands
STOP	Only with the SEND command.	All (default mode).
RUN	Automatic output.	Only command S .
POLL	Only with the SEND [addr] command.	SEND [addr] and OPEN [addr]. Other commands available after opening a line to the transmitter using the OPEN command. Use with RS-485 buses where multiple transmitters can share the same line.
MODBUS	No automatic output.	Measurement outputs must be read from the transmitter using the Modbus protocol.

Selected output mode will be activated at next reset or power up.

Example:

```
smode poll
Serial mode : POLL
```

More Information

- [Accessing Serial Interface in Devices with Modbus Output \(page 42\)](#)

7.9.2 Set Serial Line Settings

Use the **SERI** command to set the serial line settings. The new settings will be taken into use when the transmitter is reset or powered up.



If you have altered the DMT143 serial line settings and start using the MI70 handheld indicator, always switch off the other power supply (disconnect “Analog” cable if in use) before powering up the MI70.

SERI [b p d s]<cr>

Syntax	Description
b	baud rate (4800, 9600, or 19200)
p	parity (n = none, e = even, o = odd)
d	data bits (7 or 8)
s	stop bits (1 or 2)

Example (set serial line to 9600 baud, no parity, 7 data bits, and 1 stop bit):

```
seri 9600 e 7 1
SCI Baud P D S: 9600 E 7 1
```

More Information

- [Operation with DM70 Handheld Dew Point Meter \(page 38\)](#)

7.9.3 Set Transmitter Address

To operate in the POLL mode, the transmitter must have an address. If multiple transmitters share the same serial line, each transmitter must have a different address.

ADDR [address]<cr>

Syntax	Description
address	Transmitter address, range 0 ... 255.

Example:

```
addr
Address : 0 ?
```

More Information

- [Set Serial Line Operating Mode \(page 57\)](#)

7.9.4 Set Serial Line Response Time

With the **SDELAY** command you can set delay (response time) of the serial line, or view the currently set delay value.

SDELAY [delay]<cr>

Syntax	Description
delay	Serial line delay, range 0 ... 255. One unit of delay corresponds to 4 milliseconds.

Example (set delay to 120 milliseconds):

```
sdelay 30
Serial delay :      30
```

7.10 Other Commands

7.10.1 Opening the Transmitter in POLL Mode

Use the **OPEN** command to connect to a transmitter that is in POLL mode.

OPEN [address]<cr>

Syntax	Description
address	Transmitter address, range 0 ... 255.

Example (target transmitter in POLL mode, with address 5):

```
open 5
DMT143 5 line opened for operator commands
```

7.10.2 Closing the Connection to a Transmitter in POLL Mode

The **CLOSE** command closes the connection to a transmitter.

CLOSE<cr>

Example:

```
close
line closed
```

7.10.3 Configure the Alarm LED

Use the **ALARM** command to configure the alarm LED functionality.

ALARM [LED] [Alarm] [Level]<cr>

Syntax	Description
LED	Enable or disable the entire LED functionality. Allowed values: ON - Enable the LED functionality. OFF - Turn off the LED completely.
Alarm	Enable or disable the dew point alarm. Allowed values: ON - Enable the dew point alarm. OFF - Turn off the dew point alarm.
Level	Dew point temperature above which the alarm LED will turn red. The LED will turn green when the measured dew point temperature falls below this level. Range -70 ... +60 °C T _{df} .

Example (show current settings):

```
alarm ?
LED display :      OFF
Alarm display :    OFF
Setpoint Td(°C):  -10.00
```

Example (change values line by line, enter to skip line):

```
alarm
LED display : OFF ? on
Alarm display : OFF ? on
Setpoint Td(°C): -10.00 ? -40
```

Example (change alarm level to -40 °C T_{df}):

```
alarm on on -40
LED display :      ON
Alarm display :    ON
Setpoint Td(°C):  -40.00
```

Example (turn off the dew point alarm only):

```
alarm on off
LED display : ON
Alarm display : OFF
Setpoint Td(°C): -40.00
```

Example (turn off the LED completely):

```
alarm off
LED display : OFF
```

More Information

- [Alarm LED \(page 20\)](#)

7.10.4 Reset Transmitter

Use the **RESET** command to reset the transmitter.

RESET<cr>

When the **RESET** command is given, the transmitter will restart as if it had just been powered on. All transmitter settings are retained. The serial line mode of the transmitter will be set to the mode that was set using the **SMODE** command.

7.10.5 Restore Factory Settings

Use the **FRESTORE** command to restore the transmitter to its factory configuration. All user settings will be lost.

FRESTORE<cr>



After using the **FRESTORE** command, reset the transmitter using the **RESET** command.

8. Maintenance

8.1 Periodic Maintenance

8.1.1 Cleaning

You can clean the body of the transmitter by wiping with a moistened lint-free cloth. Do not immerse the transmitter in liquid, and do not use cleaning agents or solvents.

8.1.2 Calibration

DMT143 is fully calibrated as shipped from the factory. The recommended calibration interval is 2 years. If there is a reason to believe that the device is not within the accuracy specifications, you can perform a field check using the DM70 handheld dew point meter.

If the field check indicates that the DMT143 is not within its accuracy specifications, contact a Vaisala Service Center or your local Vaisala representative to have the DMT143 adjusted.

8.1.3 Changing the Filter

Replace the filter if it is contaminated. New filters are available from Vaisala.



CAUTION! Be careful when changing the filter, since it is easy to break the sensor when the filter is removed.



CAUTION! If the transmitter has the optional stainless steel filter HM47453SP for vacuum applications installed, note that it has tapered threads and is not meant to be removed on site. Trying to forcefully loosen the filter may damage the transmitter instead. The filter replacement instructions below are for the standard sintered filter DRW010335SP with parallel threads.

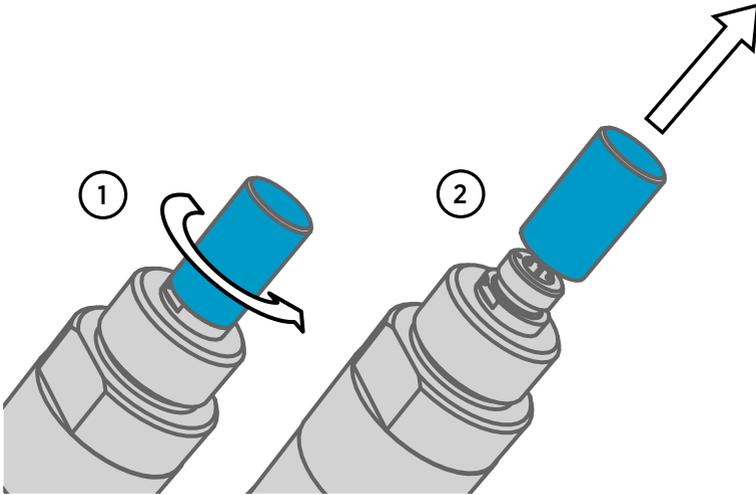


CAUTION! If the transmitter is installed in a pressurized chamber, always make sure that the pressure of the chamber is equalized with the ambient pressure prior to removing the transmitter. When the transmitter is removed for maintenance, cap the hole with a capped nut. This way, the chamber can be pressurized although the transmitter is not in place. Plugs are available from Vaisala for ISO and NPT threaded connections.

When replacing the filter, wear clean gloves to avoid depositing dirt or oil on the filter. Inspect the sealing ring for damage (used with ISO thread only), and replace it if necessary.

Replace the filter as follows:

- ▶ 1. Turn the filter counterclockwise until it is loose.
2. Pull the filter straight out carefully.



CAUTION! Do not damage the sensor.

3. Take the new filter, and insert it to the filter thread.
4. Tighten the new filter to 5 Nm by turning it clockwise.

More Information

- ▶ [Spare Parts and Accessories \(page 73\)](#)

8.1.4 Field Check Using DM70 Handheld Dew Point Meter

Vaisala recommends the following equipment for field checking:

- A fully charged MI70 indicator (the measurement display that is included in the DM70 package).
- A calibrated reference probe that is suitable for the intended measurement environment and dew point range. The DMP74B probe is recommended for checking the dew point temperature measurement accuracy.
- You also need a connection cable (Vaisala order code 219980SP) to connect the DMT143 to the MI70 indicator.



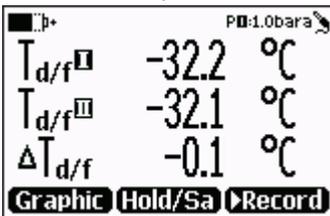
In the following procedure, the readings of the transmitter and the reference probe are checked simultaneously. You can also check the reference probe and the DMT143 separately if they cannot be connected at the same time.



The messages from the transmitter will appear in English even if the MI70 has been set to another language.

Perform the check as follows:

- ▶ 1. Place the reference probe and the DMT143 in the reference environment.
2. Connect the reference probe and the DMT143 to the MI70 indicator:
 - Reference probe to Port I
 - DMT143 to Port II
3. If you have altered the DMT143 serial port settings, switch off the other power supply (disconnect “Analog” cable if in use) before powering up the MI70. Note that this powers off the transmitter, and it will carry out the startup sequence when powered on again.
4. Turn on the MI70 indicator. Never connect or disconnect the MI70 indicator while it is powered on, as this may cause incorrect values to be displayed.
5. Check and adjust the environment settings if prompted. Refer to the *DM70 User's Guide* for the settings of the DMP74B probe.
6. Disable the **Auto power off** function of the MI70 indicator to prevent the indicator from powering off in the middle of the check. Check the setting in the **Settings - User Interface** menu, and change if necessary.
7. The MI70 can display three parameters at one time. To compare the readings of the DMT143 and the reference probe, select the desired parameter from the **Display - Quantities and Units** menu of the MI70. Select the same parameter from port I and II, and the delta parameter that shows the difference between the two. For example, $\Delta T_{d/f}$ shows the difference in dew point between the two probes.



8. After the measurement has stabilized, check the difference between the readings. It will give you an indication of the approximate drift of the DMT143 and its need for calibration. The difference between the readings should be no greater than the combined measurement uncertainty of the DMT143 and the reference probe.
9. Write down the results and repeat the comparison for each parameter you want to check.

10. If adjustment is required, contact a Vaisala Service Center or your local Vaisala representative to have the DMT143 adjusted.

More Information

- [DMT143 Startup Sequence \(page 19\)](#)

8.2 Repair Maintenance



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

If there is a problem with your transmitter that you are unable to solve yourself or with the help of Vaisala Helpdesk, contact a Vaisala Service Center. In case of mechanical or electrical failure, the Service Center may replace the transmitter with a new one.

More Information

- [Troubleshooting \(page 66\)](#)
- [Technical Support \(page 85\)](#)

9. Troubleshooting

9.1 Solving Typical Problems

Some problems can be solved by simply resetting the transmitter. You can reset the transmitter by disconnecting the power or issuing the **RESET** command using the service port.

If resetting does not help, and if the problem is related to transmitter software or settings, you can restore the factory configuration of the transmitter by issuing the **FRESTORE** command. If you are unable to solve your problem with the transmitter, contact Vaisala.

Table 14 Troubleshooting Table

Problem	Possible Causes and Solutions
One of the following occurs: <ul style="list-style-type: none"> • Transmitter outputs stars "*****" on serial line instead of measurement data. • Unavailable value in Modbus mode. • Analog signal is at error level. 	Possible causes: damaged sensor, incorrect supply voltage, and unsuitable measurement environment. Power cycle or reset the transmitter, and see if the problem continues. Check the active errors using Vaisala Insight PC software or the ERRS command. Check the power supply.
Unable to access transmitter on the RS-485 line.	Possible causes: Incorrect wiring, unknown serial settings, transmitter in POLL or MODBUS mode with unknown address. Check wiring. Check communication settings with Vaisala Insight PC software. Try connecting as instructed in section Accessing Serial Interface in Devices with Modbus Output (page 42) .
Analog output seems to be stuck, the measurement is not changing.	Possible causes: Sensor diagnostics in progress (autocal or purge), malfunction error active. Check the active errors using Vaisala Insight PC software or the ERRS command. Wait for the diagnostics to complete.
Dew point alarm LED is red even though the measured dew point is not high.	Possible causes: the alarm limit may be set incorrectly for your application. Check and correct using Vaisala Insight PC software, serial line, or MI70 indicator.

More Information

- [Vaisala Insight Software \(page 36\)](#)
- [Connecting to the Serial Interface \(page 41\)](#)
- [Technical Support \(page 85\)](#)

9.2 Error Messages in Insight Software

Table 15 Error Messages in Insight Software

Error	Likely Cause	Suggested Solution
Temperature measurement error. [44]	Temperature sensor is short circuited, damaged, or missing.	Check that the legs of the temperature sensor are not short circuited. Contact a Vaisala Service Center if the sensor is damaged.
Humidity measurement error. [45]	Humidity sensor is wet, damaged, or missing.	Wait for the humidity sensor to dry, or remove the filter and gently dry the sensor and the filter with clean instrument air. Contact a Vaisala Service Center if the sensor is damaged.
Supply voltage out of range. [55]	Supply voltage is too low.	Check and correct the power supply and wiring.
Firmware checksum mismatch. [49]	Internal transmitter failure.	Power-cycle the device, and if necessary, restore the factory settings. If the error remains, contact a Vaisala Service Center.
Device settings corrupted. [50]		
Additional configuration settings corrupted. [51]		
Sensor coefficients corrupted. [52]		
Main configuration settings corrupted. [53]		
Non-volatile memory read/write failure. [57]		

In case of constant error, contact a Vaisala Service Center.

More Information

- [Technical Support \(page 85\)](#)

9.3 Error Codes in MI70 Handheld Meter

If several errors are active at the same time, the MI70 shows the sum of currently active error codes. The label "hex" might not be displayed in MI70.

Refer to [Error Messages in Insight Software \(page 67\)](#) for more information about the error states.

Table 16 Error Codes in MI70

Transmitter Error Code in MI70	Corresponding Error
1 _{hex}	Temperature measurement error. [44]
2 _{hex}	Humidity measurement error. [45]
40 _{hex}	Device settings corrupted. [50]
80 _{hex}	Additional configuration settings corrupted. [51]
100 _{hex}	Sensor coefficients corrupted. [52]
200 _{hex}	Main configuration settings corrupted. [53]
800 _{hex}	Supply voltage out of range. [55]
10000 _{hex}	Non-volatile memory read/write failure. [57]
20000 _{hex}	Firmware checksum mismatch. [49]

9.4 Unknown Serial Settings

You can check the current serial settings of your transmitter by connecting to the serial line, or with Vaisala Insight software.

More Information

- [Accessing Serial Interface in Devices with Modbus Output \(page 42\)](#)
- [Vaisala Insight Software \(page 36\)](#)

10. Technical Data

10.1 DMT143 Specifications

Table 17 Measurement Performance

Property	Description/Value
Sensor	Vaisala DRYCAP® 180D
Sensor protection	Stainless steel sintered filter
Recommended calibration interval to confirm the specified accuracy	2 years
Dew Point Temperature	
Measurement range (typical)	-70 ... +60 °C (-94 ... +140 °F) T _d
Accuracy in air or N ₂ ¹⁾	±2 °C (±3.6 °F) T _d (see graph below)
<p>The graph plots Dew point temperature (°C) on the vertical axis against Temperature of measured gas (°C) on the horizontal axis. The vertical axis ranges from -90 to 60 in increments of 10. The horizontal axis ranges from -40 to 60 in increments of 10. A dashed line, labeled 'Water vapor saturation line', slopes upwards from left to right. The area below this line is shaded and divided into two regions. The lower region, below approximately -10°C dew point, is labeled 'Accuracy ±3 °C Td*'. The upper region, above approximately -10°C dew point, is labeled 'Accuracy ±2 °C Td'. A point at approximately 50°C gas temperature and 40°C dew point is marked with a dot and labeled 'Not recommended for continuous measurement'.</p>	
* > 12 bar, accuracy ±4 °C Td	
Analog output scalings:	
Option 1	-80 ... +20 °C (-112 ... +68 °F) T _d
Option 2	-80 ... +20 °C (-112 ... +68 °F) T _d dew point at ambient pressure

Property	Description/Value
Option 3	Free scaling
Response time 63 % [90 %] at +20 °C gas temperature and 1 bar pressure and 1 liter/min flow rate:	
-70 → -20 °C T _d (-94 → -4 °F T _d)	5 s [15 s] (typical)
-20 → -70 °C T _d (-4 → -94 °F T _d)	45 s [10 min] (typical)
Water Concentration by Volume (ppm)	
Measurement range (typical)	10 ... 40 000 ppm
Accuracy at +20 °C (+68 °F), 1 bar	1 ppm + 20 % of reading

1) When the dew point is below 0 °C (32 °F), the transmitter outputs frost point.

Table 18 Operating Environment

Property	Description/Value
Measured gases	Non-corrosive gases
Temperature ¹⁾	-40 ... +60 °C (-40 ... +140 °F)
Relative humidity	0 ... 100 % RH
Pressure ¹⁾	0 ... 50 bar _a (725 psi _a)
Sample flow rate	No effect for measurement accuracy
Storage temperature	-40 ... +60 °C (-40 ... +140 °F)

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

Table 19 Inputs and Outputs

Property	Description/Value
Analog output (scalable)	4 ... 20 mA (3-wire), 0 ... 1 V / 5 V, 1 ... 5 V
Resolution for current output	0.002 mA
Resolution for voltage output	0.3 mV
Accuracy for current output at +20 °C	± 0.05 mA
Accuracy for voltage output at +20 °C	± 0.01 V
Operating voltage with voltage output	12 ... 28 VDC
Operating voltage with current output	18 ... 28 VDC
Load for current output	Max. 500 Ω
Load for voltage output	Min. 10 kΩ

Property	Description/Value
Typical temperature dependence	0.005 % of span/°C
Digital output	RS-485, non-isolated Vaisala Industrial Protocol Modbus RTU protocol
Connector	4-pin M8 (IEC 60947-5-2)
Supply Current at +20 °C (Uin 24 VDC)	
Normal measurement	Typical 10 mA + load current
During self-diagnostics	Typical 220 mA pulsed

Table 20 Mechanical Specifications

Property	Description/Value
Mechanical connection	ISO G1/2 in or NPT 1/2
Housing material	Stainless steel (AISI316L)
Weight	G-thread version 90 g (3.2 oz) NPT-thread version 100 g (3.5 oz)

Table 21 Compliance

Property	Description/Value
IP rating	IP66
NEMA rating	NEMA 4
EMC compliance	EN61326-1, Electrical equipment for measurement, control and laboratory use - EMC requirements - Industrial environment

10.2 Dimensions

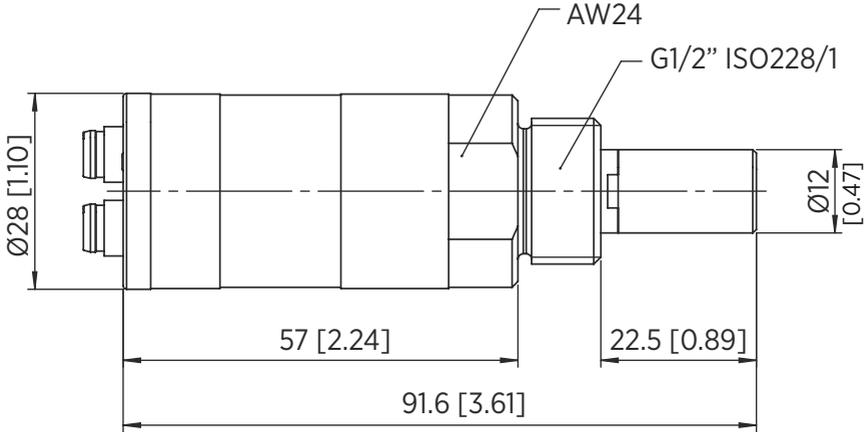


Figure 20 DMT143 Dimensions - Model with ISO Thread

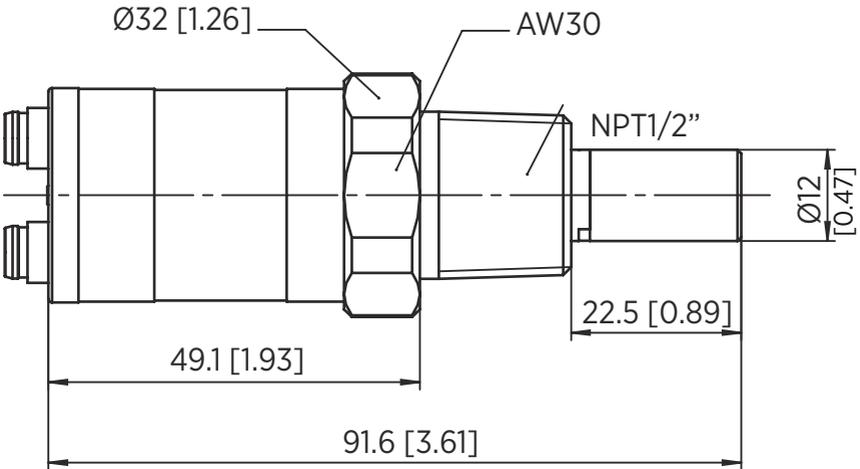


Figure 21 DMT143 Dimensions - Model with NPT Thread

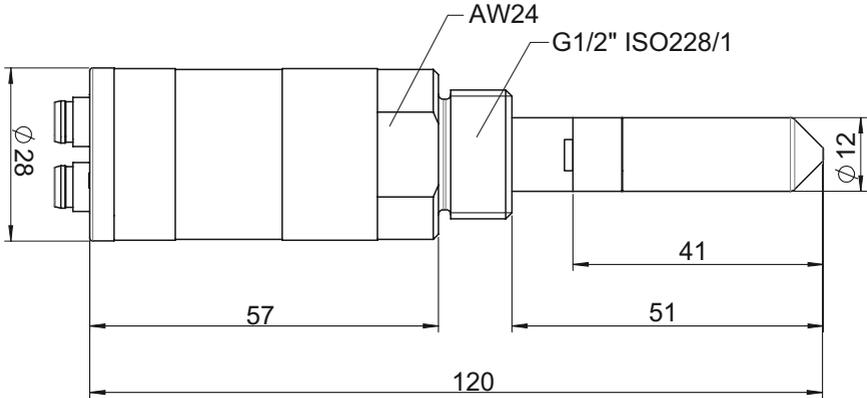


Figure 22 DMT143L Dimensions

10.3 Spare Parts and Accessories

Table 22 Spare Parts and Accessories

Item	Order Code
Connection cable for DM70	219980SP
USB cable for PC connection ¹⁾	219690
Loop powered external display	226476
Loop powered external display with relays	234759
Installation flange ISO ½	DM240FASP
Sintered filter (DMT143)	DRW010335SP
Stainless steel filter (DMT143, DMT143L)	HM47453SP
Stainless steel sintered filter (38 um) (DMT143L)	HM47280SP
Mounting nut	MOUNTINGNUTSP
Plug kit (ISO 1/2")	218773
Plug kit (NPT 1/2")	222507
Sealing ring set (3 pcs)	221525SP
NPT 1/2" adapter for models with ISO1/2" thread	210662SP
Output cables	
0.3 m (1.0 ft) shielded output cable M8, threaded connector	HMP50Z032SP

Item	Order Code
3 m (9.8 ft) shielded output cable M8, threaded connector	HMP50Z300SP
5 m (16.4 ft) shielded output cable M8, threaded connector	HMP50Z500SP
10 m (32.8 ft) shielded output cable M8, threaded connector	HMP50Z1000SP
1.5 m (4.9 ft) heavy duty cable	225777SP
3 m (9.8 ft) heavy duty cable	225229SP
Sampling Cells	
Basic sampling cell	DMT242SC
With Swagelok 1/4 in male connectors	DMT242SC2
With quick connector and leak screw	DSC74SP
Two-pressure sampling cell	DSC74BSP
Two-pressure sampling cell with coil	DSC74CSP
Cooling/venting coil	DMCOILSP
See the DSS70A product page at www.vaisala.com for further information about the sampling cells available for DM70.	

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

Appendix A. Modbus Reference

A.1 Default Communication Settings

The following table lists the default Modbus serial settings of devices ordered with the Modbus configuration option.

Table 23 Default Modbus Serial Communication Settings

Description	Default Value
Serial bit rate	19200
Parity	N
Number of data bits	8
Number of stop bits	2
Modbus device address	240
Serial delay	0
Communication mode	Modbus RTU

A.2 Function Codes

Table 24 Modbus Function Codes

Function Code (Decimal)	Function Code (Hexadecimal)	Name
03	03 _{hex}	Read Holding Registers
16	10 _{hex}	Write Multiple Registers
43 / 14	2B _{hex} / 0E _{hex}	Read Device Identification

A.3 Data Encoding

A.3.1 32-Bit Floating Point Format

Registers using "32-bit float" data format are encoded using the "binary32" encoding defined in IEEE 754 (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 masters may expect "big-endian" word order (most significant word first). In such a case, you must select "word-swapped" floating point format in your Modbus master for the Modbus registers of the device.

Reading the measurement data registers with incorrect floating point format setting may occasionally result in correct-looking values. It is highly recommended to first try reading the register number 7938 (floating point test) to see that you have configured the floating point format correctly on your Modbus host system.



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

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 25 16-bit Signed Integer Format Details

Value	Description
0000 _{hex} ... 7FFE _{hex}	Value in range 0 ... 32766
7FFF _{hex}	Value is 32767 or larger
8002 _{hex} ... FFFF _{hex}	Value in range -32766 ... -1 (2's complement)
8000 _{hex}	Value is not available (quiet NaN)



Some values may exceed the signed 16-bit range even in normal operation. To access such values, use the floating point registers instead.

A.4 Modbus Registers



CAUTION! Registers are numbered in decimal, starting from one. Register addresses in actual Modbus messages (Modbus Protocol Data Unit (PDU)) start from zero.

Please check the reference documentation of your Modbus host (PLC) for the notation of Modbus register addresses.

A.4.1 Measurement Data Registers

Table 26 Modbus Measurement Data Registers (Read-Only)

Register Number (Decimal)	Address (Hexadecimal)	Register Description	Data Format	Unit
1	0000 _{hex}	Relative humidity (RH)	32-bit float	%RH
7	0006 _{hex}	Dew/frost point temperature ($T_{d/f}$)	32-bit float	°C
11	000A _{hex}	Dew/frost point temperature at 1 atm ($T_{d/fa}$)	32-bit float	°C
21	0014 _{hex}	Water concentration (ppm)	32-bit float	ppm
257	0100 _{hex}	Relative humidity (RH*100)	16-bit signed integer	%RH
260	0103 _{hex}	Dew/frost point temperature ($T_{d/f}$ *100)	16-bit signed integer	°C
262	0105 _{hex}	Dew/frost point temperature at 1 atm ($T_{d/fa}$ *100)	16-bit signed integer	°C
267	010A _{hex}	Water concentration (ppm)	16-bit signed integer	ppm

Accessing unavailable (temporarily missing) measurement data does not generate an exception. “Unavailable” value (a quiet NaN for floating point data or 8000_{hex} for integer data) is returned instead.

A.4.2 Status Registers

Table 27 Modbus Status Registers (Read-Only)

Register Number (Decimal)	Address (Hexadecimal)	Register Description	Data Format	Notes
513	0200 _{hex}	Error status	16-bit integer	1 = No errors
514	0201 _{hex}	Online status	16-bit integer	1 = Data available 0 = Outputs frozen due to autocal or purge

Register Number (Decimal)	Address (Hexadecimal)	Register Description	Data Format	Notes
515	0203 _{hex}	Error code	32-bit integer	0 = No errors

Table 28 Error Codes on Modbus Interface

Error Code Register Value	Corresponding Error
0	No errors.
1	Temperature measurement error. [44]
2	Humidity measurement error. [45]
64	Device settings corrupted. [50]
128	Additional configuration settings corrupted. [51]
256	Sensor coefficients corrupted. [52]
512	Main configuration settings corrupted. [53]
2048	Supply voltage out of range. [55]
65536	Non-volatile memory read/write failure. [57]
131072	Firmware checksum mismatch. [49]

If several errors are active at the same time, the Modbus Error Code register contains the sum of currently active error codes.

Refer to [Error Messages in Insight Software \(page 67\)](#) for more information about the error states.

A.4.3 Configuration Registers

Table 29 Modbus Configuration Data Registers (Writable)

Register Number (Decimal)	Address (Hexadecimal)	Register Description	Data Format	Unit / Valid Range
Settings				
769	0300 _{hex}	Pressure, power-up default value	32-bit float	bar (absolute) 0.001 ... 50
771	0302 _{hex}	Pressure	32-bit float	bar (absolute) 0.001 ... 50

Register Number (Decimal)	Address (Hexadecimal)	Register Description	Data Format	Unit / Valid Range
Settings				
795	031A _{hex}	Filtering factor	32-bit float	0.00001 ... 1
Communication				
1537	0600 _{hex}	Address	16-bit integer	1 ... 247
1538	0601 _{hex}	Bit rate (b/s)	16-bit integer	5 = 9600 6 = 19200
1539	0602 _{hex}	Parity, data, stop bits	16-bit integer	0 = N81 1 = N82 2 = E81 3 = E82 4 = O81 5 = O82
1540	0603 _{hex}	Response delay	16-bit integer	0 ... 1020 ms
1541	0604 _{hex}	Interface mode	16-bit integer	6 = MODBUS
1542	0605 _{hex}	Restart device	16-bit integer	1 = Restart the device
LED Alarm				
3073	0C00 _{hex}	Indicator mode	16-bit integer	0 = Off 1 = Status only 2 = Alarm
3074	0C01 _{hex}	Alarm parameter	16-bit integer	6 = T _{d/f}
3075	0C02 _{hex}	Alarm setpoint	32-bit float	-70 °C ... +60 °C
Factory Settings				
7681	1E00 _{hex}	Restore settings	16-bit integer	1 = Restore factory settings

A.4.4 Test Value Registers

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

Table 30 Modbus Test Registers (Read-Only)

Register Number (Decimal)	Address (Hexadecimal)	Register Description	Data Format	Value
7937	1F00 _{hex}	Signed integer	16-bit integer	-12345
7938	1F01 _{hex}	Floating point	32-bit float	-123.45
7940	1F03 _{hex}	Text string	7-character ASCII string	"-123.45"

A.4.5 Device Identification Objects

Table 31 Device Identification Objects

Object Id (Decimal)	Object Id (Hexadecimal)	Object Name	Example Contents
0	00 _{hex}	VendorName	"Vaisala"
1	01 _{hex}	ProductCode	DMT143
2	02 _{hex}	MajorMinorVersion	Software version (for example "1.4.2")
3	03 _{hex}	VendorUrl	"http://www.vaisala.com/"
4	04 _{hex}	ProductName	Vaisala DRYCAP® Dewpoint Transmitter DMT143
5	05 _{hex}	ModelName	Configuration code (for example "G1A1A1A0A0ASX")
128	80 _{hex}	SerialNumber ¹⁾	Serial number of the device (for example "J1140501")
129	81 _{hex}	CalibrationDate ¹⁾	Main calibration date in YYYY-MM-DD format. Empty string if not set/valid.
130	82 _{hex}	CalibrationText ¹⁾	Main calibration information text. Empty string if not set/valid.

1) Vaisala-specific device identification object.

A.5 Modbus Communication Examples

Reading Dew Point/Frost Point Temperature Value



Device address used in the following examples is 240 (F0_{hex}).
 The values returned by the device differ depending on the ambient conditions and/or device settings. Your device might not return exactly the same values.

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
F0 _{hex}	Transmitter address	F0 _{hex}	Transmitter address
03 _{hex}	Function (Read Holding Registers)	03 _{hex}	Function (Read Holding Registers)
00 _{hex}	Register address	04 _{hex}	Number of data bytes
06 _{hex}		F5 _{hex}	Value of first register (least significant word)
00 _{hex}	Number of 16-bit registers to read (2)	96 _{hex}	
02 _{hex}		C0 _{hex}	
31 _{hex}	Modbus RTU checksum	E7 _{hex}	Modbus RTU checksum
2B _{hex}		D9 _{hex}	
(silence for 3.5 bytes)	End of Modbus RTU frame	56 _{hex}	End of Modbus RTU frame
		(silence for 3.5 bytes)	

Communication Description	
Register number	7 (1-based Modbus register number) = address 0006 _{hex} (0-based address 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	C0E7F596 _{hex} , which is binary32 representation of -7.25 (°C).

Writing Filtering Factor 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
F0 _{hex}	Transmitter address	F0 _{hex}	Transmitter address
10 _{hex}	Function (Write Multiple Registers)	10 _{hex}	Function (Write Multiple Registers)
03 _{hex}	Register address	03 _{hex}	Register address
1A _{hex}			
00 _{hex}	Number of registers to write (2)	00 _{hex}	Number of 16-bit registers written (2)
02 _{hex}			
04 _{hex}	Number of data bytes	75 _{hex}	Modbus RTU checksum
CC _{hex}	Value for the first register (least significant word)	6A _{hex}	
CD _{hex}		(silence for 3.5 bytes)	End of Modbus RTU frame
3E _{hex}	Value for the second register (most significant word)	<div style="border: 1px solid black; padding: 10px; background-color: #f0f0f0;"> <p> 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 of out-of-range values).</p> <p>To verify that the value was really accepted by the device, read the register value after writing.</p> </div>	
4C _{hex}			
DE _{hex}	Modbus RTU checksum		
E9 _{hex}			
(silence for 3.5 bytes)	End of Modbus RTU frame		

Communication Description	
Register number	795 (1-based Modbus register number) = address 031A _{hex} (0-based address used in actual communication).
Data format	Two 16-bit Modbus registers interpreted as IEEE 754 binary32 floating point value, least significant word first.
Value to write	0.2, in binary32 format 3E4CCCCD _{hex} .

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Technical Support



Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information:

- Product name, model, and serial number
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Recycling



Recycle all applicable material.



Follow the statutory regulations for disposing of the product and packaging.

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