Document Revision

Rev.	Date	Creator	Status	Reason
A	4/6/2018	JAMM		First revision

General Product info

Introduction to DMT143

Vaisala DRYCAP® Dewpoint Transmitter DMT143 is a small and lightweight dewpoint 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 two variants of the DMT143 transmitter, DMT143 and DMT143L.

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 bara (725 psia)
- voltage (V) or current (mA) analog output

DMT143L with DRYCAP® 180M sensor
- G1/2″ ISO228/1 mechanical connection
- measurement range -70 ... + 60 °C° (-94 ... +140 °F)
- operating pressure 0 ... 20 bara (0 ... 290 psia)
- current (mA) analog output

DMT143L with DRYCAP® 180S sensor
- G1/2″ ISO228/1 mechanical connection
- measurement range -50 ... + 60 °C° (-58 ... +140 °F)
- operating pressure 0 ... 20 bara (0 ... 290 psia)
- current (mA) analog output

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1 Service policy

Full Calibration service capability in HEL, BOS, TOK and BEI.

Additional three point temperature calibration is available for all models in HEL (MSL).

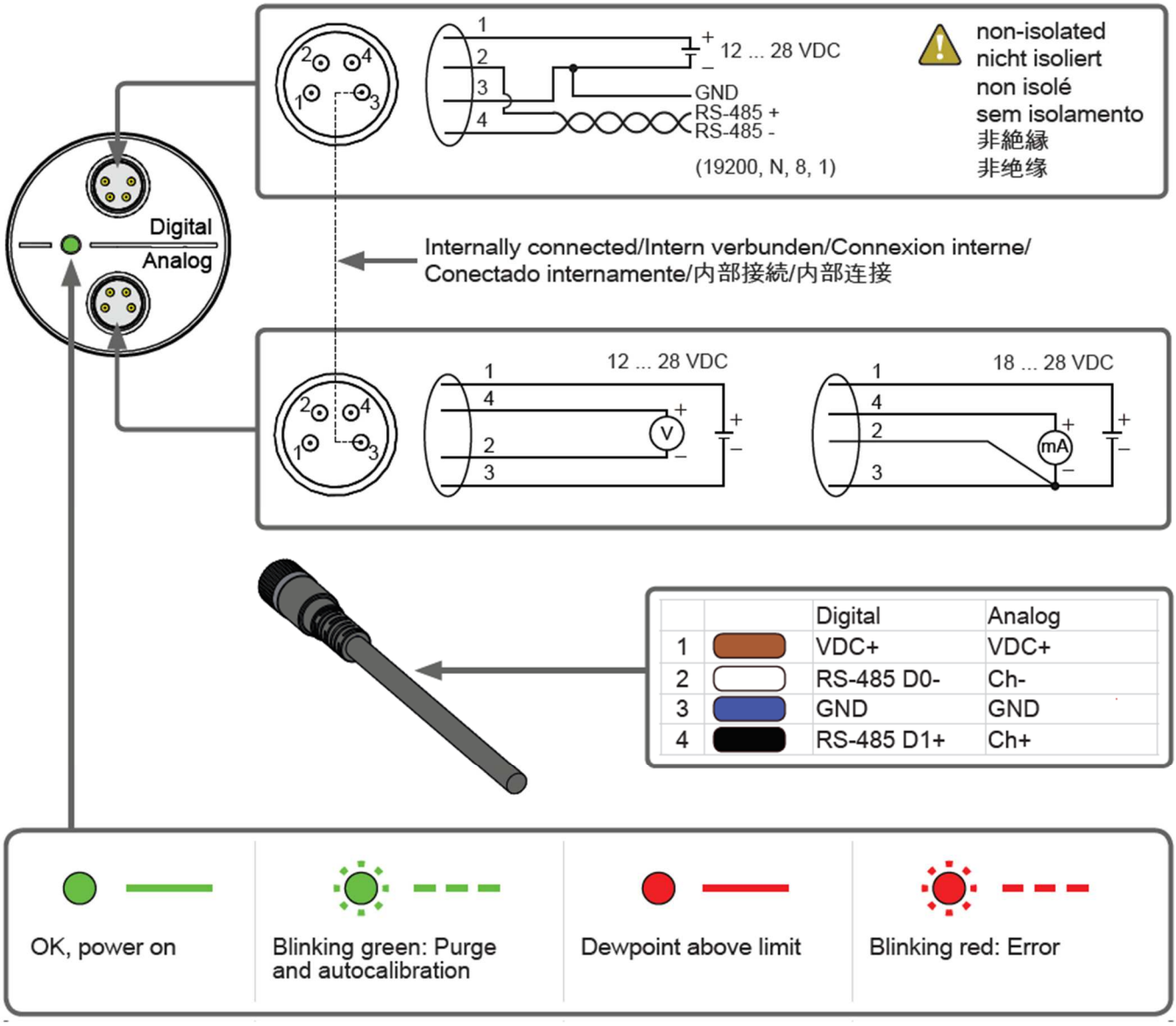
Customer selectable RH and T points are available in HEL and BOS CRS

Accredited calibration is available for a new unit and the older ones too. Configuration of the calibration is defined to order form of a new unit

2 Tools needed

- Power supply (V_{Out} 10...35V and I_{Out} > 1A)
- Standard PC terminal software
- Vaisala USB service cable (order code 219690)
- Multimeters (DVMs)

3 Wiring



Property	Description/Value
Recommended calibration interval to confirm the specified accuracy	2 years
Current Output Signal	4 ... 20 mA.
Operating voltage with current output with voltage output with RS-485	 18 ... 28 VDC 12 ... 28 VDC 12 ... 28 VDC
Pressure > 20 bara (290 psia) or temp below 0 °C (32°F),	24 ... 28 VDC
Supply current during normal measurement during self-diagnostics	 Max 10 mA + load current Max 220mA pulsed during purge
Load for current output	Max 500 Ohms
Load for voltage output	in 10k Ohms

4 Trouble Shooting

4.1 Analog Output or Display does not match expected value

Step 1.) Check the *label* on transmitter, to verify the transmitter configuration of parameters, engineering units and scale for appropriate channel.

Step 2.) With USB Service Cable, force analog outputs to 0% and 100% of scale to verify reading on the control display, PLC, chart recorder, data logger or analog receiving device displays correct scale.

Analog Output Tests

Using USB Service Cable and Service Port: ITEST Command

With the PuTTY serial program, use the ATEST command to test the operation of the analog outputs. The ATEST command forces the analog outputs to entered values. The analog outputs remain at these values until you enter the command ATEST without parameters or reset the transmitter

Examples:

atest

17.585 24000

atest 4

4.000 5447

atest 20

20.000 27298

atest

17.583 27298

4.2 Measurement Reading bounces around

If the measurement reading jumps around, this can be caused by several factors. Factors include unstable process, varying control conditions, wrong location for sensor placement, ground loops, and leaks in system allowing environmental conditions to affect process.

First, check the location of the installed sensor is not obstructed intermittently or insulated properly from ambient fluctuations.

Second, your process may fluctuate greatly. Try adjusting *Filtering* on control device in an effort to stabilize readings. Or try adjusting **FILT** command with USB Service Cable for DMT143 output filtering response

Set DMT143 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.aaa*]<cr>
where
a.aaa = Range 0.001 ... 1.0.
1.0 = No filtering, latest measurement is output without averaging
0.5 = Average of last two measurements
0.1 = Average of ca. 16 measurements (default)

Example (show current setting):

filt
Filter : 0.100 ?

Example (set filtering to 0.5):
filt 0.5
Filter : 0.500

4.3 Checking Error Messages with Service Port

If the transmitter has error messages, they can be read on the serial line using the **ERRS** command.

Error Message	Possible Cause and Solution
T MEAS error	DRYCAP® sensor damaged or missing. Contact a Vaisala service center.
F MEAS error	
Voltage error	Supply voltage out of range. Check and correct.
Voltage too low error	
Voltage too low for mA output	
Voltage is too low for V output	
Program flash check sum error	Internal transmitter error. If the error remains after a reset and restoring the factory settings, contact a Vaisala service center.
Parameter flash check sum error	
INFOA check sum error	
SCOEFS check sum error	
CURRENT check sum error	

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

errs
T MEAS error

Solving Typical Problems

Some problems can be solved by simply resetting power to the transmitter 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 technical support.

Table 2. Troubleshooting Table

Problem	Possible Causes and Solutions
Transmitter outputs stars "****" on serial line instead of measurement data	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 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 mode with unknown address. Check wiring. Try connecting as instructed in section Unknown Serial Settings on page 67. Issue the **??** command to make the transmitter respond in POLL mode.
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 the **ERRS** command. Wait for the diagnostics to complete.
Dewpoint alarm LED is red even though the measured dewpoint is not high.	Possible causes: the alarm limit may be set incorrectly for your application. Check and correct using serial line or MI70 indicator.

4.4 Checking Error Messages with Service Port

If the transmitter has error messages, they can be read on the serial line using the **ERRS** command.

Error Message	Possible Cause and Solution
T MEAS error F MEAS error	DRYCAP® sensor damaged or missing. Contact a Vaisala service center.
Voltage error Voltage too low error Voltage too low for mA output Voltage is too low for V output	Supply voltage out of range. Check and correct.
Program flash check sum error Parameter flash check sum error INFOA check sum error SCOEFS check sum error CURRENT check sum error	Internal transmitter error. If the error remains after a reset and restoring the factory settings, contact a Vaisala service center.

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

errs
T MEAS error

4.5 Operational tests using USB Service Cable and Service Port

CAUTION! Before AC power up:
Connect always first the protective ground terminal. After that connect phase and null wires to POWER-1 module.

Connect USB serial line to Service port (fixed serial line settings, 19200, 8, N, 1) and multimeters (DVMs) to analog outputs. Run PuTTY.

Power up the unit.

After power up the unit should response:

DMT143 1.3.4

Type command ? and hit enter

?
DMT143 1.3.4
Serial number : M3104715
Batch number : M18551904
Sensor number : L3820000
Sensor model : DRYCAP180D
Cal. date : 20160804

```
Cal. info          : Vaisala/HEL
Time               : 02:20:19
Serial mode        : STOP
SCI   Baud  P D S : 19000 N 8 1
Output interval    :          1  s
Serial delay       :          8
Address            :          0
Pressure           :      1.000 bar
Filter             :      0.100
```

Type command R

The unit starts showing the readings. Pressing ESC <ENTER> stops displaying the readings. Check the readings are reasonable and corresponds to the display (optional) and to the analog outputs.

```
>r
RH= 37.33  %    T= 67.66'F
RH= 37.33  %    T= 67.66'F
RH= 37.34  %    T= 67.66'F
s
>
```

Example:

```
>asel

>
```

If the analog output readings are incorrect, those can be re-calibrated with command ACAL (see the instructions from User´s Guide).

4.6 Changing Output Parameter and Channel information

If a transmitter channel information needs to be change from one parameter to another, use following procedure.

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

ASEL [*parameter*] [*lowlimit highlimit*]<cr>
where
parameter = 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.
lowlimit = Lower limit of parameter scaling.
highlimit = 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 5000
Ch1 H2O lo : 0.00 ppm
Ch1 H2O hi : 5000.00 ppm

4.7 Reset to factory ordered configuration

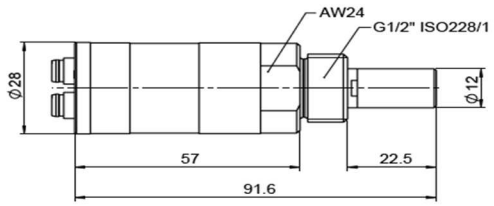
To reset the transmitter settings to factory defaults, use command FRESTORE.

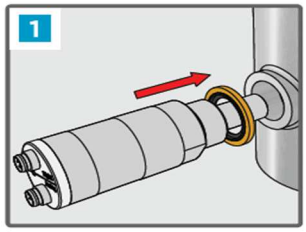
>frestore
Factory settings restored

4.8 Thread Types

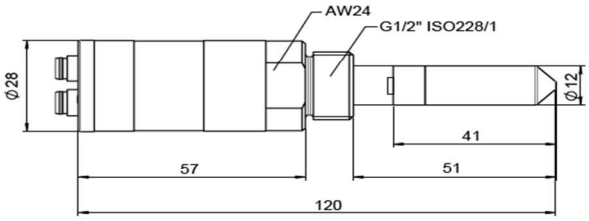
Model with ISO thread: Install with the sealing ring

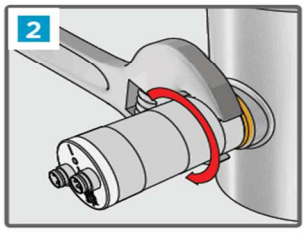
DMT143



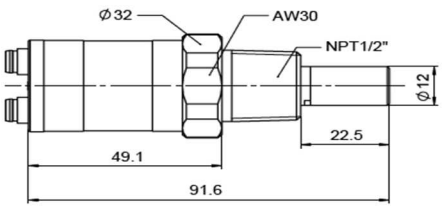


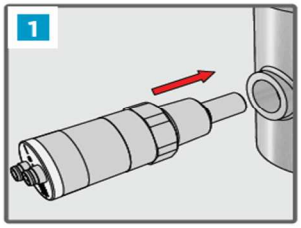
DMT143L

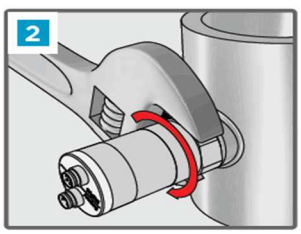




Model with NPT thread







5 Maintenance

5.1 Visual Check

This tasks should take into consideration at least following issues:

- Surface (materials)
- Oxidation, water leaking
- Sensors
- Cables (if any), cable heads
- Connectors
- Cleaning

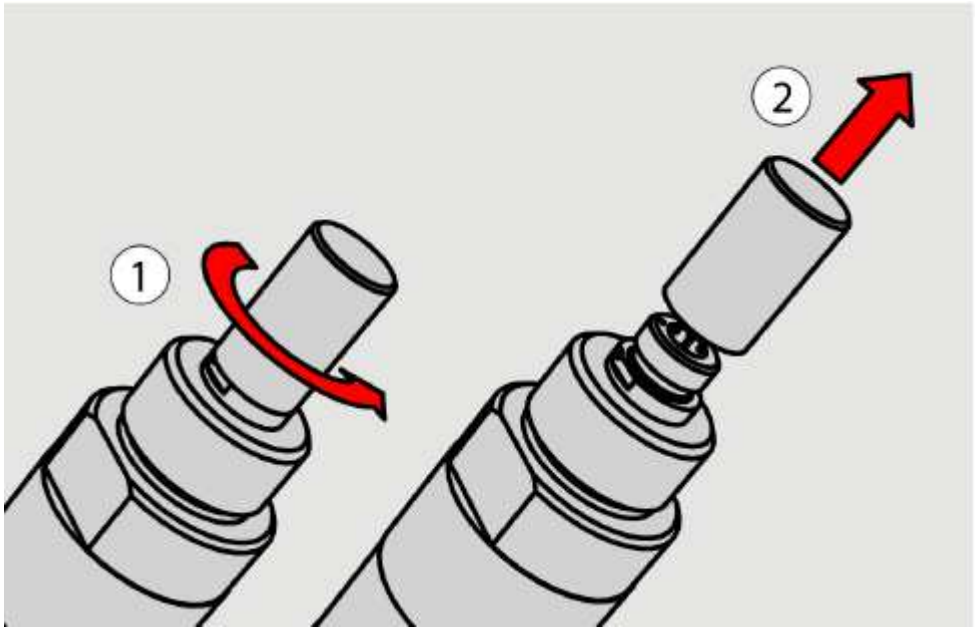
5.2 Cleaning the HUMICAP sensor

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

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

Replace the filter as follows:

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

6 Spare or Replacement parts available for customers

Description	Order Code
Connection cable for MI70 Hand-Held Indicator	219980SP
USB service cable	219690
Loop-powered external display, Nokeval 301	226476
Loop-powered external display, Nokeval 302 (with alarm 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
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) heady duty cable	225229SP
Sampling cells	
Sampling cell	DMT242SC
Sampling cell with 1/4" male Swagelok connectors	DMT242SC2
Sampling cell with quick connector and leak screw	DSC74SP
Two-pressure sampling cell	DSC74BSP
Two-pressure sampling cell with coil	DSC74CSP
Separate cooling/venting coil for sampling cells	DMCOILSP

7 CALIBRATION AND ADJUSTMENT

Calibration and Adjustment Overview

You can calibrate and adjust the transmitter using the following tools:

- Serial line commands
- Portable humidity meter HM70

Vaisala Service Centers also offer accredited calibrations dewpoint.

Field Check Using the DM70 Hand-Held Dewpoint 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 dewpoint range. The DMP74B probe is recommended for checking the dewpoint and temperature measurement accuracy.

- You also need a connection cable (Vaisala order code: 219980SP) to connect the DMT143 to the MI70 indicator.

NOTE In the procedure below, 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.

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 (see section DMT143 Startup Sequence on page 20) 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, **ΔTd/f** shows the difference in dewpoint between the two probes.

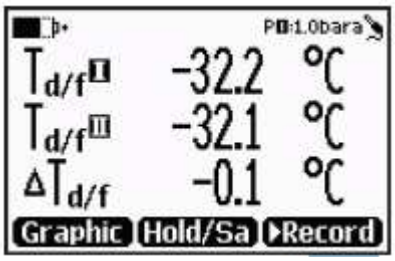


Figure 24 Comparing Dewpoint Readings on MI70

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.

NOTE Some notes on using the MI70 indicator with the DMT143:
- If you disconnect the DMT143 while the MI70 indicator is on, the parameters measured will remain on the screen, but no measurement will be shown.
- Temperature measured by the DMT143 is shown as parameter **Ta** (not T) in the MI70.
- The messages from the transmitter will appear in English even if the MI70 has been set to another language

8 DMT143 Order Codes

VAISALA

Order form
Orderer ______________________

Valid from May 2017
Order no. ______________________

DMT143 Dewpoint Transmitter

No.	Item	Selection	Details	Code
	Vaisala DRYCAP® Dewpoint Transmitter		DMT143 | | 1 | | | | 1 | | | | | A | S |	PRICE
1	Mechanical connection	**ISO G1/2" thread**		G
		NPT 1/2" thread		N
2	Digital interface	**RS485**		1
3	Analog signal output	**none**		0
		0...1 V	**(1.1V error state)**	A
		0...5 V	**(5.5V error state)**	B
		4...20mA	**(3.6mA error state)**	C
		1...5V	**(5.5V error state)**	D
		0...1 V	**(0V error state)**	E
		0...5 V	**(0V error state)**	F
		4...20mA	**(0 mA error state)**	G
		1...5V	**(0V error state)**	H
4	Analog output scaling	**-80...+20°C Td**		1
		-80...+20°C Tda, dewpoint at ambient pressure		2
		0...1000 ppmv		3
		0...5000 ppmv		4
		free scaling ppm	Define scale: ________	P
		free scaling Td °F	Define scale: ________	U
		free scaling Td °C	Define scale: ________	X
		free scaling %RH	Define scale: ________	N
5	Alarm LED setpoint	**Off**	**Only fault indication**	A
		-40°C Td	**Class 2**	B
		-20°C Td	**Class 3**	C
		-10°C Td		D
		+3°C Td	**Class 4**	E
		Other value	**define value: °C Td**	X
		Deactivated	**LED always off**	Z
6	Process gas	**Air**		1
7	Pressure setting for optimized accuracy	**1 bar (abs)**		A
		3 bar (abs)		B
		5 bar (abs)		C
		7 bar (abs)		D
		special (max 50 bar abs)*	Define value: bar	X
8	Cable	**No cable**		0
		0.3 m (1.0 ft)	*HMP50Z032*	*2*
		3 m (9.8 ft)	*HMP50Z30A*	*3*
		5 m (16.4 ft)	*HMP50Z500*	*4*
		10 m (32.8 ft)	*HMP50Z1000*	*5*
		1.5 m (4.9 ft) heavy duty cable	*225777*	*6*
		3 m (9.8 ft) heavy duty cable	*225229*	*7*
9	Sensor protection	**Standard sintered filter**	*spare: DRW010335SP*	A
		Stainless steel filter for vacuum applications	*spare: HM47453SP*	*S*
10	Accessories ONLY for ISO1/2" thread	**no accessories**		0
		basic sampling cell DMT242SC		*1*
		sampling cell with swagelok 1/4" male connectors DMT242SC2		*2*
		sampling cell with quick connector and leak screw, DSC74		*3*
		two pressure sampling cell, DSC74B		*4*
		two pressure sampling cell with cooling/venting coil, DSC74C		*5*
		duct installation flange DM240FA		*6*
		mounting nut		*7*
11	Package	**Standard**		A
12	Identity	**Vaisala**		S
13	User guide language	**no user guide**		A
		multilingual guide		X
			TOTAL	
			QTY	
			TOTAL VALUE	

* if measuring in pressures above 20 bara (290 psia) or temperatures below 0 °C, the supply voltage must be 24-28 VDC

Selections in bold are included in the prices of the basic versions.
Selections in italic are available at an extra price.

Example of order code with typical settings:

DMT143	G	1	C	1	B	1	A	3	A	0	A	S	X

End customer: ______________________

Accessories:

- 219690 USB service cable for PC
- 219980SP Connection cable for MI70 Hand-Held Indicator
- 226476 Loop-powered display 4...20 mA / -80....20 °C Tdf , Nokeval 301
- 234759 Loop-powered display 4...20 mA / -80....20 °C Tdf with relays , Nokeval 302
- 218773 Plug kit (ISO 1/2")
- 222507 Plug kit (NPT 1/2")

9 Calculate mA and Process Values

To find the mA current value from Process Value:

I = (Ihigh - Ilow)/(PVhigh - PVlow) x (PV - PVlow) + Ilow

For example:
Humidity Output: 4-20mA = -80 to 20 Td Deg C
PVhigh = 20
PVlow = -80
Ihigh = 20
Ilow = 4

PV on display = -40 Td deg C
I = (20 - 4)/(20 – (-80)) x (-40 – (-80)) + 4 = 10.40 mA

Using a calculator

I span = Ihigh-Ilow =	20 – 4 = 16 mA
PV span = PVhigh – PVlow =	20 – (-80) = 100 Deg C
Display Reading = -40 Td deg C	
Calculate PV offset =	-40 – (-80) = 40
I span / PV span =	16 / 100 = 0.16
Span x PV offset + PVlow =	0.16 x 40 + 4 = 10.40 mA

To find the Process Value from mA:

PV = (PVhigh - PVlow)/(Ihigh - Ilow) x (I - Ilow) + PVlow

For example:
Temperature Output: 4-20mA = 20 to -80 Td Deg c
PVhigh = 20
PVlow = -80
Ihigh = 20
Ilow = 4

mA Reading on Multimeter = 12.00mA
PV = (20 - (-80))/(20 - 4) x (12 - 4) + (-80) = -30 deg C

Using a calculator

PV span = PVhigh – PVlow =	20 – (-80) = 100 deg C
I span = Ihigh-Ilow =	20 – 4 = 16 mA
Multimeter Reading = 12.00 mA	
Calculate I offset =	12.00 – 4 = 8 mA
PV span / I span =	100 / 16 = 6.25
Span x I offset + PVlow =	6.25 x 8 + -80 = -30 deg C